research is a complex operation, involving continuing interaction and feedback, and is not a simple, orderly process of transmitting information from one place to another.

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7. Two recent reports examine and evaluate some specific examples of applied research in the social sciences. The first [*Policy and Program Research in a University Setting, A Case Study* (National Academy of Sciences, Washington, D.C., 1971)] examines the work done for the Office of Economic Opportunity by the Institute for Research on Poverty at the University of Wisconsin. It considers not only the specific issue, but discusses, more broadly than I have in this article, the problems involved in using university-based institutes as behavioral science research resources for mission agencies. The second report [*Behavioral and Social Science Research in the Department of Defense: A Framework for Management* (National Academy of Sciences, Washington, D.C., 1971)] also treats not only the specific question, but the more general problem of how to do research. It points out: "The idea of field testing social science hypotheses is not yet widely accepted by either researchers or policy makers. Yet there is a sufficient number of successful applied social science research on a large scale, and the testing of social hypotheses, to make it impossible to deny the potential value of such work" (p. 29). Another NAS report to be published in 1972 is the "Study conference on research strategies in the behavioral and social sciences on environmental problems and policies." This conference was held under the joint auspices of the Division of Behavioral Sciences of the National Research Council and the Environmental Studies Board of the National Academy of Sciences–National Academy of Engineering.
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NEWS AND COMMENT

National Cancer Act: Deciding on People, Policies, and Plans

During the last year and a half, scientists and politicians have been busy fighting over and bragging about the new, official U.S. commitment to the conquest of cancer. On 23 December 1971, President Nixon signed into law the National Cancer Act, which endows the National Cancer Institute (NCI) with privileged status and $1.6 billion to spend in the course of the next 5 years.

Intermingled with lavish and optimistic words of praise for this new enterprise is the often repeated caveat that biomedical research is a notoriously uncertain undertaking, that even the imprimatur of the White House and all that money cannot *guarantee* success. Be that as it may, no one, including the most sophisticated scientist, is going into this without some expectation of tangible results, and, among the public, expectations are great indeed. Consider, for example, an exchange between Representative Daniel Flood (D–Pa.), chairman of the House Committee on Appropriations' subcommittee on labor, health, education, and welfare, and Carl Baker, outgoing director of the NCI.

FLOOD: Every time the phone rings, I expect to pick it up and have you tell me that we have broken through in cancer virus [research].

BAKER: I don't think it happens as a breakthrough like that.

or again

FLOOD: What day are you going to tell us, what month and year, "Here, Hallelujah," as you have done with polio and measles?

BAKER: I don't think it is going to come that way.

To be sure, Flood's questions reflect a simplistic view of the cancer problem, but, just as surely, they represent the thinking of many members of Congress and the public. His notion that we are on the verge of a breakthrough in cancer research is, one must admit, not something he made up out of whole cloth. It is logically derived from the special pleading and hoo-ha that has attended the passage of what was billed earlier as a "cancer cure program." Cure or not, everyone is impatient for something to happen.

In this atmosphere of great expectations, the cancer effort must get off the ground—soon. In December, Nixon declared, "With the enactment of the National Cancer Act, the major components for our campaign against cancer are in place and ready to move forward." The President was a bit premature. What he had was an outline, but neither the characters nor the script for the anticancer drama. Now, however, all the key players have been cast —or will be as soon as the appointment of Frank J. Rauscher, Jr., as Baker's successor is officially announced. The script, in the form of the National Cancer Plan, which will detail the ways to spend the money, is nearly completed.

An essential feature of the new cancer act is the direct tie it creates between the NCI and the White House. The law provides for a structural reorganization that makes the director of the NCI responsible to the President—not to the Secretary of Health, Education, and Welfare (HEW) or to the head of the National Institutes of Health (NIH), as before. Both the Secretary of HEW and the NIH director have thus lost control of the NCI budget. Under the new provision, they may comment on the budget, but neither may change it by so much as a comma. It will go straight from Rauscher's desk to the President.

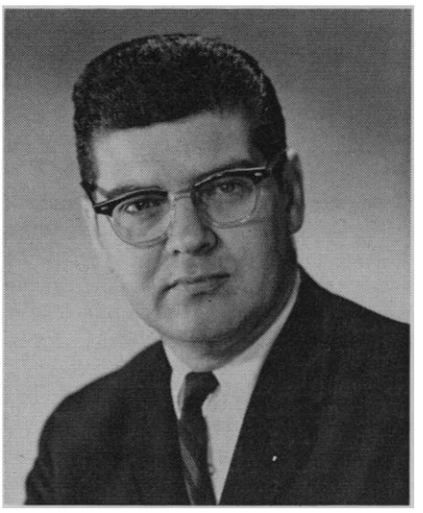
Another direct line to the White House has been opened by the creation of the National Cancer Panel, a triumvirate of one layman and two scientists, to oversee the entire operation of the NCI, reporting any bureaucratic quagmires to presidential advisers Ken Cole and James Cavanaugh, and, if need be, to Nixon himself. "The President," says Cavanaugh, "wants to be sure that this cancer effort does not become tangled in red tape. We plan to follow its activities fairly closely." (This being so, a number of cancer researchers have expressed fear that the program may be too carefully controlled from on high, but, as yet, it is too soon to say whether this will be the case.)

Benno C. Schmidt, who originally ad-

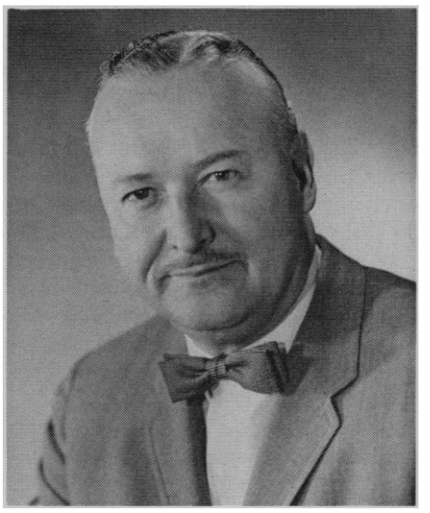
vocated taking the NCI out of NIH and building the cancer attack around an independent agency, heads the panel. He is managing partner of J. H. Whitney and Company, a New York private venture capital firm that backs developing, high risk businesses with money put up by the partners. (A number of years ago, for example, the company gambled—and won—on an invesment in the Minute Maid Corporation.) Schmidt, who has told NCI officials that when he comes to Washington he wants to hear about what is wrong, not about what is going swimmingly, aided in the selection of R. Lee Clark and Robert A. Good as the scientific representatives on the panel of three. Clark, president of the University of Texas M. D. Anderson Hospital and Tumor Institute, is a surgeon better known for his practice of administrative medicine. Under his tenure, M. D. Anderson emerged as a cancer center in this country. Good, on the other hand, is a scientist (immunologist) and doctor (pediatrician) from the University of Minnesota Medical School, who is just now trying his hand at big-time administration. Last month he accepted the directorship of the Sloan-Kettering Institute for Cancer Research in New York, an outfit that is reputedly much in need of administrative ironing out. (Notorious for his habit of canceling out of meetings at the last minute, Good promised a better attendance record when he accepted the position on the panel.)

While the panel advises the President, the National Cancer Advisory Board will advise the chief of the NCI. Currently, the board is a 26-member body that will be whittled down to 18 as the terms of persons who are serving out their appointments to the old Cancer Advisory Council expire.* Everybody in this cancer hierarchy was selected by the White House.

It is already clear that the panel will have a major say in what goes on. By law, it must meet once a month at a session that is to be transcribed and made part of the public record. It may meet more often. The board must convene four times a year to advise the director. Board members are still unclear about what their function will be.



Frank J. Rauscher, Jr.



Carl Baker

Their first meeting in mid-March has been characterized as "an introductory, getting acquainted session," a "circus," and an "outright disaster." In the first place, a consensus of members is that they themselves think the board a bit large as it stands. Add to that the fact that at the first meeting they tried to conduct business in a room jammed with more than 100 observers, and you have what one member called "chaos." "How we can be expected to carry on frank discussions in a convention-like atmosphere is beyond me," he said. W. Clarke Wescoe, president of Winthrop Laboratories in New York, proposed that the cancer board clear the room and meet in executive session. Finally, it did.

What many members describe as an endless string of reports from NCI staff members touting the activities of the institute was another source of considerable irritation. Clearly, the members of this board, headed by Philadelphia surgeon Jonathan Rhoads, who was named its chairman by the President, do not intend to be talked at; nor do they plan to be a rubber stamp of the NCI management as the former Cancer Advisory Council has been accused of being. But just how they will go about the business of effectively influencing policy remains uncertain. They next assemble during the third week in June.

The panel appointments were completed by the end of January; those to the board were made by early March. Then, the matter of NCI directorship had to be resolved. From the beginning, it was widely assumed that sooner or later Carl Baker would be replaced. Most observers betted on later, even though lists of potential candidates for his job were circulating among White House officials at least as early as last fall. But by winter, most cancer scientists had come to the conclusion that Baker would remain in office throughout the first year of the program. The White House, however, has decided it wants a change now.

Carl Baker, head of the NCI for the last 3 years, and a long-time NCI administrator, has not endeared himself to White House figures and has slowly been losing ground with the scientific community, which never admired him as an investigator but found him acceptable as an administrator. Baker, an unpolished man who projects a poor image, has lately been criticized for his failure to listen; he sometimes speaks in non sequiturs because he has not heard what was said to him. His alleged railroading tactics with his advisory council have come under attack, as well as his attitude that it is best to get on with the show and not dawdle around getting advice from all sides. He admits he finds the peer review system a waste of time, an inconvenience that delays grant giving and takes the energies of "a lot of senior people who should be doing other things." And yet this same man says, "We have been accused, I understand, of too much planning and too little implementing. We think it wise to find out what it is that we are trying to do before we launch on the spending." Baker has asked Congress for $430 million for

* The new board consists of Frank J. Dixon, John R. Hogness, Jonathan E. Rhoads, Howard E. Skipper, Laurance S. Rockefeller, W. Clarke Wescoe (6-year terms); Harold Amos, Elmer Bobst, Sidney Farber, Donald E. Johnson, Irving M. London, Gerald P. Murphy (4-year terms); and Mary Lasker, Harold P. Rusch, Wendell G. Scott, Frederick Seitz, Sol Spiegelman, James D. Watson (2-year terms).

Council members who will serve on the board until their current appointments expire are: Arnold L. Brown, James S. Gilmore, Jr., John R. Hartmann, Leon O. Jacobson, Kenneth L. Krabbenhoft, William W. Shingleton, Philippe Shubik, Danny Thomas.

fiscal year 1973, even though the cancer act itself places the ceiling for the fiscal year at $530 million. Asked whether the additional $100 million could be wisely spent if allocated, Baker told a House appropriations hearing that it could. Why, then, he didn't ask for it in the first place is something of a mystery.

In a sense, a host of things, many of them centering around matters of personality, have conspired to force Baker's ouster. It appears that there is no single, fatal faux pas that can be held against him.

By late March it was known among members of the inner circle that Frank Rauscher had been tapped for Baker's job, and by mid-April it was fairly widely known, although the White House has yet to make an official announcement. Meanwhile, the cancer community is half-functioning in limbo while waiting for the change of command, and Rauscher is trying to establish the new order as best he can in the absence of the authority that has still to be transferred. The selection of Rauscher was made by the White House and Schmidt. Clark and Good concurred. Nobody else's approval was formally sought although a few board members were polled privately.

Rauscher, 41, is a native of Hellertown, Pennsylvania. A Ph.D. graduate of Rutgers, he is one of a long line of tumor virologists who studied under Vincent Groupe, one of the pioneers in that field. He came to the NCI in 1959, secured his scientific reputation in 1962 with the discovery of the Rauscher virus, which induces tumors in animals (he says the discovery was a combination of "what I like to think was good virology plus a good deal of luck"), and moved into administration in 1964. It was then that Congress appropriated $10 million for research on cancer viruses—the first large sum so earmarked—and Kenneth Endicott, who was then the head of NCI, asked Rauscher to help in drawing up the initial research plan. The other two men who figured in the birth of what would eventually become the multimillion dollar Special Virus Cancer Program (SVCP) were Baker and Louis Carrese, now one of Baker's top aides. "Within 6 months," Rauscher recalls, "the program was off and running, and I had to decide whether to stay with it or return to the lab. It was then that I chose to go into administration." The SVCP has been off and running ever since. Today it is the financial and organizational backbone of cancer virus research in this country, one of the few examples of a programmed, targeted research effort, and one of the more controversial programs around (see *Science*, 24 Dec. 1971).

Rauscher, ironically, went on to follow in Baker's administrative footsteps, becoming scientific director for etiology in 1969, when Baker succeeded Endicott. Both Endicott and Baker are said to have predicted that Rauscher would one day head the institute.

Little known outside the world of cancer etiology, Rauscher is widely regarded by his peers as a fair and intelligent man. By and large, word of his promotion has been warmly received within the NCI, where even those staff scientists who are less than enthusiastic about the choice say that he is "balanced," "certainly closer to science than Baker," and "an essentially honest person." From the outside, there has been little response. Baker has received some calls from physicians protesting the fact that Rauscher is not an M.D., but they reportedly have come from individuals, not groups; and anyway it is generally thought that the objection has no valid basis.

Many members of the board, when asked for their reaction, pointed out that they know Rauscher only slightly but, as one commented, "I like what I've seen." His performance at the first board meeting impressed most of its members. (A few months ago, he made a similarly favorable impression on Richard Nixon during ceremonies marking the conversion of Maryland's Fort Detrick from a chemical and biological warfare center to a cancer-research facility.)

Rauscher has the tacit approval of many board members and the active support of others. Of those contacted by *Science*, only James D. Watson of Harvard voiced a negative opinion, saying, "It is a very surprising appointment, a very sad event. I have no further comment." An indirect measure of Rauscher's support was cited by a

NSF Official Resigns as Job Sinks

The Administration policy of reducing the national output of scientists has squeezed an assistant director of the National Science Foundation (NSF) out of office, the second to resign within the last 8 months. Louis Levin, NSF assistant director for institutional programs, said in a letter last week to President Nixon that the program he headed had been substantially phased out and he thought it proper to resign.

The NSF assistant director for education, Lloyd G. Humphreys, quit last September in protest against a decision by the Office of Management and Budget to withhold $30 million from the funds appropriated by Congress for the NSF's education support programs (*Science*, 17 September 1971). Levin, who has been with the NSF for 20 years, told *Science* he is not resigning in pique, but simply because of the shrinkage of the programs under him, from a high point of $80 million in 1967 to $12 million requested in next year's budget. The decline, Levin notes, started during the previous Administration.

The institutional support programs of the NSF were used, in part, as a kind of slush fund to fill the chinks between more categorical programs. Some funds could be used at the discretion of the institutions concerned, while others were assigned to building and improving the quality of instruction and research. The program was particularly important during the period of university expansion.

Levin is remaining with the NSF as an assistant to the director. His duties will include "sponsoring of research on the ethical and human value implications of science." The NSF will not attempt to lay down guidelines, but simply to encourage research that "illuminates the issues" and provides a basis for decision-making, Levin said.

The assistant directorship Levin vacates will presumably be allocated to some more fashionable NSF activity than institutional support, such as the fast growing RANN (research applied to national needs) program, for which there is $80 million in next year's budget, or the experimental R & D incentives program, a new $22-million venture designed to encourage industrial investment in R & D.—N.W.

spokesman for Representative Paul Rogers (D–Fla.) who was instrumental in seeing the cancer legislation through the House in its present form. "Usually," he said, "once a rumor of an appointment is as widespread as this now is, we begin to hear from a man's enemies. They seem to come crawling out of the woodwork. On this one, we haven't heard a thing."

One of Rauscher's toughest jobs during the next few months will be to clean house at the NCI itself. Inevitably, that means he will have to get rid of some of his friends who have worked with him for years at the administrative levels of the institute. Such bloodletting won't be easy but is seen by both board members and persons close to the White House as an important test of his ability to lead well. "The NCI is full of people who are not up to running a program of this magnitude," one board member says. "The issue is whether Rauscher is up to rooting them out."

In spite of his ties to cancer virology, Rauscher is not as single-minded an advocate of this approach as many people assume. "I think I may surprise some of my friends in basic research," he said recently, while talking about the areas he feels need new emphasis in the cancer war. He noted, as he has often in the past, that too little attention is being paid to environmental carcinogens, particularly in light of demographic data that suggest that a significant percentage of human cancers are caused or triggered by environmental factors. Immunology, in his view (which he says is shared by Good), is "ripe for exploitation, but not for wide application in man."

While fundamental cancer research plows ahead, Rauscher would like to see more action in the area of cancer control, a catch-all phrase that refers to programs for early diagnosis (Pap smears, mammography for breast cancer, and so forth), new techniques for early detection (identification of antibodies to cancer antigens, for example), and education of both the public and the medical community.

Here, Rauscher and Baker disagree on just what cancer control means. Although throughout his tenure as director, Baker argued tenaciously that research should be geared to solving the *human* cancer problem, and talked about putting new tools in the hands of the physician, he balked at the idea of liberally interpreting the section of the National Cancer Act that deals with cancer control programs. The act does enjoin the NCI from spending funds for routine patient care, and Baker has contended that cancer control can be equated with patient care. Others strongly disagree. They want cancer control programs because they see them as a way of doing something about cancer *now*. "They," in this case, is a mixed group of persons that includes Rogers, who insisted that cancer control be written into the legislation, the President and his aides, the American Cancer Society, and Frank Rauscher. (Let it be said in all fairness that Rauscher consistently has wanted more programs aimed at doing what we can about cancer right away. Cancer control is not something he has just discovered.)

Cancer control was originally a function of NCI. The program was dropped in 1964 and transferred to the Bureau of State Services. There is some reluctance within NIH to see it reinstated because of its implications to other institutes.

Nevertheless, cancer control is coming back into operation. The act puts a ceiling of $30 million on cancer control programs for fiscal 1973, raising the upper limit to $40 million by fiscal 1974. (In the appropriations requests Baker submitted for fiscal 1973, he asks only $4 million for control.)

Rauscher, however, says he is determined to get some useful cancer control programs going. By way of example, he points out that defunct programs to screen large numbers of women for cervical cancer should be rejuvenated—

POINT OF VIEW

Cancer Research: Youth and Superstars

Young biology researchers should hasten to grab a share of the new money being poured into cancer research and the National Cancer Institute (NCI), which otherwise will serve only to bolster still more the egos of the "current superstars on the cancer scene." This is the word set forth by James D. Watson, professor of biology at Harvard and author of The Double Helix, *in a provocative essay on cancer research strategy published in the* New Republic *(26 February 1972). Watson warns against the creation of "huge establishments with all the power closely controlled by superstars who daily direct their Ph.D. minions to do this or that particular experiment." Instead, he advocates free-style research groups in which younger scientists should play a dominant role. Watson is a member of the newly created National Cancer Advisory Board.*

Even if the NCI bureaucracy upon the advice of its advisory committees decides to back the formation of exciting new labs for fundamental animal cell biology, they are unlikely to know how to move. We must remember that until very recently most creative scientists avoided "cancer research" as if it were the plague. They smelled an impossible task and did not want to enter an intellectual graveyard. Now there does not exist a confident body of senior cancer workers who, armed by past success have much feeling for what the future may bring. The scientists who probably have the best ideas as to which experiments make sense and how they should be accomplished are individuals in their late twenties or early thirties. But on the whole, they have been brought up to face a world not only where the real power is held by their elders, but where common sense says to stick closely to the lab bench and grind out enough real science so that tenure will come; then they can stop worrying whether they can do science. At their age it is all too easy to equate committee membership with premature stuffiness and a secret desire to let one's students and postdocs do all the night work.

They must realize, however, that at this critical moment, there is no organized or even disorganized group of wise decisionmakers who will map out their science. The only predictable object above them is the bag of free money that our nation's people want well spent. It is much too big to sit unused for any period and very likely will fall upon those who ask for it first. So if our better younger biologists get together and quickly ask to set up flexible and nonauthoritarian new departments (institutes) the financial wherewithal can be found within the NCI and eventually the universities to let such bodies come into existence. But if they timorously sit back, the current superstars on the cancer scene will get even more money to bolster their egos.

Great Lakes Water Treaty Signed

President Nixon and Canadian Prime Minister Pierre Trudeau on 15 April signed the Great Lakes Water Quality Agreement, the first pact between two nations designed to protect and resuscitate a shared environmental resource. The agreement follows 6 years of study by the International Joint Commission (IJC), a body set up in 1909 to define the two countries' rights and responsibilities over the Great Lakes, and 2 years of detailed negotiations over mutual water quality goals.

The signing of the agreement coincides with the beginning of the International Field Year for the Great Lakes, which features a detailed analysis of Lake Ontario being conducted by the National Oceanic and Atmospheric Administration.

The Great Lakes comprise the world's most extensive bodies of fresh water and account for 20 percent of the fresh water in the lakes and rivers of the earth. Some 37 million people inhabit their shores, and this number is expected to double by the end of the century.

The agreement calls for dramatic reductions in the pollution of Lake Erie, Lake Ontario, and the international portion of the St. Lawrence Seaway, as well as for preventive maintenance to forestall the decline of Lakes Huron and Superior. Lake Michigan, which is encompassed by U.S. land, is omitted from the agreement.

Ecological Freedoms Defined

The pact holds that the lakes have a right to five freedoms: from toxic substances, nutrient overloading, oil, sludge, and noxious colors and odors. It spells out in tortuous detail the exact levels of filth and poison that will ultimately be deemed acceptable and calls for a Joint Contingency Plan to deal with oil spills. All the programs must be either implemented or en route to implementation by the end of 1975.

The agreement calls for no new money or legislation from the United States, although its facilitation will rely heavily on the new water quality bill, which is now wallowing in House-Senate conference with no compromise version in sight. The United States is expected to put about $3 billion into Great Lakes water quality over the next 5 years. Some $2 billion will come from federal, state, and local sources for municipal waste treatment; $700 million to $1 billion is what industry is expected to put into waste treatment and recycling facilities. The Canadian expenditure over the same period will be around $400 million.

The only controversial part of the agreement seems to be the matter of detergent phosphates, which contribute heavily to eutrophication, the chief pollution problem in the two lower lakes. Canada has ordered the proportion of phosphates in detergents down from 20 percent to 5 percent by the end of the year, and ultimately to 2.2 percent. The United States, in view of the fact that no viable alternative to phosphates has been found, is leaving the matter to local discretion and is concentrating on the construction of treatment plants. The agreement envisages that phosphorous loadings into Lake Erie should go down from 32,000 tons this year to 16,000 in 1976, but conservationists say that eliminating phosphates could bring the 1976 input down to 11,000 tons.

The IJC has been instructed to form a Great Lakes Water Quality Board which will have representatives from all the eight states and two provinces affected by the agreement. The commission will be given money to set up a new office somewhere in the Great Lakes Basin, and has been assigned the tasks of monitoring the cleanup, issuing annual reports on progress, and recommending adjustments in the agreement. It will have no enforcement powers, but the high-level nature of the pact is expected to supply motivation. Besides, Environmental Protection Agency Director William Ruckelshaus says the United States now has a "solemn commitment" to keeping the lakes alive and pure.—C.H.

16,000 women will die of that tumor this year, all needlessly—and that greater efforts should be instituted to get information about the benefits of aggressive chemotherapy in certain cancers, such as leukemia, out of the major centers and into the practice of medicine at large.

How the National Cancer Act, which became effective only last February, will ultimately be implemented, how that $1.6 billion plus will eventually be deployed, is something that, in theory at least, will be decided in detail soon. Whether the program can be conducted efficiently, whether it can be effectively coordinated to get results, remains to be seen.

An exercise in rational planning was initiated last winter by Baker, who contracted with a local management firm to assemble the National Cancer Plan. The NCI appointed some 250 investigators to 41 panels, sent them at various times to Airlie House, a conference center outside Washington, to review their fields and draw up plans for future research, and thereby got for itself massive quantities of data and a $900,000 bill. Baker, many close to the project say, first saw the undertaking as a ploy to satisfy the scientific community's desire to be heard. The results of their labors, however, were, in the words of one NCI staffer, "far more valuable than any of us anticipated." Said another, "It showed that the investigators broadly agree on what is needed, and, by laying the problem out, we've been able to see gaps in our knowledge that have to be filled in before we can proceed."

Copies of the rough draft of the National Cancer Plan have been circulated among the nation's scientists. The plan is now being honed into shape by the NCI staff and by the chairmen of the 41 panels. An executive report of the plan should be available by late May.

The challenge facing Rauscher, the panel, and the board is one of taking what, even in final form, will be a mass of data reflecting thousands of individual pieces of research and making some coherent sense of it. They will have to look at all the bits and pieces of knowledge we have about the malignant cell and, as Albert Sabin said not long ago, "coordinate them and attempt either to derive meaningful patterns or to delineate the gaps in our knowledge which prevents the synthesis of meaningful patterns." That is no mean task.

—BARBARA J. CULLITON