

List four different classes of eukaryotic cells.

Fungi: food from other organisms, cell walls, filamentous growth

Yeast: unicellular, budding reproduction

Protozoa: unicellular, mostly motile, can live in host

Algae: unicellular or multi, photosynthetic, simple reproductive system

plants, animals, protists, unicellular algae, fungi

What are some of the common features of eukaryotic cells? What about prokaryotic cells?

Eukaryotes: membrane enclosed organelles, nucleus, linear DNA w/ histone proteins, 80S ribosome, actin cytoskeleton

Prokaryotes: no membrane enclosed organelles, nucleoid, cell wall (peptidoglycan), circular DNA w/o histone proteins, 70S ribosomes

Describe the structure and composition of a retrovirus.

Ex. HIV

Retrovirus exists as single-stranded RNA packed into a capsid protein

reverse transcriptase: viral RNA is inserted and converted into double strand DNA

integrase: works like cut and paste transposon, integrating the DNA into the host, takes double strand DNA through nuclear pore because it contains the necessary nuclear localization signal

integrase cuts 1 chromosome of cell and insert viral DNA into chromosome and re-ligate it

Then 3 different genes (gag, Pol, ENV) can be transcribed/translated

Outline the replication cycle of a retrovirus, such as the Rous Sarcoma Virus.

gag: polyprotein gets cleaved into different structural proteins- capsid, matrix, nucleocapsid

Pol: cleaved into four parts- viral integrase, protease, polymerase (2 fragments)

2 polymerases- reverse transcriptase and RNase

ENV: codes for the envelope protein, cleaved into 2 fragments of protein

What are the major protein products encoded by the genome of a "typical" retrovirus and the functions of the proteins in the life cycle of the virus?

Capsid protein:

Reverse transcriptase:

Envelope protein:

Integrase- requires 4-5 specific nucleotides for insertion, takes the double stranded DNA through the nuclear pore using NUCLEAR LOCALIZATION SIGNAL, cuts 1 chromosome of

cell and insets viral DNA into chromosome and religates it, shuttle protein uses GTP to move integrase across the envelope

Protease- cleaves gag Pol and ENV by doing this makes it infectious

Reverse Transcriptase- makes DNA/RNA and then DNA/DNA double helix, RNase dissolves RNA once it has been replicated

***Discuss the rationales behind the mechanisms of action of drugs (either available or in development) meant to block the entry of HIV into macrophages.**

Inhibitors of reverse transcriptase, integrase, protease

Summarize the roles (and steps) of HIV gp120 and of gp41 in membrane fusion. How was it discovered that a deletion in the CCR5 gene could affect HIV tropism?

Env gene product is gp160 which is cleaved into gp120 and gp41

3 gp120s and gp41s combine in a trimer of heterodimers to form the envelope spike which mediates attachment to and entry into the host cell

Gp120- glycoprotein on HIV envelope, plays vital role in attachment to specific cell surface receptors (CD4 receptor)

- binding to CD4 induces changes in gp120 and gp41 that lead to fusion of the viral with the host membrane

CCR5- protein on white blood cells receptor for chemokines (how helper T cells are attracted to specific tissues)

HIV uses CCR5 to enter and infect host cells, coreceptor by which HIV infects cells

Tropism: the way in which different viruses have evolved to preferentially target specific hosts

***How might a cell biologist use the life cycle of a given retrovirus to study mechanisms responsible for protein targeting and sorting in eukaryotic cells?**

***Discuss which aspects of the study of retroviral life cycles directly contributed to the development of recombinant DNA technology.**

Using the reverse transcriptase in PCR to form new strands of DNA.

***Suggest a procedure for how a genetically-modified retrovirus might be used as a gene-delivery vehicle in gene therapy.**

take out the DNA/RNA in the retrovirus that codes for any proteins that cause adverse effects. Then replace it with your gene of interest. And then you introduce the retrovirus into the organism.

With one sentence, indicate the contributions to cell biology by each of the following individuals

Robert Hooke- development of compound microscope, coined the term cell, observed cork

Anton Van Leeuwenhoek- first to observe single celled organisms with a microscope "beasties", saw fungi, protozoa, algae, bacteria, archaea but not viruses

Peyton Rous-discovery of the role of viruses in cancer. Rous Sarcoma Virus

Irving Langmuir- generated Langmuir trough, made device to make measurements

Gortel and Grendel- first to propose membranes were composed of lipid bilayers

Davson- Davson proposed a cell membrane model that depicted the phospholipid bilayer sandwiched between two layers of globular proteins.

Danielli Singer- membrane consisted of lipid bilayer covered in globular proteins

Nicolson Linus Pauling- identified what holds proteins together

Review the general structural features and compositions of: T4 phage, tobacco mosaic virus, adenovirus, and the Rous Sarcoma Virus.

tobacco mosaic virus- has capsid, about 6400 RNA bases

adenovirus- double stranded DNA, no reverse transcriptase, capsid protein cover surface of virus, responsible for 10% childhood infections, 20 faced surface

T4 phage- bacteriophage, double stranded DNA genome,

Rous Sarcoma Virus: retrovirus/ oncovirus,

***What is meant by a unit membrane? Give an illustration for how the membrane would look under the electron microscope. What about under the light microscope?**

unit membrane: proteins are coating membrane on both sides