EDUCATION

Raising a Future Scientist

A Science Service study of the parents of the winners of this year's Science Talent Search obtained answers to questions about the upbringing of these promising young scientists.

By SHIRLEY MOORE

FAMILIES who "care" and homes where learning is valued for its own unique satiscation are significant influences in the development of future creative scientists.

In a SCIENCE SERVICE study, the parents of 40 outstanding young scientists were asked to describe various factors involved in bringing up their talented children. The young persons, all high school seniors, are the top winners of the 18th Science Talent Search for the Westinghouse Science Scholarships and Awards, conducted by SCIENCE SERVICE through its Science Clubs of America.

Sorting through 16 or 17 years of intimate experience, these mothers and fathers have chosen some general principles they would suggest to parents eager to encourage full development of their children's abilities.

From the very beginning, for example, they believe it is important to foster such habits and traits as independence, intellectual curiosity, perseverance, responsibility, creativity and modesty.

More than half of these parents emphasize the value of providing science books, basic materials, and equipment as specific kinds become interesting and necessary. Supplying such background need not, and probably should not, entail very much expense since children's early interests sometimes are waystations on a journey toward intense involvement in quite different fields.

Research Encouraged

Searching out information from various sources and devising equipment through ingenious use of accessible materials not only are less expensive but also provide invaluable experience in themselves.

Discussing this, one mother urges, "Give him time. And be patient when his interests lag, or change."

A father comments, "We avoided buying children's encyclopedias because we felt they were too easy and restrictive. It seemed preferable for him to go out and dig up the material himself. . . . While it is essential for parents to foster and fulfill a youngster's interest, it is dangerous to go too far and hand him everything on a platter."

Several parents mention the special role of genuine interest, generous encouragement and honest criticism from mothers and fathers. Such sharing and guidance, not pushing, in the direction of the child's own interest are explicitly described or taken for granted by virtually all of these parents.

Considered equally valuable are family activities and expeditions that expose a child to a variety of scientific fields in a sort of potpourri of stimulating experiences. Such wide acquaintance with the scientific world should be balanced by emphasis on what one parent calls "living values," to develop appropriate perspective.

When it comes to what to do about school, it is advised that youngsters should be encouraged to earn good grades for work well and honestly done and to accept the challenge of top level courses, rather than to choose "snap" courses. If it happens that the school curriculum is somewhat less than ideal, extra opportunity for learning can be devised at home and in the community.

It is the opinion of most of these parents that a child's potential is most likely to develop in a family atmosphere of enjoyment of learning, stimulating talk, and "appreciation of the wonder of the everyday commonplace." Such an environment would, of course, include some freedom to explore and experiment, and it follows that being a successful parent of a science-prone child demands a willingness to help him find answers.

As one father puts it, the "right" books, information, and resources must be discovered at the "right" time."

A number of parents mention the effectiveness of compatible companions and clubs in the development of youthful interest and ability. Others point out the prime necessity of a "private place" for a budding scientist to work and to leave his current projects undisturbed and as untidy as they sometimes must be.

Community acceptance and recognition of a youngster's efforts, which are described as very stimulating factors in his or her continued and deepening development, may be attained through encouraging students to enter science fairs and other types of science competitions, it is suggested. Some of the parents believe that such recognition may be decisive in fanning a tentative spark of interest into a flame of dedicated conviction.

Sources of Inspiration

Summing up the strongest influences upon their own children's growth, the responses of this group of parents create a picture of how latent ability becomes focused and gets into productive action.

Prominent in this picture are the persons in a possible-scientist's life and the experiences they make possible for him. Inspired teachers, sympathetic and helpful adult scientists, and a warmly encouraging family can, between them, create nearly ideal conditions for a young person's discovery of

EARLY ENCOURAGEMENT—An interested mother lends a helping hand as her pre-scientist son and his friend work on their current science projects. In a recent SCIENCE SERVICE *study, the parents of the nation's most promising young scientists emphasized the importance of such encouragement and of providing a "private place" for a youngster's experimental work.*

his personal niche in the scientific adventure.

Sixty some teachers of 33 of the young people are particularly cited for their personal interest in the student and/or his project, for their influence in originating or developing science interests, or for their example of informed and contagious enthusiasm. These teachers were important at ages ranging from five to 17, but the peak of their influence occurred when the students were between 13 and 16.

Thirty-two scientists were catalysts in the lives of 17 of these girls and boys, beginning as early as when they were eight years of age and reaching a high point at 15 and 16. The scientists are described as having inspired their youthful proteges through their advice and help on projects, their instruction in techniques, their conversation or the example set by their own obvious zest for discovering answers.

Although it is evident from the responses of virtually all of these parents that they have provided consistent encouragement of whatever talents their children showed symptoms of possessing, there are also 20 special mentions of one or both parents, other family members, or close family friends as having been wholly or partly responsible for originating the scientific glow or fanning the flame in 14 of the students through discussions, reading, trips to places of significant interest, constant support of effort and study, or demonstrations of the hows and whys of science.

From two or three years of age until about 12 such play materials as jigsaw puzzles, tinker toys, erector sets, beginner's chemistry sets and simple microscopes were important and absorbing, according to 78% of the parents.

After 11 or 12 years of age, these potential scientists put aside such relatively childish materials in favor of finding or creating their own hobby equipment for such leisure interests as collections, astronomy, photography, radio and electronics, outdoor studies, chemistry and mathematics. Reading, music and various forms of art are also contributive hobbies among these teen-aged scientists.

Love of Reading

Most of them have been ardent readers (or listeners) as long as they or their parents can remember. Scientific magazines, encyclopedias, science, mathematics, and astronomy texts, and science fiction, in that order, have been the most popular reading materials.

Although this love of reading is not surprising, the early ages at which really technical books were sought out and appreciated seems rather remarkable. For some of these children science textbooks were favorites as early as seven or eight, such books as Dr. George Gamow's "One, Two, Three, Infinity" and "Birth and Death of the Sun" at 10, 11 and 15, and comprehensive discussions of higher mathematics and mathematical reasoning as early as 13 and 14.

More than a hundred listings are made of some 37 periodicals that are read regularly and productively by these students. The publications range from well known science magazines such as SCIENCE NEWS LETTER and professional journals to "Pogo" and *The New Yorker*.

Asked about television and radio, 40% of the parents answered that they were not influences in their children's development. (Three families do not have television sets; one did not until the child was 12 years old.) On the other hand, 23 parents believe that radio and television programs have been valuable. Nineteen parents mention science programs and five cite science-fiction features.

Visits to museums, National Parks, planetaria and observatories, and scientific laboratories receive 65 mentions. Science clubs, seminars and societies are considered valuable by 26 of the 40 sets of parents, and 14 believe that early science activities in Boy and Girl Scouts of America have been productive.

More than half of the parents agree it is helpful to emphasize that it is doing and not winning that is important, to provide opportunities for contact with adult scientists, and to welcome groups of young scientists to their homes.

It is significant to note that these parents are alike chiefly in their vital interest in their children's success in their chosen fields and their willingness to help wherever possible. Otherwise, the group includes a great variety of professions, religious backgrounds, degrees of education, and viewpoints.

Although nearly three-fourths of the fathers and 60% of the mothers continued their education beyond high school (attaining, among them, 11 master's degrees, four M.D.'s, 2 LL.B.'s, and four Ph.D.'s), in 20% of the families neither parents received any higher education. There are or have been scientists somewhere in the family background of 23, or 57.5%, of the 40 talented young scientists; but, conversely, no scientists are recorded on 42.5% of the family trees.

A general conclusion to be drawn from this study might be that a child with the necessary abilities is most likely to become a productive scientist if he is given, early and always, as many opportunities as it is possible to devise to discover for himself the great challenging adventure of science. Then, with encouragement enough to convince him that he can meet the challenge, he may choose to spend all the years of his life searching for elusive answers and for frontiers beyond the frontiers of knowing.

Science News Letter, August 29, 1959

BIOPHYSICS

Electricity Kills Tumors

Cancerous tumors have been killed in mice without harming the animals. An electrical current caused 60% of mouse tumors to shrink and drop off.

ELECTRICITY can successfully kill tumor cells without harming normal tissue.

Two research scientists report in *Science* (Aug. 14) that they used an electrical current to kill cancerous tumors in mice without harming the animals.

Tissue of tumor sarcoma 180 was injected between the shoulder blades of Swiss albino mice. Tumors quickly began to grow at these points of injection, E. H. Seal of the Applied Physics Laboratory, John Hopkins University, said.

Then a plastic saddle was fastened to each mouse. The saddles contained a copper electrode covered with sponge rubber that had been soaked in a solution of water and table salt.

Each "saddled" mouse rested upon a rod covered by copper and sponge rubber. Electricity flowed from the saddle, through the tumor, to the rod upon which the mouse was fastened. The current was controlled to prevent burning the skin tissue. Each mouse was treated for an hour and then allowed to rest for an hour.

Control mice also received tumor cells between their shoulder blades and wore the saddles and equipment, but they did not receive any electrical current. Within 21 days, all controls died, presumably from the effects of the tumor growth.

The mice receiving the electrical current, however, were in good shape after 21 days. More than 60% of the tumors of these mice had shrunk and dropped off, leaving a new skin surface where the tumor had originally grown. The remaining animals died later, probably from the effects of the tumors still growing.

Similar work with another tumor, "C 3 H," did not give such satisfactory results, Mr. Seal said. The studies were directed by the late Dr. Carroll E. Humphrey.

Science News Letter, August 29, 1959

MEDICINE

Control Child's Diabetes Better With Oral Drug

AN ANTI-DIABETIC pill promises better control of the disease in children than other oral drugs now in use.

This was reported by Dr. Samuel J. H. Sugar and his associates at George Washington University School of Medicine.

Young diabetics produce little of their own insulin and their disease runs an unstable, hard-to-control course. Dr. Sugar said the new drug, DBI (Phenformin), used in conjunction with insulin injections, provide finer control. The same holds true in adult unstable diabetics.

Other oral drugs, Dr. Sugar said, provide similar control, but to a lesser degree.

Science News Letter, August 29, 1959