observational sciences. But that is enough to give mankind strong reason for following this lead in seeking the knowledge required to improve social organization.

I do not imply that the social sciences can rapidly become such assured guides to social progress as the natural sciences are to technology. Because of difficulties inhering in their subject-matter, the social sciences will continue indefinitely to lag behind the natural sciences in precision and reliability. For a long time to come we shall have to form our opinions on many social issues in the light of common sense rather than of science. Knowledge of past experience should prove helpful in this uncertain process, and advice from specialists who have studied this experience should be sought. But wise technical advisers in these difficult matters will not pretend to certitude. As citizens we shall do well to suspect the intelligence, the candor or the disinterestedness of those who promise sure cures for social ills.

Scientific men are wont to face facts, whether these facts conform to their wishes or not. Most of them are sufficiently emancipated from conventional thinking to look critically upon social institutions. They contrast the society of to-day with its poverty in the midst of plenty, its class, racial and international animosities, its puerile aims and its destructive methods, to a society they can imagine living in security and comfort, using its increasing knowledge to provide a finer life for all mankind. This contrast should not be accepted in a spirit of resignation. It is a call to action. But scientific men will not be true to their own standards, they will not render to society the largest service of which they are capable, if they let their actions be guided by their feelings. No current discouragement should blind us to the great strides in human welfare made since science assumed its modern form; no fit of impatience over delays and relapses should make us forget that knowledge is won step by step, through the toilsome efforts of thousands of men. To jump this work with its numberless failures and its gradually cumulating successes, expecting to land in Utopia, is to give up faith in science for faith in magic. Men who take scientific methods seriously as the best hope of floundering mankind will seek to apply them just as critically and remorselessly in their social as in their physical thinking.

But science can not flourish in the future and yield the fruits for which we hope unless freedom of thought prevails. That is a condition we have been inclined to take for granted as part of the heritage our predecessors won. Now we realize that what they fought to win we must fight to maintain. The investigator's right to follow truth wherever it led was part of the common man's right to freedom of conscience and freedom of speech. These rights were established by political struggles and embodied in political institutions. The democratic way of life and the scientific way of thinking grew up together, each nourishing the other. If one now fails the other will falter. Where democracy is suppressed to-day science is fettered; for autocracy can not brook disinterested criticism of its dogmas or its practices. Freedom of scientific work in the years to come can be guaranteed only by preserving the institutions that secure freedom to all citizens. Perhaps scientific men have more at stake than any other social group in the struggle to maintain democracy.

To this struggle they can make a crucial contribution. The fate of free societies hangs upon the wisdom or folly of mass decisions. The gravest dangers to democracy come from within, not from without. They are ignorance and propaganda that turns ignorance to its uses. The best way of dispelling ignorance is by diffusing knowledge. The most effective defence against meretricious propaganda is critical inquiry. John Dewey is warranted in saying that "the future of democracy is allied with spread of the scientific attitude."[5] To foster this attitude among their fellow citizens by all means within their power is a duty incumbent upon us who cherish science. As teachers in schools and colleges we can help thousands to develop respect for evidence. As citizens we can be brave opponents of prejudice and hysteria. We can promote general understanding of the methods and results of science through our own writings or those of allies more skilled in popular exposition. These things we should do, not as high priests assured that they are always right, but as workers who have learned a method of treating problems that wins cumulative successes, and who would like to share that method with others.

OBITUARY

FREDERICK ADAMS WOODS

FREDERICK ADAMS WOODS was born at Boston, on January 29, 1873, and died on November 5, 1939, in Rome, Italy. His father was Solomon Adams Woods, who, born in Farmington, Maine, 1827, came to Boston about 1847 and became a successful manufacturer of wood-working machinery. Frederick Adams Woods's mother was Sarah C. Watts. She was fond of study. Her father was a seafaring man whose later life was spent in Boston devoted to study, especially of mathematics. Frederick's career was largely determined by

[5] "Freedom and Culture," New York, 1939, p. 148.

the heritage and environment into which he was born. He had a love of study and was especially interested in the application of mathematics to biology. He became, as Henry F. Osborn once called him, "the American Galton." He inherited a patrimony that left him relatively independent. He became one of the few scientific amateurs of his time in America.

Woods studied at the Massachusetts Institute of Technology from 1890 to 1894, graduating precociously. But his interest was man, so he studied at the Harvard Medical School (graduating in 1898) and remained there to teach histology and embryology for four years. He then became connected with M.I.T. as lecturer in biology and so remained for twenty years.

Woods was actively employed in study during these years of comparative freedom from the necessity of earning a living. His first book, "Mental and Moral Heredity in Royalty" (1906), was a contribution toward "the science of history"—a science based on statistical analysis. His book opens with a regret that "so little attention is paid to heredity in the biological sense." The work struck out on new lines. Seven years later (1913) was published his "The Influence of Monarchs; steps in a new science of history." This work correlated the qualities of the rulers (classified in three grades) with the condition (in three grades) of the countries over which they ruled. Here he concludes: "The true interpretation of history must hinge upon the gametes."

It was during the time between the publication of these two books that Woods sent to SCIENCE his paper, "Historiometry as an Exact Science," in which he analyzes at some length (as an illustration of method) the relative eminence of Euripides and Sophocles. Historiometry was the keynote of most of Woods's later work. In his researches he made much use of photographs of past monarchs and others, and this led to his discussion (1919) of evolutionary changes in type of face of the New England stock.

The World War aroused an especial interest in Woods. With Alexander Baltzby ("Adams Woods fellow in Harvard University"), he wrote a book on "Is War Diminishing? A study of the prevalence of war in Europe from 1450 to the present day" (1915). This study also is quantitative; it shows up Prussia as the most pacific of the European powers.

Woods was a man of rather striking personality, nearly six feet tall and slender—decidedly of the respiratory type. His intellectual interest was always in the biology of man, especially dynamical man. That is why teaching histology and embryology at the Medical School did not satisfy him. As early as 1899 he began to breed rabbits to test Galton's Law of Ancestral Inheritance and, in 1903, published in *Biometrika* a paper on "Mendel's Laws in Rabbit Breeding." He took very active interest in the American Breeders Association and its successor, the Genetic Association. During 1918–19 he was editor of the *Journal of Heredity* and contributed numerous articles on human heredity to it. He participated on committees of the Eugenic Congresses. The Galton Society was one of his main interests before he left this country to reside in Rome. He was elected president of the Eugenics Research Association, but his health did not permit him to serve. As a speaker and writer he was always clear and very serious. His life work was all a labor of love and a product of his rare personality.

CHARLES B. DAVENPORT
COLD SPRING HARBOR, L. I., N. Y.

FRED WILLIAM TINNEY

FRED WILLIAM TINNEY was born at Saco, Montana, October 30, 1907. After graduation from the local high school, he entered the State Teachers College, Oshkosh, Wisconsin, where he received the degree of B.Ed. in 1929. He spent two years at the University of Oklahoma as assistant in botany, taking an M.S. degree in 1931. He then came to the University of Wisconsin as research assistant, which position he held until his appointment, in February, 1936, as assistant agronomist in the Bureau of Plant Industry of the U. S. Department of Agriculture, stationed at the University of Wisconsin, Madison, Wis. The degree of Ph.D. was received in 1933.

He married Madeline Morrissey on June 12, 1939. Both Dr. Tinney and his wife attended the International Congress of Genetics at Edinburgh. Both were passengers of the ill-fated *Athenia,* sunk off the coast of Scotland, on September 3, 1939. They were among those listed as missing since the disaster.

Dr. Tinney's research included a thoroughgoing study of heteropycnosis in two species of *Sphaerocarpos.* After this came an investigation of the cytology of an ornamental grass, *Agrostis nebulosa.* This led naturally to the study of the genetics and cytology of pasture grasses. After Dr. Tinney's appointment in the Bureau of Plant Industry, work in this field was carried on at Madison in cooperation with the department of agronomy of the University of Wisconsin. A paper embodying his extensive studies of blue grass (*Poa pratensis*) is in press. This grass has been the source of much confusion because of the multitude of races included within the species and of the variety of chromosomal conditions which these races manifest. Tinney's observations and studies of the peculiar methods of embryo-sac and embryo-development characterizing the species, go far toward explaining the peculiar genetic behavior of its varied forms. It promises, too, to supply a basis for the selection and breeding of improved strains of this and other grasses—a relatively new field of endeavor in America.

Deeply devoted to fundamental research in accord-