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The Value of the Inexact

INTRODUCTORY NOTE: *The following letter from Michael Polanyi to the British journal,* ***Philosophy of Science*** *was fired off in 1936. Its style and content reveal the daring and the brashness of the then Professor of Physical Chemistry at the University of Manchester. A distinguished physical chemist is contradicting what philosophers say about science as a very precise and quantitative enterprise. More significant, in retrospect, is the way this brief letter poetically embodies the major ideas of Polanyi's mature theory of knowledge. Here we can look back now and see the germ of tacit knowing and the way it explains how science works through skills, apprenticeship, and tradition.*

In 1962, I found this letter in the University of California, Berkeley library and showed it to Polanyi who was then at the Center For Advanced Studies in the Behavioral Sciences at Stanford. He read it over and laughed as he saw the continuity between it and his 1962 Terry Lectures, which later became ***The Tacit Dimension****.*

Richard Gelwick

Sir,

The subject of chemical concepts as opposed to physical ones has always been fascinating to me because it shows the great value of inexact ideas. It is easy to prove that no completely exact statement can be of any value in natural science, but when applied to physics the argument always appears to be a combination of far-fetched trivialities and sophistry. Of course, the mere fact that there is no absolute security for the validity of what we consider exact natural laws should lead to the conclusion that these laws are only valuable in combination with the element of uncertainty in them, which is compensated by the supreme sanction of validity, which is faith.

This, however, shows itself in a much more matter-of-fact fashion when we consider chemical concepts. Chemistry is a world of ideas expressed by such terms as "relative stability," "affinity," "tendency," "inclination," "general expectation," as descriptions of behavior. There is not a single rule in chemistry which is not qualified by important exceptions. The character of a substance or class of substances is as complex as the features of physiognomy and the art of chemistry appears to be the power of being aware of these complex attitudes of matter, and in a thousand delicate attempts to add further evidence to, and enlarge the field of this awareness; thus, were a million compounds synthesized it would be an achievement which could never have been attained by exact methods. It is indeed obvious, that if at any time chemists would have been so ill-advised as to let themselves be frightened by physicists into abandoning all vague methods, and to restrict themselves to the field where exact laws (or what are supposed to be such by the physicists) pertain, the development of chemistry, would, at that moment have stopped dead, and its most

valuable parts would have melted away in the rays of such foolish criticism.

I think it is good to contemplate how useless, or even harmful exactitude becomes at so close quarters to physics. Just link up two of three of the atoms of physics, and their behavior becomes so complex as to be beyond the range of exactitude. How supremely unreasonable it appears then, to claim that, by precise measurements and mathematical treatment, i.e. physical exactitude, a vital knowledge and command of such objects as living organisms and social bodies should be found. All these fields of high complexity gain real profit only from the discovery of specific tendencies of behavior incorporated in their functional outlines.

Chemistry, indeed, leads us so far away from physics, (or let us say, that physics appears, when we look at chemistry, so far remote from everything else in the world) that the description of chemical substances and the art of dealing with them lies quite near, by comparison, to the types of human behavior and the art of commanding human behavior. The mythological language of the alchemists persists in chemistry and is still characteristic of its most vital element.

M. Polanyi

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