Eukaryotes, prokaryotes and viruses

Eukaryotes

DNA: Linear bound to protein DNA, Introns. Organelles: Nucleus, membrane bound, 80S/70S ribosome. Reproduction: Mitosis and meiosis, paired chromosomes (diploid). Average size 10-100 µm. Extras: Mitotic spindle, sterols in plasma membrane, internal membranes (in organelles), ER, mitochondria, lysosomes, golgi, peroxisomes, cytoskeleton, cell wall only in some fungi.

Prokaryotes

DNA: Naked circular DNA, No introns. Organelles: No nucleus, No membrane--bound, 70s ribosomes. Reproduction: Binary fission, single chromosome (haploid). Average size: 1-5 µm. Extras: Internal membranes only in photosynthetic organisms, cell wall.

Viruses

Nucleic acid + protein coat. Needs host to replicate.

Sizes (copy)

Cytoskeleton

Actin = thinnest (muscle). Microtubules = thickest (pull daughter cells apart). Intermediate filaments = mechanical strength of cell.

Cytoplasm

cytosol + organelles

Nucleus

Only organelle visible by light microscopy. Contains packaged genetic material. Covered by nuclear envelope (double membrane) which has nuclear pores.

Plasma membrane

Phospholipid bilayer. Contains cholesterol, proteins (integral, transmembrane and peripheral) and carbs.

Sizes (copy) (cont)

Lysosome

Electron dense. Membrane bound. >50 hydrolytic enzymes for all major macromolecules. All require low pH. Organelle turnover/autophagy.

Peroxisome

Detoxification. Phospholipid synthesis. Oxidation of VLCFA (Very Long Chain Fatty Acids). Enzymes which generate & degrade H2O2. Large. Not very electron dense.

Smooth endoplasmic reticulum

Making lipids and steriods. Start of N-linked glycosylation. Detoxification of Xenobiotics.

Rough endoplasmic reticulum

Coated with ribosome (translation, proteins for secretion or insertion in cell membrane). Proteins folded (Cys-Cys brdges form). Vesicles bud off and go to golgi. RER and SER are continuous set of endosomes.

Golgi

4-8 closely-stacked, membrane-bound channels (cisterna). Modifies proteins from RER vesicles (modifying N-linked carbs and Glycosylation of O-linked carbs and lipids). Synthesis/package materials for secreted. Direct new proteins in vesicles to their correct compartments. Transport membrane lipids around cell. Create lysosomes.

Mitochondrion

Double membrane. Contain DNA & enconde some of their proteins (~1%). Sugars oxidised to generate ATP (krebs). Cristae (inner membrane folds) to increase surface area for ETC.

Chromatin

Complex of DNA with histone and non-histone proteins

Sizes (copy) (cont)

Nucleolus

Where rDNA is transcribed and ribosome subunits assembled.

Structure and function of cellular organelles

Cytoplasm

Nucleus

Plasma membrane

Lysosome

Peroxisome

Smooth endoplasmic reticulum

Rough endoplasmic reticulum

Golgi

Cytoskeleton

Mitchondrion

Chromatin

Nucleolus

Sizes

Cytoskeleton

Actin = 7nm diameter. Intermediate filaments = 8-10nm. Microtubules =25nm.

Cytoplasm

Nucleus

diam 3 - 10 µm

Plasma membrane

5 - 10 nm thick

Lysosome

0.2 - 0.5 µm

Peroxisome

0.5 - 1.5 µm

Smooth endoplasmic reticulum

50nm diam

Rough endoplasmic reticulum

Golgi

Mitochondrion

0.5 - 3 µm

Sizes (cont)

Chromatin

Nucleolus

0.2 to 3.5 µm

Extra lecture info

Electron microscopy

Involves elaborate prep & can only evaluate dead cells

Transmission Electron microscope

To look inside cell, electrons through specimen

Scanning Electron Microsope

To see cell surface, electrons scattered off surface by heavy metal coating e.g Au

Max size of cell is determined by

diffusion reduced >50 µm. As cell increases vol increases more than SA. Being too large influcnes movement of intermediates, waste products and nutrients.

Cells specialized for diffusion

Thin processes. Giant multinucleate cells: gene expression occurs in multiple places. Gap junctions: allow movement between cells.

Cellular organelles pros

allows for specialised enviroments within them

DNA

DNA packed as chromosomes. Chromosomes made up of chromatin. Chromatin made up of nucleosomes. Unless cell is dividing, chromatin is decondensed.

DNA sizes

Naked human DNA = 1.8m. DNA packaged in nucleosomes: 9.5mm. Condensed as chromosomes in mitosis 120 µm.

Secretory vesicles

Bud off golgi & fuse with inner surface of plasma membrane for exocytosis.

Extra lecture info (cont)

Mitochondria membrane lengths

0.5 - 2 µm