RESEARCH FRONTIERS IN AGING AND CANCER: INTERNATIONAL SYMPOSIUM FOR THE 1980s

HEARING

BEFORE THE

SELECT COMMITTEE ON AGING
HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

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CONTENTS

Members Opening Statements

	Page
Chairman Claude Pepper	1
Robert F. Drinan	4
Dan Lungren	4
Don Bonker	4

Chronological List of Witnesses

Lewis Thomas, M.D., general chairman of the symposium; chancellor, Memorial Sloan-Kettering Cancer Center; and member, National Academy of Sciences	5
Robert N. Butler, M.D., director, National Institute on Aging, Bethesda, Md	11
Vincent T. DeVita, Jr., M.D., director, National Cancer Institute, Bethesda, Md	13
John Ultmann, M.D., vice chairman of the symposium; and director, University of Chicago Cancer Research Center, Chicago, Ill	17
Baruj Benacerraf, M.D., chairman, Department of Pathology, Harvard Medical School, Boston, Mass	18
John Cairns, M.D., Ph. D., Imperial Cancer Research Fund, London, England	19
Howard Green, M.D., professor of cell biology, Massachusetts Institute of Technology, Cambridge, Mass	20
Francois Jacob, professor of cellular genetics, College de France, Institute Pasteur, Paris, France	21
Philip Leder, M.D., chief, laboratory of molecular genetics, National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, Md	22
Daniel Nathans, M.D., professor and director, department of microbiology, Johns Hopkins University, Baltimore Md	23
Keith R. Porter, Ph. D., professor and chairman, department of molecular, cellular, and developmental biology, University of Colorado, Boulder, Colo	24
James D. Watson, Ph. D., director, Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y	26

Appendix

Additional material received for the record:	
Vincent T. DeVita, Jr., M.D., director, National Cancer Institute, Bethesda, Md., letter	47
Robert N. Butler, M.D., director, National Institute on Aging, Bethesda, Md., letter	48

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FRIDAY, SEPTEMBER 26, 1980

U.S. HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON AGING,
Washington, D.C.

The committee met, pursuant to notice, in room 345, Cannon House Office Building, Hon. Claude Pepper (chairman of the committee) presiding.

Members present: Representatives Pepper of Florida, Biaggi of New York, Bonker of Washington, Drinan of Massachusetts, and Lungren of California.

Staff present: Charles H. Edwards III, chief of staff, Kathleen T. Gardner, professional staff member, Ronald Koshes, research assistant, Henry H. Hicks, communications director, Marie Brown, executive secretary, and Walter A. Guntharp, minority staff director.

OPENING STATEMENT OF CHAIRMAN CLAUDE PEPPER

The CHAIRMAN. Ladies and gentlemen, the committee will come to order. The other members of the committee will be coming from time to time. We have invited the members of the Senate Committee on Aging also. Since we have such important work to do, we will go ahead with our proceedings.

I want to warmly thank you for joining me today in this most meaningful congressional hearing. For the past 5 days now, internationally acclaimed experts in cancer and aging research have been meeting here in Washington, D.C., sharing with each other their most recent research findings, and exchanging ideas in their mutual quest for understanding cancer and aging.

Nowhere have so many dedicated people, so many imaginable people worked in good spirit and in a cooperative way together to try to understand human life and reduce if not prevent the tragic toll of human life exacted every year by cancer in this country alone, 405,000 people a year, one of them my beloved wife last year.

I am sure that many people in this audience have lost a loved one to that terrible disease.

Today's hearing will serve as the summary session of the conference and will shed some light on what Congress might do to assist in the fight against this dreaded disease.

Many years ago, our former Attorney General, Robert Kennedy, had something like this to say with respect to cancer: "Each of these deaths is not just a statistic, it is the snuffing out of a human life with a human potential that if fully developed could have become a university professor or written a Pulitzer Prize novel or

discovered the cure for cancer." These words were true then, they are just as true today.

Most of us have lost someone we loved to cancer. Yet, I believe we all find it hard to undertand just now devastating and destructive cancer really is. For example, nearly 55,000 persons lost their lives during the Vietnam war. That is the loss of a lot of lives. Yet, more than seven times that number of lives, 405,000, die of cancer every year.

Many of these cancer deaths occur in later life. Persons over 54 years of age constitute 81 percent of all cancer deaths. People over 60 years of age account for 60 percent of all cancer deaths.

Testimony in hearings held last year by the Select Committee on Aging revealed that as rates of death from heart disease continue to decline, cancer is on the way to becoming the No. 1 cause of death among the elderly. Whereas a 25-year-old has 1 chance in 700 of developing cancer in the next 5 years, a 65-year-old faces a frightening 1 chance in 14.

There has been progress against cancer. In 1937, the year that Congress appropriated less than $1 million to commence research into the causes and treatment of cancer, approximately one in five lived at least 5 years after treatment.

Today, we spend close to a billion dollars in the war against cancer and the ratio of those who live 5 years after treatment is 1 in 3. During this conference, I was told that with early detection and treatment almost one-half of all cancer victims can be saved.

Funding for the National Cancer Institute reached the $1 billion mark last year partly due to a $39 million increase to promote the development of several promising anticancer drugs highlighted at an Aging Committee hearing of last year. In addition, funding for the National Institute on Aging is now $76 million—an increase of $6 million.

But more should be done and we hope here today from these distinguished scientists from different countries of the world, to learn not just what our people think but what do they think we should do in this country to try to protect the people against cancer which may save the lives of many of our citizens and many of our loved ones.

Our investment of about $1.1 billion in cancer and aging research—which may save the lives of many of our citizens and many of our loved ones is woefully inadequate when compared to the $6 billion we appropriated for defense.

I have always believed that what we need is a unified approach to cancer and its causes. Over 34 years ago, I introduced S. 1875, requesting the President to call together the world's outstanding experts to coordinate and utilize their services in a supreme endeavor to discover the means of curing and preventing cancer.

Today, that dream is coming true, I am proud to say in my lifetime with the generous contributions made by the Bankers Life & Casualty Co. of Chicago and the Retirement Research Foundation, and the guidance of the National Institute on Aging and the National Cancer Institute. We are on our way to a better understanding of cancer and aging. We had the splendid cooperation of Dr. Devita and Dr. Butler and then we had magnificent assistance

of a financial nature that was imperative to the success of the enterprise.

We are profoundly grateful to them and to all others. And the support of governments worldwide who sent their scientists to share their expertise for a common good, the groundwork is well laid for what I hope will be an ongoing effort to once and for all stamp out and prevent the destruction of this killer disease.

So, I look forward to hearing the testimony of the distinguished scientists who are with us today. All are chartering the frontiers of an exciting new scientfic discovery and have already had their work recognized by Nobel, Pulitzer, Lasker, and other prestigious awards. They will discuss with us their latest research findings.

We will also hear from the Directors of our National Institutes on Aging and Cancer who will tell us how we might work together to combat this dread disease. Their testimony will be valuable to us.

For all those who are here today, who have given up something special to make this conference a reality, be it time, support, or financial assistance, remember that what we have given is small in comparison to the return we may reap.

Now we are going to have the distinguished chairman of the conference from the Sloan-Kettering Institute in New York, Dr. Lewis Thomas, who will make a summary presentation.

I would first like to read two letters that I have received from the White House.

I am pleased to have this opportunity to participate, if only indirectly, in this week's activities surrounding the International Symposium on Research Frontiers in Aging and Cancer. This conference of some of the world's foremost physicians and researchers is a vital step in the continuing search for a cure for this dread disease.

Your own efforts over three decades to bring together internationally recognized experts in research relating to cancer and the aging process have helped create and maintain a cooperative dialogue among researchers throughout the world.

I commend you and the other participants in the Symposium for this interdisciplinary, cooperative attempt to understand and conquer cancer. I thank you on behalf of this and future generations who will benefit from the fruits of your labors.

Sincerely,

JIMMY CARTER.

And the other letter from someone who has been extremely helpful to us in our endeavors on the committee.

One in four Americans now living will eventually develop cancer. This sobering fact emphasizes the urgent need to find effective methods of preventing and curing this terrible disease.

I am very pleased that the House Select Committee on Aging, in cooperation with Bankers Life and Casualty Company of Chicago, the National Cancer Institute, and the National Institute on Aging, has convened a major conference on cancer and aging.

By bringing together authorities in these two areas, the World Cancer Conference will facilitate communication among experts in these fields and shed new light on the interrelationship between this disease and the aging process.

I am also pleased that the findings of this Conference will receive widespread attention as a result of hearings planned by the House Select Committee at the conclusion of the Conference.

I join Chairman Pepper in his hope that the World Cancer Conference will hasten the day when this tragic disease can be prevented.

Sincerely,

ROSALYNN CARTER.

I have the honor now to introduce my distinguished colleague Father Drinan.

STATEMENT OF REPRESENTATIVE ROBERT F. DRINAN

Mr. DRINAN. Thank you, Mr. Chairman.

I simply want to commend this very distinguished panel. I am sorry that other obligations precluded me during the week from attending all of the sessions. I will stay here as long as I can. I may be called away.

I want to commend our distinguished chairman also, Mr. Pepper, and the staff for bringing together all these experts. I am certain that the knowledge that will be forthcoming of all the very important work will give us light and wisdom on this agonizing problem.

The CHAIRMAN. Thank you very much, Father Drinan.

Mr. Lungren.

STATEMENT OF REPRESENTATIVE DAN LUNGREN

Mr. LUNGREN. Thank you, Mr. Chairman. I am pleased to participate in today's hearings. I recall about a year ago we met in this same room and at that time we were discussing some of the terrible tragedies associated with cancer and the magnitude of the problem.

I also recall that Mr. Maguire of Bankers Life & Casualty Co. announced it was committing itself to funding this conference. I am pleased we can listen to the recommendations of this conference which will give us some guidance in pursuing these and other issues which are the subject matter of our particular committee and the entire Congress. We truly do need guidance on the issues such as this in terms of the overall perspective and what the proper Government response ought to be in dealing with a subject as serious as this is.

I look forward to hearing from the testimony of the many knowledgeable witnesses that we have regarding this conference. I congratulate you, Mr. Chairman, and the staff, for the work in organizing this and being the impetus behind it.

The CHAIRMAN. Thank you very much, Mr. Lungren.

Another distinguished member of our committee, Mr. Bonker of Washington.

STATEMENT OF REPRESENTATIVE DON BONKER

Mr. BONKER. Thank you, Mr. Chairman.

I wish to join my colleagues and commend you and the committee staff for sponsoring these hearings and for the fine panel of witnesses we have this morning.

Mr. Chairman, you have done much to advance our knowledge and support for legislative proposals to deal specifically with health care and senior citizens.

I happen to feel that this is the most vital area of concern facing America's elderly. Because of your commitment, because of the resources you have brought to bear on this issue, I think we can conclude this conference with a great sense of accomplishment.

That doesn't mean the work is behind us. We need to be terribly persistent in our efforts to focus on health problems, and in this case specifically cancer, as it affects our senior citizens.

I want to commend you again for your personal concern to this vital issue.

The CHAIRMAN. Thank you very much.

Now we will have the distinguished chairman of the symposium, chancellor of Memorial Sloan-Kettering Cancer Center, Dr. Thomas.

STATEMENT OF LEWIS THOMAS, M.D., GENERAL CHAIRMAN OF THE SYMPOSIUM; CHANCELLOR, MEMORIAL SLOAN-KETTERING CANCER CENTER, AND MEMBER, NATIONAL ACADEMY OF SCIENCES

Dr. THOMAS. Dr. DeVita and Dr. Butler are here at this table as well as the chairman of each session in the symposium.

Two weeks ago, starting on Sunday, September 14, a 5-day symposium on cancer was held in New York City, presented under the auspices of the Memorial Sloan-Kettering Cancer Center and sponsored by the National Cancer Institute and the American Cancer Society.

A good many of the scientists who took part in that conference were here in Washington for this week's International Symposium on Aging and Cancer which ended yesterday afternoon.

There was no redundancy in the organizing of two such conferences, set back to back as these two meetings were set. On the contrary, our plans were deliberately laid so that the program of this Washington symposium would become a logical necessity for last week's New York meeting, and vice versa.

The New York meeting was subtitled "Cancer 1980: Achievements, Challenges, Prospects." The program dealt with the advances of the preceding decade, since the Yarborough committee's initiation of the national cancer program in 1970–71.

In 5 full days of meetings, we were concerned with the changing approaches to the scientific investigation of cancer, and especially with the ways in which 1980's science can now be applied for the improvement of our capacity to cope with the disease.

The upshot, at the end of the New York conference, was a general sense of optimism, encouragement and high hopes for the future. Much has been accomplished in the past decade, especially with regard to the leukemias and the formerly devastating malignancies of children and young adults, also in breast cancer and cancer of the rectum.

The surgeons, especially those dealing with cancer of the lung, are beginning to make inroads on the frightful mortality of that disease.

Chemotherapy, sometimes used in combination with radiation, has become a much more effective and much less toxic method for the management of cancer, and it is possible to use the term "cure" for the results of chemotherapy in some forms of cancer that were totally incurable just a few years ago.

But there was, in addition to the excitement and interest aroused by some of the new applications of 1980 science to the cancer problem, another sort of consensus at the conclusion of the New York symposium. It was this: We do not know enough. We are in need of more fundamental information. It is necessary to understand more clearly the underlying mechanisms involved in cancer, and also the processes involved in aging, since most cancers occur in the older population.

That is what this week's symposium has been all about.

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Mr. Chairman and members of the committee, we are grateful for this opportunity to appear before you to discuss the progress of basic biomedical science.

We have had a unique opportunity during the past week to meet together in the International Symposium on Research Frontiers in Aging and Cancer and to undertake a rather detailed appraisal of the recent progress in several fields in the basic sciences clearly related to cancer and aging.

We are especially indebted to the chairman for initiating this symposium as his own idea, and to the Bankers Life & Casualty Co., the Retirement Research Foundation, the National Cancer Institute, and the National Institute on Aging for their sponsorship of the meeting.

I have been associated with the biomedical science enterprise throughout my professional career, and have attended more symposia, conferences, and seminars than I care to remember, but this past week's meeting has been far and away the most exciting and astonishing of any gathering in my experience.

I have the sense that what we have all been calling the biological revolution for the past quarter century, beginning in the early 1950's with the Watson-Crick discovery of the geometry of the DNA molecule, has suddenly been turned into a totally new revolution.

Just within the last 3 or 4 years some things have happened in the research laboratories of this country and abroad which have transformed biology into a new kind of science, as powerful and sophisticated in its way as modern physics.

We are beginning to understand intimate aspects of the living cell in ways that were literally unimaginable just a few years ago.

We are beginning to see, close up, the most subtle and intricate mechanisms within the cell—mechanisms that we did not even know existed; moreover, we are beginning to learn how to manipulate some of the mechanisms in order to find out exactly how they work.

I must not overstate the position, lest it seem that I am about to promise more than contemporary research can deliver. There is still a long way to go, and the living cell is still an exceedingly strange and mystifying structure.

We are nowhere near the final answers, nor should we even be claiming to have enough answers in hand to move directly to applying the new knowledge tomorrow to the human problems of cancer and aging.

We are not that far along, and we must be careful to say so. In short, we still have a lot to be modest about.

But what we can say, unequivocally and in total confidence, is that now we are beginning to learn how to ask very deep questions, and that is an immense step forward. The answers will come inevitably, in their own time; that side of science is the easy part. The hardest of all the tasks in research is to ask the right questions.

The second hardest thing is to recognize and accept surprise when it turns up.

It is the history of scientific progress that every time the field has moved forward in a signficant way, it has happened as the result of unexpected and usually astonishing answers.

The questions have to be smart, of course, but the answers have to be flabbergasting.

This is the sort of science that we have been discussing during the past week.

Let me give you just a few examples.

It is now possible to take pictures of the molecular structure of cells. Thanks in large part to the new high voltage electron microscopes, one can look directly at the filaments which form the skeletal support within cells. One can see protein molecules at the cell surface form neat little receptors, precisely like small baskets, for catching hold of and then taking into the interior of the cell whatever things in the outside world that the cell needs to have. The ancient field of anatomy has been transformed to molecular anatomy.

We have known that there were such things as genes for all of this century, but for most of that time the term gene was a kind of abstraction, a metaphor for particular inherited features.

Now it is possible for the human eye to see the genes, to map their positions precisely on the different chromosomes in various species, including human.

And, at last, just within the last several years, it is becoming possible to learn how the genes function; how they are switched on to make a particular protein, or switched off. We are already having more than our share of surprises in this field, thanks largely to the extraordinary power of the recombinant DNA technology for fundamental research.

A gene is no longer the straightforward linear message, written like a sentence on a string of DNA, that we thought it to be a short while ago; there are discontinuities, long strips of silent DNA between the instructions contained in a single gene, called intervening sequences.

What these segments of DNA are doing there is not known; all that is known is that they have to be there for the gene to function, and that is a surprise.

This is pure science, but not all that abstract. It is going to be useful and practical; wait and see. The most fascinating genes in which to use the new technologies, for really smart questions, are cancer cells, where some of the genes are plainly doing things they should not be doing.

And another irresistible model for the same techniques is the phenomenon of aging, where it is still a matter of guesswork but the odds are that some of the genes are failing in the accuracy of their instruction or going out of business altogether. Such matters can now be examined at firsthand, with high precision.

When we have learned still more about the mechanisms, we should be able to think of ways to intervene in the pathologic processes at the level of the gene.

The immunologic system is an immensely complicated mechanism, but fundamentally it represents a problem of genes and their messages. The new techniques have opened up the whole mechanism for the most detailed exploration, bit by bit.

We are beginning to see how the parts of the mechanism fit together, how the rearrangement of genes from one place to another can introduce nearly infinite variability in the antibodies

coded for, and this means that we can also see some of the ways in which the system can make damaging mistakes.

We are, of course, badly in need of this level of information if we are ever to understand the breakdown of the immune defenses in cancer, and also in aging.

I could go on in this discussion indefinitely, but my time is limited and the chairmen of the various sessions of the symposium are here to answer your questions with far more expertise.

I should like to end with one or two general remarks about the biological significance of aging and cancer, and then make some brief recommendations for the committee's consideration.

It has been said that cancer is an inevitable fact of life, a natural event in multicellular organisms, a price we have to pay for the complexity and longevity of creatures like ourselves, living in the kinds of environment we tend to create for ourselves. I do not believe this.

On the contrary I regard cancer—all types of cancer—as a closely related set of biological accidents, bona fide diseases, not in any sense natural or inevitable, and I believe that we are now in a position to begin learning in fine detail the underlying mechanisms responsible for the transformation of normal cells to neoplastic cells—whether by viruses or carcinogens or just spontaneously.

When we have acquired enough basic information at this new, deep level—which I emphasize is now a real-life scientific possibility—I believe we will then learn how to control the process, to reverse it or, best of all, to prevent it.

Similarly, it has been said that the infirmities of aging are also natural events, that the gradual loss of one's wits, dementia, arthritis, blindness, deafness, the decalcification of bones, strokes, and heart failure are simply inevitable parts of the human condition, and we can do nothing about such problems beyond building more nursing homes.

I do not believe this. I regard aging itself as a perfectly natural process, a gradual wearing out, as natural as dying itself, but I do not believe that the disabling and humiliating diseases that now beset so many of the aged are in any sense inevitable or natural.

Aging is itself not a disease. After all, the tennis champion who can no longer play world-class tennis in his thirties is not a sick man, he is just a somewhat older man.

Some of us are said to age away from higher mathematics in our teens. It is a perfectly natural process. The real problem in aging is the susceptibility to a whole array of superimposed diseases late in life, and what we need is a better understanding of the mechanisms involved in this vulnerability.

It is a good guess, at this stage of our knowledge, that things have gone wrong with the messages from our genes, and this aspect of the matter is surely now within the grasp of the new biology.

As I said at the beginning, I have never attended a symposium quite like this one for the enthusiasm and excitement of its members, crowded with several hundred of the world's experts in cell biology, molecular biology, immunology, genetics, virology, and the rest.

A few years ago it would have been difficult to persuade people in such different disciplines into the same room, much less to have

them sit for 5 full days absolutely entranced with the new kinds of knowledge being exchanged and talked about.

Biological science is rapidly turning into a single coherent field, filled with subspecialties to be sure but made coherent by the intuition that the advances made in any single specialty are almost immediately relevant to other fields.

Aging and cancer are themselves very broad areas, but now it is clear that whatever we learn about the one process will have meaning for the other. Now it is becoming evident that the advances of knowledge in these two fields will very likely be meaningful for other problems in biomedical science.

It would not surprise me at all if some of the basic research now in progress on the cancer problem will provide immunologic information essential for solving the problem of rheumatoid arthritis or multiple sclerosis, or even heart disease.

It is entirely thinkable that a deeper understanding of what are called the slow viruses may lead directly to the etiology of Alzheimer's disease, the principal cause of dementia in the elderly.

For the scientists involved in this symposium, the occasion has been something in the nature of a celebration. Biological science is moving ahead at a faster pace than ever before envisioned, and there is an air of what can only be called jubilation at the things that are being found out.

Problems that we thought would take years to solve, or might never be solved, are now being settled within a few weeks. Never have there seemed to be so many opportunities for discovery, just ahead.

But here is a sobering thought, one that should bring us all up short: How did we get to this point?

Have all of us suddenly turned from being ordinary investigators into brilliant geniuses overnight?

The answer is, to be entirely candid, no. We reached today's level, and today's prospects for the future, because of basic research begun 30 years ago.

Today's most exciting and useful technologies, recombinant DNA and the making of pure antibodies by hybridomas, can be tracked back to work done in the 1950's, at a time when no one had the faintest notion that such work would ultimately become useful.

In fact, we are dining out today on an information bank that we began accumulating just after World War II, and we should now be taking pains to be sure that we are constantly replenishing that bank.

This is a matter for real worry, within the scientific community and the public at large, and also within American industry.

It is a matter of the greatest national significance that we maintain, and sustain, this country's strength in basic science—not just in biomedical research but in all areas of science.

And we may be slipping, for all our enthusiasm about the very recent progress being celebrated here this week.

We are not doing as well as we should in the recruitment of new young people. Some of our brightest and most talented young M.D.'s and some of the best college students who should now be aiming for graduate school, are tending to stay away from careers in research.

I am not sure I know all the reasons for this, but I can think of a few important ones.

It has become a very insecure career for the young scientist just entering the field, a much more chancy career than ever before. Fellowship money is scarcer than it used to be and the term of fellowships is far too short, 1 year or 2—we need more fellowships lasting 5 to 7 years—and, by the way, the stipends, always limited by OMB, are far too low.

The intense competition for limited funds for basic research means that the young scientist is not likely to take chances in the design of his research plans, for fear of not having solid results by the time he must reapply, often 8 months away.

The result is that we have fewer young people in basic science than the country needs, and there is a growing tendency to limit their aims to "short-order," "safe-and-sound" research. We should all be worrying about this.

We need more money for the basic research of the future, and for the new young people who will be doing the work, and for the free use of their minds and imagination.

Here is another problem for the committee's attention. Modern biomedical science, of the kind we have been talking about this week, is heavily dependent on high-level instrumentation. The research universities and academic institutions are deeply worried about the obsolescence of their instruments, and funds should be made available for modernization and renovation.

Some types of instruments require special kinds of housing, and funds for construction of this kind are extremely hard to obtain. The issue is not a trivial one. This country is beginning to lag behind Europe and Japan in our capacity to mount the kind of high technology needed for today's basic research, and we need new funds for investment in such technology.

Finally, may I say one or two words about international collaboration? At this week's meeting we have been joined by colleagues from abroad in every session, and it is already evident that a network of close collaboration exists between scientific groups in the United States and virtually every other scientific center in the free world.

People in New York or Washington are working with colleagues in Melbourne, Paris, and Jerusalem, almost as closely as if they were down the corridor from each other.

It is a remarkable phenomenon, quite new, and highly productive. I hate to think of the telephone bills, but in every other respect this transnational research phenomenon is a vast encouragement on the international scene.

It should be helped along, I believe, whenever the opportunity arises, and this will mean a heavier investment in the foreign laboratories working in close connection with laboratories here at home.

Mr. Chairman, my colleagues who have been chairing the various sessions of the symposium are all here, and we will be delighted to answer any question that the committee may wish to ask.

The CHAIRMAN. I want to thank you very much, Dr. Thomas, for your statement. I asked my colleagues if it might be agreeable if we hold our questions until we have heard from the panel.

Doctor, I want to join your colleagues in appreciation of your splendid leadership, you, as chairman, have given to this very meaningful conference.

Now I would like to call, if I may, Dr. Robert Butler, Director of the National Institute on Aging.

STATEMENT OF ROBERT N. BUTLER, M.D., DIRECTOR, NATIONAL INSTITUTE ON AGING

Dr. BUTLER. Thank you, Mr. Chairman.

I very much imagine you appreciate the enthusiasm of this week and the week before at Sloan-Kettering. It has been a very valuable 2 weeks. I would like to suggest, given the availability of these outstanding scientists here, I submit for the record the statement which I had prepared and only make four points.

One, the pleasure and value, I believe, of the collaboration between the private and the public sector which led to this very important occasion.

Second, to indicate the commitment on behalf of the National Institute on Aging—and I know shared by the National Cancer Institute—to continue in this endeavor through the tradition of conference grant mechanism at NIH to support targeted important workshops to follow up in an effective manner upon this week's deliberation.

Third, to indicate that Dr. DeVita and I have had discussions regarding direct collaboration between the two institutes, quite independent and beyond the particularity of this last week and of the workshops that will follow.

These two potential areas for NIA and NIC collaboration may be of interest to you. They most certainly assure a relation to the pharmacology of aging as it bears upon chemotherapy, what should be the very different medication dosage levels as it bears upon a particular occurrence of cancer in older patients who may have differing response rates based upon alterations in lean body mass, et cetera.

The area of nutrition is important. Certainly the aging process and gerontology do turn upon and derive from an understanding of biology, the basic understanding of molecular and cell biology.

Fourth, the need to develop more clinical protocols that will help us to design effective studies with regard to a variety of cancers that afflict so terribly the older patient.

The importance of genetics which has certainly been remarked upon already and the age of the chromosome as it bears upon our mutual interests of the two institutes.

The importance of our making available, as funds permit, appropriate well characterized genetically and aging animals that will help us better understand the interaction of aging and cancer, particularly in naturally occurring various cancer forms in animals.

Environmental pollutants is still another.

I won't go on in any further detail. Immunology, certainly pain management, protein management, are all examples in which the two institutes can gather their forces together and in an effective and important way.

We plan to have our staff and ourselves, Dr. DeVita and I work closely to try to see evolve such an important set of programs. Thank you.

[The prepared statement of Dr. Butler follows:]

PREPARED STATEMENT OF ROBERT N. BUTLER, M.D., DIRECTOR, NATIONAL INSTITUTE ON AGING

Mr. Chairman and Members of the Committee: Thank you for the opportunity to testify before the House Select Committee on Aging's hearing on aging and cancer, held in conjunction with "Research Frontiers in Aging and Cancer: Symposium for the 1980's." We at the National Institute on Aging (NIA) have long anticipated this first internaticnal conference, and look forward to sharing in the support of future cancer and aging workshops through the regular research grant mechanism for conference support.

The conference sessions held this week have highlighted the relationship between cancer and aging, and its great medical, scientific and social significance, particularly in light of the population's increasing number and proportion of older people. While numerous theories have been postulated about the association between cancer and aging, we remain uncertain whether age-related changes result in cancer, whether both aging and cancer result from a common process, or whether the two are joined only by the requirement of a lengthy period of development. However, there is no question but that the two processes are closely related, and that the study of both phenomena should be linked. Gerontological and oncological research share many disciplines and resources, and study in one field can contribute to understanding in the other.

Since research on aging and cancer share similar approaches and goals, it is fitting that both the NIA and the National Cancer Institute (NCI) have cooperated in the planning of this World Cancer Conference. It is my hope that this spirit of collaboration will continue, as the fruits of cooperative efforts have great promise. Already, common directions in cancer and aging research have contributed greatly to our knowledge about both of these processes and their interrelationships. In particular, four especially productive and promising shared areas of research should be mentioned: cell biology and biochemistry, animal research, epidemiology and statistics, and the social sciences.

Basic research in *cell biology and biochemistry,* fundamental to greater understanding of both the cancer and aging processes, has already provided insight into the similarities and differences between tumor cells and normal cells in the laboratory. *Animal research* offers great opportunities for the development of common resources and approaches. Use of standardized, well-characterized strains of aged animals allows both aging and cancer to be studied in the same animals and the results of separate studies of each to be correlated. In both gerontology and oncology, animal studies enable the observation of the effects of environmental and genetic changes. Importantly, spontaneous cancers occurring in aging animals may be more valid models of human tumors than those induced prematurely by carcinogenic agents. *Epidemiology and statistics* have been instrumental in elucidating the quantitative relationship between cancer and aging and identifying the correlates of each. Opportunities for further research are great, and include international comparisons to assess the impact of both genetic and environmental factors. *Social science* research into such areas as coping and social support systems will improve the management of cancer and other age-associated diseases.

In addition to the promise of mutually supportive basic research into the processes of cancer and aging, there are many opportunities in clinical research in geriatric oncology. While cancer is prevalent among the aged, scant attention has been paid to the distinct clinical management and diagnosis problems presented by cancer in old age. For example, a physician unfamiliar with geriatric medicine may fail to diagnose a treatable tumor, mistakenly attributing the older patient's symptoms to old age. In order to promote the development of a cadre of physicians knowledgeable in geriatrics, the NIA has inaugurated the Geriatric Medicine Academic Award, with the dual purpose of improving curricula in geriatrics and fostering research and careers in the field of aging. Furthermore, cancer therapies have at times been inappropriate for the aged since clinical trials have frequently excluded older persons, in part to spare them from possible adverse effects. Great strides have been made in cancer management for those under age 45. Future emphasis should be on cancer management among the aged, those most likely to be cancer's victims.

Again, I would like to underscore the NIA's commitment to maximizing the potential of both aging and cancer research through the sharing of intellectual and organizational resources. This first international symposium has set the stage for

coordination and collaboration, and I am eager for the momentum to continue. I would especially like to express my gratitude to Bankers Life and Casualty Company for its foresight and imagination in spearheading this important effort and for its generous financial support. In my mind, this symposium exemplifies cooperation between the public and private sector.

This concludes my testimony, Mr. Chairman. I will be pleased to respond to questions and elaborate further on specific issues raised during the conference.

The CHAIRMAN. I want to thank you very much, Doctor, for your excellent statement and particularly to commend you and Dr. DeVita for the cooperation that you have carried out in this very meaningful program. You set a good example for all agencies and departments of our Government.

Next we will hear from Dr. Robert DeVita, Director of the National Cancer Institute.

STATEMENT OF VINCENT T. DeVITA, JR., M.D., DIRECTOR, NATIONAL CANCER INSTITUTE

Dr. DEVITA. Thank you, Mr. Chairman. I could hardly improve on the comments of my very articulate colleague so I, too, would like to submit my full statement for the record.

The CHAIRMAN. Your statement will be received in full.

Dr. DEVITA. There is one other side of the conference I would like to emphasize and that is that I think you see a combination of interesting events, that is, interested people in the public sector forcing scientists to look at their science and their work and the progress in different ways.

This has resulted, I think, in this last 5 days in an extraordinary degree of cross-fertilization between fields, nonetheless, the least of which is the point you just made, that we are looking at our own programs in ways different than last year.

We are very pleased with that and Dr. Butler has covered some advances in science. I know from our hearings last year you were interested in the kinds of programs the Cancer Institute has that might relate to improving results of therapy and prevention in the aging population.

I just would mention a couple of new developments since we last had a chance to talk to this committee.

We have in fact devoted a good bit of our time toward making treatments less toxic for older people. That involves identification of less toxic chemicals. Now that we have chemicals that we can associate a cure with, we have begun to improve on them and, thanks to the interest of this committee, the institute began last year developing a biological response modified program that was really an attempt to use the information developed in this new biology, the identification of natural materials produced by our own cells and their use in clinical treatment were appropriate.

That program has now been fully established. I am pleased to announce that we have recruited and hired Dr. Robert Oldham from Vanderbilt who will be heading that program and arriving in October.

The most exciting bit of information in terms of improvements in therapy in the elderly comes from some of our large clinical studies that have taken place over the last year and the results of treatment of cancer in the rectum have improved in the sense we just broke the code on one of our clinical trials that was comparing and

using different kinds of therapy together rather than just surgery for cancer of the rectum, and there is no question that the combination of radiation therapy, surgery, and chemotherapy now prolong the lives of those afflicted with it.

Cancer of the rectum is a very common disease, especially in the elderly. There have been steps taken to improve the lot of the majority of the patient who get their cancers over the age of 55 even though our programs are really concentrated on those who get cancers at a much younger age.

There are many efforts that relate to nutrition as well, Mr. Chairman, and we are particularly excited about one observation made on our migrating population which again are mostly elderly people.

People in the northern United States tend to have a higher incidence of colon cancer than those who migrate to your State of Florida or in retirement communities in the State of Florida.

This has raised a very interesting question that remains for us to provide some answers to, and that is, is this related to the changes in nutrition we might expect to see, the access to fresh fruits and so on, so that we now have some exciting new leads that may make a large difference in how we approach the issue of prevention in the elderly.

At this point I will conclude my comments and defer questions to my colleagues.

[The prepared statement of Dr. DeVita follows:]

PREPARED STATEMENT OF VINCENT T. DEVITA, JR., M.D., DIRECTOR, NATIONAL CANCER INSTITUTE

Mr. Chairman. I am pleased to have the opportunity to speak to you today at the conclusion of this conference on cancer and aging. The initial planning for this conference included a series of followup workshops to be held in various countries. I am pleased to tell you that the NCI and NIA have agreed to share the costs of these workshops with private sources by entertaining applications for grant support from the organizing committees.

As you know, the proportion of our population over age 65 is increasing steadily. At present, more than 10 percent of our population is over age 65, and by the turn of the century we can anticipate that one in every five persons in this country will be age 65 or older.

You know also that cancer is primarily a disease of older people. The risk of developing cancer is less than 2 percent for men and women aged 20 to 50. It rises to more than 20 percent for men and women aged 65 to 85.

And while we have successfully reduced the mortality rate from cancer in patients under age 55, we are not yet able to demonstrate a decrease in mortality for patients over age 55. We hope to be able to decrease mortality in that age group, however, because of recent encouraging results in two common cancers of the older patient: cancer of the breast and cancer of the rectum.

Central to the issue of aging and cancer is the debate over whether cancer is a consequence of aging or a consequence of long exposure to things that cause cancer. If the former, our prospects for cancer prevention would be bleak and our major hope would be in treatment. If the latter, prevention efforts would be fruitful.

At the moment, the weight of evidence asserts the latter hypothesis to be correct: that cancer in the aged is the result of lifetime exposure to cancer-causing agents.

We also suggest a third alternative: that premature aging, and disease associated with aging, may be a consequence of exposure to things that cause aging and also cause cancer. If that is so, then an astonishing panorama of possibilities is open to us. As we learn to prevent cancer we may then prevent premature aging, and preserve life and the quality of life.

There is some evidence for this kind of association in the human skin. Sunlight is known to be the cause of the commonest types of skin cancer, and almost all aging that occurs in skin is due to a lifetime exposure to the ultraviolet rays in sunlight.

The elderly have special problems we must consider in developing and using methods of prevention and treatment. Therefore, I would like to highlight parts of those programs that may have particular relevance for the older patient with cancer.

Biological response modifier program

We have allocated $13.5 million of new money in our current budget for investigation of materials normally produced by cells in response to disease—the so-called biological response modifiers. This is in addition to the approximately $20 million of ongoing studies that we have been funding in this area for some years. These are not drugs *per se* but are capable of modifying the body's response to disease. Dr. Robert Oldham has just come from Vanderbilt University to become director of NCI's Biological Response Modifier Program.

The biological response modifier you have heard most about is interferon. It is produced by body cells in response to viral invasion, and appears to be a sort of chemical early warning system that alerts and activates many of the body's defense systems. It is produced fleetingly, appearing in cells for a matter of hours, and in extraordinary small quantity.

Very early clinical work with interferon gave us hope that interferon was a potent antiviral agent and, further, that it worked in some way against tumors. Preliminary clinical studies supported by the American Cancer Society to test its anticancer properties have shown some interesting antitumor effects. And since the materials are natural substances we continue to hope the side effects will be less than those seen with chemotherapeutic agents we use now.

The National Cancer Institute has established a large clinical trial program to support clinical research with interferon, and I think we may continue to expect that it will be promising.

So far, the preparations of interferon that have been used in clinical trials have been far from pure; we hope that preparations in the future will be purer and possibly more effective.

We are now getting interferon for our trials by "conventional" methods; that is, by meticulous, painstaking extraction from cell cultures. There is indication that recombinant DNA techniques will very shortly provide us with much more interferon, at lower cost and of greater purity. It is important to note, also, that besides its antitumor effects, interferon may prove to be a very important antiviral agent.

The National Cancer Institute has already awarded contracts to three laboratories to produce a total of 150 billion units of interferon, enough to test it in clinical trials with 450 patients. These trials will test interferon in roughly 12 types of cancer and will run for approximately 24–36 months.

Our trials with interferon will complement the trials currently being sponsored by the American Cancer Society.

Another agent being investigated under our program for biological response modifiers is thymosin, a fraction of thymus gland hormone. Very early studies have indicated that this substance may restore immune functions in cancer patients and may help these patients recover from cancer. Early clinical studies showed increased survival for small groups of lung cancer patients who received thymosin in addition to combination chemotherapy. NCI-supported clinical trails with this biological response modifier are slated to begin later this year. Unlike interferon, thymosin can be produced synthetically, so we do not face the same enormous problem of supply.

Second-generation drugs

Another area that will have direct bearing on the cancer patient is that of second-generation drugs. These drugs are analogs—chemical cousins to existing anticancer drugs. They are developed in the laboratory by rearranging the molecular structure of a compound, producing a substance that is enough like the original to be effective in treating cancer, but without some of the side effects. One such second-generation drug is aclacinomycin A, an analog, or cousin of Adriamycin. Clinical studies in Japan suggested that it may be as active as Adriamycin against cancer, but it does not cause hair loss and it does not have toxic effects on the heart. Clinical trials with aclacinomycin are now in progress. Laboratory efforts to devise other analogs of existing drugs continue.

Adjuvant therapy in the older patient

We are beginning just now to learn a number of useful things about adjuvant therapies in the older cancer patient. In general, there has been a tendency to treat the older patient too gently, under the erroneous assumption that the older patient could not take rigorous courses of adjuvant therapy. We are just learning how

unfair this assumption is to the older patient, learning that he or she can take rigorous therapy and can benefit greatly from it.

In his breast cancer patients, for example, Gianni Bonadonna of the Italian National Tumor Institute in Milan used adjuvant chemotherapy less aggressively for postmenopausal women on the assumption that it would be too difficult for them. As a result, they didn't do as well as groups of premenopausal women in the study. When he began to treat the older patients more aggressively, though, they responded as well as the younger women.

A similar misconception prevailed, until recently, in older patients with rectal cancer. In general, these patients were treated only with surgical resection of the cancer. However, a major, NCI-supported clinical trial of three types of adjuvant therapy, just now being completed, has shown that adjuvant therapy in these older patients is effective. Trials of surgery plus radiation, surgery plus chemotherapy, and surgery plus radiation and chemotherapy showed that patients who received any of these adjuvant therapy regimens fared better than those who received surgery alone.

Epidemiology studies, nutrition, and prevention

Epidemiologic studies of population groups are pointing increasingly to a relationship between cancer and diet. One line of NCI epidemiologic research is concerned with population movements in the United States. It has been observed that cancer death rates from colon cancer and stomach cancer are higher in the northeast than in the South. It has also been observed that when people move from the northeast to retirement communities in Florida their death rates from these cancers seem to decrease to the death rates typical in the South.

Now, studies are following groups of people from Chicago and New York who retire to a number of communities in Florida, to see if this hypothesis is workable. The studies will ultimately test another hypothesis—whether this apparent decrease in cancer death rates is due to some dietary factor. Thus, it seems possible that the increased amount of fresh fruits and vegetables eaten in the South might alter chances of developing colon and stomach cancer.

Our improving knowledge of nutrition is also helping provide better supportive services to older patients being treated for cancer. We have learned, for example, to anticipate and treat some of the specific dietary problems caused by chemotherapy, such as zinc or magnesium depletion, and we have learned the importance of excellent nutritional status to enhancing the outcome of either chemotherapy or surgery. Total parenteral nutrition taken at home also has proved valuable in some cases.

Other epidemiologic evidence suggests that dietary fat intake may play a part in determining whether one develops certain cancers, such as breast cancer. That association is being explored with both epidemiological and laboratory studies.

There are many studies being reported indicating that nutritional status may have a number of profound effects that pertain to cancer.

One such area concerns the effects of nutritional status on the immune system. There is some evidence that an aging patient's immune status can be bolstered by nutritional manipulation; that is, by increasing the amount of protein in the diet or by decreasing the total caloric intake. If, as we suspect, immunocompetency decreases with age and, therefore, plays a part in the increased risk of developing cancer in the older patient, this line of research could have exciting application.

Research has already identified several things that people in the prime of life can do now to reduce their risks of cancer as they grow older. Although it has been said many times, it bears repeating: stopping cigarette smoking is the single most important thing individuals can do to cut their future risks of cancer. Asbestos and several other substances have been identified as hazards in the workplace, and we expect that additional occupational hazards will be identified in the future. Avoiding these kinds of known cancer hazards also reduces risk of the disease in later years.

Basic research

I would like, finally, to address the question of our continuing search for fundamental biological information. Most of the work presented this past week and described to you by Dr. Thomas was in the field of molecular and cell biology. It reflects some of the astounding advances we have made in just five years in our understanding of basic cellular mechanisms. It has been said, in fact, that we have learned more in the past five years than in the past 100 years about the basic structure of our bodies.

I believe that exactly this sort of research will ultimately give us answers to the most pressing questions we face about aging and cancer. For basic research studies such as these, studies that follow the researcher's curiosity and intuition, have been

the very studies that have brought us to our present, exciting level of understanding.

Basic research has provided us with the drugs we use to treat cancer today—Adriamycin, cyclophosphamide, methotrexate, and 30 or so others. Applied research, studies of second-generation drugs or analogs, may improve these drugs, but basic research brought them to us originally.

Basic research brought us interferon. This important substance was discovered almost by accident nearly 25 years ago by two virologists doing research on the cell. Applied research found a way to produce interferon in cell culture, but basic research discovered it.

Basic research brought us recombinant DNA techniques. These techniques may help us produce sufficient interferon, and other medically valuable substances as well. Recombinant DNA techniques also offer us one of the best chances we now have to study the cancer cell in animals, to learn what switches it on and off.

Basic research also brought us the new hybridoma technology, one that may tell us how the body's immune system changes in both aging and cancer. Potential applications in diagnosis and therapy are already appearing.

Thus, I find it enormously encouraging that this meeting has been concerned chiefly with cell biology and basic mechanisms. These are the studies that will tell us what we need to know if ever we are to unravel the puzzles of aging and of cancer. These are the studies that could only be supported in a truly enlightened society, one that realizes their ultimate importance and has the patience and the determination to see them through.

The CHAIRMAN. Thank you very much, Dr. DeVita.

As I have already said, you and Dr. Butler have not only given a splendid example of how agencies of the Government in the same country can work cooperatively but a splendid example about Government agencies and private enterprise working together as manifested in this hearing.

I think you have indicated something that may be a good thing to be observed in other parts of the world and we hope to be followed hereafter in our country.

Thank you very much.

Next is Dr. John Ultmann, director of the Chicago Cancer Research Center, who is vice chairman of the conference.

Let me commend you, too, for the excellent contribution you have made, Dr. Ultmann, to the conference as vice chairman.

STATEMENT OF JOHN ULTMANN, M.D., VICE CHAIRMAN OF THE SYMPOSIUM, DIRECTOR, UNIVERSITY OF CHICAGO CANCER RESEARCH CENTER

Dr. ULTMANN. Thank you very much, Senator Pepper.

I would like to just emphasize, if I may, five points. They all deal with what I consider the "secret" ingredient that leads to successful research, the five P rules: related to people who do research, programs they create, places where they work, the pace that makes the research possible, and, finally, patience.

The people that do research, as Dr. Thomas has said, require constant support so that medical research, the base for all our progress, can proceed. Neither aging research nor cancer research are in a vacuum and relate closely to all biomedical research and probably to research in general.

The people who now have the prepared mind need support but, as has been pointed out, the future generations, the promising young, who will assure advancement of research frontiers of the future must also be thought of.

I am sad to have to comment that young people are discouraged. If you are entering biomedical research, as they look to the role models of the successful researchers now, they are noting the prob-

lems which these successful people have in trying to make ends meet to do this research.

The second is programs. Left alone, creative, imaginative people will be able to develop programs which will lead not only to research, which they expect certain results from, but will lead to unexpected results. I think it is essential to look for the unexpected. Programs which are safe and are developed to fit short-sighted trends are not going to give our investigators the chance to see the unexpected.

Dr. Thomas has already addressed the third point I wish to make, the places and the wherewithal to do research. Our workers need modern laboratories and first-class tools. A number of studies of the National Science Foundation and others have shown that an upgrading of our technology is essential.

The fourth point was related to the payment which drives and makes research possible. This machinery is expensive. It requires steady support which does not waiver and diminish for whatever reason. This ability is necessary and absolutely essential to assure the right ambience, the right milieu in which research can progress.

Finally, I think Dr. Thomas pointed out that results come with patience. One has to be permissive and give the creative process the unique opportunity to persist, to follow new directions and to have the right moment for the eureka, the discovery to occur by chance.

I ask you, sir, and you gentlemen, to help us understand what makes the scientific progress which has occurred in the past possible, and to assist in its continuation. Thank you, sir.

The CHAIRMAN. Thank you very much, Mr. Ultmann.

Now I am going to call the members of the panel according to the way they appear on the list that I have before me.

Next is Dr. Baruj Benacerraf, chairman, Department of Pathology, Harvard Medical School.

Dr. Benacerraf, we are delighted to have you.

STATEMENT OF BARUJ BENACERRAF, M.D., CHAIRMAN, DEPARTMENT OF PATHOLOGY, HARVARD MEDICAL SCHOOL

Dr. BENACERRAF. Mr. Chairman, first I would like to state how inspiring an experience it has been to be at this meeting, where we are able to discuss the contribution of our disciplines and learn those of the important associated disciplines in a manner that can cross-fertilize our work.

Second, as a representative and also the chairman of a session that dealt with immunological sciences, I would like to state that that discipline has been growing tremendously in the last 10 years, and has contributed enormous advances which have been useful to all the other disciplines.

What we have learned about the immune system, the structure of antibody, the genes that control the structure of antibodies, the cells that are involved in the response to antigens has now permitted us to be at the threshold of a new revolution, where we shall control diseases affected by immunity in a much better manner.

However, we must have the tools to do that, and in this respect I would like to echo what our chairman, Dr. Thomas, has said re-

markably well, that this type of accomplishment has not been obtained without very skilled, trained personnel, and that the trained scientists, which we represent, have made their achievements and have worked at a time and a period where support of science was clearly an optimistic one.

At the present time, and for the last few years, support of research training has become a very considerable problem for young scientists, and particularly for those trained as physicians; and this is very sad because we desperately need physicians that are trained in the basic disciplines which are essential to medicine, such as genetics, immunology, and biochemistry. It is extremely important to have physicians trained in these disciplines to make the advances for the future.

The problem at the present time is that because of the lack of sustained and continued support for research, the young people, no matter how dedicated they are, do not perceive that there is an opportunity for them to work.

As a consequence, many people whose minds would have been capable of creative scientific research are discouraged from starting in the first place for the lack of opportunities and hope.

I urge this committee that training programs are essential to the development of medical science because scientists become capable of carrying out this kind of work independently only after 6, 7, or 8 years of research training. The programs in this area must be supported and are immensely relevant.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Dr. Benacerraf.

Next is Dr. John Cairns, M.D., Ph. D., Imperial Cancer Research Fund.

Dr. Cairns?

STATEMENT OF JOHN CAIRNS, M.D., PH. D., IMPERIAL CANCER RESEARCH FUND

Dr. CAIRNS. Mr. Chairman, I would like to add to what the previous speakers have said and report that I, too, found this meeting enormously valuable and enormously stimulating.

I am an outsider, and therefore I should not speak about the allocation of resources to cancer research and aging research in this country, but I would like to make one point.

Discoveries in basic biology are difficult to forecast. Obviously a deep and startling discovery cannot be predicted by anybody; if it could be, it wouldn't be a startling discovery. So we can't really tell what is going to come from investment in basic biology.

But, we can tell quite easily that the epidemiologist is going to give us very useful information that we can quickly apply to reducing the death rate and illness rate from cancer and from aging.

The epidemiologist has often done this in the past. It was the vigilance of the epidemiologist that detected that certain compounds in the synthetic rubber industry were causing bladder cancer at the start of the century, and resulted in change in methods of synthesis of such compounds, so that the bladder cancer disappeared.

It was the epidemiologist who discovered the carcinogenicity of asbestos and led to changes in regulations that really have saved a great many lives.

The epidemiologist discovered the association between cigarette smoking and lung cancer and, as a result of this, the climb in smoking in men—but not women—has halted, and the continuous rise in lung cancer death rate at least among men has peaked and has now started going down. That really represents a very large saving in lives.

The epidemiologist looks at different populations, say, in this country and observes that Mormons and Seventh-day Adventists have about half the cancer mortality rate at any age that is seen in the rest of the country, and indeed half the total middle age mortality from all causes. So he is saying we must look into the habits of these groups of people and other similar groups, to find out what are the good things that they are doing or the bad things that they are not doing. We can then inform the general public about what they ought to be doing, and in that way we could prevent certain cancers, and possibly prevent many of the unpleasant effects of aging.

Now, it seems to me very important that such epidemiology should continue to be supported. These people have not finished giving us useful information, and though I myself am a basic biologist and not an epidemiologist, I am very impressed with the power of their methods and the usefulness of their conclusions.

I feel that while we wait for the great discoveries in basic biology that are so hard to predict, we must remember that in the meantime we should continue supporting the epidemiologist.

Thank you very much.

The CHAIRMAN. Thank you very much, Dr. Cairns.

Next, Dr. Howard Green, professor of cell biology, Massachusetts Institute of Technology.

STATEMENT OF HOWARD GREEN, M.D., PROFESSOR OF CELL BIOLOGY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dr GREEN. Mr. Chairman, members, I would like to make only one point, an extension of one of the items that Dr. Thomas mentioned, the problem of improving instrumentation for scientific work. I have in mind particularly the field of tissue or cell culture, in which cells are taken from an animal or human, put into a culture tube, grown and studied.

This technology is now extremely important to all areas of modern biology, and I suppose that at the meeting we all attended, over half the speakers employed it to carry out some part of their work. It is used by virologists, geneticists, developmental biologists, biochemists, and immunologists, and many of the discoveries reported at the meeting depended on this technology.

One can, for example, use cell culture to study the differences between cancer cells and normal cells, the differences between young cells and old cells, to test drugs which are going to be used ultimately for clinical purposes, to study the chromosomes that have been implicated so heavily in malignant disorders, and to study growth control and how it is damaged in cancer cells.

My suggestion is that we could use some support and organization for this technology. We need to know more about the physics and chemistry of the surfaces on which we grow cells, because this is very important in determining the way cells behave. We need to know more about the chemicals that we put into the cell culture medium whether they are biological in origin or pure chemicals.

In short, we need to improve and develop cell culture in such a way as to make the results available to scientists in these different fields who use this technology but who are, for the most part, not able themselves to develop or contribute to the improvement of the technology.

I think that anything that the Congress might do to facilitate this would be very valuable.

Thank you.

The CHAIRMAN. Thank you very much, Dr. Green.

Next is Dr. Francois Jacob, professor of cellular genetics, Institute Pasteur, France.

We are delighted to have you here with us. We welcome your statement, Doctor.

STATEMENT OF PROF. FRANCOIS JACOB, PROFESSOR OF CELLULAR GENETICS, COLLEGE DE FRANCE, INSTITUTE PASTEUR, PARIS, FRANCE

Dr. JACOB. Thank you, Mr. Chairman.

I would first like to say how I have been impressed by this symposium of the last week, and impressed not only by the quality of the speakers, but also because of some kind of unity which begins to appear in the whole biology.

A few years ago there were still a lot of barriers between different disciplines. It seems to me that it was, for the first time perhaps, rather clear in this conference that some of these barriers are disappearing, and that one feels some kind of underlying unity, for instance, in the basic mechanism of cancer in that everybody begins to agree about what can be behind this.

Now, I think most of the people would agree that there is some kind of relationship between the development of the embryo and cancer. I think many people would agree that we still know very little about the mechanism of the embryonic development, how you build a man, a human being from an egg, from one cell, a fertilized egg, and that this knowledge will turn out to be extremely important for both problems we are interested in here, cancer and aging.

I would completely agree with the conclusions which were so clearly and nicely stated by Dr. Thomas. In the last year I had, with Profs. Francois Gros and Pierre Royer, to write a report to the French president about the state of biology, and the main point we insisted on was the importance of basic research, which is really providing all the foundation for any further application, and also the importance of training young people, which really is the best investment which can be made.

The last point I would like to make before ending is the importance of international relations, importance first because science is universal; science works by a network, and it is clear that a given laboratory is in a good position to do a given type of thing. As a science progresses, as biology progresses, more and more types of

experimental approaches have to be put together. That is the reason why it is very important to link laboratories.

Now, concerning international relations, I would like to make a point. At the end of the last World War, the situation of the European laboratories was extremely bad, and the help of the United States, of the granting agencies and private foundations, was tremendous in restoring the efficiency of the European laboratories, by giving grants to various laboratories, by training young people who came to the United States. For this, European laboratories were very grateful and are still grateful for this immense help.

In Europe there has been a tendency to increase these international relationships. This first occurred in physics. It occurred in what is called the CERN, which operates on a big machine, and the European governments agreed to build these big machines in common.

Then it turned out that besides interest in the big machine, there was a tremendous interest in having physicists from the various Western European countries working together, and also to have the young people of these various western countries being trained together. This type of structure, of European structure, has now been extended in the last decade to biology, namely by the European Molecular Biology Organization, which trains young people, which has workshops, and which is also trying to build strong new apparatuses for biology.

It seems to me extremely important to strengthen the international relations between Europe and the United States, probably by increasing the possibility of young people going from one side to the other of the ocean, and also eventually having common grounds from work in common.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Professor.

Next is Dr. Philip Leder, Chief, Laboratory of Molecular Genetics, National Institute of Child Health and Human Development, National Institutes of Health.

Dr. Leder?

STATEMENT OF PHILIP LEDER, M.D., CHIEF, LABORATORY OF MOLECULAR GENETICS, NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT, NATIONAL INSTITUTES OF HEALTH

Dr. LEDER. Thank you, Mr. Chairman.

I of course would like to reiterate and express agreement with the conclusions that were discussed by Dr. Thomas and the others of my colleagues who have addressed you. The sections that I chaired was touched in every aspect by the development of recombinant DNA technology, a constellation of techniques which Dr. Thomas has described as being truly remarkable and revolutionary in their application.

Following from the application of these techniques are two of what I regard to be completely unexpected outcomes. The first has been a detailed picture of the genes of man and higher organisms, which we could not have anticipated at all from the classical genetic studies that have been described over the last century; and second, following the application of these techniques, there is be-

ginning in this country and indeed throughout the world the development of an industry and industrial processes which indeed could not have been imagined as shortly ago as 5 years.

Each of these unexpected developments will have immediate or perhaps not so immediate applications in terms of insights regarding the problems of cancer and aging which we have been discussing, and also regarding the developments of pharmacologic products, drugs, industrial processes that will be of benefit to our people.

It is important to recognize I think that in the early 1970's a young scientist, who was approaching the beginning portion of his career, and who had to consider what path he would take, would be heavily influenced by the fact that the press for immediate gain was on the applied side, that cancer research was thought of in connection only with cancer cells or with patients who had cancer, and that research that would be carried out on very fundamental problems in organisms that constitute a lower form of life, bacteria, was a great risk that might not be funded.

Indeed, it might have been impossible to imagine at that time that research carried out on a bacterial virus, the bacterial virus lamda, for example, would ultimately be relevant for research that would be carried out on agents that would be used in the fight against viruses; namely, interferon.

I would, therefore, on the basis of this experience and these immediately related developments, like to reemphasize my colleague's recommendations that the place for support of basic research is very important in our biologic enterprise, that the nature of our discoveries cannot always be deduced from pure reason, and that we must await the unexpected.

Finally, and I think most importantly, as emphasized by Dr. Thomas and Dr. Benacerraf, the support for young people, which we must continue to draw into these fields, must be strengthened, both in numbers of fellowships that are available for these people, and in the quality of the life that they can lead, the recognition that a subsistence stipend must be at least a subsistence stipend will probably play a significant role in encouraging them to take the risks that are necessary in the pursuit of these answers that we seek.

Thank you.

The CHAIRMAN. Thank you very much, Dr. Leder.

Next is Dr. Daniel Nathans, professor and director, Department of Microbiology, Johns Hopkins University.

STATEMENT OF DANIEL NATHANS, M.D., PROFESSOR AND DIRECTOR, DEPARTMENT OF MICROBIOLOGY, JOHNS HOPKINS UNIVERSITY BALTIMORE, MD.

Dr. NATHANS. Mr. Chairman and members of the committee, first let me express my gratitude to you and your staff for allowing me to participate in a very exciting meeting.

The session which I chaired on viruses in aging and cancer brought out two points which have already been discussed by a number of people. First, the unity of basic biology. In studying cancer we are also studying normal cells, and in studying normal cells, we are in a sense also studying cancer; and second, the

importance of young people in the entire present and future research enterprise.

Probably the main substantive finding that was reported in the session I chaired was the discovery that many viruses which cause cancer in animals of a type that resemble human cancer do so because they have picked up genes from entirely normal cells which, when they get back into another cell, trigger the entire cancer mechanism.

This has focused attention on the structure of normal genes of this type, and what their role is in the growth and proliferation of cells.

In turn, by studying how such genes work normally, we hope to learn a great deal about how they cause cells to grow into tumors. It is this kind of interaction which emphasizes the underlying unity of biology, and I think is an important lesson in terms of the support that is required across the board for fundamental research.

The other main point that I want to make is in regard to the role of young people in present and future biological research, including cancer research. In listening to the papers presented in my session, it was evident that the progress reported was dependent on young people, young people who actually carried out the research and young people who contributed to the ideas behind the research. And the laboratory directors were themselves supported during their training period by funds from the Federal Government.

So I want to emphasize again that the entire creative effort in which we are all involved, and which we have reason to believe will teach us a great deal about both normal and cancer cells, is dependent on sustained support of training programs and young investigators.

Thank you.

The CHAIRMAN. Thank you very much, Dr. Nathans.

Next will be Dr. Keith R. Porter, professor and chairman, Department of Molecular Cellular and Developmental Biology, University of Colorado.

Dr. Porter?

STATEMENT OF KEITH R. PORTER, PH. D., PROFESSOR AND CHAIRMAN, DEPARTMENT OF MOLECULAR, CELLULAR, AND DEVELOPMENTAL BIOLOGY, UNIVERSITY OF COLORADO, BOULDER, COLO.

Dr. PORTER. Thank you, Mr. Chairman.

I am very pleased to have this opportunity to make a few comments about instrumentation for biological research. You must have noticed that scientists are forever designing instruments that they use to explore their surroundings.

The astronomers have their telescopes and now their spaceships. The physicists have their electronic accelerators, atom smashers, and the biologists have their microscopes, in addition to instruments for measuring nuclear magnetic resonance, for probing matter with electrons, for X-ray defraction, and last but not least elaborate computers for processing image information. These are highly sophisticated instruments that have taken decades to develop.

I am familiar with the subject of instrumentation as it affects research on cells, for I have in my custody a high voltage electron microscope, one of two in this Nation for biological studies.

It is one of the largest and most expensive instruments used by cell biologists. It operates at 1 million volts. It stands about 30 feet high, about as high as this room, and weighs 22 tons. It is capable of providing direct images of whole cells or parts of cells up to useful magnifications of 100,000 diameters, and it does this while providing resolutions of distances and particles as small as five ten-millionths of a millimeter. It can moreover provide the cell biologist with three dimensional images of cells and their internal structure.

The instrument I am speaking about is installed in Boulder, in the beautiful State of Colorado. It services people from all over the United States, as well as the local group of cell biologists. It was financed for us by the National Institutes of Health and is regarded as a national facility.

I can say without fear of contradiction that this instrument has already provided some new and very valuable information about cells, how these cells move about, how they control their shapes, their polarity, and intracellular transport. The pathology of cancer cells is expressed in this part of the cell.

We would know much more about cells and their structures if this country had three or four more of these valuable instruments scattered about in various locations. Currently there is none in the East, east of the Mississippi that is, and they are only now installing one in California.

I realize that is hard to believe. At the same time, there are several installations in Europe and 8 or 10 in Japan. They cost installed at this time about $3 million.

It may interest you to know that this instrument was developed in France and prepared for commercial marketing in Britain and in Japan. In this and the development of numerous other scientific instruments, we have borrowed from other countries. There is nothing particularly wrong with this, except that we have lost our independence, for we are now not even training young designers and engineers in this kind of scientific instrumentation.

This is a very serious matter and the situation with this instrument is not very different from that of the other sophisticated pieces of scientific equipment.

Even worse, we are not doing much about it. Let me illustrate. Among the many institutes and divisions and programs at NIH, there is one called biotechnology resources. I know it fairly well because I served on their advisory committee for 2 or 3 years in the recent past.

The purpose of the program is to support by way of grants innovative developments in technology and instrumentation. Through a combination of diminishing budgets and unfortunate planning, the program has very little support for new grants and so fails to achieve its primary purpose.

Instead of $15 million, which is approximately their current budget, they could use effectively $25 or $30 million. The important product would be more young people experienced in instrument design and construction.

Well, sir, the take home message is the one you have heard before at this table. We need greater funding and steadily increasing funding for instrumentation to replace the outmoded and inadequate instruments currently available to us and, second, we need a greater investment in people, young people, who can be trained in this important area of biological research.

Thank you very much.

The CHAIRMAN. Thank you very much, Dr. Porter. I hope special consideration will be given to what you said about the desirability of such mechanisms, such machinery, being available in other places.

Our next witness will be Dr. James D. Watson, director, Cold Spring Harbor Laboratory, and recognized by us all as a distinguished Nobel Prize winner for his initiative and primary work in the field of DNA.

We are glad to have you here, Dr. Watson.

STATEMENT OF JAMES D. WATSON, PH. D., DIRECTOR, COLD SPRING HARBOR LABORATORY, COLD SPRING HARBOR, N.Y.

Dr. WATSON. Mr. Chairman, I am very honored to be asked to appear in front of you, and very fortunate in being able to participate in a scientific meeting which was very interesting, being as the celebration of the wonderful things which happened to experimental biology over the past decade.

What we have listened to has been the result of basic research, that is already yielding very great dividends in our knowledge of the cancer cell. This is the result of faith which people have had now for over 30 years that if we studied biology, focused on those aspects of it which we thought would be the most important, we would someday be able to understand what a cancer cell is.

I think over the not too far future we are going to know that, and hopefully that knowledge will be useful in the treatment of the disease.

This has been a dual meeting on cancer and aging and, as many people pointed out, the majority of the papers had very direct relationships to cancer. In contrast, with only a few of them could we see the immediate consequences to the aging problem.

What this reflects is that the field of aging needs a great deal more of basic research done before we ever will be able to listen to many aging related papers of the quality that we have heard at this meeting.

A very important cause of the joy that we have now in our cancer related science has been the very enlightened allocation of research funds by the National Institutes of Health as a whole, and in particular within the National Cancer Institute, which has always known that the answers that it needs would be difficult to get and most likely only come in the far distant future. Thus they repeatedly made large monetary investments in order to get the fundamental facts of biochemistry, genetics, and cell biology.

This method of proceeding should serve as a model for many of the emerging programs of the National Institutes of Aging. It is very easy to say we will focus on looking at aged cells, but we must also focus on normal cells. How can we know what an aged cell is until we know what a normal cell is.

A very great opportunity exists for the National Institutes of Aging to be a direct participant in the development of basic facts which we will need to understand the aging process.

Here in particular I would like to emphasize that the incredible revolution in recombinant DNA techniques is essentially allowing the fields of the molecular geneticist to merge with those we might classify as the more classical geneticists, those scientists who focus on the number and types of chromosomes we have in our cells, whether they be cancer cells, normal cells, or aged cells. Now we have the possibility, if the needed resources are provided, to obtain a molecular picture of human chromosomes that would just have been unimaginable even 5 years ago.

It is almost impossible to believe that if we have this information we shall not be able to deal much more rationally with the problems not only of cancer, which we know have very clear chromosomal basis, but also of the problem of aging, where it seems very likely that many of the syndromes of aging are due also to failures of certain genes to act in the way that we would like.

The Aging Institute thus should support the best of the relevant basic sciences to provide the intellectual framework through which, some years hence, a new group of distinguished scientists could arrange a symposium devoted entirely to the aging. If such enlightened finance does materialize, we should then have the same feeling about aging research, that we have today about cancer research. What remarkable science.

I thank you.

The CHAIRMAN. Thank you, Dr. Watson, very much. We are honored to have you here.

I believe those are all the members of the panel. Before we ask any questions, I want to acknowledge the presence here of two people who have had a very, very important part in what this committee has been able to do in this critical area.

One of them is Mrs. Mary Lasker here from New York, a lovely lady who if she doesn't mind my saying so, for more than 40 years my late wife and I were privileged to work with, along with her husband in his lifetime, Mr. Albert Lasker, in trying to make the Congress more cognizant of the challenge of health on the part of the people of this country.

This great lady not only has given very generously of her own funds for cancer research, heart research, and other things that pertain to the health of human beings, but she has done more to alert the Congress and the people of the country and our Government to the need for continually going ahead and doing more than any citizen in our country, for a long, long time.

It was she who in 1946—and I was in the Senate then, and my wife and I were seeing her and her great husband from time to time about matters of what we could do to help more, to help more people.

So one day she said to me, "Look here, we are actually appropriating only $500,000 a year for the cause of cancer research." That was under a bill that had been initiated by a crippled Senator from the State of Washington named Homer Bone, who came around to all of us in the Senate one day with a bill and said, "Come on, let's do something about cancer in this country."

All of us in the Senate signed the bill, and we got it passed. The House passed it, the President approved it, and from then on until about 1947 or 1948 the appropriation was $500,000 a year by the Government of the United States to the National Cancer Institute.

But Mary Lasker wasn't satisfied with that. She said, "Look here, why can't we do something somewhat analogous to the Manhattan project. The President has been able to bring together scientists from all over the world, and we have produced something that is a scientific miracle. Why can't we do that same sort of thing with cancer?"

So, in consultation with her I introduced a bill in the Senate, and then former Senator Neely, who was then in the House, introduced the counterpart of the bill in the House of Representatives, and we had hearings for about 6 months.

I was chairman of a subcommittee of the Senate Foreign Relations Committee and held those hearings, and Mr. Neely had a subcommittee over in the House of Representatives. I remember we had Dr. Rhodes and a number of the outstanding cancer people in the country here at that time.

Then later on, when I came back here last year, brokenhearted at the death of my wife from cancer, I said, "Mary, I am going to double my efforts the rest of my life to try to do something to fight cancer." She said, "Why don't you hold a hearing of your Aging Committee, because most of the elderly die from cancer in this country, anyway"?

Then with the help of Mrs. Lasker and Mrs. William Blair, the wife of Ambassador Blair, who is also here, we put together a list of 34 of the outstanding scientists in this country, including I remember, Dr. Watson who was there, and I think some others who are here now, at that meeting.

We had 34 there and Dr. Strater from Stockholm, whom I believe is regarded as the pioneer in interferon in Europe, and out of that conference we brought Banker's Life & Casualty into it.

Then they paid for another conference of 24 outstanding scientists of the country that attended the question, should we have this kind of a conference or not, and that distinguished committee recommended that we do have this conference, for which you are here today.

One of our philosophers, Emerson, said an institution is but the length and shadow of one man. So much of America is the length and shadow of this lovely lady from New York, Mary Lasker, and we are glad to have you here.

I will now invite my colleagues. Dr. Thomas, is it your pleasure, your suggestion, that we direct our questions through you and let you handle them as you will, or what is your pleasure.

Dr. THOMAS. I will be glad to field them to the various people around the table, sir.

The CHAIRMAN. Very well. We will direct our questions to you and then let you allocate them around the table as you think.

Dr. THOMAS. Thank you, sir.

The CHAIRMAN. First, I believe our senior member is Mr. Biaggi.

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

I want to commend you for conducting these hearings, and congratulate you, Mrs. Lasker, Mrs. Blair, and Dr. Thomas and all of

those involved for producing this symposium. It is an extraordinary effort and my assessment of it as a result of chatting with a number of you has been that from a very professional point of view it is very successful, and that delights us.

It seems that many years ago, Mr. Chairman, you introduced a notion of a symposium of this type. It is an idea whose time has come, obviously. I was listening to the testimony of members of the panel, and one theme seemed to be coming through loud and clear.

There seems to be an urging on the part of the members that more young people should be invited or encouraged to get involved in the area of research. There seems to be a decline in that area.

If, Dr. Thomas, you could tell us the reason for that decline, perhaps then we could address ourselves to correcting it.

Dr. THOMAS. I would be delighted to take that question myself, Mr. Biaggi. I think one of the most important reasons has already been referred to by several members, and that is the chanciness and the insecurity and the unpredictability of a career in science for young people.

This is rather different from the situation one and two decades ago, and certainly different from what it was in the 1950's when some of us on advisory councils put together the fellowship program for young scientists.

The stipends have been kept at a level far, far below what these people can make.

Mr. BIAGGI. Let me interject at this point.

Dr. THOMAS. Yes.

Mr. BIAGGI. Who establishes the level of stipend?

Dr. THOMAS. I am not sure where this happens in the demonology, but I think there is somebody in the OMB who may have something to do with controls of this type.

Mr. BIAGGI. OMB is the universal boogeyman.

Dr. THOMAS. Yes.

Mr. BIAGGI. This is not a professional standard, is it? That is the point.

Dr. THOMAS. That is just one part of it, though. Another part of it is that with the shortage of funds for basic science, they see ahead of them young people at the post-doctoral level or at the instructor-assistant professor level, who are caught up in a system that requires the most intense competition, requires the preparation of mountains of paperwork.

I have heard it estimated by young people at my own institution that they are spending 30 percent of their time simply preparing grant applications to send to Washington.

Mr. BIAGGI. That is a universal condition, I am afraid.

Dr. THOMAS. It is no fun, and the only reason that I can imagine for going into a career in science is for fun. It is one of the most pleasurable and enjoyable ways of living out a life and having a career that I can imagine, but it has to be made possible, and these are surely two of the difficulties that confront us now.

There is also competition. There are people with doctor of medicine degrees who are capable now of making incomes far in excess of what they can make on fellowships. I am afraid that the attraction of the graduate schools for candidates for Ph. D. degrees has dropped because these people see a shortage of job opportunities

out in the university world, and there are fewer of them coming along.

This country simply has to have more of its brainy, imaginative young people coming into the sciences because there is where the future of the country lies. Something has to be done about it.

Mr. BIAGGI. The Congress has responded progressively from its meager beginnings a number of years ago, a $1 million appropriation, to better than $1 billion. But being that this symposium and panel is international in nature, Dr. Thomas, perhaps you or your colleagues could respond.

How does the United States compare in governmental participation to other nations? I think that would be a critical question for the Members of Congress to have an answer to, so we could be guided and be in a position to prod.

Dr. THOMAS. I will try a short answer and then see whether my colleagues have got a better one.

I think that the drift of things is what is worth observing. I think that the contribution that this Government, the role this Government has played in the development of science, has far outdistanced—and I think outclassed—that of any other country on earth.

But I think during the past 5 to 8 years things have changed. We are slackening off, reducing our investment and, at the same time, the Europeans and Japan are greatly increasing theirs and, I should say, also the Soviet Union.

Mr. BIAGGI. I don't know if this symposium is evidence of a continuing situation with relation to cooperation, and I will pose this question. Just what is the ongoing degree of cooperation internationally?

Dr. THOMAS. We discussed that at length yesterday in one rather long session, and we are planning with I must say a surprising amount of unanimity and enthusiasm to begin holding workshops during the several years to come.

We listed for ourselves nine very important areas within the scientific areas covered by this symposium, and with the help we hope of the Banker's Life & Casualty and the NCI and the National Aging Institute, we will be launching many symposia and workshops which will involve all of us and, we think it is very important, will also involve young people from our several various institutions.

The follow-on for this symposium I think is of great importance to all of us.

Mr. BIAGGI. In your testimony, Dr. Thomas, you advocated an increase in funding for construction. What did you mean by that, what kind of construction, and how does it relate?

Dr. THOMAS. Sir, my sights were kept rather low because I know how hard it is to elicit interest in construction these days. Therefore, I said in my remarks that in connection with trying to modernize and improve our capacity to do high technology instrumentation for our basic research, many of these instruments have to have construction of their own. They have got to have special kinds of quarters built around them, and if we are going to do something about instruments, we have also got to do some bricks and mortar work to house them.

I must say in addition all of us here in our discussions over the last several days have emphasized to each other how the physical plant in the whole country, in the universities and the research institutions, has gradually been deteriorating over the last 10 years or so, and somehow or other we hope that a program—I think one of the proposals has been a program of at least $25 million a year over the next 10 years might put us back into something more like habitable shape for the research activities of the country.

Mr. BIAGGI. Has any such effort been made with relation to the Congress, do you know?

Dr. THOMAS. Dr. DeVita, is there anything before——

Dr. DEVITA. The proposal you refer to, Dr. Thomas, was $25 million a year for the next 10 years, was a study of the National Cancer Advisory Board estimate of the upgrading of the research facilities at the cancer centers in the United States.

That just refers to the Cancer Institute's supportive research, so it is just one segment of it. That study was in fact a part of our initial budget submission in the budget we prepared for submission to the President.

Mr. BIAGGI. Has it been submitted?

Dr. DEVITA. Yes, sir. Our budget that the Congress received, however, did not have that figure in it.

Mr. BIAGGI. Has OMB erased it?

Dr. DEVITA. It has been reduced substantially, yes, sir.

Mr. BIAGGI. Mr. Chairman, I have a number of other questions, but I thank you for the occasion.

The CHAIRMAN. Thank you, Mr. Biaggi.

Mr. Bonker?

Mr. BONKER. Thank you, Mr. Chairman.

I would like to follow Mr. Biaggi's question and first pose this proposition, that this dreaded disease is a phenomenon that is obviously not limited to the United States and would it not be to our advantage and for the benefit of a more universal approach on this subject if we could pool our efforts with those of other countries to explore new ways of dealing with this disease?

Are we going off in our direction? France, I noticed in the question submitted, recently increased its budget by 20 percent for research, and I assume other advanced countries are doing likewise.

Wouldn't it be to our benefit if we could have in the world organization some international entity that could pool our research resources?

Dr. THOMAS. Sir, I think that what you have in mind is happening because of the nature of science itself and in an informational and nongovernmental organized way.

Dr. Jacob referred to science as an effort and this is in the nature of science so I can assure you that as far as the research itself is concerned there are no national boundaries and, as I said in my comments, the collaboration between people in Pasadena and Melbourne and Paris and Jerusalem is nearly as close as if we were in the same building. That part is going very well indeed.

The countries themselves in Europe, I understand, are, several of them, substantially increasing their investment in basic research

and the kind of undifferentiated science that lays beneath our understanding of the problem of cancer and aging.

I don't know what the figures are. Perhaps Dr. Cairns can tell us and then Dr. Jacob what is going on elsewhere.

Dr. CAIRNS. Unfortunately, I can't give you the figures for Great Britain. My impression is that overall support for basic research in England is actually going down and has been going down for the past 10 years. But there has been a sizable diversion of a large part of this to the specific effort of cancer research. Apropos international cooperation I am on the advisory board of what effectively is a branch of WHO, dealing with cancer research, and I can report that they, too, are now under some budgetary restriction.

My impression is that in Europe as a whole the diversion of funds to cancer research is increasing year by year rather than remaining stationary.

Perhaps Professor Jacob could correct me on that.

Dr. JACOB. I cannot give the exact figure, but I think in France the next budget for biology will be increased now for the 1981 budget of about 18 percent.

Concerning the relative fraction which can go in national versus international structure, I think it is not possible to have a complete international pool.

In the case of European biology, I think a fraction of the national budget goes to Europe and to the European structure but this, I think, is not more than a few percent. As it is, it works reasonably well.

Mr. BONKER. Thank you. Just one last question to Dr. Butler, who is no stranger before our committee, in two parts.

Dr. Butler, you are as aware as anyone of the budgetary constraints here in the Congress, in spending of any kind, and especially for research. Yet, the medicare/medicaid expenditures are growing substantially from year to year.

Is there any way that we can develop a relationship between expenditures for research which hopefully will be in some form of preventive medicine, and the resultant reductions in expenditures for medical care?

In other words, all that research ought to reap some benefits in terms of tax dollars expended.

Dr. BUTLER. That is a very important question and a very difficult one. Many heads wiser than mine have tried to think about and measure the percentage of, say, expenditures for health care in a particular area, what percentage should go into research and development.

I think it worth noting that although 30 cents of every health dollar spent in the United States, regardless of the source, private funds or public, and 55 cents out of every Federal dollar devoted to health goes to older poeple, and it does make one want to examine almost disease by disease some of the potential.

I might digress from cancer to just note, for instance, the number of hip fractures that occur in the United States every year is thought to be about 200,000. It has been estimated each one costs about $10,000 from the moment of the fall, the ambulance, the anesthesiology, the repair of the hip or the replacement of the hip—that would be $2 billion a year for one entity.

Yet, we know precious little about the age-related changes in bone structure that relate to a condition called osteoporosis.

Another incredible example is nursing home costs which also have, of course, patients who have had cancer and osteoporosis, hip fractures, but also senility which Dr. Thomas mentioned earlier in connection with this week's deliberation in which paperwork regarding slow viruses and Alzheimer's disease has been reported.

One-half of the occupants of nursing homes, about a half million people, probably are there primarily because of senility, using that term in its popular sense.

Right now we are going to have in excess of $21 billion in nursing home costs—just 4 years ago it was $10 billion; a doubling in just 4 years—and the Health Care Financing Administration projects in excess of $75 billion in nursing home costs by the year 1990.

If we had a structure for looking at the relationship, the commitment to basic research and application and its relationship to costs, then I think it would be most interesting. We think that perhaps something like less than 0.001 percent, for example, of the budget had funds in medicare and medicaid would go to aging, goes to anything that bears upon research.

Mr. BONKER. Less than 1 percent?

Dr. BUTLER. Less than 0.001 percent goes to research, of the overall expenditures that go in relationship to age for just two major medical programs, medicaid and medicare.

Mr. BONKER. So you sense a lack of commitment by the Health Care Financing agency to research?

Dr. BUTLER. For research? I don't know. I only cited the Health Care Financing Administration figures to give a dramatic expression of what is coming in terms of the health costs related to nursing homes alone.

If we do not find any new knowledge that helps assist us in preventing or ameliorating various forms of senility, we are going to have this incredible escalation of nursing home costs.

I see research myself as the ultimate cost containment as well as the ultimate service because it is through that means of fundamental research that we can prevent the occurrence of these diseases to begin with.

Mr. BONKER. Thank you.

The CHAIRMAN. Thank you very much, Mr. Bonker.

Mr. Lungren.

Mr. LUNGREN. Thank you, Mr. Chairman.

Dr. Thomas, in listening to the entire panel it is obvious that we can do a lot more with more money. Can you tell me what participation there is in the basic research in the areas of cancer and aging by the private sector?

Dr. THOMAS. A great deal, of course, is being done within the private sector if you count the universities and research institutes of the country. But most of that, as we all know, is funded from Federal funds.

I think that the philanthropic foundations of the country are beginning to exhibit more interest in the needs for basic science and their contributions will, I hope, increase in the future.

It is my own private belief that the section of this country that has the greatest stake in the long term in seeing to it this country maintains its position and power in basic science is surely corporate America.

It seems to me if I were listing the areas that would worry me if I had something close to do with major industry in this country, I would be most of all worried about the quality and volume of brand new information that might be coming in in 1995 or the year 2000.

I would like to see something more in the way of partnership arrangements between parts of industry and parts of the academic science world for the benefit of each.

Mr. LUNGREN. I ran across an article not too long ago about a particular engineering corporation dealing very much in the area of energy. The story told about how 5 or 6 years ago they had a lull in some of their contracts of major projects, and instead of letting those people go they set aside, for all intents and purposes, in the engineering field, basic R. & D. to look to the future 5 and 10 years to see if they would come up with some new things. They feel now that they have come up with some things which in the new reality of the energy situation are going to put them years ahead of possible competitors.

I wonder if we have any of that going on in private industry today in terms of these subjects we are talking about?

We had complaints before about government, particularly the FDA, in terms of its almost stifling impact on the drug industry. I have seen some statistics that whereas a decade ago the United States was way ahead of many other countries in terms of the development of new drugs and drug applications, we are losing that lead. Some say it is caused by the stifling impact of the FDA.

What I am asking is in terms of your perspective, have you seen a lessening of aggressiveness perhaps in terms of fundamental research on the part of the private sector such as drug institutions in areas that could have application in aging and in cancer?

Dr. THOMAS. I think some new things are just beginning to happen. Within the pharmaceutical industry itself over the past several years some people have moved from the universities' science world into positions as directors of the research and the R. & D. in some of the major drug houses who are among the eminences in academic science. There are at least eight of these that I could name.

Partly as a result of that phenomenon, closer connections are now beginning to be formed between bits of the pharamaceutical industry and the departments or individuals in one or another university science or medical school science laboratories.

The trouble with this from the nationwide point of view is these arrangements are all short term. They involve the expectation on the part of the industry that something will emerge that can be made of use within the next 2 or 3 years.

What we really need is something like long-term partnership arrangements where the industry, scientists, and the academic scientists can pool their resources.

I think they would get a lot of things done if they did pool them that neither group can do alone; but to have long-term investments 20 years out.

Mr. LUNGREN. I am struck by the thought that, without enough knowledge, government oftentimes criticizes inventions as being too expensive for their application.

I can recall a criticism that has taken place on the use of the brain scanner or the full body scanner. This makes an easy target for Congress or the administrative point of view because of its expense and yet I have been able to see some work done at a number of institutions in California where in the long run it may be very, very beneficial in terms of not only health but from what we have to look at, the cost-benefit ratio.

Yet, because the startup costs are so great and because the initial applications may not be entirely evident in terms of the long-range benefits, we jump on them and say, we in government have to stop the construction and application of that technology.

I guess we are all in this together. Symposiums such as this are good because we see two parts of government that oftentimes come here for individual funding being participants in a symposium which gives us some confidence there is some cross fertilization of ideas and, hopefully, application.

One last question, Doctor. It is difficult for Members of Congress to vote for funding of any kind these days. I think one of the problems has been that we have not viewed the long-range benefits of basic research, not just in the area of medicine but in the area of industrial technology, whether it is airplanes or computers or whatever. That has been one of the strengths of this country and will be in an economic sense if we are ever going to get our economic house in order.

One of the ways in which we can garner support for basic research is to give evidence of the benefits for it to the average citizen.

In that regard, could you give us an update, just a brief update or sketch, of where we stand in terms of being able to identify some of the cancers and at least applications of treatment today that we didn't have a decade ago?

Dr. THOMAS. I think Dr. DeVita will do better than I will at this. I will take a brief try at it.

It is just within the past few years that we have begun to achieve what can be called genuine cures of Hodgkin's disease, a disease which some years back was 100 percent fatal. This has resulted in very large part from basic science studies, a lot of them going on at Stanford University in Dr. Henry Kaplan's work.

There isn't any question about that. We would not be able to cure Hodgkin's disease today—and we can if we see it early—had it not been for a long backlog extending back two decades of good, high grade, basic research.

We are able these days in the cancer centers to achieve a cure in childhood leukemia, acute leukemia, in at least 50 percent of the cases. We use that word "cure" guardedly but with some degree of confidence as we are now well over 10 years along in the followup of many of them.

There are some other forms of uncommon cancer that to our surprise are responding marvelously well to chemotherapy. Where we have been lagging behind in the cancer world is in the solid tumors that are so common in adults, and Dr. DeVita has already

mentioned the encouragement that the NCI sees in some of the studies of breast cancer and cancer of the lower intestinal tract.

It is beginning to move. But I would say if you wanted to know right now what is happening from basic science, it looks like a payoff. I would say there are things going on now in recombinant DNA and in the fused cells called hybridomas, pure antibodies from recombinant DNA technology, if you track it back, that is at least two decades of basic science.

That is now making it possible to produce, to manufacture in bulk, the purest kind of interferon that any of us have ever seen. It is now going to be possible to test interferon, knowing we have something that is 95 percent pure instead of something that was 1 percent pure before.

We have heard, of course, that insulin can be made in the same fashion and a number of other important, very important hormones. That is a technology for industrial application that I think has an assured and probably brilliant future.

Technology of hybridomas has allowed us to have pure antibodies that can be used as research probes with the precision we have never had before at our disposal in immunology and that also has not only importance for basic research but it will have importance for some of the problems that confront industry as well.

Dr. DeVita. I can give you a fairly practical example. Dr. Thomas referred to the progress in the chemotherapy of cancer. We now estimate about 40,000 patients a year have their lives saved as a result of chemotherapy alone or in combination with another modality of therapy.

In 1955, Congress approved funds, at that time $5 million, for a drug development program as a result of the advances in chemistry, biochemistry, and pharmacology that identified chemicals that would do something for cancer.

We have spent a total of $500 million, roughly, since that time. We estimate that the 40,000 patients who are successfully treated with those drugs now bring, each annual cured cohort, into the economy approximately $2 billion, the taxes of which are about $500 million annually, so that is by the most conservative estimate—15 percent tax rate, $10,000 a year salary for the rest of their lives.

You can look at some of these things as enormous investments in the basic research that went into the preceding era before these programs were developed.

What Dr. Thomas said in regard to recombinant DNA technology and the payoff is in front of us. How it will come we don't know, but it will come. We are sure of that.

Mr. Lungren. I must just make one remark. I bet if we had had this panel here 15 years ago we would have cigarette smoke permeating the room. Now I don't see any of it.

Dr. Thomas. You couldn't have gotten a panel like this 15 years ago because they wouldn't have been speaking to each other. Professor Jacob said a very important thing, that is, we can perceive now within basic biological science a kind of unity or a coherence that was not there a few years ago.

Mr. Lungren. If you could give us the secret and inject it in us in the Congress, we would appreciate it.

The CHAIRMAN. Mr. Biaggi.

Mr. BIAGGI. I have two brief questions.

One, we know inflation is a universal condition and we also know there is general resistance to research and development funds, and yet we learn that in France they had a 20-percent increase in funding.

I am curious how that came about. Dr. Jacob.

Dr. JACOB. There were several factors in that direction. Our report to the French President was one of these factors.

Mr. BIAGGI. Did the public respond or was it an executive initiative?

Dr. JACOB. It was mainly an executive initiative.

Mr. BIAGGI. Dr. Thomas you said one of the reasons why there was a diminution in physicians coming into the research area was the time required to devote to proposals. I think that is a challenge to all of us. I don't know if this particular area can be treated differently.

We know it is a common lament but it certainly requires special attention. It is a challenge that should be responded to on the part of the private and governmental sector, as well as Congress. Perhaps from the private sector it seemed to me it would require some special approach.

I know the competition is acute and the application process is lengthy, and it might be difficult in asking them to restrain submissions, but it might even come to that.

There has to be a solution. Much time is wasted, absolutely wasted, in addition to discouraging and providing an obstacle in the recruitment of physicians in this area. This does not lend itself to the proper utilization of available talents; we should address ourselves to changing this.

Mr. Chairman, I think that is an important area that the staff should make a special effort to address by meeting with the responsible parties to see if something can be worked out.

Thank you very much, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Biaggi.

Dr. Thomas, you and your panel could render an invaluable service to us here in the Congress if you could tell us out of your studies and your cooperative thinking about this matter as to how much—if we were not thinking about the budget but were thinking about how we could best advance the cause of research into aging and cancer, as to how much money the Congress should appropriate and how much for the years following.

Let me just preface this statement with this comment. Under our system of government here, Dr. DeVita and Dr. Butler, with their respective agencies, are under the National Institutes of Health. Then the National Institutes of Health is under the Department of Health and Human Resources, headed by a Secretary who is a part of the President's Cabinet.

They don't come up here before the Congress and tell us how much they think they ought to have. I guess Dr. Butler and Dr. DeVita submit their estimates to NIH, and then they go to the Department of Health and Human Resources, and then it goes to the budget and then, of course, the President from time to time, in

consultation with the budget, determines what the executive branch of Government recommends or requests for funds is.

Last time a number of us pressed as hard as we could upon our appropriations subcommittees to increase the amount of appropriations, especially to the Cancer Institute.

We finally got them to accept in the House a $39 million increase in the appropriation to the Cancer Institute that had been provided in the Senate through friendly members over there.

We were interested in some of that money being allocated to aid in research on interferon, and I believe about $12 million went out of the $39 for that.

But when our Congress passed the bill appropriating $1 billion for the Cancer Institute, they felt as if they had found the Holy Grail. Surely, that isn't enough money to do anything with.

What can they need more money for; and what would it be used for? My goodness, haven't they got enough now if they have $1 billion?

I believe for 1981, beginning October 1, we raised it $1 million, one billion one.

I reckon they wanted to get their conscience reasonably clear so they did add $1 million so it would be a little more than last year.

This year, with inflation at 10 or more percent, they appropriated one billion one as against a billion for fiscal 1980.

These gentlemen don't have the freedom you gentlemen have, who are not a part of our Government, to tell us what you think we ought to do in terms of human lives. I would have paid all I make in taxes if it would have saved my wife last year; and others would too.

So I think you can render a great service if you are willing, out of your consultation, to tell us how much you think, on the basis of merit and what you know about the state of the art, the development of the science, how much should we appropriate to the National Cancer Institute, and also to the National Aging Institute, if you care to comment about that.

Dr. THOMAS. I would be glad to, Mr. Chairman.

Although my clarification may seem unrealistic, I think it is necessary to remember that as far as basic research is concerned in both cancer and, surely, in aging, we have been on not a flat budget for the past 7 or 8 years, it actually has been going down, measured in real dollars, so that the investment in basic research today is, I believe, rather less than it was 8 years or so ago. So we have some catching up to do.

I would think that—and we have discussed this briefly ourselves—if for the future, forgetting about the lag period we have just been through, we could build into the system something like 5 percent per year growth over and above whatever inflation is in a particular year.

I think that would take us up to something like 18 or 19 percent growth for the year to come—we would at least be able to hold our own and begin to catch up in basic science.

The figures that I have heard that represent the needs of the research facilities of the country, most of them in universities and private research institutions like Sloan-Kettering, in order to bring that fiscal plant and its instrumentation, equipment and to do the

construction and renovation that is needed for modernization—I have heard figures that make my hair stand on end, the ranging between $100 and $200 million a year for a few years until we get it back in place.

The CHAIRMAN. A million or billion?

Dr. THOMAS. $100 or $200 million for several years to allow us to catch up or perhaps a smaller figure——

The CHAIRMAN. Adding $100 million each year for a few years?

Dr. THOMAS. Yes. $25 million alone for the needs that are perceived for just cancer research but there is a lot of other science going on in the country and the university professors will, I am sure, tell you that their capacity to continue research programs within their decaying physical plants is becoming more and more difficult every year.

The CHAIRMAN. Let me just interrupt a minute.

Dr. DeVita, how much of basic research that is relevant to cancer is within your jurisdiction, or is there basic research outside your Cancer Institute that has to be funded some other way?

Dr. DEVITA. The Cancer Institute makes up 27 percent of the entire NIH, so the figures that Dr. Thomas referred to can just be prorated up for the entire NIH.

A lot of the other basic research conducted by the other institutes is entirely relevant to the Cancer Institute.

The CHAIRMAN. So, the $100 million would go to NIH?

Dr. DEVITA. I assume that is what Dr. Thomas was referring to.

The CHAIRMAN. That's what you meant, Doctor, that the $100 million would go to NIH and NIH would allocate it to cancer and use others for basic research?

Dr. THOMAS. This is what I had in mind. If we had really adequate funds for instrumentation, renovation, and construction, that represents a modest and conservative figure for what the real need in the country is, and that could come through NIH, of course, as it has in the past.

I would like to say in addition that something has to be done—and it will involve dollars—about the fellowship programs as they now exist for young investigators. The stipends are really, as I said before, unrealistically low, and there are not enough fellowships available.

I would suggest that whatever that sum is, that it be doubled in order to meet the need.

The CHAIRMAN. Can you excuse me just a minute.

Do those fellowships come under you, Dr. DeVita?

Dr. DEVITA. All of the institutes have them, Mr. Chairman, so we have a fellowship program, yes.

The CHAIRMAN. How much are you getting for that?

Dr. DEVITA. In 1980 dollars it was $27 million; in 1981 it was reduced to $20 and just increased to $26.5 by the House action a few weeks ago.

The CHAIRMAN. And you think, Dr. Thomas, that we should double that at least?

Dr. THOMAS. The stipends themselves are too low, and I think something has to be done about that. I have one other thing to say.

The research career development award program was one of the most brilliant inventions of the NIH for the fostering and suste-

nance of food science, basic science as well as clinical. I think that most of my colleagues would recommend that that program be strengthened and expanded over the next several years.

The CHAIRMAN. What department of Government does that come through?

Dr. THOMAS. That is each institute.

The CHAIRMAN. Dr. DeVita, what does that come through?

Dr. DEVITA. All of the institutes have them, Mr. Chairman.

The CHAIRMAN. Pardon me?

Dr. DEVITA. The training programs, actually the names of the training programs are quite similar in all the institutes. We just have the part that pertains to our own institute in ours, and the instruments that Dr. Thomas was referring to were awards to support successful investigators over a long period of time, to save them the paperwork of applying for grants on an annual or every 3 year basis.

Dr. THOMAS. They are called the research career development award.

The CHAIRMAN. Dr. Benacerraf?

Dr. BENACERRAF. Mr. Chairman, I would like to support what Dr. Thomas has said, particularly about the research development award, and I would like to add another very important program as one which should be supported very strongly; that is, the program that supports the M.D.-Ph. D. programs in medical schools.

This program is probably the most inexpensive way we have to produce scientists who are simultaneously basic scientists and physicians, which is indeed what we need in biomedical science in the future.

The M.D.-Ph. D. program supports the training in medical schools of individuals who very early understand that they want to be scientists at a time before they have become trained in medicine. They then work simultaneously to become doctors in medicine and doctors in philosophy. Their skills are essential to our welfare.

The CHAIRMAN. Thank you, Doctor.

Dr. DeVita, I think I told you, I mean I think I heard Dr. Gallup from the Harvard Medical School say they suggested or proposed maybe 20 students to come in under this program. You had funds only to take two.

Dr. THOMAS. That is right.

The CHAIRMAN. Does that sort of thing occur?

Dr. THOMAS. That is correct.

Dr. BENACERRAF. That is correct.

Mr. BIAGGI. Will the chairman yield for one question?

The CHAIRMAN. Oh, yes.

Mr. BIAGGI. Dr. Thomas, would you give us the range of those stipends?

Dr. THOMAS. $14,000 to $15,000 per year, and in the case of people who have been through medical school and have had, as most graduates of medical schools have to have these days, an internship and a residency, that means coming down with an income cut of at least 30 percent, if you want to stop being a resident in Massachusetts General Hospital and begin doing research in Dr. Benacerraf's laboratory.

Mr. BIAGGI. $14,000 to $15,000, is that what they get?

Dr. THOMAS. Yes.

Dr. DEVITA. They were just increased from about $10,000 per year.

Dr. THOMAS. I was surprised to hear they were that high because I remember $10,000 or $12,000.

Mr. BIAGGI. You are surprised to hear it that high?

Dr. THOMAS. Yes.

Mr. BIAGGI. I am surprised to hear it that low.

Dr. THOMAS. Yes.

Mr. BIAGGI. Most of us don't know what they are receiving, especially the Members of Congress, and I think this is an unconscionable figure, Mr. Chairman. if that was brought to light I am sure they would respond. We have elevator operators that are making more money than that. It is shameful.

Dr. THOMAS. Ph. D. holders and M.D.'s.

Mr. BIAGGI. I don't know about all of my collegues in the House, but I for one am shocked at that. I just assumed that the medical profession took care of itself. That is just absolutely shameful. That is a fact that should be brought out and brought to light.

Dr. DeVita, who controls that?

Dr. DEVITA. Well, within the level of our budget for research, we do have to request increases from the department, but within a given level, if we increase the stipend, it decreases the number of individuals.

Mr. BIAGGI. That is a catch-22 situation.

Dr. DEVITA. Yes.

Mr. BIAGGI. Why don't we just deal with it in a realistic way, establish a decent stipend? I don't say doubling it, but make a decent case for it and have Congress respond.

Dr. DEVITA. The NIH, as I recall—I wasn't directly involved in that—has done that over a number of years and there has been a level of debate over the level of the stipend, as you might imagine, what is decent for this type of person. I think there are a substantial number of people who feel the same way you do.

Mr. BIAGGI. I think the reason it continues to exist is most of us who are in a position to help are not aware.

Dr. DEVITA. Yes, sir.

Mr. BIAGGI. My feeling about it is pretty much as that of the general public. We assume that all the doctors are rich or are in the process of getting that way. That is just shameful. This is not medicine 100 years ago. This is medicine 1980, and so much is dependent upon research. You are talking about the threshold effort, which should be the most rewarding.

Thank you.

The CHAIRMAN. Dr. Ultmann, were you going to say something?

Dr. ULTMANN. Just, sir, trying to follow up what Congressman Bonker and Congressman Lungren alluded to about cost effectiveness.

You are perfectly correct. I think that the holding down of purchasing CAT scans is outrageous. Actually, the cost effectiveness of making diagnosis speedily has saved many an individual for example, from being crippled with some brain disorder which can be ameliorated rapidly. The balance between prolonged hospitaliza-

tion and a multitude of ineffective tests against the cost of a CAT scan is enormous. It is just cost effective.

Now, when you extend that to the health expenditures in this country, I think although it may seem a lot to give $3 billion to the National Institutes of Health or $1 billion and $1 million to the National Cancer Institute, looking at the cost, the annual cost now of these disorders, it would be proper planning and good management to allocate appropriate amounts.

I am told that we are spending $130 billion for health care and $30 billion for patients with cancer. We have already heard from Dr. Butler that savings, enormous savings, would accumulate in years hence, if we controlled certain diseases of aging.

We have already heard from Dr. DeVita that the 40,000 cancer patients who can be returned to be breadwinners, and then inevitably will pay taxes and that enormous benefits will further accrue from the fact that they do not require prolonged hospitalization. In the disease alluded to earlier, just one small disease affecting young people: Hodgkin's disease. I have made the simple calculation at the slightly higher annual income of $20,000 that the single cohort per year returned as breadwinners, the 7,000 people will earn as much, $3 billion in their lifetime, a sum which is the same as the whole National Institute of Health effort each year. This from one disease controlled.

I think your point, sir, is extremely well taken. We are looking at the wrong thing.

If we look at today's expenditure and forget tomorrow's cost-effective savings, we are going to miss the boat. We are going to miss it in the young people. We are going to miss it in the plant. We are going to miss it in the instrumentation. We are going to miss it in opportunities lost which will cost us a fortune year after year after year.

So, I am happy that you recognize it and I hope that Congress can try and turn around this pennypinching approach, which is billions, it is true, but its pennypinching when one looks at outcome results.

The CHAIRMAN. Thank you. I think a striking example—Mrs. Lasker is very familiar with this because not long ago we had the matter up before our committee of how prevention has saved expenditure; that is, in the field of stroke or heart attack diminished by blood pressure taking, trying to prevent high blood pressure.

There is a greater likelihood, as I understand it, of having a stroke or heart attack with high blood pressure, and so by providing means by which blood pressure may be detected if it is too high and treatment made available, has saved or diminished, as I recall it, the number of people who have strokes and heart attacks attributable to high blood pressure.

Dr. DeVita, in the respective scientific funds that might be relevant to you, that would all come through the health and human resources under NIH?

Dr. DEVITA. Yes, sir.

The CHAIRMAN. So they could present a comprehensive picture?

Dr. DEVITA. Yes, sir.

The CHAIRMAN. Dr. Thomas, do you have any other suggestions for us?

Dr. THOMAS. No, sir, except to express our gratitude to you for the conference and for this opportunity this morning.

The CHAIRMAN. I will tell you what, if my colleagues will agree. I think that we may be trying to invite some of you down here to testify when we have hearings before the House—and perhaps the Senate, also—Appropriation Committee because you could speak impartially and disinterestedly without the necessity of limiting your statement by your position or any unusual restraints.

One other thing. Mr. Henry Waxman, who attended some of our receptions, is Chairman of the Subcommittee on Interstate and Foreign Commerce. That is the Health Subcommittee of the Committee on Interstate and Foreign Commerce in the House.

A little bit ago they presented an authorization to the House, and it increased what it was by 25 percent in the next 2 years for cancer—for the National Cancer Institute—but also in anticipation of just what may have come out of this conference, they got authorized $100 million, if the Congress appropriates it, to meet any breakthrough; that is, if there should be any very exciting prospects of something that you need funds for, why we have got an authorization.

Under our law, in order to get appropriations, generally you have to have two things. One, an authorization by a legislative committee and by the Congress—that is the law—and the second is the appropriation of the amount of money.

Can you, Dr. Thomas, or any of you gentlemen, advise the Congress as to whether you have produced any ideas or suggestions or proposals or even possibilities that might deserve consideration under that $100 million authorization for breakthroughs?

Dr. THOMAS. I would like to think about that, as I am sure would my colleagues. I must say, sir, that if any of us at this table can be useful in providing advice or recommendations to any of the committees that you mentioned, I am pretty sure all of us would be glad to come.

The CHAIRMAN. We would be very, very grateful to you.

Are there any other questions?

Mr. BIAGGI. I don't have any questions, Mr. Chairman, but I wish to make a comment.

Dr. DeVita, I have two questions here which I will submit to you in writing for response. I just received them, and I think they are worthy of consideration.

The note states that bright ideas and carefully designed proposals aren't enough to obtain a grant. The work has to be done before a grant is given. They say it is a catch-22 situation that kills many important research proposals. Is that pretty much the way you find it?

Dr. DEVITA. I think our system has become somewhat conservative. I was actually talking to Dr. Benacerraf about this the other day and he volunteered the information that he thinks it has to do with the availability of resources. The system tends to become very conservative when the resources are uncertain.

Mr. BIAGGI. Its resources. Thank you.

The CHAIRMAN. I just asked the staff a few minutes ago to get me a complete list of all the nations which are participating in this

symposium, and I am disturbed to read it because they tell me it does not include all of the nations.

I will read the names that have been given me, to express our thanks to all of those countries, and I will ask anybody in the audience representing any country which I do not name to please stand up and give your name, because we want you to be recognized and we want to be able to express our profound appreciation to you.

The list that I have is France, Britain, Germany, Austria, Switzerland, Canada, Mexico, Venezuela, Columbia, China, Japan, and Madagascar, but I was told that there were some 20 countries altogether.

Yes, Dr. Thomas?

Dr. THOMAS. Did you mention Australia and Israel?

The CHAIRMAN. Oh, I certainly did not. I know the representative of Israel. I have talked to him many times, and he was an active participant, and Australia.

FROM THE FLOOR. And the Netherlands.

The CHAIRMAN. The Netherlands, of course, and South Africa. Are there others?

Dr. THOMAS. South Africa.

FROM THE FLOOR. Belgium.

The CHAIRMAN. Belgium, yes. I remember talking to you at the reception.

FROM THE FLOOR. New Zealand.

The CHAIRMAN. New Zealand.

Is there any other country that I did not include in the list? I am sorry that we didn't put it together sooner.

FROM THE FLOOR. Egypt.

The CHAIRMAN. There are some 20 countries altogether, and the great part of it is you have not only been together, but you have heard expressions of the spirit of cooperation that has existed among the countries that are represented here, representing various parts of the world, the Orient, Europe, Africa, and the other parts of the world, because this is a problem of humanity, not a problem of any one particular nation.

I am told, as Dr. Thomas indicated, the plan is—and it will be developed by these people who are the representatives—to go on and take specific subjects that seem to be the most valuable to pursue, and have another conference, whether it be here or in some other part of the world. This is just the beginning. Isn't that right, Dr. Thomas?

Dr. THOMAS. Yes.

The CHAIRMAN. This is just the beginning of this world cooperation against this world monster that is threatening all of us, and not the end, but the end of the beginning, as Mr. Churchill said at one time.

I feel a little bit of sentiment, of sadness having to come to an end of this happy period. We have had a wonderful time together, receptions and all. We have enjoyed it, having a sense of satisfaction of having accomplished something very meaningful for humanity.

I want on behalf of this Committee on Aging of the House of Representatives, consisting of 45 Members of our House, to express

our most profound thanks to every one of you who has participated.

I hope that you are going to see the bread that you cast upon the waters come back to you many, many fold. Thank you all.

This concludes our hearing today.

Let me reiterate our appreciation to Dr. DeVita, Dr. Butler, Banker's Life & Casualty Co., and our own staff, which has done an excellent job, and all who had a part in this great venture.

Thank you so much.

[Whereupon, at 12:05 p.m. the hearing was adjourned.]

APPENDIX

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
PUBLIC HEALTH SERVICE,
NATIONAL INSTITUTES OF HEALTH,
Bethesda, Md., November 20, 1980.

Hon. CLAUDE PEPPER,
Chairman, Select Committee on Aging,
House of Representatives, Washington, D.C.

DEAR CHAIRMAN PEPPER: Thank you for the kind words in your letter of October 28 regarding my participation in the International Symposium on Aging and Cancer. Many people worked hard to make the Symposium a success, and I am happy that it met your expectations. As requested, I am providing a statement of the NCI position on the several issues identified in your letter.

(1) The National Cancer Act of 1971 (as amended in 1978) requires the Director, NCI, to prepare an annual plan which includes budget projections for the ensuing five years. This plan is submitted to the Secretary for simultaneous transmittal to the President and the Congress. In addition, an annual budget is submitted directly to the President.

For fiscal year 1981, we submitted a budget request to the President for $1,170,000,000. In January 1980, the President submitted his budget to the Congress with a level of $1,007,800,000 for the NCI. In March, a further revision was made to $965,105,000. The House action on the budget increased it to $1,001,330,000. The Senate has not acted on this budget. For fiscal year 1982, our budget submission to the President was $1,192,000,000. Both budgets reflect an approximate 12 percent inflation and a 5 percent growth.

(2) During the Cancer and Aging Symposium, we held a special planning session to discuss the follow-up workshops—the number, subjects to be covered, possible location, etc. Some possible workshop subjects identified as important for both aging and cancer were: Atypical viruses, immunology, nutrition, and environmental factors. Prior to convening the first workshop, we will have to establish some basic operational aspects for the planning and implementation of all workshops—especially the appointment of an organizing committee to select topics, times, and places for the workshops and develop lists of participants. Some preliminary discussions on these matters have already taken place between NCI, NIA, and Bankers Life staffs and further discussions are planned.

Based on our talks with Mr. Maguire and Mr. Buchmann during the Conference, it is their intention to keep in place as a legal entity the International Symposium on Aging and Cancer (ISAC) to be the recipient of funds from private sources. Hopefully, Drs. L. Thomas and J. Ultmann will continue as President and Vice President of the Organization.

As you know, Dr. Butler and I have agreed to share the costs of the workshops on a 50–50 basis with private sources. The application for grant support of a workshop will be submitted to NIH by ISAC stating that 50 percent of the funds have already been obligated by private sources. The application will be reviewed by a special committee, and the advisory councils of the two Institutes. If approved, the application will provide the Federal share of the funds required.

It is very difficult to accurately estimate costs of these workshops because costs will vary considerably with topic, location (travel costs), length of the workshop, special facilities or equipment required, etc. From past experience, I would think that $100,000 to $150,000 should be planned for each workshop. The workshops will be valuable because they will provide both for the exchange of information, and the transfer of the latest research techniques and procedures to larger numbers of scientists working in aging and cancer research in a more effective and timely means than would be possible otherwise.

(3) Dr. Butler and I have had several meetings since the Symposium to discuss areas of common interest and ways by which we could increase collaboration. Several specific and promising actions have resulted from our discussions:

a. Age limits have been removed for patient participation in clinical protocols in the NIH Clinical Center.

b. The respective program staffs of the Institutes have been encouraged to discuss possible collaborative efforts in the following areas: (1) hospices, with particular reference to terminally ill patients, (2) the redesign of brochures and other material concerning breast cancer to reflect that it is more of a problem for older women, (3) pharmacology of anticancer drugs and the aging process, (4) immunology and aging, (5) differences in recovery of normal and tumor tissue in older patients after exposure to chemotherapy and radiotherapy, and (6) nutrition and aging.

Dr. Butler and I feel that these and other actions we will take in the future will assure that the interrelationship between our two Institutes will be productive and hopefully enable us to make better progress toward our missions.

Sincerely yours,

VINCENT T. DEVITA, Jr., M.D.,
Director, National Cancer Institute.

DEPARTMENT OF HEALTH AND HUMAN SERVICES,
PUBLIC HEALTH SERVICE,
NATIONAL INSTITUTES OF HEALTH,
Bethesda, Md., November 20, 1980.

Hon CLAUDE PEPPER,
Chairman, Select Committee on Aging,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am delighted to respond to your October 29 letter concerning follow-up to the International Symposium on Aging and Cancer. Dr. Vincent DeVita, Director of the National Cancer Institute (NCI), and I have had several productive meetings both during and subsequent to the Symposium. The following are the principal joint initiatives that have been discussed:

1. Investigations of nutrition as it relates to aging and cancer.
2. Examination of the pharmacology of anti-cancer drugs in the elderly.
3. Elimination of age limits on clinical protocols for cancer patients.
4. Preparation of lay brochures for the White House Conference on Aging.
5. Organization of a conference on prevention and treatment of cancer in the elderly.

In regard to your question about the National Institute on Aging (NIA) funding, our Fiscal Year 1981 proposed budget is $74.3 million which is 2.1 percent of the National Institutes of Health (NIH) Fiscal Year 1981 proposed budget.

It is difficult to estimate the extent of fundamental research funds devoted to aging by other agencies. The NIA is currently conducting an inventory of research on aging supported by the Federal government. We expect to have it completed during the spring of 1981. Within the NIA, the majority of our budgeted funds are spent on fundamental biological, clinical, social, and behavioral research on aging. This is achieved both through research grants to investigators as well as studies conducted at the Gerontology Research Center in Baltimore. In addition to these direct expenditures for fundamental research, the NIA is funding the training of young investigators to pursue aging research.

In regard to future international workshops, there are several areas which are of great importance to aging and cancer. These include: 1. Atypical viruses; 2. Environmental influences; 3. Immunology; and 4. Nutrition.

The cost of the workshops will be quite variable depending on size and duration; however, we estimate that most will be in the range of $100,000 to $150,000. We would expect to share on a 50–50 basis these costs with the private sector. Funding from the NIA and the NCI would be derived from conference grant requests submitted by the leadership of the International Symposium on Aging and Cancer. The grant applications will be reviewed by a special review group and by the advisory councils of the two Institutes.

Feedback from a number of sources indicate that the recent Symposium was an enormous success, and we look forward to a vigorous follow-up to it.

If I can provide additional information, please let me know.

With best personal regards,

Sincerely yours,

ROBERT N. BUTLER, M.D.,
Director, National Institute on Aging.

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