

NATIONAL SICKLE CELL ANEMIA PREVENTION ACT

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HEARINGS

BEFORE THE

SUBCOMMITTEE ON HEALTH

OF THE

COMMITTEE ON

FOR AND PUBLIC WELFARE

UNITED STATES SENATE

NINETY-SECOND CONGRESS

FIRST SESSION

ON

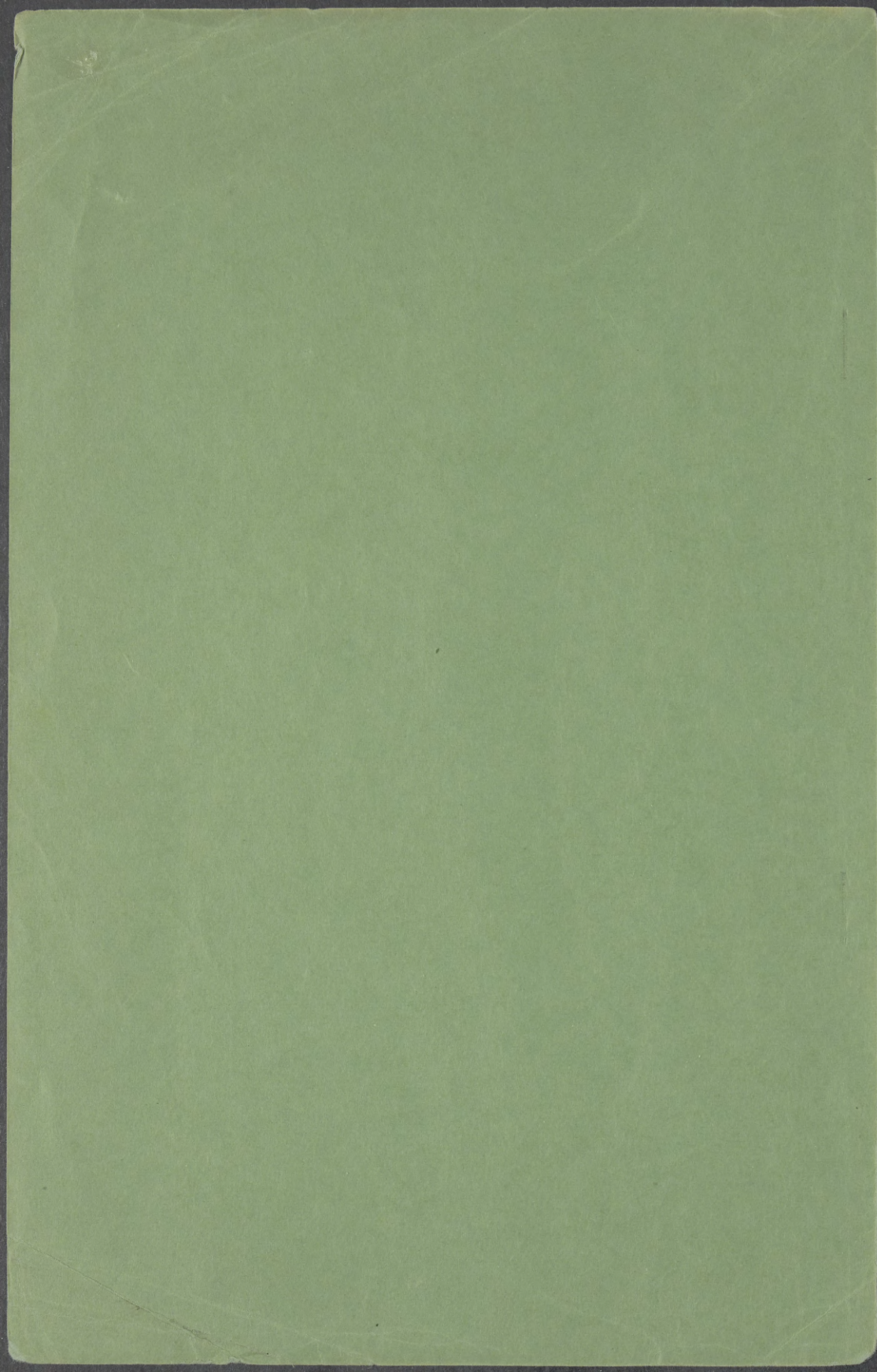
S. 2676

TO PROVIDE FOR THE PREVENTION OF SICKLE CELL ANEMIA

NOVEMBER 11 AND 12, 1971

Printed for the use of the Committee on Labor and Public Welfare





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WASHINGTON : 1972

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2. The second part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

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NATIONAL SICKLE CELL ANEMIA PREVENTION ACT

THURSDAY, NOVEMBER 11, 1971

U.S. SENATE,
SUBCOMMITTEE ON HEALTH OF THE
COMMITTEE ON LABOR AND PUBLIC WELFARE,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 4232 of the New Senate Office Building, Senator Edward M. Kennedy (chairman of the subcommittee) presiding.

Present: Senators Kennedy, Dominick, and Schweiker.

Also present: Senators Tunney and Brooke.

Staff members present: LeRoy G. Goldman, professional staff member; and Jay B. Cutler, minority counsel.

Senator KENNEDY. The subcommittee is in order. I am pleased to open hearings this morning on legislation that is not only directly vital to the health of 2 million Americans, but is also of critical importance in establishing our national health priorities.

In addition to the staff members of the subcommittee, Robert Bates of my staff has also worked on the legislative background in connection with sickle cell anemia.

Sickle cell anemia has been a neglected disease for too many years.

It is now receiving the concerted attention of many of us in the Congress and of health authorities around the Nation because of serious efforts to examine many of the ills and problems that have long affected those Americans who suffer the anguish and inhumanity of racism.

Dr. Roland B. Scott, of the Howard University College of Medicine, will readily verify that black physicians and their patients have struggled with the exasperation of inadequate resources to combat sickle cell anemia for decades.

Each year without warning, attacks of painful crises seriously affect 100,000 black Americans.

In total, 2 million black people in this country are believed to be carriers of the sickle cell trait.

Although 10 percent of all black Americans may bear the trait that leads to sickling, the tragic symptoms and the crippling effects of the disease are seen only in the offspring of two people, both of whom have the sickle cell trait.

For that reason family planning advisers are seeking to develop public awareness projects to distribute more and more information and educational materials about the disease.

Last week, Dr. Raymond L. Standard, Director of the Washington, D.C., Health Services Administration, said that the highest priorities

should be aimed at reaching junior and senior high school students who will be marrying soon, so that they might be advised of the effects the disease may have on their children.

I also want to take this opportunity to praise my colleague and long-time friend, Senator John V. Tunney, of California, for the concern he has shown about the need to combat this disease by introducing S. 2676, into the Senate.

(The text of the bill, S. 2676, follows:)

92^d CONGRESS
1ST SESSION

S. 2676

IN THE SENATE OF THE UNITED STATES

OCTOBER 8, 1971

MR. TUNNEY (for himself, Mr. WILLIAMS, Mr. BROOKE, Mr. KENNEDY, Mr. ANDERSON, Mr. BAYH, Mr. BENNETT, Mr. BENTSEN, Mr. CASE, Mr. CRANSTON, Mr. EAGLETON, Mr. GRIFFIN, Mr. HARRIS, Mr. HART, Mr. HARTKE, Mr. HUMPHREY, Mr. INOUE, Mr. JACKSON, Mr. JAVITS, Mr. MAGNUSON, Mr. METCALF, Mr. MONDALE, Mr. MOSS, Mr. MUSKIE, Mr. PASTORE, Mr. PERCY, Mr. RIBICOFF, Mr. ROTH, Mr. SCHWEIKER, Mr. TAFT, and Mr. THURMOND) introduced the following bill; which was read twice and referred to the Committee on Labor and Public Welfare

A BILL

To provide for the prevention of sickle cell anemia.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 SHORT TITLE

4 SECTION 1. This Act shall be cited as the "National
5 Sickle Cell Anemia Prevention Act".

6 FINDINGS AND DECLARATION OF PURPOSE

7 SEC. 2. (a) The Congress hereby finds and declares—

8 (1) that sickle cell anemia is a disease resulting
9 from the inheritance of a genetic factor relating to the

1 sickle cell trait which afflicts a large number of Ameri-
2 can citizens, primarily among the black population of the
3 United States;

4 (2) that the disease is a deadly and tragic burden
5 which strikes approximately one of every five hundred
6 black children, and that less than half of those children
7 who contract the disease survive beyond the age of
8 twenty; and

9 (3) that efforts to prevent sickle cell anemia must
10 be directed toward increased research in the cause and
11 treatment of the disease, and the education, screening,
12 and counseling of carriers of the sickle cell trait;

13 (4) that simple and inexpensive screening tests
14 have been devised which will identify those who have
15 the disease or carry the trait;

16 (5) that programs to prevent sickle cell anemia
17 must be based entirely upon the voluntary cooperation
18 of the individuals involved;

19 (6) that the attainment of better methods of pre-
20 vention, diagnosis, and treatment of sickle cell anemia
21 deserves the highest priority.

22 (b) In order to preserve and protect the health and wel-
23 fare of all citizens, it is the purpose of this Act to establish
24 a national program for the prevention and treatment of
25 sickle cell anemia.

AMENDMENTS TO PUBLIC HEALTH SERVICE ACT

SEC. 3. (a) Section 1 of the Public Health Service Act is amended by striking out "titles I to X" and inserting in lieu thereof "titles I to XI".

(b) The Act of July 1, 1944 (58 Stat. 682), as amended, is amended by renumbering title XI (as in effect prior to the enactment of this Act) as title XII, and by renumbering sections 1101 through 1114 (as in effect prior to the enactment of this Act), and references thereto, as sections 1201 through 1214, respectively.

(c) The Public Health Service Act is further amended by adding after title X the following new title:

“TITLE XI—SICKLE CELL ANEMIA PREVENTION
PROGRAM

"GRANTS FOR SICKLE CELL SCREENING AND COUNSELING PROGRAMS

"SEC. 1101. (a) The Secretary is authorized to make grants to and enter into contracts with public and non-profit private entities to assist in the establishment and operation of voluntary sickle cell anemia screening and counseling programs and to assist in developing and making available information and educational materials relating to sickle cell anemia to all persons requesting such information or materials, and to inform the public generally about the nature of sickle cell anemia and the sickle cell trait.

1 “(b) In making grants and contracts under this section
2 the Secretary shall take into account the number of persons
3 to be served, the extent to which such screening and coun-
4 seling is needed on a local basis, the relative need of the ap-
5 plicant, and its capacity to make rapid and effective use of
6 such assistance.

7 “(c) For the purpose of making payments pursuant to
8 grants and contracts under this section, there are authorized
9 to be appropriated \$25,000,000 for the fiscal year ending
10 June 30, 1973; \$25,000,000 for the fiscal year ending
11 June 30, 1974; and \$25,000,000 for the fiscal year ending
12 June 30, 1975.

13 “DEMONSTRATION GRANTS

14 “SEC. 1102. (a) In order to promote research in the
15 diagnosis, treatment, and prevention of sickle cell anemia,
16 development of programs to educate the public regarding the
17 nature and inheritance of the sickle cell trait and sickle cell
18 anemia, and the development of centers for research, test-
19 ing, counseling, prevention, or treatment of sickle cell
20 anemia, the Secretary is authorized to make grants to public
21 or nonprofit private entities and to enter into contracts with
22 public or private entities and individuals for projects for re-
23 search and research training in such fields.

24 “(b) For the purpose of making payments pursuant

1 to grants and contracts under this section there are author-
2 ized to be appropriated \$5,000,000 for the fiscal year ending
3 June 30, 1973; \$5,000,000 for the fiscal year ending
4 June 30, 1974; and \$5,000,000 for the fiscal year ending
5 June 30, 1975.

6 "VOLUNTARY PARTICIPATION

7 "SEC. 1103. The participation by any individual in
8 any program or portion thereof under this title (whether
9 by grant or contract) shall be wholly voluntary and shall
10 not be a prerequisite to eligibility for or receipt of any other
11 service or assistance from or to participation in, any other
12 program.

13 "APPLICATIONS

14 "SEC. 1104. A grant under this title may be made
15 upon application to the Secretary at such time, in such
16 manner, containing and accompanied by such information as
17 the Secretary deems necessary. Each application shall—

18 "(1) provide that the programs and activities for
19 which assistance under this title is sought will be ad-
20 ministered by or under the supervision of the applicant;

21 "(2) describe with particularity the programs and
22 activities for which assistance is sought;

23 "(3) provide for strict confidentiality of all test
24 results, medical records and other information regarding

screening, counseling, or treatment of any person
treated, except for (A) such information as the patient
(or his guardian) consents to be released; or (B) sta-
tistical data compiled without reference to the identity of
any such patient;

“(4) provide for appropriate consultation with com-
munity representatives in the development and operation
of any program funded under this title;

“(5) set forth such fiscal control and fund ac-
counting procedures as may be necessary to assure
proper disbursement of and accounting for Federal funds
paid to the applicant under this title; and

“(6) provide for making such reports in such
form and containing such information as the Secretary
may reasonably require.

“PUBLIC HEALTH SERVICE FACILITIES

“SEC. 1105. The Secretary shall establish a program
within the Public Health Service to provide for voluntary
sickle cell anemia screening, counseling, and treatment. Such
program shall be made available through facilities of the
Public Health Service to any eligible person requesting
screening, counseling, or treatment, and shall include notifi-
cation of all eligible persons of the availability and voluntary
nature of such programs.

1 "REPORTS

2 "SEC. 1106. (a) The Secretary shall prepare and sub-
3 mit to the President for transmittal to the Congress on or
4 before April 1 of each year a comprehensive report on the
5 administration of this title.

6 "(b) The report required by this section shall contain
7 such recommendations for additional legislation as the Sec-
8 retary deems necessary."

9 PROTECTION OF ARMED FORCES PERSONNEL

10 SEC. 4. (a) The Secretary of Defense is authorized and
11 directed to promulgate rules and regulations to provide for
12 screening and counseling of members of the Armed Forces
13 (including their dependents), civilian employees of the De-
14 partment of Defense, and persons examined at Armed Forces
15 examining and entrance stations, for the sickle cell trait and
16 sickle cell anemia.

17 (b) Such rules and regulations shall provide for—

18 (1) voluntary screening for the sickle cell trait for
19 persons described in subsection (a) who request such
20 a test, at no cost to such person;

21 (2) communication to such person described in
22 subsection (a) of the results of such test;

23 (3) voluntary referral of individuals determined to

1 possess a positive trait to an appropriate military or
2 civilian counseling or treatment agency;

3 (4) notification to persons described in subsection
4 (a) of the cost-free and voluntary nature of the screen-
5 ing and referral programs implemented pursuant to this
6 section;

7 (5) education of persons described in subsection
8 (a) regarding the nature and inheritance of the sickle
9 cell trait and sickle cell anemia; and

10 (6) assurance that all information obtained on
11 specimens submitted voluntarily under this Act shall be
12 held confidential except for (A) such information as the
13 patient (or his guardian) consents to be released or (B)
14 statistical data compiled without reference to the iden-
15 tity of any such patient.

16 (c) The Secretary of Defense shall provide for volun-
17 tary counseling or treatment of such persons described in
18 subsection (a) found to have the sickle cell trait or sickle
19 cell anemia at an appropriate military or civilian facility as
20 the case may be.

21 (d) (1) The Secretary of Defense shall prepare and
22 submit to the President for transmittal to Congress on or
23 before April 1 of each year a comprehensive report on the
24 administration of this section.

25 (2) The report required by this subsection shall con-

tain such recommendations for additional legislation as the Secretary of Defense deems necessary.

(e) The participation by any individual in any program or portion thereof under this section shall be wholly voluntary and shall not be a prerequisite to eligibility for or receipt of any other service or assistance from, or to participation in, any other program.

PROTECTION OF VETERANS

SEC. 5. (a) Chapter 17 of title 38, United States Code, is amended by adding at the end thereof the following new subchapter:

"SUBCHAPTER VI—SICKLE CELL ANEMIA PREVENTION

"§ 651. Notification and education

"(a) The Administrator shall notify all persons eligible for care under this chapter of the availability of screening, treatment, and counseling programs with regard to the sickle cell trait and sickle cell anemia and the voluntary nature of such programs.

"(b) The Administrator shall establish a program of education regarding the nature and inheritance of sickle cell trait and sickle cell anemia and make such program available to all such eligible persons.

"§ 652. Screening and treatment

"(a) The Administrator shall furnish to any person

1 eligible for care under this chapter who makes a request,
2 screening for sickle cell trait or sickle cell anemia.

3 “(b) Upon a finding that such eligible person has the
4 sickle cell trait or sickle cell anemia the Administrator shall
5 provide for voluntary counseling or treatment as the case
6 may be.

7 **“§ 653. Reports**

8 “(a) The Administrator shall prepare and submit to the
9 President for transmittal to the Congress on or before April 1
10 of each year a comprehensive report on the administration
11 of this subchapter.

12 “(b) The report required by this section shall contain
13 such recommendations for additional legislation as the Ad-
14 ministrator deems necessary.

15 **“§ 654. Voluntary participation**

16 “The participation by any individual in any program
17 or portion thereof under this section shall be wholly volun-
18 tary and shall not be a prerequisite to eligibility for or
19 receipt of any other service or assistance from, or to partici-
20 pation in, any other program.”

21 (b) The analysis at the beginning of such chapter is
22 amended by adding at the end thereof:

“SUBCHAPTER VI—SICKLE CELL ANEMIA PREVENTION

“651. Notification and education.

“652. Screening and treatment.

“653. Reports.

“654. Voluntary participation.”

Senator KENNEDY. The National Sickle Cell Anemia Prevention Act will perform two major tasks—first, it will authorize the appropriation of more money for the battle against sickle cell anemia. This will amount to more in 3 years than has been spent throughout the known history of the disease.

Second, it will serve to catalyze the enormous potential of all our health and public education resources to help solve the problems of those who are afflicted.

Probably no other disease has affected as many people in this country as sickle-cell anemia and has been as unattended as this disease.

Some 58,000 people suffered during the 1952 epidemic of polio. Despair and fear from that killer brought a shock to the Nation that generated an all-out effort to control it.

PKU—phenylketonuria—occurring about once in 10,000 births, and cystic fibrosis, occurring once in every 3,000 live births, almost exclusively among white people, have attracted astronomical amounts of money in the struggle to end the struggle they cause. But sickle-cell anemia, which occurs much more frequently, has been neglected and ignored just like most other conditions that affect only black people.

And so today, as we begin to look at the problem of how to produce relief for the victims of sickle-cell anemia, we must also focus on the fundamental social and physical components of this problem with the same intensity that we study the problem's medical research and treatment aspects. With those concerns in mind we have attempted to structure these hearings to include testimony from a broad range of witnesses.

We expect to hear accounts from the very personal and agonizing experience of a family's own battles against sickle-cell anemia. The description of screening and counseling projects will be explained by the members of a group of athletes who have formed a volunteer organization, and we shall also receive testimony from scientists and medical experts who have researched, treated, counseled, and advised thousands of people about this dread disease.

Through the data and information obtained from these witnesses, it is hoped that we may contribute to the development of plans and programs by officials of the Department of Health, Education, and Welfare who will describe the Department's work regarding sickle-cell anemia research.

The bill we shall be considering recognizes the need for a three-level attack on the problem of sickling:

First, there is the demand to develop effective screening and counseling programs that will seek out the people who suffer from sickle-cell anemia in order that they may receive the benefits of counseling and treatment.

Second, we need to establish widespread networks to distribute easily understood information about sickle-cell anemia to potential victims and especially to health care personnel. An awareness of the disease can readily serve to produce the help required to produce relief from it. Genetic counseling can be of major importance in reducing the incidence of the disease.

And, finally, I want to see this country launch a substantial research effort which will add to our medical knowledge in the areas of treat-

ment and will aid in alleviating the basic genetic defect and its consequences.

I am convinced that if PKU, cystic fibrosis, or muscular dystrophy struck the lives of white families in the proportion that sickle-cell anemia affects black Americans, our public commitment to it would be as stubborn as was our persistence last week to blow up the tiny island of Amchitka.

I am happy to welcome all of our witnesses to this morning's first session on sickle-cell anemia. Your concern and interest in this vital matter of health care will be valuable to our efforts in the Congress in developing programs that can aid those who are suffering.

It is my strong conviction that the mysteries of sickle cell anemia must be examined with all the power and might that our national medical resources will allow.

To avoid searching for the clues to that mystery, as an excuse that this is an insurmountable challenge, is merely a cover for racism.

The only battles we cannot win are the battles we do not fight. I intend to fight for help against this crippling disease.

The opening statement by Senator Javits is to be placed into the record at this time.

STATEMENT OF HON. JACOB K. JAVITS, A U.S. SENATOR FROM THE STATE OF NEW YORK

Senator JAVITS. Mr. Chairman, as we begin hearings on the National Sickle-Cell Anemia Prevention Act—S. 2676—of which I am pleased to be a cosponsor, I think it is important to note that it was President Nixon, in his 1971 health message, who first focused national attention on this tragic disease. He said:

“A second targeted disease for concentrated research should be sickle-cell anemia—a most serious childhood disease which almost always occurs in the black population. It is estimated that one out of every 500 black babies actually develops sickle-cell disease.

“It is a sad and shameful fact that the causes of this disease have been largely neglected throughout our history. We cannot rewrite this record of neglect, but we can reverse it. To this end, this administration is increasing its budget for research and treatment of sickle-cell disease fivefold, to a new total of \$6 million.”

I was concerned that the amounts requested by the administration for funding did not give sufficient priority to sickle-cell anemia and offered with Senator Kennedy an amendment—which passed the Senate but unfortunately was not accepted by the conferees—to increase appropriations to combat sickle-cell anemia by an additional \$6 million.

For too many years, sickle-cell anemia, a painful, crippling blood disease that kills 1 out of every 500 black people in this country and a disease that primarily affects the black population, has been ignored as one of the greatest killers of our Nation's people.

I am not being critical of Federal research support, for I have long advocated across-the-board increased funding for all NIH research programs; however, I cite the following revealing statistics:

Federally supported research grants of \$1,539,500 million for sickle cell anemia (1,500 new cases) by the National Heart and Lung Institute;

\$5,476,000 for muscular dystrophy (813 new cases) by the National Institute of Neurological Diseases and Stroke; and

\$2,643,000 for cystic fibrosis (1,250 new cases) by the National Institute of Arthritis and Metabolic Diseases.

Sickle cell anemia is carried from generation to generation with some people acting as carriers of the trait, while others are the unfortunate victims.

It is estimated that 50,000 blacks have the sickle cell disease; 2-million-plus are carriers of it, and at least 5,000 require hospitalization each year.

Most of the children affected with the disease die before the age of 30.

In spite of these staggering figures, there is as yet no national program to prevent the 2 million carriers of the sickle cell trait from passing it from one generation to another.

Perhaps even more importantly, there is no national program to educate these carriers as to the risks involved in having children and most shocking is that despite these tragic statistics, there has been no all-out program to inform the black communities of the significant proportions of this disease and its immediate threat to their own lives.

I believe S. 2676 is the appropriate legislative response and will permit us to institute the needed programs to adequately combat this disease, programs that should have been instituted many years ago.

Senator KENNEDY. I want to extend a very warm welcome to my colleague from Massachusetts, Hon. Edward W. Brooke.

Senator Brooke received his B.S. degree from Howard University and his master of laws from Boston University Law School, where he was also editor of the Law Review.

He served two terms as the attorney general of the Commonwealth of Massachusetts before being elected to the U.S. Senate in 1966.

Among his many honors, Senator Brooke was the recipient of one of 10 outstanding young men of Greater Boston, junior chamber of commerce award in 1952; Distinguished Service award, American Veterans of World War II; and was elected national judge advocate, 1955-57.

In addition, he was a fellow of the American Bar Association for excellence in law, 1963; is a trustee of Boston University; and served on President Johnson's Commission for Civil Rights Under Law.

Senator Brooke has been in the forefront in bringing attention to, and seeking resources to combat, sickle cell anemia.

His leadership in this battle is most welcome and encouraging to all of us joined with him.

Welcome to the subcommittee, Senator.

STATEMENT OF HON. EDWARD W. BROOKE, A U.S. SENATOR FROM THE STATE OF MASSACHUSETTS

Senator BROOKE. Thank you very much, Mr. Chairman.

I am pleased to have this opportunity to appear before the health subcommittee in support of S. 2676, the National Sickle Cell Anemia Prevention Act.

I commend you, Mr. Chairman, for scheduling these hearings so promptly to consider S. 2676 and focus attention on a dread disease that has for too long been ignored while too many have suffered silently, patiently, but painfully.

As you are aware, public attention and concern is a necessary and potent force in marshaling the resources to combat disease.

Americans are a compassionate people, who will not stand idly by while their fellow Americans suffer. But Americans cannot respond best when they do not know the nature of the afflictions and the degree to which victims are afflicted. Sick-cell anemia has, for too long, been the forgotten disease.

✓ Most Americans do not know that in this country today over 2 million people—10 percent of the black population—are carriers of a disease called sickle-cell anemia.

Each year over 1,500 new cases are discovered, and more than 5,000 victims require hospitalization.

The effects of the disease are evidenced by a number of symptoms. Less than half of the victims of the disease live past the age of 20. All of the victims are susceptible to periodic attacks of acute pain, called a sickle cell-crisis, which lasts 4 to 6 days and normally requires hospitalization.

Other general symptoms include weakness due to anemia, jaundice, malfunctioning of various organs, leg ulcers, and a host of other direct and indirect infirmities.

The disease also has the effect of lowering a victim's resistance to other infectious diseases.

So, while many deaths of sickle cell victims cannot be traced directly to the actual sickle cell disease, oftentimes, it is the indirect cause.

Its childhood victims are characterized by thin arms and legs, enlarged and protruding abdomens, and barrel-shaped chests.

As a major hereditary childhood disease, sickle-cell anemia strikes more victims each year than cystic fibrosis, muscular dystrophy, or PKU.

Yet in spite of all its wide incidence and frightening characteristics, the disease has gone relatively unnoticed.

Only in the past few years has the Federal Government begun to realize the seriousness of this anemia.

This fiscal year Congress approved the \$5 million requested by the President to combat the disease.

HEW Secretary Richardson has said that this belated effort comes from "an awareness that it is an area where there is an opportunity to move ahead with significant results."

~ But there is virtually no nationwide volunteer effort underway as there are for other crippling diseases.

✓ Fortunately, there are good research efforts going forward at the Foundation for Research and Education in Sickle Cell Disease in New York, the Sickle Cell Disease Research Foundation in Los Angeles, and by groups at Howard University here in Washington, and by community organizations and hospitals in Massachusetts, Virginia, and Tennessee.

But the revenues of all these volunteer groups combined in 1968 was estimated to be only \$50,000 while volunteer organizations for

muscular dystrophy collected over \$7 million, and cystic fibrosis raised close to \$2 million.

Mr. Chairman, more is known and understood than ever before about the disease and its treatment, yet there is still no medical cure. Present screening and counseling efforts are grossly inadequate for the massive job of reaching the black population.

Since this is an hereditary disease, all black people should be tested to find if they are carriers of the trait.

And most importantly, all black people who are considering having children should be tested and counseled as to the probability of passing both the disease and the trait onto their offspring.

Genetically, we know that individuals who inherit one sickle-cell gene and one non-sickle-cell gene are carriers of the disease, and many or may not suffer from any of the symptoms, and are relatively safe from contracting the disease itself.

But, of the children born of asymptomatic carriers, one child in four will be afflicted by the clinical disease, and two in four will be carriers.

Most certainly, parents should be fully informed of the risks of passing sickle-cell anemia onto their children.

Mr. Chairman, there is much that needs to be done to check and combat sickle-cell anemia. And, there is much that can be done if we commit our energies and resources to this end.

That is why I was pleased to join with you and my other colleagues in sponsoring S. 2676.

This bill would provide \$25 million a year over a 3-year period for screening and counseling centers, and \$5 million over a 3-year period for additional research.

The bill also extends coverage to members of the Armed Forces and veterans.

I should emphasize the importance of this last provision, for in the period from 1943 to 1970, over 518 sickle cell deaths have been reported to the Registry of the Armed Forces Institute of Pathology.

And in a recent convention in Boston of the American Society of Clinical Pathologists, it was reported that eight young Army recruits, aged 19 to 23, died suddenly after strenuous exercise, all victims of sickle-cell anemia.

One pathologist urged that carriers of the trait should be exempted from strenuous duty. I strongly suggest that the possibility of such an exemption be explored.

Mr. Chairman, other witnesses today and tomorrow will reinforce my plea that we seize this opportunity to marshal our energies and resources to control, and hopefully find a cure for, sickle-cell anemia.

Too many have suffered too long. Too little attention has been paid to this dread and crippling disease.

I believe the best response we can now make is the prompt enactment of S. 2676. I urge the Health Subcommittee to favorably consider the Sickle Cell Anemia Prevention Act.

Thank you.

Senator KENNEDY. Thank you very much.

Some of these programs have been very effective, such as dental programs; another one is family planning. Another one would be programs to fight against alcoholism.

I think that in our studies of the health crisis in the Nation, and as we have visited health facilities around the country, it is clear that the American people want this kind of program. If we are going to begin to insure that this Government is responsive, we must adopt this kind of program, modest as it is. But it will be a step in the right direction because it is well designed. With the research that has been done in the past, I think we can be assured that the resources to be appropriated under this act will be put to good use.

Would you not agree with me that this has been one instance where the people have been ahead of the Government; they have been pleading for this kind of program in the field, and that we must really meet our responsibility by accepting the challenge to move ahead in this critical area of health need?

Senator BROOKE. I certainly agree with you, Mr. Chairman, and I am hopeful that your subcommittee will report this bill favorably to the Senate.

I am sure that there are thousands and thousands of people still suffering from this disease, who have no idea of the nature of the disease from which they are suffering. It is just that bad. I do not think we have reached the peak. I just do not know what the percentage will be, but we have now an estimate of 10 percent of the black population have this affliction—it could be higher—but of that 10 percent or more, I am sure it is another large percentage that just has no idea of what is involved at all. We have to reach these people, and the only way to reach them is to expend Federal funds for a successful drive against sickle-cell anemia, so I hope that we will get prompt reporting of this bill, Mr. Chairman, and that the Congress will pass it, that it will be signed by the President, and we can get on with the job that has been delayed far too long.

Senator SCHWEIKER. I just want to compliment Senator Brooke for his interest and leadership in this area, and to say I certainly concur with this sentiment. I think it is because of men like Senator Brooke that Senator Kennedy and I and others are encouraged to take up this fight, and I thank Senator Brooke very much for that.

Senator BROOKE. Thank you.

Senator KENNEDY. Thank you very much for an excellent statement.

Senator BROOKE. Thank you very much.

Senator KENNEDY. Our next witness this morning will be the Senator from California, John V. Tunney, who has introduced this legislation, and who is an expert on it.

STATEMENT OF HON. JOHN V. TUNNEY, A U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator TUNNEY. Thank you, Mr. Chairman.

I want to say I am pleased to be before your subcommittee. I do not think there is any Member of Congress that has demonstrated more interest in the entire health field than you have.

The hearings you held around the country have demonstrated to me that we do need to have a form of national health insurance similar to the bill you have sponsored in the Senate, and I particularly want to compliment you for attempting earlier this year to increase by \$6 mil-

lion the funds that would be available to NIH for research to combat this dreadful disease. I was one who supported your efforts, and I was most disappointed that it was knocked out in conference with the House of Representatives.

Senator KENNEDY. I appreciate the comment. It was well accepted by the Senate Appropriations Committee at the time that supplemental appropriations were considered for the DHEW. Senator Magnuson and Senator Cotton, who are two fine Members of the Senate, were instrumental in having it accepted by the Appropriations Committee. They worked with others, who have a very deep understanding of the problems of health and health needs, to get the appropriations for HEW increased to include \$6 million in addition to the amount requested by the administration. But during the conference with the House of Representatives, there were Members of the House of Representatives that never heard of sickle cell anemia, they never had any understanding of what it was, they had no background or real interest in it. Though we always like to feel that our brothers on the other side have a full knowledge and understanding of these matters, it was really due to lack of information that they were successful with striking out those resources, and I think that the bill we are considering is so well designed that it will eliminate that confusion that attended the earlier congressional consideration of the appropriations measure for sickle cell anemia.

Senator TUNNEY. Thank you very much, Mr. Chairman.

Mr. Chairman, there is a blood disease in this country that kills half of its victims before the age of 20.

Few survive beyond the age of 40 and most are crippled long before death.

It was found to be a deadly killer more than 60 years ago.

It is called sickle-cell anemia and it strikes approximately one of every 500 black persons in this country.

Medical researchers estimate that over 2 million Americans carry the so-called sickle-cell trait. And yet the vast majority of Americans have no idea what sickle-cell anemia is; they have never heard of it.

The people who suffer most from this disease do not live in the suburbs; they do not belong to country clubs; they do not go to private schools; many of them do not have family doctors; many of them never receive any adequate health care. They are black, and they are being ignored.

If this country can vaccinate millions of schoolchildren against the threat of polio; if we have the facilities to perform the major medical miracles that we have all witnessed within the last 15 years, then I say that there's absolutely no excuse why the talent and research facilities of the Federal Government and the commitment and the dollars of the U.S. Congress should not be expended toward eliminating the threat of sickle-cell anemia from every black home in America. To do less is unacceptable. I think it is time that we as a nation make a commitment to end this tragedy.

For this reason, I authorized the legislation you have before you today. S. 2676, the National Sickle-Cell Anemia Prevention Act, creates a national program for the prevention of sickle-cell anemia.

Regrettably, there is no cure for this disease and none on the horizon.

But we can begin to offer the opportunity to learn the nature and risks of the disease.

And we can persist in and strengthen research to combat the disease. I am honored that you, Mr. Chairman, and Senators Brooke and Williams joined me as the prime sponsors of this bill.

And I think the fact that 35 other Senators have joined as co-sponsors is an indication of the depth of commitment in the Senate to act against this disease.

I am also honored to have had the advice and cooperation of District of Columbia Delegate Walter Fauntroy who led a group of 11 members of the Black Caucus in introducing identical legislation in the House of Representatives.

Mr. Chairman, before discussing the basic provisions of S. 2676, I would like to discuss three major points which I think the committee should keep before it in considering this bill.

As you know, 2 weeks ago, as chairman of the subcommittee on public health for the District of Columbia, I held hearings here in Washington on sickle-cell anemia.

Those hearings, to the best of my knowledge, were the first hearings ever held by any committee of the Congress on this tragic disease.

I point this out, Mr. Chairman, to indicate the fact that this has been a terribly and tragically neglected area.

And the full measure of that neglect is the fact that sickle-cell anemia has received the barest imaginable Federal research support. To put it bluntly, the Federal Government just has not cared enough.

I think it is fair to say—and research figures prove the fact—that if sickle-cell anemia afflicted primarily white people instead of black, we would have made the commitment long ago to end this disease.

Take just one example—phenylketonuria, the so-called PKU disease—is a disease that afflicts primarily white persons, and occurs with a frequency of less than 1 in 10,000 births.

For years hospitals have routinely tested white children for this disease.

Sickle-cell anemia occurs with a frequency of 1 in 500, 20 times more frequently than PKU—and yet we still do not have any major programs to test for this disease.

Mr. Chairman, the one thing that came through loud and clear in my recent hearings was that whatever progress has been made thus far has come from dedicated researchers such as Dr. Roland Scott here at Howard University who has worked almost entirely without Federal money.

Last year, we are told, \$2 million of Federal money went to sickle-cell anemia research. Just where that money went, I am not sure. But one thing we did learn in our hearings was that not much of it went to researchers like Dr. Scott. In fact, as he testified before me, Howard University received only \$2,000.

The present administration makes much of the fact that it has earmarked \$6 million in the 1972 NIH budget for sickle-cell anemia—none of which, I might add, was new money. Yet, where is that money going—if it is being spent at all?

The Director of the District of Columbia Health Services Administration testified that the District could not even get \$15,000 from NIH to piggyback a sickle-cell test on an existing testing program of

lead paint poisoning tests. I would like to quote his testimony for the record:

Dr. STANDARD. I would like to state that six months ago we were searching for \$15,000 to add on piggy-back for a lead poisoning program we were conducting throughout the District of Columbia.

It was funded through model cities, it is a good program, and with people knocking on doors, bringing children into the program.

We felt this was a good opportunity for us to piggy-back on top of this existing fairly well-financed program an additional testing for sickle cell.

When we did our costs analysis, we found out it would cost approximately \$15,000.

We searched, but to date we have not been able to come up with the additional funding.

We have, however, done some testing, using other monies from our programs.

Senator TUNNEY. Let me stop you there. You say that you could not get the \$15,000. Where did you search? [Question referred by Dr. Standard to Dr. Shufford.]

Dr. SHUFFORD. We have in many instances, Mr. Chairman, attempted to get monies from NIH. We have gone to such places as HSMHA, which is responsible for the family planning section.

We talked with a Mr. Namkins there, and we have been unable to come up with any funds.

Senator TUNNEY. You could not even get the \$15,000 from NIH?

Dr. SHUFFORD. We have not been able to get \$15,000.

Senator TUNNEY. What about the \$6,000,000 that have already been earmarked?

Dr. SHUFFORD. What was told us, concerning the \$6,000,000, that had been earmarked by the President, that it went to NIH to be used mainly for hardcore research, which takes it out of the realm of what we wanted to do.

Mr. Chairman, in the face of that record, I think the mandate upon this committee is clear.

A second point concerns yesterday's announcement by HEW Secretary Richardson of the recommendations of the HEW Sickle Cell Disease Advisory Board.

Mr. Chairman, I welcome the administration's interest in this area. I wish it had existed long ago, and I wish it were stronger.

I will not comment on the timing of this release—just 2 days prior to the commencement of these hearings.

I am gratified, however, that at the very least, the announcement demonstrates that the administration has read our bill.

Each provision of S. 2676, which we introduced over a month ago, after 6 months of extensive research and consultation with physicians, researchers, and other members of the black community, has been included in the advisory committee's recommendations to Secretary Richardson.

Mr. Chairman, I think that fact confirms the merits of this bill.

I would add, however, that the announcement also reveals the need for action on this bill, because the administration's proposals are most inadequate in terms of funding.

The advisory committee's recommendations call for no new funds—they simply allocate existing inadequate funds in an inadequate manner for a program which is itself inadequate.

The true measure of the inadequacy of those recommendations was demonstrated in our hearings 2 weeks ago.

Four separate witnesses, including Dr. Scott, the Black Athletes Foundation, and representatives of the D.C. government, told us that it would take \$4 to \$5 million to run a comprehensive program in the

District alone. Yet that is more than the amount which the administration is prepared to spend nationwide.

Let me point out another thing—I think we ought to be told just what is happening with that \$6 million which was earmarked in the 1972 budget.

First we were told that it was going for increased research. But, as Dr. Scott pointed out so eloquently, if it is going for research, it isn't going to those who have been doing the research.

Now we are told that it is not for research after all but would be used to fund this new proposal. If it is used for that purpose, I wonder if any of the centers it would fund would include the center at Howard University or Meharry Medical School.

That, Mr. Chairman, is my third point—money for any program against sickle cell anemia should begin with those institutions which are treating black people—institutions like Howard and Meharry.

Dr. Emerson Walden, the current president of the National Medical Association, stated that most eloquently in the hearings which I held last month:

Dr. WALDEN. We urge that funds for research, treatment, and so forth, of the disease be funneled directly to the two medical schools which have traditionally worked with this problem.

Howard University, College of Medicine which is located here in the District and Meharry Medical College in Nashville, Tennessee.

It is a sad story of history that funds controlled by NIH seems to be funneled to universities like John Hopkins, Harvard, Yale, Georgetown and Columbia.

THE NATIONAL SICKLE CELL ANEMIA PREVENTION ACT

The National Sickle Cell Anemia Prevention Act has four basic provisions:

First, a coordinated Federal grant program of \$25 million per year for 3 years for research, voluntary screening, and counseling and public education;

Second, a demonstration grant program of \$5 million per year for 3 years for the development of centers for research and research training in sickle cell anemia;

Third, a requirement that the Department of Defense implement a policy to provide voluntary screening, counseling, treatment, and education concerning the disease for servicemen, civilian employees, and inductees; and

Fourth, similar programs by other Federal agencies which provide direct health care for persons eligible in such agencies, namely the Veterans' Administration and the Public Health Service.

It is the purpose of this bill to provide a coordinated effort against sickle cell disease as a major public health problem and provide the means to combat it.

Thus, a primary purpose of the bill in addition to research, is to provide funds for the creation of community screening and counseling programs.

VOLUNTARY SCREENING

A simple and inexpensive test to detect the sickle cell trait has been available for many years.

Only rarely, however, have individuals had the opportunity to know in advance of marriage or in advance of childbearing that they were

trait carriers. Hence, parents usually learn they carry the trait only after they find to their sorrow that a child is born with the disease.

In order to screen, on a voluntary basis, as many people as possible, this bill would provide funds, for example, for school districts to screen their students.

Such screening could supplement other school health service programs such as physical examinations, eye testing programs, and immunizations.

Neighborhood health centers, clinics, hospitals, and mobile health units would be able regularly to include the sickle cell test.

Using such screening, Dr. Joseph Bellizzi, supervising physician for the Hartford, Conn., school system recently directed a major program which offered screening to 3,456 black children of high school age, finding 301 carriers of the trait and four cases of sickle cell anemia.

Screening programs such as this can offer the first opportunity for persons to learn whether they carry the trait and what the risks and dangers are for their children.

Similarly, parents who learn that one of their children has the trait would be able to seek similar tests for themselves and their other children.

VOLUNTARY COUNSELING

For persons who learn through screening that they possess the trait, the bill provides funding for voluntary counseling services to gain information on the disease and the risks involved.

Thus, possibly for the first time, a person with the trait can learn beforehand the chances that his children might have the disease and what it will mean for their lives.

PUBLIC EDUCATION

Finally, the bill provides funds for programs to educate the public about the nature of sickle cell anemia and the inheritance of the sickle cell trait.

As Dr. Scott has pointed out, few people know what the disease is or how to learn whether they have the trait.

Fortunately, a number of public spirited organizations including radio and TV stations, are beginning such education programs.

Thus, for example, in Hartford, Conn., station WTIC began a drive to do something about sickle-cell disease.

They ran a public education-type program on sickle-cell anemia and then began a campaign to raise money for research at the Sickle Cell Anemia Center at Howard.

As a result of the station's efforts, \$34,000 was raised for the center.

Similarly here in Washington, TV station WRC conducted a five-part series on sickle-cell anemia, a major and most impressive commitment of time and effort by that station.

The importance of such programs and the importance of screening programs was given most dramatic emphasis when the station's reporter took the test for sickle cell for the first time and learned that she had the trait.

This bill will provide funds to conduct similar public education programs toward the goal that all people may be informed about the

disease and its risks and have the opportunity to seek the sickle-cell test.

DEMONSTRATION FUNDS

A second major thrust of the bill is demonstration funds for the development of centers for research, screening, counseling, or treatment.

Funds would be available to public and nonprofit private institutions such as medical schools, hospitals, and foundations.

A principal focus of this provision is to provide funds for centers such as the very fine one at Howard University founded by Dr. Roland Scott.

Funds under this provision are intended in particular to provide the opportunity for institutions such as Howard and hospitals which serve large black communities to establish major programs against sickle-cell disease.

PROGRAMS IN THE MILITARY

In addition to grant programs, however, the bill also focuses heavily on the need and opportunity in the Armed Forces and other Federal agencies which provide health care, to offer screening, counseling and where appropriate, treatment for sickle-cell anemia.

It requires the Secretary of Defense to implement a policy to offer servicemen—and their dependents—civilian employees of the Department, and persons examined at induction centers the opportunity to learn if they carry the trait by screening tests at no cost to the individual.

It provides that such a program should include the opportunity for voluntary counseling for persons who have the trait and education of personnel regarding the availability and cost-free nature of such services.

Programs such as those provided in the bill are particularly important in the Military Establishment because of the opportunity to reach large numbers of young people.

In addition, it is particularly important for those who may have the trait to learn that fact in order to avoid certain high-stress duties, such as high-altitude flying, which may be dangerous to those with the trait.

Using one screening method, the director of the Blood Transfusion Division of the Army Research Institute at Fort Knox, Ky., has screened over 5,000 recruits in the past 18 months.

Approximately 200 persons learned they had the trait. If such screening were widely available, events such as the tragic deaths of four recruits with the trait at Fort Bliss, Tex., last year might have been avoided.

Although persons with the trait are generally not in danger, in some instances of high-stress activity some such persons can develop severe complications.

Thus, the programs required by the bill would allow anyone connected with the military to have the opportunity to learn if he or she has the trait.

Other sections of the bill provide the same opportunity for screening, counseling, and treatment in the Veterans' Administration and the Public Health Service.

VOLUNTARY PARTICIPATION AND CONFIDENTIALITY

Finally, the bill contains strict requirements to assure the voluntary nature of all programs funded or conducted pursuant to the National Sickle Cell Anemia Prevention Act and provides for protection of individual privacy by strict requirements of confidentiality.

Thus, participation in screening or counseling programs carried out under the act would be entirely voluntary. In addition, test results would be held confidential. Both of these provisions are particularly important, I believe, in order to avoid any misinterpretation of the basic purpose of programs under this bill.

It would be indeed tragic if any person should gain the impression of racial prejudice or discrimination as a result of these programs. Lest there be any doubt on that score, we have included the very strict provisions I have just described.

This bill would coerce no one. Instead, it would affirm the dignity of individuals by providing the facts needed for free and informed choices.

It is my belief that this bill will make a major contribution to the prevention and treatment of sickle-cell disease.

Mr. Chairman, the first time that sickle cell anemia came to my direct attention was earlier this year, when Dr. Phil Lee, who is connected with the University of California Medical School, came to my office to tell me that he thought this was a disease that was perhaps the most overlooked disease in the Nation. He suggested that the Congress ought to take action. As a result of my conversation with him, I felt this was a disease that had obviously not received anywhere near adequate attention from either the Federal Government or from private charitable foundations. The more study I did, the more I became convinced that the reason for this neglect was because it is a disease that primarily affects black people. This disease has a dramatic impact on the black race. One out of every 500 black children born is affected by sickle cell anemia, and the neglect demonstrates to me that there has been discrimination in the way we have allocated our Federal health research resources in this country. I think that the time has come that we recognize that we have got to do something about it.

I can assure you, Mr. Chairman, that it is clear in my mind that if we had a disease that affected one out of every 500 white children, and that if 50 percent of those children died at about the age 20 and almost all of them died before the age of 40, with the kind of excruciating pain and complications that occurs with sickle-cell anemia, we would have had a massive research effort long, long before this.

Now, Mr. Chairman, as you know, I am the chairman of the Public Health Subcommittee of the District of Columbia, and 2 weeks ago I held hearings here in Washington on sickle-cell anemia.

Those hearings, to the best of my knowledge, were the first hearings ever held by a committee of the Congress on this tragic disease. I point this out to indicate the fact that this has been a terribly and tragically neglected area, and the full measure of this neglect is the fact that sickle-cell anemia has received the barest imaginable Federal research support.

To put it bluntly, the Federal Government has not cared enough.

Now, at the hearings it came through loud and clear that a lot of

money would be needed just here in the District of Columbia. We were told, for instance, that about \$5 million would be needed in the District of Columbia to have an adequate program for screening, for counseling, for treatment, for education, and for research, with the assumption that we were to use the facilities of Howard University where Dr. Scott, a pioneer in research for the past 20 years, has been working.

Last year we were told that \$2 million of Federal money went to sickle-cell anemia research.

Just where that money went, I am not sure, but one thing we did learn at our hearings was that not much of it went to researchers like Dr. Scott.

In fact, as he testified before me, Howard University received \$2,000.

The present administration makes much of the fact that it has earmarked \$6 million in the 1972 NIH budget for sickle-cell anemia—none of which, I might add, was new money.

Where is that money going, if it is being spent at all?

The Director of the District of Columbia Health Services Administration testified that the District could not even get \$15,000 from NIH to piggyback a sickle-cell test on an existing program of lead-paint poisoning tests.

In my testimony, I quote from the colloquy between Dr. Standard and Dr. Shufford and myself. A measly \$15,000 was not available through NIH for the screening program in the District last year.

A second point concerns yesterday's announcement by HEW and Secretary Richardson on the recommendations by the HEW Sickle-Cell Anemia Advisory Board.

Mr. Chairman, I welcome the administration's interest in this area. I wish it had existed long ago, and I wish it were stronger.

I will not comment on the timing of this release—just 2 days prior to the commencement of these hearings—but the fact is, the amount is inadequate.

They are talking in terms of \$5 million. As I indicated, that would be adequate for the District of Columbia alone, but certainly not for a nationwide program.

Senator KENNEDY. Senator Tunney, we requested that information from NIH.

We have Dr. Zapp here this morning, and we are hopeful he will be able to enlighten us on this. I hope he will be able to give us that information.

It is terribly important to think if the money is expended, this would be the best place to try to use those resources in the District of Columbia, where you have such a profound expert. It does surprise me, and we will find out where that money is going, and we will ask HEW to give us that information, and we will have the GAO to look at it.

Senator TUNNEY. I am happy to hear that. I think this brings me to a third point I would like to make, before getting into a discussion of the bill itself.

Besides being told just what is happening with this \$6 million, which was earmarked in the 1972 budget, I think we ought to know to what institutions it is going.

I would like to point out that witnesses we had before our committee indicated the money was not going to those institutions that

have been doing pioneer work in research for sickle-cell anemia for the past 20 years.

Dr. Emerson Walden, the current president of the National Medical Association, stated most eloquently in the hearings that we held last month, and I quote:

We urge that funds for research, treatment, and so forth, of the disease be funneled directly to the two medical schools which have traditionally worked with this problem.

Howard University, College of Medicine which is located here in the District and Meharry Medical College in Nashville, Tennessee.

It is a sad story of history that funds controlled by NIH seem to be funneled to universities like Johns Hopkins, Harvard, Yale, Georgetown and Columbia.

The point I think he was making is that the black universities which have been most interested in doing the research in the past, ought to be considered for funding if this legislation passes the Congress, and if moneys are made available. Even if it does not pass, these universities should be the primary recipients of moneys presently available under the HEW budget. Otherwise, there will be in essence a discrimination against these black universities in favor of more traditional universities which have not shown any particular concern until very recently. I think this is most important; this point could be made very eloquently by Dr. Scott and others who will testify before you. We can make sure that the moneys that are allocated to sickle-cell research go to sickle-cell research and do not go to related diseases or unrelated diseases. I think Dr. Scott will make this very clear before your committee as he did before mine. One of the best ways we can guarantee that sickle cell will be the disease where the moneys are mainly directed, is to give it to the universities that have been traditionally doing research on it.

Mr. Chairman, as a cosponsor of the legislation, you are well aware of what the bill provides.

I would like to just highlight two or three points. No. 1, it provides for voluntary screening. I feel that is most important. I do not think it should be a mandatory program.

Inasmuch as the disease mainly strikes blacks, I think a program that stated in so many words that all black people had to be screened—and not white people as well, Orientals, or whatever it might be—that many persons would take offense. Many black people would take offense, as I rightly think they should; so I think it should be a voluntary program.

No. 2, the program provides money for counseling, and it provides money for public education. These are both very important.

The bill provides demonstration funds, and it provides programs for the military, for the public health services, and for the Veterans' Administration. These three agencies of Government are directly concerned with health delivery to the population of our country. That is why these three agencies would be given money and required to give screening programs to those people whom they regularly provide health services for. There would also be counseling and treatment programs.

Senator KENNEDY. Let me ask you, Senator Tunney, as I understand it, we are screening all returning servicemen from Southeast Asia for drugs, are we not?

Senator TUNNEY. It is my understanding that all of the servicemen coming back from Southeast Asia are being screened.

Senator KENNEDY. So you are suggesting there is no reason we could not screen all servicemen going into the Armed Forces of the United States in terms of this as well.

As I remember, having served in the Armed Forces, servicemen are tested for a variety of different kinds of illnesses and diseases, they are given numerous kinds of shots, and I think what you are suggesting now is that we ought to have the mechanism established to provide testing for sickle-cell anemia. Testing programs should at least be available to inform those who are concerned. Many people want to know whether they have the trait or not, and I suppose for a great number of citizens, testing programs would provide an extraordinary sense of relief to learn that they are not in any way affected by this trait, would you not agree?

Senator TUNNEY. Yes, I think that is true. If it were a part of routine medical testing, when entering the service. But I do not think that black people ought to be singled out for a mandatory screening program just because they are black.

Senator KENNEDY. But do you agree with me that many black people would like to be tested if they had the facilities to go to some place where this service was available to them.

Senator TUNNEY. That is true. I think it is absolutely true.

Senator KENNEDY. As a matter of fact, the leadership has really been provided by the Black Athletes Foundation, Dr. Scott of Howard University and, many other groups in this area. They have challenged the Congress to take some kind of meaningful action, and I think your bill does just that.

Senator TUNNEY. And then there is the importance of education. It is so incredibly important.

I have heard in private discussions that maybe as many as 40 to 50 percent of the black people in this country are not even aware of the disease, so public education is extremely important in this area.

Senator KENNEDY. Well, I want to again commend you for this.

I understand there are a number of communities in California that have developed voluntary programs, are there not?

Senator TUNNEY. Yes, we have voluntary groups in Los Angeles, but it certainly is inadequate.

It is completely inadequate.

I had an opportunity to talk to a doctor recently who has been very involved in research on sickle cell anemia. He told me that the terrible, terrible tragedy is when you find a family that had a sickle cell anemia child who has been tested and determined to have the disease. There is really nothing you can do for them other than give them advice on how to treat the child in order to cut down on the pain. There is no way that you can offer the patient any hope that the disease will be cured.

Senator KENNEDY. So what happens to them?

Senator TUNNEY. What happens to them is that many families spend thousands of dollars that they cannot afford to spend. They get themselves into a financial condition that in many instances could lead to dissolving the family. This is one of the reasons, by the way, that we need a National Health Insurance program.

Senator KENNEDY. What happens to the children of those affected with the trait?

Senator TUNNEY. Of the children who have the disease, 50 percent die before the age of 20 and almost all of them die before the age of 40. In addition, they have excruciating pain as you will hear in the testimony.

Senator KENNEDY. And the point you are making is that with this legislation, tremendous progress can be made with Federal help and assistance to avoid an increase of that kind of tragedy?

Senator TUNNEY. Absolutely.

Senator KENNEDY. You are emphasizing that we can provide counseling, and we can provide screening, and we can avoid the kind of personal tragedy and loss of life and all of the attendant kinds of tragedies which parents feel for their loved ones, their children, who may have the sickle cell trait or suffer from sickle cell disease. Would you agree with that?

Senator TUNNEY. Absolutely. Of course. With young people, I suppose it could have a tremendous impact on them. If both of them were just carrying the trait, it could have an impact on the decision to have children.

Senator KENNEDY. Would you not agree with me, that over on the floor of the Congress and in the Senate of the United States, we are constantly appropriating money for research, in a wide variety of different areas, like health, that are pilot or demonstration programs which seek to determine what ought to be done. But with this kind of money, we know that we can save lives.

We know for every dollar that is invested, we can really save lives and alleviate suffering, and alleviate hardship, and we know what the results are going to be; would you not agree that these kinds of programs ought to have a higher priority?

Senator TUNNEY. I could not agree with you more; 50,000 to 60,000 people in this country, as a minimum estimate, have sickle-cell anemia and, of course, hundreds of thousands more have the trait. Last year we spent \$2 million for research at the Federal level, and nobody seems to know where the money went. I certainly hope you will find out by the end of these hearings where the money did go.

Senator SCHWEIKER. I do want to commend Senator Tunney for his interest and his leadership in alerting the people of the country and the Congress to this problem, and I read with great interest the rather sad statistics on this disease.

I just want to say, I think statistics are one thing, and I just wonder if we would not have more action if more Senators knew a little more firsthand that these statistics have an impact.

I know in my own case a 29-year-old member of my staff died of this disease just a short time ago, and I think if more Senators understood the impact of the statistics, we would have a lot more action than we do now. I commend Senator Tunney for his way of bringing to the public this alert, and I wish him to know that he will have our full support.

Senator TUNNEY. Thank you very much, Senator.

It is very kind of you.

Senator KENNEDY. I want to thank you very much, Senator.

We will try to move this legislation as fast as we can.

You can be assured of our support.

Senator TUNNEY. I just want to say, Mr. Chairman and Senator Schweiker, that I am most appreciative of the opportunity you have given me to testify. More important, I think that the extraordinary leadership you have shown, not only of being interested in related matters, but calling for hearings on this bill so soon after it was introduced demonstrates the depth of your commitment.

Senator KENNEDY. Thank you very much.

Our next witness is Hon. Dan H. Kuykendall, republican, of Memphis, Tenn.

Congressman Kuykendall graduated from Texas A. & M. University with a B.S. in industrial education.

After serving in the Air Force, he joined the Procter & Gamble Co., and was a manager in Corpus Christi and Houston before going to Memphis as general manager in 1955.

His activity in civic affairs in Memphis included work in the cancer crusade.

He first came to the U.S. Congress in 1966, and has been reelected ever since.

Congressman Kuykendall, we welcome you here before the Health Subcommittee. We know you are very interested in this matter, and that you are interested in the board issues of health generally.

We want to extend a warm welcome to you.

We understand the Health Subcommittee in the House will hold hearings tomorrow. Hopefully with your very able assistance we can get this bill approved by the Congress before the end of the year.

STATEMENT OF HON. DAN KUYKENDALL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TENNESSEE

Mr. KUYKENDALL. Thank you very much, Mr. Chairman.

It is a pleasure to appear before you this morning to express my wholehearted support for S. 2676, the National Sickle Cell Anemia Prevention Act.

I wish to begin by complementing Senator Tunney, my old friend and former House colleague, for his yeoman work in this field.

As you all know, the funds that would be authorized by this bill are divided into two parts—\$25 million a year for the next 3 fiscal years for screening and counseling, and an additional \$5 million a year for basic research and testing of treatment methods.

In other words, sociological funds and scientific funds.

That is precisely the way I view the entire problem of sickle-cell anemia—as a two-headed monster, sociological and medical.

I think the distinguished junior Senator from California and I are in complete agreement, that the crying need in this field, and the general goal of this legislation, should be to increase public awareness and public understanding of sickle cell anemia.

It is undoubtedly true that heart disease and cancer kill more black Americans each year than does sickle cell anemia, but most Americans, black and white, are aware of the danger signals associated with these more familiar diseases.

Few Americans, black or white have ever heard of sickle cell anemia, let alone appreciate its danger signals and complications.

I wonder how many of the Senators serving on this subcommittee who feel they know something about this disease realize that in many cases it requires emergency treatment.

Sickle cell anemia is excruciatingly painful. A terrorizing collection of symptoms attend this disease. But there is more or to than pain and suffering.

The sociological problems of sickle cell anemia must be considered along with what we hope will be an ultimate scientific cure.

We have found in our attempts in demonstration projects in the city of Memphis, which has one of the largest concentrations of black people in the Nation, that if this problem is not properly presented to the people, there appears immediately a stigma which makes the citizenry reluctant to submit to a screening test.

We have found that the best way to explain this disease is to give the true historical background.

Being a carrier of the sickle cell anemia trait is not a weakness. It is not a stigma. Actually, it is an historic strength.

The sickle cell trait is historically a protection from malaria. It developed through the centuries among residents of malarial areas.

Progress is being made at the University of Tennessee medical units Memphis in one area of sickle cell research—that of chemotherapy.

It is for this area of research that I have been trying to get additional funds for the University of Tennessee.

Using chemotherapy doctors in Memphis have been able to reduce the length of attacks and their severity to some extent.

One of the byproducts, and I think it is a completely natural one among the young, due to the intensive pain of sickle cell anemia, is the tendency to turn to narcotics.

Sickle cell anemia victims turn to drugs not for the reasons that other young persons do, but simply to get relief from the excruciating pain.

So, in short, we must not only educate those people who might be carriers of the sickle cell trait, but we must also educate the rest of the country to the seriousness and the full ramifications of the disease.

The genetic charts that you use in studying sickle cell anemia are very clear.

If two carriers marry each other, half of their children will have the disease itself and will be doomed to a life of pain.

However, if carriers do not marry each other, there is practically no possibility of an infected child emerging.

Congressman Fauntroy ably pointed out recently that it is a more prevalent disease than leukemia, than cystic fibrosis, and actually more painful.

I must give credit for my interest in this subject to two of the outstanding researchers in the field, a husband-and-wife team at the University of Tennessee, in Memphis, who have spent a great many years in it.

They are Dr. Lorraine Kraus, who is a Ph. D., and Dr. Alfred Kraus, a distinguished M.D.

My personal involvement has been sharpened and intensified by my association with these two experts, but it stems from something much

more basic than that—it stems from the simple fact that there are a lot of people in my district affected by sickle cell anemia.

The Krauses tell me, and I think it is generally accepted, that between 8 and 10 percent of the Nation's black population has the sickle cell trait, and that one out of every 40 of those with the trait actually suffers from sickle cell anemia.

Translate that into my district—just one congressional district in this Nation.

There are approximately 720,000 people in Shelby County, Tenn. Of those, 36.9 percent, or about 266,000, are black.

Using the Krauses' percentages, that means from 22,000 to almost 27,000 people are walking around with the trait of this disease.

If we had 22,000 people in Memphis with a cystic fibrosis trait—just the trait, mind you, not the disease itself—we would have a public health crisis that would make headlines all over the world.

We must do something, we must do much, much more than we are doing, to attack sickle cell anemia on every front—through continuing research, and, above all, through education of the people, education of those susceptible to it to recognize its symptoms, education of our medical professions to treat it, education of the rest of us—and that includes the Congress—to give sympathetic understanding and help where it is needed.

A measure of that help and understanding is now being given by an organization that deserves much credit—the Black Athletes Foundation.

Led by Willie Stargell, the cleanup hitter of the world champion Pittsburgh Pirates, and Muhammad Ali, the former heavyweight champion, this private foundation is doing much to alert the public to the symptoms and danger signs, and to urge blacks to take a simple blood test.

One of the most popular areas of public misunderstanding—and here is where we must take immediate steps toward our educational efforts—is that the trait is not the disease.

The person carrying the trait is exactly like the man whose second cousin may be mentally retarded.

He himself is perfectly healthy, but if he were to marry someone whose grandmother had a retarded child, that couple might possibly have a retarded child themselves.

That is a trait, just like blue eyes are a trait, just like sickle cell blood is a trait.

Nobody, particularly if he or she looks healthy and feels healthy, likes to be told he has a "disease."

The word "carrier" brings to all of us the image of Typhoid Mary.

A large dose of education, seasoned with a milligram of salesmanship, could go a long way toward removing the stigma that the very word "disease" carries with it.

I strongly suggest that the words "disease" and "carrier" be stricken from our vocabularies when we are talking about the trait.

I was heartened, just yesterday, to learn that the National Heart and Lung Institute has allocated almost half of its funds for this year for education and counseling.

As you all know, President Nixon took the initiative earlier this year, earmarking \$5 million of the Nation's health budget for sickle

cell research and counseling, and the Heart and Lung Institute is now geared to putting its money where it will do the most good.

Mr. Chairman and gentlemen of the committee, now is the time for Congress to single out sickle cell anemia as a national objective, and to give our researchers and our sociologists the money they must have to conquer that objective.

Thank you very much.

Senator KENNEDY. Thank you very much.

Senator Schweiker has some questions for you, I believe.

Senator SCHWEIKER. I want to commend the Congressman very much for a very interesting, clarifying, and thought-provoking statement.

I had the privilege of serving in the House, and I know of his keen interest and dedication to his work. I thought you made some very interesting points that I would like to review with you for just a comment. I think the malarial background of the disease is something that is not well known.

I think this is something that should be brought out, because it ties in well with your whole concept, of not calling it a disease. And I feel this proves that it is a genetic problem which in itself would go a long way toward easing the stigma that has affected many of these situations.

Mr. KUYKENDALL. Senator, if you would yield for a moment here, I think when we talk about selling the sickle cell anemia screening programs, we must emphasize the positive aspects of the sickle cell trait. An individual who has the sickle cell trait and desires to become a missionary in Africa would never have to worry about malaria.

He is stronger in that area than other people are, and I wonder why we do not use some of the strengths and the positive aspects of this trait instead of emphasizing the "disease."

If you have the disease, you know it, but you can have the trait without knowing it.

Senator SCHWEIKER. Will you describe a little bit of the progress your friends are making?

What kind of hope do they hold out about the ultimate solution of this problem?

I am thinking more of the long-range picture. I realize it is not in the immediate future, but what is their outlook with proper funding, proper focus, and concentration of resources of getting a cure for this trait?

Mr. KUYKENDALL. Senator, as I mentioned, chemotherapy is treatment of people already infected to try to cut down on the pain and the length of their attacks.

They are making some progress.

Senator SCHWEIKER. What you described is no relief for those who are destined to die.

Mr. KUYKENDALL. It is an expediency only.

Now, the next step, they have learned what happens to the cell that allows it to sickle. They know the shortcomings of the cell that allow it to sickle, and that is about as far along as I can understand them.

I am no scientist and when doctors start talking to me about this chain of events that is happening, they tell me that they are not far enough along to promise any results as far as a timetable is concerned,

but they have learned a lot about the conditions that are wrong with that cell, and you and I know that that is at least a first step.

Senator SCHWEIKER. I thought your description of your people, and how you broke down the explanation, was very graphic.

I wonder if you could give us one more statistic, if it is not too complicated? Of the people you singled out, how many ultimately die?

Mr. KUYKENDALL. They actually die at an early age. Half of them will die before they are 20, and practically all of them will die before they are 40 due to the severe anemia. I talked to Dr. Kraus yesterday afternoon, I asked her specifically what they die of.

People who have cancer sometimes die of pneumonia, and other things, because their condition is totally weakened. These people have a tendency toward ulcers and boils because their blood vessels close up, because of lack of proper nourishment, so they all die at an early age, but only after suffering pain such as I am sure most of us have never even witnessed.

Senator SCHWEIKER. Also, as I am sure you know, the star leftfielder from Pittsburgh, Willie Stargall, from my State, who has done a great job in leading the Black Athletes Foundation, will be testifying tomorrow before the committee. I see you have referred to his work and to his activity here.

That is all of the questions that I have. I certainly appreciate your interest, and I want to assure you that this committee will meet its responsibilities and bring out a bill. We look forward to your leadership.

Senator KENNEDY. Thank you very much for your very fine statement.

Mr. KUYKENDALL. Thank you very much, Mr. Chairman.

Senator KENNEDY. Our witnesses for the administration this morning are Dr. John Zapp, Deputy Assistant Secretary for Legislation (Health), at the Department of Health, Education, and Welfare; Dr. Frank Beckles, Director for Family Planning Services HSMHA; and Dr. Robert L. Ringler, Deputy Director of the National Heart and Lung Institute, NIH.

Dr. Zapp received his B.A. from Boise College in Idaho; his D.D.S. from Creighton University School of Dentistry; and did graduate studies in dentistry at the University of Washington and the University of Oregon. He also has done postgraduate studies in political science at Portland State College.

As Deputy Assistant Secretary for Legislation, he serves as adviser to the Secretary of Department of Health, Education, and Welfare on the development of the Department's legislative program in the health field.

To assist in the implementation of the Secretary's policies relating to health, he directs the preparation of staff papers and other materials.

Dr. Beckles is responsible for establishing the operational philosophy, organizational structure, program direction, and contents for the National Center for Family Planning Services.

Dr. Ringler is responsible for program planning in the areas of heart disease, lung disease, and blood diseases and blood banking.

His main personal interest is in biochemistry.

Welcome to the subcommittee, gentlemen.

STATEMENT OF DR. JOHN ZAPP, DEPUTY ASSISTANT SECRETARY FOR LEGISLATION (HEALTH), DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE; ACCOMPANIED BY DR. FRANK BECKLES, DIRECTOR FOR FAMILY PLANNING SERVICES, AND DR. ROBERT L. RINGLER, DEPUTY DIRECTOR OF THE NATIONAL HEART AND LUNG INSTITUTE

Doctor ZAPP. Thank you very much, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I am pleased to appear before you today to discuss the problem of sickle cell disease and more specifically S. 2676, the National Sickle Cell Anemia Prevention Act, and related bills. I will use this occasion, also, to provide a status report on the sickle cell disease program that has been launched within the Department at the direction of the President in his health message this February.

Before discussing the bill, I would like to briefly describe the disease.

SICKLE CELL DISEASE

Sickle cell disease is an inherited blood disorder. It is due to a genetically determined change in the chemical substance, hemoglobin, which is responsible for the oxygen-carrying capacity of the blood. The presence of this abnormal hemoglobin, commonly referred to as hemoglobin S, leads to distortion of the normally spherical red blood cells. The distorted red blood cells take on the shape of a sickle, hence the name sickle cell anemia.

The disease may occur in two forms: A relatively benign form referred to as sickle cell trait; and the severe form, sickle cell anemia.

Carriers of sickle cell trait typically do not experience ill effects from the disease except under conditions of extreme physical stress or diminished oxygen supply. However, each offspring from two carriers of the trait has a 25 percent chance of having the overt disease, sickle cell anemia, a 50 percent chance of carrying the trait, and a 25 percent chance of being free of the disease. Said another way, on the average, 1 in 4 of the children would be expected to have normal hemoglobin, one in four would be expected to have the anemia, and 2 in 4 to have the trait.

Since carriers of the trait typically do not experience ill effects from the disease, they may not be aware of the hazard of bearing children with the overt disease if they unknowingly happen to choose a mate who is also a carrier of the trait. It is for this reason, among others, that so much emphasis is placed on screening for the carriers of sickle-cell trait and on medical counseling of those found to be positive.

Unlike the carriers of sickle-cell trait, patients with sickle-cell anemia experience frequent painful crises which are caused by blockage of normal blood flow in small blood vessels by the sickled red cells. Normal spherical red cells easily flow through small blood vessels. The distorted sickle-shaped red cells tend to form "log jams" which stop the flow, thus depriving the surrounding tissue of normal oxygen supply which in turn causes severe pain in the affected area.

At the present time, treatment of these most painful crises is aimed mainly at relief of pain, although newer forms of therapy offer some promise of our being able to shorten the crisis by hastening reversal of the sickling phenomenon. It must be emphasized that such therapy must still be regarded as being in the investigational phase of development.

Although the so-called "sickle-cell crises" are the most prominent symptom of the disease, the patients also have other symptoms. Their growth and development may be retarded, and they may have leg ulcers, jaundice, kidney problems, and an increased susceptibility to infection in general and pneumonia in particular. Some of these symptoms come from the severe anemia that results from the fact that the sickled cells are easily destroyed and cannot be replaced as fast as they are lost.

Detailed statistics on the prevalence of sickle-cell disease are currently not available. However, it is estimated that about 2 million black Americans are carriers of the trait. A few other ethnic groups of Mediterranean origins have a greatly lower incidence rate. About 1 in 500 black infants is born with sickle-cell anemia. This means that approximately 1,000 black infants are born each year with sickle-cell anemia and it is estimated that between 25,000 and 50,000 individuals are currently afflicted with it. Sickle-cell anemia kills many of its victims before the age of 20, few survive beyond the age of 40 and most are disabled before death. Because sickle-cell disease is caused by a genetic abnormality, there is no way known at present to cure the disease in these individuals. As mentioned earlier, current methods of treatment are aimed primarily at alleviating the pain.

BACKGROUND

Sickle cell anemia has been recognized since 1910 when J. B. Herrick first noted the peculiar "sickle" shape of the red blood cells of a West Indian student in Chicago. It was later learned that under conditions of deoxygenation, red blood cells of sufferers from the disease characteristically assume the sickle form. In 1949, Linus Pauling and his coworkers demonstrated that the disease results from the presence of abnormal hemoglobin (hemoglobin S) within the red blood cells of the patient. Many others have contributed to our knowledge of hemoglobin S including Dr. Makio Murayama, a member of the staff of the National Institute of Arthritis and Metabolic Diseases, who worked out the detailed special configuration of this molecule in his laboratories at NIH. He is continuing his fundamental physiochemical studies of sickling.

The present state of research in sickle cell disease presents a frustrating picture. The molecular basis for the disease is quite well understood from the work of many investigators. Yet researchers have been unable to produce a form of therapy which prevents the clinical manifestations of sickle cell anemia. Recently, new forms of treatment such as the use of urea have been introduced. These may make it possible to reverse sickling and thereby shorten or even prevent the painful crises.

DESCRIPTION OF BILL

Now I would like to turn to the bill before this subcommittee. S. 2676 would amend the Public Health Service Act to establish a sickle cell anemia prevention program consisting of two major parts:

(1) Authority for grants to and contracts with public and nonprofit private organizations to assist in the establishment and operation of voluntary sickle cell anemia screening and counseling programs, and to assist in developing and making available to the public, information and educational materials relating to sickle cell anemia.

(2) Authority for grants and contracts for research and research training in the diagnosis, treatment, and prevention of sickle cell anemia; development of programs to educate the public regarding the nature and inheritance of the sickle cell trait and sickle cell anemia; and the development of centers for research, testing, counseling, prevention, or treatment of this disease.

Other provisions of the bill call for a program to be established for eligible persons treated by the Public Health Service; annual reports by the Secretary, HEW, on the administration of the sickle-cell anemia program; authorization for the Secretary of Defense to provide for screening and counseling of members of the Armed Forces and their dependents, civilian employees of DOD, and all persons examined by the Armed Forces, for the sickle-cell trait and sickle-cell anemia; and requiring notification and a program to be set up by the Veterans' Administration for all persons eligible for medical care under title 38, United States Code, for screening, treatment, and counseling with regard to sickle-cell trait and sickle-cell anemia.

The seriousness of this disease and the lack of attention paid it in the past were recognized by the President in his health message of February 18, 1971, when he said, "It is a sad and shameful fact that the causes of this disease have been largely neglected throughout our history. We cannot rewrite this record of neglect, but we can reverse it."

To this end, he proposed increasing the budget for research and treatment of sickle-cell disease fivefold, to a new total of \$6 million.

This administration is fully committed to doing everything possible to cope with the many and varied problems of sickle-cell disease, and I would like to briefly sketch activities currently underway and planned.

In response to the President's initiative, the Secretary has assigned to the National Heart and Lung Institute, NIH, responsibility for coordinating the joint HEW effort; and Dr. Robert L. Ringler, Deputy Director, NHLI, who is here with me today, was designated coordinator for the program.

The NHLI appropriation contains the fiscal year 1972 funds earmarked for this special program. However, it is planned that some of the funds will be made available to other agencies to carry out some segments of the program.

In addition, the Secretary appointed a Sickle-Cell Disease Advisory Committee on August 4, 1971, for the purpose of recommending objectives and plans to carry out the President's initiative. I ask permission to insert in the record the names of the committee members.

Senator KENNEDY. So ordered.

(The information subsequently supplied follows:)

SICKLE CELL DISEASE ADVISORY COMMITTEE

Mrs. Ruth L. Aikens (Chairman). Associated Director for Health, National Urban League, Inc., 55 East 52nd Street, New York, New York.

Mrs. Arnita Y. Boswell, Field Work Associate Professor, School of Social Service Administration, University of Chicago, Chicago, Illinois.

Dr. George J. Brewer, Professor of Human Genetics, Department of Human Genetics, University of Michigan School of Medicine, Ann Arbor, Michigan.

Dr. William H. Bullock, Associate Professor of Medicine, School of Medicine, Howard University, Washington, D.C.

Dr. C. Lockard Conley, Professor of Medicine, Hematology Division, Johns Hopkins Hospital, Baltimore, Maryland.

Dr. Yvette Fay Francis, 115-77 Farmers Boulevard, St. Albans, New York.

Dr. Rudolph E. Jackson, Assistant Member in Hematology and Oncology, St. Jude Children's Research Hospital, 332 North Lauderdale, P.O. Box 318, Memphis, Tennessee.

Mr. Moses J. Newson, Executive Editor, Afro-American Newspapers, 628 North Eutaw Street, Baltimore, Maryland.

Mr. William B. Robertson, Special Assistant to the Governor, State Capitol, Richmond, Virginia.

Dr. Lewis W. Sullivan, Associate Professor of Medicine, Boston University School of Medicine, Boston, Massachusetts.

Mrs. Zeola Walder, South Central Multipurpose Health Services Center, 2051 East 103rd Street, Los Angeles, California.

EX-OFFICIO MEMBERS

Dr. Frank N. Beckles, Director, National Center for Family Planning Services, Health Services and Mental Health Administration, Room 12A56, Parklawn Building, 5600 Fishers Lane, Rockville, Maryland.

Col. Marcel E. Conrad, MC, USA, Director, Division of Medicine, Walter Reed Army Institute of Research, Washington, D.C.

Dr. Howard W. Kenney, Regional Medical Director, Dept. of Medicine & Surgery, Veterans Administration, Washington, D.C.

Dr. Robert L. Ringler, Deputy Director, National Heart & Lung Institute, National Institutes of Health, Bethesda, Maryland.

Dr. ZAPP. The committee held its first meeting on August 13, and a second meeting on October 7 to 8. As a result of these activities, an operational plan for the sickle-cell disease program has been developed and is now in the early phases of implementation. The program has four major goals:

(1) To develop and evaluate new modes of therapy for sickle-cell crises;

(2) To develop new knowledge on the clinical complications of the disease;

(3) To develop improved methodology for community screening and counseling programs; and

(4) To increase public knowledge and awareness of the disease through education and counseling.

In accordance with the recommendations of the advisory committee, we expect to implement the program in fiscal year 1972 in four major program segments:

(1) \$2½ million will be allocated for comprehensive centers of research and service in sickle-cell disease, no more than five in number, to be organized around ongoing programs in sickle-cell disease and to encompass all aspects of the program, from fundamental research to demonstration community service activities, and including the training of professional and allied health professions personnel.

(2) One million dollars will be allocated for screening and education clinics, 10 to 20 in number, to develop methodology and serve as models of the community service organizations capable of providing education, screening, definitive diagnosis, counseling, and referral for appropriate followup. Dr. Beckles, who is accompanying me today, has the responsibility of coordination within HSMHA.

(3) \$1.5 million will be allocated for research aimed at developing improved treatments for sickle cell crisis and new knowledge about the clinical consequences of the disease.

(4) A clearing house for educational and informational materials will also be developed. This will provide a focal point for all types of information on sickle-cell disease.

The committee also recommended that the Department of Defense screen all susceptible recruits for sickle-cell disease and that the Veterans' Administration carry out a screening and education program.

Senator SCHWEIKER. Do you know, have you received any response from either of these agencies as to what their attitude will be on the committee recommendations?

Dr. ZAPP. I think I would have to turn to Dr. Ringler for that.

Dr. RINGLER. We have not as yet received a response, but now a member of the Department of Defense serves on the advisory committee in an ex-officio capacity.

Senator SCHWEIKER. You will supply to me a response when you get it?

Dr. RINGLER. Yes, sir.

Senator SCHWEIKER. I know this is one of the two top priorities of the Black Athletes Foundation, that the Department of Defense, and the Veterans' Administration screen, so the committee will be very interested in their response. I am glad to see the advisory committee make those moves.

Dr. ZAPP. We will provide that information, Senator.

(The information from the Veterans' Administration referred to above and subsequently supplied follows:)

VETERANS' ADMINISTRATION,
DEPARTMENT OF MEDICINE AND SURGERY,
Washington, D.C.

ROBERT L. RINGLER, Ph. D.

*Deputy Director, National Heart and Lung Institute, Public Health Service,
National Institutes of Health, Bethesda, Md.*

DEAR DR. RINGLER: This is in reply to your letter of November 15, 1971, to Dr. Howard Kenney in which you asked for an official response to the recommendation made by the Sickle Cell Disease Advisory Committee that the Veterans Administration implement a broad scale sickle cell screening and educational program.

The VA has already taken steps that will lead in the near future to the activation of a system-wide sickle cell screening program. In addition, of course, all veterans found to possess the sickle cell trait, or any variant of a sickle cell disease, will be offered appropriate counseling and/or treatment, if indicated. In general, all the elements listed in your letter under the heading of Guidelines (a-f) will be incorporated in our VA program.

When this program is finalized and ready for activation, you will be notified.

Sincerely,

M. J. MUSSER, M.D.,
Chief Medical Director.

ONGOING RESEARCH

Dr. ZAPP. In addition to these new initiatives, there has been continuing activity within the Department with regard to sickle-cell disease. Ongoing research relevant to sickle-cell disease is now being supported by several of the Institutes of the National Institutes of Health. As part of its overall effort, the National Heart and Lung Institute supports research in diseases of the blood, both acquired and of genetic origin. Utilizing funds which were already available, and unrelated to the new initiative, the blood resources branch of the NHLI has awarded approximately \$500,000 in contracts for the support of the first phase of a cooperative study to test the feasibility of clinical trials of therapy for the sickle-cell vaso-occlusive crisis. While major emphasis is on evaluation of urea therapy, other therapeutic regimens are included. The Institute also supports a number of grants with major emphasis on sickle-cell disease, at a total current funding level of approximately \$450,000.

The National Institute of Arthritis and Metabolic Diseases is also quite active in the support of sickle cell disease research. I have already mentioned the importance of the fundamental work by Doctor Murayama in his laboratory at NIH. NIAMD research grant support of sickle cell disease studies totals approximately \$420,000. Both NHLI and NIAMD support a number of projects in which the work is related to sickle cell disease. The National Institute of General Medical Sciences and the National Institute for Child Health and Human Development also support projects directed at sickle cell disease, but on a much more limited scale.

SERVICE ACTIVITIES

Within the Health Services and Mental Health Administration, the National Center for Family Planning Services recently established a Sickle Cell Disease Branch. This organization is responsible for coordinating intensified efforts to improve and expand mechanisms in which services are aimed at ameliorating the debilitating effects of sickle cell disease. The scope of these efforts comprise education, definitive diagnosis and counseling. Components of these services are found in the following regional programs:

Use of NCFPS grantee facilities in four regions—New York, N.Y.; Atlanta, Ga.; New Orleans, La.; and Los Angeles, Calif.; and

Use of Community Health Services resources in four regions—Miami, Fla.; Chattanooga, Tenn.; St. Louis, Mo.; and Denver, Colo.

In addition, screening, diagnosis, and counseling services for sickle cell disease are provided by a large number of Maternal and Child Health Services funded under title V of the Social Security Act.

At the present time, the National Institute of Mental Health has made an initial commitment of approximately \$25,000 to the sickle cell disease effort. This sum represents their initial commitment and should not be construed as placing a ceiling on their effort. It is being used for studies, and improved mechanisms for dealing with psychological impacts of sickle cell disease on the individual, the family and the community.

CONCLUSION

Mr. Chairman, we are supporting the objectives of S. 2676 now. As we mentioned earlier, the President has recognized the scope of the problem and has targeted an additional \$5 million in fiscal year 1972 for the Sickle Cell Disease Program. This is over and above the \$1 million which is currently being spent in research on this disease.

Since the activities proposed in S. 2676 are already underway within the present organization of the Department or will be implemented in the current fiscal year, we feel it unnecessary to establish new authorizing legislation for the sickle cell disease program. The lead agency concept, the appointment of a specific coordinator for the program, and the establishment of the Sickle Cell Disease Advisory Committee should provide the focus and visibility for this disease problem comparable to that proposed in S. 2676.

The primary purpose of the program outlined above, at least in its initial phases, is to develop appropriate methodology before mass community efforts are undertaken. The Sickle Cell Disease Advisory Committee stressed the need for such an approach. The committee also cautioned against allowing publicity regarding sickle cell disease and/or screening programs to exceed the capacity for public education and followup for carriers of the trait as well as for patients.

The administration has recognized that sickle cell disease has afflicted black people in America many years. Moreover, only recently has there been widespread awareness of the dimensions of the problem. We believe that we have adequate authority and that the steps I have outlined constitute a solid program for developing an effort to deal with sickle cell disease.

We feel that the authority proposed in this bill is redundant and therefore unnecessary. We cannot comment on those provisions of the bill which concern the Department of Defense and the Veterans' Administration. We have been working closely with those two agencies, and this is reflected in their representation on the Sickle Cell Disease Advisory Committee through ex-officio memberships.

Mr. Chairman, we will be glad to answer any questions the committee may have.

Senator SCHWEIKER. Thank you very much. I have some questions.

There seems to be some difference of opinion here on this money that we have touched on.

In his testimony earlier this morning, Senator Tunney charged that the \$5 million was not new money.

Now, I wonder if you would like to comment on this, because the President did say this administration is increasing its treatment for sickle cell anemia to a new fivefold total of \$6 million.

What is the difference here, and what is the administration's position on the statement of Senator Tunney?

Dr. ZAPP. I have had a little difficulty in understanding the terminology of what constitutes new money. We are talking about additional funds being allocated to the program for sickle cell disease within the Department of Health, Education, and Welfare. In this case, there was \$5 million placed in the budget this year.

The research grant program last year was at about the \$1 million level for sickle cell disease. In the current year it will probably exceed this amount.

Senator SCHWEIKER. What you are saying, as I understand it, is that you are taking \$5 million of money on other projects and shifting it to sickle cell anemia, and earmarking it specifically for sickle cell use.

Doctor ZAPP. There is \$5 million of additional funds going into this program, Senator. I would have difficulty in being able to say where that \$5 million came from, but it does represent a new effort in a largely neglected program, not only within the Department, but within the entire health community.

Senator SCHWEIKER. Senator Dominick, do you have any questions?

Senator DOMINICK. Thank you.

Doctor Zapp, I think you have made a very fine statement.

I want to congratulate you on it.

The degree of work which the NIH and related agencies have been conducting on this, I do not think was well known at all, and I think this helps to bring it into focus.

A couple of things did interest me here. You say on page 11, that you are developing appropriate methods before mass community efforts are undertaken.

I presume when you talk about mass community efforts, you are talking about going into the communities which are most likely to be heavily afflicted, and warning them about it, in order to make them aware of some of the problems involved.

Doctor ZAPP. I think the methods used relate to the selection of proper types of screening programs and education. Both need to be substantially agreed upon by the people affected in the community, and by the scientists involved in the program, so that we do not create, as you say, some type of a scare.

I recognize that the fact that there are so many sponsors for the bills in Congress, the visibility given by the black athletes program, and the visibility given by the President's initiative have all resulted in an increased awareness by the many people who may have been unaware of the possibility that they may carry the trait or that they could easily be tested for it.

I would defer on the specific description of exact methods of research an screening to the two gentlemen who are accompanying me, if you would like to pursue it.

Senator DOMINICK. I just am trying to get these things into focus.

It is my understanding a good deal of research has already been done to determine what creates the problem and by and large, you think it is a genetic problem, is this correct?

Dr. ZAPP. That is correct.

Senator DOMINICK. So until we have the ability, as I understand it, to change the genetic characteristics of the hemoglobin molecules you would have great difficulty in providing a cure as opposed to assistance.

Dr. ZAPP. I would say the word cure as relates to sickle cell disease, or any genetically related disease, is one that should be avoided. I think it definitely, creates a false image.

Senator DOMINICK. If this is so, fine.

Do you want to add anything to that, Dr. Ringler?

Dr. RINGLER. I would just confirm the statement you made, that there is a change in the hemoglobin molecule, and it is not possible with our present methods to reverse the change. That is all.

Senator DOMINICK. Then if we are unable to provide a cure, I gather that this particular situation is not debilitating as far as an individual person is concerned, in the event they have a trait, as opposed to the actual disease?

Dr. RINGLER. In the great bulk of individuals, that is true. The average individual with the trait, under normal circumstances, does not experience difficulty. Under extreme circumstances of physical stress, and other kinds of stress, certain people with the trait do have problems, resembling the more severe forms of the disease.

Senator DOMINICK. Then if you went into a screening process, in any particular community, and found that x number of people had these traits, but that you were unable to do anything about it, and the major effort here would be I presume to try and not have them mate with other people who have the same trait, is this correct?

Dr. ZAPP. That is correct. That is where the counseling service comes in. Education that creates awareness is what is needed.

Senator DOMINICK. Are there any other comments on that?

Dr. BECKLES. I think the public counseling of individuals found to have the trait is a major undertaking which is vital. To say that we would try not to have the people mate is not precisely what we would recommend. We would recommend that they be given the option of choice, given the possibility of making a choice, if two people are carrying the trait to marry or not marry one another.

Senator DOMINICK. Human nature being what it is, this will be very difficult, as far as I can see.

Dr. BECKLES. Yes, Senator; and this is why it is extremely critical to begin at the earlier ages. Obviously, we must concentrate on all of the people who might be affected by either the trait or the full-blown disease, but the earlier that one can begin to do this, the better the chances of success, dealing as we are in the area of human behavior.

Senator DOMINICK. Now, when you have an Rh negative factor in newborn children, it is my understanding there is a method of changing blood, and thereby decreasing the problems with the child, or decreasing the problems of having a stillborn child; is this correct? Has anybody done this in the sickle-cell research?

Dr. RINGLER. The situation would be quite different, Senator. In sickle-cell disease, if you were to transfuse, to totally replace the blood, it would over a short period of time be replaced with the patient's blood that would sickle. Hence, this procedure would be a rather massive attempt to get by an acute situation, but it would have only a very short-lived benefit.

In the case of Rh factor, the situation is quite different.

Dr. BECKLES. I think the normal life of the red blood cell, which is the cell affected here, is probably 120 days, so that they die anyway, even if you have transfused. The life then of the cell will cause it to disappear from the bloodstream in a given period of time. The body is constantly replacing red cells with the sickle cell, either the trait, or of the full-blown disease.

Senator DOMINICK. Dr. Zapp, with the exception of one statement which you made with regard to certain people of Mediterranean heritage, you emphasized this is within the black population largely. What other ethnic groups or other groups are involved?

Dr. ZAPP. I think we would have to say that the world data on this is not substantial enough to be able to put anything in the record. There are indications that other ethnic groups have a smaller incidence of it, but there have been no cases where on a national basis, it has been studied well enough to substantiate this. It might exist in a fair number of Puerto Rican people as well as other groups around the world.

Dr. BECKLES. There is one study that says approximately 3 percent of Puerto Ricans found in New York are infected with the trait, and, therefore, we would have to look very carefully. This is one of the undertakings that will proceed this year, through the auspices of the National Center for Health Statistics. We hope to be able to begin a method of collecting better data, and studying on a broader scale the total ethnic ramifications of the disease.

Senator DOMINICK. You would have to also look into ethnic background of each person that had it, because in this cosmopolitan country of ours, it will be hard to find out who has got what, and who is responsible.

Dr. BECKLES. This is what one would look at, but one would be sure to take a sampling of ethnic groups that would be likely to set a standard, and then if there are any variations, to add that knowledge to what we now have.

Senator DOMINICK. Dr. Zapp, going back to the original question on methodology and screening, have any advanced ideas been put forward on this? In other words, would you be doing it in the schools, would it be voluntary in the schools, if you did do it there, or would everybody be required to have it?

Dr. ZAPP. I think the Department, in a sense, has its first real commitment in this area. Other than the research activities, this is one of the areas in which we are seeking counsel from the advisory committee, which I think is a very select group. We have no set policies at this time, as to whether we should have or should try to bring about any type of mandatory screening within the school system.

Senator DOMINICK. Let me ask you a question, before Dr. Ringler answers that.

At the present time in the schools, do we require inoculation of children for diphtheria and the rest of the usual series of diseases?

Dr. ZAPP. This is not a Federal activity. It is a State health requirement, and it varies.

Senator DOMINICK. Most of the States do require it?

Dr. ZAPP. Yes.

Senator DOMINICK. Are there any that do not?

Dr. ZAPP. That I would have to supply for the record. I very frankly do not know.

(The information referred to, subsequently supplied, follows:)

IMMUNIZATION REQUIREMENTS PRIOR TO SCHOOL ENTRY
SEPTEMBER, 1971

	Is there a state law requiring immunization for a specific disease or diseases prior to school entry?	Diphtheria Immunization Required	Measles Immunization Required	Pertussis Immunization Required	Polio Immunization Required	Rubella Immunization Required	Smallpox Immunization Required	Tetanus Immunization Required	If state laws are currently in effect list the administrative body having responsibility for issuing implementing regulations		Have regulations been issued?	If yes, is compliance required?	If the authority to issue these regulations has been delegated to a level of local government list the governmental dept.		If no state law at present, are there plans pending for proposing such a law?
									Dept. of Health	Dept. of Education			Health	Education	
Alabama	No														No
Alaska	No														No
Arizona	No														No
Arkansas	Yes	Yes	Yes	Yes	Yes		Yes	Yes	X	X	Yes	Yes		X	Yes
California	Yes														
Colorado	No		Yes		Yes	Yes	Yes							X	No
Connecticut	Yes														No
Delaware	No														
District of Columbia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X	X	Yes			X	
Florida	Yes														
Georgia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			No
Hawaii	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes	X		No
Idaho	No														No
Illinois	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X	X	Yes	Yes		X	No
Indiana	No														
Iowa	No														Yes
Kansas	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes		X	
Kentucky	Yes	Yes	Yes	Yes	Yes		Yes	Yes	X		Yes	Yes			
Louisiana	Yes	Yes	Yes	Yes	Yes		Yes	Yes		X	Yes	Yes			
Maine	Yes							Yes		X	Yes				
Maryland	Yes						Yes	Yes	X		Yes	Yes	X	X	
Massachusetts	Yes	Yes	Yes	Yes	Yes		Yes	Yes	X		Yes	Yes			
Michigan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			
Minnesota	Yes	Yes	Yes	Yes	Yes		Yes	Yes	X	X	Yes	Yes		X	
Mississippi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X	X	Yes	Yes		X	
Missouri	Yes	Yes			Yes		Yes		X		Yes	Yes			
Montana	No								X					X	Yes
Nebaska	No													X	No
Nevada	Yes	Yes			Yes	Yes				X				X	
New Hampshire	Yes						Yes		X						
New Jersey	No														
New Mexico	Yes	Yes		Yes	Yes		Yes	Yes	X	X	Yes	Yes		X	No
New York	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			
North Carolina	Yes	Yes	Yes	Yes	Yes		Yes	Yes	X		Yes	Yes			
North Dakota	No														No
Ohio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X	X	Yes	Yes		X	
Oklahoma	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			
Oregon	No													X	Yes
Pennsylvania	Yes	Yes	Yes		Yes	Yes	Yes	Yes	X		Yes	Yes		X	
Rhode Island	Yes	Yes	Yes			Yes	Yes	Yes		X			X	X	
South Carolina	Yes	Yes	Yes		Yes	Yes	Yes	Yes	X		Yes	Yes	X		
South Dakota	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes	X		
Tennessee	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			
Texas	Yes	Yes	Yes		Yes	Yes	Yes	Yes	X		Yes	Yes		X	
Utah	No														No
Vermont	No														
Virginia	No						Yes			X	Yes	Yes		X	No
Washington	No														
West Virginia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			No
Wisconsin	No														No
Wyoming	No														No
Guam	No														No
Puerto Rico	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	X		Yes	Yes			No
Virgin Islands	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		X	Yes	Yes	DNA	DNA	No
Total	35 Yes 19 No	24	24	17	26	18	31	21	Health: 24 Educa- tion: 7 Com- bined: 5	30 Yes	26 Yes	Health: 3 Educa- tion: 15 Com- bined: 3	4 Yes		

Source of Information: Immunization Projects, Immunization Branch, State and Community Services Division, Center for Disease Control, Atlanta, Georgia

Senator DOMINICK. Effectively, however, you would say that the vast majority of them do?

Dr. ZAPP. Yes.

Senator DOMINICK. So at least, in those areas, they are usually requiring something of this kind.

Presumably, this is because it is a prevention, and it is a preventive method, it is not a cure?

Dr. ZAPP. Yes.

Senator DOMINICK. Here we would not be dealing with that.

We would be dealing with a whole different series of problems, we would be taking children, and then going to their families, and say, look, this child has got a serious problem, that this is a health characteristic, and what will that do to the kid?

Dr. ZAPP. Well, I think that this relates very much to some comments made earlier by Congressman Kuykendall and comments you made yourself, Senator. How do you bring about the understanding, especially with the child who is so sensitive to criticism by his peers, that what he has is a trait which in itself, except in extreme exhaustive stages of exertion, would not be harmful until he gets to that point where he begins to select a mate in life? I think here early counseling should create in the parents an awareness on their part. It could be very dangerous to go to a first or second or third grade student and try to show him how he is different from the others in his class as a result of a blood test or something. That could be harmful.

Senator DOMINICK. That is part of the psychological thing I was concerned with in this so-called screening process, and I do think it could create substantial problems.

Let me ask you this, I gather that the program now is being headed up at least by the Heart and Lung Institute, this is from your testimony, but that it covers a good number of other institutes within NIH insofar as research is concerned.

Under the bill, as it is proposed, would there be any change in that?

Dr. ZAPP. Well, the bill would imply a \$5 million lid on the sickle cell disease related research within the National Institutes of Health. I suppose it certainly would not change the participation of many institutes; however, in many cases it could inhibit it. It would not be difficult to see where the total research effort in sickle cell disease could exceed that amount, because there is so much other research supported by NIH, other than that supported by the Heart and Lung Institute. Emphasis on sickle cell disease research will lead to more and more competent investigators becoming interested and involved in the field. I would think that an implied ceiling may be more limiting than the current structure of the National Institutes of Health.

Senator DOMINICK. One of the things that bothered me about the bill is on page 9, subchapter 6, "Sickle Cell Anemia Prevention," in large type. I read the sections, and as far as I can see there is no prevention in it.

All it provides for is counseling. Yet it looks like it is a method of cure, under subchapter 6.

What I am concerned with, and I guess I have been overemphasizing it here, is that we create false hope, in the fact that somebody

can be cured, once they really have the disease, and I hate to see us do that.

We tend to do it all the time, and where we do, we have problems.

Dr. ZAPP. That is correct. So much has been gained by the increased awareness of sickle cell disease and its related problems, it would be a shame if we were to create the false hope that there is a cure.

Senator DOMINICK. Do we have any idea at this point, Dr. Zapp, and you may not want to reveal it even if you do, what the fiscal 1973 budget for sickle cell anemia might be?

Dr. ZAPP. No, I would be unable to say 3 months or 2½ months away from budget submission. My crystal ball is not that good.

Senator DOMINICK. Is it your guess that there might be an increase in the present additional funding that can be provided in fiscal 1972?

Dr. ZAPP. Well, the only thing I can say, with my 3 years of experience in the Department, is that those initiatives which have been selected out on an annual basis have generally received favorable treatment in years after.

Senator DOMINICK. Let us suppose, and I will stop with this.

Let us suppose I just want to put in the screening process, and that we find a fairly substantial number of people with the sickle cell trait.

What would you then do to prevent those traits from being passed on?

How would you work that?

Dr. ZAPP. I would like to refer that question to Dr. Beckles.

Senator DOMINICK. It seems this is a moral and an ethical thing, that we were talking yesterday under Senator Mondale's bill, which is really quite interesting.

Dr. BECKLES. Senator Dominick, I think what is done in these instances is education and counseling. The National Institute of Mental Health will be the component within HSMHA that will concentrate, collaborating closely with all workers in this field, on developing the knowledge and the science of counseling, hopefully so that new means of counseling, new methods of counseling, new ways of transferring information in this area will result in a decrease of people who carry the trait. It is difficult to say or do anything beyond counseling, trusting that people in their own wisdom will act on behalf of their children.

Senator DOMINICK. Let me ask these two followup questions.

Suppose you have a male with the trait, and he marries a girl that does not have it, are there children from this couple, will their children be liable to have it, or let us suppose the male does not have it, and the mother does, are the children liable to have it?

Dr. RINGLER. The children could carry the trait, but would not have the overt disease.

Senator DOMINICK. So that if either side of the marriage has the trait, the children could carry the trait too?

Dr. RINGLER. Yes.

Senator DOMINICK. So in effect, what we are saying then, if either one of the marriage partners has the trait, they should not have any children?

Dr. RINGLER. If one carries the trait, then there would be a 50-percent chance of that partner passing the trait on to his offspring.

If the other partner also carries the trait, there would likewise be a 50-percent chance of passing the trait on.

If both of them are carriers, then half of their children would have the trait, and one-fourth of them would have the anemia.

If only one partner had the trait, I believe one in four of the children would be expected to carry the trait.

Dr. BECKLES. Senator, the point here is that they have a chance. Even though it is genetically predictable, it is a chance which one cannot accurately predict. For example, when both partners carry the trait, what we see on several occasions is that if three children are born, all three of them have the disease, so that the phenomenon is that each child has the chance of either getting the trait or the disease, when both parents have it. This is why the anemia is such an unpredictable thing.

Senator DOMINICK. So, the only way to avoid this continuing is to discourage people who have the trait from having children.

Dr. BECKLES. I would say, again, Senator, because there is the chance that they would not pass on the trait, if only one has it, I do not think that would be a position that I personally would recommend professionally.

Senator DOMINICK. Zero population growth people might.

Dr. BECKLES. I think that would be extremely unfortunate, Senator.

Senator DOMINICK. All right; thank you.

Senator SCHWEIKER. Thank you, Senator Dominick. I would like to ask a series of questions here that the staff has prepared.

How many inquiries have been received from health organizations and others for sickle-cell anemia assistance, and Doctor, if you do not know, maybe one of your colleagues might be able to answer.

Dr. RINGLER. I cannot give you a precise accounting of that, Senator. I would give you an estimate, in the neighborhood of 200.

Senator SCHWEIKER. Could you supply that for the record?

Dr. RINGLER. Yes.

(The information follows:)

The number of inquiries received was 130.

Senator SCHWEIKER. What are these groups told to do by the Department when the Department gets such an inquiry?

Dr. ZAPP. I will refer you back to Dr. Ringler, who has, I think, in this case, consulted with the advisory committee on review of these applications as they come in.

Dr. RINGLER. We have told them, up to now, that the advisory committee has been appointed, that we are seeking the advice of the advisory committee in terms of the overall scope of the program and in terms of relative priorities for each segment of it. We promised to send them guideline information once the advisory committee had made its recommendations.

What we are now doing is sending all of the individuals who inquire, this press release, dated November 9, that is being made a part of the record. It summarizes the recommendations of the advisory committee, and also includes specific recommendations on program components.

(The information referred to, and subsequently submitted follows:)



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

National Institutes of Health
Bethesda, Maryland 20014

NATIONAL HEART AND LUNG INSTITUTE

ERNEST MINER

Office (301) 496-4236

Home XXXXXXXXXXXXXXXX

FOR RELEASE IN PM PAPERS
TUESDAY, NOVEMBER 9, 1971

A program for expanding federal activities directed against sickle cell disease, in which both community-service aspects and research will receive emphasis, has been recommended by the HEW Sickle Cell Disease Advisory Committee in their second report to HEW Secretary Elliot L. Richardson.

Sickle cell disease, a painful and life-shortening inherited disease found almost exclusively among black people, is a major health problem here and abroad. The Committee, named by HEW Secretary Richardson to advise on objectives and priorities for the program which will involve NIH, HSMHA and other agencies of the federal government, met for the second time at the National Institutes of Health October 7 and 8.

The recommendations of the Committee, which is chaired by Mrs. Ruth L. Aikens, Associate Director for Health, National Urban League, New York City, are concerned with goals and functional components of the program and allocation of the additional \$5 million recently targeted by President Nixon for sickle cell disease.

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The Committee recommended:

- . that \$2.5 million be allocated for the establishment of up to 5 comprehensive research and community service centers. Each center would be organized around ongoing programs in sickle cell disease; and would bridge the gap between fundamental research, clinical application, and community service.
- . that \$1 million be allocated for the establishment of from 10 to 20 model Screening and Education Clinics in various regions of the country for the purposes of 1) screening, 2) definitive diagnosis of SCD, 3) education of the population at risk and of health personnel, 4) referral of patients with SCD to appropriate sources of therapy and followup care, and 5) acquisition of detailed data on methodology.
- . that \$1.5 million be allocated for basic and applied biomedical research into the nature and treatment of sickle cell disease.

The Committee further recommended:

- . that educational and informational materials be prepared, tested, and made available through a centralized clearing house for sickle cell disease information.
- . that training of black physicians, scientists, and allied health personnel in all aspects of sickle cell disease be encouraged.
- . that the Department of Defense screen all black recruits for sickle cell disease.
- . that a survey of federal programs be conducted for the purpose of identifying those that offer potential for assisting the Sickle Cell Disease Program in achieving its goals.

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In his February health message to Congress, President Nixon identified sickle cell anemia as a high-priority disease target and called for a \$5 million increase in federal expenditures on sickle cell disease during the current fiscal year. The National Heart and Lung Institute was assigned responsibility for co-ordinating the joint efforts of government agencies; and Dr. Robert L. Ringler, Deputy Director, NHLI, was designated coordinator of the SCD Program. The NHLI appropriation contains the FY 1972 funds earmarked for this special program, but some of these funds may be made available to other agencies to carry out part of the program.

The Sickle Cell Disease Advisory Committee appointed by the Secretary, DHEW, is composed of eleven distinguished professional and lay leaders especially knowledgeable about the problems of sickle cell disease or active in black community programs.

BACKGROUND INFORMATION--SICKLE CELL DISEASE

Sickle cell disease, the most common inherited disorder in the U.S., is believed to be present in more than 2 million black U.S. citizens. Although the disease occurs in a relatively benign "carrier" form in most of these 2 million, approximately one in every 500 black infants is born with the life-threatening form of the disease called sickle cell anemia. Such individuals undergo painful episodes called sickle cell crises.

The disease is due to a genetically determined defect in hemoglobin, the respiratory pigment in red blood cells which enables them to carry oxygen throughout the body. Under conditions of diminished oxygen supply or physical or emotional stress, the abnormal hemoglobin molecules become attached to one another in such a way as to distort the normally doughnut-shaped red cells into a distinctive crescent or sickle-shape.

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The inability of these sickled cells to pass freely through smaller blood vessels creates a "log jam" effect, blocking the flow of blood to surrounding tissues, thus causing the extremely painful sickle cell crisis.

Because sickle cell disease is genetically determined, there is no way known at the present time to cure the disease in affected individuals. Current methods of treatment are aimed primarily at alleviating the pain. However, new forms of treatment may make possible reversal of the sickling process, thereby shortening or even preventing the sickle cell crises and the resultant tissue damage. These must undergo further development and evaluation before their potential can be realized.

DETAILED DESCRIPTIONS OF PROGRAM COMPONENTS RECOMMENDED BY THE SICKLE CELL DISEASE ADVISORY COMMITTEE AND A LIST OF COMMITTEE MEMBERS ARE ATTACHED.

ADDITIONAL INFORMATION FOR POTENTIAL APPLICANTS MAY BE OBTAINED FROM:

Miss Rosalie J. Silverberg
Sickle Cell Disease Branch
Building 31, Room 5A-31
National Heart and Lung Institute
National Institutes of Health
Bethesda, Maryland 20014
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SICKLE CELL DISEASE PROGRAM COMPONENTS

1. Comprehensive Centers of Research and Service in Sickle Cell Disease

A limited number of Comprehensive Centers, probably no more than five, will be established on a competitive basis and supported by a special grant mechanism. Centers are conceived as identifiable units within the sponsoring institutions. Preferably, each one should be built around an ongoing program of research or service in sickle cell disease, and should be in a position to work cooperatively with community organizations concerned with sickle cell disease. Since the purpose in establishing Centers is to focus resources, facilities, and manpower in a coordinated approach to sickle cell disease problems, the program of each Center must include all of the following components: research, clinical applications, screening and counseling, education, and training of professional and allied health professions personnel. Hospital beds for clinical investigations must be available. Centers should be able to bridge the gap between fundamental research and clinical application, and promptly translate the results into demonstrations of community service.

2. Screening and Education Clinics

The Program will provide support by contract, awarded on a competitive basis, for a limited number of Clinics, probably no more than 10-20. Such Clinics will be established as demonstrations of the type of service organization capable of providing the following: education of the public as well as physicians and allied health professions personnel, screening (of 10,000 to 20,000 persons per clinic), definitive diagnosis by electrophoresis, and counseling for those found to be positive. Each Clinic should be in a setting with a referral capacity for appropriate follow-up and adequate medical care. Emphasis in these Clinics will be on developing methodologies best suited to mass efforts.

3. Collaborative Research and Development

In areas where specific clinical investigations or specific targets can be clearly defined (e.g. clinical trials of therapy, development of new and improved therapy, certain topics in fundamental and clinical research), work will be supported through research contracts awarded on a competitive basis. When the goals for specific individual programs have been determined, with the advice of consultants, the requirements for participation will be outlined in a Request for Proposal which will be widely circulated. An investigator feeling he can meet the specific requirements may then submit an application.

4. Biomedical Research

Research projects planned and proposed by individual investigators in accordance with their own personal interests will be supported through the traditional research project grant mechanism of the National Institutes of Health, with review by appropriate Study Section and National Advisory Council. Applications may be submitted at any time, but review occurs on a regular schedule three times a year.

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5. Training of Professional and Allied Health Professions Personnel

Training is an essential part of the Sickle Cell Disease Program. However, it can be carried out best in the setting of Comprehensive Centers and Screening and Education Clinics, or as part of broader programs of training in hematology or genetics. It is not anticipated that training programs devoted solely to sickle cell disease will be established, but rather that training will be an integral part of the Centers and Clinics programs described above.

6. Public and Professional Information

Educational and informational materials will be prepared and tested, and then made available through a centralized clearing house yet to be established. This will be a focal point for all types of sickle cell disease information.

Senator SCHWEIKER. What kind of program does the Department envision to receive funding for sickle cell anemia?

I wonder if you could just describe a little bit how these programs theoretically would operate, and what kind of programs will the Department fund?

Dr. RINGLER. For one of the largest segments of the programs described in Dr. Zapp's statement, that which is called comprehensive research and service centers, the committee has recommended allocation of approximately half of the \$5 million. The intent is to create an environment, in which research and community service kinds of programs can go on in a setting where clinical care for patients with sickle cell anemia is being provided.

I think our point would be, really, that at the research level and at the community level, quite a bit is known about the disease. We would hope through these centers, to create incentives so that various kinds of talents could be brought to bear in a unified attack on the problem. That is one major aspect of the program.

A second major aspect has to do with the creation of 10 to 20 screening and education clinics, where the intent is to get at some of the problems that Senator Dominick brought up in his earlier questioning, namely, what is the best way to screen people, the best way to counsel them, at what age should it be done, and how to perfect those methodologies.

A third major segment of the program as we see it, has to do with an attempt to develop better ways of managing the clinical problems of sickle cell anemia, not only the sickle cell crisis, but also the continuing problems that these patients experience, such as those we mentioned earlier, ulcers, jaundice, and so forth; for this reason the committee has advised that a million and a half of the \$5 million be used for research aimed at the clinical problems. Lastly, we speak about a program of education in which it is hoped that we could generate educational materials that could be made available widely throughout the Nation in order to increase public awareness about the disease.

Senator DOMINICK. Will the Chair yield at that point?

On page 7, Dr. Zapp, you refer to \$2½ million would be organized around ongoing programs of sickle cell disease.

Where are those programs?

Dr. RINGLER. These centers are not in being at the present time, Senator. This is one of the committee's recommendations for the allocation of the \$5 million in this year's appropriation.

Senator DOMINICK. You mean there are no ongoing programs now?

Dr. RINGLER. Yes, sir; but on page 7, where it refers to the \$2½ million for centers, this applies to the new program that is to be implemented during this fiscal year. We expect that these centers would be activated this coming spring. The ongoing program is described on page 8 of the opening statement.

Senator SCHWEIKER. In the programs that involve the communities, will there be an effort to involve black organizations, and will there be a mix between lay and professional people? What concept do you envision when you are dealing with a community approach?

Dr. ZAPP. I think I could properly leave that to Dr. Beckles.

Dr. BECKLES. Senator, I beg your pardon.

Could you repeat the question?

Senator SCHWEIKER. Where you are dealing with a community in these programs, just what concept or role do you foresee in terms of a mix between the lay person, professional person, and also black groups that probably want to participate, such as the Black Athletes Foundation? What role do you see for these various participatory groups in your setup?

Dr. BECKLES. I think, Mr. Chairman, the way to respond to that, is that the program at the community level has several components.

There is the component which in one instance might deal just with public education. There is a component which would deal just with the role of the community voluntary worker, the raising of community funds, and the level of community interest in sustaining this.

The interaction at the level of the clinic of the community, and the patient, depends on the particular setting, but we would hope to be able to create within the clinics screening and testing, which would be carried out. The sensitivity, respect, and dignity reflected in the program would depend on the nature of the community.

Senator SCHWEIKER. When we talk about screening and educational clinics, the 10 or 20 in number you envision under the \$1 million phase, are we talking here about utilizing neighborhood clinics, mental health clinics, children and youth projects, child care centers, or public health facilities?

Dr. BECKLES. Senator, there would be a variety of such clinics. I think there exists a variety of facilities now. We will probably not create a new series of clinics across the country, just for sickle cell anemia.

The degree to which the program is therefore placed in an ongoing institution, in an operative institution, depends on the particular nature of the community.

For example, one might have such a screening clinic, which does screening, counseling, and education, and then refers patients to a larger institution, when this is necessary. What we envision is a kind of feeder mechanism, where one establishes, for example, a center, in which is found a range of capabilities that would cover such areas as development of educational materials and the training of manpower, because we are going to need many people here to do this work. This is another role in which the community worker will be hopefully involved, so that this comprehensive center would have all of the services needed in a given community. In certain geographical locations one could have either permanent clinics, to do a part of the work, or temporary facilities such as mobile screening clinics, or a school which can screen, envisioned as a temporary setting, which then feeds back to a more permanent center, depending on the nature of the cases discovered.

Senator SCHWEIKER. Since one of the major problems with this situation is education, what is being done now, or what is planning to be done on the basis of encouraging physicians and nurses, who are in the flow of our medical service delivery systems now, to actually look out for and be aware of this disease?

What are we doing in this area, if anything?

Dr. RINGLER. Mr. Chairman, what we are doing at this point in time is little. What we envision doing is manifold. The National Institute of Mental Health will next week sponsor a conference at the

Meharry University to deal with the problems you have raised in the question of education. This will be a beginning.

How does one work with the physicians, the laymen, the various allied health professions; what are the best ways of working with them; what are the best ways of developing educational materials; and so forth, concentrating here particularly on the technique of counseling. These are the questions to be answered.

The regional medical problems agencies within the Mental Health Administration would provide a network so that when materials are developed, or training is to be offered across the United States, the physicians and other health professionals can come to these or be reached through this mechanism.

Again, it is envisioned that the comprehensive center would work in developing its own materials, and then in collaboration with expert organizations, such as NIH, would perfect the development and use of educational materials. There is envisioned a multifaceted approach to the development, the testing, the dissemination, and the evaluation of educational materials.

Senator SCHWEIKER. What about medical schools, knowing that this is the key source of education of future doctors, what do you envision as far as medical school education is concerned?

Dr. RINGLER. We will try to orient physicians who are now practicing. We need also to emphasize this disease phenomenon in the training of medical students.

I dare say it is included, Senator, but not adequately covered in the course of the preparation of medical students. I am quite certain, that with increasing awareness, we could envision working with such organizations as the American Medical Association and the National Medical Association to make sure that the curricula of medical students begin to reflect new knowledge, as it is learned and made available.

Senator SCHWEIKER. There recently appeared an article in the Washington Star describing cutbacks in the National Institute of Mental Health program, which was investigating genetic engineering.

Inasmuch as genetic engineering is a very key part of this whole approach, are we not moving backwards in this area, and what efforts will we make to reverse the cutback of genetic engineering, which has so much to do with this problem?

Dr. ZAPP. I am unaware of that, Senator. We would have to supply that information for the record.

(The information referred to and subsequently supplied, follows:)

NIH PROGRAM ON GENETIC ENGINEERING

NIMH research reported in the October 8 issue of *Nature*, an eminent British scientific journal, described for the first time a technique involving the use of viruses to transfer genes from bacteria to defective human cells in tissue culture. Tests showed that the genetic material thus transferred apparently corrected the defect in the human cell.

The study has been conducted over the last three years by Dr. Carl R. Merrill and Mr. Mark R. Grier of the Laboratory of General and Comparative Biochemistry, NIMH, in association with Dr. John C. Petricciani, Division of Biologics Standards, NIH.

This report of successful functioning of bacterial genes in human cells opened the way for new research in all diseases where heredity is involved. Recognizing the importance of this study and its potential for improving human health,

NIMH gave it top priority. Despite the severe limitations imposed by personnel and budget restrictions (to which the Washington Star article quoted by Senator Schweiker referred), two new staff positions (one's a doctorate level chemist, the other for a tissue culture technician) have been assigned to Dr. Merrill. As the design for these studies is developed and further expansion is required, every effort will be made to see that specific needs are met. Such funding from existing resources, however, must come from other programs within the Institute whose benefits, while important, seem destined to develop more slowly. Extensive new initiatives in the field of genetic research will have to be supported through additional appropriations.

Senator SCHWEIKER. All right. That is all I have.

Senator KENNEDY. I want to apologize for not being here during all of your testimony.

I do not want to go over old ground, but I want to get some answers to my own satisfaction, and clearly I would like to clear my own mind on your position.

The administration does not support this legislation, is that correct?

Dr. ZAPP. We feel the legislative authority requested here is unnecessary. We are currently, in response to the initiative of the President in his health message, and also through the new Sickle Cell Disease Advisory Council, working on the same objectives as the bill before the committee.

Senator KENNEDY. What did the administration request last year in terms of this program?

Dr. ZAPP. For this current fiscal year, the request was \$6 million.

Senator KENNEDY. This year, 1972?

Dr. ZAPP. Yes, for this current fiscal year.

Senator KENNEDY. Will you tell us what your request is in terms of next year?

Dr. ZAPP. We went through that a minute ago. I am unable to say what the request for next year will be. I can only say on the basis of experience, that in the past where initiatives have been singled out like this, they generally continue to receive favorable treatment. It is, in essence, a commitment to this disease as we noted in our statement.

Senator KENNEDY. Have you given us some indication of how you will spend that money, the \$6 million; could you give that to us, have you given it to us?

Dr. ZAPP. Yes, in my testimony previously.

Senator KENNEDY. And to go back, we requested how the resources were being extended, the money that has been available previously, and how HEW, NIH has allocated those resources; you will provide that for us?

Dr. ZAPP. Yes.

(The information referred to, subsequently supplied, follows:)

SUMMARY OF NIH-SUPPORTED RESEARCH IN SICKLE CELL DISEASE

NATIONAL HEART AND LUNG INSTITUTE

Through its extramural programs, the NHLI supports investigator-initiated research projects dealing with pathogenesis, prevention, and treatment of sickle cell disease and its complications, particularly those resulting from vaso-occlusive episodes. The research may be fundamental or clinical. The mechanism of support is by research project grant.

The Institute now supports a number of grants with major emphasis on sickle cell disease, at a total current funding level of approximately \$450 thousand.

Utilizing funds which were already available, and unrelated to the new initiative, the Blood Resource Branch has awarded approximately \$500 thousand in contracts for the support of the first phase of a cooperative study to test the feasibility of clinical trials of therapy for the sickle cell vaso-occlusive crisis. While major emphasis will be on evaluation of urea therapy, other therapeutic regimens will be included.

A contract has also been awarded for studies on the effect of cyanate on the sickling phenomenon, and the *in vivo* survival of cyanate-treated red blood cells.

NATIONAL INSTITUTE OF ARTHRITIS AND METABOLIC DISEASES

The overall commitment of the National Institute of Arthritis and Metabolic Diseases is to research in those diseases that are of metabolic origin. For the blood and blood-forming organs, this includes basic and clinical studies of a metabolic nature on anemias and hemoglobinopathies, and hemoglobin structure and synthesis. This Institute also supports research on genetically determined diseases when the primary interest is on factors affecting growth, development, and maturation.

A member of the intramural staff of the NIAMD is Dr. Makio Murayama who worked out the detailed spatial configuration of hemoglobin S. In his laboratory at the NIH, he is continuing his fundamental physicochemical studies of the mechanism of sickling, and the effect of urea at varying concentrations on intact sickled erythrocytes. He has also initiated studies on an intracellular co-factor, found in erythrocytes from patients with sickle cell disease, which apparently is essential for polymerization of the hemoglobin S.

Through its extramural programs, the Institute currently supports eleven projects, at a total of approximately \$420 thousand, which deal directly with sickle cell hemoglobinopathy. All or a greater part of the activity is concerned with hemoglobin S—its structure, properties and synthesis—and/or observations on, and treatment of patients with sickle cell disease. A second group, of three projects, deals with a number of different aspects of hematology, including a component relating to sickle cell disease. A third group of projects supported by this Institute concerns the search for basic knowledge of the genetic control of protein synthesis which has significant implications in the therapy of *all* molecular disease.

NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES

The National Institute of General Medical Sciences supports noncategorical health-related research encompassing a broad range of scientific disciplines, and multidisciplinary efforts involving both fundamental biological research and clinical investigation. This Institute is responsible for support of projects that are of significance to more than two of the other Institutes of NIH. One of this Institute's program areas is genetics. The research supported is less disease related, and more oriented toward improved understanding of basic mechanisms involved at the biological level, at the chemical level, and at the molecular level.

Significant components of three large multidisciplinary, multicategorical programs in genetics, supported by grants, relate to research on sickle cell disease and hemoglobin S.

One of the component parts of the extramural program is a continuing study by Dr. Harvey Itano of the synthesis of the abnormal sickle cell hemoglobin.

Senator KENNEDY. Do I understand correctly, that the Department can do the kind of work that has been suggested in this legislation without enacting new legislation?

Dr. ZAPP. That is right. Our only difference, Senator, is with the necessity for this authorizing legislation. We are currently using a variety of legislative mechanisms within the Department.

Senator KENNEDY. The problem I have seen in the past, for example, with lead-based paint poisoning, when that bill was introduced, the administration said the same thing—that additional legislation

wasn't needed. DHEW testified that adequate legislation was already on the books to resolve the problems of lead-based paint poisoning.

Although the legislation itself was passed overwhelmingly in the Senate, and in the House, I think we stimulated the administration to take greater action on this issue than would otherwise occur.

I think the same thing is generally true concerning sickle cell anemia. I do not question that you can somehow find the authority to provide the resources for this kind of health need, but it just is not being done.

Dr. ZAPP. I think this case is probably different from some of the other legislative debates that have taken place on categorical versus comprehensive programs.

This is different since we started in February with a presidential initiative, and we are currently using that authority, as opposed to saying, on the other hand we would use some authority. We are actually in the process. The only thing we have really waited for is getting the recommendations from the new Sickle Cell Disease Advisory Committee.

We have been waiting for them to suggest to us how we should use these funds.

Senator KENNEDY. How should the Congress—

Well, do you have the power to do all of the things that are in the legislation?

Dr. ZAPP. Yes.

Senator KENNEDY. And how can Congress indicate its sense of priority on this question, if we just leave this up to the administration?

Could we have a role to play in identifying areas of high priority, and should we not respond to that responsibility if we feel very strongly about it, rather than leaving the questions up to the executive branch?

Dr. ZAPP. I most certainly would think so, Senator.

Senator KENNEDY. How would you suggest we indicate or register our sense of deep concern?

Dr. ZAPP. I think there are a variety of mechanisms, other than new legislative authority.

Senator KENNEDY. We have done it in some other areas.

We have been able to do that in efforts to get additional kinds of resources to fund legal services, and nutrition programs, and for lead based paint poisoning. We on this subcommittee believe in the need to try and establish at least the sense of priority for sickle cell anemia.

Let me try to find out how strongly you are opposed to this legislation.

Dr. ZAPP. Well, I am not sure that I could categorize the difference in regard to this particular bill.

The departments many times has a variety of existing authorities. An example of this is in community services where there are many current authorities that can be used.

Senator KENNEDY. Do you have any problems in terms of the amounts of the money?

I am not asking you now as a spokesman for the administration, but in terms of the need, the kinds of applications, in terms of the money, could \$25 million be used for sickle cell anemia programs?

Dr. ZAPP. Well, I very frankly could not answer whether it could be used, but I think the advisory committee will probably get into this later.

For instance, perhaps the greatest needs are by the people who need transfusions and hospitalization at key times.

Senator KENNEDY. We will have to recess just briefly in order to cast a vote on the Senate floor.

We will recess for 10 minutes.

(Whereupon, the hearing was in short recess.)

Senator KENNEDY. The subcommittee will come to order.

We had talked a little bit before about the resources that were being expended by NIH, HEW, in terms of this disease.

Could you tell me, I understand Senator Schweiker earlier asked you where, if you could, track those resources, and is there anything you could tell us about that?

Dr. ZAPP. In fact, I appreciate the opportunity to clarify the line of questioning.

I think the question was related to Senator Tunney's statement, earlier in the hearing this morning, that this was not new money. I think perhaps that created an illusion that this was just money used for sickle cell before, but only now labeled sickle cell, and, therefore, was not new. This, in fact, represents not only an additional \$5 million of new money, but is added to the \$1 million that was expended on sickle cell disease research last year by the NIH.

I think the confusion arose as a result of the fact that in the submission of the 1972 budget, there was \$22 million of research training grants funds which was transferred from the Institutes into the Bureau of Health Manpower Education, to be administered by the Bureau, as opposed to having been previously administered by each of the separate Institutes. In so doing, about \$4½ million from the research training grants program of the National Heart and Lung Institute was transferred. So that with the additional \$5 million that was put into the Heart and Lung Institute as lead agency for the sickle cell disease program it looks like what was happening was a renaming of the money, but it was totally unrelated.

Senator KENNEDY. So this is in effect new money?

What was it being used for before?

Dr. ZAPP. Well, it was money that was not in the Department before.

Senator KENNEDY. Do you know for what it was being used?

Dr. ZAPP. Well, I really could only address the money that we have within the Department. It was essentially new funds requested by the administration for the Department's activities.

Senator KENNEDY. Now, as I understand, you have had \$2½ million allocated for the establishment of comprehensive research and community service centers, a million dollars to be allocated for the establishment of model screening and education clinics, and a million five for applied medical research; is that correct?

Dr. ZAPP. That is correct. We were following the recommendations of the new sickle cell disease advisory committee on how we could most appropriately use the funds.

Senator KENNEDY. Did they make any dollar recommendations?

Dr. ZAPP. It is my understanding they did. In this case, I will turn to Dr. Beckles, ex-officio member of the advisory committee.

Senator KENNEDY. Do you remember what it was?

Dr. BECKLES. These are the recommendations of the committee, as recorded in the minutes, Mr. Chairman.

Senator KENNEDY. In terms of the amounts?

Dr. BECKLES. The same answer; yes.

Senator KENNEDY. What was the study; was that an in-house study done by HEW, or an independent outside group?

Dr. BECKLES. The committee, Mr. Chairman, it is an outside committee created by the Secretary to advise the agencies in HEW as to how they would best spend moneys that are appropriated.

Senator KENNEDY. Do we have a copy of the study—could you make that study available to us?

Dr. ZAPP. Earlier, along with my testimony, I asked the permission of the Chair to submit it as a part of our record.

Senator KENNEDY. It just seems the amounts in terms of medical research are extremely modest, and in terms of screening and education clinics, once again, they seem modest.

I do not see why you would not be setting up screening clinics in all of the neighborhood health centers; why couldn't you do that?

I have visited personally; 18 to 20 of the neighborhood health centers across the country. Most of them are in the urban centers, in disadvantaged areas, and it just seems to me they have got the facilities, most of them are fairly ample, they have got the room that I suppose it would take to adequately run a sickle cell anemia program. Why shouldn't the Department establish screening tests on a voluntary basis in terms of neighborhood health centers?

Dr. BECKLES. Under the Mental Health Administration, under the community house services, the agency which funds the neighborhood health centers, we plan to establish program components in these neighborhood health centers, and so on, for example, in clinics using the child health services funds, clinics in which people come for family planning services, in essence, wherever clinics exist, that serve large populations that are black, this would be a component service that is added.

This is not a part of the \$5 million, and we considered in the intramural, if you wish, programs of health services.

Senator KENNEDY. You mean you will be expending more?

Dr. BECKLES. More in addition, yes.

Senator KENNEDY. How much more?

Dr. BECKLES. This is not a level that has been established, Mr. Chairman.

Senator KENNEDY. How do we know what your program is?

If it has not been established yet, how do we really know how extensive it is?

Why would you not want to establish a screening program in every neighborhood health center?

Doctor BECKLES. I think there are two problems here. One would be, if we, for example, if the United States established tomorrow, or launched tomorrow a mass screening program, I think that the yield, the numbers of people identified, who would need a programed followup counseling, if only on that level, for the trait people, would

create the need for the level of manpower in counseling with that skill that we do not now have, and I think it takes a phased effort in order to do that.

Senator KENNEDY. Are you saying then that if you tried you could certainly find people in need of sickle cell assistance? And that you would find a lot of people who are affected by this tragic disease and its complications, but that you do not have the manpower to cope with this after you would locate them or identify them?

Doctor BECKLES. Yes, Mr. Chairman. I think, for example, we talked earlier when we alluded to the broad public concern that has been created because of the increase in heightened emphasis through the media, the work by various private organizations, and the whole increased level of attention focused on this disease, and the anemia during this year.

I think the offshoot of that is that many people hearing about sickle cell anemia for the first time are in somewhat of a quandary as to what it is, and how are they affected.

Senator KENNEDY. What is the best way to meet that quandary; is it not to have a program or to have a program?

Dr. BECKLES. To have a program adequately staffed manpower-wise, and I think in order to have that level of manpower throughout the Nation, that it would envision varying intensivity of program over a time period.

Senator KENNEDY. Are you requesting funds now for additional manpower that will be trained; are you up here for that?

Dr. ZAPP. Mr. Chairman, at least from our standpoint, I would like to put it in the way that I consider it to be in context.

Senator KENNEDY. I think this is in context. I think it is a very understandable context. The simple fact is that this administration is either unwilling or unable to meet the health needs of 2 million Americans who are affected by a very serious disease—sickle cell anemia.

Dr. ZAPP. We started out from ground zero. We went out and selected, I am sure you will see from the makeup of the advisory committee, some of the most competent people in the country to consult with us and advise us on how to establish a program. This has all occurred just within the last few months. An inventory of all the private groups, as well as all the public groups, some Federal, some State, some local, that are doing sickle cell screening, many of which we are unaware of at this time, and to establish the commensurate amount of manpower to go along with this screening, and development of methodology, all require time.

Senator KENNEDY. The only thing that troubles me is for you to come on up here and say, we have got all of the legislative authority, and we are allocating this new kind of money; you are describing these kinds of programs, giving the kinds of demands, and claiming that on a voluntary basis the need will be met, but then saying that you do not want to spend any more, because you do not have the other kinds of resources, like manpower, facilities, and equipment. And then you come up here and still fail to request the resources or to describe any plans to do so.

Dr. ZAPP. Mr. Chairman, that is only one facet of it.

Senator KENNEDY. What is the other facet? That is one limitation.

Dr. ZAPP.. You have to have not only the manpower, but you must have the facilities.

Senator KENNEDY. Let us take the many neighborhood health centers.

Dr. ZAPP. The neighborhood health facilities most probably would be one of the ideal ones. But there are a variety of screening tests that are used, and even though some of them are very simple tests, if you get a positive reading, you then have to have an established facility ready to offer further service to those people.

Senator KENNEDY. Let us get back to the facilities needed for adequate support of sickle cell anemia programs.

Can you not do that in the existing neighborhood health centers with the facilities that are in existence now?

Dr. ZAPP. You could probably do the screening very easily, but if you have a positive reading, and need a second much more complicated examination, and you do not have the proper type of equipment, what have you done then?

Senator KENNEDY. Now, we have facilities, and we have training and now equipment.

Are you prepared to come on up here and make a request to the Congress for additional equipment?

Dr. ZAPP. Well, what we are prepared to do——

Senator KENNEDY. Just answer. You say you need additional equipment. If we are going to evaluate the seriousness of the administration's attitude on this question, I think it is perfectly within our purview to find out if you are really serious.

You have come to us with a rather limited budget, and you say you can only step before you run.

You say you cannot step because you have not got the facilities, you have not got the equipment, and you have not got the manpower to carry this on.

At least, this is what I gather from your response.

Dr. ZAPP. I say those are all essential components.

Senator KENNEDY. Are you coming up here requesting, are you prepared, is the administration prepared to come on up here and say we need *x* amount of money in terms of equipment, in terms of facilities, in terms of manpower?

If you can show this, then I think, at least on my behalf, and in terms of the members of the Health Subcommittee, then we will be convinced that what you are talking about is more than rhetoric, and you really mean business.

Can you give us that assurance? If not, I think we are completely within our rights to say we will go on our own then.

Dr. ZAPP. I think before we do that, or before anybody could do that, things not related to what you could do with the authority must be done. We have already stated our position on that. An inventory on a national basis of the facilities, of equipment, of the manpower, of the education and counseling service has not been made as yet. We are just starting, and we are going from perhaps a crawl to almost an upright and rapidly mobile stage.

Senator KENNEDY. That is your evaluation in terms of the dimension of the program, which will put \$1 million in 10 to 20 screening and educational centers. That amounts to \$50,000 per center for 20 centers.

That does not seem to me that you are going from a crawl to a standup position. As I see it you will continue to crawl. With \$50,000 per center you might be able to afford two professional personnel, but I can see no way for you to get any equipment, with that meager sum; it does not seem to me you are moving from a crawl to a standup position. The cancer program is an example of moving toward a commitment to resolve a basic health problem. We have just increased the cancer program by \$100 million this year.

Dr. ZAPP. The Cancer Institute was formed in 1937, and there has been a continuous awareness and fear of cancer.

Senator KENNEDY. You say you are doing all kinds of research in terms of biomedical research. You say you are sufficiently concerned about this to establish a task force, and you say you really want to pour some resources into sickle anemia research.

That is what we in the Congress would like to see. We hope that the superb facilities over at NIH will be able to respond, not with a million five, but with substantial resources. I am talking of maybe \$8 to \$10 million, as a start.

Dr. ZAPP. I am sorry Dr. Ringler is not here. I would question if in biomedical research you could take a program at a million-dollar level and put \$7 to \$8 million in it, and in that same fiscal year have the research competence, to use it properly.

The same thing was faced in cancer, where the commitment was there, but to request and use whatever resources can be reasonably used, you have to have people that are skilled and have a background in that research.

Senator KENNEDY. You and I know the process. You know the kinds of restrictions you are under in terms of a budget. I do not question one bit your responsibility in defending the administration's position in terms of budget restrictions on this, Doctor. I respect that.

What I want to know is whether there is a feeling here of having to respond to the problem of sickle-cell anemia in terms of the information about the critical need for helping those who suffer with the disease. There is a difference between taking the administration's position and expressing the human or personal viewpoint on these kinds of issues.

It surprises me to hear you suggest that you could not expend a good deal more resources to perform medical research on sickle-cell anemia. I am very surprised at that response.

Second, I am distressed to hear you claim there are additional problems in terms of manpower. As you know, we just passed the health manpower legislation, we had extensive hearings on that, and we did not hear anything in terms of what the administration wanted in terms of training personnel; and if you need additional kinds of resources in terms of facilities, in terms of equipment, we should hear about that.

Dr. ZAPP. I agree with the Senator, but I think the manpower area is a classic example of a new kind of flexible authority which has now been passed by both Houses. This same commitment to sickle-cell disease, the need for the kind of manpower there, has to get back to the people running the medical schools, the people who are running the different medical health professional schools in the country, to begin to develop—

Senator KENNEDY. Have you visited the medical schools in trying to get it?

Dr. ZAPP. Yes.

Senator KENNEDY. What has been their reaction; what has been their response?

Dr. ZAPP. I think that the medical schools are probably being extremely responsive.

Senator KENNEDY. In what way?

Dr. ZAPP. First of all, they probably have a variety of approaches.

Senator KENNEDY. Not probably. What approaches, and in which medical schools?

Dr. ZAPP. You are talking specifically about sickle-cell disease?

Senator KENNEDY. Yes.

Dr. ZAPP. I visited many medical schools, obviously. I have not visited one to discuss the aspects of sickle-cell anemia.

Senator KENNEDY. Has anybody in the Department, that you know of, gone out to a medical school and said, we are concerned about this, the administration is concerned, our Department is concerned, and we want to know what you are doing, what you can do, and what you are able to do?

Have you met with the American Medical Association? What have they told you?

All we are trying to get here is a measure of the Department's commitment in terms of trying to do something on this.

I do not question yourself or Dr. Beckles. I do not question it one bit, and I have a great respect for you gentlemen, because you have been enormously helpful personally to me in this subcommittee, but you come here in terms of presenting the administration's view, and I am sure you do it in good faith; but we have a right to judge whether the administration is really interested in doing something, and you say the medical schools are preparing to do something.

I want to know who has gone down there and visited those schools, and what they have told you.

I want to know who has gone to the great research centers of this country and spoken to them on the sickle-cell anemia problem, and what have their responses been, and what they have told you about the kinds of resources that are being used to fight this disease.

I want to know if the medical schools are doing any new kinds of training programs.

I want to know if any of the medical schools are developing criteria to help assist young physicians, and which medical schools are leading the way. Those particular medical schools which are leading the way ought to be commended, and we ought to know what they are providing in terms of leadership, and I would like to know in terms of whether you have met with neighborhood health centers, and if they have been asked if they could handle this program, and I would like to know their response, and I would like to know whether you have met with the consumer advisory groups and asked whether they are interested and concerned with the problems of sickle-cell anemia and with helping their community. I want to know all of those things in terms of initiatives.

Dr. ZAPP. I think you have every right to know that, and we will certainly supply the information you have requested. Dr. Ringler had to leave earlier because of his wife being hospitalized.

Senator KENNEDY. Well, you have some idea of what we are looking for.

Dr. ZAPP. I think Dr. Beckles could give you a discussion of it on the service side as it relates to the medical schools.

Dr. BECKLES. Mr. Chairman, we have worked in some small way with medical institutions, like Howard University, Meharry, and clinics such as those in New York on the private side. It is because of this kind of exchange of information that we have been able to structure the kind of program that we propose to follow.

I daresay, as in every other instance, the medical schools that we have worked with have said that they would do more, but they do not have the overall budget with which to follow these kinds of emphasis.

Senator KENNEDY. I think it is a very fair response on this.

As I said, I believe you gentlemen, if you could spend all of your time doing it, and do a great job at it, but just in terms of trying to evaluate whether we are responsible in allocating this kind of limited resource, \$25 million initially in terms of screening programs, \$5 additional million that may be used in research, we want to know whether we are in the ball park with these amounts.

I think we are in terms of the kind of information we have had here. If you could provide supplemental information on this, we would appreciate it.

Dr. ZAPP. We would be pleased to do it.

(The information referred to, subsequently supplied, follows:)

DISCUSSIONS BETWEEN DHEW AND OUTSIDE ORGANIZATIONS ON SICKLE CELL DISEASE PROGRAM

Contact has been made with many types of organizations or groups which might be expected to participate in this effort. The makeup of our Advisory Committee reflects this, representing as it does the large medical schools, city hospitals, neighborhood clinics, major university research centers, social service agencies, neighborhood centers, the black press, and the community itself. Many conversations and visits, to private and public, large and small, institutions spread widely throughout the country have taken place to date. A meeting is planned with representatives of those other government agencies concerned with providing health care in order to determine the willingness and ability of each of these to make a contribution in support of this initiative.

Dr. ZAPP. A preliminary study was done for the Advisory Committee, and it is fairly lengthy, but I do not think it is in any way complete. I would like to supply an outline of the survey for the record of the subcommittee.

(The information subsequently supplied follows:)

SURVEY OF ONGOING PROGRAMS RELATED TO SICKLE CELL DISEASE

Information on the magnitude and extent of ongoing work in the area of Sickle Cell Disease was requested from 31 organizations known to be engaged in these activities; 21 responded. A broad spectrum of groups was consulted, from large privately supported medical or academic institutions to voluntary health groups with limited local coverage.

A population sample of about 100,000 had been screened for SCD by these groups, and included infants, children, young adults and routine obstetrical patients. About $\frac{3}{4}$ of these were screened as part of SCD programs which include follow-up clinical diagnoses, hemoglobin genotyping, counselling in both the genetic aspects and medical management of the disease, and often active programs of SCD research. Two such comprehensive programs of long standing, those at Howard University and Meharry Medical College, are responsible for screening more than half of the patients enumerated.

All of the groups questioned expressed some cautionary feelings regarding what has become a recurring major concern—the need for adequate follow-up to screening and the provision of appropriate educational material. In 70% of the groups, initial screening was followed by confirmatory analysis; 60% of the organizations have incorporated a counselling service into their programs; many provide educational literature and offer medical referral.

The operating facilities vary from hospital clinics to schools and mobile units; the staff personnel are equally varied, though most groups include or consult with physicians and nurses in addition to their lay or para-professional workers. Support for these groups generally comes from private donations; departmental funds are usually used for those programs with academic or medical school connections.

Senator KENNEDY. Thank you very much.

It was nice to have you with us this morning.

Our next witnesses this morning are a mother and daughter, Mrs. Dorothy Boyd and her daughter, Mrs. Kaaren Winston.

Mrs. Boyd is financial secretary of the National Sickle Cell Disease Foundation and Mrs. Winston is a medical technician in Rochester, N.Y., at Strong Hospital of the University of Rochester.

In her work at the hospital she detects victims of sickle cell anemia and counsels with patients.

Mrs. Boyd has four children—two have the disease. One has the trait, and one child is not affected.

All four of her children were born before she and her husband knew they were passing on this disease.

Her daughter, Mrs. Winston, has the disease, but her—Mrs. Winston's—daughter does not have it.

I want to welcome both of you to the subcommittee this morning.

We are looking forward to hearing your testimony.

You relax now, just take your time, just tell your story.

We get all excited when we sometimes have those administration people up here, but I just want to let you know that you are among friends, and we are friends of the administration too, and you just tell us your story, and we are looking forward to hearing from you.

STATEMENT OF MRS. DOROTHY BOYD, SILVER SPRING, MD., AND OF MRS. KAAREN WINSTON, ROCHESTER, N.Y.

Mrs. BOYD. I guess the thing to do would be to start at the beginning.

I remember, in 1945, my husband came home from the Second World War. We had an infant daughter.

My husband entered the seminary and worked part time, leaving me alone with this young baby. We lived with my parents.

We were very young. Being alone, I spent a great deal of time with the baby and formed the habit of putting the baby in the bed with me.

Kaaren must have been about 8 months old when she had trouble with her elbows swelling.

I can remember my mother giving me a long lecture about putting the baby in my bed. She thought I had rolled over on the baby and caused her to have swollen joints.

Shortly after that, Kaaren began to have bronchial infections, which would develop into pneumonia. One night she actually went into a coma.

We struggled along with this, off and on, for two and a half years, thinking that the child would grow out of it. We had no idea of anything, except that she was weak.

This is what the doctor said, she was just a weak child.

In 1947 my husband and I moved to Magnolia, Ark., and he assumed the responsibility of his first charge.

He was earning all of \$28 per week. We did not know anyone. It was ironic. We moved into this new small community and Kaaren's health began to deteriorate. She was sick most of the time and had to have a blood transfusion about every 6 to 9 weeks.

She would perk up immediately after the blood transfusion, and then go back down again, so that in approximately 2 months, she would return to the hospital for another transfusion.

At this point no one said anything about sickle cell anemia.

The doctor said he thought she had rheumatic fever. He changed it and said it was malaria. He put her on a constant dosage of coco quinine, which really did not help at all.

It hindered the whole thing. We found out later it was dehydrating her system.

She became thinner and her abdomen was swollen; she did not look well at all.

We thought we had a quiet child, but we really had a very sick child.

Senator KENNEDY. What did you think was wrong with the child?

Mrs. BOYD. What the doctor said.

He said it was malaria. Neither one of us could figure out where she got it.

We knew vaguely about mosquitoes.

Senator KENNEDY. The doctor said malaria?

Mrs. BOYD. He said malaria, and we had to accept it as that.

Magnolia, Ark., my home is in Chicago, and to move from Chicago to Magnolia, Ark., is like going to a swamp.

It is about 18 miles north of the Louisiana border, and I thought maybe that is where the disease came from, the malaria.

In 1949, we moved to Tyler, Tex., to a new situation.

Senator KENNEDY. Did they treat the child for malaria?

Mrs. BOYD. Yes. That was the coco quinine.

Senator KENNEDY. What happened, did it have any effect?

Mrs. BOYD. It seemed to. We found out later, that she was dehydrated. The doctor who told us this contributed some of it to the coco quinine, which she took daily, every so many hours, night and day, for about a year.

Senator KENNEDY. Where were you getting this drug?

Mrs. BOYD. We bought it at the drugstore.

Senator KENNEDY. You paid for it?

Mrs. BOYD. Yes.

Senator KENNEDY. For about a year?

Mrs. BOYD. Yes. The blood transfusions at that time, you had to pay I think \$50.

Senator KENNEDY. For a transfusion?

Mrs. BOYD. Yes.

Senator KENNEDY. Do you remember what your medical bills were generally over that period of time, approximately?

Mrs. BOYD. They were out of sight. They were so large, we just lived from day to day, from week to week, and just managed.

While we were in Magnolia, we were fortunate, somebody decided that we needed help. The Kiwanis Club there helped us with the bill for the blood.

Senator KENNEDY. Which Kiwanis Club?

Mrs. BOYD. That has been so long ago.

Senator KENNEDY. In Magnolia?

Mrs. BOYD. In Magnolia, Ark.

When we moved to Tyler, she became desperately ill, and we knew no doctor.

A friend of mine suggested I use her doctor, who incidentally was an internist.

I did not know what that meant at the time. It turned out that this man, a Jewish doctor, diagnosed sickle cell anemia.

That was the first time we had ever heard of it.

Senator KENNEDY. How old was she?

Mrs. BOYD. She was 4. He admitted he knew very little about it.

He sat down with us in his office with a textbook, and read maybe 10 lines, and that was it.

We used this doctor, for approximately 3 years. During this time we had another child, he was a normal child, as far as sickle cell anemia is concerned.

He was a very large, active baby. The doctor was afraid that Kaaren's spleen would be ruptured with this rough boy child bouncing around. Her spleen was absorbing the damaged sickle cells, this is what made her stomach so large. The doctor suggested that we allow her to have a splenectomy. We were given to understand that the spleen should be removed because if she bumped herself at the correct angle, she would bleed to death before he could get to her. So, that this was the primary reason for the splenectomy. The doctor explained Kaaren might experience some relief from the sickle cell anemia incidental to the surgery. The operation was performed: however, Kaaren continued to have her crises, although they did not seem to be as severe. Before surgery all of her limbs ached and were swollen, and she could not walk.

After the splenectomy, most of the crisis pain was centered in her abdomen and back.

That is all we knew. No one told us that Kaaren's illness was congenital.

Senator KENNEDY. Did you have to pay for that splenectomy as well?

Mrs. BOYD. We at that time were able to afford hospital insurance, and they did it for whatever was paid by the insurance company.

Then, let's see, and we struggled along, and eventually we wound up in Decatur, Ill.

Senator KENNEDY. Did anyone counsel you or advise you?

Mrs. BOYD. The doctor in Tyler did tell us that Kaaren had a chronic disorder, sickle cell anemia, and the best thing for us to do would be to adjust to it. We were advised to learn to live with it like any other chronic disorder, and to try above all else not to develop hypochondriac. This is what we did.

Senator KENNEDY. Did they suggest anything about having the other children tested?

Mrs. BOYD. Not at this point.

By the time we were living in Decatur. This was 1958, about 13 years later, we had two more sons, the entire family was born.

We still did not know very much. No one had counseled us as to whether we should have any children.

In 1958, the pediatrician we used tested everyone, all six of us. This is when we learned that I have a trait, my husband has a trait, Kaaren, the oldest child, has the disease, the second child has nothing, the third child has the disease, and the youngest child has a trait. This is when it was suggested that Kaaren undergo a tubal ligation.

We were informed she would never live to see womanhood; that if she did, very shortly thereafter she would die, and that there was nothing anyone could do, so, you know, get yourselves together, and get ready to face it.

Senator KENNEDY. Who gave you this marvelous story?

Mrs. BOYD. I cannot remember his name, but he was a pediatrician. We were in Decatur, Ill.

We decided, my husband and I, that the decision was not ours to make concerning whether Kaaren should or should not undergo a tubal ligation.

This was something for her to decide. Consequently we did not accept his advice. Kaaren managed to get along, and eighteen years after her birth she entered Spellman College, Atlanta, Ga., and we moved here into this area.

Now, when Kaaren got to school, she was away from us, at her own choosing, she decided, I guess all children do, she wanted to get as far away from us as she could, and when she made the decision, we were living in Kansas City, Mo., so Spellman was far away, which was Atlanta, Ga.

Well, as luck would have it, we moved right up here to Washington, D.C.

The school doctor and nurse decided Kaaren was, according to Kaaren, a chronic goldbrick, and a hypochondriac; that she had no need for her medication, which she kept always, a little box of Darvon. We had been informed by this time that the pain one suffers could be controlled somewhat with Darvon. A person with sickle cell anemia learns to manage the pains but needs additional help when a crisis strikes.

You do not give into every little pain. This is what Kaaren was doing, in trying to make her classes.

When she was ill, and confined in the school hospital, they took away the Darvon and gave her aspirin. When she was released from the hospital, they refused to let her make up her exams, and so it got to be a very, very tight thing.

Senator KENNEDY. Did they not know she had sickle-cell disease?

Mrs. BOYD. They did not believe her.

Senator KENNEDY. They did not test her?

Mrs. BOYD. No, they did not test her. They had her medical charts from our doctors. She took all of this with her when she went away to school, but they just refused to accept it.

I do not know what happened, but that is the way it turned out.

Shortly thereafter, Kaaren came home and announced, I am getting married, and, of course, my husband and I just went into orbit.

We talked and talked, and we pleaded and begged, of course, she got married.

There was nothing we could do about that. She stayed with us during her pregnancy.

She had no problems at all, amazingly enough, she was cared for at Georgetown University Hospital, her pregnancy was considered a normal one.

She went into labor and a crisis simultaneously and scared the doctor to death.

He told me later that if he managed to finish his internship, he would never, never take another pregnant sickle-cell patient.

He said that he just knew she had suffered a heart attack, and was going to die. We were very appreciative.

Senator KENNEDY. Please continue.

Mrs. Boyd, you do not look like you had all of that trouble.

Mrs. BOYD. The baby was born, and was fine. Kaaren developed pneumonia after the child's birth, and stayed in the hospital for weeks and weeks. Finally, she did get herself together, she was released and she is doing quite well.

She does have crises from time to time.

What I would like to say before I close, is that down through the years, we have felt that somebody failed because no one was able to tell us anything.

The normal, run of the mill people, do not know about sickle-cell anemia, also a whole lot of professional people, even doctors, do not know. It seems that out of the whole situation, the most important thing would be a program whereby people could be educated. To think that a doctor would examine a child, care for a child over a period of 2 years, and not be able to diagnose the correct disease is frightening.

I understand that medical schools give only a little information about it.

There is a disease called sickle cell anemia. My daughter tells me she has been in classes with medical students and they say there is a disease called sickle cell anemia, flash a big picture of a sickle cell on the screen and say, "This is a sickle cell," and that is it.

It seems that most doctors just do not know enough about the disease and its treatment. It is a frightening thing to consider, that you must depend on somebody to know something, and they really do not know it. I think education is very, very much needed.

I feel that is all I have to say.

Senator KENNEDY. Let me ask you this: If you had known, been tested at the time you were married, and you and your husband had realized that you had the trait, and that he had it, do you think you would have gone on and had children?

Mrs. BOYD. If I were that age, 20, and as knowledgeable then as I am now, I imagine that I might have taken a different approach to having a family, because you can adopt children.

There are all methods of acquiring a family, and I probably would have taken another course. If I had been told a little bit about it, the fact that we carried the trait and that there was a possibility of our children being born ill, I do not think that would have been enough. I would have had to know more.

Senator KENNEDY. Mrs. Winston, what would you like to add to this?

Mrs. WINSTON. Mr. Chairman, I have a statement I would like to enter into the record.

I am Kaaren Boyd Winston, senior counselor in the Department of Preventive Medicine and Community Health, University of Rochester School of Medicine and Dentistry, Rochester, N.Y.

I work primarily in the area of sickle cell education and testing under the supervision of Mrs. Naomi Chamberlain, assistant professor in preventive medicine and community health, and Dr. Robert Berg, chairman of the department.

Before working in this department I was employed for 3 years by the university medical center as a hematology technician.

Sickle cell anemia and sickle cell trait have been described as one of the most neglected health problems in the Nation today.

Virtually all sickle cell anemia victims are of Afro-American heritage, but not exclusively.

It is also prevalent among Latin Americans, Puerto Ricans, Indians, Asians, and people of the Caribbean.

Among blacks, the prevalence of the trait is said to range from 7 percent to 13.4 percent.

The generally accepted estimate for prevalence of the trait is 10 percent.

The anemia occurs in one out of 400 or about 0.2 percent.

The counted 22.5 million blacks and a reported possible 5 million undercount means there are approximately 3 million persons affected by this inherited condition.

Sickle cell anemia is one of the many hereditary blood conditions known to be caused by an abnormal hemoglobin.

Hemoglobin is the substance in the red blood cells which enables the cells to carry oxygen to the tissues of the body and to transport carbon dioxide away.

It is responsible for the color of the red blood cells. Normal red blood cells are biconcave and disc shaped. When the red blood cells of a person with sickle cell anemia receive a decreased amount of oxygen, the cells assume a sickle or crescent shape. Thus, the name of the condition is derived from the distorted shape.

Red blood cells normally live about 120 days. A sickled red cell may live from 40 to 60 days.

The rapid loss of red blood cells causes the chronic anemia of the condition.

Cells with this abnormal shape also exhibit a tendency to congregate in the small blood vessels and to block the circulation.

These two facts are the causes of the symptoms manifested by those persons with sickle cell anemia, a chronic anemia and various types of crises.

Any organ system can be involved in a (thrombotic) crisis.

Those most often involved are the bones, abdominal organs, lungs, brain, and kidneys.

This serves to explain why a person who is having a sickle cell crisis may be diagnosed as having appendicitis because of the extreme pain and tenderness in the abdomen, or as having rheumatic fever or arthritis due to swelling and involvement of the bones.

Sickle cell was first described in medical literature by Dr. J. B. Herrick in 1910—over 60 years ago.

Subsequently, in 1949, the Nobel Prize winning research of Pauling and his associates cast further light on this condition.

Nevertheless, there continues to be a dearth of programs dealing with sickle cell anemia, reflecting the low priority this serious health condition has held.

A child with sickle cell from earliest infancy is a financial as well as psychological drain on his family.

In school-age children, frequent bouts of pain and fatigue are serious deterrents to ordinary school achievement.

The child's physical activity must be controlled, competitive sports are not recommended, and the child's entire educational program must be tailored to his physical capabilities.

Excellent academic achievement should be encouraged, as individuals with anemia are limited, generally, to sedentary occupations.

There is a mother of a 6-year-old boy with sickle cell involved in our program at the University.

She has told us many times of the numerous problems she encountered when her son first exhibited symptoms.

The doctors had no idea what was wrong with the boy.

She was given several different diagnoses, varying from rheumatic fever to allergies, to viral infection.

This went on for 3 years. She almost lost her home because of excessive medical bills incurred at this time.

The boy still is quite ill and by the end of the first month of school this year had missed 9 days of class.

At the end of his first year in school, he had missed a total of 72 days.

Good vocational guidance is of extreme importance. A man with sickle cell anemia will find it difficult to obtain and hold a job to support himself and his family, and a woman will have to superimpose the problems of a chronic illness on the duties of homemaking.

Employers must have an understanding of the illness and be willing to accept an employee who may lose a good deal of time from work.

Persons with sickle cell must be most carefully instructed as to what is necessary for their health care.

Proper nutrition, good hygienic and dental care, avoidance of exposure to infections, and prompt medical treatment when a crisis or other complications occur are essential.

For these persons the need for competent education and counseling is obvious.

With this need appearing so obvious, the lack of these services is amazing.

A young mother who has sickle cell disease told us of how she found out what her health problems were arising from.

She was expecting her first child, and was being seen by her obstetrician regularly.

She was given no hint of anything being wrong until she came in at the end of her seventh month for her regular appointment and was told that she would be admitted to the hospital that day and labor would be induced immediately. She has since spent 8½ months in a body cast because of involvement of the bones in her hip joints.

The needs of those with the trait are not so obvious. At this point, no one is sure who is affected, or how many of these people there are, or even where they are.

There are very few solid facts concerning how having the trait affects a person's health.

It is only known that there is the possibility that persons with the trait can encounter difficulties. For instance, there were four black servicemen who died while undergoing Army basic combat training at a post at an altitude of 4,060 feet.

It was stated that all four were healthy, had no family history of anemia, and originated from low altitude areas.

Under autopsy, the four had sickle cell trait and evidence was found of sickle crisis.

Distended vessels were found to be packed with sickle cells and there were no other causes of death present.

For 3 years, the Department of Preventive Medicine and Community Health has spearheaded intensive educational efforts in the area of sickle cell.

These have been directed toward medical students and doctors, regarding the social and family impact, staffs of agencies in the community. Rotary Clubs, Sunday schools, penitentiary inmates, and elementary school children in special projects.

Within the past year, through these efforts, the following agencies in the Rochester area have added sickle cell screening as part of their routine physical examinations:

Planned parenthood; three nursery schools; one State school; one public school; one job training program; one children's center; three industrial firms.

The educational component has been the main thrust, with the Department of Preventive Medicine assuming the responsibility for the followup and counseling of both families and health workers.

Our experience has shown that the often used label of apathy and indifference has proven untrue as it relates to sickle cell anemia programs.

The demands far exceed the ability of the department in terms of reaching the 55,000 persons of Afro-American heritage and the 22,000 persons of Caribbean origin who live in Rochester, N.Y.

Some of the needs include:

(a) Adequate insurance coverage without prohibitive premiums.

(b) Need for research: How much does the disease cost the Nation? The trait? What effects does the trait have during a person's lifetime? What is the expense of misdiagnosis of problems caused by the trait?

(c) More intense and improved education for health workers and communities.

(d) The need for development of mandatory child health programs for genetic disorders which threaten health status of children, including sickle cell anemia, should be determined.

(e) There is a need for increased research grants and fellowships for the study of sickle cell anemia and sickle cell trait.

I would like to pass on in the discussion to mention my last crisis and what happened at that time.

It took place about a year ago. The cause never was established, you know, what brought the crisis on was not established.

I had worked at my job, my regular hours that week, and I had come home from work, and prepared the evening meal. I decided that I wanted to go out shopping, so at that time I felt fine.

I went out shopping for perhaps 2 hours, and while I was in the store, one of my legs started to ache, finally it got to the point where

I ended up, sort of leaning on a counter, trying to decide if it was going to stop, or if I should perhaps take some medication. Being in the store, I had to get home, I had my daughter with me, and there was no one else there to help.

Finally, we got home, and I had taken my medication. I applied some heat to the leg, put my daughter to bed, and sort of just sat there, still trying to decide what was going to happen.

I started to feel a little better, so I went to bed, and I decided if I felt better in the morning, I would go to work.

If not, perhaps I would stay home the next day, but during the night I woke up, and the pain had increased tremendously.

At the time I woke up, the medication I had taken had not worn off, so the pain did wake me up, it had sort of forced itself through the medication; that is sort of my cutoff point, as to whether I contact my doctor or not.

If I feel that the medication he has given me can control what is going on, so I can function, I do not contact him, but if it does not, then I call him.

This is what I did, and I was told to go into the emergency ward, at the hospital immediately.

I was still at home, so I had to try to contact somebody to come and take care of my daughter, and to drive me to the hospital.

I was taken to the hospital, and they gave me some additional medication to try to relieve the pain.

I am not sure whether it relieved the pain, or just sort of put me in a position where I really did not care anymore.

They also started fluids.

Senator KENNEDY. You do not know what the drug was?

Mrs. WINSTON. It was a combination of three drugs. I cannot remember what they were, but codeine was one.

They started fluids intravenously, and they were giving me oxygen, as well as the drugs to relieve the pain. That was the extent of what was done.

They tried to determine whether or not I had an infection that could be cleared up to try to help halt the crisis.

Hematology studies were done, but the values that I had at that time were my normal values, so that my red count had not changed, my white count was slightly elevated, but not to any great extent.

I was hospitalized for a week and a half at that time, and, finally, after I sort of nagged everybody to the point where they could not take it anymore, they let me go home. I stayed at home for about a week, still taking some medication, and calling the doctor, perhaps every other day, sort of reporting in.

At the end of that time, about 2½ weeks, I went back to work, and back to my usual duties.

Senator KENNEDY. Were you covered by insurance during this period of time?

Mrs. WINSTON. I am covered by Blue Cross/Blue Shield on the hospital group policy.

Senator KENNEDY. Did you have some medical expenses at that time?

Mrs. WINSTON. I think they were \$1,100 or \$1,200 for that particular crisis.

Senator KENNEDY. Between \$1,100 and \$1,200 for that particular crisis?

Mrs. WINSTON. For one crisis, yes.

Senator KENNEDY. Of which how much was paid by the Blue Cross/Blue Shield?

Mrs. WINSTON. I am not sure. All of it was paid by somebody, not by me.

I am not sure exactly what Blue Cross/Blue Shield paid, and I am also on the university policy, because my husband is a student there, so I am covered from about three different policies.

Senator KENNEDY. You still have Blue Cross/Blue Shield?

Mrs. WINSTON. Yes, I do at this time.

I do not know what is going to happen if I ever leave the university, because before I started working there, I did not have Blue Cross/Blue Shield for a period of about 2½ years, because the policy was canceled.

Senator KENNEDY. Why was it canceled?

Mrs. WINSTON. I do not know. The excuse I was given was non-payment of premiums, but the reason I was not paying the premium was because I was not sent the bill. I was told not to pay until I received the bill, and after about 4 or 5 months of this, they canceled the policy for not paying the premium.

Senator KENNEDY. Now, with regard to the programs at Rochester, who is funding those programs?

Mrs. WINSTON. Nobody.

Senator KENNEDY. It is voluntary?

Mrs. WINSTON. The entire staff with the exception of myself and one other person I can think of is volunteering.

Senator KENNEDY. Do you think if you got some resources from the Federal Government, just modest resources, you could really expand that program?

Mrs. WINSTON. I am sure.

Senator KENNEDY. Do you know of other screening programs that have taken place, not only in Rochester, but in some of the other communities around Rochester, any of the cities?

Mrs. WINSTON. Most of the ones around Rochester that I know of are those that have sprung up through the influence of our program.

Senator KENNEDY. But are there a few?

Mrs. WINSTON. Yes.

Senator KENNEDY. OK. Well, that is very, very helpful.

I want to express our appreciation. It is never easy to talk about these matters, because they involve things that are personal, but you have given us an added dimension and insight into the problem, and I think it is enormously helpful and valuable to this subcommittee in considering the legislation. I want to thank you both very much.

The subcommittee stands in recess until 9:30 tomorrow morning.

(Whereupon, the hearing was recessed until 9:30 a.m., November 12, 1971.)

NATIONAL SICKLE CELL ANEMIA PREVENTION ACT

FRIDAY, NOVEMBER 12, 1971

U.S. SENATE,
SUBCOMMITTEE ON HEALTH OF THE
COMMITTEE ON LABOR AND PUBLIC WELFARE,
Washington, D.C.

The subcommittee met at 10 a.m. in room 4232, New Senate Office Building, Senator Edward M. Kennedy (chairman) presiding.

Present: Senators Kennedy, Hughes, Javits, and Schweiker.

Staff members present: LeRoy G. Goldman, professional staff member; and Jay B. Cutler, minority counsel.

Senator KENNEDY. The subcommittee will come to order.

This morning we begin the second day of hearings on the National Sickle Cell Anemia Prevention Act. I am grateful for the concern expressed by everyone who is working to produce a substantial commitment in this vital area of health need.

During yesterday's hearing, Mrs. Dorothy Boyd delivered a deeply moving account of her family's 26-year battle with sickle-cell anemia. Of the Boyd's four children, two have lived with sickle-cell anemia all their lives. For that family, sickle-cell anemia, the neglectedcrippler, has produced years of agony, doubt, pain, and wonder. The Boyds' have personally struggled with enormous medical costs and immeasurable anguish, for a disease that America has ignored for decades.

As we listened yesterday to the descriptions of agony that the crises of sickle-cell victims are destined to endure, only inadequate, unjustified excuses were offered by the Department of Health, Education, and Welfare, as a response to the need of those who are suffering.

These 2 days of hearings are conducted in order to fully examine the ways in which the Federal Government might join in the battle against sickle-cell anemia. The bill we are considering, S. 2676, authorizes \$30 million each year, for 3 years, to begin to meet that disease.

The proposed legislation would establish \$25 million a year for the development of programs to test, screen, counsel, and inform potential sickle-cell anemia victims of the problems the disease can produce.

In addition, this bill, which has strong bipartisan support from 31 Members of the Senate, authorizes \$5 million a year for each of 3 years, to support research that will lead to improved treatment procedures.

For the 2 million black Americans who are believed to bear the sickle-cell trait, and for the estimated 100,000 victims who suffer from

the debilitating effects of the disease, S. 2676 offers to produce a beginning in the struggle against this malady.

Officials from the Department of Health, Education, and Welfare told the committee yesterday that they are indeed aware of the requirements for an adequate sickle-cell anemia treatment center, even though the Department appears unable or unwilling to meet that need.

Thus, neither adequate physical facilities, the development of substantial personnel training, nor the procurement of equipment is currently underway, according to HEW officials.

This lack of concern is dismaying. As I emphasized yesterday:

Sickle-cell anemia has been a neglected disease for too many years. It is now receiving the concerted attention of many of us in the Congress and of health authorities around the Nation because of serious efforts to examine many of the ills and problems that have long affected those Americans who suffer the inhumanity of racism. Probably no other disease has affected as many people in this country as sickle-cell anemia and has been as unattended as this disease. Some 58,000 people suffered during the 1952 epidemic of polio. Despair and fear from that killer brought a shock to the Nation that generated an all-out effort to control it.

But sickle-cell anemia, which occurs much more frequently, has been neglected and ignored just like most other conditions that affect only black people.

I am convinced that if sickle-cell anemia struck the lives of white families with the same impact it strikes black families, we would have made a public commitment to end the disease long ago.

As chairman of the Health Subcommittee, I want to reemphasize that I will firmly support every effort to obtain relief and assistance for those who suffer with this disease.

We cannot move rapidly enough at this stage to begin with a serious effort to combat it. I am announcing, therefore, that on Tuesday, November 16, the Health Subcommittee will meet in executive session to try to take final action in preparing this bill, S. 2676, to be reported to the full Committee on Labor and Public Welfare.

I look forward to the testimony this morning from the very dedicated witnesses who are an important part of the growing assault on sickle-cell anemia. I want to say it is a very deep personal pleasure to welcome a panel of distinguished physicians and scientists: Drs. Roland Scott, Robert Rhodes, Anthony Cerami, and Maurice Rabb.

These gentlemen will describe the clinical and technical aspects of sickle-cell anemia and the requirements needed to resolve the mysteries of this disease. Preceding the presentation from the panel of medical experts, we are delighted to have with us this morning another panel of gentlemen who are widely known to many Americans because of their outstanding successes in the world of sports.

They are here today, however, because they share with us the commitment to fight against sickle-cell anemia. Representing the Black Athletes' Foundation, we have with us: Horace Davis, executive director; John Henry Johnson, and Hank Aaron.

Before hearing from them we would like to extend a warm word of welcome to Congressman Bill Clay from St. Louis, and then later in the morning we are going to hear from Mr. Clarence Mitchell, as our final witness, who is the director of the Washington bureau of the NAACP.

Senator JAVITS. Mr. Chairman, I could not be here yesterday because of the various other problems we are facing here in the Senate, but I wish to associate myself with the remarks of the Chair.

I represent a State which probably has the largest number of Americans who are black of any in the United States, including New York City. I know how serious this problem is. It is a unique problem, and while we constantly shy away from any note of difference between white and black Americans, in this particular case we are dealing with a physical manifestation which seems to have the unique and tragic impact upon a particular section of the population.

I think the Chair is quite justified, therefore, in adopting the approach it has and leading us toward help for this particular disease. We have done the same thing for kidney disease, heart disease, and stroke, and we are trying very hard to do it for cancer. I see no reason why we should not act in this special field as well; and for that reason, I have associated myself with the chairman's bill and will do my best to help him get it passed.

Thank you, Mr. Chairman.

Senator KENNEDY. Thank you Senator Javits.

Our first witness is Hon. William Clay, the Representative from the First District of Missouri. Congressman Clay received his B.S. from St. Louis University and shortly afterward became the alderman for the 26th ward of St. Louis. He is also a former executive board director of the NAACP's St. Louis chapter and a member of CORE. He has worked hard to advance job opportunities for Negroes in Missouri. Elected to the 91st Congress in 1968, he was reelected to the 92d Congress.

Congressman, we want to welcome you here. I had a good opportunity to have you appear before two committees of which I am a member, the Judiciary Committee earlier this week concerning the qualities of nominees to serve on the Supreme Court, and this morning on this important matter, which shows the range and breadth of your concern and interest and we always welcome you before the subcommittee and we want to thank you for coming.

STATEMENT OF HON. WILLIAM CLAY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MISSOURI; ACCOMPANIED BY DR. ELMER ANDERSON, CHAIRMAN, RESEARCH FOUNDATION FOR SICKLE-CELL ANEMIA IN THE LOS ANGELES (CALIF.) AREA; AND DR. ACCIE MITCHELL, BOARD MEMBER OF THE FOUNDATION

Mr. CLAY. Thank you, Senator. It seems like I am spending more time on this side of the Hill than I am on my own side.

First of all, I would like to express my gratitude to you and the other members of the subcommittee for extending an invitation to me to come over and testify on this very crucial piece of legislation.

Accompanying me this morning on my right is Dr. Elmer Anderson, who is a medical consultant in the Los Angeles area. He is also the chairman of the board of the Research Foundation for Sickle-Cell Anemia in the Los Angeles area. He has 23-years experience in this field. On my right is Dr. Accie Mitchell, who is a board member of the Research Foundation for Sickle-Cell Anemia in Los Angeles, and he has been devoting his time and efforts for the past 5 years in this area.

I would like to start by saying that in my opinion I think that sickle cell anemia is the most neglected disease in this Nation. Even the

smaller charitable organizations are raising more money annually for less important causes than can be raised for sickle cell anemia, which is a killer. Many small charitable organizations in Los Angeles County raised more money in 1970 than the Sickle Cell Anemia Foundation has raised in the last 10 years. The total net income for the Sickle Cell Foundation in the city of Los Angeles, which has a population of some several million people, in 1970 was \$6,000. The average total cost per patient who has a severe sickle cell anemia crisis is between \$2,000 to \$3,000 per hospitalization. On the average, consider the complications of sickle cell anemia which could be—bone lesions, pneumonia, or pulmonary emboli or cardiac complications, et cetera—you will see that the hospital cost and cost of outpatient care would be more than the average family could afford over a period of time.

Let me emphasize this is not a one episode-type of illness. These patients have to be seen approximately every 6 to 8 weeks on an outpatient basis and, on occasion, more often in times of stress. So what we are talking about here is a disease entity that people have been afflicted with for many years and a disease the structural design of which we know quite a bit. Yet we have no definitive treatment or ways of stopping thousands of people from dying every year, because of the manifestations of this disease.

So what we are emphasizing, gentlemen, is not the idea that we are asking for \$25 million for programs for testing, research, and education; but a chance to get this disease in its right perspective so that we can save lives. We are very late in finally now becoming aware of what we should be doing. I think at this stage of the game it would benefit us all to appreciate the fact that we should stop politicking and devote our energies toward creating centers where these people can go for screening and good definitive treatment and research facilities where they can do research specifically for sickle cell anemia and not as an afterthought while considering another project to work on.

I suggest the following:

1. The development of screening centers in urban areas conducted by paramedical personnel under the direction of a medical doctor.

2. Development of education programs in urban and suburban areas so people will understand and seek advice about the disease instead of living in fear of whether or not they have it. This would include in many instances education of medical personnel who have no knowledge of how to treat this disease.

3. I recommend development of research centers in large urban areas which have met the qualifications of the National Sickle Cell Anemia Foundation Board. This measure is proposed in order to intensify the concentration on research of sickle cell anemia and not as a minor project. In too many instances we find that research on sickle cell anemia is only an appendage of research on some other projects.

So, for those three reasons primarily, we are advocating that the course of this legislation follow in the direction that we have proposed.

Mr. Chairman, I wish to thank you again for permitting me to come and testify, and if there are any questions that you would like to ask I have with me two people who are well qualified to answer them.

Senator KENNEDY. I was interested, Congressman, are there any voluntary programs in your district in Missouri, efforts that are being made to develop programs or screening programs?

Mr. CLAY. Well, there are a few efforts in the St. Louis area that we are attempting to get off the ground. One of the problems is that we do not have the capacity for raising the kind of money that is necessary. There are some dedicated people in my area but they do not have the resources. There are some people who are attempting to counsel and test those who may have the trait; but other than that, there is no effective kind of program in my community or in any others, to my knowledge.

Senator KENNEDY. Do you have a neighborhood health center out there in your district?

Mr. CLAY. Well, we have three neighborhood health centers that have been financed by the Federal Government.

Senator KENNEDY. Do you see any reason why those neighborhood health centers could not be the facility in which these screening programs could be readily made available to the community? Do you think that could be sort of an umbrella type of organization to get this kind of information out into the community?

Mr. CLAY. Well, I think it could, Senator, but I think what we need to do is put particular emphasis on this program; and if we are going to use the neighborhood health centers, we ought to have a special section that is funded and financed by this Government that will accompany all of the neighborhood health centers.

Senator KENNEDY. It is not being done now?

Mr. CLAY. It is not being done now.

Senator KENNEDY. And I think that what you are expressing is representative of the people of your community as well as many other communities, that there is a desire of the people to have it done and there are existing facilities in various communities, I think. There is a will and desire for this kind of program. You have mentioned the voluntary efforts that are getting off the ground in your community and we are hearing examples of this in practically every community across the country, and I think those of us who are aware of the enormous potential over at NIH know that they have got the ability to dramatically increase resources for work in genetics and other kinds of biomedical research to help in this particular area. I believe the case has been made for this kind of legislation, which provides additional resources for biomedical research, additional resources for screening and supporting local organizations that have already begun to work in this area.

I think we have the existing facilities in a variety of different communities, neighborhood health centers and other community facilities to house the facilities needed to help with sickle cell anemia. I think that what we have heard in this hearing makes a strong case for legislation of this type, creating a specific program to combat a specific disease.

Mr. CLAY. I would hope, Senator, that it is specified in the legislation that comes out of committee, that the research in this area is to be independent of other research programs, because what seems to be happening is that this particular disease is taken very lightly even in the medical field. And when you merge those research funds with all of the other types of research, I'm sure that the programs that have the big lobbyists supporting them are going to be able to get a vast amount of the moneys for research in some of the other more popular,

if you want to say that, crippling diseases; and I would hope that the research money for this particular disease is specified for exactly what it was intended to be spent for.

Senator KENNEDY. You are suggesting, therefore, that we earmark money for this kind of research. You are obviously not satisfied with the sort of general expression of concern by the Department of HEW, even though that expression may be in good faith. You want to have it so the money is earmarked and we can assure that research is done in this particular area?

Mr. CLAY. Precisely.

Senator KENNEDY. At least in the dimensions that are outlined in this bill, which are terribly, terribly modest compared to the hundreds of millions of dollars that are being expended in medical research annually. There is \$1.5 billion a year being spent on medical research by the Federal Government, \$1.5 billion, and you are asking for \$5 million of that just to insure that research will be done on sickle cell anemia. I do not see how anybody can dispute that kind of a request or find it unreasonable. I think it is such a modest request.

Mr. CLAY. I agree with you.

Dr. ANDERSON. Mr. Chairman, the point we are trying to make is that in the Los Angeles area, we have made tremendous efforts to get programs this year. Our board of supervisors gave us money for a community program, \$23,000, and that amount would only test a limited number of patients. The problem is not just the cost of doing the tests themselves, which does not take into account the research, but how you get to actually find the cases, identify them and counsel these people so that they can avoid the problems of complications which add them to the enormous cost from the clinical standpoint.

We think that the funds that have been mentioned are totally inadequate for a national program, for one thing; and secondly, as Representative Clay has said—this has to be given some special priority in the whole gamut of research in the health care system; otherwise, it gets lost as a very minor problem, which we think is very unfair to the people who need this care.

Senator KENNEDY. The case is made by the administration that we do not have adequate trained personnel to utilize this money effectively. We all know that the very modest sum of \$25 million for a nationwide program can only be a start. We do not have the trained personnel nor the facilities nor the equipment to fully operate the kind of sickle cell anemia program that will effectively control this problem. These are the three areas in which the administration indicates there is a shortage. Therefore, they feel that the request for \$6 million as mentioned in yesterday's testimony, is much more realistic in insuring the adequate expenditures of taxpayers' funds since it is not possible at this point to do everything that would be required for a full-scale operation.

What could you tell me about the adequacy of personnel out in Los Angeles, for instance, or the ability to be able to utilize these resources described in the bill before us today? I would think you would almost be able to take the whole amount of money from this bill just for the Los Angeles area.

Dr. ANDERSON. I can assure you we could take that and more. In Los Angeles, we have a master plan being developed, and this is all on a voluntary basis. Our foundation has been active for 12 years. We have worked and we have actually sponsored some summer camps. We started out with a camp for these kids and the establishment told us it could not be done. I think some of the other expert witnesses—

Senator KENNEDY. You have been working how long in this area?

Dr. ANDERSON. This particular organization I am with, the Sickie Cell Foundation of Los Angeles, has been in existence for 13 years; and 4 years ago we started our first summer camp. We took kids who were told they could never go to camp. This gave these kids new hope that their lives were not to be snuffed out before they were 20. The first year we took 20, and last year we took 75. We had requests for about 200 kids to go to camp. So just in this area we had a backlog of people we could give service to if we had the funds.

Our project in Los Angeles for testing that was just done as a voluntary thing by physicians and paramedicals—as noted in the recommendations here, we are talking about the use of the whole team approach to doing case findings; not just doctors, but people who work with us every day in the paramedical field.

We have also traveled throughout the South. I come originally from Orleans Parish in Louisiana and Hancock County in Mississippi, and we know we have colleagues in those areas who are willing to start programs to help these people if they can have the funds.

Senator KENNEDY. What can you tell me about your knowledge of other communities? You have mentioned it just at the latter part of your comment here. Could you expand that a little bit? Are there other voluntary programs that are taking place in other cities that you are familiar with that have the interest and the personnel to be able to move ahead in terms of screening?

Dr. ANDERSON. Yes. We have had two meetings. One of the first meetings this year was hosted by us in Los Angeles where we were trying to get together a federation of sickle cell groups throughout the Nation.

As you know, Senator Tunney was our guest at that time, and we had representation from five of the major areas of the Nation.

We had another meeting here which Dr. Scott and Dr. Ferguson hosted at Howard primarily, with many of the people locally; and we have another meeting next month, and there is a growing interest in a type of federation approach.

I have talked personally with the Directors of the March of Dimes about the idea that they might lend us some expertise so that we can develop that type of grassroots thing throughout the Nation. I think that it is timely and people are certainly very interested in working in this area if they can just be given the support and funds that we think they deserve from the tax structure.

We have written to HEW in the past and in some cases they have not shown us the courtesy of answering letters. I have personally written to the President on four occasions. I think I have gotten two answers, never really to the point of the problem that we think this represents.

Senator KENNEDY. Do you find that you can develop these programs in terms of initial screening programs relatively inexpensively, or what are the great expenses in terms of the programs? Where do you really run into the cost?

Dr. ANDERSON. We have gone so far as to talk to the Offutt Co. who produces these. They were originally charging us 50 cents a test, and if you want to do 10,000, it immediately runs your limited budget up.

Senator KENNEDY. Is it complicated to give the test?

Dr. ANDERSON. We had problems initially for the first part of the test. The sickle-dex test was costing us 50 cents or a dollar. That price could be brought down if we were doing it in large volumes. As we mentioned, we could have paramedical personnel do the tests and we supply the equipment.

Senator KENNEDY. You developed the trained personnel to administer the tests relatively easily?

Dr. ANDERSON. Yes.

Senator KENNEDY. And do you know as a doctor whether there are people who would be willing to be trained to give these tests? Are there members of either the black or white community that are prepared to be trained to help administer the tests?

Dr. ANDERSON. Yes, sir. We think there would be a lot of people.

Senator KENNEDY. Or you might get returning paramedical personnel from the military services to be trained for these programs.

Dr. ANDERSON. That would be part of the center's action, as we mentioned, in the development of the project.

Mr. CLAY. Dr. Mitchell has been giving these tests and I want him to explain to you some of the problems that he encountered as a result.

Dr. MITCHELL. The main problem that we have out in the Los Angeles area in the ghetto is the fact that we do not have the money to test these people. It is simply because of the fact that there are no funds available. We have the personnel and we have the doctor volunteers who are willing to go out and see that these tests are done and carried out properly, but as long as we do not have any money we run into a problem of calling off tests; and then people become dissatisfied with the way we are conducting the tests. It is simply because we do not have the money and they cannot be tested when they want to be tested, and therefore the cause becomes a little bit unpopular and we lose a lot of people that we could have found in the first place.

The other thing here is that in the Greater Los Angeles area there is no facility per se to treat sickle cell anemia. We have the county hospital where there is a very fine pediatrician hematologist by the name of Dr. Powers, who takes care of most of the serious sickle cell patients in the city; but the fact is that there is no place that these people generally can go if they are really bad off. This is what we need, some type of facility where they can go if they have a crisis. Children's Hospital was asking for a research facility for sickle cell anemia, but they cannot come up with the funds; and I think Dr. Anderson has spoken with the people at Children's Hospital about this.

Senator KENNEDY. What is the willingness of the members of the community to take these tests? Do you find that there is an interest in it? Are they willing to take these tests if it is given at a decent time and under adequate kinds of circumstances and in clean facilities? You mentioned the problems that you are confronted with, that there is no place they can do it out there; but what can you tell us, as people who have worked in this field, Doctor, for some 13 years; are people willing to be tested? Do they want to know about sickle cell anemia.

Dr. ANDERSON. Very much so. We had one example. We had what we called "Sickle Cell Month" during the month of September. On one occasion, just one of our neighborhood newspapers had a note that there would be a clinic testing, and I think on 1 day we had to turn away something like 250 people.

Now, with the pressures that our small voluntary group has put on the establishment, as I call it—the health department—we are now having evening clinic testing programs about once a week or twice a week in some areas. These are always to capacity so far as people coming to be tested.

Senator Kennedy, I have also heard some feedback on this, that people are afraid that if you tell them what they have you are going to create hysteria. As a clinician—

Senator KENNEDY. We heard that yesterday.

Dr. ANDERSON. I think that is the most asinine kind of thing—forgive me for getting so upset, but it is like the young woman who comes in with a lump in her breast—she might be frightened, but she wants to know what it is. I think this is how most of the black people feel who are aware of the fact that health is an important factor. If they have a problem, they want to know about it. We think any human being has a right to know about any health problem he might have, and certainly counseling that person to deal with his hysteria, which I think is totally unfounded—

Senator KENNEDY. Do I interpret your comment that if we were to provide what I think is an extremely small amount of resources for the development of an educational, screening, and testing program, that people would take advantage of it and welcome it in terms of your experience in working in this field for 13 years, rather than being frightened by it?

Dr. ANDERSON. That is my opinion; yes, sir. They would take advantage of it and be very, very thankful and happy to have it. We think that we owe this to our citizenry, to our patients. We have an obligation. Every young person getting ready to get married wants to know something about what he might be passing on to his offspring.

The other point that I wanted to make in this; my other interest in this became more acute about 5 or 6 years ago when girls were being given birth control pills without regard to whether they had sickle cell disease. At the UCLA Medical Center, each week at our radiological council, we were finding girls with lung infarctions, blood clots in their lungs. I brought this to the attention of my colleagues and we thought no girl should be put on the birth control pill if we did not know if she had sickle cell disease or not, because a lung clot could kill her.

I have tried to teach this to medical students and colleagues. The British reported this years ago and we in America could never even come to grips with this as a complication. We think that there is certainly an interplay between things that are being done for the community that makes it mandatory that we know when a person does have this type of blood condition.

Senator KENNEDY. Have you talked to the deans of the medical schools—Los Angeles is one of our great medical centers. We visited out there with the health subcommittee and we have seen for ourselves and visited the marvelous new hospital in Watts, the Martin Luther King Hospital. Have you talked to the deans of medical schools out there or met with them? Could you tell us what kind of reaction you are getting from the medical schools in terms of trying to acquaint the younger medical students about this problem. Are they doing anything about it that you know about?

Dr. ANDERSON. I think, as I said to someone—

Senator KENNEDY. Have they ever come down—has the UCLA medical school ever come down and talked with you?

Dr. ANDERSON. UCLA medical school does not have a primary program in this area. I have talked with Dean Melenkoff, who I am associated with on a number of projects. They are currently willing to accept money from us to start some projects.

Senator KENNEDY. They are willing to take money from you?

Dr. ANDERSON. Yes; they will.

Senator KENNEDY. They will take money.

Dr. ANDERSON. We recently had a telethon. This was put on by the citizens. I wish the Senator could have seen some of the enthusiasm. The volunteers put on the telethon for 3 days and raised \$60,000. We are going to give some of this money to the schools, but I think it should be the other way around.

Senator KENNEDY. It certainly should.

Mr. CLAY. In response to your question, I think perhaps we might be able to give you a description of what the commitment of the medical schools is in this area by citing an example. One of the most prestigious and most prominent medical schools in this country is located in the State of California, and its total research in the area of sickle cell is performed by a medical student who composes the total number of people involved in the program; and I think that this demonstrates the kind of commitment or lack of commitment that medical schools in this country have in the field of sickle cell.

Senator JAVITS. Would the Senator yield for one question?

Senator KENNEDY. Yes; this is an indication of the fact that the research money for the medical schools comes from NIH, and if they do not put a sense of priority on sickle-cell anemia here in Washington, then we cannot expect to get it out in the medical school. We

would like to see the medical schools themselves generate a greater interest in this area.

So we are going to telegram the American Association of Medical Colleges today and ask them what is their position on this legislation and what medical schools all over the country are doing in terms of developing the curriculum, making their students aware, and what they anticipate to be done. We ought to get that.

Senator JAVITS. That is exactly what I wanted to urge when I asked the Chair to yield for a question.

Senator KENNEDY. Thank you.

(The information referred to and subsequently supplied follows:)

TELEGRAM FROM DR. JOHN A. COOPER, PRESIDENT OF THE AAMC

I am more than happy to be able to supply information to the Senate Health Subcommittee concerning research that is being conducted by the academic medical centers relating to sickle cell anemia.

SCA is one of the best understood of the genetic diseases. The molecular basis of the disease is quite well understood from the work of many investigators. This understanding has depended upon biochemical and biophysical studies, conducted primarily in academic medical centers. Yet, researchers have been unable to produce a form of therapy which prevents the clinical manifestations of SC disease. Significant contributions both to the understanding and the treatment of the disease have been made by researchers at Howard University College of Medicine, the Johns-Hopkins Hospital, Meharry Medical College, University of Chicago, Medical College of Virginia, University of Tennessee, Wayne State University, University of Michigan School of Medicine, George Washington University School of Medicine, University of Washington School of Medicine, and Case-Western Reserve.

Research related to SC disease is now being supported by several of the National Institutes of Health. Most of this research is being carried out in laboratories and clinical facilities of United States Medical Schools.

The National Heart and Lung Institute has awarded \$500,000 in contracts for the first phase of a cooperative study, testing the feasibility of clinical trials of therapy for the SC crisis. Most of the work will be done at 5 medical schools (Tenn, Emory, Duke, Meharry and Bowman Gray). Major emphasis is on the evaluation of urea therapy, but other methods are included.

In addition, the National Heart and Lung Institute is supporting 11 grants with major emphasis on SC disease at a current funding level of approximately \$450,000. This work is being done at 8 medical schools (Tenn, Johns-Hopkins, Fla., Ga., Albert Einstein, Arizona, Pittsburgh, Case-Western Reserve).

The National Institute of Arthritis and Metabolic Diseases is also active in the support of sickle cell disease research. Important fundamental work is being done in the NIH laboratories and in addition NIAMD provides research grant support for SCA disease studies totaling about \$420,000 in 11 grants. Granting institutions include medical schools at the University of Texas, Galveston, Tennessee, Pennsylvania, Albert Einstein, Arkansas and Johns-Hopkins.

I can assure you and your subcommittee that the academic medical centers of this country stand ready to continue and expand their research into sickle cell anemia. I hope this will assist you during your executive markup of the bill, S. 2676.

Sincerely,

Dr. JOHN A. COOPER,
President, AAMC.

Telegram

NO. WDS.-CL. OF SVC.	PD. OR COLL.	CASH NO.	CHARGE TO THE ACCOUNT OF	THIS MESSAGE WILL BE SENT AS A TELEGRAM UNLESS IT IS OTHERWISE INDICATED.	PRESS DPR	OVER NIGHT TELEGRAM
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OB

November 12, 1971

MESSAGE

To: President
Association of American Medical Colleges
1 DuPont Circle
Washington, D.C.

Dear Dr. Cooper:

As you may know, the Senate Health Subcommittee is currently holding hearings on the bill, S. 2676, "The Sickle Cell Anemia Prevention Act of 1971." One of the principal thrusts of the bill is to increase biomedical research with respect to this disease. In that regard, it has been pointed out to the Subcommittee, that the medical schools of this Nation do not now conduct substantial research with respect to this debilitating disease. As President of the AAMC, could you apprise the Subcommittee of the extent to which the enormous biomedical research capacity of this country stands ready to make a massive research and educational effort against Sickle Cell Anemia if substantially increased funds are made available by the Congress to the NIH for this purpose.

The Senate Health Subcommittee has scheduled an executive mark-up session on this bill next Tuesday morning at 9 a.m. I would appreciate it very much if we could have your response prior to that session.

Sincerely,

Edward M. Kennedy, Chairman
Senate Health Subcommittee

Dr. ANDERSON. Senator, I brought some copies of something done by one of these medical students from Palo Alto that I would like to pass up to you.

Senator KENNEDY. We will take them and admit in the record the relevant parts and make it a part of the total file.

Dr. ANDERSON. This was done by the black medical students at Stanford, which would be part of the statewide organization we are developing in California.

(The information referred to follows:)

THE UNIVERSITY OF CALIFORNIA
SCHOOL OF MEDICINE
PALO ALTO, CALIFORNIA

REPORT OF THE STUDENTS OF THE
SCHOOL OF MEDICINE

ON THE
SCHOOL OF MEDICINE

AND
SCHOOL OF MEDICINE

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OUTLINE OF FACULTY AND STUDENT ACTION COMMITTEE
FOR SICKLE CELL

- I. EDUCATION: Developing educational materials and systems to further inform the general population of Sickle Cell Anemia and the nature of this disease.
- a. Student and faculty committee for Sickle Cell Education.
 - b. Aid in the preparation of printed materials regarding Sickle Cell.
 - c. Production of a film or films to explain Sickle Cell Disease and its effects.
 - d. Formation of a Speaker Bureau and Sickle Cell Task Force.
- II. COMMUNICATION SYSTEM: Organization of a communication team to function as a network of Sickle communication agents. To forward and disburse facts about the action taken on behalf of the Sickle Cell Foundation throughout the state of California and the nation. The system will be made up of students and educational professionals.
- a. Each campus of all the educational systems in the state will have an appointed Sickle Cell Representative. This person will relate directly to a central state or regional committee.
 - b. Student newspapers should be directly involved in continued publication of information regarding Sickle Cell.
 - c. Campus medical centers will be enlisted to disburse information about Sickle Cell Anemia.

ELMER A. ANDERSON, M.D., F.A.C.P.
1127 Wilshire Boulevard
Suite 912
Los Angeles, California 90017

- d. Campus Organizations: All campus organizations such as fraternities, sororities, service groups, and etc. will be solicited for volunteers to aid in the development of a student and professional communication network.

III. TESTING: In the state of California, our efforts will be directed toward the testing of all people who are involved in any area of education.

- a. Support of legislation: To provide a requirement at all levels of education that Sickel Cell Testing be mandatory for students, faculty, and staff.
- b. Area of higher education: That the four segments of higher education in California will involve their medical facilities in the battle against Sickel Cell Disease.
 - 1. The four year private Universities and Colleges.
 - 2. Public Universities.
 - 3. Public Colleges.
 - 4. Community Colleges.

Our concern is that the on-campus medical centers will:

- 1. Disburse Sickel Cell information.
- 2. Will provide testing for all new students, staff, and faculty.

IV. RESEARCH: To work for the funding of specialized research projects that relate directly to Sickel Cell Anemia, its' treatment and cure. Sickel Cell must be a priority research target for all "Black" students on all levels.

V. FUND RAISING: As students and faculty of the state of California, we will with the support of the Sickle Cell Foundation work to co-ordinate continuous fund raising actions that will generate funds for:

- a. Research.
- b. Treatment and services.
- c. Education.
- d. Support of Foundation activities.

STUDENT FACULTY LIST

Northern California

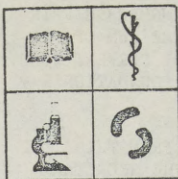
1. S. T. Saffo ----- San Jose State College.
2. Vernon J. Adams, Jr. ----- U. C. Santa Cruz.
3. Bonnie Williams ----- Community Worker.
4. Jame Ware ----- Sanoma State College.
5. Eddie Sloan ----- Community Worker.
6. David West ----- San Francisco State.
7. Mike Fearn ----- Sacramento State College.
8. Paul Burkheart ----- Cal State Hayward.

*** Coordinators -- H. Sands and R. Dawson ***

Southern California

1. Tim Bowles -----U. C. Irvne.
2. Wittis Edwards ----- S. B. Pres. - CSCLA.
3. Lamar Lyon ----- S. B. Pres. - UCLA.
4. Wayman Johnson ----- San Diego State.
5. Theodore Eagans ----- Loyola Law School.
6. Bill Clifton ----- UCLA Law School.
7. Mike Anderson ----- EPIC; CSCLA.
8. Clifford Stuart ----- Student Film Program.
9. Russell Podeman ----- UCLA Medical School.
10. Andrew Wright ----- UCLA Medical School.
11. Mel Johnson ----- USC Medical School.
12. Walter Regard ----- UCLA School of Business.
13. Xavier Willis ----- ~~EXX~~ UCLA Graduate Student.

14. Hazel Love ----- UCLA Graduate Admitt. Program.
15. Dan Walker ----- UCLA; EOP.
16. Ken Washington ----- State College Chancellors' Office.
17. Dewey Herbert ----- Cal State Long Beach.
18. Charles Thompson ----- Mont Sac.
19. Dale McColloun ----- Pasadena City.
20. Milt Jackson ----- LACC.



MID PENINSULA SICKLE CELL ANEMIA FOUNDATION
POST OFFICE BOX 2308
STANFORD, CALIFORNIA 94305

321-1200 X 5456

BY-LAWS

ARTICLE I

THE NAME OF THIS ORGANIZATION SHALL BE THE MID-PENINSULA SICKLE CELL ANEMIA FOUNDATION.

ARTICLE II

OBJECTIVES

- A) COMPREHENSIVE EDUCATIONAL PROGRAMS DESIGNED TO INCREASE THE COMMUNITIES LEVEL OF AWARENESS ABOUT SICKLE CELL ANEMIA.
- B) TO ENCOURAGE EXTENSIVE RESEARCH IN SICKLE CELL DISEASE, HOPEFULLY LEADING TOWARD A CURE FOR THE DISEASE.
- C) TO CREATE A MASSIVE SCREENING PROGRAM WHERE INDIVIDUALS WITH THE TRAIT AND DISEASE MAY BE IDENTIFIED AS EARLY AS POSSIBLE.
- D) TO ENCOURAGE THE CREATION OF A SICKLE CELL DISEASE CLINIC AT STANFORD UNIVERSITY HOSPITAL WHERE A COMPREHENSIVE TREATMENT PROGRAM MIGHT BE INSTITUTED, IN ORDER TO MAXIMIZE COORDINATED PATIENT CARE AS WELL AS EFFECTIVELY MINIMIZE THE PERSONAL AND SOCIAL ASPECTS OF THE DISEASE UPON THE INDIVIDUAL PATIENT AND HIS OR HER FAMILY.
- E) TO INSTITUTE AN EFFECTIVE AND HUMANE APPLICATION OF MEANINGFUL CONCEPTS OF GENETIC COUNSELING, GEARED TO MEET THE NEEDS AND WISHES OF THE INDIVIDUAL AND HIS OR HER FAMILY.
- F) TO STIMULATE AND ENCOURAGE COMMUNITY SUPPORT AND INVOLVEMENT IN MOVING TOWARD A CURE FOR SICKLE CELL ANEMIA, BY WORKING WITH OTHER SICKLE CELL ANEMIA UNITS FOR A NATIONAL FOUNDATION.

ARTICLE III

MEMBERSHIP

SECTION 1. THE MEMBERSHIP OF THIS FOUNDATION SHALL NOT BE RESTRICTED IN NUMBER, NOR SHALL ANY PERSON BE DENIED MEMBERSHIP ON THE BASIS OF RACE COLOR, CREED, RELIGIOUS OR NATIONAL ORIGIN.

SECTION 2. ANY RESIDENT OF THE AREA OF RESPONSIBILITY OF THIS FOUNDATION SHALL BE ELIGIBLE FOR MEMBERSHIP IN THIS FOUNDATION. HOWEVER, MEMBERSHIP SHALL NOT BE DENIED TO ANY PERSON LIVING BEYOND THE CONFINES OF THIS FOUNDATION'S GEOGRAPHICAL BOUNDARIES, PROVIDED SUCH PERSON RECOGNIZES HIS OBLIGATIONS TO THE FOUNDATION AND DISCHARGES THEM ACCORDINGLY, AS SPECIFIED IN ARTICLE III, SECTION 3.

SECTION 3. THERE SHALL BE NO FORMAL INITIATION FEE FOR MEMBERSHIP IN THIS FOUNDATION. HOWEVER, EACH MEMBER SHALL BE ASKED TO PAY THE SUM OF ONE DOLLAR PER YEAR, PAYABLE AT THE MEMBERS' DISCRETION FOR THE CURRENT YEAR. THIS FEE WILL ENTITLE THE MEMBER TO BECOME A RECIPIENT OF THE FOUNDATION'S MONTHLY NEWSLETTER.

SECTION 4. ANY MEMBER DESIRING TO RESIGN OR DISSOCIATE FROM THIS FOUNDATION SHALL SUBMIT HIS OR HER RESIGNATION IN WRITING TO THE SECRETARY OF THE FOUNDATION, WHO SHALL THEN SUBMIT IT TO THE EXECUTIVE COMMITTEE FOR ACTION.

SECTION 5. UPON THE SIGNED RECOMMENDATION OF ONE MEMBER, SECONDED BY ANOTHER MEMBER, AND BY A THREE-FOURTHS VOTE BY BALLOT AT THE ANNUAL MEETING. HONORARY LIFE MEMBERSHIP CAN BE CONFERRED UPON ANY PERSON WHO SHALL HAVE RENDERED NOTABLE SERVICE TO THE FOUNDATION OR TO THE CAUSE OF EITHER SICKLE CELL ANEMIA OR GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY RESEARCH AND/OR EDUCATION. AN HONORARY MEMBER SHALL HAVE NONE OF THE OBLIGATIONS OF MEMBERSHIP IN THIS FOUNDATION, BUT SHALL BE ENTITLED TO ALL OF THE PRIVILEGES EXCEPT THOSE OF MAKING MOTIONS, OF VOTING AND OF HOLDING OFFICE UNLESS HE OR SHE IS A REGULAR MEMBER OF THE FOUNDATION.

SECTION 6. ANY PERSON, FIRM, ORGANIZATION OR OTHER ENTITY MAY BE ELECTED TO ASSOCIATE MEMBERSHIP IN THIS FOUNDATION BY THE VOTING MEMBERS IN RECOGNITION OF AN OUTSTANDING CONTRIBUTION OF FINANCES OR SERVICES DESIGNED TO FURTHER THE AIMS OF THIS FOUNDATION. EACH ASSOCIATE MEMBER THUS ELECTED SHALL BE ELIGIBLE TO PARTICIPATE IN ALL FUNCTIONS OF THIS FOUNDATION AND SHALL BE ENTITLED TO ONE(1) VOTE IN ALL TRANSACTIONS OF FOUNDATION BUSINESS. FIRMS, CORPORATIONS OR GROUPS OF PEOPLE COMPOSED OF MORE THAN TWO PERSONS SHALL BE ENTITLED TO ONE (1) VOTE IN FOUNDATION AFFAIRS. ASSOCIATE MEMBERS SHALL NOT BE ELIGIBLE TO HOLD OFFICE IN THIS FOUNDATION, BUT SHALL HAVE ALL OTHER PRIVILEGES OF MEMBERSHIP.

ARTICLE IV

OFFICERS

SECTION 1. THE OFFICERS OF THIS FOUNDATION SHALL BE A PRESIDENT, A VICE-PRESIDENT, A TREASURER, A SECRETARY, A PARLIAMENTARIAN AND NO LESS THAN ELEVEN (11) AND NO MORE THAN FIFTEEN(15) DIRECTORS. THESE OFFICERS SHALL PERFORM THE DUTIES PRESCRIBED BY THESE BY-LAWS AND BY THE PARLIAMENTARY AUTHORITY ADOPTED BY THIS FOUNDATION. THESE OFFICERS AND BOARD OF DIRECTORS SHALL REPRESENT CROSS-SECTIONS OF THE LAY COMMUNITY AND PROFESSIONALS, AND SHALL SERVE TERMS IN OFFICE FROM 1 TO 3 YEARS, ALTERNATING IN SUCH A FASHION THAT REPRESENTATION IS ADEQUATE AND RESPONSIBLE.

SECTION 2. AT THE REGULAR MEETING HELD ON THE SECOND THURSDAY IN NOVEMBER OF EACH YEAR, A NOMINATING COMMITTEE OF THIS FOUNDATION SHALL BE ELECTED. THE COMMITTEE SHALL SELECT ITS OWN CHAIRMAN FROM AMONG THE MEMBERS ELECTED. IT SHALL BE THE DUTY OF THIS COMMITTEE TO NOMINATE CANDIDATES FOR THE OFFICES TO BE FILLED AT THE ANNUAL MEETING ON THE SECOND SATURDAY IN JANUARY. PRIOR TO THE ELECTIONS AT THE ANNUAL MEETING, ADDITIONAL NOMINATIONS FROM THE FLOOR SHALL BE PERMITTED.

SECTION 3. THE PRESIDENT, VICE-PRESIDENT, SECRETARY, TREASURER AND PARLIAMENTARIAN SHALL BE ELECTED BY BALLOT TO SERVE FOR ONE (1) YEAR OF UNTIL THEIR SUCCESSORS ARE ELECTED, AND THEIR TERM OF OFFICE SHALL BEGIN AT THE CLOSE OF THE ANNUAL MEETING AT WHICH THEY ARE ELECTED. THE DIRECTORS SHALL BE ELECTED TO SERVE FOR THREE YEARS AND THEIR TERM OF OFFICE SHALL BEGIN AT THE CLOSE OF THE ANNUAL MEETING AT WHICH THEY ARE ELECTED.

SECTION 4. NO MEMBER SHALL HOLD MORE THAN ONE OFFICE AT A TIME AND EACH OF THE OFFICERS, INCLUDING THE DIRECTORS, MAY SUCCEED HIMSELF/HERSELF ONLY ONCE. ANY MEMBER WHO HAS ONCE HELD AN OFFICE IS ELIGIBLE FOR ELECTION TO ANY OFFICE OF THIS FOUNDATION AS AN OFFICER OR DIRECTOR AND, IF SO, HAS BEEN OUT OF OFFICE FOR AT LEAST ONE CALENDER YEAR.

ARTICLE V

MEETINGS

SECTION 1. REGULAR MEETINGS OF THIS FOUNDATION SHALL BE HELD ON THE SECOND THURSDAY OF EACH MONTH THROUGHOUT EACH YEAR UNLESS OTHERWISE ORDERED BY THE EXECUTIVE COMMITTEE OR BY THE VOTING MEMBERS OF THE FOUNDATION.

SECTION 2. THE REGULAR MEETING SCHEDULED FOR JANUARY WILL BE DEFERRED TO THE SECOND SATURDAY IN JANUARY, AND SHALL BE KNOWN AS THE ANNUAL MEETING AND SHALL BE FOR THE PURPOSE OF ELECTING OFFICERS AND DIRECTORS, RECEIVING REPORTS OF OFFICERS AND COMMITTEES, AND FOR ANY OTHER BUSINESS THAT MAY ARISE. A KEYNOTE GUEST SPEAKER OR ANY OTHER ORGANIZED PROGRAM WOULD BE IN ORDER AT THAT MEETING OF THE FOUNDATION.

SECTION 3. SPECIAL MEETINGS CAN BE CALLED BY THE PRESIDENT OR BY THE EXECUTIVE COMMITTEE. THE PURPOSE OF THE MEETING SHALL BE STATED IN THE CALL. EXCEPT IN CASES OF EMERGENCY, AT LEAST THREE DAYS NOTICE SHALL BE GIVEN BY THE SECRETARY.

SECTION 4. SEVEN TO TEN MEMBERS OF THIS FOUNDATION, AT LEAST 3 OF WHOM ARE ON THE EXECUTIVE COMMITTEE, SHALL CONSTITUTE A QUORUM.

ARTICLE VI

THE EXECUTIVE COMMITTEE

SECTION 1. THE OFFICERS OF THIS FOUNDATION, INCLUDING THE DIRECTORS, SHALL CONSTITUTE THE EXECUTIVE COMMITTEE.

SECTION 2. THE EXECUTIVE COMMITTEE SHALL HAVE GENERAL SUPERVISION OF THE AFFAIRS OF THIS FOUNDATION BETWEEN ITS BUSINESS MEETINGS, FIX THE HOUR AND PLACE OF MEETINGS, MAKE RECOMMENDATIONS TO THE FOUNDATION, AND SHALL PERFORM SUCH OTHER DUTIES AS ARE SPECIFIED IN THESE BY-LAWS. THE EXECUTIVE COMMITTEE SHALL BE SUBJECT TO THE ORDERS OF THE FOUNDATION AND NONE OF ITS ACTS SHALL CONFLICT WITH ACTION TAKEN BY THIS FOUNDATION.

SECTION 3. UNLESS OTHERWISE ORDERED BY THIS COMMITTEE, REGULAR MEETINGS OF THE EXECUTIVE COMMITTEE SHALL BE HELD AT THE DISCRETION OF THE COMMITTEE. SPECIAL MEETINGS OF THIS COMMITTEE CAN BE CALLED UPON WRITTEN REQUEST OF THREE MEMBERS OF THE COMMITTEE.

ARTICLE VIICOMMITTEES

SECTION 1. A MEDICAL ADVISORY COMMITTEE COMPOSED OF AT LEAST THREE PHYSICIANS AND FOUR OTHER PERSONS FROM PROFESSIONAL FIELDS RELATED TO MEDICINE. SUCH A COMMITTEE SHALL BE APPOINTED BY THE EXECUTIVE COMMITTEE AFTER EACH ANNUAL MEETING. THE MEDICAL ADVISORY COMMITTEE SHALL SELECT ITS OWN CHAIRMAN; SHALL MEET AT THE CHAIRMAN'S DISCRETION; SHALL ADVISE THE EXECUTIVE COMMITTEE AND THE FOUNDATION ON MEDICAL AFFAIRS AND SHALL SUBMIT A WRITTEN REPORT OF ITS ACTIVITIES AT EACH ANNUAL MEETING.

SECTION 2. THE COMMUNICATIONS COMMITTEE SHALL BE COMPOSED OF AT LEAST FIVE (5) PERSONS AND SHALL BE CHARGED WITH THE RESPONSIBILITY OF WRITING AND PUBLISHING THE MONTHLY NEWSLETTER OF THE FOUNDATION. THIS COMMITTEE SHALL ALSO MAINTAIN CONTACTS WITH SIMILAR ORGANIZATIONS WHEREVER THEY MAY EXIST. THIS COMMITTEE WILL SELECT ITS OWN CHAIRMAN.

SECTION 3. THE PUBLIC RELATIONS COMMITTEE SHALL BE COMPOSED OF AT LEAST FIVE (5) PERSONS AND SHALL BE CHARGED WITH THE RESPONSIBILITY OF MAINTAINING CONTACTS WITH COMMUNITY GROUPS, ETC., AND VERBALIZING THE GOALS AND EXISTENCE OF THE FOUNDATION. ITS MODE OF OPERATION COULD BE IN THE FORM OF WORKSHOPS, NEWSPAPER ARTICLES, OR ANY OTHER ACTIVITY WHICH WOULD CONTACT THE GENERAL PUBLIC DIRECTLY OR INDIRECTLY. THIS COMMITTEE WILL SELECT ITS OWN CHAIRMAN.

SECTION 4. A FINANCE COMMITTEE COMPOSED OF THE TREASURER AND AT LEAST FOUR (4) OTHER MEMBERS SHALL BE APPOINTED BY THE PRESIDENT PROMPTLY AFTER EACH ANNUAL MEETING. IT SHALL BE THE DUTY OF THIS COMMITTEE TO PREPARE A BUDGET FOR THE FISCAL YEAR BEGINNING THE FIRST DAY OF FEBRUARY, AND TO SUBMIT IT TO THE FOUNDATION AT THE ANNUAL MEETING IN JANUARY. THE TREASURER SHALL SERVE AS CHAIRMAN OF THE COMMITTEE.

SECTION 5. A FUND-RAISING COMMITTEE SHALL BE SELECTED BY THE PRESIDENT FROM AMONG THE FOUNDATION MEMBERS AT THE ANNUAL MEETING IN JANUARY. IT SHALL BE THE RESPONSIBILITY OF THIS COMMITTEE TO GENERATE AND INITIATE ACTIONS AND PROGRAMS DESIGNED TO ENHANCE THE TREASURY OF THE FOUNDATION.

SECTION 6. COMMITTEE FOR GENETIC COUNSELING CONSISTING OF 10-12 INDIVIDUALS WHOSE PRIMARY RESPONSIBILITY WILL CONSIST OF DEVELOPING AND IMPLEMENTING GENETIC COUNSELING TECHNIQUES AND COUNSELING THOSE INDIVIDUALS SO SCREENED AS TRAIT CARRIERS OR THOSE AFFLICTED WITH THE DISEASE. AT LEAST 3 PHYSICIANS SHOULD BE MEMBERS OF THIS COMMITTEE.

ARTICLE VIIIPARLIAMENTARY AUTHORITY

THE RULES CONTAINED IN THE CURRENT EDITION OF ROBERT'S RULES OF ORDER NEWLY REVISED SHALL GOVERN THE FOUNDATION IN ALL CASES TO WHICH THEY ARE APPLICABLE AND IN WHICH THEY ARE NOT INCONSISTENT WITH THESE BY-LAWS AND ANY SPECIAL RULES OF ORDER THE FOUNDATION MAY ADOPT.

ARTICLE IXADMENDMENT OF BY-LAWS

THESE BY-LAWS CAN BE AMENDED AT ANY REGULAR MEETING OF THE FOUNDATION BY A TWO-THIRDS VOTE, PROVIDED THAT THE AMENDMENT HAS BEEN SUBMITTED IN WRITING AT THE PREVIOUS REGULAR MEETING.



TWO COMMON DISEASES OF BLACKS

FACTS ABOUT SICKLE CELL ANEMIA
AND GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY

MID PENINSULA SICKLE CELL ANEMIA FOUNDATION
P. O. BOX 2308
STANFORD, CALIFORNIA 94305
PHONE (415) 321-1200 Ext. 5456

ELMER A. ANDERSON, M.D., F.A.C.P.
1127 Wilshire Boulevard
Suite 512
Los Angeles, California 90017

TWO COMMON DISEASES OF BLACKS
FACTS ABOUT
SICKLE CELL ANEMIA
AND
GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY

by

BLACK MEDICAL STUDENTS
STANFORD MEDICAL SCHOOL
STANFORD, CALIFORNIA
SUMMER, 1971

TO

TUNISIA IMANI

(THE BEAUTIFUL SISTER ON THE COVER)

AND

THE BLACK HOSPITAL AND MEDICAL SCHOOL WORKERS

FOR PROVIDING VIVID EXAMPLES OF YOUNG
BLACK CHILDREN OF TODAY AND BLACK
ADULTS OF TODAY AND THE FUTURE WHO MUST
NOT REMAIN UNAWARE OF THESE DISEASES.

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WHAT CAN BE DONE	15

P R E F A C E

This brochure, entitled Two Common Diseases of Blacks, is written primarily as a source of information about Sickie Cell Anemia and Glucose 6-Phosphate Dehydrogenase (G6PD) Deficiency. It is the hope of the authors that this material will serve as an introduction for those who are unaware of these diseases as well as providing a reliable source of reference for those laymen who are already familiar with them. The necessity for an intensified effort to educate Blacks about these diseases has provided the primary stimulus for preparing this brochure.

It should be emphasized that this brochure is prepared essentially for the lay reader; therefore, we will not list a bibliography. However, we are indebted to Dr. Roland B. Scott of Howard University College of Medicine, Washington, D.C. for providing us with valuable material that aided us tremendously in developing the format of this brochure. Also, the authors feel strongly indebted to the Black Panther Party and Dr. Bert Small for providing the initial stimulus through their Intercommunal News Service and their efforts to provide free Sickie Cell tests at the George Jackson Health Clinic in Oakland and other clinics across the country.

Black Medical Students
Stanford University School of Medicine
Stanford, California

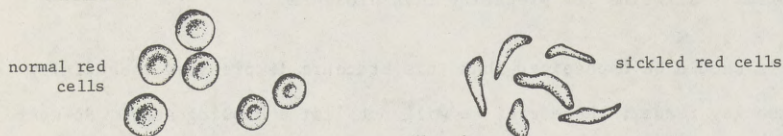
DEFINITIONS

What is anemia?

Anemia is a lack of hemoglobin, the red coloring matter of blood. Hemoglobin supplies all of the body tissues with oxygen.

What is Sickle Cell Anemia?

Sickle Cell Anemia is an inherited abnormal blood condition which occurs predominantly in Black people. There are two forms of Sickle Cell Anemia - Sickle Cell Disease and Sickle Cell Trait.* The red blood cells contain an abnormal hemoglobin called Hemoglobin S which causes them to take on an abnormal shape resembling a sickle. These sickled cells have a much shorter life span than normal cells because they are rapidly destroyed. The rate of destruction exceeds the rate of production and thus anemia results. The destruction of the red cell is called hemolysis. Therefore, we say SCA is a hemolytic anemia.



What is Glucose 6-Phosphate Dehydrogenase Deficiency?

This too, is an inherited abnormality of the red blood cells. The abnormality is due to a lack of Glucose 6-Phosphate Dehydrogenase (G6PD). G6PD is an enzyme essential for the normal functioning of the red blood cells. When exposed to certain drugs the abnormal cells become leaky. Water enters the cells causing them to burst. This destruction is also called hemolysis. Thus, G6PD Deficiency is a hemolytic anemia also.

What is a carrier?

A seemingly healthy person who carries an inherited defect that can be passed on to his children is called a carrier.

A. Carrier of Sickle Cell Trait

An individual who carries both the normal hemoglobin (Hemoglobin A) and the abnormal or sickle hemoglobin (Hemoglobin S) in his or her blood cells is a carrier of sickle cell trait.

A. Carrier of G6PD Deficiency

All carriers of G6PD Deficiency are women! However, all women who are carriers have red blood cells with normal levels of G6PD and red blood cells with low levels of G6PD.

*See Appendix

ETIOLOGY

What causes Sickle Cell Disease?

When two carriers of Sickle Cell Trait marry, 25%, or 1 out of 4, of their children could have Sickle Cell Disease. That is, at each pregnancy there will be a 25% chance of the child having Sickle Cell Disease. This is illustrated by the family tree in Fig. 2. There are approximately 60,000 persons in the United States with Sickle Cell Disease. Ten percent of the Black population, 2.5 million persons, are carriers.

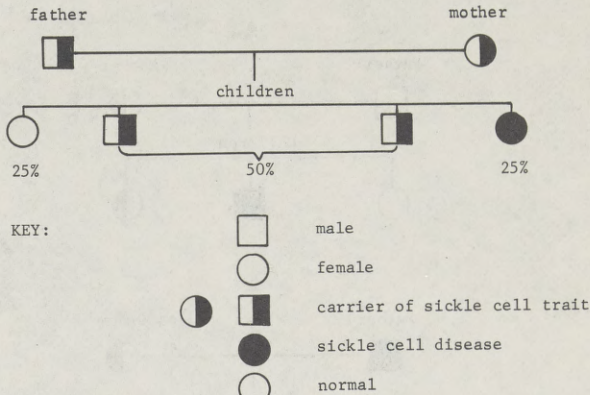
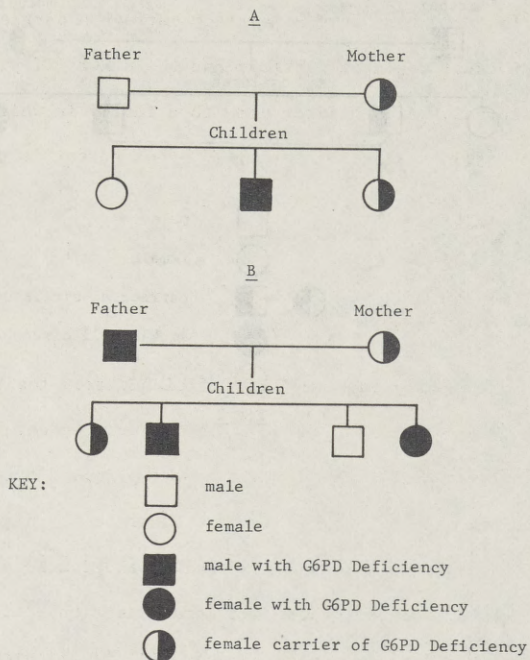


Fig 2

What causes G6PD Deficiency?

A carrier for the G6PD defect who marries a normal male can pass the defect to a daughter producing another carrier or to a son producing an affected individual. This disease is prevalent among Black American males with 13% of them being affected.

Another possibility is for a carrier to marry an affected male. Fifty percent of their daughters could have G6PD Deficiency because they have a defective gene on both X-chromosomes, the one from the father and the one from the mother (See Fig.3) This situation is very rare and only 3% of Black American females have G6PD Deficiency.



A. Offspring of a carrier and normal male

B. Offspring of a carrier and affected male. This is the only way a woman can have G6PD Deficiency.

Fig.3

SUMMARY - SICKLE CELL ANEMIA

Sickle Cell Anemia is not contagious! It is passed from parents to children. Black men and women are equally affected. Two carriers have a one-in-four chance at each pregnancy of having a child with Sickle Cell Disease. Fifty percent of the offspring resulting from a marriage between a carrier and a normal individual could be carriers and the other fifty percent could be normal. All children born to a family in which one parent has Sickle Cell Disease and the other parent is normal will be carriers.

SUMMARY - G6PD DEFICIENCY

Males can only receive G6PD Deficiency from their mothers. Males are never carriers. Whenever they have the defect they are affected and will suffer symptoms when exposed to certain drugs. Females can be carriers or they can receive the defect from both parents and be affected. Generally the female carrier suffers no symptoms, however, there are some exceptions. The female receiving the defect from both parents will be affected in a manner similar to the affected male. The affected female is very rare. Approximately 3% of Black female population is affected in the United States.

SYMPTOMS

What symptoms does the person with Sickle Cell Disease have?

Persons with Sickle Cell Disease (SCD) are a lot like people with other types of anemias. They are usually short of breath and tire easily and they may have an enlarged heart due to the increased work placed on the heart by the lingering anemia.

However, the person with Sickle Cell Anemia has an abnormal hemoglobin which causes the red blood cells to assume an abnormal shape. These sickled cells jam the small blood vessels. This jamming cuts off the blood supply to the body tissues causing joint, stomach, back and bone pain; destruction of bone; rupture of small blood vessels causing frequent nose bleeds and even strokes; and an increased susceptibility to infection.

What is a "Crisis"?

When the sickling increases, the blood vessels become more jammed and therefore the symptoms become worse. Doctors call this a "crisis". Crises begin to occur early in life. The first may occur anywhere between the first four months and the first two years of life. They recur days, weeks or months apart for the rest of the person's life.

These "crises" are characterized by very severe pain of joints, back, stomach and bones with fever. They last from several hours to several days.

What are the symptoms of G6PD Deficiency?

The person with G6PD Deficiency is free of symptoms until exposed to certain drugs. Upon exposure to drugs such as aspirin, antimalarials and antibiotics, symptoms and signs common to all hemolytic anemias develop; these are: weakness, yellow color of the white of the eyes and dark urine. In severe cases there may be stomach and back pain. These symptoms begin abruptly after exposure to the drug and end in about a week even though exposure to the drug may continue. The symptoms can be prevented entirely by avoiding exposure to the harmful drugs. Unlike Sickle Cell Disease, the symptoms of G6PD Deficiency can present as early as the tenth day of life.

DIAGNOSIS

How is Sickle Cell Disease diagnosed?

The person with Sickle Cell Disease will have the characteristic symptoms of anemia; he will be tired and weak. In addition he will suffer with episodes of mild to severe pain. Special examination of the blood will reveal the sickled red cells and Hemoglobin S.

How is Sickle Cell Trait diagnosed?

Usually the person with Sickle Cell Trait, that is, the carrier, does not suffer from symptoms due to the sickling of cells. However, under certain circumstances he may experience a "crisis" similar to the person with Sickle Cell Disease. For example when the carrier is exposed to high altitudes or anesthesia before surgery he may undergo a "crisis". Therefore, it is important to diagnose this condition. The diagnosis can be made in the same way Sickle Cell Disease is diagnosed; through special examinations of the blood the characteristic sickled cells containing the abnormal Hemoglobin S are found.

How is G6PD Deficiency diagnosed?

The person with G6PD Deficiency will be unnoticeable until he is exposed to certain drugs. When this occurs he will undergo a hemolytic crisis and suffer the symptoms characteristic of hemolytic anemias. (See above). Special examination of the blood will reveal the lack of the crucial enzyme Glucose 6-Phosphate Dehydrogenase.

How is the carrier of G6PD Deficiency found?

If a female has an affected brother one should suspect her of being a carrier since her mother is a carrier. Chemical examination of her blood will reveal whether or not she is a carrier of the defect.

TREATMENT

How is the person with Sickle Cell Disease treated?

THERE IS NO CURE FOR SICKLE CELL ANEMIA! Treatment consists of relieving the pain of a "crisis" with pain-killers and adequate hydration to loosen the jammed sickled cells from the blood vessels. Blood transfusions are sometimes needed. However, transfusions provide only temporary relief and can be dangerous. Therefore, transfusions should be given with caution.

Can SCA Crisis be prevented?

NO! At the present time there is no known treatment which will prevent the occurrence of SCA Crisis.

What about Urea?

Recently the newspapers and other portions of the media informed the public about a new revolutionary cure for SCA; the use of Urea to relieve the symptoms of SCA Crisis was heralded as the ultimate form of therapy. Even though the urea treatment or modifications of it provide a promising future approach to the problem it is still in the experimental stage. Thus, the urea treatment should be regarded with caution until more is known.

How is the person with G6PD Deficiency treated?

When the person with G6PD Deficiency is exposed to one of the drugs that causes the destruction of the red blood cells (hemolysis) he suffers the symptoms of a hemolytic crisis. Therefore, the best treatment for G6PD Deficiency is prevention. That is, the person with G6PD Deficiency should not be exposed to those drugs that cause the destruction of their red blood cells. However, if exposure to such drugs does occur, the individual is treated primarily by removing the drugs responsible. If the hemolysis is severe then the individual is given a blood transfusion. However, this is rarely necessary.

MORE FACTS ABOUT THE PERSON WITH SCA AND G6PD DEFICIENCY

How is the person with SCD⁺ different from others?

The teenager with SCD may not be as well developed physically or as sexually mature as the normal person his age. For example, the onset of menstruation is usually delayed in the female with SCD. The child with SCD is more prone to infection than the normal child. This is a major disadvantage because infections such as the common cold can cause a "crisis".

The woman with SCD will encounter more difficulties with pregnancies than the normal female. The anemia becomes worse during pregnancy. These women experience more stillbirths, premature infants and miscarriages than the normal female.

The person with SCD should avoid high altitudes and extreme physical exertion. Airplane travel should be limited to pressurized aircraft* and physical exercise, although not eliminated, should be limited to avoid causing crisis.

How is the carrier of Sickle Cell Trait different?

There is no visual difference between the normal individual and the carrier of Sickle Cell Trait. The only difference is the presence of the abnormal sickled cells in the blood of the carrier. The carrier under certain circumstances, however, may have crises similar to the person with Sickle Cell Disease. Cases of death occurring as the result of exposure to high altitude and extreme exercise have recently been reported. Such cases have been regarded as rare; however, they may be more common than we realize. The carrier may also be more susceptible to kidney disease than the normal person.

Life Expectancy of the person with SCD

The person with Sickle Cell Disease who survives childhood may be able to lead a relatively productive and comfortable life. The crises may be milder and the intervals between them may be longer. However, the survival rate is low with most individuals dying before thirty years of age.

Life Expectancy of the person with Sickle Cell Trait

The person with Sickle Cell Trait seems to have the same life expectancy as the normal individual.. At the present time however, this is not certain.

* All commercial airplanes (TWA, UNITED AIRLINES, etc.) are pressurized.

+ SCD = Sickle Cell Disease

How is the person with G6PD Deficiency different from the normal individual?

The individual with G6PD Deficiency is usually indistinguishable from the normal individual until he is exposed to the drugs causing hemolysis of the defective red cells. However, the defect can be detected by testing the blood. The affected person may also be color-blind. Color-blindness and G6PD Deficiency seem to be inherited together.

How is the carrier of G6PD Deficiency different from the normal individual?

The carrier can only be distinguished from normal by chemical tests of the blood. These individuals will have a lower level of the enzyme Glucose 6-Phosphate Dehydrogenase in some of their red blood cells.

Life Expectancy of persons with G6PD Deficiency

Some have suggested that the affected person has a shorter life expectancy than normal. This conclusion is based on studies of the general Black population showing lower numbers of older males with G6PD Deficiency as compared to the number of young males with the defect. This conclusion is still open to question. Even less can be said about the life expectancy of the carrier.

ORIGIN OF SICKLE CELL ANEMIA AND G6PD DEFICIENCY

Blacks living in the malaria belts of Africa, particularly Eastern, Western and Central Africa have for centuries been exposed to malaria. Malaria is an infection caused by a parasite that destroys the red blood cells. There is evidence to indicate that African individuals carrying sickled cells and/or having decreased amounts of the enzyme G6PD in their red blood cells are more resistant to malaria.

Thus, as a process of natural selection (only the strong survive), Blacks came to bear these red blood cells which provided protection against a dreaded and deadly parasite. When Blacks were imported by the American Slave System to America where malaria is virtually non-existent the advantage of having Sickle Cell Trait or Glucose 6-Phosphate Dehydrogenase Deficiency was eliminated and an asset became a liability.

WHAT CAN BE DONE

Sickle Cell Anemia

As previously stated, there is no known cure for Sickle Cell Anemia nor is there an adequate form of treatment to relieve and prevent the suffering of the victims of Sickle Cell Disease. At the present time the only cure available to Blacks is to prevent the child with Sickle Cell Disease from being born. This is a very limited alternative; nevertheless, it is the only one available to the Black race at this time. The utilization of such a technique of prevention is based entirely on the personal decision of the parents at risk of having a child with Sickle Cell Disease. Such a technique of prevention may be acceptable to some and unacceptable to others. However, it is the right of every individual finding it necessary to make such a decision to know what the consequences are of any choice that he might make.

In order to insure that young Black couples will be able to make an informed decision about giving birth to a child who might have Sickle Cell Disease, it is absolutely necessary that information be made available to the Black population about this deadly blood disorder. At the present time efforts must be made towards a massive education program for the entire Black population - young and old. The necessity for such a program results from the years of neglect this aspect of the Sickle Cell problem has received. There is no reason to expound on the cause of this neglect.

In conjunction with the massive education program a screening and genetic counseling system is necessary to identify and advise those two and a half million Blacks who are carriers of Sickle Cell Trait. Such information should become a part of the individuals' permanent medical record early in his life, as soon after birth as possible. The Black child with Sickle Cell Trait should be made aware of the blood condition and the consequences of having it as soon as he is able to comprehend. Such an approach would eliminate in several decades the present uninformed adult population as well as possibly eliminating or decreasing the prevalence of Sickle Cell Disease.

Glucose 6-Phosphate Dehydrogenase Deficiency

We have already pointed out that the problems encountered by a G6PD Deficient individual can be avoided if he and his physician are aware of his having the defect. The symptoms of G6PD Deficiency are avoided by avoiding the drugs (antimalarials, certain antibiotics, aspirin, etc.) that precipitate a hemolytic crisis in these individuals. Thus, it is extremely important that an affected individual be aware of his condition in order that he may be able to inform his physician. This information should also become a part of an individual's medical record as soon after birth as possible. The infant with G6PD Deficiency who is challenged with any of the harmful drugs could be placed in a life-threatening situation.

Similar to the Sickle Cell Anemia problem, the G6PD Deficiency situation requires a massive educational and screening effort.

The Sickle Cell Anemia Foundations

As mentioned above, the only cure available to the Black population for Sickle Cell Anemia is to prevent the mating and procreation of children by carriers. Hopefully in the future modern medicine will be able to provide adequate treatment for Sickle Cell Disease. This would eliminate Black couples having to make a decision about bearing a child who might not live to thirty years of age.

However, the Sickle Cell Anemia problem has been around a long time and this day still has not arrived. Black people can have a great impact on the progress of Sickle Cell research to develop adequate treatment and on the initiation of massive educational and screening programs. This impact could be in the form of establishing a national Sickle Cell Anemia Foundation. We cannot depend entirely upon the Federal Government to provide funding for such programs. We can see how such dependence in the past has allowed the present situation to develop.

At the present time there are several Sickle Cell Anemia Foundations in the country. None of them are extremely wealthy; none are able to finance the types of programs required to eradicate the suffering of the victims of Sickle Cell Disease and their families. However, if we could establish one Sickle Cell Anemia Foundation with branches across the country providing needed information and money and coordinating their efforts we will be able to accomplish much more than we could in a disunified manner.

It should be pointed out that such diseases as cystic fibrosis, phenylketonuria, muscular dystrophy, and childhood leukemia, which occur primarily in the white race occur with a much lower frequency than Sickle Cell Anemia. For example, the number of children born with Sickle Cell Disease is twice that of cystic fibrosis and nearly nine times that of phenylketonuria. Nevertheless, these disorders have received much more attention than Sickle Cell Anemia. The population at risk for these disorders are much more aware of them and their consequences than Blacks are of Sickle Cell Anemia. More research has been done on these diseases than on Sickle Cell Anemia. In other words, more time, effort and money have been spent attempting to eradicate these diseases than has been expended for Sickle Cell Anemia which occurs with a higher incidence. Black Americans must now move to eliminate these inequities in health care by establishing a national Sickle Cell Anemia Foundation to coordinate and fund research, screening and genetic counseling programs.

The Stanford Black Health Care Project

Black medical students at Stanford Medical School have begun work on a massive education and screening program. During the summer of 1971 these students initiated a pilot project aimed at the Black employees at the Stanford Medical Center. The success of this project will determine the possibility of launching a program which will include the entire Black population of East Menlo Park and East Palo Alto. In cooperation with the Charles R. Drew Clinic they will attempt to screen and counsel the entire Black population of these two communities on a house-to-house basis, if necessary.

This group also explored the possibility of establishing a Sickle Cell Anemia Foundation in the mid-peninsula area with hopes of coordinating the various aspects of research and education in Sickle Cell Anemia in the entire region. As a result of their efforts, several representatives of a half-dozen interest groups met with the Black students and formulated the basic structure of the Mid-Peninsula Sickle Cell Anemia Foundation.

APPENDIX I

What are Genes?

A gene is an inherited factor found in all cells of the body. A person receives a set of genes from both parents. These two sets control the entire body development; they control the eye and hair color, the texture of the skin, body height and weight, etc. Genes also control the type of blood cells and the substances made in these cells. For example the red blood cells make a substance called hemoglobin. Hemoglobin is the red pigment or coloring agent of blood. It carries oxygen to all parts of the body and is therefore important for proper body function. Hemoglobin production is controlled by a pair of genes; one gene is inherited from each parent.

Abnormal Genes and Sickle Cell Anemia

Genes may be normal or abnormal. Abnormal genes are inherited just as normal genes are. Some abnormal genes produce severe disease. For example, Sickle Cell Disease is a deadly blood disorder found predominantly in Blacks that results from a child receiving an abnormal gene for hemoglobin from both parents. This particular abnormal gene produces an abnormal hemoglobin called Hemoglobin S or sickle hemoglobin because it causes the red blood cells to assume a crescent or sickle shape when the oxygen in the red blood cells is low. These sickled cells jam the small blood vessels. This jamming cuts off the blood supply to body tissues causing frequent nose bleeds and even strokes. We say a person with Sickle Cell Disease (SCD) has received a "double dose" or that he is homozygous for the "sickle gene" because he received a sickle gene from both parents. If a child receives only one sickle gene from either mother or father we say he is a carrier or that he is heterozygous.

Therefore there are two forms of Sickle Cell Anemia. If a child receives the sickle gene from both parents he has Sickle Cell Disease and if he receives the sickle gene from only one parent he has Sickle Cell Trait.

APPENDIX II

The Mid-Peninsula Sickle Cell Anemia Foundation, an outgrowth of several activities generated by a small group of Black medical students at Stanford University, is sponsoring a series of lectures under the auspices of the Department of Community and Preventive Medicine. Most of the talks will be given by the students themselves and will be oriented towards the lay person interested in learning more about Sickle Cell Anemia and G6PD deficiency. A tentative schedule of lectures has been outlined and all interested persons are urged to attend.

The discussions will be held at 7:30 p.m. in Room M106 of the Medical School School.

"Symposia on Sickle Cell Anemia and Glucose-6 Phosphate
Dehydrogenase Deficiency"

- 22 Oct 71 A History of Sickle Cell Anemia and of Glucose-6-Phosphate Dehydrogenase
- 19 Nov 71 The Genetic and Biochemical Descriptions of
 - 1. Sickle Cell Disease
 - 2. Sickle Cell Trait
 - 3. Glucose-6-Phosphate-Dehydrogenase Deficiency
- 17 Dec 71 The Psycho-Social Impacts of Sickle Cell Anemia
- 14 Jan 72 Past and Present Research in Sickle Cell Anemia
- 18 Feb 72 Clinical Manifestations in Sickle Cell Anemia
- 18 Mar 72 A Review and Analysis of Methods for Detection of Sickle Cell Anemia and G-6-P-D Deficiency
- 15 Apr 72 The Treatment of Sickle Cell Crisis
- 14 May 72 Sickle Cell Foundations
 - 1. Number and Locations
 - 2. Activities
 - 3. The Mid-Peninsula Sickle Cell Anemia Foundation

Senator SCHWEIKER. Thank you, Mr. Chairman.

I would like to compliment Congressman Clay for the leadership and initiative he has shown in this field and I wonder, Congressman, if either Dr. Mitchell or Dr. Anderson might answer a few technical questions about your program out there.

In terms of screening equipment, how much does it cost to equip a screening operation for detecting the sickle cell trait? Could you give us a rough idea?

Dr. ANDERSON. It is a difficult thing in a sense. If you are talking about the very limited amount of screening with the present tests we have, I would think that a center could be operational, allowing for personnel, certainly for an amount around \$50,000 to \$100,000, just for the initial screening.

But if we are talking about a center that screens, carries it out to the end and gives some initial counseling, my figure runs anywhere from \$2 to \$12 million for a significant biological center.

We can give you this back in writing, Senator, and break it down for you.

Senator SCHWEIKER. OK. Bill, in your testimony you cite that when a patient has a severe attack it is a \$2,000 to \$3,000 hospital bill.

Mr. CLAY. Yes.

Senator SCHWEIKER. I wonder if one of your colleagues could give us an idea—a patient that has terminal sickle cell anemia, how many times does he have to go to the hospital on the average?

Dr. MITCHELL. You are talking about seeing a patient maybe on a daily basis to relieve the pain. If he has an infection, you are talking about giving him an injection every day on an out-patient basis. If the crisis is severe enough you are talking about putting that patient in the hospital, and that patient just might remain in the hospital up to a month or more, and you are talking about astronomical figures.

Senator SCHWEIKER. And how often might he go back?

Dr. MITCHELL. It depends on the severity of the disease. If you are talking about a real critical case, the patient might not come out of the hospital for a long period of time. When he comes out, it is only because of the fact that they need the hospital space and directions can be given on an out-patient basis, because there is no definitive treatment at this time for sickle cell.

Senator SCHWEIKER. So we are really saying that for a person who is a terminal case, it is almost a catastrophic medical expense, in terms of what the family has to bear, in addition to the hardship of the disease. We are placing a tremendous burden on the family that has to carry on.

Dr. MITCHELL. Right. I would daresay, in a situation such as sickle cell anemia, most of the people do not have medical coverage, so they are totally dependent on the State.

Senator SCHWEIKER. Is there any prohibition for somebody covered under group insurance plan, if it is known that he has sickle cell

anemia? Will they include him or is there any exclusion on this basis?

Dr. MITCHELL. We have seen policies where they would not include them. We have seen policies where they would include them.

Senator SCHWEIKER. They would be excluded?

Dr. MITCHELL. Excluded and included on certain policies.

Senator SCHWEIKER. I think that is very significant because it has a lot to do with all of our group approaches.

Dr. ANDERSON. In terms of the practical portion of health care delivery, in the State of California, people on the medical program are allowed only two visits per month to the doctor and they are allowed two prescriptions per month. So they could get two prescriptions and two visits to the doctor when these may require two visits per week, if people are on antibiotics.

Senator SCHWEIKER. So what we are saying is that many of our group practice plans do not even cover these cases or begin to touch the cost or the involvement.

Dr. MITCHELL. Right.

Senator SCHWEIKER. And they either become public cases or totally neglected, one or the other, depending on what happens?

Dr. MITCHELL. They have to go to the county hospital for care. The Children's Hospital located in the heart of Los Angeles has a program in which they see the families and counsel the families, but only on a voluntary basis. The doctor that is carrying on this program is doing this just because of the fact that he is interested in sickle cell anemia, but he cannot carry out the program the way he wants simply because he does not have any funds. That makes it bad when the patient goes into crisis because they have to send him to Los Angeles County Hospital.

Senator SCHWEIKER. Have you had any cases that you have come across where because of lack of funds treatment either has been refused or denied, or has this not been a problem?

Dr. MITCHELL. No. I have not run across any cases where the treatment has been refused or denied.

Dr. ANDERSON. I do not think treatment is denied anywhere across this Nation, but the problem is you do not even get to the doctor until you have a major complication. This is what we are talking about. These people are subject to die because they are already carrying low blood counts. We are concerned not only that they have access to care, but that the quality and amount of care needed in this type of complicated cases will be adequate. It is not the case now.

Senator SCHWEIKER. The quality in this particular kind of medicine is very, very significant. That is all I have.

Senator KENNEDY. Dr. Caper, who was at the Boston City Hospital, reminds us of a case where one patient visited the Boston City Hospital 48 times with sickle cell anemia before he died at 38 years of age—imagine the medical bill associated with that.

Senator Hughes?

Senator HUGHES. Mr. Chairman, I yield to you.

Senator KENNEDY. I want to thank you very much. You have presented very helpful commentary and very helpful testimony. We want to thank you, Congressman. In the material you submitted here, Dr. Anderson, does that give a bit of a rundown on the program out there in Los Angeles.

Dr. MITCHELL. Right.

Senator KENNEDY. That meeting that you had of the various foundations, sickle cell foundations, I do not know if they passed some resolutions or whether they made some recommendations. If there is some material from that, we might—either you or our staff can get together and they might have some very useful commentary that would be helpful to us.

Thank you very much.

Our next group represents the Black Athletes Foundation, if they will be kind enough to come up: Hank Aaron, Horace Davis, John Henry Johnson.

Gentlemen, we want to extend a warm word of welcome to you men. You have distinguished yourselves in the athletic fields across this Nation and are not satisfied with that, utilizing your leadership qualities in a very important significant area, and I want to commend you for your efforts and the initiatives which you have provided in this area which is something which is very impressive, and I think you are performing an enormously significant public service.

Just before getting into your commentary or testimony, I want to recognize Senator Schweiker.

Senator SCHWEIKER. Thank you, Mr. Chairman.

I just want to say that the group here, the Black Athletes Foundation, started and is headquartered in Pittsburgh. I have had the opportunity to meet with Horace Davis, Willie Stargell, and John Henry Johnson to discuss their program in Pittsburgh and was most impressed by their ideas about how to combat sickle cell anemia. I am proud to know that such an outstanding pilot program is already underway in Pittsburgh, and I appreciate the chairman's willingness to schedule them as witnesses today.

The list of the foundation's officers reads like a "Who's Who" in the world of sports. Former heavyweight boxing champion Muhammad Ali is chairman; Willie Stargell, member of the world champion Pittsburgh Pirates, is president; professional basketball stars Connie Hawkins and John Brisker are vice president and treasurer, respectively; and John Henry Johnson, formerly of the Pittsburgh Steelers football team, and Pirate pitcher Dock Ellis are members of the board of directors.

In a matter of months the Black Athletes Foundation has focused an extraordinary amount of attention on sickle cell anemia.

But the foundation has done more than simply draw attention to the problem; they are doing something about it, day by day, in the city of Pittsburgh.

The Black Athletes Foundation's pilot project is unique in bringing together all agencies from both the public and private sectors that are concerned with the disease. They have begun a program of voluntary blood testing to identify carriers of the sickle cell trait. They are embarking on family planning and counseling programs for carriers of the trait. Their testimony today should be of great interest to all members of this subcommittee.

Groups like the Black Athletes Foundation can go only so far before the money and the resources run dry. They have taken up the torch and carried it to us; now we must go about the business of researching, treating, preventing, and eventually curing sickle cell anemia.

In the 1940's and 1950's, this Nation was galvanized in the battle against polio. With sufficient funding and research, we cured polio. With sufficient Federal funding and research, we can cure sickle cell anemia.

I am cosponsoring S. 2676, the National Sickle-Cell Anemia Prevention Act, because I feel it is an important first step, and I am proud to present the Black Athletes Foundation from my State and also proud to see the leadership that Senator Kennedy and Senator Javits and this committee is giving to encouraging groups that really started the programs themselves.

Thank you very much and we appreciate your coming here today to tell us a little bit about how you did it.

Senator KENNEDY. We are glad to have you. I say to Hank Aaron, if you had played up in Boston when the old Boston Braves were still up there, we might still have them. Did you have 46 home runs last year?

Mr. AARON. Forty-seven.

Senator SCHWEIKER. We have been beset a little bit by injuries and weight problems. Willie Stargell has a knee operation and could not come at the last minute, and we are very regretful of that. Muhammad Ali is over his fighting weight—he is up to 230 instead of 217—so the trainers confined him to the camp in view of the pending fight; so other than that, we will have Hank Aaron carry the ball.

Senator JAVITS. I would like to assure these wonderful Americans that not only do we appreciate their being here, but you are going to help see that something comes of this, which is what you are here for. I have to go to another hearing to do something else, but I can assure you that the fate of this bill is in very strong hands. Thank you very much.

(The prepared statement submitted by Elmer A. Anderson, M.D., follows:)

SCDRF

SICKLE CELL DISEASE RESEARCH FOUNDATION

2921 WEST VERNON AVE., ROOM 203
LOS ANGELES, CALIFORNIA 90008

MEDICAL RESEARCH - EDUCATION - COMMUNITY SERVICE

Statement of

Elmer A. Anderson, M. D., F. A. C. P., F. R. S. H.

2nd Vice President and Co-Founder of

Sickle Cell Disease Research Foundation of California

Medical Consultant Department of Hospitals

Los Angeles, Calif.

before the

U.S. SENATE SUB-COMMITTEE ON PUBLIC HEALTH, EDUCATION

AND WELFARE

HEARING ON THE "NATIONAL SICKLE CELL ANEMIA PREVENTION ACT"

S2676

Nov. 11 & 12, 1971

Mr. Chairman: I am grateful to you and the members of your Committee for your courtesy in receiving this statement.

I have been painfully and acutely aware of the problem of Sickle Cell Anemia for 23 years, since my medical school days at Meharry Medical College. I joined other concerned citizens 13 years ago to establish the S. C. D. R. F. of California in Los Angeles, dedicated to education, patient and community service, medical research and therapeutic recreational rehabilitation in the form of a summer camp.

Page (2) cont'd. ---Statement of E. A. Anderson, M. D.
Senate Hearing Sickle Cell Anemia

The major thrusts of our efforts in Public Education was made possible by the assistance of CBS-TV this year with the documentary, "The Neglected Disease," and the sponsoring of Sickle Cell Month during September throughout Los Angeles County.

We sponsored the First National Clinical Conference on Sickle Cell Disease with the establishment of the Cleve Ewell Memorial Lecture Series in St. Louis, Missouri 5 years ago. We saw hope in the eyes of the hopeless when we sponsored the first medically supervised summer camp for children victims of this disease in 1968. Yet, we attended the burial of Kim Mims, a 6 year old girl, for whom help was too late. Three weeks ago, a young mother of two died with post-operative complications because not enough was known about Sickle Cell Disease.

Sixty-one years ago this crippling medical problem was first described in America. Yet, we have no cure for the continuing painful suffering of its' many victims.

Page (3) cont'd. ---Statement of E. A. Anderson, M. D.
Senate Hearing Sickle Cell Anemia

We have initiated and carried out these limited programs without any significant help from the major tax, government, and health funding resources such as, HEW and/or U.S. Public Health Services. However, the identifiable needs, the scientific and social expertise is available in this nation. If you will enact this legislation, we feel it will be an important step forward.

STATEMENT OF HORACE DAVIS, EXECUTIVE DIRECTOR, BLACK ATHLETES FOUNDATION; ACCOMPANIED BY JOHN HENRY JOHNSON, HENRY AARON, AND DR. ANTHONY J. GIORGIO

Mr. DAVIS. Mr. Chairman, all of us wish to offer our sincere thanks for giving the opportunity to address you on a subject of such great importance to millions of black Americans.

So that there will be time for you to ask whatever questions you may have of us, I will touch upon only a few aspects of this major health problem and the legislation concerning sickle cell anemia that is now before you. I would like to ask, at the same time, that our full statement be entered into the official record of this hearing.

Little more than 2 weeks ago, on October 27, our foundation presented testimony before the Subcommittee on Public Health of the Senate Committee on the District of Columbia, which was considering legislation which would establish in the city of Washington, D.C., a pilot program on sickle cell anemia. Because much of that testimony also is relevant to the bill now before this subcommittee, let me just outline the major points we then stressed.

Because statistics on the incidence of this or any other disease attain meaning and significance only to those who understand what it does in the individual case, it is important to recognize that sickle cell anemia not only involves premature death, but also untold suffering for the patient and his or her family. We described a case which followed a typical course—18 hospitalizations by age 24 and death soon after.

A total program, involving a variety of public and private agencies, is the only kind that can lick this disease. It must be both adequately funded and properly coordinated.

Washington, D.C., the only city in the country in which a majority of residents are black, is a most appropriate site for an initial federally funded pilot program dealing with sickle cell anemia.

Testing and screening on a massive scale can, we strongly believe, drastically reduce the incidence of sickle cell anemia, although all aspects of the program must and should depend upon the voluntary cooperation of the affected communities and individuals.

Clearly, there is a growing recognition in Congress of the need for action in meeting the serious problem of sickle cell anemia. In testifying today in strong support of the National Sickle Cell Anemia Prevention Act, we wish to commend those Senators and Congressmen who are sponsoring this measure and the companion bill that would establish a demonstration program here in the Nation's Capital. We urge prompt and positive action on both proposals.

It is estimated that today 50,000 Americans are dying of sickle cell anemia—a fatal disease which kills a majority of its victims before they reach 21 years of age. It is a disease that involves terrible pain and suffering. Because it is hereditary—that is, passed on in the genes of the parents to a child—it can mean tremendous feelings of guilt for the parents of its victims, who often learn of the risks involved in having children only when the disease shows up in one of their own. For the afflicted family, too, the financial burden of sickle cell anemia is staggering.

More than 2 million black Americans—one in every 10—carry the sickle cell trait. Most are symptom-free and their greatest risk lies in marrying another trait carrier and having children who have the disease. The chance is very high—25 percent in every case—that a child of two trait carriers will have sickle cell anemia. Trait carriers, too, however, may themselves experience “sickle cell crises” in certain situations where the normal supply of oxygen is reduced such as at high altitudes or under general anesthesia. And a few, under normal conditions, may show symptoms which, while far milder than those associated with anemia itself, can be troublesome.

Doc Ellis, who is unable to be here today because he is among a group of athletes currently making a tour of Vietnam, is a trait carrier and has health problems associated with that fact which he described in his recent appearance before the Public Health Subcommittee of the Senate Committee on the District of Columbia. And Willie Stargell—we had hoped he could be here today but he is in the hospital—could outline for you some of the experiences of his 9-year-old daughter Wendy, who also is a carrier of the sickle cell trait.

But it is the disease itself, one must remember, that is the killer. The problems of the trait carrier are mild in comparison to the agonizing pain and the terror that the sickle cell anemia victim endures. Consider then that this disease strikes an estimated one in every 200, or even one in every 500, black persons born in this country, and you begin to appreciate the magnitude of the sickle cell anemia problem in the United States.

Because the disease is inherited, its spread can be halted, and the tragedy is that we are only now beginning to launch an attack of significant scope against it. There certainly can be no justification for any further delay. In urging the quickest possible affirmative action on the legislation that is before you today, we pledge ourselves, too, to providing all the possible help that we can give in seeing that this fight is won.

This is a “must game,” so to speak—a contest calling for the all-out effort of all who are interested in seeing victory achieved.

The roles that we believe our foundation can play in this struggle, on both national and local levels, are fundraising, education, and program coordination. Among the athletes who have agreed to help in the Black Athletes Foundation’s plan to open offices and to become involved in testing and screening programs in every major sports city in the United States are Roy Campanella in New York City; Ernie Banks in Chicago; Bob Gibson in St. Louis; Willie Davis in Los Angeles; Jim Wynn in Houston; Walter Johnson in Cleveland; Hank Aaron in Atlanta. There will be many more to follow.

Although our foundation is quite new, having been incorporated in late May of this year, already we have been involved in the coordination of a pilot program in Allegheny County—that is, the Pittsburgh, Pa., metropolitan area—where our major office is located. And our experience there leads us to certain conclusions which, we believe, are relevant to a national sickle cell prevention program.

The Black Athletes Foundation offers the following four recommendations:

(1) The bill now before you appropriately places great emphasis on the screening and testing aspect of a prevention program. Because

electrophoresis is clearly the best method for carrying out sickle cell testing on the massive scale contemplated by the bill, it is our strong belief that the legislation should specify that this method of testing be used. Unlike the sickle-dex test and the sickle-prep test, which cannot accurately distinguish between the trait carrier and the anemia victim, the electrophoretic test can make such a determination. Additionally, it can pick up other abnormalities of the hemoglobin, such as hemoglobin C.

Although a rather expensive laboratory procedure when isolated samples are involved, its cost is as inexpensive as any of the other sickle cell tests when large numbers of samples are to be run. In such cases, the total cost of the electrophoretic test, including collection of the blood and salaries paid to the technicians involved, approximates 50 cents per sample. The sickle-dex test, in contrast, costs about \$1.25 to \$1.50 per sample, whether small or large numbers of samples are to be tested. Factors of both cost and effectiveness, therefore, dictate the electrophoretic method in large-scale testing programs for sickle cell anemia.

(2) An important part of an effective attack on sickle cell anemia must be a strong followup plan not only for counseling trait carriers, but also for advising and treating those persons who have the disease. In the coordinated program in which we are involved in Pittsburgh, the Allegheny County Health Department, the federally funded Homewood-Brushton Health Center, the Central Blood Bank of Pittsburgh, the Bidwell Cultural and Training Center, the local Pittsburgh Sickle Cell Society, Planned Parenthood, and the University of Pittsburgh are all making one effort for us to test and screen a quarter of a million blacks in Allegheny County.

Field interviews conducted by skilled personnel with trait carriers and anemia victims alike are essential to the program's success. The identification of trait carriers provides such persons with the information that allows them, for the first time, to make crucial choices—in the selection of a marriage partner or in adopting children as an alternative to having their own. These choices clearly must be voluntary, as is, in fact, the decision to be tested in the first place. Yet, it is important that trait carriers be given the facts, impartially and without causing unnecessary alarm, about the risks they may face. While the very personal decisions about their families are their own to make, skilled counseling is crucial to stemming the disease in an atmosphere free from undue anxiety.

Nor can the sickle-cell anemia victims be forgotten, however. As I mentioned earlier, there are probably about 50,000 such victims in the United States today. While there is currently no cure for the disease, its victims must be provided with the best possible treatment which may ease their suffering and prolong their lives. Many such patients will be from families whose levels of income are insufficient to meet the brutal financial demands that adequate care calls for.

Strong followup programs under the National Sickle-Cell Anemia Prevention Act must be designed to meet both the problems of the trait carriers and the victims of the disease.

(3) It is our best estimate that the costs of properly doing the needed testing, screening, and followup work in Allegheny County which has a black population of about one-quarter million, will run to

about \$1.9 million. Now, this is a program strictly for screening and testing. It is not for purchase of equipment. It is screening and testing and followup and counseling.

Senator KENNEDY. Do you think you could put that money to good use now? You have the personnel that are prepared to go ahead with the program? You have the equipment necessary? Do you think that money would be utilized effectively toward the goal that you would desire?

Mr. DAVIS. Right. We made a final step in that Tuesday when we purchased \$10,000 worth of electrophoresis equipment. If we had the money, we could move tomorrow on the program.

Senator KENNEDY. This is just in that county, Allegheny County; is that right?

Mr. DAVIS. Right. The reason we are confining it to Allegheny County, we felt that we would have a complete program there before we move into any other city. We encountered a lot of problems in Pittsburgh, so by ironing out our problems in Pittsburgh, we would not encounter the same problems in Atlanta or Chicago, for instance.

Senator KENNEDY. You are hopeful that based on the success in Allegheny County, with the kind of approach developed there, you could apply that system to other communities. As I understand, you are trying to put that kind of a high-powered program in operation across the country. Rather than referring to these programs as "pilot" projects because that denotes the need for a good deal more study and research to determine what to do, we know from testimony earlier this morning, the directions needed to launch an attack on sickle-cell anemia. What you are saying here is you have got the people and the personnel you need, and all you need now is the go-ahead; and the go-ahead in this case happens to be resources. Do I understand you correctly?

Mr. DAVIS. Right. We realize that sickle cell anemia is too large a problem for one organization to assume the responsibilities in any metropolitan city taking on this themselves.

As a general estimate, we feel that the cost of such a program will be between \$1.5 and \$2 million for every 250,000 blacks in the population. On that basis, we estimated, in our testimony on the bill calling for a demonstration program in Washington, D.C., that the program's cost would run between \$3,444,000 and \$4,592,000. Yet, while Washington, D.C., is the city which has the highest proportion of blacks in its population of any city in the country, there are five American cities that have larger black populations than Washington's 574,000. They are New York City, with 1,500,000 black residents; Chicago, with 1,150,000; Detroit, with 800,000; and Los Angeles and Philadelphia, with about 700,000 each.

Clearly, these five cities are natural locations for the establishment of sickle cell centers described in section 1102 of title XI, under the proposed bill. It is our belief, however, that the \$5 million in each of the next 3 fiscal years, which the bill calls for in demonstration grants, is insufficient to properly do the job.

If our estimates on a Washington program are correct, the establishment of centers for these five additional cities alone will cost a great deal more. Yet, hopefully, demonstration grants also will be

available for the implementation of other innovative suggestions as to how screening and testing can be accomplished in other regions. Large black populations of workers at plants that are not located in major cities, for example, might be reached by testing programs carried out at the job site.

The legislation not only must provide enough latitude to allow innovative programs of this nature to be tried, but there must also be sufficient demonstration grant funds available to make this possible.

The problem of sickle cell anemia has been too long neglected. It is extremely important that, in now focusing public attention on this problem and in raising the hopes of so many that the problem will be met, sufficient funds be allocated to do that job.

It is our strong recommendation that the amount to be set aside for demonstration grants be doubled—to \$10 million in each of the next 3 fiscal years.

(4) Finally, we wish to emphasize again that the problem of sickle cell anemia differs from many other health problems in that more than just scientific expertise must be brought to bear. It is an educational proposition, too, in very large measure, as the proposed bill, with its major thrust in the area of screening and testing, makes very clear. For this reason, we believe it is important that sickle cell programs receive input from those who are most affected—the lay person, as well as the professional, and certainly the black, whom this disease attacks almost exclusively.

The National Advisory Committee that will coordinate the implementation of the sickle cell anemia program through the National Institutes of Health sets a fine example of black involvement. It is essential to the program's success, however, that this example be followed up at the local level. Screening and testing is a program that will take place in the black communities of America, with its success dependent upon the widespread participation by the residents of those communities. Their confidence and participation can best be assured, we believe, if qualified black community leaders and black professionals play leadership roles in the planning and implementation of the program.

The Black Athletes Foundation, at the same time, is firmly of the conviction that the help of all Americans is needed to see that this fight is won. Our own board of directors is an integrated body, as is our medical advisory committee. The fundraising activities in which we have been engaged are directed to members of all races. And today we call upon all Members of the Congress to join the struggle by acting promptly and affirmatively on the bill you have before you.

There is, as we have tried to stress before, a great need for speed. A loss of any more time means a further loss of life. All of us, together, must help prevent that from happening.

Thank you, Mr. Chairman and members of the subcommittee. We would be happy to respond to any questions that you may have.

Senator KENNEDY. Thank you very much. Do you have any other comments, Mr. Aaron?

Mr. AARON. I think what we all would like to see, we would like to see this program expanded.

Senator KENNEDY. Could you tell me how you got interested in this? How did you know about it? How did you first hear about the

program? I would be just interested in how you became involved in the foundation.

Mr. AARON. Well, of course, Willie Stargell and I are very close friends and his daughter has sickle cell anemia, and he got me involved in it about 2 years ago and he talked to me about it and, of course, I expressed my interest in it and told him whatever I could do that I would be glad to help.

Of course, in the Atlanta area there is nothing being done there, so I decided that I would take it upon myself to try to start this program to get it expanded all over the United States.

Senator KENNEDY. Are there any efforts that you know about in Atlanta, any voluntary groups that are working in the community at all that you know?

Mr. AARON. I do not know of any at this moment.

Senator KENNEDY. And is it your impression from your contacts with thousands of people that they would welcome this kind of a program to provide some screening and testing and education in terms of the nature of the disease?

Mr. AARON. I think this is the only way that it could probably be stamped out, and I think that the people that I have talked to welcome a program of this sort.

Senator KENNEDY. Now, it has been suggested, Mr. Aaron, that if you pass this kind of legislation with the money that is suggested, some \$90 million over 3 years, that you are going to frighten members of the black community and perhaps others as well because of the enormity of the program, and you are going to stir things up and make them scared.

What is your reaction and feeling about this? Do you think that is true or do you think people would welcome this kind of help and assistance?

Mr. AARON. I think they would welcome it, really. I think the money that will be appropriated would be just a drop in the bucket in really fighting to stamp out this dreadful disease.

Senator KENNEDY. I gather from what you are suggesting here that we in Congress often appropriate money for programs that we are hopeful of being successful somewhere down the road, and I think you have made a strong case this morning that we can actually save people's lives and you can save people from suffering and from the enormous kind of human tragedy and heartache which is associated with this disease if we pass this very modest request and legislation. Do I gather correctly that this is at least part of the reason why you are supporting this legislation?

Mr. AARON. That is very true.

Senator KENNEDY. If we could come back to the Allegheny situation, you have a program there now which would cost approximately \$1.9 million to 150,000 people, and I suppose if you project figures, that would mean it would project a number of testing programs for the country at large that we would be talking about hundreds of millions of dollars really if we were going to test the whole country. Is that correct?

Mr. DAVIS. Right.

Senator KENNEDY. If you take the sort of program that you have developed in Allegheny, after a great deal of thought and deliberation and planning and programing, considering the various different kinds of tests, that actually if we were to project that program nationwide, we are talking somewhere around \$200 million. I gather you are here today to urge the Congress to take the very hesitant and general step of some \$90 million over these next 3 years.

Mr. DAVIS. Right. I feel that there should never be any thought of cutting back on the \$90 million. There should always be thought in the direction of increasing the \$90 million.

Senator KENNEDY. Right. Finally, how committed is the foundation, at least, to trying to address themselves to this problem? How strongly do they really care about it? How firmly are they committed to it?

Mr. DAVIS. I think you would have to ask Dr. Giorgio, who is on our medical staff at the University of Pittsburgh, who works very closely with the foundation. I think he could answer that question.

Dr. GIORGIO. Mr. Chairman, there is no doubt in my mind that the Black Athletes Foundation's greatest asset is their obvious ability to increase the awareness among the black population of this society, and indeed, I have witnessed very zealous devotion on their part with respect to parents and screening programs wherein they would shake dozens of hands and sign baseballs, et cetera, all in their off time, and mind you, during busy schedules as far as their athletic duties go.

Right now, it is estimated that perhaps one in 10 black Americans is aware of this serious and prevalent disease; and despite medical efforts to educate, this ratio of unawareness has really not changed very much. The black athletes surprised me in their ability to steer interest and to educate this summer. Mr. Davis and the Black Athletes Foundation approached us who are members of the Department of Medicine at the University of Pittsburgh in the Hematology Section, and they asked us for some help with respect to giving them laboratory support for a screening program which Mr. Davis thought he might hold in an East Hill shopping center outside of central Pittsburgh; and he assured me that he could attract 4,000 or 5,000 black people for screening if he had Willie Stargell and Dock Ellis and some other members of the Pittsburgh black athletic community. I doubted it because we had attempted mass screening programs and the most people we ever screened happened to be 800.

As it turned out, 5,000 people showed up at this activity, about 99.9 percent of whom were black, all for sickle cell screening. Because we ran out of supplies, we screened just slightly less than 4,000 in 3 days. We were truly overwhelmed with the tremendous impact that the black athletes' support has in just taking the first step in the conquest of this disease, and that is increasing the level of awareness in the black community of it.

Senator KENNEDY. The limitation, then, was really on the adequacy of the resources, because of financial support; is that right?

Dr. GIORGIO. Yes. We have a very small grant from regional medical funds in support of our laboratory, \$25,000 a year, and we just cannot employ full-time personnel in an adequate number to cover these large screening programs.

As it turned out, many devoted volunteers from the black community, both B.A.F. and the Sickie Cell Society of Pittsburgh, really participated and made that screening program a success by their voluntary efforts.

Senator KENNEDY. Do I understand your position clearly, Mr. Aaron and others, that the administration has indicated that they are prepared to spend a million and a half dollars on research and \$31½ million on screening, and the bill that we have before us is \$30 million a year, \$5 million certainly on research and \$25 million for screening and testing and other kinds of grants—is it your feeling, first of all, that the current program is inadequate and you might even suggest it is grossly inadequate, measured against the needs that exist in this country at this time? Is that correct?

Mr. DAVIS. Yes. We felt that we would first take the money and then prove to you that this was not enough money, but the \$90 million—it's a token as far as the Black Athletes Foundation is concerned. You are appropriating billions and billions of dollars for health and here you are talking about a disease that afflicts—well it bothers one out of 10 blacks—and you are talking about giving us \$90 million, and I do not think that—

Senator KENNEDY. \$5.5 billion in military foreign aid this year, and you are asking for \$90 million over 3 years which can have a direct impact in terms of alleviating the suffering and human misery of hundreds of thousands of citizens of this country. Do I understand further that your approach—that the administration's program is \$1.5 million in terms of research. We spend a billion dollars a year on medical research in this country. The administration talks about \$1.5 million in terms of research for sickle cell anemia. Do I gather correctly that you think this is grossly inadequate as well?

Mr. DAVIS. Yes. All the pending bills and legislation on sickle cell anemia are monies that they have appropriated or the money that they are anticipating appropriating, as I termed it, they are tokenism money right now, the \$90 million, the \$6 million. I think that was the biggest joke of all, where you appropriated \$6 million for pilot programs and \$1 million of that went to research.

Senator KENNEDY. And do I understand further from your experience in these areas, that first of all, there is a desire by the community, the black community and others, for this program; second, from your experience, there are enough adequately trained personnel to conduct the screening programs. But that the ingredient that is really lacking, is adequate resources to help these kinds of local efforts which have been so admirably demonstrated in the Allegheny County and the Pittsburgh area. It is hoped that similar programs will spring up in communities around the country where the Black Athletes Foundation is so prominent. But whatever is done can be successful only with the proper resources.

Mr. DAVIS. Resources, no question about it.

Senator SCHWEIKER. I wonder if you could explain just very briefly what kind of reaction and response you have experienced in the Pittsburgh community. You cite in your testimony the agencies that you are working with and some of the groups that are cooperating. What kind of public reaction, response and community reaction, have you received so far with your efforts?

Mr. DAVIS. Well, I will first give you the reaction on the screening and testing. We originally set a time on screening and testing in the last 3-day event when we put them between the hours of 12 and 6. At 10 o'clock at night people were still lined up on the street waiting to be tested and screened for sickle cell anemia.

Of course, as Dr. Giorgio indicated, we ran out of supplies. In just that 3-day period I think it was just heartwarming to see old people, young people carrying their young kids, waiting to be tested and screened. In fact, at one time the medical supplies had given out and there was about a two and a half hour wait, but no one left the line. We are being constantly called and asked when we are going to give another screening and testing program. We cannot do this until we receive some more moneys.

So the reaction in Pittsburgh, I would say, is quite favorable. Everyone is extending a helping hand, such as the University of Pittsburgh and all the other health-related agencies.

Senator SCHWEIKER. I think one of the major things—I know Senator Kennedy asked this question earlier—are the efforts to assure people it is to their interest to participate in the program and not to be concerned and perhaps a little bit leery of any widespread testing program like this. I think it is one of the reasons for your success, which I think has been very overwhelming in terms of public acceptance, in my judgment—and I think you pretty well confirmed that from what you said. Is it not true that the key to this thing is doing exactly what you folks have done, which is to involve the best known leaders? You have selected as a goal of your group to get the black athletes who are, first of all, well known, obviously; but second, they are respected; and they are trusted. I think that you folks have the vehicle here to do the very thing that other people would be concerned about not being able to do. I think that is why it is so important that we focus on your approach of using the leaders in the black community, Hank, Willie and others. I think it is the best kind of salesmanship possible, and I only hope, and I say this as a compliment, that whatever national program we finally get together through our legislation—and I am convinced we will—that we pattern it after what you folks have pioneered and also involve you very directly because you have the key.

With the people and sports personalities you have used, nobody is going to be afraid of anything when you say it is in their best interests and tell them that you are for it and you are supporting it. So I just hope that our people who administer and set up this program will

pattern it after that. I really think this is the key to what you folks have done and it is not so much a question as a compliment to the fact that I think you have solved the educational problem. In terms of the money and the effort and the resources, no; we have to focus that.

Mr. DAVIS. Let me say this: I feel that this is the first time that the black athletes have even united together for one common cause, I think since the inception of Jackie Robinson in baseball, but this is the first time that athletes from all professions—boxing, baseball, football, and basketball—have joined together for one common cause; and we feel that the black community recognizes this.

This is the reason we feel like you indicated before, the acceptance of our program on sickle cell anemia, because there is no one that can look at our organization and say "Well, they are out for the money," because we have some board members who are—well, we roughly figure our board average is \$50,000 a year—but we feel that it takes a lot of promoting. I would say that Dr. Giorgio and people who are involved in sickle cell anemia, they felt that we were a little braggadocio in what we felt we could do, but we are quite satisfied with the results and it is through the athletes.

Senator SCHWEIKER. Thank you very much, Mr. Chairman. That is all I have.

Senator KENNEDY. I want to thank you very much. Senator Schweiker has said it so well, and Senator Javits and Senator Hughes. I think we all agree you have performed a very important public service. We welcome you to the subcommittee and wish you the best of luck in this and look forward to working with you in achieving the desired outcome and goals. Thank you very much.

The subcommittee will stand in recess for 10 minutes.

(Recess)

Senator KENNEDY. The subcommittee will come to order.

Our next witnesses are a panel of doctors. Dr. Maurice Rabb of Chicago; Dr. Anthony Cerami of Rockefeller University in New York City; Dr. Robert S. Rhodes of Meharry Medical College in Nashville; and Dr. Roland Scott of Howard University here in Washington.

Dr. Rabb received his M.D. from the University of Louisville. He is currently assistant professor of ophthalmology at the University of Illinois; is chairman of the section of ophthalmology at Mercy Hospital; and is chief of ophthalmology section at the Martin Luther King Health Center.

Dr. Cerami received his Ph. D. from Rockefeller University and is an experimental hematologist. At Rockefeller, he is an assistant professor in the department of chemical biology and is trying to evaluate the potent use of the drug sodium cyanate in the treatment of sickle cell anemia.

Dr. Rhodes received his B.S. from South Carolina State and his M.D. from Meharry Medical College. He is now a fellow in medicine at Vanderbilt University and is an instructor in the division of hematology at Meharry.

Dr. Scott received his M.D. from Howard University College of Medicine; spent his internship at Kansas City General Hospital; and his residency in pediatrics at Provident Hospital in Chicago. He is professor and chairman of the department of pediatrics and child health at Howard University College of Medicine and is also chief pediatrician at Freedman's Hospital.

Gentlemen, we welcome you. Dr. Scott, why do we not start with you, unless you have an order of preference.

**STATEMENT OF DR. ROLAND SCOTT, PROFESSOR AND CHAIRMAN
OF THE DEPARTMENT OF PEDIATRICS AND CHILD HEALTH,
HOWARD UNIVERSITY**

Dr. SCOTT. Senator, we are very grateful for this opportunity to appear before your committee. My colleagues and I, namely, Dr. Ferguson and Dr. Hudson, who are in the room, have presented a prepared statement which we would like to have entered into the record. In order to save time for the rest of my colleagues who are here to my left, I will not read the statement, but would like to comment on certain aspects of it.

We, of course, are based at Howard University College of Medicine. Howard University is 100 years old and those of us who are involved in sickle cell anemia research are based in the medical center which consists of the college of medicine, the college of dentistry, the college of pharmacy, the school of nursing, and Freedman's Hospital.

Nearly half of the black physicians in the United States were trained at Howard University. We have been interested and involved in studies and research in sickle cell anemia since 1948. At that particular time our first publication occurred and it dealt with the screening for sickling in newborn infants. Since that time, there have been over 50 publications dealing with different aspects of sickle-cell anemia, and we have participated in 35 or 40 medical meetings at which time either papers or exhibits were presented dealing with this disease.

We have all too frequently observed children, particularly children and youth, suffering from sickle cell anemia; and just briefly to mention some of the complications, we see enlargement of the heart, enlargement of the spleen, liver, marked susceptibility to infections, particularly those involving the lung and bone; not infrequently, we see children coming in who are paralyzed because they have involvement of the muscles of the brain so that they come down with the paralysis or a stroke. We have also seen a few children who had serious impairment of vision because of sickle cell anemia, and just a month ago we participated in a conference here in Washington, D.C., where a child was presented who was blind because of sickle cell anemia. I am sure the complications relating to the eyes will be brought out by another panelist.

In addition, sickle cell anemia interferes seriously with the growth of children. Children and youth with this disease usually enter puberty late. They have a delay in the onset of their menstrual periods. There is a delay in the appearance of their secondary sex characteristics. This creates a distorted body image and causes serious worry on the part of these adolescent children about their delay in their growth and development.

We are all aware of the fact that sickle cell anemia is a particular hazard for pregnant women who have sickle cell anemia, and I should not leave some of the problems and complications without just briefly mentioning the psychosocial and economic problems relating to sickle-cell anemia. In the case of children, there is this loss in time at school. Oftentimes they get behind in work because of the frequent hospitalizations, and the previous speakers have already talked about the extra expense for hospitalization, medical care, nursing, and so forth, as well as difficulty in getting coverage through insurance companies.

Now, more recently, we have organized our personnel, our facilities and our interests, aims, goals and objectives into a center for sickle-cell anemia at Howard University which is now active and is involved in screening individuals, providing genetic counseling, diagnosis, treatment; in addition, we are providing consultation not only to professional groups of physicians, but also to the lay public, because as we all know, there is a great deal of interest on the part of the lay public in sickle cell anemia.

Many groups are becoming involved in testing and screening, and particularly lay groups are in need of medical advice and counseling.

We would like to develop our center further to the point where it could actually become a demonstration project, a demonstration center, so that we could extend the screening, the detection, diagnosis, and do many other things, including the presentation of seminars on sickle cell anemia for interested medical as well as lay groups. I think it is very important that we not leave out the lay groups in developing our program for sickle cell anemia.

Now, the main obstacle or the main problem we have had in relationship to the further development of our center at Howard University is the inadequacy of support. For instance, the whole college of medicine has a research budget of \$1.1 million per year and of that, only \$200,000 is allocated for research in sickle cell anemia. Further, I would say that over the past 15 years we have received from Federal support only \$68,000 over a 15-year period to support research in sickle cell anemia, and this has certainly been a very frustrating aspect of our work because there has been so little support from the Federal Government.

Just last year, in 1970, we wrote up a project which was presented to the Government for the development of a conference on sickle cell anemia here at Howard University and this was presented for funding. The amount of money we asked for was \$43,000; this was not forthcoming and our frustration was heightened when the NIH decided

that instead of funding our project, they would set up a sort of intramural conference on sickle cell anemia themselves, to which we were not invited. We, of course, are very much concerned about that and frustrated, and we let them know how we felt about it. So they said, "Well, here is \$2,000. See what you can do with that." Of course, this again, was very inadequate to carry out the project that we wanted to become involved in.

I would like to say at this point——

Senator KENNEDY. Did you accept the \$2,000?

Dr. SCOTT. Well, no, because I did not know what we could do with it. You know, to get a speaker from California, that is \$500 just there, so that we did not—we have not turned it down, but we have not been able to find very much that we could do with it because we had plans to have many speakers. As a matter of fact, some of those that we had listed in our research protocol were the ones that NIH invited themselves.

At this particular point, I would like to say that we wholeheartedly support the bill that is under consideration at the present time. We feel that we have the nucleus at Howard University to become involved to a large extent and certainly to develop a regional center for sickle cell anemia which could extend itself into offering screening, counseling and medical care to people in this regional area.

We would propose that the District of Columbia and Howard University serve as the national model for the control and combat of sickle cell disease. As I say, we have a nucleus based at the university: a medical school, a hospital, nurses, physicians, investigators. We have the capability of extending our usefulness and becoming involved and integrated with the local health agencies; in this way we could complement and supplement what will be carried out in the health facilities in Washington and in that way save some funds by collaborating and using existing facilities in the health departments and other medical facilities, neighborhood clinics, and so forth, to maximum extent. So our center could serve in a comprehensive way in participating in screening, genetic counseling, upgrading the medical care of patients, training not only interns, residents and medical students, but also offering short refresher courses for physicians who would wish to upgrade their knowledge of sickle cell anemia and also train so-called paraprofessionals such as medical social workers, public health nurses to become competent in providing the genetic counseling and education which are necessary companion for any well-organized screening program.

In summary, we support the establishment of regional centers which are provided in the bill, and we recommend that active programs be conducted by the local facilities which could work in conjunction with the center to be established which could be increased in significance and support at Howard University.

Again, I appreciate the opportunity to appear here and support this bill, and if there are any questions that I could answer later on I would be happy to do so.

(The prepared statement of Dr. Scott follows:)

Statement by

Roland B. Scott, M.D.
Professor and Chairman
Department of Pediatrics
Howard University College of Medicine

Angella D. Ferguson, M.D.
Professor, Department of Pediatrics
Howard University College of Medicine

and

Robert L. Hudson, M.D.
Physician-Coordinator
Center for Sickle Cell Anemia
Howard University College of Medicine

Before the

Senate Committee on

Labor and Public Welfare

Subcommittee on Health

on

S. 2676

November 12, 1971

(A modification of the statement presented before the Senate Committee on the District of Columbia Subcommittee on Public Health, Welfare and Safety on October 27, 1971).

Sickle Cell Anemia is a genetic disease which results in the occurrence of an abnormal hemoglobin in the red blood cells. This disease occurs predominately in the Black race. It is also found in some members of the white race whose ancestors came from the Mediterranean area. It has also been detected in other population groups in India, South America and the Middle East. The condition affects approximately 10 per cent of the Black race in the United States.

Inasmuch as sickle cell anemia is a disease of genetic origin, it may be transmitted from one generation to the next. The disease occurs essentially in two general forms. The trait (carrier) or heterozygous form represents a single dose or inheritance from one parent. The anemic form represents a double dose or inheritance from both parents (homozygous).

There are a variety of available tests for the detection and diagnosis of the different types of this disease. Some of these tests are simple and can be carried out in the field, others are more sophisticated and require laboratory equipment and specially trained personnel.

Sickle cell anemia is characterized clinically by low hemoglobin levels (anemia), pallor, weakness, poor physical development, jaundice, enlargement of certain organs (heart, liver, spleen), skin ulcers and increased susceptibility to certain infections.

Victims of the disease experience recurrent episodes of pain known as crises. The pain may involve any part of the body but is particularly common in the extremities, abdomen and back. The crises are of different types, namely, aplastic, hyperhemolytic, thrombotic and sequestration. Although treatment for different types may vary, all current therapeutic measures are essentially symptomatic since there is no curative treatment at present for the disease.

The anemic form of the disease occurs in about one in 500 Black births in the United States and the median survival is about 20 years of age. The incidence of this disease in the United States is much more frequent than such conditions as cystic fibrosis of the pancreas (1:3000) or phenylketonuria (1:10,000) which affect predominately members of the white race. Notwithstanding the greater frequency of sickle cell anemia in the American population, volunteer organizations and the National Institutes of Health have allocated considerably more money for less common hereditary diseases.

Sickle cell disease is a crippling and disabling disorder. Practically any part of the body may be a site of complications as outlined below:

Complications of SCA Encountered Most
Frequently in Washington, D. C.

Cardiomegaly	Attacks of Jaundice
Pneumonia	Priapism
Frequent Infections	Nephritis-Nephrosis
Pulmonary Fibrosis	Hypogonadism
Focal Vascular Occlusions	Growth Retardation
Cholelithiasis	Delayed Puberty
Chronic Constipation	Paralysis

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Hepatomegaly
 Splenomegaly-
 Hypersplenism
 "Hand-Foot Syndrome"
 Weakness

Osteomyelitis
 Aseptic Necrosis
 Leg Ulcers
 "Arthritis"

These complications cause a great deal of suffering for the victims. Considerable time is lost from school, work, play and other usual activities of living. Large sums of money are spent by the families of the affected person on medication, physician's fees and hospital costs. Despite the high cost of medical care it is estimated that less than 50 per cent of the victims survive to adulthood.

Of the approximately 54,000 Blacks in the District of Columbia who are estimated to have sickle cell trait, 1,000 are affected with sickle cell anemia.

The magnitude of the problem can perhaps be appreciated from the costs of medical care. Those patients who have sickle cell anemia have their greatest difficulty during the early childhood years. During this time they may require as many as 3-4 hospitalizations a year lasting as long as 7-10 days each. Costs for hospitalization amounts to approximately \$3,000 per patient on an annual basis. The cost for scheduled outpatient visits approaches \$100 annually. This figure does not include emergency visits necessitated by periodic crises.

When related to the overall prevalence of the disease, the public awareness of its occurrence and severity is relatively low. In many cities, voluntary organizations have been formed consisting of lay and professional persons, with the aim of educating the public and initiating screening programs.

One such organization, the Association for Sickle Cell Anemia Research, Inc., is based at Howard University in Washington, D.C. These voluntary organizations are funded from dues and donations, and, in general, operated on a small scale. With adequate support, however, they could be an effective conduit for community educational and screening programs. An effective way of increasing community involvement is through an intensive educational program. The local health agencies could sponsor or conduct massive educational programs within their regions. With adequate sensitization of the public regarding this disease, there needs to be facilities for screening, diagnosis, counseling, treatment and adequate follow-up of those affected. The responsibility for these facets of the total program could be carried on in existing community care facilities, hospitals and medical centers.

Howard University has taken a leadership role in the study of sickle cell disease. Over a twenty year period, more than 50 scientific publications concerning sickle cell disease have resulted from intensive clinical study by members of the Departments of Medicine and Pediatrics. Scientific exhibits have been displayed at more than 30 medical meetings or conventions. In addition, during this time, we have positively screened patients admitted to the Pediatric Service, Freshman students entering Howard University and all members of the community who requested testing or were referred by their private physicians.

Currently Howard University is continuing its activities in and making contributions to the understanding of sickle cell disease and its victims. We are endeavoring to expand and intensify previous programs and projects under the administrative concept of a Center for Sickle Cell Anemia. The Center is concerned with the establishment of national guidelines and resources to support research, training, service, scientific communication and educational programs related to sickle cell anemia. However, the present scope of activity of the Center for Sickle Cell Anemia at Howard University is limited only by the availability of financial support.

With adequate funding, the Center could provide the following basic services to advance a national sickle cell disease program:

- (1) Direct and supervise investigative studies into the nature and clinical manifestations of sickle cell disease and support attempts to find more effective methods of management.
- (2) Provide a training facility in the technique of detection, diagnosis and total management of hematologically handicapped persons with sickle cell anemia and its related conditions. A component part of the Center would be a demonstration project or pilot clinic to provide a facility for the referral of patients and their families from the community for screening, diagnosis, total management and genetic counseling. In addition, it could offer a training experience for residents, interns, fellows, general practitioners and all paramedical personnel who come in contact with this

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population. It has been shown that not all physicians are familiar with sickle cell disease either because Blacks constitute a minority of their patient population or because emphasis or knowledge of its existence was not widely known during their period of formal education. Training for all levels would be varied from long to short duration.

(3) Initiate and promote an educational program in the sickling diseases for lay persons, college students, medical students and other interested groups, through seminars, conferences, exhibits and printed material.

Past financial support for efforts at Howard University has come from both private and Federal sources. However, that support has been meager in comparison to support for other diseases.

We maintain that Federal and private support have been inadequate to date and vigorously request that additional emphasis be placed on this disease such as recommended in the Bills being discussed today (Bills S. 2676 and S. 2677). This is an encouraging beginning.

We would also respectfully remind the members of this Committee that there remains a great deal to be learned about this serious disease. We feel that Howard University can make a lasting and maximum contribution to the control of this disease through the continued operation and further development of the Center for Sickle Cell Anemia.

Financial support in proportion to the magnitude of this national public health problem must be made available to insure that these efforts can be made.

With the means provided by S. 2676 and 2677, programs could be established to effectively deal with Sickle Cell disease on a nationwide basis.

We agree with and endorse the concept that Centers should be strategically situated in major geographic regions across the country. Such Centers will offer sophisticated diagnostic and treatment facilities to the victims of Sickle Cell Disease within their geographic region. They will also offer training and educational opportunities to personnel from satellite facilities within those regions.

It is proposed that the District of Columbia and Howard University serve as national models of the control and combat of Sickle Cell Disease. For this we are prepared and eager to do our part. A logical and economical approach to setting into operation a Sickle Cell program is the utilization of existing facilities to the maximum extent possible. Neighborhood clinics, public health clinics, hospitals and private clinics should find little difficulty in including such services as sickle cell screening and limited genetic counseling in their present routines. The Center would be a supportive facility that would perform the services previously described.

In summary we support the establishment of regional centers that would direct and lead a national program of prevention and control of sickle cell disease. We recommend that active programs being conducted by local facilities be employed as the vehicles through which sickle cell services are provided to the population at risk.

We unreservedly support Bills S. 2676 and S. 2677 and applaud their sponsors. We feel that these Bills make a belated but important thrust in the right direction.

Senator KENNEDY. I think we will hear the full panel and then ask some questions. Dr. Rhodes.

**STATEMENT OF ROBERT RHODES, M.D., FELLOW IN MEDICINE,
VANDERBILT UNIVERSITY**

Dr. RHODES. Senator Kennedy, my name is Dr. Robert S. Rhodes. I am an assistant professor of medicine in hematology at Meharry Medical College in Nashville, Tenn. I also hold an appointment on the medical faculty at Vanderbilt University and I am a Josiah Macy Foundation Faculty Fellow. I might mention that Meharry Medical College has graduated over 43 percent of the black physicians practicing in the United States. As a hematologist, I am intimately involved with sickle cell disease from both the research and clinical points of view.

As has been mentioned by others, sickle cell disease is a heritable disorder with red cells containing an abnormal hemoglobin called "Hemoglobin C." Hemoglobin S, when present, is either the symptomatic dreaded homozygous form, which is the usual form in which the disease is symptomatic, or it may be present in the heterozygous form, which is the sickle cell trait.

Hemoglobin S in the United States occurs, in about 8-11 percent of the blacks in the United States. Of those carrying it, about 2 percent have the anemic form of the disease. In other words, approximately one black child in every 400 born in the United States will have sickle cell anemia.

The sickle cell trait, the heterozygous form, can have many of the deadly manifestations of sickle cell anemia as we shall point out. In most instances, however, this is compatible with a normal lifespan and is discovered most often during incidental hemoglobin electrophoresis or family studies.

There are usually no deviations from the normal with respect to physical examination, and except that an occasional patient's urine specific gravity will not exceed 1.010, the usual laboratory determinations are normal. Occasionally, a patient with sickle cell trait has a vasoocclusive phenomenon, or a hemolytic process when unique anatomic or functional conditions exist.

Recent observations in the clinic and at the postmortem table indicate that extensive in-vivo sickling can be fatal in sickle cell trait if extreme hypoxia or intravascular pooling with stasis takes place. Such conditions have been seen in marked respiratory depression (deep anesthesia, acute alcoholism) or in spinal anesthesia with dilatation of the splanchnic vasculature.

Senator KENNEDY. What does that mean?

Dr. RHODES. This means that the blood in individuals with sickle cell trait under conditions of, say, at high altitudes or during anesthesia may clog up the blood vessels. It will assume the twisted, bent form—the cells of their blood under low oxygen concentration in the air—may assume the bent or twisted character of the sickle cell and thereby clog their blood vessels and prevent blood from reaching certain vital areas of the body.

This has occurred in individuals on many occasions, and recently in the medical literature it was reported—and I do not have the reference in front of me—but several young recruits died in military training and were found as a result—I am sure you are familiar with it—who had sickle cell trait and had not been tested for it.

There are numerous other severe medical problems that can be associated under adverse circumstances with sickle cell trait. These I have outlined in my testimony and they involve virtually every organ system of the body, to include both kidneys, the brain, so that they can possibly suffer from strokes if appropriate conditions are present. They may suffer from adverse conditions of their bones, and a whole gamut of medical problems can also be related to sickle cell trait as well as to sickle cell anemia.

I must emphasize, however, that it is not every day that this occurs, but the danger is ever present and if an individual with sickle cell trait, unknown to have the trait, is exposed to these conditions then certainly he stands to experience the most dreaded complications which could cause him to lose his life as certainly has happened.

Hematuria usually spontaneously but occasionally following trauma, urinary tract infection or hypotensive episodes occurs at a significant frequency. It may occur with or without pain or clots, it may be prolonged and recurrent and is usually from the left kidney.

Sickle cell trait, under conditions that bring about low oxygen tension, can result in serious and potentially fatal clinical complications. These complications can be avoided or minimized if the physician is aware of existing latent abnormality.

Nearly the complete spectrum of the major vaso-occlusive complications seen in sickle cell anemia has been described for the trait with no other pathogenic explanation. These include aseptic necrosis of the bone, intestinal infarction, infarctive necrosis of the liver, pulmonary infarction, neurologic disorder, kidney infarcts, leg ulcer, priapism and increased complications of pregnancy. These findings all remain a constant threat to young blacks with sickle cell disease, particularly in the patient with manifest symptoms.

Due to the high complement of fetal hemoglobin present in the red cells at birth and the consequent low percentage of hemoglobin S, the occurrence of the sickling phenomenon and clinical expression is hindered. Therefore, sickle cell anemia is usually detected only after the first several months of life.

Sickle cell disease has often been fatal before adolescence, but with early detection, medical management, education and counseling, survival to 40 years and longer is now possible. It has been shown that the adolescent ages may show a significant degree of growth failure, delay in appearance of secondary sex characteristics, and delay in the onset of menarche.

Once the disease has been established, it pursues a rather constant course combining the signs, symptoms, and limitations of persistent anemia with the episodic and unpredictable interurrences of various types of crises.

Early detection, patient education, followup studies, and some preventive measures will lessen the severity of the anemia, painful crises,

and the numerous other complications and morbid features of this disease.

One of the most serious complications is the aplastic aregenerative crisis. It is usually associated with a viral or bacterial infection, the bone marrow is physiologically hypoplastic and ceases to function as an effective blood making organ while the infection persists. The rapid fall in hemoglobin may reach fatal levels in a few days. However, it should be emphasized that the painful crises unless accompanied by a prolonged febrile course are not usually associated with increased severity of the anemia, and that aplastic or aregenerative crisis need not be accompanied by a painful episode.

The laboratory findings are those of severe anemia: hemoglobin content usually 5-9 gm./100 mg., with proportional drop in the hematocrit and red cell count resulting in normocytic and normochromic red cell indices. The stained peripheral blood smear shows variation in size and shape of red cells with 0.5 to more than 20 percent of red cells sickled.

As many of the facts and figures available attest, sickle cell anemia is a much studied and written about disease in the medical sphere. In spite of this, it continues to be a much neglected disease and a major economic problem in this Nation. This malady afflicts countless black people, most of whom are already of marginal economic means and the occurrence of this disease is sufficient to result in impoverishment by frequent expensive hospitalization. Sickle cell anemia has been estimated by the World Health Organization to kill over 80,000 children annually worldwide.

In the past very little money has been made available for work in sickle cell disease. Almost none of this money has been available for patient care, screening, education, and counseling.

The development of support programs for sickle cell disease will of natural necessity require adequate expenditures for development of strong victim-oriented clinical programs as well as continued research efforts.

I would remind the committee that much of the effort directed toward the afflicted patient victim of sickle cell disease has been largely experimental. There have been no accolades for the numerous physicians and the several medical centers which have attempted to carry on the clinical efforts against this disease.

Adequate funds must be made available to allow upgrading and expansion of existing programs in patient care, screening, and population education and counseling. Support must be provided for new innovative approaches in these same areas.

Until recent months, grants from the National Institutes of Health have given sickle cell disease a low priority in support, when compared with several exceedingly rare disorders. The attitude in many quarters has been formulated by the basic research accomplishments mentioned earlier. Virtually no concern has been shown for the major problem with this disease: The unfortunate black victim.

There remain undoubtedly many sections of the country with sizable black populations where very little medical care is available. In these and other more fortunate areas virtually nothing is known approximating the true incidence of sickle cell disease nor its morbidity or mortality. Funds must be provided to support development of such studies and to provide some care, education, and counseling of victims so pinpointed.

In terms of realistic figures of funds required to support a fairly circumscribed screening and education program, the following are illustrative: Establishment of a proposed pilot project in Davidson County, Tenn., which anticipates, among other things, utilizing a mobile screening unit to initially screen 24,000 black schoolchildren. It has been estimated this project would cost a minimum of a paltry sum of \$50,000 in direct costs. In subsequent years, this program would be expanded to include other locales in the region as far as the southern parts of Kentucky and northern parts of Alabama and possibly also into some areas of Mississippi where Meharry Medical College currently has various programs in operation. This type of program is planned to utilize community organizations and recruit volunteer workers.

Using currently accepted incidence figures, this program in 5 years should screen approximately 150,000 to 175,000 people. As a result, some 2,500 patients with hemoglobin S will be picked up per year. Of this group of victims, approximately 57 to 60 or so per year would actually have sickle cell disease. The economic impact of this is illustrated by the fact that when you consider an average which may be fairly minimal of five crises per year requiring hospitalization, this would cost approximately \$19,000 to \$20,000 a year for this small number of patients. This is based on an estimate of about 4 to 5 hospital days at an average figure for hospitals across the country set by the American Hospital Association at \$78 per day per patient.

The figures which we have presented are a fairly reasonable estimate based on data collected from various reported medical studies and our current hospital figures.

No estimate has been attempted in this statement on such things as outpatient costs, which certainly should be contained in the legislation proposed.

In summary, for all too long, sickle cell anemia has been virtually ignored as an important disease among a major segment of this Nation's population. The victim, maligned and used in many instances as only a "good source of interesting research material." The time certainly has come to give adequate support to such programs as will provide both care for the victim and continue to expand our knowledge of this patient and his disease. It is hoped that the current spurt of interest in sickle cell disease will remain high and provide the victim with support so long denied.

(The prepared statement of Dr. Rhodes follows:)

TEXT OF TESTIMONY OF ROBERT S. RHODES, M.D. - ON S 2676

To Select Senate Subcommittee

Chairman Edward L. Kennedy

12 November 1971

Senator Kennedy, my name is Dr. Robert S. Rhodes. I am an Assistant Professor of Medicine in Hematology at Meharry Medical College in Nashville, Tennessee. I also hold an appointment on the Medical Faculty at Vanderbilt University and I am a Josiah Macy Foundation Faculty Fellow. As a hematologist I am involved with sickle cell disease from both the research and clinical points of view.

Sickle cell disease is a heritable disorder with red cells containing an abnormal hemoglobin called "Hemoglobin S". Hemoglobin "S" when present is either the symptomatic dreaded, homozygous form (SS - sickle cell anemia) or heterozygous (SA - sickle cell trait).

Hemoglobin S in the United States occurs, in about 8-11% of the blacks in the United States. Of those carrying it about 2% have the anemic form of the disease. In other words, approximately one black child in every 400 born in the United States will have sickle cell anemia.

The sickle cell trait, the heterozygous form, can have many of the deadly manifestations of sickle cell anemia as we shall point out. In most instances however, this is compatible with a normal life span and is discovered most often during incidental hemoglobin electrophoresis or family studies.

There are usually no deviations from the normal with respect to physical examination, and except that an occasional patient's urine specific gravity will not

exceed 1.010, the usual laboratory determinations are normal. Occasionally, a patient with sickle cell trait has a vaso-occlusive phenomenon, or a hemolytic process when unique anatomic or functional conditions exist.

Recent observations in the clinic and at the postmortem table indicate that extensive in-vivo sickling can be fatal in sickle cell trait if extreme hypoxia or intravascular pooling with stasis takes place. Such conditions have been seen in marked respiratory depression (deep anesthesia, acute alcoholism) or in spinal anesthesia with dilatation of the splanchnic vasculature.

Hematuria usually spontaneous but occasionally following trauma, urinary tract infection or hypotensive episodes occurs at a significant frequency. It may occur with or without pain or clots, it may be prolonged and recurrent and is usually from the left kidney.

Sickle cell trait, under conditions that bring about low oxygen tension, can result in serious and potentially fatal clinical complications. These complications can be avoided or "minimized" if the physician is aware of existing latent abnormality.

Nearly the complete spectrum of the major vaso-occlusive complications seen in sickle cell anemia has been described for the trait with no other pathogenic explanation. These include aseptic necrosis of the bone, intestinal infarction, infarctive necrosis of the liver, pulmonary infarction, neurologic disorder, kidney infarcts, leg ulcer, priapism and increased complications of pregnancy. These findings all remain a constant threat to young blacks with sickle cell disease, particularly in the patient with manifest symptoms.

Due to the high complement of fetal hemoglobin present in the red cells at birth and the consequent low percentage of hemoglobin S the occurrence of the sickling phenomenon and clinical expression is hindered. Therefore, sickle cell

anemia is detected only after the first several months of life.

Sickle cell disease has often been fatal before adolescence, but with nearly detection, medical management, education and counseling, survival to forty years and longer is now possible. It has been shown that the adolescent ages may show a significant degree of growth failure, delay in appearance of secondary sex characteristics and delay in the onset of menarche.

Once the disease has been established it pursues a rather constant course combining the signs, symptoms, and limitations of persistent anemia with the episodic and unpredictable interurrences of various types of crises.

Early detection, patient education, follow-up studies and some preventive measures will lessen the severity of the anemia, painful crises and the numerous other complications and morbid features of this disease.

One of the most serious complications is the aplastic aregenerative crisis. It is usually associated with a viral or bacterial infection, the bone marrow is physiologically hypoplastic and ceases to function as an effective blood making organ while the infection persists. The rapid fall in hemoglobin may reach fatal levels in a few days. However, it should be emphasized that the painful crises inless accompanied by a prolonged febrile course are not usually associated with increased severity of the anemia, and that aplastic or aregenerative crisis need not be accompanied by a painful episode.

The laboratory findings are those of severe anemia: hemoglobin content usually 5-9 gm/100 mg, with proportional drop in the hematocrit and red cell count resulting in normocytic and normochromic red cell indices. The stained peripheral blood smear shows variation in size and shape of red cells with 0.5 to more than 20% of red cells sickled.

As many of the facts and figures available attest, sickle cell anemia is a

much studied and written about disease in the medical sphere. In spite of this it continues to be a much neglected disease and a major economic problem in this nation. This malady afflicts countless black people, most of whom are already of marginal economic means and the occurrence of this disease is sufficient to result in impoverishment by frequent expensive hospitalization. Sickle cell anemia has been estimated by the World Health Organization to kill over 80,000 children annually world wide, (W.H.O., 1966).

In the past very little money has been made available for work in sickle cell disease. Almost none of this money has been available for patient care, screening, education and counselling.

The development of support programs for sickle cell disease will of natural necessity require adequate expenditures for development of strong victim oriented clinical programs as well as continued research efforts.

I would remind the committee that much of the effort directed toward the afflicted patient victim of sickle cell disease has been largely experimental. There have been no accolades for the numerous physicians and the several medical centers which have attempted to carry on the clinical efforts against this disease.

Adequate funds must be made available to allow upgrading and expansion of existing programs in patient care, screening and population education and counselling. Support must be provided for new inovative approaches in these same areas.

In the past, grants from the national institute of health have given sickle cell disease a low priority in support, when compared with several exceedingly rare disorders (JAMA Vol. 214: 731). The attitude in many quarters has been formulated by the basic research accomplishments mentioned earlier. Virtually no concern has been shown for the major problem with this disease: The unfortunate black victim.

There remain undoubtably many sections of the country with sizable black populations where very little medical care is available. In these and other more

fortunate areas virtually nothing is known approximating the true incidence of sickle cell disease nor its morbidity or mortality. Funds must be provided to support development of such studies and to provide some care, education and counseling of victims so pinpointed.

In terms of realistic figures, of funds required to support a fairly circumscribed screening and education program the following are illustrative: Establishment of a proposed pilot project in Davidson County, Tennessee to screen initially 24,000 black school children would total an estimated \$57,000 in direct costs. Subsequent years would be at approximately the same level with expansion into other locals and actual number of persons screened increasing. Subsequent costs per screened individual should decrease. This type of program is planned to utilize community organizations and recruit volunteer workers.

Using currently accepted incidence figures this program in 5 years should screen approximately 150,000 to 175,000 people. As a result some 2,500 patients with hemoglobin S will be picked up per year. The number of victims afflicted by the dreaded homozygous form would total approximately 57 per year. Should these victims have an average of five vaso-occlusive crisis per year each projected this would require a minimal cost outlay for hospitalization alone of \$19,000 - \$20,000 (based on hospitalization for 4-5 days per crisis at A.H.A. figure of approximately \$78.00 per day for each 57 homozygous patients detected).

The above figures are fairly reasonable estimated based on data collected from various reported medical studies and our current hospital figures.

No estimate is given for medical center outpatient costs which should be included in legislation such as that proposed.

In summary, for all to long sickle cell anemia has been virtually ignored as an important disease among a major segment of this nations population. The victim, malinged and used in many instances as only a "good source of interesting

research material". The time certainly has come to give adequate support to such programs as will provide both care for the victim and continue to expand our knowledge of this patient and his disease. It is hoped that the current spurt of interest in sickle cell disease will remain high and provide the victim with support so long denied.

Senator KENNEDY. The subcommittee will be in recess for 15 minutes.

(Recess.)

Senator KENNEDY. We apologize to our witnesses here for these interruptions. They are completely unavoidable. They are an attempt to extend some unemployment compensation payments to people who are unemployed in many of our communities and States, so it is a good cause. I apologize.

**STATEMENT OF MAURICE RABB, M.D., CHIEF OF OPHTHALMOLOGY,
MERCY HOSPITAL, CHICAGO**

Dr. RABB. Thank you, Senator Kennedy.

I will not read the entire text.

Senator KENNEDY. We will include all of your statements in the record as if read at the end of your testimony, and you can highlight it. I have a few questions at the end.

Dr. RABB. I am Maurice F. Sabb. I am presently chief of ophthalmology, Mercy Hospital, Chicago: assistant professor of ophthalmology, University of Illinois Eye and Ear Infirmary; medical director, Illinois Eye Bank and Research Laboratory; member of the Ophthalmic Advisory Group to the Food and Drug Administration; ophthalmic consultant, Martin Luther King, Jr. Health Center and Daniel Hale Williams Medical Center.

I would like to take this opportunity to express my concern about sickle-cell disease, particularly sickle cell eye disease, as a public health hazard today in the United States.

Even though this disease entity was discovered over 50 years ago, most Americans, black and white, are still unaware of its devastating effects upon the black population. In recent months, much has been written in the popular press dealing with the classical clinical manifestations of sickle cell disease, such as joint pains, ulceration of the lower extremities, abdominal pains, fever, jaundice, cardiac, and neurological disturbances, and the frequent fatalities.

As more attention is focused upon these crippling effects of the disease, it is astonishing that the majority of the public as well as the medical profession are unaware of the potential danger that exists to the eyes.

The eye symptoms are numerous. The classical picture of sludging of the blood in conjunctival capillaries has been described frequently in the ophthalmic literature. However, it is in the fundus or retina of the inner eye where the damage produced by the disease manifests itself most dramatically and tragically. This damage often goes un-

noticed since the so-called proliferative sickle retinopathy or retinal disease originates in the peripheral portion of the retina where both the patient and the doctor find it difficult to be aware of any abnormality in the early stages of the disease. The retinal disease begins initially as the small capillaries in the periphery of the retina become blocked off by the abnormal sickle shaped red blood cells. Next, these tiny capillaries which ordinarily never connect with one another unite, forming abnormal communications. The next stage consists of new blood vessel formation with associated fibrous scar formation. If the disease process is allowed to progress, larger patches of vessels develop, called "sea fans." Should these abnormal vessels break, and they almost invariably do, a serious hemorrhage in the eye may occur with subsequent detachment of the retina and often permanent loss of vision. Eventual loss of the eye is not uncommon.

Which individuals are affected? If a person receives the abnormal sickle gene from one parent, he then possesses a sickling trait, and only in exceptional circumstances shows any sign or symptoms of the disease in the eye. However, should two abnormal genes be transmitted, the homozygous individual suffers from sickle cell disease. Another condition persists as sickle cell thalassemia (S-thal hemoglobin) which differs little from sickle cell trait (SA) except for a higher percentage of hemoglobin S, and a higher percentage of patients with new and dangerous vessels in the retina. Patients with S hemoglobin and C hemoglobin show similar retinal pathology.

HOMOZYGOUS SICKLE CELL DISEASE (SICKLE CELL ANEMIA)

Although this is the most serious form of the disease as far as the general body is concerned, it does not have serious effects on vision in most cases. Characteristic of sickle cell anemia are circular, black chorioretinal scars, "black sunbursts." These lesions represent sequelae of small blood vessel occlusions or hemorrhages but do not ordinarily affect visual acuity. These lesions are found in 43 percent of patients with sickle cell disease. New blood vessel abnormalities are found in 10 percent of patients.

In the heterozygous sickle-cell hemoglobin disease, which is called SC hemoglobin disease, dangerous neovascular abnormalities are found in 60 percent to 70 percent with SC disease. Black chorioretinal scars are found in only 18 percent. The early sign of capillary anastomoses has been observed in 91 percent of cases examined which makes hemoglobin SC disease the most prevalent variety to have the type of proliferative retinal disease that leads to bleeding into the inside of the eye. Several recent scientific articles are submitted with this testimony to document what little is known of sickle eye disease.

(The information referred to follows:)

Natural History of Untreated Proliferative Sickle Retinopathy

Morton F. Goldberg, MD, Baltimore and Chicago

In this clinical study of the natural history of proliferative retinopathy in sickle cell-hemoglobin C disease, 25 eyes were observed without therapeutic intervention for an average duration of 31 months (range: 6 to 77 months). A new ophthalmoscopic and angiographic classification allowed quantitative assessment and comparison of these eyes at the beginning and at the end of the observation period. Clinically symptomatic and significant stages of proliferative sickle retinopathy (PSR) were frequently observed in patients between the ages of 20 and 30. All stages of PSR appeared to progress. This seemed particularly true of that stage characterized by spontaneous vitreous hemorrhages; ie, 28% of eyes had evidence of vitreous hemorrhage initially, whereas 44% of the same eyes had similar evidence at follow up. No proliferative lesions were seen to regress.

THE DEVELOPMENT of proliferative sickle retinopathy (PSR) appears to reflect a relatively orderly sequential course of events that begins as peripheral arteriolar occlusion in the retina, and ends as retinal detachment.¹⁻³ This report concerns the rate and mode of progression of untreated PSR.

Materials and Methods

Twenty-four Negro patients (47 eyes) with sickle-cell hemoglobin C disease (SC disease) were available for ocular fundus studies. (The file of patients with SC disease in the Division of Hematology of the Johns Hopkins Hospital includes a total of 172 individuals, not all of whom are either alive or being observed at the present time.) These eyes constitute the "origi-

nal" population, from which hypotheses have been drawn concerning the pathogenesis and classification of PSR.^{1,4} Four eyes presented with retinal detachments which required immediate surgery² and were thus not included in further studies concerning the untreated course of PSR. Fifteen eyes were treated by photocoagulation for various reasons, including vitreous hemorrhage from neovascular proliferations, and will be included in a separate report concerning therapy of PSR. Three eyes were lost to follow up. Thus, 25 eyes (16 patients) of the "original" 47 eyes were left for observations concerning the untreated course of this retinal disease and will be designated the follow-up population. Because many patients were originally referred only if they had ocular symptoms, possible bias in selection of these eyes for this follow-up study is apparent.¹

Ocular fundi of all patients were studied by indirect ophthalmoscopy and fluorescein angiography, the detailed techniques of which have been reported previously.⁴⁻⁶

Eyes were observed for a minimum of six months and for a maximum of 77 months (mean: 31 months). The frequency distribution for follow-up durations is shown in Fig 1. Follow up was terminated at varying intervals for arbitrary reasons or when progression of neovascular proliferations or of vitreous hemorrhages was sufficiently rapid or severe that therapeutic intervention appeared warranted.

At the initial examination and at the end of the follow-up period, each of the eyes was

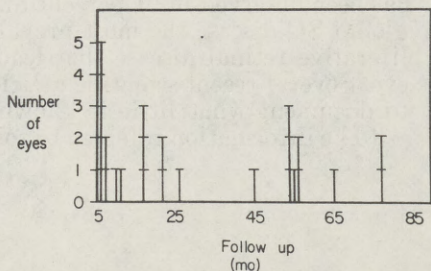


Fig 1.—Distribution of follow-up durations for 25 untreated eyes of patients with sickle cell-hemoglobin C.

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personally evaluated and graded according to a recently devised classification of PSR¹ (Table 1 to 3). This classification (*vide infra*) reflects both increasing severity of the retinopathy as well as its presumed pathogenesis. Major stages of this classification are designated with Roman numerals, and substages are designated with Arabic numerals. In an attempt to describe quantitatively the extent of the PSR, each retina was given a substage grade for each of the major stages (Table 1). In this series of patients the retinopathy was sufficiently advanced that more than one major stage was present in most eyes at the time of initial examination; ie, the retinopathy had advanced beyond stage I in most cases.

Classification of PSR¹

Stage I.—Peripheral arteriolar occlusions

Substage 0.—None

Substage 1.— $\leq 30^\circ$ of circumferential fundus involvement and $\leq$ three occluded arterioles

Substage 2.— 31° to 60° of circumferential fundus involvement or four to six occluded arterioles.

Substage 3.— 61° to 90° of circumferential fundus involvement or seven to nine occluded arterioles

Substage 4.— $\geq 91^\circ$ of circumferential fundus involvement or $\geq$ ten occluded arterioles

Stage II.—Peripheral arteriolar-venular anastomoses

Substage 0.—None

Substage 1.— $\leq 30^\circ$ of circumferential fundus involvement and $\leq$ three arteriolar-venular anastomoses

Substage 2.— 31° to 60° of circumferential fundus involvement or four to six arteriolar-venular anastomoses

Substage 3.— 61° to 90° of circumferential fundus involvement or seven to nine arteriolar-venular anastomoses

Substage 4.— $\geq 91^\circ$ of circumferential fundus involvement or $\geq$ ten arteriolar-venular anastomoses

Stage III.—Neovascular and fibrous proliferations

Substage 0.—None

Substage 1.— $\leq 30^\circ$ of circumferential fundus involvement and $\leq$ three proliferations

Substage 2.— 31° to 60° of circumferential fundus involvement or four to six proliferations

Substage 3.— 61° to 90° of circumferential fundus involvement or seven to

nine proliferations

Substage 4.— $\geq 91^\circ$ of circumferential fundus involvement or $\geq$ ten proliferations

Stage IV.—Vitreous hemorrhages

Substage 0.—None

Substage 1.— $\leq 30^\circ$ of circumferential fundus involvement

Substage 2.— 31° to 60° of circumferential fundus involvement

Substage 3.— 61° to 90° of circumferential fundus involvement

Substage 4.— $\geq 91^\circ$ of circumferential fundus involvement

Stage V.—Retinal detachments

Substage 0.—None

Substage 1.— $\leq 30^\circ$ of circumferential fundus involvement

Substage 2.— 31° to 60° of circumferential fundus involvement

Substage 3.— 61° to 90° of circumferential fundus involvement

Substage 4.— $\geq 91^\circ$ of circumferential fundus involvement

Although an occasional eye "skips" a stage in its progression, most eyes enter a *more* advanced stage only *after* having demonstrated lesions of a *less* advanced stage.¹ Thus, more than one stage can coexist, possibly with different grades of severity. Consequently, each eye is simultaneously graded into substages within *each* major stage (Table 1 and 2).

Results

When the average ages of the original cases are tabulated against increasing grades of fundus involvement (Table 4), it appears (with the exception of one 50.5-year-old woman who was graded stage I only), that there is a slight tendency for higher stages of fundus involvement to be characterized by a higher average patient age. This tendency is not obvious if one tabulates the average age of only the follow-up cases in the same manner, possibly because the size of the follow-up population is too small, or possibly because the tendency of increasing grades of fundus involvement to be associated with a higher patient age is spurious. Also, although the number of eyes available for follow up was much too small for tests of statistical significance, it can be seen from Fig 2 that the percentage of affected eyes appears to have increased slightly during the observation period for *each* of the major stages of PSR. The percentage of eyes with arteriolar

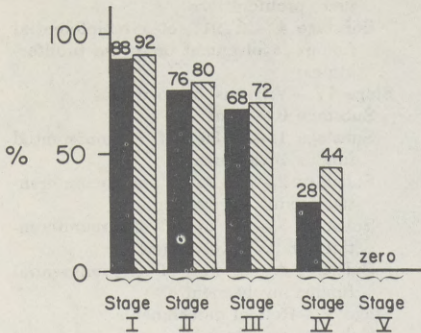


Fig 2.—Percent of eyes involved by stages of PSR in SC disease. At time of last follow-up examination, percentages of eyes involved with specific lesions of stage I, II, III, and IV had increased. Most marked increase in percentage occurred in stage IV (vitreous hemorrhage). No eye in this particular untreated series developed retinal detachment (stage V).^{1,2,4} Solid bar indicates initial examination; hatched bar, at follow up (mean: 31 months).

Fig 3.—Number of eyes with stage I lesions (peripheral arteriolar occlusions) appeared to increase slightly by time of follow up. Eight eyes had retinopathy graded substages 3 and 4 at follow up, whereas on four eyes were graded substages 3 and 4 initially.

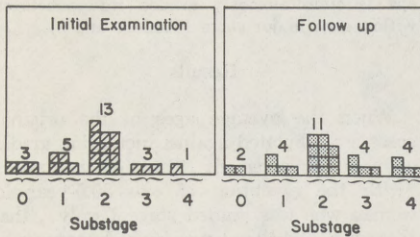


Fig 4.—Number of eyes with stage II lesions (peripheral arteriolar-venular anastomoses) appeared to increase slightly by time of follow up. Eight eyes had retinopathy graded substages 3 and 4 at follow up, whereas only four eyes were graded substages 3 and 4 initially.

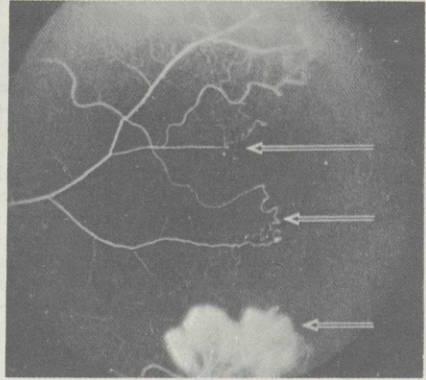
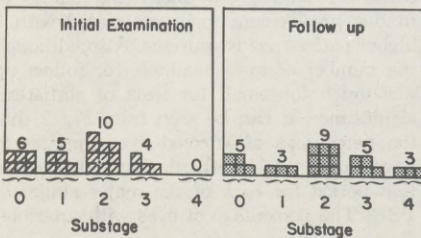


Fig 5.—Temporal periphery OS during arteriovenous phase. Top arrow shows stage I lesion (peripheral arteriolar occlusion); middle arrow, stage II lesion (arteriolar-venular anastomosis); bottom arrow, stage III lesion (neovascular proliferation). Note that peripheral retina (at right) appears totally ischemic.

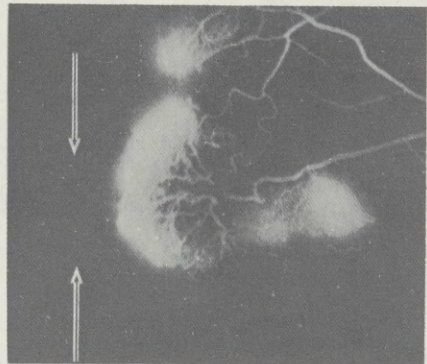
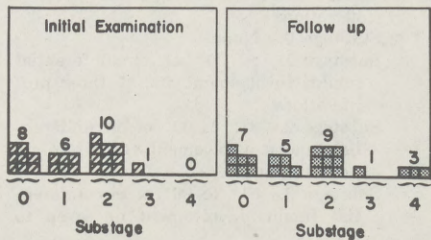


Fig 6.—Arteriovenous phase of neovascular lesions (stage III) in temporal periphery OD. Note peripheral retinal ischemia (arrows).

Fig 7.—Number of eyes with stage III lesions (neovascular and fibrous proliferations) appeared to increase slightly by time of follow up. Four eyes were graded substages 3 and 4 at follow up, whereas only one eye was graded in these two substages initially.



PROLIFERATIVE SICKLE RETINOPATHY—GOLDBERG

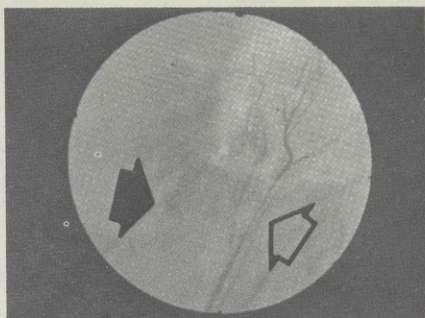


Fig 1.—Superotemporal quadrant OS at equator. A large, neovascularized, fibrous sheet is present (stage III lesion). It and its major feeding vessel (open arrow) have been pulled anterior to plane of retina. A small, spontaneous vitreous hemorrhage (stage IV lesion) is seen at closed arrow. Angiogram of same fundus area is shown in Fig 9, bottom.

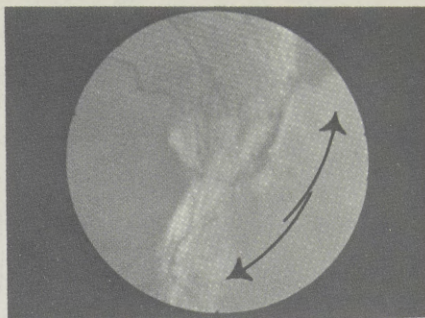


Fig 2.—Temporal region OS at equator. A large, neovascularized, fibrous sheet is present (stage III lesion). A spontaneous vitreous hemorrhage (stage IV lesion) is seen at its peripheral edge. Preequatorial retina is ischemic (double arrow).

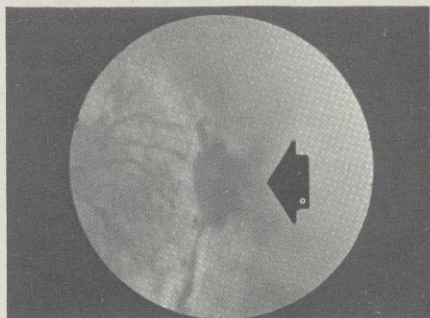


Fig 3.—Superior aspect of lesion seen in color Fig 2. Arrow indicates spontaneous localized vitreous hemorrhage (stage IV lesion) arising from neovascular and fibrous fan (stage III lesion).

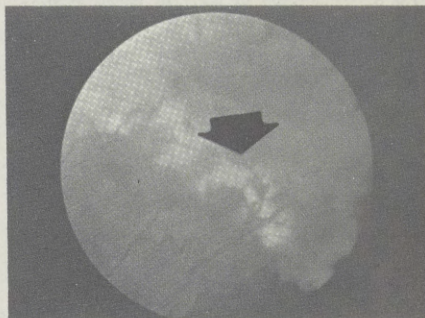


Fig 4.—Superotemporal quadrant OS at equator. A large preretinal and vitreous hemorrhage (stage IV lesion) arises from a stage III (neovascular) lesion (arrow).

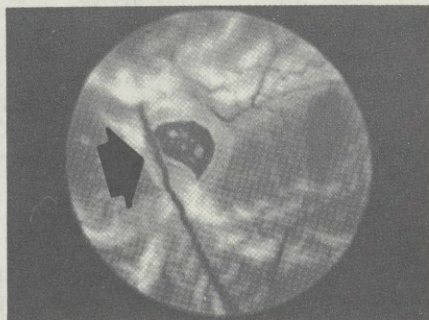


Fig 5.—Superior region of retina which is detached (stage V lesion). A retinal hole (arrow) is seen just posterior to neovascular tissue (stage III lesion), adjacent to which is a vitreous hemorrhage (stage IV lesion).

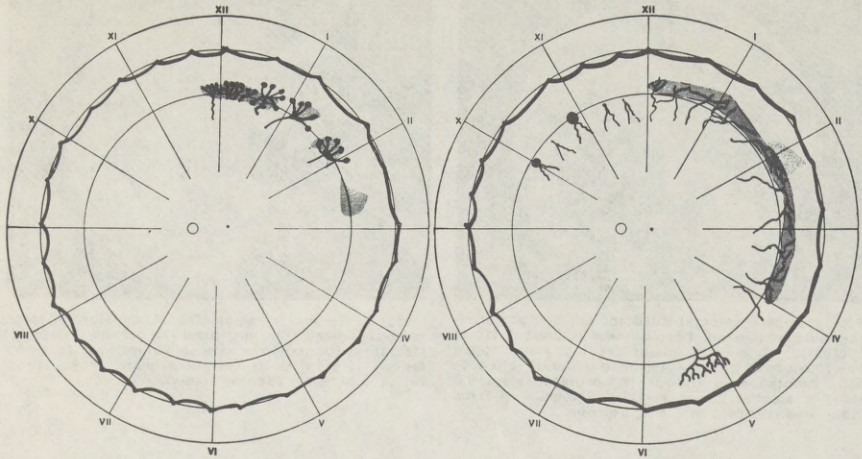


Fig 8.—Progression of stage III lesions (neovascular proliferations) OS, case 5. *Left*, Two years after entering study, left eye is graded stage III, substage 3. Multiple neovascular lesions—sea-fans—are present superotemporally at equator. *Right*, Two and one-third years later, superotemporal sea-fans have coalesced and extended, and new neovascular lesions have appeared at 5:15 o'clock and at 10 to 12 o'clock (stage III, substage 4). A spontaneous vitreous hemorrhage (stage IV, substage 1) has occurred at 2 o'clock.

occlusions (stage I) increased over the observation period from 88% to 92%. Within stage I there also seemed to have been a slight increase in the number of peripheral arteriolar occlusions. At the time of initial examination, for example, only four of 25 eyes had had sufficient arteriolar occlusions to be classified substage 3 or 4, whereas a total of eight eyes was found to be in these two substages at follow up (Fig 3). Also, the mean substage grade increased from 1.8 to 2.2 (Table 3).

The percentage of eyes involved with lesions of stage II (peripheral arteriolar-venular anastomoses) increased over the observation period from 76% to 80% (Fig 2). Within stage II there also seemed to have been a slight shift toward more extensive fundus involvement. As in the case of stage I lesions (Fig 3), only four of 25 eyes had had sufficient peripheral lesions to be classified substage 3 or 4 initially, whereas a total of eight eyes was found to be in these two substages at follow up (Fig 4). Moreover, no eyes could be graded substage 4 initially, whereas three eyes had progressed to this substage by the time of follow up. The mean substage grade increased from 1.5 to 1.9.

The percentage of eyes involved with stage III lesions (neovascular and fibrous prolif-

erations) increased over the observation period from 68% to 72% (Fig 2, 5, and 6). Within this stage slight progression of fundus involvement also appeared to have occurred. No eyes could be graded substage 4 initially, whereas three eyes had progressed to this substage at follow up (Fig 7). Selected individual eyes observed during the follow-up period show a dramatic increase in severity of stage III lesions (Fig 8 and 9). The mean substage grade increased from 1.2 to 1.5 (Table 3).

Although all major stages showed an increased percentage of involved eyes at the last follow up (when compared with the initial examination), the increase in percentage was most marked in the stage of vitreous hemorrhage (stage IV); viz, 28% of eyes had had evidence of vitreous hemorrhage initially, whereas 44% of eyes had evidence of vitreous hemorrhage at follow up (Fig 2). Within stage IV, slight progression of fundus involvement also seemed to have occurred (Fig 10). The most notable change seemed to have occurred in substages 1 and 2. Whereas five eyes had fallen into these substages initially, nine eyes had these grades of vitreous hemorrhage at follow up (Fig 10). Most newly occurring hemorrhages, in other words, appeared to have remained relatively

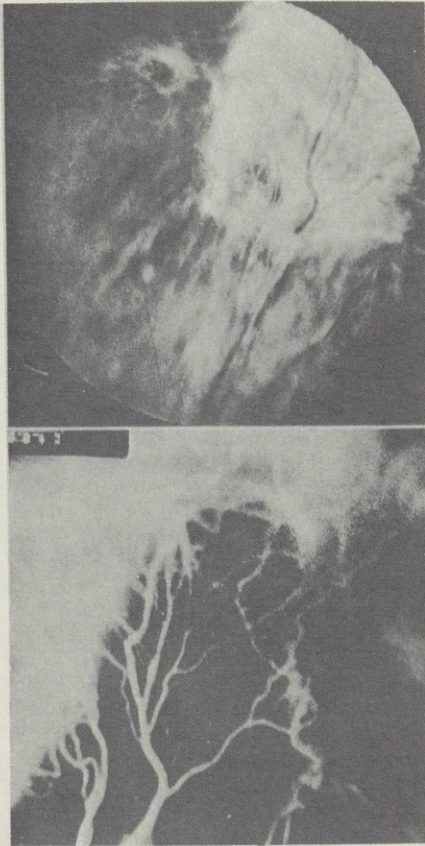
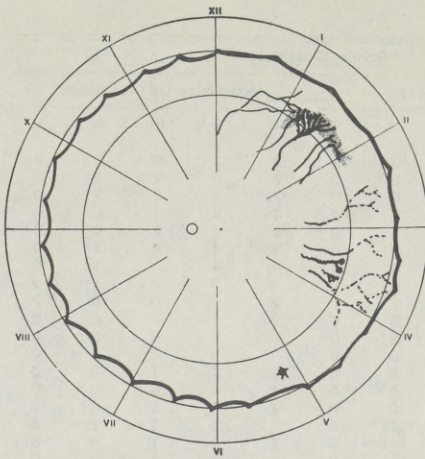


Table 1.—Classification of Retinopathy: Follow-Up of

Case	Age in Years (At Last Follow Up)	Sex	Eye
1	39	M	OS
2	20	M	OS
3	21	F	OS
4	38	F	OD
			OS
5	23	M	OD
			OS
6	22	F	OD
7	25	F	OD
8	57	F	OD
			OS
9	33	F	OD
			OS
10	23	M	OD
			OS
11	42	F	OD
			OS
12	27	M	OD
			OS
13	31	F	OD
			OS
14	28	F	OS
15	29	F	OD
16	25	M	OD
			OS
Mean: 30		6 M; 10 F	25 eyes (12 OD; 13 OS)

* Fresh vitreous hemorrhage (red).

† Old vitreous hemorrhage (white).

localized in the vitreous overlying the responsible stage III lesions¹ rather than to have broken into the entire vitreous space. Also, the mean substage grade increased from 0.6 to 0.8 (Table 3).

No new retinal detachment (stage V) developed in the follow-up series of patients.

Visual acuity was good in all eyes of the follow-up population at the time of initial examination. Vision of seven of the 25 eyes fell two or more lines on the Snellen chart during the follow-up period, but vision of six of these seven eyes was 20/40 or better. The seventh eye (case 11, OS) sustained a spontaneous, localized vitreous hemorrhage from an equatorial neovascular lesion at 3 o'clock.

Fig 9.—**Top**, stage III lesions (neovascular proliferations) seen at follow up OS, case 3. None had been present 65 months previously when eye entered study. Two small sea-fans¹ (stage III) are present at 3:30 o'clock and appear to be growing into an area of occluded arterioles (stage I) and ischemic retina. A spontaneous vitreous hemorrhage has occurred at 1:30 o'clock (stage IV, substage 1) from a complex, larger sea-fan (center). **Bottom**, Fluorescein angiogram of lesion.

Untreated Cases With Sickle Cell-Hemoglobin C

			Retinal Classification									
Visual Acuity		Duration of Follow-Up (mo)	Initial (Stages)					Last Follow-Up (Substages)				
Initial	Last Follow-Up		I	II	III	IV	V	I	II	III	IV	V
20/20	20/20	6	2	2	2	0	0	2	2	2	0	0
20/20	20/20	6	2	2	2	2	0	2	2	2	2	0
20/20	20/20	65	0	0	0	0	0	2	2	2	1*	0
20/15	20/25	54	3	3	1	0	0	3	3	1	0	0
20/15	20/25	54	2	2	2	0	0	2	2	2	0	0
20/15	20/20	26	2	2	2	2*	0	4	4	4	2*	0
20/15	20/20	54	3	3	3	0	0	4	4	4	1*	0
20/20	20/20	11	4	3	2	0	0	4	3	2	1*	0
20/15	20/30	6	2	0	0	0	0	2	0	0	0	0
20/20	20/40	77	2	0	0	0	0	2	0	0	0	0
20/20	20/40	77	0	0	0	0	0	0	0	0	0	0
20/20	20/25	10	2	2	2	0	0	2	2	2	0	0
20/40	20/25	56	1	1	1	0	0	1	1	1	0	0
20/20	20/20	17	2	2	2	0	0	2	2	2	0	0
20/20	20/20	17	1	0	0	0	0	1	0	0	0	0
20/15	20/20	56	1	1	1	1†	0	1	1	1	1†	0
20/15	20/200‡	55	1	1	1	4†	0	1	1	1	4†	0
20/20	20/20	22	2	2	2	1†	0	4	4	4	0	0
20/15	20/30	22	2	1	1	1†	0	3	3	3	4*	0
20/15	20/20	45	1	1	0	3†	0	3	3	0	2†	0
20/15	20/20	6	2	2	2	0	0	2	2	2	2*	0
20/50	20/15	17	2	2	2	0	0	2	2	2	0	0
20/15	20/20	6	3	3	1	0	0	3	3	1	1‡	0
20/20	20/20	7	0	0	0	0	0	0	0	0	0	0
20/20	20/20	7	2	2	0	0	0	2	2	0	0	0
Mean: 31 (range: 6-77)			Mean =1.8	Mean =1.5	Mean =1.2	Mean =0.6	Mean =0	Mean =2.2	Mean =1.9	Mean =1.5	Mean =0.8	Mean =0

‡ A local vitreous hemorrhage from an equatorial sea-fan* at 3 o'clock caused a vitreous traction band to form and tug on the macula leading to cystic changes and reduction in vision.

§ Fresh vitreous hemorrhage (red) secondary to falling and striking the head on a blunt object.

in the left eye. Subsequently, a vitreous traction band developed from the hemorrhage to the macula. This band presumably tugged on the macula, leading to cystic changes therein, and reduced central visual acuity from 20/15 to 20/200.

Comment

The small number of eyes (25) and the relatively short follow-up period (6 to 77 months) make additional study mandatory before precise conclusions can be reached concerning the rate and mode of progression of untreated PSR. Nonetheless, certain tentative conclusions seem possible. From the limited data available, untreated PSR appears to have progressed slowly during the follow-up period by having passed through the stages and substages of the classification used herein (Fig 2 to 4, 7, 10, and color Fig 1 to 5). In this sense the severity and extensiveness of PSR may be considered somewhat age dependent. In addition, data from

the original population suggest that severity of PSR possibly may be related to an increasing average patient age, although the age ranges of the various stages of PSR overlap (Table 4).

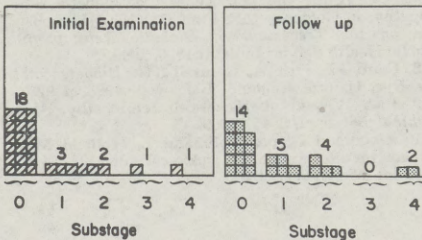
Of perhaps more practical importance is the observation that the stage of neovascular and fibrous proliferations (stage III) had been reached by 11 patients whose mean age was only 25 (Table 4). Moreover, the subsequent two stages, during which clinical symptomatology is first manifested (stage IV, vitreous hemorrhage; stage V, retinal detachment [color Fig 1 to 5]), had been reached by ten patients whose mean ages were also 30 or less (Table 4). Consequently, although inspection of Fig 2 to 4, 7, and 10 indicates that progression of PSR seems to be relatively slow and may be somewhat age-dependent, stages of clinical significance (stages III, IV, and V^{1,2}) occur at a relatively early age.

Once stage III has been reached, further increase in its severity (ie, an increase in its

Table 2.—Percent of Eyes Involved by Each Stage and Substage of PRS in Untreated SC Disease Initially and at Follow Up

	Initial (%)	Follow Up (%)
Stage I (total)	22/25 = 88	23/25 = 92
Substage		
0	3/25 = 12	2/25 = 8
1	5/25 = 20	4/25 = 16
2	13/25 = 52	11/25 = 44
3	3/25 = 12	4/25 = 16
4	1/25 = 4	4/25 = 16
Stage II (total)	19/25 = 76	20/25 = 80
Substage		
0	6/25 = 24	5/25 = 20
1	5/25 = 20	3/25 = 12
2	10/25 = 40	9/25 = 36
3	4/25 = 16	5/25 = 20
4	0/25 = 0	3/25 = 12
Stage III (total)	17/25 = 68	18/25 = 72
Substage		
0	8/25 = 32	7/25 = 28
1	6/25 = 24	5/25 = 20
2	10/25 = 40	9/25 = 36
3	1/25 = 4	1/25 = 4
4	0/25 = 0	3/25 = 12
Stage IV (total)	7/25 = 28	11/25 = 44
Substage		
0	18/25 = 72	14/25 = 56
1	3/25 = 12	5/25 = 20
2	2/25 = 8	4/25 = 16
3	1/25 = 4	0/25 = 0
4	1/25 = 4	2/25 = 8
Stage V	None in this series	None in this series

Fig 10.—Number of eyes with stage IV lesions (vitreous hemorrhages) appeared to increase slightly by time of follow up. Whereas five eyes were graded substage 1 and 2 initially, nine eyes fell into these categories at follow up.



substage grade) may not occur, despite a prolonged follow-up period, eg, case 4, Table 1. Spontaneous regression of stage III lesions, however, has not yet been observed in a single instance in this series, unlike the situation pertaining to the somewhat analogous neovascular lesions of proliferative diabetic retinopathy (PDR).⁷

On the other hand progression of stage III lesions may occur to a marked extent (eg,

Table 3.—Classification of PSR in SC Disease Initially and at Follow Up

	Initial	Follow Up
Stage I		
Substage		
Mean	1.8	2.2
Range	0-4	0-4
Mode	2	2
%	88	92
Stage II		
Substage		
Mean	1.5	1.9
Range	0-3	0-4
Mode	2	2
%	76	80
Stage III		
Substage		
Mean	1.2	1.5
Range	0-3	0-4
Mode	2	2
%	68	72
Stage IV		
Substage		
Mean	0.6	0.8
Range	0-4	0-4
Mode	1	1
%	28	44
Stage V	None in this series	

Table 4.—Average Patient Age According to Stages of PSR Present at Time of Classification of Original Patients' Eyes

Stages of PSR* Present at Initial Classification	Av Age (yr)	Age Range	No. of Patients
I	50.5	50.5	1
I-II†	24	24	1
I-III†	25	15-38	11
I-IV†	28	24-37	7
I-V†	30	19-38	3‡

* If two eyes of one patient differed in stages, the more advanced stage of the two was used for purposes of this tabulation. One patient was not included because his age was unknown.

† Because most patients' retinas proceeded sequentially through earlier stages prior to showing signs of later stages, the categories involving later stages are listed, for example, I-IV, rather than simply IV.

‡ Three patients in the original population had retinal detachments. Because they required surgery, these eyes were not included in the follow-up study and thus do not appear in Table 2 and 3.

case 3 and 5, Table 1, Fig 8 and 9), thereby threatening the eye with potential vitreous hemorrhage or retinal detachment or both (color Fig 1 to 5).¹ Those factors causing or potentiating such a progression are currently obscure. Since pregnancy was associated with florid progression of stage III lesions in one patient, it is possible that the "pregnant state" may be one of those factors in certain circumstances. An analogous situation has

been postulated for pregnant diabetics with PDR, although the data are not entirely clear cut.⁸

In SC disease almost all eyes with vitreous hemorrhage appear to have undergone neovascular proliferations *prior* to any episode of bleeding. The reverse sequence of events (ie, spontaneous vitreous hemorrhage *followed* by previously nonexistent neovascularization) only rarely,⁹ if ever, appears to occur, but may possibly apply to the right eye of case 13 (Table 1). Alternatively, the responsible patch of neovascularization may simply have been small enough to escape detection in this eye.

Initially, vitreous hemorrhages may be totally asymptomatic because the extravasated blood may remain localized in the peripheral vitreous, which overlies the bleeding neovascular tissue (color Fig 1 to 3). Such blood slowly turns from red to white and may become organized. The underlying neovascular tissue may then proliferate further or may re-bleed in an erratic, unpredictable fashion with varying severity. Occasionally,

a vitreous hemorrhage breaks into the center of the vitreous space, thereby producing visual symptoms. Marked reduction of visual acuity (of variable duration) may occur. Blunt trauma may uncommonly precipitate a fresh vitreous hemorrhage,¹⁰ but most bleeding episodes are apparently spontaneous. Although vitreous detachment is intimately related to the pathogenesis of vitreous hemorrhages in diabetes mellitus,⁷ its possible role in PSR is not yet known.

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Key Words.—Sickle cell disease; retinopathy, proliferative; natural history; classification; arteriolar occlusions; arteriolar-venular anastomoses; sea-fans; neovascularization; vitreous hemorrhage; retinal detachment; ischemia.

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CLASSIFICATION AND PATHOGENESIS OF PROLIFERATIVE SICKLE RETINOPATHY

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Proliferative retinopathy is characteristic of certain abnormal hemoglobin states, particularly sickle cell hemoglobin C disease (SC disease).¹ Spontaneous vitreous hemorrhage,² which can be either localized or diffuse, and retinal detachment, which is exceedingly resistant to successful surgical repair,³ are the ultimate results of a predictable sequence of events which occur in the retinae of such patients.

This paper will present a classification of proliferative sickle retinopathy (PSR), which reflects both severity of the disorder as well as its postulated pathogenesis. Repeated ophthalmoscopic and fluorescein angiographic observations of 24 untreated SC patients were utilized in an attempt to reconstruct the ostensible series of retinal and preretinal events that may eventuate in vitreous hemorrhage and retinal detachment.

MATERIALS AND METHODS

Twenty-four Negro patients (47 eyes) in various untreated stages of PSR were personally evaluated after referral from the out- and in-patient services of the Johns Hopkins Hospital and the Wilmer Institute. Nine of the patients were male and 15 were female. Observations made in 13 of these patients provided the clinical bases for a description of the characteristic ophthalmoscopic finding of SC retinopathy, the sea-fan sign.¹ The sea-fan is an arteriolar-venular fan-shaped vasoproliferative lesion which projects from the retina into the vitreous. The name was cho-

sen because superficially the typical lesion resembles a common marine invertebrate called the sea-fan (*Gorgonia flabellum*).

Evaluation of all fundi was accomplished by indirect ophthalmoscopy through dilated pupils, scleral depression, fluorescein angiography, and, when indicated, Goldmann 3-mirror lens studies, although 3-mirror evaluation of the peripheral vitreoretinal interface was somewhat difficult in most of these patients, making it impossible to evaluate precisely any peripheral vitreoretinal adhesions or vitreous detachments in the SC cases.

Evaluation of most patients was repeated on several occasions and findings were recorded on 8 × 12-inch fundus drawings. In addition, color and black and white fundus photographs, and fluorescein angiographic photographs were made according to techniques published previously.^{4,5}

Diagnosis of SC hemoglobin was confirmed by Samuel Charache, M.D., of the Special Hematology Laboratory, Johns Hopkins Hospital, via hemoglobin electrophoresis.

CLASSIFICATION

As the result of observations from indirect ophthalmoscopy and fluorescein angiography, the sequence of fundus events in these SC patients could be divided into five naturally occurring, progressive stages, one leading into the next (Table 1):

Stage I: Peripheral arteriolar occlusions.

Stage II: Peripheral arteriolar-venular anastomoses.

Stage III: Neovascular and fibrous proliferations.

Stage IV: Vitreous hemorrhage.

Stage V: Retinal detachment.

Each of these five stages was further sub-

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TABLE 1

CLASSIFICATION OF PROLIFERATIVE SICKLE RETINOPATHY FOR USE WITH INDIRECT OPHTHALMOSCOPY AND FLUORESCEIN ANGIOGRAPHY

Stage	Circumferential Involvement	Other
I. Peripheral arteriolar occlusions		
Substage 0	None	
1	$\leq 30^\circ$	and ≤ 3 occluded arterioles
2	$31-60^\circ$	or 4-6 occluded arterioles
3	$61-90^\circ$	or 7-9 occluded arterioles
4	$\geq 91^\circ$	or ≥ 10 occluded arterioles
II. Peripheral arteriolar-venular anastomoses		
Substage 0	None	
1	$\leq 30^\circ$	and ≤ 3 discrete anastomoses
2	$31-60^\circ$	or 4-6 discrete anastomoses
3	$61-90^\circ$	or 7-9 discrete anastomoses
4	$\geq 91^\circ$	or ≥ 10 discrete anastomoses
III. Neovascular and fibrous proliferation		
Substage 0	None	
1	$\leq 30^\circ$	and 3 $\leq$ discrete proliferations
2	$31-60^\circ$	or 4-6 discrete proliferations
3	$61-90^\circ$	or 7-9 discrete proliferations
4	$\geq 91^\circ$	or ≥ 10 discrete proliferations
IV. Vitreous hemorrhage		
Substage 0	None	
1	$\leq 30^\circ$	
2	$31-60^\circ$	
3	$61-90^\circ$	
4	$\geq 91^\circ$	
V. Retinal detachment		
Substage 0	None	
1	$\leq 30^\circ$	
2	$31-60^\circ$	
3	$61-90^\circ$	
4	$\geq 91^\circ$	

divided in order to quantify the circumferential extent of the fundus involvement:

Substage 0: No circumferential involvement.

Substage 1: Circumferential involvement of up to 30 degrees of the fundus.

Substage 2: Circumferential involvement of 31 to 60 degrees of the fundus.

Substage 3: Circumferential involvement of 61 to 90 degrees of the fundus.

Substage 4: Circumferential involve-

ment of 91 or more degrees of the fundus.

This classification reflects largely the equatorial and pre-equatorial pattern that PSR naturally assumes. It places major emphasis on the initial 90 degrees of involvement (substages 1, 2, and 3), because most lesions of PSR are confined to an area in the fundus less than one quadrant in circumferential extent.

In the case of Stages I, II, and III, further modification of the substages was employed, based on the number of characteristic fundus abnormalities visualized with the binocular indirect ophthalmoscope or by fluorescein angiography. For example, modifications of Stage I (peripheral arteriolar occlusions) included:

Substage 1: $\leq 30^\circ$ circumferential involvement and ≤ 3 occluded arterioles.

Substage 2: $31-60^\circ$ circumferential involvement or 4-6 occluded arterioles.

Substage 3: $61-90^\circ$ circumferential involvement or 7-9 occluded arterioles.

Substage 4: $\geq 91^\circ$ circumferential involvement or ≥ 10 occluded arterioles.

The number of peripheral arteriolar-venular anastomoses, as visualized with the indirect ophthalmoscope or by fluorescein angiography, was also used to quantitate Stage I and the number of neovascular and fibrous proliferations was also used to quantitate Stage III (Table 1). For purposes of classification, no attempt was made to distinguish between neovascular proliferations and fibrous proliferations, because both forms of proliferation frequently co-existed in the same lesion.

If the circumferential involvement and the number of abnormal arterioles, anastomoses, or proliferations did not coincide within one substage, the substage used for purposes of classification was the more advanced of the two parameters: e.g., if a patient had four small neovascular proliferations totalling 20 degrees of angular extent, the classification for neovascularization was Stage III-2 (and not III-1). Also, if there was one large con-

TABLE 2
INITIAL FUNDUS CLASSIFICATION IN 24 CASES OF SC DISEASE

Case	Sex and Age (years)†	Classification*									
		Right Eye					Left Eye				
		I	II	III	IV	V	I	II	III	IV	V
1. J.B.	M-38	2	2	2	4	4	2	2	2	0	0
2. T.B.	M-19	2	2	2	0	4	2	2	2	2	0
3. A.C.	F-15	1	1	2	0	0	0	0	0	0	0
4. M.Cl.	F-28	1	1	1	0	0	1	1	1	0	0
5. M.Co.	F-33	3	3	1	0	0	2	2	2	0	0
6. B.D.	M-18	2	2	2	2	0	3	3	3	0	0
7. E.D.	M-27	0	0	0	2‡	0	4	4	4	0	0
8. D.E.	F-21	4	3	2	0	0	1	1	1	0	0
9. R.G.	F-38	1	1	1	0	0	1	1	1	0	0
10. T.H.	M-?	3	3	3	0	0	—	—	—	—	—
11. B.J.	F-24	2	0	0	0	0	2	1	1	2	0
12. O.J.	F-34	2	2	2	4	0	1	1	1	4	0
13. E.K.	F-50	2	0	0	0	0	0	0	0	0	0
14. E.M.	F-28	2	2	2	0	0	1	1	1	0	0
15. S.Mc.	F-22	3	3	2	0	0	3	3	2	0	0
16. D.M.	M-21	2	2	2	0	0	1	0	0	0	0
17. M.M.	F-21	1	1	1	0	0	1	1	1	0	0
18. B.P.	F-37	1	1	1	1	0	1	1	1	4	0
19. J.P.	M-25	2	2	2	1	0	2	1	1	1	0
20. B.S.	F-27	1	1	0	3	0	2	2	2	0	0
21. L.S.	M-31	3	1	1	3	4	3	3	3	0	4
22. J.S.	F-26	1	1	1	0	0	2	2	2	0	0
23. A.S.	F-28	3	3	1	0	0	2	2	2	1	0
24. J.T.	M-24	0	0	0	0	0	2	2	0	0	0
Mean: 28 years		1.8	1.5	1.2	0.4	0.5	1.7	1.6	1.4	0.6	0.2
Mean for both eyes:		1.8	1.6	1.3	0.5	0.3					

* Roman numerals=stages; arabic=substages, as defined in Table 1. Note that each eye is classified for each stage.

† At time of initial classification.

‡ From retinal tear.

tinuous neovascular proliferation, up to 91 degrees, for example, the classification for neovascularization was Stage III-4 (and not III-1).

Because lesions of all five stages often coexist in the same eye, it is best, for purposes of precise classification, to describe the degree of involvement present for each of these five stages through the use of the substages as outlined above (Table 2). The natural history of PSR progresses in such a way that, generally speaking, an eye exhibits Stage I lesions before exhibiting Stage II lesions and so on.

RESULTS

Tabulation of each patient's classification is shown in Table 2, and summarization of these data is shown in Table 3 and in Table 4.

Stage I: Peripheral arteriolar occlusions—

In almost all cases, the vasculature in the posterior pole of the retina showed little or no abnormality by indirect ophthalmoscopy and fluorescein angiography. The peripheral vasculature, however, particularly between the equator and the ora serrata, was markedly abnormal (Fig. 1). Only four of the 47 retinas evaluated showed no ophthalmoscopic

TABLE 3

PERCENT OF EYES INVOLVED BY EACH STAGE AND SUBSTAGE OF PSR IN SC DISEASE*

	Right Eye	Left Eye	Both Eyes
Stage I, (total):	22/24 = 91%	21/23 = 91%	43/47 = 91%
Substage 0	2/24 = 9%	2/23 = 9%	4/47 = 8%
1	7/24 = 29%	8/23 = 35%	15/47 = 32%
2	9/24 = 37%	9/23 = 39%	18/47 = 38%
3	5/24 = 21%	3/23 = 13%	8/47 = 17%
4	1/24 = 4%	1/23 = 4%	2/47 = 4%
Stage II, (total):	20/24 = 83%	20/23 = 87%	40/47 = 85%
Substage 0	4/24 = 17%	3/23 = 13%	7/47 = 15%
1	8/24 = 33%	9/23 = 39%	17/47 = 36%
2	7/24 = 29%	7/23 = 31%	14/47 = 30%
3	5/24 = 21%	3/23 = 13%	8/47 = 17%
4	0/24 = 0%	1/23 = 4%	1/47 = 2%
Stage III, (total):	19/24 = 79%	19/23 = 82%	38/47 = 81%
Substage 0	5/24 = 21%	4/23 = 18%	9/47 = 19%
1	8/24 = 33%	9/23 = 39%	17/47 = 37%
2	10/24 = 41%	7/23 = 31%	17/47 = 36%
3	1/24 = 5%	2/23 = 8%	3/47 = 6%
4	0/24 = 0%	1/23 = 4%	1/47 = 2%
Stage IV, (total):	8/24† = 33%	6/23 = 26%	14/47 = 30%
Substage 0	16/24 = 67%	17/23 = 74%	33/47 = 70%
1	2/24 = 8%	2/23 = 8%	4/47 = 8%
2	2/24 = 8%	2/23 = 8%	4/47 = 8%
3	2/24 = 8%	0/23 = 0%	2/47 = 5%
4	2/24 = 8%	2/23 = 8%	4/47 = 8%
Stage V, (total):	3/24 = 12%	1/23 = 4%	4/47 = 8%
Substage 0	0/24 = 0%	0/23 = 0%	0/47 = 0%
1	0/24 = 0%	0/23 = 0%	0/47 = 0%
2	0/24 = 0%	0/23 = 0%	0/47 = 0%
3	0/24 = 0%	0/23 = 0%	0/47 = 0%
4	3/24 = 12%	1/23 = 4%	4/47 = 8%

* Percentages do not always add up to 100 because of rounding off.

† Hemorrhage in one case is from a retinal tear, not from neovascular proliferation.

evidence of arteriolar obstruction (Tables 2, 3, and 4). Of the affected eyes, most fell into substage 2. The right and left eyes were, in general, equally involved. The most obvious obstructions were in the temporal quadrants. Arterioles were either totally invisible in these locations, or had been converted in their terminal branches to "silver wires." Occasionally, terminal arteriolar branches appeared normally red on ophthalmoscopic observation, but fluorescein angiography provided direct evidence of abrupt, complete occlusion (Figs. 2-5). A frequent clue to peripheral retinal ischemia was a blurred retinal appearance that obscured the underlying

choroidal markings. Acute ischemic retinal edema (cloudy swelling) was not observed, possibly because of paucity of ganglion cells, possibly because of overall thinness of the peripheral retina, or possibly because by chance the acute episodes of occlusion were not observed.

Stage II: Peripheral arteriolar-venular anastomoses—Because it is sometimes difficult to observe anastomoses of small, peripheral arterioles and venules with indirect ophthalmoscopy, printed fluorescein angiograms are required for precise classification. Angiograms taken during the arteriovenous phase were thus judged for the presence of

TABLE 4
INITIAL CLASSIFICATION OF PSR IN SC DISEASE
(47 eyes)

Stage I:	Substage mean	1.8
	range	0-4
	mode	2
	% eyes with Stage I	91%
Stage II:	Substage mean	1.6
	range	0-4
	mode	1
	% eyes with Stage II	85%
Stage III:	Substage mean	1.3
	range	0-4
	mode	1
	% eyes with Stage III	81%
Stage IV:	Substage mean	0.5
	range	0-4
	mode	0
	% eyes with Stage IV	30%
Stage V:	Substage mean	0.3
	range	0-4
	mode	0
	% eyes with Stage V	8%

direct arteriolar-venular connections (Figs. 4, 6). If one assesses a very early or a very late angiogram, an anastomosis may be invisible because only the arteriolar or only the venular phase may be captured in the photograph.

As in Stage I, these lesions were found in most eyes (only seven of 47 eyes had none visible). Of the affected eyes, most fell into substage 1. The right and left eyes were, in general, equally involved. These anastomoses were most commonly observed in the temporal quadrants, in areas which had already been subjected to peripheral arteriolar obstruction (i.e., had already exhibited Stage I lesions). Thus, Stage I and Stage II lesions frequently existed side by side (Fig. 4).

Incipient anastomoses were characterized by a tortuous elongation and moderate dilatation of a small peripheral arteriole whose other terminal branches were apparently occluded. Eventually, connection with an adjacent terminal venule appears to occur, usually at the interface of postequatorial (vascularized) retina and pre-equatorial (is-

chemic) retina (Fig. 6). With the clinical techniques utilized in this study, it is difficult to state if the elongating arteriole represents neovascular growth or enlargement of a pre-existing vessel.

Stage II is characterized by intraluminal retention of fluorescein, however. No extravascular leakage of fluorescein or staining of vascular walls was observed to occur in Stage II, even when fluorescein angiograms were taken 30 and 45 minutes after injection. Because fluorescein leakage characterizes most, if not all, forms of retinal neovascularization, absence of leakage in Stage II may be taken as evidence, however slight, that the abnormal arterioles represent enlarged pre-existing vessels, possibly capillaries, rather than newly formed vessels.

Stage III: Neovascular and fibrous proliferations.—Because proliferations frequently have associated fibrous components, these two types of tissue are combined here for purposes of classification. Although most proliferative patches can be seen by ophthalmoscopic techniques, small ones can easily be overlooked (Fig. 7). Thus, fluorescein angiography again provides the most accurate means of detection and classification. Patches of PSR almost invariably leak intravenously administered fluorescein into the vitreous, even when the patches appear totally fibrous (Fig. 8). Consequently, ophthalmoscopic detection of small proliferations is made easier if one inspects the fundus two or three minutes after fluorescein injection. The leaks produce diffuse clouds of fluorescein, which may coalesce in the vitreous. If one examines the fundus after five or more minutes, therefore, the exact number, morphology, and location of proliferative patches may be obscured.

Proliferative patches apparently arise from pre-existing arteriolar-venular anastomoses (Stage II). Possibly, proliferative patches may arise prior to the development of arteriolar-venular connections, but angiographic evidence appears to indicate the reverse sequence (Figs. 4, 6) in many cases.

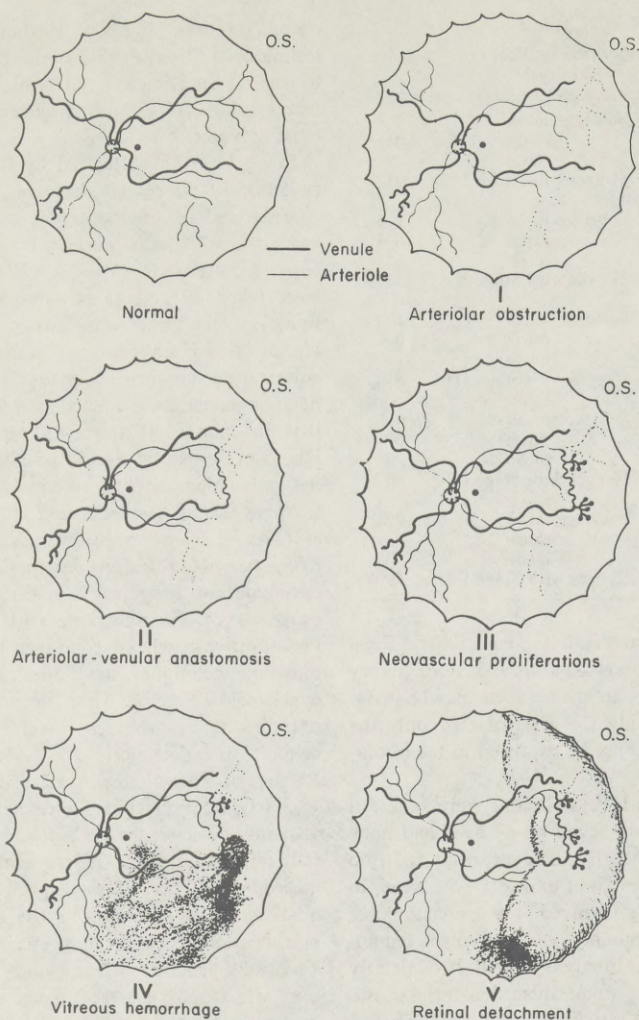


Fig. 1 (Goldberg). Schematic representation of a new classification of proliferative sickle retinopathy. The earliest observed abnormality is peripheral arteriolar obstruction (Stage I), occurring particularly in the temporal periphery (dotted lines). Stage II is characterized by A-V anastomoses. From these anastomoses, neovascular proliferations appear to sprout (Stage III). These neovascular lesions may bleed into the vitreous (Stage IV). Ultimately, retinal detachment (Stage V) seems to occur from vitreous traction and retinal hole formation. All stages may co-exist in a given retina.

The direction of growth of proliferative patches is generally anterior—i.e., into or towards the pre-equatorial (ischemic) retina (Fig. 9).

It is rare to find more than one proliferative patch at different anteroposterior levels of a given meridional axis; e.g., it is decidedly uncommon to observe two proliferative

Fig. 2 (Goldberg). Fluorescein angiogram of temporal periphery of left eye (early arteriovenous phase). Abrupt obstruction of major arteriole (arrow) is seen (Stage I). The peripheral retina (right of frame) appears totally ischemic (ISCH), whereas the more posterior retina (left of frame) has arteriolar and capillary perfusion.

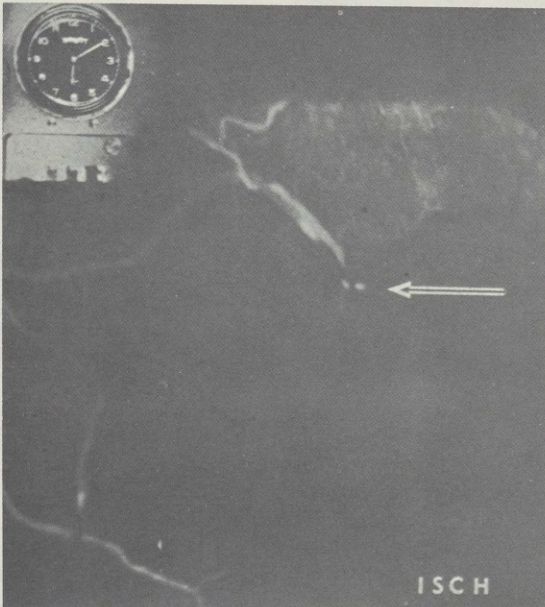
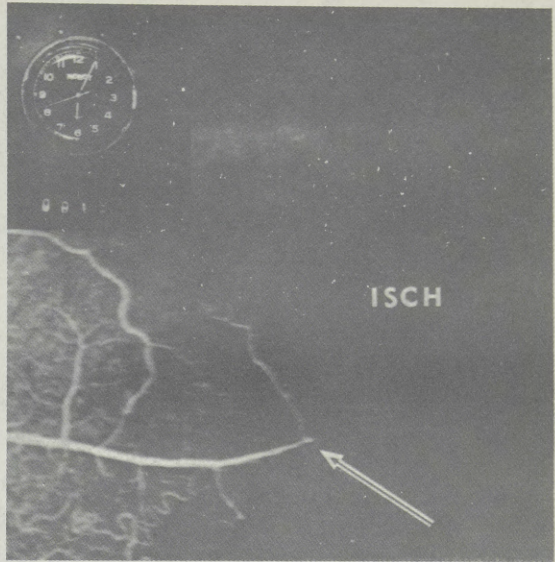


Fig. 3 (Goldberg). Fluorescein angiogram of inferotemporal periphery of left eye (Early arteriovenous phase). Abrupt arteriole obstruction (Stage I) is seen (arrow). The nonperfused terminal segments of the occluded arterioles are seen as dark lines. The peripheral retina (lower right) appears totally ischemic (ISCH), whereas the more posterior retina (upper left) retains arteriolar and capillary perfusion.

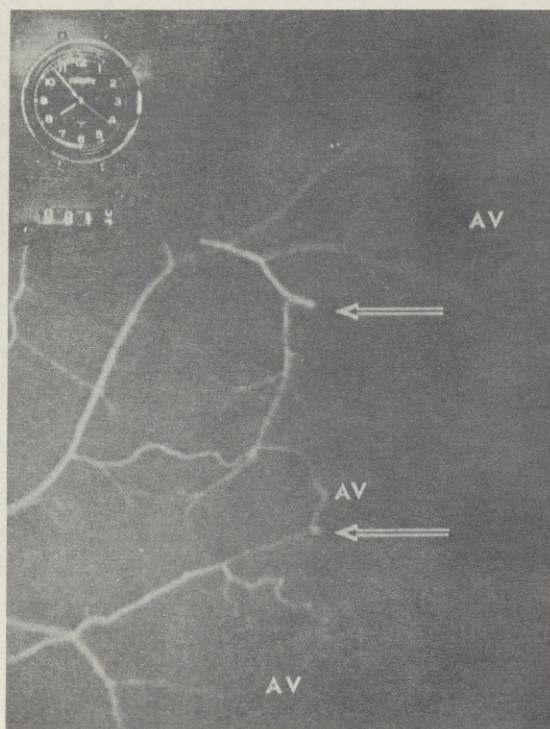


Fig. 4 (Goldberg). Fluorescein angiogram of temporal periphery of left eye (early arteriovenous phase). Abrupt arteriolar obstruction is seen in numerous places (arrows). Several A-V anastomoses are also present (A-V); i.e., Stage I and II are seen side by side.

patches at 1:30 o'clock, one being more anterior than the other. More likely by far is the occurrence of several patches, all of which are found along the same approximate circumferential arc (usually at about the level of the equator). Individual patches of fibrovascular proliferation may coalesce along this arc, in which case their feeding arterioles and draining venules frequently form complex anastomoses and arborizations. Although fluorescein angiography in Stage II confirms direct arteriolar-venular flow of blood, there is, in Stage III, an apparent shunting of blood from the feeding arteriole into the capillaries of the proliferative patch before venular flow commences (Figs. 7 and 8).

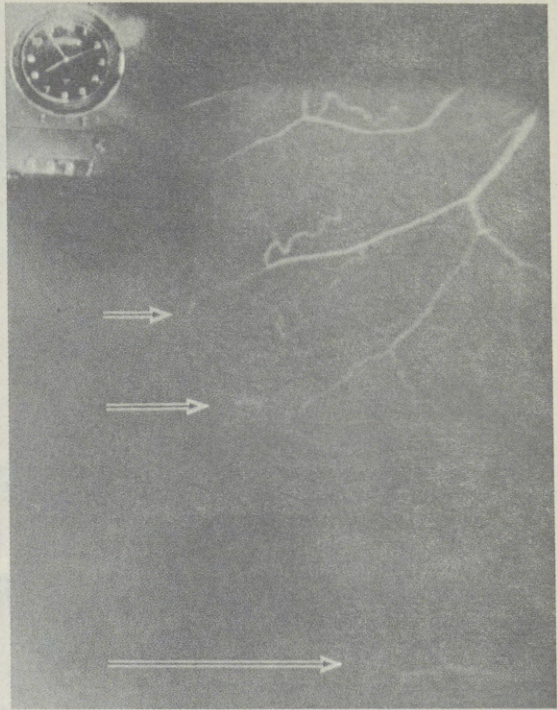
When a neovascular patch remains relatively isolated from similar neighboring

patches and coalescence does not occur, the characteristic sea-fan anomaly may be observed (Figs. 7, 8, 9). The sea-fans were found to have predilection for the supero-temporal quadrants of the fundus (Fig. 10).

Only nine of the 47 eyes studied failed to show neovascular or fibrous proliferations. Most of the involved eyes fell into substage 1.

Stage IV: Vitreous hemorrhage—Vitreous hemorrhage in PSR occurs sporadically, without demonstrable systemic or exogenous factors, or may infrequently occur following rather insignificant trauma such as a mild blow to the head. In most cases, a neovascular patch can be demonstrated to be the source of the hemorrhage (Fig. 11). The role of vitreous contraction in hemorrhages associated with PSR is currently unknown. Such

Fig. 5 (Goldberg). Fluorescein angiogram of temporal periphery of right eye (early arteriovenous phase). Abrupt arteriolar obstructions (Stage I) are seen (arrows). The peripheral retina (left of frame) appears totally ischemic.



hemorrhages often seem to remain localized in the cortical vitreous which overlies the responsible patch of proliferative retinopathy. Thus, once again, a circumferential pattern is observed in the fundus abnormality, and, as in the lesions in Stages I, II, and III, the peripheral temporal quadrants are preferentially involved. Such localized vitreous hemorrhages are frequently asymptomatic, even in the presence of the usually intact peripheral visual field, and are observed only if routine ophthalmoscopy is performed at a fortuitous time. Occasionally, however, a vitreous hemorrhage is extensive enough to spread into the visual axis or into the premacular area, thereby causing visual symptoms, including reduction in visual acuity (Fig. 12). Indirect ophthalmoscopy is the best means for detecting and quantitating vitreous hemorrhage associated with PSR.

Evidence for vitreous hemorrhage was present in 14 of the 47 eyes studied. Eight of these fell into substage 1 or 2, and four fell into substage 4.

Stage V: Retinal detachment—Retinal detachment is the ultimate and most severe stage of PSR (Fig. 13). Because such detachments are frequently related to adjacent vitreous changes (which in turn are related to neovascular proliferations and hemorrhages), they assume a temporal, equatorial configuration similar to the configurations of the antecedent Stages I-IV. Retinal tears, which are both round and horseshoe in shape, often are found adjacent to neovascular proliferations.

Four eyes had retinal detachments when initially examined and classified. In all these eyes, two or more quadrants of the retina were detached. In one case, J.B., there was

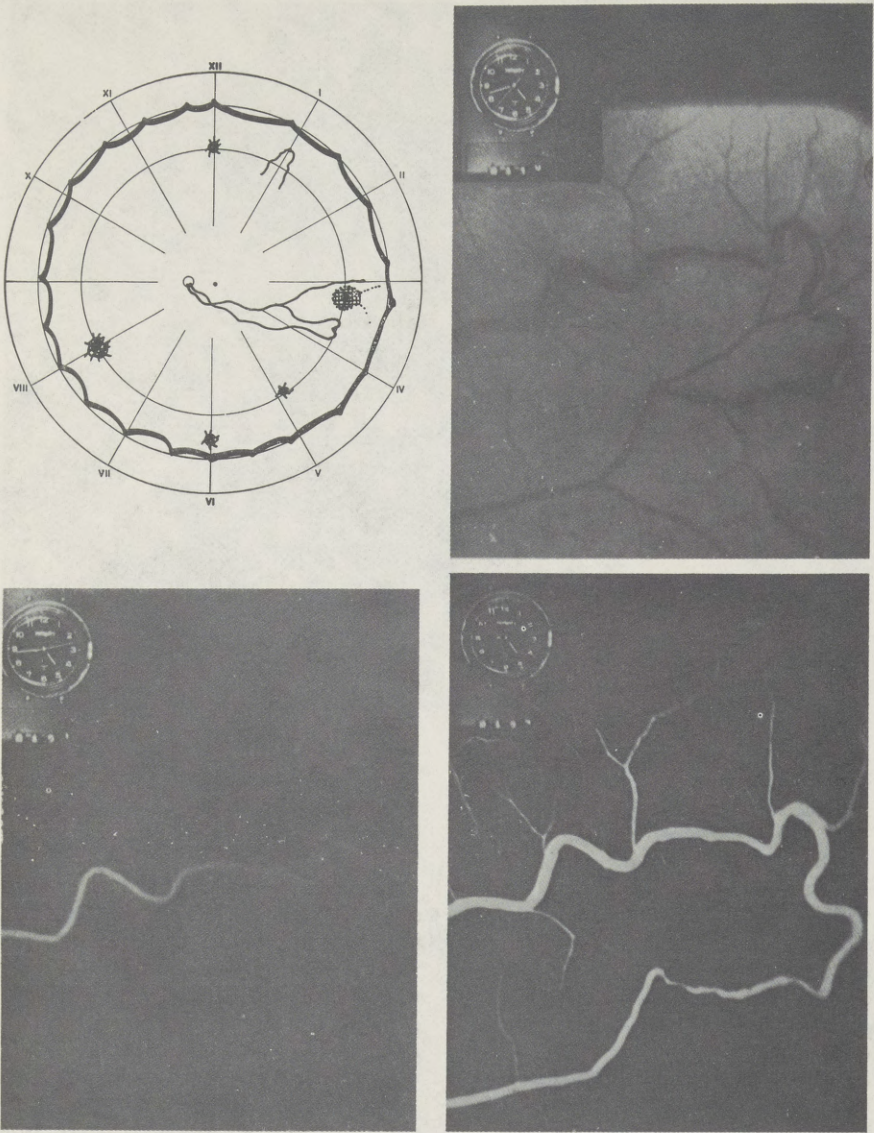


Fig. 6 (Goldberg). Arteriovenous anastomoses characterizing Stage II. Top left: A schematic representation of A-V anastomosis at 3:30 o'clock (multiple chorioretinal scars, "black sun-bursts," are also depicted). Top right: Photograph of the 3:30 o'clock anastomosis prior to fluorescein injection. Bottom left: Early arterial phase of fluorescein angiogram. Bottom right: Early arteriovenous phase, demonstrating direct A-V anastomosis.

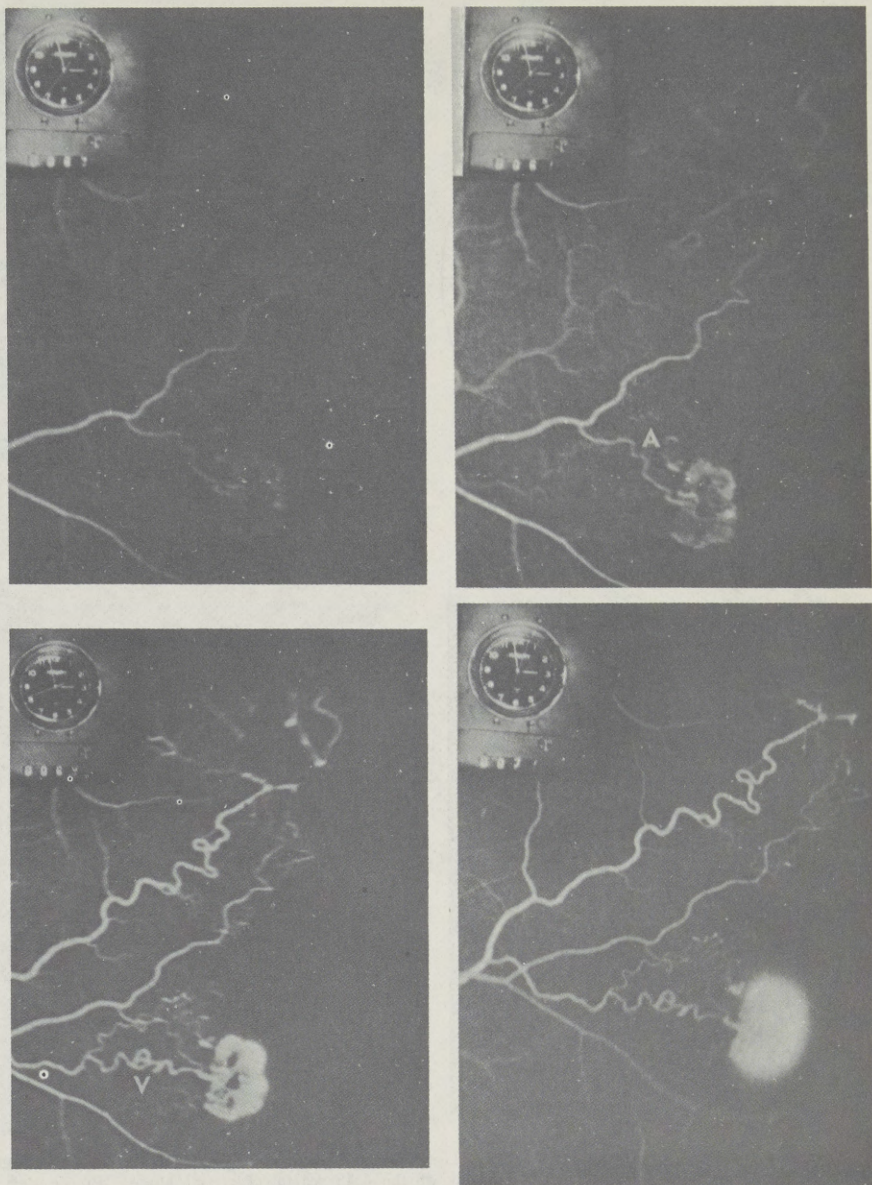


Fig. 7 (Goldberg). A small sea-fan lesion (Stage III), as shown by sequential fluorescein angiography. The neovascular capillary bed is perfused before venous flow commences. Top left: Early arterial phase; sea-fan is perfused. Top right: Early arteriovenous phase (A = arteriole). Bottom left: Late arteriovenous phase (V = venule). Bottom right: Late arteriovenous phase; fluorescein leaks out of sea-fan into vitreous.

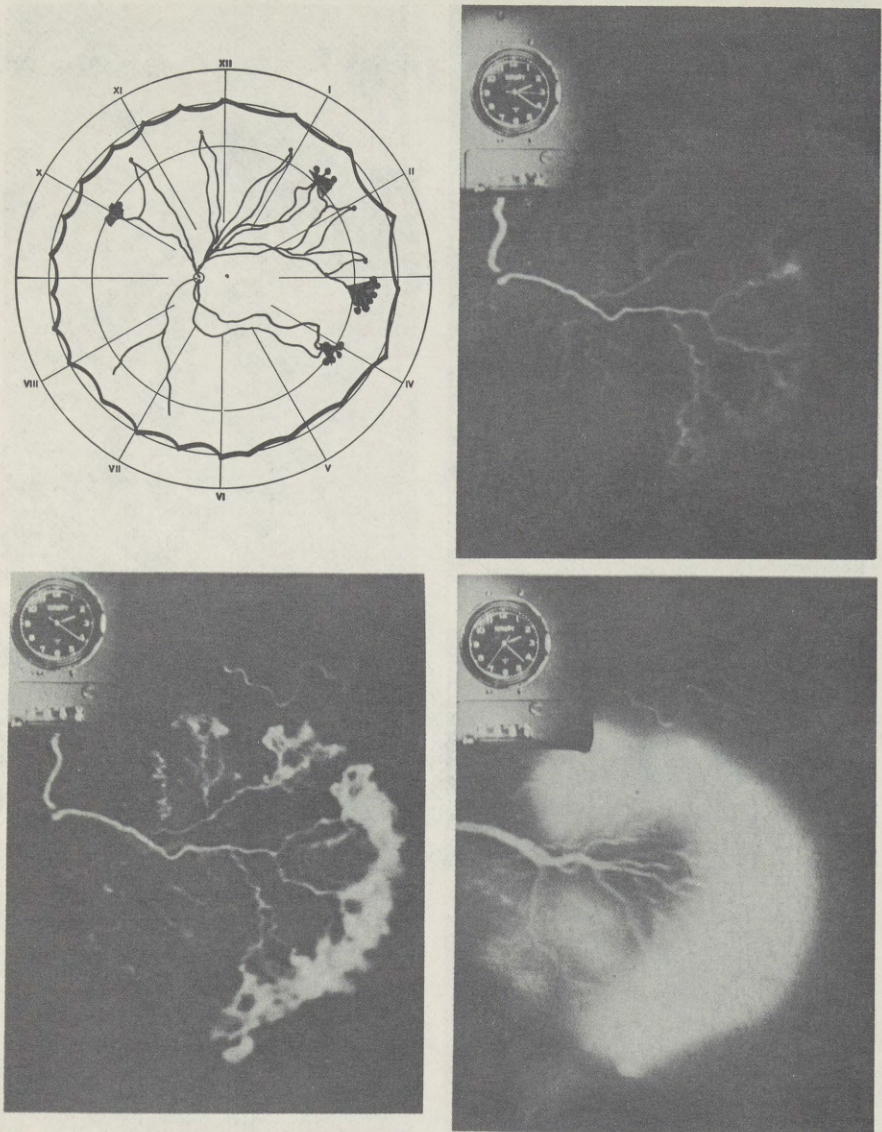


Fig. 8 (Goldberg). Top left: Sea-fans (Stage III neovascular lesions) are present at 10, 1:30, 3:15, and 4:15 o'clock. Top right: Fluorescein angiography of the 4:15 sea-fan (arterial phase). Bottom left: Early arteriovenous phase. Bottom right: late arteriovenous stage, when fluorescein leaks profusely from the neovascular capillary bed.



Fig. 9 (Goldberg). Fluorescein angiogram of a sea-fan (Stage III), demonstrating that such lesions tend to grow into an area of retinal ischemia (ISCH) caused by Stage I lesions.

complete detachment; in another, T.B., there was 225° detachment; in a third patient, L.S., there was 330° detachment in the right eye and 180° detachment in the left eye), and all were classified substage 4 (i.e., Stage V-4).

COMMENT

It is readily apparent that this study was based on cases with severely affected eyes. Under the conditions of this study, totally asymptomatic SC patients were less likely to be referred for ophthalmoscopic evaluation than were those with easily observed fundus abnormalities or those with visual complaints. Since my interest in the sea-fan lesion was known to the referring sources, it

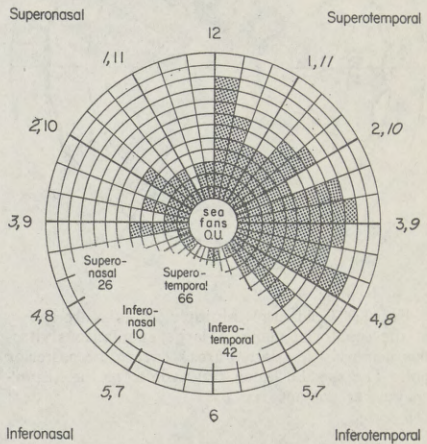
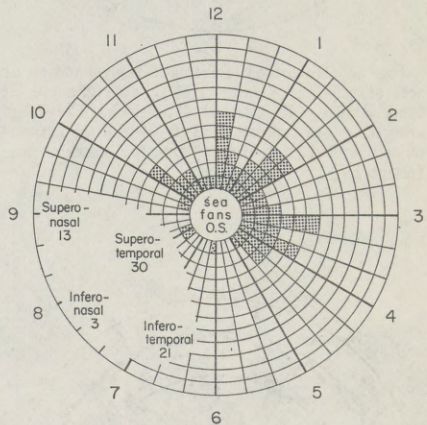
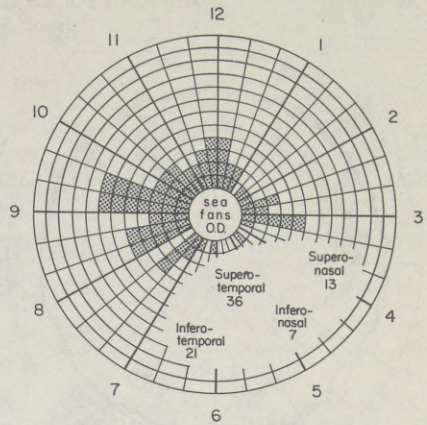


Fig. 10 (Goldberg). All the sea-fans of the 47 eyes in the series are plotted (each dotted rectangle represents one sea-fan). Predilection for the supero-temporal quadrant is seen when the right eyes are plotted (top) when the left eyes are plotted (center), and when all eyes are superimposed on the same chart (bottom).

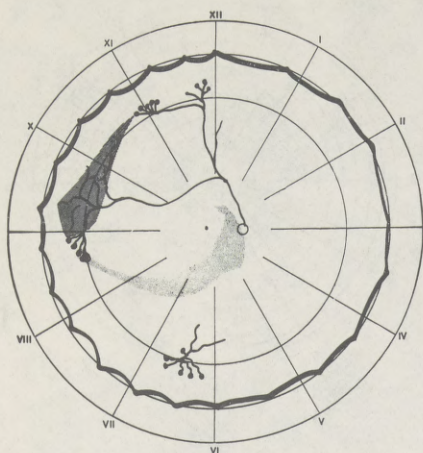


Fig. 11 (Goldberg). Schematic representation of several sea-fans (Stage III); i.e., right eye at 6:30, 8:30-10, 11, and 11:45 o'clock. The large arborizing sea-fan at 8:30-10 o'clock had spontaneously bled (dotted area) into the posterior pole (Stage IV).

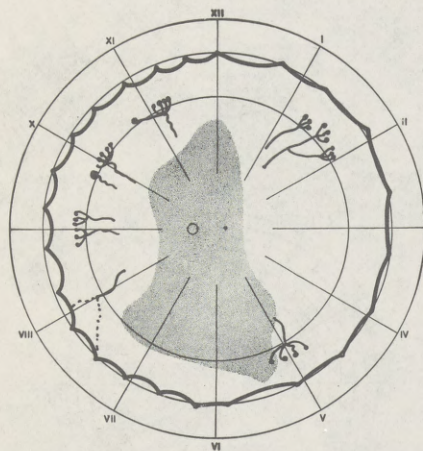


Fig. 12 (Goldberg). Multiple sea-fans are shown at the equatorial plane. A large, spontaneous vitreous hemorrhage (dotted area) covers the posterior pole. The specific lesion responsible for the hemorrhage was not apparent.

is likely that more cases with Stage III fundi are included in this series than would be included in a random sample of SC patients. It remains to be seen what percentage of unselected SC patients reach the various stages and substages of the classification proposed herein.

The sea-fan lesion is an immediately recognizable fundus abnormality in SC disease. Although not pathognomonic, it is highly characteristic of one stage (Stage III) in the development of proliferative retinopathy in SC disease. In perspective, then, this lesion represents one rather specific variety of proliferative retinopathy. I have also observed Stage III lesions (although less often) in other varieties of sickle hemoglobinopathies, including sickle thalassemia (Sthal), sickle cell disease (SS), and even in cases of sickle cell trait (SA).

The precise factors leading to the development of the sea-fan and other varieties of Stage III lesions are not well understood. The earliest clinically observed fundus abnormality in SC disease is peripheral arterio-

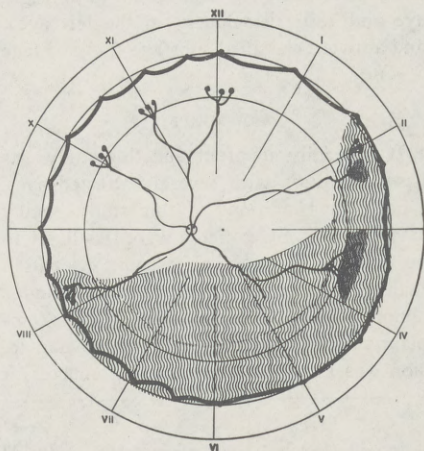


Fig. 13 (Goldberg). A retinal detachment (Stage V) from 1:30 to 8:30 o'clock is depicted, along with multiple sea-fans (Stage III lesions). Retinal tears were not found until surgery was performed.

lar occlusion with essentially complete absence of retinal vascular perfusion in involved areas of the peripheral retina. While ischemia and hypoxia may thus exist in the inner layers of the retina, currently no specific information is available concerning oxygenation of the outer retinal layers in SC disease.

Obstructed arterioles enlarge and apparently anastomose with adjacent venules at the interface of ischemic and nonischemic portions of the retina. This presumably sets the stage for neovascular proliferation on the retinal surface. Possibly in response to some chemotactic or other stimulus, and seeming in an attempt to revascularize the ischemic retina, vasoproliferative lesions sprout anteriorly from these anastomoses. Uncommonly neovascular growth may occur directly from obstructed arterioles. With time, recurrent localized vitreous hemorrhages occur, which, upon organization, result in white fibrous components in the proliferating tissue. How often—if ever—fibrous proliferations occur in the absence of pre-existing vitreous hemorrhage in PSR is currently unknown. It appears, however, that most of these fibrotic lesions do arise only after antecedent hemorrhage. These lesions leave the surface of the retina and project into the vitreous at varying intervals, possibly as a result of processes of vitreous contraction similar to those observed in proliferative diabetic retinopathy.

At any time in the development of neovascularization in PSR, massive vitreous hemorrhage, and, ultimately, retinal detachment may occur. Such detachments are associated with vitreous hemorrhage, contraction, and band formations, and are also usually associated with retinal tears.

By defining substages according to Table 1, a useful separation of Stages I, II, III, and IV (Table 3) is obtained. However the four eyes with retinal detachments in this series (Stage V, Tables 2 and 3) were all classified substage 4, because all had retinal de-

tachments of 91 degrees or more in extent. Although it may further complicate the classification, re-definition of Stage V's substages may prove to be necessary after further experience with SC detachments is gained. For example, one could define the substages of Stage V as: up to 90 degrees (1), 91-180 degrees (2), 181-270 degrees (3), and 271-360 degrees (4). Then, the four eyes with retinal detachment are separated into Stage V-2 (L.S., left eye), V-3 (T.B.), and V-4 (J.B. and right eye of L.S.), rather than including each in V-4 according to the current definitions of Table 1. Until additional cases are detected and evaluated, however, the cause of simplicity is served by defining the substages of all five major stages in the same way.

Comparative study of proliferative retinopathies associated with other diseases (retrolental fibroplasia, diabetes mellitus, carotid hypotension, Takayasu's disease) is of value in underscoring the apparent importance of ischemia in the development of PSR. In retrolental fibroplasia, for example, Patz⁶ and others have shown that the primary effect of hyperoxia in the immature retina is vasoconstriction and ischemia. In addition, hyperoxia has a direct cytotoxic, destructive effect on the vascular endothelium, with resulting obliteration of an affected vessel's lumen. After restoration of normal oxygen levels, the secondary response of vasoproliferation into ischemic areas of retina occurs. The peripheral and temporal predilection for this proliferative retinopathy, as well as the apparent purposeful attempt at revascularization of an ischemic retinal area, obviously resemble Stage III of PSR.

In diabetes mellitus, Davis and associates⁷ have suggested that ischemia is the underlying pathogenetic factor responsible for all stages of diabetic retinopathy, but especially for the proliferative phase. Taylor and Dobree⁸ have shown that proliferative diabetic retinopathy preferentially affects the retinal quadrants in a pattern similar to that of pro-

liferative sickle retinopathy—i.e., supero-temporal, inferotemporal, superonasal, inferonasal.

Knox^{9,10} has also reviewed reports that retinal neovascularization associated with atheromatous or surgically induced carotid insufficiency may be due primarily to ischemia of the retina. Similar evidence from fluorescein angiography is available in the case of the proliferative retinopathy of Takayasu's (pulseless) disease.¹¹⁻¹³

Charache and Conley¹⁴ have indicated that all events in sickle cell disease can be related to the sickling phenomenon, which in turn, may be considered a response to ischemia and hypoxia.

Although the high frequency of Stage I lesions in this series of patients with PSR underscores the importance of retinal ischemia in the development of subsequent neovascularization, the exact pathogenesis of peripheral arteriolar occlusion in SC disease has not yet been delineated. It is possible that the small caliber of involved peripheral vessels prevents passage of clumps of sickled erythrocytes. It is also possible that the oxygen tension in the temporal retina falls to a level that is low enough to induce local sickling and thrombosis.

The classification proposed in this paper reflects both the severity of the retinopathic process as well as the presumed natural course of events in its development. Since PSR can be quantitated relatively easily by means of this classification, it is now possible to describe the natural course of this disease in rather precise terms. It should also be possible to describe the effect of various types of prophylactic and therapeutic interventions in similar terms.^{15,16} In addition, use of this classification makes data on PSR from different institutions suitable for valid comparison.

A previously offered classification of sickle retinopathy¹⁷ appears inadequate in view of the new findings from fluorescein angiography and indirect ophthalmoscopy. With the use of these techniques, it is appar-

ent that vaso-occlusive phenomena are the first events to appear in the proliferative, retinopathic process and thus these are justifiably classified as Stage I. Neovascular proliferation occurs only subsequently; thus it is designated as Stage III. However, in the older attempt at classification,¹⁷ neovascularization and telangiectasia were called Grade 2, whereas obstruction of small veins and arteries was called Grade 3. The stage of arteriovenous communications (Stage II) was not delineated previously, possibly because of the unavailability of the fluorescein technique. Also, retinitis proliferans and vitreous hemorrhages were listed in the most advanced category of the older classification (Grade 4), but no grade was provided for the important stage of retinal detachment¹⁸ (Stage IV in the classification offered here).

SUMMARY

The ocular fundi of 24 selected patients with sickle cell-hemoglobin C disease were studied by indirect ophthalmoscopy and fluorescein angiography. Based on these studies, a new, quantitative classification of proliferative sickle retinopathy (PSR) was devised, which reflects both increasing severity of the retinopathy as well as its natural progression.

The first sign of PSR is peripheral arteriolar occlusions (Stage I); 91% of eyes were affected. Peripheral arteriolar-venular anastomoses (Stage II) were observed in 85% of eyes. Neovascular and fibrous proliferations (Stage III), which develop from the A-V anastomoses, occurred in 81% of eyes. Seafan lesions are part of this stage. Vitreous hemorrhages (Stage IV) from the neovascular proliferations occurred in approximately 30% of eyes, and retinal detachment (Stage V) was observed in 8% of eyes.

Pathogenetic parallels appear to exist between PSR and other vasoproliferative disorders, such as diabetes mellitus, hypotensive vascular diseases, and retrolental fibroplasia.

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TREATMENT OF PROLIFERATIVE SICKLE RETINOPATHY

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TREATMENT OF PROLIFERATIVE SICKLE RETINOPATHY

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RETINAL neovascularization is characteristic of certain varieties of sickle cell disease, particularly sickle cell-hemoglobin C disease (SC) and sickle cell thalassemia (S thal).^{1,2,4-6,10} Retinal neovascularization in sickling disorders frequently progresses in a sequential, predictable manner to stages of vitreous hemorrhage and retinal detachment, and it rarely, if ever, spontaneously regresses.² Thus, it can cause significant visual loss, often in young people. Surgical treatment of retinal detachment caused by proliferative sickle retinopathy (PSR) is difficult, often fails, and can result in blindness and phthisis bulbi.⁹ Consequently, an attempt to interrupt the natural course of PSR prior to the development of irreversible fundus complications seems rational.¹⁰

This report summarizes the results of efforts to obliterate neovascular lesions in 15 patients with SC disease and two patients with S thal. A total of 27 eyes were treated, mostly by xenon arc photocoagulation (Table 1).

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MATERIALS AND METHODS

Diagnosis of SC or S thal was established by starch block hemoglobin electrophoresis and by family studies.

Seventeen patients (27 eyes) were treated. Their average age was 32.5 years. For purposes of data analysis the eyes were classified into (1) a "therapeutic" group and (2) a "prophylactic" group. Retinas were included in the therapeutic group (10 eyes) if vitreous hemorrhage had already occurred spontaneously from preexistent neovascular lesions and had caused symptoms, or if these neovascular lesions had shown spontaneous growth and enlargement after several months of observation. Retinas were included in the prophylactic group (17 eyes) for coagulation if the neovascular lesions had not obviously enlarged and had not caused symptomatic hemorrhages (Table 1).

Prior to and following coagulation, visual acuity was determined on a distance Snellen chart, and peripheral visual fields were determined on the Goldmann hemispherical projection perimeter with the I-4-e and V-4-e white test objects.

After mydriasis, all patients' fundi were studied by the author at frequent intervals by indirect ophthalmoscopy, routine fundus photography, and fluorescein angiography. For purposes of comparison and follow-up, a recently described clinical classification of PSR was utilized (Table 2).¹ In this classification, retinal stages are divided and are

TABLE 1
RESULTS OF TREATMENT OF PROLIFERATIVE SICKLE RETINOPATHY

PATIENT	AGE AT LOW-FOLLOW-UP	SEX	HEMOGLOBIN	EYE	PRE-SENT-SYMPTOM	TYPE OF TREATMENT	THERAPEUTIC (Rx) OR PROLIFERATIVE (Px)	NO. OF TREATMENTS	SEA FANS OBLITERATED, SEAS TREATED	PRE-TREATMENT VISION	POST-TREATMENT VISION	STAGES AND SUBSTAGES OF RETINAL CLASSIFICATION*							COMPLICATIONS OR FIELD LOSS	FOLLOW-UP AFTER FIRST TREATMENT
												JUST PRIOR TO FIRST TREATMENT			POST-TREATMENT					
												III	IV	V	III	IV	V			
1	46	M	Sthal	OD	Vitreous hemorrhage OD	Xenon arc	Rx	1	1/2	20/20	20/25	1	2	0	1	2	0	0	36	
				OS	...	Xenon arc	Px	1	1/1	20/20	20/25	1	0	0	0	0	0	Supero-nasal field constric-tion from 55°-35°	27	
2	40	F	SC	OS	Vitreous hemorrhage OS	Cryo-coagulation	Rx	1	1/2	20/50	20/40	1	0	0	1	0	0	Supero-nasal field constric-tion from 60°-40°	4	
3	21	F	SC	OD	spots OD	Xenon arc	Rx	1	2/2	20/20	20/30	2	0	0	0	0	4	Retinal de-tachment	1.5	
				OS	...	Xenon arc	Px	2	2/3	20/20-2	20/20	2	1	0	1	0	0	0	7	
4	35	F	SC	OD	...	Xenon arc	Rx	1	5/6	20/20	20/20	2	0	0	1	0	0	Nasal field constric-tion from 55°-50°	1.5	
				OS	Flashing lights OS	Xenon arc	Rx	4	13/13	20/20	20/20-3	4	0	0	0	0	0	Nasal field constric-tion from 50°-30°	38	
5	22	M	SC	OD	Vitreous hemorrhage OD	Xenon arc	Rx	3	3/4	20/15	20/20	2	2	0	1	0	0	Nasal field constric-tion from 40°-25°	29	
				OS	...	Xenon arc	Rx	1	1/2	20/15	20/20	4	2	0	4	4	0	Vitreous hemor-rhage OS	1.5	

TABLE 1—Continued
RESULTS OF TREATMENT OF PROLIFERATIVE SICKLE RETINOPATHY

PATIENT	AGE AT FOLLOW-UP	SEX	HEMOGLOBIN	EYE	PRE-SENTING SYMPTOM	TREATMENT	THERAPEUTIC (Rx) OR PROPHYLACTIC (Px)	NO. OF TREATMENTS	SEA FANS OBLITERATED/TREATED	PRE-TREATMENT VISION	POST-TREATMENT VISION	STAGES AND SUBSTAGES OF RETINAL CLASSIFICATION*										COMPLICATIONS OR FIELD LOSS	FOLLOW-UP AFTER FIRST TREATMENT (MO)
												JUST PRIOR TO FIRST TREATMENT			POST-TREATMENT								
												III	IV	V	III	IV	V	VI	VII	VIII	IX		
6	32	M	SC	OS	Retinal detachment OD	Xenon arc	Px	2	0/1	20/20	20/20-2	1	0	0	1	0	0	0	0	55			
7	22	F	SC	OD	...	Argon laser	Rx	1	0/1 (markedly improved)	20/20	20/20	2	0	0	2	1		0	0	4			
8	43	F	SC	OS	...	Xenon arc	Px	2	0/1	20/20	20/20	1	0	0		1	0	0	0	16			
				OD	...	Xenon arc	Px	1	1/1	20/20	20/20	1	0	0	0	0	0	0	0	0	Nasal field constriction from 60°-40°	63	
9	24	F	SC	OS	...	Xenon arc	Px	3	3/3	20/20	20/20	1	0	0		0	0	0	0	63			
				Vitreous hemorrhage OS	Xenon arc	Rx	3	1/1	20/70 (vitreous hemorrhage)	20/20	1	2	0	0	0	0	0	0	0	Inferonasal field constriction from 50°-40°	10		
10	38	F	SC	OD	Vitreous hemorrhage OU	Xenon arc	Rx	1	4/4	20/20	20/30	2	4	0		0	4	0	Minor vitreous hemorrhage on second post-treatment day and again 1 yr later	61			

TABLE 1—Continued
RESULTS OF TREATMENT OF PROLIFERATIVE SICKLE RETINOPATHY

PA- TIENT	AGE AT FOL- LOW- UP	SEX	HEMO- GLOBIN	EYE	PRE- SENT- ING SYM- PTOM	TYPE OF TREAT- MENT	THERA- PEUTIC (Rx) OR PRO- PHYLACTIC (Px)	N.O. OF TREAT- MENTS	SEA FANS OBLITER- ATED/ TREATED	PRE- TREATMENT VISION	POST- TREATMENT VISION	STAGES AND SUBSTAGES OF RETINAL CLASSIFICATION*							COMPLICATIONS OR FIELD LOSS	FOL- LOW-UP AFTER FIRST TREAT- MENT)
												JUST PRIOR TO FIRST TREATMENT			POSTTREATMENT					
												III	IV	V	III	IV	V	III		
11	27	M	S thal	OD	Vitreous hemor- rhage OS	Xenon arc	Px	2	3/3	20/20	20/20	1	0	0	0	0	0	Nasal field constriction from 40°-20°	6.5	
				OS	...	Xenon arc	Rx	2	2/2	20/30	20/25	1	2	0	0	0	0	Inferior field con- striction from 40°-25°	6.5	
12	32	F	SC	OD	...	Xenon arc	Rx	2	0/1	20/20	20/25	2	0	0	2	0	0		46	
				OS	...	Xenon arc	Px	1	1/1	20/40	20/25	1	0	0	1	0	0		1	
13	31	F	SC	OD	Vitreous hemor- rhage OD	Xenon arc	Rx	3	6/8	20/15	20/25	2	0	0	1	0	0	Infero- temporal field con- striction from 40°-30°	108	
				OS	...	Xenon arc	Px	4	3/8	20/20	20/25	2	0	0	1	3	0	Superior field con- striction from 60°-30°	33	
14	41	F	SC	OS	...	Xenon arc	Rx	2	1/1	20/200 (macular cyst)	20/200	1	4	0	0	0	0		23	

TABLE 1—Continued
RESULTS OF TREATMENT OF PROLIFERATIVE SACKLE RETINOPATHY

PATIENT	AGE AT FOLLOW-UP	SEX	HEMOGLOBIN	EYE	PRE-TREATING SYMPTOM	TYPE OF TREATMENT	THERAPEUTIC (Rx) OR PROPHYLACTIC (Px)	NO. OF TREATMENTS	SEA FANS OBLITERATED/TREATED	PRE-TREATMENT VISION	POST-TREATMENT VISION	STAGES AND SUBSTAGES OF RETINAL CLASSIFICATION*					COMPLICATIONS OR FIELD LOSS	FOLLOW-UP AFTER TREATMENT			
												STAGES PRIOR TO FIRST TREATMENT							POST-TREATMENT		
												III	IV	V	III	IV			V		
15	31	F	SC	OS	vitreous hemorrhage OS	Xenon arc	Rx	8	3/3	20/20	20/20-2	2	2	0	0	3	0	48	Minor vitreous hemorrhage; field constriction superiorly from 60°-50° and inferonasally from 40°-30°		
16	31	F	SC	OD	vitreous hemorrhage OD	Xenon arc	Rx	3	1/2	20/50	20/20	1	1	0	1	0	0	17	Post-treatment iritis		
				OS	...	Xenon arc	Px	1	2/2	20/15	20/15	2	0	0	0	0	0	1			
17	28	F	SC	OS	vitreous hemorrhage OS	Xenon arc	Rx	2	0/3	20/40	20/50	2	1	0	2	1	0	4			
TOTALS 17 patients (4 M; 13 F) 27 eyes Av age 32.5													1.6 =av	0.85 =av	0 =av	0.77 =av	0.66 =av	0.15 =av	12 field constriction 1 retinal detachment 1 post-coagulation iritis 3 vitreous hemorrhages	30.4 =av	

* Stage III = neovascular and fibrous proliferation; stage IV = vitreous hemorrhage; stage V = retinal detachment. Arabic numerals = substage: 0 = none; 1 = $\leq 10^\circ$ of circumferential fundus involvement (or 4.6 proliferations or 3.4 stages); 2 = 31° to 60° of circumferential fundus involvement (or 4.6 proliferations or 3.4 stages); 3 = 61° to 90° of circumferential fundus involvement (or 7.9 proliferations or 3.4 stages); 4 = $\geq 91^\circ$ of circumferential fundus involvement (or ≥ 10 proliferations or 3.4 stages).

indicated by Roman numerals in the following manner: stage I, peripheral arteriolar occlusions; stage II, peripheral arteriolar-venular anastomoses; stage III, neovascular and fibrous proliferations; stage IV, vitreous hemorrhage; and stage V, retinal detachment. For purposes of qualification and for further quantification, each stage is divided by

Arabic numerals into substages which reflect the *extent* of fundus involvement by whatever retinal lesion is characteristic of that particular stage (Table 2). That is, each retina was graded into substages for *all* of the major stages. For example, a retina might be simultaneously classified "I-3, II-2, III-2, IV-1, V-0" (Table 2).

TABLE 2
CLASSIFICATION OF PROLIFERATIVE SICKLE RETINOPATHY
(FOR USE WITH INDIRECT OPHTHALMOSCOPY AND FLUORESCIN ANGIOGRAPHY)

Stage I. Peripheral arteriolar occlusions	
Substages	
0.	None
1.	$\leq 30^\circ$ circumferential involvement and ≤ 3 occluded arterioles
2.	31° - 60° circumferential involvement or 4-6 occluded arterioles
3.	61° - 90° circumferential involvement or 7-9 occluded arterioles
4.	$\geq 91^\circ$ circumferential involvement or ≥ 10 occluded arterioles
Stage II. Peripheral arteriolar-venular anastomoses	
Substages	
0.	None
1.	$\leq 30^\circ$ circumferential involvement and ≤ 3 discrete anastomoses
2.	31° - 60° circumferential involvement or 4-6 discrete anastomoses
3.	61° - 90° circumferential involvement or 7-9 discrete anastomoses
4.	$\geq 91^\circ$ circumferential involvement or ≥ 10 discrete anastomoses
Stage III. Neovascular and fibrous proliferation	
Substages	
0.	None
1.	$\leq 30^\circ$ circumferential involvement and ≤ 3 discrete proliferations
2.	31° - 60° circumferential involvement or 4-6 discrete proliferations
3.	61° - 90° circumferential involvement or 7-9 discrete proliferations
4.	$\geq 91^\circ$ circumferential involvement or ≥ 10 discrete proliferations
Stage IV. Vitreous Hemorrhage	
Substages	
0.	None
1.	$\leq 30^\circ$ circumferential involvement
2.	31° - 60° circumferential involvement
3.	61° - 90° circumferential involvement
4.	$\geq 91^\circ$ circumferential involvement
Stage V. Retinal detachment	
Substages	
0.	None
1.	$\leq 30^\circ$ circumferential involvement
2.	31° - 60° circumferential involvement
3.	61° - 90° circumferential involvement
4.	$\geq 91^\circ$ circumferential involvement

The lesions of stages III, IV, and V are the ones which are responsible for visual symptomatology in PSR. Consequently, for purposes of this report, only these stages were assessed pre-coagulation and postcoagulation (Tables 1 and 3 through 5). Stage III lesions were not considered to be obliterated unless complete absence of fluorescein leakage into the vitreous could be demonstrated by fundus photography 10 to 15 minutes after intravenous injection of dye.

Twenty-five eyes were treated by photocoagulation with the West German Zeiss xenon arc photocoagulator. In most instances, the regular "green" load setting was utilized, with 3°, 4.5°, or 6° apertures in the image field diaphragm, and with a slightly constricted iris diaphragm (approximately setting No. 4). Photocoagulation lesions of moderate intensity (gray-white retinal reaction) were considered desirable. Retrobulbar anesthesia was used in all patients. One eye was treated with transconjunctival cryocoagulation, and one eye was treated with argon laser coagulation.

When a neovascular lesion lay flat on the retina, therapy was usually directed at the abnormal capillary bed. When a neovascular lesion was found to be elevated from the retina, therapy was directed to the feeding arterioles at its posterior edge (between the lesion and the optic disc), where these vessels were flat on the retina. Because of the characteristic manner of development of neovascular lesions in PSR, arteriolar feeder vessels are almost never found at these lesions' anterior borders (that is, between the neovascular lesions and the ora serrata).^{1,2} Thus, in practical terms, there is no need for photocoagulation between the neovascularized retina and the ora serrata. When more than one photocoagulation was indicated, as evidenced by persistent perfusion of the neovascular lesion with intravenously

administered fluorescein, an interval of at least six weeks from the previous treatment was allowed. Patients were patched bilaterally and kept in bed for two to three days following photocoagulation.

Follow-up observations were recorded at 1 to 108 months after institution of treatment. The average period of time during which follow-up observations were made was 30.4 months (Fig 1).

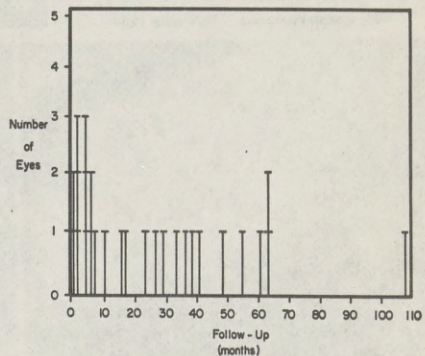


FIG 1—Follow-up of 27 eyes treated for PSR. Average period of time was 30.4 months.

Control observations were provided by a similar study by the author of the natural, untreated course of PSR in the eyes of many of the patients reported herein.² Statistically significant differences between the untreated and treated course of PSR were judged by the chi-square test and by Fisher's exact test.

RESULTS

Of the total number of eyes in this study, 16 (59%) required more than one photocoagulation (Table 1 and Figs 2 and 3). The average number of treatment episodes per eye was 2.1, with a range of one to eight. Seventy-four percent of the neovascular lesions ("sea-

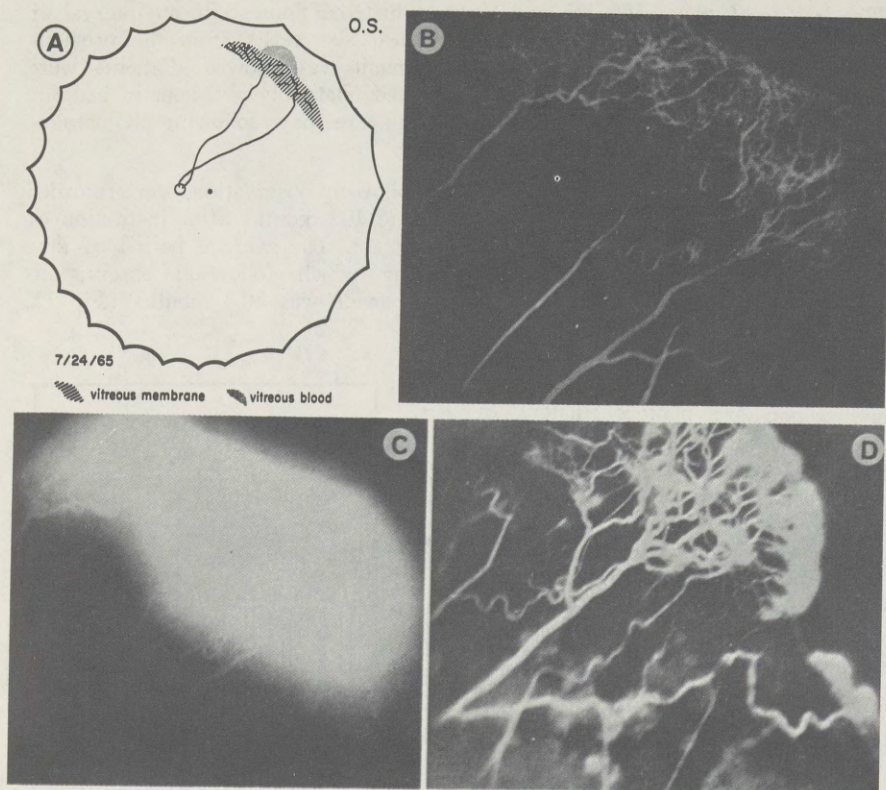


FIG 2—(A) Schematic appearance of left eye of patient 15. Large preretinal neovascular and fibrous proliferation ("sea fan") is present superotemporally, a characteristic location.^{6,7} (B) Fluorescein angiogram of superotemporal neovascularization in early arteriovenous phase. Numerous arteriolar feeder vessels and complex capillary bed are revealed. (C) Late arteriovenous phase shows leakage of fluorescein from neovascular capillary bed into vitreous. (D) Late arteriovenous phase after one photocoagulation of arteriolar feeder vessels reveals slight diminution in capillary vessels.

fans"¹⁰) were completely obliterated or were rendered harmless by having their arteriolar supply shut off, as shown by fluorescein fundus photography (Fig 4). Fluorescein angiography was essential in determining if the neovascular tissues were still carrying blood following photocoagulation. With ophthalmoscopy alone, perfused neovascular channels were easily camouflaged by the surrounding, hyperpigmented photocoagulation scar (Fig 5).

Small sea fans (stage III-1), particularly when they lay flat on the retina, were easily obliterated, often with only one photocoagulation treatment (Fig 6). Larger sea fans (such as stage III-4), particularly when elevated into a preretinal location, or when supplied by more than one arteriolar feeder vessel, were considerably more difficult to treat successfully (Figs 7 and 8). In such instances, cessation of perfusion of the sea fans was more difficult to obtain, and

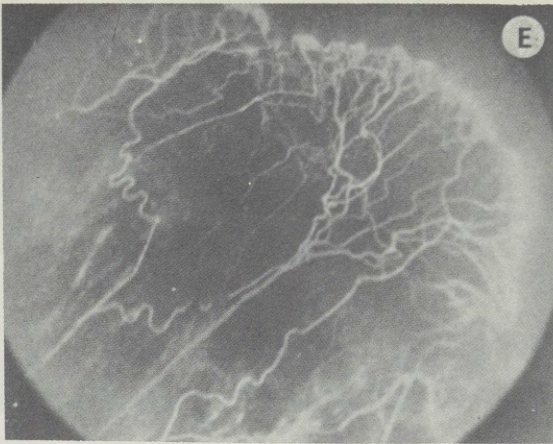
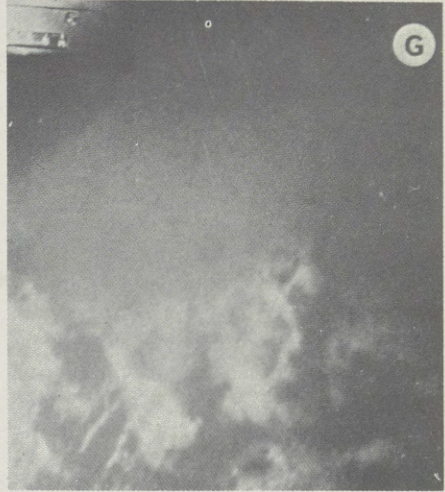
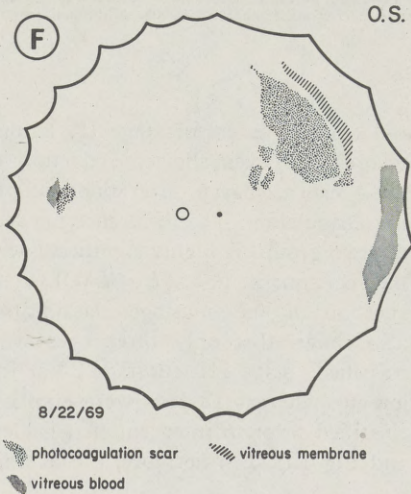


FIG 2 (continued)—(E) Late arteriovenous phase after another episode of photocoagulation. Fluorescein angiogram reveals further diminution of capillary bed, but perfusion of neovascular tissue persists.



(F) Schematic appearance of fundus after eight photocoagulations. (G) Following eighth photocoagulation, fluorescein angiogram during late arteriovenous phase confirms complete absence of perfusion of neovascular tissue (seen as dark area in upper right of photo). Mottled appearance is created by retinal pigment migration. There is no leakage of dye.

photocoagulation-induced vitreous hemorrhage seemed more likely to occur. Of the 58 treatment episodes, three (5.2%) were complicated by vitreous hemorrhage within 24 hours, and all three occurred with large, elevated, complex sea fans (Fig 2). Two of the hemorrhages were minor and cleared rapidly. The third re-

mained ophthalmoscopically visible and caused symptoms for at least six months. During the course of photocoagulation, three other eyes rebled spontaneously; that is, there was no apparent temporal relationship to a previous photocoagulation episode.

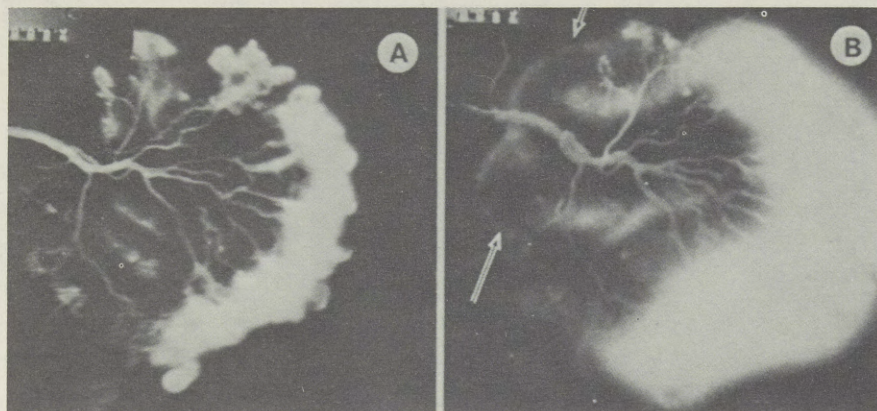


FIG 3—Fluorescein angiograms of left eye of patient 13 taken during arteriovenous phase. Sea fan at the 4:30 position is shown. (A) Prior to photocoagulation. (B) Following accurate placement of several photocoagulation burns on and around feeder vessels (arrows), fluorescein perfusion of sea fan persists. Additional coagulation is required to occlude feeder vessels.

At the onset of therapy, all 27 eyes in this series (100%) had stage III (neovascular) lesions (Fig 9). At the time of the most recent follow-up, this number had been reduced to 15, or 55% of the total. The eyes used as controls² and the eyes treated by coagulation were divided into those which showed reduction in extent of neovascularization (as judged by the substage grades for stage III lesions) and those which did not (Table 3). No eye showed spontaneous

reduction in extent of stage III lesions, whereas 17 eyes showed reduction of these neovascular proliferations following coagulation. The difference between the two groups is highly significant with the chi-square test ($P < 0.001$). Inspection of the substage classification also shows that only three eyes were classified "stage III, substage 2" at follow-up, whereas 12 eyes were similarly classified prior to intervention (Table 1 and Fig 10). Furthermore, the average

TABLE 3
REDUCTION IN EXTENT OF STAGE III LESIONS*
(NEOVASCULAR AND FIBROUS PROLIFERATIONS)

GROUP	LESIONS REDUCED (NO. OF EYES)	LESIONS UNCHANGED OR PROGRESSED (NO. OF EYES)	CHI-SQUARE TEST
Control	0	25	} $P < 0.001$
Treated by coagulation	17	10	

* As judged by the substage grades of stage III.

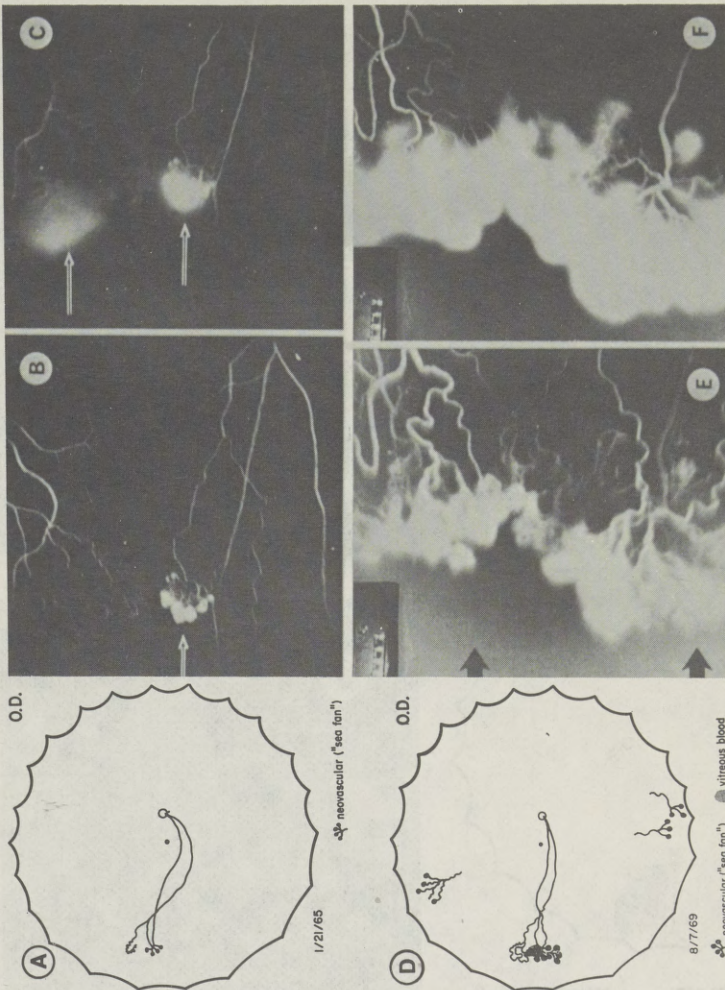


FIG 4—In right eye of patient 4, neovascular tissue showed spontaneous growth, following which photocoagulation was performed. (A) Schematic appearance of temporal neovascularization. (B) Early arteriovenous phase of fluorescein angiography compared with C shows sea fan (arrow) at 10:30 position (1965). (C) Late arteriovenous phase of lesion seen in B. Fluorescein leakage reveals previously inapparent growth of temporal neovascular tissue. New sea fans have appeared. (D) Schematic appearance of same retinal area four years later, revealing significant growth of temporal neovascular tissue. (E) Late arteriovenous phase of fluorescein angiography reveals enlarged sea fans in 9:30 and 10:00 clock positions. (F) Late arteriovenous phase of lesion seen in E reveals fluorescein leakage into vitreous. Arrows correspond to position in B and C.

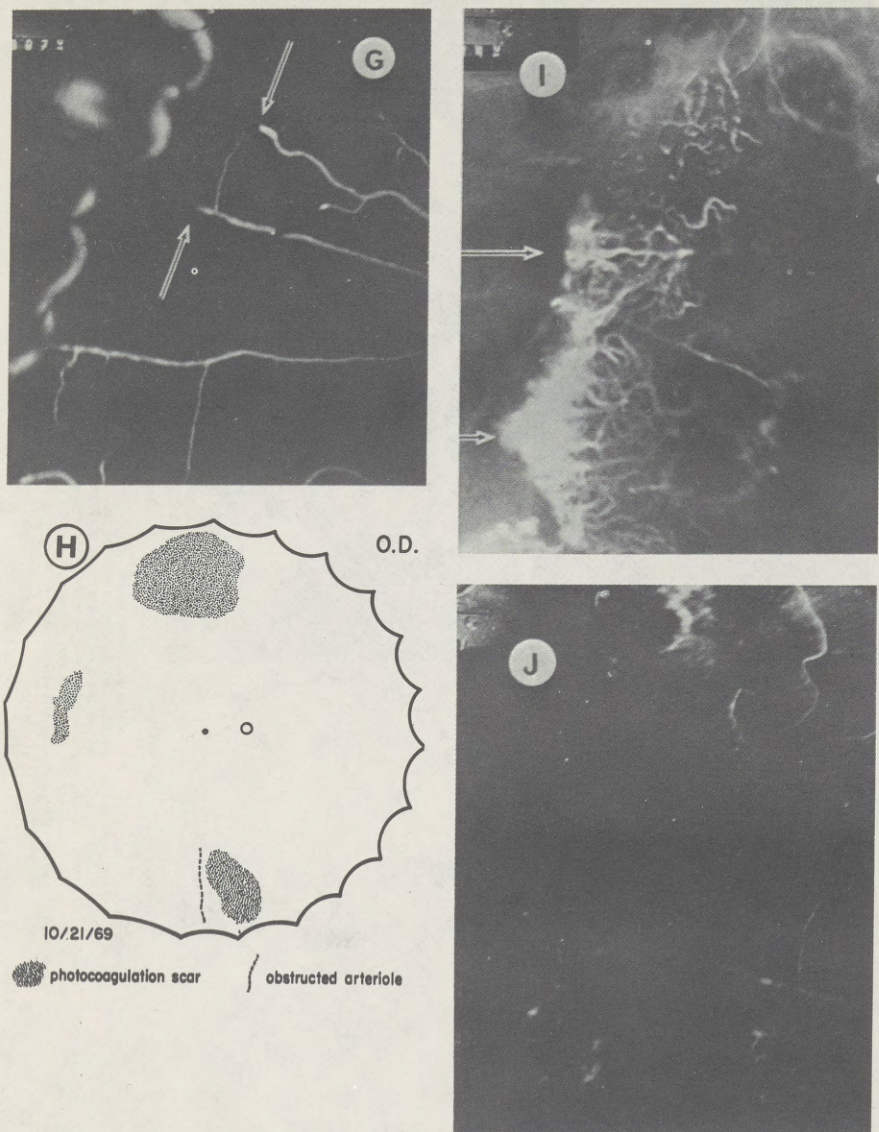
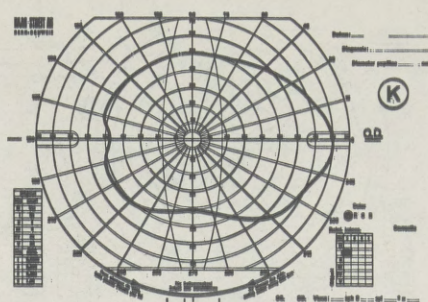


FIG 4 (continued)—(G) Immediately after photocoagulation of arteriolar feeder vessels, abrupt cessation of perfusion has occurred (arrows). (H) Schematic appearance of sea fans ten weeks after first and only photocoagulation. (I) Fluorescein angiogram (late arteriovenous phase). Ten weeks following photocoagulation of 9:30 and 10-o'clock feeder vessels, neovascular tissue appears white but is not perfused and, consequently, does not leak fluorescein. Arrows correspond to Fig 4E; photocoagulation scars appear as black circles. (J) Several months after photocoagulation, angiogram (late arteriovenous phase) of retinal area depicted in Fig 4E, F, G, and I reveals complete atrophy and lack of perfusion of neovascular tissue.



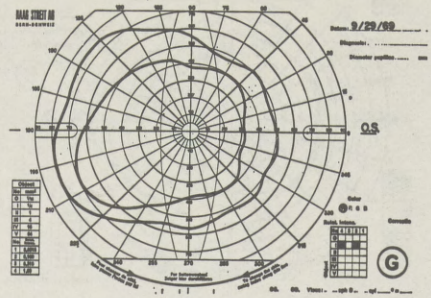


FIG 5 (continued)—(E) Flourescein angiogram of lesion seen in *D* reveals that an arteriolar feeder vessel continues to perfuse sea fan (late arteriovenous phase). (F) Following a second (and last) photocoagulation, all feeder vessels are occluded, and sea fan is no longer perfused. Dumbbell-shaped white area represents exposed choroidal vessels. (G) Following temporal photocoagulation, there is insignificant blunting of nasal visual field.

substage classification for stage III lesions decreased from an initial value of 1.6 to a value of 0.77 at follow-up (Table 4). Individual eyes, however, occasionally showed marked exacerbation of stage III lesions following incomplete photocoagulation (Fig 7). Further treatment episodes are planned for residual neovascular lesions.

Initially, 11 (41%) of the 27 eyes had signs of spontaneous vitreous hemorrhage (stage IV). After therapy, this number had diminished by the time of

follow-up to seven eyes, or 26% of the total (Fig 9 and Table 4). Inspection of the substage classification shows that only one eye was classified "stage IV, substage 2" at follow-up, whereas six eyes were similarly classified initially (Table 1 and Fig 11). Furthermore, the average classification for stage IV lesions decreased from an initial value of 0.85 to a value of 0.66 (Tables 1 and 4) at follow-up. For purposes of further comparison, both the eyes in the control group² and the eyes treated by coagulation were divided into those which showed reduction in extent or no change (as judged by the substage grades for stage IV lesions) and those which had

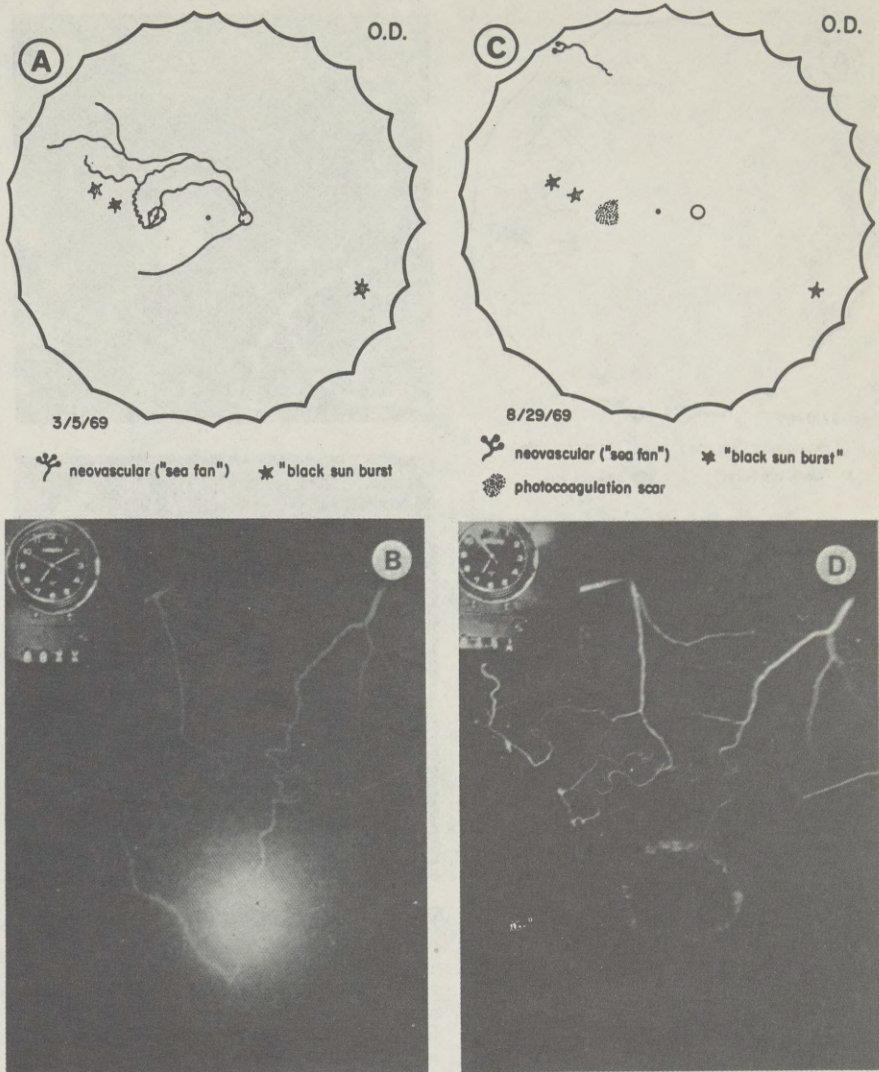


FIG 6—In patient 11 S that retinopathy was treated by direct application of photocoagulation to small neovascular capillary bed. (A) Schematic appearance of right eye. (B) Fluorescein angiogram (late arteriovenous phase) of 9-o'clock sea fan shows leakage of fluorescein into vitreous. (C) Schematic appearance of retina after photocoagulation. (D) Following placement of one spot of photocoagulation directly onto sea fan, fluorescein angiogram (arteriovenous phase) shows complete obliteration of neovascular tissue.

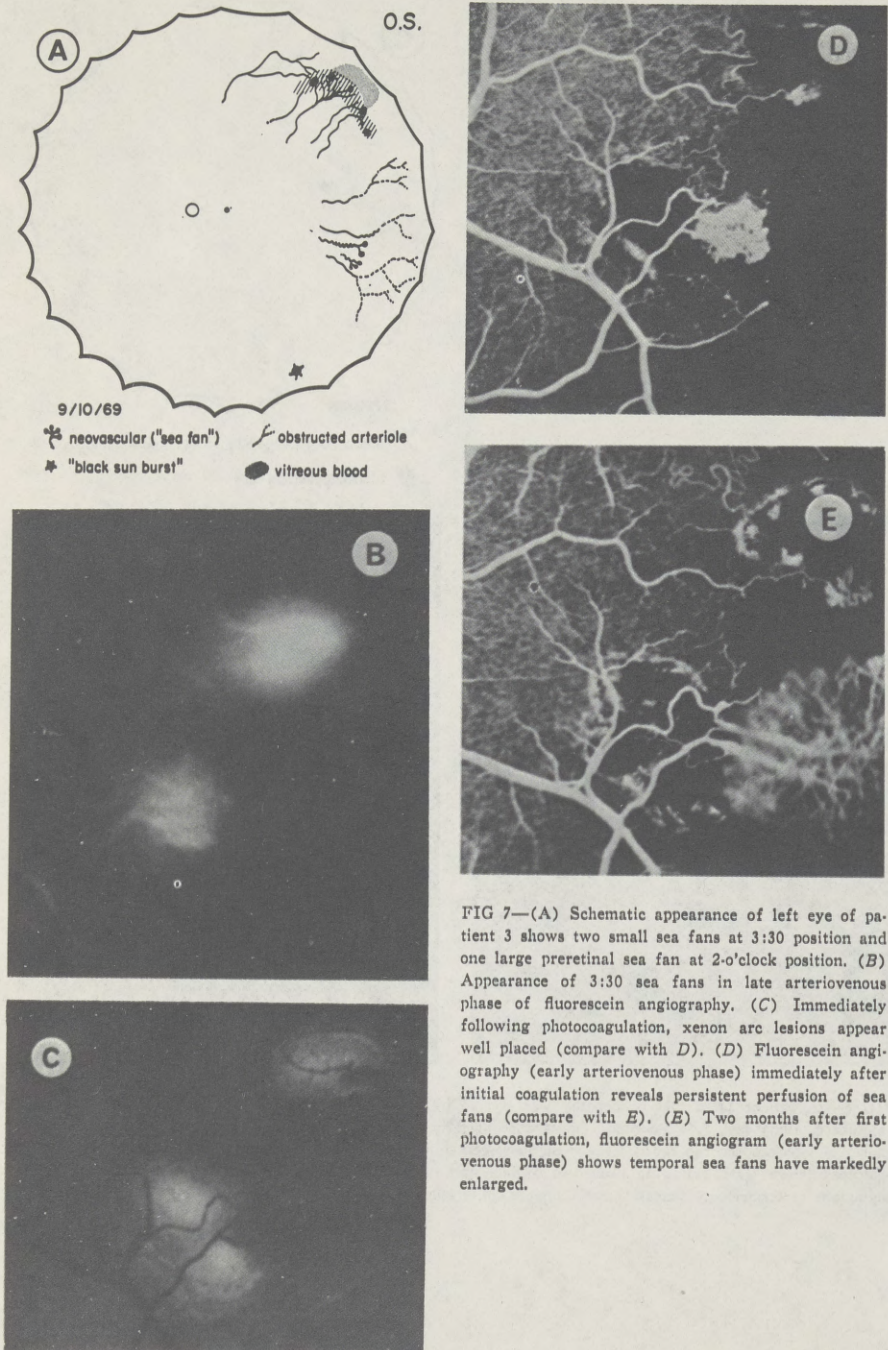


FIG 7—(A) Schematic appearance of left eye of patient 3 shows two small sea fans at 3:30 position and one large preretinal sea fan at 2-o'clock position. (B) Appearance of 3:30 sea fans in late arteriovenous phase of fluorescein angiography. (C) Immediately following photocoagulation, xenon arc lesions appear well placed (compare with D). (D) Fluorescein angiography (early arteriovenous phase) immediately after initial coagulation reveals persistent perfusion of sea fans (compare with E). (E) Two months after first photocoagulation, fluorescein angiogram (early arteriovenous phase) shows temporal sea fans have markedly enlarged.

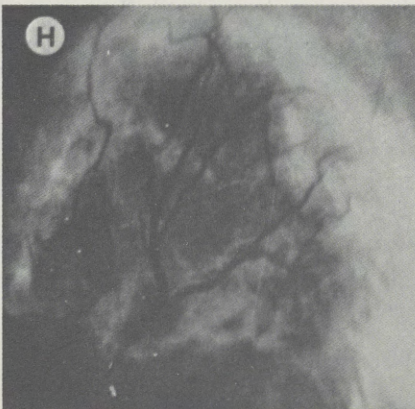
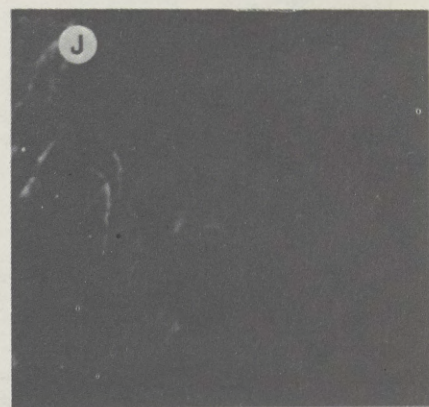
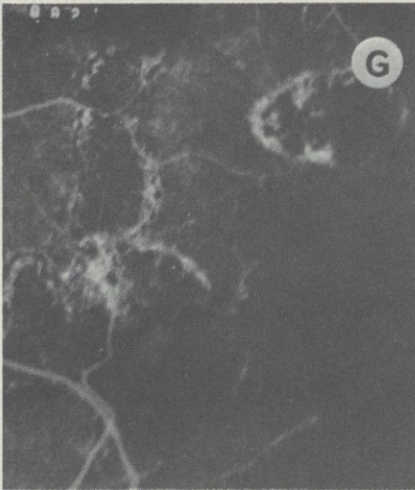
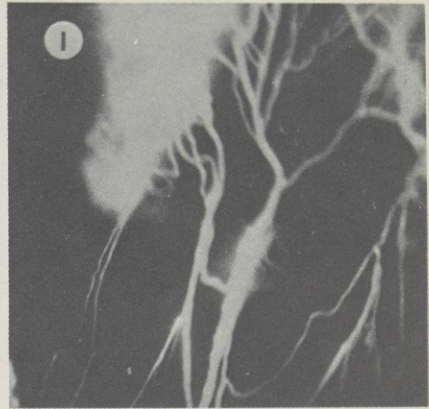
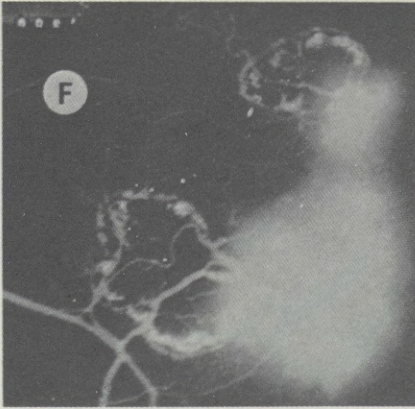


FIG 7 (continued)—(F) Two months after first photocoagulation, late arteriovenous phase of fluorescein angiogram reveals persistent leakage of dye into vitreous. (G) Fluorescein angiogram (late arteriovenous phase) following a second photocoagulation shows temporal sea fans completely free of perfusion. (H) Superotemporal preretinal sea fan prior to fluorescein injection. (I) Fluorescein angiogram of superotemporal sea fan. Note numerous feeder vessels and leaking capillary bed. (J) Following two episodes of photocoagulation to its feeder vessels, superotemporal sea fan is no longer perfused.

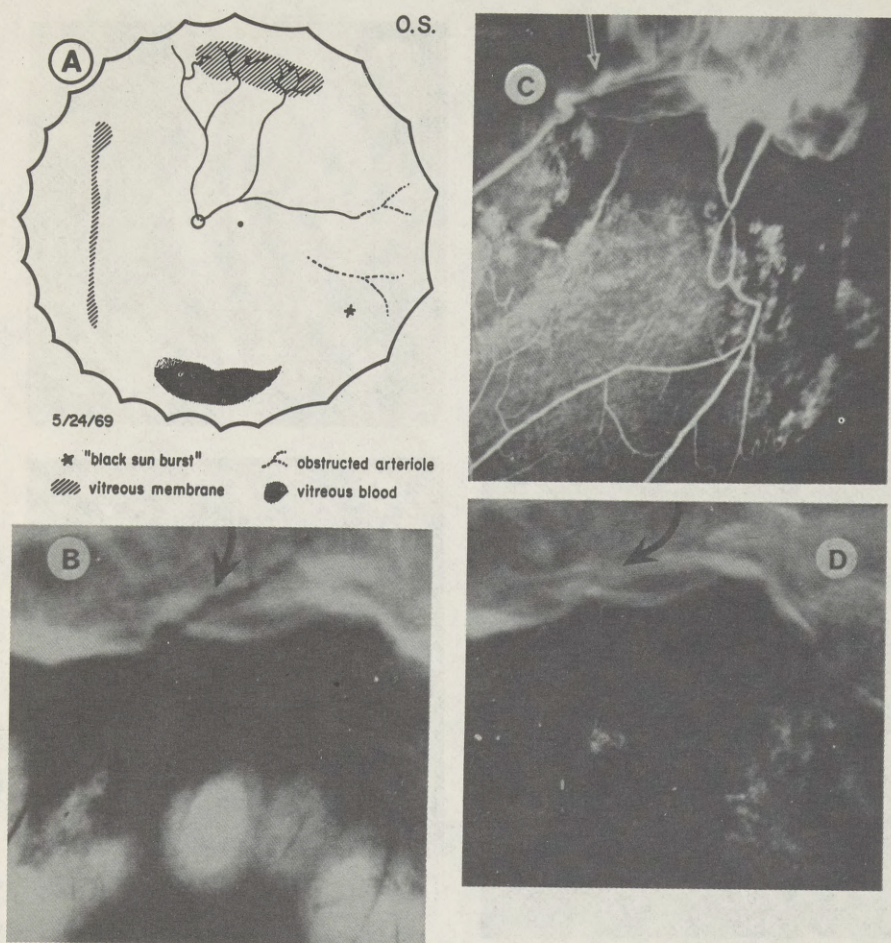


FIG 8—(A) Schematic appearance of left eye of patient 9. Large preretinal, neovascularized membrane is present superotemporally. (B) Appearance of sea fan immediately after first photocoagulation (white circles). Photocoagulation lesions appear well placed, but large vessel (arrow) in neovascular and fibrous sheet appears to be perfused (compare with C). (C) Fluorescein angiogram (late arteriovenous phase) of superotemporal sea fan one month after first photocoagulation confirms persistent perfusion of vessel indicated in B (arrow) and of entire neovascular capillary bed. (D) Appearance of sea fan one month after second photocoagulation. Large feeder vessel shown in B and C is no longer apparent (arrow).

progressed (Table 5). Inspection of Table 5 suggests that the extent of vitreous hemorrhages increased more in the control group of eyes (24%) than in the eyes treated by coagulation (15%), but

the difference was not statistically significant.

When the initial and follow-up data are divided as to those eyes for which

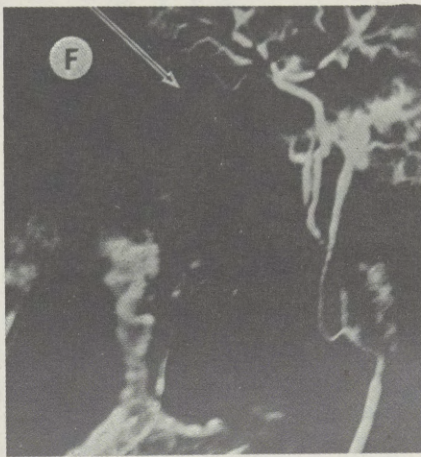
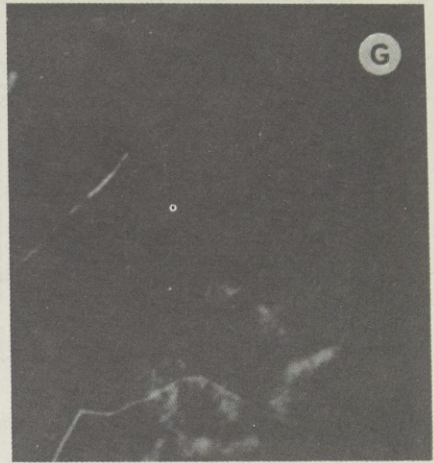
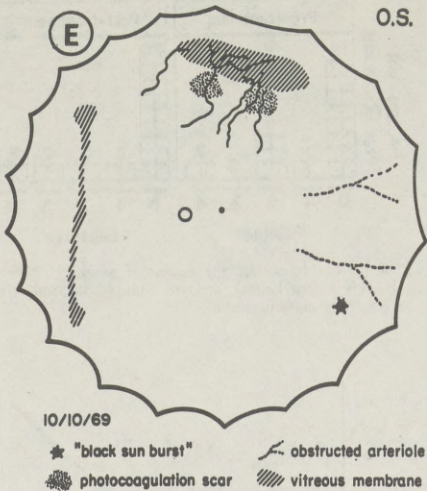


FIG 8 (continued)—(E) Schematic appearance of photocoagulations to feeder vessels. (F) Fluorescein angiogram (late arteriovenous phase) confirms occlusion of large vessel indicated in B and C (arrow), but residual perfusion of thinned-out capillary bed is apparent. (G) Fluorescein angiogram (late arteriovenous phase following third (and last) photocoagulation. Feeder vessels are totally obstructed, and sea fan is no longer perfused.

photocoagulation was employed for therapeutic indications and those for which it was employed prophylactically, no major difference in the results for stages III and IV are apparent (Table 4), even though the eyes in the therapeutic group had more advanced PSR. At the time of the most recent follow-up, approximately half of the eyes showed stage III (neovascular) lesions which were either nonperfused (Fig 4) or which were completely obliterated

(Fig 6), irrespective of the original indication for intervention (Table 4).

One retinal detachment (stage V) occurred six weeks after obviously excessive photocoagulation (overload or "red" intensity), but this did not constitute a statistically significant difference from the control group of eyes.² This retinal detachment was successfully repaired, and all the sea fans were obliterated.⁹ All other eyes were treated with regular load ("green") intensities,

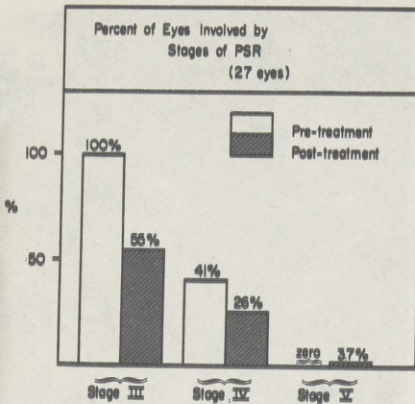


FIG 9—Percent of eyes involved by stages of PSR (27 eyes).

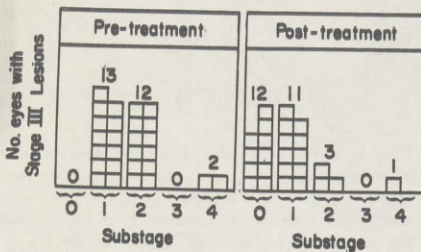


FIG 10—At follow-up, the extent of stage III (neovascular) lesions is reduced, as indicated by substage classifications.

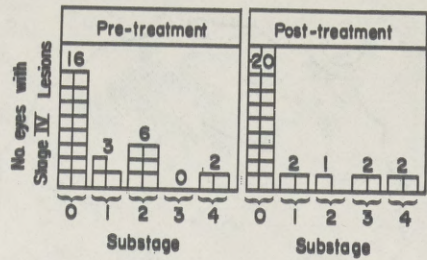


FIG 11—At follow-up, the extent of stage IV lesions (vitreous hemorrhages) appears reduced, as indicated by substage classifications.

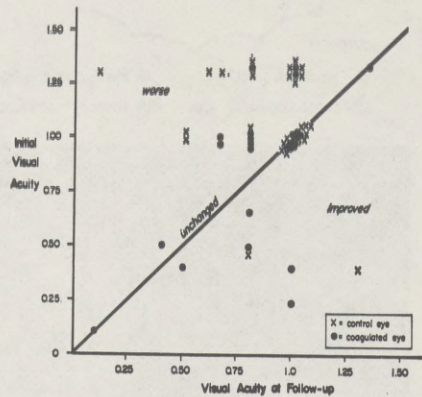


FIG 12—Plotted for all eyes is initial visual acuity vs visual acuity at follow-up.

without subsequent detachment of the retina.

Visual acuity was converted to decimal notation and plotted as worse, unchanged, or improved (Fig 12). The visual acuities of eyes in the control group appear clumped predominantly in the "worse" category. Statistical analysis by the chi-square test, however, reveals no significant difference from the eyes treated by coagulation (Table 6A). However, if the visual acuities are divided as to those which either improved or did not decrease more than two Snellen lines, vs those which did decrease

more than two Snellen lines, the eyes in the control group fared significantly worse than did the eyes treated by coagulation (Table 6B).

The peripheral visual field isopters were somewhat constricted by photocoagulation in 12 of the 27 eyes (44%). In no such instance, however, was the field constriction noticeable to the patient, except under circumstances of perimetric testing. Because most treatments of neovascular lesions occurred in the anterior equatorial regions of the retina, often superotemporally,^{1,2} corresponding field defects remained peripheral and often occurred inferonasally, an

TABLE 4
SUMMARY OF TREATMENT RESULTS ON PSR

		INITIAL STAGE			FOLLOW-UP STAGE		
		III	IV	V	III	IV	V
Therapeutic indications	Substage average	1.9	1.3	0	0.95	0.88	0.23
(17 eyes)	% of eyes affected	17=100%	10=59%	0	10=59%	6=35%	1=5.8%
Prophy-lactic indications	Substage average	1.3	0.1	0	0.5	0.3	0
(10 eyes)	% of eyes affected	10=100%	1=10%	0	5=50%	1=10%	0
Total	Substage average	1.6	0.85	0	0.77	0.66	0.15
(27 eyes)	% of eyes affected	27=100%	11=41%	0	15=55%	7=26%	1=3.7%

area in which visual field defects did not appear to interfere with performance of normal daily functions.

COMMENT

In previous communications, evidence for a postulated pathogenesis of PSR has been presented.^{1,2} In this proposed sequence of events, the primary abnor-

mal retinal event appears to be arteriolar and capillary obstruction (stage I). Subsequently, arteriolar-venular connections (stage II) can be demonstrated, both by fluorescein angiography^{1,2} and by trypsin digestion of whole mounts of retinas affected by PSR.⁸ The onset of neovascular growth from the preceding lesions ushers in stage III.

TABLE 5
REDUCTION IN EXTENT OF STAGE IV LESIONS*
(VITREOUS HEMORRHAGES)

GROUP	LESIONS REDUCED OR UNCHANGED (NO. OF EYES)	LESIONS PROGRESSED (NO. OF EYES)	CHI-SQUARE TEST
Control	19	6 (24%)	P > 0.50
Treated by coagulation	23	4 (15%)	

* As judged by the substage grades of stage IV.

TABLE 6
CHANGE IN VISUAL ACUITY
A

GROUP	VISION UNCHANGED OR IMPROVED (BY DECIMAL NOTATION) (NO. OF EYES)	VISION DECREASED (BY DECIMAL NOTATION) (NO. OF EYES)	CHI-SQUARE TEST
Control	11	14	} $P > 0.2$
Treated by coagulation	17	10	

B

GROUP	VISION UNCHANGED (WITHIN 2 SNELLEN LINES) OR IMPROVED (NO. OF EYES)	VISION DECREASED (BY > 2 SNELLEN LINES) (NO. OF EYES)	FISHER'S EXACT TEST
Control	20	5	} $P < 0.025$
Treated by coagulation	27	0	

In a series of eyes observed previously by the author, and followed *without intervention* for an average of 31 months, the percent of eyes involved by stage III lesions increased slightly from 68% to 72%, and the percent of eyes involved by stage IV lesions (vitreous hemorrhage) increased from 28% to 44%.² Many of the eyes included in that study of the natural history of PSR are reported again here, and they serve as the control group. Furthermore, it is of importance to the interpretation of the results of photocoagulation that *no* eye has shown *spontaneous* regression of neovascular lesions. The natural course of PSR thus appears to reflect a progressive, sequential, and pathogenetically related chain of events, leading ultimately, in many cases, to retinal detachment (stage V). Consequently, therapeutic and prophylactic intervention appear warranted prior to the onset of those factors, such as neovascularization and vitreous hemorrhage, that apparent-

ly lead to retinal detachment. Following intervention with photocoagulation, the reduction of the number of eyes in this series with neovascular lesions (from 100% to 55%) and the reduction of eyes with vitreous hemorrhage (from 41% to 26%) appear to represent a favorable reversal of the natural course of events in PSR; without intervention, stages III and IV, as shown by the control group, characteristically either stayed the same or worsened, but did not improve spontaneously. It also must be stressed that many eyes reported here, which have residual patent sea fans, are still undergoing photocoagulation therapy, and with additional follow-up, are likely to show complete absence of residual stage III lesions.

There appears to be little, if any, difference between the results of therapeutic photocoagulation and those of prophylactic photocoagulation. However, one should not necessarily conclude from

these data that it is safe to await progressive neovascularization and vitreous hemorrhage prior to beginning a course of photocoagulation. Fellow eyes of several patients in this series were excluded from consideration here, because they had already passed through the stages of (untreated) neovascularization and vitreous hemorrhage into that of retinal detachment and, consequently, required scleral buckling rather than photocoagulation.^{2,6,9}

Visual acuity prior to treatment appeared largely unaffected by PSR, including the visual acuity of those eyes with spontaneously occurring hemorrhages into the vitreous. The explanation for the retention of visual acuity in the presence of advanced retinopathy lies in the characteristic retinal geography of PSR. Neovascular lesions tend to arise preferentially in the equatorial region of the temporal quadrants of the fundus. Initial vitreous hemorrhages usually do not break into the center of the vitreous cavity, and thus the symptomatology may include "spots," "flashes," "floaters," and so on, but not usually a significant reduction in central acuity. Moreover, the equatorial lesions are peripheral enough that constriction of the visual field is not apparent to the patient and cannot usually be demonstrated in perimetric visual determinations.

Complications incurred through the use of photocoagulation did not seem excessive, and visual acuity was not adversely affected. The most common complication was peripheral field constriction of a symptomatically insignificant type. Maculopathy did not occur, possibly because of the peripheral location of the photocoagulation.⁷ However, one case of maculopathy did occur in the control group, probably because of a traction band leading from a bleeding neovascular lesion to the macula.² Vitreous hemorrhage, which could be at-

tributed to the effects of photocoagulation, occurred three times in a total of 58 treatment episodes. This rate of vitreous hemorrhage seems clinically acceptable, when one considers that the untreated natural course of events includes a definite rate of spontaneous vitreous hemorrhage (from a value of 28% initially to 44% two years later in the series of untreated eyes),² and when one considers that photocoagulation in the eyes treated was able to eliminate the neovascular sources of vitreous hemorrhages 74% of the time (Table 1).

Because of the apparently favorable results reported herein, and because of the relative ease with which small, flat neovascular lesions are obliterated, it would seem advantageous to photocoagulate stage III lesions as soon as they are detected, even if vitreous hemorrhage has not yet occurred. If one permits a sea fan to remain perfused with blood, definite risks of progressive neovascularization and vitreous hemorrhage are incurred.² Furthermore, larger sea fans, when photocoagulated, are more likely to bleed and are more difficult to occlude than are smaller ones.

As new sea fans make their appearance, the present evidence suggests that repeat photocoagulation may well be in the patient's best interests. In one respect, PSR resembles proliferative diabetic retinopathy.⁷ In both types of retinal disorders, the presence of a systemic disease is responsible for the continued development of retinal neovascularization.³ Consequently, such retinas cannot necessarily be considered permanently cured, even if all visible neovascular lesions can be eliminated at any one time. Fluorescein angiography should be performed at regular intervals on such patients. Persistent perfusion of neovascular tissue with fluorescein is evidence of incomplete treatment.

SUMMARY

Twenty-seven eyes with PSR were treated, primarily by xenon arc photocoagulation. The average follow-up duration was 30.4 months. The number of retinas with neovascularization was reduced from 100% to 55%, and the number of eyes with vitreous hemorrhage was reduced from 41% to 26%. Of the total number of neovascular lesions, 74% were obliterated by photocoagulation. The reduction in extent of retinal neovascularization was statistically significant when compared with an untreated control group of eyes. Intervention thus appeared to interrupt the natural course of PSR.

Fluorescein angiography is essential in the evaluation of completeness of photocoagulation, because perfused neovascular channels may be invisible with ophthalmoscopy alone.

Elimination of neovascular lesions by photocoagulation appeared safer and more likely to occur when these lesions were small and lay flat against the retina.

Vitreous hemorrhage following photocoagulation appeared more likely to occur when individual neovascular lesions were enlarged and elevated.

Photocoagulation did not adversely affect vision and, within limits, may have preserved it. Peripheral field constriction results from photocoagulation, but it is symptomatically insignificant.

ACKNOWLEDGMENT

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ported by grant HE02799 from the National Heart Institute.

Key Words: Sick cell-hemoglobin C disease; sickle cell thalassemia; photocoagulation; argon laser; cryocoagulation; fluorescein angiography; proliferative retinopathy; vitreous hemorrhage; neovascularization; retinal detachment; sea fans; xenon arc.

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DISCUSSION

AUSTIN I. FINK, MD, Brooklyn, NY: Dr. Goldberg should be congratulated for his carefully controlled study with which he has established a rationale for abating and possibly arresting the devastating effects of sickle cell-hemoglobin C disease (SC) on the retina and, ultimately, the vision of patients so afflicted. Through careful observation, he has evolved and classified its pathogenesis, and he has presented convincing evidence to demonstrate that through the quantitation afforded by fluorescein photography of the retinal vasculature, one may successfully use xenon arc or laser photocoagulation to control and to obliterate these proliferative changes.

When we attempt to explain why SC disease, more than any other hemoglobinopathy, gives rise to such devastating retinal pathologic changes, we are presented with a number of paradoxes. Actually, it is the homozygous hemoglobinopathy sickle cell (SS) disease rather than the mixed heterozygous SC disease that presents the severe and frequent systemic crises and that shortens so considerably the life of the patient. SC disease runs a less violent course, with milder and less frequent crises that appear in the teens or later. Why, then, does the retinal picture differ so?

It has been suggested that local anoxia may explain the onset of proliferative sickle (SC) retinopathy. Avascular areas surrounding the sea fans and the high oxygen consumption of the retina resulting in the rapid formation of deoxygenated blood are offered as evidence of such anoxia. If these suppositions are correct, one might expect the retina pathologic changes to be more widespread and of greater intensity in patients with SS disease. SC hemoglobin requires a greater depth of anoxia to produce the same degree of sickling. Moreover, studies of patients with systemic manifestations of anoxia, as are found in patients with chronic carbon monoxide poisoning or the Pickwickian syndrome, do not make mention of retinal vessel neovascularization. Strangely enough, it is among premature infants under conditions of prolonged hyperoxia that we find a vascular pathogenesis of neovascularization, retinal hemorrhage, vitreous retraction, and retinal detachment somewhat similar to the findings encountered in patients with SC disease.

A mechanical difference has been offered as an explanation for the neovascular change in that the tactoids associated with reduced sickle SS hemoglobin may produce larger vessel occlusions, whereas SC hemoglobin affects the capillaries because of the rod-shaped C-hemoglobin crystalloid. However, a recent study on hemoglobin interaction indicates that hemoglobin C can participate with hemoglobin S in the formation of the filamentous fine structure characteristic of the sickling phenomenon.¹ Moreover, the frequent finding of capillary microaneurysms in the conjunctiva of patients with SS disease and the infrequency of such findings in patients with SC disease, does not support this mechanistic hypothesis.

Some answer may be found in the red cell membrane itself or in its interaction with the retinal arterioles and capillaries. A recently published report on studies of the red cell membrane of patients with spherocytosis indicates that there is increased activity of the sodium pump.² It would be interesting to determine whether or not some alteration is evident in the red blood cell membrane of patients with SC disease.

Finally, I would like to know whether or not repeated xenon arc or laser photocoagulation of the sea fans has, ultimately, some therapeutic effect, that is, does it decrease the incidence of sea fans and so improve the retinal prognosis? Regression of new vessels following successful laser coagulation has been reported among patients with proliferative diabetic retinopathy. One explanation offered is that the multiple chorioretinal scars reduce the metabolic requirements of the retina. A similar response in the retinal vessels of patients with SC disease would be most welcome.

In conclusion, I would like to commend Dr. Goldberg for his excellent presentation and for having made a significant contribution to a difficult clinical problem.

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ANTERIOR SEGMENT ISCHEMIA FOLLOWING SCLERAL BUCKLING IN SICKLE CELL HEMOGLOBINOPATHY

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The "anterior segment ischemia syndrome" comprises a set of severe complications of retinal detachment surgery. This syndrome may frequently nullify an otherwise successful scleral buckling procedure,¹⁻⁴ due to the development of postoperative keratopathy, intraocular inflammation, hypotony, and cataract. Its pathogenesis has been attributed to several different factors at the time of surgery, including (1) interruption of the anterior ciliary arteries,^{5,6} (2) damage to the long posterior ciliary arteries,^{1,7} and (3) placement of an encircling element.⁸

Although generally an uncommon complication of scleral buckling operations, we have observed anterior segment ischemia, in a very high percentage of patients with sickle cell-hemoglobin C disease (SC disease) who have undergone retinal detachment surgery. The following nine case reports illustrate this complication of scleral buckling in SC disease. Possibilities for prophylaxis and therapy are presented, based on hypotheses regarding the pathogenesis of anterior segment ischemia in eyes with a propensity for intravascular sickling.

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MATERIALS AND METHODS

The hospital records of all hemoglobinopathy patients undergoing ocular therapy during the last five years (August, 1964, to September, 1969) were reviewed. Six patients from the Wilmer Institute Residents' Service were found to have had scleral buckling operations. One patient (Case 1) had bilateral retinal detachment procedures. The hemoglobinopathy of all six cases was found to be the SC type by hemoglobin electrophoresis. All patients had been personally examined by at least one of us by indirect ophthalmoscopy and biomicroscopy. During the same time interval, in which over 100 patients with various types of hemoglobinopathies (SS, SA, SC, SThal, SD, AC, CC) were actively studied for retinal abnormalities, no other hemoglobinopathy patient was found to have retinal detachment. An additional SC patient (Case 5), who had retinal detachment surgery prior to the five-year review period, is also included in this report. The pertinent clinical and surgical details of these seven cases (eight eyes) constitute part of the material of this report (Fig. 1). Cases 8 and 9, from the University of Illinois Eye

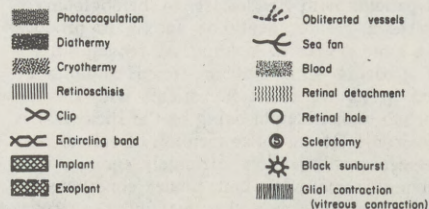


Fig. 1 (Ryan and Goldberg). Key to illustrations of Cases 1 through 7 (Figs. 2 through 9).

TABLE 1
RESULTS OF SCLERAL BUCKLING PROCEDURES IN SICKLE CELL HEMOGLOBIN C RETINOPATHY*

	Case 1		Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
	OS	OD						
Hemoglobin electrophoresis	SC	SC†	SC	SC	SC	SC	SC	SC
Age, sex, race	26 M/N		15 F/N	22 F/N	34 F/N	19 M/N	38 M/N	32 M/N
HCT (in %) at surgery	42	38	31	33	37	47	40	34
Date of scleral buckling	7/1/69	9/26/69	8/14/64	6/25/65	8/3/65	1/6/61	11/24/64	11/29/68
Anesthesia (general or local)	General	Local	General†	Local	Local	General	General	General‡
Rectus muscles detached	0	0	1	0	1	2	1	0
Encircling band	Yes	Yes	Yes	No	No	Yes	Yes	Yes, "tight"
Diathermy or cryotherapy	Cryotherapy	Cryotherapy	Diathermy	Diathermy	Diathermy	Diathermy	Diathermy	Diathermy and cryotherapy
Long posterior ciliary treated	Yes	No	Probably	Yes	No	Probably	No	Possibly
Scleral dissection or exoplant	Exoplant	Exoplant	Scleral dissection	Scleral dissection	Scleral dissection	Scleral dissection	Scleral dissection	Exoplant
IOP (Schiotz in mm Hg) after surgery	17	28	Normal	Sixth post-operative day: 15	16	12	Soft, intra vitreal injection	6
Preoperative vision	20/30	20/200	20/400	20/25-1	20/70-1	20/40	CF	2/200
Postoperative vision	20/25	HM	20/30	20/20-1	20/20	HM	LP	NLP
Length of follow-up	7 months	4 months	5 years	5 months	4 years	5 months	4 months	13 months
Postoperative ischemia syndrome	Yes	Yes	No	No§	Yes	Yes	Yes	Yes

* With the exception of Case 1, cases are listed in the order of increasing severity of the anterior segment ischemia.

† Preoperative transfusion, RE. Hb S 40%, Hb C 40%, Hb A 20%.

‡ In Case 2, blood pressure fell from 115/65 to 90/65 mm Hg during operation; in Case 7, blood pressure fell from 110/70 to 90/60 mm Hg during operation.

§ Retinal ischemia present anterior to diathermy.

and Ear Infirmary, presented with retinal detachments after analysis of the results in Cases 1-7. They were operated upon using the prophylactic recommendations cited below, and are also included. To our knowledge, there have been no other SC cases that 'ave had retinal detachment surgery in our hospitals.

Cases 2-7 are listed in increasing order of severity of the anterior segment ischemia (Table 1). Cases 8 and 9 did not develop ischemia (Table 2).

In order to compare the incidence of postoperative anterior segment ischemia in SC patients with that in patients with normal hemoglobin, a review was made of the first 20 consecutive retinal detachment cases on the Wilmer Residents' Service from each of the last five years.

CASE REPORT

Case 1—This 26-year-old man had chronic reduction of vision in his right eye, and complained of loss of his superior field in his left eye.

Left eye: The extent of the retinal detachment

TABLE 2

RESULTS OF SCLERAL BUCKLING USING PROPHYLACTIC MEASURES (INCLUDING EFFECTIVE PARTIAL EXCHANGE BLOOD TRANSFUSION) VS. SICKLING

	Case 8	Case 9
Hemoglobin electrophoresis	SC	SC
Age, sex, race	37 M/N	37 M/N
HCT at surgery %	37	47
Date of buckling	6/25/70	7/17/70
Anesthesia	Local	Local
Rectus detached	0	0
Encircling band	Yes	Yes
Diathermy or cryotherapy	Cryotherapy	Cryotherapy
Long posterior ciliary treated	No	No
Scleral dissection or explant	Explant	Scleral dissection
IOP (Schiotz) at end of surgery	Slightly elevated	29 mm Hg
Preoperative vision	CF	LP
Postoperative vision	20/400	HM
Follow-up	10 months	6 weeks
Postoperative ischemia syndrome	No	No

and distribution of sea-fans⁸ are shown in Figure 2. On July 1, 1969 a scleral buckling procedure was performed on the left eye (Fig. 2). Table 1 lists the technical factors that might have predisposed the patient to develop the anterior segment ischemia which occurred postoperatively (Fig. 2-bottom). The intense inflammatory response failed to respond to a multitude of therapeutic measures but subsided gradually over approximately three weeks. Vision returned to 20/25. Midstromal iris atrophy and a few scattered posterior subcapsular opacities in the lens were the only residua.

Right eye: His right eye had a virtually complete retinal detachment and extensive vitreous traction (Fig. 3). Preoperatively, the patient underwent partial exchange blood transfusion in addition to other prophylactic maneuvers (which are recommended below). The buckling procedure is described in Figure 3 and in Table 1. Due to laboratory error, the patient did not achieve the recommended⁹ 60% hemoglobin A prior to surgery. Postoperatively, he developed anterior segment ischemia again. Low molecular weight dextran (Rheomacrodex), topical corticosteroids, and atropine were of no avail, as the eye went on to phthisis (Fig. 3).

Case 2—This 15-year-old girl developed a rhegmatogenous retinal detachment six weeks following heavy photocoagulation to sea-fan neovascularization in the temporal periphery of her right eye (Fig. 4). A scleral buckling operation was done under general anesthesia, during which mild systemic hypotension occurred (Fig. 4-bottom right). The lateral rectus muscle was temporarily detached; the area overlying the temporal long posterior ciliary nerve and artery was treated with scleral diathermy, and an encircling band was placed. Despite these events, the postoperative reaction was limited to modest swelling and tenderness of the conjunctiva and eyelids, and no definite signs of anterior segment ischemia were noted. The retina was re-attached. Five years later, vision was 20/30.

Case 3—This 22-year-old woman gave a presumptive history of recurrent vitreous hemorrhage in the right eye, and was found to have a retinal hole and localized retinal detachment at 9 o'clock (Fig. 5). A small scleral diathermy procedure was carried out over this area, and involved the temporal long posterior ciliary complex (Fig. 5-bottom). No muscle was removed at the time of operation, which was done under local anesthesia, and no encircling band was placed. The postoperative course was uneventful, except for ischemia of the retina anterior to the treated area. The retina was re-attached. Vision was 20/20-1.

Case 4—This 34-year-old woman had recurrent vitreous hemorrhages in both eyes. The patient underwent a limited trap-door procedure in the left eye under local anesthesia for a retinal hole which was under traction (Fig. 6). The lateral rectus muscle was temporarily removed during the procedure, but the long posterior ciliary nerve and vessel complex was spared. No encircling strap was placed (Fig. 6-bottom). Postoperatively, there was anterior chamber haze with keratic precipitates as well

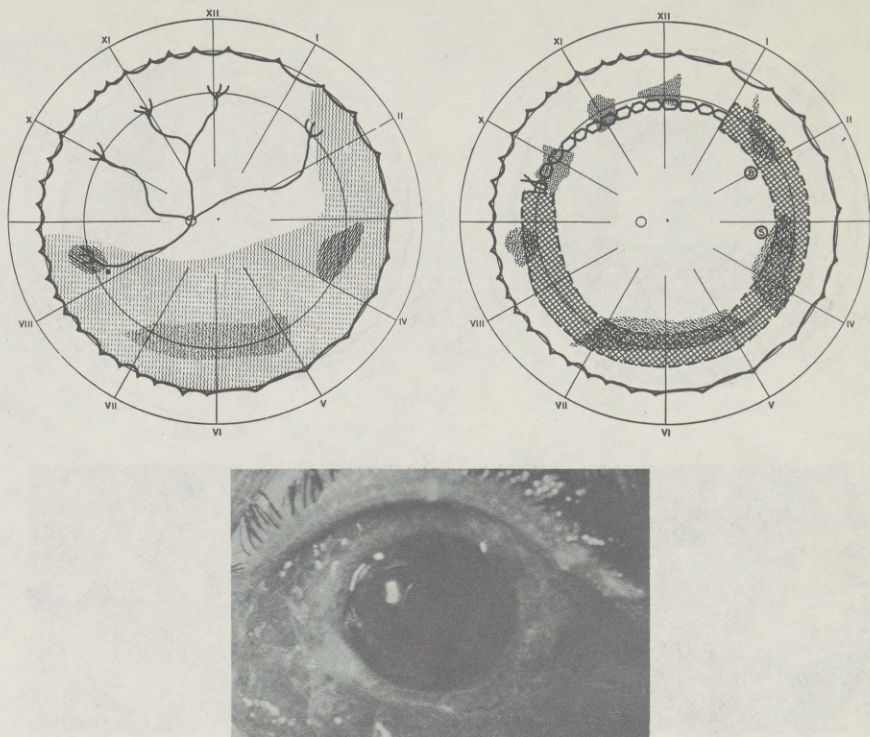


Fig. 2 (Ryan and Goldberg). Case 1, left eye. Top left: The retinal detachment in the left eye from 1:15 to 8:45 o'clock spares the macula. Sea-fans are present at 8:30, 10, 11, 12, 1:30 o'clock. Old white and fresh blood are present inferiorly, and glial proliferation is seen at 3:30 and 8:30 o'clock. At operation, holes were found at 3:30 o'clock, anterior and posterior to the glial scar. Top right: The operation is diagrammed. Sea-fans at 10, 11 and 12 o'clock were photocoagulated. Cryotherapy (freeze and refreeze) was applied to sea-fans at 8:30 and 1:30 o'clock, to the glial scar at 3:30, where two holes were discovered, and to the region of the old hemorrhage from 5 to 7 o'clock. A No. 20 silicone strip was placed as an exoplane from 1:00 to 9:30 o'clock, and a No. 40 encircling band was placed around the globe, and clipped at 9:30 o'clock. Sclerotomies were performed at 2:00 and 3:15 o'clock with release of moderately xanthochromic fluid. This eye did well following resolution of anterior segment ischemia, and vision is 20/25. Bottom: The same eye is shown six days after scleral buckling. Anterior segment ischemia is manifested by chemosis and irregular necrosis of the iris (with production of an irregular pupil).

as vitreous haze. Since endophthalmitis was considered possible, and because systemic antibiotics were already being routinely administered, systemic steroids were added to the postoperative therapeutic regimen. Four years later, the retina was attached, and vision was 20/20.

Case 5—In 1961, this 19-year-old man underwent a scleral buckling operation with diathermy for a retinal detachment in his right eye (Fig. 7). The medial and inferior rectus muscles were temporarily detached. Postoperatively, there was corneal edema, aqueous ray and hypotony. Endophthalmitis was

suggested, and a course of systemic penicillin, streptomycin, chloromycetin, and corticosteroids was begun.

One month later there were posterior synechiae, irregular dilatation of the pupil, moderate aqueous ray, cortical cataracts, and innumerable cells and dense haze in the vitreous. The retina was completely attached.

Five months later, when last seen, vision in the right eye was hand movements only. Only a red fundus reflex could be discerned, due to residual blood from several episodes of recurrent vitreous

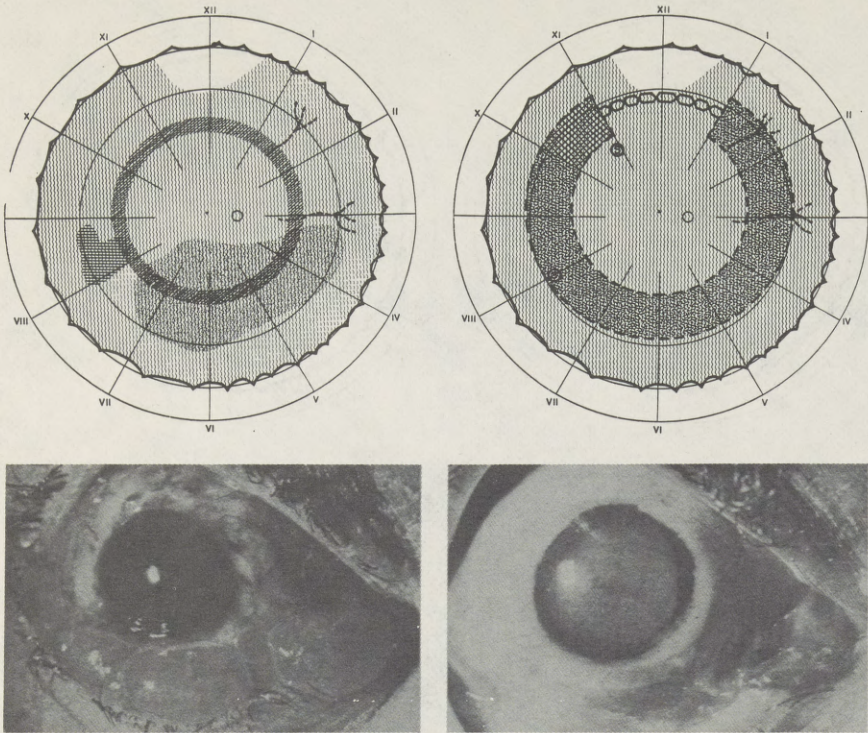


Fig. 3 (Ryan and Goldberg). Case 1, right eye. Top left: Only a small area of retina (from 11:30 to 12:30 o'clock) was attached in the right eye of Case 1. Marked vitreous traction, with an equatorial, circumferential band of condensed vitreous (resembling a purse string) was seen. Retinoschisis was present at 8:30 o'clock adjacent to a small hole, which was visualized only at operation. Obliterated old sea-fans were seen at 1:30 and 3 o'clock, and old vitreous blood obscured the fundus from 3:15 to 7:30 o'clock. Top right: The operative result is illustrated. Meridional rows of cryotherapy were applied from 1 to 10 o'clock. A No. 281 silicone tire explant was secured from 1 to 11 o'clock with an encircling No. 240 band. A sclerotomy at 8 o'clock yielded large amounts of fluid, but no further fluid could be obtained from a sclerotomy at 11 o'clock. The retina never settled. Severe anterior ischemia developed, and the eye progressed to phthisis. Bottom left: The right eye of Case 1 is shown 14 days after scleral buckling. The cornea is clear, as it is in the later Figure to the right, but marked chemosis and irregular pupillary dilatation were present. Bottom right: The same eye is shown 11 weeks after scleral buckling. Phthisis bulbi, with cataract and extensive iris necrosis, has occurred.

hemorrhage. The intraocular pressure was 7 mm Hg. The prognosis for useful vision appeared hopeless.

Case 6—This 38-year-old man developed a total retinal detachment in his right eye (Fig. 8). At surgery, a normal blood pressure was maintained under general anesthesia. The patient underwent a scleral buckling procedure with diathermy, a buried implant, and an encircling band (Fig. 8-bottom). The long posterior ciliary neurovascular complexes were spared, but the inferior rectus mus-

cle was temporarily detached. Postoperatively, conjunctival hyperemia, chemosis, shallow anterior chamber with choroidal effusion, keratic precipitates, fibrin clot and cataract developed. Thirteen days postoperatively, the patient was started on systemic corticosteroids. The eye had progressed to the prephthical stage when last examined four months postoperatively.

Case 7—This 28-year-old man had a scleral buckling procedure under general anesthesia for a total retinal detachment in the right eye (Fig. 9).

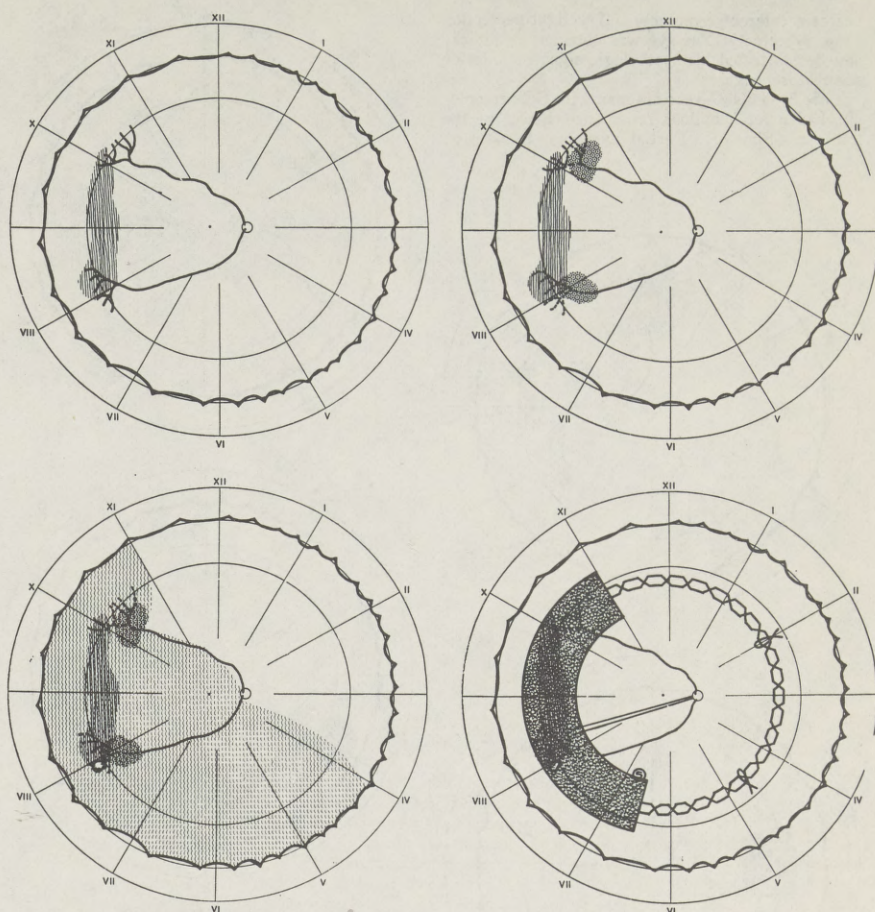


Fig. 4 (Ryan and Goldberg). Case 2. Top left: On initial examination, this patient had arborizing sea-fans at 8 and 10 o'clock, with glial membrane or vitreous sheet connecting the two areas of neovascularization. Top right: Photocoagulation (Zeiss) with overload No. 1 intensity and the 3° image field produced avascularity of the fans. Bottom left: Forty-four days after photocoagulation, retinal detachment with a hole at 8 o'clock was noted. Bottom right: The operation is illustrated. Diathermy was placed at the retinal hole at 8 o'clock and in the bed of a lamellar scleral dissection from 6:30 to 11 o'clock. An 8 mm wide silicone strip was implanted, and a No. 40 encircling band was clipped at 2 o'clock. The vitreous sheet remained over the buckle from 7:30 to 9:30 o'clock. A white retinal traction fold ran from the buckle at 8:30 to the disk, causing macular distortion and vision of 20/30. There was no anterior segment ischemia.

Blood pressure fell from 110/70 to 90/60 during surgery. Diathermy and cryotherapy were applied to the retinal breaks. Silicone sponge exopiants were applied meridionally, and an encircling band was pulled tightly following subretinal fluid drainage (Fig. 9-center). No muscles were detached. Postoperatively, he developed chemosis, cloudy cornea,

pigmented keratic precipitates, shallow anterior chamber, rapidly intumescent cataract, and yellow vitreous haze which prevented fundus examination. Because of a presumptive diagnosis of endophthalmitis, systemic therapy with penicillin, chloromycetin, and corticosteroid was instituted. Eight months later, the eye was phthisical, and had iris

necrosis, cataract, hypotony, and no light perception (Fig. 9/bottom). The eye was obtained at autopsy and demonstrated histopathologic signs of anterior segment ischemia.

Case 8—This 37-year-old man with SC hemoglobin, had a total, bullous retinal detachment of the left eye (Fig. 10). Partial exchange transfusion

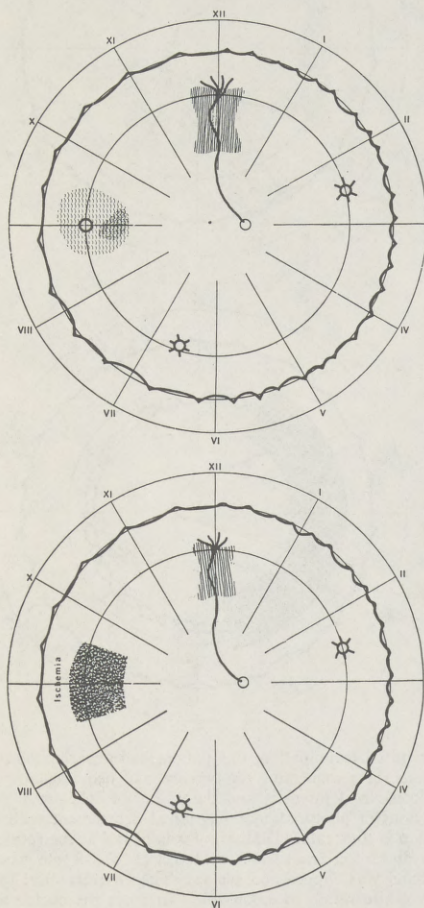


Fig. 5 (Ryan and Goldberg). Case 3. Top: The retinal hole, and localized retinal detachment and vitreous blood are seen at 9 o'clock in the right eye. A sea-fan is present at 12 o'clock, and two black sunbursts⁸ are at 2:30 and 6:30 o'clock. Bottom: The operation was a trap door procedure with diathermy, but no implant was used. Ischemia developed in the retina anterior to the area of treatment, but central vision remained normal.

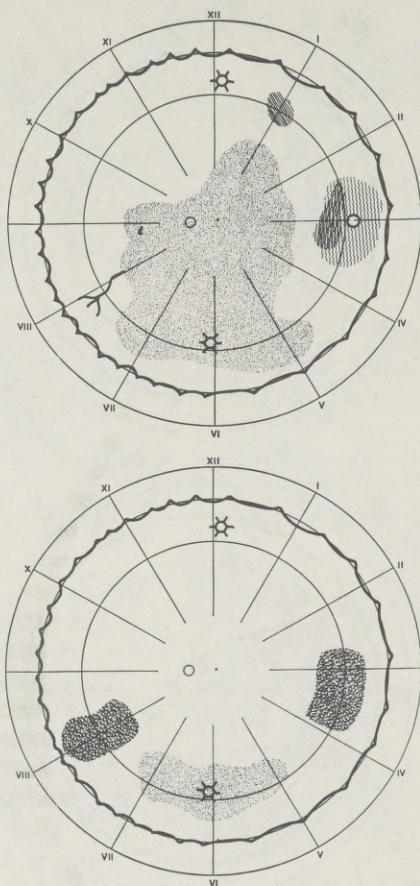


Fig. 6 (Ryan and Goldberg). Case 4. Top: A hemorrhage obscuring the posterior pole is shown. Black sunbursts are present at 12 and 6 o'clock. Glial retinal scars extending into the vitreous can be seen at 1 and 3 o'clock. A retinal hole with localized retinal elevation is present at 3 o'clock. A single sea-fan at 7:45 o'clock is also seen. Bottom: The operation is illustrated. Diathermy was placed at the 3 o'clock hole and at the 7:45 sea-fan. A temporal scleral trap door procedure was carried out, with diathermy placed in the bed of the trap door and with implantation of a sheet of silicone sponge. Minimal anterior segment ischemia resulted. Subsequently, vision was 20/20.

raised his hemoglobin A to 64%. A four and one-half hour exoplant and cryotherapy procedure was carried out under local anesthesia. A stellate gan-

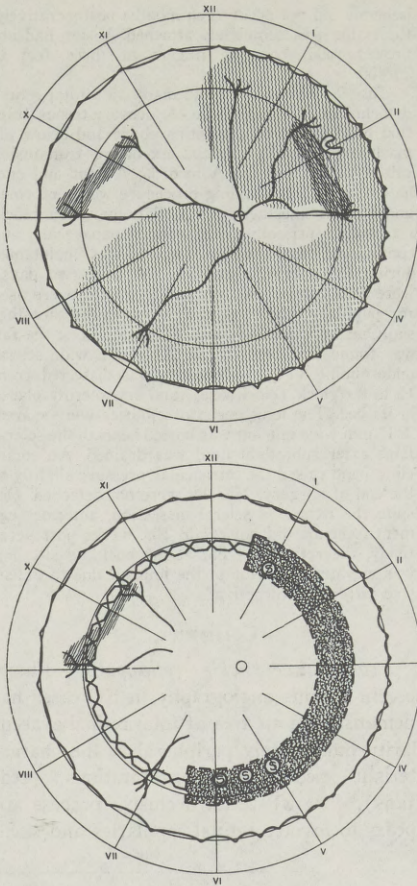


Fig. 7 (Ryan and Goldberg). Case 5. Top: A horseshoe tear at 2 o'clock and the retinal detachment are seen. Sea-fans are present at 12:30, 1:30, 3, 7, 9 and 10:30 o'clock, along with glial sheets at 2 and 9:30 o'clock. Bottom: At operation, a lamellar scleral bed was cut from 12:30 to 6:30 o'clock. Diathermy was placed in the bed, and an encircling polyethylene tube was tied at 10:30 o'clock. Sclerotomies were performed at 1, 5, 5:30, and 6 o'clock. Postoperatively, the patient developed anterior segment ischemia, the visual results of which negated the successful reattachment of his retina.

gion block, retrobulbar priscoline, intravenous papaverine, and continuous nasal oxygen (which was maintained during the operation and for the next two days) were administered. There were no sympathomimetics used for pupillary dilatation or re-

trolbulbar anesthesia. One horseshoe tear at 1:30 o'clock was found adjacent to a sea-fan,* and was frozen. Two No. 279 silicone tires were sutured to

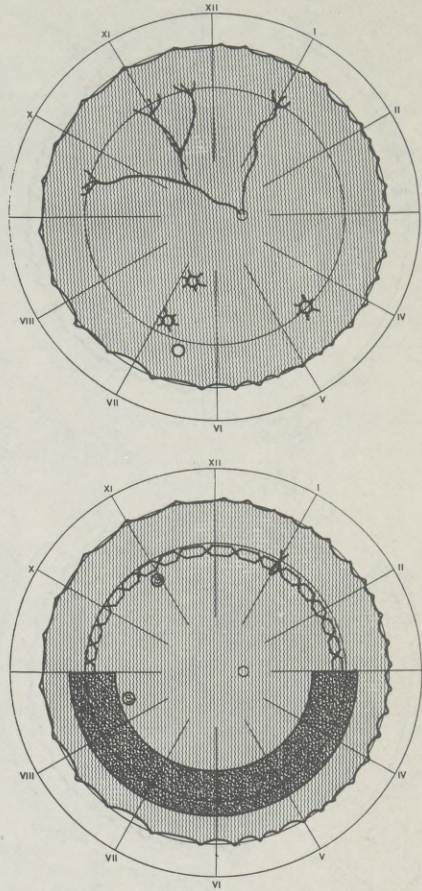


Fig. 8 (Ryan and Goldberg). Case 6. Top: A total retinal detachment and a hole at 6:30 o'clock are seen. Black sunburst scars are present at 4:30 and 6:45 o'clock. Numerous obliterated and patent areas of neovascularization are seen at 9:30, 11, 11:30, and 1 o'clock. Bottom: The operative procedure is shown. The inferior rectus was detached. A lamellar scleral bed was dissected from 3 to 9 o'clock and diathermy was placed in the bed. A No. 31 silicone implant was left in the bed, and a No. 40 encircling band was tied at 1 o'clock. Two sclerotomies were performed (at 8:30 and 11 o'clock). Postoperatively, the retina remained detached, and the patient developed severe anterior segment ischemia.

the sclera (Fig. 10-bottom), and subretinal fluid was drained. Intraocular pressure was slightly elevated at the end of the operation. Anterior segment

ischemia did not occur. Ten months postoperatively, the retina was completely attached. Vision had improved from counting fingers at three feet to 20/400.

Case 9—This 37-year-old man had a total retinal detachment in the left eye. A dense vitreous traction band pulled on the retina above and below the macula (Fig. 11). Partial exchange transfusion raised his hemoglobin A to 67%. A four and one-half hour scleral buckling procedure was performed under local anesthesia. A stellate ganglion block, retrobulbar prilocaine, intravenous papaverine, and continuous nasal oxygen (which was maintained during the operation and for the next two days) were administered. No sympathomimetics were used for pupillary dilatation or for retrobulbar anesthesia. One large tear adjacent to the 3 o'clock sea-fan was found, and was frozen. A 15 mm wide scleral undermining (Fig. 11-bottom) was dissected from 11 to 8 o'clock (clockwise), and cryothermy placed in its bed. The long posterior ciliaries were spared. A 13 mm wide implant was buried beneath the scleral flaps after subretinal fluid was drained. An encircling band raised the intraocular pressure slightly at the end of surgery. Muscles were not detached. Despite the extensive scleral dissection, anterior segment ischemia did not occur. Six weeks postoperatively, the retina was flat at the buckling site, but was elevated posterior to the implant due to extensive vitreous contraction.

COMMENT

Proliferative sickle retinopathy—Fluorescein fundus angiography in SC cases has demonstrated an area of total retinal avascularity immediately peripheral to the characteristic neovascular proliferations (sea-fans),^{8,10-13} where an occlusive process appears to involve retinal capillaries and small

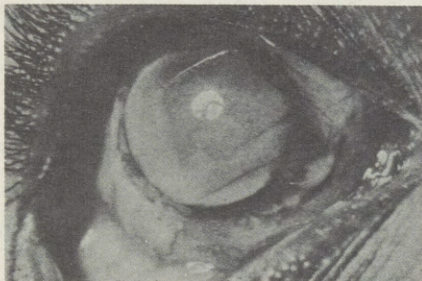
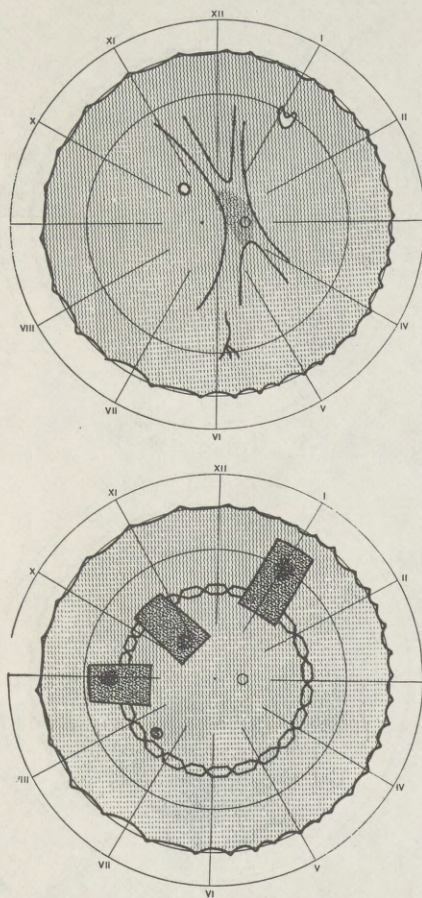
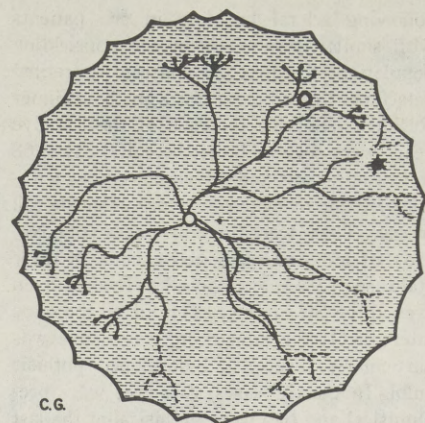
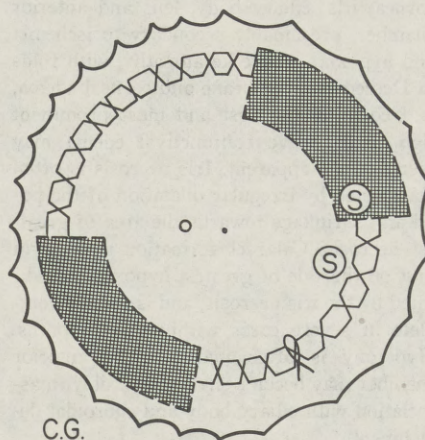


Fig. 9 (Ryan and Goldberg). Case 7. Top: The total retinal detachment, dense vitreous bands, old vitreous blood, large retinal tears at 11 and 1 o'clock, and neovascularization at 5:45 o'clock are illustrated. Center: At operation, the retinal holes, plus an additional hole at 9 o'clock, were treated with a central spot of diathermy and encircling cryothermy. A 5 mm silastic sponge was placed under the 11 o'clock hole, and 3 mm sponges were placed under the 9 and 1 o'clock holes. A No. 240 band encircled the eye posterior to the equator. A sclerotomy was performed at 7:30 o'clock posterior to the band. The patient developed severe anterior segment ischemia, which progressed to phthisis. Bottom: The same eye as photographed eight and one-half months after scleral buckling. There is phthisis bulbi with cataract and extensive iris necrosis.



C.G.

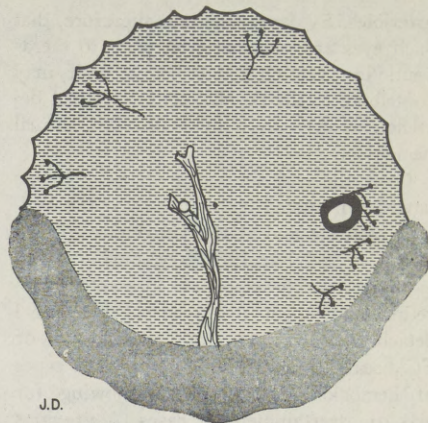
- Sea fan
 Obliterated vessels
 Black sunburst
 Retinal detachment
 Retinal hole



C.G.

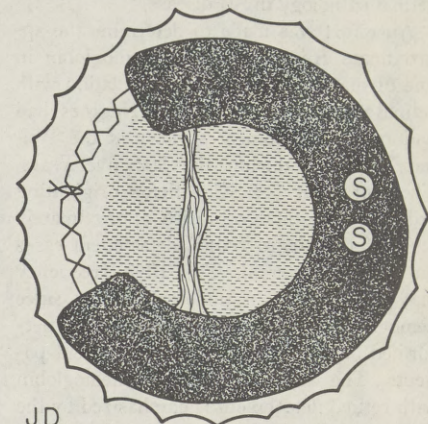
- Clip
 Explant
 Sclerotomy
 Encircling band

Fig. 10 (Ryan and Goldberg). Case 8. Top: The left eye of Case 8 had a total detachment with a single superotemporal retinal hole adjacent to a sea-fan. Bottom: Anterior segment ischemia did not develop postoperatively, despite two large buckles, prolonged operating time, elevated intraocular pressure and an encircling band. Several prophylactic measures, including partial-exchange blood transfusion, had been taken preoperatively.



J.D.

- Blood
 Retinal detachment
 Sea fan
 Retinal Hole



J.D.

- Cryotherapy
 Encircling band
 Sclerotomy
 Clip
 Retinal detachment

Fig. 11 (Ryan and Goldberg). Case 9. Top: The left eye of Case 9 showed extensive vitreous contraction and hemorrhage. A single retinal hole was found adjacent to a sea-fan at 3 o'clock. Bottom: A 15 mm wide scleral dissection was created for a 13 mm wide silicone implant from 11 to 8 o'clock. Despite prolonged operating time, elevated intraocular pressure, an encircling band and very extensive surgery, anterior segment ischemia did not occur. Several prophylactic measures, including partial-exchange blood transfusion, had been employed preoperatively. The retina reattached at the buckling site, but remained elevated posterior to the implant because of extensive vitreous membrane formation and contraction.

arterioles. Evidence suggests, therefore, that such eyes are ischemic even prior to therapeutic intervention.¹¹⁻¹³ Ischemia, itself, may contribute to the development of retinal detachment, even in individuals with normal hemoglobin.¹⁴

Over the last six years 45 SC patients have been studied by one of us at the Wilmer Institute and at the University of Illinois Eye and Ear Infirmary, during which eight patients developed or presented with retinal detachment. It is apparent that retinal detachment is a significant complication of SC disease (but seemingly not in other types of hemoglobinopathy), even allowing for bias of ascertainment of cases. A previous histologic report¹⁵ confirms the severity of retinal pathology in SC disease.

An effort was made to determine the approximate frequency of SC hemoglobin in one of our hospital's Negro population with retinal detachment. Sixty-one Negroes had had retinal detachment surgery at the Wilmer Institute during the last five years. Therefore, our six SC patients originating from this hospital comprise approximately 10% of the Negro retinal detachment cases during this interval. The 10% frequency may actually be an underestimation, since hemoglobin electrophoresis was not performed on all Negro retinal detachment patients. The association of SC hemoglobin with retinal detachment is emphasized by the realization that it represents an approximately 33-fold increase over the frequency of SC hemoglobin in the general Negro population (which is about 0.3%).¹⁶

One of the alleged reasons that Negroes have less retinal detachments than Caucasians is their diminished frequency of vitreous degeneration.¹⁷⁻¹⁹ Conversely, the high frequency in Negro retinal detachments of SC retinopathy is apparently related to the extensive vitreous degeneration, contractions, and hemorrhage which are seen in this disorder.^{8,11,12}

In an attempt to compare the frequency and severity of anterior segment ischemia

following scleral buckling in SC patients with similar parameters in the nonsickling population, the first 20 consecutive retinal detachment cases performed on the Wilmer Residents' Service for each of the last five years were reviewed. Of these 100 cases, 68 were Caucasians and 32 were Negroes without systemic or ocular evidence of sickle cell disease. There were three instances (one Negro) of anterior segment ischemia in these 100 cases (3%), as opposed to five of seven eyes in the SC cases (71%) during the same interval. Of the nonsickling cases, one was particularly severe, and developed phthisis bulbi. In the SC cases, two eyes were prephthisical and two were phthisical at the last follow-up examination.

Anterior segment ischemia—Six of the 10 eyes reported here showed some ischemic signs. The anterior segment ischemia syndrome consists of necrotic changes in the cornea, iris, ciliary body, lens and anterior chamber, presumably secondary to ischemia and hypoxia. Striate keratopathy, with folds in Descemet's membrane and corneal edema, is frequently the first and most prominent sign. Progressive conjunctival edema may then become apparent. Iris necrosis is often manifested by irregular dilatation of the pupil and shrinkage towards the area of greatest necrosis. Cataract formation may begin first on the side of greatest hypoxia, as indicated by the iris necrosis, and is usually complete in severe cases within three months. Hypotony is often marked. The anterior chamber may become shallow, possibly in association with ciliary body and choroidal detachment.

Haziness of the ocular media in this syndrome may mimic the appearance of postoperative, infectious endophthalmitis, and, when coupled with chemosis and keratopathy, may erroneously suggest a diagnosis of infectious panophthalmitis. It is instructive that in at least three of these patients (Cases 4, 5, and 7) an infectious etiology was considered seriously enough to warrant intensive therapy with systemic antibiotics.

The pathogenesis of anterior segment ischemia has been related to interruption of the anterior ciliary arteries (those major arteries, usually seven in number, coursing through the rectus muscles),⁵ to occlusion of one or both of the long posterior ciliary arteries,^{1,2} as well as to the constricting effect of an encircling band.^{1-3,5} Various experimental methods have been employed^{6,7} in an attempt to reproduce this syndrome. However, the exact pathogenesis is unknown, and any or all of the above factors may play responsible roles. It would seem, however, that this disorder is related to impaired circulation and hypoxia of the anterior segment. Similar clinical findings have been noted in patients who undergo no surgery, but who have ischemia on the basis of atherosclerosis or other disease processes affecting the vascular supply of the eye.²⁰

Surgical factors—No positive, consistent correlation (Table 1) can be made in this series of patients between the development of ischemia and any one of the following technical aspects of the surgery: (1) Detachment of the rectus muscle. Two patients (Case 1, both eyes, and Case 7) developed anterior segment ischemia even though no rectus muscle was detached. (2) Use of an encircling band. Case 4 did not have an encircling element, and developed ischemia, whereas Case 2 had a band but did not become ischemic. (3) Treatment over the long posterior ciliaries. In Cases 1 (right eye), 4, and 6, these vessels were spared, but ischemia occurred, whereas the long posterior ciliary artery was diathermized in Case 2, but ischemia did not occur. (4) Cryotherapy vs diathermy. Cases 1 and 7 were treated with cryotherapy, whereas diathermy was used in Cases 4, 5, and 6, but all developed ischemia. (5) Exoplane vs implant. Cases 1 and 7 had exoplane without scleral surgery, but were ischemic nonetheless. (6) Ocular hypertension. No case had a significant elevation of tension. (7) Systemic hypotension. Normal blood pressure in Cases 1, 4, 5, and 6 did not prevent ischemia. The possibility that the ex-

tent of the retinal detachment and vitreous traction (and thus the extent of the required surgery) can be correlated with the development of anterior segment ischemia must be considered, since several eyes with the most difficult detachments developed the most severe ischemia. However, Case 2 had diathermy $> 120^\circ$ and did not develop ischemia, whereas Case 4 had 60 degrees of diathermy and did develop ischemia. Case 2 did not develop anterior segment ischemia, despite the following technical maneuvers which might theoretically predispose to ischemia: systemic hypotension during anesthesia, scleral surgery and diathermy with involvement of the long posterior ciliary complex, detachment of a rectus muscle and placement of an encircling band. Also, Cases 8 and 9, with severe detachments and extensive surgery, did not develop ischemia (Table 2). Thus, it appears that no common surgical denominator can be derived from the technical aspects of scleral buckling in these cases which can be held responsible for postoperative anterior segment ischemia.

Nonsurgical factors—Certain nonsurgical factors can be correlated with lack of development or less severity of anterior segment ischemia following retinal detachment operations in SC patients. For example, Cases 2-4 are females (Table 1), and were affected either mildly or not at all. Cases 2 and 3 were also characterized by having a lower average age and a lower average hematocrit than those patients who did develop anterior segment ischemia (Table 3). Since vascular occlusions occur intermittently and progressively during the lifetime of SC patients, it is possible that enough patent vasculature existed in the younger patients to allow adequate perfusion of the anterior segment during and following surgery. However, even the factor of youthfulness in Case 5 did not prevent the development of anterior segment ischemia (which may have been related in his case to temporary detachment of two rectus muscles).

It appears possible that SC hemoglobin

TABLE 3
SCLERAL BUCKLING IN HEMOGLOBIN SC DISEASE
(Cases 1-7, eight eyes)

	Age (avg. years)	Hct (avg. %)	Sex		Anesthesia		Rectus Off	Encirc. Band	Dia- thermy	Cryo- thermy	Im- plant	Exo- plant	Postoperative Vision		Rx for Endoph- thalmitis
			M	F	Loc.	Gen.							20/30	HM	
ischemia (2 eyes)	19	32	0	2	1	1	1	1	2	0	2	0	2	0	1
Ischemia (6 eyes)	29	39	5	1	2	4	3	5	4	3	3	3	2	4	3

plays a responsible role in the development of anterior segment ischemia. The clinical severity of the different sickle hemoglobinopathies is directly related to the rate of increase of viscosity of blood during deoxygenation.⁹ The concentration of hemoglobin S and the degree of interaction between the various hemoglobins are the major determinants of this rate. The viscosity of blood containing sickled erythrocytes is proportional to the product of the percentage of sickle hemoglobin and the square of the hematocrit value.⁹ A higher hematocrit with a concomitant, increased viscosity predisposes to the multiple thrombotic events characteristic of this disease. These considerations may be helpful in explaining the frequent occurrence of vascular occlusive manifestations in patients with certain heterozygous sickling disorders, such as SC, who do not have appreciable anemia.^{9,21,22} The lower hematocrit in Cases 2 and 3 may have allowed less viscosity, better perfusion, and, therefore, improved oxygenation of the anterior segment as compared with those cases with higher hematocrits.

The phenomenon of intraoperative, intravascular sickling is well recognized, and is thought to be related to relative hypoxia in association with anesthesia.²³⁻²⁸ While most sicklers are subject to this hazard, SC patients with their nearly normal hematocrits (frequently 35 to 40%) seem particularly prone to intravascular sickling under these conditions.

An instructive, though distressing, operation was that for the right eye of Case 1.

This was the first instance, to our knowledge, in which the association between anterior segment ischemia and SC hemoglobin was known preoperatively. Thus, a large number of prophylactic measures (listed in Table 4) were utilized in the management of this eye. Despite all these measures, anterior segment ischemia developed postoperatively. Extensive cryotherapy and a large exoplant, which were necessitated by the marked vitreous traction, may have contributed. However, similar surgery in Case 9 did not cause the ischemic syndrome. A laboratory error in Case 1, however, led to inadequate exchange transfusion preoperatively, such that only 20% of the patient's hemoglobin was normal hemoglobin A at the time of surgery. This is markedly less than the 60% hemoglobin A which is the recommended minimal preoperative goal of partial exchange transfusion in sickle cell disease. If nothing else, Case 1 underscores the association of postoperative anterior segment ischemia with SC disease, since a conscious and reasonable effort was taken to avoid or minimize most, if not all, of the other factors that might ordinarily predispose to ischemia.

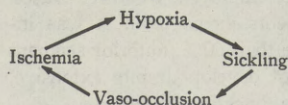
Cases 8 and 9 represent, perhaps the strongest argument for the role of intravascular sickling in the development of anterior segment ischemia following scleral buckling. In these two patients extensive and prolonged operations were performed after exchange transfusion had provided greater than 60% hemoglobin A. Anterior segment ischemia did not develop in either case.

Recommendations—The data of Charache

TABLE 4

POSTOPERATIVE ANTERIOR SEGMENT ISCHEMIA IN SICKLE RETINOPATHY

Postulated pathogenesis:



Recommended prophylaxis:

- Preoperative:
1. Local anesthesia without sympathomimetics
 2. Stellate ganglion block, papaverine administration
 3. Pupillary dilatation with parasympholytics only
 4. Partial exchange transfusion
 5. Lowered intraocular pressure

- Intraoperative:
1. Supplemental oxygen
 2. Minimization of peritomy
 3. Avoidance of rectus muscle detachment or traction
 4. Avoidance of long posterior ciliary vessels
 5. Diathermy vs cryotherapy (?)
 6. Explant vs scleral implant (?)
 7. Subretinal drainage
 8. Avoidance of encircling band if possible (one is frequently necessary because of extensive vitreous traction)

Recommended postoperative therapy:

1. Supplemental oxygen
2. Pupillary dilatation
3. Papaverine (?)
4. Low molecular weight dextran (?)
5. Adrenal corticosteroids (?)
6. Anticoagulants (?)

and Conley⁹ support the concept that all the clinical manifestations of sickle cell disease are attributable to the consequences of intravascular sickling of erythrocytes. Because of the lack of any other consistent surgical factor in these patients which could be correlated with anterior segment ischemia (Table 1), it would appear that the sickling process is probably also related in some causal way to the development of anterior segment ischemia in our patients. That this may be so is underscored by the high percentage of sicklers who developed this disorder following scleral buckling in comparison with the non-sickling population. Also, as noted above, those patients previously transfused successfully tolerated the scleral buckling procedure well. Consequently, the recommendations in Table 4 for clinical management of SC patients who require retinal detachment

surgery are based on attempts to avoid intraoperative and postoperative ischemia, hypoxia, and sickling. The onset of sickling in the eye, as elsewhere, sets up a vicious cycle of events leading to decreased perfusion, with further ischemia, hypoxia, and sickling (Table 4).

Since the effects of anterior segment ischemia are sometimes irreversible, prophylaxis is preferable to therapy. The common objective underlying these recommendations (Table 4) is increased perfusion and oxygenation, with decreased sickling and ischemia.

Because of the danger of sickling during parturition, pregnant women with SC disease have been effectively managed prior to delivery by partial exchange transfusion.²⁷ This exchange of normal red blood cells for those containing SC hemoglobin has also been recommended prior to general surgical

procedures.^{26,28} Complications from parturition and surgery can usually be minimized if partial exchange transfusion results in a red blood cell mass in which about 60% of erythrocytes have normal hemoglobin A. It would seem reasonable, therefore, to treat cleral buckling cases similarly. Since even local anesthesia obviously does not eliminate all causes of ocular ischemia and hypoxia that occur during retinal detachment surgery, this recommendation applies even when retrobulbar anesthesia is employed. The possibility, however, of inducing serum hepatitis or septicemia by partial exchange transfusion must be considered.

Cryotherapy with an exopiant would theoretically appear to be more advantageous than diathermy and a scleral dissection. In any event, drainage of subretinal fluid will soften the eye and tend to counteract any tendency towards decreased vascular perfusion.

Other prophylactic and therapeutic measures with potential merit are listed in Table 4.²⁹⁻³⁸

SUMMARY

Ten eyes of nine sickle cell-hemoglobin C patients (SC) underwent retinal detachment surgery. Six eyes showed signs of anterior segment ischemia postoperatively, and one showed signs of retinal ischemia. Four eyes became phthisical or prephthisical. In three cases, anterior segment ischemia was erroneously thought to be infectious endophthalmitis.

In a sampled hospital population, 71% of buckled eyes of SC patients developed anterior segment ischemia, whereas only 3% of nonsickling eyes developed this postoperative complication during the same five-year period. Patients with SC hemoglobin thus appear particularly vulnerable to anterior segment ischemia following scleral buckling.

Lower hematocrit, younger age, and female sex were associated with clinically less severe postoperative findings.

Technical surgical factors did not seem to

influence the presence or absence of postoperative anterior segment ischemia. Partial exchange blood transfusion and additional measures were employed in three cases. When the patients' hemoglobin A was increased to more than 60%, anterior segment ischemia did not develop despite extensive, prolonged scleral buckling operations.

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Ophthalmologic Manifestations of Sickle Cell Thalassemia

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Vascular abnormalities were studied in the eyes of 14 patients with sickle cell thalassemia (S-thal). Angioid streaks were observed for the first time in a patient with S-thal. "Black sunbursts," which are seen more often in the fundi of patients with sickle cell anemia (SS disease) than in those with sickle cell hemoglobin C disease (Hb SC) were generally few in number in the fundi of patients with S-thal. Proliferative sickle retinopathy, which is much more characteristic of Hb SC than of SS disease, was seen in nine patients with S-thal. The retinas of S-thal thus resemble those of Hb SC more than SS. The hemoglobin composition of a patient's red blood cells can be predicted, to a degree, from the presence and type of certain retinal anomalies in sickling disorders. Overall clinical status is not usually as good as indicator of hemoglobin composition.

A variety of ocular abnormalities has been reported in sickling disorders. The "conjunctival sign" of sickle cell disease, for example (vascular segmentation which can be observed with the +40 diopter lens of a hand ophthalmoscope or with a slit lamp), was shown to occur in patients with several types of sickling.¹⁻³ It was suggested that this sign was more evident in those individuals with sickle cell hemoglobin C disease (Hb SC) and sickle thalassemia (S-thal) who had the most se-

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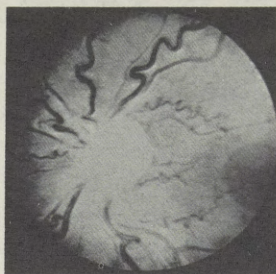


Fig 1.—Tortuosity of the retinal arterioles and venules is demonstrated in Negro woman with sickle-thalassemia (patient 5). Vision is not affected.

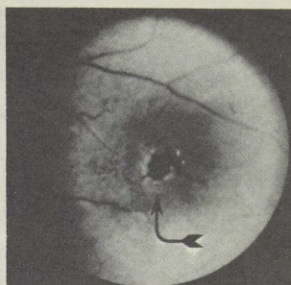
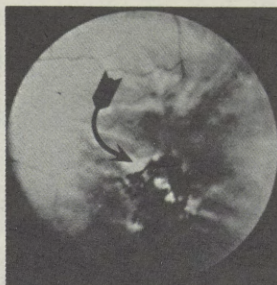
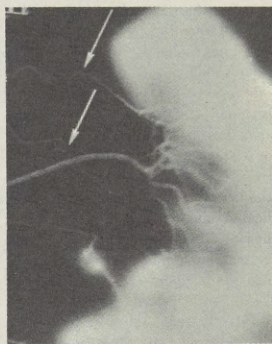
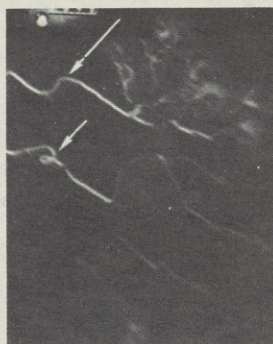


Fig 2.—Left and Right, Black sunbursts* (black chorioretinal lesions) are seen (arrow) in the fundi of a male patient with sickle thalassemia (patient 9). They are also characteristic of sickle cell anemia.

Fig 3.—Left, Left fundus (patient 11). Optic disk and macula are in the center. Scalloped border represents ora serrata. Multiple neovascular proliferations (sea fans)* are seen in temporal periphery, photographs of which are seen in center and at right. Center, Arterial phase of fluorescein angiogram. Early perfusion of sea fans (patient 11).

Venous return of fluorescein has not yet occurred. Arrows indicate vessels seen in arteriovenous phase (compare right). Right, Later arteriovenous phase of fluorescein angiogram. Large white areas represent fluorescein leaking from neovascular tissue into vitreous. Arrows are placed similarly in Fig 3, center.



vere systemic manifestations.¹

Tortuosity of the retinal vessels was also noted in early descriptions of the sickling disorders⁶ (Fig 1) but is nonspecific, and is of little diagnostic or clinical significance. More

impressive and significant abnormalities can be visualized through dilated pupils by direct and indirect ophthalmoscopy, but these have been infrequently noted by internists. Characteristic of sickle cell anemia

(SS) are circular, black chorioretinal scars, so-called "black sunbursts"⁶ (Fig 2). These lesions, which may represent the sequelae of small infarctions or hemorrhages, were found in 43% of patients with SS, but

in only 18% of patients with Hb SC. Their presence does not ordinarily affect visual acuity.

Most significant is proliferative retinopathy (Fig 3), which may be responsible for vitreous hemorrhage,⁷ retinal detachment,⁸ and loss of vision. These neovascular lesions can be prophylactically obliterated by photocoagulation⁹ (Fig 4). Recent evidence^{10,11} suggests that the initial event in the development of proliferative sickle retinopathy is a peripheral arteriolar (and probably capillary) occlusion (Fig 5). Rather than producing a scar, this ultimately develops into a tuft of proliferating vessels, the "sea fan"⁶ (Fig 3). These neovascular abnormalities are commonly observed in the superotemporal quadrant of the retina, approximately midway between the optic nerve and the anterior pole of the eye. They were found in 60% to 70% of patients with Hb SC disease, but in less than 10% of patients with sickle cell anemia.⁶ By use of fluorescein angiography, it is usually possible to visualize leakage of dye from these lesions into the vitreous^{9,12} (Fig 3 and 4). None of these retinal lesions has been observed with an appreciable incidence in patients with sickle cell trait (AS).⁶ In patients with S-thal, previous reports indicated similarly that there were either no abnormal retinal findings or retinal vascular tortuosity only.^{13,14}

The hemoglobin components of patients with S-thal do not differ qualitatively from those of patients with sickle cell trait. Because of the inherited defect in synthesis of normal hemoglobin A, however, S-thal red blood cells contain 60% to 95% hemoglobin S, rather than the 35% found in individuals with AS.¹⁵⁻¹⁶ Although systemic manifestations of S-thal are extremely variable, severity of these manifestations can some-

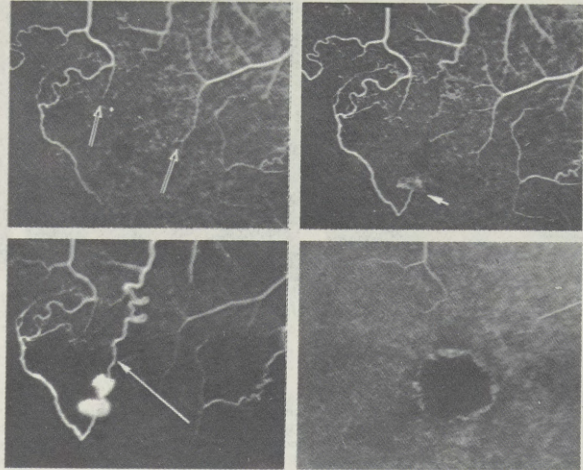


Fig 4.—Top left, Arterial phase of fluorescein angiogram of (patient 7) a Negro man with sickle thalassemia. Peripheral retina (lower left corner) is not perfused, due to capillary and arteriolar obstruction (arrows). Top right, Two seconds later, angiogram reveals small neovascular patch (arrow). Bottom left, Five seconds after photograph was taken in Fig 4, top right, angiogram reveals extent of neovascular tissue. Fluorescein is beginning to leak into the vitreous. Venous drainage of sea fan is now seen (arrow). Bottom right, Several weeks following prophylactic photocoagulation of sea fan seen in Fig 4, bottom left, only an atrophic chorioretinal scar is observed in fluorescein angiogram. Neovascular tissue has been obliterated, and there is no leakage of fluorescein.

Table 1.—Systemic and Hematologic Findings in Patients With S-thal

Patient (At First Exam)	Age-Sex	Systemic Status	Hct (%)	Hgb A ₂ (%)	Hgb A (%)	Hgb F (%)	Hgb S (%)	Reticulocytes (%)
1	8 M	Very mild	44	31.1	...	2.4	66.5	4.7
2	10 F	Moderate	28	16	3.73	3.7	76.6	3.1
3	18 M	Mild	20-33	0	...	5-14	83-92	5
4	20 M	Mild	34	19.5	...	3.1	77.4	3.7
5	22 F	Very mild	33	15.3	...	9.1	75.6	3.3
6	24 F	Very mild	41	39.1	...	0.8	60.1	2.3
7	27 M	Moderate	30-35	S>A	...	3	S>A	8
8	29 F	Moderate	38	35.1	...	3.3	61.6	2.4
9	36 M	Mild	33-40	S>A	...	...	S>A	1
10	37 M	Moderate	...	10	5	5	80	...
11	41 F	Mild	43.9	27.7	...	2.3	66.4	3.1
12	42 M	Moderate	...	22.4	1.2	...	74.6	...
13	52 M	Moderate	25-40	20-25	...	2.5	66	4
14	64 M	Moderate	37-43	22	3.2	5.2	69	2.1

Table 2.—Ophthalmologic Findings in Patients With S-thal

Eye	Vision (at First Exam)		Conjunctiva*		Refractile		Black		Retinal		Angioid		PSR† Stage I (Peripheral Arteriolar Occlusions)		PSR Stage II (Peripheral Arteriolar Venular Anastomoses)		PSR Stage III (Neovascularization)		PSR Stage IV (Vitreous Hemorrhage)		PSR Stage V (Retinal Detachment)		Negative Fundi
					Deposits	Sunbursts	Tortuosity	Streaks	R	L	R	L	R	L	R	L	R	L	R	L	R	L	
1	20/25	20/25	+	+	+	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	20/20	20/20	+	+	+	+	1	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
3	20/30	20/20	+	+	+	+	4	10	+	+	0	0	2	3	1	0	0	0	0	0	0	0	0
4	20/20	20/20	2+	2+	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+
5	20/30	20/30	+	+	+	0	0	1	0	+	+	0	0	0	0	0	0	0	0	0	0	0	0
6	20/20	20/20	—	—	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+
7	20/20	20/30	?	?	0	0	2	1	0	0	0	0	3	2	3	2	1	1	0	2	0	0	0
8	20/20	20/25	0	0	0	+	0	3	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
9	20/20	20/20	0	0	+	+	multiple OUG		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	20/20	20/20	+	+	0	0	5	6	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0
11	20/50	20/50	4+	4+	+	0	4	6	0	0	0	0	1	3	1	3	1	3	0	0	0	0	0
12	NLP‡	20/20	+	+	—	+	—	2	—	0	—	—	—	2	—	2	—	2	4	0	—	0	0
13	20/20	20/20	0	0	0	0	1	2	0	0	0	0	2	0	2	0	2	0	1	0	0	0	0
14	20/20	20/20	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	+

* Vascular segmentation in bulbar conjunctiva.

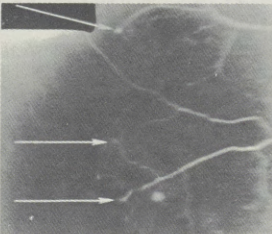
† PSR = proliferative sickle retinopathy. Roman numerals refer to stages in classification; Arabic numerals refer to substages in classification: 0 = none; 1 = $\leq 30^\circ$ of circumferential fundus involvement and ≤ 3 occluded arterioles (or ≤ 3 anastomoses or neovascularizations); 2 = 31° to 60° of circumferential fundus involvement or four to six occluded arterioles (or four to six anastomoses or neovascularizations); 3 = 61° to 90° of circumferential fundus involvement or seven to nine occluded arterioles (or seven to nine anastomoses or neovascularizations); 4 = $\geq 91^\circ$ of circumferential fundus involvement or ≥ 10 occluded arterioles (or ≥ 10 anastomoses or neovascularizations).

‡ NLP = No light perception. Massive vitreous hemorrhage obscured details of the right fundus of this patient.

|| OU = each or both eyes.

|| Nine months later: I = 1, II = 1, III = 1, IV = 0, V = 0.

Fig 5.—Fluorescein angiogram in retinal periphery of Negro man with sickle thalassemia (patient 13). Multiple spontaneous arteriolar obstructions are present (arrows). Extreme retinal periphery (at left) is completely nonperfused.



times be related to the proportion of hemoglobin S in patients' red blood cells. It was, therefore, of interest to examine the eyes of 14 patients with S-thal, and attempt to relate their ophthalmologic findings to both clinical status and to hematologic findings.

Materials and Methods

All 14 patients were Negroes who were referred from the hematology clinics of the Johns Hopkins Hospital, Baltimore, the West Side Veteran's Administration Hospital, Chicago, and the University of Illinois Hospital, Chicago.

The diagnosis of sickle thalassemia was established by quantification of the proportions of hemoglobin S in patients' hemolysates by elution after starch block or cellulose acetate electrophoresis (S. Charache, M. Bartalos, and V. Schneider, unpublished data). If it can be determined that the patient has not had a transfusion, a hemolysate containing 60% to

95% hemoglobin S, a small amount of hemoglobin F, and the remainder hemoglobin A is diagnostic of S-thal. Family studies are required to establish a diagnosis in patients with higher proportions of hemoglobin S. One parent must have sickle cell trait, and the other beta-thalassemia trait. The latter diagnosis is established by demonstration of an increased proportion of hemoglobin A₂ (> 3.5%). Such family studies were carried out in patients 1, 3, 5, 6, 8, and 13 (Tables 1 and 2).

All patients' conjunctivas were examined with a slit lamp in order to determine the presence or absence of the characteristic vascular segmentation of sickling disease.¹⁻³ Each retina was evaluated through dilated pupils by indirect ophthalmoscopy and scleral indentation. Large (8 × 12 in) fundus drawings were made. Fluorescein angiography was performed according to techniques published elsewhere.^{6,12,17} Black sunbursts were counted. Each retina was graded according to a recently described classification^{10,11} of proliferative sickle retinopathy (PSR) (Table 2).

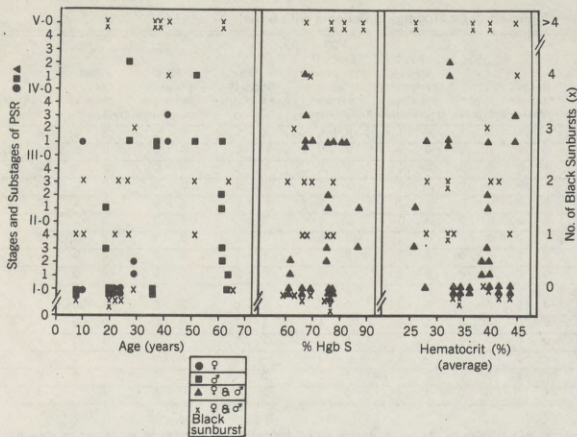


Fig 6.—Stages and substages of proliferative sickle retinopathy and number of black sunbursts are plotted on vertical axes. A precise relationship between these factors and patient age, percent of hemoglobin S, and hematocrit value is not apparent.

Results

A summary of findings is presented in Table 1 and Fig 6. Vascular segmentation in the conjunctiva was seen in eight of the 14 patients. These lesions were qualitatively similar to those described by Paton and others¹⁻³ in homozygous sickle cell anemia and in Hb SC disease, in that they were isolated comma and curlicue-shaped segments of small-caliber vessels. Granular flow, sludging, and erythrocytic clumping are not diagnostic of sickling disorders, and were not observed. In S-thal, the isolated vascular segments were much fewer and far less noticeable than in SS disease.

Fundus abnormalities similar to those described in SC and in SS diseases were observed in all but three of the 28 eyes studied. Refractile deposits in the retina,^{6,18} which may or

may not be true lipid, were noted in 11 eyes. Black sunbursts were present in 20 eyes (Fig 7), and were numerous in eight of the eyes. Retinal vascular tortuosity was present in only two patients and was pronounced in only one. Angioid streaks were observed in one patient (Fig 8).

Proliferative retinopathy was graded according to the classification in Table 2. Fourteen of the eyes had at least the earliest signs of proliferative retinopathy (peripheral arteriolar obstruction, stage I). Many of the remaining retinas showed evidence of arteriolar-venular anastomoses (stage II) and neovascular and fibrous proliferations (stage III). The sea fan neovascularization was present in nine of the retinas (Fig 9). Spontaneous vitreous hemorrhage (from the neovascular proliferations) had occurred unilaterally in three patients (stage IV) (Fig 10). In one

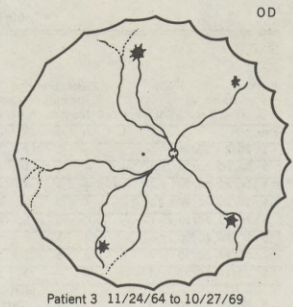


Fig 7.—Right fundus of a Negro man with sickle thalassemia (patient 3). Multiple black sunbursts and obstructed arterioles. There was no change in the fundus appearance from Nov 24, 1964, to Oct 27, 1969.

of these, the hemorrhage was massive. Retinal detachment (stage V) was not observed in this series.

There appeared to be no precise relationship between either extent of PSR or number of black sunbursts and patient age, percent of hemoglobin S, and hematocrit value (Fig 6). However, black sunbursts were especially numerous in patient 3, whose red blood cells contained the highest percentage of hemoglobin S in this series (Table 1).

Comment

Significant ocular abnormalities in thalassemia were first reported by Rudd et al in 1953.¹⁹ They observed areas of hemorrhage and retinal detachment in a 22-year-old Negro man, who was initially considered an example of thalassemia minor. Subsequent evaluation, however, revealed latent sickling, and the cor-

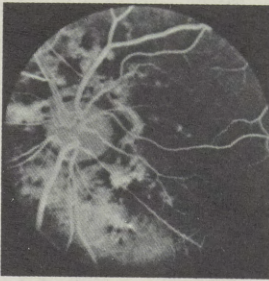
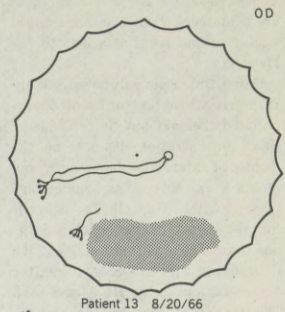


Fig 8.—Fluorescein angiogram of a Negro man with S-thal (patient 12). Irregular white areas represent angioid streaks. Optic disk and retinal vessels appear normal.



Patient 10 6/10/70
Neovascular (sea fan) * black sun burst

Fig 9.—Right fundus of a Negro man with sickle thalassemia (patient 10). Two sea fans and five black sunbursts are seen.



Patient 13 8/20/66
Neovascular (sea fan) * vitreous blood

Fig 10.—Right fundus of a Negro man with sickle thalassemia (patient 13). Two sea fans are seen. One of them had bled spontaneously, and the blood had gravitated to inferior vitreous, where it obscures a black sunburst.

rect diagnosis may well have been S-thal. Kahan et al²⁰ then called attention to vitreous hemorrhage in a case of thalassemia minor, and vascular veils in the vitreous of a patient with thalassemia minima. In 1969, Toselli et al²¹ studied 13 individuals with unexplained intraocular hemorrhages. Six of them were found to have thalassemia minor or minima, but not S-thal. Conjunctival signs similar to those described here have never been described in thalassemia.

Conjunctival lesions are much more numerous and obvious in patients with SS than in patients with SC.¹ In our series, the conjunctival vasculopathy observed in eight patients with S-thal was qualitatively similar to that seen in patients with SC and SS, but was less pronounced. Its presence could not be related to severity of disease, age, percent of hemoglobin S, or to hematocrit value.

Angioid streaks have been reported previously in SS and in Hb SC

diseases.²²⁻²⁴ One patient with Hb AS was reported to have angioid streaks,²⁵ but also apparently had pseudo-xanthoma elasticum. To our knowledge, patient 12 is the first S-thal case to be reported with angioid streaks. The pathogenesis of these cracks in the elastic lamina (Bruch's membrane) separating the retina from the choroid remains obscure.²² However, it is possible that chronic hemolytic anemia may result in chronic iron deposition in Bruch's membrane, and cause brittleness and crack formation.

Vitreous hemorrhages arising from patches of neovascular, proliferative retinopathy have also been reported in various sickle cell diseases. Although proliferative retinopathy (with or without vitreous hemorrhage) may occur in SS disease, and even in sickle cell trait, it is decidedly uncommon in any of these disorders when compared with its prevalence in SC diseases. For example, neovascular and fibrous prolif-

erations (stage III) have been reported in a majority of patients with SC hemoglobin and in a small minority of patients with SS hemoglobin. Conversely, the black sunburst lesions (circular, black, chorioretinal scars) are more characteristic of SS than of SC disease, having been observed more than twice as commonly in the former than in the latter condition.

The retinas of our patients appear more similar to those of patients with Hb SC disease than to those of patients with sickle cell anemia, in that proliferative lesions were frequently observed. In vitro studies can be interpreted to predict such findings.²⁶ When blood from a patient with a sickling disorder passes through a deoxygenated vascular bed, its viscosity increases. The magnitude of the increase depends upon the rate at which the cells sickle and the hematocrit value of the blood. In the extreme case, vascular occlusion results. Rates of sickling in S-thal

and SC diseases are very similar, as are hematocrit values, and one might expect retinal manifestations to follow suit.

Susceptible cells will not sickle until a critical concentration of deoxygenated hemoglobin is exceeded.²⁶ That concentration depends on the degree of interaction between hemoglobin S and any other hemoglobins present within the cell. The SC cells contain about 70% hemoglobin S (ie, less than that of S-thal cells), but Hb C interacts with Hb S to a greater degree than does the Hb A of S-thal. The two factors (percent of S and degree of interaction) more or less cancel out, and, during controlled deoxygenation, the two types of cells sickle

at much the same rate. Hematocrit values for patients with Hb SC disease and for those with S-thal are approximately the same: average hematocrit value for 50 patients with SC is 33.5%; average value for 7 patients with S-thal is 33.4% (S. Charache, MD, unpublished data).

One might also expect systemic manifestations to parallel in vitro factors. They do, in general terms, but degree of incapacitation in an individual patient may be impossible to predict from the blood alone. Patient 5, for instance, considers herself to be in good health, whereas patient 13, whose red blood cells contain less hemoglobin S, has recurrent, painful crises. It was, therefore,

of interest to find the most black sunbursts (which are characteristic of SS disease) in the patient with the highest concentration of Hb S, although his general clinical status was no more severe than that of other patients. Certain retinal abnormalities, such as the black sunburst and the sea fan, thus, may be more directly related to the in vitro behavior of red blood cells than is overall clinical status, which appears to be a resultant of additional factors.

This investigation was supported in part by Public Health Service training grant EY-24-13, research grant 5-R01-HE-02799-14, the Illinois Eye Bank, and a research fellowship from the Illinois Society for the Prevention of Blindness.

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Dr. RABB. The retinas of S-thal patients resemble those of hemoglobin SC disease more than (SS) disease. Sixty-six percent of persons with S-thal were found to have the dangerous type of proliferative sickle retinopathy.

SICKLE CELL TRAIT

Although few ocular symptoms have been reported in the very few patients with sickle cell trait that have been examined, much investigation must be done since the majority of the abnormal hemoglobin population falls into this category.

Currently very little ophthalmological research related to sickle cell disease is being done on an organized scale throughout the country. The University of Illinois Eye and Ear Infirmary, under the direction of Dr. Morton F. Goldberg, is one exception, having already undertaken a clinical investigation program for detecting, diagnosing, and treating sickle cell disease of the eye. With the University of Illinois leading the way, other local affiliated hospitals such as Mercy Hospital of Chicago have instituted plans for routine sickle screening. Those persons demonstrating positive sickle cell tests automatically receive hemoglobin electrophoresis to determine the specific abnormal hemoglobin.

Once the determinations have been made as to which type of abnormal hemoglobin, the individual receives a thorough examination of the retina. However, the diagnostic and treatment programs already described cannot be administered and/or broadened in scope without additional funding, and essentially no organized eye research exists in the country for the disease.

WHY MORE RESEARCH IS NEEDED

Throughout the Nation there are large urban areas with predominantly black populations, all of which show a significant incidence of sickle diseases. Many of these areas do not presently have any organized program for diagnosing, treating, and counseling of persons with sickle cell disease, particularly the ocular component. It is estimated that upward of 60 percent to 70 percent of persons with sickle hemoglobin SC disease alone may eventually have some permanent loss of vision in one or both eyes:

What are the different aspects of research needed?

1. Clinical investigative studies. Clinical studies of patients with sickle cell disease and sickle cell trait to determine the incidence, prevalence, and degree of retinal pathology, the potential progress of the disease, and to determine when and how to treat. The usefulness of various lasers for obliterating abnormal and dangerous blood vessels in the retina must be evaluated.
2. Laboratory studies. To develop newer, more accurate ways of quick, reliable, and inexpensive detection of abnormal hemoglobins and abnormal retinas.
3. Community education. To develop centers to promote screening, counseling, and education both generally as well as ophthalmologically.

RECOMMENDATIONS

1. To influence patients to have eye examinations periodically by setting up large scale community education programs.
2. Increase the scope of inner eye and retinal examinations in all persons with sickle cell disease or trait.
3. Create funding for sickle cell fellowships for ophthalmologists to learn how to detect and treat the eye disease.
4. Institute financial help for diagnostic and research equipment so that careful and detailed eye research and treatment can be carried out not only in university centers but hospital centers anywhere in the country.

In summary, sickle cell diseases can commonly cause blindness through retinal disease. The medical community have to be educated to this tragic fact. Funding is needed to support programs in: (1) community and medical education; and (2) basic and clinical research into the causes and cures of blindness in these sickling disorders.

(The prepared statement of Dr. Rabb follows:)

PREPARED STATEMENT FOR THE HEALTH SUBCOMMITTEE

UNITED STATES SENATE

Edward M. Kennedy, Chairman

Regarding Sickle Cell Eye Disease

Maurice F. Rabb, M.D.

University of Illinois Eye and Ear Infirmary

I am Maurice F. Rabb, M.D. I am presently Chief of Ophthalmology, Mercy Hospital, Chicago; Assistant Professor of Ophthalmology, University of Illinois Eye and Ear Infirmary; Medical Director, Illinois Eye Bank and Research Laboratory; Member of the Ophthalmic Advisory Group to the Food and Drug Administration; Ophthalmic Consultant, Martin Luther King, Jr. Health Center and Daniel Hale Williams Medical Center.

I would like to take this opportunity to express my concern about sickle cell disease, particularly sickle cell eye disease, as a public health hazard today in the United States.

Even though this disease entity was discovered over 50 years ago, most Americans, black and white, are still unaware of its devastating effects upon the black population. In recent months, much has been written in the popular press dealing with the classical clinical manifestations of sickle cell disease, such as joint pains, ulceration of the lower extremities, abdominal pains, fever, jaundice, cardiac and neurological disturbances, and the frequent fatalities.

As more attention is focused upon these crippling effects of the disease, it is astonishing that the majority of the public as well as the medical profession are unaware of the potential danger that exists to the eyes.

The eye symptoms are numerous. The classical picture of sludging of the blood in conjunctival capillaries has been described frequently in the ophthalmic literature. However, it is in the fundus or retina of the inner eye where the damage produced by the disease manifests itself most dramatically and tragically. This damage often goes unnoticed since the so-called proliferative 'sickle retinopathy' or retinal disease originates in the peripheral portion of the retina where both the patient and the doctor find it difficult to be aware of any abnormality in the early stages of the disease. The retinal disease begins initially as the small capillaries in the periphery of the retina become blocked off by the abnormal sickle shaped red blood cells. Next, these tiny capillaries which ordinarily never connect with one another unite, forming abnormal communications. The next stage consists of new blood vessel formation with associated fibrous scar formation. If the disease process is allowed to progress, larger patches of vessels develop, called "sea fans." Should these abnormal vessels break, and they almost invariably do, a serious hemorrhage in the eye may occur with subsequent detachment of the retina and often permanent loss of vision. Eventual loss of the eye is not uncommon.

Which Individuals are Affected?

If a person receives the abnormal sickle gene from

one parent, he then possesses a sickling trait, and only in exceptional circumstances shows any sign or symptoms of the disease in the eye. However, should two abnormal genes be transmitted (SS hemoglobin) the homozygous individual suffers from sickle cell disease. Another condition persists as sickle cell thalassemia (S-thal hemoglobin) which differs little from sickle cell trait (SA) except for a higher percentage of hemoglobin S, and a higher percentage of patients with new and dangerous vessels in the retina. Patients with S hemoglobin and C hemoglobin show similar retinal pathology.

(SS) Homozygous Sickle Cell Disease (Sickle Cell Anemia)

Although this is the most serious form of the disease as far as the general body is concerned, it does not have serious effects on vision in most cases. Characteristic of (SS) sickle cell anemia are circular, black chorioretinal scars, "black sunbursts." These lesions represent sequelae of small blood vessel occlusions or hemorrhages but do not ordinarily affect visual acuity. These lesions are found in 43% of patients with (SS) disease. New blood vessel abnormalities are found in 10% of patients.

(SC) Heterozygous Sickle Cell Hemoglobin SC Disease

Dangerous neovascular abnormalities are found in 60% to 70% of persons with SC disease. Black chorioretinal

scars are found in only 18%. The early sign of capillary anastomoses has been observed in 91% of cases examined which makes hemoglobin SC disease the most prevalent variety to have the type of proliferative retinal disease that leads to bleeding into the inside of the eye. Several recent scientific articles are submitted with this testimony to document what little is known of sickle eye disease.

(S-thal) Sickle Cell Thalassemia

The retinas of S-thal patients resemble those of hemoglobin SC disease more than (SS) disease. Sixty-six percent of persons with S-thal were found to have the dangerous type of proliferative sickle retinopathy.

(SA) Sickle Cell Trait

Although few ocular symptoms have been reported in the very few patients with sickle cell trait that have been examined, much investigation must be done since the majority of the abnormal hemoglobin population falls into this category.

Current Research

Currently very little ophthalmological research related to sickle cell disease is being done on an organized scale throughout the country. The University of Illinois Eye and Ear Infirmary, under the direction of Dr. Morton F. Goldberg, is one exception, having already undertaken

a clinical investigational program for detecting, diagnosing and treating sickle cell disease of the eye. With the University of Illinois leading the way, other local affiliated hospitals such as Mercy Hospital of Chicago have instituted plans for routine sickle screening. Those persons demonstrating positive sickle cell tests automatically receive hemoglobin electrophoresis to determine the specific abnormal hemoglobin. Once the determinations have been made as to which type of abnormal hemoglobin, the individual receives a thorough examination of the retina. However, the diagnostic and treatment programs already described cannot be administered and/or broadened in scope without additional funding, and essentially no organized eye research exists in the country for the disease.

Why More Research Is Needed

Throughout the nation there are large urban areas with predominantly black populations, all of which show a significant incidence of sickle disease. Many of these areas do not presently have any organized program for diagnosing, treating, and counselling of persons with sickle cell disease, particularly the ocular component. It is estimated that upward of 60% to 70% of persons with sickle hemoglobin SC disease alone may eventually have some permanent loss of vision in one or both eyes.

What Are the Different Aspects of Research Needed?

I. Clinical Investigative Studies

Clinical studies of patients with sickle cell disease and sickle cell trait to determine the incidence, prevalence, and degree of retinal pathology, the potential progress of the disease, and to determine when and how to treat. The usefulness of various lasers for obliterating abnormal and dangerous blood vessels in the retina must be evaluated.

II. Laboratory Studies

To develop newer, more accurate ways of quick, reliable and inexpensive detection of abnormal hemoglobins and abnormal retinas.

III. Community Education

To develop centers to promote screening, counselling and education both generally as well as ophthalmologically.

Recommendations

- I. Influence patients to have eye examinations periodically by setting up large scale community education programs.
- II. Increase the scope of inner eye and retinal examinations in all persons with sickle cell disease or trait.

- III. Create funding for sickle cell fellowships for ophthalmologists to learn how to detect and treat the eye disease.
- IV. Institute financial help for diagnostic and research equipment so that careful and detailed eye research and treatment can be carried out in university departments of ophthalmology and in other centers.

In summary, sickle cell diseases can commonly cause blindness through retinal disease. The medical community have to be educated to this tragic fact. Funding is needed to support programs in:

- 1) community and medical education
- 2) basic and clinical research into the causes and cures of blindness in these sickling disorders.

Senator KENNEDY. Thank you very much. Dr. Cerami.

STATEMENT OF ANTHONY CERAMI, M.D., ASSISTANT PROFESSOR. DEPARTMENT OF CHEMICAL BIOLOGY, ROCKEFELLER UNIVERSITY

Dr. CERAMI. Thank you.

First of all, I must apologize for my voice and if it goes out completely I have some standins, some colleagues that I brought along.

The purpose of my visit here today is to discuss with you our investigations in the possible use of cyanate in the treatment of sickle cell disease.

Hardly more than a year ago there was an atmosphere of despair and pessimism about the possibility of making a breakthrough in the treatment of sickle cell disease. Recent investigations have provided scientists with a new insight, which has created a more optimistic attitude toward research on this disease.

Several months ago, Dr. James M. Manning and I found that cyanate, a very simple molecule consisting of carbon, nitrogen, and oxygen, could permanently prevent, in the test tube, the sickling of red blood cells from patients with sickle cell disease. We were able to pinpoint exactly where on the hemoglobin S molecule the cyanate reacted. Fortunately, this location is such that it reacts with cyanate much faster than other proteins and this confers on it a high degree of specificity.

We have done many experiments to study the toxicity of cyanate. For example, in the mouse, approximately 5 percent of an injected dose of cyanate reacts with the hemoglobin molecule and the remainder is excreted as the harmless waste products, ammonia, and carbon dioxide.

We have found that cyanate, in experimental animals, is no more than three times as toxic as aspirin—relatively safe compound. We have been injecting or feeding a sublethal amount of sodium cyanate daily to dogs, monkeys, mice and rats for several months and have not observed any abnormalities.

Recently, in collaboration with Dr. Peter N. Gillette of the Rockefeller University Hospital, we have begun an evaluation of the anti-sickling effect of cyanate in patients with sickle cell disease. In our initial studies, which will appear in the November issue of the Proceedings of the National Academy of Sciences, we compared the life span of a small sample of cells that had been treated with sodium cyanate, in a test tube, and then returned to the patient.

The life span of untreated red cells, from a patient with sickle cell disease is abnormally short due to sickling and the eventual entrapment of the cells within the tissues. On the other hand, cells that have been treated with cyanate in the test tube and returned to the patient

have a significantly increased life span and this provides evidence that the cyanate inhibition of sickling observed in the test tube is retained in the patient.

This strengthens the rationale for further clinical investigations of cyanate. As a result of these studies, we have received the necessary approval from the Food and Drug Administration and the Rockefeller University Hospital Committee to begin a limited investigation of the use of sodium cyanate in the treatment of sickle cell disease. We have initiated this program, and hope to establish within the next 6 months whether cyanate will prove to be a useful therapeutic agent in the treatment of sickle-cell disease.

There are many important questions which must be answered regarding the long-term effectiveness and safety of this treatment. Since the cells that are inhibited from sickling will eventually be replaced by new untreated cells, the patient will have to be on a maintenance program of cyanate treatment for his or her entire life. It is therefore obvious that the question of long-term toxic effects is of paramount importance. In addition, many patients will have to be treated and followed to determine whether the treatment with cyanate is effective in ameliorating the disease process.

One of the significant implications of our work is that abnormal molecules can be caused to function normally by treatment with specific therapeutic agents. This leads us to hope that other genetic disorders may be studied and treated in similar fashion.

We and other scientists have been encouraged to approach further studies optimistically and with the reasonable expectation that our results will produce new hope for patients with sickle cell disease. The continuation of research will depend on the extent to which funds are made available. I urge you to consider the need for continuing research funds as you formulate the legislation to combat sickle-cell disease.

Senator KENNEDY. Very good.

Is there any question in your mind, Doctor, that a great deal of money could be usefully expended in increasing research in the sickle cell disease, the genetic area, for example? We are talking approximately about \$5 million a year now. Do you think that could be expended valuably?

Dr. CERAMI. I could give you an estimate that we obtained just to develop cyanate as a drug for possible use in the treatment of sickle cell disease; it will probably cost anywhere in the range of \$3 to \$10 million in order to do the long-term toxicity programing and in order to do evaluation of patients.

Senator KENNEDY. And this is just one sort of hopeful effort, is it not?

Dr. CERAMI. That is right.

Senator KENNEDY. But as a clinical researcher, do you think this money, at least the \$5 million a year, could be very well and carefully spent?

Dr. CERAMI. Yes, I believe it can be, because I think the problem is attackable, there are many reasons why people have not investigated sickle-cell disease, as you have heard witnesses explain their reasons. The other important thing, as a scientist in the devising of new drugs, was that it was very difficult to figure out what to do, and so people were thinking in terms of long-term answers—changing the bone marrow, for example, of a person with the disease so that he would now produce normal cells. Technically, I think this is a problem that we may be able to solve in the future, but not for quite a while.

Senator KENNEDY. Dr. Scott and Dr. Rhodes and Dr. Rabb, do you think in terms of what you know about, one, the facilities that exist generally in the country; and two, the types of manpower which are presently in service in the Nation; and three, with the equipment that we do have—against the background and experience of years of work in this field, do you think that \$25 million a year for the next 3 years is excessive resources to devote toward this particular problem? Do you think that money could be valuably expended and in worthwhile programs to provide some immediate relief to people?

Dr. RHODES. Well, certainly I feel that \$25 million a year is a sum of money that could be valuably spent for sickle-cell disease with an association with some programs which are now in effect and to create other programs which are not in effect. I think that \$25 million is certainly not too much money.

I think it is a beginning point in terms of expenditure of funds in this particular area. In supporting the patient—not only in research—I feel research is important, but I also feel it is equally important to do something for the patient now in terms of the things that can be done to help the patient clinically and to develop both the university medical center and also to bring home to the local physician that treats many of the patients and at the small medical centers here the capability of helping people with sickle-cell anemia. This is one of the things that money could certainly be valuable and useful for.

Dr. SCOTT. Senator, I would think that \$25 million is certainly not too much. My question would be if it is enough.

I was just looking at some figures we have here at Howard University, in order to set up a center that would provide comprehensive care for patients and to provide the necessary staff and to renovate or put up new laboratories and to provide all of the facilities that one would need in order to have a comprehensive center. We would need \$4.4 million the first year to set this center up, and then subsequently, about \$2 million a year for ongoing expenses.

If one would extrapolate that to other centers and other activities throughout the country, to say nothing of the screening programs which would be carried out in the neighborhood clinics and so on, I think the \$25 million probably is not quite adequate.

Senator KENNEDY. You know, just finally, it seems to me, of course, we come down to, tragically, the questions of dollars and cents, and that does not even begin to measure the heartache and suffering and anxiety that both the victims and the immediate family and friends feel about this; but just to make a hardnosed business judgment, this is really going to be saving the taxpayers millions of dollars, as I understand by the time you extrapolate on the figures of people that have the disease, their various visits—as I understand, approximately five to 10 crises a year up to 6 years of age and three crises after that—the cost of \$1,000 to \$2,000—about \$10,000 a year for the young people you are talking about, anywhere from 50,000 to 100,000 people in this country that have had that. I mean, what we are talking about is hundreds of millions of dollars spent by people that have the disease, and what we are talking about here is really a very modest kind of an attempt by the Federal Government to support existing kinds of local efforts and research groups which I think you have commented on, and to save the taxpayers money, which is always a factor ultimately in terms of what this Congress does, let alone the enormous saving in suffering and human misery.

Dr. RABB. I would just like to add that from an ophthalmological viewpoint, so far there is no treatment or cure for sickle cell disease. However, those patients with the less severe disease, the SC hemoglobin disease, may not have many symptoms, generally speaking, but may have eye problems that can lead to blindness. Presently, we can treat these patients with argon laser and other photocoagulation instruments, but these instruments cost money; for instance, one instrument could be \$30,000 for one center. Also, there are many people in other areas of this country where there are not university centers, and for these patients to also have the opportunity to be treated would bring about a much higher cost.

Therefore, I do not really think that the \$25 million is enough for this type instrumentation alone.

Senator KENNEDY. I could not agree with you more. Thank you very much, gentlemen. You have been very helpful. I am sure you have given careful attention to the bill. If there are any other technical comments that you want to make or file with us, we will be happy to consider them when we bring up the bill next Tuesday in executive committee. You might take the bill with you if you have any other particular kinds of questions.

(The prepared statement of Dr. Cerami follows:)

Testimony before the Senate Health Subcommittee on S.2676

Washington, D.C., November 12, 1971

Anthony Cerami, Ph.D.

The Rockefeller University, New York, New York

Hardly more than a year ago there was an atmosphere of despair and pessimism about the possibility of making a breakthrough in the treatment of sickle cell disease. Recent investigations have provided scientists with a new insight, which has created a more optimistic attitude toward research on this disease.

The purpose of my visit here today is to discuss with you our investigation of the possible use of cyanate in the treatment of sickle cell disease.*

Several months ago, Dr. James M. Manning and I found that cyanate, a very simple molecule consisting of carbon, nitrogen and oxygen, could permanently prevent, in the test tube, the sickling of red blood cells from patients with sickle cell disease (PNAS 68: 1180, 1971). We were able to pinpoint exactly where on the hemoglobin molecule the cyanate reacted. Fortunately this location is such that it reacts with cyanate much faster than other proteins and this confers a high degree of specificity.

We have done many experiments to study the toxicity of cyanate. For example, in the mouse, approximately 5% of an injected dose of cyanate reacts with the hemoglobin molecule and the remainder is excreted as the harmless waste products, ammonia and carbon dioxide.

We have found that cyanate, in experimental animals, is no more than three times as toxic as aspirin - a relatively safe compound. We have been injecting or feeding a sublethal amount of sodium cyanate daily to dogs, monkeys, mice and rats for several months and have not observed any abnormalities.

Recently, in collaboration with Dr. Peter N. Gillette of the Rockefeller University Hospital, we have begun an evaluation of the anti-sickling effect of cyanate in patients with sickle cell disease. In our initial studies, which will appear in the November issue of the Proceedings of the National Academy of Sciences, we compared the life span of a small sample of cells that had been treated with sodium cyanate, in a test tube, and then returned to the patient.

The life span of untreated red cells, from a patient with sickle cell disease is abnormally short due to sickling and the eventual entrapment of the cells within the tissues. On the other hand, cells that have been treated with cyanate in the test tube and returned to the patient have a significantly increased life span and this provides evidence that the cyanate inhibition of sickling observed in the test tube is retained in the patient.

This strengthens the rationale for further clinical investigations of cyanate. As a result of these studies, we have received the necessary approval from the Food and Drug Administration and the Rockefeller University Hospital Committee to begin a limited investigation of the use of sodium cyanate in the treatment of sickle cell disease. We have initiated this program, and hope to establish within the next six months whether cyanate will prove to be a useful therapeutic agent in the treatment of sickle cell disease.

There are many important questions which must be answered regarding the long-term effectiveness and safety of this treatment. Since the cells that are inhibited from sickling will eventually be replaced by new untreated cells, the patient will have to be on a maintenance program of cyanate treatment for his or her entire life. It is therefore obvious that the question of long-term toxic effects is of paramount importance. In addition many patients will have to be treated and followed to determine whether the treatment with cyanate is effective in ameliorating the disease process.

One of the significant implications of our work is that abnormal molecules can be caused to function normally by treatment with specific therapeutic agents. This leads us to hope that other genetic disorders may be studied and treated in similar fashion.

We and other scientists have been encouraged to approach further studies optimistically and with the reasonable expectation that our results will produce new hope for patients with sickle cell disease. The continuation of research will depend on the extent to which funds are made available. I urge you to consider the need for continuing research funds as you formulate the legislation to combat sickle cell disease.

* Our investigations have been supported in part by Grants from the National Science Foundation, USPHS and the National Foundation-March of Dimes.

Senator KENNEDY. Our final witness is Mr. Clarence Mitchell.

Mr. MITCHELL. I wonder if you could hear me briefly.

Senator KENNEDY. Fine. I appreciate it and apologize for the interruptions. I think you have been up on the Hill long enough to realize the problems we are having. I appreciate your appearance.

**STATEMENT OF CLARENCE MITCHELL, DIRECTOR, WASHINGTON
BUREAU OF THE NAACP**

Mr. MITCHELL. With your permission, I would like to just file my statement for the record and comment briefly on the thrust of it.

Basically, it is a statement commending you and your colleagues for your very diligent work in bringing this matter into proper focus and also calling attention to what I would best describe as a perfecting amendment in the findings on the bill.

In addition to that, I would like to say, just in case they get ready to leave, that I was very proud to be around here when Dr. Rabb was testifying. I happen to be a very close friend of his mother and father. His father is a very distinguished physician in Louisville, and Dr. Rabb has long had a reputation down there for excellence. He graduated from the University of Louisville, and he is accompanied here by his mother, Mrs. Murphy, and his wife and sister-in-law.

As a practical and political matter, I think we have to be sure when this money is authorized and appropriated that it goes to the places where you intended for it to go.

I was at the hearings before the Senate District of Columbia Committee, and it was developed there that money which you had succeeded in getting directed toward sickle cell anemia had, in fact, been channeled to NIH and thereafter into things other than that which you intended it to be spent for.

I think one way to achieve that would be to make sure that as a condition of receiving any of this money, the recipients would have to show that they have an active, ongoing program in the area of sickle cell anemia. This would mean it would be channeled to a great extent to Howard University, Meharry; and I understand there is some very excellent work being done in Los Angeles and other places.

So, with that said, I thank you for the opportunity to appear and will desist.

(The prepared statement of Mr. Mitchell follows:)

STATEMENT OF CLARENCE MITCHELL, DIRECTOR
WASHINGTON BUREAU OF THE NATIONAL ASSOCIATION
FOR THE ADVANCEMENT OF COLORED PEOPLE BEFORE
THE SENATE SUBCOMMITTEE ON LABOR AND PUBLIC
WELFARE ON SICKLE CELL ANEMIA
FRIDAY, NOVEMBER 12, 1971

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE, I AM CLARENCE MITCHELL, DIRECTOR OF THE WASHINGTON BUREAU OF THE NATIONAL ASSOCIATION FOR THE ADVANCEMENT OF COLORED PEOPLE. ON BEHALF OF THE NAACP, I WISH TO COMMEND YOU AND THE SPONSORS OF THE BILL FOR YOUR CONCERN ABOUT THE TOLL OF ILLNESS AND DEATH EXACTED BY SICKLE CELL ANEMIA.

THE TESTIMONY OF WITNESSES IN HEARINGS HELD BY THE SUBCOMMITTEE ON PUBLIC HEALTH, EDUCATION, WELFARE AND SAFETY OF THE SENATE DISTRICT COMMITTEE AND OTHER STATEMENTS BY HIGHLY RESPECTED AUTHORITIES SHOW THAT THIS DEADLY DISEASE IS ONE THAT CAUSES SUFFERING AND EVEN DEATH, BUT APPARENTLY HAS RECEIVED VERY LITTLE ATTENTION IN THE MEDICAL SCHOOLS AND RESEARCH LABORATORIES OF OUR COUNTRY. THE MEMBERS OF THE MEDICAL PROFESSION WHO HAVE WORKED TIRELESSLY TO FOCUS ATTENTION ON THIS MALADY DESERVE THE HIGHEST PRAISE. IT IS A FACT OF LIFE THAT SICKLE CELL ANEMIA IS STILL PUTTING A SUBSTANTIAL NUMBER OF OUR CITIZENS IN THE GRAVEYARDS AND A TRAGICALLY LARGE NUMBER OF THESE VICTIMS ARE CHILDREN AND YOUNG PEOPLE WHO DO NOT SURVIVE BEYOND THE AGE OF 20. IT IS VERY CLEAR THAT UNLESS THIS DISEASE IS GIVEN SPECIAL CONSIDERATION AND UNLESS CONGRESS AUTHORIZES PROGRAMS AND EXPENDITURES DIRECTED TO DETERMINING ITS CAUSES AND POSSIBLE CURES, IT WILL NOT RECEIVE THE ATTENTION THAT WE NOW GIVE TO SUCH WELL KNOWN KILLERS AS TUBERCULOSIS, CANCER AND HEART DISEASE.

BECAUSE THE MEMBERS OF OUR ORGANIZATION ARE GRAVELY CONCERNED ABOUT THE NATION'S FAILURE TO GIVE ATTENTION TO THIS FORM OF ILLNESS, OUR 62ND ANNUAL CONVENTION WHICH MET IN MINNEAPOLIS IN JULY OF 1971 SPENT CONSIDERABLE TIME IN FORMULATING A NATIONAL POLICY WHICH WE HOPE WILL HELP TO AROUSE PUBLIC INTEREST. THE CONVENTION RESOLUTIONS COMMITTEE REPORTED A SUGGESTED POSITION OF OUR ORGANIZATION ON THE ERADICATION OF SICKLE CELL ANEMIA. AFTER A VERY SPIRITED AND INFORMATIVE DEBATE, THE LANGUAGE OF THE COMMITTEE ON RESOLUTIONS WAS REVISED BY DELEGATES ON THE FLOOR. THE REVISION EXCLUDED WORDS IN THE COMMITTEE'S RESOLUTION WHICH, IT WAS THOUGHT, TENDED TO IDENTIFY THE DISEASE OF SICKLE CELL ANEMIA AS ONE HAVING GREATER INCIDENCE AMONG BLACK AMERICANS THAN AMONG OTHER NATIONALITY GROUPS.

PAGE 2

DURING THE DEBATE ON THE FLOOR, HIGHLY RESPECTED MEMBERS OF THE MEDICAL PROFESSION WHO WERE ATTENDING THE CONVENTION AS DELEGATES EXPRESSED THE OPINION THAT GEOGRAPHIC, RATHER THAN RACIAL FACTORS, ACCOUNTED FOR THE HIGH INCIDENCE OF THE DISEASE AMONG ITS VICTIMS. THESE MEDICAL MEN SUPPORTED THE VIEW THAT, BECAUSE SO LITTLE IS KNOWN ABOUT THE CAUSES OF THE DISEASE, IT WOULD BE UNWISE TO SUGGEST THAT NEGROES, PER SE, WERE MORE SUSCEPTIBLE TO IT.

AFTER STATING THAT SICKLE CELL ANEMIA IS A MAJOR KILLER, THE DELEGATES APPROVED THIS LANGUAGE:

"WHEREAS LITTLE OR NO RESEARCH HAS BEEN MADE BY GOVERNMENT OR PRIVATE INSTITUTIONS TO FOCUS ATTENTION OF THE CAUSES AND CURES OF THIS DREAD DISEASE, AND WHEREAS THIS DISEASE PRIMARILY STRIKES THE YOUNG WHO ARE THE FUTURE OF MANKIND, THEREFORE, BE IT RESOLVED THAT THE NAACP CALL ON THE FEDERAL GOVERNMENT TO ASSIGN THE HIGHEST PRIORITY TO THE TASK OF SETTING UP A PROGRAM OF RESEARCH AND THERAPY WHICH WILL ATTACK AND ERADICATE THIS KILLER."

IN LINE WITH THE VIEW EXPRESSED AT OUR CONVENTION, WE SUGGEST THAT SUCH WORDS AS "PRIMARILY AMONG THE BLACK POPULATION OF THE UNITED STATES" WHICH APPEAR AS A FINDING IN S. 2676 BE STRICKEN. OTHER REFERENCES TENDING TO IDENTIFY THE DISEASE AS ONE SPECIFICALLY AFFECTING BLACKS SHOULD ALSO BE REMOVED. WE MAKE THIS SUGGESTION BECAUSE THE LIMITED RESEARCH IN THIS AREAS DOES NOT APPEAR TO ESTABLISH A SUFFICIENT BODY OF SCIENTIFIC EVIDENCE ON WHICH TO BASE ^{SUCH} A FINDING BY THE CONGRESS. THE HEARINGS SUCH AS THIS IN WHICH WE ARE NOW PARTICIPATING, AND MANY OTHER METHODS OF INQUIRY COULD BE USED TO DOCUMENT THE NEED FOR THIS LEGISLATION.

WE ARE GRATEFUL FOR THE EFFORTS OF MEMBERS OF CONGRESS AND HUNDREDS OF PERSONS OUTSIDE OF CONGRESS WHO ARE DETERMINED TO ERADICATE THIS DISEASE. WE ARE ALSO AWARE OF THE FACT THAT FINDINGS TO DATE SUPPORT A HIGH INCIDENCE OF IT AMONG NEGROES. HOWEVER, WE WOULD BE JUST AS CONCERNED ABOUT IT IF FINDINGS TO DATE INDICATED THAT SICKLE CELL ANEMIA WAS PREVALENT AMONG CHILDREN OF ALL RACIAL AND GEOGRAPHIC CLASSIFICATIONS. WE SHALL DO ALL IN OUR POWER TO ASSIST IN THE PASSAGE OF THIS BILL.

Senator KENNEDY. Very good. I want to thank you, Mr. Mitchell. As a spokesman for the NAACP, of course, you speak with great authority and with great interest in many matters, and we welcome you here to this committee and value greatly your comments and your views, which are extremely helpful to us whether it is in the Judiciary Committee or Health Subcommittee or whatever committee any of us sit on.

I want to thank you very much for your appearance here and apologize to you again for the tardiness in the timing. We appreciate it very much.

At this point, I order printed all statements of those who did not attend and other pertinent material submitted for the record.

(The information referred to follows:)

HERMAN E. TALMADGE, GA., CHAIRMAN
 ALLEN J. ELLENDER, LA.
 JAMES O. EASTLAND, MISS.
 B. EVERETT JORDAN, N.C.
 GEORGE McGOVERN, S. DAK.
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COTY S. M. MOUSER, CHIEF CLERK

JACK MILLER, IOWA
 GEORGE D. AIKEN, VT.
 MILTON R. YOUNG, N. DAK.
 CARL T. CURTIS, NEBR.
 ROBERT DOLE, KANS.
 HENRY BELLMON, OKLA.

United States Senate

COMMITTEE ON
 AGRICULTURE AND FORESTRY
 WASHINGTON, D.C. 20510

November 22, 1971

The Honorable Edward M. Kennedy
 Chairman, Subcommittee on Health
 Committee on Labor and Public Welfare
 United States Senate
 Washington, D. C. 20510

Dear Mr. Chairman:

I strongly commend the recent action of the Senate and House Subcommittees on Health in holding public hearings on legislation to launch a comprehensive attack on sickle cell anemia, which takes such a heavy toll among the black citizens of our country. The Sickle Cell Anemia Prevention Act (S. 2676) merits prompt Congressional action, if we are to make a decisive advance in research and screening programs whose critical needs have received only a modest response from the Administration.

On October 20, 1971, it was my privilege to join in a press conference in Philadelphia, Pennsylvania, to help launch a fund-raising drive by the Black Athletes Foundation for Sickle Cell Anemia Research, to establish an International Research Institute in Lawnside, New Jersey. I strongly believe that adequate financial support must be directed to such research efforts where there is a total and immediate identification with the critical health problems confronted by minority groups in America. Such programs at Meharry Medical College in Nashville, Tennessee, and at Howard University in Washington, D. C., where Dr. Roland B. Scott has been conducting research since 1948, fully merit Federal assistance. For too long, our major medical centers have ignored this crippling and painful disease.

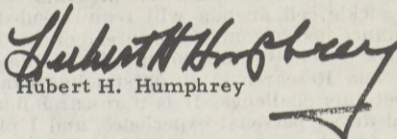
And in launching a nationwide public and private program for the prevention of sickle cell anemia, we must greatly expand the screening, counselling, and treatment programs in our armed services and in the Veterans Administration medical service. During the period

1943-1970, over 518 deaths due to this disease have been reported to the registry of the Armed Forces Institute of Pathology. And during an 18-month screening of over 5,000 recruits at Fort Knox, Kentucky, the director of the Blood Transfusion Division of the Army Research Institute found that 200 soldiers had the sickle cell trait.

I would appreciate your including this letter in the hearing record on S. 2676, as well as the text of my remarks at the press conference on October 20th and an article appearing in the Philadelphia Evening Bulletin.

With best regards,

Sincerely,


Hubert H. Humphrey

Enclosures

STATEMENT ON SICKLE CELL ANEMIA AND THE HEALTH NEEDS OF AMERICA'S
MINORITIES

By SENATOR HUBERT H. HUMPHREY

PHILADELPHIA, PENNSYLVANIA, OCTOBER 20, 1971

One of the most important challenges confronting medical research today is the discovery of a cure for sickle cell anemia.

This blood disease will afflict at least one of every 500 black babies born this year, and the children afflicted will face a life expectancy of only 20 to 40 years, with much of that time spent in pain and recurrent illness and hospitalization.

It is a national disgrace that we have failed to launch an all-out effort to detect and combat this disease caused by a genemutation occurring almost exclusively among black people.

Almost 2,000,000 Americans today carry the sickle cell trait, or defective gene. When inherited from both parents, it is transformed in a significant percentage of children into a malady affecting the red blood cells that elongate under stressful activity to block capillaries and deprive tissues of vital oxygen.

A comprehensive national program of research, testing, and public education on sickle cell anemia will require substantial public and private financial assistance just to control the spread of this insidious disease.

The recent establishment of the Black Athletes Foundation for Sickle Cell Anemia Research is an outstanding example of the kind of action required to meet this challenge. It is a research-financing effort born of deep commitment and direct personal experience, and I pledge my full support and assistance to the founders of this vital organization, Willie Stargell and Dock Ellis of the Pittsburgh Pirates.

Adequate financial support can greatly accelerate the significant progress that has already been made in the development of two accurate tests for the identification of the sickle cell anemia trait and disease, and in the discovery of vital disease-crisis treatment measures.

We must immediately provide for the intensive evaluation of these medical advances and the promotion of further discoveries. We must wage an all-out campaign to educate people about this disease and to encourage their voluntary participation in testing programs.

To help move toward these goals, I have joined as an original sponsor of the National Sickle Cell Anemia Prevention Act, introduced by Senator Tunney of California.

I have called for prompt Congressional action on this bill. It would provide for a coordinated federal grant program of \$25 million per year for 3 years for research, voluntary screening, and counseling and public education, as well as a special \$15 million grant program over three years for the development of centers for research and research training in sickle cell anemia.

Emphasis is also placed in this bill on the development of screening and counseling programs by the Department of Defense for all military personnel and civilian employees. And a similar requirement is directed at the Veterans' Administration and the Public Health Service on behalf of persons eligible for health care in these agencies.

Under all these programs, the voluntary participation of an individual and the protection of his privacy, through holding test results confidential, must be assured.

I am appalled at the failure of the federal government to have taken more comprehensive measures by now to promote research, voluntary testing, and public education on sickle cell anemia, in the face of the extensive evidence of this disease and developments in research that have come to light in recent years.

The budgetary allocation of \$6 million for research in the current fiscal year represents an important beginning. Hopefully, it will be pressed forward by the recently appointed National Advisory Committee on Sickle Cell Disease under the Department of Health, Education, and Welfare.

It is time we faced the clear facts of higher rates of disease and death among the disadvantaged minority groups of Americans an equal right to good health. It is time for us to act to assure all Americans an equal right to good health.

Today in the bicentennial city of Philadelphia, let us establish the priority goal to be achieved by 1976: The conquest of sickle cell anemia.

To a child, sickle cell anemia represents suffering, chronic fatigue, consistent absences from school.

In a man, the condition makes the holding of a job extremely difficult.

A woman may have severe difficulty with all phases of her pregnancy and delivery; she, too, faces intermittent illnesses.

With no known medical cure, physicians can only help relieve symptoms, reduce pain and prevent complications.

To effectively combat sickle cell anemia, we need more money and manpower all along the line—for research, education, therapy and counseling.

And we need resources where they count—in the neighborhoods of black Americans and in rural America, with blacks involved in the planning and delivery of these services.

I urge that we give priority to screening every single pre-school and school child in America.

We can set up screening centers at fixed sites as well as in mobile vans that would travel to schools, playgrounds, parks and residences.

Under the Medicaid Law, every child of welfare families was long since to have been screened for all major ailments; this law must be implemented now for sickle cell and for all other major health problems.

But in all such efforts, we must become fully aware of the larger significance of the disease of sickle cell anemia. And that is that the overall health statistics for black, Spanish-surname, and Indian Americans are much worse than for white Americans.

Look at the toll taken by specific killers and cripplers—heart disease, cancer, stroke, kidney disease, tuberculosis, accidents. In instance after instance the color of one's skin increases the likelihood of being a victim of disease, disability and premature death. Nearly 200 years after our national independence, black, Spanish-speaking, and Indian Americans are still in bondage—to excessive physical and mental afflictions as well as to slums, inferior education, and poor jobs.

We know sickness makes people poor and poverty makes people sick. We know how poverty and malnutrition skyrocket infant mortality.

But there is much we do not know.

This is not a task for the U.S. Government alone; it is a task for state and local governments; for foundations, medical and paramedical societies; private citizens, yes, for all of us.

Let this be a decisive action by which we endeavor to assure all Americans equal health opportunity.

[From the (Philadelphia, Pa.) Evening Bulletin, Oct. 20, 1971]

HUMPHREY AIDS SICKLE CELL ANEMIA DRIVE

Sen. Hubert Humphrey (D-Minn) flew into Philadelphia today to help launch a fund-raising drive for the International Research Institute for Sickle Cell Anemia, an hereditary blood disease that strikes blacks.

Humphrey joined Elliot G. Heard Jr., a Woodbury, N.J., lawyer and president of the institute, former Phillies infielder Tony Taylor, Phillies reserve outfielder Byron Browne, and various doctors at a press conference at the Bellevue-Stratford.

Heard said the institute, founded this month, hopes to build its research center in Lawnside, N.J.

Research in the disease, which strike one in 400 to 500 blacks, has been sporadic, he said. The center would be the first institution devoted to the disease, which can be treated but is not curable.

Sickle cell anemia results in red blood cells changing their shape from disks to sickles that can clog the arteries and can result in great pain, stroke and other problems. Half of its victims, it is estimated, die before they reach the age of 20.

"There is a disproportionate amount of pain, suffering and disease among minority groups," Humphrey said, "We need an international effort to concentrate on these problems.

Humphrey predicted Congress would pass the National Sickle Cell Anemia Prevention Act, introduced by him and Sen. John Tunney (D-Cal.) He said it would provide some \$15 million in yearly research grants.

Humphrey said a private effort, similar to that again muscular dystrophy, must be launched against sickle cell anemia. He pledged his private and public support to the institute.

Browne said the Black Athletes Foundation for Sickle Cell Anemia Research would go to baseball club owners to raise funds for the institute.

Dr. George W. Ward, chief of pediatrics at Mercy-Douglass Hospital, while endorsing the proposed center, said there is not enough money in Philadelphia now to screen and treat sickle cell victims.



American Nurses' Association, Inc.

10 Columbus Circle, New York, N.Y., 10019

(212) 582-7230

Hildegard E. Peplau, Ed.D., R.N.
President

Eileen M. Jacobi, Ed.D., R.N.
Executive Director

Washington Office:
1030 15th Street, N.W.
Washington, D.C. 20005
(202) 296-7140

November 18, 1971

The Honorable Edward M. Kennedy
Chairman
Senate Subcommittee on Health
Committee on Labor & Public Welfare
4230 New Senate Office Building
Washington, D. C. 20510

Dear Senator Kennedy:

The American Nurses' Association would like to have the enclosed statement included in the record of your hearings held on November 11 and 12, 1971, dealing with S. 2676, the National Sickle Cell Prevention Act. Our statement is addressed to supporting programs for the prevention, diagnosis and treatment of sickle cell anemia, and S. 2676.

Sincerely yours,

Eileen M. Jacobi, Ed.D., R.N.
Executive Director

EMJ:mw

cc: Senator Harrison A. Williams

75th ANNIVERSARY 1896-1971

AMERICAN NURSES' ASSOCIATION

Statement on

The National Sickle Cell Anemia Prevention Act

to

Senate Committee on Labor and Public Welfare

Subcommittee on Health

The American Nurses' Association is the professional organization of registered nurses in the United States. Its purposes are to foster high standards of nursing practice, promote the professional and educational advancement of nurses, and promote the welfare of nurses to the end that all people may have better nursing care. These purposes shall be unrestricted by considerations of nationality, race, creed, color or sex. We would like to direct our remarks toward the support of programs for the prevention, diagnosis and treatment of sickle cell anemia.

One of the major reasons for the existence of the American Nurses' Association is the promotion of optimum health care for all people. A large portion of our people, particularly Black people, cannot achieve optimum health because of sickle cell anemia. It is estimated that 600,000 Black Americans have sickle cell anemia and approximately 2.5 million Black Americans have sickle cell trait. Although the sickle shaped red blood cell was first identified and reported in 1910, there has been little interest in this health problem until very recently. Advances in science and technology must be directed toward the prevention, diagnosis and treatment of this condition in order to reach our goal of optimum health for all people.

The American Nurses' Association stands for health care as a right unrestricted by considerations of nationality, race, creed, sex, age or socio-economic status.

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Health care in this nation is not universally available. Our poor and our minorities do not even have access to the less than adequate health care available to the more affluent.

Black people comprise a disproportionately large segment of the lowest income level in this society. Nurses, particularly public health nurses, have been aware of the marked effect of sickle cell anemia and sickle cell trait on the individual's ability to cope with the normal stresses of living. To cite a vivid example, the common cold, a frequent health problem to children living in substandard housing, can be the terminal event for the child with sickle cell anemia. Certainly sickle cell anemia is only one of the many, many problems of Black Americans. Yet, this could be one of the problems solved somewhat more easily if funds are made available. It is a responsibility of government to provide these funds.

Sickle cell anemia is one of the disorders of the blood routinely discussed in schools of nursing. The pathology as discussed in a classroom is often not very impressive until the student cares for the child of 3 who limps and has difficulty walking because of a blood clot to the brain developed during a crisis, or the 8 year old hospitalized three and four times during the school year because of the painful crises, and the 20 year old undergoing skin grafts in an attempt to heal large leg ulcers. Only at this time is the individual tragedy of the illness recognized.

Being "left back" in school, being fired from a job, being unable to support a family, being unable to "mother" children, dying at age 20 are problems quickly identified by students as agonizing and critical issues for the individual, family and society. The cost of chronic illness to individuals, families and communities, financially and emotionally, cannot be estimated. The cost is more than monetary,

-3-

the cost is the loss of the individual's potential contribution to the society.

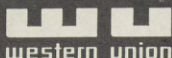
The student, particularly the Black nursing student, asks why more hasn't been accomplished in the treatment of this illness when science and technology have made it possible to transplant kidneys, place artificial valves in hearts, and cure some cancers. What is the answer?

In the past decade, health care professionals and the American public have witnessed dramatic breakthroughs in medical care. The fact that the individual who has a coronary has a greater chance of survival today than ten or fifteen years ago is due to the efforts of the health care team. This same health team effort is needed for the fight against sickle cell anemia.

Prevention and early recognition of illness is a primary health care role of nurses and other community health care workers. Identification of the research and health care needs to combat this multifaceted illness, sickle cell anemia, requires the collaborative efforts of all providers of health care services. Nurses are vital links between medical therapy and patient services. The nurse has traditionally been the facilitator for individual and family entrance into the health care system and nurses are currently expanding this role to become the patients advocates.

The American Nurses' Association has since its origin 75 years ago recognized and worked for health as a national priority. The prevention, diagnosis and treatment of Sickle Cell Anemia is another step in achieving this goal.

JK:md
11/18/71



Telegram

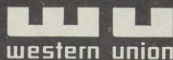
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 SEN EDWARD KENNEDY ATTN DR PHIL CAPER HEALTH SUB-COMMITTEE
 NEW SENATE OFFICE BLDG RM 4226 WASHDC

IN CONVERSATION WITH DR PHIL CAPER AFTER THE CONCLUSION OF
 THE HEARING ON SICKLE CELL ANEMIA FRIDAY NOVEMBER 11 1971,
 IT BECAME APPARENT THAT SPECIFIC INFORMATION ABOUT THE COST
 OF A TYPICAL RESEARCH PROJECT SUCH AS OUR OWN MIGHT BE USEFUL
 IN JUDGING THE ADEQUACY OF THE PROPOSED FIVE MILLION DOLLAR
 ANNUAL ALLOCATION FOR RESEARCH. IT IS REQUESTED THAT THE FOLLOWING
 STATEMENT BE ADDED TO THE RECORD AS CONTINUATION OF THE TESTIMONY
 BY DR ANTHONY CERAMI ENTITLED THE USE OF CYANATE AS A POSSIBLE
 THERAPY FOR SICKLE DISEASE. STATEMENT BEGINS. WE HAVE
 BEEN STUDYING THIS POTENTIAL THERAPY FOR SICKLE CELL ANEMIA
 FOR ONE YEAR. THE RESEARCH TEAM COMPRISES FOUR CHEMISTS, TWO
 PHYSICIANS, ONE NURSE, FOUR TECHNICIANS AND ONE SECRETARY WHOSE
 SALARIES TOTAL \$39,000 ANNUALLY. SUPPLIES EQUIPMENT AND OTHER
 LABORATORY EXPENSES ARE ESTIMATED AT 50 THOUSAND FOR THIS YEAR
 THE COST FOR THE INITIAL CLINICAL STUDY OF 15 PATIENTS FOR
 IN-PATIENT AND OUT-PATIENT CARE, THE CLINICAL LABORATORY, AND
 THE PHARMACY WAS \$250 THOUSAND FOR THIS YEAR, AND THIS SUM WILL
 DOUBLE OR TRIPLE AS THE INVESTIGATION EXPANDS IN THE NEXT TWELVE
 MONTHS. PRESENTLY THE CLINICAL WORK IS FUNDED PARTLY BY THE

MARCH OF DIMES, AND PARTLY BY A CLINICAL
 RESEARCH CENTER GRANT FROM N I H THE CHEMISTRY IS FUNDED PARTLY
 BY A CONTRACT FROM N H L I AND PARTLY BY THE ROCKEFELLER UNIVERSITY,
 THE NSF AND THE MERCK FOUNDATION. THE ESTIMATED EXPENDITURE
 OF \$459,000 SO FAR THIS YEAR HAS BROUGHT THE INVESTIGATION
 OF ONE POSSIBLE THERAPY FOR THIS DISEASE THROUGH INITIAL LABORATORY
 WORK, THE BARE ESSENTIALS OF ANIMAL TOXICITY STUDIES AND EARLY

SF-1201 (PS-42)



Telegram

TRIALS IN A FEW PATIENTS, AS WITH ANY NEW THERAPY AT THIS STAGE OF DEVELOPMENT THERE IS NO ASSURANCE OF SUCCESS, BUT THE RESULT AT PRESENT IN OUR STUDIES SUGGEST CAUTIOUS OPTIMISM.

THE COST TO A PHARMACEUTICAL COMPANY FOR DEVELOPING ANY NEW MEDICATION IS CURRENTLY ESTIMATED AT 3-8 MILLION, AND FURTHER WORK ON THIS THERAPEUTIC AGENT IN OUR LABORATORIES AND HOSPITALS WILL COST 1 AND 1/2 TO 2 AND 1/2 MILLION EVEN BEFORE LARGE SCALE CLINICAL TRIALS CAN POSSIBLY BE CONSIDERED. A BROAD, MULTI-HOSPITAL CLINICAL TRIAL MAY COST 5 TO 10 MILLION, FOR EXAMPLE THE NEW STUDY OF ARTERIOSCLEROSIS IN NEW YORK CITY. BEFORE THIS POSSIBLE THERAPY FOR SICKLE CELL ANEMIA COULD EVER REACH THE PRACTICING DOCTOR AND THE DRUGGISTS SHELF A TOTAL OF 9 1/2 TO 20 1/2 MILLION MAY NEED TO BE SPENT OVER A PERIOD OF

SF-1201 (45-60)

THREE YEARS. THE MAJOR POINT TO EMPHASIZE IS THAT THESE FIGURES REPRESENT AN INVESTMENT IN ONLY ONE POSSIBLE MODE OF THERAPY, AND THAT CERTAINLY OTHER INVESTIGATIONS AT THE OTHER INSTITUTIONS CURRENTLY STUDYING SICKLE

CELL DISEASE SHOULD CONTINUE UNTIL A SUCCESSFUL TREATMENT HAS BEEN DEvised. IN LIGHT OF THESE FIGURES, A TOTAL COMMITMENT OF FIVE MILLION ANNUALLY FOR RESEARCH IN SICKLE CELL DISEASE WOULD SEEM TO BE CONSIDERABLY LESS THAN ADEQUATE. THE FUNDING OF ONLY THREE RESEARCH EFFORTS SUCH AS OURS WOULD REQUIRE TEN TO TWENTY MILLION DOLLARS ANNUALLY, AND THERE ARE MANY INSTITUTIONS IN THE COUNTRY READY AND CAPABLE OF PRODUCTIVE STUDY OF THIS ILLNESS. END OF STATEMENT. IT IS HOPED THAT THESE FIGURES MIGHT BE OF USE FOR PASSAGE OF THE BILL, AND IF FURTHER INFORMATION OR ELABORATION WOULD BE HELPFUL, PLEASE CONTACT ME OR MY COLLEAGUES AT THE ROCKEFELLER UNIVERSITY, 212-360-1000. YOURS TRULY

SF-1201 (45-60)

ANTHONY CERAMI PETER GILLETTE AND JAMES MANNING.

RAY CHARLES ENTERPRISES

OFFICE OF
SENATOR
EDWARD M. KENNEDY
WASHINGTON, D.C.

NOV 19 1 28 PM '71

RAY CHARLES
PRESIDENT

November 15, 1971

Senator Edward Kennedy
Chairman, Health Committee
United States Senate
Washington, D.C. 20510

Dear Senator Kennedy and Members of the House Committee:

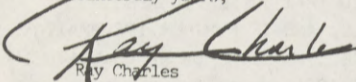
As an entertainer working in many areas of our Country, as well as a citizen concerned with health problems of all people, I am indeed happy to express my whole-hearted support for the efforts and attention being given to the problem of sickle cell disease.

For a number of years, I have served as National Chairman of the Sickle Cell Disease Research Foundation of Los Angeles, California and have been acutely aware of the many persons suffering from this condition that primarily strikes the children and young adults of our Nation and of many countries of the world.

During some of my travels, young patients, parents and relatives of those afflicted with this disease have told me of their great hardships due to the inadequate attention given both the massive medical and social needs caused by this disease.

I strongly recommend and request passage of the pending Sickle Cell Anemia Prevention Act, with an appropriation large enough to attempt to meet some of the urgent medical and health problems. I feel passage of this Act could ultimately lead to the control of this major, national and international public health problem and end the suffering of so many helpless children and young adults.

Sincerely yours,



Ray Charles

RC/rr

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western union

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WU POM NF WSH

WU RB PCH WSH

RPA TLX037 TC PDR RR WASHINGTON DC 11-15 450P EST
 SENATOR EDWARD M KENNEDY CHAIRMAN SENATE HEALTH SUBCOMMITTEE
 OLD SENATE OFFICE BLDG /WASHI GTON DC 20510

I AM MORE THAN HAPPY TO BE ABLE TO SUPPLY INFORMATION TO THE SENATE HEALTH SUBCOMMITTEE CONCERNING RESEARCH THAT IS BEING CONDUCTED BY THE ACADEMIC MEDICAL CENTERS RELATING TO SICKLE CELL ANEMIA. SICKLE CELL ANEMIA IS ONE OF THE BEST UNDERSTOOD OF THE GENETIC DISEASES. THE MOLECULAR BASIS FOR THE DISEASE IS QUITE WELL UNDERSTOOD FROM THE WORK OF MANY INVESTIGATORS. THIS UNDERSTANDING HAS DEPENDED UPON BIOCHEMICAL AND BIOPHYSICAL STUDIES CONDUCTED PRIMARILY IN ACADEMIC MEDICAL CENTERS YET RESEARCHERS HAVE BEEN UNABLE TO PRODUCE A FORM OF THERAPY WHICH PREVENTS THE CLINICAL MANIFESTATIONS OF SICKLE CELL ANEMIA. SIGNIFICANT CONTRIBUTIONS BOTH TO THE UNDERSTANDING AND THE TREATMENT OF THE DISEASE HAVE BEEN MADE BY RESEARCHERS AT HOWARD UNIVERSITY COLLEGE OF MEDICINE, THE JOHNS HOPKINS HOSPITAL, MEHARRY MEDICAL COLLEGE, UNIVERSITY OF CHICAGO MEDICAL COLLEGE OF VIRGINIA, UNIVERSITY OF TENNESSEE, WAYNE STATE UNIVERSITY, UNIVERSITY OF MICHIGAN SCHOOL OF MEDICINE, GEORGE WASHINGTON UNIVERSITY SCHOOL OF MEDICINE, UNIVERSITY OF WASHINGTON SCHOOL OF MEDICINE AND CASE WESTERN RESERVE. RESEARCH RELATED TO SICKLE CELL DISEASE IS NOW BEING SUPPORTED BY SEVERAL OF THE NATIONAL INSTITUTES OF HEALTH. MOST OF THIS RESEARCH IS BEING CARRIED OUT IN THE LABORATORIES AND CLINICAL FACILITIES OF U S MEDICAL SCHOOLS.

THE NATIONAL HEART AND LUNG INSTITUTE HAS AWARDED \$500,000 IN CONTRACTS FOR THE FIRST PHASE OF A COOPERATIVE STUDY. TESTING THE FEASIBILITY OF CLINICAL TRIALS OF THERAPY FOR THE SICKLE CELL CRISIS. MOST OF THIS WORK WILL BE DONE AT FIVE MEDICAL SCHOOLS (TENNESSEE, EMORY, DUKE, MEHARRY, AND BOWMAN GRAY). MAJOR EMPHASIS IS ON THE EVALUATION OF UREA THERAPY BUT OTHER METHODS ARE INCLUDED.

IN ADDITION, THE NATIONAL HEART AND LUNG INSTITUTE IS SUPPORTING 11 GRANTS WITH MAJOR EMPHASIS ON SICKLE CELL DISEASE AT A CURRENT FUNDING LEVEL OF APPROXIMATELY \$450,000. THIS WORK IS BEING DONE AT 8 MEDICAL SCHOOLS (TENNESSEE, JOHNS HOPKINS, FLORIDA, GEORGIA, ALBERT EINSTEIN, ARIZONA, PITTSBURGH, AND CASE WESTERN RESERVE). THE NATIONAL INSTITUTE OF ARTHRITIS AND METABOLIC DISEASES IS ALSO ACTIVE IN THE SUPPORT OF SICKLE CELL DISEASE RESEARCH. IMPORTANT FUNDAMENTAL WORK IS BEING DONE IN THE NIH LABORATORIES AND IN ADDITION, NIAMD PROVIDES RESEARCH GRANT SUPPORT FOR SICKLE CELL DISEASE STUDIES TOTALLING ABOUT \$420,000 IN 11 GRANTS. GRANTEE INSTITUTIONS INCLUDE MEDICAL SCHOOLS AT UNIVERSITY OF TEXAS, GALVESTON, TENNESSEE, PENNSYLVANIA, ALBERT EINSTEIN, ARKANSAS AND JOHNS HOPKINS.

I CAN ASSURE YOU AND YOUR SUBCOMMITTEE THAT THE ACADEMIC MEDICAL CENTERS OF THIS COUNTRY STAND READY TO CONTINUE AND EXPAND THEIR RESEARCH INTO SICKLE CELL ANEMIA. I HOPE THIS WILL ASSIST YOU DURING YOUR EXECUTIVE MARK UP SESSION ON S. 2676.

JOHN A D COOPER M D PRESIDENT ASSOCIATION OF AMERICAN MEDICAL COLLEGES.
 (510).

*

WU POM NF WSH

WU RB PCH WSH

V



NATIONAL CONGRESS OF PARENTS AND TEACHERS

National Office

700 North Rush Street
Chicago, Illinois 60611
(312) 787-0977

OFFICE OF
SENATOR
EDWARD M. KENNEDY
WASHINGTON, D.C.

Nov 16 9 52 AM '71

1715 25th Street
Rock Island, Illinois 61201
November 13, 1971

The Honorable Edward M. Kennedy
Chairman, Subcommittee on Health
Senate Committee on Labor and Public Welfare
Room 431, Senate Office Building
Washington, D.C. 20510

Re: S-2676 - Sickle Cell Anemia

Dear Senator Kennedy:

On May 25, 1971, in convention assembled, the National PTA delegate body voted to support funds for research concerning sickle cell anemia.

The National PTA, with a membership of approximately 10 million members represents the interests of all the children of our great nation. Great concern was expressed for the magnitude of the problem of sickle cell anemia and the lack of research being done in this field. Since this is a disease primarily among the black people, and many of our members are black, this is a personal tragedy to them and their children, with little hope at the present in combatting the disease or bringing comfort to those afflicted.

We were pleased when Senator Tunney introduced both S-2676 and s-2677-The National Sickle Cell Anemia Prevention Act and the Pilot Program for the District of Columbia. We have contacted Senator Tunney expressing our interest and support.

Since the hearing started yesterday, November 12, 1971 and I was not aware in time to ask that we be heard, I would now hope that you would include our support in the findings of this committee. At this point in time when so much can be done and is being done to provide the greatest opportunity possible for all our children we wholehearted support this act to establish a national program for the prevention and treatment of sickle cell anemia.

Thank you very much for hearing our views.

Sincerely yours,

Carol G. Kimmel
Mrs. Walter G. Kimmel
Coordinator of Legislative Activities

THE GEORGETOWN UNIVERSITY MEDICAL DIVISION
DISTRICT OF COLUMBIA GENERAL HOSPITAL
WASHINGTON, D. C. 20003

November 9, 1971

Honorable Senator Edward Kennedy
United States Senate
Washington, D. C.

Attention:

Mr. Robert Bates

Dear Mr. Bates:

In support of S. 2676, "To Provide for the Prevention of Sick Cell Anemia," I submit the following data and discussion:

Sickle cell anemia is a serious hereditary disorder characterized by an increased rate of red blood cell destruction, acute episodic painful crises, and progressive damage from loss of blood supply to multiple organs such as the spleen, kidneys, lungs, etc. Especially in childhood there is increased susceptibility to infections. Maternal morbidity and mortality are increased in mothers with sickle cell anemia. About 50% of pregnancies terminate in miscarriage, stillbirth or neonatal death. Although life expectancy is reduced, and about half of the patients with sickle cell anemia die before they reach the age of 20, some patients are able to live longer and relatively productive lives. Sickle cell disease is most commonly seen in Afro-Americans but is also found in people coming from Sicily, Greece and other Mediterranean areas.

The sickling phenomenon is caused by aggregation of the abnormal hemoglobin molecules through intermolecular hydrophobic chemical bonds which form when the hemoglobin has given up its oxygen. This molecular aggregation increases the rigidity of the red blood cells and decreases their ability to withstand the buffeting normally experienced during the circulation of the blood. Instead of the normal four months, red cells of patients with sickle cell anemia last only 10 to 25 days in the circulation. Since the bone marrow can not produce enough red cells to keep up with this loss, anemia occurs. These rigid sickled cells may logjam in small blood vessels, blocking the circulation and leading to pain and, if prolonged, death of tissue deprived of oxygen. Most of the clinical manifestations of these disorders can be readily explained by these phenomena.

The protein part of the hemoglobin molecule is comprised of two dissimilar halves, each of which has a pair of chains made up of over 140 amino acids. Thus there are two α and two β chains in each whole molecule. The sickling abnormality comes from the substitution of one amino acid for another in each of the two identical β chains. There are a large number of other single substitutions leading to other abnormal hemoglobins, only a few of which have gained any great frequency anywhere in the world. Some, however, exert a profound influence on the number of red blood cells and their ability to function. These abnormal proteins are direct products of abnormal genes. Their study has shown that the genetic code, first understood in the lower organisms and in the laboratory, also applies in identical fashion to humans.

Patients with sickle cell anemia are homozygous for the sickling gene, i.e., they inherit the abnormal gene from each parent. Those with sickle cell trait have only one sickle gene. Some individuals have sickle cell trait plus another abnormality such as a hemoglobin C trait or β -thalassemia trait. Hemoglobin C is another abnormal hemoglobin which has a single amino acid substitution. Thalassemia causes a decreased production of normal hemoglobin. Patients with C-S disease (i.e., both hemoglobin C and hemoglobin S traits) or with S- β thalassemia disease have qualitatively similar disorders to those with sickle cell anemia, but it is generally less severe. There are other abnormal hemoglobins which may occur with hemoglobin S trait and produce disease of intermediate severity also, but they are much less common.

Subjects with only sickle cell trait have relatively little trouble. Most go through life without knowing that they have it. There is no anemia and no painful crises. They may have blood in the urine without other cause. Pregnant women with S trait are more likely to have kidney infections than are women with no S abnormality. S trait subjects may be incapacitated by hypoxia and hence should not have hazardous occupations which subject them to low oxygen, e.g., airplane pilots, stewardesses, etc.

Our studies in Washington, D. C., indicate that about 7% of Blacks have S trait; about 3% have hemoglobin C trait, and 1% have β -thalassemia trait. Each individual with an abnormal trait has a 50 - 50 chance of passing that trait on to any child they might have. When two people with traits marry, they have a 25% chance of having a child with both abnormalities.

Before, and for a short while after birth the infant has predominantly a fetal type of hemoglobin (hemoglobin F). One-half of the hemoglobin F molecule is like adult hemoglobin (or sickled hemoglobin) i.e., the α peptide chains. The other half is quite different, made of two peptide chains designated γ . Around the time of birth, there is a gradual switch from γ chain production to β chain production. If the β chains made are abnormal, such as with hemoglobin S, the hemoglobin is abnormal. This is why sickle cell anemia rarely troubles a child before age 6 months and often doesn't become manifest until the age of two years or older.

Therapy for sickle cell disease is supportive, symptomatic and unsatisfactory. Many agents first seemed to work but later were found to have no value. Evaluation of a therapeutic agent is very difficult because of the marked variability in the course of sickle cell disease, both between patients and within the same patient from one time to another. Hence, carefully controlled clinical trials are essential. An obvious method of therapy would be to replace the sicklable cells with normal cells by transfusion, repeated at intervals so that the individual has very few of his own abnormal red cells circulating. Transfusion "shuts off" his own red cell production. Whereas this would appear to be a simple way to normalize the blood, the risk/benefit ratio of this treatment is not known. Many physicians believe it to be too high to be useful as a routine therapy. Urea holds some promise as a "molecular treatment for a molecular disease" but controlled trials have just begun. Cyanate is a chemical that can also block sickling (urea's action, if any, may possibly be related to this chemical) but investigation of it as a therapeutic tool is only starting.

It is possible to screen easily large numbers of people for the sickling phenomenon by manual or automated procedures. It is more difficult to determine whether they have sickle cell trait, one of the less severe sickling diseases, or sickle cell anemia itself. It is also more difficult to detect hemoglobin C trait or thalassemia trait. All of these latter problems require electrophoresis for identification (a more complicated and time consuming procedure). If all potential parental pairs, both members of which have the sickling phenomenon, had no children, sickle cell anemia would disappear. Sickle cell trait would remain and decrease in frequency very slowly unless no one with S trait had children, regardless of what his partner had, an unlikely possibility. Nevertheless, it is very desirable for potential parents to be able to be tested and

counseled so that they can make an intelligent choice regarding child bearing, based on their own needs, plans, etc. This availability must be on a continuing basis indefinitely.

The time is ripe for a stepped-up attack on sickle cell disease as proposed in this Bill. This attack should involve: 1.) education of the lay population and medical personnel; 2.) widespread testing for sickling and other abnormal hemoglobin traits, followed by appropriate counseling; 3.) enlargement of present facilities for treatment, with a special regard for psycho-social aspects (vocational counseling, etc.); 4.) clinical and basic research, founded upon the very broad base of fundamental research in the past.

Education of the lay population is best done through mass media plus a Junior High School program to be mentioned below. Public Health authorities can also help through their usual educational channels. Needed is a reasonably comprehensive, lay-oriented treatise on sickle cell disease and related disorders. Teachers and other interested people could then have a reference for further information. Physician education should be aimed at improving the accuracy of diagnosis and providing more sympathetic therapy, as for other handicapped people. More accurate genetic diagnosis will improve the ability to prognosticate and plan therapy. General medical care needs to be improved for these people, as it does for the entire population from which they come.

Populations to be tested and counseled should be given ordered priorities, since facilities and funds cannot be provided overnight for a total program: 1.) pregnant women in pre-natal clinics should be first because sickle cell trait increases slightly the risk of pregnancy. Counseling should be available to them for the next pregnancy. 2.) Birth Control Clinic patients are next because they are in the child-bearing years and presumably sexually active. The influence of sickle cell trait on complications of the "pill" is unknown. 3.) Junior High School students are next. By this age they are able to comprehend, they have not yet begun to have children, and they have not yet dropped out of school. Information about sickling and related disorders should be part of the health or hygiene course given to all students at this time. The course could and should inform in general about genetic disorders, as well as about sickling diseases. 4.) Finally, as wide a population as possible should be tested. Pre-school children are given a low priority because good medical care

will enable those with the sickling diseases that need care to be detected. Pre-school detection of S trait is probably too early; by the time it is important for reproduction and genetic counseling, both parents and children will probably have forgotten the result of the test. Nevertheless, the ultimate goal is to test every member of all affected ethnic groups.

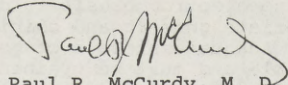
Screening should include not only a test for sickling but also electrophoresis to detect other abnormal hemoglobins. Appropriate genetic and clinical counseling must be made available. Adequate numbers of genetic counselors are probably not available and must be trained. It is better to do the job right for fewer people than to jump into mass testing without adequate resources. Testing is probably best done by building from existing programs, when there are such.

Research should be an integral part of all programs. It need not be sophisticated, although additional basic information is needed. Immediate goals should include: 1.) pressing the chemical attack on sickling, such as with urea and cyanate and additional medications yet to be discovered. 2.) Development of an ability to make pre-natal diagnosis of sickle cell anemia early in pregnancy. Parents could choose to abort a fetus with sickle cell anemia and start another pregnancy, should they have a strong desire to have a child of their own. For those who wish to avoid therapeutic abortion, pre-natal diagnosis may help them cope with the handicapped child, medically and emotionally, after it is born. 3.) Develop an understanding of the mechanism that turns off fetal hemoglobin production and turns on adult hemoglobin production around the time of birth. Returning the blood to the fetal state would block most if not all of the manifestations of sickle cell anemia and permit a normal life. It is a goal well worth seeking but will require considerable basic research.

The Bill, S. 2676, appears to make a good start in the establishment of the above programs. It properly emphasizes the voluntary nature of participation in the testing and counseling programs. I do believe, however, that education in Junior High School about sickle cell anemia and related diseases can be made as compulsory as any part of the educational

system and not significantly affect individual freedom. Without diminishing the emphasis on clinically oriented patient care services, I believe that the stimulus to research can and should be increased. It is from such research that information is obtained that leads to satisfactory treatment.

Very truly yours,



Paul R. McCurdy, M. D.

PRM/hg

Enclosure

CURRICULUM VITAE - PAUL R. McCURDY, M.D.

1946 A.B., with Honors in General Scholarship, Wesleyan University, Middletown, Conn.

1949 M.D., cum laude, Harvard Medical School, Boston, Mass.

1949-1950 Intern, Hartford (Conn.) Hospital

1950-1951 Jr. Assist. Resident, Medicine, Hartford (Conn.) Hospital

1951-1953 Active duty, U.S.N.R. -- USS Yellowstone, AD-27 USNH, Beaufort, S.C.

1953-1954 Resident, Medicine, V.A. Hospital, Seattle, Wash.

1954-1955 Fellow in Medicine (Hematology), Georgetown University Hospital, Washington, D.C. (16 months)

1955-present Medical Officer, D.C. General Hospital, Washington, D.C.

1955-1959 Instructor in Medicine, Georgetown University School of Medicine, Washington, D.C.

1959-1965 Assistant Professor of Medicine, Georgetown University School of Medicine, Washington, D.C.

1965-present Associate Professor of Medicine, Georgetown University School of Medicine, Washington, D.C.

1956 Certified, American Board of Internal Medicine (Sept. 25, 1956)

MEMBER: Medical Society of the District of Columbia
 American Medical Association
 American Federation for Clinical Research (Senior member)
 Southern Society for Clinical Investigation
 American Society of Hematology
 Fellow, International Society of Hematology
 Fellow, American College of Physicians
 American Society of Human Genetics
 American Association of Blood Banks

CURRICULUM VITAE - PAUL R. McCURDY, M. D.

- 1 -

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CURRICULUM VITAE - PAUL R. McCURDY, M. D.

- 2 -

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CURRICULUM VITAE - PAUL R. McCURDY, M. D.

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STATEMENT
by
NATIONAL URBAN LEAGUE

on

"National Sickle Cell Anemia Prevention Act"
(S. 2676)

for the

Senate Subcommittee on Health

COMMITTEE ON LABOR AND PUBLIC WELFARE

Friday, November 12, 1971

Statement by the
NATIONAL URBAN LEAGUE
on the
National Sickle Cell Anemia Prevention Act
(S. 2676)
for the
Senate Subcommittee on Health
COMMITTEE ON LABOR AND PUBLIC WELFARE
Friday, November 12, 1971

The National Urban League is a professional, non-profit, non-partisan community service organization founded in 1910 to secure equal opportunities for black Americans and other disadvantaged minorities. It is governed by an interracial Board of Trustees and seeks to foster good race relations and increased understanding among all people of these United States. Harold R. Sims is its acting executive director, and Vernon E. Jordan, Jr., is executive director-designate.

The National Urban League works to obtain its goals by developing and operating programs to (1) equalize the life chances of minorities; (2) encourage and stimulate youth in the pursuit of responsible citizenship; (3) develop and strengthen healthy family life, and (4) involve minorities in seeking solutions to their own problems in the areas of housing, employment, education, health, economic development, and individual family services.

With local affiliates in some 99 cities in 36 states and the District of Columbia, the League maintains a national headquarters in New York City and regional offices in Akron, New York, St. Louis, Atlanta, and Los Angeles. A Washington Bureau, Research Department and Development Foundation are based in the Nation's Capitol.

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A professional staff of some 1,300 persons conduct the day-to-day activities of the organization throughout the country, assisted by upward of 10,000 volunteers who bring expert knowledge and experience to the resolution of the problems which minority Americans face in a variety of fields.

The National Urban League has studied the National Sickle Cell Anemia Prevention Act (S. 2676) and supports it because it offers an opportunity for a serious and concerted attack on sickle cell disease. The League believes, however, that the fight against sickle cell disease must be viewed in a broader context---in the context of the Nation's fragmented health system and its needs for drastic overhaul.

At present, America's system of health care is not, and cannot as presently organized, responsive to the needs of all segments of the population. If it were funded appropriately, preferably through general tax revenues, it would be possible to organize our health system to meet the needs of every consumer---including those afflicted with sickle cell anemia and the sickle cell trait.

The National Urban League has enunciated its position in respect to the reorganization of the Nation's health system in a policy statement entitled Toward a National Health Program. We believe that this statement constitutes a matrix within which sickle cell disease, which may afflict as many as 2.5 million blacks, would be conquered on a par with diseases that afflict other segments of the population.

In this connection, the League feels that the current Health Security Act (S. 3) comes closest of all the health bills now being considered by Congress to reflecting the position we have taken, but there are gaps even in that, notably in the areas of training and distribution of health professionals.

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In any case, the fight against sickle cell disease must be seen as a piece of the whole health picture---in an adequately funded health system responsive to all segments of the population, white, black and brown.

The \$5 million embodied in present legislation at the behest of the President for research and treatment of sickle cell disease must be seen as a good faith beginning, but S. 2676 makes possible more realistic economic support of the effort. The numbers of people affected, approximately 10 per cent of the black population, are so large that monies in this magnitude are essential. The screening, treatment and research necessary to overcome sickle cell disease may even cost far more than that.

At present there is no cure for sickle cell anemia. With adequate research, far beyond what is presently contemplated, the Nation may be able to produce either an outright cure or a control, as in the case of diabetes. Funds for research in sickle cell disease have been scarce in the past. In comparison with funds made available for research and treatment of diseases which strike the majority population, they have been infinitesimal. In 1968, revenues from volunteer groups for muscular dystrophy were \$7,203,000; for cystic fibrosis, \$1,998,716; while for sickle cell anemia the figure was only \$50,000.

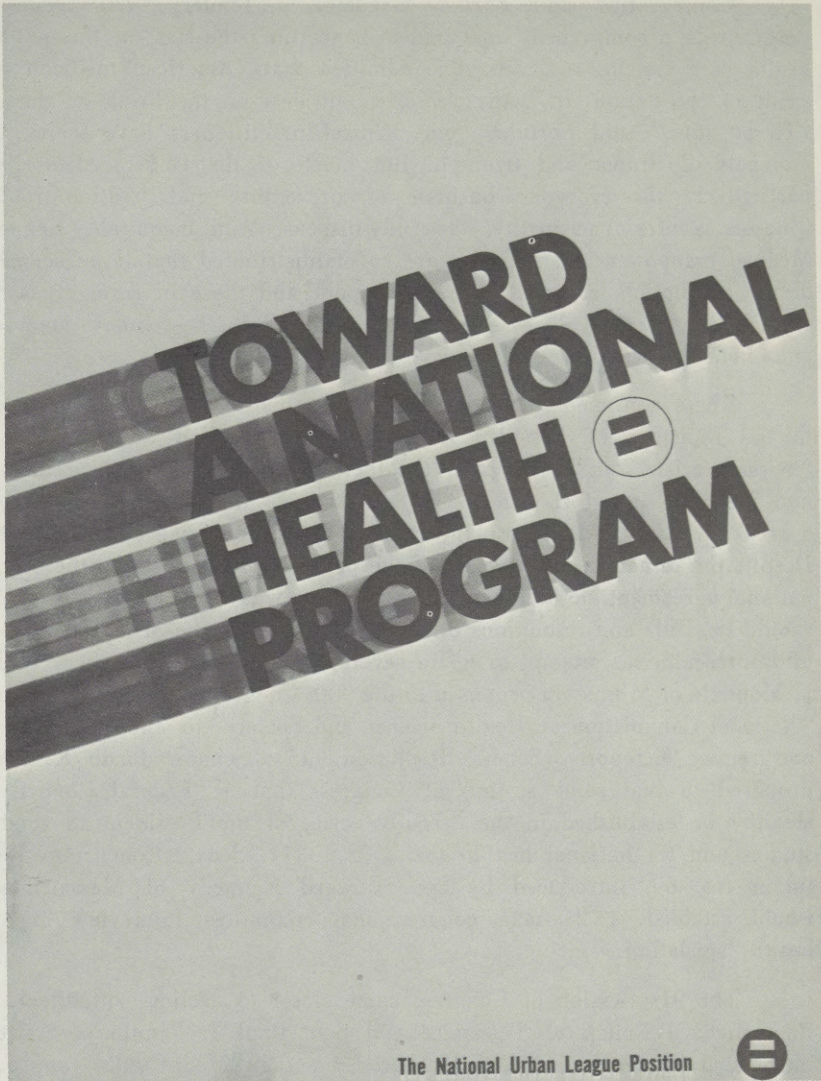
Current Federal grants for sickle cell anemia total only one-third of the number of grants made for either cystic fibrosis or muscular dystrophy despite the fact that in 1967 there were an estimated 1,155 new cases of sickle cell anemia, 1,206 of cystic fibrosis, and 813 of muscular dystrophy.

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Even with those monies now becoming available and those presently contemplated, the need in the field of sickle cell disease is for a much more comprehensive effort than any presently projected.

The National Urban League also feels that monies made available for treatment and research in the field of sickle cell anemia should be directed into the black community to strengthen black institutions. Research and the delivery of services should draw on black talents and capacities and serve to strengthen the black community. Yet, most of the sickle cell research grants let by the Federal government this year have gone to the medical schools of white universities in the South. Howard and Meharry universities are the only two exceptions. The League feels strongly that inasmuch as sickle cell disease is a predominantly black disease, efforts must be made to build both the competence and the institutions necessary to deal with it in the minority community.

A copy of the National Urban League's policy statement, Toward a National Health Program, is attached.



The National Urban League Position



Conservative, staid *Fortune* magazine, in January 1970, began the decade with a comprehensive statement concerning the state of this nation's health care system. In it, *Fortune* admitted that "American medicine, the pride of the nation for many years, stands now on the brink of chaos."¹ "To be sure," said *Fortune*, "our medical practitioners have their great moments of drama and triumph. But much of the U.S. medical care, particularly the everyday business of preventing and treating routine illnesses, is inferior in quality, wastefully dispensed, and inequitably financed. Medical manpower and facilities are so maldistributed that large segments of the population, especially the urban poor and those in rural areas, get virtually no care at all — even though their illnesses are most numerous and, in a medical sense, often easy to cure."

These sentiments have been echoed almost everywhere. Following in the footsteps of President Nixon, who has called attention to the "massive crisis"² in health care, the then Secretary of Health, Education and Welfare, Robert H. Finch, also agreed that "this nation is faced with a breakdown in the delivery of health care unless concerted action is taken."³ Despite the rather clear statement of the problem from all sides, there is no national agreement, no national commitment, on what that "concerted action" should be. Bills and resolutions thus far introduced in the Senate and House of Representatives attempt to go in several directions at once. Sen. Walter F. Mondale of Minnesota proposed to the 90th Congress a 15 man temporary "National Commission on Health Science and Society" to study the situation and render a report. (Senate Resolution 145). Senator Jacob K. Javits proposed to that same session of Congress that a "Federal Council on Health" be established in the executive office of the President to conduct studies and set national health goals, (S.1347). Senate Concurrent Resolution No. 69, introduced by Sen. Edward Kennedy of Massachusetts, would establish a 24 man congressional committee to review existing health legislation.

The 91st session of Congress came closer to dealing with the issue. Rep. Richard Fulton of Tennessee and Sen. Paul J. Fannin of Arizona introduced health insurance bills based on the "Medi-Credit" approach of the American Medical Association. Rep. Durward G. Hall of Missouri submitted a national health insurance plan that would replace Medicaid by voluntary health insurance covering 80% of health care costs and

major illnesses when health care costs exceed a fixed percentage of the family's income. Rep. Martha Griffiths of Michigan introduced an AFL-CIO proposal that would replace Medicare and Medicaid with a program of comprehensive health benefits for all ages and income groups, financed by 3% employer, 1% employee Social Security tax and matching federal revenues. Sen. Abraham Ribicoff of Connecticut introduced a "Health Organization Act", (S. 2898) which would establish in the executive office of the President a council of health advisors to suggest policy and evaluate programs. Later, Senator Ribicoff called for an investigation of private health insurance plans.⁴ Senator Javits also introduced a national health insurance bill (S. 3711).

Widely publicized is the program developed by the United Auto Worker's Committee of 100 under the leadership of the late Walter Reuther and introduced as legislation by Senators Kennedy and Yarborough. Under this plan, national health insurance costs, estimated at \$40 billion a year, would be financed by employer, employee, and government contributions and would provide comprehensive coverage. Yet nowhere in this legislation or in the myriad of bills, resolutions, or plans that have been advanced to date, is there any clear mandate to establish and implement with speed any coordinated national health system.

Medical care in the United States is a gigantic, expensive business dwarfed in cost only by the business of defense; (estimated expenditures for 1969: \$85.2 billion).⁵ In 1969, medical care cost the people of this nation almost \$63 billion, roughly 7% of the gross national product and more than we spend either on social security or the education of our children.⁶ Despite this huge investment, the United States ranks 17th among all nations in the life expectancy of women and 14th in the rate of infant mortality.⁷ Life expectancy is lower and infant mortality is even higher



The United States ranks 14th among all nations in the rate of infant mortality

among the black and the poor. Despite this huge investment, most of our nation's 313,000 active physicians work alone as private entrepreneurs, largely responsible only to themselves and constituting "an army of push-cart vendors in an age of supermarkets."⁶ Clearly, our ailing medical care system — or non-system, to be more accurate — requires immediate and radical surgery. It is the purpose of this National Urban League position paper to explore closely the nature of the surgery necessary and to set forth principles and criteria against which specific proposals for the treatment of our medical care system can be evaluated.

NEEDED: A NATIONAL HEALTH SYSTEM

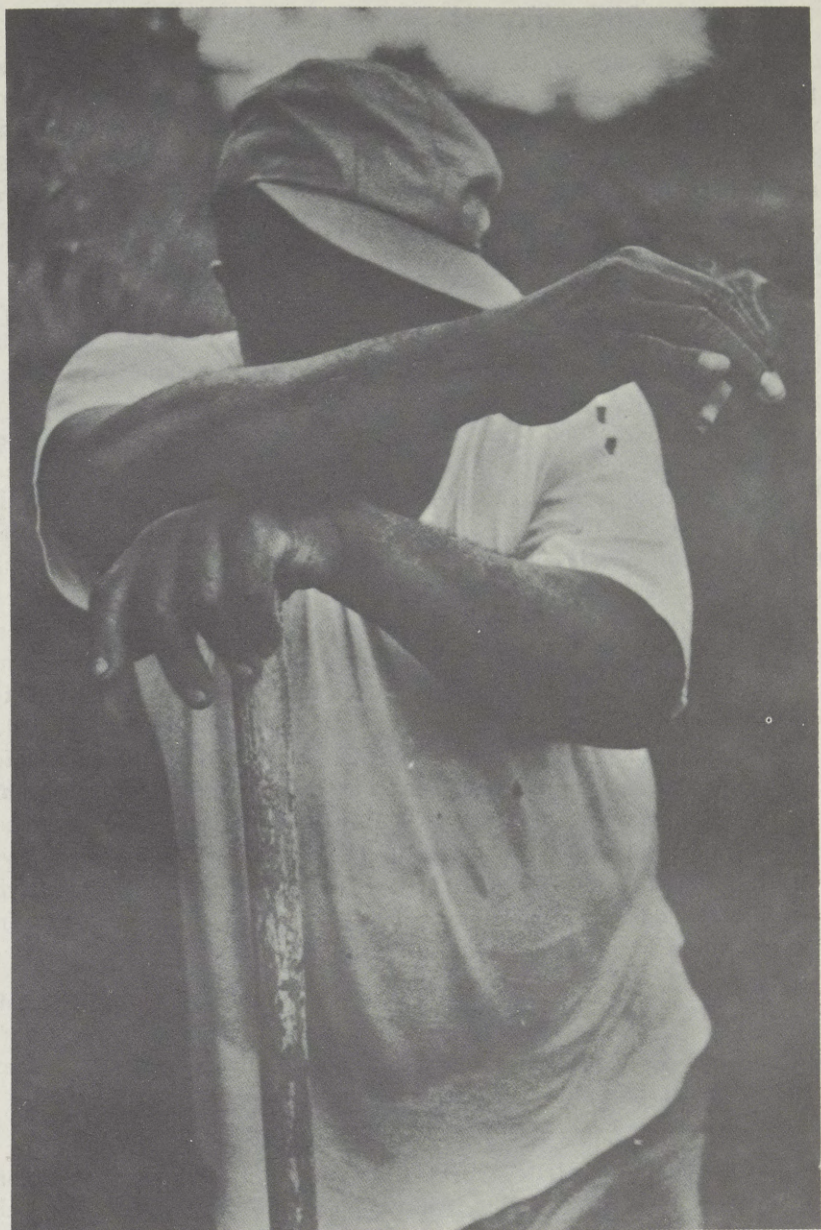
National Financing Cannot Be Divorced from National Health Care.

To establish a nation-wide health financing program without concurrently providing for the delivery of comprehensive health services under that program would be to perpetuate the existing system with all of its glaring deficiencies.

Accordingly, To Be Considered Favorably, Any Proposals, Plans or Suggestions Must Make Specific Provision for Both To Be Coordinated into A National Health System.

The National Health System Must Be Available To and Function Effectively for All Regardless of Age, Race, Sex, Location, Citizenship Status, or Income.

This is a vital requirement, particularly in view of the fact that some 24 million Americans under 65 now have no health insurance. Even those enrolled in insurance plans have significant gaps in their coverage and therefore cannot make extensive, prolonged use of the health care services currently available.⁴ The present uneven and discriminatory pattern of health insurance coverage is illustrated by the following statistics: 85% of the people under 65 have some hospitalization insurance and about 78% are covered to some extent for surgeon's fees, only 51% have coverage for x-rays and lab tests outside the hospital, and only 40% for visits to the physicians office. From the differentials evident in this example between the percentage of persons covered by insurance for physicians and hospitalization, it may be easily inferred that the 3 major components of comprehensive health care services, prevention, early diagnosis, and treatment, are less likely to be available and utilized by those disadvantaged persons who need them most.



NEEDED: MORE HEALTH PROFESSIONALS

A National Health System Must Provide A Tax Supported Public Health Professional Education and Training Program Which Is Free to Any Applicant able to Utilize the Training and Education Necessary to Fulfill a Wide Range of Health Professional Roles. The Recipient of Public Health Professional Education and Training Would Be Required to Fulfill a Five Year Service Commitment. Such an Educational System Must Be Non-Discriminatory and Genuinely Open to All.

The federal government is already in the business of educating physicians, social workers, and nurses. Most professional schools are highly subsidized by federal funding through research grants and a variety of matching grants. A public system would allow a more effective and non-discriminatory utilization of the tax dollar. Through the Physician Augmentation Program, administered by the Department of Health, Education and Welfare and funded under the Special Project Grant section of the Health Manpower Act of 1968 (P.L. 90-490), schools are expected to increase their first year enrollments by 1,000 students per year, beginning in the fall of 1970.³ In 1969, the American Medical Association and the American Association of Medical Colleges (AAMC), in a joint statement on federal support of medical education, called upon the Nixon administration and the Congress to provide \$117 million under the Health Manpower Act for support of operating costs of medical schools, \$170 million for construction and renovation of health education facilities, and another \$20 million for construction of health research facilities.⁹ It is interesting to note that this joint statement reversed previous A.M.A. policy by calling for increased federal funding of loans to medical students for tuition and other expenses. Before, the A.M.A. had said that private loans were sufficient to meet the need. Comparable programs are available for nurses and social workers, but generally lacking for other health professionals.

Such efforts are at best feeble and inadequate to meet the needs. Seven states: Alaska, Delaware, Idaho, Maine, Montana, Nevada, and Wyoming, have no medical schools.¹⁰ Of these, only Nevada has any expectation of starting a school as soon as the fall of 1971 and even then it is only expected to open with 64 first year students.³

The number of MD's graduated each year did not exceed 8,000 until 1969. With the advent of the 1968-1969 academic year, the number of first year students in all medical schools totaled 9,863. The A.M.A. sees these figures as evidence that "the 'tooling up' process in American medical education is beginning to show results in terms of more medical students and more graduates". Even the A.M.A. has had to admit that "the response of the system is painfully slow when considered in relation to the public demand for more physicians to provide more medical care."³

NATIONAL MEDICAL ASSOCIATION MEMBERSHIP BY SPECIALTY AND SPECIALTY BOARD CERTIFICATION — 1967

	Total NMA Members (100%)	Board Certified	% Board Certified	Not Board Certified
Total Physicians	4805	1074	22.4	3731
Allergy	4	0	0.0	4
Anesthesiology	79	27	34.2	52
Aerospace (Aviation) Medicine	9	0	0.0	9
Cardiovascular Diseases	14	3	21.4	11
Child Psychiatry	25	8	32.0	17
Colon and Rectal Surgery	1	1	100.0	0
Diagnostic Roentgenology	1	1	100.0	0
Dermatology	49	22	44.9	27
Gastroenterology	8	2	25.0	6
General Practice	1867	16	0.9	1851
General Preventive Medicine	10	6	60.0	4
General Surgery	479	206	43.0	273
Internal Medicine	540	110	20.4	430
Neurological Surgery	15	3	20.0	12
Neurology	22	5	22.7	17
Obstetrics and Gynecology	425	152	35.8	273
Occupational Medicine	10	3	30.0	7
Ophthalmology	78	38	48.7	40
Orthopedic Surgery	65	16	24.6	49
Otolaryngology	33	10	30.3	23
Pathology	56	31	55.4	25
Pediatrics	280	143	51.1	137
Pediatric Allergy	1	0	0.0	1
Pediatric Cardiology	2	2	100.0	0
Physician Medicine & Rehabilitation	22	7	31.8	15
Plastic Surgery	6	3	50.0	3
Psychiatry	275	81	29.5	194
Public Health	19	7	36.8	12
Pulmonary Disease	8	0	0.0	8
Radiology	109	74	67.9	35
Thoracic Surgery	14	12	85.7	2
Urology	78	40	51.3	38
Not Recognized (1)	65	34	52.3	31
Unspecified	136	11	8.1	125

(1) includes 55 Administrative Medicine

PREDOMINATELY WHITE MEDICAL SCHOOLS RESPONSIBLE FOR TRAINING MORE THAN 20 BLACK GRADUATES

University of Illinois College of Medicine	57
University of Michigan Medical School	48
Wayne State University School of Medicine	38
Indiana University School of Medicine	35
Ohio State University School of Medicine	30
New York University School of Medicine	27
Harvard Medical School	23
Northwestern University School of Medicine	22
Loma Linda University School of Medicine	22
Chicago Medical School	21

As of the 1968-1969 academic year, there were 35,809 students enrolled in 98 U.S. medical schools. Of these, only 858 or 2.39% were black.¹¹ This is a slight improvement over the 1967-1968 figures of 2.28%.¹² Since the black population of the United States approximates between 11 and 12% of the total, the total admission of black students to medical school reflects the widespread denial of equal opportunity. Although there has been some progress in black student recruitment in the past few years, stimulated in part by the Macy Conference held in June, 1967,¹² the progress has been painfully slow. This is particularly true in view of the fact that two predominantly black schools — Howard and Meharry — enrolled 61.77% of all the future black physicians and 13 of the other 96 schools have no black students at all. It is revealing that 11 of the 13 schools with no black enrollment are supported by state tax revenues.¹¹

ENROLLMENT AND GRADUATES OF U.S. MEDICAL SCHOOLS 1968-69

Enrollment 1968-1969	98 Schools	96 Schools*
Total	35,809	35,236
Black	858	328
% Black	2.39	.93
Class of 1968		
Total	7,930	7,778
Black	155	47
% Black	1.95	.60
Class of 1969		
Total	8,168	8,037
Black	167	60
% Black	2.04	.75
Class of 1970		
Total	8,596	8,450
Black	196	34
% Black	2.28	.40
Class of 1971		
Total	9,403	9,212
Black	217	70
% Black	2.31	.76
Class of 1972		
Total	9,717	9,545
Black	278	130
% Black	2.87	1.37
% Change	.92	.77

* excluding the two predominately black schools, Howard University and Meharry Medical College.

A task force of the AAMC recently recommended that minority group students in medical degree programs be increased to 12% of the total enrollment by 1975-1976.¹³ The task force suggested that increases in the number of places available in medical schools, more student loans and special counseling would make the goals possible. Nevertheless, based on projections of the current rate of growth by the Public Health Service, there will be 13,000 first year medical students in 1975-1976.¹⁰ If the goal of the AAMC task force is attained, this would mean that only 1,560 of those students entering medical school in 1975 would be black. And this would still not begin to meet the needs of the black community. If successful the AAMC Task Force efforts will not materially change the 1967 fact that among white American citizens, one in 560 becomes a doctor, whereas among black citizens the ratio is 1 in 3,800.¹²

The thrust of this discussion has been on physicians only because the shortage of doctors is most dramatically acute. Further, the medical profession has the longest and most complex professional training period. There could be, however, a comparable discussion relative to each of the health professions.

Any Law Establishing a National Health System Must Clearly and Unequivocally Commit This Nation to the Principles of Non-Discrimination and to the Training of Sufficient Numbers of Health Professionals — Including Doctors, Dentists, Pharmacists, Occupational Therapists, Administrators, and Others — to Meet the Increasing Needs of an Expanding Population and Economy.

A National Health System Must Also Provide for and Encourage the Continuing Formal Education of Physicians, Nurses, Administrators, Technicians, and Other Personnel without Loss of Income.

This should be considered an integral part of the system's thrust for greater efficiency, productivity, and higher quality care. The health professional needs both the encouragement and the opportunity to attend post-graduate courses, seminars, and professional meetings without financial loss. In 1968-1969, 71 medical schools reported 127,377 registrations in regular continuing education courses.³ Since physicians who do enroll in post-graduate courses tend to enroll in more than one, the probability is that no more than 63,688 or only 20% of the nation's active doctors actually participate in medical school programs. While radio and television courses attract another 24,658 registrants, this experience cannot compare with the participation with peers in an intellectually stimulating, productive, and more conducive learning environment. Health professionals would participate in continuing education if courses were readily available, if they were assured of being able to participate without financial loss and

if there is provision for adequate care of their patients during periods of absence. Further, participation in post-graduate courses could be encouraged by special income incentives for salaried health professionals or income tax incentives for the self-employed.

A National Health System, As Part of Its Thrust to Improve the Quality of Medical Care, Should also Encourage Physicians to Seek Certification by the Specialty Board in the Field in Which They Are Working.

As of 1967, only 38% of all physicians in internal medicine were board certified, only 36% in psychiatry, 46% in obstetrics, and 68% in radiology.¹⁴ Board certification is no guarantee of quality care, but it is the only objective measure beyond mere licensure that the consumer has for determining clinical competence. Since, with the exception of those in radiology, black physicians have not been granted sufficient opportunities for advanced study leading to board certification, a non-discriminatory national health system could eliminate this problem.

**PERCENTAGE OF BLACK SPECIALISTS WHO ARE BOARD CERTIFIED
1967**

	% Board Certified (Black)	% Board Certified (U. S.)
Internal Medicine	20	38
Psychiatry	30	36
Obstetrics & Gynecology	36	46
General Surgery	43	48
Pediatrics	51	57
Radiology	68	68

NEEDED: BETTER DISTRIBUTION

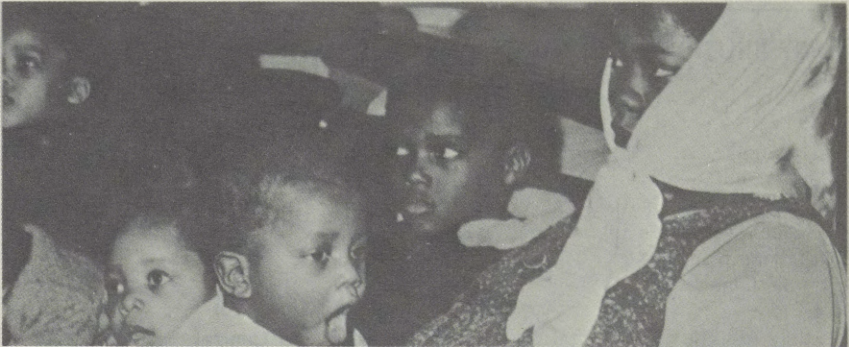
A National Health System Must Assure That Comprehensive and Specialized Health Care Services Are Distributed Evenly Throughout the Nation by Area and in Accordance with the Needs of the Populace.

With proper planning, health professionals may be encouraged to serve in the rural and poverty areas of the nation where the need is most apparent. This could be accomplished by requiring, in return for government financed training, a minimum five year period of service, or other incentives in assigned areas. Precedents for this approach may be cited from the experiences such as Puerto Rico, Mexico, and some European countries.

Contrary to widespread belief, the second major barrier to health care in the United States, after its high cost, is not physical distance from hospitals. Hospital facilities of 25 beds or more are now within 25 miles of all but 2% of the population, and within 10 miles of any urban area.¹⁵

Rather than in distance, the problem lies in fear, distrust, denial of treatment, or the inaccessibility of care to the poor, the black and the isolated.

While more is involved in the supply of medical services than the number of physicians available, their number is crucial. When the National Advisory Commission of Health Manpower issued its report in 1967, the Commission cited three problems patients characteristically face: difficulty of reaching a physician at nights or on weekends, except through emergency rooms of local hospitals; long delays in obtaining appointments for routine care; hurried and impersonal attention even after long hours wasted in



Long hours wasted in waiting rooms discourages many patients from seeking medical care

waiting rooms.¹⁵ These indicators pointing to the kind of service the nation receives is tied to the critical shortage of treating physicians since the physician is an integral part of the health team and usually is its leader.

Since 1950, the number of physicians has grown some 25% faster than the general population. By 1967, there were 277,729 active physicians — doctors of medicine or osteopathy — outside of the federal services, roughly 135 per 100,000 population.¹⁶ (The Department of Health, Education, and Welfare estimates that at present rates of growth, there will be 361,500 active physicians in 1975, a ratio of 160 per 100,000 population.) It must be noted, however, that such overall statistics tend to obscure the actual situation. About a third of all active physicians are in research, public health, hospital administration, industry, or teaching. The actual doctor-patient ratio including specialists is closer to 92 per 100,000.¹⁷ If just those physicians providing day-to-day family care are considered — the general practitioners, internists and pediatricians — then the ratio is down to 50 per 100,000.¹⁷ This is the heart of the problem. It is through just these practitioners that the first treatment of illness is sought.

In addition to the physician shortage in general, the supply of those available is extremely uneven geographically. The District of Columbia

leads the nation with 318 non-federal physicians providing patient care per 100,000. New York State is second with 199 per 100,000. Colorado ranks third (168/100,000); Connecticut, fourth (164/100,000); and California, fifth (161/100,000).¹⁶ At the bottom of the scale, Mississippi and Alaska have but 69, and Puerto Rico only 68. Even in states in favorable positions, distortions in distribution are common. Private physicians tend to settle in prosperous, predominantly white, middle class urban neighborhoods or suburban areas.¹⁷ Ohio, for example, had in 1967, 129 non-federal physicians providing care per 100,000 population.¹⁶ But a survey

DISTRIBUTION OF NMA PHYSICIANS BY REGION AND STATE 1967

Division State	Total NMA Members	Division State	Total NMA Members
New England	93	Virginia	138
Connecticut	41	West Virginia	12
Maine	3	East South Central	275
Massachusetts	43	Alabama	61
New Hampshire	0	Kentucky	37
Rhode Island	6	Mississippi	44
Vermont	0	Tennessee	133
Middle Atlantic	976	West South Central	244
New Jersey	178	Arkansas	17
New York	562	Louisiana	62
Pennsylvania	236	Oklahoma	30
East North Central	921	Texas	135
Illinois	265	Mountain	29
Indiana	99	Arizona	12
Michigan	270	Colorado	8
Ohio	256	Idaho	0
Wisconsin	31	Montana	0
West North Central	197	Nevada	3
Iowa	12	New Mexico	5
Kansas	23	Utah	0
Minnesota	19	Wyoming	1
Missouri	135	Pacific	598
Nebraska	7	Alaska	0
North Dakota	1	California	574
South Dakota	0	Hawaii	4
South Atlantic	1084	Oregon	6
Delaware	11	Washington	14
D. of Columbia	417	Possessions	22
Florida	82	Puerto Rican	11
Georgia	86	Virgin Islands	11
Maryland	163	Address Unknown	84
North Carolina	130	Overseas	262
South Carolina	45	Foreign Countries	20

Total Physicians: 4,805

in Cleveland found only .45 physicians per 1,000 in poverty neighborhoods, but more than double that frequency in non-poverty areas (1.13 per 1,000).¹⁸

Like their white counterparts, black physicians tend to gravitate towards the better neighborhoods in New York, California, and the District of Columbia. A 1967 study by the National Medical Association, a predominantly black professional organization, found that of its 4,805 members, 574 were in California, 562 in New York, and 417 in Washington, D.C.¹⁴

If the distribution of physicians is considered by medical specialty, the situation appears particularly uneven. Recent attempts to attract more students to general practice or family medicine have not been notably successful. As of the 1968-69 academic year, only 20 programs in these fields have been established, only 713 interns, residents, or fellows were on duty in these programs and 43% of the internships and residencies offered went vacant.³ Such efforts will not materially alter the fact that only 22% of all physicians³ and 38% of black physicians are in general or family practice, the point of contact through which most patients enter medical care.

At present the most attractive specialties among all physicians are, in rank order, internal medicine (14%), surgery (10%), and psychiatry, obstetrics-gynecology and pediatrics (6%). Preferences among black physicians follow a similar pattern.

However, the gravity of the specialty problem shows up most clearly on close examination of the distribution of any one specialty group. For example, even in favored New York, there are only 25 psychiatrists per 100,000 population. Rural states suffer even greater lack of psychiatric treatment: Maine, Kentucky, Indiana North Dakota, New Mexico have only 4 psychiatrists per 100,000. Poorer states such as Alabama and Mississippi have only 3 per 100,000.¹⁶

NUMBER AND PERCENTAGE OF BLACK SPECIALISTS OF CERTAIN CATEGORIES

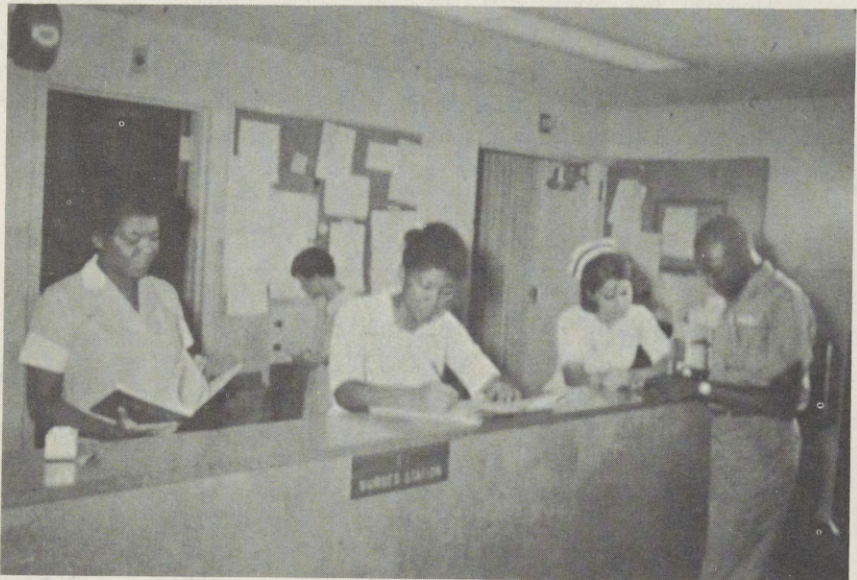
	U.S. Physicians 1967	Black Physicians 1967	Per Cent
Internal Medicine	42,325	540	1
General Surgery	29,687	479	2
Psychiatry	19,749	275	1
Obstetrics and Gynecology	17,964	425	1
Pediatrics	17,614	280	2
Radiology	10,877	109	1

A National Health System Could Alleviate the Shortages of Particular Specialties by Making Residencies in This Field Particularly Attractive Financially or Through the Use of Other Incentives.

NEEDED: NEW WAYS TO SERVE

Clearly, health manpower in all categories is and will remain in critically short supply unless creative solutions are conceived. In view of the increased demand for improved and more readily accessible services, the problem will never be solved merely by recruiting more people into traditional training programs, however expanded and attractive such programs become. Rather, the key to the improvement of medical care lies in a bold re-ordering of priorities, careful re-definition of previous roles and realistic evaluation of the amount of formal education necessary to carry out new responsibilities successfully and efficiently.

In many areas of medical care, innovative approaches have already begun to point the way. Faced with impossible shortages of care-giving personnel, institutions all over the nation are finding new avenues of more effective service in the "paraprofessional", the warm, empathetic person who not only relates more easily and more personally to the patient in distress but who also carries a significant and substantial part of the work load previously reserved for professionals with lengthy and expensive training. In less than a week, for example, hospitals in New York have



Training "paraprofessionals" to do routine jobs has opened new avenues of effective service

trained aides, most of whom are black and not formally educated beyond ninth grade, to take and record temperatures and blood pressures, routines that at one time were thought to require a full nursing education. In North Philadelphia ghetto as well as rural Iowa, psychiatrists have discovered that local housewives and others without high school diplomas can, after only a brief period of "on the job" training, serve effectively in helping most families and individuals in emotional crises.

In many instances, programs that began strictly as manpower production schemes have found that by tapping new human resources, the quality of care is improving substantially. In what started out as merely an attempt to assist its overburdened professional psychiatric staff, not long ago the U. S. Army began to produce "social work/psychology specialists" in a ten week training program. Needless to say, the enlisted men often find these "specialists" easier to talk and confide in than the Army psychiatrists who are all of officer rank. Similar situations prevail in civilian life, especially in rural or disadvantaged urban communities where differences in status or race tend to act as barriers to communication between the highly trained, middle class professional and the patient in need of his services. In such instances, the use of the paraprofessional aides may be essential to the delivery and maintenance of high quality, dignified and comprehensive care.

A National Health System Must Be Committed to the Flexibility Necessary to Discover and Implement New Ways to Raise Standards of Care Through the Recruitment and Training of Paraprofessional Personnel and to the Establishment of "Career Ladders" Which Enable Advancement to Higher Levels of Service.

NEEDED: PUBLIC EDUCATION

A National Health Care System Must Emphasize Case-Finding and Public Education as Part of Its Preventive and Treatment Efforts.

It is not enough for a concerned health system to sit back and wait for patients to present themselves. Experience has shown that many patients will neglect themselves out of ignorance or fear or mistrust. To be effective, the national health service must reach out beyond institutional doors. One imaginative approach is the project undertaken at Hunters Point ghetto of San Francisco. "The program is unique in that it doesn't include the usual charity clinic concept and no stigma is attached to the recipients," Edwin T. Johnson, M.D., reported in the *Journal of the National Medical Association*.¹⁹ "Backed by government financing and sponsored by a local medical society, a program has begun in which teams of social workers, nurses, and health aides go into neighborhoods, often knocking on doors and surveying the

health needs of the community block by block. These teams assist people to the proper entrance into the medical field. They instruct the community about their health needs; they inform them of proper facilities available; they return patients to their own physicians or clinics and inform them of indigenous private physicians if they have no doctor." A similar effort by the University of Rochester Department of Preventive Medicine and Community Health uncovered 10,000 residents 65 or over in need of some specific treatment other than for senility. Of the 10,000, only 41% were receiving the care they needed.¹⁹

Community surveys have long been part of the routine among workers in public health. Many hospitals, community health centers and medical school Departments of Community Medicine have reached out into the community in similar ways, thereby making themselves better known and more acceptable in the communities involved. By utilizing indigenous professional and paraprofessional personnel, such pilot programs have to a great extent begun to overcome the resistance and distrust in disadvantaged areas. Successful programs can serve as models for national health system procedures.

Similarly, the model of the National Institute of Mental Health in its use of television, radio, and other mass media for public education purposes, can be utilized to promote health education programs on a nation-wide basis.

NEEDED: A SINGLE HEALTH AGENCY

To Be Effective. A National Health System Must Be Administered by A Single Agency under Community Influence and Control and Have a Secretary of Health at Its Head.

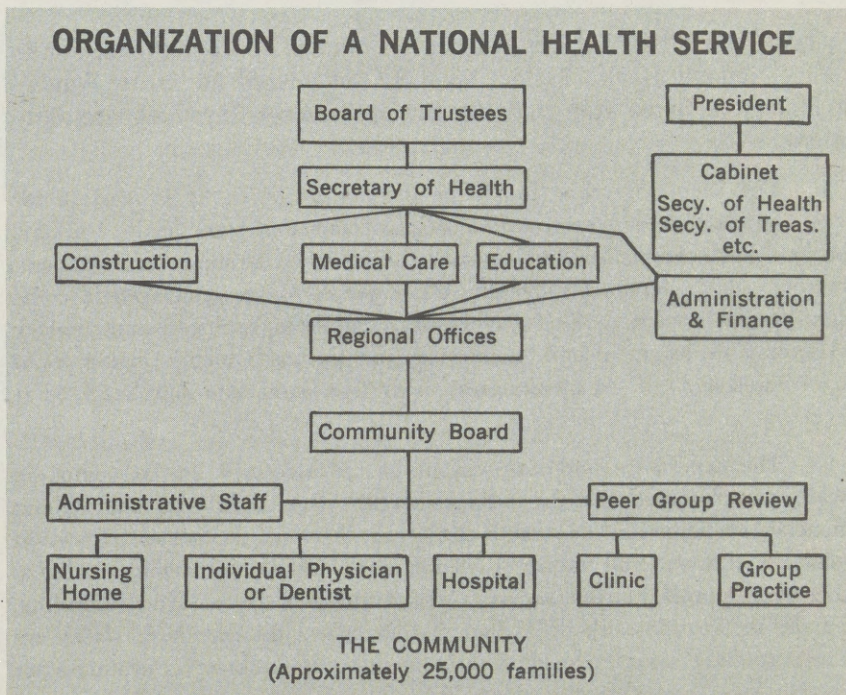
It should be organized in such a way as to take under its wing all civilian health, mental health, and environmental activities now conducted by a variety of separate federal, state, and local government agencies. The organization of this agency must provide for influential consumer participation at all levels of its functioning and assure community control of those facilities and programs which provide direct services.

Some indication of the extent of the fragmentation and duplication of health matters in government is shown in the recent experience of the Joint Commission on the Mental Health of Children. Dr. Reginald Lourie, the Commission's President, has stated that his staff found more than 70 separate, distinct, and uncoordinated federal programs directly related to childhood mental health and these programs were spread over more than 40 different government agencies and bureaus. Another example is the Environmental Science Services Administration which is now in the Commerce

Department while other environmental matters are covered by the Public Health Service. Still another example is the problem of air pollution which is now a responsibility of the Public Health Service, while water pollution is in the hands of the Department of the Interior.²⁰

A well-coordinated single agency could bring together and thereby maximize the effectiveness of similar efforts. In 1969, while the Department of Health, Education, and Welfare was spending \$122 million for the construction of private hospitals and another \$74 million on health research and education, the Veteran's Administration was spending \$1,582 million on its own hospitals and medical care.²¹ All such facilities could be merged into the national health system, thereby making them available to all instead of to selected segments of the population. Veterans could still be entitled to special benefits, but their treatment would often be more convenient in hospitals or other facilities closer to their homes and an emphasis on outpatient care would discourage dependency and chronicity.

The nucleus of an agency capable of operating a national health system already exists in the U.S. Public Health Service and its supporting structures, the Consumer Protection and Environmental Health Service, the Health Services and Mental Health Administration, and the National Institutes of Health.²⁰ Reorganization to provide consumer participation in policy making and planning at all levels from national office to local neighborhood would be necessary.



Starting at the top, a broadly representative, (including consumer and community representation), Council of Health Advisors should help set national standards for health care and environmental protection, provide for national licensing of health workers in all categories, determine other specific policies and guide the implementation of these policies. Long range planning on a national scale should be the responsibility of a central office in Washington with divisions headed and manned by career civil servants rather than political appointees. Funds should be allocated to representative regional boards for regional planning, establishment of regional medical centers for specialized care, and for distribution to community boards concerned mainly with providing and elevating the quality of care in their own localities. Community boards finding themselves with similar problems and needs could associate themselves on an area basis. Essential to effective operation and elevation of standards of care would be review panels to check on the quality of care being rendered and to act on consumer complaints.

To provide and extend the facilities of the existing federal hospitals system, regional and community boards could enter into contractual agreements with county, state, or municipal hospital systems, private hospitals and clinics, individual physicians or physicians in group practice.

FINANCING THE NATIONAL HEALTH SYSTEM

To Avoid the Pitfalls of Dependence on Annual Appropriations, Funds for the National Health System Must Be Considered As "Trust Funds" in Much the Same Way that the Social Security Revenues Are Considered Now.

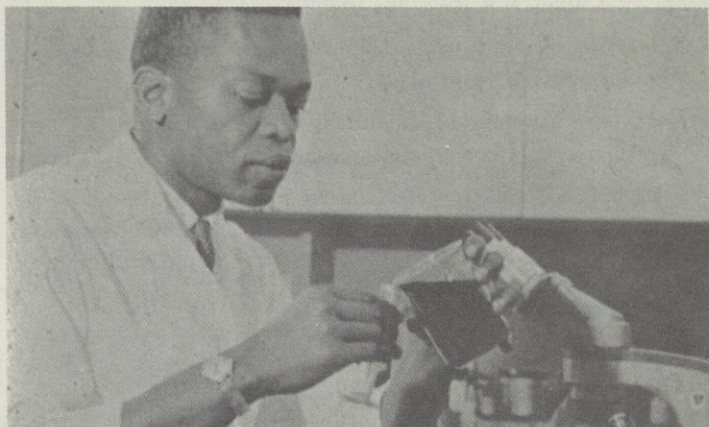
The general revenue should be the major source. It is feasible for adequate resources for the education of physicians and other health workers, for public education, for administration, for the construction of treatment, training, and research facilities and other phases of the system could come from the general federal tax revenues, employer-employee contributory taxes, or a surtax on income marked for this purpose. Such revenues could be reviewed and revised by Congress every five years, and supplemented if necessary on an annual basis.

The experience under provisions of the Medicaid law as compared to Medicare, suggests that the national health system should operate without financial participation or "matching grants" from the states. To date, because of the optional nature of Medicaid, the people of Alabama, Alaska, Arizona, Arkansas, Florida, Indiana, Mississippi, New Jersey, North Carolina, and Tennessee are without Medicaid coverage, although these states are known to have sizable "medically indigent" populations.²² Further, after

it had been in existence for only about a year, the New York State Legislature, frightened by the \$461 million Medicaid was costing, raised the standard for participation, thereby reducing the number of people who could be served.²³ A similar attempt, which would have cut "Medi-Cal" expenditures by some 25% was blocked by the California Supreme Court.²⁴

KEEPING COSTS DOWN

A National Health Financing System Must Also Operate to Control, Rather than Inflate the Cost of Medical Care.



"Piece-work" method of medical billing for special services has caused medical costs to soar above other costs of living

One important factor in the rising health costs of the recent past is the growing use of increasingly expensive hospitalization.⁶ The effective use of preventive medicine, early diagnosis and increased emphasis on the treatment of disease on an outpatient basis and in its initial rather than acute phases, would reduce the need for hospitalization. Further, the present "piece work" or fee for service method of billing for medical care — separate for lab tests, x-rays, hospital room and board, visits to the doctor, surgery, anesthesia, etc. — has in the past few years made the costs of medical care soar above those of other costs of living. In addition, by insuring hospitalization and not health, existing private insurance plans as well as Medicare and Medicaid have encouraged unnecessary hospitalization. By using a cost-plus formula of reimbursing hospitals after fees are incurred, these programs have further served to inflate the nation's health bill. Medicare and Medicaid provisions for the payment of "usual and customary" fees have encouraged physicians to raise the level of fees for all.

A National Health Financing System Must Be on a Pre-Paid Rather Than "Reimbursement" Basis. It must Encourage Preventive and Out-patient Care Where Possible and Promote Efficiency and Effectiveness in Hospital Management. This Places the Emphasis of a National Financing System on the Maintenance of Health Rather than on Care of Disease.

SUMMARY

To be effective, a national health program must be sufficiently comprehensive to make specific provision for the delivery of health services, financing, education, and training. It must:

- be administered by a single agency under community influence and control;

- have a Secretary of Health at its head and be manned primarily by career civil servants;

- encompass all civilian health, mental health, and environmental activities now covered by a variety of separate agencies; and

- hold and control its own funds in trust for those it serves.

The primary goal of a national health system is to provide high quality, comprehensive, dignified medical, dental, and mental health care and environmental protection for all people in the United States regardless of race, sex, location, citizenship status or income. To attain this goal, the national health system must:

- take responsibility for the accessibility and even distribution of quality comprehensive health services and appropriate health professionals to meet the needs of the nation as a whole and poverty and rural areas in particular;

- devise a system of public tax-supported education and training for health professionals with a required service commitment; such a system would be void of all forms of discrimination:

- provide for and encourage the continuing formal education of all health professional personnel without loss of salary; to encourage physicians to seek specialty board certifications; practitioners of specialties must be encouraged to achieve appropriate certification and accreditation:

emphasize and promote research, case-finding, and public education in health; and

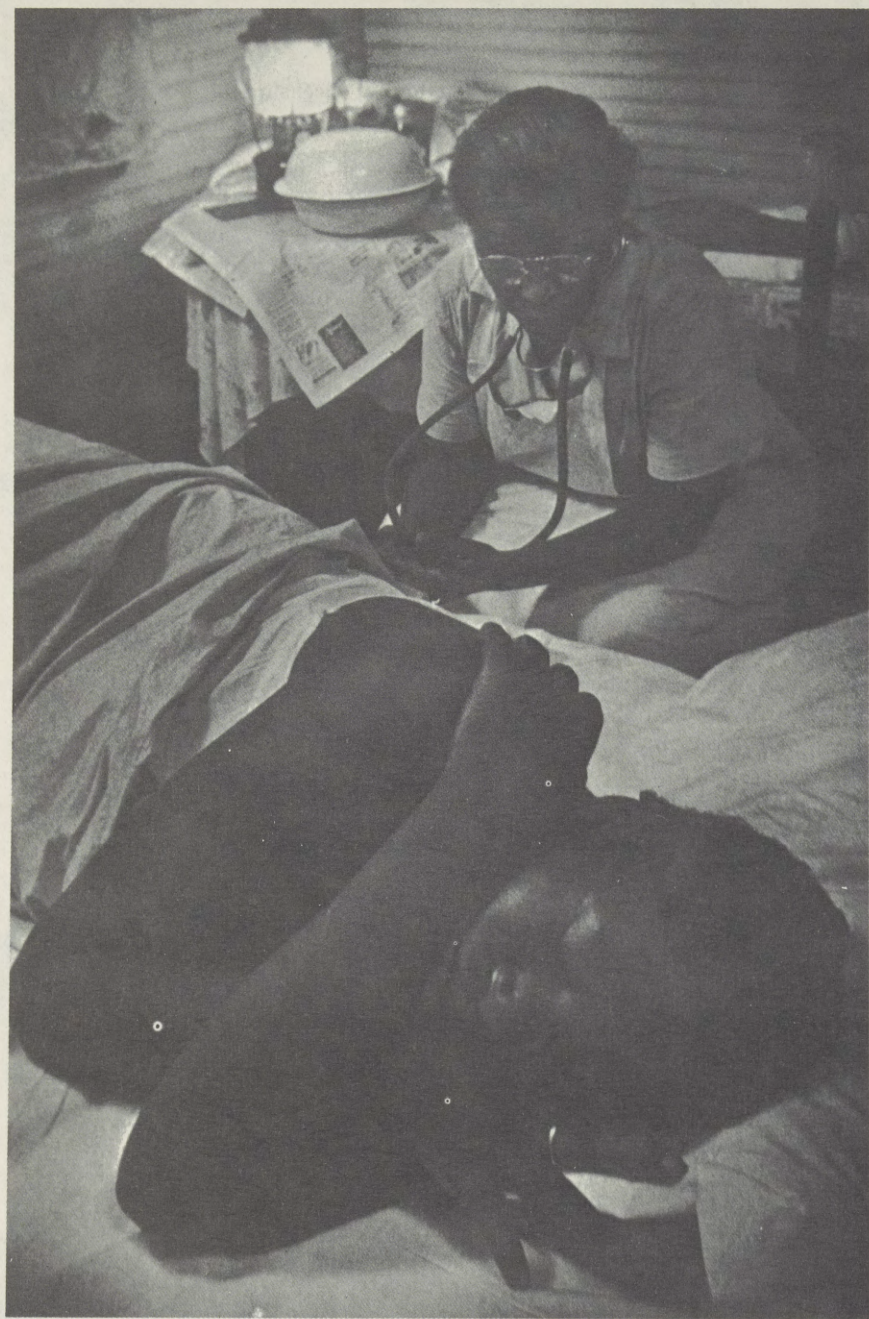
provide for national certification or licensure of health workers in all categories.

Through regional and community boards, the national health service may contract with existing private or public facilities, individuals or groups to provide needed services. However, to control the cost of care, such contracts shall require payment on a per capita or other basis, taking into consideration area needs, and shall not provide for payment on a reimbursement or "fee for service" basis. Further, such contracts shall in all cases provide for local review of the quality of service rendered.

Funds to support the national health system may be drawn from many sources. The most promising approach would be the utilization of the general tax revenues, but other methods such as contributory taxes from employers and employees or a surtax on income earmarked for this purpose may be alternatives. In any event, health systems funds should be organized in a trust fund plan to assure program stability.

The nucleus of an agency capable of operating a national health system already exists in the U. S. Public Health Service and its supporting structures: the Consumer Protection and Environmental Health Service; the Health Services and Mental Health Administration; and the National Institutes of Health.

The United States is the only so called "developed" nation in the world that does not now have a national health system. As a people we are pledged not only to provide for the common defense but also to promote the general welfare. In the past, as demonstrated by Social Security and Medicare, our nation has responded to a nation-wide problem on a nation-wide, federal basis. The time has come to do the same with medical care. The World Health Organization defines health as a state of complete physical, mental, and social well-being — not merely the absence of infirmity or disease. America can do no less.



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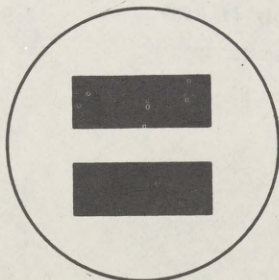
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FOUNDATION FOR RESEARCH AND EDUCATION IN SICKLE CELL DISEASE,
New, York, N.Y., November 11, 1971.

Additional testimony in support of bill S. 2676, to provide for the prevention of Sickle Cell Anemia, presented by Dr. Y. F. Francis, representing the Foundation for Research and Education in Sickle Cell Disease.

SCREENING

Purposes of screening are :

1. To identify the extent of the problem, and
2. To reduce the number of severe cases by the identification and counseling of the carrier state.

The entire Black population of the United States should be screened. This is 25 million people. The minimal figure that we have today is that the cost of initial screening is approximately \$1.00 per person. Perhaps, this amount can be reduced by more efficient methods. It is easily seen, therefore that the 25 million dollars proposed in the bill could be devoted almost entirely to screening, although as we show later on, that this initial effort will have to do other things as well. In the second phase of screening, it can confidently be predicted that two and a half million people will have some form of Sickle Cell Disease, the majority of them will have the trait form. They will require definitive counseling and referral. The figures that we have at present indicate \$10.00 to \$20.00 per person for adequate services in the second phase. We must not forget that there is an appreciable incidence in Sickle Cell Disease in people not identified as Black, particularly Spanish speaking people from the Caribbean and South American area, and to a lesser extent, in Greeks and Italians. They must also be serviced, and their numbers will require additional expenditures.

PROGRAMS AND FACILITIES

Application of such knowledge that we do have concerning Sickle Cell Disease requires a network of programs and facilities throughout the involved communities. Over the last five years, the Black community has exerted great effort on its own, and by all groups in the communities, professional health workers, volunteer agencies, social action groups, and plain social clubs. These groups have organized fund raising; have organized screening; have developed educational materials including brochures, films, newspaper and television articles, etc.; have developed comprehensive clinical programs; have developed blood programs; have stimulated and developed research programs. Thus, the overall Black community has laid the foundation of research and clinical services. This effort now requires funding, but the basic structure is already present. This is in contrast probably, to the beginning of the anti-poverty programs where set-up and structure followed funds rather than preceding them. In this case, therefore, there is more likelihood that the funds will be sufficiently spent, that the returns will be greater, and that the programs may be continued even after the initial federal effort until a cure is found.

TRAINING

Members of the community are already pleading for further training of lay and professional personnel in Sickle Cell techniques. Physicians want to know how to care for their patients; parents want to know how to handle their children; teachers want to know what to expect from their pupils in the classroom; employers want to know in what capacity their employees may best function; geneticists want to know what techniques of counselling can reduce the incidence of the serious form; students want to know how they can participate in community involvement. Training is needed at all levels. And hand in hand with this goes the further development of educational materials.

MILITARY

We are happy to see that the bill stresses the importance of a large military program. The military is in a unique position to define the risks involved in having the trait. This is because they can observe their personnel in a large variety of environmental conditions, the variety of physical and mental activities, and under a variety of conditions of duress, or relaxation.

RESEARCH

Because of the limited funds heretofore available, present research activity involves chiefly clinical trials or attempts to control sickling in the already afflicted patient. This is not unimportant, but it is the only kind of research that can be done with small amounts of funds. The techniques of modern genetics, however, that are available at present, could be applied to Sickle Cell Disease for preventive purposes if sufficient funds were available and sufficient time were available to make it worthwhile for research teams to tool up and organize more sophisticated techniques. For instance, the pre-natal, and peri-natal diagnosis of Sickle Cell Disease could presently be solved with available techniques if the funds were available. Again, the introduction of genetic material capable of forming normal hemoglobin could theoretically be done early enough in utero so that immune mechanisms would not interfere. Practical application of this might take five to ten years, but could be initiated immediately. In this same manner, bone marrow transplantations of Sickle Cell patients probably could be practically developed in this short space of time. Homozygous could be converted to heterozygous. This type of research could be initiated now with available funds. Twenty-five million dollars of federal funding would not only supplement but further stimulate private effort, so that in the foreseeable future, this disease would be under control to the extent that hundreds of millions required now and in the future in treatment efforts, not to mention the cost of suffering and mental anguish. This money could be channeled elsewhere.

Submitted by,

JEREMIAH FOWLER.

WGN CONTINENTAL BROADCASTING Co.,

Chicago, Ill.

WGN EDITORIAL—"SICKLE CELL ANEMIA"

Have you ever heard of sickle cell anemia? If you paid close attention to President Nixon's message to Congress earlier in the year, you may have heard of it. If you are Black, the chances are one in six hundred that you have it, like an estimated 50,000 other Black Americans. Two million other Blacks are believed to be carriers.

Sickle cell anemia is an inherited blood disease limited almost exclusively to Blacks. Presently, there is no cure for it, as the President said. He put it only second to cancer as a targeted disease for increased research.

In the meantime, until a cure is found, early detection, as early as possible, can help. It can ease the pain and suffering of those who have it. It can alert carriers to the possibility that their children, both alive and yet unborn, could have it.

Testing for sickle cell anemia is routine in the maternity, infant, and child-care programs of the Board of Health, and in testing in lead-poisoning cases. The test, according to Chicago Health Commissioner Murray Brown, is simple and can be done with a blood sample taken for other purposes.

There are two areas where testing could be done voluntarily, and begun immediately, with the cooperation of the medical profession. First, there are blood tests required for other reasons, before a marriage license is issued. The same blood could be tested for sickle cell anemia, with information on positive findings forwarded to the doctor who drew the sample. Second, there is the physical examination required of all children enrolling in public schools. Doctors handling these usually-routine check-ups could include a test for sickle cell anemia. Should the tests be positive, these doctors could begin treatment, perhaps even before symptoms develop. In the meantime, the Legislature, when it meets again in October, should consider making such tests mandatory.

MIDWEST ASSOCIATION FOR SICKLE CELL ANEMIA, INC.,

Chicago, Ill.

Mr. Chairman, members of the committee, ladies and gentlemen . . . My name is Howard Anderson, I am president of the Midwest Association for Sickle Cell Anemia (MASCA), an organization that formed in the spring of 1971. I, along with several concerned members of Chicago's Black community, came together to discuss what we could do to help eradicate the dread disease, sickle cell anemia, and MASCA was born. We had very little knowledge about the disease so we solicited the help of several physicians and hematologists who gave us the information necessary to wage our battle. In the course of listening to Doctors

Billie Wright Adams, Paul Heller, and Earl Fredericks describe the origin of the disease, its debilitating effect on its victims and its dreary prognosis, MASCA decided that its primary and most important contribution to the fight against Sickle Cell Anemia would be (1) informing the public in general and the Black community specifically about the disease; (2) raise funds to help provide care and comfort for those afflicted with sickle cell disease, and (3) with the help of our consulting physicians, would be counseling carriers of the sickle cell trait and victims of the disease.

Our reasons for this approach are that only recently has the general public even become slightly aware of the magnitude of Sickle Cell Anemia, despite the fact that the disease was discovered and named over 60 years ago. We felt that this disease and its frequency among Black Americans could no longer remain obscure. It is of utmost importance that Black people be made aware of sickle cell anemia, and its characteristics. But, we had no funds. We, therefore, turned to the mass media for help. Ladies and gentlemen, I beg your indulgence while I read excerpts from editorials which were broadcast to Chicago area viewers and give you the results of our efforts.

WBBM-TV, JULY 21, 1971

Quietly, without fanfare, a movement has started to fight sickle cell anemia, a disease which strikes Blacks almost exclusively.

There should be anger and outrage that the disease has been so neglected. If the disease hit as many white children as it does Blacks, we believe there would be an outcry. Millions of dollars are collected to fight diseases which affect but a fraction of the number struck down by Sickle Cell Anemia, for which only a hundred thousand dollars is collected annually.

Money is needed for testing, education, and research. You can help by joining the Midwest Association for Sickle Cell Anemia at 841 East 63rd Street, Chicago, Illinois. Membership is ten dollars.

They flashed our name and address on the screen as this appeal was being made. We received ten dollars in the mail.

WBBM-TV, AUGUST 17, 1971

Tonight at nine o'clock WBBM-TV will present a documentary entitled, "The Neglected Disease." The program is well titled, for it concerns Sickle Cell Anemia, a disease which strikes Blacks almost exclusively. Sickle Cell Anemia strikes down one Black child in 500. The disease is characterized by severe anemia, bone pain, and increased susceptibility to infection. Half the children born with the disease die before they are twenty.

Yet the public does little about the disease. Its neglect is outrageous. Locally there is no provision for mass testing, education, or counseling. Our small organization, the Midwest Association for Sickle Cell Anemia has been formed mainly to educate Blacks about the disease and its effects. Unfortunately, it is having trouble getting off the ground. No one in the organization can afford to devote his full time to it. But, they keep trying.

You can help by sending ten dollars to this address: Midwest Association for Sickle Cell Anemia, 841 East 63rd Street, Chicago, Illinois 60637. Would you write it down so you have it before you as you watch the documentary, "The Neglected Disease".

The documentary, and solicitation for funds brought \$300.

Presently, we, the members of the Midwest Association for Sickle Cell Anemia are volunteers. While this is commendable, it is also a handicap. The task before us is herculean. Volunteers do not have the time, nor can they marshal the resources needed to fight Sickle Cell Anemia.

True, to date, we have provided the stimulus for a few television editorials, a radio show, and some newspaper columns, but our efforts—vis-a-vis the problem—are miniscule. The need for a full-time director and staff to direct further work is urgent. Effective planning requires time and money.

Mr. Chairman, ladies and gentlemen, we feel that the most important aspect of the fight against Sickle Cell Anemia is an informational program for the public in general and Black people specifically concerning the cause, characteristics and symptoms of the disease. An informational program to motivate all Blacks—prior to and during the child-bearing age—to find out whether they

have the disease or the sickling gene is imperative. Genetic counseling for carriers of the sickling gene, and guidance and vocational counseling programs for the parents and the victims of the disease are necessary to enhance the ability of these individuals to live satisfying and productive lives. But, we also believe that for testing and counseling programs to be effective, Black people must know what they are being tested for—what the implications are and where do they go for help if they have the trait or the disease. No testing program or counseling program can be effective if the people are not aware that they may be carriers of the trait or victims of the disease.

What are the implications for trait bearers inducted into military service? U.S. Army Surgeon General Hal B. Jennings, in response to Illinois Congressman, Abner J. Mikva and 36 Congressmen's pleas that trait bearers be exempted from military service, replied thusly, "Sickle Cell Anemia is a cause for rejection from the military service while sickle cell trait is not". In reference to the four recruits who died at Fort Bliss in 1968-1969, all had the trait, the Surgeon General had this to say: "Many individuals with sickle cell trait have trained at Fort Bliss over the years without any previous reports of death".

The position of the Army notwithstanding, in May, 1971, the Illinois State Medical Society passed a resolution asking that persons having sickle cell trait be exempt from military service.

Here is a letter referred to us by the Martin Luther King Neighborhood Health Center; the letter, dated August 29, 1971, reads:

Dear Sir: I am writing you this letter to ask you if you can help my son. I have a child. He has Sickle Cell Anemia. He has a bad heart, too. I have tried to get help here in Alabama, but they could not help us. We do not have money to pay the doctor and the hospital what we owe them. Please, if you can help us, please let us hear from you. The doctors here have done what they can do for me to help him. We need help with him . . . not only the money, but doctor's help. Maybe we can come to Chicago if you can help us with him. There are other doctors and hospitals in Alabama, but it is just the same as it always is. The doctor can help us some, but we just need money, to pay the doctor bills and the hospital bills. The doctor gets tired of waiting on us when it takes so long to pay our bills . . . please write me right back and let me know if you can help us with our son. If you cannot, just say so. I have had other people to tell me no all of the time, because I have tried so many times to get help . . . Thank you so very much.

The letter originated in Buhl, Alabama. We are awfully sorry that we could do no more than refer the lady to the Sickle Cell Center at the University of Tennessee.

Mr. Chairman, and members of the Committee, the Midwest Association for Sickle Cell Anemia believes that any disease that affects one out of every ten Black people is of epidemic proportions and constitutes a national health problem. We, therefore, urge you to bring the legislation before you to the full Congress of the United States of America and unconditionally recommend its passage so that the victims of Sickle Cell Anemia will receive the necessary health care. Thank you.

MIDWEST ASSOCIATION FOR SICKLE CELL ANEMIA, INC.,
Chicago, Ill., November 26, 1971.

HON. EDWARD M. KENNEDY,
U.S. Senate,
Washington, D.C.

DEAR SIR: Your efforts on behalf of S. 2676, the sickle cell bill, are sincerely appreciated. If the Midwest Association for Sickle Cell Anemia (MASCA) can be of assistance in the fight ahead please call on us.

Please include the attached remarks in the record for the hearings on the National Sickle Cell Prevention Act. I am including a letter that I received from a lady in Alabama seeking financial and medical assistance because I think it dramatically demonstrates the urgent need for a total health care program in the nation.

My apologies for the delay.

Sincerely,

HOWARD D. ANDERSON, *President.*

WBBM-TV EDITORIAL—THE NEGLECTED DISEASE

Tonight at nine o'clock WBBM-TV will present a documentary entitled "The Neglected Disease." The program is well titled, for it concerns Sickle Cell Anemia, a disease which strikes Blacks almost exclusively. We are certain if a disease struck as many white children as this one does Blacks, there would indeed be a massive outcry, with huge and successful campaigns for funds to care for sickle cell victims and find a cure.

Sickle Cell Anemia strikes down one Black child out of every 500. The disease is characterized by severe anemia, bone pain, and increased susceptibility to infection. Half the children born with the disease die before they are twenty.

Yet the public does little about the disease. Its neglect is outrageous. Locally there is no provision for mass testing, education or counseling.

One small organization, the Midwest Association For Sickle Cell Anemia, has been formed mainly to educate Blacks about the disease and its effects. Unfortunately, it is having trouble getting off the ground. No one in the organization can afford to devote his full time to it. But they keep trying.

You can help by sending ten dollars to this address: Midwest Association For Sickle Cell Anemia, 841 East 63rd Street, Chicago, Illinois 60637; Phone 667-3888. We'll repeat that address: Midwest Association For Sickle Cell Anemia, 841 East 63rd Street, Chicago, Illinois 60637; Phone 667-3888. (FULL SCREEN CARD: Address and phone number as above.) Would you write it down so you have it before you as you watch the documentary, "The Neglected Disease," at nine tonight on WBBM-TV.

SICKLE CELL ANEMIA

Quietly, without fanfare, a movement has started to fight Sickle Cell Anemia, a disease which strikes Blacks almost exclusively.

There should be anger and outrage that the disease has been so neglected. If the disease hit as many white children as it does Blacks, we believe there would be an outcry. Millions of dollars are collected to fight diseases which affect but a fraction of the number struck down by Sickle Cell Anemia, for which only a hundred thousands dollars is collected annually.

(SILENT FILM: Showing blood cells affected by the disease. 23 seconds.) Sickle Cell Anemia is a hereditary blood disease which affects one in five hundred Blacks. Normal red blood cells, which carry oxygen, collapse, become crescent shaped like a sickle, tend to stick together and form clots. The disease is characterized by severe anemia, bone pain, and increased susceptibility to infection. Half the children born with the disease die before they are twenty.

One in twelve Blacks have the sickle cell trait. When two persons with the trait have children, one out of four of these children become sickle cell victims.

(SILENT FILM: Showing child in whirlpool treatment. 30 seconds.) They need treatment to ease the pain, such as this sickle cell child in Los Angeles. Also, there is need for testing, education, and research into the disease locally. Chicago has no provision for mass testing of Black children, although the test is simple. It could and should be done in the schools. Then there should be counselling of parents of children with the disease or trait, and education of young people regarding its genetic implications.

Money is needed for testing, education, and research. You can help by joining the Midwest Association For Sickle Cell Anemia at 841 East 63rd Street, Chicago, Illinois. Membership is ten dollars. (FULL SCREEN CARD: Midwest Association For Sickle Cell Anemia, 841 East 63rd Street, Chicago, Illinois 60637. Phone: 667-3888).

Senator KENNEDY. The subcommittee stands in recess.

(Whereupon, at 12:55 p.m., the subcommittee was adjourned.)



THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and development. It begins with the first settlers who came to the continent in search of a better life. They found a land of vast resources and a people who were eager to learn from them. The settlers brought with them the knowledge and skills of their European ancestors, and they used these to build a new society. They established farms, towns, and a system of government that was based on the principles of liberty and justice. Over the years, the United States has grown from a small colony to a great nation. It has fought wars, both with and without the world, and it has emerged as a leader in the field of science and technology. Today, the United States is a country of many peoples and many cultures, but it remains a country that is united by a common history and a common destiny.

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