GENERAL SCIENCE

Projects Are Important Fun

During high school years science projects often develop into surprisingly mature research work and lead to successful college and career experience.

By SHIRLEY MOORE

➤ THE MOST exciting word in education today is "project."

By the hundreds of thousands, boys and girls in our schools are doing science projects—experiments and demonstrations that teach by the fun of doing.

But projects were not invented by educators as a teaching technique. They grew, as naturally as Topsy, out of the things children do for the sheer fun of it.

Unless and until they are talked out of it by more orderly adults, children are born collectors of bits and oddities. They spend blissful hours seeing how the world's objects from a bird's nest to the kitchen timer are put together, what they can be made to do, and why or why not. Unhampered by "accepted" ideas, they look at life with brand new curiosity and the simple honesty of the small boy in the story of "The Emperor's New Clothes."

Left to his own inclinations, much of a child's time is spent happily experimenting with private projects. He is born with many of the most important characteristics of the adult scientific mind, although the people around him may not think of it just that way!

Adults Encourage Projects

Parents and teachers are learning to encourage such characteristics, cheerfully putting up with a certain amount of clutter and revising old-fashioned ideas of how clean a child must be kept. If "George" and "Susan" want to spend hours lying on their stomachs watching ants on busy errands or getting acquainted with a couple of earthworms, their mothers are very likely to put them in blue jeans and jerseys, and let them alone.

When he is 18, George may win the interest and praise of other students and science fair judges with his ingenious and thorough exhibit of the interior of an ant hill.

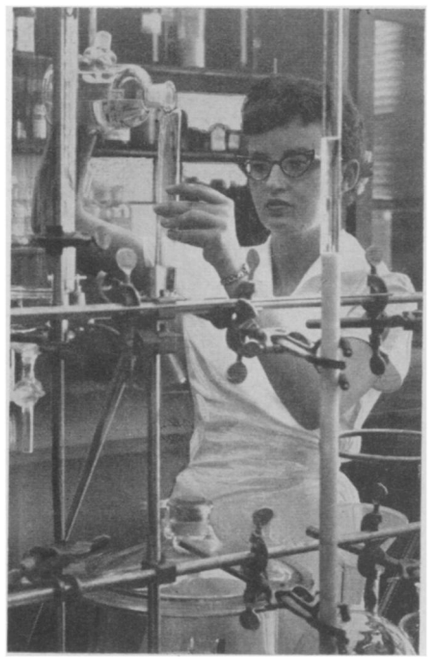
A real George, George Markin of Helena, Mont., did just that. He won first awards in his school and regional fairs and a third place in the National Science Fair. Now he looks forward to a career as a naturalist or an archaeologist.

It may occur to Susan, when she is a junior in high school, that earthworms might carry a built-in antibiotic in their digestive systems, which protects them again bacteria in ingested soil.

Susan Lynn Hopkins of Waterloo, Iowa, had such a notion and developed it into a project that earned her first awards in local fairs and the National Fair. Susan was invited to continue her research on the extracted antibiotic at the College of Medicine of Iowa State University in summer, 1956. The next fall, an expert on antibiotics, Dr. F. Bustinza of Madrid, Spain, asked for details of Susan's work. This past summer she worked as a biochemist in the laboratories of the Eli Lilly and Company on purification procedures for new antibiotics. She entered college as a pre-med student this fall.

Projects for Every Child

Science project activities have proved to be one of the most appealing and strikingly successful means of catching the interest of large numbers of children and teenagers, and of giving such interest "room to grow in." As the idea has caught on, projects have been adapted to all age levels until students, from the smallest kindergarten novice to the most talented high school senior, are engrossed in searching out their own answers, and constructing projects or writing reports to demonstrate their discoveries. Many are done as class work and are dramatic, enjoyable means of learning.



PROJECT PROGRESS—This promising and pretty young scientist is 18-year-old Susan Lynn Hopkins of Waterloo, Iowa, a summertime employee of Eli Lilly and Company. She is shown working on a step in the purification of an antibiotic, the direct result of a first-award-winning science project at a National Science Fair.

For example, there are reports such as the one about some Chattanooga youngsters who studied nutrition by watching the progress of two white rates. One thrived contentedly on balanced meals; the other did not do very well on a diet of sweets, in spite of a nocturnal escapade during which he snacked on the teacher's geranium, some orange peels and a rubber stopper.

Plants and animals come alive for city classrooms when the children grow tree seedlings, cacti, and a colorful variety of flowers, and affectionately raise hamsters, chickens, fish, turtles, praying mantids, snakes, and baby alligators.

Meet Josephine Groundhog, for instance, from Red Bank, Tenn. Her ability as a weather prophet turned out to be extremely poor, but she spent so much time in class that the teacher is reported to have said that Josephine had almost earned a science credit.

Imaginative teachers relate this pleasurable kind of nature study to somewhat less popular subjects such as spelling, arithmetic and geography.

The Wonder of Experiments

When the materials are handy, youngsters delight in making gadgets and experimenting with assorted motors and switches, bells and push buttons, mirrors and prisms.

At the School of Education of the University of Chicago, Dr. Carleton J. Lynde filled a stock room with such inexpensive equipment and let students buy it at cost to take home and "fool around with." The stock room was open to all ages from kindergarten through college, but records kept of the eager buyers show that the peak of interest was among the nine-year-olds.

Dr. Lynde comments, "When these young scientists are thrilled by an experiment, they do it over and over to enjoy again the wonder of it. Then they show it to family and friends and teacher thereby 'leavening the lump.'"

Many projects put together out of ingeniously used odds-and-ends are exhibited eventually at school science fairs. Other projects are done originally because they are required by the teacher or give the student extra credit in a physics, chemistry, or biology course. Still others are created specifically for the fairs that are held all over the country each spring. Whatever their source, the total number of projects proudly exhibited in science fairs each year is now almost astronomical. A fair may be a simple classroom open house or it may include many schools and exhibit 800 projects to 27,000 interested visitors. There are school fairs, regional and state fairs, and the National Science Fair conducted every

year by Science Service's Science Clubs of America for the finalists of nearly 150 affiliated regional fairs.

Projects' Scope Broadens

The scope of the projects has done some growing, too. The once-upon-a-time exhibit of several butterfly specimens casually mounted in a box top has given way to expert demonstrations and astonishingly mature research work.

The younger generation keeps up with the latest developments, and many a professional scientist has been amazed to see the newest design in artificial kidneys or ultrasonic interferometers or rockets very competently exhibited at a science fair. These are not just models, copied from drawings. They involve real understanding of the principles and often include new features designed by the young exhibitor. If it is a winning project, some work had been done with the equipment after it was built.

At the most recent National Science Fair, held in Los Angeles last May, high school students showed judges and visitors a new fuel additive, a spray method of autogenous skin grafting, an original design for a liquid fuel rocket which eliminates pressurized fuel tanks, a new type of photographic wide-angled lens, and a study of electroluminescence demonstrating that the excitation voltage varies with the doping material and is proportional to the distance between the electrodes. These are just some samples of the 231 exhibits.

A few of the more complicated projects have grown so large that some fairs now discourage exhibitors of extremely heavy apparatus from competing for the honor of being sent to the National Science Fair as representatives of the regional fair. The cost of transporting such massive equipment sometimes exceeds the entire expense of sending the finalist!

Four-Ton Project

A few years ago, for instance, a 17-year-old finalist's betatron project weighed four tons and had to be sent to the National Fair in a 35-foot moving van. Its young builder had spent four years putting it together and it included, besides the betatron itself, 7,000 pounds of lead shield, 10,000 pieces of steel, 130 capacitors, 14 switches, and an unknown number of miles of wire. (In operation, the device was reported to sound like "a herd of bull moose in distress.") After the fair was over, the exhibitor presented his project to a university where it is now in use.

Regardless of size or simplicity, the experience of doing an independent project and of the contacts with other science-minded students and mature scientists often starts a chain reaction of enthusiasm.

Many youngsters learn, to their own surprise, what ability they have in science. Suddenly they want very much to study science and mathematics courses, looking forward to college training in one of the sciences or in science and math teaching. Others, the already eager science-aspirants, are more convinced than ever that they have chosen an exciting and rewarding career.

The United States Office of Education reports that this year, for the first time in nearly half a century, the percentage of high school students taking mathematics and science has increased. There are probably many reasons for this increase, but successful personal experience with physics, chemistry, or mathematics would come high on the list, in the opinion of most researchers, of what makes a scientist.

Of the 444 finalists in the Seventh and Eighth National Science Fairs, well over 90% of the boys and girls looked forward to careers in research science, medicine, engineering, science teaching, technical laboratory work or related fields. What is more, studies have shown that up to 88% of the students who reach the level of the national fair actually do go into such careers.

Apparently encouraging the younger generation to do what comes naturally is an inspired way to fill in some of the gaps in our scientific manpower!

Science News Letter, October 12, 1957

● RADIO

Saturday, Oct. 19, 1957, 1:30-1:45 p.m., EDT

"Adventure in Science" with Watson Davis, director of Science Service, over the CBS Radio network. Check your local CBS station.

Dr. James A. Reyniers, research professor of bacteriology, University of Notre Dame, Notre Dame, Ind., will discuss "Germ-Free Life."

PUBLIC HEALTH

Stomach Not Hurt by Swallowing Plutonium

➤ SWALLOWING large amounts of radioactive plutonium will not hurt the stomach or intestines, Drs. Maurice F. Sullivan and Roy C. Thompson, General Electric Company, Richland, Wash., report in *Nature* (Sept. 28).

Their finding disagrees with the earlier idea that these organs are sensitive targets for radioisotopes, especially those that give off alpha particles.

They tested the effects of plutonium-239, an alpha-emitting isotope, on a group of laboratory rats. Very large doses of the isotope could be eaten before any symptoms of intestinal radiation damage appeared.

For all practical purposes, the dangers from such isotopes in the stomach and intestines can be ignored when calculating the maximum permissible radiation exposure.

Alpha particles probably cause no damage because they travel only short distances and the radiation-sensitive cells of the intestinal wall are too far away to be affected by them. Also, the particles have such low energy that a single sheet of paper can stop them.

With beta-particle emitters the situation is different. Tests with yttrium-91 showed that this isotope, when ingested, caused as much damage as heavy X-ray exposure.

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