

# LYSOSOMES & PEROXISOMES

10/28/91, rvsd 10/27/93, 10/31/94, 25 Oct 95, 27 Oct 99, 31 Oct 01, 29 Oct 03, 27 Oct04, 9 Nov 07, 19Nov08  
BRP: p. 254-265, BKH: 359-370, BKH 5<sup>th</sup>: 353-362, 6<sup>th</sup>: 349-359, 7<sup>th</sup>: 352-360

## LYSOSOMES:

First shown by de Duve in 1950s. (p 92-93)

First thought to be in mitochondria, seperated by differential centrifugation

**acid phosphatase** associated with new vesicles (p 350, 352) (pH 5 optimum)

(DeDuve localized by staining with  $Pb^{++}$ , forms insoluble  $PbPO_4$  staining lysosomes) as well as:

RNAase  
DNAase  
proteases  
B-glucuronidase

All **degradative, all acid hydrolases (pH 5)**, DeDuve termed organelle lysosome

Budded off fr Golgi (p 333, 353), trans-Golgi Network. All glycoproteins, 'labeled' with unusual oligosaccharide containing mannose-6- $PO_4$ , enzymes recognized by Golgi: *addressed to lysosome*

## FUNCTIONS:

cellular digestion, nutrition & defense:	1. <b>Phagocytosed material</b> (esp in macrophages & PMNs) in vacuole fuse with lysosomes, digestion, leaving residual body which cannot be eliminated...
recycling	2. <b>autophagy</b> : broken organelles wrapped in membranes, digested. materials recycled (p 352)
differentiation cell death	3. <b>Autolysis</b> : cell death in shaping organs: fingers etc.
extracellular digestion	sperm acrosome's action on egg.

May play role in rheumatoid arthritis. cortisone stabilizes lysosomes.

**STORAGE DISEASES:** without lysosomal enzymes, **accumulate pathological material** (40 examples):

Causes muscle weakness, skeletal deformities, mental retardation, often fatal:

**Hurler syndrome and Hunter syndrome:** can't degrade acid glycosaminoglycans.

secondary lysosomes accumulate causing mental retardation due to damage to nerve cells (rich in glycolipids.)

**Tay-Sachs:** missing  $\beta$ -N-acetylhexosaminidase accumulate gangliosides, infants mentally retarded (Accumulate glycolipids: ceramide-glucose-galactose-N acetyl neuraminic acid)

**type II glycogenosis:** lack  $\alpha$ 1,4-glucosidase, accumulate glycogen in liver, heart, muscle...die.

## PEROXISOMES:

deDuve found **urate oxidase** in 'lysosomal fraction,' *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)

All have **catalase**: detoxify peroxides,  $H_2O_2$ , byproducts of oxidative metabolism, called **peroxisome**

**oxidases are flavoproteins, remove electrons from substrate transfer to oxygen, make  $H_2O_2$ .**

detoxify by peroxidatic action: **oxidize toxins, make  $H_2O_2$  as byproduct**

(EtOH, nitrites, phenols, etc common in liver where detoxification occurs.)

catalase destroys  $H_2O_2$ , is 15% of protein in peroxisomes

FA oxidation occurs in peroxisomes (plants: 100%, Animals: 25-50%, rest in mitochondria)

can also reduce oxygen tension, protect cell