MBB-1405: Multicellular Organization of Life (2010-2011)

Friday 3/12

1. Introduction to development (Michalis Averof), 2hr **(10.00-12.00)**
   How different cells become different (Are there common principles in development?)
   Cell autonomous versus non-autonomous mechanisms
   Organizers and long range patterning by morphogens
   Concepts of cell fate (fate maps), cell specification, commitment and differentiation

Monday 6/12

2. Cell fate specification: neural cell type specification (Christos Delidakis), 2hr **(9.00-11.00)**
   Introduction to Drosophila CNS development
   The different steps needed to make a neuron- spatial info, lateral inhibition, temporal info.
   Stem cell maintenance vs differentiation by asymmetric cell division
   Intrinsic and extrinsic factors in asymmetric progenitor divisions

Tuesday 7/12

3. Long range patterning: regulatory cascade in early Drosophila embryo (Michalis Averof), 2hr **(11.00-13.00)**
   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

4. Long range patterning: morphogen gradient formation and readout (Christos Delidakis), 2hr **(13.00-15.00)**
   Long range patterning in the wing disc
   Morphogen gradients versus signal relay
   Cell biology of morphogen gradient formation, factors that shape gradients
   Readout of positional values from the gradient

Wednesday 8/12

5. Growth control (Christos Delidakis), 2hr **(10.00-12.00)**
   Growth vs proliferation, differences and mutual dependence
   Growth of an organ primordium – example: the fly wing
   Role of morphogens in orchestrating correctly proportioned growth
   Apoptosis, compensatory growth and cell competition

6. Stem cells (George Mavrothalassitis), 2hr **(13.00-15.00)**
   Totipotent 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?

Thursday 9/12

Friday 10/12

7. Ageing (Nektarios Tavernarakis), 2hr **(10.00-12.00)**
   Insulin/IGF-1 signaling
   Caloric restriction
   Cellular energy metabolism

Cellular repair and maintenance
Age-associated disorders
Evolution of ageing

8. Plant versus animal development (Kriton Kalantidis), 2hr **(13.00-15.00)**
   Introduction to plant development
   Differences between plant and animal development
   Shoot apical meristem development
   Leaf development, specification of leaf polarity

Monday 13/12

9. Papers/discussion: ageing (Nektarios Tavernarakis), 2hr **(10.00-12.00)**

HAPPY NEW YEAR 2011

Monday 10/1

10. Papers/discussion: development meets cell biology (Christos Delidakis), 2hr **(9.00-11.00)**

Tuesday 11/1

11. Papers/discussion: evo-devo (Michalis Averof), 2hr **(10.00-12.00)**

Wednesday 12/1

12. Papers/discussion: morphogens, growth control (Christos Delidakis), 2hr **(10.00-12.00)**

Thursday 13/1

13. Protozoan life cycles, host-pathogen interactions (Inga Siden-Kiamos), 3hr **(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

Friday 14/1

14. Neural tube patterning and migration in the vertebrate CNS (Domna Karagogeos), 2hr **(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

15. Axon pathfinding (Maura Strigini), 2hr **(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

Monday 17/1

16. Neural circuits: integration in sensory/motor systems (Nektarios Tavernarakis), 1hr **(10.00-11.00)**
    Sensory integration and locomotory response circuits in C. elegans
    Arithmetic of neural cells and circuits (Yiota Poirazi), 1h **(11.00-12.00)**

17. Genetics of cognition and behavior: learning and memory (Maria Monastirioti), 2hr **(13.00-15.00)**
    How an organism acquires specific behavioral patterns as a response to environmental changes

Intoduction to memory and memory types
Genetics of associative learning (Drosophila)
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

Teusday 18/1

18. Mechanisms of adaptive immunity: T-cell development (Charalambos Spilianakis), 2hr **(10.00-12.00)**
    T-cell development in the thymus
    Differential expression of surface molecules during differentiation
    Distribution of T lymphocytes at different stages of differentiation
    VDJ recombination in the T-cell receptor

19. Mechanisms of adaptive immunity: T-cell development (Charalambos Spilianakis), 2hr **(13.00-15.00)**
    Positive and negative selection mechanisms operating on thymocytes
    Role of different cell sub-populations in selection
    Flow cytometry for phenotypic studies of lymphocytes
    Mechanisms of survival and homeostasis of mature peripheral lymphocytes
    Mechanisms of peripheral tolerance

Wednesday 19/1

20. Immune regulation, autoimmunity and immunotherapy in humans (Dimitris Boumbas), 2hr **(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

Thursday 20/1

21. Papers/discussion: neural induction in vertebrates and neuronal migration(Domna Karagogeos), 2hr **(15.00-17.00)**

Friday 21/1

22. Papers/discussion: axon pathfinding (Maura Strigini), 2hr **(10.00-12.00)**

Monday 24/1

23. Arithmetic of neural cells and circuits (Yiota Poirazi), 2hr **(10.00-12.00)**

Tuesday 25/1

24. Papers/discussion: cognition and behavior (Maria Monastirioti), 2hr **(10.00-12.00)**

Wednesday 26/1

25. Papers/discussion: mechanisms of adaptive immunity (Charalambos Spilianakis), 2hr **(10.00-12.00)**

Tuesday 1/2

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.