Similarly, the transference number in the suspension may be a well-defined (but not simple) average of transference numbers in the solutions and in the resin. In dilute solutions, where the resin may be a much better conductor, the transference number in the suspension may approach that of the resin alone.

On the other hand, when a salt bridge containing concentrated KCl is inserted into such a suspension, conditions may vary greatly, depending on the construction of the bridge and other experimental details. The two possible extremes occur when the concentration gradient between concentrated KCl and the dilute salt solution either contains no resin or is formed entirely within the resin. When the concentration gradient is established through a layer of the suspension, intermediate effects may be expected.

Where the concentration gradient is entirely formed in solution so that the resin plays no part, the transference numbers of the K^+ and Cl^- are substantially equal and, as usual in simple electrolyte solutions, the junction potential is negligible.

Where the resin plays a role, conditions are quite different from the classical case of a salt bridge immersed in a solution containing a mobile colloidal ion and separated from another solution by a semipermeable membrane. Here the colloidal ion shows its peculiar behavior only at the membrane, whereas at the salt bridge its effect is swamped out by the high concentration and equal mobility of the K^+ and Cl^- ions. In other words, the situation of the salt bridge is essentially the same as in the presence of any simple electrolyte solution. This is presumably the case Marshall had in mind when he assumed that the junction potential of the salt bridge is negligible. The resin, on the other hand, contains immobile ions. It needs no membrane to show the Donnan effects, and it shows these effects at any boundary of solutions. When a concentration gradient from dilute to concentrated KCl is formed between two sides of a resin (or within a resin suspension), the Donnan effects, particularly near the dilute region, cause an inequality of concentrations of the K^+ and Cl^- ions and hence an alteration of their transference numbers, thereby giving rise to junction potentials that need not be negligible. These potentials can be calculated, either as shown by Jenny, from measured transference numbers in the same system, or under idealized conditions from the Meyer-Sievers-Teorell theory or its extensions.

Contrary to Erikson's statement, the Meyer-Sievers theory does not predict a negligible potential for this case. If their Equation 6 is applied to a membrane separating a very low and a very high concentration of an electrolyte whose anion and cation have equal transference numbers, it simplifies to

$$E = \frac{RT}{F} \cdot \frac{1}{2} \ln \frac{A}{A-A},$$

where A is the concentration of immobile ions of the membrane and the remaining symbols have their usual meaning. In other words, the membrane potential tends toward infinity under these conditions, if A (the exchange capacity of the resin) is not negligible.

Apparently, it is *because* of the existence of Donnan effects in suspensions of ion exchange resins that, as suggested by Jenney *et al.*, the use of salt bridges in these and related systems can lead to high junction potentials, which necessitate considerable caution in the interpretation of potentiometric measurements, even of simple pH determinations.

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Book Reviews

Propagation of Short Radio Waves. M.I.T. Radiation Laboratory Series, Vol. 13. Donald E. Kerr, Ed. New York-London: McGraw-Hill, 1951. 728 pp. $10.00.

This book is another excellent volume of the reference series that resulted from the work of the MIT Radiation Laboratory during World War II. In contrast to most of the series, this book does not restrict itself to the radar problem but treats propagation of short radio waves (microwaves) through space without specific regard to their application.

The phrase "propagation of radio waves" usually implies the phenomenon of propagation of radio waves through space as it is affected by the presence of ground and atmospheric disturbances. This book uses a more general definition of propagation, defining the later as transmission of signals from a transmitting to a receiving antenna. In the case of a radar system, this implies that reflection properties of the target must be considered, as well as the characteristics of the background illuminated by the transmitting beam. This book, in fact, devotes considerable space to the study of echoes from various kinds of radar targets, starting from idealized subjects such as scattering from a sphere, and proceeding to the more complex ones such as reflection from aircraft, the

surface of the sea, mountains, trees, and other complex objects.

Included in the book is a section on atmospheric attenuation due to the presence of uncondensed gases and scattering objects such as raindrops. Both of these effects are extremely important at the very short wavelength and, in fact, play the predominant role in evaluating the usefulness of certain classes of communication systems.

In the introduction, the editor gives a number of facts that are of importance in understanding the value of the book. First of all, short radio waves mean here the wavelength range of about 3 m to 1 mm. Although much of the material is perfectly applicable to the longer wavelength region, the reader must be aware that outside this region other phenomena may occur that may well play the more important role.

Second, the authors quite properly state that the book is neither a handbook nor a text, but is rather an interim report on a rapidly changing subject. The basis of the book is the tremendous amount of research accomplished by the Propagation Group of the Radiation Laboratory. Of course, an immense quantity of material, both theoretical and experimental, was available to the authors from many sources. Being most familiar with their own work, they have relied upon themselves much more than would normally be desirable in such a large, complex field. But the reader should understand that both space in the book and time for its preparation were limited, and the authors had limited opportunity to evaluate the work of others. An effort was made to refer the reader to the reports and work of other organizations throughout. Moreover, the manuscript was apparently referred to several experts in the U. S. and England prior to its publication.

The book is extremely well written and the material is well organized and easy to understand even for a nonspecialist. Although the book was based upon research completed prior to 1946, this reviewer believes that it still presents an up-to-date account of knowledge in this important field.

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Fossil Mammals of Africa: The Miocene Hominoidea of East Africa, No. 1. W. E. Le Gros Clark and L. S. B. Leakey. London: British Museum (Natural History), 1951. 117 pp. and 9 plates. 1£ 15s.

Until now, the Tertiary land mammals of Africa south of the Sahara have been among the least known of all continental faunas. A new British Museum series, ably begun, will describe a new and rich collection that includes 10 mammalian orders, about 18 families, and 18 genera identified so far, to be treated by appropriate specialists. These collections have been made at intervals since 1909, often under extraordinary difficulties, such as Pigott's fatal encounter with a crocodile. The authors consider the numerous faunules as essentially contemporaneous and accept the previous interpretation of early Miocene age (Burdigalian, roughly equivalent to the Harrison of Nebraska). This careful, detailed monograph on the abundant fossil ape remains of Kenya introduces critically important material for vertebrate paleontology and anthropology.

The Kenya collections include remains of 13 lemurs, 13 monkeys, and 226 apes. This paper furnishes the first full data on any Miocene ape—previously known essentially from jaws and teeth. Since men and apes presumably split apart about this time, the importance of this new material can hardly be overstated. The apes are *Limnopithecus,* with two species, *Sivapithecus africanus,* and *Proconsul,* with three species. *Limnopithecus* is a gibbon which forms a link in the rough sequence *Parapithecus–Propliopithecus–Limnopithecus–Pliopithecus–Hylobates. Sivapithecus africanus* is generically inseparable from the Indian form on the basis of the material available. *Proconsul* is the abundant primate, ranging from smaller than a chimpanzee to gorilla size. Besides numerous jaws and teeth, it is represented by a skull, lacking the occiput, the associated mandible, and by tentatively assigned clavicle, humerus, femur, talus, and calcaneum. *Proconsul* has a small cranium, with indications of a brain comparable in grade to that of living Old World monkeys, marked prognathism, receding chin, but no sagittal crest or supraorbital ridges. The incisors are of human type, the canines moderately large, the cheek teeth those of a generalized great ape, something like *Dryopithecus,* with an elongated third lower molar and a reduced third upper molar. The limb material suggests habitual quadrupedal rather than brachiating posture, but the calcaneum indicates that it could assume a more erect posture than can the chimpanzee. It remains to be seen whether additional evidence will sustain the authors' suggestion that man did not pass through a brachiating stage.

The closest resemblances of *Proconsul* are to *Dryopithecus* and *Sivapithecus,* then to other great apes, and then to apes and men in general (Hominoidea), with a few primate features, which, among living forms, characterize Old World monkeys and baboons. The authors are justifiably cautious about phylogenies, but this full information about *Proconsul* will be an invaluable basis for all future studies of human evolution. Even without implications as to their exact interrelationships, the morphological series *Proconsul–Australopithecus – Pithecanthropus – Sinanthropus – Homo neanderthalensis–H. sapiens* is nicely graduated from a generalized ape to modern man, now represented, for each stage, by adequate material and with only moderate anatomical gaps between stages. *Proconsul* thus immediately assumes key importance for discussions of human origin.

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