available is smaller than necessary. The 5 to 100-micron size range would be sufficient for countless mineralogical and metallurgical problems that cannot now be reached by fluorescent x-ray spectroscopy. Both the electron optics and the viewing microscope would be greatly simplified for a 5 to 100-micron instrument and the cost might easily be reduced to compete with ordinary electron microscopes.

The electron probe is making it possible to study phenomena heretofore not remotely possible and the results indicate the crucial need for further work in other fields. For instance, the mathematics of the solid-solid diffusion process is largely undeveloped for the commonplace situation where intermediate phases of fixed composition form in the diffusion zone. Experimental data can be turned out so rapidly with the electron probe that there should be sufficient measured values to aid in perfecting and testing any mathematical method. In another area, the composition of individual segregations in alloys may be related to the position with respect to grain boundaries, dislocations, etc. This means that the metallurgical theory of alloy properties must become much more sophisticated in order to catch up to empirical facts. Still another area is corrosion, where the interactions that occur at surfaces may now be analyzed *in situ* and so rapidly that the chemistry of corrosion will have to develop to keep pace with the flow of experimental data.

Shortcoming. One shortcoming of the electron probe in common with fluorescent x-ray spectroscopy is the present inability to measure elements below atomic number 11 (Na). The limitation arises from the difficulty of generating the long wave lengths (10 to 100 A.) from lower atomic numbers in anything but the cleanest vacuum system and from the difficulty of dispersing and detecting such x-rays even if generated. Metal-ion pumps seem to offer possibilities for cleaner vacuum systems for generating the radiation, and ruled diffraction gratings have already been used for dispersion under laboratory conditions. Energy discrimination and unfold-