Giorgio M. Innocenti – Selected references

Innocenti, G. M. (2011). Development and evolution: two determinants of cortical connectivity. *Progress in Brain Research, 189,* 65-75.
Notes: The production of genotypic and phenotypic diversity (differentiation) is the final outcome of both development and evolution, of nervous systems and of their components. Cortical axons, in particular, differentiate into a variety of phenotypes which are responsible for computational transformations of messages exchanged among neurons. One aspect of this differentiation concerns axon diameters whose diversity in development, but also within and across species, is enhanced by the addition of a relatively small proportion of thicker axons to some axonal pathways. This, combined with differences in the length of pathways and in brain volumes, has rescaled and expanded the temporal range of interneuronal communication. In both development and evolution, this and other aspects of axonal phenotypes, namely the structure and distribution of axonal arbors, differentiate by the combined action of cell intrinsic (genetic) variation, overproduction, and selection by the environment
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Innocenti, G. M., Caminiti, R., & Hof, P. R. (2010). Fiber composition in the planum temporale sector of the corpus callosum in chimpanzee and human. *Brain Struct.Funct., 215,* 123-128.
Notes: In humans the planum temporale is usually larger in the left hemisphere and related to Wernicke's language complex. A slighter leftward asymmetry, unrelated to vocal perception, was reported in the chimpanzee. Searching for differences between the human brain and that of the chimpanzee, we analyzed the fiber composition in the sector of the corpus callosum containing fibers from the planum temporale. This sector was identified in chimpanzee and human myelin-stained materials by comparison with anatomical tract-tracing in the macaque monkey. The axon diameters in the planum temporale sector of the corpus callosum were not different in human and chimpanzee, suggesting that this feature of the output of the planum temporale was preserved since the common ancestor of both species and may not be uniquely related to language. However, the larger size of the human brain probably amplified slow and temporally dispersed conduction between the hemispheres. A trend with thicker axons dorsally and thinner axons ventrally in the corpus callosum was evident in human brain, but was much weaker, or absent in the chimpanzee
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Innocenti, G. M. (2009). Dynamic interactions between the cerebral hemispheres. *Experimental Brain Research, 192,* 417-423.
Notes: The cortical areas of the two hemispheres interact via the corpus callosum. This paper reviews recent findings in animals and man, showing that the visual areas of the two hemispheres control each other's dynamics. The interaction is stimulus-dependent and stimulus-specific. It consists of both excitatory and inhibitory inputs controlling the formation of synchronous neuronal assemblies across and within the hemispheres. The findings are consistent with the geometry of callosal axons and their inferred computational properties. These are the first findings to suggest a direct relationship between the geometry of cortical connections, and the formation of stimulus-driven synchronous neuronal assemblies

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Innocenti, G. M. (2007). Subcortical regulation of cortical development: some effects of early, selective deprivations. *Progress in Brain Research, 164*, 23-37.
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Selective deprivations, such as the lack of sensory input, of social contacts and of language during the critical (sensitive) period of brain development have profound consequences for the structure and function of the adult brain. The field is largely uncharted since only the consequences of the most severe forms of deprivation are known, and that too only in a few systems. It is similarly unknown if the opposite of deprivation, selective over-stimulation in development, which appears to enhance the acquisition of certain skills, for example musical skills, has collateral deprivation-like effects in other domains. In spite of these uncertainties, I propose that the common mechanism underlying the effects of deprivation may be the altered stabilization of neuronal morphologies, particularly connectivity, in the period when their exuberant development is down regulated

Innocenti, G. M. & Price, D. J. (2005). Exuberance in the development of cortical networks. *Nature Reviews Neuroscience, 6,* 955-965.
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The cerebral cortex is the largest and most intricately connected part of the mammalian brain. Its size and complexity has increased during the course of evolution, allowing improvements in old functions and causing the emergence of new ones, such as language. This has expanded the behavioural and cognitive repertoire of different species and has determined their competitive success. To allow the relatively rapid emergence of large evolutionary changes in a structure of such importance and complexity, the mechanisms by which cortical circuitry develops must be flexible and yet robust against changes that could disrupt the normal functions of the networks

Restrepo, C. E., Manger, P. R., Spenger, C., & Innocenti, G. M. (2003). Immature cortex lesions alter retinotopic maps and interhemispheric connections. *Annals of Neurology, 54,* 51-65.
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Unilateral lesions of the occipital visual areas performed on postnatal day 5 (P5) in the ferret are not compensated by the appearance, in the lesioned hemisphere, of visual responses at ectopic locations. Instead, when parts of the visual areas are spared, they show abnormal retinotopic organizations; furthermore, callosal connections are abnormally distributed in relation to the retinotopic maps. Lesions that completely eliminate the visual areas including the posterior parietal cortex cause the appearance of abnormal callosal connections from the primary somatosensory cortex on the lesion side to the contralateral, intact, posterior parietal cortex. The occipital visual areas (17, 18, 19, and 21) of the intact hemisphere show a normal retinotopy but lose callosal connections in territories homotopic to the lesions. These findings clarify the nature and limits of structural developmental plasticity in the visual cortex. Early in life, certain regions of cortex have been irreversibly allocated to the visual areas, but two properties defining the areas, that is, retinotopy and connections, remain modifiable. The findings might be relevant for understanding the consequences of early-onset visual cortical lesions in humans