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Resource allocation to brain research in Europe (RABRE)

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Abstract

This article is a markedly condensed summary of a longer report [Resource allocation to brain research in Europe (RABRE), part 2] that is simultaneously published on line: (i) as supplementary material linked to this European Journal of Neuroscience article (http://www.blackwell-synergy.com/loi/ejn) and (ii) on the website of the European Brain Council (http://www.europeanbraincouncil.org/publications). We have recently shown that brain diseases account for 35% of the overall disease burden and cost European society almost €400 billion per year (a billion is understood to mean one thousand million throughout this report). The aim of the present study was to estimate funding for brain research in Europe and the cost–benefit of further investments in this area of research. The assessment of funding included public sources (governmental agencies plus charities) and industry funding. The assessment of publicly financed research support for brain research was based on a comprehensive survey, and industry investment in brain research was assessed based on published data on pharmaceutical development. The total funding of brain research in Europe was estimated at €4.1 billion in 2005, of which public grants amounted to <€900 million. Thus, industry funding accounted for 79%. Although cancer only incurred 50% of the cost of brain diseases in 2005, public grants for cancer research were almost twice as high as the public financial support of brain research. US-based funding of brain research was almost four times higher than European funding. We assessed the cost–benefit of further investment in brain research using different methods. They all showed that increased investment in brain research is likely to be highly cost-effective. We conclude that European spending on brain research, particularly public spending, is low compared to other fields of research and to the US, and that increased investment in brain research seems warranted.

Background

This is a markedly condensed summary of a longer report that is simultaneously published on line: (i) as supplementary material linked to this European Journal of Neuroscience article (http://www.blackwell-synergy.com/loi/ejn) and (ii) on the website of the European Brain Council (http://www.europeanbraincouncil.org/publications). In this work, brain disease includes all diseases affecting the brain, the spinal cord and peripheral nerves, as well as neurological and psychiatric diseases. Brain research refers to all research relating to the nervous system and thus covers the traditional concepts of clinical and basic neuroscience. We have previously assessed the burden of brain diseases in terms of disability-adjusted life-years (DALYs) and in terms of their economic cost. In Europe, brain diseases accounted for 35% of the overall disease burden (Olesen & Leonardi, 2003) and the costs amounted to a conservative estimate of €386 billion per year (Andlin-Sobocki *et al*., 2005). (A billion is understood to mean one thousand million throughout this report). These costs will increase considerably in the coming years due to the ageing European population. One way of curbing this increase and possibly decreasing the cost of brain diseases is via intensified research. More brain research may lead to decreased disease burden, but is also important in itself as it provides better knowledge about normal brain functions such as emotions, aggression, learning and memory. The aim of the present study was to collect information about spending on brain research in Europe and compare this to the burden and cost of brain diseases, research spending in other disease areas, and similar estimates for the US.

Methods

The present study examined all known sources of funding, including governmental grants as well as charitable and industry funding.

To estimate public spending (by both governments and charities), a survey was conducted which evaluated the way brain research is funded across Europe. By directly contacting the primary sources of research funding, the estimate represents the money spent by European institutions rather than the actual total research investments at European research institutions. The latter may include research funded from outside Europe, for example the National Institutes of Health (NIH) in the US. For countries where insufficient information was reported on funding for brain research, estimates were assigned based on data from other countries.

Industry funding was measured by three different approaches: (i) by using a worldwide survey of pharmaceutical expenditure according to disease area (Centre for Medicines Research International, 2006); (ii) by considering the published cost of developing a new drug and applying that cost to the number of new chemical entities (NCEs)

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launched in Europe in the past decades (Wilking & Jönsson, 2005); and (iii) by applying the share of drugs for brain diseases that have entered the market between 1985 and 2004 to total research and development expenditure by pharmaceutical companies in Europe over the same period of time.

Furthermore, we assessed the cost–benefit of investment in brain research using different methods. All financial figures presented in billions refer to one thousand million.

Results

Total spending on brain research in Europe in 2005 amounted to approximately €4.1 billion (see Fig. 1), out of which €855 million was from the public sector (21% of total funding). Governmental funding constituted 78% of total public funding, while 22% came from charitable foundations. The European pharmaceutical industry spent approximately €3.3 billion on brain research per year (range €2.7–3.9 billion), corresponding to 79% of the total funding for brain research in Europe.

By contrast, in the US, about €6.1 billion came from public sources (93.5% government and 6.5% charities) and €8.4 billion from industry funding on brain research (58% of the total funding); see Fig. 1.

Cancer research, on the other hand, received similar levels of investment as brain disorders in Europe. Cancer research in Europe received about €1.5 billion of public funding (50% government and 50% charities) and around €2.5 billion of industry funding.

Public funding for brain research varied between countries, ranging from €60 000 in Malta to €312 million in the UK. Ireland had the highest level of public spending per inhabitant (€6.73), followed by the UK (€5.2) and Hungary (€2.7). The lowest level was found in Latvia (€0.14 per inhabitant). Hungary, the Netherlands, Norway, Sweden and France also had per capita spending above the European average, estimated at €1.2.

It was possible to attribute 53% of the total research spending to specific brain disorders. Psychiatric disorders received one-third of investments for brain research while two-thirds went to neurological disorders. In our previous study on cost of brain disorders, psychiatric disorders accounted for 67% of the overall cost and neurological disorders for 33%. In the present study we found a considerable difference between research spending in different brain disorders. Affective disorders received total funding of about €600 million, whereas brain cancer received €70 million and traumatic brain injury €12 million.

Public funding of brain research amounted to 0.2% of the cost of brain diseases per year and industry funding to 0.8%. Comparing research spending to the cost of individual brain diseases, brain cancer received proportionally the highest funding, corresponding to 0.5% of its costs, whereas affective disorders and migraine received the least funding compared to their economic cost (0.035 and 0.025%, respectively). The absolute funding of cancer research is at approximately the same level as the funding of brain research (Table 1). However, public funding of brain research is smaller and the cost and burden of brain disease is almost double that of cancer.

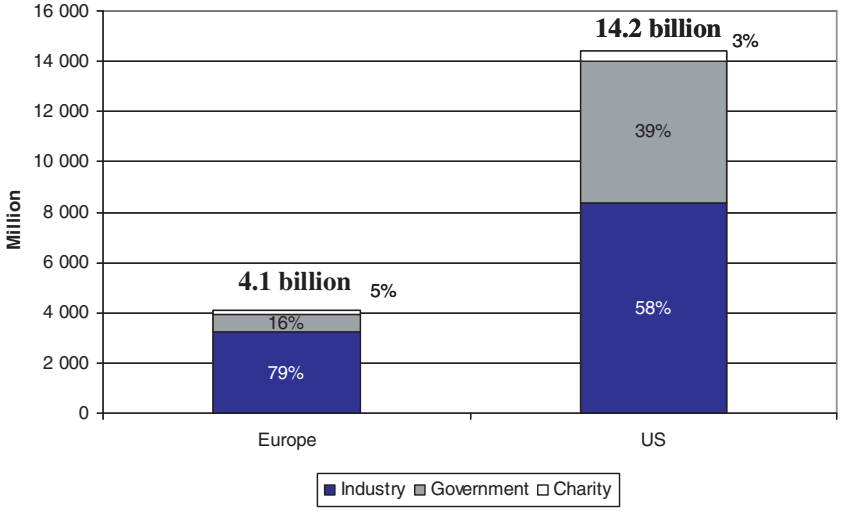

FIG. 1. Total funding of brain research in Europe compared to the US (2005).

TABLE 1. Research funding, costs, deaths and burdens of cancer compared to brain disorders in Europe (2005)

	Burden of disease				Funding relative to burden		
Disorder	Funding (million €)	Costs (million €)	Deaths due to disease (2002)	DALYs lost	Funding as a percentage of cost	Funding per death (€)	Funding per DALY (€)
Cancer	3996[a,f]	226 486[a]	1190 295[c]	9 839 035[d]	2%	3357	406
Brain disorders	4107	389 364[b]	687 170[c]	20 582 746[d,e]	1%	5977	200

DALY, disability-adjusted life-year. The cost estimates are based on 19 European countries as stated in Wilking & Jönsson (2005) for comparability. The cancer cost estimate assumes that indirect costs are three times the direct costs, giving a relatively high estimate (see discussion in Wilking & Jönsson, 2005). The cost estimate is also inflated to 2005 year values. The death estimates exclude Cyprus. Source references: [a]Wilking & Jönsson (2005); [b]Andlin-Sobocki *et al*, 2005; [c]World Health Organization (2006); [d]World Health Organization (2004); [e]Olesen & Leonardi (2003); [f]European Commission (2005).

Discussion and policy implications

This is the first study to evaluate the private and public spending on brain research ever conducted in Europe. We consider it an important accomplishment to have gathered the necessary information for these purposes. This would hardly have been possible for any single researcher or group of researchers. However, due to the extensive network of the European Brain Council it was possible to secure cooperation from most countries. The results strongly suggest that funding of brain research must be increased in Europe, particularly public funding.

While these general statements certainly hold true, a more precise interpretation must be made with some caution. In total 71% of the public funding agencies provided adequate responses to the survey conducted, but only 53% of the countries included provided complete data for the assessment. The assumed funding estimates for countries with no or incomplete data are surrounded by uncertainty.

No data from universities were included in the total estimate, although they make considerable investments, particularly in basic brain research. This was because of lack of data and the risk of double counting. In many instances, we encountered difficulties in differentiating between expenditure on brain research and other purposes, leading to potential overestimations of research funding in some countries. On the other hand, due to missed organizations and exclusion of universities, the results might represent an underestimation. Our best (but still highly uncertain) estimate of university-funded brain research is €700–800 million. Even after inclusion of this figure, public funding of brain research remains low compared to the US and public brain research funding still constitutes only a minute fraction of the costs of brain disorders. Hence, the above-mentioned caveats will not alter these overall conclusions.

Industry funding includes development costs as well as research costs. Our figures for industry funding of brain research may therefore be considered to be too high. However, both basic and clinical research is needed to bring new medicines to the market and to provide the necessary information for their optimal use. In comparison to the US, there seems to be an under-funding of both basic and clinical brain research in the public sector (National Institutes of Health, 2005; Hamilton *et al*., 2005). We have not been able to document the interaction between publicly and privately funded research, but this is a key factor for success in bringing new therapies to patients.

Several different analyses showed that increasing brain research would bring great benefits. Even with very conservative estimates, a high financial return on increased investment in brain research was predicted. This was true even within a 10-year period although the benefits from brain research may endure over the long-term future. Allowing for long-term benefits from investments in brain research, it is likely to provide substantial annual returns. Our findings are in agreement with previous findings for the US (Johnston *et al*., 2006).

Conclusions and recommendations

Spending on brain research in Europe, particularly public spending, is low compared to other fields of research such as cancer, and it is particularly low compared to the US. Increased public investment in brain research in Europe may be highly cost-effective and bring great benefits. The EC prioritization of brain research in the Seventh Framework Programme of Research is supported by the present data. Each European nation should follow the example of the EC and make brain research one of its research priorities for the years to come. It is important that both basic and clinical research receive adequate funding. Basic research is responsible for the most fundamental breakthroughs and often leads to subsequent paradigm shifts in drug development and patient treatment. Clinical research may direct basic research towards disease-related mechanisms and is instrumental in translating findings of basic research into new products and treatments.

Using the same methodologies as in the present study, further studies could be undertaken in each European country to assess more precisely the spending on brain research. To facilitate more accurate future studies, industry and public funding bodies should group together funding for 'brain research', including stroke, brain tumour, developmental disorders, mental retardation, brain trauma and brain infections. This would enable future studies to establish the necessary priorities for investments in brain research.

Supplementary material

The following full-length report of this work is published as supplementary material on the websites of the European Brain Council (http://www.europeanbraincouncil.org/publications) and Blackwell Synergy (http://www.blackwell-synergy.com/loi/ejn).

Full report S1. Resource allocation to brain research in Europe - a full report.

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