A Technological Controversy

Clipped Wings. The American SST Conflict. MEL HORWITCH. MIT Press, Cambridge, Mass., 1982. xx, 474 pp., illus. $25.

The effort to develop an American supersonic transport plane touched off one of the most fascinating technological controversies of the 20th century. During the late 1960's and early 1970's, a diverse coalition of public and environmental interest groups confronted the aerospace industry and its Washington lobby in a highly visible and extremely emotional battle that determined the fate of the SST. The conflict was structured and focused, because the financial support of the United States government was indispensable for the development of the aircraft. Congress became pivotal to the fortunes of the SST, and the American public was afforded a rare opportunity to assess the costs and benefits of a technological innovation before crucial decisions were made.

The publication of Mel Horwitch's *Clipped Wings* provides the occasion for reflection and analysis of a conflict that spanned more than a decade and involved four presidential administrations. *Clipped Wings* is the product of a prodigious research effort involving extensive primary sources assembled from federal agencies, presidential libraries, citizen groups, and the National Academy of Sciences. It offers a detailed account of the SST program from its origins in the late 1950's through the final congressional vote in March 1971, and it provides a revealing glimpse of the institutions and actors that participated in the debate.

Horwitch describes the interagency disputes and personality conflicts that bedeviled the project from the outset. The effort of the Federal Aviation Administration (FAA) to maintain control over development of the SST in opposition to the President's Advisory Committee on Supersonic Transport (PAC) consumed the energies of scores of public officials during the mid-1960's. Key actors, such as Najeeb Halaby, William McKee, and Jewell Maxwell of FAA and Robert McNamara and Stephen Enke of PAC, emerge from these pages as bureaucrats who sought to defend the interests of their agencies while implementing their perception of the public interest.

Clipped Wings also chronicles the rise, and ultimate triumph, of the anti-SST lobby. Horwitch details both the activities of the various citizen groups that campaigned against development of the aircraft and the efforts of federal agencies and SST supporters to respond to criticism of the project. Although the author's sympathies clearly lie with SST opponents, he never consciously distorts his presentation of their activities to cast a more favorable light on them. But the bureaucrats in *Clipped Wings* are more complex and interesting characters than the activists, and Horwitch's portrait of bureaucratic politics is far more fascinating than his description of citizen group activities.

There are some interesting revelations in this book that will confirm many of the suspicions nurtured by project opponents throughout the battle. The marginal economic prospects of the SST were understood from the outset, and the commercial carriers, who would have been the primary consumers of the product, were privately skeptical even as they publically trumpeted the virtues of development. U.S. officials never regarded the Concorde as a serious competitor, even when they pointed to the European effort as evidence of the necessity for continuation of the project. No American president championed development of the SST; even Lyndon Johnson, who as vice president had lobbied on behalf of the aircraft, lost much of his enthusiasm for the project following his elevation to the presidency.

These revelations will make *Clipped Wings* an enjoyable reading experience for SST opponents. Readers who seek insight into the conflict, however, will be disappointed with the book. Although the empirical research is impressive, the author never succeeds in extracting himself from his data and providing the reader with an analysis and interpretation of the conflict. Was the SST project defeated by a new public interest lobby, or did it collapse of its own weight? How significant was bureaucratic conflict, as opposed to lingering technological problems or economic skepticism, in retarding development of the aircraft? How valid were the arguments raised by supporters and opponents of the SST during the public debate over development? And how did the demise of the project affect American leadership in aviation technology? Such issues are addressed only indirectly in this book.

The author, moreover, makes no effort to analyze the impact of the SST conflict on American attitudes toward science and technology. During the 1970's, students of technology and society generally regarded the decision to terminate the SST program as a turning point in America's love affair with technology. The socioenvironmental lobby that emerged victorious from the conflict proceeded to confront other technological objectives in the 1970's from a position of strength, as a wary public appeared increasingly skeptical of the virtues of technology. But public attitudes seem to be shifting once again in the 1980's, and environmentalists now appear to be on the defensive. Did the SST conflict, then, mark the dawn of a new era, or was it merely a temporary aberration reflecting the political climate of the late 1960's and early 1970's? Unfortunately, the author has chosen to ignore the issues of lasting importance that emerged from the conflict.

Clipped Wings may well be the definitive history of the SST controversy. Certainly, no other study is likely to produce the richness of detail that characterizes this book. But the reader would have been better served if Horwitch had been more selective with detail and more expansive with analysis. Nearly 350 pages of memoranda and explicit accounts of meetings make the book difficult to read, and those who complete the task are unlikely to emerge with a clear appreciation of the episode. *Clipped Wings* will be of interest to students of bureaucratic conflict and may prove useful in management training courses, but those who expect a detailed case study to provide analysis and interpretation along with description will be sorely disappointed.

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Relics of Solar System History

Meteorites. A Petrologic-Chemical Synthesis. ROBERT T. DODD. Cambridge University Press, New York, 1981. xii, 368 pp., illus. $69.50.

Meteorites preserve the record of numerous processes that occurred during the first 100 million years of the history of the solar system. Chondritic meteorites formed in the primitive solar nebula and have approximately solar abundances of all but the most volatile elements. Some chondrites underwent

moderate amounts of solid-state reheating and recrystallization, but others remained cool and preserved intact the details of nebular processes.

Differentiated meteorites formed by melting. Some are samples of crusts and mantles of asteroid-sized bodies and provide key test materials for scaling igneous models to planets varying widely in such properties as size and pressure. Most iron meteorites formed in cores; they are the only core samples we shall ever be able to subject to laboratory study. The fractionation of some of these cores was more efficient than that found in the most differentiated terrestrial layered intrusions.

During the past two decades the rate of meteorite research has greatly increased, and it is more difficult each year to review the entire field. Thus it is pleasant to discover that Dodd's long-awaited monograph is an exceedingly valuable compendium on the formation and evolution of meteorites. Dodd's approach is petrologic, but he includes relevant data (especially on composition) from all disciplines.

The book opens with a 12-page introduction that includes definitions and fall statistics. It closes with a 12-page discussion of parent bodies and their formation and storage locations. The intervening pages are devoted to discussions of the individual groups of meteorites.

Chondrites are the most primitive meteorites and the most common among observed falls, and it is not surprising that about half of the book is devoted to them. Dodd has devoted his career to chondrites, and this is reflected in the detailed understanding evident in this portion of the book. There is some overlap among the chapters on the differentiated meteorites because of the inferred relationships among the groups. Roughly 30 pages are devoted to the iron meteorites, and 87 pages to the achondrites and stony-irons.

Over the years Dodd has published numerous hypotheses that are by no means universally accepted (in this field, there are often as many models as there are researchers). On the whole his discussion of them here is quite satisfactory. Although Dodd places more emphasis on certain ideas (for example, his sampling model bearing on the formation of porphyritic chondrules) than most others would have, he presents the full spectrum of viewpoints and is laudably cautious about the firmness with which conclusions can be reached.

The strongest part of the book is the extensive discussion of chondrite petrology. The least strong is the discussion of isotopic data; the coverage of age data and isotopic anomalies includes most of the material relevant to chondrite formation but (perhaps wisely) few of the speculations regarding the formation of anomalies in stellar and interstellar settings. In constructing models Dodd is not skeptical enough regarding the use of mineral or track data to infer model-dependent monotonic cooling rates. There are great difficulties in reconciling the inferred low values with old formation ages and coexisting unequilibrated minerals.

The book is copiously referenced, with key references at the end of each chapter and a comprehensive list at the end of the book. The references seem reasonably complete through 1979. It is useful to compare Dodd's book to books by Mason and Wasson published in 1962 and 1974 respectively. Dodd's petrologic approach is similar to that in Mason's book, which is now badly out of date, and complimentary to the more chemical and physical approach found in my book.

The book is remarkably free of typographical errors or printing problems. All meteorite researchers and earth science libraries should have it.

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Neurobiology

Neuropharmacology of Insects. Papers from a symposium, London, June 1981. Pitman, London, 1982 (U.S. distributor, CIBA Pharmaceutical Company, Summit, N.J.). x, 330 pp., illus. $35.

Professor Underwood introduces this volume by asking why insect neuropharmacology is often neglected by workers in other fields. The answer may lie in how well insect neuropharmacologists succeed in using insect preparations to address basic biological questions not amenable to attack in other preparations. Though there can be no doubt that this volume will be of use and interest to researchers who care about insects, it may be fair to ask what basic new concepts or information it offers to those who are not insect physiologists.

Papers by Cull-Candy and Gration describing characteristics of glutamate and gamma-aminobutyric acid (GABA) channels on insect muscle fibers are of significance to all of neuropharmacology. The octopamine modulatory system in insects, clearly described in a paper by Evans, has been influential in the development of the distinction between classical neurotransmitters and neuromodulators.

Much progress in neurobiology has come from the use of venoms and toxins isolated from various plants and animals. A paper by Piek describing recent work on wasp venoms and toxins is of wide interest because some of these substances may prove useful as probes for some excitatory glutamate receptor-channel complexes. Papers by House and Ginsborg, Mordue, and Berridge and Heslop on aminergic and peptidergic systems should also be valuable to vertebrate and invertebrate investigators alike.

In other cases the investigators working with insect preparations are at best trying to attain the level of information already available with other preparations. Notable in this regard are papers concerning the purification and isolation of the putative acetylcholine receptors from insects. Ironically, in spite of the undisputed importance of cholinergic mechanisms in insects, the physiological, biochemical, and pharmacological characterization of acetylcholine receptors in insects has seriously lagged behind work in many other systems. Also lagging behind work with vertebrates are studies of synaptosomal preparations and attempts to characterize glutamate and GABA receptors biochemically. Therefore, although papers in the book on these subjects result from years of careful work, they are likely to be of real value only to insect neuropharmacologists and will be of limited interest to a general audience.

Perhaps the most novel contributions to molecular neuropharmacology made with insect preparations in the past few years have come from the use of genetics in *Drosophila*. One would have welcomed more than the three papers on the subject in the volume (though the three do provide a beginning for the interested reader). Other fields in which invaluable contributions are being made by the use of insect preparations are perhaps also underrepresented.

One of the most enjoyable features of the volume is the extended discussion section that follows each paper. The discussions contain frank and frequently amusing interchanges among the participants (one of the highlights is Eldefrawi's account of fattening a cockroach by injecting it with 10 mouse-lethal doses of ∝-bungarotoxin), which in many cases are more illuminating than the papers themselves. The presence of J. S. Kelly at the meeting enlivened it,