

# ARGONNE NATIONAL LABORATORY

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July 4, 1980

Honorable Alan Cranston  
229 Russell Senate Office Building  
Washington, DC 10510

Dear Senator Cranston:

On rare occasions, several scientific discoveries link up to profoundly alter our future. Initially the implications are evident to only a few, and the challenge is to be among them.

Such a convergence of new information and technologies has occurred in biology and related fields which now offers immense opportunity. We can now plan a comprehensive program in which all, or at least a large fraction of the estimated 30,000 to 50,000 different proteins of which human cells are made can be separated, indexed, mapped, and correlated with human diseases and disorders for use in diagnosis and treatment.

The majority of human illness, including cancer, degenerative diseases (including the various forms of arthritis), aging, and all genetic disease are either due to or reflect alterations in the structure, placement, or amount of one of these thousands of proteins. An alteration in any one of them may produce illness.

At a recent meeting held in Washington under the auspices of the Fund for Integrative Biomedical Research, the feasibility of a major effort to map human proteins was given careful evaluation. Present at those discussions were cell biologists, those of us who have pioneered the electrophoretic techniques for protein mapping, and experts in scientific management with extensive experience in the application of computer technology in large scale, highly-technical programs.

It was our conclusion, reaffirmed at a number of other similar meetings, that it is now technically feasible to separate and index in a systematic manner a very large fraction of all proteins found in man and simultaneously to correlate their structure and presence in the human body with the occurrence of specific diseases and disorders. The various parts of the technology required to carry this work to completion exist in the U.S. Department of Energy, in the NIH, DOD, NASA, and in several high-technology industries.

The implications of this work defy present imagination. The result would be a redefinition of pathology and much of medicine at the molecular level. With a single step our knowledge of the fundamentals of human health, aging and disease would be vastly increased. Disease could be diagnosed very early and treated with a level of accuracy and effectiveness far beyond that available in the practice of medicine today.

In the ordinary course of events, we estimate that a relatively complete index of the proteins of man would be completed in 30 to 50 years, given no focussed effort or integration. Were there a well organized NASA-style effort to explore inner space, we estimate that the same work could be done in six years.

Until now the major limiting factor in research of this type is that it has been conducted on a small scale in a few laboratories - a fractionated approach which does not insure the precise standardization of techniques required to assemble a comprehensive and unified data base on human proteins. To accomplish the goals of mapping and correlation will require a program of national scope and size.

It is difficult to convey the breadth of the effort required, the foreseeable implications for human health and the quality of life, or the excitement which now surrounds this work. What I hope can be conveyed is first the dramatic change in the future of medicine which can now be brought about; and secondly, the overriding necessity for leadership in this emerging area.

There is no precedent in the biomedical sciences for a integrated effort of the type now required, hence no mechanism for implementation exists which would be suitable and effective.

During the very brief history of the human indexing program the scientists involved have been cooperative, and the work has been international. Many foreign scientists have been trained in the techniques of indexing in American laboratories. For example, some 40 individuals have been trained in our laboratory. These scientists have come from Norway, Germany, England, Canada, and France. In addition, we have been approached to train staff for the Institute of Human Genetics in Moscow.

As the medical, and ultimately industrial, implications of this work have become appreciated, an atmosphere of international competition is beginning to emerge alongside the heretofore dominant spirit of international cooperation. Of course, all of mankind will be the benefactors even if this work should evolve into an international competition. While the economic implications are great, I do not believe the driving force behind the emerging competition is economic alone. The prestige associated with leadership on the world stage in an area so fundamental to human well-being may far exceed the prestige associated with leadership in either space or nuclear energy.

I believe it is in the vital interest of the United States to launch a comprehensive effort to separate and index these basic building-blocks of human life. This would require team work and collaboration by American scientists from all over the country.

In view of the urgency of this work, I am prepared to take whatever steps are, in your judgement, required to help launch it. For example, I would be happy to arrange a briefing for you and others by a number of scientists from the government, academic, and industrial laboratories involved, to review the present status of this work.

With my highest regards,

Sincerely,

*Norman G. Anderson*

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Molecular Anatomy Program