Neurobiology

Applicants are expected to have thorough knowledge of (and marked interest for) the fundamental properties and functions of neural systems, namely:

- Cellular component of the Nervous System (*Organelles, Dentrites, Axons, Axonal transporter, Microtubules, Neurons, Astrocytes, Glia)*
- Excitability of the neuronal membrane and axon (*Electro-tonic property, Ionic Pumps, Nernst Equation)*
- Origin and propagation of the Action Potential.
- Electrical and chemical synapses: Neurotrasmitters and Receptors (*Ionotropic and Metabotropic Receptors; the Neuro-muscular junction)*
- Synaptic Integration in the Central Nervous System (*EPSP and IPSP. Temporal and spatial integration of synaptic signals*)

Cell Biology

Applicants should have a sound knowledge of the major processes and principles that govern the organization and function of the cell. These include: structure and function of plasma membrane, organelles and cellular macromolecules; protein synthesis, co-translational and post-translational translocation; cytoskeleton and vesicle trafficking; cell adesion and migration; cell cycle and differentiation; basic features of stem cells.

Developmental Biology

Applicants are expected to have thorough knowledge of the main issues concerning vertebrate embryo development. These include:

a) Descriptive embryology: segmentation, gastrulation, neurulation, body axes determination, tissues and organs derived from each germ layer, generation and role of extraembryonic membranes;

b) Concepts of fate map and specification maps, commitment and differentiation; embryonic induction;

c) Molecular regulation of embryo development: techniques and strategies used in the main vertebrate model systems (zebrafish, Xenopus, chick, mouse) to study gene function during development; molecular pathways involved in body axes determination and pattern formation

Molecular Biology

Applicants should have solid knowledge of the main issues related to Molecular Biology. In particular:

- Structure and properties of nucleic acids and proteins.
- Mechanisms of DNA replication and associated factors.
- Transcription in prokaryotes and eukaryotes and associated factors.
- RNA processing
- Protein synthesis and genetic code interpretation.
- Regulation of gene expression at transcriptional and post-transcriptional levels.

Furthermore he/she should know the basic approaches of recombinant DNA technology.

Biochemistry

Applicants are expected to know the basic concepts of biochemistry, including the structure of amino acids and metabolites:

- Protein structure
- ATP structure and function
- Structure of biological membranes
- The glycolysis and gluconeogenesis
- Glycogen, structure, function and metabolism
- Enzyme kinetic
- Coenzymes involved in redox reactions.
- Oxidative phosphorylation
- The lactic fermentation

Genetics

Applicants should have solid knowledge of Genetics. In particular:

- Mendel's laws
- Analysis of linked genes (two-points and three-points crosses)
- Analysis of pedegrees for mendelian traits
- Population genetics: Hardy-Weinberg equilibrium
- Mitosis and meiosis
- Main methods of chromosome analysis
- The effects of mutations (phenotype-genotype relationship).