ΒΙΟ 1405 Πολυκυτταρική Οργάνωση Ζωής
Multicellular Organization of Life
Δεκέμβριος-Ιανουάριος/ Διάρκεια: 5 εβδομάδες
PART A: Development and aging
Principles of developmental fate decisions –Morphogens - C. Delidakis (2h)
Determinants vs morphogens
Organization of animal tissues into compartments
Transcriptional response to morphogen signaling
Morphogen dispersal modes: diffusion, transcytosis or direct delivery?
Evolutionary Developmental Biology - A. Pavlopoulos (2h)
- History, scope and basic concepts of EvoDevo
- Phylogeny and developmental genetic toolkit of animals
- Evolution of developmental programs and morphological diversity
How morphogens regulate tissue growth - C. Delidakis (2h)
Distinction between growth and proliferation
Morphogen crosstalk with insulin receptor and Hippo pathways
Plant development - K. Kalantidis (2h)
Shoot apical meristem development
Leaf development, specification of leaf polarity
Localized determinants and asymmetric stem cell divisions - C. Delidakis (2h)
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
Plant versus animal development - K. Kalantidis (2h)
Introduction to plant development
Differences between plant and animal development
Papers/discussion: Morphogens and localised determinants - C. Delidakis (2h)
Trajectory analysis of cell fates - M. Lavigne (2h)
Gene regulatory networks
Trajectory analysis and systems approaches to decipher multicellular mechanisms
Transcription factor molecular behavior - D. Papadopoulos (2h)
Methods to study transcription factor concetration and chromatin-binding kinetics
Sources of noise, regulation of transcription factor variability
Formation of biomolecular condensates
Reactive oxygen species in health and disease - D. Bazopoulou (2h)
Molecular Basis of Redox Signaling
Measuring ROS: Methods and Applications
Redox Homeostasis during Aging and Stress
Antioxidants and Pro-oxidants: Benefits and Misconceptions
Physical basis of development - A. Pavlopoulos (2h)
- Beyond a gene-centric view of development
- Morphogenetic cell and tissue dynamics
- Mechanical properties and physical forces in developmental processes
Molecular motors and mechanical sensing-emphasis on plants - P. Moschou (2h)
paper/discussion - D. Bazopoulou (2h)

Transcription factor concentration and kinetics in development and disease - D. Papadopoulos (2h)
Transcription factor dynamics in developmental decisions
Transcription factor haploinsufficiencies and human disease
paper/discussion - D. Papadopoulos (1.5h)
PART B: NEUROBIOLOGY
Neuronal cell fate in development and aging: the role of Neurotrophins (G. Charalampopoulos) 2h
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
Axon pathfinding and migration (D. Karagogeos) 2h
Neuronal extension - the growth cone
Axon guidance introduction: concepts and families of molecules
Midline crossing (Drosophila, vertebrates).
Morphogens as axon guidance signals
Intracellular events
Genetics of cognition and behaviour I M. Monastirioti 2h
How an organism acquires specific behavioral patterns as a response to environmental changes
Introduction to memory and memory types
Genetics of associative learning (Drosophila)
Introduction to computational neuroscience - simplified neuron models (Y. Poirazi) 2h
Genetics of cognition and behaviour II M. Monastirioti 2h
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
Functional maps M.Froudarakis
Detailed biophysical neuron models (Y. Poirazi) 2h
Axonal growth in health and disease/ adult neurogenesis M. Vidaki 3h
Papers/discussion: Models complementing experiments (Y. Poirazi) 1h
PART C: INFECTIONS AND IMMUNITY
Signal transduction pathways in innate and adaptive immune responses - C. Tsatsanis (2h)
Signal transduction pathways in innate and adaptive immune responses
Regulation of metabolic inflammation and the role of the adipose tissue
Interaction of the immune system with the gut microbiome
Mechanisms of Innate/Adaptive immunity - G. Bertsias (2h)
Properties and overview of Immune responses
Innate Immunity
Cells and tissues of the Adaptive Immune System
Molecular mechanisms of phagosome biogenesis in Health and Disease - G. Chamilos (2h)
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

Major arthropod-borne diseases and modulation of vertebrate host homeostasis - M. Kotsyfakis (3h) ок
Malaria, Dengue Fever, Lyme Disease
Arthropod Salivary Gland Role
Modulation of Host Homeostasis
Potential Therapeutic Targets
Research Implications
Immune regulation, autoimmunity and immunotherapy in humans - G. Bertsias (2h)
Homeostatic mechanisms in the immune response
Autoimmunity: general concepts
General approaches to immunotherapy - Biologic therapy
Innate Immunity in Plants: The role of NLR receptors in plant-microbe interactions (P. Sarris)
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
Papers/ discussion Infection & Immunity 1 - G. Chamilos (2h)
Immunometabolism and host defense
Hematopoiesis: a human perspective (C. Pontikoglou) 2h
Overview of primitive and adult hematopoiesis
Transcriptional regulation of hematopoietic stem cells
Stem cell niches witihin the Bone Marrow
Tumour Immunology - I. Keklikoglou (2h)
Papers/ discussion Infection & Immunity 2 Regulation of innate immune responses - C. Tsatsanis (2h)
Papers/discussion: mechanisms of adaptive immunity - G. Bertsias (2h)
Paper discussion - I. Keklikoglou (1h)
Papers/discussion: cognition and behavior (M. Monastirioti) 2h
Round table discussion – A. Pavlopoulos, M. Vidaki, G. Bertsias et al.
Final exam
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).