

## **Syllabus for DENTAL students, academic year 2020-21**

The syllabus contains 74 questions, subdivided into following sections:

- I. Biopolymers - structure, synthesis and self-assembly**
- II. Genome organization and gene expression**
- III. Cell cycle and cell communications**
- IV. Reproduction - mechanisms of fertilization and early embryogenesis**
- V. Methods to study biopolymers and cells - molecular basis**
- VI. Immunity - molecular and cellular basis**
- VII. Evolution and development**
- VIII. Biology of medically important parasites**

### **I. Biopolymers - structure, synthesis and self-assembly**

1. Origin and evolution of cells.
2. Proteins. Protein domains. Protein families.
3. Nucleic acids. DNA. RNA
4. Recognition and self-assembly of macromolecules. Cytoskeleton.
5. Transcription.
6. RNA processing.
7. Genetic code. Translation.
8. Proteins after translation: sorting, folding, modifications, degradation.
9. DNA replication.

### **II. Genome organization and gene expression**

10. Prokaryotic genome and regulation of gene expression.
11. Eukaryotic genome and regulation of gene expression.
12. Cytoplasmic (extrachromosomal) inheritance in prokaryotes and eukaryotes.
13. Chromatin. Nucleosomes.
14. Human karyotype. Types of chromosomes.
15. Gene mutations. Mechanisms and mutagenic factors.
16. Chromosomal mutations. Evolution of karyotype.
17. Genes and alleles. Dominance and recessivity - mechanisms, medical examples. Penetrance and expressivity.
18. Phenotype, genotype and allele frequencies. Hardy – Weinberg law.
19. Factors influencing allele frequencies: mutations, migrations, natural selection.
20. Effects of isolation: genetic drift, inbreeding.
21. Quantitative traits.

### **III. Cell cycle and cell communications**

22. Cell cycle. Mitosis. Cell cycle control.
23. Cell senescence. Cell death: apoptosis, necrosis.

### **IV. Reproduction - mechanisms of fertilization and early embryogenesis**

24. Meiosis. Origin of germ cells.
25. Spermatogenesis. Mammalian spermatozoa.
26. Oogenesis. Mature mammalian ova.
27. Fertilization. Interaction of maternal and paternal genomes.
28. Assisted reproduction: IVF, ICSI.
29. Embryonic development – early stages (zygote to neurula).
30. Embryonic development – regulative and mosaic. Morphogens and embryonic induction.
31. Preimplantation mammalian embryo.

### **V. Methods to study biopolymers and cells - molecular basis**

32. Methods of karyotyping and chromosome analysis.

33. Immunological methods. Diagnosis of viral infections.

## **VI. Immunity - molecular and cellular basis**

34. Innate immunity.

35. Structure of antibodies.

36. Functions of antibodies.

37. Molecules of cell-mediated immunity.

38. Cytotoxic and helper T lymphocytes.

39. Genetic basis of antibodies and T-cell receptors.

40. Lymphocyte differentiation in central lymphoid organs.

41. Lymphocyte differentiation in peripheral lymphoid organs. Immune response

42. Immune memory.

43. Immune tolerance. Regulatory T lymphocytes.

44. Transplantation immunity.

45. Blood group alloantigens. ABO and H blood groups.

46. Rhesus blood groups.

## **VII. Evolution and population genetics**

47. Animal evolution before vertebrates.

48. Sequence of evolutionary innovations in vertebrate classes

49. Principles of skeleton construction

50. Phylogeny and development of the skull

51. Phylogeny and development of digestive system and teeth.

## **VIII. Biology of medically important parasites**

52. Protozoa. Phylum Sarcomastigophora. Subphylum Mastigophora (Flagellata). *Trypanosoma brucei gambiense*, *Trypanosoma brucei rhodesiense*. *Trypanosoma cruzi*.

53. *Leishmania donovani*. *Leishmania tropica*. *Leishmania braziliensis*.

54. *Trichomonas vaginalis*. *Trichomonas tenax*. *Giardia lamblia* (*Lamblia intestinalis*).

55. Subphylum Sarcodina. *Entamoeba histolytica*. *Entamoeba dispar*. *Entamoeba gingivalis*.

56. Phylum Apicomplexa. *Toxoplasma gondii*.

57. *Plasmodium vivax*. *Plasmodium malariae*. *Plasmodium falciparum*. Morphological differences in the erythrocyte schizogony of the genus *Plasmodium*.

58. Metazoa: important evolutionary changes associated with the transition to multicellularity. Phylum Cnidaria (Coelenterata). Genus *Hydra*. Genus *Obelia*.

59. Phylum Platyhelminthes: important evolutionary changes. Class Trematoda. *Fasciola hepatica*.

60. *Dicrocoelium dendriticum* (*D. lanceatum*).

61. *Opisthorchis felinus*. Genus *Schistosoma* and its species.

62. Class Cestoda. *Diphyllobothrium latum*.

63. *Taenia saginata*. *Taenia solium*.

64. *Echinococcus granulosus*. *Hymenolepis nana*.

65. Phylum Nematoda. *Ascaris lumbricoides*.

66. *Enterobius vermicularis*. *Trichuris trichiura* (*Trichocephalus trichiurus*).

67. *Trichinella spiralis*.

68. Phylum Annelida: important evolutionary changes. *Lumbricus terrestris*. *Hirudo medicinalis*.

69. Phylum Arthropoda: important evolutionary changes. Class Crustacea: general characterization. Class Arachnida. Orders Scorpiones and Araneae.

70. Order Acari. Medical importance of ticks and mites.

71. Class Insecta. The role of insects as vectors and mechanical carriers.

72. *Pediculus humanus*. *Phthirus pubis*. *Cimex lectularius*. *Pulex irritans*.

73. Genus *Culex* and genus *Anopheles*: morphological differences. *Phlebotomus papatasi*.

74. Overview of parasitism.