mined, and new applications introduced. These applications have taken interesting directions: the earlier uses of rare-earth metal mixtures in the magnesium technology and of rare-earth oxides to improve the quality of carbon-arc light have been followed by new, rapidly expanding applications in metallurgy, ceramics, electronics, nucleonics, and space science.

A well-known phenomenon gives the rare-earth series a particular academic interest: the regular variation, along the series, of internal electronic structure, beneath the valence shell. The study of correlations between this regularity and physicochemical properties, for example, provides insight into the reasons for the latter. Initially yttrium, lanthanum, and thorium were seen to be similar to the 14 rare-earth elements proper and were normally associated with the series. The much more recent transuranium elements, together with the final natural elements of the periodic table, have been recognized as constituting a parallel series. From all this has emerged a unifying picture of an extensive group of elements of similar electronic structure and properties, constituted by the lanthanide series and the actinide series, plus yttrium. Altogether, these series comprise nearly one-third of all the chemical elements. This alone is enough to give a measure of their importance.

Increasingly numerous publications and periodicals on these elements, especially on the lanthanides, are appearing in Europe and the United States. In the United States an important series was initiated in 1961 by publication of the proceedings of the first of a series of symposiums on Rare Earth Research; the editors of this volume, F. H. Spedding and A. H. Daane, made a notable achievement by very effectively condensing the knowledge on the rare earths into a very well organized and unified book. The proceedings of three other symposiums have since appeared. The system and background of the lanthanide field having been set by Spedding and Daane, any of these proceedings can be better appreciated within the series, as additions and updatings.

The most recent volume, **Rare Earth Research, III** (LeRoy Eyring, Ed. Gordon and Breach, New York, 1965. 769 pp., illus. Professional edition, $19.50; reference edition, $39.50), is not, in itself, easily susceptible to adequate review. This fact is at the same time its most significant feature: it offers coverage of widely different aspects of current research on the lanthanides and associated elements, ranging from purely theoretical papers to accounts of elaborate experimentation. It collects the papers of the fourth symposium, held at Phoenix, Arizona, in April 1964. An invited contribution opens each of the five sections: I, Magnetic and Electrical Properties of the Rare-Earth Compounds; II, Properties of Rare-Earth Metals and Alloys; III, Optical Properties and Solution Chemistry of Rare-Earth Materials; and IV and V, Solid-State Chemistry of Rare-Earth Materials (A and B). The total number of papers is 46, most of them being grouped in sections IV and V. The title of section III may sound rather odd, and it becomes more puzzling when one sees that the corresponding invited paper deals with "Séparations et purifications par la voie sèche dans le groupe des terres rares."

An interesting account of the magnetic history of the lanthanides is given in the first section. Section III includes some analytical-chemistry procedures—a proposed new reagent for rare earths, a paper on partial differences between the lanthanides and trivalent actinides, and a dry-distillation approach to the classical problem of separating the rare earths from each other. Thermal analysis, mixed oxide systems, properties of carbides, and the preparation, physical chemistry, crystallography, and heats of formation of different compounds are frequent subjects in sections IV and V. In a similar fashion, section II deals with the metals and their alloys.

All the papers are accompanied by abstracts, with the exception of the one paper not written in English, where it would seemingly be more required. No records of discussions are given.

R. H. RODRIGUEZ-PASQUÉS
Radioactivity Section, National Bureau of Standards, Washington, D.C.

Fighting

Konrad Lorenz has two roles. One is that of a highly respected observer of bird behavior and dean of the European school of ethology. The other is that of a popular writer of fascinating, romantic, and sentimental children's books on animal behavior, of which *King Solomon's Ring* is the best known. He has never attempted to keep these roles completely separate and does not do so in the present book, **On Aggression** (Harcourt, Brace, and World, New York, 1966. 320 pp., illus. $5.75). On the one hand he presents a serious chapter on the evolution of social behavior in ducks, and on the other he is perfectly capable of quoting Jack London and A. A. Milne in support of his ideas.

The book is a translation (by Marjorie Kerr Wilson) of one originally published in Austria in 1963 under the title *Das sogenannte Böse: Zur Naturgeschichte der Aggression,* which may be freely translated, "So-called Evil: On the Natural History of Aggression." One gathers that it was originally written as a reaction to the Freudian theory of aggressive instinct. Lorenz points out that social fighting has certain constructive, as well as destructive, functions, such as dispersion and the maintenance of adequate breeding territories. He also points out that many of the higher social, carnivorous mammals have evolved the capacity to develop forms of fighting which are relatively harmless, or "ritualized."

Beyond this, the book is full of ideas, some stimulating (such as the idea that adolescent human males go through a critical period in which they may take up a cause), some highly speculative (militant enthusiasm in man is a true autonomous instinct), and some merely absurd (man's social organization is very similar to that of rats).

As to facts, many of these are based on Lorenz's own serious scientific work and as many on his more casual observations. He has drawn a limited sample from the works of others, mostly from European research with which he is personally familiar. He has entirely omitted the great body of research on dominance orders in chickens by Allee, Guhl, and others. In describing fighting among mice and rats, he quotes certain limited European studies and does not refer to the much larger and often contradictory studies done by American workers. When he does quote non-German literature it is not always accurately. I doubt that Washburn and DeVore would agree that the baboon troop is ruled by a "senate of older males." Lorenz's observations on dogs leave much to be desired, and he repeats his old statement that the sub-

missive dog presents his jugular vein to the dominant animal. I have observed aggressive behavior in dogs for over 20 years and have seen a great variety of adjustments between dominant and subordinate dogs, but I have yet to see a behavior pattern that could be interpreted as presenting the jugular vein.

There are two defects in the classical instinctual analysis of behavior as presented by Lorenz. One is that it provides a theoretically complete explanation for behavior and so offers no new leads for research. The second defect arises out of the first. Because it is limited by theory, the analysis provides only limited practical solutions. If destructive aggressive behavior is caused by a spontaneous outburst of internal energy, then sublimation is the only practical answer to the problem. While it has some application, sublimation by itself is a very weak reed upon which to rest our attempts to control aggression. Lorenz is on the side of the angels, but his theory limits him to using only one of the many tools available. This is essentially the same as William James's idea of the Peace Army, which has become a modern reality as the Peace Corps. As we know, this will not by itself eliminate aggression.

Actually, there is no evidence that there is any physiological mechanism in any mammal which produces stimulation to fight in the absence of external stimulation. Rather, there is much evidence indicating that mechanisms exist which are easily excited by external stimulation and which function to prolong and magnify the effects of this stimulation. Aggressive behavior can be greatly enhanced or completely suppressed by training; the capacity to develop such behavior can be greatly magnified or almost completely eliminated by genetic selection. Furthermore, Lorenz has entirely missed one of the most important newer findings arising from the study of animal behavior, namely, that a major cause of destructive fighting in animal societies is social disorganization.

As a student of the evolution of bird behavior, Lorenz has presented a bird's-eye view of mammalian and human aggression. It is fascinating, but it is only 50 percent science.

J. P. SCOTT

Department of Psychology,
Bowling Green State University,
Bowling Green, Ohio

A Tribute to Littlewood

A special volume of the **Proceedings of the London Mathematical Society** [vol. 14A (1965). J. D. Wesson, Ed. Oxford University Press, New York, 1966. 320 pp., illus. $12.80] was presented to J. E. Littlewood, professor emeritus at Cambridge University, on the occasion of his eightieth birthday, 9 June 1965. Here was a felicitous occasion: Littlewood is one of the greatest living mathematicians, the London Mathematical Society (with which he has been closely identified for decades) was to celebrate its centenary the following month, and the papers in the volume (written by prominent mathematicians) are almost all in fields to which he has greatly contributed.

Littlewood's name is frequently mentioned in the form Hardy-Littlewood, signalizing his notable collaboration of 35 years with G. H. Hardy. (An atrocious example, which nonetheless illustrates the point: the wife of a number theorist, herself no mathematician, on learning that Littlewood was traveling to the local university and was then 77, exclaimed, "My, but he's a hardy Littlewood!") A good half of Littlewood's output is in joint papers with Hardy. The collaboration, conducted almost entirely by correspondence, was governed by two inflexible rules: (i) either one, on acquiring any idea, however rough or tentative, had to write it down in a letter that was then sent to the other; and (ii) the recipient didn't have to read the letter. Perhaps the most famous fruit of the collaboration is the "Hardy-Littlewood method," also known as the "circle method." If the authors had done only this, they would still be permanently enshrined in the mathematical hall of fame. The method was successfully applied in the twenties to the fundamental problems of additive number theory; for example, in how many ways can a positive integer be written as a sum of squares, of primes, of kth powers, and so on. It survives and will continue to survive as a fundamental tool in analytic number theory and has been used recently, to give only one example, to obtain powerful new results in the theory of diophantine equations (Davenport, Birch, Lewis).

Many of the papers in the volume under review are closely connected with Littlewood's own work. A good example is A. E. Ingham's article, "On Tauberian theorems." Consider a series Σa_n; if it converges, then the power series $\Sigma a_n x^n$ converges in $|x| < 1$, and it is relatively easy to show that $\Sigma a_n x^n \to A = \Sigma a_n$ as $x \to 1$ (with $x < 1$). But the converse is false: with $a_n = (-1)^n$, $\Sigma a_n x^n = 1/(1 + x) \to \frac{1}{2}$ but Σa_n is not convergent. However, if we impose the condition $na_n \to 0$ as $n \to \infty$, the converse theorem becomes true, as was proved by A. Tauber. In 1910 Littlewood made the outstanding improvement of assuming only that na_n is bounded as $n \to \infty$ and proving the convergence of Σa_n. For this purpose Littlewood used a "peak function" $u^N e^{-su}$, which as a function of u has a peak at $u = N/s$, and the peak becomes sharper as N increases. In 1930 Karamata greatly simplified Littlewood's proof. At first sight Karamata's method seems to have nothing to do with Littlewood's, but Ingham points out that there is a peak function concealed in Karamata's argument. He then generalizes the whole situation, eventually obtaining theorems which include not only the original Littlewood method but some of a more numerical nature that are of more recent discovery.

This volume will take its place of honor in the long list of distinguished volumes commemorating the lives and work of outstanding mathematicians.

J. LEHNER

Department of Mathematics,
University of Maryland, College Park

Festschrift for Weisskopf

It is a custom, more in Europe than in this country, to honor outstanding men of science by publishing books or special issues of journals containing articles by their colleagues and former students. What other purpose, if any, can such *Festschriften* serve? An answer to this question must be given in order to give a fair appraisal of **Preludes in Theoretical Physics, In Honor of V. F. Weisskopf** [A. de-Shalit, H. Feshbach, and L. Van Hove, Eds., North-Holland, Amsterdam; Interscience (Wiley), New York, 1966. 361 pp., illus. $12.75].

The disadvantages of the practice of publishing *Festschriften*, especially in the case of the special issues of scientific journals, have recently been put forward eloquently by S. A.