THE BATEMAN PROJECT

"This work is dedicated to the memory of Harry Bateman as a tribute to the imagination which led him to undertake a project of this magnitude, and the scholarly dedication which inspired him to carry it so far toward completion."

THESE WORDS INTRODUCE a monumental work on mathematics conceived by Dr. Harry Bateman, who at his death seven years ago at the age of 63 was Professor of Mathematics, Theoretical Physics, and Aeronautics at the California Institute of Technology. Carrying forward the work he began, an international team of mathematicians directed by Professor A. Erdélyi has dedicated some 15 man-years of their efforts to complete it.

These efforts have resulted in a three-volume series called *Higher Transcendental Functions.* Volume I is scheduled for publication this month. *Tables of Integral Transforms,* in two volumes, will follow.

This work is the outgrowth of the Bateman Manuscript Project which was sponsored at Caltech by the U. S. Office of Naval Research. It is expected to become indispensable to pure and applied mathematicians, theoretical physicists, some electrical engineers and others for whom special mathematical functions are almost a daily tool of their research. It will be a standard reference, useful whenever special functions are needed to solve problems.

A mathematical function expresses the relation between two or more variable quantities. Simple examples are $y=x+2$ and $y=\cos x$. The higher transcendental functions are considerably more involved than these algebraic and trigonometric functions. They are used to describe more complex relationships and to solve more difficult problems than those involving simple quantities or relationships of angles.

Virtually all special functions originally were mathematical inventions, but many have been found to be valid representations of natural phenomena. A few examples are Bessel functions, which can be used to describe the motion of water waves spreading from the point where a rock fell onto a smooth surface; Legendre functions, the electromagnetic radiations from a radar antenna; and confluent hypergeometric functions, the waves scattered from an atomic nucleus by an electron.

The books carry out Bateman's objective of compiling an encyclopedic reference work in which the contributions to mathematical analysis of hundreds of mathematicians, living and dead, would be available. They describe the properties and interrelations of special functions and bring together information now scattered widely through many journals and books. Without them, a scientist wanting the properties of a specific function might have to seek out a dozen or more different sources, some in rare periodicals. With them, many scientists will save days or weeks of search.

Bateman had a unique and impressive combination of interests and knowledge. An adroit and skillful analyst, he made contributions to aerodynamics, hydrodynamics, geophysics, thermodynamics, electromagnetic theory, and a host of other fields. He came close, in fact, to anticipating Einstein's general theory of relativity.

He looked far ahead of technical development. During the first World War, for example, he published a paper on the stability of helicopters, which came into wide use only during the second World War. A key man on a National Research Council Committee on Hydrodynamics, he wrote most of its definitive 600-page report. He was a member of both the U. S. National Academy of Sciences and the Royal Society of London. He almost invariably replied to requests for solution of problems by return mail. He documented these solutions with extensive bibliographies, many of them supplied from memory.

He planned a work in which he would lay down all the mathematical analysis he used in these endeavors, to make it easily accessible to all. Then, at his untimely death, he left notes scattered through his three offices. At least ten thousand pages were filed, but not indexed, in many places—including dozens of shoe boxes.

After a preliminary survey by Dr. A. D. Michal of Caltech, the research team was brought together in 1948: Drs. Erdélyi, University of Edinburgh, now of Caltech; Wilhelm Magnus, University of Göttingen, now of New York University; Fritz Oberhettinger, University of Mainz, now of the American University, Washington; Francesco G. Tricomi, University of Turin; and several younger mathematicians and assistants.

They had to select judiciously from Bateman's voluminous legacy if their job was to be done in a reasonable period. They added a good deal from their knowledge of the literature and their own research.

The Bateman work is unique in that no other exists on a similar scale. It provides all the information commonly needed on special functions. It stands as a permanent monument, available for daily reference by scientists in the many fields to which Bateman contributed.