

The Unanswered Questions of Science
(TUQOS)

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In *My Fair Lady*, the musical adaptation of Shaw's *Pygmalion*, Professor Higgins wonders "why can't a woman be more like a man?" That tune crosses my mind when pondering "why can't scientific and technical journals be more like magazines or even newspapers?"

Titles of journal articles pose *questions* or describe *problems*--they usually don't provide *answers*. Titles of newspaper articles, i.e., the headlines, give boiled-down 'facts'. Newsmagazines like *New Scientist* do something in-between. They frequently use as subtitles the equivalent of "terse conclusions."^{1,2}

Students and laymen can't at first understand why scientists like to scan contents pages, until it is compared with scanning newspaper headlines. This random reading of titles becomes even more comprehensible if one imagines a question mark at the end of each article title. The title then restates the question the author had in mind when he began the work his article reports.

Scientists are, of course, interested in facts. But they are frequently more interested in the facts they "need" than in those they have. It is the unknown fact, the unanswered question that fascinates the scientist. It distresses me that so few students and laymen find any interest in such unanswered questions.

I don't know of any test that measures the degree of one's interest in unanswered questions. I suspect that such a test would better reveal potential for scientific work than achievement in a fixed regimen of courses. I imagine that fascination by the un-

answered question may be largely a cultural thing, a highly 'civilized' characteristic. I doubt, or would be surprised to find, that it exists among primitive or "culturally deprived" peoples.

Many years ago a little periodical was published in the United Kingdom. It was called *Unanswered Questions*, and was designed as an aid to technologists. I regret that it was discontinued, for I felt and still feel much sympathy with its purpose. I frequently think of myself, for example, as a cataloger of the unanswered questions of science. So many remain to be answered that I am not only skeptical but incredulous when I hear or read that we may, in the foreseeable future, run out of questions to ask.³ How right was the Victorian gentleman who is supposed to have suggested that continuance of the Patent Office was a waste of time--since obviously, to him, what there was to be discovered had been discovered?

We may laugh now at that gentleman, but how really different is the attitude of some graduate students who have 'difficulty' selecting a dissertation topic. Admittedly, factors other than intellect enter into thesis selection. But if the difficulty of such a student is primarily intellectual, one can more than facetiously ask whether he or she ought not to be dissuaded from graduate work. This poses an unanswered question for some graduate student of sociology. Is there any relation between difficulty in choosing a dissertation topic and later performance in research? If an advisor must lead a student to a dissertation topic, can

he comfortably expect the student to provide the original thinking any dissertation topic deserves? The choice of dissertation topics is well-treated by Serratos in an interesting section of *The Scientist Speculates*.⁴

If cataloging The Unanswered Questions Of Science (TUQOS) does not intrigue you, think of it in larger terms, and consider the problem of today's science policy makers. How does one go about establishing the goals of the scientific establishment and their priorities? Indeed does one truly 'establish' them or do they simply 'emerge' by some random process?

I have been preoccupied with TUQOS for many years. At one time I imagined a market-research approach to the problem. In library school I thought about sending a questionnaire to each of the world's scientific elite. We would ask them what they thought were the most important unanswered questions in their particular field. We would also ask them to select important unanswered questions in other fields. This may sound as though I anticipated the Delphi technique, but I make no such claim. My purpose was different. It is one thing to ask people where the world is probably going. It's another to ask where they think it ought to go. I suspect we would find major differences between such a survey of TUQOS and a Delphi questionnaire among scientists. Many scientists believe that the important questions in their own fields are not

being funded or studied adequately. They would have no trouble with a Delphi questionnaire, and the results would be depressing in view of what is being funded. What is 'popular' research may not be taking us in the direction we need to go. The cancer program is a good illustration.

A firm believer in democracy, I am intrigued by the value of a consensus one might establish about the Unanswered Questions of Science if a few thousand of the scientific elite could be interviewed in depth. The results, I am sure, would be more reliable than the pressure-cooker output of small and inbred cliques typified by too many of our past presidential scientific advisory groups.

At the least, one might have hoped some PSAC group of the NAS would have been sufficiently objective to have implemented the kind of study I suggest. Perhaps under Handler's or Steven's leadership at NAS and NSF, we may obtain such implementation—even on an international scale.⁵ It might be contracted to even such politically oriented groups as UNESCO or OECD.

Let any social scientist think that my proposal is limited to the hard sciences, I hasten to add that such studies in the behavioral sciences may be needed even more urgently than in the hard sciences. Knowing the concern of most scientists with societal problems I would not be surprised that they would give highest priority to the unanswered questions of human behavior.

1. Garfield, E. Unintelligible abbreviations and sloppy words in article titles create magic (invisible) spots for indexers. *Current Contents*® No. 48, 29 November 1972, p. 5-7.

2. The term 'terse conclusions' was coined by Charles Bernier. See: Bernier, C. Terse literatures. I. Terse conclusions. *J. Amer. Soc. Inform. Sci.* 21:316-19, 1970.

3. Mussett, A. Discovery: a declining asset? *New Scientist* 60(878):886-89, 27 December 1973.

4. The problem of choosing a dissertation topic would be fully solved by catalogs of *Ignoratica*. See F. Serratos. "Ignoratica". in: *The Scientist Speculates: An Anthology of Partly-Baked Ideas*. Ed. by I.J. Good, A.J.

Mayne, J.M. Smith (London: Heinemann, 1962), pp. 4-9.--The whole of this delightful book concerns the unanswered questions of science, and their importance. For example: "Even the great Newton filled the greater part of the end of his *Opticks* by queries which were really speculations. Interestingly enough, it was precisely Newton's queries that were to have the greatest effect on the development of physics . . . It was not what he could prove . . . but it was what he did not know that stimulated other people to work." *Ibid.*, p. 11-12.

5. Anonymous. Handler candidly assesses federal science. *Chem. & Eng. News* 13 May 1974, p. 13-14.