

# 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, 20Nov09, 19Nov10  
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, separated by differential centrifugation, but...

**acid phosphatase** associated with new vesicles (pH 5 optimum)

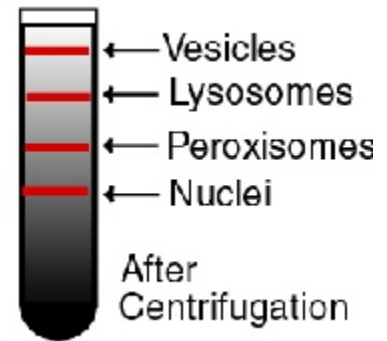
(p 352) DeDuve localized by staining with  $Pb^{++}$ , forms insoluble  $PbPO_4$  staining lysosomes, as well as:

- RNAase
- DNAase
- proteases
- B-glucuronidase

**ALL: degradative, acid hydrolases (pH 5)**, DeDuve termed organelle lysosome.

Budded off from trans-Golgi Network: 'labeled' with unusual oligosaccharide containing mannose-6- $PO_4$ , (p 353).

*Addressed to lysosome:* Golgi recognizes these glycoproteins, by their  $CH_2O$  "address".



## FUNCTIONS OF LYSOSOMES:

- cellular digestion, nutrition & defense: **Digest phagocytosed material:**  
(esp in macrophages & PMNs) in vacuole fuse with lysosomes, digestion, leaving **residual body** which cannot be eliminated...
- recycling: **Autophagy:**  
Break down organelles: wrapped in membranes, digested. materials recycled (p 352)
- differentiation cell death **Apoptosis:**  
(Autolysis): cell death in shaping organs, fingers etc.
- extracellular digestionL: **Egg penetration:** sperm acrosome's softens vitelline membrane.

## rheumatoid arthritis

May play role in. 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, detoxify by peroxidatic action: remove electrons from substrate transfer to oxygen, 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

