frequency throughout the range of a species. The saltational model, on the other hand, provides for the possibility that chromosomal rearrangement is causally related to the very small size of a population, perhaps as a genetic effect of forced inbreeding. Another difference between the two models is that the product of stasipatric speciation is assumed to be adaptively superior from its inception whereas the saltational model does not call for a priori superiority. In the most extensively studied case of presumed saltational speciation, the origin of *Clarkia lingulata* from *C. biloba*, it has been shown that the derivative species is genetically less variable and, under all conditions tested, less fecund than the parental species.

Of greater significance, I believe, than the presumed differences between the stasipatric and saltational models of speciation are the similarities. Both models involve chance fixation as homozygotes of one or more chromosomal rearrangements that as heterozygotes have a selective disadvantage because of reduced fecundity. Both models call for fixation to occur in very small inbreeding populations that are at least temporarily isolated from populations of the ancestral species. Although the presumed differences pose interesting questions they seem to me to be secondary in evolutionary importance to the similarities.

Species that reproduce asexually are allotted a special chapter. The chapter, however, deals primarily with examples of asexual species of animals and the various interesting mechanisms by which they reproduce asexually, rather than with their origin. Most of the asexual species discussed are demonstrably of hybrid origin, and one might have expected a more extensive discussion of the general role of interspecific hybridization in speciation, especially among plants. The final chapter of the book does contain some discussion of hybridization in relation to speciation, but the subject receives less emphasis than it deserves, perhaps because, although the fact is not stated, the focus of the book is on animals.

The final chapter is entitled "Conclusions," but it is replete with new topics and new examples. Of particular interest is a discussion of the role of ethological isolation in speciation and whether or not speciation is ever initiated by ethological differentiation. One gets the impression from the variety of topics introduced that the final chapter is used to mention and discuss briefly a number of interesting subjects that did not fit into the other chapters. The result is a medley of ideas and examples rather than a tightly reasoned set of conclusions as the title would suggest.

This book is an important contribution and has something new to say to everyone with an interest in speciation, whether that interest be casual or intensely professional. After reading the book no one can help agreeing with the author that speciation is a complex and wide-ranging set of phenomena for further inquiry and not one concerning which all the answers are known.

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A Means of Self-Evaluation

Social Comparison Processes. Theoretical and Empirical Perspectives. JERRY M. SULS and RICHARD L. MILLER, Eds. Hemisphere, Washington, D.C., and Halsted (Wiley), New York, 1977. xii, 372 pp. $23.50.

In 1954 Leon Festinger published his seminal article "A theory of social comparison processes." The article represented a formalization and extension of previous research and theory stemming from the tenet that humans have a basic drive to evaluate their opinions and abilities. The theory suggested that, although people may first attempt to evaluate their opinions and abilities by objective nonsocial means, when such means are unavailable they evaluate themselves by comparisons with the opinions or abilities of other people and that, "given a range of possible persons for comparison, someone else close to one's ability or opinion will be chosen for comparison."

From these and other hypotheses and corollaries, Festinger and later Schachter and others attempted to derive propositions that would aid in our understanding of a number of basic social processes having to do with affiliation, communication, conformity, the rejection of deviates, competition, self-esteem, level of aspiration, the effects of racial integration, equity, and emotion. Now, two dozen years have passed and Suls and Miller have set out to provide for us perspectives on the present status of social comparison theory.

For those who are interested in social comparison, this book provides everything: thorough reviews of the literature, thoughtful critiques of previous experiments, stimulating theoretical applications and conceptual advances, new theoretical ideas, and 16 previously unreported experiments. Between the effective scene-setting first chapter by Suls and an unusually incisive final chapter by Ladd Wheeler and Miron Zuckerman are a dozen original chapters each focusing on a different aspect of social comparison. The 23 authors represented in this volume include old hands and young turks, social comparison theorists and plowers of other theoretical fields.

The authors did not provide, nor did the editors impose, uniformity; the chapters differ in goal, content, style, and scope. Most readers will find some chapters more interesting than others. I especially liked two chapters, one by George Goethals and John Darley that attempts to reformulate social comparison theory in terms of Harold Kelley's attribution model, and one by Philip Brickman and Ronnie Janoff Bulman that sets out to prove that the opposites of three statements from social comparison theory are also true. In the course of their attempt, Brickman and Bulman shed new light on identical twins, married couples, class reunions, the effects of success on friendship, the negative consequences of tourism for developing countries, and the effects of status on the ability to choose evaluation occasions. Although I was not entirely convinced by this chapter, I spent an enjoyable evening with the book and think that others interested in social comparison will also find it stimulating.

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Particles in Space

Topics in Interstellar Matter. Papers from a meeting, Grenoble, Aug. 1976. HUGO VAN WOERDEN, Ed. Reidel, Boston, 1977. viii, 300 pp., illus. $30.

In the past decade, developments in radio, infrared, and space astronomy have led to a revolution in our understanding of the physics and chemical composition of the interstellar medium. The space between the stars of spiral galaxies such as our own is not devoid of material, as 19th-century astronomers believed, but is filled with a low-density gas and with sub-micron-sized particles of matter that are called "interstellar dust." It is known that the gas and dust are mostly concentrated in relatively high-density, low-temperature regions, called clouds, that are separated by a much higher-temperature, low-density intercloud medium.

Because the density of photons is so low in interstellar space the atoms and molecules that exist there are almost universally in their absolute lowest energy state. The resonance lines of abundant atoms occur mostly in the vacuum ultraviolet whereas the radiation from molecular species is rotational transitions that are detected at millimeter and centimeter radio wavelengths. The launching of the Orbiting Astronomical Observatory series of satellites, culminating in the launching of the Copernicus satellite, has enormously expanded our ability to detect and recognize the ionization state of the abundant elements in the interstellar medium, and advances in millimeter-wave and radio astronomy have now led to a list of over 40 distinct molecules detected in the interstellar medium.

At the 16th General Assembly of the International Astronomical Union, the Commission on Interstellar Matter met jointly with commissions on space research, radio astronomy, galactic structure, and galaxies to present a series of 24 invited review papers that discussed recent developments in the understanding of the interstellar medium.

It was originally intended that the papers would be presented only orally, but their reception inspired van Woerden, the president of the Commission on Interstellar Matter, to publish them. A number of the papers are not as thorough as they might have been if they had been prepared for a publication aimed at a more general audience. Complete coverage of the field was sacrificed in order to cover some of the newer developments in depth. Notably missing are reviews of the wealth of material Copernicus has accumulated on the physical conditions in neutral hydrogen clouds and of the radio observations of high-galactic-latitude neutral hydrogen clouds and a definitive review of the status of the classical observations of interstellar absorption features in the visual region of the spectrum.

With the exception of these gaps the entire subject is covered, and the numerous references would be useful to anyone interested in extending his or her knowledge of specific topics. Particularly noteworthy are the papers on the interstellar coronal gas by Jenkins, Cox, McKee, and McCray, the paper on compact HII regions by Shaver, the papers by Dalgarno, Zuckerman, and Watson on molecular clouds, and the paper on isotopic abundances by Townes. The papers on the distribution of gas clouds in our galaxy by Hart and Burton and Gordon and the work on interstellar matter in external galaxies reported by Webster, Peimbert, and van Woerden are excellent summaries of the state of the art. Our current understanding of the important atomic and molecular processes in the interstellar medium, the interactions of the dilute, hot, gas phase with dense, cool clouds, and the history and distribution of gas in spiral galaxies is well documented by this collection.

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Early Irrigation Agriculture

Studies in the Archeological History of the Deh Luran Plain. The Excavation of Chagha Sefid. FRANK HOLE. With contributions by M. J. Kirkby and Colin Renfrew. University of Michigan Museum of Anthropology, Ann Arbor, 1977. xiv, 370 pp., illus. Paper, $10. Memoirs of the Museum of Anthropology, University of Michigan, No. 9.

Early southern Mesopotamian civilization was generated and maintained by a mode of production based upon the surplus yields of irrigation agriculture. Six-row hulled barley was the primary crop (at the end of the third millennium as much as 80 percent of temple-owned fields were under barley cultivation), and productivity was phenomenal: some mid-third-millennium texts indicate a 76-fold yield, and those of the late third millennium suggest still impressive 20-fold averages. Peasant agriculture in southern Iraq today, using basin-flow irrigation, rarely exceeds a 10-fold yield for a modern barley (*1*). When and why irrigation agriculture was first used in southern Mesopotamia is not known.

Until six years ago, the earliest known settlements in southern Iraq were those of the village- and town-based Ubaid ceramic tradition, beginning in the late sixth millennium and continuing, with no evidence for exogenous cultural change, into the period of city-states characterized by the Uruk ceramic tradition (around 3700 to 3200 B.C.). Under modern climatic conditions dry farming is not possible in southern Iraq; hence the early Ubaid settlers were assumed to have practiced simple gravity-flow basin irrigation, locating their villages along easily broken river levees. The origins of the Ubaid ceramic tradition were not known; no sites in southern Iraq provided a transition from the earlier Samarran sites distributed in the area to the northeast.

In the Susiana plain of southwestern Iran, a ceramic tradition parallel to the Ubaid of southern Iraq has been the subject of more extensive investigation; but the origin of the Susiana cultures has also been uncertain. Today dry farming is possible on the Susiana plain; only in the middle of the Susiana ceramic sequence did settlements align themselves in ways that indicate the practice of irrigation agriculture.

The Deh Luran plain lies northwest of the Susiana plain in the Zagros piedmont steppe. In 1963, Frank Hole, Kent Flannery, and James Neely excavated a succession of sedentary village occupations in Deh Luran which began around 7000 B.C. and continued into a sequence of cultures with ceramics similar to those of the Susiana plain (*2*). The earliest Susiana-related phase of occupation, the Sabz phase, provided evidence for irrigation agriculture, but the immediate antecedents of this phase were not present in the excavated sequence. The earliest Ubaid cultures in southern Iraq and the earliest Susiana cultures in southwestern Iran both seemed to be irrigation-based, but their origins remained obscure.

By 1967 evidence was accumulating for an irrigation-based culture, with ceramics apparently ancestral to those of the Sabz phase in Deh Luran, at the site of Choga Mami, 150 kilometers to the northwest in a drier Zagros piedmont zone. Hence the 1969 report of the Deh Luran excavations suggested that the Sabz phase represented the intrusion of an irrigation-farming culture into the Deh Luran plain. In 1968–69 Frank Hole excavated a sample of the site of Chagha Sefid in Deh Luran to document the cultures that immediately preceded the Sabz phase and to test the hypothesis of an intrusion from the area of Choga Mami.

The present monograph presents the results of those excavations, along with a detailed set of arguments for the hypothesis that irrigation agriculture was introduced by a migration from the Choga Mami area. This volume and Hole's earlier Deh Luran excavation report are unique in Near Eastern archeology: they are the only fully documented final reports of prehistoric Near Eastern excavations to appear since the Second World War. Hole's problem-oriented and interdisciplinary research continues to provide a foundation and a reference point for much of the prehistoric archeology conducted in Iran and Iraq. The Chagha Sefid report contains detailed and quantified descriptions of the architectural remains and the ceramic and lithic assemblages recovered from Hole's excavations, as well as a chapter that treats the relative and absolute chronology of the new occupation phases for