LYSOSOMES & PEROXISOMES


LYSOSOMES:
First observed by de Duve in 1950s. (p 92-93) Used sucrose gradient;
First thought to be in mitochondria, separated by differential centrifugation, but...
DeDuve localized by staining with Pb++ (PbNO3?), forms insoluble, black PbPO4
acid phosphatase associated with the new vesicles, released PO4- (pH 5 optimum) (p 352)
New organelle also contained these enzymes as well:
RNAase
DNAase
proteases
B-glucuronidase

ALL: degradative, all with pH optimum around 5 (acid hydrolases), DeDuve termed the organelle “lysosome”.

FUNCTIONS OF LYSOSOMES:
1. Digest phagocytosed material cellular digestion performed by lysosomal enzymes. Both nutrition & defense. Macrophages & PMNs fuse with phagocytosis vacuoles: leaves residual body, cannot be eliminated...
2. Autophagy recycling ‘effete’ organelles: Break down organelles:
wrapped in membranes, digested. materials recycled (p 352)
3. Apoptosis Autolysis: differentiation cell death cell death in shaping organs, fingers etc.

rheumatoid arthritis lysosomes may play role in RA. Cortisone stabilizes lysosomes, ameliorates RA.

STORAGE DISEASES: without lysosomal enzymes, accumulate pathological material (40 examples) often mentally retarded:
Causes muscle weakness, skeletal deformities, mental retardation, often fatal:
Hurler (1/100,000) & Hunter syndromes (X linked: 1/130,000’s): can’t degrade glycosaminoglycans (GAGs)
accumulated material damages nerve cells (rich in glycolipids.)
Tay-Sachs: (1/3,500 Ashkenazi Jews) missing $\beta$-N-acetylhexosaminidase accumulate gangliosides
(accumulate glycolipids: ceramide-glucose-galactose-N acetyl neuraminic acid)
Type II glycogenesis: lack α1,4-glucosidase, accumulate glycogen in liver, heart, muscle...die.

PEROXISOMES: deDuve found urate oxidase in 'lysosomal fraction,' but not an acid hydrolase
Able to separate slightly by sucrose equilibrium dens centrifug’n: 0.75-2.3 M suc, 1.10-1.30 g/mL
DENSITY: lysosomes light, mitochondria medium, peroxisomes dense
resolution increased by triton detergent:
administered to animal, accumulates in lysosomes, increases their buoyancy (figures on p 326)
Catalase present, lacking in lysosomes:
Catalase detoxifies peroxide by products of oxidative metabolism (esp H2O2, called peroxisome

Oxidases are prominent: flavoproteins, detoxify by peroxidatic action:
transfers electrons from substrate to oxygen, make H2O2 as by product.
(Oxidases are common in liver: detox EtOH, nitrites, phenols, etc.)

H2O2 byproduct destroyed by catalase: 15% of protein in peroxisomes

Fatty Acid Oxidation occurs in peroxisomes
(plants: 100%, Animals: 25-50%, rest in mitochondria)

(Can also reduce oxygen tension, protect cell from harmful O2.)