"technologist" would not increase the number of *real* scientists and technologists, but it would classify with them enormous numbers of incompetents and great numbers of members of many labor unions, whose united votes would drown out real scientific opinion. I query if this is an object of the bill.

There seems to be considerable misunderstanding as to the extent to which scientists are "mobilized." *The New York Times* editorial which is printed in SCIENCE for May 28 states: "Despite assertions to the contrary, scientists and technologists are not fully mobilized"; and in the issue of June 4, L. C. Dunn points "to the thousands of biologists of all kinds, of geologists, mathematicians and other scientists whose work has no immediate relation to the war; and to the many laboratories which are operating as usual without reference to either the war or the government." It is true that many scientists are carrying on the control of food and water supplies and the numerous manufacturing operations by which are produced most of the necessities for the civilian population as well as for the armed forces, and also training and teaching more chemists, engineers and other scientists and technologists—but all this is *important* to the conduct of the war, even if it has no *immediate* relation.

Furthermore, the word "mobilized" is a weasel word. Competent scientists and technologists are listed in the membership lists of hundreds of scientific and technical societies and in professional directories, and have also been listed by the National Roster of Scientific and Specialized Personnel. I have yet to hear of cases where scientists have refused to answer a government call; even though many of them probably never will be called, they are all ready to serve, if and when their services are called for. Just as only a few of those "mobilized" in our armed forces are on the actual firing line at any moment, so too many scientists must abide finding their proper and wanted call to the war effort. As Milton wrote: "They also serve, who only stand and wait." And in the meanwhile, they keep the home fires burning. Any attempt to supersede the thousands of actively operating scientific and technological agencies by a dominant group of appointees would be disastrous. And of the seven "top" appointees, only two must be "scientists and technologists" in the falsified meaning of these words.

Human nature and politics being what they are, nepotism and favoritism are not impossible in appointive positions, and government "brass hats" do not always recognize real merit and advanced ideas, as General "Billy" Mitchell and General de Gaulle found out. With the intense competition existing not only in individual businesses but also between whole industries, the urge to develop and perfect new methods and materials and products has led to outstanding advances. Our government scientists do splendid work within their limitations and render great public service; but consider the great array of new products, medicines and machinery (electric iceboxes, autos, vacuum sweepers, vitamins, improved lighting and transportation, etc.) which have been brought to the public at great savings in cost by industrial laboratories. We have Nylon to replace silk and quite a number of "synthetic rubbers"; radios; substitutes for many raw materials cut off by the war; magnesium and aluminum at low cost, etc., etc. According to *Mining and Metallurgy* (April, 1943), under the best conditions only about 5 per cent. of the total development cost of most products is claimed by laboratory research and patent prosecution—the balance goes into pilot-plant research, experimental design and construction and in getting the process into commercial operation. Following Langley's unsuccessful attempt to fly his apparatus, financed by Congress, nothing was done of account until two enthusiastic bicycle mechanics, the Wright Brothers, built and flew their own machine, and established the airplane industry.

Despite the good intentions behind those who framed and support the Kilgore bill, its results will be evil. Neither science nor technology, nor scientists nor technologists will thrive under regimentation. Far from being a "Magna Charta of Science," as Thurman Arnold called it, it might well become a tangle of chains to enslave science and industry. We must guard against unwise concentration of power in the hands of appointees and sub-appointees, and its possible and even probable misuse or abuse, with results that can now be seen in Germany, Japan and Italy.

JEROME ALEXANDER

BIOLOGY AND THE KILGORE BILL

PROFESSOR L. C. DUNN in an article[1] entitled "The Opposition to the Kilgore Bill" takes Dr. Gustav Egloff severely to task for certain of his recent statements concerning the bill, one of which was that "over 95 per cent. of our scientific and technical manpower and facilities are now highly organized and coordinated to the single end of advancing the war effort." Professor Dunn asserts that this statement is certainly not true and goes on to say that "one has only to point to the thousands of biologists of all kinds, of geologists, mathematicians and other scientists whose work has no immediate relation to the war. . . ."

To support his contention, Professor Dunn quotes from an article by Professor J. S. Nicholas, "The War Problem of Manpower in Biology and Agriculture," commenting thereon as follows: [Professor

[1] SCIENCE, 97: 510–11, 1943.

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.

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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.