November 10th 2004

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Dr. MARCO CANEPARI

May 29th 1970 — **Born in Milan, Italy.**

June 1994 — **Degree in Physics (110/110 Cum Laude) at Genoa University, Italy.**
- Undergraduate thesis on **recording techniques from small biological neural networks** under the supervision of ***Prof. Vincent Torre.***

August-November 1994 — **Experience in NTT Basic Research Laboratories in Atsugi, Japan in the laboratory of *Dr. Akio Kawana.***
- **Multisite recordings of the electrical activity in neural networks of cultured cortical neurons using multielectrode arrays.** Study of the dependence of spontaneous activity of this type of network on the ionic concentration of the extracellular medium.

January-November 1995 — **Fellowship from Istituto Nazionale per la Fisica della Materia (INFM) supported by *Prof. Vincent Torre.***
- **Optical recordings of the electrical activity in the leech nervous system using voltage sensitive dyes.** Detection of optical signals from identified neurons in leech ganglions.

November 1995- February 1999 — **PhD in Biophysics at the International School of Advanced Studies (SISSA-ISAS), Trieste, Italy.**
- Thesis under the Supervision of ***Prof. Enrico Cherubini***, Co-supervisor ***Dr. Alessandro Treves*** on **Intrinsic variability and short-term changes in synaptic transmission in the rat hippocampal CA3 region.**
- Collaboration with ***Dr. Fabio Mammano*** for the **development of a fast system for calcium imaging**. Measurements of calcium signals generated in hippocampal pyramidal cells and in hypoglossal motoneurons in slice.

December 1997 — **Period at Hadassah Medical School, Jerusalem, Israel, in the laboratories of *Prof. Rami Rahamimoff.***

March 1999-Today — **MRC postdoctoral research at the National Institute for Medical research, London, UK, in the laboratory of *Dr. David Ogden.***

Research on metabotropic glutamate receptors (mGluR) – mediated signals in cerebellar Purkinje neurons using near UV photolysis of caged L-glutamate. This research was supported by an individual Marie Curie Fellowship of the European Community (programme Human Potential) from March 2000 until March 2002. The results of this project have yielded a detailed characterisation of the biophysics and pharmacology of several molecules involved in the mGluR pathway. During this period I had the opportunity to do practical teaching at the Micro-electrodes (September 2003) and Optical (April 2003, April 2004) workshops organised in Plymouth by David Ogden.

June-August 2004

Period in Wood Hole, MA, USA in the laboratory of *Dr. Dejan Zecevic.* Voltage sensitive dyes imaging from individual neurons. This experience is partly supported by an individual grant from the Physiological Society.

Special Awards

Winner of Premio Borsellino given by the Italian Society for Biophysics, for the best Italian PhD thesis in Biophysics, Parma, Italy, October 2000.

Principal international schools and meetings attended.

- *International biophysics school A. Borsellino, Erice (TP), Italy (May 1995)* [*]
- *4th World IBRO congress, Kyoto, Japan. (July 1995)* [#]
- *International biophysics school A. Borsellino, Erice (TP), Italy (June 1997)* [*]
- *Israel Neuroscience meeting, Eilat, Israel (December 1997)* [#]
- *European Neuroscience Association Forum, Berlin, Germany (June 1998)* [*,#]
- *British Neuroscience Association meeting, Harrogate, UK (April 1999)* [#]
- *Physiological Society meeting, London, UK (April 1999)* [+]
- *FENS Winter School, Kitzbühel, Austria (December 1999)* [*]
- *Biophysical Society 44th annual meeting, New Orleans, USA (February 2000)* [*]
- *FENS meeting, Brighton, UK (June 2000)* [*,#]
- *Biophysical Society 45th annual meeting, Boston, USA (February 2001)* [#]
- *Neurochemistry Winter Conference, Solden, Austria (March 2001)* [*,+]
- *FENS/IBRO Summer School, Sulejow , Poland, (July 2001)* [*]
- *Society for Neuroscience annual meeting, S.Diego, USA, (November 2001)* [#]
- *Neurochemistry Winter Conference, Solden, Austria (March 2002)* [*,#]
- *Physiological Society meeting, Liverpool, UK (July 2002)* [#]
- *FENS meeting, Paris, France (July 2002)* [*,#]
- *6th World IBRO congress, Prague, Czech Republic (July 2003)* [*,#]

** Participation was supported by an individual grant awarded.*
 # Poster presentation
+ Oral Communication
I will be an invited speaker on the 20th Biennial Meeting of the International Society for Neurochemistry and the European Society for Neurochemistry, in Innsbruck, Austria, in August 2005.

Principal research interests

- *Synaptic transmission and integration.*
- *Development of experimental and theoretical techniques for analysis and interpretation of neuronal signals.*
- *Information processing in neural networks.*

Professional expertise

- *Electrophysiology.*
- *Fluorescence imaging (Ion-sensitive and voltage sensitive dyes).*
- *Optical techniques for caged compounds photolysis.*
- *Computer programming.*
- *Modelling in biophysics and theoretical neuroscience*

Teaching experience

- *University student assistance as post-graduate student in Italy.*
- *Teaching electrophysiology and optical techniques in Plymouth (Micro-electrode and optical workshops organised by David Ogden)*.

REFERENCES

Prof. Enrico Cherubini
Biophysics sector, (SISSA/ISAS), via Beirut 2-4, 34014 Trieste Italy, tel. +39 040 3787223, (cher@sissa.it)

Dr. David Ogden
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tel. +44 20 88162003, (dogden@nimr.mrc.ac.uk)

Dr. Dejan Zecevic
Department of Cellular and Molecular Physiology, Yale University School of Medicine, 333 Cedar Street, New Haven CT 06520 8026, USA, tel. +1 203 7852989, (dejan.zecevic@yale.edu)

Prof. Vincent Torre
Biophysics sector, (SISSA/ISAS), via Beirut 2-4, 34014 Trieste Italy, tel. +39 040 2240470, (torre@sissa.it)

Prof. Fabio Mammano
Dipartimento di fisica Galileo Galilei, via F. Marzolo 8, Padova Italy. (fabio.mammano@unipd.it)

Prof. Alessandro Treves
Biophysics sector, (SISSA/ISAS), Via Beirut 2-4, 34014 Trieste Italy, tel. +39 040 3787426, (ale@limbo.sissa.it)

Prof. Rami Rahamimoff
Department of Physiology, Hebrew University Hadassah Medical School
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Prof. T.V.P. Bliss, F.R.S.
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PUBLICATIONS (in chronological order)

1) ***CANEPARI, M.**, CAMPANI, M., SPADAVECCHIA, L. AND TORRE, V.* (1996). CCD imaging of the electrical activity in the leech nervous system*.* ***European Biophysics Journal***, 24: 359-370.

2) ***CANEPARI, M.** AND TORRE, V.* (1996). Tecniche sperimentali per l'analisi di reti nervose*.* ***Le Scienze** (Italian edition of Scientific American)*, 340: 82-87.

3) ***CANEPARI, M**. AND CAMPANI, M.* (1996). Electrical activity in the leech nervous system can be studied using a CCD imaging technique. In ***Neurobiology: Ionic Channels, Neurons and the Brain**,* (ed. by V.Torre and F.Conti), Plenum press.

4) ***CANEPARI, M**., BOVE, M., MAEDA, E., CAPPELLO, M. AND KAWANA, A*. (1997). Experimental analysis of neuronal dynamics in cultured cortical networks and transitions between different patterns of activity. ***Biological Cybernetics***, 67: 153-162.

5) ***CANEPARI, M**. AND CHERUBINI, E*. (1998). Dynamics of transmitter release: analysis of synaptic responses in CA3 hippocampal neurons following repetitive stimulation of afferent fibres. ***Journal of Neurophysiology***, 79: 1977-1988.

6) ***CANEPARI, M**. AND CHERUBINI, E*. (1998). Dynamics of neurotransmitter release in CA3 hippocampal neurons. In ***Neural Circuits and Networks***, (ed. by V.Torre and J.Nicholls), NATO ASI Series F, Vol. 167, Springer Verlag, Berlin-Heidelberg.

7) ***CANEPARI, M**. AND MAMMANO, F*. (1999). Imaging neuronal calcium fluorescence at high spatio-temporal resolution. ***Journal of Neuroscience Methods***, 87: 1-11.

8) *MAMMANO, F.,* ***CANEPARI, M.**, CAPELLO, G., IJADUOLA, R. B., CUNEI, A., YING, L., FRATNIK, F. AND COLAVITA, A.* (1999). An optical recording system based on a fast CCD sensor for biological imaging. ***Cell Calcium***, 25: 115-123.

9) *COLAVITA, A., CAPELLO, G., IJADUOLA, R. B., CUNEI, A., LAGOSTENA, L.,* ***CANEPARI, M.** AND MAMMANO, F.* (1999) Intracellular gradients of free calcium visualized in sensory and neuronal cells by a high-performance fluorescence imaging system. In ***Optical Diagnostics of Living Cells**.* (ed. by D.L. Farkas, R.C. Leif and B.J. Tromberg) *Proceeding of SPIE, Vol. 3604.*

10) ***CANEPARI, M.**, MAMMANO, F., KACHALSKY, S. G., RAHAMIMOFF, R AND CHERUBINI, E*. *(2000)*. GABA- and glutamate-mediated network activity in the hippocampus of neonatal and juvenile rats revealed by fast calcium imaging. ***Cell Calcium***, 27 :25-33.

11) ***CANEPARI, M.** AND TREVES, A.* (2001) Characterisation of the variability of glutamatergic synaptic responses to presynaptic trains in rat hippocampal pyramidal neurons. ***Network***, 12: 175-198.

12) ***CANEPARI, M.**, PAPAGEORGIOU G., CORRIE J. E. T., WATKINS C. AND OGDEN D.* (2001) The conductance underlying the parallel fibre slow EPSP in rat cerebellar Purkinje neurones studied with photolytic release of L-glutamate. ***Journal of Physiology***, 533: 765-772.

13) *ASHTON, A. C., VOLYNSKI, K. E., LELIANOVA, V. G., ORLOVA, E. V., VAN RENTERGHEM, C.,* ***CANEPARI, M.**, SEAGAR, M. AND USHKARYOV, Y. A.* (2001) Alpha-latrotoxin, acting via two Ca2+-dependent pathways, triggers exocytosis of two pools of synaptic vesicles. ***Journal of Biological Chemistry***, 276: 44695-44703.

14) ***CANEPARI, M.**, NELSON, L., PAPAGEORGIOU G., CORRIE J. E. T. AND OGDEN D.* (2001) Photochemical and pharmacological evaluation of 7-nitroindonyl- and 4-methoxy-7-nitroindonyl-amino acids as novel, fast caged neurotransmitters. ***Journal of Neuroscience Methods***, 112: 29-42.

15) ***CANEPARI, M.** AND OGDEN D.* (2003) Evidence for protein tyrosine phosphatase, tyrosine kinase, and G-protein regulation of the parallel fiber metabotropic slow EPSC of rat cerebellar Purkinje neurons. ***Journal of Neuroscience**,* 23: 4066-4071.

16) *DONATO, R.,* ***CANEPARI, M.,** LAPE, R. AND NISTRI, A.* (2003) Effects of caffeine on the excitability and intracellular Ca2+ transients of neonatal rat hypoglossal motoneurons in vitro. ***Neuroscience Letters***, 346: 177-181.

17) ***CANEPARI, M.**, AUGER, C. AND OGDEN D.* (2004) Ca^{2+} ion permeability and single channel properties of the parallel fibre metabotropic slow EPSC of rat Purkinje neurones. ***Journal of Neuroscience***, 24: 3563-3573.

Research plans

Personal profile and research history

I started my research activity by working on experimental techniques for the analysis of neuronal network activity. At the NTT in Japan, I worked on multi-electrode array recordings from neuronal cultures. In 1995, I worked under the supervision of Prof. V. Torre, on the analysis of electrical activity in the leech nervous system, using the optical technique of voltage sensitive dyes imaging. My PhD thesis at SISSA, under the supervision of Prof. E. Cherubini and Dr. A. Treves, was on short-term plasticity in hippocampal synapses. The project focussed on the understanding of the presynaptic mechanisms underlying facilitation and depression in the hippocampal CA3 area. During my PhD, I was also involved in the development of an imaging system for fast ion imaging in collaboration with Dr. F. Mammano. I used this imaging system to investigate calcium signals generated by GABAergic depolarisation in hippocampal pyramidal neurones of neonatal rats and by electrical activity in hypoglossal motoneurones. My postdoctoral research at NIMR with Dr. D. Ogden has focussed on the slow excitatory postsynaptic current evoked by metabotropic glutamate receptors (mGluR1) at parallel fibre synapses in cerebellar Purkinje neurones in acute brain slices.

I am using flash photolysis to rapidly release L-glutamate from novel caged compounds developed and characterised at the NIMR. My work has demonstrated that the mGluR1 current is mediated by a Ca^{2+} permeable cation conductance with low open probability and sub-pS single channel conductance. It was also found that the mGluR1 current is not mediated by Ca^{2+} release from stores, it is a G-protein dependent mechanism and it is regulated by a tyrosine phosphatase step that couples the mGluR1 to the cation conductance. The mGluR1 current is a putative source of localised Ca^{2+} entry that can play an important role in synaptic plasticity. This signal and Ca^{2+} release from intracellular stores via $InsP_3$ receptors can be observed in the same cell when mGluR1 are activated. I am now focussing on the characterisation of the interaction between these two signals using patch clamp recodings and simultaneous Ca^{2+} imaging. I also started a collaboration with Dr. Dejan Zecevic (Yale University) to do voltage imaging from individual Purkinje neurones.

Future plans

I would like in the near future to establish as an independent scientist and to continue my research activity on cerebellar studies. In mammals, the cerebellum plays and important role in motor coordination. The investigation of synaptic transmission at molecular/cellular/network level in the cerebellum is fundamental to understanding motor behaviours. Purkinje neurones (PN) provide the only output of the cerebellar cortex and synaptic integration occurring in these neurones is crucial in the cerebellar function. In March 2005 I will move to Yale University to work on voltage imaging in PN. The aim is to do an extensive study of electrical activity in different subcellular compartments, claryfying different aspects related to localisation and timing of synaptic signals and plasticity. The question of the propagation and spread of fast signals in PN is crucial to understand synaptic integration. In particular, the study of coincidence of Climbing fibre and Parallel Fibre synaptic potentials, a mechanism needed for Long Term Depression, requires the capability to record local membrane potential changes. As shown in the figure below, this is possible using the protocols developed by Dejan Zecevic.This is for me a unique opportunity since I will be able to work in the laboratory where the voltage imaging technique has been developed and, in particular, with the scientist (Dejan Zecevic) who succeded in recording voltage-dependent optical signals individual neurons (Zecevic, Nature 381: 322-5, 1996; Djurisic at al., J. Neurosci. 24: 6703-14, 2004). The plan is to stay there for 2-3 years, possibly obtaining an individual grant, and then to obtain a permanent academic position, preferably in Europe. To this purpose, I am already looking for outstanding universities or other academic institutions where to continue my career after the Yale experience.