



Dipartimento di Scienze e Tecnologie

ANNO ACCADEMICO 2017/2018

PROGRAMMA

CORSO DI STUDIO IN BIOTECNOLOGIE INSEGNAMENTO IN BIOLOGIA CELLULARE

DOCENTE Prof.ssa AMBROSINO CONCETTA

Biological macromolecule: Protein structure

Protein structure in space, protein domains. Protein-protein interaction, relationship between protein structure and their function and structural changes and activity.

Structure of DNA and RNA their role in the eukaryotic cell. Organization of chromatin.

Structure of DNA and various types of RNA. Molecular basis of nucleic acid-protein interaction: nucleosome and chromatin. Chromatin remodelling.

The ribosome and ribonucleoproteins: role of the transport of RNA.

DNA replication

The stoichiometry and the reaction mechanism of the DNA biosynthesis. Prokaryotic and eukaryotic DNA polymerase. The CIS elements of the replication in prokaryotes and eukaryotes. Molecular mechanisms of "proofreading" and of telomere replication.

The transcription

The stoichiometry and reaction mechanism of RNA biosynthesis. Structure of the prokaryotic and eukaryotic RNA polymerase, of the various classes of promoters. Structure of the beginning complex and role of the "general" transcription factors (TF). Transcriptional activators and inhibitors and their cofactors.

Post-transcriptional RNA maturation and translation.

General aspects of the maturation of eukaryotic RNA: an overview of alternative splicing and nucleus-cytoplasmic transport of messengers.

The biosynthesis of proteins with particular regard to the role of: tRNA and TRNAaminoacilsintetasi, start, elongation and release factors in translation.

General cell organization. Biological membranes. Membrane transport.

The general organization of a prokaryotic cell and a eukaryotic cell;

The chemical-physical properties of the membranes in relation to their lipid composition. Intrinsic and extrinsic membrane proteins and their topological organization in the lipid bilayer. Main functions of membrane proteins and receptors.

Modes of transport of small molecules through the plasma membrane for simple diffusion, facilitated diffusion, active transport. The different functioning of membrane pumps and ionic channels, the role of Na⁺/K⁺-ATPase in the generation and maintenance of the electrochemical gradient.

Mitochondria

Structure and function of mitochondria: concepts of genetic metaautonomy of mitochondria and cytoplasmic inheritance, the process of cellular respiration and ATP biosynthesis (overview).

The cellular compartments and the processes of their biogenesis and maintenance.

Molecular properties and characteristics of the cytosolic compartment;

Synthesis of the structural characteristics of the following organelles: nucleus, smooth and wrinkled reticulum, Golgi, endosomes, lysosomes and mitochondria (overview);

General mechanisms of transport of proteins to the different cell compartments: the transport of RNA Between the nucleus and cytoplasm and the transport of mitochondrial proteins.

The regulation of protein vesicular traffic..

The co-translational transport of proteins in the ER and "protein folding";



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Vesicular transport of proteins between the various compartments: the ER, the Golgi, the endosomes, the plasma membrane. The role of the address signals present in proteins. Molecular dynamics of the fission and fusion processes of the membranes; The biological significance of post-translational protein modifications, the topology of biosynthesis and describe the modalities of transport of the main cellular lipids in bio-membranes, the polarized transport of proteins and lipids to the apical and baso-lateral compartments of the plasma membrane.

Molecular mechanisms of exocytosis and endocytosis.

Protein secretion; Modalities and mechanisms of the various forms of endocytosis: The pinocytosis, the phagocytosis and the receptor-mediated endocytosis; Role and function of the endosomes in the endocytosis process; The internalization process of: transferrin, LDL, EGF and virus with membrane.

The cytoskeleton. Motor proteins. Cell motility.

The molecular composition and structural organization of the different components of the cytoskeleton; the role of cytoskeleton in maintaining the functional integrity of cells. How to adjust the assembly and disassembly of the different components of the cytoskeleton, the ' motor proteins ' and their functional role. Ancillary proteins.

Cell communication. General principles, intracellular receptors, membrane receptors coupled to G proteins, Tyro/Ser/Thr_kinase receptors and enzyme-associated receptors. Cell-Cell and cell-matrix interactions:

cell-cell junctions, their main molecular components and their properties;

molecular components of the extracellular matrix: fibronectin, collagen, the small , elastin

the structural organization of the extracellular matrix and the role of integrin in cell-matrix interaction

The relevance of cell interaction and extracellular matrix in maintaining the correct functioning of cells

Cell cycle: Its logic, its phases and its regulation. Apoptosis.

The cell cycle of the eukaryotic cell: temporal, morphological and molecular aspects of the different phases of the cell cycle. The complexity of DNA replication in eukaryotic cells. The control of cell proliferation and the role of growth factors. Cell death and apoptosis.

The mechanics of cell division. The mitosis.

Biological significance and the phases of mitosis. Molecular aspects of the different phases of the cell cycle and of the different "checkpoints". Structural modifications of chromosomes during mitosis. The dynamic organization and the role of the cytoskeleton during mitosis. The organization of the main intracellular organelles during mitosis. Meiosis.

Biology Laboratory

Instruments in a basic laboratory for cell biology: operation and use.

Cell fractionation

Textbooks

Alberts - Biologia Molecolare della Cellula VI edizione - Zanichelli

Lodish - Biologia Molecolare della Cellula III edizione- Zanichelli