manner. The first group covers certain chemical aspects of flavin nucleotides: semiquinone formation by irradiation of flavoproteins, photochemical reduction of free and enzyme-bound flavins, and products obtained by anaerobic photolysis of riboflavin. One could also include in this group the stimulating contribution by Kosower on pyridinyl radicals.

Mitochondrial enzymes traditionally have been the subject of much argument. It is not surprising, therefore, to find a certain amount of controversy surrounding the papers in the second group, covering mitochondrial flavoproteins and related topics. Previous debates over whose mitochondrial DPNH dehydrogenase was the most "physiological" have now largely been placed by such questions as: At what point in the respiratory chain does rotenone exert its inhibitory effect? What is the nature of the "occult" thiol group in the reduced diphosphopyridine nucleotide (DPNH) dehydrogenase chain? Does the DPNH chain contain more than one flavoprotein? What are the structural differences between the various nonheme iron entities in the mitochondrial electron-transport chain?

The wealth of information available about the chemistry of flavin nucleotides, and the fact that many flavoproteins have been isolated in essentially homogeneous form, might suggest that very little remains unknown about the mechanism of these enzymes. Such is not the case, however, as is evidenced by papers in the final group. Although it is clear that a "minimal" flavoprotein should operate by a two-step mechanism in which reducing power is transferred from substrate to flavin to acceptor, the actual situation encountered in the various flavoproteins is far more complex. Thus, interaction of a substrate with the enzyme-bound flavin can result in formation of the flavin semiquinone, the fully reduced flavin, a charge-transfer complex between the substrate and the flavin, or a group-transfer complex in which the substrate is bonded covalently to the flavin. Similar possibilities exist during interaction of the flavin with the electron acceptor (which, for expediency, is often a nonphysiological oxidant). Further complications arise when the enzyme contains more than one flavin nucleotide or other oxido-reduction groups (such as metals, thiol groups, hemes). It is hardly surprising to note, for example, that both red and blue radicals can be generated from the same enzyme (see discussion, pp. 250–51).

In addition to providing specific information about the mechanism of various flavoproteins, this book is of value in illustrating how the techniques of absorption spectrophotometry (especially when used over short time intervals), electron paramagnetic resonance, and optical rotatory dispersion can be utilized to study complex mechanisms. It is a definitive work both for specialists in this field and for biochemists and chemists in general who may wish to obtain some insight into one of the more rapidly developing areas in the study of enzyme reaction mechanisms.

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A Species in Trouble

Ecology and Behaviour of the Black Rhinoceros (Diceros bicornis L.). A Field Study. RUDOLF SCHENKEL and LOTTE SCHENKEL-HULLIGER. Parey, Hamburg, 1969. 104 pp., illus. Paper, DM 28. Mammalia Depicta.

The authors have conducted a thorough investigation of the black rhinoceros in several East African national parks over a period of almost three years. The reasons for these studies were the apparent ecological changes taking place in the rhino's habitat, an increasing elephant population being one of the major problems. Rhinos and elephants normally coexist; however, serious competition for food and water often occurs. Relationships with other ungulates, as well as predators, showed no special problems.

Black rhinos were found to lead a nomadic life, and did not have individual territories. The same mud wallows, watering and sleeping places, and other areas were used by many different rhinos. Population counts of adults and young were made by both ground and aerial studies. Observations of single animals showed how far they would stray from water, and also how long they could do without it. Feeding habits were watched by following individual rhinos along their daily routes. Specimens of food plants were collected for identification, the result being a large list of bushes and shrubs. Several sick or dying rhinos were shot and examined for possible identification of diseases and parasites and in order to note the general condition of the animals.

Social reaction and mating behavior are well covered. The information obtained is very important, for the breeding of the rhinoceros in zoos is a must. Premating fights, which so often occur in closely confined captive rhinos, were found to be minor or to consist of nothing more than threatening gestures. The authors also found little or no horn rubbing in wild rhinos. Zoo specimens rub their horns to blunt stumps, as compared to the wild rhino's long sharp ones. This could be the result of boredom in the captive rhino.

This work clearly shows that the black rhinoceros is in serious trouble. It seems that even the national parks may be too small to save this beast from extinction. The principal problem is organized poaching, which must be stopped if the species is to survive. To make matters worse, the bush country, which is the rhino's home, is fast becoming dry grassland as a result of drought, brush fires, and the destruction of trees and shrubs, which are the rhino's food, by elephants. To conserve the species in its few remaining strongholds, the authors suggest ecological investigations of these regions over a number of years. These would include analysis of the rhino and elephant populations along with changes in topography and vegetation. Strict control of the elephant herds is also advocated. This could raise the question of which is to survive, the elephant or the black rhino.

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Microscopic Anatomy

Comparative Vertebrate Histology. DONALD I. PATT and GAIL R. PATT. Harper and Row, New York, 1969. x + 438 pp., illus. $14.95.

Two major problems must be solved in the production of a book such as this one. First, because the illustrations are crucial to the exposition, some way must be found to include a large number while keeping the price within textbook limits. Second, a mass of scattered and often contradictory observations must be pruned into a logical and useful exposition. In this volume these problems have been dealt with in an ade-