Brenda Milner

2009 Balzan Prize for Cognitive Neurosciences
For her pioneering studies of the role of the hippocampus in the formation of memory and her identification of different kinds of memory system.

Hemispheric Interaction in Cognitive Processes

Montreal Neurological Institute at McGill University
Adviser for the General Balzan Committee: John Krebs

Brenda Milner will devote the second part of the 2009 Balzan Prize for Cognitive Neurosciences to recruit several post-doctoral fellows from well-established neuroimaging labs. The young researchers will work under her supervision at the Montreal Neurological Institute at McGill University, using functional imaging to explore the issue of hemispheric interaction in cognitive processes, first in healthy volunteers, and possibly later in selected neurosurgical patients. A recent study from Marcus Raichle's lab (Johnston J.M., et al., *Loss of resting interhemispheric functional connectivity after complete section of the corpus callosum*, "Journal of Cognitive Neuroscience", 28:6453–645, 2008), Washington University in St. Louis School of Medicine, uses functional magnetic resonance imaging to explore changes in resting interhemispheric connectivity after complete section of the corpus callosum in a 6-year old child, thus suggesting a powerful methodological approach.
Brenda Milner began her research project with a "brainstorming" session in Montreal, focused on the development of the appropriate experimental paradigms and involving researchers including Marcus Raichle. The *Workshop on Hemispheric Interaction* was held on April 21, 2010 at the Montreal Neurological Institute & Hospital (MNI). It was attended by Joelle Crane (MNI), Simon Eickhoff (University Hospital Aachen, Germany), Alan Evans (MNI), Stefan Köhler (University of Western Ontario), Hesheng Lui (Massachusetts General Hospital and Harvard Medical School), Brenda Milner, Morris Moscovitch (University of Toronto), Marcus Raichle (Washington University), Kate Watkins (Oxford University), and Robert Zatorre (MNI).
Since the early stages of her career, Brenda Milner has worked on delineating the differing and complementary specializations of the left and right cerebral hemispheres of the human brain (Milner, B., *Hemispheric specialization: Scope and limits*. In *The Neurosciences: Third Study Program*, F.O. Schmitt and F.G. Worden (Editors), Cambridge, Mass., MIT Press, pp. 75-89, 1974). In particular, in the domain of memory,

she has used special tasks with patients undergoing unilateral temporal-lobe removals for the relief of epilepsy to demonstrate material-specific deficits that vary with the side of the lesion. These laterality effects were even more striking in the case of Sperry's patients tested after cerebral commissurotomy. However, in working with the commissurotomized patients, and comparing their results with those of a matched group of patients in Montreal with intact commissures, it became evident to Brenda Milner and others that each hemisphere acting alone was severely handicapped on memory tasks (Milner, B. and Taylor, L.B., *Right-hemisphere superiority in tactile pattern-recognition after cerebral commissurotomy: Evidence for nonverbal memory*, "Neuropsychologia", 10, 1-15, 1972). This excited her interest in further exploring how the two hemispheres work together, both in health and disease. Subsequently, functional imaging studies have shown, for example: increasing bilaterality of involvement in normal healthy subjects as they grow older (Reuter-Lorenz P., Jonides J., et al., *Age differences in the frontal lateralization of verbal and spatial working memory revealed by PET,* "Journal of Cognitive Neuroscience", 12:174–187, 2000); and increasing involvement of the right hemisphere, as verbal tasks become more demanding. The aim of the research project funded with the second part of her Balzan Prize is to gain a better understanding of the significance of such "recruitment".

Statement by the Prizewinner: *I wish to thank the Balzan Foundation for the challenge they have set me in dedicating half of this Prize to new research, preferably involving young scientists. Not many people at this late stage in their careers are given such an opportunity to engage with the future, and I am grateful for it. In the coming months, with selected young colleagues, I plan to explore further the ways in which the left and right hemispheres of the human brain interact in response to varying cognitive demands or to brain disease. This is still a relatively uncharted field.* Brenda Milner (Berne, 20.11.2009)