Nicholas] "estimates that in the biological sciences alone exclusive of medicine, there are available about 67,000 scientists."[2]

Professor Dunn appears to have completely misread Professor Nicholas's article, the purpose of which was to show the vital relation of the work of the said estimated 67,000 biological scientists to the war effort. In fact, his whole article is a plea for the conservation of manpower in the biological sciences to prevent an imminent shortage of workers in these fields so essential to the maintenance of our war effort.

A few quotations from Professor Nicholas's article will make this abundantly clear:

> The services must be fed and clothed, and increased amounts of materials essential to these vital functions must be produced by a campaign of blood and sweat as rigorous as that involved in the mining of metals or the extraction of fuel. No other field must contribute so much to the war effort in material and in morale as do biology and agriculture; they provide the ultimate foundation for victory. . . . At no time in our history has this group been loaded with a greater responsibility. This it accepts, asking only that Selective Service carefully consider the importance of the biological group and the maintenance of its personnel; that legislative planners be brought, if possible, to think of how serious and far-reaching would be the effect of ill-considered restrictions of its efforts.

This is a far cry from Professor Dunn's assertions implying that 67,000 biological scientists are available for war work. He evidently disagrees with Napoleon that "An army travels on its stomach" and apparently would have us believe that the only people whose work relates immediately to the war are those who make bullets and those who fire them.

DONALD PRICE

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THE MOSCOW SCHOOL OF TOPOLOGY[1]

FROM a purely logical point of view, topology, the mathematical science of continuity, is one of the most fundamental branches of mathematics. According to Hermann Weyl, all mathematics grows out of algebra, which studies the realm of discrete operations with numbers and other mathematical symbols, and topology unites these symbols into continuous variations.

From a more practical point of view, topology occupies one of the key positions among the many different branches of modern mathematical science. In nearly all these branches of mathematics as well as in many fields of physics and engineering there is an increasing number of problems where the essential difficulty of solution lies in working out a subtle quantitative analysis which can be performed only by topological methods.

Little wonder, then, that topology attracts the special attention of mathematicians the world over. Henri Poincaré, the greatest mathematician of the beginning of this century, devoted his most profound research efforts to topology. In the United States of America topology and its applications occupy almost exclusively such great scientists as Birkhoff, Veblen, Alexander and Lefschetz. The energetic work and brilliant discoveries of the last three mentioned scientists have made Princeton a world center of topological thought which has given refuge to such famous European scientists as Hermann Weyl and J. V. Neumann.

A school of topologists working no less intensively was established in the U.S.S.R. by Paul Uryson, Paul Alexandrov and Leo Pontryagin. Even the initial works of Alexandrov and Uryson, which were done in 1920–1924, created large new branches of topology—the theory of dimensions of Uryson and the theory of bicompact spaces of Alexandrov. Uryson died at the age of 26 and Alexandrov devoted himself with exceptional energy to arranging and publishing Uryson's unfinished work, an activity which resulted in a number of sizable memoirs. Alexandrov at the same time introduced a new trend into topology by devoting his efforts to a synthesis of the classical combinational topology of simplest geometrical figures with general ideas of theoretical-multiple nature. The general combinational topology created by him has become one of the fundamental trends for further research by topologists and mathematicians the world over.

By the end of the twenties Alexandrov's pupil, Leo Pontryagin (now a corresponding member of the Academy of Sciences), collaborated in his teacher's research. After his initial efforts, which constituted a continuation of Alexandrov's work, Pontryagin turned his attention to the theory of continuous groups in which he achieved fundamental results, changing this branch of mathematics at its very roots. His basic accomplishments were published in a book which appeared in 1939 simultaneously in the U.S.S.R. and U.S.A.

In addition to Pontryagin, a brilliant group of pupils has gathered around Alexandrov. Among them are Andrei Tikhonov, Leo Tumarkin and Alexander Kurosh. These men have done a great deal both in topology and in its applications. For instance, Tikhonov (who is now also a corresponding member of the Academy of Sciences) applies topological methods successfully to mathematical analysis and geophysics.

The work of Soviet topologists continues with unabating intensity even in wartime. Alexandrov himself completed during 1941–1942 his fundamental research on the properties of the mutual disposition of

[2] *The Sigma Xi Quarterly*, 30: 4, 294–97, 1942.

[1] Received via radio by the American Association of Scientific Workers.

geometrical figures for which he was granted one of the Stalin first prizes for 1942. Pontryagin, Tikhonov and several other topologists are now actively working on special war problems.

A number of topologists of the younger generation are in the ranks of the Red Army. Some of them send their scientific works to the Academy of Sciences for publication in its Reports, even from the front. Graduate students Shanin and Fomin completed their topological work while in the Red Army and came from the front to take their examinations.

Soviet topologists strive even under the most trying conditions of war not to lose their place in the international cooperation of mathematics.

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SCIENTIFIC BOOKS

METEOROLOGY AND CLIMATOLOGY

Basic Principles of Weather Forecasting. By VICTOR P. STARR. 299 pp. 125 figs. New York: Harper and Brothers. 1942.

Workbook in Meteorology. By ATHELSTAN F. SPILHAUS and JAMES E. MILLER. 163 pp. Figs. and maps in end pocket. New York: McGraw-Hill. 1942. $3.00.

Climatology, General and Regional. By THOMAS A. BLAIR. 478 pp. 101 figs. 1 fold map. New York: Prentice-Hall. 1942. $5.00.

An Introduction to the Study of Weather and Climate. By HAROLD B. WARD and WILLIAM E. POWERS. 112 pp. 24 figs. Evanston, Ill.: Privately printed. 1942.

Ways of the Weather. By W. J. HUMPHREYS. 400 pp. 75 figs. Lancaster, Pa.: The Jaques Cattell Press. 1942. $4.00.

THE publication of Espy's epoch-making "Philosophy of Storms" a century ago initiated a period of great development in meteorology in this country. Espy had recruited a corps of volunteer weather observers in the eastern part of the United States, and from the reports received from them by mail he undertook to systematize the information on size, form and rate and direction of travel of individual storms. The later development of the telegraph made it possible to get weather reports quickly and led to the conviction that the weather could be foretold. For a few years prior to the Civil War the Smithsonian Institution issued daily public weather forecasts. Official meteorological services were established in many countries during the 1870's; our own was created in the first year of that decade within the Army Signal Service. Thus meteorology in this country became an official technology and the responsibility for its welfare rested in a government agency, which presently was reorganized and became the Weather Bureau. The chief preoccupation of the bureau was with weather forecasting.

There were no trained meteorologists and unfortunately little encouragement was given to the development of adequate training facilities in the universities. New employees in the Weather Bureau were recruited at the sub-professional level and were trained through a system of apprenticeship to fill professional positions. University administrators were not willing to establish facilities for training and for research in meteorology so long as there were no professional opportunities for graduates.

With the rapid development of commercial and military aviation during the last 20 years there arose a need for weather forecasts more detailed and specialized than the Weather Bureau could provide. In 1927, with the support of the Guggenheim Fund for the Promotion of Aeronautics, an experimental airways weather service was established for the air route between Los Angeles and San Francisco. Carl-Gustaf Rossby was selected to conduct the trial. This airways weather service quickly proved that meteorology could be of inestimable service to aviation and a need for trained meteorologists soon became evident. With the support of the Guggenheim Fund, a meteorology course was instituted at the Massachusetts Institute of Technology in 1928, with Rossby in charge. Gradually, young men who had taken this course began to make themselves felt in the Army and the Navy and in civil aviation. At the same time fundamental research in meteorology was greatly stimulated and graduate work in the subject led to the conferring of the first Sc.D. degree in meteorology in this country about eight years ago. During the last five years Rossby and his students have been responsible for the establishment of departments of meteorology in three other first-rate institutions: New York University (1938), the University of Chicago (1940) and the University of California at Los Angeles (1940).

A logical by-product of the phenomenal growth of aeronautical meteorology in the last decade has been the publication of text-books. Already they occupy a five-foot shelf and they are mostly of very high quality. In the main, however, they are strongly biased by the special needs of aviation and do not even claim to treat of the whole of meteorology. For this state of affairs Rossby and his associates can not be blamed. They realize that there can be no important advance in the art of weather forecasting without