

- 6) There are 2 types of death
 - a. senescence: cell dies of old age
 - b. Apoptosis: cells programmed to die, a gene program turned on during some point of development and says 'die'
- 7) Dead cells are internalized by macrophages b/c they contain proteins that have an 'Eat Me' signal

Slide #7

Pinocytosis with Clatherin coated vesicles...they are much smaller than phagosomes
There are two types of Endocytosis due to Clatherin coated vesicles

- 1) constitutive Endocytosis: happens all the time, things taken in @ steady pace,
- 2) no Endocytosis unless there is a signal...the signal is due to specific binding of a ligand to a receptor...
 - a. the ligand is outside bound to the receptor on the plasma membrane

Slide #10

- 1) Example: endothelial cells; very important layer of cells that are along blood vessels; they internalize LDL (low density lipoprotein)
- 2) LDL: you have a vesicle; you have a protein that goes in and out of cell membrane and on outside (dots are cholesterol molecules) and holds different kind of cholesterol molecules inside
- 3) Inside the cholesterol is esterified meaning it has a little Fatty Acid tail
- 4) The cholesterol in the membrane is unesterified
- 5) LDL = Low Density Lipoprotein
- 6) 500 phospholipid molecules:
 - a. 50 unesterified cholesterol embedded in the membrane
- 7) the 'membrane' is not a membrane actually it is a single layer of phospholipids
 - a. inside of that is 1500 esterified cholesterol

slide #11

what happens when you have Endocytosis?

- 1) Part A: Endothelial cell has receptor for LDL protein
 - a. The receptor binds with adaptor protein and Clatherin coat
 - b. Formation with a lot of LDL
- 2) Part B: Disease defective receptors cause people to have low cholesterol
 - a. Cholesterol functions to tighten membrane
 - b. So low cholesterol disease causes leaky membranes which means these people have a higher risk of cancer
 - c. For example,
 - d. Dr. Ma has a colleague that finishes $\frac{1}{2}$ jar of Elman butter (which has higher cholesterol than peanut butter) for lunch every day to supplement cholesterol b/c he has this disease

The late endosome and lysosome are located near the nucleus & Golgi (further away from plasma membrane)

Refer to drawing in class of cell with apical and basal side....Endocytosis can happen anywhere that is close to the plasma membrane in all the different regions highlighted in the drawing

Slide #17

What happens to internalized membrane proteins?

Refer to drawing in class of plasma membrane, receptor & cargo

Usually, the receptor and cargo is internalized by lysosome and the low pH causes the cargo to be released from the receptor but in some cases the ligand and receptor are stuck, and fused to the endosome

When a protein is not desired by a cell it is linked to ubiquitin which directs it to be destroyed.

Ubiquitin binds, invagination of endosome membrane occurs, this forms vesicles, the vesicle internalizes some cytosolic fluid; ubiquitin, and the receptor bound to the cargo this complex becomes a vesicle within the endosome and is called multi vesicular bodies....this type of endosome does not mature to late endosome but is directed to fusion with the lysosome. The lysosome chews up the receptor, ligand, and ubiquitin....This describes the process of how a cell gets rid of a ligand-receptor complex it does not want which is through the formation of multi-vesicular bodies (inside an endosome) which is then directed to fuse with the lysosome

Slide#19

There are 2 types of Pinocytosis:

- 1) Clathrin coated vesicles
- 2) caveolin

There are different or several pathways where secretory vesicles can go, this slide only shows Clathrin coated vesicles

Case A: Endocytosis: decoating, naked, fuse with endosome, later fuses with lysosome, and chewed up

Case B: Secretory vesicle fuses with endosome and another secretory vesicle buds out and returns the secretory vesicle to the membrane where it comes from: this is called recycling→returning specific membrane proteins to its origin so for example, basal membrane proteins that are internalized can be eventually returned to the basal membrane by formation of secretory vesicles with the Trans membrane protein that originated from the basal membrane; membrane of secretory vesicle fuses with basal membrane and membrane protein is returned = recycling

Case C: Transcytosis; endosome has part of secretory vesicle bud out and transport to other side of membrane; after fuse with membrane, endosome can have part of the secretory vesicle bud out and transport it to other side of the membrane = transcytosis

An example of transcytosis is mother's milk's antibodies transcytosed via clathrin coated secretory vesicles.....