

oceans, and, in addition, suggests numerous problems for further examination.

The material is voluminous, and there is much more to come. It is obvious that marine geologists must reserve large portions of their time, resources, and interest for the opportunities that this material presents. It is equally obvious that the energy, initiative, and monies devoted to acquiring the cores, which constitute a major share of the total effort devoted to

oceanographic studies, must be matched by equal support for the research that this material permits. This will require the same degree of imaginative far-sightedness on the part of the National Science Foundation that caused it to support the drilling project to begin with. This report provides a strong foundation and justification for continued effort.

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Three-Dimensional Geodetic Measurement

Mathematical Geodesy. MARTIN HOTINE. Environmental Science Services Administration, Washington, D.C., 1969 (available from the Superintendent of Documents, Washington, D.C.). xvi + 416 pp., illus. \$5.50. ESSA Monograph 2.

Geodesists, concerned with measuring and mapping the earth's surface, have been traditionally thinking in terms of the two surface dimensions rather than the three dimensions of space. Maps are two-dimensional. This does not mean that elevations are not taken into account, but the way this is done reflects a characteristic bifurcation in geodesy: horizontal position and elevation are treated in completely different manners. This is quite natural, since the system of horizontal and vertical not only permeates our everyday life but also serves to orient the surveyor's instruments.

Carl Friedrich Gauss was inspired by his geodetic work when he founded, 150 years ago, the intrinsic differential geometry of surfaces, the surface being considered as a kind of two-dimensional space, abstracted from its three-dimensional environment. Subsequently, Bernhard Riemann generalized Gauss's conception of an intrinsic geometry from two to an arbitrary number of dimensions; and Riemannian geometry in four dimensions forms the mathematical background of Einstein's General Theory of Relativity, tensor calculus providing the technique.

At present the traditional bifurcation of geodesy is under fire from different sides. Theorists, dissatisfied with it for conceptual reasons, have insisted on a "three-dimensional geodesy" which treats the horizontal and the vertical on an equal basis. And in the last 10 or 20 years the mission of geodesy has extended into space and artificial

satellites have introduced new measuring techniques for which a separation into horizontal and vertical no longer makes sense.

Martin Hotine was one of the most ardent and most influential champions of the three-dimensional concept. Shortly before his death he finished this comprehensive presentation of his ideas.

It is an unusually well written book. The reader will enjoy both a continuous, flawless line of mathematical reasoning and brilliant comments. He will learn a great deal about the mathematical and physical foundations of geodesy, about triangulation no less than about the use of the earth's gravity field and of satellite orbits.

Characteristic for the book and in no small measure contributing to its charm is its exquisite mathematical texture, which is three-dimensional differential geometry treated by means of general tensor analysis—the bifurcation of geodesy helped to create the weapon later to be turned against it. Tensor calculus permits a unified treatment of the various, often curvilinear, coordinate systems currently used and stresses the theoretical equivalence of all reference systems. It is thus excellently suited for the book's purpose, especially when handled with Hotine's virtuosity.

Hotine's book is frankly unconventional and intensely personal: "This book is an attempt to free geodesy from its centuries-long bondage in two dimensions. . . ." It is certainly the most fascinating attempt in this direction.

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Chinese Livestock

Domestic Animals of China. H. EPSTEIN. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England, 1969. xviii + 166 pp. + plates. 80 s.

H. Epstein of the Hebrew University in Jerusalem is the acknowledged authority on domestic mammals of Africa and the Near East; he visited China in 1963 at the invitation of the Chinese government to record by description and photograph the rapidly disappearing local breeds of domestic mammals in Manchuria, Inner Mongolia, Tibet, and China proper. The resulting semi-popular book, enriched with a wealth of historical detail, is both a catalog and an encyclopedia.

Each species has a general introduction, which usually includes data on its earliest domestication and presence in China; then follows a description of each breed and its varieties with data on size, weight, growth rate, color, uses, and capacities, followed by its history insofar as it is known and sometimes interesting anecdotes about the animals. If pertinent, as in the case of pigs and dogs, historical information on the introduction of different varieties into Europe and America is included, and similar information is offered on any recent importation of several kinds of breeding livestock into China. There is thus a wealth of illustrated, well-documented (and well-indexed) information here that is not to be found elsewhere. Of Chinese domestic mammals, only cats are ignored, except for mention of Persian cats in Peking in the 18th century. Common cats, similar to the American and European alley variety, are present everywhere in China, generally at least one to a household, I am told by people who have lived there. True, there is no tradition of breeding of varieties of cats in China, but the total lack of mention of them is strange.

A single map is provided, and on it only the provinces are named. One is assumed, therefore, to know rivers, cities, towns, and the names of local areas; few of us do, and this lack of compensation for the natural ignorance of almost every reader is an annoyance.

I find it interesting that the Chinese, so systematically encyclopedic about so many matters, have never compiled a record of the varieties of their own domestic mammals. Now many of

these local populations are disappearing, quite as has happened elsewhere in the world, under necessities imposed by central planning for standardizing livestock for purposes of greater production. Thus local gene pools, adapted to local conditions of environment or human culture, are being lost, as are a wealth of localized beliefs and practices of management. Someday people will be interested in recovering this information, and Epstein's book may be the only source they will have for some of it. Even here, except for information on toy dogs (information which the Chinese already have), there is not much on the history of selection leading to varietal specialization. Probably little of this information was ever recorded, and thus it was not available to Epstein.

The pig, with more than 100 recorded varieties, easily earns its popular place as China's most important domestic mammal. Considering that Chinese pigs, from Inner Mongolia south, seem to function in major part as ambulatory fat reservoirs, the wide distribution and great popularity of fat-tailed sheep is surprising; however, these sheep do not occur in the southern third of China, where the pig is ubiquitous, and do have their major distribution in the drier areas of northern China where pig raising (although often accomplished) is not so easy as in the semitropical south.

With regard to histological details and qualities of fleece of sheep, cashmere goats, camels, and reindeer (these last limited in China to a small part of the northeastern Inner Mongolia), Epstein often tells us more than most of us are going to want to know. I suspect that wool in particular and fleeces in general are favorite subjects with him. His enthusiasm for the pilose even extends to pig bristles, which obviously are still an important by-product of pig raising.

Although the book is essentially a practical compendium on cattle, yaks, buffalo, sheep, goats, reindeer, camels, pigs, horses, asses, mules, and dogs, many bits of quaint and otherwise forgotten lore are included. One not mentioned, however, comes to mind by the omission. The only human use for yak tails listed is as fly-whisks. How have the mighty fallen to lowly functions? When Genghis Khan was the scourge of the world his standard consisted of nine yak tails; when the yak tails were raised and the kettledrums roared, for-

ward swept the horsemen and empires fell. That is the proper function of a yak tail!

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East European Neuroscience

Neurobiology of Invertebrates. Proceedings of a symposium, Tihany, Hungary, Sept. 1967. J. SALÁNKI, Ed. Plenum, New York, 1968. 504 pp., illus. \$27.50.

Although only a few of the 34 papers in this volume do more than present recent research, the book is interesting because about two-thirds of the articles are from laboratories in Eastern Europe. Their standard of research is high in the fields of neuroanatomy and biophysics. Papers such as those on cephalopod statocysts (Vinnikov *et al.*, Leningrad), structural changes in photoreceptors of arthropods caused by light (Röhlich, Budapest), and the influence of ionic environment on the activity in giant neurons of mollusks (Kostyuk, Kiev) show that there is no noticeable difference with the best research in the Western part of the world. In the field of integrative neurophysiology the Eastern research still clearly suffers from the mysticism and authoritative inheritance that have characterized neurophysiology, especially Russian, for many decades.

It should be pointed out that the title of the book may be slightly misleading, for mollusks have by far the most pages devoted to them, with arthropods a poor second and other phyla having few or none. Though mollusks have come very much in the limelight because of their identifiable cell bodies, such a distribution reflects more the interest in the Eastern countries than that on a global scale. One paper, illustrating an important use of the features of molluscan nerve cells, may be especially mentioned. Glazner (Southampton) studied systematically the effect of four potential transmitting substances on a good-sized population of identified cells in the garden snail, *Helix aspersa*. It was found that even neighboring cells, though reacting identically in different specimens, showed a wide variation in their reactions to the four substances—a beautiful proof of the diversity in properties of central nervous elements.

In some of the Eastern articles, the language barrier is still present, so that it is difficult to understand what the author really means, but this is here less pronounced than one has come to expect. Figures and general editing are of good quality, but a definite drawback is the absence of an index, which would have been useful even if it only included the names of chemical substances and species. In general, this book illustrates again that, at least in invertebrates, the innate properties of nerve cells are of great diversity and that one should not neglect these properties when networks based on interconnectivity are modeled to represent central nervous functions.

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A Primate Group

The Chimpanzee. Vol. 1, Anatomy, Behavior, and Diseases of Chimpanzees. G. H. BOURNE, Ed. Karger, Basel, and University Park Press, Baltimore, 1969. xii + 468 pp., illus. \$28.50; by subscription, \$25.

This book, the first volume of a proposed multivolume series, is in effect an account of the anatomy of the head and brain of the chimpanzee. Chapters on the growth changes in the skull, face, jaws, and teeth, on the larynx, and on the brain constitute 70 percent of the text. Apart from Schultz's general review of the skeleton, the anatomy of the chimpanzee ends at the neck.

The behavior section is composed of two short chapters, one on comparative nesting patterns of the great apes and one on research on home-raised chimpanzees. The section on disease is equally condensed, there being two shortish chapters, one on malaria and one on intestinal infections. Although not flagged in the subtitle the first two chapters, by W. C. Osman Hill on the discovery, geographic distribution, and history of the chimpanzee, are satisfyingly learned, well-written, and informative.

The book, I am afraid, is a thorough hotchpotch, unbalanced, uninspiring, and unrepresentative. The problem facing a reviewer of multi-authored volumes is to differentiate between the worth of the individual contributions and that of the total concept. There is