In addressing itself to the manner in which the nation's universities utilize scientific and engineering manpower, the committee associated itself with a series of criticisms that probably now amount to a consensus on what is ailing higher education in the sciences.

It noted that there is a need to recognize that while research and teaching are closely associated, a poor researcher can often be a first-class teacher; it also noted the existence of "migratory research workers following available funds" and expressed concern that institutional loyalties are being eroded by loyalties to federal granting agencies. And it called for the creation of new research centers but cautioned that this should be accomplished with special development funds and not by using research funds to build up the have-nots.

Need for Data

Finally, the committee frankly acknowledged that while a great deal is being said about scientific and engineering manpower requirements, large gaps exist in our information about the actual deployment, productivity, and requirements for scientists and engineers. Statistics often run 2 or 3 years behind, projections of need frequently turn out to be far off the mark, and very little study has been done on the role of technicians and machines in assisting scientists and engineers in their work.

"The United States," the report concludes, "is fast becoming a research-oriented society. Rational problem-solving is replacing decision by random trial and error. Growing pains unavoidably accompany such changes, but we can reduce them by strengthening our understanding of this key group, the scientists and engineers, and of the environment in which they work."

Perhaps the most significant thing about the report is the extent to which it carries forward the concept that scientists and engineers are a national resource whose well-being is a proper concern of the organizations—governmental and nongovernmental—that employ them. From the early days of the Republic it was recognized that scientific strength was a component of national strength, and the federal government, accordingly, has ever since been intimately involved in the promotion of research and scientific education.

However, the report carries this involvement still further by stating, in effect, that scientific and engineering manpower is so critically important to national well-being that, to a large extent, it should be insulated against technological and economic ups and downs. This may make a great deal of sense, but since no one is saying the same thing about truck drivers, violinists, or architects, the proposal raises some interesting issues of public policy. The committee, for example, notes that "scientists and engineers can play a key role in creating new opportunities for the nation," and it goes on to observe that "if the burden of defense lightens, they should be involved in the conversion of defense industry to other national objectives or to civilian purposes. If their potential is to be utilized productively, cooperative action will be needed to facilitate the transition. Provisions are required to enable existing defense industrial contractors more readily to utilize their scientists and engineers in transforming the enterprise. Incentives to facilitate the formation of new enterprises, based on the capabilities of creative groups wishing to apply technology with which they are familiar to the civilian economy, will also be of value.

"It would be in the national interest if, during periods of transition, attractive opportunities could be provided for individual scientists and engineers to replenish and augment their professional value through education and training, possibly at university centers, as well as within the organizations in which they work."

Having said this, the committee duly noted that "these objectives are difficult to achieve," and it added that they should not involve "coercive methods" or "encroach upon the proper prerogatives of responsible free enterprise."

Serving with Killian on the committee were Richard H. Bolt, Bernard R. Berelson, Paul W. Cherington, Karl A. Folkers, Walter H. Gale, Louis C. Goad, Crawford H. Greenewalt, Frederick H. Harbison, Clark Kerr, Augustus B. Kinzel, Douglas M. Knight, Herbert E. Longenecker, John W. Macy, Haakon I. Romnes, Merriam H. Trytten, Dean E. Wooldridge, and Marvin Adelson, executive director.

Copies of the report, *Publication 1191*, are available for $3 from the Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C. 20418.—D. S. GREENBERG

Ohio: With New Board of Regents, Master Plan in Works, State Takes Plunge into State-Wide Planning

The state of Ohio is passing through a period of adjustment with its public higher education system, a painful experience now being shared in neighboring Big Ten states and, in fact, throughout the country. But the symptoms seem particularly acute in Ohio, perhaps because the matter has attracted wide public attention and prompted fairly drastic action.

Institutions of higher education in Ohio and elsewhere now face the college harvest of the post-World War II baby crop. This year's high school graduating class forms the biggest wave of would-be college students since the veterans of World War II, financed by the GI Bill, swept down on the colleges and universities.

Ohio's problems with higher education take the form of a true dilemma. It appears doubtful to many informed observers that enough new money will be made available to provide faculty and facilities for the proliferating undergraduates and at the same time finance fully the expansion and improvement of graduate and professional education deemed necessary by many to keep Ohio competitive in the arena of economic growth.

To meet its double crisis in higher education, Ohio has embarked on a course of centralizing planning and control for higher education. This represents a marked departure from previous practice in Ohio, a state where planning and centralization of authority in public bodies has been automatically suspect. By legislation, a board of regents has been formed to produce a master plan, now in the process of formulation, and to coordinate and oversee the operations of all state-supported institutions of higher education.

One difficulty facing Ohio is that of adapting a pattern of state institutions of higher education, established in the 19th and early 20th century, to new conditions. There are six state-supported institutions now and these are fairly well distributed geographically (see map). But only one, Ohio State University in Columbus, is located in a major population center.

The four other universities—Ohio University, Miami, Kent State, and Bowling Green State—and Central State College are situated in what can

fairly be called college towns. The siting of the state institutions reflects an almost universal preference among legislators in rural states in the South and Midwest in bygone days for locating state colleges and universities far from fleshpots of the cities. Whatever the effect on the physical, mental, and moral health of students has been, the result of putting big state universities in small towns has been to make them residential universities, thereby increasing costs for most students and obliging the state to finance and manage dormitories and provide a wide range of student services.

Three municipally supported universities—at Akron, Cincinnati, and Toledo—have offered students in these cities publicly subsidized higher education, but the resources of these institutions, which began essentially as "streetcar colleges," have been naturally limited by competing demands on city finances. These three municipal universities seem certain to be absorbed into the expanded state university system, though the terms remain to be worked out.

The biggest present anomaly in the Ohio system is that Cleveland, the state's largest city, surrounded by the most populous metropolitan area, does not have a publicly supported 4-year institution of higher education. The nearest is Kent State University at Kent, about 35 miles southwest of Cleveland and hardly within easy commuting distance.

Recently the regents, in one of their first significant actions, recommended to Ohio Governor James A. Rhodes that action be taken to establish a state university in Cleveland. Rhodes is expected to forward the proposal to the legislature at a special session. A board of trustees would be formed for a "Cleveland state university," and this board in turn would negotiate with the trustees of Fenn College, a private engineering and liberal arts college in Cleveland, which is considered to offer a logical nucleus for a state institution.

One lack which Ohio shares with most other states is a lack of public 2-year college-level institutions—the terms *junior* and *community college* are nearly interchangeable for describing them—capable either of providing terminal education for high school graduates or of serving as feeders to colleges and universities and taking some enrollment pressure off them by accommodating numbers of freshmen and sophomores.

Publicly assisted universities in Ohio. *Municipal: 1a*, University of Akron; *1b*, University of Cincinnati; and *1c*, University of Toledo. *State*: *2*, Ohio University; *3*, Bowling Green University; *4*, Ohio State University; *5*, Kent State University; *6*, Miami University; and *7*, Central State College.

Ohio's state colleges and universities have established more than 30 branches around the state, many of them in major metropolitan areas, but these have been essentially part-time operations, located in borrowed or rented facilities—generally high schools—and offering late-afternoon and evening classes. While the branches, with their low tuition, have obviously met a demand (particularly, it seems, in teacher education), they are regarded within the universities as a stopgap at best in their present form.

In the state university system, graduate and professional education has been centered at Ohio State. The other state universities operate a variety of master's degree programs and a few doctoral programs in cooperation with Ohio State. But Ohio State's research budget and graduate student enrollment completely overshadow those of the other state universities.

One of the biggest problems facing the regents is to find ways and means to upgrade and expand advanced education in the sciences, engineering, and medicine in the cause of economic growth. A future article in this space will examine Ohio's public universities as sources of research and manpower for industry in the state, a matter which is getting increasing attention.

The present status of public higher education in Ohio is influenced heavily by the strong private college tradition in the state. Western Reserve University and Case Institute of Technology in Cleveland and such small colleges as Antioch, Kenyon, Oberlin, and Ohio Wesleyan continue to account for a higher percentage of students than is found in most states with old and strong state systems of higher education. In 1962 some 41.4 percent of full-time campus students in higher education were enrolled in private institutions, 12.9 percent in municipally supported institutions, and 45.7 percent in state institutions. The public-private division in Ohio approximates the national average, but the figures show a much smaller proportion of students enrolled in public higher education than in neighboring Michigan, where the percentage in public institutions is said to be over 70 percent.

The distribution pattern in higher education in Ohio is sure to be shattered, however, by the oncoming wave of students. Projections show that from a level of about 200,000 students in public and private institutions in Ohio last year, enrollment will rise to about 224,000 in the coming school year and to 247,000 in 1965. The projections indicate that enrollment will climb to 278,000 by 1970 if the proportion of students in the 18-to-21 age group who attend college is the same as in 1960, but will top 338,000 if the proportion rises at the rate of increase experienced during the decade from 1950 to 1960.

While it is expected that private colleges and universities in Ohio may be able to expand enrollment as much as 50 percent in the next decade, it is assumed that they will not be able to maintain their present share of total enrollment. Higher costs at the private schools, higher entrance requirements at many of them, and the close religious affiliations of some are limiting factors. It must be remembered also that a substantial proportion of students at the private institutions are from outside Ohio.

Burden on State System

The burden of accommodating a big majority of the expected additional students therefore will fall on the public institutions. The big demand in Ohio, as elsewhere, is for the expansion of opportunities for inexpensive college education close to home. This means, in effect, the creation of a coordinated state system of universities, community colleges, and technical institutes, with the emphasis on expansion in the centers of population.

The task of planning and carrying

through the construction of the new system falls to the new board of regents. According to the act of the legislature which created the board in 1963, the regents are responsible for coordinating all activities—both financial and academic—of all state-supported institutions of higher education. The board has the authority to submit the biennial budget for higher education to the legislature and the power to approve or disapprove the establishment of new publicly supported institutions of higher education and all new degree programs at state institutions. On paper, the Ohio regents, therefore, seem to be a "strong" board, conceived, it appears, in the image of the California regents (*Science*, 3 April 1964).

The Ohio regents are a product of politics—both the internal politics of public education and regular partisan politics.

Creation of the regents brought to an end a period of voluntary coordination and planning in higher education in Ohio that began before World War II. A rivalry for funds among the state institutions led in 1939 to the formation of an Inter-University Council, in which all the state institutions were represented. For nearly two decades existence of the council enabled the state schools to present a common front in making their budget requests to the legislature and to divide appropriations among themselves.

By the late 1950's, however, serious strains on the gentlemen's agreement developed as the universities began to feel that state appropriations were not increasing fast enough to meet the rising costs of higher education and to satisfy the aspirations of the individual institutions to expand expensive programs of graduate and professional education.

A Campaign Issue

In state politics, higher education became a full-blown issue in the gubernatorial campaign of 1962. The incumbent governor, Democrat Michael V. DiSalle, accused the Republican majority in the state legislature of supporting higher education inadequately. The Republican nominee, James A. Rhodes, who won the election, blamed the Democratic administration for the lag in economic growth in the state, citing shortcomings in research as one cause. He made passage of the bill to create a board of regents a part of his official program.

Some $175 million of a $250 million state bond issue has been earmarked for higher education and in effect will be used to implement the master plan. The money must be spent only for construction and for purchase of land and equipment. Rhodes is pledged against seeking any new revenues for higher education in the next biennium, so old and new institutions may encounter real difficulty in finding operating funds for expansion. Revenues are running ahead of estimates, however, and a surplus could ease this squeeze.

How successful the new board of regents will be in the long run in following a line of action independent of governors and in winning the cooperation of legislatures, of course, remains for the future to tell. The first big test for the regents will be formulation of the master plan, in which they are to take into account all aspects of both public and private education and chart a course for higher education in Ohio for the next 10 or 15 years.

Master Plan Consultants

To gather information and give advice for the master plan, the regents are employing the Academy for Educational Development (AED), a New York-based nonprofit corporation devoted to educational consulting, headed by Sidney G. Tickton, a former program associate for the Fund for the Advancement of Education.

Heading the Ohio project for AED is an advisory committee of six men, all of whom have been associated in one way or another with the Ford Foundation and have national reputations as authorities on various aspects of higher education and research. On the committee, in addition to Tickton, are Alvin C. Eurich, now president of the Aspen Institute for Humanistic Studies; Oliver C. Carmichael, former president of the University of Alabama; Jesse Hobson, former director of the Stanford Research Institute; Lyle Nelson, former vice president of the University of Michigan; and Douglas Whitaker, vice president of the Rockefeller Institute.

In addition, an array of consultants of national repute are to work on special aspects of the report. The surveyors are making an extensive study of existing facilities, faculty, and programs, and are expected to provide a detailed estimate of the future needs of higher education in Ohio and recommendations on how to meet those needs, even down to suggesting policies and procedures for the board of regents. The AED survey will cost the regents a little less than $200,000.

The regents are expected to develop a master plan on the basis of the AED report and recommendations, and to submit it to the governor in time for the legislature to act on it when it meets after the first of the year.

Since actual activation of the board of regents last summer, the board's own small staff has been headed by Warren M. Chase, a retired executive of Ohio Bell Telephone Company. Chase moved last year from a post as director of the State Department of Commerce, under Rhodes, into the job of secretary to the board of regents. The energetic Chase is regarded as having had an important hand in the choice of the Tickton group; he has traveled a good deal around the state as a liaison man, smoothing the way for the master plan.

The regents' chief statutory administrative officer has just officially taken over his post. Termed "director" in the act creating the regents, he will be known by the academically more elevated title of chancellor. The new chancellor is John D. Millett, who resigned as president of Miami University to take the post. Millett was chairman of a state Interim Commission on Education Beyond the High School. He had been an advocate of stronger coordination of public higher education and alone among the six presidents of state institutions supported the original proposal to create the regents.

The new chancellor will serve at the board's pleasure, and his duties will be prescribed by the regents. The role of the chancellor, therefore, is not yet clearly defined, but Millett seems to have accepted the job on the understanding that it would be a policy-making rather than a merely administrative post; it appears that the presidency of the University of California is the model that Millett and the regents have generally in mind.

Whatever the details of the master plan prove to be, it is obvious that there will be rough places in the road ahead. To decide the terms on which the municipal universities will be inducted into the state system is likely to require delicate negotiation. Relations between the regents and the trustees of the existing state institutions may prove tricky, especially at first. A compromise which gave

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the regents authority over only appropriated funds in the universities' budgets is counted on to minimize friction, however. The regents face a formidable task in persuading the Ohio legislature not only to provide increased funds for space and services for the influx of undergraduates but also to make the heavy investments necessary to expand and upgrade graduate and professional education and to establish a viable system of community colleges and technical institutes.

It can fairly be said that, compared to California, Ohio and the other Midwestern states have been laggardly in organizing to provide the coordinated system of low-cost, accessible, and diversified public higher education for which a heavy demand has developed since World War II. To maintain perspective it should be noted, however, that Ohio, on the one hand, does not have California's rocketing population to cope with and, on the other, has a much solider foundation to build on in public higher education than the Northeastern states, for example, where opportunities in public higher education have been decidedly limited, both in quality and in quantity.

But even if the educational planners in Ohio bring about a reconstruction of public higher education on terms now seen as optimum, it is a safe bet that the ideal of equilibrium between supply and demand won't be achieved, for experience elsewhere has shown that this is one field where increasing the opportunities seems automatically to create excess demand.—JOHN WALSH

Announcements

The National Science Foundation last week announced establishment of a **division of engineering**. John M. Ide, former director of the NATO Antisubmarine Warfare Research Center, Spezia, Italy, has been named director. National Science Foundation support for engineering research heretofore was directed by a subordinate section of the Division of Mathematical, Physical, and Engineering Sciences.

The National Aeronautics and Space Administration requests proposals from scientists for scientific experiments to be carried out on five Advanced Technological Satellites (ATS) scheduled for launching from 1966 through 1968.

The primary mission of the ATS spacecraft is to evaluate advanced communication techniques, meteorological components, and gravity gradient stabilization systems. There will be payload space available on each satellite for additional scientific experiments. The launch vehicle will be the Atlas-Agena. Additional information on the program is available from Robert H. Pickard, spacecraft manager, Building 6, Goddard Spacecraft Center, Greenbelt, Md. Proposals should be sent to Harold Zaret, Procurement Division, Building 8, Goddard Spacecraft Center.

Recent Deaths

Joseph Bunim, 58; clinical director of the National Institute of Arthritis and Metabolic Diseases; 8 July.

Zaccheus Daniel, 89; retired astronomer at Allegheny Observatory of the University of Pittsburgh; 30 June.

A. Raymond Dochez, 82; professor emeritus of medical and surgical research at Columbia University College of Physicians and Surgeons; 30 June.

Henry Doubilet, 57; associate professor of surgery at the New York University–Bellevue Medical Center school of medicine; 6 July.

Isidor Fankuchen, 59; head of the division of applied physics at the Polytechnic Institute of Brooklyn; 28 June.

Leland Griggs, 86; professor emeritus of zoology at Dartmouth; 28 June.

Elizabeth W. Kidwell, 65; scientific director of Willcox Research Institute; 8 July.

Ross MacCardle, 62; research biologist at the Laboratory of Pathology, National Cancer Institute; 23 June.

Ralph McBurney, 81; professor emeritus of bacteriology, Medical College of Alabama; 21 June.

M. Morris Pinckney, 58; president-elect of the Richmond Academy of Medicine; 14 June.

Charles M. Pomerat, 58; director of research at the Pasadena Foundation for Medical Research; 18 June.

Waldemar J. A. Wickman, 63; former assistant chief of the Public Health Service's division of hospitals; 18 June.

Herman Yagoda, 51; of the Air Force Cambridge Research Laboratories, Massachusetts; 27 June.

Erratum. The first word in the title of the report by T. P. Rooney and P. F. Kerr (*Science*, 19 June, p. 1453) should have been "Clinoptilolite." This word was also misspelled in the index issue (26 June).