tomical changes in the central nervous system, in contrast to the striking lesions found in the litter-mates maintained on the deficiency for the entire period. Growth of bone eventually ceases in vitamin A deficiency and this fact must enter into the explanation of the effect described. However, the study of rats whose growth has been retarded at an equal rate and degree—(1) through inadequate diet with full vitamin complement and (2) through riboflavin deficiency—showed normal relations of nervous system to skeleton. Guinea pigs in general responded to the deficiency, as did rats. One experiment with dogs indicates that the maximum effect in this animal will be found in cranio-cerebral relations. We are unable to explain satisfactorily this disproportionate growth established in young animals by vitamin A deficiency. In order to evaluate data on hand, a more complete knowledge of the growth sequences of the skeleton of the rat must be obtained. We are convinced that vitamin A deficiency does not retard the growth of the nervous system. Our studies thus far suggest that the most important consequence of vitamin A deficiency upon growth of the skeleton is upon those sequences concerned in the substitution of bone for cartilage—*i.e.*, endochondral growth of bone. Unretarded growth of the central nervous system and disturbances in initiation and development of centers of ossification are the two obvious factors to be considered in the search for an explanation of the effects we have described. These two factors, when considered in relation to normal growth sequences and anatomical differences of the several species exhibiting lesions of the central nervous system in consequence of A deficiency, may possibly explain the different effects thus far described in rats, dogs and calves.

(To be concluded)

REPORTS

THE NATIONAL DEFENSE RESEARCH COMMITTEE

DR. VANNEVAR BUSH, chairman of the National Defense Research Committee, has made public a list of scientific men and engineers who have thus far accepted definite appointments to work with the committee. The committee will deal with particular problems as they arise. Further appointments will be made as rapidly as effective use can be made of additional individuals in the solution of specific problems.

Created by order of the Council of National Defense on June 27, the National Defense Research Committee consists of the following eight members:

Vannevar Bush, *Chairman*, president, Carnegie Institution of Washington.
Richard C. Tolman, *Vice-Chairman*, dean of the Graduate School, California Institute of Technology.
H. G. Bowen, Rear Admiral.
Conway P. Coe, Commissioner of Patents.
Karl T. Compton, president, Massachusetts Institute of Technology.
James B. Conant, president, Harvard University.
Frank B. Jewett, president, National Academy of Sciences; chairman of the Board of Bell Telephone Laboratories.
G. V. Strong, Brigadier General.

The secretary of the committee is Dr. Irvin Stewart, director of the Committee on Scientific Aids to Learning.

Dr. Bush, as chairman, is coordinating the work of the committee with that of other governmental and private agencies and is maintaining direct supervision over a limited number of problems. General Strong and Admiral Bowen are responsible for the maintenance of close working relationships between the committee and the military services. Commissioner Coe is in charge of matters relating to inventions and patents and provides a direct connection between the committee and the National Inventors Council.

Dr. Tolman is chairman of the division dealing with armor and ordnance, Dr. Conant of the division dealing with chemical problems, Dr. Jewett of the division dealing with communication and transportation, and Dr. Compton is in charge of the work on detection, controls and instruments.

Professor Charles C. Lauritsen, of the California Institute of Technology, is vice-chairman of the division concerned with armor and ordnance. Those who have already accepted appointments to work on problems with which that division deals include:

P. H. Abelson, Carnegie Institution of Washington.
Samuel K. Allison, University of Chicago.
Ralph D. Bennett, the Massachusetts Institute of Technology.
Robert A. Becker, California Institute of Technology.
L. V. Berkner, Carnegie Institution of Washington.
Walker Bleakney, Princeton University.
John E. Burchard, the Massachusetts Institute of Technology.
Donald S. Clark, California Institute of Technology.
R. H. Crane, University of Michigan.
J. A. Fleming, Carnegie Institution of Washington.
Wm. A. Fowler, California Institute of Technology.
Ralph E. Gibson, Carnegie Institution of Washington.
R. H. Goddard, Clark University.
George Kenneth Green, Carnegie Institution of Washington.
L. R. Hafstad, Carnegie Institution of Washington.
C. N. Hickman, Bell Telephone Laboratories.
J. C. Hubbard, the Johns Hopkins University.
Emory Lakatos, Bell Telephone Laboratories.
R. C. Meyer, Carnegie Institution of Washington.
R. B. Roberts, Carnegie Institution of Washington.
H. P. Robertson, Princeton University.

H. D. Smyth, Princeton University.
John F. Streib, Jr., California Institute of Technology.
John T. Tate, University of Minnesota.
M. A. Tuve, Carnegie Institution of Washington.

Professor W. K. Lewis, of the Massachusetts Institute of Technology, and Professor Roger Adams, of the University of Illinois, are serving as vice-chairmen, under Dr. Conant, of the division dealing with chemical problems. Among those who are working with that division are the following:

Homer Adkins, University of Wisconsin.
W. E. Bachmann, University of Michigan.
J. C. Bailar, Jr., University of Illinois.
G. P. Baxter, Harvard University.
Henry Bent, University of Missouri.
Wm. Crowell Bray, University of California.
Weldon Grant Brown, University of Chicago.
Arthur M. Buswell, University of Illinois.
H. M. Chadwell, Tufts College.
E. W. Comings, University of Illinois.
G. O. Curme, Jr., the Carbide and Carbon Chemicals Corporation.
Farrington Daniels, University of Wisconsin.
Tenney L. Davis, the Massachusetts Institute of Technology.
B. F. Dodge, Yale University.
R. C. Elderfield, Columbia University.
J. C. Elgin, Princeton University.
Henry Eyring, Princeton University.
W. C. Fernelius, the Ohio State University.
L. F. Fieser, Harvard University.
Wm. Francis Giauque, University of California.
Henry Gilman, the Iowa State College.
C. S. Hamilton, University of Nebraska.
Henry B. Hass, Purdue University.
A. L. Henne, the Ohio State University.
Carroll Hochwalt, the Monsanto Chemical Company.
T. R. Hogness, University of Chicago.
Charles R. Hoover, Wesleyan University.
O. L. Hougen, University of Wisconsin.
C. C. Hurd, Northwestern University.
J. R. Johnson, Cornell University.
W. C. Johnson, University of Chicago.
H. F. Johnstone, University of Illinois.
F. G. Keyes, the Massachusetts Institute of Technology.
Morris S. Kharasch, University of Chicago.
Walter Raymond Kirner, Carnegie Institute of Technology.
G. B. Kistiakowsky, Harvard University.
Izaac M. Kolthoff, University of Minnesota.
C. A. Kraus, Brown University.
Victor LaMer, Columbia University.
Irving Langmuir, General Electric Company.
W. M. Latimer, University of California.
P. A. Leighton, Stanford University.
W. H. McAdams, the Massachusetts Institute of Technology.
W. L. McCabe, Carnegie Institute of Technology.
Duncan MacInnes, Rockefeller Institute.
C. S. Marvel, University of Illinois.
Thomas Midgley, Ethyl Gasoline Corporation.
C. R. Noller, Stanford University.
W. A. Noyes, Jr., the University of Rochester.
Linus Pauling, California Institute of Technology.
G. A. Richter, Brown Company.
W. H. Rodebush, University of Illinois.
W. C. Schumb, the Massachusetts Institute of Technology.
T. K. Sherwood, the Massachusetts Institute of Technology.
J. H. Simons, Pennsylvania State College.
G. B. L. Smith, Polytechnic Institute of Brooklyn.
George F. Smith, University of Illinois.
L. I. Smith, University of Minnesota.
Reston Stevenson, the City College of New York.
Charles A. Thomas, Monsanto Chemical Company.
Victor Howard Turkington, Bakelite Corporation.
E. S. Wallis, Princeton University.
Archie James Weith, Bakelite Corporation.
Albert Easton White, University of Michigan.
F. C. Whitmore, Pennsylvania State College.
Hobart H. Willard, University of Michigan.
E. B. Wilson, Jr., Harvard University.
M. L. Wolfrom, the Ohio State University.
J. H. Yoe, University of Virginia.
Don M. Yost, California Institute of Technology.

Assisting Dr. Jewett are three vice-chairmen—Dr. C. B. Jolliffe, of the Radio Corporation of America, in charge of communications; Hartley Rowe, of the United Fruit Company, in charge of transportation, and R. D. Booth, of the engineering firm of Jackson and Moreland, in charge of electrical and mechanical problems. Those who are assisting in the work of that division include the following:

Harry L. Bowman, Drexel Institute of Technology.
O. E. Buckley, Bell Telephone Laboratories.
Hallowell Davis, Harvard University.
J. H. Dellinger, National Bureau of Standards.
W. L. Everitt, the Ohio State University.
Harvey Fletcher, Bell Telephone Laboratories.
J. A. Hutcheson, Westinghouse Electric and Manufacturing Company.
L. F. Jones, Radio Corporation of America.
Vern O. Knudsen, University of California.
Frank H. Moore, formerly with the Tennessee Valley Authority.
A. F. Murray, consulting television engineer.
Haraden Pratt, Mackay Radio Company.

Dr. Alfred L. Loomis, of the Loomis Laboratories, is vice-chairman of Dr. Compton's division. Those assisting in the work of that division include the following:

Walter S. Adams, Mount Wilson Observatory.
Kenneth T. Bainbridge, Harvard University.
R. R. Beal, Radio Corporation of America.
Harold H. Beverage, Radio Corporation of America.
E. L. Bowles, the Massachusetts Institute of Technology.
Ralph Brown, Bell Telephone Laboratories.

S. H. Caldwell, the Massachusetts Institute of Technology.
E. U. Condon, Westinghouse Electric and Manufacturing Company.
Donald Cooksey, University of California.
C. S. Draper, the Massachusetts Institute of Technology.
E. W. Engstrom, Radio Corporation of America.
W. C. Evans, Westinghouse Electric and Manufacturing Company.
T. C. Fry, Bell Telephone Laboratories.
L. O. Grondahl, Union Switch and Signal Company.
William W. Hansen, Stanford University.
G. R. Harrison, the Massachusetts Institute of Technology.
Thomas H. Johnson, Franklin Institute.
M. J. Kelly, Bell Telephone Laboratories.
Paul Klopsteg, Central Scientific Company.
Ernest O. Lawrence, University of California.
Frank D. Lewis, Loomis Laboratories.
George Metcalf, General Electric Company.
J. P. Molnar, the Massachusetts Institute of Technology.
Philip McCord Morse, the Massachusetts Institute of Technology.
Edward J. Poitras, the California Institute of Technology.
Louis A. Turner, Princeton University.
Warren Weaver, Rockefeller Foundation.
H. Hugh Willis, Sperry Gyroscope Company.
C. L. Wilson, Research Corporation.

Serving on committees reporting directly to the chairman or otherwise assisting the chairman are the following:

J. W. Beams, University of Virginia.
Gregory Breit, University of Wisconsin.
Lyman J. Briggs, director, National Bureau of Standards.
T. H. Dillon (Colonel), Carnegie Institution of Washington.
Ross Gunn, Naval Research Laboratory.
John H. Howard, the Massachusetts Institute of Technology.
G. B. Pegram, Columbia University.
H. C. Urey, Columbia University.

Lloyd Sutton is serving on a Patent Advisory Committee with Commissioner Coe.

With the exception of six who have obtained leave of absence from their regular positions and who are devoting full time to the work of the committee, all have volunteered their services on a part-time basis without compensation. The committee has completed or has under negotiation approximately sixty contracts with industrial laboratories and universities for carrying out research on specific problems.

According to Dr. Bush, the scientists and engineers of the United States have been most enthusiastic in the offer of their services. In addition, they have understood that it is not possible on short notice to make the most effective use of the skill and talent of thousands of persons, and they have been sympathetic with the program of the committee in accepting the services of individual scientists only as problems were brought into a form where their talents could most effectively be used.

The task assigned to the committee by the Council of National Defense is that of correlating and supporting scientific research on mechanisms and devices of warfare. It does not extend to such matters as food or medicine and health. For that reason the men selected to aid the committee will continue to be drawn largely from the fields of chemistry, physics and engineering.

SPECIAL ARTICLES

THE LOGISTIC CURVE AND THE CENSUS COUNT OF 1940[1]

EARLY in 1920 Pearl and Reed[2] published the results of fitting a logistic curve to the census counts of the population of the United States from 1790 to 1910, inclusive. At the time the computations were made in 1919 the results of the census of 1920 were not available, and therefore were not and could not be included in the calculations. Soon after the original paper was published the notation was improved, and the curve took the definitive form, still, however, *without* the use of the 1920 count:

$$y = \frac{197.27}{1 + 67.32e^{-0.0313x}} \qquad (1)$$

where y denotes calculated population in millions, and x time, in base units of one year. This curve (1) will be hereinafter referred to as Logistic I. It is depicted graphically in Fig. 1 with the actual census counts of 1920, 1930 and 1940 (preliminary figure) inserted as crossed circles connected by a dash line to indicate that in the derivation of equation (1) no census count after that of 1910 was used.

Thirty years have elapsed since the last *datum* (the census count of 1910) available when the curve was calculated. It seems justifiable now to make a further examination of how the case goes, as was done in 1930.[3] The following tabulation gives the facts.

It thus appears that the forecast made by Logistic I missed the counted population by *16 parts in a thousand* in excess in 1920; by *2.5 parts in a thousand* in defect in 1930, and by *37.3 parts in a thousand* in excess in 1940. The error in 1940 is of perhaps about

[1] From the department of biology and the department of biostatistics (Paper No. 215) of the School of Hygiene and Public Health, Johns Hopkins University.

[2] R. Pearl and L. J. Reed, *Proc. Nat. Acad. Sci.*, 6: 275–288, 1920.

[3] R. Pearl and L. J. Reed, SCIENCE, 72: 399–401, 1930.