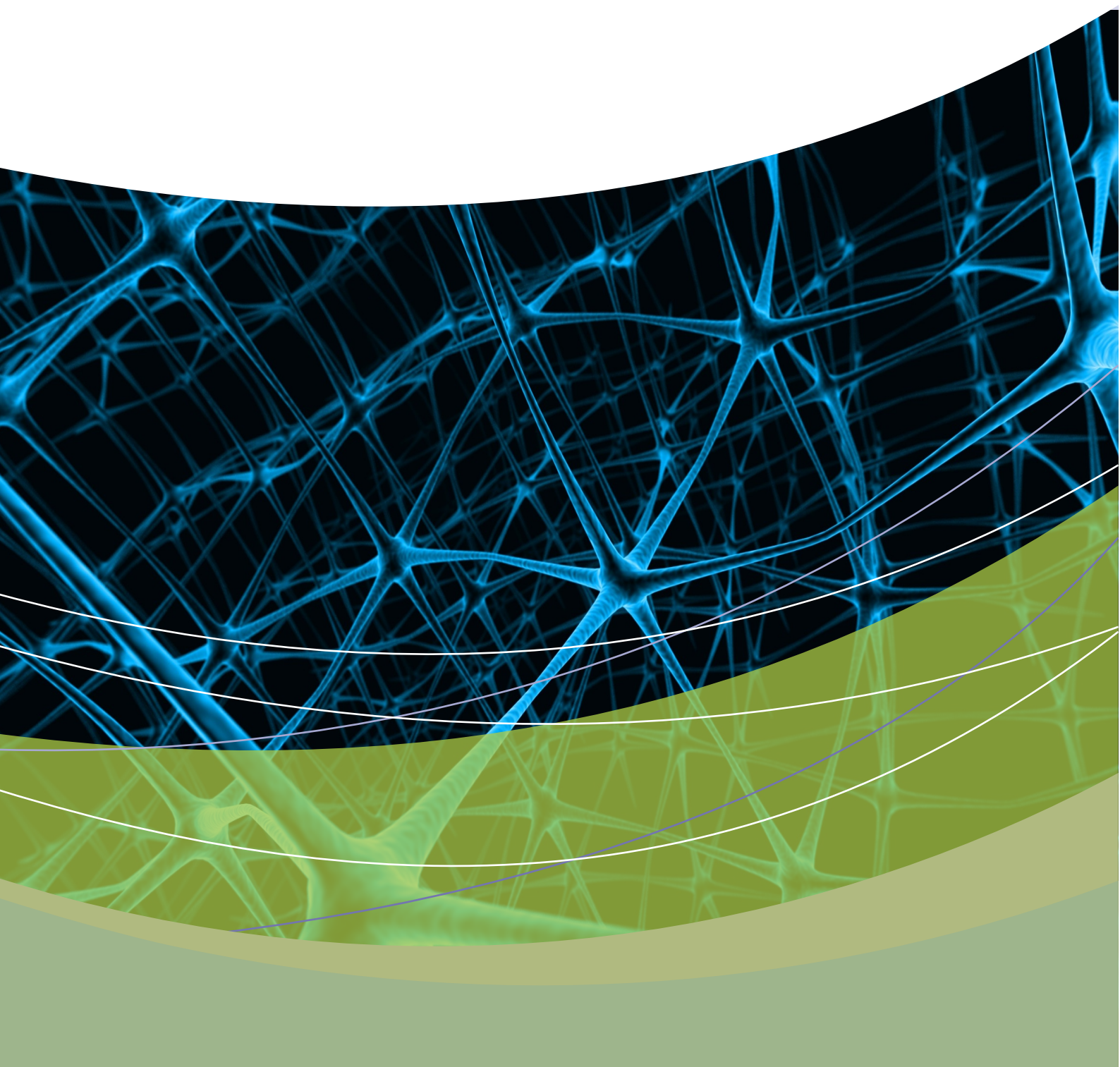


# Romanian Institute of Science and Technology

## 2010 Annual Report



The Romanian Institute of Science and Technology (RIST) is a non-governmental, not-for-profit, independent research institute, founded in 2009.

RIST currently performs research on complex systems, computational, theoretical and experimental neuroscience, biologically-inspired robotics, artificial intelligence and dynamical systems.

RIST aims to provide an appropriate institutional and administrative support for world class scientists that would like to work in Romania and are not satisfied by the conditions offered by existing Romanian research institutions, which are often much too bureaucratic. According to a survey performed in 2006 among scientists working in Romania, only 30% were considering that their institutions provide appropriate support for their work.

RIST especially welcomes Romanian scientists currently working abroad.

RIST is a grassroots initiative, resulting from the enlargement of the Center for Cognitive and Neural Studies (Coneural), another independent, not-for-profit research institution, founded in 2002 by several Romanian scientists.

## **Affiliated scientists**

- Marius F. Danca
- Răzvan V. Florian
- Ovidiu F. Jurjuț
- Vasile V. Moca
- Raul C. Mureșan
- Sergiu P. Pașca
- Cătălin V. Rusu
- Ioana Țincaș

## **Staff**

- Cosmina Pavel

## **Board of directors**

- Răzvan V. Florian
- Liviu Giosan
- Raul C. Mureșan

## Structure

### ***Experimental and Theoretical Neuroscience Laboratory***

The lab explores the brain by means of experimentally recorded data from humans (using EEG and eye tracking) and from the visual cortex of mammals (highly parallel recordings) and also through computer simulations of realistic models of cortical microcircuits. In addition, it develops new, non-conventional techniques of data analysis.

The first important line of investigation is related to the analysis of neuronal data recorded from real brains. The lab explores high-density EEG and eye tracking data recorded in humans, as well as parallel recordings from mammalian visual cortex. The second line of research investigates neurocomputational principles in simulations of large scale networks of spiking neurons. This includes studies ranging from new biologically-inspired computational models of vision to general studies related to the dynamics of large-scale neuronal microcircuits and issues regarding their computational simulation. Finally, the lab develops new and non-conventional analysis tools for spike-trains, LFP and EEG signals, as well as for the characterization of the complex, non-linear dynamics of neuronal populations.

People: Raul C. Mureşan (group leader), Vasile V. Moca, Ioana Țincaş, Ovidiu F. Jurjuţ (on leave at the Frankfurt Institute of Advanced Studies, Germany), Sergiu P. Paşca (on leave at Stanford University, USA).

### ***Neurobotics Laboratory***

The lab uses principles revealed by the study of brain and body as a whole integrated system interacting with the world (embodiment, interactivism, constructivism), to build models that on one side are inspired by the functioning of brains, and on the other side are capable of reproducing complex behaviors in embodied systems (robots or robot-like simulations).

The lab has developed several learning rules for spiking neural networks and uses them to train such neural networks for robotic control.

People: Răzvan V. Florian (group leader), Cătălin V. Rusu.

### ***Dynamical Systems***

Marius F. Danca studies chaotic dynamical systems.

## Publications in 2010

M. F. Danca, Q. Wang (2010), Synthesizing attractors of Hindmarsh-Rose neuronal systems, *Nonlinear Dynamics*, 62 (1-2), pp. 437-446.

M. F. Danca (2010), Chaotic behavior of a class of discontinuous dynamical systems of fractional-order, *Nonlinear Dynamics*, 60 (4), pp. 525-534.

R. V. Florian (2010), Challenges for interactivist-constructivist robotics, *New Ideas in Psychology*, 28 (3), pp. 350-353.

Y. Mao, W.K.S. Tang, M. F. Danca (2010), An averaging model for chaotic system with periodic time-varying parameter, *Applied Mathematics and Computation*, 217 (1), 355-336.

M. F. Danca (2010), Attractors synthesis for a Lotka-Volterra-like system, *Applied Mathematics and Computation*, 216 (7), pp. 2107–2117.

M. F. Danca (2010), Finding stable attractors of a class of dissipative dynamical systems by numerical parameter switching, *Dynamical Systems*, 25 (2), pp. 189-201.

M. F. Danca, K. Diethlem (2010), Fractional-order attractors synthesis via parameter switchings, *Communications in Nonlinear Science and Numerical Simulations*, 15 (12), pp. 3745–3753.

C. V. Rusu, R. V. Florian (2010), A new spike train metric, Nineteenth Annual Computational Neuroscience Meeting: CNS\*2010. *BMC Neuroscience* 2010, 11 (suppl. 1), p. 169.

A. Martin, G. Pastor, M. Romera, A. B. Orue, M. F. Danca and F. Montoya (2010), Dendritas de Misiurewicz en el conjunto de Mandelbrot, *Proceedings of NoLineal 2010*, F. Balibrea et al. (eds), p. 108, Cartagena (Murcia), Spain, 8-11 June 2010.

G. Pastor, M. Romera, A. B. Orue, A. Martin, M. F. Danca and F. Montoya (2010), Dibujo de los rayos externos de Douady and Hubbard, *Proceedings of NoLineal 2010*, F. Balibrea et al. (eds), p. 110, Cartagena (Murcia), Spain, 8-11 June 2010.

## **Publications of the Center for Cognitive and Neural Studies in 2010, prior to its affiliation to RIST**

S. P. Paşca, W. Singer, D. Nicolic (2010), Surround modulation of neuronal responses in V1 is as stable over time as responses to direct stimulation of receptive fields, *Cortex* 46 (9), pp. 1199-1203.

M. Dronca, S. P. Paşca (2010), Paraoxonase 1 status, environmental exposures and oxidative stress in Autism Spectrum Disorders. In A. Chauhan, V. Chauhan, T. Brown (editors), *Autism: Oxidative Stress, Inflammation and Immune Abnormalities*, Taylor & Francis, Boca Raton, FL.

M. F. Danca (2010), On the uniqueness of solutions to a class of discontinuous dynamical systems, *Nonlinear Analysis Series B: Real World Applications*, 11 (3), pp. 1402-1412.

S. P. Paşca, E. Dronca, B. Nemes, T. Kaucsár, E. Endreffy, F. Iftene, I. Benga, R. Cornean, M. Dronca (2010), Paraoxonase 1 activities and polymorphisms in autism spectrum disorders, *Journal of Cellular and Molecular Medicine*, 14 (3), 600-607.



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