ADDRESS BY PROFESSOR ROGER LEMON
RECIPIENT OF THE INTERNATIONAL PRIZE 2015 OF FYSSEN FOUNDATION

Monsieur President, Vice-President, Members of the Fyssen Council, Ladies and Gentlemen, dear colleagues:

I should like to express my deep thanks to the Fondation Fyssen for awarding me the prestigious Fyssen International Prize for 2015.

I should also like to thank my family and my many scientific colleagues who all contributed in their various ways to the work that was honoured by this Prize.

My lecture this evening is entitled **"The Hand: a window on to the mind".**

I will begin by talking about the importance of the human hand in human culture, communication, technology and evolution. I shall emphasise the enormous versatility of the human hand in exploring and shaping the world around us. This versatility comes partly from the skeletal and muscular structures of the hand itself. But major roles are played by the advanced neural systems controlling the hand. A sophisticated sensory system interprets tactile information coming from the hand. A specialised motor system delivers motor commands to the many different muscles of the hand. These 30-odd muscles act to position the hand and to move its digits. Skilled hand movements are guided both by touch and by vision, so the process is a sensori-motor phenomenon.

I shall describe the anatomy and function of the neural mechanisms characteristic of the human hand control system. We share these with some of our primate relatives. In particular, I shall elaborate the late evolution of direct control of hand muscles from the primary motor cortex, via the fibres of the corticospinal tract. This cortico-motoneuronal system allows the brain to orchestrate the huge motor repertoire of the grasping hand.

I shall go on to show that these direct corticospinal projections are particularly well developed in dexterous, tool-using monkeys and apes. I shall demonstrate that the cortical neurons making these connections are actively involved in the use of a tool.

I shall then consider this hand control system in the light of the discovery of the mirror neuron system by Giacomo Rizzolatti, Vittorio Gallese and their colleagues. We have recently shown that some of the neurons contributing fibres to the corticospinal tract show 'mirror' properties. This means that they are active not only when you perform a skilled grasp yourself, but also when you observe a similar grasp performed by another person. Using the brain's own vocabulary for active grasp as a reference, the mirror neuron system allows for rapid identification of the nature and purpose of the actions of others.

The discovery of mirror neurons has had a major impact on theories of mind and social neuroscience. However, it also has implications for our own actions and, in particular, the suppression of unwanted movement.

I will have emphasised the many advantages for versatile hand control conferred by the primate sensorimotor control system. But we also need to recognise that unfortunately this evolutionarily advanced system is especially vulnerable to neurological damage and disease. I shall finish by briefly talking about how basic research in experimental primates is helping to understand motoneurone disease, stroke and spinal injury, and, in some cases, leading to new therapeutic approaches.

With your kind consent, I will now continue my lecture in English.

Roger Lemon