University of Birmingham

Dr Emil Toescu M.D., D.Phil.

Senior Lecturer in Neuroscience

Neurobiology

Contact details

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Qualifications

- MBChB (equivalent) Faculty of Medicine, Institute of Medicine and Pharmacy, University of Bucharest, Romania;
- Doctor-Medic degree, Institute of Medicine and Pharmacy, University of Bucharest, Romania
- D.Phil. degree, Board of Physiological Sciences, Oxford University (Nov. 1990)

Biography

Dr. Toescu graduated the Medical degree in Bucharest, Romania, where he practised general medicine for 1 year and a half, while maintaining an active interest in basic research. After leaving Romania, he arrived at the University of Oxford, where he worked as Departmental Demonstrator in the Dept. of Human Anatomy, while completing a D.Phil. project under the guidance of Drs. J.F. Morris and C.A.R. Boyd. The topic of research was an assessment of the of hormone secretion form the posterior pituitary gland, and the development of a model of secretory nerve terminals from this gland, called neurosecretosomes. After finishing the D.Phil, Dr. Toescu moved to Liverpool, to work with Prof. O.H. Petersen, in the Dept. Physiology, Liverpool University. The topic of research was the study of the mechanisms regulating the generation and propagation of the intracellular Ca^{2+} waves and Ca^{2+} oscillations, with a particular focus on the role of InsP3 and the ER Ca^{2+} stores in controlling such activities. After being offered an academic position in the Department of Physiology, Dr. Toescu moved to the University of Birmingham, where he returned to his interest in neurosciences and developed his current research portfolio, based on the study of the mechanisms of neuronal ageing.

As part of the academic activity, Dr. Toescu organised and continues to takes part in a variety of international scientific meetings and symposia, from meetings organised under the auspices of national learned societies, such as Physiological Society or the British Neuroscience Association, or international organisms, such as the Federation of European Neuroscience Societies.

Dr. Toescu continues to maintain an interest in the development of the scientific establishment in his country of origin, Romania, where he collaborates with a number of research groups from several cities. Research collaboration are also taking place with research groups in Germany, France and Spain

Another important part of Dr. Toescu professional activity is dedicated to the process of public engagement with science, starting from the view that it is important for all scientists to present and engage the public in discussion on science and its methodologies. To this purpose he was the organiser, for a period of 3 years of the Birmingham's Cafe Scientifique, while contributing also to the activities of the national network of Cafes. More recently he organised a city-wide series of events relating to the Brain Awareness Week initiative, including a Festival of Neurosciences.

Teaching

MBChB

- 1st year: Respiratory module (SGTs); Digestive module (lectures & SGTs)
- 2nd year: Cardiovascular module (SGTs); also SP1 modules: "Normal Brain Ageing" and "Meditation in Medicine"
- 3rd year: SP2: "Normal Brain Ageing"

BMedSci

- 3rd year – "Neuroscience III" Module (5 lectures) and "Neurobiology of the brain" Module (3 Lectures)

Postgraduate supervision

Dr. Toescu is interested in supervising doctoral research students in the following areas:

- **Neurophysiology of Normal Brain Ageing** – the role of the triad Ca^{2+} homeostasis – mitochondrial dysfunction – free radicals in mediating the changes in neuronal function with age.
- **Management of the increased neuronal vulnerability with ageing** – interventional studies testing and devising compounds and processes that could reduce the increased neuronal vulnerability shown by the aged neurons.
- **Cellular basis of cognitive dysfunctions in normal brain ageing**- correlating cognitive performance *in vivo* and *in vitro* animal models of normal ageing with the neuronal network properties and assessing the cellular mechanisms (metabolic, electrophysiological) that explain such changes.

If you are interesting in studying any of these subject areas please contact Dr. Toescu on the contact details above.

Research

Normal ageing is associated with a degree of decline in a number of cognitive functions. Apart from the issues raised by the current attempts to expand the lifespan,

understanding the mechanisms and the detailed metabolic interactions involved in the process of normal neuronal ageing continues to be a challenge for developing and implementing programs of healthy ageing.

Metabolic basis of neuronal ageing

One model that attempt to explain the age-dependent cognitive impairment, views neuronal ageing as a metabolic state characterized by an altered function of the metabolic triad: intracellular Ca^{2+}–mitochondria–reactive oxygen species (free radicals). We have shown that one of the most reproducible effect of ageing on neuronal Ca^{2+} homeostasis is a level-dependent decrease in the capacity of neurones to recover the resting Ca^{2+} values after stimulation. We also showed that in the aged neurones the mitochondrial population is chronically depolarised, a process that might involve a chronic flicker activation of the mitochondrial permeability transition pore (mPTP). The combined effect of these metabolic changes generate a state of decreased homeostatic reserve, in which the aged neurons could maintain adequate function only during normal activity, as demonstrated by the fact that normal ageing is not associated with widespread neuronal loss, but become increasingly vulnerable to the effects of excessive metabolic loads, usually associated with trauma, ischaemia or neurodegenerative processes.

Age-dependent changes in neuronal networks activity

In collaboration with Dr. M. Vreugdenhil, we showed that one type of neuronal network oscillation activity that has been implicated in mediating some forms of cognitive activity, the gamma frequency range (30-80 Hz), is significantly attenuated in the aged animals. Further studies showed again that the age-dependent functional changes are not present in resting conditions, and become manifest only at higher levels of stimulation and activity. In the absence of exogenous excitatory stimulation, the spontaneous gamma oscillation power, intrinsic firing properties and intracellular calcium levels of CA3 interneurons were unaffected by age. In contrast, when kainate provided an exogenous excitatory drive, ageing was associated with reduced gamma oscillation power, increased sAHP and mAHP amplitude and larger intracellular calcium transients in interneurons. Further characterization of the role of interneurones and definition of protocols of intervention to improve the performance of these neurones are currently under way.

Other activities

Professional engagements

Grant reviewer:

- MRC,
- BBSRC,
- EU grants (ERA-Net Neurone);
- German Ministry of Science,
- Romanian's Ministry of Science and Education.

Member Editorial Boards:

- Frontiers Neuroscience (Aging section),
- Cell Calcium,
- Journal of Cellular and Molecular Medicine,
- Journal of Medicine and Life.

Peer reviewing:

- Cell Calcium
- Frontiers Neuroscience
- Eur Journal of Neuroscience
- J. Neurochemistry
- Aging Cell

Lectures and presentations at Conferences

- Position paper at the "**Diaspora in Cercetarea Stiintifica si Invatamantul Superior din Romania**" organized by the Romanian Government, September 2010, Bucharest.
- Lecture at the Exploratory Workshop "**New perspective in the investigations of brain function**", Sept. 2010, Bucharest.
- Lecture at the **6th Congress of the Society for the Study of Neuroprotection and Neuroplasticity**, July 2010, Eforie, Romania
- Speaker at the 2nd Joint **Congress of the Global College of Neuroprotection and Neuroregeneration and Society for the Study of Neuroprotection and Neuroplasticity**, March 2009; Vienna
- Invited Speaker at the **Participation of Diaspora in Romanian Science** Conference, Sept. 2008, Bucharest, Romania.
- Invited **Raporteur International Neuroscience Research – lesssons for Romania at the Participation of Diaspora in Romanian Science** Conference, Sept. 2008, Bucharest, Romania.
- Key-note Speaker at the **First Joint Congress of the Global College of Neuroprotection and Neuroregeneration and Society for the Study of Neuroprotection and Neuroplasticity**, March 2008; Bucharest.

Public Engagement with Science:

- Organiser of the Brain Awareness Week 2011 for the University of Birmingham, events including: **Neurosciences in the Schools, Neurosciences in the Evening** and the **Festival of Neurosciences.**
- Organiser of the Brain Awareness Week 2010
- Organiser of Birmingham's Cafe Scientifique

Publications

Lu CB, Jefferys JG, Toescu EC, Vreugdenhil M.(2010) In vitro hippocampal gamma oscillation power as an index of in vivo CA3 gamma oscillation strength and spatial reference memory. **Neurobiol Learn Mem**. (Nov 18).PMID: 21093596

Toescu EC, Vreugdenhil M. (2010) Calcium and normal brain ageing. **Cell Calcium** 47(2):158-64.

Lu CB, Hamilton JB, Powell AD, Toescu EC, Vreugdenhil M. (2009) Effect of ageing on CA3 interneuron sAHP and gamma oscillations is activity-dependent. **Neurobiol**

Aging PMID: 19523715.

Popescu BO, Toescu EC, Popescu LM, Bajenaru O, Muresanu DF, Schultzberg M, Bogdanovic N. (2009) Blood-brain barrier alterations in ageing and dementia. **J Neurol Sci**. 283(1-2):99-106.

Powell AD, Toescu EC, Collinge J, Jefferys JG (2008) Alterations in Ca2+-buffering in prion-null mice: association with reduced afterhyperpolarizations in CA1 hippocampal neurons. **J Neurosci**. 28(15):3877-86.

Toescu EC, Verkhratsky A. (2007) The importance of being subtle: small changes in calcium homeostasis control cognitive decline in normal aging. **Aging Cell**. 6(3):267-73

Verkhratsky A, Toescu EC. (2006) Neuronal-glial networks as substrate for CNS integration. **J Cell Mol Med**. 10:826-36.

Balthasar S, Samulin J, Ahlgren H, Bergelin N, Lundqvist M, Toescu EC, Eggo MC, Tornquist K (2006).- Sphingosine 1-phosphate receptor expression profile and regulation of migration in human thyroid cancer cells. **Biochem J**. 15;398(3):547-56.