such concentration of leading mathematicians in various fields as in the five to ten leading American universities. Princeton, the Cambridge area, the New York area, the Bay area in California, and Chicago are well recognized as exceptionally strong centers in mathematical life."

A weakness of the COSRIMS report is the fact that its analysis of the need for increased federal support of academic research in mathematics proceeds from a discussion of figures derived from the fiscal 1966 budget, figures now 3 years old. Because of war-induced budgetary stringencies, however, the mathematics research budgets for the National Science Foundation and other agencies have remained largely static and, in some cases, have actually declined (fully up-to-date federal-support figures are not available).

In fiscal 1966, federal obligations for research in the mathematical sciences totaled nearly $125 million, according to COSRIMS. Of this amount, about $46.5 million was reported to be for basic research (including research in applied mathematics that is not narrowly "mission-oriented"), and, of this, some $35 million was for research done at academic institutions.

Funds provided by the Department of Defense, and especially by its Army, Navy, and Air Force research offices, accounted for about 70 percent of the total federal support. On the other hand, NSF was, and is, by far the most important source of support for academic research, having provided for this purpose almost $15 million in fiscal 1966, or about 45 percent of all such support.

According to COSRIMS' wishful projections, federal support for academic research would almost double, reaching $66 million a year by fiscal 1971; support for research apprenticeship would increase to about $30 million, up from roughly $10 million in fiscal 1966. Though calling for a 16-percent-a-year growth rate overall for research and graduate education, COSRIMS was giving the higher priority to the latter, recommending an annual rate of growth of 24 percent for research apprenticeship, as against a rate of 14 percent for research. COSRIMS proposed that federal support, in the form of research assistantships, fellowships, and traineeships, be given to at least a third of full-time graduate students, and that the number of research assistantships be not less than the number of senior investigators supported.

Mathematics has fared tolerably well in the competition with other sciences for able students, but, for reasons which COSRIMS finds not altogether clear, far fewer Ph.D.'s have been conferred in mathematics than in other fields. According to U.S. Office of Education statistics, 21,190 bachelor's degrees were conferred in mathematics in the 1965–66 academic year, compared with 18,020 conferred in the physical sciences and 25,680 in the biological sciences. In the same year, 5220 master's degrees were conferred in mathematics, 5470 in the physical sciences, and 4390 in the biological sciences. But, in the case of the Ph.D., only 770 were conferred in mathematics, as opposed to 2960 conferred in the physical sciences and 2030 in the biological sciences. According to Office of Education projections, the disparity will lessen by 1975, but the 2200 new Ph.D.'s in mathematics projected for that year will not satisfy the demand which COSRIMS foresees for Ph.D.'s in teaching and research.

The wide discrepancy between the number of masters and Ph.D. degrees conferred in mathematics, COSRIMS indicates, can be attributed partly to the fact that many students are preparing for secondary school teaching careers and do not seek a Ph.D. It suspects, however, that another reason may be simply that doing research acceptable for the Ph.D. degree is harder in mathematics than in other fields, leading fewer to try for this degree in mathematics and causing a higher attrition rate among those who do. COSRIMS suggests, as one means of encouraging people competent to teach (if not competent to create new mathematics and win a doctorate) to enter or remain in undergraduate teaching, that an "associate Ph.D." be awarded students who meet all requirements for the doctorate except for completion of the dissertation.

The COSRIMS report is long (251 pages) and somewhat diffuse. One goal of the committee has been to inform the scientific community and, to some extent, the scientifically literate lay public of the "state of the mathematical sciences." A third of the report is devoted to that end. (A supplementary volume, *The Mathematical Sciences: A Collection of Essays*, to be published by M.I.T. Press, will carry this effort further.)

Inasmuch as it required a combined effort on the part of the 12 members of COSRIMS and of numerous panelists, preparation of the report provided an unusual opportunity for people from all branches of pure and applied mathematics to learn more of one another's problems and opportunities. For example, as Harvey Brooks, chairman of COSPUP, noted in a letter accompanying the report, COSRIMS has called attention to the special problem of computer science in universities. "The development of computer science only as a by-product of the application of computer techniques in other fields often results in failure to develop a distinctive body of theory and technique in computer science in its own right," Brooks observed.

In a section on "criticisms and tensions," COSRIMS acknowledges that, while the penetration of mathematics into other scientific fields has been generally recognized, mathematicians are nevertheless sometimes said to have alienated themselves from the mainstream of scientific development. "It is also claimed that what contemporary pure mathematicians do is of interest only to themselves and most, if not all, of it will never be used in any other discipline," the report says.

It is true, COSRIMS concedes, that pure mathematics has, in fact, separated itself from sister disciplines, such as physics and astronomy. But, it says, "the history of science has shown that it is impossible to predict what mathematical theories will turn out to be useful outside of pure mathematics."

—LUTHER J. CARTER

RECENT DEATHS

Walter H. Boyce, 43; dean of men at Bates College in Missouri; 8 November.

Denniston Burney, 79; British inventor of the major antisubmarine paravane; 13 November.

Michael Duda, 59; president of California State College, California, Pa.; 12 November.

Joseph Pick, 60; professor of anatomy at New York University School of Medicine; 9 November.

Kirill I. Shchelkin, 56; one of the Soviet Union's leading atomic scientists; 8 November.

William B. Snow, 65; former acoustics engineer with Bell Telephone Laboratories, Inc., and Bissett-Berman Corporation; 5 October.

Albert Tyler, 62; professor of biology at California Institute of Technology; 9 November.