

The Scientists

Except in photo captions, there are very few names in this book. That is not because scientists prefer anonymity; far from it. Like most other men and women, they appreciate credit; they have no objection to seeing their names in print. But hundreds of scientists and technologists have been responsible for the many research projects described in *Always Something New*, and space limitations will not permit identifying them, even when their specific contributions are known or remembered.

A scientific discovery or invention is rarely the work of only one man or woman. Even Edison had a shop filled with creative assistants. It is commonplace today for important research projects to be carried out by a team of men and women trained or experienced in several disciplines. In the Western laboratory, for instance, a research team that is using the tools of biotechnology to improve the quality of wheat proteins includes a chemist, a biochemist, a microbiologist, a geneticist, a physical chemist, and a biologist with special training in plant tissue culture. The particular expertise of each of these specialists is essential.

The image of the scientist presented in the black-and-white films of the 1940's, of an antisocial eccentric working in secret in a tower laboratory, probably never had any validity. It certainly doesn't today. Today's researcher, far from being a recluse, is a member of one or more professional societies; a chemist may belong, for example, to the broadly based American Chemical Society and the more specialized American Oil Chemists' Society. Typically, a scientist keeps up with change by reading the society's professional journals and attending local, State, and national society meetings. It is not unusual for an ARS researcher to serve as an officer of one of these societies or to receive its top honors or awards.

Regional lab scientists also attend (and often address) industry meetings related to their research. For example, Peoria cereal

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*Increasingly, complex research projects are carried out by teams of scientists trained in several disciplines. In the Peoria center, for example, the research group studying *Fusarium* mycotoxins includes (clockwise from front) organic chemist Odette Shotwell, research associate Yangkyo Salch, chemist Susan McCormick, microbiologist Thomas Hohn, chemist Harold Gardner, biochemist Anne Desjardins, and geneticist Marian Beremand.*

chemists participate in corn utilization conferences held by the National Corn Growers Association. In addition, scientists in the course of their work develop close working relationships with industry researchers and university and State experiment station people. Increasingly, ARS researchers also work with industry people to iron out problems that may arise in transferring technology from the lab bench to the manufacturing process. No researcher works in an ivory tower.

What sets the scientist off from people in other lines of work is adherence to the scientific method. Scientists ask questions that have not yet been answered. They look for answers through systematic observation and orderly experimentation. While it is part of their method to speculate, they know the difference between a hypothesis, which has been described as an “educated guess,” and a theory, which is a hypothesis that has undergone rigorous testing and investigation. Only rarely does one hear a scientist refer to a finding as a “fact”.

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... Louis Pasteur

As much as any accountant, a researcher is scrupulous in keeping records; every experiment, every scrap of data, is carefully recorded and dated. When scientists believe they have proved their theories sufficiently or made original discoveries, they must publish their methodology and results where their colleagues can read them, and, if they so wish, build on them, criticize them, or even refute them. Science is not a profession for the thin-skinned or for prima donnas.

The process of submitting a scientist’s work to the scrutiny of other scientists is called peer review. In the Agricultural Research Service, peer review is used in several ways: To examine the quality of specific research projects, to assess the

agency’s national research programs, and to evaluate its research personnel for possible advancement. There are few areas of human endeavor in which a person’s work is subjected to such intense and frequent review by peers as in the sciences.

Scientists do not always remain in the area of study or specialization in which they began their careers. Many change fields several times in a lifetime, pursuing exciting new interests. And they frequently make important contributions in the new area. That is understandable; the body of scientific knowledge is expanding so rapidly today that researchers must continuously relearn their disciplines; scientific information doubles every few years. A scientist may have little more difficulty in becoming proficient in a related field than in keeping up to date in an old one and may bring fresh insights to the new disciplines.

“I would not want nonscientists to suppose,” says a regional lab researcher, “that we are flawless automatons, invariably moving toward solutions of problems in an orderly way, from point A to point B. As Charles Kettering, the inventor of the self-starter for automobiles, pointed out, scientists and inventors typically fail more often than they succeed. That is the price of exploring the unknown. And sometimes, we make important discoveries by accident—or find that an invention or process is good for something other than what we invented it for.”

He mentioned several unexpected spin-offs from research at the Western lab. In one instance, an enzyme isolated from papaya to tenderize meat was found to help treat herniated spinal disks. In another, shrinkproofing wool was found to make it more receptive to dye and easier to clean. He had a dozen other examples, all purporting to demonstrate that scientists are, after all, human beings who occasionally make mistakes or have lucky breaks. What he didn’t say, however, was that it takes an alert scientist to spot the significance of research “accidents” and to make the most of them. As Louis Pasteur said, “Chance favors the prepared mind.”