EVOLUTION AND THE THEORY OF GAMES.

By John Maynard Smith. Cambridge University Press, Cambridge and New York. $34.50 (hardcover); $11.95 (paper). viii + 224 p.; ill.; subject and author indexes. 1982.

During the last decade a new and powerful method has been developed to model evolution. This method, which is based on mathematical game theory, seeks an evolutionarily stable strategy (ESS) from among a set of real or imaginary alternative strategies. Game theory is a particularly useful means for analyzing evolution when the fitness of a phenotype is influenced by its frequency in the population. Many behavioral and life-history traits are frequency-dependent in fitness: aggression, communication, territoriality, sex ratio, hermaphroditism, parental care, and size at maturity, to name a few.

Maynard Smith, the leading thinker in evolutionary game theory, in this book reviews the directions that game theory has taken, clarifies methods, solves some new problems, and demonstrates the utility of the theory to a broad audience. He begins with the basic models of evolutionary game theory; these include pairwise contests between individuals, games in which individuals evolve against the population average, and situations where animals

choose from a continuously distributed set of strategies rather than from among a set of discrete alternatives. Next he considers the relationship between game theory and models in population genetics. Asexual inheritance is an assumption in ESS models, but most researchers deal with diploid organisms that reproduce sexually. If contestants are not related to one another, however, Maynard Smith concludes that genetics will make little difference. Predictions from ESS theory are then applied to field data from the few natural history studies that have tested them. This lack of data reflects the newness of the ideas and the difficulty of correctly measuring some important parameters. To this end, Maynard Smith stresses the kind of information that is needed to constitute a proper test. The rest of the book is more theoretical, and examines sexual selection, the transfer of information during contests, and the evolution of cooperation. There is some new material on life-history strategies that includes a model for an evolutionarily stable size at maturity. An Appendix of mathematical techniques and proofs is also provided.

Novice students may have trouble with this book. Intermediate steps are skipped in some of the models, and the writing style is often terse. In addition, the genetics that underlie ESS models will need to be explored further, and the table that classifies mechanisms of variable behavior is of limited use. These criticisms are minor, however. Many people believe that the concept of the ESS will reshape how biologists view phenotypic evolution. This book will be the key reference to that reshaping for many years to come. It is full of rich insights and directions for the future, and is worthy of careful study.

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