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Book Review: *The Kinetic Theory of Gases*

The Kinetic Theory of Gases: An Anthology of Classic Papers with Historical Commentary. S. G. Brush, World Scientific Publishing Co., River Edge, NJ, 2003.

This volume includes a compilation of classic papers on the Nature of Gases and of Heat in Part I and Irreversible Processes in Part II. In addition, in Part III there are Historical Discussions by the author. The compilations in Parts I and II have been previously published as have the discussions in Part III. Part IV is an extremely useful bibliography of papers on kinetic theory and thermodynamics.

In Part I, there are classic papers by Boyle, Newton, D. Bernoulli, Gregory, Mayer, Joule, von Helmholtz, Clausius, and Maxwell with an introduction by the author. All of these names are familiar except, perhaps, Gregory whose work published in 1798 strongly advocates the caloric theory. The general topics discussed include kinetic theory and gas laws, caloric theory, and conservation of energy.

What I found most interesting are the contributions of much less familiar names and the role of the Royal Society in repressing important scientific contributions. Boyle's Law seems to have been postulated originally by Richard Townley and Henry Power. Their work and that of the more famous contributors was attacked by scientific dilettantes like Thomas Hobbes and Franciscus Linus. D. Bernoulli had a much more important role in developing atomism and kinetic theory than I knew.

The two men whose work was most directly affected by the Royal Society's inbreeding and intolerance were John Herapath, who wrote convincingly about kinetic theory and anti-caloric theory in 1821, and John Waterston, who wrote a significant contribution to kinetic theory in 1851. The manuscripts of these men were not published by the Royal Society due to the opinion of Roget, who later contributed more usefully to mankind by publishing his thesaurus.

In Part II on Irreversible Processes, there are classic papers by Maxwell, Boltzman, Thomson, Poincare, and Zermelo and an introduction by the author. The papers by Maxwell and Boltzmann describe the

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development of kinetic theory and the concept of the mean free path. The results of Maxwell and Boltzmann were carried to completion by Chapman and Enskog.

The H theorem was introduced by Boltzmann and the consequences of the second law of thermodynamics were laid out by Clausius. There were strong statements against these ideas by Ostwald, Duhem, and Mach. The H theorem was also attacked by a number of authors because of the concept of recurrence. The leaders in this attack were Loschmidt, Poincare, and Zermelo and, surprisingly, Nietzsche, who became extremely interested in the subject and took up the study of physics and mathematics.

The second law was developed further by W. Thomson (Lord Kelvin) and von Helmholtz. Thomson pushed the concept of the Dissipation Theorem in which the universe runs down as the entropy increases. The Dissipation Theorem had an effect on geology and the determination of the age of the earth with controversy among Thomson and Tait and Huxley. Because of the Uniformitarian Theory of Thomson, there was doubt about the Darwin–Wallace theory of biological evolution because it was too slow and would be overtaken by the running down of the Universe. Thomson had pushed his ideas too far since he neglected the effect of radioactivity. These incorrect consequences of the second law were taken up by Herbert Spencer and Henry Adams.

Thus, as in modern times, valid scientific ideas like entropy and irreversibility led to misunderstandings of nature even by superb scientists like Lord Kelvin.

Part III is a compilation of articles published by the author on Gadflies and Geniuses, Irreversibility and Indeterminism, the Impossibility of Ergodic Systems and Statistical Mechanics, and the Philosophy of Science. By far the most interesting is the first article on Gadflies and Geniuses in the History of Gas Theory. Among the gadflies were Buys-Ballot, Loschmidt, and Zermelo, who forced the developers to concretize their results. In general, in this section, there is too much emphasis on phase transitions and not enough on the progress in Brownian motion, hydrodynamics, and slow phenomena-like jamming.

One of the most important contributions of this volume is the bibliography in Part IV. It is entitled: A Guide to Historical Commentaries: Kinetic Theory of Gases, Thermodynamics, and Related Topics.

This is a useful book and should be on the shelves of all kinetic theorists and statistical mechanics.

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