

Priorities for brain research: the point of view of the neuroscientists

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Brain Research in Europe

Brain research is a rapidly evolving field, and increasingly at the forefront of science, but highly needed for our understanding of the still unknown basic functions of the nervous system

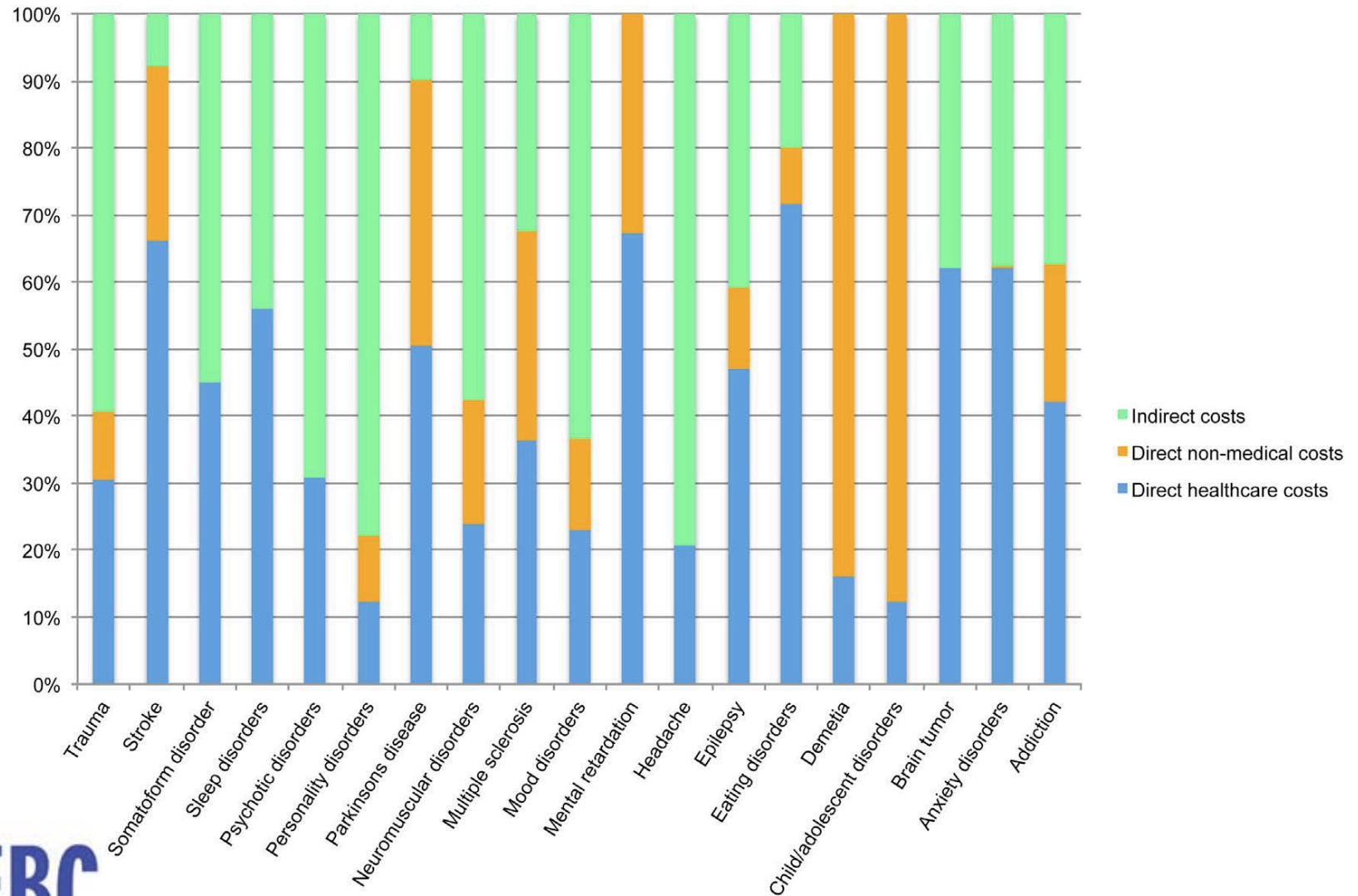
The complexity of understanding brain functions brings responsibilities as well as opportunities : responsibility to develop novel tools and approaches in order to integrate and advance our knowledge; opportunities to provide a better understanding of the underlying pathogenic mechanisms of brain diseases, and thus to generate novel therapeutic approaches for the benefit of society.

The Cost of Brain Diseases: A Burden or a Challenge?

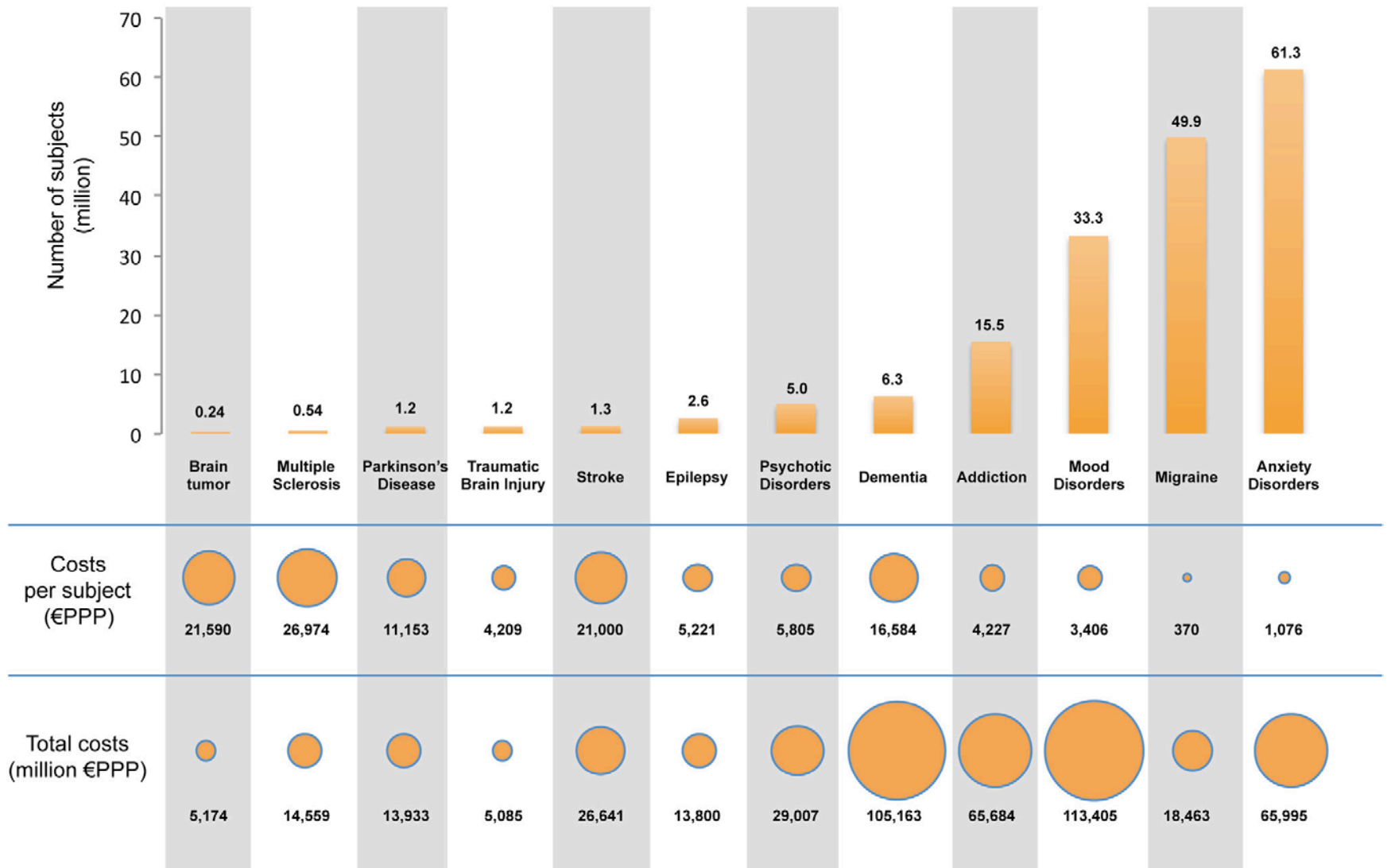
The cost of brain diseases in Europe has been estimated 798 billion euros

(The economic cost of brain disorders in Europe. Olesen et al, Eur J Neurol. 2012; DiLuca & Olesen, Neuron 2014)

Cost distribution of Brain Diseases: 19 diseases in 27 countries



The Cost of Brain Diseases: A Burden or a Challenge?



Issues at stake of brain research

- Understanding the brain and its diseases remains one of the greatest scientific challenge
- Complex and highly multidisciplinary research
- Brain diseases constitute a major burden to our society, with a cost of about €800 billion in 2010
=> € 1.5 million per minute
- Europe's population is getting older

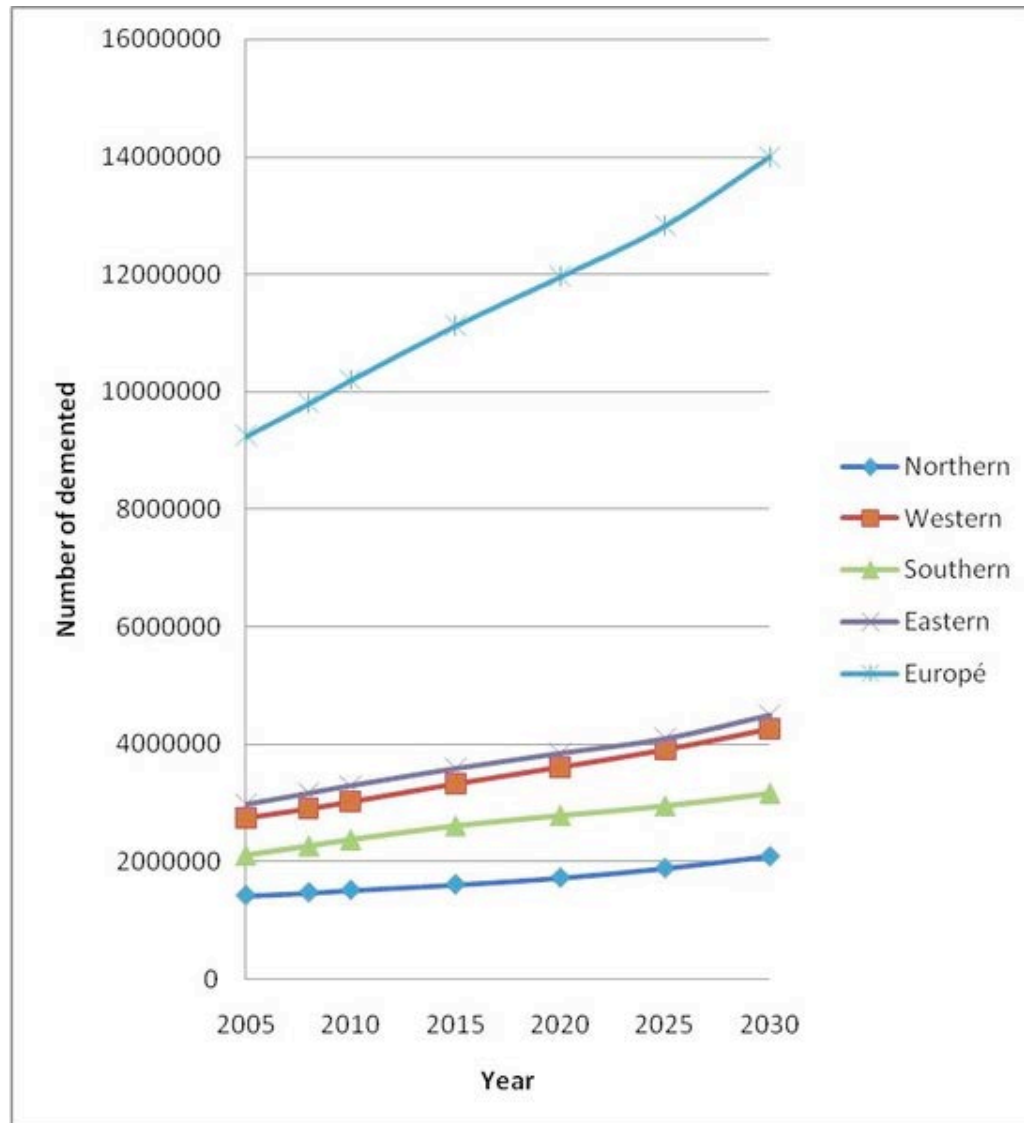


By 2025 20% of European citizens
will be 65 or over



A major societal challenge for the coming years

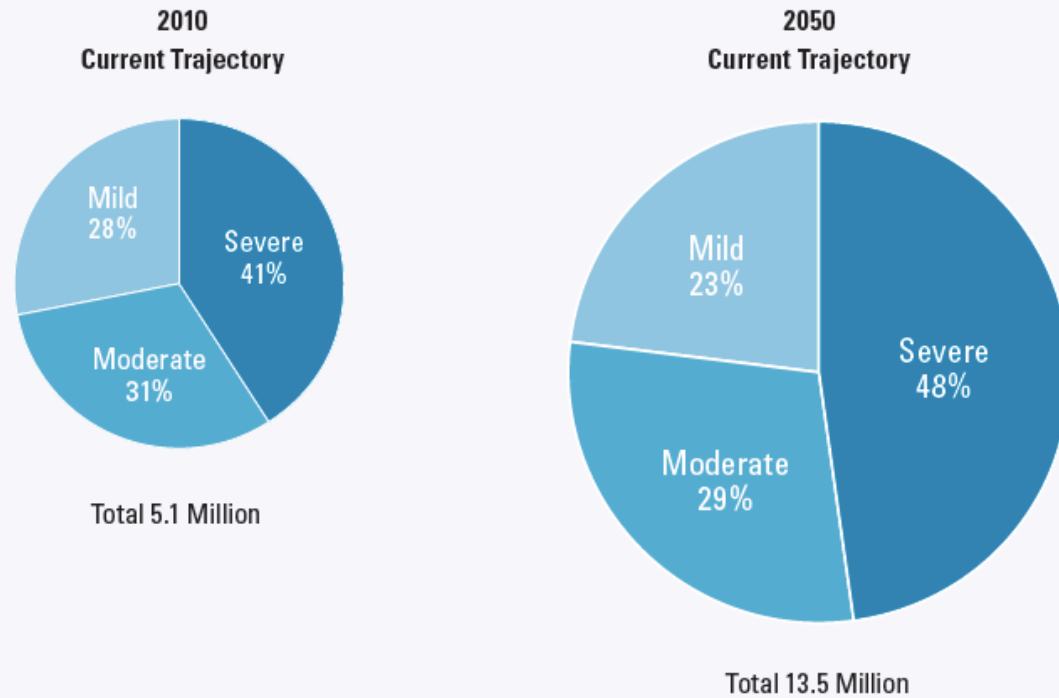
Prospective study on dementia in Europe: number of patients in 2030



The “Change Trajectory” study in US

Figure 2:

Proportion of Americans Age 65 and Older with Alzheimer’s Disease by Stage of Disease, 2010–2050

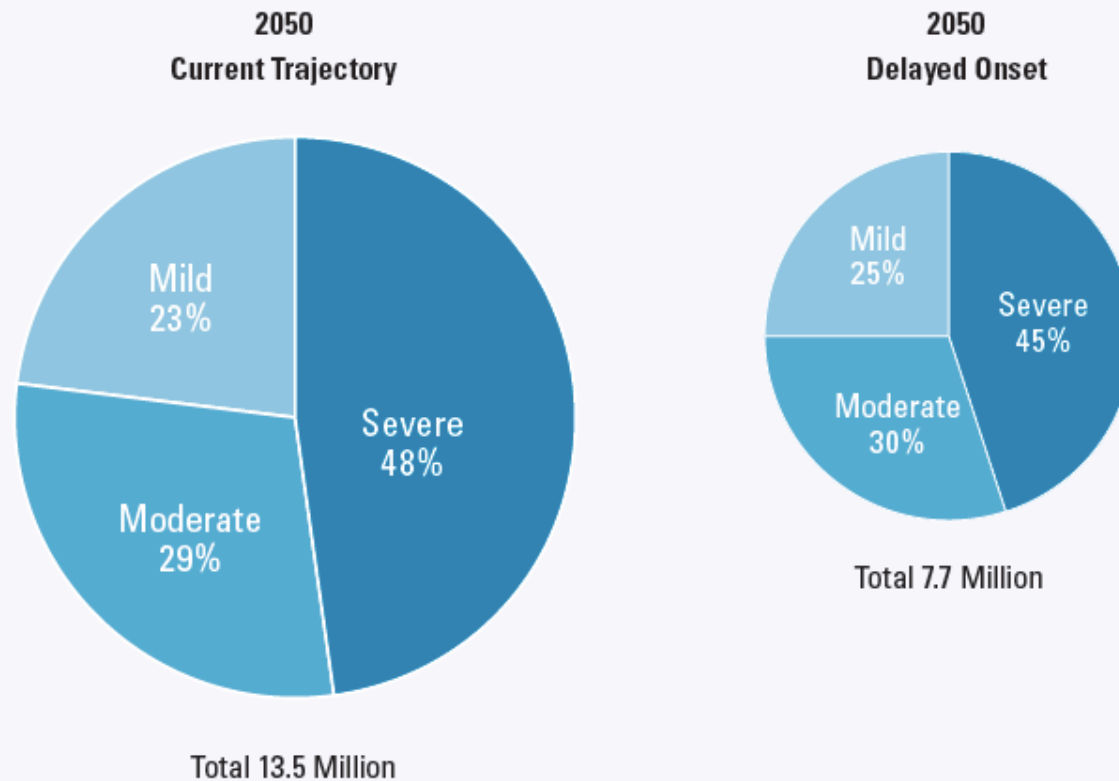


What if we delay the onset and progression?

Changing the trajectory

Figure 5:

Impact of a 5-Year Delay in Onset by Stage of Disease, Americans Age 65 and Older with Alzheimer's Disease, 2050



The need of brain research to tackle societal challenges

Tackling societal challenges and making breakthrough discoveries is not a linear process, and therefore what is needed is support for science and innovation as a holistic system.

In particular, the challenges presented by brain diseases for which insight into basic functional mechanisms are still poorly understood, requires support for the full breadth of neuroscience research.

EU response to this challenge

- Provided a comprehensive support for brain research in FP7
- Dedicated financial resources unmatched by any previous research framework programme
- More than EUR 2.5 billion dedicated to brain-related research since 2007 (yearly allocation of more than EUR 300 million)
- 1,268 projects
- 4,312 participations of 1,515 institutions

Major initiatives to support brain research

- Different funding measures
 - ERA-NET neuron
 - JPND
 - Roamer
 - International Initiative for traumatic Brain Injury research
 - International Neuroinformatic Coordinating Facility
 - Human Brain Project
 - IMI (public-private)

Issues at stake of brain research in Europe

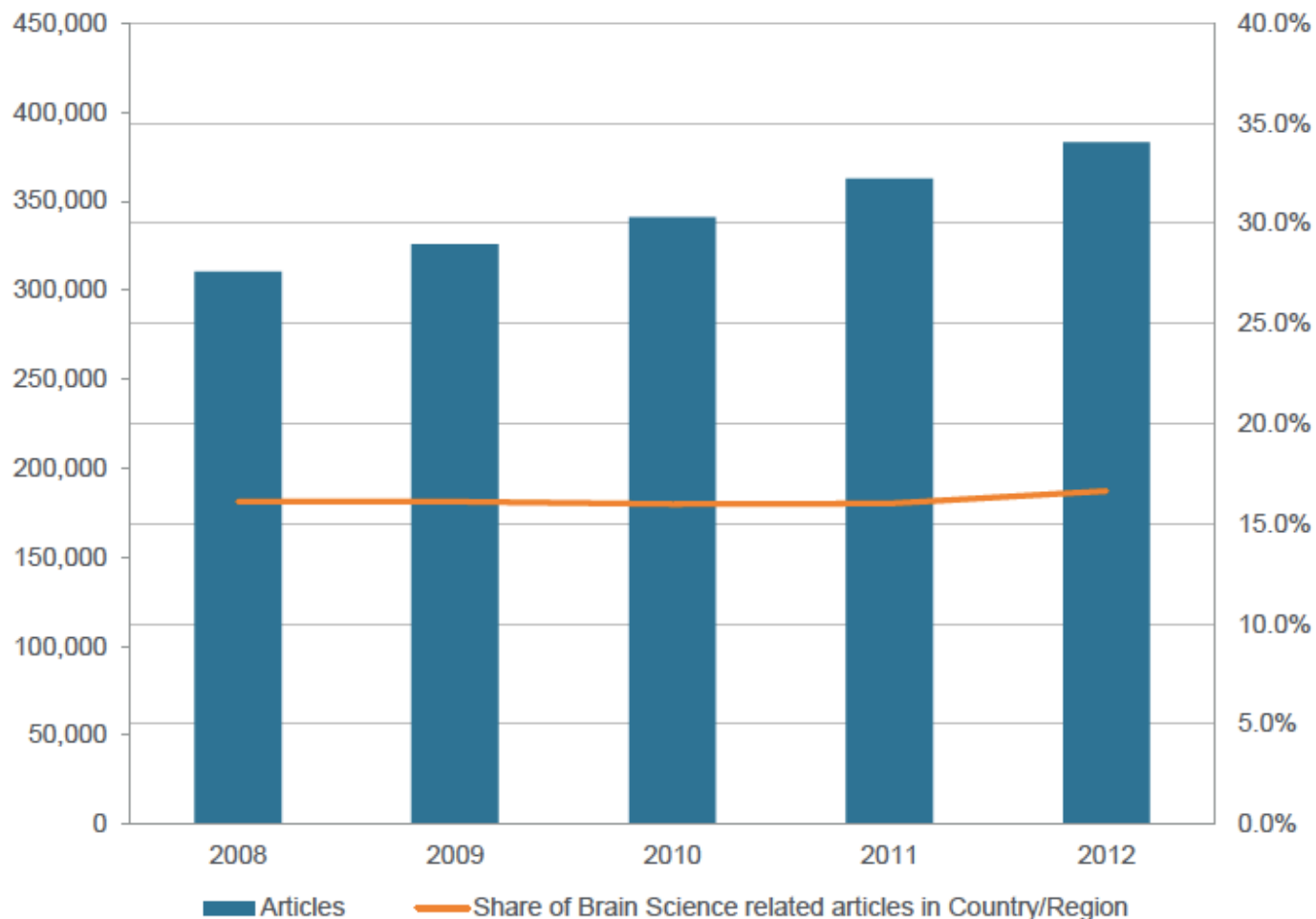
- In the last few years, several pharmaceutical companies reduced or closed their neurosciences R&D facilities because of lower perspectives of return on investment



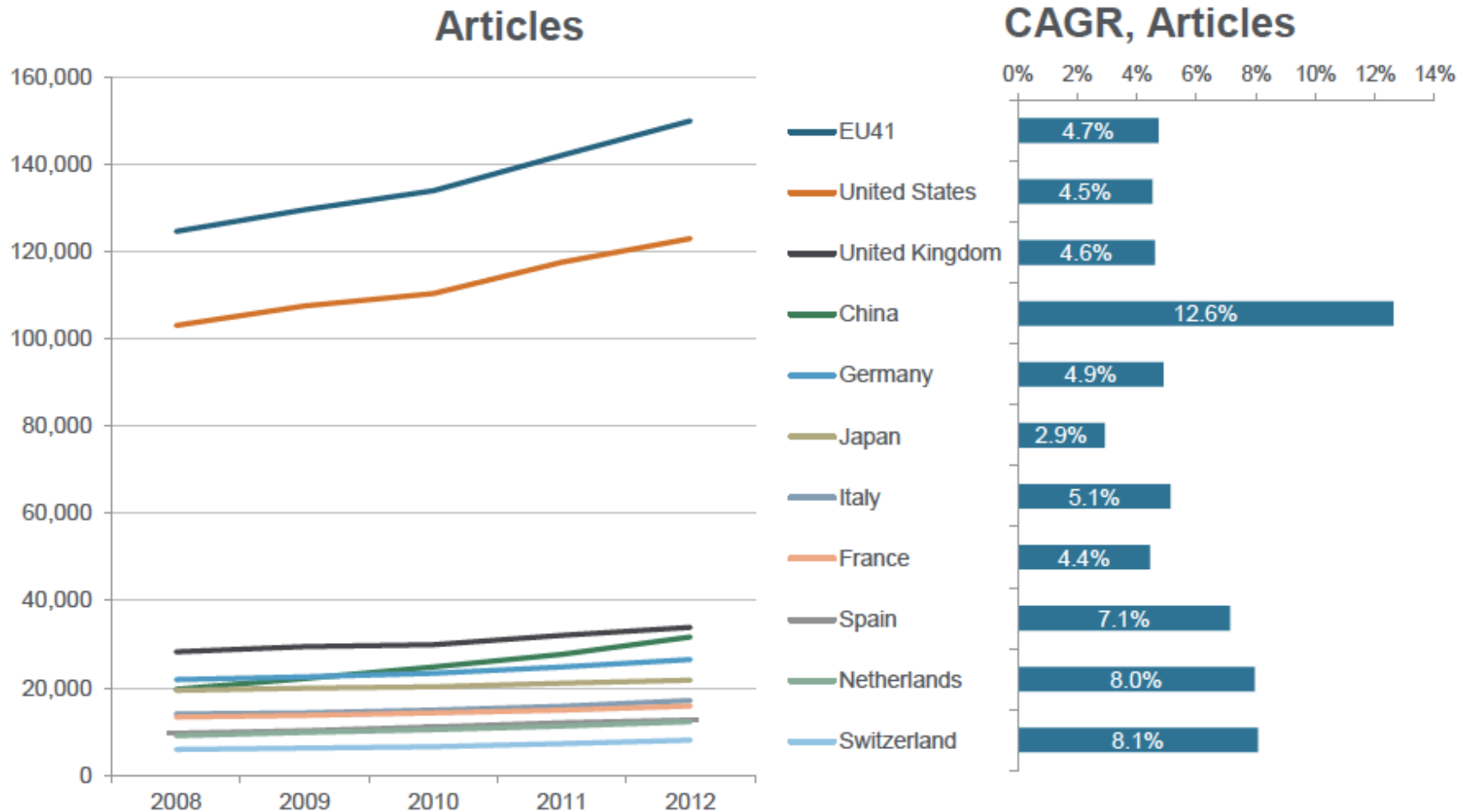
The outcomes

Increasing publication output in Brain Science with stable share at ~16% of world output

Brain Science related articles from World



The top 10 most prolific countries in Brain Research and the EU41 all show growth in the last 5 years



Neuroscience at the cross-road

Need for support to basic brain research with the ambition to increase European and cross-sectoral research collaboration keeping in mind that research excellence needs to be balanced between policy priorities, societal challenges and emerging lead technologies.

Support for European education and integration according to these priorities is central to prepare Europe for the challenges of the future.

The importance of continuously supporting brain research for the benefit of our society: a new consensus document

Consensus Statement on European Brain Research The need to expand Brain Research* in Europe – 2015

Morris RGM, Oertel W, Arteel P, Gaebel W, Goodwin G, Little A, Westphal M, Nutt DJ, Di Luca M

European Brain Council

European Academy of Neurology (EAN)

European Association of Neurosurgical Societies (EANS);

European College of Neuropharmacology (ECNP);

European Federation of Neurological Associations (EFNA);

European Psychiatric Association (EPA);

Federation of European Neuroscience Societies (FENS);

Global Alliance of Mental Illness Advocacy Networks-Europe (Gamian-Europe);

The board of the European Brain Council (EBC) adopted the present document on November 26th 2015.

**note – in this document brain research is used to refer to both fundamental curiosity-driven and translational research on disorders of the brain, spinal cord and peripheral nervous systems and to cover both psychiatric (mental) and neurologic illnesses*

A new consensus document: challenges in brain research

Making the brain: developmental neuroscience

- The bridge from brain development to mature circuit function and dysfunction as seen also in neuro-developmental disorders

A new consensus document: challenges in brain research

Understanding causal mechanisms: linking cellular/molecular mechanisms to complex behaviours and disease states

- Another major challenge in neuroscience is a variety of ‘bridging’ problems. Specifically, understanding the mechanisms that bridge multiple spatial and temporal scales, namely the task of linking the activity of individual components (e.g., molecular biology, genetics, and neuron networks) to the overall complex dynamic behavior of the brain and nervous system remains very difficult. It is, however, vital for progress.

A new consensus document: challenges in brain research

Information processing: what the brain does.

- The brain controls behaviour, and it succeeds in doing this through an interlinked set of elaborate mechanisms: *sensing the world around us (e.g. seeing), and the world within (e.g. proprioception); the transformation of this sensory input into an object-oriented understanding (via perception); linking this knowledge with stored information from memory; and the organisation of actions and habits guided by emotion and motivation.* We understand a lot, but so many aspects of these processes remain a mystery, especially fundamental concepts like numerosity and decision-making, but also how they are impaired in neurologic and mental health disorders

A new consensus document: challenges in brain research

Brain and mental health disorders - Neurological and psychiatric brain disorders of children and adults

A new consensus document: challenges in brain research

Computational Neuroscience and data repositories

- The large number of technological advances in basic neuroscience has led to an exponential growth of data production regarding various aspects of the brain, under numerous different conditions and across several species. Computational neuroscience approaches including theoretical modeling and large scale data analysis/integration methods will be essential to turn this data into better understanding of the brain and help develop new tools for dealing with brain dysfunctions.

A new consensus document: challenges in brain research

Understanding and Improving Drug Delivery to the Brain.

- Increasing insight into the pathophysiology of brain diseases, be they metabolic, inflammatory, traumatic, immunological, neurodegenerative or oncological has led to the development of many promising reagents which as drugs may have tremendous impact on the disease processes. The brain, however, is well protected against influx of many reagents by the blood-brain barrier which in particular does not allow crossing of large molecules, especially proteins which as monoclonal antibodies can be tailored to many relevant dysfunctional molecules in all the aforementioned disease classes. The biggest challenge for newly designed neuro-therapeutics unless they are freely penetrable “small molecules” is to reach an even distribution in the brain beyond the blood brain barrier.

The importance of continuously supporting brain research for the benefit of our society: a new consensus document

Recommendation

- We call upon the European Commission to recognize the continued major needs in basic and clinical brain research, but still insufficient targeted research support.
- DG Research must explore ways to continue sustain brain research within Horizon 2020, the Marie-Slodowska-Curie program, and through other platforms.
- An immediate step could be for the Commission to liaise with the European Brain Council to optimise ways of supporting services for patients and research.

Getting the balance right

