UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Mr Imaging Of Normal And Pathological Human Brain Development

2627-122R-20

Title

Magnetic Resonce Imaging Of Normal And Pathological Human Brain Development

Teacher(s)

Giovanni Palumbo

Language

English

Short description

"Magnetic Resonance Imaging Of Normal And Pathological Human Brain Development" is an intensive four-part seminar series designed specifically for neuroscience PhD students seeking to bridge the gap between cellular neurobiology and advanced in vivo neuroimaging. The human brain undergoes an extraordinarily complex, precisely orchestrated sequence of developmental events from early fetal life through adolescence. Understanding these processes—and how they go awry—is fundamental to both basic neuroscientific inquiry and clinical translation. This course provides a comprehensive framework for understanding how state-of-the-art MRI can map, quantify,

and track the transforming brain. We will begin by exploring the radiological milestones of normal structural maturation, including fetal cortical folding, the predictable spatiotemporal patterns of white matter myelination, and the changing tissue contrasts of T1- and T2-weighted sequences in infancy. Moving beyond conventional imaging, the course highlights advanced modalities such as Diffusion Tensor Imaging (DTI) and tractography, alongside resting-state functional MRI (rs-fMRI), to illustrate how structural and functional connectomes dynamically assemble during early human life.
The second half of the course transitions from physiological milestones to pathology, examining the morphological and microstructural disruptions that characterize developmental anomalies. Students will analyze the distinct MRI signatures of congenital malformations of cortical development—spanning proliferation, migration, and post-migrational organization disorders. We will also investigate the imaging phenotypes of acquired perinatal insults, such as hypoxic-ischemic encephalopathy (HIE) and white matter injury in the premature infant, concluding with an exploration of the structural correlates of broader neurodevelopmental disorders like autism spectrum conditions.
By integrating real-world clinical neuroradiology cases with neurobiological mechanisms, this course equips translational researchers with the critical visual and analytical tools required to interpret developing brain anatomy. Ultimately, students will gain a deeper competency in leveraging imaging phenotypes, understanding the limitations of developmental imaging data, and applying these insights directly to their own neuroscience research paradigms.

CFU / Hours

1 CFU / 8 hours

Teaching period

may

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING