

Course Title: Molecular and Cellular Physiology

Course Description:

This course aims to provide students with an understanding of the cellular and molecular mechanisms that underlie physiological processes and their dysfunctions. The course will cover various cellular and molecular physiology topics, including homeostatic control, intercellular communication, synaptic transmission, ionic channels and receptors, sensory perception, neuron-glia interaction, and neuro-hormonal communication. The course will also include student project work, allowing students to apply their knowledge and skills to a research project.

Week 1 (Oct 2): 2h

Tuesday, 4-6 pm: Introduction to the course, homeostatic control, positive and negative feedback
Cellular and molecular bases of intercellular communication - synaptic paracrine and hormonal

Week 2 (Oct 14 – Oct 16): 6h

Monday, 4-6 pm: Ion channels and transporters
Thursday, 4-6 pm: Voltage-gated Ion channels

Week 3 (Oct 21 – Oct 23): 10h

Monday, 4-6 pm: Ionotropic Receptors (ACh and Gaba)
Wednesday, 4-6 pm: Ionotropic Receptors (Glu). Metabotropic Receptors

Week 4 (Oct 28 – Oct 30): 14h

Monday, 4-6 pm: Student project works. Q&A
Wednesday, 4-6 pm: Synaptic transmission – molecular determinants of electrical neurotransmission

Week 5 (Nov 6): 16h

Wednesday, 4-6 pm: Synaptic transmission – molecular determinants of chemical neurotransmission

Week 6 (Nov 11 – Nov 13): 20h

Monday, 4-6 pm: Synaptic transmission – molecular determinants of chemical neurotransmission
Wednesday, 4-6 pm: Student project works. Q&A

Week 7 (Nov 18 – Nov 20): 24h

Monday, 4-6 pm: Channelopathies of cardiac muscle (long QT syndrome), skeletal muscle (myasthenia), epileptic and ALS associated channelopathies
Wednesday, 4-6 pm: Channelopathies of cardiac muscle (long QT syndrome), skeletal muscle (myasthenia), epileptic and ALS associated channelopathies

Week 8 (Nov 25 – Nov 27): 28h

Monday, 4-6 pm: Neuronal chloride homeostasis: membrane transporters and their regulation during development and epilepsy – depolarizing GABA
Wednesday, 4-6 pm: Student project works. Q&A

Week 9 (Dec 2 – Dec 4): 32h

Monday, 4-6 pm: Neuron-glia interaction in CNS functions: Glial cells

Wednesday, 4-6 pm: Astrocytes

Week 10 (Dec 9 – Dec 11): 36h

Monday, 4-6 pm: Neuron-glia interaction in CNS functions: astrocytic functions, tripartite synapse

Wednesday, 4-6 pm: Neuron-glia interaction in CNS functions: microglia

Microglial functions, microglial involvement in synaptic remodeling

Week 11 (Dec 16 – Dec 18): 40h

Monday, 4-6 pm: Microtubules and Microglia (Caterina Sanchini, PhD IIT)

Wednesday, 4-6 pm: Student project works. Presentations

Week 12 (Jan 8): 42h

Wednesday, 4-6 pm: Scientific Frauds – the oligomeric Abeta

Week 12 (Jan 13 – Jan 55): 48h

Monday, 4-7 pm: Student project work presentations

Wednesday, 4-7 pm: Course review and final remarks