Letters

Creativity and Age

Harvey C. Lehman's painstaking studies on the subject creativity and age [see *Science* **127**, 1213 (1958)] graphically express the fact that most creative work is performed at an early age. This is a very disturbing fact when taken at its face value. Psychologically, it would mean that a scientist does not develop after, say, age 39. Conceptually, it has the strangest implications with regard to the relationship between science and experience. Presumably, as a scientist ages he acquires more experience, but this apparently does not help him in creatively contributing to science.

Lehman does not extend his work to any such conclusions; he purposely limits himself to statistics. Yet, he would like to see his results used as the basis for some kind of action; he indicates that in the cited article. However, his only conclusion is akin to the ancient device *carpe diem*—and not much more. If we wanted to arrive at further conclusions, we would have to know about the causes responsible for the statistical facts. In view of the wide implications I mentioned, I should like to point out two of the causes for Lehman's undoubtedly established facts: (i) The biographies of individual "great" chemists—and other scientists as well—show that, as these men grew older, administrative and public duties absorbed an increasing amount of energy previously applied to scientific work. Therefore, age in itself is not necessarily cause for creative decline. (ii) The men who remained creative during a long life were frequently those who changed their fields. Richard Willstätter did it within chemistry when he went from chlorophyll to anthocyanins and to enzymes. Wilhelm Wundt started in medicine and physiology, then turned to philosophy and to psychology.

It is certainly good for society to have administrators who have demonstrated creative abilities, and it may often be advantageous to change from one scientific field to another one. Lehman would give deeper meaning to his statistics if he would carefully weigh the individual factors and causes. He would then also arrive at a better means for judging who were the "greatest" chemists, and for his "statistical" choice of Berzelius and Dumas, he might then find reasons to substitute others.

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I fully agree with Farber's assertion that age in itself is not necessarily a cause of creative decline. I thought I made that point clear in my article. I disagree, however, with his statement that I chose Berzelius and Dumas as the "greatest" chemists. My article refers to them as two "great" chemists—not as the two "greatest" chemists.

If, prior to writing the above letter, Farber had turned to my book, *Age and Achievement* (Princeton University Press, 1953) (as was suggested in my article), he would have found (pages 328 ff.) a list of 16 *general* causative factors which help to account for my statistical findings but which I omitted from my article because I had already published them in my book. *Individual* causative factors are a far more difficult matter to deal with, for the simple reason that causes rarely operate singly.

Here are some reasons why I did not try to investigate *individual* causes. Many psychologists doubt that the individual is fully aware of his own deepest motivations; surface behavior is not always a dependable guide to the serious student of human behavior; the psychoanalysts would scorn any explanation of causative factors that fails to take subconscious factors into account; and there must also be social and economic as well as a host of other causative factors at work. It is also true that thumbnail sketches such as Farber submits in his letter are oversimplifications and are not very illuminating.

To date I have published more than 400 age curves, selected as the most

representative and most revealing from among a total of several thousand curves that I have made which set forth the relationship between age and creative achievement. These curves were obtained by study of the accomplishments of over 30,000 individuals—more than half of the creative "greats" of Christendom. When duplicate names and the names of living persons are deleted, the total number of individual achievers is still quite large. Not all of my data have been analyzed as yet, and my task is not yet ended. I say all this not boastfully, but merely to point out that it is impossible for any one investigator to do everything.

In criticizing a research report it is more important to note whether the investigator has achieved his goal than to say that he should have selected other goals or additional goals. Although Farber mildly chides me because I did not set for myself goals that he would have set, and although it is his privilege to do so, his criticism is not at all relevant to the integrity of my findings. When he asserts that I did not "carefully weigh individual factors and causes," I can only say in reply that that statement is correct.

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Soviet Scientific Literature

I have read with great interest the article "American use of Soviet medical research," by Saul Herner [*Science* **128**, 9 (1958)]. While my experience with Soviet scientific literature is in the fields of chemistry and related sciences, some 27 years of experience lead me to conclusions very similar to those of Herner. Much of the work is excellent, some is indeed mediocre. Some bears the earmarks of plagiarism from previously published Western work, but some is also pathbreaking.

From my point of view as an abstractor for *Chemical Abstracts,* one of the most exasperating things about Soviet scientific literature is the carelessness of the editing. Frequently references to the literature contain typographical errors, and typographical differences between what would appear to be the same mathematical equation on different pages have more than once cost me considerable time in rechecking a derivation.

Soviet book reviews I have in general found to be very detailed and critically analytical. Unlike journal articles, they do at times tend toward the nationalistic and political.

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