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EDITORIAL

The Dimensions of the Brain

We are in the middle of what has been characterized as the Decade of the Brain. Perhaps there has been no era in history in which both the opportunities and importance of the brain needed more emphasis. The opportunities at the research level are vast. Never before has the array of tools been so impressive. Not only are new techniques available for probing the molecular biology and biochemistry at the cellular level, but computers and information processing are providing insight at the circuitry level, and various noninvasive or quasi-invasive probes can examine the whole brain in action. Research in classical areas of psychology is adding to the past foundations to become increasingly sophisticated about brain operation. There is real hope that complex processes, such as memory, information processing, perception, and so forth, will be understood on a level never appreciated before.

It could not have come at a better time because the problems of the world are truly challenging. The environment is threatened by a population growth that is proceeding largely unchecked. Increased crowding creates tensions and frictions on its own, and a struggle for diminishing resources brings out some of the worst features of any animal population, including mankind. An aging population with increased mental problems, and a population that does not properly care for the mentally ill, also creates new problems for the world. The complexity of modern civilization means that formal education, as distinct from learning by experience, must play a more central role.

In this aura of insecurity and competitiveness a better understanding of the brain and its functions is increasingly important. No single gene will be discovered for tolerance or compassion or altruism, but an understanding of the brain, its limitations, and its capabilities, can provide the background for education and therapy that can mitigate the stresses of the modern era and provide a happier life for its citizens. When *Homo erectus* evolved he and she had to cope with floods, pestilence, and predators, but not with cellular phones, a global economy, and bankruptcies.

The need for increased emphasis on brain research is not a sure cure for the ills of the world but it is a beginning. A better understanding of the brain can certainly help us solve such disorders as Alzheimer's, manic depression, schizophrenia, visual impairments, and hearing deficiencies. It may also lead us to the understanding of more vague and ill-defined responses such as aggressiveness, nationalism, bigotry, and sadism. Knowledge of how much of brain function is native and how much is learned becomes useful if education is to produce a more tolerant and peaceful world. A basic instinct that allowed prehistoric humans to distinguish prey from predator may turn into prejudice against foreigners in an urban world. If aggressiveness and identification with one's own group are inherited, they can still be modified by education, but it will require more work and an earlier start than if they are not innate.

The brain, however, occupies a particularly exalted and revered niche in the hierarchy of organs for study. As a result, many are repelled by a reductionist approach that has proved so successful in understanding other organs of our bodies. The unexpected and counterintuitive is amusing when it involves the curvature of light or weightlessness in space, but it is not greeted with detachment when it is uncovered in areas such as nationalism, aggressiveness, or competitiveness. Some are repelled by the idea that we can use education or medicines to overcome basic instincts. Others are unwilling to accept the idea that some instincts are anachronistic. Many are concerned that research in any brain area that is controversial is likely to be misused. So much misinformation abounds already that a little truth is unlikely to hurt.

Progress in neuroscience today is breathtaking. It needs more funding, more mutual sensitivity between scientists and laymen, and more speed in converting the frontiers of science to the applications of world anxieties. The new tools of neuroscience from molecular biology to the PET scan of the working brain are awesome. They can be used to enhance our lives as individuals and to improve society as a whole. The challenges are increasing, but fortunately, the technologies and the individuals needed to respond to the challenge are becoming available.

Daniel E. Koshland, Jr.