Letters

Prescient

Oscar Hertwig (1849–1922), professor extraordinarius of anatomy at the University of Berlin, generally remembered for his basic discovery of the process of fertilization, developed a theory of particulate inheritance before the recognition of the Mendelian laws. In the present decade, which has witnessed fascinating discoveries on the nature of the genetic code, an excerpt from his book *The Cell* (Macmillan, New York, 1895) merits the historian's interest:

> The hypothetical idioblasts . . . are, according to their different composition, the bearers of different properties, and produce, by direct action, or by various methods of cooperation, the countless morphological and physiological phenomena, which we perceive in the organic world. Metaphorically they can be compared to the letters of the alphabet, which, though small in number, when combined form words, which in their turn, combine to form sentences or to sounds, which produce endless harmonies by their periodic sequence and simultaneous combination [p. 340].

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The Physician and the Drug Disputes

Lasagna's article "Problems of drug development" (24 July, p. 362) placed insufficient emphasis, it seemed to me, on the role of the physician in the administration of medication. To date the major onus of providing safe and effective medicines has been divided between the pharmaceutical industry and the expanding Food and Drug Administration. The medical profession, in not being given a modicum of blame for past errors (thalidomide, triparanol), and in not being included among the groups to whom recommendations concerning medication have been made, has suffered a grevious insult. By these apparently complimentary but actually patronizing omissions, the physicians have been told in effect that, since their prescription writing has been indiscriminate and often unwise, judgment in matters of materia medica will be taken from their hands and made instead the business of government and industry.

A physician's prescription rights are virtually limitless. He can, if he chooses, administer medicaments concocted on his kitchen stove. His judgment has been traditionally respected and his freedom trammeled only by his conscience, knowledge, and experience. Yet something has happened to this collective judgment. We see the same physician who approaches poisons such as digitalis and quinidine with the utmost caution pounce avidly on chloromycetin for minor degrees of illness; or the man who wouldn't think of administering tetanus antitoxin without prior skin testing and other safety measures give injections of penicillin to any office patient who demands it, a procedure as lethal as the indiscriminate use of tetanus antitoxin.

We can only conclude that the discrepancy in judgment reflects a discrepancy in the teaching of pharmaceutics in the medical schools and beyond. Whereas digitalis, quinidine, tetanus antitoxin, and so on were approached with reverence for their awesome powers and fearsome dangers, the newer drugs are probably discussed with the familiarity that breeds contempt.

By imposing restrictions on the pharmaceutical industry to achieve ends that could be accomplished by a self-disciplined medical profession, we may be thwarting the release of many beneficial remedies. For example, strict laws about efficacy might have prevented the appearance of iproniazid, which was introduced for the treatment of tuberculosis, but which turned out to be the first of the "psychic energizers." The unrestrained use of thalidomide in early pregnancy resulted in tragedy, but this drug, which is now not obtainable, might be of inestimable value in the treatment of the aged. Which test of efficacy would one propose for aspirin? Could gold salts, with their recognized 30-percent morbidity rate in some uses, possibly receive FDA approval today?

Ultimately a drug has to pass or fail in the hands of the physician; and even the most elaborate laboratory precautions cannot protect the entire public from individual idiosyncrasies or from the unsuspected toxicity of certain drugs when taken in conjunction with certain foodstuffs.

I don't plead for a laissez-faire attitude, but I do claim that if the medical schools taught the same regard, reverence, and fear of the new drugs as they do of the old, the physician could be trusted to become an equal or even greater-than-equal partner in the struggle for the safe application of poisons in the treatment of disease. The role of the government is commendable, but it cannot arrogate to itself prescription rights unless the physician fails to reclaim his traditional prerogatives.

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Science in Less-Developed Countries

A dichotomy of opinion characterized the United Nations Conference on the Application of Science and Technology for the Benefit of Less-Developed Areas, held at Geneva in 1963. The opinion voiced by representatives of more advanced countries was that primary emphasis should be placed on applying existing technology to the solution of economic problems and to elevating standards of living in less-developed areas. In contrast, a substantial number of representatives from less-developed areas emphasized the desirability of developing in their countries the capacity for contributing to new scientific knowledge, rather than relying solely on adopting existing technology to meet their pressing needs. This dichotomy of opinion, and in particular the issues relating to the latter opinion, have received scant consideration by the scientific community of the United States.

During the past year I have attempted to explore these issues through correspondence and conferences with a number of scientists and science administrators. This inquiry indicates that scientists from the United States might participate more effectively in encouraging the growth of science in currently less-developed areas of the world. To do so requires a greater opportunity for scientists (those from government and industry as well as from universities) to spend appreci-

able time overseas. It requires an organization of effort permitting a sustained interaction with scientists in these less-developed areas despite rotation of particular personnel. Many suggested that success could only be assured through an organization having some of the attributes of the Peace Corps but which would not demand financial sacrifice by volunteers.

Copies of the complete course of this inquiry are available. I shall welcome further comment and will attempt to make such views available to anyone concerned.

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Crackpot Scale Applied

Gruenberger's "A measure for crackpots" (25 Sept., p. 1413) has interesting possibilities. But I wonder why the author wastes his time considering those harmless believers in the dowsing rod or in ESP, who, after all, are only looking for a little water or a little insight into the muddled minds of men. If Gruenberger glanced around where he works (the Rand Corporation), he would find far more challenging subjects for his scale. I refer, of course, to the nuclear strategists, those earnest applied scientists who are regularly defended in the pages of *Science* itself.

Let's apply the Gruenberger Scale to nuclear gaming, strategic simulations, and the like:

1) *Public verifiability—12 points.* To quote Gruenberger, "The crackpot often says, 'This is revealed truth; sorry, but I and my followers are the only ones who can obtain these results.' " Compare this with testimony before Congress on projected nuclear casualties, the effect of shelters, and so on, by several experts. Score: 0.

2) *Predictability—12 points.* Refer, as an example, to Kahn's book on thermonuclear war, and compare his prediction for the 1964–65 period with the Russian-Chinese tension, the test-ban treaty, insurgency in small countries around the world—that is, with what is actually happening. Score: 0.

3) *Controlled experiments—13 points.* Clearly, the nature of hydrogen warfare makes experimentation impracticable except in a prototype (final) sense. Score: 0.

4) *Occam's razor—5 points.* The tortured intricacies of he-thinks-that-I-think-that-he-thinks-that-I-know-whereas . . . are fun when Dr. Strangelove does it but far from the simplest way to approach conflict resolution. Score: 0.

5) *Fruitfulness—10 points.* Need I comment? Score: 0.

6) *Authority—10 points.* Nobody can argue with all those hotshot degrees. Score: 10.

7) *Ability to communicate—8 points.* There is no lack of journal space devoted to this stuff. Score: 8.

8) *Humility—5 points.* Cf. the Teller-style bluff and bluster. Score: 0.

9) *Open-mindedness—5 points.* When I recently took a writer to task because of possible downwind effects a cratering attack on the eastern missile sites might have on New England, he said my criticism was improper because I supposedly did not believe in the principle of deterrence. In other words, a technical argument is invalidated by a person's ethical beliefs. Score: 0.

10) *Fulton non sequitur* and (11) *Paranoia—5 points each* (if negative). Strategists are not being laughed at, so they need not invoke the shade of Fulton. Nor are they suffering from persecution complexes. Why should they be? Score: 10.

12) *"Earth-shaking" complex—5 points* (if negative). These prophets of doom score: 0.

13) *Statistics compulsion—5 points* (if negative). Is anybody not familiar with the megadeath games? Score: 0.

Total score: 28 points out of 100—the same score as the dowsers'. Angelologists—those who study the existence and habits of Angels—score even lower.

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Training in Microbiology

During the past 5 years I have noticed severe deficiencies in the training of undergraduate majors in microbiology. My views have been corroborated by a survey conducted by the Education Committee of the Society for Industrial Microbiology and by the discussions at an SIM symposium on training microbiologists at the bachelor's level (held at the 1964 annual meeting of the American Institute of Biological Sciences).

Gross inadequacies in five skills were repeatedly noted. Many college graduates with majors in microbiology (i) cannot prepare, sterilize, and dispense culture media; (ii) cannot serially maintain pure cultures; (iii) cannot effectively search the literature for relevant publications on a particular subject; (iv) cannot record concisely an experimental design or clearly report the results; and (v) are not familiar with standard references such as *Bergev's Manual of Determinative Bacteriology, Lange's Handbook of Chemistry*, and the *Merck Index*.

A colleague said, "Does it really matter? These are things that can be learned within a few months." True, but shouldn't an undergraduate major in microbiology be able to do these things? What happens to the new graduate who does not have a qualified supervisor?

In our haste to teach all that is new, and with pressure to train more students, we must not omit the simple, basic techniques.

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On Quoting

Skinner's letter (25 Sept., p. 1385) calls attention to an error in referencing in my article "Empiricism in latter-day behavioral science" (31 July, p. 464). Let me apologize both to Skinner and to readers of *Science* in acknowledging that the reference should have been to *Cumulative Record* (Appleton-Century-Crofts, 1959) rather than to *Science and Human Behavior* (Macmillan, 1953). Page references remain unchanged.

As regards Skinner's other criticisms, to the effect that he had been quoted out of context and misrepresented, I have little really to say. Any quotation is subject to the same objection. I selected the Skinner quotes and those from Sidman's book (*Tactics of Scientific Research*, Basic Books, 1960) because they illustrated my honest understanding of the essentials in the Skinnerian position. The informed reader will have no doubt already made a judgment as to whether I have or have not represented Skinner fairly. To the interested but less informed, I would hasten to urge, indeed, a direct perusal of the references cited (as herein corrected).

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