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THE CANCER SCHOLARSHIP PROGRAM: AN IOWAN TRADITION

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Many highly able and motivated students in science have interest in research. Student participation in the total science process, including data collection, recording, reporting, experimental interpretation, synthesis and even publication, can provide the ultimate means of activating science potential. A cooperative effort between the American Cancer Society (ACS) - Iowa Division and The University of Iowa has provided this type of experience, as a facet of the Research Participation Program. For the past 12 years, 100 students who have completed grade 10, 11, or 12, representing 50 Iowa communities, have received financial support from the ACS to participate in the Cancer Scholarship Program (CSP). For six or eight weeks during the summer months, these students have researched in diversified disciplines including biochemistry, internal medicine, microbiology, nutrition sciences, otolaryngology, pharmacology, radiology, surgery and zoology. Many of the research studies have been interdisciplinary in nature, often on the cutting edge of new discoveries.

Unique and Challenging Curriculum

The Cancer Scholarship Program has been designed (1) to demonstrate the nature of scientific research by providing first-hand experience in research laboratories under the guidance of research scientists; (2) to stimulate superior students by familiarizing them with the daily activities of the scientist; (3) to supplement usual high school activities with some real experiences in scientific research; (4) to verify or alter supposed interests in scientific careers in research and (5) to reduce the costs for students interested in a research experience in a cancer-related area.

In general, each student spends approximately eight hours a day, five days a week in the research laboratory. However, given the immense diversity in the types of projects, a wide variation, especially the terms of when each student works, is the practice. The program, although uniquely tailored for each of the CSP participants, is broken down into seven broad stages of activity: (1) orientation; (2) meeting with research scientist (and/or other staff); (3) awareness, training, and actual experimentation; (4) data collection and analysis; (5) evaluation and preparation for writing a formal research report; (6) student symposia; (7) ACS - Iowa Division Annual State Meeting in the fall. In practice, the stages blend into one another and are adapted to individual students and their laboratory projects.

CSP participants spend the first days in orientation activities. These include special seminars and tours to important facilities on campus including the residence halls, libraries, research centers, computer centers and recreational areas. Other orientation activities include creative problem solving, group sessions, seminars on laboratory safety (especially radiation safety rules and regulations), and hands-on study of some general principles of research and laboratory techniques. Concluding the orientation stage is a visit to the research laboratory where the student will work for the next six or eight weeks. This provides an overview of the purpose and function of the laboratory.

The next stage involves meeting the research scientist (and/or other staff) and receiving a detailed view of the research laboratory complete with personnel, equipment and facilities that are specific to the projects. During the initial conferences, the focus is on some of the available options for projects. Reading related studies helps the student determine the topic and direction to pursue. A project design, tentative timeline for phases of the project to be completed and a work schedule are drafted cooperatively by the scientist and the student. In many cases, the participant engages in an on-going project.

Typically, students in the laboratory proceed on a daily basis combining awareness, training, and actual experimentation. Awareness continually adds to the knowledge base that the student has previously acquired. Basic scientific knowledge is fundamental to doing research. Throughout the program, students will broaden their knowledge base. Reading related research studies is necessary to determine what, if any, changes should be considered as well as to determine the direction to pursue. Laboratory safety is a must and exploration under supervision is required. Technique training plays an important role in the daily work of the junior scientist. Students must learn scientific laboratory techniques and/or skills that will be required to complete the project. Repetition is usually necessary to insure mastery of laboratory techniques. The development of techniques to maximize utilization of library resources is also necessary. Computer searches including the MED-LINE and ERIC searches, help the junior scientist to locate expediently the most current research. Library research usually dominates the students' time outside the laboratory. For most students, the awareness and training procedures take two or three weeks, often with much trial and error. Generally, mastery of additional techniques will be required as the student engages in actual experimentation. To facilitate the next stage, the research protocol is formalized.

Many CSP participants have commented that the actual experimentation is the most exciting part of the program. These talented students often amaze themselves and others with their abilities to understand and manipulate complex research experimental designs and tasks. The results are impressive. The success that results is due to the close association and interaction with the staff of scientists. By being an accepted, active team member, the junior scientist receives support and reinforcement similar to that given other team members. The reinforcement, both positive and negative, is genuine. The fact that this support is genuine increases student motivation and productivity. As with senior

scientists, the rewards of doing research become intrinsic. No longer is the research being performed for a grade or to complete a course requirement. The limitations, some of which are self-imposed, are removed, and new intellectual heights can be achieved. This stage of the research experience results in tremendous growth and changes within the junior scientist. The act of taking command and being in control of one's destination (project) produces a surge of confidence. Soon the transformation of a "junior" team member to a team member, or in many cases to a principal investigator, becomes reality. It's no wonder that the participants remember this feeling of exaltation.

The last couple of weeks of the research experience involves data collection and analysis, evaluation and preparation for writing a formal research report to be published, and making a presentation to their peers and members of the research community. Students participate in an evening "Communications in Science" course designed to improve their writing and oral presentation skills. Special seminars are held each week in which participants have an opportunity to interact with each other and various members of the faculty. Participants include philosophers, scientific writers and various noted researchers. This allows students to observe how different, renowned scientists organize their materials for presentation to their colleagues. This modeling by senior scientists is an essential supplement in preparing to present a research paper. Students have the opportunity to participate in tutorial sessions where instruction is given in the use of computers for text-editing and word-processing. This is often their first exposure to this valuable computer tool. Frequently, on weekends, enrichment experiences such as museum and laboratory visitations are available to broaden the scientific horizons of the participants. This is a necessary facet of the program since many students have multidimensional interests in science. An excursion to Chicago, including the exploration of a planetarium, aquarium, museum of natural history, and science and industry, helps participants to visualize and reinforce science interest, concepts and research, as well as to see how these aspects can be communicated to others.

The six or eight-week research experience culminates with the student symposia. Students present their research in the format of the Junior Science and Humanities Symposium sponsored by the U.S. Army Research Office. This is done in order to share their experiences with one another and sharpen their communication skills for future presentations. Abstracts of the presentations are published paralleling the publications of scientists. These publications are distributed not only to the CSP participants, but also to university affiliates and high school libraries. They serve as valuable resources to teachers and students, as exemplars of research design and the types of research projects that other students may be capable of performing. The intense, in-depth research experience provides a realistic approach to the joys, satisfaction and frustrations involved in doing research. The life of a research scientist becomes tangible; no longer do the students have to imagine what research is all about. They know — firsthand.

The CSP participants attend the American Cancer Society - Iowa Division Annual State Meeting in the fall where they have the opportunity to present their own research and to learn about other areas of on-going cancer research. After the 1984 meeting, Ms. Tommie A. Mann, former Public Information and Education Director of ACS-Iowa Division, commented that "... the scholarship recipients are often the biggest hit of the annual meeting. Everyone, from the National President of ACS, Dr. Willis J. Taylor, M.D., to the volunteers from the smallest Iowa townships, were seeking out the students to praise them for their research efforts."

Benefits to the Participants

The list of potential benefits to the CSP participants is nearly unlimited in scope, range and number. Surveys, student interviews and other evaluative instruments indicate that the major goals of the program are being fulfilled. By working directly with research scientists in their laboratories, participants find out the true nature of a scientist's work, lifestyle and career. Students, after completion of the program, are better equipped to make decisions about their prospective college and professional careers. Very importantly, these students find adjustment to college lifestyle and living on large university campuses relatively easy. But beyond these likely outcomes, other components of the program praised by the students include the interaction with fellow high-ability science students. These talented teenagers are often one of only a few or perhaps the "only" truly gifted science student at his/her high school. The students find it delightful to have the opportunity to study and live in the same residence hall with peers, and also to have access to each other to share intimately personal, academic and social views. Often long-lasting friendships are the results of these experiences.

Former CSP participants have found that their research experiences have helped them gain acceptance into university research programs, honors programs, medical schools and other professional institutions. Often students have co-authored published research articles in refereed science journals, while also achieving success in local, state and national symposia and science competitions such as the Westinghouse Science Talent Search. Two former participants were selected to represent the United States in the World Science and Humanities Symposium in London, England. Indeed, a major proportion of past scholarship recipients have succeeded not only academically, but have gone on to highly successful professional careers. It is apparent that doors opened that were unknown to the student prior to their involvement in the Cancer Scholarship Program.