



Project number: 026400 (INCO)

Project acronym: NEUROIMAGE

Project title: REINFORCING A CENTER FOR LASER
MICROSCOPY AND CELL PROFILING FOR REGIONAL
NETWORKING

Instrument: SSA

Thematic Priority: “Integrating and Strengthening the European Research Area,
Specific Measures in Support of International Cooperation (INCO)”

PUBLISHABLE FINAL ACTIVITY REPORT

Period covered: from 01/07/2006 to 30/06/2009

Date of preparation: 23/07/2009

Start date of project: 01/07/2006

Duration: 36

months

Project coordinator name: Prof. Pavle Andjus

Version: 1

Project coordinator organisation name: Institute for Physiology and Biochemistry,
Faculty of Biology, University of Belgrade, Serbia – IPB

The main objective of the project is to improve research capacities of a Western Balkan (WB) research center and of WBs in general, for the groundbreaking research field of cell and tissue imaging in life sciences for health, particularly neurosciences and neurology. The WB center which is the single contractor of this action is

Institute for Physiology and Biochemistry (IPB, participant no. 1),

Faculty of Biology,
University of Belgrade
Strudentski trg 3; POB 52; 11001 Belgrade; Serbia

with its *Center for laser microscopy, CLM* (<http://clm.bio.bg.ac.rs>). In addition to diverse resources for neuroscience and physiology the Institute is equipped with a *laser scanning confocal microscope* that will present the core facility for the project research management. The principal objective is planned to be met through a work plan designed to

- 1) develop the confocal imaging core platform taking into account specific scientific directions, i.e. physiology time-series and plasticity development and molecular genetics,
- 2) increase the capacity to participate in the research programmes of the EU and to improve already existing links with well-established European research centers via intense networking,
- 3) strengthen the technical capacity by upgrading and maintenance of equipment and by provision of key skills, employment of young researchers and exchange visits of scientists,
- 4) bridge the gap between theoretical and applied science and serve the socio-economic needs of the country by supporting medical and pharmaceutical research through interaction with medical institutions,
- 5) disseminate knowledge of cell imaging beyond the field of neuroscience and forming a wide regional database of potential users and collaborators.

In addition to IPB (#1) as the co-ordinator the participants in the project (as third parties) are

Participant no.	Participant organisation name	Participant org. short name
2	Medical Faculty, University of Ljubljana, Institute of Pathophysiology- Laboratory of Neuroendocrinology - Molecular Cell Physiology	LNMC
3	Scuola Normale Superiore/NEST Centre, Pisa	INCNR
4	Laboratory of Molecular Neuroscience, Centre for Molecular Biology and Neuroscience, University of Oslo	LMN
5	Centre for Brain Repair "Rita Levi Montalcini" Department of Neuroscience, University of Turin	CRLM
6	School of Medicine, University of Zagreb - The Croatian Institute for Brain Research	CIBR

Aims and impact

- The principal aim of the project is to strengthen the cell imaging and profiling platform of the IPB thus upgrading it to a *center of regional significance* i.e. open to collaboration and exploitation by partners and clients from WB.

In this respect in the basic confocal core facility was upgraded (a third 633nm laser, higher magnification objectives - x63 and x100 with additional optical accessories, software for physiology time series measurements, and an additional transmitted light channel), and reinforced with and electrophysiology setup, thus making the microscope stage universal and capable to cover a wider area of scientific disciplines. Human resources were reinforced with three postdocs and two students were chosen from a new PhD programme in Neuroscience at the Faculty and awarded a start-up fellowship from the grant. The *employment plan for young researchers* is meant to be continued after the project finalization through *applications for national projects* for basic research (already two PhD students on the project are also engaged on a national project – funded by the Ministry of Science, Rep. of Serbia) and for *innovation centers*. Both project schemes, should offer opportunities for salaries for young research fellows.

- *Dissemination of knowledge and technology* is planned through networking with EU partners, comprising of study visits and specialized workshops

In the final project year two one-month visits of young researchers from IPB were performed to the EU participants of the project, namely to Ljubljana (LNMCP) and to Oslo (LMN). Short visits from IPB personnel were also organized to Ljubljana (LNMCP) in order to discuss further collaborations. Several other short visits were performed to other EU research centers and relevant scientific meetings in order to disseminate knowledge and potentially widen the network of partners.

The dissemination plan comprising of an intense mobility plan is also shared with the WB partner (CIBR) that has a similar confocal facility and complementary neuroscience programmes, thus *amplifying the impact on the WB region*. On the other hand, during workshops general courses on confocal microscopy and its applications will be organized also aiming at *recruiting new partners* and clients from WBs, *beyond the scope* of neurophysiology and neurology. An interaction was first made in September 2006 with an IBRO sponsored workshop “Imaging in neurosciences and beyond” organized by the co-ordinator and Steering committee partners at Sveti Stefan, Montenegro. In the 2nd reporting period the *Dissemination of knowledge workshop* was organized in Belgrade with the participation of representatives of all partners and of new potential partners and clients of the IPB Center. In the 2nd reporting period IPB also organized a Training School in Neuroimaging and complementary techniques that was co-financed by ESF-COST (Action B30) and IBRO. In the 3rd reporting period CIBR and IPB organized jointly the *Regional multidisciplinary biomedical workshop* (RMBW) in Opatija, Croatia. This workshop was also organized with the COST action B30 and along with a workshop of the Croatian Microscopy Society. The participation of young researchers from the WB region was notable.

Tracking and updating of a respective user list will be possible through maintenance of the Center’s Web page (<http://files.bio.bg.ac.rs/news/fp6.htm>) and Forum facility (<http://forum.clm.bio.bg.ac.rs/>) installed at the IPB server.

The main potential impact is that with the help of reinforcement of new technologies and on the ground of traditionally strong scientific potential already present in the WB partner centers (e.g. cellular neurophysiology in IPB, Belgrade twined with neuroanatomy in CIBR, Zagreb) the resulting facility will represent a *necessary and complementary unit to be integrated in ERA*. The following scientific programs will be pursued in the reinforced center:

- *In vivo* and *in situ* imaging of subcellular physiological changes of enzymes and ions in cells
 - live *cell profiling* according to electrical features of nerve cells
 - imaging of the nerve cell functional profiles according to the neuroanatomical location
 - profiling of consequences of genetic modifications on the neurons and the brain
 - prerequisites for the development of *cell imaging diagnostic protocols*
- The achieved impact should be reflected in new *international scientific projects* comprising of WB and EU partners.

In fact, in the reporting period the coordinator has taken part with some of the participants in *two EC FP7 consortium project proposals* and one *bilateral* (with CIBR). In addition, four participants of NEUROIMAGE - IPB, CIBR, LMN and CRLM are already members of a new COST action – B30 “Neural regeneration and plasticity” – NEREPLAS that was launched in July 2006. This action covers a wide population of ERA centers that offers very good possibilities for interaction with NEUROIMAGE.

EU partners interfacing with this project have been selected for their diverse experience and competence in cell imaging and profiling, especially regarding the rapidly developing technology of laser scanning confocal microscopy and its applications in neurosciences. This presents a *European added value* to the project that brings the exchange of expertise and allows the IPB Center to be *integrated in the European process of development of knowledge in these fields of neuroscience*.

So far as a result of interactions with NEUROIMAGE several project initiatives have risen: the *bilateral* project with CIBR was approved; an EC networking grant with the University of Szeged (Hungary) was approved; a bilateral grant proposal with University of Debrecen (Hungary) is pending; a DFG grant proposal with University of Hamburg is also pending.

- In the course of the project members of IPB have published *11 journal publications* (*5 with international co-authors*).

NEUROIMAGE coordinating person,



Pavle R. Andjus

ANNEX – Journal papers published by IPB members within and during the NEUROIMAGE project (2006-2009).

1. Bataveljić, D., Homšek, B., Bačić G., Pochet R., Andjus P.R. “Magnetic resonance imaging of the brain in the superoxide dismutase 1^{G93A} transgenic rat model of amyotrophic lateral sclerosis”. Proceedings of the VIPSI – 2006 Montenegro/Italy, 2006 (CD-ROM: ISBN 86-7466-117-3)
2. Radenovic L, Selakovic V, Andjus P. “Neuroprotection by MK-801 following cerebral ischemia in Mongolian gerbils.” *Arch. Biol. Sci.* 60, 341-346 (2008)
3. Radenovic L., Selakovic V., Janac B., Andjus P. “Neuroprotection in gerbil model of cerebral ischemia: morphological and behavioral study.” *Physiology (Romania)* 18, 58-62 (2008)
4. Radenović L, Selaković V, Bajić A, Andjus P. Use of confocal microscopy in the study of ischemia-induced hippocampal neuronal damage. *Arch. Biol. Sci.* 60, 561-565 (2008).
5. Jorgacevski J, Stenovec M, Kreft M, Bajić A, Rituper B, Vardjan N, Stojilkovic S, Zorec R. *Hypotonicity and peptide discharge from a single vesicle.* *Am J Physiol Cell Physiol.* 2008; 295(3): C624-31.
6. Nicaise C, Soyfoo MS, Authelet M, De Decker R, Bataveljic D, Delporte C, Pochet R. Aquaporin-4 Overexpression in Rat ALS Model. *Anat Rec (Hoboken)*. 2009 ;292:207-13.
7. Jakovceviski I, Siering J, Hargus G, Karl N, Hoelters L, Djogo N, Yin S, Zecevic N, Schachner M, Irintchev A. Close homologue of adhesion molecule L1 promotes survival of Purkinje and granule cells and granule cell migration during murine cerebellar development. *J Comp Neurol.* 2009;513:496-510.
8. Bataveljić D., Djogo N., Župunski Lj., Bajić, A., Nicaise C., Pochet P., Bačić G., Andjus P.R. «Live monitoring of brain damage in the rat model of amyotrophic lateral sclerosis.» *Gen. Physiol. Biophys.* (2009) - *in press.*
9. Andric, M., Dozic, B., Popovic, B., Stefanovic, D., Jovanovic, G.B., Djogo, N., Andjus, P., Milasin, J. Survivin expression in odontogenic keratocysts and correlation with cytomegalovirus infection. *Oral Diseases* (2009). doi:10.1111/j.1601-0825.2009.01612.x - *in press.*
10. Andjus, P.R., Bataveljić D., Vanhoutte, G., Mitrecic, D., Pizzolante, F., Djogo, N., Nicaise, C., Gankam Kengne, F., Gangitano, C., Michetti, F., Van der Linden, A., Pochet, R., Bačić, G. “*In vivo* morphological changes in animal models of amyotrophic lateral sclerosis and Alzheimer's-like disease: MRI approach.” *Anatomical Record* (2009) - *in press*
11. Spasojevic, I., Bajić, A., Jovanović, K., Spasić, M., Andjus, P. Protective role of fructose in the metabolism of astroglial C6 cells exposed to hydrogen peroxide. *Carbohydr. Res.*(2009) – doi:10.1016/j.carres.2009.05.023 - *in press.*