Yet the record clearly shows that the invasion was coincident with extinction of more modern residents of South America. By contrast, the impact of the southern dispersers on the North American faunas was certainly less important and enduring (Webb, Mares).

Why were the effects of this exchange so one-sided? Webb puts forth a form of the argument promoted by G. G. Simpson and other biogeographers. The northern invaders hail from a vast staging area, where the Holarctic continents were broadly joined in the Early Cenozoic. In this sense, the invaders were already well traveled. They were also adapted to a variety of temperate environments and to the more marked faunal mixing of the Northern Hemisphere. It was this legacy, and not some inherent biological superiority, that promoted their success in South America. Though plausible, this explanation smacks more of narrative than of a theory anchored by hard evidence. Indeed, the chance of a decisive explanation seems slight. However, it is only with the kind of lavish historical documentation assembled by Stehli and Webb that we can presume to consider these more challenging mysteries.

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Atmosphere Physics

Physical Meteorology. HENRY G. HOUGHTON. MIT Press, Cambridge, MA, 1985. x, 442 pp., illus. $37.50.

As Houghton points out in the preface to this book, "physical meteorology" is an inept term for a subdivision of meteorology, since all of meteorology involves the application of physical principles to the atmosphere. Early in the present century the term was introduced to designate the parts of meteorology not considered to be directly applicable to weather forecasting, which was then the principal focus of the subject. Though it has always been recognized that radiation from the sun is the prime source of the energy for atmospheric motions, explicit evaluation of its influence was not considered necessary, since it was thought that atmospheric behavior, as summarized on weather maps, implicitly included its role as well as that of the physical processes involved in the formation of clouds and precipitation.

The study of atmospheric behavior empirically using weather maps is called "synoptic meteorology." Prior to the availability of high-speed large-capacity computers, weather forecasting was carried out by the application of the rules obtained from this study to the movement of pressure and wind systems. The theoretical study of atmospheric flow patterns using the partial differential equations of motion is called "dynamic meteorology." The complexity and nonlinearity of these equations did not permit their integration even approximately before the development of high-speed computers with large memories. With the availability of computers of adequate speed and capacity, dynamic meteorology has largely replaced synoptic meteorology as the basis for weather forecasting. Thus synoptic and dynamic meteorology have been regarded as the central branches of meteorology. Other meteorological topics involving the direct application of the laws of physics are lumped into "physical meteorology."

Of these other aspects, Houghton has selected the transfer of radiation—shortwave from the sun and longer infrared from the earth and atmosphere—through the atmosphere and the physics of the formation of clouds and precipitation for most of his attention, devoting three chapters to each of these topics.

The atmosphere is commonly regarded as a mixture of gases, principally nitrogen and oxygen. In fact, in addition to gases it contains solid and liquid particles that, though they make up a very small proportion of its mass, play very important roles in the transfer of radiation and the formation of clouds and precipitation. To provide a basis for the treatment of these roles, Houghton presents in his first chapter a summary of the nature, methods of measurement, sizes, composition, and sources of particles in the atmosphere and in the second chapter a summary of scattering by molecules and by these larger particles. Finally, after the six chapters covering his major topics, he devotes one chapter each to optical phenomena in the atmosphere and atmospheric electricity.

In recent years several applications of meteorology have led to a great increase in interest in radiative processes in the atmosphere. These include studies of the possibility that carbon dioxide and other polyatomic trace gases added to the atmosphere by human activities may be affecting the earth's climate, the use of radiation measurements by satellites to infer the temperature and humidity distribution in the atmosphere as initial conditions in numerical weather prediction, and, most recently, studies of the possible influence that the introduction of smoke and dust in a nuclear war would have in producing a "nuclear winter." Similarly, interest in cloud physics was stimulated by attempts to increase precipitation, dissipate fog, reduce lightning, and otherwise modify the weather, by studies of the interaction of cloudiness and radiation in climatic modeling, and by investigations of the rainout and washout of pollutants to produce acid rain. In this book the fundamental physics for all of these applications is discussed.

The treatment throughout is clear and concise. In some places derivations are complete; in others they are only indicated, or results are given without deriviation. An extensive list of references, some 600 of them, guides the reader to fuller treatments of each topic.

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Brain Asymmetries

Cerebral Lateralization in Nonhuman Species. STANLEY D. GLICK, Ed. Academic Press, Orlando, FL, 1985. xiv, 287 pp., illus. $49.50. Behavioral Biology.

It has been widely believed that cerebral lateralization is uniquely human. Although animal asymmetries were not unknown, it seems to have been assumed that they were relatively isolated and unimportant, and irrelevant to the understanding of higher mental faculties. The explicit challenge of more recent research has been to demonstrate that cerebral asymmetries in other species are homologous to the well-documented asymmetries of the human brain.

In the preface to the volume under review, Glick asserts that several homologies do indeed exist. One candidate is the recently discovered left-hemispheric control of vocalizations in passerine birds, an asymmetry that at once evokes the left-cerebral dominance for speech in humans. Arnold and Bottjer's careful review suggests, however, that the parallels are not so straightforward as they seemed at first. Recent work by McCasland challenges the cerebral basis of the asymmetry, and there is little correlation across species between asymmetric neural control and either the complexity of the song or its dependence on learning. There is no evidence of asymmetry of vocal control, for instance, in that highly talkative and imitative bird, the parrot—although, oddly enough, most parrots are left-footed!

Seven of the 11 chapters are devoted primarily to asymmetries in rodents. Most of these are concerned with cerebral lateralization in the rat and suggest parallels between rat and human in the asymmetries of transmitter systems and in the influence of