

A Pleasant Adventure

Phenomena, Atoms and Molecules: an attempt to interpret phenomena in terms of mechanisms or atomic interactions. By Irving Langmuir. 436 pp. Philosophical Library, New York, 1950. \$10.00.

Must a book of this sort be reviewed by an expert in the fields covered? That would be difficult when the book is by a worker so versatile as Irving Langmuir. I for one have profited directly from small segments of his achievement, but I certainly cannot hope to follow him with any competence through all of the fields explored in *Phenomena, Atoms and Molecules*.

The book is a reprinting, without comment, except for those in the five-page introduction, of twenty papers, or about a tenth of those the author has written. These twenty and the rest are listed in a complete bibliography at the end of the book. Some of the technical papers are a direct reporting of research and have appeared, for instance, in the *Physical Review* or the *Journal of the American Chemical Society*. Others review fields of Langmuir's work, as the Nobel Lecture on *Surface Chemistry* and a Perkin Medal lecture on atomic hydrogen. A few papers, such as *Science, Common Sense and Decency*, are nontechnical.

For the uninitiate the technical papers can be a pleasant adventure. They begin with the simplest of ideas, the simplest of mathematics; they invoke deceptively simple experiments, and they lead one in plain English to unexpected conclusions. Here is the real wonder in science, the action of a clear and intuitive mind in unraveling seemingly hopelessly confused behavior in terms of a few simple, understandable concepts. There is no better way to find out how science really works than to follow Langmuir, for instance, in his adventures with surface adsorption or surface films.

In that these adventures in science are recounted unaltered as they appeared originally, the telling is most direct and honest. However, through rewriting or even through introductions, the material could easily have been given a more general interest. The simple laws invoked could have been introduced and explained to the uninitiate, and something of further stages of the story could have been told through an evaluation of work done in the twenties and thirties in the light of present-day knowledge.

There is more in this book than the facts of scientific adventure. There is an explanation of that attitude, both of Langmuir and of the company for which he worked, which made this adventure possible. Langmuir chose fundamental problems because they interested him. General Electric profited handsomely through this. Langmuir made valuable inventions and contributions to the art merely by keeping his mind and eyes open as he pursued his task of understanding. Of course, this way of working requires superior talent, but in a day when even universities may have highly organized research programs directed toward narrow ends, one wonders if there is enough of it in American scientific and technical life.

Some of the papers in the book discuss philosophical and

social matters. Philosophically, Langmuir classifies many natural and social phenomena as "divergent phenomena" to which strict causality does not apply, and in which large consequences arise from small indeterminate events. Of social problems he says, "I believe the field of application of science in such problems is extremely limited." "There is no logical scientific method for determining just how one can formulate such a problem or what factors one must exclude. I see no objections to recognizing that the field of science is limited." "Why not do what the human race always has done—use the abilities we have—use common sense, judgment and experience?" All this would be extremely discouraging if one were forced to swallow it whole. But systems containing statistical elements can be stable as well as unstable. When they are stable, useful statistical predictions can be made. Even unstable systems can be dealt with to some extent, or at least the fact of and the reasons for their instability may be recognized.

Langmuir's judgments on various matters are those of an able and experienced man, and they are therefore worth weighing. They are stated briefly in a few chapters, with none of the development accorded to his scientific work. Some of them are:

"I believe that this patent system more than any other factor has been responsible for the great industrial progress in our time.

"... monopolies are necessary and beneficial when properly controlled.

"A much more reasonable principle of taxation would be that taxes would be distributed according to the best public interest. With such a principle the importance of incentives would be recognized.

"Some important Army and Navy post-war projects must be assigned to private industrial laboratories almost solely because of the known impossibility of carrying out this work in Government Laboratories under Civil Service restrictions.

"Old age pensions, unemployment compensation, the 'right to a job' often tend to remove incentives which would be in the public interest.

"A science program to be efficient must be planned by scientists.

"The Russians are shrewd bargainers. . . . Then they live up to their commitments scrupulously."

Undoubtedly there is wisdom here, but there may be some difficulty in unerringly picking it out. Honesty and directness are, however, great virtues. Langmuir admits in the preface that he was wrong about Russia, but he nevertheless publishes just what he said.

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On Using Electron Microscopes

Electron Microscopy—Technique and Applications. By Ralph W. G. Wyckoff. 248 pp. Interscience Publishers, Inc., New York, 1949. \$5.00.

The progress of the scientist toward an understanding of natural phenomena is most apparent at those times when he is able to discern a general relationship or "law" which embodies a collection of heretofore unrelated experiences. He then advances with a new all purpose mental tool vastly simpler to wield than the manifold specialized ones which it replaces. Other scientists learn its use and wide application of the new principle is made, its limitations begin to appear, finally to stand out clearly and demand another