National Cancer Program

Report of the President's Cancer Panel

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Submitted to
The President
of the United States
for transmittal to
The Congress

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HEALTH, EDUCATION,
AND WELFARE
Public Health Service
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It is now five years since the passage of the National Cancer Act of 1971. This provides a proper occasion to assess our progress and to consider the opportunities for making the Federal support of cancer research more effective. With a fourfold increase in the budget, the National Cancer Institute has been able to support during the past five years the most extensive program in biomedical research ever undertaken anywhere. There is no question that there has been during this period an enormous extension of our science base and our knowledge as a result of the vast amount of highly excellent fundamental basic research that has been supported. But this extension of our knowledge only underlines how vast are the areas of ignorance which remain. Just as the past five years have brought a greatly enlarged science base, they have also brought important improvements in the clinic in dealing with cancer, but here again our progress only serves to emphasize how far we have to go.

While the National Cancer Program has had the strong support of the Congress, the Administration, the public, and a large segment of the scientific community, criticisms are still coming in from many quarters. This is to be expected in a program of this size and complexity, and these criticisms need careful listening to and even more careful sorting out. There are hard things being said, and we need to think our way carefully through the answers. I would like to deal in this report with several of the important questions that continue to arise and see if we can, to some extent at least, separate myth and misconceptions from valid criticisms.

BENNO C. SCHMIDT, LL.B.,
Chairman

Issues

The two most important and persistent questions about the cancer program deal with opposite sides of the same issue. On the one hand it is said that there is not a sufficient recognition in the cancer program of the importance of fundamental basic research. The opposite and equally vehement criticism is that we are spending too much on fundamental basic research and not enough on applied and clinical research oriented toward a more immediate payoff. These questions go to the essence of whether the cancer program has the proper balance, and they deserve serious and continuing consideration. Other criticisms of the program include the suggestion that those in charge of the program are under the mistaken impression that techniques of business management can be used to unravel the profound mystery of biology; that an attempt is being made to target research that cannot be targeted; that we have become shackled by our own efforts at planning in areas where planning is impossible; that our insistence on targeting has resulted in an enhanced use of contracts at the expense of grants, and that contracts mean less effective research; that our preoccupation with centers is causing us to fund second-rate research at places called centers while first-rate research applications go begging in our traditionally excellent educational institutions; that control, demonstration and service expenditures are siphoning off the funds which should be used for research; that there is a lack of appreciation of the necessity for training the manpower that is needed to provide for the continuity of excellence that good research demands; that environmental carcinogenesis is receiving too little emphasis; and that the cancer program is raising false hopes and false expectations that will result in disillusionment and ultimate abandonment of the program to the detriment of all science. These are the most frequently voiced complaints. There are others, but the ones I have mentioned provide more than a full agenda for this report.

Support of Basic Research

First, is the cancer program supporting enough basic research? To put the answer to that question in context, let us take a brief look at a bit of history. In 1970, when the Senate of the United States appointed a Senate panel to make recommendations with respect to cancer research, biomedical research in general and cancer research in particular were on the back burner. The budget of the NCI was $180 million. In 1971, as a result of the discussions which the Senate panel stimulated in the Congress, the NCI budget was increased to $228 million. In 1972, the first year after the passage of the National Cancer Act, the budget was $378 million. In 1973 it was $432 million. In 1974, $589 million. In 1975, $691 million. In 1976, $762 million, and this year's budget is $815 million. As a result of these increases, we have been able to give this country programs in both basic biomedical research and clinically-oriented research in cancer that are unprecedented, both in their scope and their excellence. While the other institutes of the NIH have not had increases comparable to cancer, the total NIH budget for biomedical research is $2 and one half billion in 1977 compared to $1 billion, 143 million in 1970.

In 1976, 52% of the NCI budget, or $396 million, was spent on basic research. This compares with less than $100 million in 1970. Throughout the past five years, the National Cancer Program has consistently devoted about one half of the substantial budget increases to the support of basic research. Moreover, a large portion of that is investigator-initiated, peer-reviewed, grant-supported, basic research. For example, of the $396 million devoted to basic research in this year, $152 million represents traditional research grants, $58 million represents

the basic research portion of program project grants, $30 million represents support of basic research in the excellent Intramural Program on the NIH campus, $30 million is for construction and fellowship grants in support of basic research, and $79 million represents research contracts in areas, such as virology, which were already being supported by the contract mechanism prior to the passage of the National Cancer Act of 1971, and which, with strengthened peer review, we have continued to support by contract rather than disrupt good ongoing programs. These amounts are spent in support of fundamental research to expand our knowledge at the most basic levels. So when my friend, Arthur Kornberg, says, "We don't know enough about biology to do a proper job in spending huge amounts of money successfully on cancer," it seems to me that this loses sight of the fact that a very substantial amount of the money provided for cancer research goes to the support of excellent basic biological research in the very areas of ignorance to which Dr. Kornberg refers.

During a recent hearing of the Senate Health Subcommittee, I was asked whether we should be supporting so much basic research under the cancer program. The question was, "Can we afford so much basic research or should we devote our funds to activities where the probable payoff is more immediate and more apparent?" My answer is that we cannot afford not to support basic research. Without it, there will be no payoffs. Basic research is still the lifeline of medicine. It is essential in order to provide the science base upon which to build improved technologies for prevention, diagnosis, and treatment of cancer. What we need at the end of the line, and simply must have if cancer is to be eliminated from the roster of major human diseases, is an understanding of the underlying processes of cancer at a far more profound and sophisticated level than we possess today. For we are, in truth, profoundly ignorant about the real nature of cancer. We do not really understand what happens. We cannot fully explain the processes, although there are now attractive clues all over the place. Viruses may be centrally involved, in some cancers at least they probably are, and therefore virology is an important part of the effort. The basic processes of cell differentiation and membrane structure and physiology are surely involved, and we are moving in those areas. Carcinogenesis, cellular genetics, molecular biology, immunological recognition systems, the regulators of growth and differentiation, perhaps even influences of the nervous system—all of these represent fields for inquiry, and none of us can really predict at this stage of our ignorance where the most crucial bits of information now lie hidden away from us. We are confronted by one of the most complex mysteries in all of nature. There are no books to follow for instruction. Committees cannot provide us with the questions we need, much less the answers. We must explore every lead that looks like a good lead, watching for suggestions. For work of this kind we are totally dependent on the flexibility of human imagination, above all the imagination of our youngest and brightest investigators.

We are looking for new ground, but we have come far enough along in the biological revolution to know, for an absolute certainty, that the problem of cancer is an approachable and soluble biological problem, even though none of us can predict when or at what cost. This is the reason that expenditures for basic research under the cancer program since 1972 have totaled well over $1 billion and a large fraction of this is investigator-initiated, peer-reviewed, grant-supported, basic research being done under increasingly rigorous standards of peer review for excellence.

We *must* continue the support of fundamental basic research, and no one should assume that good basic research cannot be supported by a categorical institute. Whether this basic research involves research directed at disease mechanisms, categorical in the sense that investigators will be driven by their own interest in the puzzle of one disease or another, or whether it is noncategorical, pure, undifferentiated biomedical research of the kind that has taken us deep into the biological revolution, we must encourage and support this type of research. It is the excellence of the research that matters, not whether it is supported by the Cancer Institute or the Institute of General Medical Sciences. I think some scientists assume that if basic research is supported by the Cancer Institute, it is somehow targeted or directed. That is not so.

One thing that worries me is the developing notion that there is good basic biomedical research that is relevant and there is good basic biomedical research that is not relevant, and that scientists or administrators should be able to tell the difference in advance.

The individual questions are much too small. It is the total of the science base that becomes relevant, and any building block that elucidates cell structure or mechanisms is relevant, although it may not seen so when described separately in advance. We must not allow this notion or any other to erode our support of the best basic science.

Support of Applied Research

Simultaneously with the expansion of our knowledge through the support of fundamental research, we must also make the best effort of which we are capable today in the areas of prevention, diagnosis and treatment of cancer. This means the support of applied research where an adequate science base exists and the support of clinical research for the development, application, and trial of the best technologies of which we are capable. In 1976, $241 million was obligated under the cancer program for treatment research, of which $68.5 million was spent for the direct support of research in clinical treatment. While we have not had spectacular breakthroughs in cancer comparable to the antibiotics in infectious diseases or the polio vaccine, there is no question that the cancer patient has a better chance today in the hands of good cancer doctors than has been true at any time in the past. Not only are we doing better all the time with acute lymphocytic leukemia, osteogenic sarcoma, and a number of other tumors in children, Hodgkin's disease and other lymphomas, but a new era has begun in the use of combination therapy in treating the more common tumors. Postoperative or postradiation chemotherapy appears to be effective in a large number of cases to avoid metastasis and recurrence where surgery or radiation or both are used to eliminate the primary tumor. In addition, it has now become apparent that tumors are antigenic and immunotherapy therefore will almost certainly become an important tool in treatment, particularly in the postoperative periods when low volumes of tumor exist.

It is quite possible then that even with our existing tools we may be able to improve significantly the survival of patients today. In those cases where tumors are resectable, there has been a tremendous increase in the past three or four years in the emphasis upon the use of chemotherapy and immunotherapy postoperatively to treat those patients with detectable or nondetectable micrometastases. Early results with these techniques are very encouraging and it now appears likely that cure rates will be materially increased for such common cancers as breast and colon cancer over those achieved in the past by surgery alone.

These recent developments represent a drastic alteration in the way medicine is practiced in this country. Utilization of these advances in cancer treatment often requires the melding of the talents of several specialties, the surgeon or radiation therapist, the medical or pediatric oncologist, and the researcher, and such a joint effort has not been and is not today common medical practice. It must become more common in cancer therapy, so long as our basic knowledge is at present levels, and this is an area where I hope we can look to the Comprehensive Cancer Centers to lead the way. In fact, some of the most significant advances in cancer treatment occur not as a direct product of sponsored research but as normal or unusual progress in a good center where surgeons, medical oncologists, and researchers are working together every day in the handling of cancer patients. This unsponsored but natural fallout is one of the greatest values to be derived from the support through research, construction, and training grants of this center type environment.

Cancer Control Program

Under the cancer control program, the Cancer Institute is mandated by the Congress to extend clinical research to demonstration programs in those areas where beneficial technologies exist but where their acceptance and utilization is not widespread. This is an area that troubles a great many scientists because they are concerned that the entry of the NCI into the service area, even to this extent, will ultimately result in the diminishing of its resources for research. Fortunately, the Congress has to date been willing to budget the control activities separately, and I see no indication of a change in this policy. So long as this is true, the NCI should be able to expend the control dollars usefully without diminishing its research capability.

In fiscal 1976 control expenditures were $54 million and this year they are budgeted at $60 million. The more important control programs include breast cancer detection, cervical screening, programs for screening persons with hazardous occupational or chemical exposure, rehabilitation programs following cancer surgery, programs to enable Comprehensive Centers to extend cooperation to other hospitals in their areas, demonstration networks for breast cancer and head and neck cancer, community organized programs in cancer control, and radiologic physics centers to assist hospitals throughout their areas properly to plan and program their radiation therapy.

As for the charge that the cancer program is overly targeted, I wish I could make clear once and for all the fact that those who manage the national cancer effort are not obsessed with the idea of targeting. There is some applied research that can and should be targeted because the science base exists, and in those cases, with the advice of the best scientists available, a targeted effort is made. However, we are as aware as anyone anywhere of the limitations of targeted research, and we are not attempting to target the basic research, that will give us the understanding of the origins and nature of cancer. Similarly, with respect to the issue of contracts vs. grants, we have been substantially diminishing the percentage of contract support and increasing grant support in the area of basic science, and we intend to continue to do so. One of the problems of communications has been that our budgets often lump all contracts together, and this figure is sometimes taken by members of the scientific community to represent contract research. In fact, over half of the contract expenditures are for necessary supplies and services which can only be obtained through the contract mechanism. The contract mechanism is used for the support of basic research today principally in those areas where it was in use prior to the passage of the National Cancer Act, primarily cancer virology, and in those limited areas its use with strengthened peer-review has been continued in order not to impede strong ongoing programs. However, the present management of the NCI has been deemphasizing the contract mechanism in the support of basic research and will continue to do so.

This brings me to the National Cancer Plan which has been the subject of so much criticism from so many scientists. When Dr. James Watson was reported recently as having said at M.I.T. that the National Cancer Program was a "sham," he was, in fact, talking about the National Cancer Plan. He made this somewhat clearer in a letter of apology than he did in his speech, but there is no question that he was talking about the plan and not the program. I suspect that if we took a vote, most scientists would be happier if there were no cancer plan—if there had never been a plan. It seems to imply to a lot of people that somebody in a position of authority thinks that the problems of cancer can be dealt with in the same manner as the problems of building an atom bomb or landing a space craft on the moon. I assure you there is no such thought. The plan is not designed for the purpose of telling us how to run the program. The plan was an attempt by the scientific community, by those responsible for doing the science, to indicate those areas which, at the present time, seem to offer the greatest promise. Like most plans, its principal value may well be in the communications which take place during the planning process. It is also a useful vehicle for assessing the program on a continuing basis, and presenting the program to OMB and the Congress. However, it does not put the program in any sort of straitjacket nor does it put blinders on those who are administering the program. The program is, in fact, what goes on at several hundred educational and research institutions, plus the intramural work at the NCI. This is determined almost entirely by the best peer-review available in the scientific community. So, in the last analysis, scientific initiative and peer-review, not the plan, determine the cancer program.

Scientists who are engaged in this work at their own universities know that the plan is not determining what science they do or how they do it. I have never felt that worries about the plan were particularly well-founded. Of course there is a large element of unplanned, untargeted, undirected, investigator-initiated science required in this undertaking, but no one thinks differently and there is nothing in the plan to cause them to think differently. The program is designed to provide an open system with fair and even peer-review and an environment optimal for discovery. We need brilliance, hard work, serendipity, and a large measure of good luck. I hope we are doing nothing to block ourselves off from any of these.

Another frequently heard charge, and one also recently repeated by Dr. Watson at M.I.T. is that our centers' support represents the support of inferior research and thus deprives institutions of greater excellence of that support. This allegation does not withstand examination. In supporting the 19 Comprehensive Centers that have thus far been recognized, we are not only helping to bring better clinical care to a greater number of our citizens, but we are also supporting some of the best research institutions that exist in this country.

At the time the National Cancer Act was passed, three institutions in the nation were recognized as having Comprehensive Cancer Centers. They were:

- Memorial Sloan-Kettering Cancer Center, New York City
- M. D. Anderson Hospital and Tumor Institute, Houston
- Roswell Park Memorial Institute, Buffalo

Since the passage of the Act at the end of 1971, 16 additional institutions have been recognized as Comprehensive Cancer Centers. They are:

- Sidney Farber Comprehensive Cancer Center, Boston
- Yale University Comprehensive Cancer Center, New Haven
- The Fox Chase Cancer Center, Philadelphia
- Johns Hopkins Oncology Center, Baltimore
- Georgetown University-Howard University Comprehensive Cancer Center, Washington, D.C.
- Duke University Comprehensive Cancer Center, Durham
- Comprehensive Cancer Center of the State of Florida, Miami
- University of Alabama Comprehensive Cancer Center, Birmingham
- Illinois Cancer Council, Chicago
- University of Wisconsin Cancer Center, Madison
- Mayo Comprehensive Cancer Center, Rochester, Minnesota
- Colorado Regional Cancer Center, Denver
- University of Southern California/Los Angeles County Comprehensive Cancer Center, Los Angeles
- Fred Hutchinson Cancer Research Center, Seattle
- Ohio State University Cancer Research Center, Columbus
- University of California, Los Angeles Cancer Center, Los Angeles

I think that no one would question that the research done at these great institutions, both fundamental and clinically oriented research, compares favorably with the best biomedical research done anywhere. Certainly these institutions are also in the forefront of those which provide the best clinical care in cancer. The advances that take place at these institutions will greatly enhance the success of our efforts against cancer—both in the understanding of the disease and in treating it during our period of incomplete understanding. We can be enormously proud of our achievement in extending so successfully the number and geographic distribution of these outstanding Comprehensive Cancer Centers. The belittling of the effectiveness and accomplishments of these great institutions reflects a sad lack of understanding of the total picture in cancer research and treatment today.

By historic happenstance, the term "Centers Program" at the National Cancer Institute has come to refer to all those institutions which receive "core grants" or "program project grants" or both. Therefore, we support under our Centers' Program research not only at the great institutions which I have mentioned as recognized Comprehensive Cancer Centers, but also at many other institutions that have been called specialized centers because they receive core or program project grants. These institutions include Stanford, the University of California, Indiana, Harvard, M.I.T., the University of Minnesota, Albert Einstein, Mount Sinai, and some fifty other fine institutions too numerous to mention, but including, ironically, Cold Spring Harbor Laboratory, where Dr. Watson's support has gone from $435,000 in 1970 to $1,962,665 in 1976 under the NCI Centers' Program. So I say to Dr. Watson and those like him who question the excellence of the research supported under the Centers' Program that peer-review is alive and well in the Centers' Program just as it is in the other programs of the National Cancer Institute.

There *is* a legitimate worry about the Comprehensive Cancer Centers which relates to future funding in the event of the recognition of too many such centers. Comprehensive Cancer Centers must compete on the merits with all other institutions for the can-

cer research dollar. Therefore, if too many centers are recognized and we have centers which cannot compete on the merits, we will then be in a position of having recognized centers which we are unable to support. The fear is that, under those circumstances, political pressures would be brought to bear which would force the support of the Comprehensive Centers at the expense of other institutions capable of better cancer research. The answer to this perceived future problem is strictly to limit the recognition of the Comprehensive Centers and to recognize them only at institutions that have established academic, clinical, and scientific leadership, and are clearly capable of competing on the merits.

The most serious mistake we have made in the support of our biomedical research during the period that I have been actively associated with this enterprise was the discontinuance by OMB of the biomedical fellowship and training programs. It is absolutely essential to our success in the cancer program and in biomedical research generally that we bring a portion of our brightest young people into these programs, and fellowships and training grants have proved to be the most effective and most economical ways of doing that. These are among the best dollars we spend in terms of value received.

Fortunately, one way or another the NCI has been able to keep its training programs going at about the same dollar level as existed before the OMB action. However, the training programs of other parts of the NIH, particularly the predoctoral programs of GMS, have been adversely affected, and that ultimately affects the cancer program as surely as if these programs were in the NCI.

One of the worst aspects of the training picture during the past few years under both the Weinberger Program and the National Research Training Act has been the on again-off again uncertainty that comes with defining new programs, producing new regulations, not having funds in certain periods, having funds in other periods, and putting the whole research establishment in the hurry-up-and-wait, now-you-have-it-now-you-don't posture. However, we are supporting training substantially, and I hope we can get a uniform understanding and a uniform program that can go on year after year without the turbulence that has characterized the past several years. This has been very distressing, I know, from the standpoint of the institutions, and it has made for less efficient expenditure of the Federal dollars in this field.

In recent months there has been an enormous increase in the public interest in chemical carcinogenesis. This interest has now manifested itself legislatively in the Toxic Substances Act. In urging the Cancer Institute to devote more of its resources to environmental carcinogens, some have greatly oversimplified the problem. It has been suggested that, since it is generally assumed that at least 80% of all cancer is environmental in origin, and since environmental carcinogens can be identified by toxicological testing, we could eliminate 80% of the cancer by determining those elements in our environment that are causing the cancer and eliminating them. Unfortunately, the problem is not that simple. We have been able to identify and peg a number of chemical carcinogens, but there are undoubtedly many that have not yet been identified, and the scientific methods available to us today for identification of carcinogens are not adequate to quickly and clearly identify the carcinogens in our environment.

The best method for identifying carcinogens today is through animal bioassays. These tests take three years, require 750 laboratory animals, cost $150 thousand each, and then are often not conclusive. Nevertheless, the Cancer Institute has been doing such testing for a number of years and this work was greatly intensified after the passage of the Cancer Act in 1971. At present, NCI commences the testing in its animal bioassay program of 150 to 200 carefully selected new substances each year. This means that ap-

proximately 500 substances are under test at any given time. One of our biggest needs today is an *invitro* test that would enable us to screen rapidly and inexpensively for environmental carcinogens. The Cancer Institute has supported research in this area for many years, and intensively since 1972. We have several *in vitro* tests that look very promising and some, such as the Ames' Test, are good enough today to be useful in preliminary screening. However, there are a sufficient number of false positives and false negatives to make animal testing essential as a backup procedure.

The Cancer Institute will continue to support research to improve these rapid and inexpensive *in vitro* tests and to use them to the fullest extent possible in selecting chemicals for animal screening. We want the best programs in chemical carcinogenesis that it is possible to provide and, as we are able to define effective approches, we will do our best to obtain funds sufficient to conduct whatever programs the public interest requires.

In 1976 the Cancer Institute spent $120 million on environmental carcinogenesis. This included the animal bioassay program, epidemiological and field studies, program in smoking and health, and a small portion of the control monies which were spent on environmental carcinogenesis, primarily occupational exposure to carcinogenic substances.

Grants in the field of carcinogenesis included support of research in the identification and discovery of environmental carcinogens, in the mechanisms of action of chemical carcinogens including co-carcinogens (particularly viruses and chemical carcinogens), and the development of *in vitro* tests for rapid and inexpensive screening. The Institute also supports epidemiological work designed to explore cancer incidence and to relate this to environmental factors where possible.

There is increasing cooperation today between the NCI and the Environmental Protection Agency, the FDA, NIOSH, and other agencies having responsibility for some part of the environmental carcinogenesis problem. This cooperation is being tightened up and better formalized under the Toxic Substances Act so that the role of each agency will be well defined and parts of the problem will not fall in the crack. The total Federal effort must be effectively coordinated. A Clearinghouse on Environmental Carcinogens has been set up by the NCI to serve as an information center and an early warning network for scientists, industry, Federal Agencies, and others concerned with environmental carcinogenesis.

One discouraging aspect of the environmental carcinogenesis picture is our experience with cigarettes. There is absolutely no question that cigarettes are carcinogenic and that the epidemic increase in primary lung cancer is due to cigarette smoking. A part from those cases of lung cancer caused by occupational carcinogens such as asbestos, uranium, and certain chemicals, virtually all the primary lung cancer occurs in the lungs of long-term, habitual smokers. It is less certain, but, from the epidemiological evidence reasonably certain, that some portion of the bladder, esophageal, pancreatic, and head and neck cancers are also due to smoking. Therefore, it is clear that a very large portion of the environmentally-induced cancers are associated with cigarette smoking. Yet, we are not able by law, education, or in any other way to eliminate this carcinogen from the environment. We have not been able so far even to reduce total use. Our only hope is that lower tar and nicotine content will make some contribution to the reduced carcinogenicity of this environmental hazard.

Will we do better if the causative properties of other entrenched substances in our culture are established? We are not going to eliminate the bulk of the environmentally-induced cancers by eliminating those substances which cause five or ten percent of the disease. However, we must pursue the identification of these substances and the determination of how they work, for that is a part of the knowledge we must have in order to make progress against this disease. We must do our best to keep new carcinogens from entering our environment and to get rid of as many as possible of those that are with us. This will not be an easy task, but the NCI will intensify its effort to carry adequately its portion of this mission.

I would like to say a few words about the biomedical research budget, because there is no question that the combined problems of inflation and recession and the economic difficulties which confront us have created great pressure for the reduction of Federal expenditures on biomedical research. This is one of the few areas that can be reduced and therefore it is a prime target. However, it is my opinion, and has been my advice to the President and to the Congress that it would be a serious mistake to cut these programs in such a way as to lose the momentum that has been established. I think we must continue our Federal support.

We have had in the United States in the past twenty-five years a revolution in basic biomedical science. This has been largely due to the Federal commitment to basic biomedical research implemented through that remarkable institution of the Federal Government, the National Institutes of Health, and its extraordinary partnership with the medical schools, universities, teaching hospitals, and research institutions of this nation. This mix of public support and private sector initiative has made our biomedical research effort the envy of the world. It should be a national priority of the highest order to maintain the momentum of this program. It may well be our nations most valuable contribution to human civilization during this period in our history.

Unfortunately, in a free enterprise system, basic biomedical research cannot be carried forward on the scale that is required without Federal support. Profit incentives are not there to support adequate basic research in this area, and philanthropic institutions, while providing most of the facilities and personnel needed for this enterprise, must have government help in order to stimulate their activities and to sustain them at the level which the public interest requires.

The cost of medical care is such an enormous and increasing expense for our people and, therefore, for the Government, that we cannot afford to starve the research efforts which will provide us the knowledge we need to avoid the crushing burdens of medical care. If it were not for the results of past biomedical research, we would still be saddled today with the horrendous costs and burdens of tuberculosis, polio, and all of the infectious diseases which through the products of research have been virtually eliminated from our medical picture. We must continue our research until cancer, heart disease, stroke, arthritis, multiple sclerosis, diabetes, and other diseases that agonize our people and fill our hospitals have been added, or largely added, to that list.

If any well-run business were spending $130 billion per year on medical care, it would be spending at least 5% of that amount on research to reduce those costs. While we cannot go to that level under today's circumstances, sound business judgment requires that we not cut back on the present effort.

Finally, the Federal expenditures in biomedical research are leverage dollars. Hundreds of millions of dollars of institutional facilities built by our universities and other philanthropic institutions, and thousands of people whose salaries are paid by these institutions, are mobilized in the cause of biomedical research by the relatively few Federal dollars that are spent in stimulating this activity. However, stop the flow of Federal dollars under today's circumstances, and these essential activities will grind virtually to a standstill. This we must not do.

For the past two years the cancer budget has been level in constant dollars. This has put the program this year under serious pressure. By virtually eliminating new construction, we may be able to get by in 1977 without too serious damage to the program. However, if we do not get a reasonable increase for 1978, there will be a loss of momentum which we cannot afford.

In conclusion, the scientific and medical community, and all of us connected with the program must continue to explain at every opportunity to the American people and to the Congress that the cancer program is a vast undertaking which will require long-term support and great patience. We are still far away from being able to put either a date or a price tag on the ultimate conquest of cancer. We are making progress in our understanding of this disease, and there is no question that the benefits of our research are increasingly available to the American people in the form of better treatment as time goes by. But it is a long road that will require patience and constancy on the part of the Congress, the Administration, and the public. In fact, at this stage of our progress, it is true in a very real sense that "the goal is the course we travel together, and the end is only the beginning."

Appendix

International Cancer Research Data Bank Program

I would like also to update the information on the progress of the National Cancer Institute in implementing the provisions of the cancer legislation calling for the establishment of an International Cancer Research Data Bank and other cancer communications programs.

The purpose of the International Cancer Research Data Bank is 1) to assist researchers in this country and around the world in obtaining current information about research that is under way and the progress of such research and 2) to enable practitioners to obtain the latest information on the diagnosis and treatment of the various types of cancer. The National Cancer Program has made enormous progress in fulfilling the purposes of this provision of the Act.

The core of the International Data Bank Program, the actual data bank, is a computerized information retrieval system called CANCERLINE. The hardware for this system is located in the National Library of Medicine and is available to all users who have computer terminal access to other "on line" systems at the National Library of Medicine, e.g., "Medline," "Toxline," and "Chemline." Internation access is available through twelve Medline Centers outside the U.S.

CANCERLINE currently has three data bases which may be described as follows:

1) CANCERLIT contains over 60,000 abstracts of published articles from more than 2000 journals, from books, from proceedings of scientific meetings, and from other documents related to cancer research. Coverage of recent cancer-related literature is now very comprehensive. Between 25 and 30 thousand abstracts are added to this file each year. Speed is emphasized and mechanisms are being developed to enter abstracts in the file within eight weeks after publication.
2) CANCERPROJ contains some 15,000 brief descriptions of ongoing cancer research projects. This data base is updated every three months.
3) CANCERPROT contains active treatment research protocols which are abstracted to a common format. This file likewise will be updated on a regular basis at least twice a year.

A fourth data base—CANCERCITE— is being built at the present time. It will contain bibliographic citations to cancer-related articles published prior to the creation of CANCERLIT.

In cooperation with the Smithsonian Science Information Exchange, a Current Cancer Research Project Analysis Center has been established. This Center is responsible for building and maintaining the CANCERPROJ data base, for providing to scientists special searches and services, and for the preparation of Special Listings. The latter are compilations of projects in a specific subject area which are sent to contributing researchers on a regular basis as part of a current awareness service.

Cancer Information Dissemination and Analysis Centers have been designated for three major research areas: 1) carcinogenesis, 2) clinical investigation, 3) virology, immunology and other cancer biology.

The major product of these Centers will again be a current awareness service based on dissemination of CANCERGRAMS containing abstracts of recently published papers on specific subjects. These will be sent automatically each month to scientists working in the particular subject field.

These Centers will also conduct special searches on request, prepare technical bulletins on current topics of interest, monitor the quality of information in the data bases, and evaluate the benefits and effectiveness of the ICRDB services.

The ICRDB Program has implemented two personnel exchange programs which permit individual scientists or small groups of investigators located in different countries to work together for 1 to 3 weeks on a common research problem. These programs are administered by the International Union Against Cancer utilizing a prestigious panel of scientific reviewers. The operational design permits processing of applications with rapid notification of the reviewers' actions.

A number of special programs, projects and services are sponsored and supported by the International Data Bank. These include:

- The International Registry of Tumor Immunology
- The International Clearing House of Epidemiology
- The Latin American Cancer Research Information Program
- International Medical Information Center in Tokyo

Increased emphasis is being given to international participation through the use of existing resources, encouraging development of new services, and by negotiating arrangements with international organizations and institutions for collection of information, dissemination of services, and development of new services.

In addition to data storage and retrieval, the International Research Data Bank is also responsible for a variety of publications as a means of further disseminating information on cancer research. Among these are:

Cancergrams

CANCERGRAMS provide cancer researchers with monthly listings of abstracts of published research results directly related to their current research projects. There are currently some 35 different CANCERGRAMS per month, each covering a narrow cancer research area. When the program is fully implemented by the end of this year, there will be 60-80 different CANCERGRAMS monthly. These CANCERGRAMS are distributed to about 500 scientists around the world. Each monthly issue of a CANCERGRAM on a specific topic usually contains 15-60 abstracts, depending on the extent of research activities in the area covered by that CANCERGRAM.

Oncology Overviews

ONCOLOGY OVERVIEWS contain selected abstracts on high-interest topics, such as a specific anticancer agent or a specific carcinogenic agent.

Each ONCOLOGY OVERVIEW is similar to a special bibliography with abstracts and is useful for reference to all significant papers published about a specific cancer topic in recent years.

Special Listings of Current Cancer Research

SPECIAL LISTINGS contain descriptions of current ongoing research projects. The descriptions are prepared by cancer researchers in nearly 50 different countries around the world.

Each SPECIAL LISTING contains some 130-200 descriptions of projects in a specific area of cancer research.

About 60 SPECIAL LISTINGS, each covering a different major area of cancer research, are prepared and distributed each year.

Distribution of ICRDB Publications

Most cancer-related publications of the ICRDB Program are prepared for automatic distribution to investigators working in the specific research area covered by each publication. These investigators are identified on the basis of descriptions of their current research projects provided to the ICRDB Program directly or via granting agencies. Others can order ICRDB publications directly from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, Virginia 22161

The International Cancer Research Data Bank Program has also established Centers for Information Dissemination and Analysis in three broad areas of cancer research. These Centers are staffed by scientists and consultants who have a thorough and detailed understanding of the subject areas covered by the particular Centers. Areas of cancer research covered by the three Cancer Information Dissemination and Analysis Centers are:

Clinical CIDAC:

—Covers Cancer Detection, Diagnosis, Therapy, Rehabilitation, and other Clinical Aspects.

—Operated by the M.D. Anderson Hospital and Tumor Institute, Houston, Texas.

Carcinogenesis CIDAC:

—Covers Chemical, Environmental, and Physical Carcinogenesis, and Cancer Epidemiology (excluding viral carcinogenesis).

—Operated by the Stanford Research Institute, Menlo Park, California.

Virology/Immunology/Biology CIDAC:

—Covers Cancer Virology, Immunology, and Cancer Biology (excluding clinical aspects).

—Operated by the Franklin Institute, Philadelphia, Pennsylvania.

The CIDACs provide *active* dissemination of cancer research information to scientists and act as reference and referral centers for investigators. CIDACs offer several major types of service.

These Centers for Information Dissemination and Analysis also prepare CANCERGRAMS in their areas for monthly inclusion among the CANCERGRAMS described above, and they prepare Oncology Overviews, which are special bibliographies containing abstracts of recent results on specific high-interest topics.

In addition, each CIDAC is responsible for:

—Optimizing methods for indexing, retrieving, and summarizing scientific information and findings.

—Identifying and implementing new projects to promote exchange of technical information between cancer researchers on a worldwide basis.

—Identifying new results that are of special importance and represent significant progress in specific cancer research areas.

—Providing custom searches of the cancer literature and responding to other specialized requests for cancer information made by researchers who have no local access to on-line biomedical information services.

The International Cancer Research Data Bank Program also includes a Cancer Research Project Analysis Center which is operated for the NCI under contract with the Smithsonian Science Information Exchange. The major services and publications of this Center include:

—SPECIAL LISTINGS containing descriptions of more than 15,000 currently active research projects in some 60 different specific cancer research areas.

—The *CANCERPROJ* Data Base which can be used to retrieve all cancer research projects on specific topics in a matter of minutes.

—The *CLINPROT* Data Base

The Center has prepared protocol summaries of clinical cancer therapy protocols for use in building the CLINPROT data base. Research clinicians at more than 500 locations in the U.S. and other countries can retrieve outlines of clinical protocols dealing with specific types of cancer, anticancer agents, or modalities.

—Comprehensive Compilations of Clinical Protocols

A Compilation of Clinical Protocols containing over 450 summaries was published in June 1976. A new edition will be published in mid-1977 and will contain nearly 1,000 protocol summaries.

—Compilations of Clinical Protocols by Organ Site.

—Compilations and listings of research projects for use in Program Analysis and Management Information Systems.

—A six volume compilation of nearly 7,000 cancer research projects which was distributed to cancer centers and researchers around the world.

The Center also serves as a reference and referral center for researchers and provides quality control for entries in the CANCERPROJ data base.

International Programs

The International Cancer Research Data Bank is also engaged in a number of highly effective special international programs.

1. *Clearinghouse for Ongoing Work in Cancer Epidemiology.* This cooperative project is supported jointly by the ICRDB Program, the International Agency for Research on Cancer (IARC) in Lyon, France, and the German Cancer Research Center in Heidelberg, Germany. The Clearinghouse, located in Lyon, collects, processes, and disseminates detailed data on research related to cancer epidemiology and studies of human cancer causation in countries around the world.

The Clearinghouse also prepares lists of epidemiology researchers and resources, responds to technical questions, and produces a series of products and services. One such product is a recurring *Directory of On-Going Research in Cancer Epidemiology.*

2. *International Scientist-to-Scientist Communication.* The ICRDB Program, through the International Union Against Cancer (UICC) in Geneva, Switzerland, encourages international scientist-to-scientist communication through two different mechanisms:

The INTERNATIONAL CANCER RESEARCH TECHNOLOGY TRANSFER PROGRAM promotes direct and rapid transfer of information about new or improved technology or methodology between two or more investigators located in different countries. This is accomplished by supporting short-term visits for the purpose of conducting brief research projects, collaborating with a fellow investigator, or resolving discrepancies in results obtained by two investigators working in different countries.

The INTERNATIONAL CANCER RESEARCH WORKSHOP PROGRAM provides partial support for workshops in cancer research where scientists meet on an international basis. The aimi is to increase the frequency, speed, and efficiency of direct information exchange among small groups of cancer investigators. These researchers, although working in different countries, are all active in the same field of basic, clinical, or behavioral research related to cancer.

3. *A Project to Promote International Collaboration Between Cancer Research Organizations.* In cooperation with the International Union Against Cancer (UICC) in Geneva, support is provided for a Special Committee for International Collaborative Activities (CICA) within the framework of the UICC. The Executive Secretary and members of CICA are providing advisory, consultative, and liaison services to support the international activities of the United States National Cancer Program in general, and the ICRDB Program, in particular.

CICA aids in the collection of data about ongoing cancer research projects (including clinical protocols) from countries around the world. CICA personnel also identify and promote collaborative projects among cancer centers and cancer scientists in different countries. An *International Directory of Specialized Cancer Research and Treatment Establishments* has been published containing descriptions of more than 500 cancer centers around the world.

4. *Latin American Cancer Research Information Project.* Coordinators from various Latin American countries met in Sao Paulo, Brazil in November 1975 to establish this program for promoting participation of Latin American countries in the ICRDB Program and other components of the National Cancer Program. As part of this project, the Pan American Health Organization (PAHO) and its Regional Library of Medicine in Sao Paulo have developed and implemented mechanisms for identifying, collecting, and supplying Latin American biomedical literature and data about ongoing cancer-related research projects in Latin America for input to the CANCERLINE data base at the National Library of Medicine.

PAHO is also editing the Spanish and Portuguese version of the International Classification of Diseases for Oncology (ICD-O) and is conducting ICD-O field trials in Latin America.

Additionally, PAHO is acting as the focal point for updating the Latin American entries for the UICC directory of cancer centers and mechanisms have been established to disseminate ICRDB publications and information services to cancer researchers in Latin America.

5. *International Medical Information Center.* The development of an ICRDB-sponsored center in Japan has been initiated. This Center will coordinate the screening and collection of cancer-related information from Japan and Asian countries for entry into the data bank. It will also include mechanisms for providing ICRDB publications and other information services to scientists working in the Far East.

In addition to the wide spectrum of information disseminated by the International Cancer Research Data Bank primarily for the benefit of research scientists and clinicians, the National Cancer Institute operates extensive information resources through the Office of Cancer Communications, primarily for the benefit of the public and, through the Cancer Control Division for the benefit of practicing physicians, health professionals and the public. The NCI also supports two other major facilities for enhancing cancer communications. One of these is the Cancer Information Service which is based in fifteen of the Comprehensive Cancer Centers and the other is the Cancer Information Clearing House.

The Cancer Information Service is primarily designed to provide information to health practitioners and to motivate them to use new cancer knowledge and technology. Toll free regional WATS lines operated by the Comprehensive Centers received about 20,000 calls in the first year of operation. The NCI also operates a national toll free WATS line to back up and support this regional system.

The CIS offices are also working with the NCI on cancer information and education programs aimed at Black Americans, American Indians, Spanish speaking Americans and other minority groups. The service is reinforcing and coordinating preexisting professional and public educational programs at national, regional, and community levels.

The Cancer Information Clearing House is a service of the NCI Office of Cancer Communications. It collects and disseminates information on cancer for patient, public, and professional audiences. The Cancer Clearing House sponsors a special Communications Alert which is used to communicate specific information to targeted audiences, including cancer-related institutions and organiza-

tions, selected media, health professionals and certain public audiences. A highly categorized mailing list can be utilized to alert special groups about pertinent issues within just a few days. This office maintains a speakers bureau to provide public and professional groups access to the latest information on cancer, ranging from cancer research to control activities.

The Office of Cancer Communications also publishes and disseminates the reports of the environmental carcinogenesis program's testing of compounds for cancer-causing activity. Reports on the results of the testing of a variety of chemicals are made each year. These reports are of great interest to regulatory agencies, industry, labor, consumer groups, scientists, the press, and the public at large.

The Cancer Control Division has a variety of programs which are designed for the education and training of physicians and health professionals and it also supports demonstration projects to enhance the quality of diagnosis and care.

During 1976, more than 46,000 letters—nearly double the 1975 level—were written by the Office of Cancer Communications in response to inquiries. Telephone inquiries averaged 1,500 per month. Most of the inquiries were from cancer patients or their families seeking assistance or treatment information. A number of new publications have been developed to provide the type of information necessary to answer the types of inquiries most frequently received.

During 1976, the NCI mailed more than 450,000 publications in response to requests from the public. It has distributed to the public more than 4 million copies of its publications through a supermarket distribution system and another 100,000 through the Consumer Information Center of the General Services Administration.

NCI scientists participated in the annual American Cancer Society Science Writers Seminar for reporters from newspapers, wire services, and periodicals, with a combined circulation of tens of millions. They also participated in interviews in numerous radio and television programs to communicate information about cancer progress and problems to the public.

Several NCI exhibits were shown, including two developed specifically for the Nation's bicentennial celebration. One of these was placed in the HEW building, Washington, D.C., and the other at Cape Canaveral. More than 850,000 people viewed the exhibits, and more than 1.5 million NCI publications were distributed. Other NCI exhibits were shown at 11 professional meetings, which resulted in the distribution of another 161,000 publications.

In discussing communications one *caveat* is necessary. When one of our more advanced cancer centers develops a treatment that is more effective than those theretofore available for a particular type of cancer, it is highly desirable to get this treatment into widespread use as soon as possible. The public tends to view this as a problem in communications or education. Unfortunately, this is only partially true. The complex skills of the surgeon, the radiation therapist, the medical oncologist and the researchers which are responsible for the good results can very often be duplicated in comparable medical centers, but it is very difficult to duplicate them in less skilled centers, community hospitals, and doctors' offices. Nevertheless, we must do the best we can in this area. And there is no question we have made great progress in the past seven years.

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