Book Reviews

American Chemists

The Professional Scientist. A study of American chemists. Anselm L. Strauss and Lee Rainwater. Aldine, Chicago, 1962. xiv + 282 pp. $6.

In view of the fact that the authors had previously made a survey of one of the nation's leading governmental scientific agencies, they must have been aware of the "unique characteristics" which are required of a career government scientist and which distinguish him from the academic and the industrial scientist. The government scientists (and scientists who work in State and foundation laboratories should be included in this group) constitute a group almost as large as the academic group, and they certainly merit separate consideration in studies of this sort. Combining the government science group with the scientists who work in industry would appear to reduce the differences between the academic and the government-industry group, for it is often obvious that academic and government scientists have similar attributes that are different from those of the industrial scientists. The average of a group is not as informative as the deviations from the average. The average may be gray, but the constituent parts may be either white or black.

The objectives of the survey were apparently to determine the chemist's attitude toward his professional society (the American Chemical Society) and to ascertain what he feels he can do for the society and what it can do for him. Many questions were asked of many people but, in the words of the sage, "we seem to have come out the door wherein we went."

One is often led to believe that the experienced social survey worker has a set of carefully worked out questions and that the answers to these questions lead by machine combination to a series of precise analytical values, although the questions may not appear, to the person interviewed, to be significant or interrelated. If there is a simple key to the questions used by those who conducted this survey, it is not apparent; although the answers to many questions are interesting, in that they show the various attitudes of the professional scientist, there are few indications of what should be developed, or of what should be repressed, other than that which is already known and supported.

The chemist who supports his society is interested in knowing how those chemists who do not belong explain their inactivity. It appears that too few were queried to provide a reasonable sample, and the concentrated geographic locations of the sample would lead to other factors that are not included in the inquiry.

The conclusion that chemists are normal and do what would be predicted or expected is not surprising. Nor is it surprising to know that, because such a wide variety of attitudes is encountered among the group, the average is not typical.

Perhaps I am disappointed because I expected more than can be realized from a sociological survey. If the results portrayed are typical of such surveys, then one must concede that the science of social research has to make considerable progress before it can be as precise in analysis as the chemical sciences.

The survey should provide students, who are concerned with the attitude of scientists, with some useful raw material, but it will not serve as a well-developed guide to those who seek advice on how to administer a scientific society.

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Thermodynamics

Thermodynamic Properties of Helium. To 50,000°K. Wilbert J. Lick and Howard W. Emmons. Harvard University Press, Cambridge, Mass., 1962. v + 122 pp. Charts. Illus. $3.25.

The current interest in gases at temperatures so high that appreciable ionization occurs has led to a demand for information on transport and thermodynamic properties of systems in this region. The advent of digital computers permits the printing of tables of properties, given by the equations of kinetic theory and statistical mechanics, from photographic reproductions of the typed output of the computer. In the present tables Lick and Emmons list (i) the density, energy, enthalpy, entropy, constant volume and constant pressure heat capacities, speed of sound, composition, electron density, and compressibility factor for an equilibrium mixture of He, He^+ He^{++}, and e^- from 8000° to 49,800°K at intervals of 200°, and from 10^{-4} to 10^3 atmospheres at each power of ten; and (ii) the energy, enthalpy, entropy, and constant volume heat capacity of He and of He^+ over the same temperature and pressure ranges. Two large scale Mollier charts for equilibrium helium are boxed with the pamphlet.

Helium was chosen because of the simplicity of the model required to write down its partition function. Even so, approximations are necessary. The thermodynamic properties of each of the species were calculated by neglecting the effect of particle interaction on the determination of system energy levels from particle energy levels (the perfect gas assumption) but including this effect on the particle energy levels. For the latter, the approximate treatment of Unsöld was used.

The properties of the mixture were then found from the calculated composition and the properties of the species were found by application of the Gibbs-Dalton law (mislabeled Dalton's law, as usual).

Many possible sources of error are given careful study and evaluation in so far as this is possible. The authors conclude that their method of calculation yields values which are accurate to within a few percent up to pressures of the order of 10^3 atmospheres and from room temperature up. This esti-

mate may be true in the temperature range of the tables, but a simple calculation of density will show that it is not correct for room temperature.

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History of Science

The World of Leonardo da Vinci. Man of science, engineer, and dreamer of flight. Ivor B. Hart. Viking Press, New York, 1962. 374 pp. Illus. $7.95.

The universal genius of Leonardo da Vinci has attracted considerable attention since the first portion of his manuscripts was published as the *Trattato della Pittura* in 1651. That treatise on painting was assembled by Francesco Melzi, his heir and admirer, from the great, encyclopedic miscellany of 5241 holograph pages which Leonardo left behind in his cryptic, refractory script. It initiated the raids into, and the reconstructions from, the manuscripts which, from the 17th century to the present, have given us the works of da Vinci—a series of books on such topics as architecture, painting, engineering science—which the author himself never saw, and which, in some cases, he might never have recognized as his own if he had.

Among those who have discussed the technical and scientific accomplishments of Leonardo in English, Ivor Hart's work remains among the best. His earlier book, *The Mechanical Investigations of Leonardo da Vinci* (1925), was an achievement of considerable merit. Indeed, his new volume, *The World of Leonardo da Vinci*, is disappointing when read with the book published 37 years ago in mind. The new book is prettier, the plates and diagrams not only more abundant but qualitatively improved, but in all other respects it falls far short of the earlier standard.

In almost half the volume (144 pages) Hart attempts to cover the historical background of Leonardo's life and times. It should never have been written; the purpose is laudable, but the accomplishment is lamentable. The reader is treated to a series of outdated clichés on the cultural history of Western Europe from classical antiquity to the city-states of Renaissance Italy, that would barely pass muster in a freshman history survey course. Recent research in the history of science, especially for the background period in question, is almost completely neglected, and occasionally we are treated to really astounding statements. "Democritus . . . is of importance because of his association with the early history of alchemy" (p. 113). We are not given the evidence for this argument. "The atomic theory was quietly forgotten [after Lucretius] until it was revived in the nineteenth century by Dalton" (p. 114). To say the least, this ignores the 17th-century atomism of Pierre Gassendi, Robert Boyle, and Isaac Newton. In speaking of Aristotle, Hart writes, "we should record his notable contributions in the field of deductive geometry" (p. 118), but the meaning of this extraordinary remark is never developed!

In the discussion of Leonardo's work itself, the author is on more certain ground, and his familiarity with Leonardo's writings is immediately obvious. Leonardo's flair for technological innovations and his rich intuitive grasp of the principles of mechanics are brought out with fine expository skill, whether the issue be the simple application of levers or the complex distribution of forces in the problem of flight. Yet, even here, the reader may take issue with the author, for the latter part of this new book is basically a reorganization of his older study of Leonardo's mechanics. Some additional material has been incorporated into the text (such as the work of L. Reti and G. H. Gibbs-Smith), but the new narrative does not make other changes very clear. Much of the earlier book has been mined for precious pages, and these nuggets (without alteration or even reference to the previous lode) have been set into the present text as if they were newly discovered gems.

Ivor Hart's *da Vinci* is neither a carefully revised edition of his earlier study nor a new treatise set into the context of recent research into medieval and renaissance science. Either approach would have been very welcome from one who has devoted a lifetime to the study of Leonardo da Vinci, as Hart has. Unfortunately this is not what we have received.

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Fossil Brains

Cerveaux d'Animaux Disparus. Colette Dechaseaux. Masson, Paris, 1962. 148 pp. Illus. NF. 25.

The brain is the most important single organ of the vertebrates, and the study of its progression and diversification is an essential branch of evolutionary biology. Although the brain, as such, is never preserved in fossils, its outer form can often be reconstructed with some fidelity from casts of the interior of the bony skull. That is particularly true of mammals, in which the bones closely model the soft tissues immediately surrounding the brain. Paleontologists from Cuvier on have described hundreds of endocranial casts, often loosely called "fossil brains," of extinct animals. In this small book Colette Dechaseaux has provided an interesting semipopular introduction to those studies.

Although they have an interest of their own, isolated descriptions of endocranial casts have little general significance unless they are related to evolutionary sequences and principles. In 1884 O. C. Marsh published "laws" (generalizations) of mammalian brain evolution which rested on shaky, indeed partly incorrect evidence, but some of which are now supported on better grounds. In a monograph of 1948 Tilly Edinger demonstrated the objective, descriptive evolution of the horse brain by a long phylogenetic sequence from eohippus to the living horses. Dechaseaux points out that this work established a new basis for a science of paleoneurology, but it must be added that the example remains unique. Most of Dechaseaux's own attempts to formulate new interpretive principles are not convincing, and the needed, more meaningful synthesis in this field is not yet in sight.

The materials for Dechaseaux's summary are largely drawn from scattered sections, mostly by Dechaseaux herself, in the *Traité de Paléontologie*, published under the direction of P.-P. Grassé, and further particulars and references must be sought in that work. A basis for further progress is being laid by Edinger in an annotated bibliography that is well advanced but not yet ready for publication.

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