the opportunity for their active participation in the training of the body of teachers and scientific and professional men that the Colonial peoples so greatly need, and must provide as rapidly as possible from their own ranks. He suggests not only taking a mission—with a harmonium rather than a big drum—around the universities to enlist their active contribution, but also the establishment of a central organization of some kind to watch over the needs of the higher education of Colonial peoples, and to bring their needs and the opportunities these offer continually to the notice of schools, universities and learned societies at home."

THE British National Trust has acquired nine hundred and fifty acres of land at Avebury for the nation. The purchase includes the greater part of the group of prehistoric remains that make this one of the most important archeological sites of Europe.

THE Library of Congress has acquired a microfilm of *Khimicheskii Referativnyi Zhurnal* (chemical abstracts journal) for the years 1938 to 1941 (Volumes 1–4, No. 9) except for No. 4, 1939, and No. 12, 1940. This publication contains abstracts of scientific material published exclusively in the U. S. S. R. The microfilm is available for consultation in the Microfilm Reading Room of the Library of Congress or positive prints may be obtained from the Library of Congress Photoduplication Service.

ACCORDING to a Reuter dispatch from London, Sir Isaac Newton's library has been sold to the Pilgrim Trust. The library consists of 858 volumes, nearly all in contemporary calf bindings. The most important items are first and second editions with many corrections in Newton's handwriting. A number of the books have Newton's autograph signature. The destination of this collection has not been announced. Some months ago the Pilgrim Trust bought the Newton birthplace for the nation.

DISCUSSION

SCIENCE AND WAR

IN SCIENCE (Vol. 97, p. 485), Professor R. A. Millikan attempts to refute the argument that the physical sciences are largely the offspring of war and in so doing makes statements to which scholars who have devoted their lives to the history of science and technology will probably object.

There is no acceptable proof that "gunpowder was invented and first used only for peaceful purposes about 880 A.D." Professor George Sarton has studied all the original sources of information and concluded that gunpowder first appeared toward the close of the thirteenth century either in Syria or western Europe. Moreover, it was used in incendiary and explosive hand grenades soon after its invention.

Professor Millikan maintains that the application of artillery "first began on a serious scale about 1800 A.D." Cannon and muskets were so effective by the sixteenth century that they were rapidly displacing the long bow and other feudal equipment. Sombart goes into this matter thoroughly in his "Krieg und Kapitalismus."

To insist that the discovery of the principles of Galilean-Newtonian mechanics "had nothing whatever to do with war" is to fly in the face of the facts. All the physicists of the Renaissance were inspired by military problems. Newton and Galileo were much concerned with ballistics. The historic evidence that both were strongly influenced by military and naval considerations has been gathered and weighed by B. Hessen in "Science at the Crossroads." His interpretation is widely accepted.

Professor Millikan's statement that science flowered with exceptional vigor from 1814 to 1914, one of the few relatively peaceful periods in European history, ignores the fact that every country was then preparing for possible war, that standing armies were increasing in numbers and that military and naval technology were brought almost to their present pitch of perfection. It was in this period of armed peace that we had such developments as battleship armor, built-up guns, machine-guns, high explosives, coal-tar chemistry (closely linked with explosives), the reduction of nitrogen from the atmosphere (for military purposes primarily), aviation (encouraged for military reasons by every power) and the beginning of synthetic rubber (developed by the Germans in view of an inevitable blockade).

In considering this period Professor Millikan ignores "derivative problems," as Professor Robert Merton calls them, that is, such problems as the expansion and compressibility of gases, strength of metals, rates of combustion of powders, resistance of the air to projectiles and a host of others which were presented by explosives and which received the attention of physicists to the advantage of both war and science. Professor Millikan seems to imply that because the research scientist may be unaware of social pressure he remains immune to it. But the pressure is there and can not be avoided.

It is difficult to see that Professor Millikan proves anything by saying that "the average span of life . . . is about sixty years, whereas only 150 years ago it was about thirty years." Soldiers benefit from advances

in medicine and sanitary organization as much as do civilians. A good deal of medicine and hygiene came out of war.

The relation of science to war is not easy to disentangle from a complex of factors, such as the downfall of feudalism, the Reformation, the rise of liberalism and democracy and hence of "high capitalism" and the trader. But the evidence collected by specialists indicates plainly the pressure that the exigencies of war have exerted upon physical scientists.

The effect of war on technology is especially clear. There is not the slightest doubt that the blast-furnace, the coke-oven, the steam-engine, machine-tools and the heavy chemical industry came directly out of military necessity with the introduction of firearms. Here the researches of such scholars as Merton and Werner Sombart are authoritative.

The branches of biology which have made most progress are agriculture and medicine, and the relation of both to war has been brought out time and time again. Moreover, it is significant that the biological sciences as a whole lag behind the physical sciences for the reason that military advantage and profits lie in chemistry, physics and engineering but not in the study of life.

Lastly, there is the remarkable fact that the Chinese, on the whole a stable and pacific people with a culture that has come down intact from ancient times, long made no military use of gunpowder, though they were familiar with it for centuries. As technicians and craftsmen they were in no way inferior to their European contemporaries until the arrival of the Jesuits. Much of the Taoist doctrine of non-action and non-violence must have sunk into the masses. It is significant that in Europe, where gunpowder was used in war, science leaped forward with the introduction of cannon, whereas in China, where gunpowder was used only in pyrotechnics, experimental science was not developed. At any rate it is clear that social influences can not be disregarded in tracing the history of science. And the social influences in Europe have always been chiefly military and economic, with war and economics evolving hand in hand.

WALDEMAR KAEMPFFERT

AREA FIGURES FOR UNITED STATES AND GREAT LAKES STATES

IT will be a surprise to practically every one to realize that the leading reference books of the world give the total area of the United States some 61,000 square miles less than it actually is; the State of Michigan some 40,000 square miles less; Wisconsin about 10,000 square miles less; with similar though lesser diminution of the total area figures for all the other Great Lakes States.

These errors are due to the practice of computing the total areas as if the northern boundary of the United States, which is also the northern boundary of each of the Great Lakes States, were the southern shoreline of the Great Lakes; whereas the international line through the Great Lakes region has nothing whatsoever to do with shore, channel or even presence of water, but is as definite and fixed in perpetuity as the 49th parallel.

Publishers of various reference books, when advised of these inaccuracies, reply that they are quoting the official figures of the U. S. Bureau of the Census.

The Bureau of the Census, in its area table, has an outright error in the total area of the United States. The same tabulation, by its misleading manner of presentation of the facts concerning the total areas of the Great Lakes States, has given rise and authority to the currently quoted total area figures for those states, which are incorrect.

Former Director Austin of the Census Bureau saw these mistakes—which have been of long standing—and agreed to correct the misleading method of presentation in the Census of 1940. After a change of directorship was made, the decision was reversed.

The Bureau of the Census refused to revise its manner of presentation (1) for its own statistical convenience; and (2) because it wishes not to arouse sea-coastal states which advance uncertain claims for strips of ocean water of varying width. For these two reasons it prefers to disregard the fact of absolute ownership by the United States and the Great Lakes States of the American portion of the Great Lakes, and continues to treat this part of the United States as if it were the high seas.

In final extenuation of their attitude, the Director of the Census has advised: "I call your attention to the fact that *land and water areas shown in Census publications have no legal status.* They are used by us solely for statistical purposes."

In direct contrast with the foregoing paragraph is the statement of the Librarian of Congress that the Bureau of the Census is the only authority at present for figures concerning the area of the United States and of the individual states.

The director of the American Geographical Society, speaking for himself, not in behalf of the society, agrees that from the jurisdictional point of view the waters of the Great Lakes within the international boundary should be considered as part of the United States, and their areas assigned to the several states of which they are a part, and that the Census Bureau would have done well to have made this clear.

Canada and Ontario find nothing to prevent the inclusion of their share of the Great Lakes in their total area figures.