



# **The Human Brain – From Cells to Society**

**Towards Better Mental Health in Europe**

**Executive Summary**

At the frontiers of science in the 21<sup>st</sup> century lie our efforts to understand the human brain. Brain disorders currently affect a very large proportion of the European population, and substantial research effort is needed to understand their causes, to discover new treatments and to improve prevention. Evidence increasingly indicates that the human brain is highly plastic, not just in infancy but through into adulthood. Consequently, efforts are required to identify those psychosocial and educational factors that will promote the future health and wellbeing of all members of our society. In December 2011, the European Science Foundation brought together experts from a wide range of disciplines to discuss the issues that will influence the development of a healthier, more brain-aware European society. This report summarises the main outcomes of that discussion and highlights important considerations to support improved mental health in Europe.

The human brain can be understood on various different levels, from the control of gene expression through to the psychosocial factors that influence behaviour. Although much work has been done to link gene variants and molecular changes, for instance, to higher-level behaviour, the challenge is now to fill in the gaps and determine how genetic and molecular components control brain function through synaptic interactions, microcircuits, and cross-talk between brain areas. Likewise, we must work in the opposite direction to understand how psychosocial factors influence brain physiology and plasticity through microcircuits, synaptic interactions, and changes in molecular and gene-expression profiles. Such an integrated understanding of the human brain will require interdisciplinary research, particularly at the boundary between biology and psychosocial interactions.

At the interface of biology and psychology, key advances are being made in the treatment of neuropsychiatric disorders. Psychotherapeutic approaches are now displaying similar efficacy to psychopharmacologic interventions and attention is beginning to focus on the effectiveness of combined interventions. Future research is expected to address how psychosocial interactions influence brain physiology and organisation, and to explore in detail the pathology underlying neuropsychiatric and other brain disorders. This will require the development of more appropriate model systems, however, not only for basic research but also to test potential interventions.

As we further our understanding of brain function and pathology, and develop tools that can manipulate brain development and physiology, we will be increasingly faced with ethical, social, legal and policy challenges. The identification of factors that predict behavioural traits or future brain-related health issues requires that we also understand how to deal with that information ethically and in the best interests of the individual. Likewise, we must define the ethical and legal limits to be applied to the use of emerging neurotechnologies, including their potential military, commercial and legal applications. At the interface between brain and society, it will be essential to understand more about how scientific concepts relating to the human brain are understood by different groups.

Within the areas discussed by the interdisciplinary expert group, the following opportunities were identified to advance our understanding of the human brain and work towards improved mental health in Europe:

1. The development of integrated neuropsychotherapeutic approaches to the treatment of psychiatric disorders.
2. The development of more valid disease models for research into psychiatric disorders.
3. An improved understanding of the relationship between biology and environment, particularly in relation to developmental plasticity and emerging pathology.
4. More comparative studies to explore how scientific concepts relating to the human brain are received and understood in different sociocultural contexts.
5. Research into the legal and ethical implications of recent developments in the brain sciences, including behavioural screening and manipulation, and emerging neurotechnologies.

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