Printing Office, Washington, D.C.), vol. 1, pt. 1, Table 202.
4. Scientific personnel in government employment do not show so high a proportion of women in the biological sciences: the proportion female by major scientific field among those federally employed is 8 percent for physical sciences, 4 percent for biological sciences, 1 percent for engineering (*2*, Appendix D).
5. D. Hiestand, *Economic Growth and Employment Opportunities for Minorities* (Columbia Univ. Press, New York, 1964).
6. 1962 National Register data, reported in *Physics: Education, Employment, Financial Support, A Statistical Handbook* (American Institute of Physics, New York, 1964).
7. *1960 Census of Population: Characteristics of Professional Workers* (Government Printing Office, Washington, D.C.).
8. *Ibid.*, rates calculated from data in Tables 3 and 6.
9. J. Davis, *Great Aspirations: The Graduate School Plans of America's College Seniors* (Aldine, Chicago, 1964), pp. 154–155.
10. N. Miller, "One year after commencement," *National Opinion Research Center, Chicago, Report No. 92* (1963), pp. 125–126.
11. Preliminary results of a recent questionnaire sent to the same sample as in Davis (*9*).
12. H. Martineau, *Society in America*, S. M. Lipset, Ed. (Doubleday, New York, abridged ed., 1962), p. 295.
13. H. Lehman, *Age and Achievement* (Princeton Univ. Press, Princeton, N.J., 1953).
14. A. Rossi, *Daedalus* **93**, 615 (1964).
15. F. I. Nye and L. W. Hoffman, *The Employed Mother in America* (Rand McNally, Chicago, 1963).
16. R. Hess, *J. Marriage and the Family* **26**, 422 (1964).
17. One experimental day-care center in Syracuse, New York, will test the effect of an optimal environment for 6-month-to-3-year-old children on learning readiness at school age. B. M. Caldwell and J. B. Richmond, *ibid.*, p. 481.
18. A. Roe, "A psychological study of eminent biologists," *Psychol. Monograph No. 65* (1951), p. 331; "A psychological study of physical scientists," *Genet. Psychol. Monograph No. 43* (1951); "Psychological study of research scientists," *Psychol. Monograph No. 67* (1953), p. 2; "Crucial life experiences in the development of scientists," in *Talent and Education*, E. Torrance, Ed. (Univ. of Minnesota Press, Minneapolis, 1960); *The Making of a Scientist* (Dodd, Mead, New York, 1963).
19. G. Stern, M. Stein, B. Bloom, *Methods in Personality Assessment* (Free Press, Glencoe, Ill., 1956).
20. E. Maccoby, "Woman's intellect," in *The Potential of Women*, S. Farber and R. Wilson, Eds. (McGraw-Hill, New York, 1963), gives a more detailed summary of sex differences in intellectual ability.
21. E. Bing, *Child Development* **34**, 631 (1963).
22. J. Coleman, *The Adolescent Society* (Free Press, Glencoe, Ill., 1961).
23. M. Rosenberg, *Occupations and Values* (Free Press, Glencoe, Ill., 1957).
24. J. Davis, *Undergraduate Career Decisions*, in press.
25. R. Eckert and J. Stecklein, "Job motivations and satisfactions of college teachers," *U.S. Office of Education Coop. Res. Monograph No. 7* (1961).
26. E. Pollard, *Science* **145**, 1018 (1964).

News and Comment

Kansas City: New Medical Complex, University Should Complement Midwest Research Institute

Since World War II the economic indicators have shown the Midwest to be suffering a decline in relation to the "growth" areas of the country, notably the East and West coasts, the mountain states, and the sunshine states of Florida and the Southwest. In such categories as population, income, new jobs, and share of national output the Midwest has generally fallen below national average on the growth indexes. An unfavorable pattern in the distribution of federal R & D funds has caused political rumblings in the Midwest in recent years. And one of the sorest points has been the brain drain—the loss of scientifically and technically trained people produced in large numbers at considerable expense by the state universities of the region.

A grouping of six states in the trans-Mississippi Midwest—Iowa, Missouri, Arkansas, Nebraska, Kansas, and Oklahoma—has fared even less well, it appears, than the Midwestern states of the Great Lakes region. Near the geographical center of this six-state, have-less region, and, in fact, near the center of the United States, is Kansas City, which has shared to a degree the economic travails of the states around it and sees itself not only as a transportation center and market for the area but also as the natural leader in an overdue economic resurgence.

At the upper levels, at least, the brain drain does not seem to have hurt Kansas City too badly. The operating heads of most of the major education, health, and research institutions are from outside the region and in many cases from the East or West coasts.

Kansas City, more than many places, has a tolerance of outsiders with ideas and ability. An early application of technology to business, which did much to "make" Kansas City, provides an illustration. It is said that it was an Illinois man named McCoy who, after the Civil War, conceived the idea of having cattle driven north on the long trail from Texas to Abilene and there loaded on trains for Kansas City, which was a major rail hub. McCoy convinced Kansas City businessmen to build cattle pens and loading platforms at Abilene, and the saga of the Kansas City steak began. Incidentally, another outsider, Charles Francis Adams, Jr., of the Boston Adamses, was named president of the Kansas City stockyards.

Today, even a random look at the institutions and industry in the area on both sides of the Kansas-Missouri state line which makes up the Kansas City metropolitan area reveals that new Kansas Citians are ubiquitous. Dean of the University of Kansas Medical School is Arden Miller, who joined the faculty in the 1950's from the Yale medical school. President-elect of the University of Missouri at Kansas City (which until 2 years ago was the privately supported University of Kansas City) is physicist Randall M. Whaley, who was born in Hastings, Nebraska, but spent nearly 2 decades of his career at Purdue and is currently vice-president for graduate studies and research at Wayne State University in Detroit. Director of the Linda Hall Library of science and technology (*Science*, 21 May) is Joseph C. Shipman, who came to Kansas City 20 years ago from Ohio via Baltimore. Executive director and chief surgeon of Menorah Hospital, a private hospital with ambitious programs in preventive medicine, research, and medical education, is Martin E. Silverstein, an energetic proponent of measures to insure that new medical and surgical techniques are widely and safely applied. Silverstein is a graduate of Columbia College and was associate dean of New York Medical College before going to Kansas City. Kansas City's congressman, Representative Richard Bolling (D–Mo.), was born in New York City, and grew up in the South. He went to Kansas City after the war to take a job in the university's administration

and was elected to Congress in 1948. Attorney Arthur Mag, who is a sort of one-man interlocking directorate in health, education, and civic matters and played a major role in the process which led to the absorption of the university by the state system, came to Kansas from Connecticut and Yale in the early 1920's and stayed.

Mobility, of course, at the managerial level is high in both industry and public service institutions, but in Kansas City the immigrants seem to stay around.

A prime example is Charles Kimball, who for 15 years has been president of the Midwest Research Institute, an independent nonprofit research organization. Kimball is a vigorous advocate not only of his institute's cause but of the value to the region of increased technological resources and their effective application. For a number of years he has probably ranked as chief prophet and nag in behalf of technology in the area.

Kimball graduated from Northeastern in Boston with an electrical engineering degree in the early Depression years and made what was then an unusual move across the Charles River to win master's and doctoral degrees at Harvard. He worked in RCA research laboratories in the late 1930's, and in 1941 went to Kansas City to join a small aircraft accessories firm, working during the war on airborne radar countermeasures equipment. He then went to Bendix in Detroit, and in 1950 moved out of the lab and back to Kansas City as second head of MRI.

MRI was established in 1944 by nine influential "old" Kansas Citians. A principal role seems to have been played by the late J. C. Nichols, an extremely successful land developer. Soon after the turn of the century Nichols started with a small tract south of the city, and this has grown (the company is headed now by his son, Miller Nichols) to 6000 acres of very pleasant middle- and upper-income residential areas. One Eastern immigrant calls the more posh of the controlled development neighborhoods "Larchmont on the Missouri." The elder Nichols was an entrepreneur who saw which way the economic wind was blowing, and MRI is as much a monument to him as the imported statuary and classical urns and columns which decorate the landscaped streets of his Country Club District.

MRI, which is located on the fringe of the district, now has a net worth of more than $3 million and business of some $5 million a year.

MRI is small in comparison to the Stanford Research Institute, with its propinquity to Stanford and its ties to the blooming electronics industry on the San Francisco peninsula, and small as compared to Battelle Memorial Institute, with its firm foundation in metallurgical research for industry. But MRI, with a staff of about 350, now competes with its bigger peers without apology and with frequent success.

Some 225 of MRI's employees are listed as "technical" staff, and about half have masters' or doctors' degrees. The institute operates five divisions—chemistry, biological sciences, engineering, mathematics and physics, and economic development.

Activity in Chemistry

The chemistry division has been the biggest and most active of the divisions since the inception of the institute. Work in organic chemistry and organic synthesis has been a strong suit in the chemistry division, but activities have ranged across most of the specialties in the field. In recent years, increasing stress has been placed on physical chemistry.

MRI interest in cancer chemotherapy dates back to the late 1940's, and the institute for several years has participated in the National Institutes of Health cancer chemotherapy program. A 15-man cancer-chemotherapy section is headed by C. C. Cheng. Recently, compounds synthesized by the group have shown promise of being effective against strains of malaria resistant to drugs now commonly used, and the government is showing active interest in further development and testing of the compounds.

The biology division, established 2 years ago, is the newest of the institute's five divisions. It was separated from the chemistry division apparently in recognition of new life in the life sciences and new opportunities for research in the biosciences, because of the space program, and in such areas as food technology and nutrition.

The economic development division, set up in the late 1950's and next-newest of the MRI divisions, carries the most direct responsibility for serving the founders' original intention that MRI should assist the region's economic growth and development.

According to an MRI promotional brochure, the economic development division "focuses the skills of engineers, physical and biological scientists and economists on the opportunities inherent in technological change. They cooperate in the solution of problems relating to the profitable use of R & D information through both the interpretation of long-range scientific trends and the immediate impact of a specific development on an individual firm or industry."

A number of the division's contracts have been for market research projects. In the field of regional economics the division has acquired experience in making economic base studies and surveys of economic resources, opportunities, and obstacles. In recent years the division has been increasingly occupied with the problem of technology transfer—of putting existing scientific information to actual use.

MRI was contractor for a National Aeronautics and Space Administration pilot program in technology transfer started in 1961. The NASA technology utilization program now comprises about half the work of the division.

MRI's job is to look at the results of research done for NASA and take out things applicable to industry, particularly industry in the region. A start was made with, as one staff member describes it, a series of evangelical meetings. Some 3000 people representing 200 firms have been involved in one way or another. Information in research abstracts supplied by NASA is evaluated by technical people drawn from the various divisions of the institute. The results are adapted, to the greatest extent possible, to the needs of specific participating firms.

As the program developed, MRI found its audience more interested in new processes and new materials which would require only "incremental changes," rather than new products with the investment in new plant and risks in marketing that these involve.

Both NASA and MRI have operated on the assumption that the program would eventually be partially or, if possible, totally self-supporting. MRI is now setting up a program on a fee basis for the fall. An acid test of MRI's technology transfer program is, therefore, in the offing.

The matter of technology transfer is close to MRI director Kimball's heart. A frequent and quotable speaker, Kimball continually stresses the point that research activity alone is no panacea for a region which is lagging economically. The results of research must be translated into applications for industry, medicine, or defense. This is why he displays a distaste for the term "support of research" and sees a special role for MRI and the others in the dozen major independent research institutes which employ about 10,000 people and have an annual dollar volume of about $160 million, or about 1 percent of the national budget for research and development.

"Only at this type of institute," said Kimball at a state science and technology conference in Washington last year, "do we find a blending of broad scientific and commercial values. Here the scientist engaging in sponsored research must keep in mind the ultimate commercial objectives of his work. Probably the greatest shock to a young Ph.D. coming out of the halls of ivy is to find that he must not only solve the scientific problem—he must find a solution that works, and yet, stay within a definite time and cost limit. The institutes are peopled largely with scientists who have learned this important fact of life early.

"The growth of these institutes is dependent on their ability to perform high quality research at competitive costs over a wide range of scientific fields. I am aware of no other incentive for quality and efficiency in research performance which is so compelling as that of survival in a competitive market. We as independent laboratories, probably to a greater extent than any other group represented here, are subject to the law of natural selection, the survival of the fittest."

In the same speech he observed that "the economic utility of science and the resulting technology lies totally in what can be done with it to enhance corporate profits, government mission capability and regional economics. Somewhere along the line," he said, "we are making inadequate use of this great resource. This is one of the great intellectual challenges of our time."

MRI has made some progress in meeting this challenge. One example is a cooperative effort with the state of Nebraska. In 1959 Nebraska's legislature passed a 1/10-mill levy on property, the receipts from which were to be spent on research in the cause of finding new industrial uses for agricultural products. MRI was given major responsibility in a 5-year program. Results include a packaging film made from corn amylose. This film is said to compare favorably with petro-based films as a packaging medium and in cost. It is also edible and dissolves when units of food wrapped in it are dropped into boiling water.

Other results of the program are development of a survival-ration wafer dubbed "Nebraskit," and of potential commercial uses for agricultural staples in paints, biodegradable detergents, plasticizers, and resins.

Nevertheless, while Kimball is a prophet with honor in his own region, MRI has grown to its present stature primarily because it has competed successfully for research contracts outside Kansas City and the surrounding states. The institute, in other words, had to lead a life of its own—to achieve success on a national scale—if it was to compete successfully in the national marketplace to recruit and retain highly trained people with the particular combination of abilities which Kimball stresses so strongly. MRI, therefore, has wielded influence, but necessarily limited influence, on the economy of Kansas City and its area.

Diagnosis and Cure

As Kimball himself emphasizes, the diagnosis of technological lag is much easier than the cure. The formula for progress is a stubbornly complex one, including political, geographical, sociological, and financial as well as technological factors.

Kansas City and St. Louis, on opposite sides of the state of Missouri, are opposites in other ways. With its 19th-century German immigrant influence and early stake in the Mississippi River traffic, St. Louis can be said to look eastward and to claim more highly developed cultural and educational roots than Kansas City. Settled by Southerners and with its back to the Ozarks, Kansas City has traditionally looked West.

About the 20th-century political history of Kansas City there seems to be substantial local disagreement. It would probably take a Lincoln Steffens to provide an answer to what seems to be the main question: How bad was the Pendergast machine for the city and how effective have been the reform forces which succeeded the machine? Agreement seems to be fairly widespread, however, that, for whatever reasons—emigration or disenchantment—the generation of native Kansas Citians now in their late 30's and 40's has not until recently produced very dynamic civic leadership.

The city has what might be called some negative urban virtues. Air pollution is relatively low, due, it seems, to the city's "clean" industry and the winds off the wheat lands. Racial friction appears not to be a serious factor now, a situation attributed to the hard work of a few community leaders. Traffic seems a less frustrating phenomenon than in many cities of comparable size. Water pollution problems centering on the Missouri River are regarded locally, perhaps too optimistically, as soluble.

In terms of long-run scientific and technological growth two developments are especially noteworthy. An expanding "medical industry" is foreseen for Kansas City with the expansion of a "Hospital Hill" medical complex. Key to the project is the involvement of the University of Missouri Medical School, which is now located only at Columbia, Missouri. Kansas City's public general hospital, which by the 1950's was generally recognized as a disgrace to the community, has been upgraded in terms of staff and facilities. The transfer of some teaching functions by the Missouri Medical School will give the Kansas City area the probably unmatched distinction of having two major state medical schools represented in the area. The Hospital Hill plan calls for a big expansion of clinical and research facilities.

The second major development is the transfer of the University of Kansas City to the state university system, with the broader horizons and funding prospects, especially for graduate study and research, that implies. Remarkable for realism at this stage is the realization among those interested in raising the university to excellence that state support will not be sufficient to make the university first-rate and that only heavy support from local industry and philanthropy will enable the university to achieve real distinction.

While these projects are out of the blueprint stage, it is much too early to judge whether the high hopes will be realized. It is possible to say, however—to reach for intangibles—that Kansas City these days is a place with a sense of momentum.—JOHN WALSH