ment, on the other hand, often involves a "shotgun approach" with many different kinds of drugs being applied even though many of them might not likely be of any benefit. This practice seems to follow from the lack of emphasis on specific diagnosis and from the cultural expectation of Chinese patients that they receive "powerful" drugs when they are in the hospital.

According to this book, medicine in China seems to be practiced quite well, given the economic and technological constraints. However, the authors suggest that the authoritarianism of the *danwei* system may stifle innovation and impede coordination among different sectors of the society, thus in the long run impeding the modernization of medicine in China. Recent changes in Chinese economic policy may lead to a relaxation of the grip of the *danwei* on urban life, but even if this happens *The Chinese Hospital* will remain an important baseline against which to measure the direction of China's economic and political changes.

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History of Mathematics

Number Theory. An Approach through History. From Hammurapi to Legendre. ANDRÉ WEIL. Birkhäuser, Boston, 1984. xxii, 375 pp., illus. $24.95.

André Weil has prepared an incisive and well-written account of the development of number theory. His book is divided into four chapters and 11 appendixes. The chapters are (i) a quick trip through the ancient world, with particular attention to the contributions of the Mesopotamians, Greeks, and Indians; (ii) a visit with Fermat (1601–1665); (iii) an extended stay with Euler (1707–1783); and (iv) brief stops to see Lagrange (1736–1813) and Legendre (1752–1833). Weil's account ends short of Gauss's monumental *Disquisitiones Arithmeticae* of 1801, though note is taken of the development of various themes in the hands of Gauss. The appendixes are devoted to technical matters, some detailed proofs, and accounts of the further development of some of the subjects.

The term "number theory" is used by Weil in the vernacular sense, namely to refer to the study of properties of integers. It is worth noting that this definition in fact omits many topics—for example diophantine approximation—that appear under "Number Theory" in the table of contents of *Mathematical Reviews*.

Let us view briefly two of Weil's principal personae, Fermat and Euler. Fermat was the first European since the Greeks to contribute significantly to number theory. A translation of the *Arithmetic* of Diophantus served as Fermat's inspiration and notebook. His contributions include methods of solving diophantine equations and criteria for representing numbers as sums of squares.

In addition, Fermat raised such important questions as his famous "last theorem" that the equation $x^n + y^n = z^n$ has no nontrivial solutions in integers x,y,z for any integer n exceeding 2. Weil considers this assertion to be outside the scope of the book and devotes little space to it. He describes the "last theorem" as the "one ill-fated occasion [when Fermat mentioned] a curve of higher genus" and notes with irony that it is the foundation upon which Fermat's "reputation in the eyes of the ignorant came to rest." Fermat established the case $n = 4$ by his method of descent, and he claimed also to have treated other cases as well, but no details are known about this or most of Fermat's other work. He failed to attract any worthy successors, and his subject became dormant with his passing.

Weil next describes how number theory was revived by the universal and prolific Euler. Euler's first venture into number theory was to disprove a conjecture of Fermat's that all numbers of the form $2^{2^n} + 1$ are prime. He proceeded to give proofs of most of Fermat's assertions. In fact, Weil uses these very arguments in the chapter on Fermat, "on the plausible but unproved assumption that [Fermat's proofs] could not have differed much from those later obtained by Euler." Euler went on to extend number theory into several new areas. Weil shows Euler struggling with quadratic reciprocity, launching the theory of partitions, and discovering remarkable properties of what is today called Riemann's zeta function.

The book offers an interesting picture of the progress of mathematics between the times of Fermat and Euler. Euler had employment as a mathematician; Fermat did not. Fermat had little algebra at his command; Euler's algebraic manipulations were impressive even by today's standards. We know of Fermat's work only through surviving letters, his personal notes in *Diophantus*, and one anonymously published paper. Euler, in contrast, published everything he regarded as serious work—70 volumes' worth!

The notation used in the book is generally modern, which greatly facilitates reading the mathematical details. As an example of early writing, consider Fermat's formulation of the so-called "Pell equation" (a misnomer due to Euler!): "Given any number not a square, then there are an infinite number of squares which, when multiplied by the given number, make a square when unity is added" (quoted from D. J. Struik, *A Source Book in Mathematics, 1200–1800*). Weil has also presented the material from a modern point of view, focusing attention on ideas that have proved fruitful. A very simple example is the interpretation of the algebraic identity

$$(x^2 + y^2)(z^2 + t^2) = (xz \pm yt)^2 + (xt \mp yz)^2$$

in terms of the norm of a complex number.

Weil's book is not light reading in the vein of E. T. Bell's *Men of Mathematics*. It does, however, present such a wealth of material so well that it should have appeal to people with varying degrees of interest in number theory, and its appearance is to be warmly applauded.

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Allometry

Scaling. Why Is Animal Size So Important? KNUT SCHMIDT-NIELSEN. Cambridge University Press, New York, 1984. xii, 241 pp., illus. $29.95; paper, $9.95.

Size, Function, and Life History. WILLIAM A. CALDER III. Harvard University Press, Cambridge, Mass., 1984. xiv, 431 pp., illus. $32.50.

Body size influences many structural, physiological, and ecological relations of animals, ranging from mitochondrial volumes and enzyme activities of different tissues to home range areas and rates of population growth. It is common practice to express these mass-influenced relationships with the power equation $Y = aM^b$, where Y is the predicted variable, M is body mass, and a and b are the empirically fitted coefficient and exponent. Some of these factors vary ("scale") proportionally with body mass (that is, $b = 1.0$), but most do not. Consequently this analysis is often termed "allometry," indicating non-isometric scaling of variables with body size. Size-dependent analysis has become increasingly popular in comparative physiology and ecology, and three books on the topic have appeared during the past year. Two of these, by Schmidt-Nielsen and Calder, respectively, are reviewed here; the third is *The Ecological Implications of Body Size* by R. H. Peters (Cambridge University Press, 1983). Though some of the same ground is covered in all three books, Schmidt-Nielsen's deals principally with physiological and morphological scaling, Peters's with scaling of ecological factors, and Calder's with the entire spectrum. Both Schmidt-Nielsen and Calder have been major workers in the field of allometric analysis and have contributed much original research to its development and promotion. Their books and viewpoints are thus of particular interest.

Schmidt-Nielsen's book is the basic introduction to the topic. As we have come to expect from his other works, it is entertaining, instructive, and clear. The material, which is presented at a level appropriate for undergraduate biology majors, is developed logically and discussed thoroughly. The design is attractive, although the presence of the sea serpent on the dust cover is unexplained. The book proceeds from examples and definitions through a discussion of allometry of structural features to a discussion of scaling of metabolic rate. Delivery of oxygen to tissues and scaling of factors associated with activity and thermoregulation are discussed subsequently. The best sections are the initial ones, which elegantly demonstrate the utility and power of allometric analysis. The section on oxygen delivery has several undocumented assertions (for example, the length given for the minimum possible cardiac cycle). The section on activity repeats familiar material that Schmidt-Nielsen has reviewed several times; its references are highly selective and the discussion is not comprehensive. Philosophically, the author's viewpoint is that of an adaptationist; his statement on optimal design is a clear assertion of the economy of nature and the efficacy of natural selection. The criticisms of this viewpoint by Stephen Gould and Richard Lewontin are not so much met as ignored. A more spirited and robust defense of adaptationism would have been both enjoyable and educational. I have no doubt Schmidt-Nielsen could have provided a challenging and entertaining one.

Calder's book is a more comprehensive and advanced discussion of allometry, appropriate for graduate students or faculty with some knowledge of the topic. It contains a compendium of numerous equations gleaned from a very diverse literature and would be useful for that alone. The text spans the same physiological topics covered by Schmidt-Nielsen but also includes ecologically pertinent topics such as the effect of body mass on reproduction, growth, and life history and adaptive digressions from allometric expectations. The treatments of these topics are among the best sections of the book, along with an excellent section on thermoregulation. The recounting is often personalized with a fair amount of philosophizing. The weakness of the book is its organization. In the author's enthusiasm for his subject, he often fails to develop his presentation clearly. For example, the chapter on structural support jumps immediately into the match of empirical data with a model of elastic similarity. There is no prior development of models of geometric, static, and elastic similarity and their predictive consequences, nor is one presented subsequently. A reader probably would not be familiar with this topic and could not follow this discussion. Calder often attaches points of general importance for methodology and theory to discussions of other matters. For instance, the discussion of the important topic of intra-versus interspecific allometry is appended to a discussion of interordinal differences in metabolic rates of birds. It is consequently often difficult to locate desired material.

These are useful books in different ways and are important contributions to the popularization of allometric analysis. I wish, however, that they were more critical of the methodology of and future directions for the approach. Several points should have been developed that were not. These include some stipulations about appropriate sample sizes, mass ranges, and analysis of mean values and unequal sample sizes among species. Calder implies that sample sizes need not be large, but we have already seen a complete reinterpretation of locomotor costs of bipedality when the number of species examined was increased. This should be an important cautionary tale. The inappropriate use of b exponents to examine design limits (for example, to "test" symmorphosis) should also be discussed. An important analytical approach not discussed in these books is the analysis and removal of mass effects (for example, by regression), which makes it possible by analysis of residual variation, either intra- or interspecifically, to expose correlated factors. Phylogenetically the coverage of these books is generally restricted to birds and mammals, although this limitation was not always necessary or desirable. Future studies might profitably concentrate on analysis of observed pattern rather than more description. We are still, for instance, far from understanding the basis of the interspecific scaling of metabolic rate ($b = 0.75$), although the relationship has been apparent for over 50 years. The differential allometry of metabolic rate intra- and interspecifically as pointed out by Alfred Heusner is a serious challenge to those who would attempt to explain the physiological basis of metabolic scaling. Its analysis may provide important clues concerning the basis of these patterns. The explanation of Thomas McMahon relating metabolic rate to maximal power output is a useful first approach but fails to explain metabolic allometry in important organs, such as kidney, liver, and brain, that are unrelated to muscular power generation or oxygen transport. It seems to me that a harder look at the methods and future of allometric studies would have improved both volumes, especially Calder's, which is aimed at a more advanced level.

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An Expedition to Pakistan

The International Karakoram Project. K. J. MILLER, Ed. Cambridge University Press, New York, 1984. In two volumes. Vol. 1, xxx, 412 pp., illus. $79.50. Vol. 2, xxviii, 635 pp., illus. $89.50. From two conferences, Islamabad, June 1980, and London, Sept. 1981.

This two-volume set contains papers delivered at conferences that took place before and after the International Karakoram Project (IKP). The IKP was a major expedition into the remote Karakoram Mountains of northern Pakistan using the recently completed Karakoram Highway, which follows the old silk road between India and China. The project was undertaken, in a two-month period, during the summer of 1980 as part of the Royal Geographic Society's 150th anniversary celebration. It brought together earth scientists mainly from three cooperating nations, the United Kingdom, Pakistan, and the People's Republic of China. The principal studies involved glaciology, topography, seismology, housing as it relates to natural hazards, geomorphology, and geology.

The first volume contains papers delivered at the conference preceding the