acteristics and our understanding of their causes." In a sense, this single statement says it all.

The illustrations in the book, including pictures, diagrams, and several color plates, are clear and well reproduced. As is typical of the Space Science Series, a comprehensive bibliography and glossary are included. Researchers will welcome the bibliography, which contains some 1500 detailed references. The glossary provides invaluable assistance to the reader who may not be fully familiar with the terminology, abbreviations, and acronyms of contemporary planetary science. With the ever-increasing use of jargon and acronyms in today's scientific writing, the context can often be confusing, not only to the lay reader but even to those scientists who work in closely related fields. Unfortunately, inconsistencies in the content of the glossary—for example, the inclusion of acronyms for some, but not all, of the Voyager scientific instruments—would suggest that contributions to the glossary compilation were not uniform among the various authors.

The current state of funding for planetary exploration, both in this country and in Europe, is such that there can be little optimism that Uranus will be revisited by planetary spacecraft for at least a decade. And, though impressive advances in telescope design and instrumentation continue to improve the capability of gathering new knowledge from ground-based observatories, it seems unlikely that such facilities can add significantly to what Voyager has already shown us. This book is, and will continue to be, the primary source of information about the Uranus system at least to the turn of the millennium and probably longer.

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Buckyballs

Fullerenes. Synthesis, Properties, and Chemistry of Large Carbon Clusters. GEORGE S. HAMMOND and VALERIE J. KUCK, Eds. American Chemical Society, Washington, DC, 1991. xiv, 195 pp., illus. $44.95. ACS Symposium Series, 481. From a symposium, Atlanta, GA, April 1991.

It was less than two years ago that astrophysicists Krätschmer and Huffman reported the isolation of stable C_{60} and C_{70} molecules, now known as fullerenes or "buckyballs," from specially prepared graphite soot. These results substantiated previous work by Smalley, Kroto, and co-workers, who had not only suggested the structures (usually football and soccer-ball shapes, hence the term "buckyball"), but gave proof of their formation in the vapor phase. However, not until Krätschmer and Huffman's research made these compounds available on a macroscopic scale did study of their physical and chemical properties take off.

Fullerenes is the result of an American Chemical Society Fast-Breaking Events symposium organized only nine months after Krätschmer and Huffman's report, and it is remarkable that such a significant amount of pioneering research is presented in the volume. It opens with an editors' preface and an overview by Hammond. The succeeding 12 chapters include such diverse topics as synthetic approaches to C_{60} and other carbon clusters, theoretical studies, low-resolution, single-crystal x-ray structure determination, conductivity and superconductivity of alkali metal-doped C_{60} (a particularly intriguing subject with potentially great practical interest), the preparation and structural determination of the first well-defined monosubstituted C_{60} derivative (for example, osmylated C_{60}), mass spectrometry, and the chemical reactivity of C_{60}.

The expanding revelations of the properties and possible applications of fullerenes rightly fascinate chemists and physicists alike. Although the present pace of discovery will probably not continue unabated, these new caged-carbon allotropes are of great interest and their chemistry and physics hold substantial promise. How soon this promise will be fulfilled by practical application is difficult to judge. It is, however, reassuring that science continues to produce unexpected and fascinating results that open up new vistas.

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Immunological Reformulations

Metchnikoff and the Origins of Immunology. From Metaphor to Theory. ALFRED I. TAUBER and LEON CHERNYAK. Oxford University Press, New York, 1991. xx, 247 pp. + plates. $45. Monographs on the History and Philosophy of Biology.

Elie Metchnikoff clearly belongs in the pantheon of late-19th-century scientific medicine, alongside contemporaries such as Robert Koch and Paul Ehrlich. Born in 1845 as the fifth and youngest child on a minor Russian estate, Metchnikoff studied comparative zoology at the University of Kharkov and began his research career investigating the phylogenetic and ontogenetic development of a wide variety of invertebrate groups. In the 1870s he specialized in sponges and medusae in order to understand the origins of metazoans and the phylogenetic development of the digestive system.

In 1883, however, his career underwent a sudden reorientation—from comparative embryology to pathology. Today he is best known for the phagocyte theory of inflammation and immunity, which states that special amoeboid cells seek out and engulf pathogenic parasites and that inflammation is essentially this active response to the invading agent. Although most pathologists immediately opposed Metchnikoff's theory for its teleology, the gravest blows came from a number of studies in the late 1880s that showed that natural and acquired immunity was more likely mediated by a humoral factor. In 1890 Emil Behring and Shibasaburo Kitasato discovered serum antitoxins (later named antibodies), and thereafter the view that cells alone were responsible for immunity became increasingly untenable. Nevertheless, Metchnikoff did share the 1908 Nobel Prize with Paul Ehrlich, the leading proponent of the idea of antibody-mediated immunity.

Notwithstanding the renaissance of cellular immunology in the 1950s and 1960s, Metchnikoff has, until recently, been of interest only to historians of science and medicine. In a series of articles in *Cellular Immunology* and other journals, however, Boston University pathologist Alfred Tauber and philosopher Leon Chernyak have set out to resuscitate Metchnikoff, or rather his metaphysics, for present-day immunologists. Although their immediate philosophical motivation is not clearly explicated in the present book, a concurrently published work edited by Tauber (*Organism and the Origins of Self*, Kluwer, 1991) indicates that they have been challenged by the recent so-called autonomous network approach to the immune system, an epistemologically radical extension of Niels Jerne's well-known theory of idiotypic networks proposed in 1973.

Accordingly, notions of anti-reductionism, dialectics, and self-determining systems (albeit not autopoiesis) reverberate throughout this expanded book version of Tauber and Chernyak's articles. The authors' main claim is that the real novelty in Metchnikoff's phagocyte theory of inflammation and immunity was his reformulation of the notion of organismic integrity. Tra-