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ANTONIO BORSELLINO COLLEGE ON NEUROPHYSICS

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"The Structural Basis of Interhemispheric Interactions"

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These are preliminary lecture notes, intended only for distribution to participants.

THE STRUCTURAL BASIS OF INTERHEMISPHERIC INTERACTIONS

Introduction

The brain conforms to the general, bilateral symmetry of body pattern.

Functional integration between the hemispheres uses:i) bilateral projections, ii) commissures. Some brains, notably the human brain deviate from perfect symmetry. In these brains commissures partially restore the functional equivalence of the hemispheres.

The two telencephalic commissures: corpus callosum and anterior commissure interconnect different territories of the two hemispheres; their degree of separation varied in evolution.

Size and shape of the corpus callosum differ across individuals. Differences may relate to genetic factors, sex and/or handedness. The cellular correlates of these differences are unclear.

Commissural connections provide a model for the study of cortical connectivity.

Systemic aspects of callosal connections

Callosal axons interconnect corresponding and non-corresponding locations in the two hemispheres.

Each area is interconnected with its own, characteristic set of areas in the contralateral hemisphere. Concepts of feed-forward and feed-back connectivity apply to the callosal connections.

Not all sensory areas are equally connected by the corpus callosum. Primary sensory areas are relatively devoid of callosal connections.

Callosal connections terminate, and less clearly originate in "columns" whose meaning varies across areas.

Cellular aspects of callosal connections

Callosal axons originate from neurons with cell body in the supragranular (mainly) or infragranular (some) layers. These neurons belong, with a few exceptions, to the pyramidal type.

The targets of callosal axons include other pyramidal neurons and probably non-pyramidal, inhibitory neurons.

Callosal axons perform two operations computational in nature: spatial mapping and, probably, control of activation delays between columns of the two hemispheres or of the same hemisphere.

G.M. Innocenti, May, 1995

EXUBERANCE IN CORTICAL DEVELOPMENT AND ITS RELATION TO DEVELOPMENTAL PLASTICITY

Regression of dendritic processes.

Loss of projections. Qualitative and quantitative aspects.

Early deprivations and lesions can alter the process of maintenance and elimination of cortical projections

Lyon's syndrome and the problem of molecular changes responsible for axonal stabilization

The development of axonal morphologies

Development of connections through progressively restricted exuberant growth

G.M. Innocenti, May 1995

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