Network of European Funding for Neuroscience Research

ERA-NET NEURON

‘European Research Projects on Cerebrovascular Diseases’ Joint Transnational Call 2011

Impact Report

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Abbreviations

AKA	Suomen Akatemia, Academy of Finland (Finnish NEURON partner)
ANR	Agence Nationale de la Recherche (French NEURON partner)
AT	Austria
BMBF	Bundesministerium für Bildung und Forschung (German NEURON partner)
CA	Canada
CIHR	Canadian Institutes of Health Research
CSO-MOH	Chief-Scientist Office, Ministry of Health (Israeli NEURON partner)
DE	Germany
DLR-PT	Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR), German Aerospace Center, Project Management Agency (German NEURON partner; NEURON coordinator)[1]
EAHERDIF	Executive Agency for Higher Education, Research, Development & Innovation Funding
ECR	Early-Career Researcher
ERA-NET	European Research Area Network
ES	Spain
FI	Finland
FNR	Fond National de la Recherche (Luxembourgian NEURON partner)
FR	France
FRQS	Fonds de recherche du Québec – Santé
FWF	Fonds zur Förderung der Wissenschaftlichen Forschung (Austrian NEURON partner)
IF	Impact Factor
IL	Israel
ISCIII	Instituto de Salud Carlos III (Spanish NEURON partner)
IT	Italy
JCS	Joint Call Secretariat
JTC	Joint Transnational Call for research proposals
MICINN	Ministerio de Ciencia e Innovacion (Spanish NEURON partner)
MOH	Ministero della Salute (Italian NEURON partner)
MoU	Memorandum of Understanding
MRI	Magnet Resonance Imaging
NCBiR	Narodowe Centrum Badan i Rozwoju (Polish NEURON partner)
NEURON	Network of European Funding for Neuroscience Research
PI	Principal Investigator
PL	Poland
SVD	Small Vessel Disease

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Abstract

Research into the human brain and brain-related disorders is one of the major challenges of the 21st century. Despite significant progress in understanding the mechanisms of neurological and psychiatric disorders, effective cures are still not at hand. Developing novel treatments for diseases like schizophrenia is an endeavour that lies beyond the power of single countries. The Network of European Funding for Neuroscience Research (NEURON) provides a platform for funding organisations and ministries to develop joint activities and programmes to support transnational research projects in the field of disease-related neuroscience. A key element in NEURON's scheme is the implementation of annual Joint Transnational Calls (JTC) for research proposals, in which NEURON partners from Europe, Israel and Canada participate. The JTCs cover a wide range of topics in neuroscience, neurology and psychiatry.

The topic of JTC 2011 was '*European Research Projects on **Cerebrovascular Diseases'***. Ten multinational research consortia were selected for funding in a peer-review process. NEURON's quality assurance measures include continuous monitoring of the projects and the evaluation of the projects' success at the end of each JTC. The present analysis is based on the responses to a questionnaire distributed amongst the project coordinators together with the final report. Key performance indicators were developed to allow a standardised evaluation.

The key performance indicators measure to which extent NEURON's objectives were achieved. The overarching objectives are:

- Enhancement of cooperation between European scientists in the field of neuroscience
- Promotion of multidisciplinary and translational research
- Support of development of innovative or shared resources and technologies
- Support of development of new strategies for diagnosis, therapy, and rehabilitation.

The analysis of the data revealed that, overall, JTC 2011 contributed successfully to NEURON's objectives. In summary, funding under JTC 2011 strengthened transnational cooperation among neuroscientists. NEURON helped both to create new collaborations and to sustain existing ones. The collaborations produced a considerable output in terms of scientific publications: Overall, 162 publications in peer-reviewed journals were reported; 59 were joint publications. 50% of the projects published repeatedly in high impact journals (IF > 10). This demonstrates the high quality of the funded research. Resources were efficiently shared among the project partners. Each project was multidisciplinary, including at least one medical doctor. All followed a translational approach, encompassing basic and clinical research, with 50% of the projects involving patients. Importantly, the projects produced outcomes with direct impact on health, e.g. medical treatments and novel technological developments. Most of the projects (80%) developed novel strategies for prevention, diagnosis, therapy or rehabilitation; for instance a procedure for vision rehabilitation by non-invasive electrical brain stimulation or an online library that implements machine learning algorithms. There was exchange of biomaterials and clinical data. In addition, two new patient databases were established. These resources will be used by the consortia even after termination of the funding period.

In particular the interdisciplinary approach encouraged by the NEURON funding scheme, was considered beneficial by the researchers. The requested size of the consortium was appraised as very suitable, not least because many new collaborations were initiated. Yet, it was stressed that for sustainability of the consortia, a repetition of the call topic would be helpful to allow immediate follow-up application.

Introduction

Most European countries invest considerable resources into research, leading to major advancements in science. Still, many important questions remain unanswered and major societal challenges need to be solved which cannot be confronted on a national level alone. In order to pool resources effectively in a concerted effort to address these issues, the European Commission has initiated European Research Area Networks (ERA-NETs) in various fields of research. The aim of the ERA-NETs is the coordination of research programmes to reduce fragmentation and duplication of efforts, thereby promoting European competitiveness in research. ERA-NETs support research that is conducted across countries, allowing research groups to jointly work on specific scientific questions, exchange ideas, and benefit from transnational expertise and resources.

The Network of European Funding for Neuroscience Research (NEURON; www.neuron-eranet.eu) was initiated in 2003 as a pilot Specific Support Action. It was developed into a full-fledged ERA-NET by 2007 and was funded by the European Commission in two phases: NEURON I (2007 – 2011) and NEURON II (2012 – 2015). In 2016 NEURON entered a new phase as NEURON Cofund under the EU framework programme Horizon 2020. To-date, NEURON brings together 27 funding organisations from 19 countries engaging in a joint effort to promote excellent research in disease-oriented neuroscience.

Brain-related diseases and disorders of the nervous system impose a heavy burden on society. In Europe alone more than 38% of the population are affected[2], suffering from a considerable loss of quality of life. Moreover, according to the European Brain Council, the annual costs of brain disorders amount to approx. 800 billion €[3]. Apart from the suffering of the individual patients, these numbers highlight the impact on economies and health care systems. In many cases the underlying disease mechanisms are still not well understood and no curative treatments are available.

Hence, NEURON aims to support basic, clinical and translational research paving the way for new or improved prevention, diagnosis, therapy and rehabilitation. In the long term, NEURON wants to promote the application of knowledge and new technologies to improve the situation of patients, their families and carers.

Joint Transnational Calls for Research Proposals

Joint Transnational Calls (JTC) for research proposals are the centrepiece of NEURON's transnational activities. Since 2008, NEURON has launched annual JTCs in the field of disease-related neuroscience, addressing important areas in fundamental neuroscience, neurology, or psychiatry. Call topics are usually broad and cover various aspects of research fields, encouraging cross-disciplinary proposals. Researchers from Europe, Israel and Canada can apply with small scale research consortia (up to five research groups). Selection criteria for funding are scientific excellence (novel ideas, methodology), feasibility of the project, international competitiveness of participating groups in the field, high quality of the collaborative interaction between the groups, a clear added value of the research consortium, and, finally, high potential of the expected results for future clinical and other health-relevant applications.

The calls were intended to promote multidisciplinary and translational research, as well as the development of new strategies for diagnosis, therapy and rehabilitation. Apart from promoting novel research, NEURON also supports the development of shared resources and technologies to optimise the

[2] Wittchen HU,, Jacobi F et al. (2011): The size and burden of mental disorders and other disorders of the brain in Europe 2010. Eur Neuropsychopharmacol, 21(9): 655-679

[3] Olesen J, Gustavsson A, Svensson M, Wittchen HU, Jönsson B; CDBE20 10 study group; European Brain Council (2012): The economic cost of brain disorders in Europe. Eur J Neurol, 19(1):155-62

use of resources. Above all, excellence is the main selection criterion for the research projects to be funded. Further information about the peer-review process is shown below.

Evaluating and monitoring the results of the funded consortia intends to analyse the projects' achievements compared to the expectations of NEURON partners. Key performance indicators were developed to allow a standardized analysis[4]. Feedback from the PIs was also obtained in order to improve, NEURON's performance towards future calls. Hence, a questionnaire was sent to the coordinators of the JTC 2011 after the end of the funding period (see Annex II). The present report is based on the analysis of the questionnaire capturing the key performance indicators.

During the first five-year phase of the ERA-NET work (NEURON I), four JTCs were implemented. They covered the topics 'Neurodegeneration' (JTC 2008), 'Technology development' (JTC 2009), 'Mental disorders' (JTC 2010), and 'Cerebrovascular diseases' (JTC 2011) (Table 1). The research projects funded under these calls have already been completed and the results from their evaluation published on the NEURON website in 2014, 2015, and 2017, respectively. The evaluation of the JTC 2011 is the subject of the present report.

Table 1: *List of JTCs during NEURON I*

Year	Topic	Impact report
2008	Neurodegeneration	published in 2014
2009	Technology development	published in 2015
2010	Mental disorders	published in 2017
2011	Cerebrovascular diseases	published in 2017

'European Research Projects on Cerebrovascular Diseases', JTC 2011

The JTC on cerebrovascular diseases was launched in January 2011 under the umbrella of NEURON I. Thirteen funding organisations from 11 countries participated in the call: Austria (FWF), Canada (CIHR, FRQS), Finland (AKA), France (ANR), Germany (BMBF/DLR-PT), Israel (CSO-MOH), Italy (MOH), Luxemburg (FNR), Poland (NCBiR), Romania (EAHERDIF), and Spain (ISCIII, MICINN). The Joint Call Secretariat (JCS) organising proposal review and funding selection was hosted by DLR-PT (Germany). For further details refer to the call text (Annex I).

Call Topic

Cerebrovascular diseases are a major cause for morbidity, mortality and impaired quality of life. This group of conditions affect the blood vessels in the brain encompassing silent stroke, cerebral small vessel disease, chronic or repetitive ischemia, and vascular cognitive impairment. Cerebrovascular diseases are a great challenge for treatment and research alike as rapid assessment and treatment is crucial, i.e. for immediate medication of acute stroke. Because of these complexities a multidisciplinary research approach is required. To support this, the NEURON partner organisations selected cerebrovascular diseases as the topic for JTC 2011.

A workshop on 'Future developments in neuroscience' was held in September 2010. The discussion with renowned scientists from various areas of brain research helped to shape the call in accordance with the newest scientific advances in the field and to define research priorities.

[4] The key performance indicators were developed by the French National Research Agency (ANR).

Peer-Review and project selection

A two-step procedure was applied to select the best research consortia for funding. In the first step, 57 pre-proposals were submitted. The requested budget amounted to about 49.4 million €. A panel of 32 international experts reviewed the pre-proposals and provided written evaluations. Following the resulting ranking list, 29 consortia (51%) were invited to submit full proposals. The full proposals were reviewed at a panel meeting by 11 peer reviewers who provided a final ranking list. The national funding organisations jointly reached a final funding decision following this ranking and considering the availability of financial means. Eventually, 10 research consortia were funded (34% of full proposals). Thus, the overall success rate was 18%. The granted budget amounted to about 10 million € (see Table 2), Proposal submissions per country are summarised in Figure 1. Additional statistical information, e.g. of the number of coordinators and gender distribution are available on the NEURON website (www.neuron-eranet.org/en/329.php).

Table 2: *Submission details and results in the two review steps.*

Step 1	Pre-proposals	Invited for full proposal submission
No. of pre-proposals	**57**	**29**
Principal Investigators involved	229	116
Overall funding requested	49.4 M€	25.4 M€
Pre-proposal success rate	**51%**	
Step 2	**Full proposals**	**Funded projects**
No. of full proposals	**29**	**10**
Principal Investigators involved	117	42
Overall funding requested	26.3 M€	9.6 M€
Full proposal success rate	**34%**	
Overall success rate	**18%**	

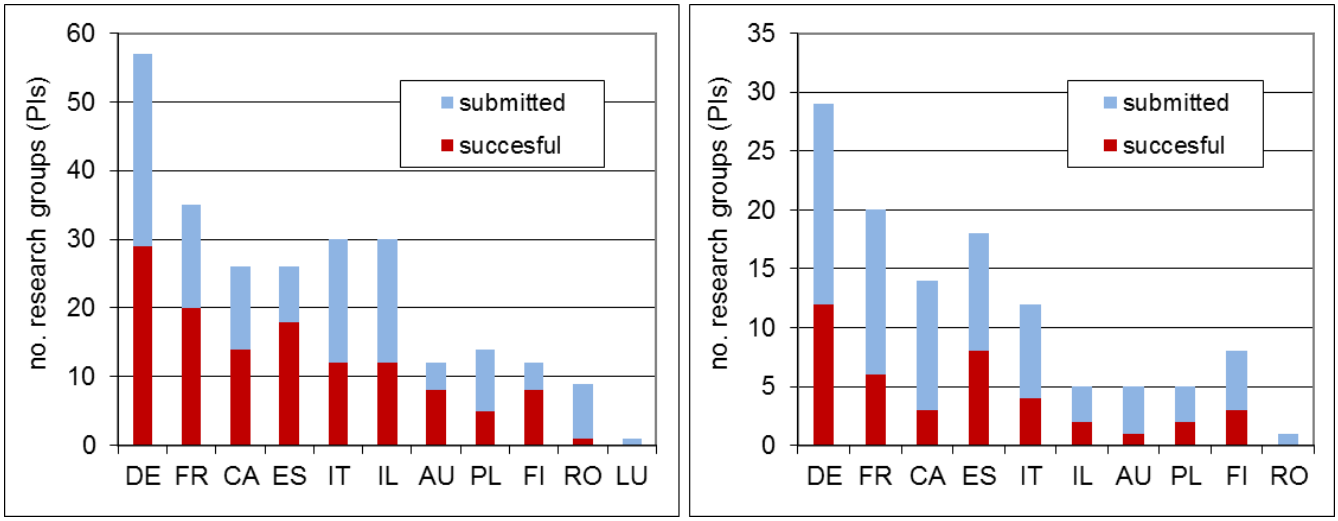

Figure 1: *Number of research groups (PIs) applying to JTC 2011 per country. Left panel: pre-proposals; right panel: full proposals.*

Selected Projects

The 10 projects selected for funding tackled cerebrovascular diseases such as e.g. ischemic stroke or small vessel disease, using a variety of methodological approaches. The projects are listed in Table 3.

Table 3: *Projects funded in the frame of JTC 2011.*

Acronym	Project Title (short)	Coordinators and Principal Investigators	Project Keywords	Pathology
BIODVAS	Neuroimaging and molecular biomarkers of vascular cognitive impairment.	**T. Farr (DE)** C. Po (FR) G. Soria (ES)	Imaging techniques, Animal models, Biomarkers, Cognition	vascular cognitive impairment (VCI)
CCM	Cerebral Cavernous Malformations. From pathobiology to therapeutic strategies.	**A. Fischer (DE**) C. Albiges-Rizo (IT) E. Tournier-Lasserve (FR) J. Zalvide (ES)	Molecular and genetic approaches, Cell pathology, Imaging techniques, Animal models	cerebral cavernous malformations (CCM)
COGSTROKE	Cognitive recovery after stroke. Translational approach to new therapies of higher motor deficits.	**F. Binkofski (DE)** G. Buccino (IT) J. Classen (DE) J. Doyon (CA) A. Karni (IL)	Imaging techniques, Biomarkers, Brain repair, Rehabilitation, Cognition	apraxia, stroke
GINA	Biomaterials scaffolding for brain reconstruction in stroke	**J. Barcia-Albacar (ES)** D. D'Avella (IT) R. Unger (DE) A. Lozano (CA) M. Monleón-Pradas (ES)	Animal models, Brain repair	stroke
MEMS-IRBI	MRI Navigated Enhancement of Mesenchymal Stem Cell (MSC) Homing Toward Stroke Lesion – Evaluating an Impact on Animal Recovery with Behavioral Testing and Imaging	**B. Lukomska (PL)** J. Boltze (DE) J. Jolkkonen (FI)	Imaging techniques, Animal models, Brain repair	stroke
MESCOG	Mechanisms of Small Vessel Related Brain Damage and Cognitive Impairment: Integrating Imaging Findings from Genetic and Sporadic Disease	**M. Dichgans (DE)** H. Chabriat (FR) J. Mangin (FR) R. Schmidt (AT)	Imaging techniques, Biomarkers, Cognition	small vessel disease (SVD), subcortical infarcts and leukoencephalopathy CADASIL
NanoStroke	Role of danger signals in stroke and therapeutic targeting by nanobodies	**T. Magnus (DE)** C. Kleinschnitz (DE) A. La Sala (IT) C. Matute (ES) A. Planas (ES)	Cell pathology, Animal models, Neuroprotection, Pharmacology	stroke
PROTEA	Influence of Proteases before, during, and after Stroke	**D. Vivienl (FR)** J. Koistinaho (FI) J. Montaner (ES) J. Paramo (ES)	Molecular and genetic approaches, Imaging techniques, Animal models, Biomarkers, Neuroprotection, Brain repair	ischemic stroke
REVIS	Restoration of Vision after Stroke	**B. Sabel (DE)** P. Rossini (IT) T. Tatlisumak (FI) W. Waleszczyk (PL) U. Warschewske (DE)	Brain repair, Rehabilitation	stroke, visual impairment
SDSVD	Spreading Depolarization in Small Vessel Disease	**J. Dreier (DE)** U. Dirnagl (DE) A. Friedman (IL) B. MacVicar (CA)	Imaging techniques, Animal models, Neuroprotection	stroke, migraine, small vessel disease (SVD)

Impact Analysis of JTC 2011

The progress of the projects was continuously monitored during the runtime of the projects. Monitoring comprised several measures. The consortia delivered brief annual reports and presented progress and interim results of their projects at a mid-term symposium. After termination of the projects, the consortia submitted final reports summarising the most important results and achievements Together with the final report the consortia returned a questionnaire (see Annex II) that builds the basis for this impact analysis.

The questionnaire was used as an instrument to measure key performance indicators related to NEURON's main objectives (see Table 4). Additional information was extracted from the final reports. The analysis was performed analogous to the impact analyses of JTC 2008 - 2010. These analyses allow a standardized evaluation of NEURON's funding activities and provide support for short- and long-term strategic planning. The results will help to improve NEURON's future performance.

Table 4: *The key performance indicators in relation to the objectives of the funding programme. The number of the respective question in the questionnaire is given in brackets. (Note that the order of questions in the questionnaire follows a different logic than the order of objectives to ease filling in for the researchers).*

Objective of the Funding Programme	Key performance indicators	Measures (i.e. questions in the questionnaire)
1. Enhance cooperation between European scientists working in the field of neuroscience	NEURON JTC as starter of new collaboration	Have the partners participating in the NEURON project collaborated before applying for the NEURON JTC2011? (*Question 3.1)*
	New research groups from other countries joining the consortium	During the life time of the project has the consortium established collaboration(s) with other teams (not already participating in the JTC 2011 project)? (*Question 3.2)*
	Sustainability of the collaboration (obtaining further funding for the same consortium)	Have the results led to new initiatives in other types of funding programmes? (*Question 3.3)*
	Intensity of collaboration (meetings, mobility)	List of meetings, lab visits/exchange of researchers, and training within the consortium (*Question 3.4)*
	Level of excellence of the funded research	Use of bibliometric indicators (IF, other indicators) List of publications (*Question 1.2)*
2. Promote multidisciplinary consortia and to encourage translational research proposals (from bench to bedside)	Composition of the consortium	List of research groups
	Involvement of patients	Analysis of full proposals and final reports
	List of patents and other outcomes with impact to health	Patents and other outcomes with impact to health (*Question 2)*
3. Support development of innovative or shared resources and technologies	Evaluation of the development and the use of new resources	Has the consortium created a new or further developed an existing transnational patient registry, database or biobank? Have the consortium partners exchanged biomaterials (DNA, tissues, cells, animals)? (*Questions 4.1 and 4.2)*
4. Support research to develop new strategies for diagnosis, therapy, and rehabilitation procedures	Evaluation of the development of new strategies for diagnosis, therapy, and rehabilitation procedures for cerebrovascular diseases	Have the results of the NEURON research projects allowed the development of new strategies for: diagnosis, therapy (preparation of clinical trials), and rehabilitation procedures for cerebrovascular diseases, prevention or anything else? (*Question 5.1)*
	Major achievements	Please list the major achievement of the consortium. *(Question 5.2)*

Objective 1: Enhance Cooperation between European Scientists Working in Neuroscience

Indicator: The NEURON JTC as a Starter of New Collaboration

This indicator was measured through question 3.1 in the impact questionnaire: 'Have the partners participating in the NEURON project collaborated before applying to the NEURON JTC 2011? If so, please indicate the partner numbers of teams that previously collaborated.'

Four consortia (40%) consisted of research groups that had not collaborated before applying to the NEURON JTC 2011; these are named 'new consortia' (Figure 2). The remaining six consortia (60%) were 'pre-existing', i.e. at least two partners of the consortium had previously worked together. In most of the pre-existing consortia (4/6) only part of the partners had previously collaborated. Only in two consortia all partners had worked together before the NEURON call in various constellations, but never in a single consortium. In 5/6 (84%) of pre-existing consortia the coordinator had participated in the previous collaborations.

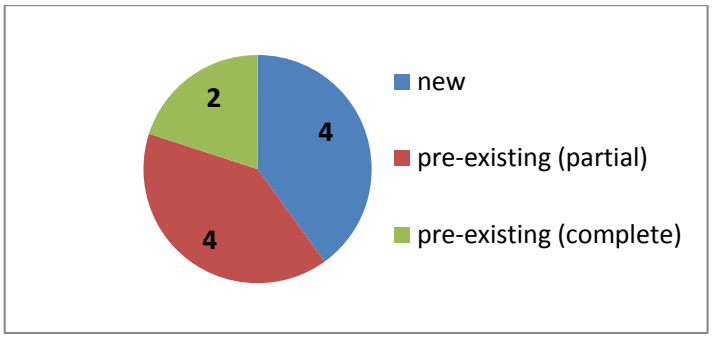

Figure 2 *Initiation of new collaboration. Four consortia were composed of partners who had not collaborated before (new). In six consortia, partners had previously collaborated (pre-existing); either some (4/6, partial) or all (2/6, complete) partners were involved in previous collaborations albeit in different subsets and in no case in a single consortium.*

In summary, new consortia were formed in response to the JTC 2011, although more projects were carried out by researchers who had known each other before the call was published. Hence, funding by NEURON served both, establishing new collaborations and helping to sustain and foster collaborations that already existed.

Indicator: New Research Groups from other Countries Joining the Consortium

This indicator was measured through question 3.2 in the impact questionnaire: 'During the lifetime of the project, has the consortium established collaboration(s) with other team(s) (not already participating in the JTC 2011 project)? If so, please name the institutions and countries.'

More than half of the consortia (7/10) reported the establishment of new research groups during the runtime of the NEURON projects. Five consortia included countries that were initially not represented in the consortium. Of these, three research groups came from countries that did not participate in this call, namely two from United States of America and one from Ireland.

In summary, NEURON's funding helps to expand transnational collaboration, even beyond the countries participating in a particular call. The reasons were not covered in this survey. The NEURON funding mechanism offers flexibility to acquire new partners, if added resources and expertise help to answer questions that arise during the progression of the project.

Indicator: Sustainability of the Collaboration

One way to measure the sustainability of NEURON-funded consortia is by counting the number of consortia that applied for further transnational funding during the lifetime of the NEURON project. This indicator was measured through question 3.3: 'Have the results led to new initiatives in other types of funding programmes?'

The majority of consortia (80%) reported applications for further funding in other programmes. In total, 25 new grant applications were based on the projects funded by NEURON, 14 of those in transnational programmes.

Overall, half (5/10) of the funded consortia had at least two Principal Investigators (PIs) applying jointly for further funding. This form of sustainable collaboration occurred in pre-existing consortia, but not in newly formed consortia.

The reported transnational funding programmes to which the PIs applied included:

- EU Framework Programme FP7 (1) and Horizon 2020 (4)
- ERA-NET NEURON (3) JTC2015 and JTC2016
- JPND (1)
- ERA-NET RUSPLUS (1)

Five out of ten consortia did not apply for further joint funding in the reporting period.

In summary, the data underlines the fact that NEURON may pave the way for sustainable transnational collaboration beyond NEURON's funding period. Why successful sustainability of collaborations was only reported in pre-existing consortia is not known. Yet, a comment at the mid-term symposium suggested that the funding period of 3 years may too short to allow to prepare follow-up network activities for new consortia.

Indicator: Intensity of Collaboration (Meeting, Mobility and joint publications)

This indicator was measured by the number of meetings including two or more research groups of each individual consortium, number of lab visits/ exchange of researchers as well as number of joint publications.

All funded consortia participated in the mid-term symposium which was organized by NEURON. Each consortium had several meetings during the lifetime of the project. On average six meetings took place (range 3 – 11). In total, there were 59 consortium meetings. More than half of these meetings (61%) were attended by all partners of the consortium (Figure 3).

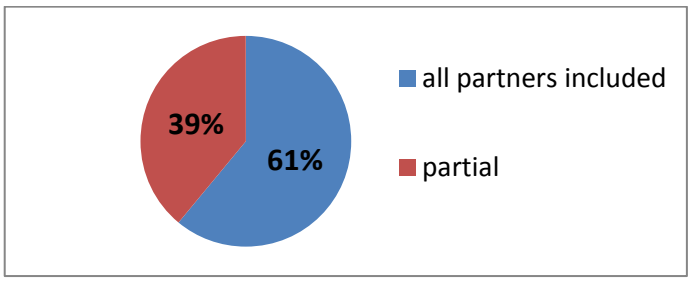

Figure 3 *Participation in consortia meetings as a measure of collaboration intensity. All partners included: proportion of meetings that were attended by all partners of a given consortium; partial: proportion of meetings that were not attended by all partners*

Mobility was also assessed by the number of mutual lab visits or exchange of researchers within the consortia. More than two thirds of the consortia (70%) reported cross-border exchanges of personnel. More than three lab visits during the project runtime took place on average in these "mobile" consortia.

Supporting Early-Career Researchers (ECR) is one of NEURON's main objectives. Therefore, the involvement of ECR in the projects was analysed. Overall, 23 postdocs, 38 PhD students and 13 master students worked in the projects. Mostly, these ECR contributed to the above-mentioned mobility. Within the scope and the runtime of the projects, 8 dissertations and 9 (master) theses were completed.

To further assess the intensity of cooperation the number of 'joint publications' was counted. Publications that were authored by at least two research partners were defined as 'joint publications'. In total, 59 joint publications (36% of all publications) were issued during the time period that could be covered by this survey. All consortia reported joint publications. On average, each consortium had six joint publications (range: 2 – 20). Both, pre-existing as well as new consortia published jointly.

In summary, the number of meetings and high mobility indicate close collaboration within the consortia. This is also reflected in the high proportion of joint publications. In addition, a number of PhD students could complete their dissertations in the reporting period. This shows that in this way NEURON creates opportunities for ECR to advance their academic careers.

Indicator: Level of Excellence of Funded Research

Despite the well-known limitations of assessing publication numbers and Impact Factors, one way to measure this indicator is by analysing the lists of publications (Question 1: Please indicate the number of publications and communications in which NEURON support was acknowledged).

The NEURON-funded consortia were very productive and successful in terms of dissemination of results: Each of the consortia published articles in peer-reviewed scientific journals. In total, 162 peer-reviewed publications were reported (due date: six months after termination of project runtime) in which NEURON funding was acknowledged. On average each consortium published 16 peer-reviewed articles (range: 4 – 42).

The articles were published in peer-reviewed journals with an average impact factor of 5.59 (range: 1.10 – 28.71). Altogether, five consortia published 17 articles (10% of all publications) in high impact journals (IF > 10), amongst others (listed are journals with impact factor > 15):

- Lancet Neurology (3)
- Pharmacological Reviews (1)
- Neuron (1)
- Cell (1)

Apart from scientific articles, 90% of the consortia reported communications at scientific meetings. In total, more than 188 communications were reported.

In summary, the number of publications highlights the productivity of the funded projects. Moreover, the number of publications in high impact journals demonstrates that the competitive NEURON selection procedures result in funding of productive consortia and excellent research.

Objective 2: Promote Multi-disciplinary Consortia and Translational Research Proposals (from Bench to Bedside)

Indicator: Composition of the Consortium

To strengthen the bench-to-bedside approach it is important that clinicians collaborate with fundamental researchers. As an indicator, the number of medical doctors involved in the projects was analysed. All consortia included at least one medical doctor. In total, 25 PIs were medical doctors (60%). The majority of consortia (70%) were coordinated by a medical doctor.

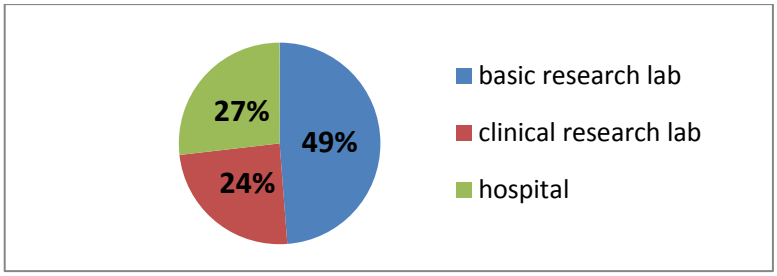

Figure 4 *Composition of the consortia. The figure shows the proportion of basic and clinical research laboratories as well as hospitals that were involved in the projects.*

The PIs mainly worked in basic research laboratories (49%), but also in clinical research laboratories (24%) and in hospitals (27%, Figure 4). All consortia applied a multidisciplinary research approach. The researchers covered different disciplines ranging from molecular biology, through psychology to psychiatry and neurology.

In summary, all projects funded under JTC 2011 were truly multidisciplinary. They brought together basic research labs with clinical research labs and hospitals. A significant number of medical doctors was involved, who also played an important role in coordinating the projects. In this way NEURON promoted a bench-to-bedside approach.

Indicator: Involvement of Patients

For a successful bench-to-bedside approach and translation of research results into clinical application, it is crucial to combine research in animal models with research in patients. This was implemented in more than half of the projects: Overall, animal models were used in 80%, and patients were involved in 50% of the projects. Three projects used both animal models and performed human studies, five projects exclusively worked with animals while two projects only performed human studies.

In summary, patients were involved in half of the projects. The combination of studies in animals and studies in humans fosters the translation of results from basic research into clinical application.

Indicator: Patents and Other Outcomes with Impact to Health

An indicator for the degree of transfer of research results into application is the number of patents. Two consortia submitted a total of four EU or international patents, two of them dealing with biomaterials:

- a biohybrid for use in regenerating neural tracts,
- a composite material of hyaluronic acid and at least one acrylic polymer for biomedical applications,
- a novel method for determining the propensity of a patient for hemorrhagic transformation after stroke,
- a novel mutated tissue plasminogen activator and its uses.

Outcomes with impact to health included also the development of software. For instance, one consortium developed a novel magnetic resonance imaging (MRI) marker for Small Vessel Disease (SVD) and published the according protocol, while another developed an open-source software for visual field examination.

In summary, the outcome emphasizes the impact of this transnational funding scheme beyond scientific utilization of the results. The approach to encourage multidisciplinary work and translational research was fruitful in promoting substantial outcomes with an impact to health.

Objective 3: Support Innovative or Shared Resources and Technology

Indicator: Evaluation of the Development and the Use of New Resources

The indicator chosen to assess this objective was the number of consortia that effectively developed and/or shared innovative resources or technology. This was measured through questions 4.1 and 4.2.

Two patient databases were established by two consortia. Of these, one database was an entirely new set-up, while the other database built on existing national resources. Likewise, patient recruitment involved both existing networks of clinicians as well as newly acquired collaborations.

The majority of consortia (80%) exchanged biomaterials among the partners. Exchange of biomaterials included DNA, tissues, cells, animals. For an overview see Figure 5. Clinical data was shared within 20% of the consortia.

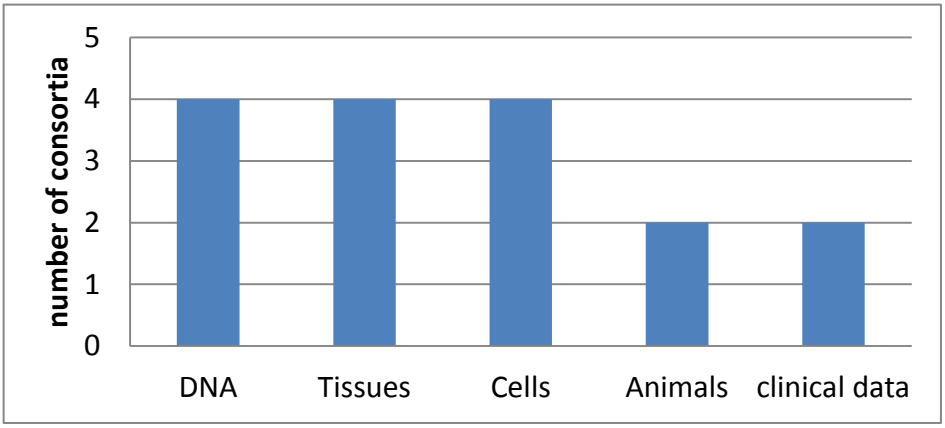

Figure 5 *Exchange of biomaterials and clinical data among the consortia. Bars indicate the number of consortia reporting exchanges.*

In summary, resources were quite efficiently used within the consortia by exchanging data and materials. Moreover, databases were established for shared use within the consortia. This shows that NEURON's funding scheme is suited to initiate the development of such infrastructures that can be used to collect and distribute data. It is also evident that establishing new infrastructures and open access may require additional resources from other parties as well as already existing data and networks.

Objective 4: Develop New Strategies for Diagnosis, Therapy, and Rehabilitation Procedures

Indicator: Development of New Strategies for Diagnosis and Therapy, and Rehabilitation Procedures (Question 5.1)

More than two thirds of consortia (70%) reported the development of new strategies for prevention, diagnosis therapy, or rehabilitation.

One consortium (10%) reported that their results allowed the development of **new prevention strategies**. For example:

- Generation of novel models of post-injury epilepsy using the intraventricular injection of albumin or TGF-beta.

Three consortia (30%) reported advancements towards **new diagnostic strategies**. These included:

- Identification and characterisation of biomarkers, including MR imaging marker for SVD in human, DTI to identify changes in the hypoperfused rodent brain, or Nano-zymography to detect and characterize proteolytic cell-derived microparticles,
- Development of Spreading Depolarization as biomarker for the neuromonitoring of cerebrovascular disease in patients,
- Insight in effects of transorbital puls current stimulation in cortical and subcortical structures of the visual system.

Four consortia (40%) reported the development of **novel strategies for therapies**, including:

- Neurosurgical innovation: New strategy for stroke surgical approach,

- Development of innovative combination therapies involving stem cells, biomaterials and brain stimulation,
- Generation of novel (animal) model systems, e.g. photothrombotic stroke animal model for acute stroke,
- Use of P2X7-targeting nanobodies as modulators of brain inflammation,
- First time use of angiotensin receptor antagonist and TGF-beta signalling blocker, losartan, as a treatment for microvascular pathology and blood-brain barrier dysfunction,
- New medical devices:
    - Biohybrid for treatment of injuries of the central nervous system,
    - Treatment device for patients with vision loss to regain their vision.

Three consortia (30%) reported that their results allowed the development of **new rehabilitation procedures**. These included:

- Motor training to improve apractic symptoms.

In summary, the funded consortia contributed to the improvement of prevention, diagnosis, therapy, and rehabilitation of cerebrovascular diseases. As for many cerebrovascular diseases effective therapies are still limited and time-critical, finding new ways for treatment and rehabilitation is highly important.

Indicator: Major Achievements of the Funded Consortia

From a list in the questionnaire the researchers could pick themes that described the major achievements of their consortia (Question 5.2)

The consortia reported a broad spectrum of major achievements from the generation of new model systems to identification of biomarkers (Fig. 6).

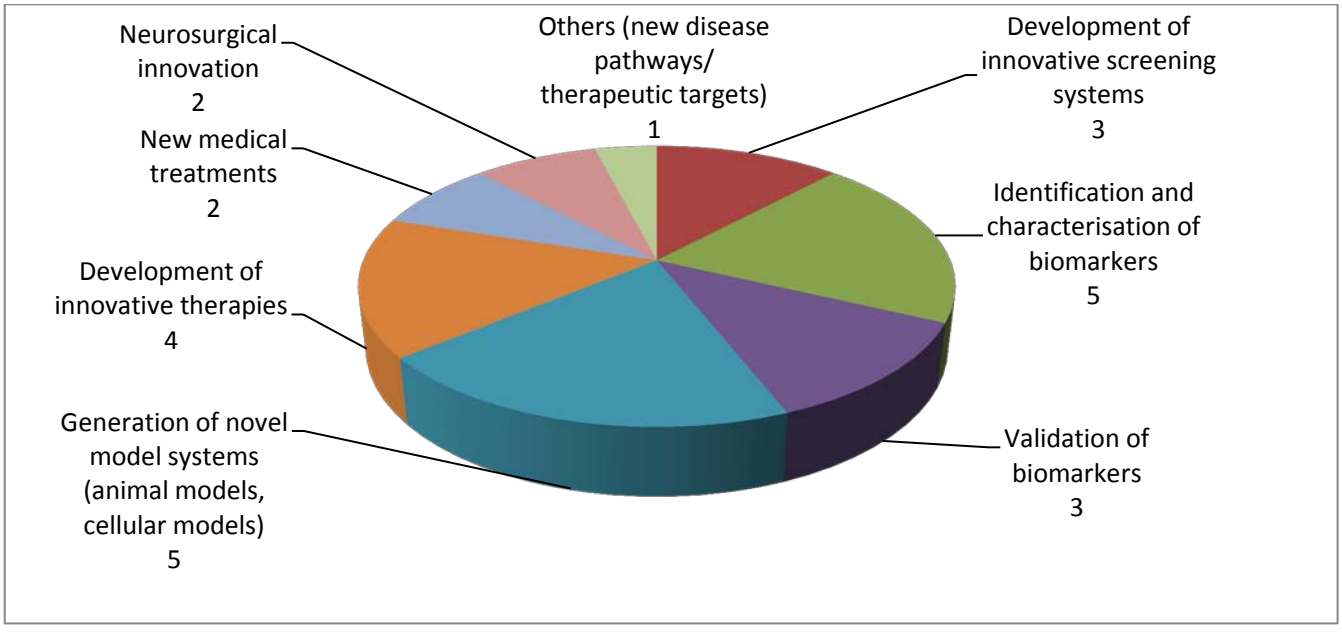

Figure 6 *Major achievements. The numbers in the pie-chart indicate the number of consortia reporting a given achievement.*

In summary, the major achievements of the consortia span the way from bench to bedside, demonstrating the translational character of NEURON's funding scheme. The consortia improved our understanding of the pathophysiology of cerebrovascular diseases, i.e. by investigating disease pathways. Based on such pre-clinical findings, the consortia validated biomarkers and further developed new

treatments that will potentially be translated into clinical application. In sum, the outcome of the funded research promises to significantly impact on health research.

Mid-Term Symposium

The consortia had the opportunity to present their projects at a symposium that was held in Warsaw in September 2013. The results of the projects were presented in short talks by the coordinators.

Three members of the original review panel of this call attended the symposium to assess the projects' preliminary results. The reviewers expressed their content about the good progress after 1.5 years of funding. They appreciated the sincere efforts to make the projects truly collaborative with exchange of people, methods or materials to solve the scientific tasks.

In addition, the funded researchers were asked to provide feedback to the funding organisations on NEURON's funding scheme in general and the implementation of JTC 2011 along guiding questions:

- Is funding of this kind in the neuroscience field useful and is there an added value of the collaboration?
- Was the call topic appropriate?
- Were the procedures (application, review, communication with the JCS, and national procedures) suitable?

Overall, the NEURON funding scheme was considered highly important and useful. NEURON served as a role-model in terms of effectiveness and slim bureaucracy and was a very good example in research funding in general.

The scientific value of the collaborations was described as very high. Particularly, the interdisciplinary approach encouraged by the NEURON funding scheme, was considered beneficial. Many new collaborations were initiated to meet the minimal consortia size according to NEURON JTC regulations. Exchange between partners worked excellently and may lead into long-standing partnerships. Yet it was remarked that follow-up funding was necessary to guarantee sustainable collaborations. A funding period longer than 3 years would allow more time to prepare follow-up network activities (new applications etc.). The researchers considered the requested consortium size as appropriate. Bigger networks would be more difficult to manage and coordinate.

Regarding the call topic, the scope of the past NEURON calls was generally considered to be appropriate for an ERA-NET. Disease-specific call topics were considered better than broad topics. It was pointed out that repeating a call topic would be desirable to allow re-application. Brain repair and plasticity were suggested as additional call topics.

Administrative regulations required by NEURON were assessed as manageable, relatively fast, and considerably lighter as compared to other funding initiatives. The 2-step application procedure was appreciated. The transparency of the review process was pointed out, as reviewers' comments were provided to the applicants. A harmonisation of the start date for all partners of a consortium would be desirable. Similarly, a harmonization of budgets available by the various funding agencies was recommended. It was reported that in single cases cuts of some national budgets caused problems to the projects.

Overview of all Results and Conclusions

The analysis of the key performance indicators reveals that the four principal objectives of NEURON were achieved with the implementation of JTC 2011 'Cerebrovascular Disease' (see Tables 5 and 6). NEURON's funding enhanced the collaboration between researchers in Europe and beyond. New transnational consortia were formed. New collaborations extended even beyond the range of countries

participating in the call. At the same time JTC 2011 offered the opportunity for PIs to sustain existing collaborations. Many researchers continued working together and jointly applied for grants in other funding programmes. The output in terms of number and quality of publications underline the excellence of the funded collaborations.

Moreover, the funded consortia were truly multidisciplinary and applied a translational approach. This is reflected in a high number of medical doctors collaborating with fundamental researchers as well as the involvement of patients in many projects. The projects yielded outcomes that have a positive impact on health, e.g. new diagnostic biomarkers or patents for new biomaterials.

NEURON also promoted the development of innovative and shared resources and technologies. New databases were established. The researches also exchanged both data and biomaterial with their consortium partners, thus effectively using the funding provided by NEURON. It remains unclear in how far data and materials were made openly accessible. This aspect should be covered in future evaluations of the NEURON calls.

Finally, NEURON's funding supported the development of new strategies for diagnosis, therapy, rehabilitation and prevention. The results obtained by the consortia are promising to lead to new approaches and medical application. For instance, new animal models and biomarkers may lead to better diagnosis and therapies of cerebrovascular diseases.

The direct feedback given by the researches during the midterm symposium demonstrates that NEURON is very positively received by the scientific community despite some criticism concerning national administrative regulations and budgets.

Table 5: *Quantified responses by funded research consortia.*

Objective of the Funding Programme	Key performance indicators	Results (percent of funded consortia, if not specified).
1. Enhance cooperation between European scientists working in the field of neuroscience	NEURON JTC as starter of new collaboration	→ 40% were newly formed consortia → 40% pre-existing consortia (part of PIs collaborated before) → 20% pre-existing consortia (all PIs collaborated before)
	New research groups from other countries joining the consortium	→ 50% acquired new collaborations during the lifetime of the project.
	Sustainability of the collaboration (obtaining further funding for the same consortium)	→ 44% had at least 2 PIs applying jointly for further funding.
	Intensity of collaboration (meetings, mobility, joint publications)	→ 100% attended the mid-term symposium → On average each consortium held 6 meetings; 61% of the meetings were attended by all partners → 59 articles (36% of all publications) were published jointly in peer-reviewed journals
	Level of excellence of the funded research	→ 50% published at least one primary research publication in a peer-reviewed journal with an Impact Factor above 10 (in total 17 articles)
2. Promote multidisciplinary consortia and to encourage translational research proposals (from bench to beside)	Composition of the consortium	→ In 60% the coordinator was a medical doctor. → In 100% at least one PI was a medical doctor. → PIs worked in basic (49% of PIs) and clinical (24% of PIs) research labs as well as hospitals (27% of PIs)
	Involvement of patients	→ Patients were involved in 50% of the projects.
	Patents and other outcomes with impact to health	→ 20% submitted at least one European or international patent; other outcomes with impact to health comprise development of software and prototypes, the launch of services and platforms
3. Support development of innovative or shared resources and technologies	Development and the use of new resources	→ 80% exchanged biomaterials and data (DNA: 40%, tissues: 40%, cells: 40%, animals 20%, clinical data: 20%)

4. Support research to develop new strategies for diagnosis, therapy, and rehabilitation procedures	Development of new strategies	→ 10% developed new strategies for prevention → 30% developed new strategies for diagnosis → 40% developed new strategies for therapy → 30% developed new strategies for rehabilitation
	Major achievements	→ The major achievements that were most frequently reported include: novel model systems (50%), biomarkers (50%), and development of innovative therapies (40%)

Table 6: *Summary of the results per project.*

Indicator/Measure	BIODVAS	CCM	COGSTROKE	GINA	MEMS-IRBI	MESCOG	NanoStroke	PROTEA	REVIS	SDSVD
New consortium	yes	no	no	yes	yes	no	no	no	yes	no
Addition of research group	yes	yes	yes	no	no	no	no	yes	no	yes
Subsequent applications	yes	yes	yes	no	no	yes	no	yes	yes	yes
Intensity of collaboration										
- number of meetings	5	6	10	3	5	7	3	5	11	4
- meetings with all partners	4	3	5	2	4	7	3	5	3	-
- number of lab visits	-	1	7	3	4	-	3	1	5	-
Excellence										
- total number of publications	4	6	4	17	12	26	42	19	10	22
- number of joint publications	2	4	3	7	4	20	5	8	3	3
- number of journals IF > 10	0	2	0	0	0	3	6	2	0	4
Composition of consortia										
- COO is a medical doctor	yes	yes	yes	yes	no	yes	yes	no	no	yes
- number medical doctors	1	3	4	4	1	3	2	3	1	3
- basic research labs involved	2	4	2	2	2	1	3	2	1	1
- clinical research labs involved	0	0	2	0	1	2	1	1	2	1
- hospitals involved	1	0	1	3	0	1	1	1	1	2
Involvement of patients	no	no	yes	no	no	yes	yes	yes	yes	no
Number of patents	0	0	2	0	0	0	0	2	0	0
Number of databases/registries/biobanks	0	0	0	0	0	1	0	0	0	1
Exchange of:										
- DNA	no	yes	no	no	yes	yes	no	yes	no	no
- tissues	yes	yes	no	no	no	no	no	yes	no	yes
- cells	no	yes	no	yes	yes	no	no	yes	no	no
- animals	no	yes	no	no	no	no	yes	no	no	no
- clinical data	no	no	no	no	no	yes	no	yes	no	no
Novel strategies for:										
- diagnosis	yes	no	no	no	no	yes	no	no	no	no
- therapy	no	no	yes	yes	no	no	yes	no	no	yes
- rehabilitation	no	no	yes	yes	no	no	no	no	yes	no
- prevention	no	no	no	no	no	no	no	no	no	yes
Major achievements:										
- identification of new genes	no	no	no	no	no	no	no	no	no	no
- screening systems	no	no	no	no	yes	no	yes	yes	no	no
- identification of biomarkers	yes	no	no	no	yes	yes	no	yes	no	yes
- validation of biomarkers	yes	no	no	no	no	yes	no	no	no	yes
- novel model systems	yes	yes	no	no	yes	no	no	no	yes	yes
- innovative therapies	no	no	yes	yes	no	no	no	yes	no	yes
- new medical treatments	no	no	no	no	no	no	no	no	yes	yes
- new medical devices	no	no	no	yes	no	no	no	no	yes	no
- neurosurgical innovation	no	no	no	yes	yes	no	no	no	no	no
- Others	no	no	no	no	no	no	no	no	yes	no

Acknowledgements

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Annex I - Excerpt of the Call Text JTC 2011

1. Purpose

The maintenance, improvement and restoration of human health are of fundamental importance and priority in all countries. Biomedical and health research provide an important basis for the improvement of healthy living. Among the many diseases affecting human health, disorders of the brain are major causes of morbidity, mortality and impaired quality of life. According to estimates, more than one billion people suffer from disorders of the central nervous system. In Europe, disorders of the brain account for approximately one-third of the total burden of all diseases. Thus, neuroscience research and its translation into diagnostic and therapeutic measures are of high priority.
In this context, the 'Network of European Funding for Neuroscience Research' (NEURON) has been established under the ERA-Net scheme of the European Commission (http://www.neuron-eranet.eu). The goal of the ERA-Net NEURON is to coordinate the research efforts and funding programmes of European countries in the field of disease related neuroscience.
Under the umbrella of NEURON, a joint transnational call is launched in the field of cerebrovascular diseases. The following funding organisations have agreed to fund the joint call for multinational research projects in this scientific area. The call will be conducted simultaneously by the funding organisations in their respective countries and coordinated centrally by the Joint Call Secretariat (JCS).

- Austrian Science Fund (FWF), Austria
- Canadian Institutes of Health Research (CIHR), Canada
- Fonds de la Recherche en Santé du Québec (FRSQ), Canada (Québec)
- Academy of Finland (AKA), Finland
- National Funding Agency for Research (ANR), France
- Federal Ministry of Education and Research (BMBF), Germany
- Chief Scientist Office, Israel Ministry of Health (CSO-MOH), Israel
- Ministry of Health (MOH), Italy
- National Research Fund (FNR), Luxembourg
- National Centre for Research and Development (NCBiR), Poland
- Executive Agency for Higher Education, Research, Development & Innovation Funding (EAHERDIF), Romania
- Ministry of Science and Innovation (MICINN), Spain
- Institute of Health Carlos III (ISCIII), Spain

2. Aim of the call

The aim of the call is to enable multi-national, collaborative research projects that will address important questions relating to cerebrovascular diseases. The call may receive proposals within the breadth of research from understanding basic mechanisms of disease through proof-of-concept clinical studies in man. These may include, but are not limited to, research on silent stroke, cerebral small vessel disease, chronic or repetitive ischemia, vascular cognitive impairment, and related areas involving the cerebrovascular system. Research on subarachnoidal hemorrhages is not included in the present call.
The ERA-Net NEURON funding organisations particularly wish to promote **multi-disciplinary work** and to encourage **translational research proposals** that combine basic and clinical approaches.
Research proposals should cover at least one of the following areas:
a) Fundamental research on the pathogenesis and aetiology of cerebrovascular diseases. This may include the development of innovative or shared resources and technologies. The relevance of the research to disease must be clearly indicated.
b) Research to develop new strategies for (early) diagnosis, therapy, and rehabilitation procedures for cerebrovascular diseases.
Projects may include, **for example**, identification, characterisation and validation of biomarkers, development of innovative technologies, generation of novel model systems, mechanisms of cognitive decline, brain-immune-interaction, neuroprotection, brain repair, and regeneration. Clinical studies are eligible up to the point of proof of concept.
The individual components of joint applications should be complementary and contain novel, ambitious ideas. There should be **clear added value** in funding the collaboration over the individual projects.

[…]

4. Evaluation and decision

[…]

4.2 Peer-review of proposals

The reviewers will carry out the evaluation according to specific evaluation criteria:

1. Relevance to the aim(s) of the call
2. Scientific quality of the proposal (innovation potential, methodology)
3. International competitiveness of participating research groups in the field(s) of the proposal (previous work in the field, expertise of the research groups)
4. Feasibility of the project (adequacy of project work plan, budgetary and other resources, time schedule)
5. Quality of collaborative interaction between the groups, and added value, on both levels scientific and transnational, of the research consortium. Consortia not meeting this criterion will be downgraded.
6. Potential of the expected results for future clinical and other health relevant applications.

4.3 Decision

[…]
The international Joint Peer Review Panel will establish a ranking list of the proposals with a threshold above what is fundable based on scientific assessment. Based on this ranking list the Call Steering Committee will determine the projects to be funded, taking into account the national budgets available. Based on these recommendations, final decisions will be made by the funding agencies and will be subject to budgetary considerations..

[…]

Annex II- Questionnaire / Impact of the Project

Results of this questionnaire may be published in an anonymised way to give an overview of each call's general output.

Q.1 Publications and communications

*Please indicate the number of publications and communications in which NEURON support was **acknowledged**. Please do not mention publications anterior to the start of the project.*

Q.1.1 Number of publications and communications

Type of publication	Total N°
Peer reviewed articles	
Books or book's chapters	
Reviews	
Articles dedicated to general public	
Communications in scientific congresses	
Dissertations	
Others	

Add lines as appropriate

Q.1.2 List of publications and communications

Please list the publications that result from the funded project. Please group them according to the categories presented in the table above. In column 1, please underline the name of the NEURON-funded partners. In column 2, please point out the project partners involved by using the numbering applied in section I General information (e.g. partner 1 or P1).

Publication (authors, title, journal, year, issue, pp.)	**Partner(s)**	**Impact factor**

Add lines as appropriate

Q.2 Patents and other outputs with impact to health

Q.2.1 Number of patents, licences and other outputs

Type of patent or licence	N° Submitted	N° Obtained
International patents		
EU patents		
National patents		
Licences (of exploitation/cession)		
Creation of firm (enterprise)		
Other (specify)		

Add lines as appropriate

Q.2.2 List of patents

If details regarding patents need to be treated confidentially, please indicate as such.
In column 2, please point out the project partners involved by using the numbering applied in section I General information (e.g. partner 1 or P1)

Patent description	Partner(s) involved	Main partner (moderator)

Add lines as appropriate

Q.2.3 List of other outputs with impact to health

Please list below:

	Category: if applicable, please specify	Partner(s)
☐	software and other prototypes:	
☐	launching of a product or service, new project or contract:	
☐	creation of a platform available to a community:	
☐	creation of a firm, fundraising:	
☐	others (please specify):	

Q.3 Consortium – collaboration and sustainability

Please tick when applicable

Q.3.1 Have the partners participating in the NEURON project collaborated before applying for NEURON JTC 2011? YES ☐ NO ☐

►**If YES**, please indicate the partner numbers of teams that previously collaborated:

……

Q.3.2 During the lifetime of the project has the consortium established collaboration(s) with other team(s) (not already participating in the JTC 2011 project)? YES ☐ NO ☐

►**If YES**, please name the institutions and countries:

…..

Q.3.3 Have the results led to new initiatives in other types of funding programmes (e.g. grants, grant applications) ? YES ☐ NO ☐

►**If YES,** please specify the partners who applied (partner numbers) and the corresponding programme (FP7, etc.) :

……

Q.3.4 Intensity of collaboration: Meetings, human mobility and training within the consortium

A. Collaboration meetings

Meetings involving at least two partners of the project (e.g. consortium meetings, WP meetings, workshops, or others)	**Partners involved**

Add lines as appropriate

B Young scientists' involvement in the project, training and mobility between partners
1. Please list academic staff involved in the project. Please also list postdocs, PhD students, master students, undergrad students…
2. Furthermore, please indicate if lab visits or longer-term exchanges between partners happened based on NEURON funding.

Partner #	**Career stage**	**Academic dissertation** (year, degree)	**Year of birth**	**Name, Gender**	**Exchange from / to** (country)	**Duration of Exchange** weeks / months
					From … to ...	

Q.4 Development of innovative or shared resources and technologies

Q.4.1 Has the consortium created a new or further developed an existing transnational…

Patient registry ☐ Patient database ☐ Biobank ☐ N/A ☐ ?

►**If YES, please complete** (repeat this section as many times as necessary):

- Name of the registry/database/biobank: ……
- How was the registry/database/biobank created?

  Totally new set-up ☐ By compiling national sources that existed already ☐

- How were new patients recruited?
  - o Via already existing network of clinicians ☐
  - o By the establishment of contact with NEW networks of clinicians ☐
- Please specify how the registry/database/biobank will be maintained/financed after the end of this projects ……..

Q.4.2 Have the consortium partners exchanged bioresources (DNA, tissues, cells, animals)?

DNA ☐ tissues ☐ cells ☐ animals ☐ clinical data ☐ N/A ☐

►**If YES, please specify:**

- Were there enough samples in order to reach the goal? YES ☐ NO ☐
- Have the samples allowed common studies? YES ☐ NO ☐

Q.5 Potential health impact / achievements

Q.5.1 Have the results of the NEURON research projects allowed the development of new strategies for:

- Diagnosis ☐
- Therapy (Preparation of clinical trials) ☐
- Rehabilitation procedures for neurodegenerative diseases ☐
- Prevention ☐
- Other (please specify) ……. ☐

Q.5.2 Please list the major achievements of the consortium

Achievements		Please specify
Identification of new genes	☐	
Development of innovative screening systems	☐	
Identification and characterisation of biomarkers	☐	
Validation of biomarkers		
Generation of novel model systems (animal models, cellular models)	☐	
Development of innovative therapies	☐	
New medical treatments	☐	
New medical devices	☐	
Neurosurgical innovation	☐	
Others	☐	

Add lines as appropriate

Annex III - Workshop “Scientific workshop ’Future developments in neuroscience’”

The workshop “Scientific workshop ’Future developments in neuroscience’” was held in Berlin in September 2010 to delineate the challenges facing the scientific community, and to define the priorities for research into mental disorders. The workshop was part of WP4: Thematic input for programmes. Presentations on specific aspects of brain research were given by invited speakers. Five internationally renowned experts shed light on bipolar disorders, schizophrenia, autism, and drug addiction. The workshop provided pivotal input that helped to shape the call text.

Presentations at the workshop:

- Marlies Dorlöchter, Germany, NEURON coordinator: "*The ERA-Net NEURON*"
- Jim Van Os (Maastricht University, the Netherlands) Gene environment interactions in psychiatric diseases
- Richard Frackowiak University of Lausanne, Switzerland/University College London, UK) Brain neuroimaging for disease and cognition
- Viktor Jirsa (CNRS, France) Multiscale Brain Dynamics in the Computational Neurosciences
- Alain Prochiantz (CNRS, France) Neurodevelopment and cell biology: Why studying development is important to understand hidden aspects of brain physiopathology
- Martin Dichgans (LMU Munich, Germany) Stroke research: Challenges and opportunities