topics. A formula for the frequency is given in some locations, whereas the term is used only discursively in others; the Index does not discriminate. "Resonance tank circuit" (in volume 13) and "Resonance, electric (tank)" (in volume 4) are separated in the Index by nearly two columns of entries. I am willing to believe that out of all of this richness of detail our student could put together an impressive report provided he is unusually persistent as well as interested. I'm more willing to believe that he would soon wander off the track, bemused by the other fascinating articles turned up as he bats from one volume to another. Perhaps it's better this way.

The Index gives some 300 entries beginning with the word "nuclear." Under "nuclear engineering" appear dozens of topics including "background count," "barn," "Geiger-Müller counter," "multipole radiation." Under "nuclear physics" are listed only seven citations, but none of the above—although they and perhaps half of the 300 are in fact topics of nuclear physics. The history of our understanding of the nucleus is treated in the article "Nuclear chemistry"! I'm not a nuclear physicist commenting out of pique; it just seems unnecessary that the organization of the material should obscure its origin and nature.

As a final example I cite the articles named after the principal areas of science and technology—"Botany," "Engineering," "Physics," and so on. These vary greatly in length and approach, from nine pages for "Ecology" to four sentences for "Zoology." In the three-page "Chemistry" article appears another historical summary of events and people associated with the development of the concepts of the atom and the nucleus, a description of the literature of chemistry, and a discussion of employment prospects for chemists. The "Mathematics" article gives, in five pages, a very nice account of the structure and aims of its fields. One page is given to a survey of the development of astronomy and its branches. Why could there not have been some common purpose and format for these key articles?

One is left with the impression that in its fine structure the *Encyclopedia* is for the most part well done; all of the thousands of assigned places in the organization chart have been filled. Editing, however, seems to have been carried out only on an intradisciplinary, article-by-article basis. Judging from my samples and the comments of the earlier reviewers, it would appear that no editor read a manuscript in juxtaposition with others treating related or analogous material, no editor used a wide-angle lens. The indexing appears to have been accomplished in a mechanical fashion; it suffers from a kind of aimlessness and inattention to overall considerations. Of course an encyclopedia is not a textbook, to be organized according to some author's conception of a logical or pedagogically sound treatment. Neither is it a dictionary, organized solely according to our peculiar notion of an alphabet. It must follow the alphabetical sequence in order to be universally useful, but, unlike a dictionary, it can have an overall harmony and its organization is a matter of discretion. There is freedom that can be exploited poorly or well by the editorial staff.

The 11th edition of the *Encyclopaedia Britannica* contains a long editorial introduction which discusses in several places the relationship between its editorial staff and the individual contributors. The editor-in-chief quotes as his guiding principle a statement from his predecessor of the 9th edition, "No effort has been spared on the part of the editorial staff to secure the accuracy and sufficiency of every contribution, and to prevent those repetitions and inconcinnities which necessarily occur where each contributor is absolutely and solely responsible for the articles which bear his name." The *Encyclopedia of Science and Technology* begins with a brief preface by its publisher, who makes no such claim. Well-executed in many of its parts, thorough in its coverage, and valuable as it stands, it will not reach excellence until he can do so.

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Prehistory of the Midwest

Pleistocene and Recent Environments of the Central Great Plains. A symposium, Lawrence, Kans., Oct. 1968. WAKEFIELD DORT, JR., and J. KNOX JONES, JR., Eds. University Press of Kansas, Lawrence, 1970. xii, 434 pp., illus. $25. University of Kansas Department of Geology Special Publication 3.

The grassy plains of North America's heartland form an enormous, seemingly monotonous province that has been commonly accepted as a legacy of geologic time. Indeed, even thoughtful observers since the time of F. E. Clements half a century ago have regarded these vast grasslands as the consequence of a dry climate, maintained by the uninhibited impact of strong winds. Forces opposing these uniformitarian concepts, however, claiming that the apparent permanence of the grasslands is misleading and that these plains were even forested in many places during the Pleistocene Epoch, have been slowly gathering strength, especially in the last decade. To assess various reports of intelligence, the contributors to this book and many of their colleagues closed ranks and held a symposium. Quite obviously, they were in virtual agreement, having mustered material from a variety of sources, including some understanding of physical features, matters of archeology, and new results from botany, together with some truly synoptic work in zoology and zoogeography. These subjects were analyzed both in the perspective of the fossil record and in the immediacy of the present.

With all this ammunition, and with the leading generals in charge, this resulting symposium volume is a frontal attack on the idea of permanent grasslands on the Great Plains—and much more. Several of the generals loom as heroic figures. Even so, this written history of the assault shows a lack of coordination and a raggedness of effort. The editors as organizers of the symposium did not make the ground rules clear enough, and the necessary matters of present-day geography, regional geology, climate, phytogeography, and so on are left out. Worse, an observer trying to piece the action together has a hard time because he is never given the plan of battle. For my part, I had to discover the supporting tactics by a careful reading of the whole book, because the editors provided no substantive introduction, no summary of the outcome, and no index

of the complexities of interplay among the various participants.

Dedicated readers of this collection of papers can, of course, prepare their own catalogs of cross-references, and they are given many productive sources to draw from. For such readers, these sources of information make the book quite worthwhile. In the remarks below, I touch on some of the highlights as a geological reader who is appreciative of the value of multiple approaches for understanding past environments. I do not dwell on the brief papers on local geology, climate, and archeology, not because they are without interest to some readers but because (in my view) they are not focused on the main point of this book.

The environmental history of the Central Great Plains that emerges from this book, as might be expected, is a sequence of cyclic changes prompted by the oscillations between glacial and interglacial climates. The beginnings of these cycles and their tangible effects, in the perspective of the preceding Tertiary environment, are outlined by P. V. Wells in a brief review of the paleobotanical record. The history continues in a paper by C. W. Hibbard, who argues from the evidence of vertebrate fossils that conditions of the early and middle Pleistocene were comparatively equable. From sparse records of fossil pollen described by R. O. Kapp, the vegetation of the Central Plains was then marked by spruce and pine, even though the vertebrates show that subtropical climates extended north into Nebraska during the interglacials. Kapp's results suggest that substantial areas of prairie did not exist until the late Illinoian. From then on, the oscillations of climate became more severe and culminated in the present sharp zonation of climate in late Wisconsin time. Because of Wisconsin-age forests at many sites, which are described in papers on fossil pollen by H. E. Wright, Jr., F. Wendorf, and P. J. Mehringer and his co-workers, the grasslands as seen today are very largely a post-Pleistocene development. Interestingly, a stratigraphic and geographic review by R. V. Ruhe on the buried, relict, and present soils also indicates the wider extent of former forests, even in areas that were receiving deposits of windblown silt from glacial streams laden with outwash. The culminating blow to the dogma that the treeless grasslands are a persistent product of climate is struck by P. V. Wells in two papers, which show not only the recent existence of large stands of mature juniper and ponderosa pine in one of the driest areas (the Laramie Basin) but also the significance of existing "scarp woodlands" that are scattered throughout the Great Plains. To Wells, these protected stands of trees indicate that other factors (dominantly fires) have been more influential than climate in maintaining the prairie environment. In the matter of prairie fires, Ruhe explains that the organic carbon in surface soils can date back more than a thousand years, but this supportive fact was apparently not made known to Wells.

The sharply contrasted environments of the late Pleistocene, which led to greatly reduced areas of grassland during glacial times and to their probable expansion during interglacials, have stimulated zoogeographers to account for the observed distributions of several groups in terms of these changing habitats. Thus H. H. Ross, in reporting that only three of 108 grasshoppers and only a few of the lataline leafhoppers are prairie endemics, concludes that the areas of grassland during glacial stages were indeed small. R. M. Mengel, in a comprehensive study of 233 species of birds, only 37 being indigenous to the present Great Plains, sees the northern taiga as an intermittent connecting route for migration between the eastern deciduous forest and the western montane forest. The taiga was surely broad during interglacials when the grasslands were large, and it probably was frequently broken during glacial episodes when the grasslands were small. Mammalian distributions, however, as analyzed by R. S. Hoffman and J. K. Jones, Jr., seem to require at least some grassland throughout the late Pleistocene. In a longer view, F. B. Cross discusses the fishes as indicators of post-Pliocene environmental change in the Great Plains (details for Kansas are provided by G. R. Smith and D. R. Fisher). His review of the discontinuous ranges of fishes implies a history of reduced surface water and of lessened diversity in aquatic habitats.

These findings from botany, paleontology, pollen studies, and zoogeography are a long step forward, but the results are still indecisive for assessing the relative dominance of glacial and interglacial environments in directing evolutionary trends in the Great Plains. As these matters are worked out, the meaning of the fossil record for comprehending changes in the Pleistocene environment will become clearer.

Thus, a reader with the time and patience to search through some of the papers in this book will find that the traditional view about persistent grasslands in the Great Plains has crumbled under the combined attack of many techniques of study.

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A Weather Pattern

Monsoon Meteorology. C. S. RAMAGE. Academic Press, New York, 1971. xiv, 298 pp., illus. $15.

The large fraction of the world's population living in monsoon countries, especially in tropical Africa and Asia, is critically dependent on weather for survival and progress. Yet it is not until now, when Ramage has drawn together the scattered bits of information available around the world, that a comprehensive survey of the weather factors that different monsoon areas do or do not have in common has been available.

Ramage's approach is that of traditional meteorology. He opens with a search for an adequate definition for the monsoon areas and concludes that the distinguishing characteristics are large seasonal reversal of prevailing wind and, within each season, a paucity of weather disturbances that mask the general pattern for any length of time. Appropriately, amount of rainfall is rejected as a criterion. Then follows a discussion of the general circulation in the monsoon belts, the day-to-day features leading to the observed large variations of precipitation within the rainy seasons, and a detailed discussion of weather through the year in all monsoon areas. The last topic takes up one-third of the book. There is some discussion of seasonal precipitation anomalies, their causes and forecasting. But this information is rather compressed; topics such as weather modification and air pollution are largely omitted; and the author does not take up the option his general title allows of considering the interdisciplinary and environmental aspects—notably water resource management—of meteorology for the monsoon areas.

In line with the contents of the book Ramage specifies in the introduction that his text is intended for graduate or