

## BOOK REVIEWS

*Cybernetics*. By Norbert Wiener. The Technology Press; New York, Wiley; Paris, Hermann, 1948. 194 pp. \$3.00.

As most of the readers of this review are aware, the word cybernetics has been coined to serve as the name of the new branch of science which deals with control and communication generally. The first problems that were considered in this field were, naturally, problems concerning control and communication in the inanimate systems of physics and engineering. However, it now appears, more or less clearly, that cybernetics may also have important applications in biology, psychology, and perhaps other sciences. Before beginning to comment specifically on Professor Wiener's book, it will be well to say a little about the subject of cybernetics itself.

In its present state of development cybernetics is concerned with three main themes.

First, consider the problem of control in its pure form. We desire, let us say, to make some physical variable a prescribed function of time, or, equivalently, to make some "output signal" equal to a given "input signal." In general it is impossible to achieve the desired equality exactly, but we can achieve approximate equality in various ways, depending upon the particular case in hand. Now in many cases the best way of achieving a good approximation to the desired result is by using a system which measures the difference between the input and output signals continuously or intermittently, and which operates so as to reduce the magnitude of this error. This leads us to the first main theme of cybernetics, the subject of feedback control systems. Linear feedback systems have a very attractive mathematical theory, which depends upon nothing more than the classical theories of linear differential equations and analytic functions.

The physical or other systems with which we deal in practice are always subjected to disturbances of one kind or another, and consequently the signals transmitted through the systems are accompanied by more or less troublesome "noise." The second major theme of cybernetics is concerned with the statistical properties of such noises, with means for protecting the signals against the noise, insofar as that is possible, and with the problem of correctly interpreting a received signal which is seriously perturbed by noise.

Finally, we have the part of the subject that is concerned with the nature of information itself, and with problems of coding, that is, with the selection of suitable signals for the most efficient transmis-