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