

The Effectiveness of the National Cancer Institute
In Cancer Research and Development

Linus Pauling

Linus Pauling Institute of Science and Medicine
2700 Sand Hill Road, Menlo Park, California 94025

26 April 1977

Give refs
including
LP 1971
& Stone
1972
[also others
by Pauling
1966 etc]

During the past quarter century the National Cancer Institute has spent several billion dollars in the effort to obtain an increased control of cancer, its budget this year being more than 800 million dollars. Thousands of investigations have been carried out, and these investigations have provided additional insight into the problem of controlling cancer. There has, however, been only a small change in the age-corrected incidence of ^{and} mortality from cancer as a whole, although some definite improvement in the treatment of some kinds of cancer ~~has been achieved~~.

(1971)

Several years ago I formed the opinion that the most promising way of achieving a large decrease in the age-corrected incidence of and mortality from cancer was through the use of substances normally present in the human body, such as the vitamins, ~~which are~~ in particular vitamin C (ascorbic acid, sodium ascorbate, calcium ascorbate) in amounts hundreds of times larger than those usually ingested. ~~It is~~ A similar opinion was expressed also by Irwin Stone (1972), on the basis of published reports. The use of these substances might be considered to lie in the field of nutrition in relation to cancer, for which Congress in recent years has appropriated funds.

2

In 1971 Dr. Ewan Cameron, Chief Consulting Surgeon of Vale of Leven Hospital, Loch Lomondside, Scotland, began treating patients with advanced cancer by giving them sodium ascorbate, usually in the amount 10 grams per day. The apparent improvement in health of the patient^R who received ~~the~~ sodium ascorbate was so striking that in the spring of 1973 I went to the National Cancer Institute[/] with case histories of the first forty patients to have been treated in this way, and asked the officials of the Institute to carry out a controlled trial. I was told that the National Cancer Institute would not carry out a controlled trial until animal studies had been made, and was invited to submit an application for support of such studies. I submitted the application, and three similar applications, during later years. These grant applications were turned down. I now have another application pending - an application for support not only of animal studies, but also of basic scientific studies of the action of ascorbic acid, especially in relation to the immune process, and clinical studies in several hospitals. The developments in the field of ascorbic acid in relation to cancer during the past four years, especially the ^{observations} of Ewan Cameron and his associates, have been so striking as, in my opinion, to justify ^{the allocation} of a significant fraction of the total budget of the National Cancer Institute to the investigation of vitamin C and other vitamins in relation to the prevention and treatment of cancer.

I have received from Roger H. Halterman, Chief, Diagnosis and Treatment Branch, Division of Cancer Research Resources and Centers, National Cancer Institute, a copy of the Summary Statement about the review

by the Experimental Therapeutics Study Section^{3.}

1 of my grant proposal (reference 1 R01 CA 21970-01; letter from Dr. Halterman dated 14 April 1977). The first sentence of the Summary Statement is "Based on evaluation of scientific merit of this application, disapproval must be recommended." Dr. Halterman in his letter writes that "The grant application and recommendation of the Experimental Therapeutics Study Section will be reviewed by the National Cancer Advisory Board at its meeting on May 23-24."

I have for some time been observing the actions of the National Cancer Institute and thinking about its lack of success. The efforts of the National Cancer Institute to achieve a decrease in incidence of and mortality from cancer are of two kinds: research, the discovery and study of new methods of prophylaxis and therapy, and development, the refinement of existing methods. It is my opinion that the National Cancer Institute has been doing an excellent job in the field of development. For example, hundreds of therapeutic trials of chemotherapeutic agents in which the effects of different amounts of the agents or of different combinations of them with respect to cancers of one or another type have been carried out, in the effort to achieve some increase in the effectiveness of these substances. On the other hand, it is my opinion that the National Cancer Institute does not know how to carry on research nor how to recognize a new idea.

The criteria for assessing the value or promise of a grant application for research should be quite different from those for a grant application for development. There is as a rule nothing novel about a grant application for development. The existing knowledge permits the detailed formulation of the

plan for the entire project, and the decision about the grant application may and should depend on the assessment of the plan and of the experience that the investigators have had in carrying out similar studies. On the other hand, ~~the most important aspect of a grant application for research is the idea on which it is based.~~ the most important aspect of a grant application for research is the idea on which it is based. The idea must be a new one, or, if it is not new, one that has been overlooked and has remained uninvestigated. Each new idea should be studied to the extent justified by the evidence about its possible importance, and, in the case of the National Cancer Institute, the investigation of the new idea should be continued until its value with respect to the prevention and treatment of cancer has been determined. I believe that it would have been proper for the National Cancer Institute to have made a grant of \$50,000 or \$100,000 to me four years ago, when there was ^{some} indication that vitamin C in amounts ~~several times~~ considerably greater than those usually ingested might have significant value in preventing and treating cancer, and that it would be quite proper now for a grant of several million dollars to be made for the same purpose, because the evidence ^{for} of the importance of vitamin C has become so much stronger, through the work of Ewan Cameron. It would have been proper for the National Cancer Institute to have ^{provided support for} ~~setup~~ clinical trials four years ago; it is imperative that it be done now, ~~if the National Cancer Institute carried out~~ proper function

The report of the Experimental Therapeutics Study Section of the National Cancer Institute on my pending application ^{contains} / several pages of statements to the effect that the application is not sufficiently detailed and

^{proposed}
 precise in the description of the studies of vitamin C in relation to cancer,

~~that will be carried out.~~ The application is treated as though it were a

proposal to carry out developmental work. It is not such a proposal;

instead, it is a proposal to make various studies about a new idea. There

is a tremendous amount of work that will have to be done, in case that

vitamin C turns out to have the value in controlling cancer that I believe

it to have. The studies that are mentioned in the grant application are

only examples of those that would be carried out if the grant application ^{were to be}

~~is~~ successful. For example, a couple of studies with mice are described,

and we have in fact embarked upon one of them. The mouse, however, is

not a good animal to use in studies of ascorbic acid, because the mouse

manufactures ascorbic acid in its own cells, at a rate corresponding to an

intake of about 20,000 milligrams per day by a man. / ^{There have been many} kinds of cancer

that have been studied in mice, and the effect of ascorbic acid might be

checked for any one of them. The guinea pig, which requires exogenous

vitamin C, would be a better experimental animal, but there is not so much

known about cancer in guinea pigs as in mice or rats (rats also manufacture

ascorbic acid). We have recently begun some preliminary studies on a way

of inhibiting the synthesis of ascorbic acid by mice. This work is not mentioned

in the application. If it should turn out that the synthesis of ascorbic acid by

mice could be inhibited without large physiological effects of other sorts, the

mouse might well ^{than I could} ~~turn out to be~~ ^{laboratory} be the best animal to use in the study of intake of

ascorbic acid in relation to the control of cancer.

When a decision is made about a grant application for research, it should be on the basis of an assessment not only of the originality and promise of the idea basic to the proposed study, but also of the ability of the investigator to carry on research. It is not necessary that his experience in research be in exactly the same field as that of the project, and if the idea is sufficiently novel it may well be that neither the investigator nor any one else has had experience in the field. When in 1935 I had the idea that it would be worth while to study the magnetic properties of hemoglobin and its derivatives, to see if some questions about the structure of the molecules and the nature of the binding of the iron atom to the globin and to the attached oxygen molecule or carbon monoxide molecule could be answered, I applied to ~~The~~ Rockefeller Foundation, and was given a grant. I had had essentially no experience in measuring magnetic susceptibilities, and the apparatus that I had built, with the help of a student, E. Bright Wilson, Jr., was very simple, involving a borrowed electromagnet and an analytical balance. Charles D. Coryell was able to increase the sensitivity to the extent necessary for success in the investigation. ^{of hemoglobin.} The detailed procedure used in the magnetic studies could not have been described in my application to the Rockefeller Foundation, because it was ^{developed only} ~~worked out~~ when the studies were carried out, after the grant was received. The officers of ~~The~~ Rockefeller Foundation apparently decided that my success in experimental studies of the structure of crystals by the x-ray diffraction method and of the study of gas molecules by the electron-diffraction method indicated that I could also ^{plan and carry out} ~~make~~ measurements of the magnetic susceptibility of blood, ~~and could carry on work in immunochemistry,~~ ~~for which they also provided a grant.~~

No serious harm would have been done in 1935 if ~~The~~ Rockefeller Foundation had delayed for a year in making its grant for the work on the magnetic properties of hemoglobin. Delay in supporting research on cancer is, however, far more serious. Some of the work that my associates and I propose to carry out if our present application is approved ~~could~~ ^{would} have been carried out four years ago if the first application had been approved. If, as I believe, a great decrease in the age-corrected incidence of and mortality from cancer can be achieved through the optimum use of vitamin C and other vitamins, each year of delay in the program of research and development in this field means unnecessary suffering for tens of thousands or hundreds of thousands of people.

In 1971 I published my opinion that a decrease of 10% in the age-specific incidence of and mortality from cancer could be achieved by use of vitamin C. There is far more information now than was available in 1971, and my present estimate is that a decrease of 75% can be achieved by use of vitamin C alone, and a further decrease by the use of other nutritional measures. In 1966 Ewan Cameron presented the thesis that potentiation of the natural protective mechanisms of the body would permit a considerable control over cancer to be achieved. Several studies have shown that an increased intake of vitamin C potentiates these natural protective mechanisms. Epidemiological studies ~~have shown that an increased intake of this vitamin increases the incidence of~~ ^{age-specific} the prophylactic value of vitamin C against cancer, and the clinical studies by Ewan Cameron have shown its therapeutic value. It is imperative that this important discovery ~~be~~ thoroughly investigated. The National Cancer Institute should not continue its present policy of preventing progress toward the control of cancer from being made.