Speaking of Science

Creativity: Can It Be Dissected? Can It Be Taught?

More than 90 percent of scientific innovation, it is frequently argued, has been accomplished by fewer than 10 percent of all scientists. This situation presumably exists because only a few scientists have creativity—that ill-defined state of mind which allows the investigator to forge anomalous or apparently unrelated facts into bold new chains of theory. The pace of innovation could certainly be increased to meet pressing technological problems if the number of creative scientists could be increased, but how to accomplish this feat remains a very difficult problem. Is it, in fact, possible to teach creativity? Is it possible even to create conditions that nurture preexisting creativity? Or is it possible only to expand the number of practicing scientists in the hope that the percentage of creative scientists will remain constant?

One might expect that at least partial answers to such questions could be obtained from individuals who are themselves creative. On that assumption, the West German pharmaceutical company C. H. Boehringer Sohn last month brought together some 21 of the world's more prominent scientists and philosophers of science* to dissect "the creative process in science and medicine." The eminence of the participants guaranteed that the conference would be interesting, but the deliberately informal nature of the proceedings and the apparent lack of preparation by many of the conferees perhaps also guaranteed that the conference would be less productive than its sponsor might have hoped. The assembled group was able to agree on many innate characteristics that contribute to creativity—characteristics that would be readily recognized by anyone familiar with the vast literature about creativity—but it did not reach any consensus about what might be done to enhance these characteristics.

Perhaps the principal problem, as Leon Eisenberg pointed out in a somewhat different context, is that the scientist who attempts to explain in retrospect how he developed a creative idea is only rationalizing a series of events that he thinks might have happened. The events, in fact, probably did not happen in quite the way he recalls them: Innovation is, for a majority of people, essentially a preverbal process, and the necessity of translating that thought process into words almost certainly alters the perception of the process. Many conclusions drawn from this verbal reconstruction of the creative process may be incorrect if the reconstruction is itself faulty.

Despite the lack of a consensus, however, one major theme did emerge from the discussions—that a major element of scientific success is the ability to distinguish between ideas and good ideas. Creativity, suggested Sir Karl Popper, can be divided into two stages—obtaining ideas and criticizing those ideas to determine which are worthless and which are worthwhile. It can then be argued that the ability to generate ideas is the innate part of creativity that probably cannot be altered, while the development of a critical faculty is the essential part of creativity that can be nurtured through education. Failure to develop this faculty, argued Gustav Born, is one of the major causes of scientific sterility. The scientist who does not have this faculty can spend his lifetime working on problems that are not ripe or that are trivial, and thus will not obtain any results that might be labeled creative.

And how is this creative faculty developed? Generally, most of the participants agreed, through the master-apprentice relationship that arises from working with a successful scientist. Sir Hans Krebs, for example, discussed his relationship with his mentor, Otto Warburg: "He taught me how to go about asking the right kind of question—a question which is worthwhile and a question which can be tackled with the tools available at the time. And he paid particular attention to impressing people and showing this by example. . . . And he was also an example in his ruthless self-criticism." Research, Warburg taught Krebs, is "the art of finding problems that can be solved."

But few young scientists are able to enjoy the luxury of working and associating with Nobel-quality scientists. What then can be done to help them develop this necessary critical faculty? Most of the conference participants argued—often for undefined reasons—that "creative science" could not be taught in universities. Many of them, furthermore, spoke derisively of the practice of American universities teaching courses in creative writing, suggesting that it is not possible to teach creativity in any subject.

The title "creative writing," however, is actually a misnomer; most such courses are actually teaching criticism of creative writing. That is, the instructor begins the course with the assumption that the students have some creative writing ability, then teaches them how to distinguish good writing from bad writing, how to avoid making certain types of mistakes in writing, and how to avoid the banal and the trivial. The analogy to creative science is straightforward and, though the application of the concepts may be somewhat more difficult than is the case with creative writing, the benefits that might be derived from this type of education in science could be far greater.—THOMAS H. MAUGH II

* The participants included: Sir Hans Krebs, Richard Dawkins, Bryan Magee, Desmond Morris, and Nicolaas Tinbergen of Oxford University; Lady Helena Eccles and Sir John C. Eccles of the State University of New York at Buffalo; Sir Karl Popper of the London School of Economics and Political Science: Jacques Monod of Institut Pasteur, Paris; Manfred Eigen and Ruthild Winkler of the Max-Planck-Institut für Physikalische Chemie, Göttingen; Gustav Born of the University of Cambridge; Setsuro Ebashi of the University of Tokyo; Leon Eisenberg and Arthur M. Kleinman of Harvard Medical School, Boston; Frits Hartman of the Medizinische Hochschule Hannover; A. O. Lucas of the University of Ibadan; Heinz Maier-Leibnitz of Technische Universität, München, Arne Peterson of the University of Copenhagen; Gerhard Thews of Universität Mainz; and Anthony Storr of London. The proceedings of the symposium will be published later this year by Excerpta Medica.