ENDOMEMBRANE COMPARTMENTS (P 325):

Endomembrane systems partition compartments (reticule = netted handbag). Elucidated by combination of EM & cell fractionation

SUBCELLULAR FRACTIONATION STEPS:
1) homogenization
2) differential centrifugation Claude, Palade & deDuve, Nobel Prize, 1974

Illustrate set up for sucrose (etc) gradient (1.10-1.30 g/mL) (0.75-2.3 M sucrose)

p. 331 density gradient centrifug.
1000 x g 10 min: nuclei
20,000 20 min: mitochondria, lysosomes, chloroplasts, peroxisomes
80,000 1 hour: microsomes
200,000 2 hours: ribosomes, viruses

p. 330 differential centrifugation:
sedimentation rate depends on mass
1000 x g 10 min: nuclei
20,000 20 min: mitochondria, lysosomes, chloroplasts, peroxisomes
80,000 1 hour: microsomes
200,000 2 hours: ribosomes, viruses

ENDOPLASMIC RETICULUM: (P 326)

50-90% of total membrane is Endoplasmic Reticulum
ER first seen late 19th century: secretory cell basophilic regions
Consist of cisternae, partitioned from cytoplasm under cell fractionation, membranes break up into microsomes

PLASMA VS ER MEMB:
7.5 nm thick for plasma membrane, ER: 5-6 nm
different composition: endo- has 2x protein, no cholesterol
characteristic enzymes: cytochrome b subscripts 5 and cytochrome b subscripts 5, reductase, cytochrome c reductase, glu-6-PO subscripts 4,ase, and cytochrome P-450.

ROUGH ER:
lg flattened sheets, prominent in secretory cells
carry ribosomes on outer surface (p 326)

SMOOTH ER: p 326,332 tubular networks, perform multiple biochem. functions

REATIONS OF SMOOTH ER:

1) HYDROXYLATION: incr’sd solubility in water, then excreted in urine
pathway: NAD(P)H to cytochrome P-450, activates O subscripts 2, makes ROH + H subscript 2 O

DRUG DETOXIFICATION (especially in the liver)
mixed function oxidases (or mono-oxygenases)
synthesis is stimulated by barbiturates (etc) (drugs require ever incr’sing doses)
antibiotics, narcotics, steroids, and anticoagulants are also inactivated by this mechanism.

ARYL HYDROCARBON HYDROXYLASE hydroxylates polycyclic hydrocarbons
Including phenylalanine to make tyrosine
CARCINOGEN ACTIVATION: also activates smoke procarcinogen benzo(p)pyrene to carcinogen:

2) GLYCOGEN CATABOLISM (fig 12-3, p 332)
Glycogen stored as granules in smooth ER, cAMP triggers hydrolysis
1 glycogen phosphorylase splits glycogen to Glucose-1-P subscripts 4 by adding a PO subscripts 4 to the alpha 1,4 bond
2 phosphoglucomutase isomerizes G-1-P to G-6-P subscripts 4 (allosteric reg: AMP incr, ATP decre)
3 glucose-6-phosphatase splits off PO subscript 4, allows export of glucose to blood
(no G-6-P subscripts 4ase in muscle or brain: they use all the Glu-6-P subscripts 4 locally, no export)

3) CALCIUM ISOLATION:
Sarcoplasmic reticulum in muscle fibers removes, holds Ca superscript + + fr. sarcomere

4) FAT, PHOSPHOLIPID AND STEROID SYNTHESIS
Leydig cells in testes replete with smooth ER: synthesis of testosterone

MEMBRANE BIOSYNTHESIS & TURNOVER:

Proteins: integral membrane proteins not destined for secretion, synthesized on rER, stay attached
Glycosylation (marking for export) started in rER, completed in Golgi on luminal surface (inside of saccules)
Membrane lipids: synthesized in sER
transfer via pinched off transfer vesicles
Turnover:
radiotracer shows T subscript 1/2: phospholipids hours proteins days

1) nuclear
2) rough ER
3) smooth ER
4) Golgi
5) lysosomes
6) vesicles