MBB-1405: Multicellular Organization of Life

Thursday 18/1/2018
Introduction to development (D. Alexandraki) 2h 10:00-12:00
- How different cells become different (Are there common principles in development?)
- Cell autonomous versus non-autonomous mechanisms
- Asymmetric cell division, Organizers and long range patterning by morphogens, Pattern formation
- Concepts of cell fate (fate maps), cell specification, commitment and differentiation, de-differentiation, regeneration
- Genetic toolbox, Evo-Devo, Current approaches to old problems

Long range patterning: regulatory cascade in early Drosophila embryo (D. Alexandraki) 2h 13:00-15:00
- Introduction to early drosophila development (oogenesis, blastoderm)
- Experimental embryology, genetic and molecular approaches
- Progressive subdivision of the embryo through a regulatory cascade
- Maternal gradients, gap domains, pair rule and segmental stripes
- Regulatory interactions at each level
- cis–trans interactions (quantitative-qualitative, time and space specific)

Friday 19/1/2018
Principles of developmental fate decisions –Morphogens C. Delidakis 2h 10:00-12:00
- Determinants vs morphogens
- Organization of animal tissues into compartments
- Transcriptional response to morphogen signaling
- Morphogen dispersal modes: diffusion, transcytosis or direct delivery?

Plant versus animal development K. Kalantidis 2h 13:00-15:00
- Introduction to plant development
- Differences between plant and animal development

Monday 22/1/2018
How morphogens regulate tissue growth C. Delidakis 2h 10:00-12:00
- Distinction between growth and proliferation
- Morphogen crosstalk with insulin receptor and Hippo pathways

Plant development K. Kalantidis 2h 13:00-15:00
- Shoot apical meristem development
- Leaf development, specification of leaf polarity

Tuesday 23/1/2018
Localized determinants and asymmetric stem cell divisions C. Delidakis 2h 10:00-12:00
- Introduction to Drosophila neurogenesis
- The molecular machinery that ensures asymmetric segregation of fate determinants in Drosophila neural stem cells
- Function of determinants
- Comparison with mammalian neural stem cells
- Aberrant determinant segregation and tumorigenesis

Stem cells (G. Mavrothalassitis) 2h 13:00-15:00
Totalipotent and pluripotent stem cells
Embryonic stem cells; Mouse vs Human differences and similarities
Adult stem cells and fate switching; myths and reality
The stem cell niche; factors contributing in maintenance and differentiation
Cancer stem cells vs normal adult stem cells; are they really different?

**Wednesday 24/1/2018**
Papers/discussion: (K. Kalantidis) 2h 10:00-12:00
Papers/discussion: C. Delidakis 2h 13:00-15:00

**Thursday 25/1/2018**
Neural tube patterning in the vertebrate CNS (V. Nikoletopoulou) 2h 10:00-12:00
- AP and DV patterning of the neural tube (Hox genes, retinoic acid, shh, BMPs)
- Generation of secondary signaling centers in brain (forebrain, ZLI, isthmic organizer)
- Spinal cord: dorsal and motor neuron progenitor domains and diversity
- Neuronal migration, generation of layers
- Radial vs tangential migration, signals

Axon pathfinding and migration (M. Savvaki) 2h 13:00-15:00
- Neuronal extension - the growth cone
- Axon guidance introduction: concepts and families of molecules
- Midline crossing (Drosophila, vertebrates).
- Morphogens as axon guidance signals
- Intracellular events

**Friday 26/1/2018**
Neuronal cell fate in development and aging: the role of Neurotrophins (G. Charalampopoulos) 2h 10:00-12:00
- Neurotrophic theory in nervous system development
- Neurotrophins and their receptors as regulators of neuronal survival and cell death
- Neurotrophins role in neuro/glia-regeneration and adult neurogenesis
- The pharmacology of neurotrophins

**Monday 29/1/2018**
Papers/discussion: neural induction in vertebrates (V. Nikoletopoulou) 10:00-12:00
Papers/discussion: Neuronal migration and axon guidance (M. Savvaki) 13:00-15:00

Genetics of cognition and behaviour I  M. Monastirioti 2h 13:00-15:00
- How an organism acquires specific behavioral patterns as a response to environmental changes
- Introduction to memory and memory types
- Genetics of associative learning (Drosophila)
Tuesday 30/1/2018 HOLIDAY

Wednesday 31/1/2018

M. Monastirioti 2h 10:00-12:00
Cellular models for short and long term memory (Aplysia, Mouse, molecules and mechanisms)
Mechanisms of synapse marking
Mechanisms of synapse changes during long term memory

Papers/discussion: (C. Delidakis) 2h 13:00-15:00

Thursday 1/2/2018

Hematopoiesis: a human perspective (C. Pontikoglou) 2h 10:00-12:00
Overview of primitive and adult hematopoiesis
Transcriptional regulation of hematopoietic stem cells
Stem cell niches within the Bone Marrow

Zebrafish as an animal model in biomedical research (M. Pavlidis) 13:00-15:00
- The zebrafish as an animal model (pros & cons)
- Husbandry and the life-cycle in captivity
- Application of zebrafish in biomedical research
- Zebrafish as an emerging model in stress neurobiology

Friday 2/2/2018

Immune regulation, autoimmunity and immunotherapy in humans (G. Bertsias) 2h 10:00-12:00
Overview of the normal immune response
Homeostatic mechanisms in the immune response
Autoimmunity: general concepts
General approaches to immunotherapy
Biologic therapy

Mechanisms of Innate/Adaptive immunity (C. Spilianakis) 2h 13:00-15:00
Properties and overview of Immune responses
Innate Immunity
Cells and tissues of the Adaptive Immune System

Monday 5/2/2018

Papers/discussion: cognition and behavior (M. Genetics of cognition and behaviour II Monastirioti) 2h 10:00-12:00

Papers/discussion: mechanisms of adaptive immunity (C. Spilianakis) 2h 13:00-15:00
A Long Noncoding RNA Mediates Both Activation and Repression of Immune Response Genes
Tuesday 6/2/2018

Protozoan life cycles, host-pathogen interactions (I. Siden-Kiamos) 3h 10:00-13:00

Introduction to protozoan parasites
Giardia, Trypanosoma brucei: Life cycles, cell biology, antigenic variation
Plasmodium: Life cycle, cell invasion/motility, antigenic variation, modification of host cells

Wednesday 7/2/2018

Phagosome biogenesis, Host-fungal interplay, molecular mechanisms of immunodeficiency (G. Chamilos) 2h 10:00-12:00

Signaling pathways regulating phagosome maturation
Pathogenetic mechanisms of phagosome maturation arrest induced by airborne fungi
Congenital and acquired mechanisms of immunodeficiency at the phagosome level

Innate Immunity in Plants: The role of NLR receptors in plant-microbe interactions (P. Sarris) 13:00-15:00

• Why is it important to study plant immunity?
• Innate immunity in Plants, different types of immune receptors; a comparison to mammalian innate immunity.
• Signaling pathways to defense activation.
• Plant-pathogen virulence strategies

Thursday 8/2/2018

Round table discussion – C. Delidakis 10:00-11:00

Wednesday 14/2/2018

Final exam 10:00-13:00

Students will be continuously evaluated by their performance in discussion sessions and overall class participation. This, together with the final exam, will count towards their final grade (30% oral – 70% written).