Network of European Funding for Neuroscience Research

ERA-NET NEURON

‘Development and advancement in methods and technologies towards the understanding of brain diseases’ Joint Transnational Call 2009

Impact Report

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July 2015

Funded by the European Commission

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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)
CNMP	National Centre for Programme Management (Romanian NEURON partner in 2009)
CSO-MOH	Chief-Scientist Office, Ministry of Health (Israeli NEURON partner)
DE	Germany
DLR	Deutsches Zentrum für Luft- und Raumfahrt (German NEURON partner; NEURON coordinator)[1]
ECS	Early-Career Scientists
ERA-NET	European Research Area Network
ES	Spain
FI	Finland
FNR	Fond National de la Recherche (Luxembourgian NEURON partner)
FR	France
FWF	Fonds zur Förderung der Wissenschaftlichen Forschung (Austrian NEURON partner)
IL	Israel
ISCIII	Instituto de Salud Carlos III (Spanish NEURON partner)
IT	Italy
JCS	Joint Call Secretariat
JTC	Joint Transnational Call for research proposals
LU	Luxembourg
MICINN	Ministerio de Ciencia e Innovacion (Spanish NEURON partner)
MOH	Ministero della Salute (Italian NEURON partner)
MoU	Memorandum of Understanding
NCBiR	Narodowe Centrum Badan i Rozwoju (Polish NEURON partner)
NEURON	Network of European Funding for Neuroscience Research
PL	Poland
RO	Romania

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Abstract

Despite considerable progress in understanding various neurological and psychiatric disorders, research is still far from being able to offer solutions to overcome them. The ERA-NET NEURON was initiated to create a strategically operating group of funding organizations in Europe and beyond to enhance international collaboration. Its mission is to promote research on the human brain and its diseases. Developing joint funding programmes is the core activity of the ERA-NET NEURON aiming to fund excellent research projects in this field. Topics of the annual programmes encompass research areas from fundamental neuroscience, neurology and psychiatry. NEURON partners from Europe, Israel and Canada contribute to this activity.

In 2009, the topic of the Joint Transnational Call for proposals (JTC 2009) was '*Development and advancement in methods and technologies towards the understanding of brain diseases'*. Ten multinational research consortia passed the peer-review process and were funded for three years by the relevant national funding agencies. Monitoring of the results and the outcome of these projects provides information on the impact and success as well as shortcomings of the funding programme. Key performance indicators were developed to compare the outcome against the goals and expectations of the programme, which comprised:

- 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

At the end of the funding period, together with a final report, the consortia coordinators were asked to hand in a questionnaire about the outcome of their projects. The responses were analysed and are presented in this impact report.

In brief, the analysis of the key performance indicators revealed that overall the funding programme underlying JTC 2009 met its above mentioned goals. New collaborations were formed and already existing ones were strengthened. Thus, NEURON funding supported sustainability of collaborations, which manifested in subsequent initiatives for further funding. The joint research efforts yielded a high number of publications (216 articles were published, 31 were joint publications, 34 articles published in journals with impact factor > 10). All consortia were multidisciplinary and tackled translational aspects. Moreover, resources were efficiently shared within the consortia. Finally, new strategies for diagnosis, therapy and rehabilitation were developed. This includes e.g. the identification of novel pharmacological targets and the development of nanoparticles for improved drug delivery across the blood-brain-barrier. These achievements may ultimately find their way into clinical application. No major obstacles related to the funding programme were reported. However, benchmarking of national procedures was suggested to improve application procedures. It was also criticized that in-kind contributions were necessary in some cases to implement the work plan.

Thus, the overall outcome of the JTC was positive and highlights the effectiveness of transnational funding measures in the area of disease-related neuroscience research.

Introduction

Most European countries invest considerably 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. To-date, 24 ministries and funding agencies from 18 countries across Europe, Israel, and Canada have joined forces to fight diseases of the nervous system.

Indeed, brain-related diseases and disorders of the nervous system impose a heavy burden on society. In Europe alone more than 380 million patients 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.

The ERA-NET NEURON aims to support basic, clinical and translational research, directed at a better understanding of the brain and nervous system and related diseases in order to pave the way for new or improved means for diagnosis and therapy. In the long term, NEURON's aim is the application of knowledge and new technologies to ameliorate the burden of disease for patients and their careers.

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 applications. Researchers from Europe, Israel and Canada can apply with small scale (up to five Principal Investigators/research groups) research consortia. 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. Detailed information on the selection criteria and the peer-review process are described below.

In order to reduce fragmentation and pool resources, NEURON aims to enhance the cooperation between European scientists in the field of neuroscience. In this effort, NEURON is clearly disease-oriented and its overarching aim is to translate new knowledge into clinical applications. Hence, 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 so that resources will be

[2] Gustavsson A, Svensson M, Jacobi F et al. (2011): Cost of disorders of the brain in Europe 2010. Eur Neuropsychopharmacol, 21(10):718-79

[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

effectively used. Above all, excellence was the main selection criterion for the research projects to be funded.

Evaluating and monitoring the results of the funded consortia intends to measure the outcome compared to the expectations of NEURON partners. Key performance indicators were developed to allow for quantification of the outcome[4]. Feedback from the Principal Investigators was also obtained in order to improve, if necessary, NEURON performance towards future calls. Hence, a questionnaire was sent to the coordinators of the JTC 2009 after the end of the funding period (see Annex II) and the responses were analysed for the present report.

During the first five-year phase of the ERA-NET work (NEURON I) four JTCs were implemented. They covered the topics 'Neurodegeneration', 'Technology development', 'Mental disorders', and 'Cerebrovascular diseases' (Table 1). The research projects funded under the first two calls (JTC 2008: 'Neurodegeneration'; JTC 2009: 'Technology Development') have already been completed. Results from the evaluation of JTC 2008 have been published in December 2014 (Joint Transnational Call 2008 'Neurodegeneration' – Impact Report; www.neuron-eranet.org/en/558.php). The evaluation of the JTC 2009 is the subject of the present report. The funded projects of the other calls are still running and will be completed in 2016/2017. An impact report will be published for each of them, and eventually the data will of all calls will be pooled for an over-all report of the projects funded under NEURON I.

***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	pending
2011	Cerebrovascular diseases	pending

'Development and advancement in methods and technologies towards the understanding of brain diseases', JTC 2009

The second JTC of the ERA-NET NEURON was launched in January 2009. Eleven ministries and funding agencies from 10 countries participated in the call: Austria (FWF), Finland (AKA), France (ANR), Germany (BMBF/ DLR), Israel (CSO-MOH), Italy (MOH), Luxemburg (FNR), Poland (NCBiR), Romania (CNMP), Spain (ISCIII, MICINN). The process leading to the proposal review and funding selection was coordinated by a Joint Call Secretariat (JCS) run by AKA (Finland). For details of the requirements to applicants, see call text in Annex I.

Call Topic

The development of novel methods and technologies is crucial to meet the challenge of understanding brain diseases and paving the way for innovative treatments. In order to lay a solid scientific basis for the call design, two workshops were held by NEURON to discuss the major frontiers and technological progresses in the field of neurosciences (*'Prospects for Funding Neuroscience in Europe',* July 2008, Geneva; *'New Technologies in Neuroscience'*, September 2008, Warsaw; for further information see Annex III or the related NEURON newsletters: www.neuron-eranet.org/_media/NL4.pdf, www.neuron-eranet.org/_media/NL5.pdf)

[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. Eighty-one consortia had submitted pre-proposals, requesting about 80 million € in total. Based on written evaluations of 30 international peer reviewers and the resulting ranking list, the coordinators of 29 (36%) applications were invited to hand in full proposals. These proposals were reviewed at a panel meeting of 12 peer reviewers who compiled a final ranking list. The national funding organizations jointly reached a final funding decision based on this ranking list and availability of financial means. Eventually, ten research consortia were funded (34% of full proposals). Thus, the overall success rate was 12%. The granted budget amounted to 9.8 million €.

The list of the funded consortia, the distribution by country (Table 2 and Fig. 1) and further details of the review process were published on the NEURON web site (www.neuron-eranet.eu/en/222.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	**81**	**29**
Principal Investigators involved	325	127
Overall funding requested	80 million €	
Pre-proposal success rate	**36%**	
Step 2	**Full proposals**	**Funded projects**
No. of full proposals	**29**	**10**
Principal Investigators involved	127	43
Overall funding requested	30.5 million €	9.8 million €
Full proposal success rate	**34%**	
Overall success rate	**12%**	

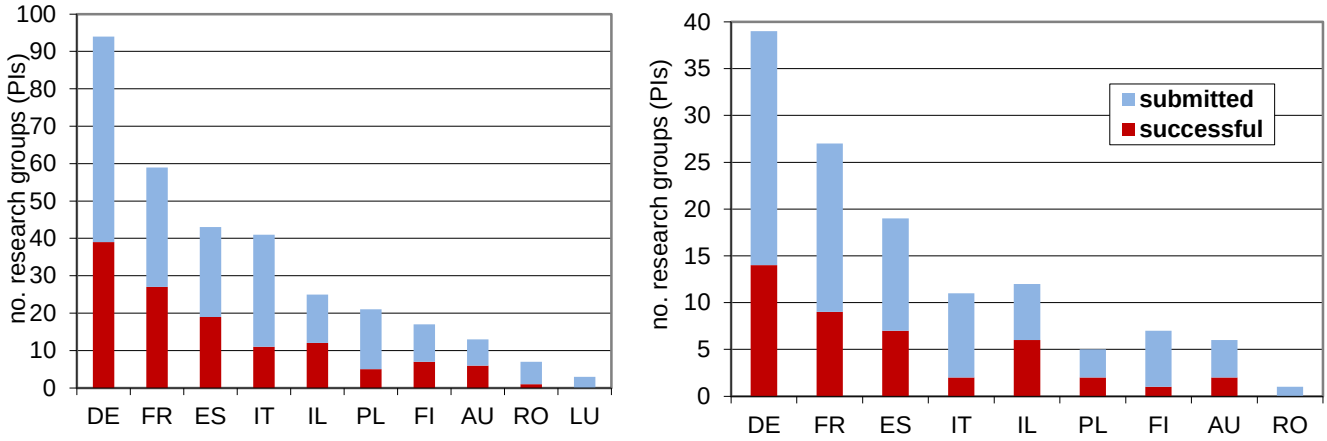

***Fig. 1**: Number of research groups applying to JTC 2009 per country. Left panel: pre-proposals; right panel: full proposals*

Selected Projects

The ten projects that were selected for funding covered a broad scope of topics, ranging from innovations in imaging techniques to the development nanoparticles for drug delivery. While most projects focused their research efforts on specific diseases like Alzheimer's disease or schizophrenia, two consortia (NANOSYN and PANS) tackled general pathomechanisms.

***Table 3**: Projects selected for funding in JTC 2009.*

Acronym	Project Title	Coordinators and Principal Investigators	Project Keywords	Pathology
2p-Imaging	High-speed two-photon imaging for in vivo analysis of brain disease	**A. Konnerth (DE)** T. Misgeld (DE) M. de Curtis (IT) Y. Yarom (IL)	two-photon fluorescence imaging, electrophysiology, microscopy, neuronal hyperactivity	Alzheimer's disease
BEYONDVIS	When attention meets perception: Non invasive neurostimulation technologies to boost visual perception in intact subjects and cerebrally damaged patients	**A. Valero-Cabre (FR)** J. Lupianez (ES) P. Bartolomeo (FR) C. Hilgetag (DE)	TMS, attention, visual performance, rehabilitation	Stroke
DISCover	Multidisciplinary project investigating the neurobiology of chronic mental disease from single molecules to behavioral analysis in animal models	**C. Korth (DE)** J. Huston (DE) O. Reiner (IL) J. Requena (ES), C. Zurzolo (FR)	Protein pathologies, transgenic rat model, electroporation, bioluminescence imaging	Schizophrenia
EpiNet	Understanding and manipulating epileptic networks with optical stimulation and advanced population recording techniques	**H. Beck (DE)** R. Cossart (FR) B. Kaupp (DE) I. Lampl (IL) L. Menendez de la Prida (ES)	Microscopy, animal models, optogenetics, dendritic inhibition, neuronal circuit morphology	Epilepsy
ImageNinND	Imaging Neurogenesis in Neurodegenerative Disease: In vivo imaging of dopaminergic adult-born neurons in the olfactory bulb of animal models of Parkinson's disease.	**J. Herms (DE)** J. Jaworski (PL) P.-M. Lledo (FR) A. Mizrahi (IL)	two-photon imaging, synaptogenesis, olfactory bulb, transgenic mouse model	Parkinson's disease
MODDIFSYN	Development of new chemical and optical tools to study and modulate glutamate receptor surface trafficking in synaptic transmission in different models of neurodegenerative diseases	**D. Choquet (FR)** B. Bioulac (FR) E. Gundelfinger (DE) L. Kaczmarek (PL) R. Tampé (DE)	Glutamate receptors, synapses, single molecule tracking, mouse model	Parkinson's disease
NanoBrain	Alzheimer drugs incorporated in nanoparticles for specific transport over the Blood Brain Barrier	**C. Pietrzik (DE)** H. von Briesen (DE) M. Deutsch (IL) R. Schmidt (AU) M. Windisch (AU)	Bood-brain-barrier, pharmacology, nanoparticles, live-cell imaging, MRI	Alzheimer's disease
NANOSYN	Manipulation of synapses with nanotechnologies to study molecular mechanisms of neurodegeneration	**R. Fernandez-Chacon (ES)** M. Oheim (FR) W. Parak (DE)	Degeneration of synapses, mouse model, glial cells, microscopy, nanoparticles	Neurodegeneration
PANS	Probing the Auditory Novelty System	**C. Escera (ES)** I. Nelken (IL) M. Huotilainen (FI) M. Sánchez Malmierca (ES)	Auditory novelty system, cognitive dysfunction, electrophysiology, EEG, MEG, infants	Cognitive dysfunction
REPark	Modeling Parkinson's disease by iPS technology: generation of human affected dopaminergic neurons and gene disease correction by site-specific integration	**V. Broccoli (IT)** J. C. Izpisua-Belmonte(ES) G. Auburger (DE) A. Brice (FR)	Stem cells, *in vitro* model, cell reprogramming, electrophysiology,	Parkinson's disease

Impact Analysis of JTC 2009

Monitoring the progress of the projects was done in several steps: i) Coordinators submitted brief annual reports and final reports, at the end of the projects, to the Joint Call Secretariat and ii) presented results in a mid-term and a final symposium.

In addition, a standardized evaluation of the funding activities provided support for short- and long-term strategic planning and for improving the NEURON performance. Several indicators for monitoring the impact and the added value of NEURON JTCs were defined and applied in the present impact report.

Table 5 summarizes the main objectives of the NEURON funding programme, the key performance (output) indicators, and means to measure them. These indicators were challenged by analysing the ten funded projects. A questionnaire was built using these indicators for self-evaluated impact analysis (see Annex II). Project coordinators were asked to respond to it at the end of the project duration of three years. Data could not be collected from all consortia, since two did not return the questionnaire (2p-Imaging and REPark). For one consortium partial information is lacking (ImageNinND). The calculation of percentages reported in the following is always based on the number of consortia that provided information. Some information could also be extracted from the final reports. Thus, the number of evaluated consortia differs for the different indicators and is stated in the respective sections. The data from each consortium is summarized is Table 7.

***Table 5**: Relation of key performance indicators and way of measuring them 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 partner participating in the NEURON project collaborated before applying for the NEURON JTC2008? (*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 2008 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 multi-disciplinary 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 bioresources (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	Have the results of the NEURON research projects allowed the development of new strategies for: diagnosis, therapy (preparation of clinical trials), rehabilitation procedures, 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 2008? If so, please indicate the partner numbers of teams that previously collaborated.'

About 43% of the consortia included research groups that had not collaborated before applying to the NEURON JTC 2009 (3/7); these are named 'new consortia' (Fig. 2). The remaining 57% were 'pre-existing' consortia consisting of two to five Principal Investigators who had previously collaborated with each other (4/7). The coordinator of the current consortium was always among those. For three consortia information was not available.

In summary, new consortia were formed in response to the JTC 2009, 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.

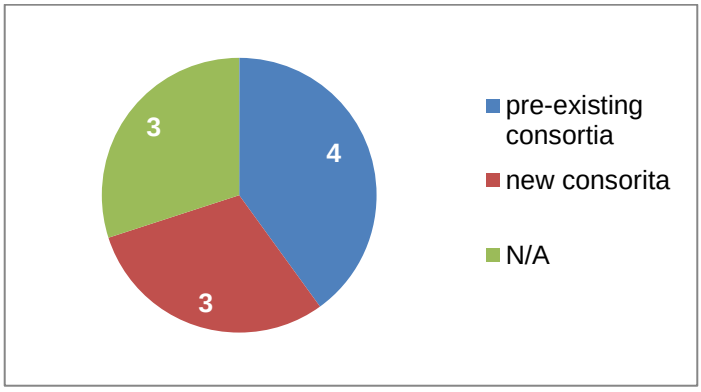

***Fig. 2**: Results of indicator 1.1, the NEURON JTC 2009 as a starter of new collaborations. New consortia = consortia with partners that had not known each other before; Pre-existing consortia = consortia with partners that had been or still were collaborating before applying to NEURON JTC 2009; N/A: information not available because questionnaire was not returned or not filled in completely.*

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 2009 project)? If so, please name the institutions and countries.'

Two out of seven consortia stated to have established new collaborations within the lifetime of the project. In one case, this included transatlantic collaborations with partners from the USA and Canada. The remaining consortia did not form new collaborations (5/7) or information was not available (three consortia).

In summary, although there was a potential to form new collaborations even outside Europe, in most cases collaborations beyond the consortia were not established. The reasons for this are not known. Possibly the consortia saw no necessity to include further partners since they worked very successfully in their initially established composition. Another reason may be lack of additional financial support.

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?'

Overall, five of the funded consortia (5/7) had at least two Principal Investigators (PIs) applying jointly for further funding. On average three PIs were involved. This form of sustainable collaboration occurred both in pre-existing (40%) and newly formed (60%) consortia. Two out of seven consortia did not apply for further joint funding. For the remaining three consortia information was not available.

The transnational funding programmes to which the PIs applied included:

- NEURON JTC 2013 on 'Mental Disorders'
- FP7 programmes
- Horizon 2020 programmes

In summary, the data underlines the fact that NEURON may pave the way for a sustainable collaboration beyond its funding period.

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 and final symposia which were organized by NEURON. Overall, each consortium had on average 6 meetings (range: 4 – 10). The majority of these meetings (62 %) were attended by all partners of the consortium (Fig. 3). The numbers are based on the information given by eight consortia. For two consortia information was not available.

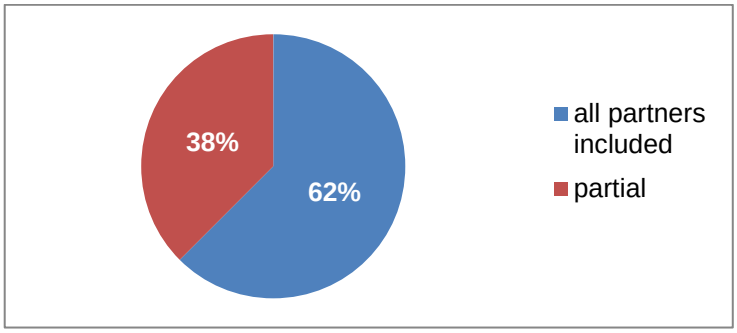

***Fig. 3**: Participation in consortia meetings as a measure of collaboration intensity. All partners included: proportion of meetings that were attended by all partners of a given consortium; partial: proportion of meetings that were not attended by all partners*

Additionally, mobility was assessed by of the number of lab visits/ exchange of researchers. More than half of the consortia (6/10) in the JTC 2009 reported exchanges between countries. Three lab visits took place on average in these "mobile" consortia. Two consortia did not report any exchanges and two consortia did not provide information about mobility.

Since the support of Early-Career Scientists (ECS) is a major goal of NEURON's activity, the involvement and training of ECS was analysed, too. In total, 23 PhD/MD students, 26 postdocs and two master students were reported to have contributed to the projects. There were 19 dissertations completed as a part of the funded projects. Furthermore, most of the lab visits involved these ECS and only four of the travels listed in the questionnaires were of senior scientists.

All but two of the ten consortia published results jointly - i.e. at least two partners were authors – in peer reviewed journals. On average each consortium published three articles jointly (range: one to nine joint publications). Overall, 31 articles were joint publications (about 14 % of all articles, see below). It

is notable that most of the joint publications were by consortia that already had collaborated previously to the NEURON project (cf. Table 7). In fact, the researchers reported some difficulties in establishing functioning collaborations during the initial phase of the projects and stressed that it was challenging for 'new' consortia to achieve joint publications in high ranking journals within the relatively short timeframe.

In summary, there was a high intensity of collaboration within the consortia. There were regular well attended meetings to exchange information. Moreover, relatively frequent lab visits may have facilitated the transfer of knowledge between the partners and provided training possibilities for ECS. Finally, consortia also collaborated closely in publishing of their results which is shown by a number of joint publications.

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, 216 peer-reviewed publications were reported (due date: six months after termination of project runtime) in which NEURON funding was acknowledged. Overall the funded consortia published in peer-reviewed journals with an average impact factor of 7.7 ± 3.3 (mean ± standard deviation). Altogether, eight of the funded consortia published 34 articles in high impact journals (impact factor > 10), amongst others (listed are journals with impact factor > 15):

- Nature (3)
- Nature Cell Biology (1)
- Nature Medicine (1)
- Nature Methods (1)
- Nature Neuroscience (2)
- Neuron (8)
- Molecular Psychiatry (2)

In addition to publication in journals, results were disseminated in scientific congresses. Half of the consortia (5/10) reported communications in congresses (in total 106 communications). The other half either did not report such communications (3/10) or information was not available (2/10).

In summary, the impressive number of publications in high-ranking journals demonstrates the excellence of the funded projects. It indicates that the transnational consortia worked very well and closely together. The exchange of knowledge, data transfer, and the collaborative approach in general were successful tools for conducting research on relatively small budgets (compared to some national or EU funding schemes).

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

Indicator: Composition of the Consortium

The analysis of the career background of funded researchers showed that

- in 50% of the consortia (5/10) the coordinator was a medical doctor;
- in 80% of the consortia (8/10) at least one Principal Investigator was a medical doctor;

The research was carried out mainly in basic research labs (91%, 39/43 research groups). One consortium included a company. The remaining 9% (4/43 research groups) were based in hospitals. According to the call text multidisciplinary approaches were highly encouraged. Indeed, the analysis showed that all of the funded consortia undertook multidisciplinary research, i.e. combining different disciplines within or beyond biomedical research. The involved disciplines ranged from medicine, neurobiology and psychology to chemistry and physics.

In summary, the NEURON JTC 2009 paved the way for collaboration of research groups across disciplines. With a high number of medical doctors involved, the projects were closely linked to medical application. Nevertheless, to facilitate the translation of novel technologies to clinical application, more hospitals and clinical research labs as well as companies should be encouraged to participate in future calls.

Indicator: Involvement of Patients

As an additional measure of the translational aspect of the funded research, the involvement of patients in the projects was evaluated. 30% of the consortia (3/10) included patients in their studies. In contrast, the majority (7/10) conducted their research in *in vitro* systems or on animal models.

In summary, there was relatively little involvement of patients in the funded consortia. This may be due to the topic of this particular call "Technology Development". It is evident that the development of novel technologies requires foremost basic research approaches. The necessary validation and finally an application in patients is usually a long process.

Indicator: Patents and Other Outcomes with Impact to Health

Patents are an indicator of the use of project results in terms of application. Of all funded consortia 40% (4/10) submitted at least one European or international patent. In total six patents were submitted. The patents covered, for instance, a system for image processing and a method to generate dopaminergic neurons. Moreover, three consortia reported the development of software and other prototypes. One consortium created a firm / fundraising based on their work funded in the JTC 2009. The type of this endeavour was not further specified.

In summary, the outcome emphasises the impact of this international funding scheme beyond mere 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.

None of the funded consortia reported involvement in large scale data sharing by creating or further developing databases or registries.

More than half of the consortia (5/8) reported exchanges DNA, tissues, cells and/or animals among partners. Three consortia considered this option as not applicable. There was no data available from two consortia. (Fig. 4).

In summary, creating large scale data bases such as patient registries or databases and bio banks was clearly beyond the scope the present NEURON call that focused on development of technology. In contrast, the exchange of resources, where applicable, was common among the research groups in a

consortium, demonstrating reliable collaborations. Hence, the allocated resources were efficiently used.

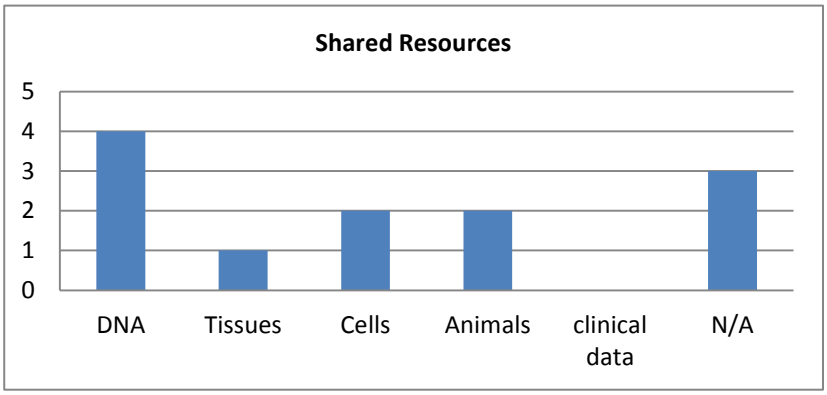

***Fig. 4**: Exchange of DNA, tissues, cells, animals or clinical data. Bars show the number of consortia, respectively. N/A: not applicable*

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)

Two out of eight consortia reported advancements towards **new diagnostic strategies**. These comprise

- the application of advanced mathematical methods on imaging data of stroke patients to functionally correlate brain regions to behavioural deficits after brain lesions,
- a novel testing protocol to characterise cognitive dysfunctions in pre-term born infants.

More than half of the consortia (5/8) reported the development of **novel strategies for therapies**. These included, for instance,

- the identification of new pharmacological targets to modulate molecular pathways that play a role in Parkinson's disease
- advances in cell replacement therapy as a neuroprotective tool to restore degenerative brain circuits, e.g. in Parkinson's disease,
- the use of nanoparticles to increase the transport of pharmacologically active compounds across the blood-brain-barrier and thus improve the effectiveness of medication especially in Alzheimer's disease.

One consortium has initiated a clinical trial after the runtime of the project to test the D-serine supplementation as a therapeutic for chronic epilepsy.

In addition, one consortium reported on the development of a protocol for rhythmic Transcranial Magnetic Stimulation (TMS) that enhances visuo-spatial awareness. This protocol may be applied to improve rehabilitation of stroke patients with spatial neglect

Taken together, 75% of the consortia (6/8) yielded results that have an impact on diagnostics, therapy, or rehabilitation. None of the funded consortia has proposed measures for disease prevention.

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 responses of the consortia are summarized in Figure 5. The generation of novel model systems and the development of innovative therapies rank as the main achievements reported by the consortia. In addition, the development of new medical devices as well as innovative screening systems, the identification of biomarkers and new genes, and characterisation of new disease pathways or therapeutic targets were referred to as major achievements.

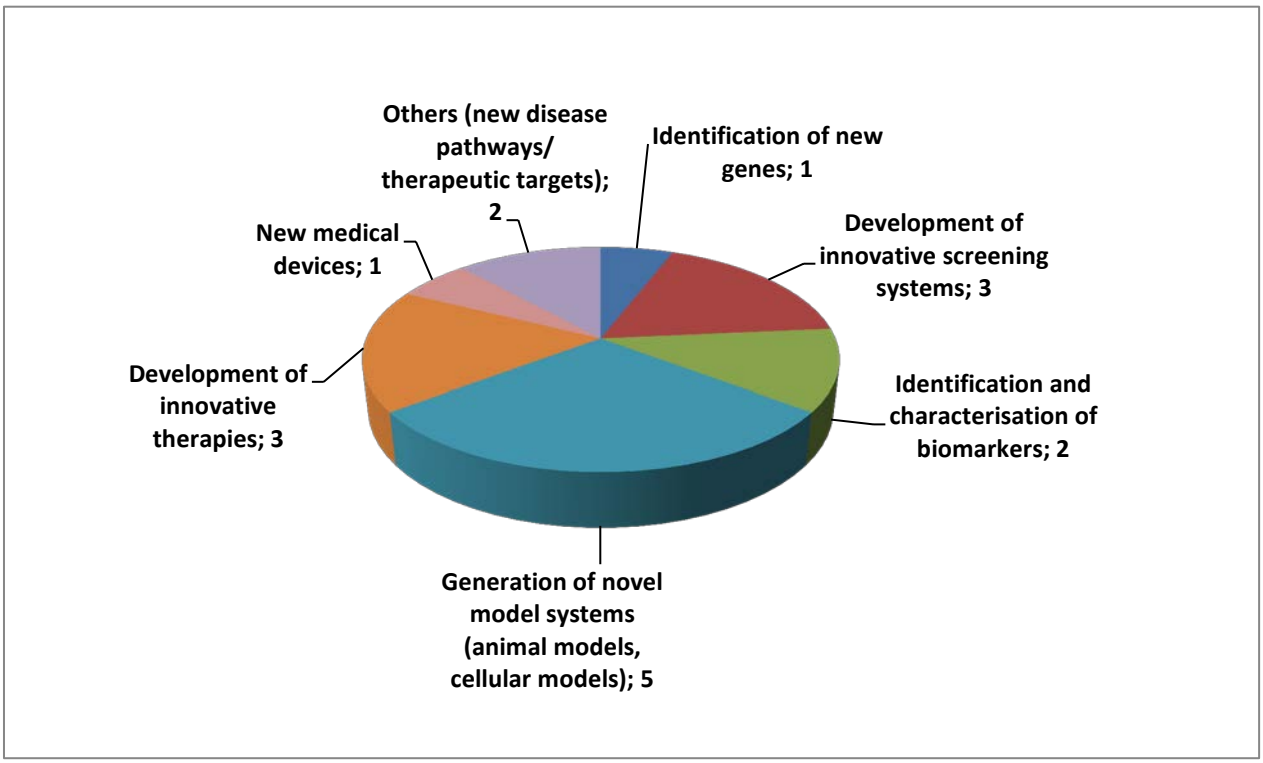

***Fig. 5**: Major achievements. The numbers in the pie-chart indicate how many of the consortia reported a respective achievement.*

In summary, the results achieved by the consortia are highly relevant for further advances in health research. The fact that the generation of novel model systems was selected most frequently as a major achievement highlights that the consortia funded through JTC 2009 focused on the enhancement of pre-clinical research systems to enable an improved investigation of disease pathways and better testing of therapeutic strategies. Application of these improved systems in future research projects may lead to new diagnostic tools and novel therapies. This highlights the importance of such projects for patients. Taken together, the achievements of the consortia promise to have a significant impact on health research.

Final Symposium

Results from the funded projects were presented at a final symposium in January 2013 (see also: www.neuron-eranet.org/_img/article/NL18neuron.pdf). Two members of the review panel of this call attended the symposium to evaluate the project outcomes. In summary, they concluded that expecta-

tions were largely met and the aims of the call were achieved. They considered the funded projects to be of top quality.

In addition, the funded researchers were asked to provide feedback to the call and its implementation 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?

The researchers pointed out that the projects would not have been possible without this specific collaboration and source of funding. Although demanding challenges in terms of language, technologies, and methodology had to be overcome to initiate the collaborations, the transnational and interdisciplinary structure of the consortia was essential for achieving the complexity of results. Because of the difficulties in establishing the collaborations first results emerged only towards the end of the projects duration.

Concerning the call topic, it was emphasized that the high demands on cutting edge techniques, novelty, originality and ambition in JTC 2009 were very unusual. Technology development was considered a highly welcome topic which is crucial for progress in brain research but nevertheless lacks funding opportunities from other sources. It was recommended to keep these aspects in future calls. On the other hand, it was acknowledged that such a broad unrestricted theme may receive too many proposals and lowers the funding rate of success.

There was a general agreement that the review and Joint Call Secretariat related processes were quick and did not involve much bureaucracy. It was, however, criticized that national requirements were not standardized and in some cases very time consuming because e.g. of required translations of the proposal, additional reporting items, and submission of all invoices in the financial report. In addition, it was noted that the available budgets were in some cases too low to cover the costs of the projects. The researchers asked for improvements of this situation to avoid underfunding.

Taken together, the funding measure was successful in terms of supporting cutting-edge research. Moreover, the general NEURON procedures received an overall positive feedback.

Overview of all Results

In summary, the evaluation of the JTC 2009 shows that the funding programme met its major goals: enhancement of cooperation between European scientists, promotion of multidisciplinary and translational research, support of development of innovative technologies, and development of new strategies for diagnosis, therapy and rehabilitation. Our key performance indicators capture that all of these objectives were tackled in the call (cf. Table 6). For instance, the JTC encouraged the formation of new, research consortia which subsequently applied jointly for further funding thus proving to be sustainable. On the other hand, it also helped to strengthen already existing collaborations. The degree of cooperation among the researchers was high and fruitful as indicated by the impressive publication record reported back to NEURON. On the whole, 216 articles were published in peer-reviewed journals. Of these, 31 were joint publications (i.e. at least two Principal Investigators were among the authors). The fact that 34 articles were issued in high impact journals (impact factor > 10) demonstrates the excellence of the research. The excellent publication record is also evidence for an efficient selection process of projects to be funded. Moreover, NEURON encouraged formation of multidisciplinary consortia. Indeed, seven consortia pursued a combined approach by research groups from various disciplines. The major achievements yielded by the projects were the generation of novel model systems as well as innovative strategies for therapies. This includes, for instance, the identification of novel phar-

macological targets and the development of nanoparticles for improved drug delivery across the blood-brain-barrier. Taken together, these results emphasize that transnational funding for disease-oriented neuroscience research is very efficient in fostering collaboration and producing high quality research outcomes. Translational aspects were covered by each consortium to different degrees. The direct feedback given the researches during the final symposium demonstrates that NEURON is very positively received by the scientific community despite some criticism concerning national regulations and budgets.

***Table 6**: Quantified responses by funded research consortia*

Objective of the Funding Programme	Output Indicators	Results
1. Enhance cooperation between European scientists working in the field of neuroscience	NEURON JTC as starter of new collaboration	→ 43% of funded consortia were newly formed. .
	New research groups from other countries joining the consortium	→ 29% of consortia acquired new collaborations during the lifetime of the project.
	Sustainability of the collaboration (obtaining further funding for the same consortium)	→ 71% of consortia had at least 2 PIs applying jointly for further funding. → 60% of these were newly formed consortia
	Intensity of collaboration (meetings, mobility, joint publications)	→ 100% of the funded consortia attended the mid-term and final NEURON symposia → On average each consortium held 6 meetings; 62% of the meetings were attended by all partners → 31 articles (14% of all publications) were published jointly in peer-reviewed journals
	Level of excellence of the funded research	→ 80% of consortia published at least one primary research publication in a peer-reviewed journal with an Impact Factor above 10 (in total 34 articles)
2. Promote multidisciplinary consortia and to encourage translational research proposals (from bench to beside)	Composition of the consortium	→ In 50% of funded consortia the coordinator was a medical doctor. → In 80% of funded consortia at least one Principal Investigator was a medical doctor. → 91% of the projects was carried out in basic research labs (this included one company)
	Involvement of patients	→ Patients were involved in 30% of the projects.
	Patents / other outcomes with impact to health	→ 40% of consortia submitted at least one European or international patent; other outcomes with impact to health are shown below
3. Support development of innovative or shared resources and technologies	Development and the use of new resources	→ 63% of consortia exchanged bio resources (DNA: 40%, tissues: 10%, cells: 20%, animals 20%, clinical data: none).
4. Support research to develop new strategies for diagnosis, therapy, and rehabilitation procedures	Development of new strategies for diagnosis, therapy, and rehabilitation procedures Major achievements	→ 25% of consortia developed new strategies for diagnosis → 63% of consortia developed new strategies for therapies. → 13% of consortia developed new strategies for rehabilitation → the most frequent major achievements were the generation of novel model systems (50% of consortia) and the development of innovative therapies (40% of consortia)

Table 7: *Summary of the results per project.*

Indicator/Measure	2p-Imaging	BEYONDVIS	DISCover	EpiNet	ImageNinND	MODDIFSYN	NanoBrain	NANOSYN	PANS	REPark
New consortium	-	no	no	yes	-	no	yes	yes	no	-
Addition of research group	-	no	yes	no	-	no	yes	no	no	-
Sustained collaboration	-	no	yes	yes	-	yes	yes	yes	no	-
Intensity of collaboration										
- number of meetings	-	4	6	5	5	5	7	6	10	-
- meetings with all partners	-	4	3	2	3	5	4	2	7	-
- number of lab visits	-	0	1	9	2	3	0	1	2	-
Excellence										
- total number of publications	21	35	30	12	21	21	3	26	38	9
- number of joint publications	2	9	6	0	0	6	3	1	3	1
- number of journals IF > 10	6	1	1	4	7	4	0	9	0	2
Composition of consortia										
- COO is a medical doctor	yes	yes	yes	yes	yes	no	no	no	no	no
- number of PIs being medical doctors	2	2	1	1	1	1	1	0	0	2
- basic research labs involved	4	4	4	4	4	5	4	3	4	3
- hospitals involved	0	0	1	1	0	0	1	0	0	1
Involvement of patients	no	yes	no	no	no	no	no	no	yes	yes
Number of patents	0	0	3	1	0	1	0	0	0	1
Number of databases/registries/biobanks	0	0	0	0	0	0	0	0	0	0
Exchange of:										
- DNA	-	no	yes	no	no	yes	yes	yes	no	-
- tissues	-	no	yes	no	no	no	no	no	no	-
- cells	-	no	yes	no	no	no	yes	no	no	-
- animals	-	no	yes	yes	no	no	no	no	no	-
- clinical data	-	no	no	no	no	no	no	no	no	-
Novel strategies for:										
- diagnosis	-	yes	no	no	no	no	no	no	yes	-
- therapy	-	yes	no	yes	yes	no	yes	no	no	-
- rehabilitation	-	yes	no	no	yes	no	no	no	no	-
- prevention	-	no	no	yes	no	no	no	no	no	-
Major achievements:										
- identification of new genes	-	no	yes	no	no	no	no	no	no	-
- development of screening systems	-	no	yes	no	no	no	yes	no	yes	-
- identification of biomarkers	-	no	yes	no	no	yes	no	no	no	-
- validation of biomarkers	-	no	no	no	no	no	no	no	no	-
- development of novel model systems	-	no	yes	no	yes	yes	yes	yes	no	-
- innovative therapies	-	yes	yes	yes	no	no	no	no	no	-
- new medical treatments	-	no	no	no	no	no	no	no	no	-
- new medical devices	-	yes	no	no	no	no	no	no	no	-
- neurosurgical innovation	-	no	no	no	no	no	no	no	no	-
- Others (disease pathways, therapeutic targets)	-	no	no	yes	no	no	no	yes	no	-

Acknowledgements

We thank Dr. Natalia Martin, Dr. Jenifer Clark, and Déborah Zyss (Agence Nationale de la Recherche, ANR) for developing the key performance indicators and the questionnaire. We also thank Dr. Alexander Klein (Deutsches Zentrum für Luft- und Raumfahrt, DLR) for collecting the final reports and questionnaires and support in the analysis. Finally, we would like to thank the Principal Investigators and their research teams for their kind cooperation.

Annex I

Excerpt of the Call Text JTC 2009

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 by the World Health Organisation (World Health Report 2001), 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. With increasing average life-expectancy of the population especially in highly industrialized countries this percentage will continue to rise, as the incidence of neurodegenerative conditions increases with age. 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 first transnational call was launched in January 2008 on the topic of neurodegenerative diseases of the central nervous system. The topic for the second joint transnational call was selected in the field of innovative technologies in neuroscience. The following funding organisations have agreed to fund the second 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
- Academy of Finland (AKA), Finland
- National Research Agency (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
- National Centre for Programme Management (CNMP), 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 the development and advancement in methods and technologies towards the understanding of the brain and its diseases. The scope of this call is not the funding of pure technology development per se. The focus of this call explicitly does not lie on the funding of infrastructure. Research projects have to be hypothesis-driven, combine cutting-edge technological developments with a clear, substantial research question. There is no sharp restriction concerning the specific technologies or methodologies used in the applications. These may include (without excluding others): Imaging techniques (including optical, MR and PET techniques), molecular and genetic approaches, stem cells and neural differentiation in relation with cell therapy, gene targeting in the brain, electrical and magnetic brain stimulation, and molecular modelling techniques. Neurodegenerative diseases pose an outstanding problem of ageing societies. Proposals addressing these diseases are especially welcome although the call is not restricted to this area.

The call may receive proposals within the breadth of research from understanding basic mechanisms of brain function and disease through to clinical studies in man. Clinical studies are eligible up to the point of `proof of concept´2. The ERA-Net NEURON partners particularly wish to promote **multidisciplinary working** and to encourage **translational research proposals** that combine basic and clinical approaches (from bench to bedside).

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. Based on this ranking list, the Call Steering Committee will suggest the projects to be funded. Based on these recommendations, final decisions will be made by the national 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 (entreprise)		

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 2008? 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 2008 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 registrydatabase/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 ☐
- 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

Scientific Workshops

To define the call topic according to the needs of the scientific community two workshops were held at which the major frontiers and technological progresses in the field of neuroscience were discussed with representatives of funding agencies and researchers. In the first workshop (Geneva), on the one hand, different funding programmes in Europe and North America were discussed. On the other hand, illustrate how technological and methodological advances can help answer several fundamental questions related to the normal and pathological function of the nervous system. These discussions helped to identify current frontiers and challenges in neurosciences to be addressed in the call. The second workshop (Warsaw) was dedicated to new technologies that may yield major breakthroughs to elucidate disease-mechanisms of disorders of the nervous system and eventually promise new treatments. In combination the two workshops provided the necessary scientific input to design the call.

Presentations of the scientific workshop held in Geneva in July 2008:

- Marlies Dorlöchter, Germany: *'Funding of Neuroscience in Europe: the ERA-Net NEURON'*
- Patrizia Tosetti, European Commission: '*The EC funding policy for neuroscience*'
- Joel Hasse Ferreira, Portugal: *'EC Parliament representative (Scientific and Technological Options Assessment: STOA)'*
- Richard Nakamura, USA: *'The Funding policy for Neuroscience in North America'*
- Paola Bovolenta, Spain: *'Advances and Challenges in Neuroscience'*
- Daniel Choquet, France: '*Nanoscience and optics to understand synaptic transmission'*
- Mart Saarma, Finland: *'Biology and Therapeutic Potential of Neurotrophic Factors'*
- Laurent Cohen, France: *'Neuropsychology and imagery of word reading: footprints of culture in the brain'*
- Niels Birbaumer, Germany: *'Brain Computer Interfaces: Applications in Paralysis and Emotional Disorders'*

For more details see: http://www.neuron-eranet.org/_media/NL4.pdf

Presentations of the scientific workshop held in Warsaw in September 2008:

- Jean Livet, France: *'Current approaches to visualize neuronal circuits: Engineering tools for "connectomics"'*
- John Rothwell, UK: *'Advances in Transcranial Brain Stimulation'*
- Mohamed Jaber, France: *'Current aims and hopes in cell based therapies of neurodegenerative diseases'*
- Arthur Konnerth, Germany: *'High-resolution optical imaging in the living brain'*
- Jacques Mallet, France: *'Gene Therapy for Diseases of the Nervous System'*
- Bertram Müller-Myhsok, Germany: *'Convergent-omics approaches as a major tool in neuropsychiatric research'*

For more details see: http://www.neuron-eranet.org/_media/NL5.pdf