

The inclusion of a kinetic theory of diffusion also appears as a worthwhile extension of the old avenues of attack. One would guess that the "true" picture of the diffusion processes of a metabolizing cell lies somewhere between the two extremes—the hydrodynamic, continuous model and the kinetic, discontinuous one. A two-sided attack on the problem seems the logical way to proceed.

A third, extremely promising, methodological innovation is the introduction of Boolean algebra (or logical calculus, or symbolic logic) methods in the construction of models for neural nets with specified properties. The method was initiated in a paper by McCulloch and Pitts published in *The Bulletin of Mathematical Biophysics* in 1943. In the hands of Rashevsky and his collaborators, notably Householder and Landahl, the method was greatly extended and enriched. In particular the previous "continuous" theory of neural nets was reinterpreted as a limiting case of the "discontinuous" theory involving a large number of neural elements. One is inclined to regret that a more extended development of the method was not included in the revised edition.

The new applications of mathematical biology form the other direction in the extended work of Rashevsky. It is particularly gratifying to see the inclusion of a considerable amount of experimental data, which were only scantily represented in the first edition. Significantly, the reason for the paucity of experimental evidence in the first edition is that a great deal of it was obtained *since* 1938. It thus forms to some degree a corroboration of the *predictions* of the theory.

In part I, the most interesting data are those dealing with the rates of cell division, exhibiting an interesting relation between the rate of elongation and the rate of constriction, predicted by Rashevsky's theory of cell division based on the approximation method.

The most abundant extensions of applied mathematical biophysics are found in Part III, which deals with the central nervous system, especially in the chapters on discrimination, delayed reflexes, error elimination and learning, and visual perception. These chapters now include an impressive amount of experimental evidence in sufficient agreement with the Rashevsky two-factor theory of nervous excitation to put beyond doubt the usefulness of the theory.

A. RAPOPORT

Equazione differenziali. By Francesco Tricomi. Turin, Einaudi, 1948. 312 pp.

This text contains a somewhat unusual but interesting and well integrated sequence of topics. A Picard type existence theorem is

given and a singular point for a first order differential equation is investigated. Most of the discussion is concerned with second order equations or the equivalent systems. For these the linear dependence of solutions, the Wronskian theory, the variation of parameters method, the circuit of a singularity in the complex plane, Fuchs theorem, solution by power series, the Sturm-Liouville theory and the asymptotic behaviour of characteristic functions and characteristic values are given. The last chapter also contains a Cauchy type existence theorem, based on majorants.

There is a valuable emphasis on individual functions, whose properties are derived from the fact that they are solutions of a differential equation. For instance the circular and elliptic functions are treated in this way. The asymptotic behaviour of the Laguerre and Legendre polynomials and the Bessel functions are used to illustrate the characteristic function theory. The hypergeometric series is developed in the last chapter. On the other hand as a matter of policy the usual methods for the integration of first order equations are omitted.

The style is clear and the book should prove a valuable reference. The author claims, quite justly, that this corresponds to a "modern course" in differential equations and there is quite a contrast with the American courses on "methods of solution" and "theory." The pressure from applications and the results of theoretical developments are clearly present. However the existence theory is not the most general possible and the elementary methods and the constant coefficient linear equations are worth considering. The need of two courses seems clear but they should be carefully organized for maximum usefulness.

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Tables of generalized sine- and cosine-integral functions. Parts I and II. (Annals of the Computation Laboratory of Harvard University, vols. 18, 19.) Harvard University Press, 1949. Part I, 38+462 pp. \$10.00. Part II, 8+560 pp. \$10.00.

DEFINITIONS:

$$\begin{aligned}
 S(a, x) &= \int_0^x \frac{\sin u}{u} dt; & C(a, x) &= \int_0^x \frac{1 - \cos u}{u} dt; \\
 Ss(a, x) &= \int_0^x \frac{[\sin u] \sin t}{u} dt; & Sc(a, x) &= \int_0^x \frac{[\sin u] \cos t}{u} dt;
 \end{aligned}$$