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A SHORT HISTORY OF THE COLLABORATIVE BIOMEDICAL PROGRAM

The origin and structure of the 16-year-old Collaborative Biomedical Program between the Johns Hopkins School of Medicine and APL are summarized.

The major impetus to the formation in 1965 of the collaborative program between the School of Medicine and the Applied Physics Laboratory of The Johns Hopkins University was internal. There were physicians and researchers in the Johns Hopkins Medical Institutions who were faced with problems for which there were no apparent solutions. At APL, there were physicists, engineers, and mathematicians who were interested in applying their problem-solving abilities to areas extending beyond national defense.

The focus of interaction at the Medical Institutions was the then newly formed Subdepartment of Biomedical Engineering and the focus at APL was the Research Center. The initial mechanism of interaction, the exploratory seminars, proved to be highly successful. The Department of Ophthalmology had a number of clinical and research problems for which they felt there might be technological solutions. Accordingly, the first seminars focused on their interests. The ophthalmologists wrote brief descriptions of their problems. These were compiled and distributed among selected APL staff members. An all-day seminar was then held at APL during which the ophthalmologists made brief presentations of each biomedical problem. The APL staff members who attended were those who, based on the abstracts, thought they might be able to contribute to a solution. Each presentation was followed by a lively interchange. In many instances these conversations led to further interaction and an exchange of visits between APL and the University's Wilmer Eye Clinic.

This interaction led to a second seminar during which members of the APL staff presented proposed solutions to those problems that appeared amenable to technologic solution. Again, there were extended comments and criticisms, clarifications and revisions. Ultimately, six of the interactions between APL and the ophthalmological collaborators were formed into a program grant application that was funded by the National Institute of Neurological Diseases and Blindness. The grant that supported this initial formal collaborative effort is still in existence!

Fortunately, the first venture was a success. In the course of time, it became clear what the ingredients for success were:

- The biomedical problems need to be clearly and correctly defined.
- The biomedical problems must be significant, not trivial.
- The proposed technological approach to the solution should be feasible or show promise of being feasible.
- If feasibility is not demonstrable, the solution should be tested before committing resources to its implementation of the solution.
- Both the physical scientist and the biomedical scientist should have sufficient interest to be willing to commit personal time and effort to the project.
- Both the physical scientist and the biomedical scientist should be highly competent in their respective fields.

Although these dicta sound simple, they are deceptive. The failure of collaborative programs elsewhere, as well as our own occasional failures, can be traced to the disregard of one or more of these criteria.

The external climate was also favorable to such interaction in the late 1960's. The University was actively seeking and supporting interdivisional collaborative ventures. This program received strong support from the University leadership both in soliciting external funds and in facilitating the interaction among the participants. The National Institutes of Health felt that the benefits of this type of collaboration were sufficiently promising that they were willing to provide funding for exploratory projects with the expectation that they would develop into full-scale collaborations. APL was encouraged by its principal sponsor, the Department of Defense, to contribute its technologic expertise to the solution of

civilian problems. Other foci of national interest included the National Academy of Engineering's Committee on the Interplay of Engineering in Medicine and Biology, in which Johns Hopkins was an active participant, and the National Aeronautics and Space Administration's programs to transfer space technology to the solution of civilian problems.

Since its initiation in 1965, the collaborative program has developed major investigations in the following branches of medicine:

- Ophthalmology
- Neurology
- Neurosurgery
- Neurophysiology
- Cardiovascular medicine
- Cardiac surgery
- Oncology
- Radiology and radiological Science
- Laryngology and otology
- Orthopedic surgery

The extent of the interaction can be perceived from the fact that 96 Medical School faculty members have become involved with more than 100 APL staff members; 58 of the APL participants have been co-project investigators. More than 125 specific projects have been undertaken, and there have been many more informal interactions. These projects have led to more than 240 scientific publications, with even more abstracts and presentations at major scientific and medical meetings. A remarkable record of productivity!

As the collaborative program matured, APL developed a Biomedical Program Office in 1974, and Biomedical Engineering became a full University department in 1970. The Medical School collaborations in several departments became firmly enough established that they were recognized by joint appointments. At present 18 members of the APL staff have appointments in the Medical School and 16 members of the medical faculty have Principal Staff appointments at APL.

Although this program is successful and has been cited as a model by many, there are at least two important unsolved problems. First, there is a dearth of funds for the support of pilot feasibility studies. As mentioned earlier, there is often a technologically weak link in a proposed solution. Although the link is usually amenable to feasibility testing, $5000 to $10,000 is usually required for the purpose. Neither federal granting agencies nor Johns Hopkins has funds to devote to this type of activity.

Second, there is no acceptable mechanism for bridging the gap between development of a successful prototype solution and supplying this solution in small quantities for evaluation by the general biomedical community. The resources required to bring a prototype into the marketplace are often several-fold larger than the research support required to produce the prototype. Federal research programs cannot engage in this type of activity; the private sector is reluctant to embark on a full-scale development program until a number of prototypes have been evaluated in institutions other than the one in which they were developed. This, too, represents an unmet need. It is an important need, for the objective of this program is not simply to benefit the Johns Hopkins community, but to permit general access to the solutions of important problems.