isotopic temperature graphs of core A179-4 and its pilot core A179-TW4 (*1*, Figs. 2 and 7) shows clearly that nothing was lost from the top of core A179-4. It is not unreasonable to assume that the cores of Table 3, which were all raised with Ewing's piston corer (compare *4*), are also complete. If so, the discrepancy may be explained by assuming that burrowing organisms mixed the top few centimeters of the sediment. Complete homogenization could occur only within thicknesses of a centimeter or so, and mixing would be smaller for greater thicknesses. Very little mixing, if any, is believed to have occurred between levels 10 centimeters apart. Failure of the isotopic data of pilot cores (*1*, Figs. 7–10) clearly to reveal temperature variations corresponding to the Wisconsin substages may be an indication of such mixing.

If mixing is occurring at the present sedimentary surface, the same process may be assumed to have disturbed sediments deposited at earlier times. If the radiocarbon age of the modern, superficial sediment is 2000 years, it might be necessary to reduce all radiocarbon dates so far obtained from deep-sea cores by that amount. Consequently, the previous estimate of 15,000 years for the beginning of the last temperature rise would be reduced to 13,000 years.

It is apparent, from this discussion, that dating of the last temperature rise of the superficial waters of the oceans is unsatisfactory at present. Further research of greater detail is needed. In particular, closely spaced samples from deep-sea cores, covering the last 20,000 years, should be analyzed isotopically, and radiocarbon measurements should be performed on foraminiferal shells from critical core levels.

References and Notes

1. C. Emiliani, *J. Geol.* 63, 538 (1955).
2. ———, *Quaternaria* 2, 87 (1955).
3. D. B. Ericson and G. Wollin, *Micropaleontology* 2, 257 (1956).
4. ———, *Deep-Sea Research* 3, 104 (1956).
5. D. B. Ericson *et al., Science* 124, 385 (1956).
6. H. E. Suess, *ibid.* 123, 355 (1956).
7. M. Ewing and W. L. Donn, *ibid.* 123, 1061 (1956).
8. Temperature variations as shown by deep-sea cores permit subdivision in stages and corresponding ages. Age 1 is the present warm interval, age 2 the preceding cold one, and so on. Thus, even numbers refer to cold stages and odd numbers to warm stages. The stages are numbered backward in time. This classification was introduced by G. Arrhenius [*Repts. Swedish Deep-Sea Expedition 1947–1948*, vol. 5, fasc. 1 (1952)]. See also my article (*1*, p. 547).
9. C. Emiliani, *J. Geol.* 64, 281 (1956).
10. The Russian experiments mentioned by Ericson and Wollin (*4*) were conducted on finely precipitated $CaCO_3$. Rapid isotopic exchange may take place between this material and water under the proper conditions. H. C. Urey *et al.* [*Bull. Geol. Soc. Amer.* 62, 399 (1951)] and Lowenstam and Epstein [*J. Geol.* 62, 207 (1954)] showed that Cretaceous chalks exchanged considerably with percolating continental waters. These authors stressed the fundamental differences between fossils and matrix. On the other hand, oxygen isotopic analyses of bulk core material by Epstein [in G. Arrhenius *et al., Tellus* 3, 222 (1951)] showed that the finer carbonate fraction did not appreciably exchange with surrounding water in more than 60,000 years.
11. A paper describing core 280 is in preparation.
12. M. Rubin and H. E. Suess, *Science* 121, 481 (1955).
13. ———, *ibid.* 123, 442 (1956).
14. W. S. Broecker, J. L. Kulp, C. S. Tucek, *ibid.* 124, 154 (1956).
15. Core 280 indicates that the normal rate of sedimentation for the area where core R10-10 was raised is about 7 cm per 1000 years.
16. F. P. Shepard and H. E. Suess, *Science* 123, 1082 (1956).

Recruitment of Women in the Engineering Profession

William M. Evan

The widespread use of the term *manpower* in connection with problems of labor shortages and the utilization of human resources suggests a pervasive cultural bias, for what about "womanpower" in the labor force? To contend that this is merely a manner of speaking overlooks the fact that language is related to cultural and social phenomena. This bias may result in ignoring or underestimating one major source of supply in the current efforts to solve the shortage of engineers.

The underrepresentation of women in engineering is marked indeed. In 1955, 0.2 percent (or 62) of 22,589 engineering graduates were women (*1*). And the proportion of women in the engineering profession as a whole, as of 1950, was 1.24 percent (*2*, p. 230, Table VIII. 1). This is a notably smaller proportion than is found in any of the other professions which are not predominantly female. (In the "predominantly female" category are nursing, social work, library work, and school teaching.) In 1950, the proportion of women in medicine was 6.1 percent; in law, 3.5; in the ministry, 4.1; in college teaching, 23.2; and in journalism, 32.0 (*2*). Thus, both in absolute and in relative terms, the role of women in engineering is negligible.

What are the obstacles to recruitment of women in engineering? What factors, if any, favor recruitment? What are the policy implications of the analysis of this problem?

Obstacles to Recruitment

Of all factors that may account for the negligible number of women engineers, those pertaining to biology—allegedly, IQ and temperament—are least relevant. Psychologists have found that intelligence is normally distributed and is not related to sex. Likewise, temperament, about which little scientific knowledge exists, would not account for the low rate of recruitment of women in engineering. Whatever the temperament of engineers, assuming that it is distinctive, it has not been established that it is a common—much less exclusive—attribute of males.

Psychological factors in terms of personality development *are* relevant. Again, such factors may vary independently of sex, though the possibility is by no means excluded that engineers tend to have, or tend to develop, characteristic modes of thinking and feeling, and characteristic interpersonal relations, which are less commonly found among American women.

Such an old psychological dichotomy as "tough-mindedness" versus "tender-mindedness" may be related to sex. Assuming that engineers are generally "tough-minded" because of the occupational demands for "rational" and "factual" analysis, women, who may be predominantly "tender-minded" and given to "intuitive" and "emotional" patterns of behavior, would not be attracted to the profession. These psychological differences may exist, though they have been inadequately studied insofar as occupational recruitment in general is concerned and engineering recruitment in particular.

Of central importance are the sociological aspects of the problem, namely, the cultural and social factors impeding

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recruitment of women in the major professions, including engineering. Culturally, the American woman, particularly in the middle class, is expected to assume and to value the housewife's role in the family. Since, in general, she derives her social status from her husband, any serious occupational involvement, such as a professional career would entail, might mean competing with her husband. If she should excel him in occupational achievement, this would upset the prescribed identity of social status within the family, to the possible detriment of the husband's career and contradict the culturally approved roles for the married couple.

This cultural definition of the female role in the family tends to channel the interests of college women into general liberal arts and home economics curricula, on the one hand, and into female professions, on the other.

It is quite possible that, of all the major professions, engineering enjoys the most masculine public image. This may be due, in part, to the fact that the public image of the engineering profession prevalent today is still that of engineering of a generation ago, when its kinship with skilled trades was closer than it is now. Early civil, mechanical, and mining engineers may have had to engage in a modicum of muscular and manual activity, or so the public thought upon contemplating such end-products as bridges and tunnels. Given this highly masculine public image, the college woman would have to be exceptionally highly motivated to major in engineering. This might be interpreted as detracting from her femininity and reducing her matrimonial chances.

Social factors also operate to discourage women from pursuing professional careers, including engineering. From infancy onward, influences and pressures are brought to bear on the girl to learn and value the culturally approved adult female role of the housewife. Parents insist on appropriate feminine toys for their daughter, preferring dolls to chemistry sets; playmates enforce a pattern of speech and action which is deemed ladylike; teachers tend to relax intellectual standards for girls; and mass media of communication extoll the glamorous girl, the loving mother, the efficient homemaker.

These sex-differentiated cultural expectations and social relationships extend to the college campus as well as the labor market. Some administrators of engineering and other professional schools are prejudiced against admitting women, doubting their intellectual ability or the propriety of women's performing such occupational roles (*3*, p. 237). Likewise, some employers discriminate against women professionals, including engineers, in their employment practices (*2*, pp. 232–233; *3*, p. 240; *4*, p. 9), either because of the high turnover of women in industry resulting from marriage and pregnancy or because of the opposition of male employees who feel that the presence of women is a threat to the cohesiveness of the work group (*3*, pp. 241–242).

That these cultural and social factors serve to restrict the recruitment of women in engineering, and in other principal professions, becomes even more evident when we compare the role of women in the professions in the United States with that in the U.S.S.R. Because of internal and external pressures for rapid industrialization, since the Russian Revolution, and because of the Communist ideological emphasis on social equality of the sexes and on extensive educational opportunities, Soviet women occupy a prominent role in the professions in general, and in engineering in particular. In sharp contrast to the situation in the United States, the proportion of women in all professions in the Soviet Union in 1954 was about 50 percent (*5*).

Factors Favoring Recruitment

Offsetting, in part, these obstacles to recruitment of women in engineering and other professions are long-term trends in industry, in the family, and in education.

Technologic advances that have resulted in rising productivity levels have led to a shift in the labor force from agricultural and manufacturing industries to service industries, such as communication, education, health, and entertainment (*6*). Service industries (and these include professional services) afford more suitable employment for women, in terms of working conditions, than do agriculture and manufacturing. Technologic advances combined with expansion of service industries have, in turn, reduced the "man-hours" the housewife is required to expend in management of the home. Furthermore, the decline in the number of working hours—a corollary of some of these industrial changes—facilitates performance both of the role of housewife and of that of career woman. Attesting to this fact is the rising proportion of women in the labor force, which reached 28.5 percent in 1950 (*7*).

Supporting this dual role for the woman are two trends in the family institution. First, with earlier marriages, child-rearing is completed earlier, and this frees the woman sooner for a possible career. Second, as the patriarchal authoritarian family is increasingly replaced by the companionate equalitarian family (*8*), the married career-woman is finding greater cultural acceptance. An emerging value in this new type of family is that both spouses—especially the wife—have the opportunity to realize their talents and capacities.

Interrelated with these trends are ongoing changes in the sphere of education. College education has not only become more available than it was in the past, at both public and private colleges and universities, but also more valued. With increasing college enrollment, the proportion of women students has risen. And the occupational behavior of women college graduates has been, and will probably continue to be, distinctive. Regardless of age and marital status, women college graduates are more likely to be in the labor force than are noncollege women (*2*, pp. 226–228). Furthermore, not only do women with college degrees comprise an increasingly large proportion of the labor force but their proportion in all the major professions has been increasing in the past few decades (*2*, pp. 229–230).

Together, these trends in industry, in the family, and in education are creating more favorable conditions for the recruitment of women in all professions, including engineering.

Policy Implications

Given these trends, a program of action —following a policy decision on the desirability of recruiting women engineers —aimed specifically at overcoming some of the obstacles to the entry of women in engineering may prove effective (*9*). The audience for such a program would vary, depending on the particular objective in view. The public at large, and especially parents, would have to be informed about the work of engineers—that "most professional engineering jobs are accomplished at a desk" and "require no more physical exertion than wielding the compass and slide rule" (*4*, p. 7)—to counteract the highly masculine public image of the engineering profession. Grade-school and high-school teachers must be convinced that girls are intellectually capable of pursuing interests in science and technology. College administrators must be persuaded of the wisdom and propriety of admitting women students to engineering schools. Female high-school students should be informed of the diversity of talents called upon in the various branches of engineering and of the contribution they can make to the development of technology. And finally, employers should be prevailed upon to liberalize their employment policies regarding women engineers. In the conduct of such a program of action, professional engineering societies can exert their influence and prestige to increase the likelihood of its effectiveness.

Although usually the rates of cultural and social change are slow, planned action, particularly if it is in harmony with ongoing changes, may serve to accelerate them. Although no single measure is likely to restore the balance between labor supply and demand in the engineering profession, utilization of the potential source of womanpower offers one of the most effective solutions to a problem which is likely to persist for many years to come.

References and Notes

1. W. A. Jaracz and H. H. Armsby, *Engineering Enrollments and Degrees 1955,* Circ. 468, U.S. Dept. of Health, Education and Welfare (U.S. Govt. Printing Office, Washington, D.C., 1956), p. 14, Table I.
2. D. Wolfle, *America's Resources of Specialized Talent* (Harper, New York, 1954).
3. T. Caplow, *The Sociology of Work* (Univ. of Minnesota Press, Minneapolis, 1954).
4. Women's Bureau, U.S. Department of Labor, *Employment Opportunities for Women in Professional Engineering,* Bull. 254 (U.S. Govt. Printing Office, Washington, D.C., 1954).
5. N. DeWitt, *Soviet Professional Manpower* (U.S. Govt. Printing Office, Washington, D.C., 1955), pp. 171, 256.
6. See C. Clark, *The Conditions of Economic Progress* (Macmillan, London, ed. 2, 1951); G. J. Stigler, *Trends in Employment in the Service Industries,* National Bureau of Economic Research, No. 59 (Princeton University Press, Princeton, N.J., 1956), chapters 1 and 8.
7. A. J. Jaffee and C. D. Stewart, *Manpower Resources and Utilization* (Wiley, New York, 1951), pp. 161–162.
8. See E. W. Burgess and H. J. Locke, *The Family: from Institution to Companionship* (American Book, New York, 1945).
9. L. A. DuBridge, *Science* 124, 302 (1956).

News of Science

Device for Measuring Radiation

A new and relatively inexpensive device for world-wide comparisons of x-ray measurements, intended eventually to contribute to uniform standards and to help control the medical irradiation of populations, will soon be made generally available through the cooperation of the United Nations Educational, Scientific and Cultural Organization, the World Health Organization, and the U.S. National Bureau of Standards.

The radiation measurement project received the endorsement of the United Nations Scientific Committee on the Effects of Atomic Radiation at its session in New York in October 1956. The committee found that diagnostic radiology and radiotherapy now constitute in some countries the principal source of artificial radiation, in amounts approximately equal to natural radiation. The fact that many countries have no primary standards of x-ray measurement was recognized as a serious problem after studies of radiation demonstrated that populations may be subjected to more radiation from medical radiology than from fallout or effects of nuclear waste disposals.

Not only do many countries have no primary standards, but they have had no opportunity to check the standards they use against the primary standards in use in scientifically more advanced countries. To meet this problem, the National Bureau of Standards in Washington, D.C., has developed an ionization chamber and accessory equipment that UNESCO and WHO will circulate to countries that request it. Specialists in the operation of the instruments will also be provided. The National Bureau of Standards plans to have the equipment available for circulation very shortly.

UNESCO's participation in the program was approved by the organization's General Conference at its recent meeting in New Delhi, and UNESCO plans to finance the use of the equipment in countries requesting it under the general program of aid to member states. The cost of the equipment itself is small—on the order of $2500—and UNESCO now plans to purchase a second set from the National Bureau of Standards. In that case, one set probably could be sent to Asia for circulation among nations of that area.

Public Health Training

The Public Health Service has announced that it is ready to accept applications from public health workers for graduate or specialized training for the 1957–58 academic year under the special training legislation voted by Congress last July.

In the President's budget, submitted 16 Jan., $2 million is requested for the program in fiscal year 1958 to give additional training to physicians, sanitary engineers, nurses and other professional people who are now working in public health or who are interested in entering this field. Congress voted $1 million for the first year of operation of the program, and more than 300 traineeships have been awarded, either directly by the Public Health Service or through grants to the training institutions. This includes 16 physicians, 150 nurses, 33 health educators, 25 sanitary engineers, 26 sanitarians, 11 laboratory workers, 10 dentists, and 9 veterinarians.

The traineeships provide, in addition to academic costs and fees, stipends covering living expenses for the trainee and legal dependents. Applicants are urged to submit their applications *by 1 Apr.,* if possible. Information regarding the program is being made available by the service's Bureau of State Services, Division of General Health Services.

Maya Excavation

Gordon F. Ekholm, associate curator of archeology at the American Museum of Natural History, has left for Tabasco, Mexico, where he will lead the second phase of an archeological study of the ancient Maya that is being sponsored by the museum. He plans to continue work begun last spring at Comalcalco in southeastern Mexico. This city, an important center of the pre-Colombian world, thrived from about A.D. 500 to 900. There are some partially preserved buildings still standing at the site but most of the constructions that once existed have been reduced to mounds of earth.

The work at Comalcalco is part of a long-range project to learn more about western Tabasco and the whole Isthmus of Tehuantipec region, an area of potentially great importance to Middle American archeology. The site at Comalcalco is the most westerly of the big Maya cities dotting southeast Mexico and Guatemala and, therefore, represents the farthest penetration of Mayan civilization in that direction. It also enjoys the distinction of being the only archeological site in the New World built entirely of fired brick.

During the first phase of the investigations, carried on last spring, two important buildings were excavated: a palace and a temple. In addition 1700 pounds of pottery, fragments of stucco sculpture,