GENERAL SCIENCE

Winners' Science Projects

The 40 Science Talent Search winners that will travel to Washington for the Science Talent Institute showed great resourcefulness in their projects, Shirley Moore reports.

➤ WITH ELECTRONIC computers being used to accomplish feats that sound like science fiction, some of the nation's most talented teen-aged scientists have launched their own explorations into computer science.

Computers have been put to work answering some of the biologist's most elusive problems, solving quadratic equations and proving thousands of geometric theorems by two of the top 40 winners of the Science Talent Search, Robert M. Axelrod of Skokie, Ill., and William D. Rothman of Brooklyn, N. Y.

Seventeen-year-old Bob Axelrod believes that computers may be able to tell space pioneers the best "balance of life" system for a spaceship and what sort of living creatures to expect to find in other parts of the universe. He also suggests that with the help of a computer paleontologists may be able to deduce the kind of environment in which ancient life forms developed.

In a report that helped him to become one of the winners in the Search, Bob described his attempt to investigate life forms by simulating them on a digital computer.

Bill Rothman, a 16-year-old senior from Brooklyn, has designed and built two computers christened the "Quadraticator" and the "Geometron." The first device can solve quadratic equations and factor quadratic trinomials. In building this 40-pound Quadraticator at a modest cost of $25, Bill made ingenious use of springs designed for ball point pens, rubber stamp bases, erector set parts and several miles of wire.

Geometron Costs $50

The compact, 50-pound Geometron cost $50 to put together and boasts a wiring system that looks like a mass of loosely woven spaghetti. This computer is capable of proving nearly all the exercises in Book I of standard high school and college geometry texts, says the young designer. When the given information is fed into the machine, it takes over from there and produces a complete formal proof with statements and reasons lighting up in logical sequence.

Bob and Bill will have a chance to debate their ideas with 38 other outstanding student-scientists when the winners come to Washington from all around the country to spend five days together at the Science Talent Institute, March 2 through 6. During the Institute the winners will be judged for $34,250 in Westinghouse Science Scholarships and Awards. The annual Search is conducted by Science Clubs of America, an activity of SCIENCE SERVICE.

Doves a-courting, crayfish a-molting and toads sitting on dry sand under a hot sun have been the unusual and productive subjects of scientific research for three 17-year-old boys who live in New York, Georgia and Florida.

Joshua Wallman of New York City has spent many hours at the Institute of Animal Behavior of Rutgers University observing and making motion pictures of the ritualistic bowing and cooing of male ring doves eager to impress female doves. Josh wanted to find out whether this kind of courting behavior was completely instinctive and not affected by the bird's receptors, as one theory states.

In his paper submitted to the 20th Science Talent Search, which helped him to become one of the top 40 winners, the young biologist reported that his experiments and observations convinced him that there is, instead, a feedback relationship between the dove's receptors and the central nervous system which involves esophageal air pressure.

When a female dove is put into the male's cage, the gentleman responds immediately by filling his esophagus with air, raising his head and foreparts and then bowing very low. As the dove makes his courtly bow, he coos at the lady. Having won her and having raised their first brood, he scales down subsequent courting of his mate. He goes on bowing, to be sure, but the bows are somewhat shallower and less dramatic.

James Michael Hosford of Atlanta, Ga., another winner in the Science Talent Search, investigated the function of gastroliths in crayfish and the effect of a molt-controlling hormone on these stony structures. He did research on his subject in the libraries of two universities, then designed experiments to discover the physical and chemical characteristics of the hormone that controls the molting of the crayfish.

Finds Unknown Characteristics

Mike was able to find three previously unknown characteristics of the hormone. He reported in his Science Talent Search paper that this hormone is heat-resistant, has a large molecular structure and is a lipo-protein.

His work suggests that the hormone may be a steroid and, therefore, possibly related to cortisone. Since the hormone inhibits calcium deposits in the crayfish, it might also do so in humans and might have an effect on joint diseases such as arthritis and diseases concerned with over-calcification of the muscles.

The third biologist of the trio is William Milton Adkins III of Melbourne, Fla., who has spent the past three years experimenting in the field of stress. His specialty has been observing the reactions of southern toads to light, temperature and degrees of soil moisture when their pineal glands are shielded from light.

Studies being carried on in several lab-

PROUD WINNER—Bill Rothman with his Geometron at the 11th National Science Fair-International in Indianapolis, May, 1960.

oratories in the U. S. use fish and lizards as experimental animals. Bill has extended his investigations to amphibia, using southern toads for the studies reported in his Talent Search paper and currently using frogs for further work.

With the pineal gland shielded from light, the toad exposes itself to higher temperatures and light intensities and drier sand than normally preferred. Bill believes that normal functioning of the pineal apparatus in response to light is necessary for the survival and well-being of the toad, preventing the more rapid exhaustion of its energy resources.

Lines, Color Examined

Finding out how people see vertical and horizontal lines and whether fruit flies see color has kept two attractive young feminine scientists busy during hours that some high school girls dedicate to cokes and girlish gossip at the soda shop.

The vision experiments of Laura Sue Kaufman, 16, of Brooklyn, N. Y., started from her father's comment that in his work in calligraphy it was sometimes necessary to use unequal lines to make letters look regular.

Laura designed her own test cards to measure illusion factors of contrast, width, bisection and vertical position, and used her friends and their brothers, sisters and parents as her 33 test subjects. She found that the younger age group, 12 to 21 years of age, was less easily deceived by illusions, that bisecting a line makes it look shorter, that a vertical line appears longer than an equal horizontal one, and a high line longer than a lower one.

It was also evident that a line that stands out from its background looks longer than one that does not. All of these effects were more apparent when white lines were seen on black backgrounds.

Laura submitted complete records of her test data and conclusions as her project report in the 20th Science Talent Search. In combination with her score on the Science Aptitude Examination, academic achievements and personal qualifications, it won her the honor of being one of the 40 students judged most promising among the nation's science-talented high school seniors.

Vision of Fruit Flies

Another of the nine girls included in the winner group, Ann Mayer of Fairborn, Ohio, reported on her experiments to discover whether fruit flies see color.

"Although I do not know what the fly sees," she wrote, "it is definite that things are not seen the way humans see them."

Collecting the insects that were drawn to white, yellow and pink lights, Ann concluded that the flies responded to the intensity of the light and its physiological effect on the fly rather than to the color. She believes, however, that the physiological effect may be partly the result of color.

Ann also found that the color pigment in the eye of the fly itself has an effect on the perception of color. Although blue and green apparently look the same to a wild strain of Drosophila, they do not appear

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similar to the scarlet and brown strains of the fruit fly.

The young entomologist is now attempting to condition the Drosophila to colored light. If she is successful in this experiment, she believes that she will have proved that the flies do have true color perception. The next step will be a detailed study of the physiology of the eye.

Apparently 11 or 12 years old is not a whit too soon to begin active preparation for a professional career in physics research.

At 16, Roger M. Phillips of Western Springs, Ill., already has five years of intense interest in nuclear physics and four years of well planned experimentation and self-training behind him.

During these years he has methodically explored: radioactive tracers through ten demonstrations of their use in studying metals, plants and animals; more complicated experiments using radioactive tracers to study animal metabolism and plant growth regulators, tracer techniques in researching solid state diffusion of zinc into lead; and electron paramagnetic resonance through the design construction and application of a radio frequency electron paramagnetic resonance spectrometer.

Will Meet Experts

Roger reported his four years of experience with the peaceful atom to the 20th Science Talent Search. He became one of the 40 top winners from all over the country and during the trip to Washington, D. C., for the five-day Science Talent Institute in March, he will have an opportunity to talk with some of the nation's most distinguished physicists and to see some top level physics laboratories in action.

Another highly promising future physicist among the Science Talent Search winners is John Craig Wheeler, 17, of Idaho Falls, Idaho, who already has produced his own design for a proton accelerator. This is a colliding beam accelerator on which proton pulses are accelerated one-half cycle out of phase from both ends of the tube, colliding at a ring-shaped electrode.

The accelerating tube is designed so that the effectiveness of the available energy is doubled. Extensive high voltage rectification is not necessary since alternating current is used.

Novice scientists are eagerly looking into such important subjects as the sensitivity of bacteria to irradiation, the action of drugs on cancer, the biochemistry of leukemia and a rapid, accurate diagnostic technique for diseases of internal organs.

For example, a 16-year-old Chicago boy, Barry R. Dworkin, carried out experiments designed to discover the exact point in the life cycle of the common intestinal *bacterium E. coli* when it is most sensitive to X-ray irradiation. He built a high voltage X-ray machine, an electronic thermostat and a differential densitometer, a device to count bacteria very rapidly. Using this equipment for repeated tests, Barry concluded that the bacterium is most sensitive immediately after it has divided and that it then becomes relatively insensitive.

Studies Leukemia

Rita C. Manak, 16, of Cleveland, Ohio, explored the biochemistry of leukemia to prepare herself to help in possibly solving the question of whether the metabolism of normal white corpuscles, or leukocytes, differs from that of leukemic leukocytes. As a first important step, Rita studied and analyzed the metabolic steps performed by a normal leukocyte.

For four years Bernard S. Rappaport, 17, of Staten Island, N. Y., has been interested in paper chromatography as a promising technique for making screening tests for liver, kidney and related internal disease. Now he has devised an inexpensive, rapid and accurate method of diagnosing diseases related to amino acid metabolism.

Cancer research has been the special project of Robert J. Gordon, 16, of Brooklyn, N. Y. Since early tumors resemble inflammations of other types, he investigated the possibility of slowing or stopping the growth of cancers by using anti-inflammatory drugs.

He found that cortisone inhibited the growth of the Walker rat tumor, partly because of its general destructive effects on the body, and that acetylcholine increased the rate of growth. But a combination of the two drugs successfully inhibited tumor growth to 4.3% of the controls.

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Questions

BIOCHEMISTRY—What is the minimum number of different forms of chlorophyll-a in plant cells? p. 131.

OCEANOGRAPHY—What is the new ice-detecting instrument used by the International Ice Patrol? p. 134.

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