EUROBRAIN

Achievements and challenges of the Decade of the Brain

Ten years is a very short time in the history of science, but the last decade has been rather special for neuroscience. This discipline – the study of the nervous system – has emerged as an independent field of science, tackling issues of enormous intellectual and practical significance. It has been said that knowledge in this area has doubled in the last ten years. The Society for Neuroscience in USA boasts an attendance of more than 25,000 delegates at its annual meetings. The new Federation of European Neuroscience Societies now provides a high-profile Forum for Europe's neuroscientists. And the International Brain Research Organization has more than 50,000 members representing 111 countries.

But what has really been achieved during this "Decade of the Brain" and what does the future hold?

President George Bush and the US Congress, with the encouragement of leading American neuroscientists, designated the nineties as the Decade of the Brain, and many other nations, including the European Community, adopted the Decade. It recognized the scientific excitement surrounding research on brain and also its significance for the health of the public, given the massive toll of diseases and disorders of the nervous system. A couple of years ago, the total cost of such medical problems in the United States was estimated at $600 billion or more. Because so many neurological and

The European Dana Alliance for the Brain

CONTACT

Béatrice Roth, PhD
Institut de Physiologie
7, rue du Bugnon
CH–1005 Lausanne
Switzerland
Tel./Fax: +41 21 692 55 25
dana1997@iphysiolsg1.unil.ch

Elaine Snell
Vicarage House
58-60 Kensington Church Street
London W8 4DB, UK
Tel.: +44 207 937 7713
Fax: +44 207 937 4314
edab@which.net

Achievements and of the Decade

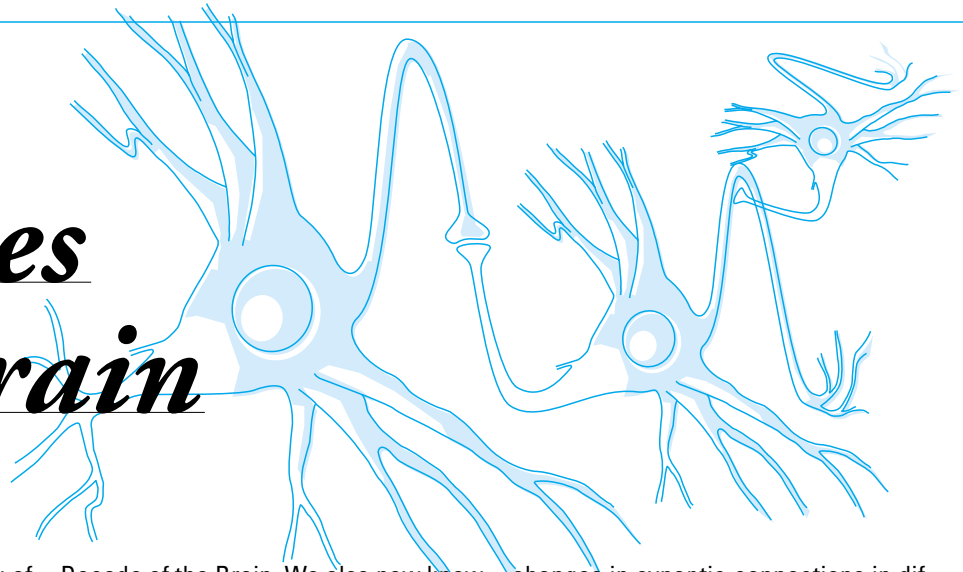
psychiatric disorders, such as stroke, Alzheimer's Disease and Parkinson's, are associated with old age, that burden is bound to grow.

However, the Congressional Declaration did not immediately translate into the additional funds for research that had been anticipated by American neuroscientists. In November 1992, James Watson, Nobel Laureate for discovering the structure of DNA, and W. Maxwell Cowan, Chief Scientific Officer of the Howard-Hughes Medical Institute, convened a meeting of 28 eminent neurologists, psychiatrists and basic scientists to discuss the problem. Fortunately, they also invited David Mahoney, Chairman of the Board of the Charles A. Dana Foundation, based in New York, a non-profit private foundation with grant programmes in health and education. Mr Mahoney, with his business acumen and his sense of public opinion, persuaded the scientists to prepare a statement of achievable goals for the Decade, and to sign up to the mission of raising public awareness of the importance of neuroscience. That was the birth of the Dana Alliance for Brain Initiatives, supported by the Dana Foundation, which now has a membership of two hundred leading basic and clinical neuroscientists. In January 1997, with the encouragement of the Dana Foundation and their American colleagues, sixty European neuroscientists established the European Dana Alliance for the Brain (EDAB), also devoted to informing the public about the necessity of brain research.

100,000 BILLION NEURONS, EACH RECEIVING INPUT FROM AN AVERAGE OF ABOUT 10,000 OTHERS, THAT'S 10^{15} CONNECTIONS – AN INFORMATION-PROCESSING NETWORK OF STAGGERING COMPLEXITY, RESPONSIBLE FOR OUR PERCEPTIONS, THOUGHTS, EMOTIONS, INTELLIGENCE, LANGUAGE AND CREATIVITY.

At the end of this Decade, neuroscientists can surely be proud of what has been achieved, but realistic about the magnitude of the problem that remains. The human brain is the most complex known object in the universe, with its 100,000 billion neurons, each receiving input from an average of about 10,000 others. That's 10^{15} connections – an information-processing network of staggering complexity, responsible for our perceptions, thoughts, emotions, intelligence, language and creativity.

challenges of the Brain



It is fascinating to review how many of the objectives set by the Dana Alliance and the European Dana Alliance have been achieved or substantially advanced. Most dramatic, as in other areas of the biological sciences, is the pervasive impact of genetic research. The defective genes responsible for Huntington's Disease and a variety of other inherited disorders have been identified, and several genes have been described that seem to be associated with the familial forms of other clinical conditions, including Alzheimer's and Parkinson's Diseases, Amyotrophic Lateral Sclerosis, schizophrenia, manic-depression, and even autism and dyslexia. In the post-genomic era, we can look forward to a much fuller understanding of the way in which genetic faults lead to, or exacerbate, the hundreds of heritable disorders of the nervous system. And with that knowledge will come, very quickly, new, targeted drugs and preventive measures. Eventually we can look forward to radical genetic treatments, including germ-line gene therapy, in which faulty genes are replaced and whole families are relieved, forever, of the curse of genetic disease. Of course, such speculation raises the spectre of eugenics, a dilemma that brain research will have to face and resolve in the 21st century.

NEW NEURONS ARE BEING CREATED: A SCIENTIFIC REVOLUTION

Much progress has been made in understanding the biological basis of addiction – a major target for the Decade of the Brain. We also now know much more about why nerve fibres do not regenerate over long distances in the adult mammalian brain, and this offers of the hope, in the near future of dramatic improvements in the treatment of spinal injury and stroke. At the close of the Decade of the Brain, we have even witnessed a scientific "revolution", in the terminology of as Thomas Kuhn. One of the strongest dogmas of brain science, namely that no new nerve cells are born in the adult brain, has been swept aside with the recent discovery that new neurons are being created, especially in the cerebral cortex and the hippocampus, which is thought to be involved in the laying down of personal memories.

PLASTICITY

Perhaps the most daunting problem of all in neuroscience is to understand how the nervous system develops, how neurons are produced and migrate, and how nerve fibres find their way to their targets, make synaptic connections, and then, in some cases, use their own activity to modify the strengths of those connections and even the structure and function of the target cell. The "plasticity" of certain parts of the brain is one of the most exciting, and potentially valuable discoveries of the past decade or so. This holds the key to understanding not only normal development, but also learning and memory, and the response to injury. There have been extraordinary advances in the past ten years in the study of the various forms of memory, which seem to depend on selective changes in synaptic connections in different parts of the brain. This basic research has already led to new drugs to ameliorate the memory disorders of Alzheimer's and to reduce the spread of damage in the brain after a stroke.

FUNCTIONAL IMAGING

Great progress has been made in the study of the normal human brain, as well as damaged and diseased brains, not least through the remarkable developments in functional imaging. Given the recent proliferation of research in this field, it is hard to believe that the first scientific publication on functional Magnetic Resonance Imaging (fMRI) was less than ten years ago. FMRI and Positron Emission Tomography (PET) are helping us to bridge the gap between the detailed knowledge of the structure and function of neurons gained from the study of animals and the understanding of human perception, motor control and cognition, based on more traditional methods.

Meanwhile, techniques for recording the activity of nerve cells in animals are showing us the way in which the cerebral cortex is composed of a vast patchwork of functional areas, specialized for analyzing particular aspects of the sensory world or of plans of action.

"Test-tube" methods have been brilliantly applied, enabling neuroscientists to study, in tissue culture or acute slices of brain tissue, the proliferation and migration of neurons, the growth of

axons and formation of synapses, and chemical communication between and within cells.

BRAIN AWERENESS WEEK

To attempt to understand brain function and to overcome illness associated with the brain was the spur for the Decade of the Brain. The task of neuroscientists in the coming century is immense, but at least the scale of the problem and the importance of the effort are increasingly being recognized by the public and by governments around the world, not least because of the work of the Dana Alliance and the European Dana Alliance. One of the main programmes of these two organizations is Brain Awareness Week each year, in which researchers, clinicians, advocacy groups, funding agencies and many others with an interest in the brain mount events and activities to raise public awareness. Next year Brain Awareness Week, from 13-19 March 2000, will be a global celebration of neuroscience, with activities all over the world, not only in North America and Europe.

THE CENTURY OF THE BRAIN

It is probable that every one of us will be affected by some brain-related disorder at some point in our lives. The World Health Organization predicts that by the year 2020, depression alone will be the second most common cause of the loss of healthy, working life, with 78 million/person years of lost healthy life every year world-wide. The relentless increase in life expectancy will bring a growing burden of degenerative disease, pain and stroke. At the other end of the scale there is great concern for the mental health of young children, and the risk of alcohol and drug abuse among adolescents. While we can be proud and amazed by what has been achieved in the Decade of the Brain, we must be realistic about the scale of the problems that remain. But with the support of the public and of governments, the 21st century – the "Century of the Brain" – surely offers hope of further, remarkable progress.

By **Colin Blakemore,** Chief Executive,
European Dana Alliance for the Brain
and Professor of Physiology, University of Oxford

Published in *Laboratory News*

Colin Blakemore

Brains in Brighton

In June 2000, the Victorian seaside town of Brighton in South East England will play host to some 4000 neuroscientists from around the world. The occasion is the European Forum of Neuroscience, one of the most important conferences for brain researchers.

The Forum is being organized by the British Neuroscience Association, a member of the Federation of European Neuroscience Societies (FENS). FENS represents the many different disciplines within neuroscience not only within Europe, but also around the world. The pace of progress in research in how the brain and mind work is moving very fast and the Forum in Brighton will enable neuroscientists to get together, exchange knowledge of the latest developments and increase their network of global contacts.

In 1998, European neuroscience put itself firmly on the map following the Forum in Berlin, designed to complement the massive annual conference of the Society for Neuroscience in the USA that attracts nearly 30,000 specialists. Thus, to reinforce the role of European expertise, the Forum in Brighton has an exciting programme spanning four days.

A whole range of topics will be covered and will be presented at lectures, symposia, workshops, posters and discussions:

- ➔ brain development
- ➔ cell biology
- ➔ transmission of messages in the nervous system
- ➔ the brain's control of body functions
- ➔ senses and movement
- ➔ behaviour
- ➔ disorders of brain and mind
- ➔ computer simulation and artificial intelligence.

The European Dana Alliance for the Brain, whose mission it is to promote brain research to the outside world, is playing an active part in the Forum. EDAB will be running a press office on site so that news from the Forum can be publicised by the media.

Brain Awareness Week, co-ordinated by EDAB, takes place in March and is now a well-established annual event when universities, hospitals, schools

and even actors and artists organise public events related to the brain and brain research. At the Forum EDAB will hold a reception at which presentations will be given by a number of our partners to review the success of Brain Awareness Week and encourage more people to take part.

There will be a public discussion on "Brain, Mind and Society at the Millennium" where authors of popular neuroscience books will convey their thoughts and opinions for the audience to debate. Members of the Dana Alliance from Europe and USA will be speaking at what promises to be a vigorous and stimulating evening.

This Forum in Brighton will undoubtedly help to advance brain research at a time when the world is facing a time bomb for brain diseases in ageing populations. For instance, in the U.K. alone, over the age of 65, one in every hundred people has Parkinson's disease and eight in hundred people has Alzheimer's. But it is not only older people who suffer. One million children are estimated to have some form of mental illness and over 200,000 people have severe learning difficulties.

The problems confronting neuroscientists around the world are, therefore, immense which is why a major event, such as the European Forum of Neuroscience that attracts world leaders in brain research, is so vital. Discovering how the brain and mind function in health, finding out the causes and developing ways to diagnose, treat and prevent brain disorders has never been more important – or more promising.

By **Elaine Snell,** Contributing Editor