

ments and many common inorganic compounds. It is particularly useful as a source of reference to the many papers in the literature on this subject.

The Characterization of High-Temperature Vapors is appropriately dedicated to the new generation of high-temperature scientists and engineers. It also has much to offer to persons currently in the field. It will undoubtedly serve as a guidepost to physicists, chemists, metallurgists, engineers, ceramists, and others doing research at high temperatures.

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Regulators of Development

The Evolution of Differentiation. WILLIAM S. BULLOUGH. Academic Press, New York, 1967. viii + 206 pp., illus. \$8.

This unusual and interesting treatment of differentiation emphasizes the importance of the role played by chemical messengers such as nutrient materials, metabolites, inducing substances, and hormones. With data from a broad spectrum of organisms ranging from bacteria to the most complex systems, the theme is carefully developed that differentiation has evolved from the more-or-less reversible, labile state found in microbes and plants to the inflexible, stable state seen in mammals. At all stages of complexity, differentiation is viewed as the outcome of a progressive and selective closure of an originally totipotent genome, through the action of specific chemical messengers which travel within and between cells, activating and repressing genes according to the theory of Jacob and Monod. The thesis is advanced that closure of the genome has become progressively tighter with the progress of evolution, the ultimate stability being represented by systems in which genetic activity has ceased completely and control is exercised at the RNA level. An unconventional approach (and a somewhat awkward terminology) is used in one of the most thought-provoking sections of the book, dealing with tissue homeostasis. A new look at the incompatibility of mitosis and tissue function is offered as the view is developed that cells may differentiate to synthesize either only those enzymes required for mitosis or those which determine a

composite program for aging and function. At this level also, the action of tissue-specific chemical messages (on the relative inhibition of mitotic activity) is considered to be primarily responsible for the balance between the rival forces of cell duplication, function and death.

It is more a comment on the state of the field than a criticism of the presentation to say that this book provides a fascinating example of the consequences of current tendencies to force all explanations in terms of gene regulation. In view of the (laudable) emphasis on chemical messengers which are not made of DNA or from DNA, and do not usually act on DNA, it is somewhat confusing to assume that such messengers exist only for the purpose of regulating genetic activity. This is particularly so in view of the fact that, mechanistically, more is known about their mode of action at nongenic levels, for example, in the activation and inhibition of existing enzymes and as a source of energy and precursor material for synthetic pathways. Thus some very pertinent questions (and conflicting conclusions) are automatically eliminated from consideration. The assumption is made that differentiation essentially involves nothing more than the elaboration of an ancient theme of gene control in bacteria. Although this is very probable as applied to the genetic level of control in differentiation, it hardly does justice to the equally important role of other levels of control. Unlike bacteria, which are susceptible to influence by various exogenous inducers, a differentiating system must furnish its own chemical messengers. The nature and source of the messengers, the control of their synthesis and utilization, and the mechanism of their action at nongenic as well as genic levels must be considered in understanding the evolution of differentiating systems. Soon we must also ask whether the catalytic products of genetic activity are produced in limiting (that is, controlling) amounts, or in excess compared to the other cellular components (such as metabolites) essential to the expression of their activity.

On the whole, this book condenses an impressive amount of information and a variety of viewpoints in a stimulating and interesting manner.

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(Continued on page 610)