Book Reviews

A Marshaling of Arguments

Scientists Confront Velikovsky. Papers from an AAAS symposium, San Francisco, Feb. 1974. DONALD GOLDSMITH, Ed. Cornell University Press, Ithaca, N.Y., 1977. 184 pp., illus. $8.95.

Velikovskianism has survived two wars and a cold war. It is as old as "curb-feelers," commercial television, and the steady state cosmology. Could the Russian-born psychiatrist who spawned it foresee that a generation later the scientific community would expend so much of its energy reacting to his creation? While a literal interpretation of catastrophes delineated in the scriptures seemed unorthodox, the attribution of such affairs to short-term cataclysmic events in the recent history of the solar system was heretical and the celestial demolition derby Velikovsky devised to work out the details downright preposterous.

According to Velikovsky, 2500 years ago Venus, then a comet, was ejected from the bowels of Jupiter, nearly collided with Mars, causing that planet to shift its orbit, encountered the earth twice, depositing carbohydrates and insects onto its surface, stopped the earth from rotating momentarily, and finally settled into its present orbit to become our sister planet. In a single tremor the foundations of Newtonian mechanics, thermodynamics, cosmochemistry, geology, and biology were set to quaking. The reaction of the post-war scientific establishment was predictable—censure and condemnation. But instead of confronting their antagonist head on the solons of academia blackballed him from the literature, a near-fatal mistake for which they have been eating public crow ever since.

Dormant during the hectic days of the '60's, Velikovsky's brand of catastrophism recently has enjoyed a vigorous rebirth. It rides on the crest of a wave of novel pseudoscientific theories that have come rippling through the '70's to reach a new generation of untrained ears tuned in to listen to it through cooperative media. The belated backlash from the scientific community was inevitable, and it is unleashed full force in the compact collection of essays under review here. Originally intended as a platform to square off pro- and anti-Velikovskyites, the Velikovsky symposium held at the 1974 AAAS meeting lacks, in its published form, one of the principal parties in the encounter—Velikovsky himself, who failed to submit his manuscript for publication. Reaching print, however, are five anti-Velikovsky essays that utterly lay waste his theories.

In a succinct foreword Issac Asimov discusses the human psychology of Velikovskianism. He attributes the popularity of this "exoheretic" to skillful use of scientific jargon coupled with seductive appeal, all of it immersed in a matrix of fascinating material. Donald Goldsmith's introduction sets the stage for the attack by recounting the history of catastrophism from the appearance of Velikovsky's first text up to the present. Sociologist Norman Storer provides the humane backdrop in his essay on the sociological context of the controversy. In a brief taxonomy of the human scientific community, he shows why the confrontation was inevitable: In the eyes of the public Velikovsky appears as "a kind of 'Mr. Smith Goes to Washington,' who brings the virtues of unadorned honesty and a simple concern for the truth into the midst of a self-serving club of arrogant, powerful politicans," hardly a view shared by the scientists. Little wonder some of them became antagonized.

The bulk of the text centers on three papers by astronomers who deal in structural, reasoned approaches with the details of the core of the theory, each skillfully dismantling and examining its complex implications.

Carl Sagan's paper, "An analysis of *Worlds in Collision*," is clearly the main event. By far the longest and most meticulous discourse, it is amusing, acrid, and totally devastating. Touching only lightly on the mythological context of catastrophism (he dismisses himself as unqualified though interested in such arguments), Sagan proceeds to examine the physical evidence relating to ten major problems posed by the Velikovsky hypothesis. For example, what are the physical implications of the ejection of a cometary body from Jupiter? How can the sudden braking of the earth's rotation be accomplished and what are the physical consequences? What physics is involved in the circularization of the orbit of Venus? By a combination of reductio ad absurdum and the demonstrated lack of physical evidence, his essay alone is sufficient to reduce the Velikovsky theory to anile fancy. The arguments are laid out quite clearly for all to see, with appendices for those who care to go through the calculations.

With slight overlap, the other two astronomical essays accomplish what Sagan leaves undone. Derral Mulholland focuses on dynamical implications. Most of Velikovsky's time scales, particularly those involving the rotation of the earth and the revolutions of the satellites of Mars, are found to be far too short to account for the facts of observation. Everything we know about celestial mechanics points to long-term dynamical stability in the solar system. David Morrison disserts on the physics of planetary atmospheres, surfaces, and interiors. A hot Venus, often alleged to be one of the Velikovsky trump cards—it is a prediction emanating from his theory that he claims was later confirmed—is shown not only to have been predicted earlier by somebody else, but also to have nothing to do with Velikovsky's heating mechanism. The blanketing effect of the Venusian atmosphere accounts both for its high temperature and the bizarre chemistry, about which Velikovsky's picture is shown also to be fallacious. The discussion of planetary cratering in the light of recent data from space probes shows the opposition both incorrect and out of date. All other criticism aside, how can a theory that refuses to modify itself in the face of new facts be taken seriously?

Wedged in between these vigorous attacks from the domain of the hard sciences, we find a fascinating paper on the historical issues by Peter Huber entitled "Early cuneiform evidence for the existence of the planet Venus." It is among the most original and interesting contributions to the text. If Venus was created when the Israelites fled from Egypt, then records of its apparition prior to that era could hardly be expected. Huber demonstrates that Venus, indeed, was known well before the second millennium (ancient Middle Eastern myths clearly refer to it as morning and evening star) and furthermore that archaic records per-

taining to its motion imply that the planet possessed essentially its present orbital characteristics. Huber correlates Venus's heliacal risings and settings with textual recordings of the lunar calendar in a long technical section to prove the latter point. For consistency, the lunar-planetary ephemeris is found to be in accord with pre-Babylonian historical chronology.

The overall organization, editing, and presentation of the text are commendable. This reviewer found no typographic errors and only a few incorrect references. The inclusion of identical graphs in two essays (pp. 83 and 163) seemed unnecessary.

What does all of this one-sided debating accomplish?

On the home field of the scientists there is no contest. Velikovsky is flatly and totally disproven. But few scientists ever gave credence to his ideas in the first place, and the book is not directed primarily toward members of the scientific community anyway. For the general reader the volume can be difficult in places. Undefined terms like "latent heat of fusion," "vapor pressure," "three-body problem," "bolometric albedo," and "Curie point" do not adorn the pages of *Newsweek*, though they might sneak into *Scientific American*. Notwithstanding, most educated lay readers will find the book stimulating and convincing.

Which brings us to the primal issue in any discussion of '70's pseudoscience. It is skirted in a statement tucked away on the next to last page of text: "It is difficult for anyone with training in the physical sciences to understand how Velikovsky's ideas, after such a consistent record of failure, can continue to attract wide public interest and generate ardent defenders." The solution is simple: Velikovsky proponents do not deal with his views on a scientific basis because they do not understand the ways of science. The truth about the workings of the natural world are demonstrably best arrived at by the reasoned approach of science we have so painstakingly cultivated. The scientific edifice, interlocking, interdependent, and self-cleansing, produces beautiful results. It is a pity so few who live outside understand what occurs within its walls. The scientist is partly to blame for failing to educate a wanting public, which can often become hostile and suspicious. This book, though it may not have the broad appeal of *Origins* or *The Dragons of Eden*, can be counted among the welcome pieces of responsible literature for the public finally beginning to emanate from the scientific community. As far as Velikovskianism is concerned it is dead and buried. The final nail has been driven. It is to be hoped that we can now move on to more exciting things.

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Mesophases

Liquid Crystals. S. CHANDRASEKHAR. Cambridge University Press, New York, 1977. x, 342 pp., illus. $38.50.

Joseph Needham, writing in *Biochemistry and Morphogenesis* (Cambridge University Press, 1942), argued that "the paracrystalline state seems the most suited to biological functions, as it combines the fluidity and diffusibility of liquids while preserving the possibilities of internal structure characteristic of crystalline solids." To a considerable extent Needham's adumbration remains unrealized although, to be sure, much more is known today concerning lyotropic liquid crystalline phases than might have been true had the subject of liquid crystals not undergone a substantial and somewhat unexpected growth since 1942.

Lyotropic mesophases (those associated with solvent systems) are not treated in detail by Chandrasekhar, but virtually everything else of current interest in liquid crystal physics is, and in an especially satisfactory manner for anyone who wishes to get a good first impression of the subject. In itself that is a valuable contribution, for the subject has needed a treatment that begins with the facts and works its way through the interpretations to the state of the art.

Readers familiar with liquid crystals may find the presentation deficient in this or that favorite aspect of the subject. For example: A central question in liquid crystal science concerns the proportions of attractive and repulsive forces that compel the various phase transitions and order the phases. That question, and its concomitants, are treated incompletely in this exposition, partly because valuable work has appeared since the book went to press and partly because the earlier work has not been treated in a sufficiently critical manner. As early as 1968 the view had begun to take root that an ordered, anisotropic, nematic mesophase resulted from excluded-volume effects between essentially hard, elongated rods in a fluid phase modulated by attractive forces that fixed the density and in some less significant manner assisted the ordering within the mesophase. Such a view can properly be called a "van der Waals model" of the nematic phase. Indeed, it was, and in several recent papers the analysis has been carried rather far forward. Yet over 30 years ago Frenkel suggested that such a circumstance doubtless prevails. After dismissing local dipolar fields as insufficient to account for the phenomenon of mutual orientation between molecules larger than a few atoms, he wrote in his remarkable book *Kinetic Theory of Liquids* (Oxford University Press, 1946): "In this case it is more expedient to treat the molecules as small rigid bodies of definite shape, with superficial fields of attractive forces tending to press them against each other as tightly as possible, so as to ensure a spatial distribution corresponding to the smallest possible volume of the whole system."

Cavils aside, this book is to be commended for what it does especially well. It has a splendid account of the continuum theory, a very strong association between the experimental situation and its interpretation, as carefully assembled a bibliography as any newly interested reader could possibly want, and a felicitous prose style that captures without pedantry the excitement and mystery of mesophases.

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Phytopathology

Plant Disease. An Advanced Treatise. Vol. 1, How Disease Is Managed. JAMES G. HORSFALL and ELLIS B. COWLING, Eds. Academic Press, New York, 1977. xxii, 466 pp. $29.

This volume, the first of five, is a synthesis of the specialties in plant pathology into an integrated approach to disease management. Subsequent volumes will be concerned with epidemiology, metabolic changes in diseased plants, mechanisms of pathogenesis, and mechanisms of disease resistance.

Most of the 21 chapters in the volume under review present principles of disease management in combination with thoughtful projections about future directions of research. The chapters proceed logically from the sociology and history of plant pathology through the topics of disease diagnosis, assessment of crop losses, and the principles of disease management to the specifics of dis-