story of historical reports on the glowing of cats' eyes, the light of the warrior's eyes during battle, Aristotle's observations on light which appears when the eyeball is pressed, and so forth. The first recorded explanations of the phosphorescence of the sea, wood, and flesh are ingenious and fantastic when compared with contemporary beliefs. It is surprising how frequently luminescence stimulated the great men of all branches of science, and, as Newton Harvey points out, the "history of luminescence is a guide to the history of science in general." It might also be said that men of literature were influenced by luminescence: for example, Dante, in the *Inferno* ("Fire-flies innum'rous spangling o'er the vale") or Shakespeare, in *Pericles* (1609) ("Like a glow-worm in the night the which hath fire in darkness, none in light.")

Harvey, who has spent more than 40 years in the study of luminescence, has provided us with a very readable and detailed history of a subject which is fast becoming the universal method of illumination and communication.

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Concepts of Force. A Study in the Foundations of Dynamics. Max Jammer. Harvard University Press, Cambridge, Mass., 1957. viii + 269 pp. $5.50.

Physical theories operate with concepts which, though free creations of the human mind in their strict logical character, are usually found to have their roots in human experience extending over long periods of time. Hence, critical examination of them is a peculiar combination of historical and methodological research. This is particularly true of the concepts of mechanics, the oldest of physical theories. The attitude of scientists toward these has undergone great changes from the days of Greek science to our own. It is the purpose of the author of *Concepts of Force* to trace the development of the idea of force from its meaning in ancient physics to that in 20th-century science.

The story is a long and complicated one, demanding great skill on the part of the writer in the choice of the relevant elements in an enormous body of more or less obscure material. He has to search for the origin of the idea in the groping attempts of our ancestors to give an explanation for motion in general, based on the analogy with human exertion and activity represented in such terms as *effort, force, power, work*. He must then proceed to note how these ideas were refined by abstract thinkers, given quantitative status, and made useful for the solution of practical problems. Finally he has to show how, in the process of refinement, the concept of force reaches the stage where it can be eliminated from the logical structure of the theory without hampering the deductions of the latter and becomes a mere heuristic device whose precise philosophical meaning no longer has significance.

The author has obviously studied the literature with great thoroughness. Historians will approve his dependence, in most cases, on original rather than secondary sources. His interpretations are carefully made, though he is candid in admitting the ever-present difficulty of really understanding what ancient writers on mechanics meant by what they said. This problem makes the history of science an involved and uncertain discipline, though perhaps only a few degrees more so than history in general. Two-thirds of the book is devoted to the history of the force idea, from Galileo to modern times. There is a particularly good discussion of the problem of the possible influence of theological ideas on Newton's concept and of the converse problem of the influence of his mechanics on theological thought in the 18th century. Probably not enough attention is paid to Newton's third law, which has had such an enormous influence on the development of modern physics through the conservation theorems.

I am glad to see adequate justice done to the ingenious ideas of Boscovich (1745), with his point centers of force. Moreover, there is an excellent presentation of the famous controversy between the followers of Descartes and of Leibnitz on the "true" measure of the effect of a force. Through the careful critiques of Hertz, Mach, and Poincaré, the logical status of force in modern physics has been completely clarified, though the melancholy fact remains that many writers of elementary textbooks are still not aware of this. It is to be hoped that the publication of books like that of Jammer will help to rectify this situation.

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New Books

The Shakespearean Ciphers Examined. An analysis of cryptographic systems used as evidence that some author other than William Shakespeare wrote the plays commonly attributed to him. William F. Friedman and Elizabeth S. Friedman. Cambridge University Press, London, 1957. 320 pp. $5.

Marysvale, Utah, Uranium Area. Geology, volcanic relations, and hydrothermal alteration. Special Paper 64. Paul F. Kerr, Gerlad P. Brophy, Harry M. Dahl, Jack Green, Louis E. Woolard. Geological Society of America, New York, 1957. 212 pp.

Angular Momentum in Quantum Mechanics. A. R. Edmonds. Princeton University Press, Princeton, N.J., 1957. 154 pp. $3.75.

Synthesis of Passive Networks. Theory and methods appropriate to the realization and approximation problems. Ernst A. Guillemin. Wiley, New York; Chapman & Hall, London, 1957. 759 pp. $15.

Quantitative Inorganic Analysis. G. Charlot and Denise Bezier. Translated by R. C. Murray. Methuen, London; Wiley, New York, 1957. 701 pp. $15.

The Visual Pigments. H. J. A. Dartnall. Methuen, London; Wiley, New York, 1957. 223 pp. $6.

An Encyclopaedia of Annual and Biennial Garden Plants. Faber & Faber, London, 1957 (order from Macmillan, New York 11). 488 pp. $12.50.

The Faunal Connections between Europe and North America. Carl H. Lindroth. Wiley, New York; Almquist & Wiksell, Stockholm, 1957. 344 pp. $15.

Bacterial Fermentations. H. A. Barker. Wiley, New York; Chapman & Hall, London, 1956. 102 pp. $3.

A Classified Bibliography of Gerontology and Geriatrics. Supplement 1, 1949–1955. Nathan W. Shock. Stanford University Press, Stanford, Calif., 1957. 553 pp. $15.

Nomina Anatomica. Fr. Kopsch. Thieme, Stuttgart, Germany, 1957. 166 pp. $1.55.

For Future Doctors. Alan Gregg. University of Chicago Press, Chicago, 1957. 174 pp. $3.50.

Science in Australian Primary Schools. C. D. Hardie. Melbourne University Press, Carlton, N.3, Victoria, 1957 (order from Cambridge University Press, New York). 90 pp. $3.75.

Advances in Radiobiology. Proceedings of the Fifth International Conference on Radiobiology held in Stockholm on 15–19 Aug. 1956. George Carl de Hevesy, Arne Gunnar Forssberg, John D. Abbatt. Oliver & Boyd, Edinburgh, Scotland, 1957. 519 pp. 77s. 6d.

Dawn in Arctic Alaska. Diamond Jenness. University of Minnesota Press, Minneapolis, 1957. 222 pp. $4.75.

Chemistry for the Laboratory. Alfred B. Garrett, Joseph F. Haskins, Thor R. Rubin, Frank H. Verhoek. Ginn, Boston, ed. 2, 1957. 423 pp. $4.25.

Language: An Enquiry into Its Meaning and Function. Ruth Nanda Anshen, Ed. Harper, New York, 1957. 384 pp. $6.

Religion without Revelation. Julian Huxley. Harper, New York, 1957. 252 pp. $4.

The Divine Quest in Music. R. W. S. Mendl. Philosophical Library, New York, 1957. 265 pp. $7.50.

Handbook of Chemical Data. F. W. Atack, Ed. Reinhold, New York, 1957. 629 pp. $6.75.

The Carbohydrates. Chemistry, biochemistry, physiology. Ward Pigman, Ed. Academic Press, New York, 1957. 919 pp. $20.

Conservation. An American story of conflict and accomplishment. David Cushman Coyle. Rutgers University Press, New Brunswick, N.J., 1957. 296 pp. $5.