cline in mortality took place before variolation had even been introduced to the American colonies. The decline of smallpox, like the decline of other infectious diseases during the 18th and 19th centuries, surely requires a more nuanced explanation than the sort of monocausal hypothesis that Razzell offers us here.

Nonetheless, Razzell's work deserves better than the cavalier rejection it has met (in earlier versions) from some virologists and medical authorities. One thinks, for example, of Thomas McKeown's *The Modern Rise of Population* (Academic Press, 1976). McKeown rightly insists upon the contributions that current medical knowledge can make to historical inquiry. But serious objections can be lodged against his own effort to ascribe the modern rise of population chiefly to improved nutrition, and he has admitted the need for considerable tolerance in the face of uncertainty. Given the complexity of the factors that affect mortality from infectious diseases at different times and different places, it is unfortunate that McKeown seems as impervious to Razzell's historical evidence as Razzell is to standard medical opinion. We might all benefit from a modus vivendi between the two approaches.

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## Microbial Ecology

**Microbial Interactions**. J. L. REISSIG, Ed. Chapman and Hall, London, and Halsted (Wiley), New York, 1978. x, 436 pp., illus. $39.50. Receptors and Recognition, Series B, vol. 3.

The inclination to view microbes as independent entities separable from each other and from their natural environment emerged in the 19th century as the dominant strategy in microbiology and was a direct consequence of the spectacular successes of the pure culture approach of Robert Koch and his colleagues. For the next hundred years the attention of most microbial physiologists was focused on the dispersed growth of pure cultures in laboratory media. Any microbial activities that depended on attachment, attraction, communication, or development were oddities and out of the mainstream.

However, a second school of thought arose from the work of Sergei Winogradsky. Winogradsky was the first true microbial ecologist, the first to begin to formulate the activities of soil bacteria in chemical terms and certainly the first to think in terms of process, cycles, and interacting members of an ecological niche. Out of this school emerged microbiologists such as Selman Waksman and René Dubos who pioneered the concept of antibiosis and emphasized that the microbe was only one member of a complex interaction, whether that interaction be disease or a process occurring in the soil.

The past decade has seen the reemergence of this more holistic microbiology, and *Microbial Interactions* exemplifies the excitement and sophistication of the field. The book consists of nine reviews of various kinds of microbial interactions plus an excellent overview by the editor. There are chapters on aggregation and cell surface receptors in cellular slime molds (Newell), bacterial receptors for phages and colicins as constituents of specific transport systems (Braun and Hantke), bacterial chemotaxis (Hazelbauer and Parkinson), attachment of bacteria to the surfaces of animal cells (Jones), and five chapters on interactions manifested by the exchange of genetic material ("Binding and entry of DNA in bacterial transformations" by Lacks, "A redefinition of the mating phenomenon in bacteria" by Achtman and Skurray, "Cell-cell interactions during mating in *Saccharomyces cerevisiae*" by Manney and Meade, "Mating interactions in *Chlamydomonas*" by Goodenough, and "Cell-cell interactions in ciliates: evolutionary and genetic constraints" by Nanney).

Although the chapters vary widely in the extent to which they present detailed, mechanistic analyses of the interactive phenomena, they are uniformly excellent—readable, analytical, and well organized. They emphasize the overview, yet contain enough data to illustrate their points or to convince the skeptical reader.

One is almost always inclined to quarrel with the emphasis and choice of topics in such a collection. There is no mention of the developmental biology of prokaryotes, where investigations of cell interactions among the myxobacteria or the cyanobacteria are opening up whole new areas of inquiry. There is no discussion of the *Bdellovibrio*-host relationship, of chemostat studies on two- and three-membered interacting populations, of cross-feeding microbial consortia, or of lectin-mediated interactions between plants and microbes. However, in spite of its necessarily limited scope, the volume does illustrate the wide range of interactive microbial activity.

The investigation of interactions among microbes offers us the almost unique option of applying immensely powerful concepts of molecular and regulatory biology to interacting populations that are experimentally tractable. It is not unreasonable to hope that the examination of microbial behavior can uncover and clarify new strategies of interaction or new aspects of the evolution of multicellularity.

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## Gold and Its Compounds

**The Chemistry of Gold**. RICHARD J. PUDDEPHATT. Elsevier, New York, 1978. x, 274 pp., illus. $49.75. Topics in Inorganic and General Chemistry, 16.

Surveying the chemistry of an element, even one as little studied as gold, is an extensive undertaking. Puddephatt has prepared a well-organized, cohesive, and clearly written book that will be required reading for research groups studying the chemistry and biochemistry of gold or using gold and its compounds in technological applications. After an introduction to gold and its chemical properties, the chemistry of its binary compounds, stable oxidation states (I, II, III, V), and organometallic compounds is discussed in detail. Other topics discussed include gold-metal bonds, reaction mechanisms, spectroscopy, and analysis of gold compounds. Finally, the uses of gold and its compounds are summarized.

The book is divided into well-defined chapters, which will facilitate its use for reference. Only two topics seem misplaced—gold-boron complexes, which are discussed in the chapter on gold-metal bonds, and gold(III) fluorophosphates and nitrates, which are discussed in the chapter on binary compounds—and they can be located in the carefully prepared index and table of contents. Running heads would have facilitated both the use of the references at the end of each chapter and cross-referencing between chapters.

The most exciting subjects of current inorganic research are thoroughly explored: organometallic chemistry, gold-cluster compounds, oxidative-addition-reductive-elimination reactions, and gold(II) and gold(V) complexes. Yet earlier research on basic chemistry and reactions is discussed in sufficient detail to

give a balanced overview. The literature coverage is complete through 1976 and includes many 1977 references.

One criticism is that the discussion of some topics is bibliographic rather than critical or incisive. The conditions for carrying out specific reactions or isolating certain molecular structures are sometimes lost in the wealth of detail. Greater use of tabular data for similar compounds and more attention to the scope and limitations of reactions would have strengthened the book.

The failure to include a chapter on gold biochemistry is unfortunate. Heavy metal biochemistry is important as a stimulus to developing new inorganic chemistry and as a scientific basis for pharmacological and medical research. Although a brief discussion of the subject is included in the section on the biological applications of gold, it is inadequate and somewhat naive. For example, the numerous recent studies of the interactions of gold with the immune system are not discussed. The only serious error noted was in this section. The inhibition of lysosomal enzymes by gold(I) thiolates clearly occurs in vivo and in vitro and is a useful working hypothesis concerning the mechanism of chrysotherapy (gold treatment for rheumatoid arthritis). However, no evidence establishes it as the mechanism of action, as is suggested on pp. 250–252. In fact, the inhibition of certain immunochemical reactions has given rise to an alternative hypothesis, that gold acts as an immunosuppressive reagent.

The flaws, however, are minor. The book fills a gap in the literature. Its main assets are clear organization and balanced coverage of research on gold chemistry. I recommend it highly.

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## Seismology

**Earthquakes**. A Primer. BRUCE A. BOLT. Freeman, San Francisco, 1978. xii, 272 pp., illus. Cloth, $12; paper, $7. A Series of Books in Geology.

Bolt states in the preface to this book that his aim is "to provide a short, simple, and up-to-date account of our present knowledge of earthquakes that will be of general interest." He has done exactly that. The book is a nonmathematical summary of the state of the art in earthquake seismology. It is written in a simple, clear style that will make it attractive to the average reader, and it will have extensive use as a starting point for students, journalists, and others who want to learn something about earthquakes.

"The God-Superior from the Kashima shrine, Japan, tells the daimyojin to drive down the pivot stone hard on the Edo (Tokyo) earthquake namazu (catfish) to warn other earthquakes. Each of the onlooking namazu is a historical earthquake. From left, Kwanto, Osaka, Koshu, Echigo, Odawara, and Sado earthquakes." [From *Earthquakes*]

The book starts with a discussion of seismic geography, relating it to modern theories of plate tectonics. Chapter 2, "What we feel in an earthquake," discusses several earthquakes and includes a transcript of a tape recording, made during the 1964 Alaskan earthquake, which is more an illustration of the emotional response of individuals to such an event than a scientific description of an earthquake. The relations of earthquakes to faults, volcanoes, and seismic sea waves are developed. Several chapters are devoted to modern ideas about physical processes that are involved in earthquake generation, including a chapter on earthquakes generated by humans and one on earthquake prediction. The last chapters are concerned with earthquake-resistant building design and self-protection in an earthquake.

The book includes a very brief but well-selected bibliography of reference works that lead the reader to more thorough treatment of various aspects of seismology, a glossary of seismological terms, and an earthquake quiz.

The book is easily read and contains many illustrations. Scientists and others interested in natural phenomena will find it enjoyable as well as informative. Geoscientists who have not kept up with recent developments in seismology will find sections such as the one on earthquake prediction particularly useful. The book emphasizes recent advances in knowledge. Because of its elementary nature, seismologists will find little that is new to them in the book. Those looking for books to recommend to students may want to read it. The useful appendixes include two listing important earthquakes in the United States and elsewhere, one on seismic instrumentation, and one on how to calculate the magnitude and energy of an earthquake.

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**Arithmetic and Calculators.** How to Deal with Arithmetic in the Calculator Age. William G. Chinn, Richard A. Dean, and Theodore N. Tracewell. Freeman, San Francisco, 1977. viii, 488 pp., illus. Cloth, $17; paper, $9.95.

*(Continued on page 550)*