



BORDER BETWEEN SCIENCE AND PSEUDOSCIENCE: RIGID OR SOFT?

by

Mihály T. Beck
Department of Physical Chemistry
Lajos Kossuth University
Debrecen, HUNGARY

Discussant Response to **Nicholas Kurti's**

LIMITS OF SCIENTISTS' SCIENCE

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Department of Physical Chemistry, Lajos Kossuth University, Debrecen

4010 Hungary

The question mark in the title of Committee I (The Limits of Science?) may suggest that the general opinion of the contributors is that there are no limits of science. This is definitely not true. All the contributors agree that there are a number of limitations of science, although there are rather divergent opinions concerning the nature and extent of the limits.

Some of the scientists' limits are obvious and connected with the infiniteness of the outer world and the finity of the comprehension of both the individual and the mankind.

I have reservations on the rather common tautological definition of science, mentioned in Prof. Marx's overview, that is "science is what scientists do". This would be true if the idealized view of scientist could be held. According to this view, all scientists are unbiased, absolutely honest and objective human beings, who, at least in their scientific researches, always act as such. This view is not idealized only, but is rather naive, too. The scientists cannot always and completely disregard their prejudices, the objectivity is necessarily limited: Polanyi titled his seminal book *Personal Knowledge*¹. Alas, there are many indications that in the last few decades the honesty of a much

higher fraction of scientists is questionable than in earlier times. For many people involved in scientific research, in the "R & D industry", the job is not a passion, but simply means to earn money. The present situation, the highly competitive features of the scientific world is more favourable for the manifestation of the *pathological tendencies of science*. This term was originally coined by Langmuir², and the paper by Prof. Fleming³ provides an excellent analysis of the wrong side of science. A particularly interesting feature of his paper is that by treating the strange excursion of Langmuir himself to the field of weather control, he pointed out that the recognition of the dangers of the pathological behaviour does not make immune against practicing it.

Prof. Fleming's list of the characteristics of pseudo-scientists is practically complete. The last item may be extended by the rationalization of national prejudices. This was the basis of the so called "German physics", and, at least partly, was responsible for the support of Lysenko. In this context, may I refer to the term *popovism*, the meaning of which is exaggerated priority claim based on chauvinistic motivation. This is closely connected with the problems under the subtitle of Prof. Fleming's paper "Pathologies of National Science: Age and Size". In the particularly flowering period of certain fields in a country, there is a tendency to exaggerate the situation, and to make childish and dangerous generalizations, such as Adolphe Wurtz's (in)famous saying that "chemistry is a french science". In the same part of his paper, Prof. Fleming touches the future of science and I am sure that his statement will be disputed. It seems to me that, in contrast with some other contributors, he thinks that the developed countries, particularly the United States, spend too much for scientific research. I believe that the situation is

rather complex. The different developed countries probably spend too much for applied military researches, and all countries too mediocre pure scientific researches, but not enough to really imaginative basic researches which do not promise immediate practical applications, and to different applied researches to eliminate and prevent the dangers of the inevitable industrial development. I would like to call your attention to a most interesting paper by J. Klein on the "Hegemony of mediocrity in contemporary sciences, particularly in immunology"⁴. This paper provides a thorough analysis of certain problems of the institutionalized science.

A great danger of the not fully honest behaviour of the scientists is that frequently the main motivation of the research is the business. This motivation is quite natural and understandable to a certain limit, but it seems to me that this limit is frequently transgressed. It is enough to mention the contradictory results of researches concerning the carcinogenic effect of sugar, sacharine, glutamate, smoking, etc. The problem of the biological effects of low frequency electromagnetic fields mentioned by Prof. Kurti⁵ also belongs to this category. .

The spectrum of the researches from the rigorous, fully scientific to the crazy, pseudoscientific is continuous. The fundamental principles based on careful, multiply corroborated experiments and/or observations are on the one end of this spectrum and the patently absurd statements and speculations, e.g. on pyramid energy and Bermuda triangle on the other end. Some of the researches and speculations on extraterrestrial life are scientific (although I believe that they are too expensive to worth for support presently), while the "factual" reports on UFOs and on encounters of the 2nd, 3rd and 4th kind with

extraterrestrials appear follies. I do believe that most of the pseudo-scientific literature has a very dangerous effect on the views of the man on the street on the world in general and on the scientific aspects in particular.

There is a broad spectrum of the misconducts in science, too. Babbage gave a whole list of misconducts already in 1830⁶. He distinguished hoaxing, cooking, trimming and forging. Although, obviously the forging is the greatest sin in the scientific research, it is not easy to decide that which kind of the misconducts is the more dangerous for science. To publish important "results" of never made experiments is a capital crime, but socially not dangerous since the lack of reproducibility immediately indicates that something is wrong with this piece of research. (Of course, this type of misconducts gives an opportunity to the enemies of science for demagoguery against science and scientists in general.) The erroneous results of sloppy experimental work, the "trimming" and "cooking" of the published data is much more difficult to point out and, obviously, this kind of dishonesty is much more frequent than the outright fraud.

Another type of violation of the principles of ethics of science is plagiarism. It has also a broad spectrum from the republication of a whole paper under different name(s), through the word by word quotation of important parts of another paper without reference to it, to more subtle methods. A different, but related problem is the order of the authors, for which a most interesting example is mentioned by Prof. Kurti. In connection with this particular case, however, it would be necessary to consider the weight and extent of the contribution of the different authors. In this particular case Wu initiated the whole program, therefore her name as the first author seems to be justified.

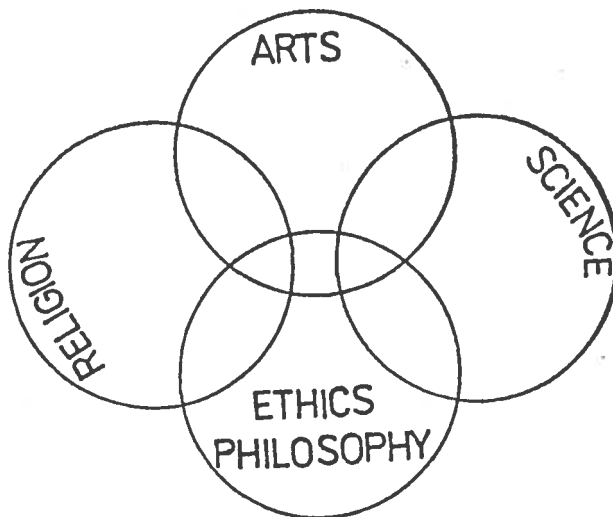
The alphabetical order of the authors may appear as the most fair, in fact it can be the source of injustice. (It is possible that a friendly gesture of Kamen may cost him a Nobel prize⁷.)

Prof. Kurti masterly analyzed several examples of great scientific discoveries which met for quite a long period with the resistance of the community of the scientists. The situation was characterized by him with a few quotations from Planck, Mitchell and Schopenhauer. All these, and many other contradictory quotations are true and false simultaneously. They are valid for certain cases and fail to correctly characterize other ones. As G.B. Shaw wrote: "The golden rule is, that there are no golden rules", or, as the anonymous dictum says: "for example is not a proof". It is obvious that a certain resistance of the scientist against the new idea is a necessary element of the sound progress of science and follows from the critical nature of the scientific thinking. If all the new principles offered by scientists (and pseudo-scientists) would be enthusiastically accepted, there would not be science at all. The important point to both the individual scientist and the scientific community to find the sound balance between the rigid resistance to the well established old principles and the enthusiasm for the revolutionary new ideas. The ambivalence of the practicing scientists is beautifully expressed by Polanyi⁸: "The process of expaining away deviations is in fact quite indispensable to the daily routine of research. In my laboratory I find the laws of nature formally contradicted at every hour, but I explain this away by the assumption of experimental error. I know that this may cause me one day to explain away a fundamentally new phenomenon and to miss a great discovery. Such things have often happened in the history of science. Yet I shall continue to explain away my odd results, for if every anomaly observed in my

laboratory were taken at its face value, research would instantly degenerate into a wild-goose chase after imaginary fundamental novelties."

Hoaxes are treated by both Professors Fleming and Kurti. As in the all other types, there are great differences in the character and effect of the hoaxes. Several of them are mere jokes, although with some serious aim, as the classical letter by Wohler undersigned as S.C.H. Windler⁹. Sometimes it is not easy to decide whether the paper in question is genuine or a hoax, e.g. the paper by Crick and Orgel on the directed panspermia¹⁰.

As Prof. Fleming pointed out in his contribution, one source of the pathological behaviour in science is the rationalization of strongly held *religious or ideological convictions*. Such a behaviour is based on the confusion of the nature of science and religion. They difference does not follow from giving different answers to the same questions, but rising different questions. The relations among certain spheres of human cultures are shown on the following figure:



Religion and science belong to different, but not overlapping sets. Any confusion of these two huge sets of human culture is dangerous for both religion(s) and science.

Finally, I would like to second Prof. Kurti's suggestion that one of the coming ICUS may deal with problems of parapsychology. It is crucially important, however, that, as he wrote in his contribution, that this subject would get a sober assessment and the discussion would be unemotional. Unfortunately, it will not be easy to find experts with a minimum degree of open-mindedness who wish such a discussion and able for it. It is still a characteristic feature of the people interested in this field, that they are either rather uncritical or almost superstitiously incredulous.

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