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A Social Design for Science

It appears that industrial societies can continue producing more and more of everything, for larger and larger numbers of persons, as they have done at an increasing rate during the past two centuries. And yet, I believe that, despite appearances, the kind of quantitative expansion of the economy which has been so characteristic of the 19th and 20th centuries will soon come to an end and that we shall witness within a very few decades a reorientation of the scientific and technologic enterprise.

All ecological systems, whether man-made or natural, must in the long run achieve a state of equilibrium and be self-regenerating with regard to both energy and materials. The ecology of highly industrialized nations has been in a state of disequilibrium for several decades. Furthermore, ecological instability is increasing at such an accelerated rate that disasters are inevitable if the trend continues. We cannot afford to delay much longer the development of a nearly "closed" system in which materials will retain their value throughout the system, by being recycled instead of discarded.

The ecological constraints on population and technological growth will inevitably lead to social and economic systems different from the ones in which we live today. In order to survive, mankind will have to develop what might be called a steady state. The steady state formula is so different from the philosophy of endless quantitative growth, which has so far governed Western civilization, that it may cause widespread public alarm. Many persons will mistakenly assume that the world is entering a period of stagnation, leading eventually to decadence. Yet, a steady state is compatible with creative changes. In fact, change within a closed system will probably offer intellectual (and, in particular, scientific) possibilities much more challenging than those offered by the kind of rampant growth that has prevailed during the past century. The steady state might in the end generate a scientific renaissance. But this will not happen without a conscious, and probably difficult, effort on the part of the scientific establishment.

So far, universities and research institutes have largely remained aloof from the problems that the world will face in an acute form before this century is over. But the pressure of public opinion will soon force scientists out of this aloofness. Scientists will have to redirect their thoughts and skill away from the problems in which they are now interested, toward problems of larger social significance. Rapid and profound shifts in areas of emphasis will therefore occur with regard to theoretical science and to technology.

New scientific concepts emerge from science itself, either as products of its own internal logic or through accidental discoveries which present some analogies to the mutations of the biological world. This aspect of the advancement of knowledge might be called the internal history of science. Equally important is the external history of science, because the development of a new concept, and especially its conversion into a form which is meaningful for society at large, is profoundly influenced by the social milieu. In this sense, many discoveries have been a function of the conditioning scientists receive as members of society. The constraints inherent in the world of the immediate future make ideas concerned with design, rather than accumulation of facts related to growth, the dominant needs in the advancement of science and of technology.—RENE DUBOS, *Rockefeller University*

This editorial is adapted from a speech delivered on 14 November at the dedication of the new science building at Barnard College of Columbia University.