and the cortex as equipotential are equally dead. Obviously such studies are going to throw much light on questions relating to human behavior.

"Communication" is considered in a very broad way in the book—even the possibilities that sneezing, coughing, and vomiting may be forms of communication are touched on. A fundamental confusion arises where the organized social group is regarded as being identical with the system of communication; I believe that it is much more useful to view the communication system as one of the essential mechanisms by which group behavior is organized, a point of view which leads to more emphasis on the function of the message and less on the particular channel. This is particularly important in the study of nonhuman primates, where, as is pointed out by Altmann, the message may have no auditory component or, if it does, this component may be unimportant. The long discussion of design features common in primate communication leaves the reader with no clear notion as to why human language appears to be so different. Emphasis on the message clarifies this point, as the nonhuman primates can convey very little information, whereas human language by virtue of using names for environmental reference can convey a vast number of messages. Probably the greatest difference between man and the nonhuman primates is language and the anatomical structure which makes it possible. Study of the communication systems of the nonhuman primates can reveal both the fundamental differences and the importance of human language.

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Theoretical Battles Waged and Won

Electrons, Ions, and Waves. Selected works of William Phelps Allis. Sanborn C. Brown, Ed. M.I.T. Press, Cambridge, Mass., 1967. 452 pp., illus. $20.

In this volume Sanborn C. Brown has collected some of W. P. Allis's theoretical papers to commemorate his colleague's new appointment as professor emeritus at M.I.T. The grapevine has it that this task was accomplished in the greatest secrecy just in time for formal presentation on a most festive evening when wine, women, and song abounded.

Allis battled the Boltzmann equation long before the modern era of plasma physics dawned on us, and most of those armchair generals who like to relive battles at their desks will find, upon reading *Electrons, Ions, and Waves,* an easy answer to the question of how they would have fared in this intellectual struggle: The Boltzmann equation would have won. Allis, more courageous and talented than many, has managed to fight the inscrutable equation to a draw: Involved partial differential equations, in anywhere from one to seven independent variables, are handled by extensions of the perturbation kinetic method that Lorentz applied to electron motion in metals. The list of problems solved is impressive, and includes, among others, a determination of the velocity distribution of the electrons drifting and diffusing in a Townsend apparatus and a theoretical treatment of high-frequency electrical breakdown in gases. The Townsend problem involves an approximate solution of the space-dependent Boltzmann equation, a boundary-value problem which has not been exactly solved to this day. Evaluation of breakdown potentials requires a precise determination of the high-energy tail of the electron velocity distribution when both elastic and inelastic collisions with real neutral atoms play an important role. It is no surprise then that this collection includes also some of the most detailed modern calculations made on the scattering loss of charged particles from magnetic-mirror confinement systems. These are all challenging problems in kinetic theory.

During the 1950's Allis tackled the ambipolar diffusion problem by a mixture of analytical and numerical techniques. Anyone who has ever tried to subtract slightly differing plasma electron and ion charge densities without ending up with 10^6 volt/cm will appreciate that his paper on "The Transition from Free to Ambipolar Diffusion" is a classic. According to the editor's explanatory remarks such subtraction continues to be a problem in this field, and led to the inclusion of a recent unpublished paper, "On the Ambipolar Transition."

Many have been dismayed by the jungle of misnomers, semantic confusion, and redundancy in the literature of wave propagation in plasmas. Toward the end of the 1950's Allis decided to do something about it. In the period that followed, the notions extraordinary wave, $m/M = 0$, right-hand polarized, left-hand circular, ordinary, cut-off, $M/m >> 1$, resonance, and the like went into the grinder and reappeared as principal lines and as phase velocity curves on what has come to be called the CMA (Clemmow-Mullaley-Allis) diagram. Some approximations had to be made: Collisionless damping fell by the side, and most other thermal effects were ignored. This upset some of the purists, but when all is said and done Allis's classification of waves has proved its worth, especially to the experimentalists who now frequently interpret wave propagation through nonuniform plasmas with the help of such diagrams. About one-fourth of this volume is devoted to these subjects in wave propagation. Here too, in his paper "Electron Plasma Oscillations," we find Allis (1958) deriving a Landau damping rate, correct apart from a factor $16\pi^2$. Present-day readers may be upset to find that his derivation is based on a calculation of the work electrostatic waves do on the trapped electrons, a nonlinear effect, when the Landau derivation was based on linear phenomena. The resolution of this difficulty is left to the reader, who is encouraged to remember the emotions Landau damping generated ten years ago.

These selected works mirror the characteristic style with which one man has influenced many colleagues and students over the past four decades. For his editorial efforts in collecting these works Brown deserves the thanks of all who wish Allis well.

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Why Science Succeeds

The Organization of Inquiry. Gordon Tullock. Duke University Press, Durham, N.C., 1966. 242 pp., illus. $5.50.

In *The Organization of Inquiry* Gordon Tullock attempts to explain how the apparently nebulous structure of scientific activity has enabled scientists to produce a coherent and cumulative body of knowledge. He begins his treatment with an analysis of the social organization of science and goes on to consider the question Why in-