

Difference Between Primary and Secondary Lysosomes

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Key Difference - Primary vs Secondary Lysosomes

Lysosomes are the accidentally discovered **organelles** by a Belgian Scientist Christian De Duve in 1955 through the process of fractionation. Lysosomes are membrane-enclosed organelles that contained a number of valuable **enzymes** which can degrade all biological **polymers** such as, **proteins, fats, nucleic acids,** and **carbohydrates**. It is the digestive system of the cell that degrades the matters that are taken up outside of the cell in order to digest the obsolete components. In general, lysosomes are visualized as spherically shaped vacuoles, but they can be displayed in different shapes and sizes based on the matters that are taken up for digestion from the cell outside. So, lysosomes are morphologically diverse organelles displaying the common function of digestion of intracellular materials. It has been identified 50 different degradative enzymes in the lysosomes. Most of them were identified to be hydrolases that can degrade proteins, fats, nucleic acids, and carbohydrates. Mainly three types of lysosomes are found, such as; primary lysosomes, secondary lysosomes, and tertiary lysosomes. The **key difference** between primary and secondary lysosomes is that, **primary lysosomes are formed from the Golgi apparatus (GA) while the secondary lysosomes are formed from the fusion of primary lysosome and an endocytotic/phagocytotic vesicle (phagosome or pinosome).** Tertiary lysosomes are old secondary lysosomes that contain only waste materials.

What are Primary Lysosomes?

The Golgi apparatus or Golgi complex is the major component of the **eukaryotic cell** that forms primary lysosomes. They form tiny vesicles which are described by some as “buds” from the Golgi cisternae. These vesicles are constituted of different hydrolases type of enzymes that can degrade all **biopolymers** such as proteins, fats, carbohydrates and nucleic acids. The **proteases,** nucleases, and **lipases** containing these vesicles formed from Golgi apparatus which are known as “primary lysosomes.” Primary lysosomes are small in size and spherical in shape. Sometimes primary lysosomes are buds that are formed from the **endoplasmic reticulum** (ER complex).

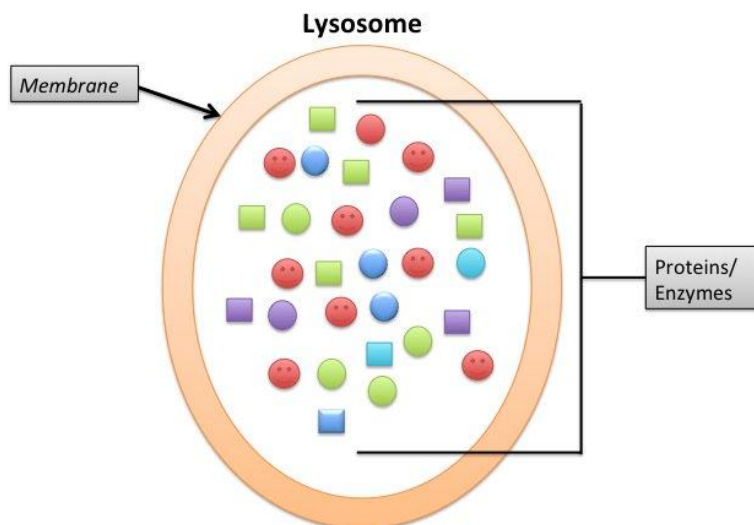


Figure 01: Lysosomes

The most important fact identified is the primary lysosomes do not release its content out of the vesicle into the [cytoplasm](#). The acid hydrolases that contains in the primary lysosomes are originated from [rough endoplasmic reticulum \(RER\)](#) membrane and sorted out in the Golgi apparatus. Primary lysosomes are surrounded by a membrane of [phospholipids](#) that separates the inside of the lysosome from the external environment. This is known as a single membrane. The internal environment of the primary lysosome is acidic and having low pH value (pH 5) which enable the activation of acid hydrolases enzymes. Initially, the primary lysosomes are contained an inactive complex of enzymes which activate after they are bound by a phagosome. This process renders them a different morphology and active enzymes.

What are Secondary Lysosomes?

The secondary lysosomes are formed from binding primary lysosome with a phagosome or a pinosome. Initially, in the primary lysosome, inactive state degrading enzymes is observed. But after its fusion with a phagosome, the degrading enzymes become active. So, in the secondary lysosomes, they contain an active class of digestive hydrolases that can degrade biomolecules such as proteins, nucleic acids, carbohydrates and lipids into their individual components. The secondary lysosomes may release useful products into the cytoplasm via facilitated diffusion.

Phagocytosis

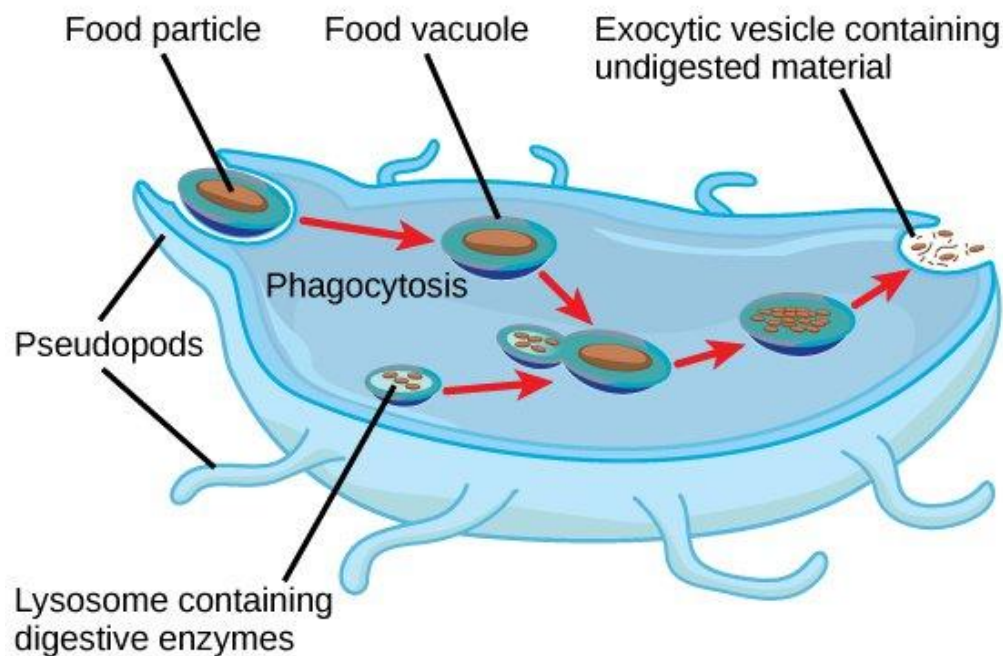


Figure 02: Secondary Lysosomes

They also can release waste materials that cannot be digested out through the process of [exocytosis](#). The morphology of secondary lysosome is large in size with a spherical shape. The secondary lysosomes depict different biological functions as they possess active state of acid hydrolases. Functions of secondary lysosomes include,

- Release enzyme outside of the cell (exocytosis) in order to destroy foreign materials.
- Breakdown of material inside the cell (digestion) that is termed as [autophagy](#).
- Breakdown of material outside of the cell that is termed as heterophagy.
- Recycling of the products of biochemical reactions and aid in [biosynthesis](#).
- Complete breakdown of cells that have died ([autolysis](#)).

What are the Similarities Between Primary Lysosomes and Secondary Lysosomes?

- Both primary and secondary lysosomes constituted of acid hydrolases that degrade biomolecules.
- Both primary and secondary lysosomes surrounded by a single phospholipid membrane.
- Both primary and secondary lysosomes are spherical in shape.

What is the Difference Between Primary Lysosomes and Secondary Lysosomes?

Primary Lysosomes vs Secondary Lysosomes	
Primary lysosomes are membrane-bounded organelles that bud from the Golgi apparatus and contain many enzymes.	Secondary lysosomes are the organelles which form the combination of a primary lysosome and a phagosome or pinosome and in which lysis takes place through the activity of hydrolytic enzymes.
Formation	
Primary lysosomes are formed by the Golgi apparatus or ER complex.	Secondary lysosomes are formed by the fusion of primary lysosome with a phagosome or a pinosome.
Function	
Primary lysosomes are storage vacuoles.	Secondary lysosomes are digestive vacuoles.
Location	
Primary lysosomes are found in rough endoplasmic reticulum (RER).	Secondary lysosomes are found in the smooth endoplasmic reticulum (SER).
Exocytosis	
Primary lysosomes do not release its content.	Secondary lysosomes release its content outside into cytoplasm (exocytosis).
Biosynthesis	
Primary lysosomes do not involve in the biosynthesis in the useful materials to the cell.	Secondary lysosomes involved in the biosynthesis are important materials to the cell.
Acid hydrolases	
Primary lysosomes contain inactive acid hydrolases	Secondary lysosomes contain active acid hydrolases.

Waste Products

Primary lysosomes do not release waste products.

Secondary lysosomes release waste products through exocytosis.

Summary - Primary vs Secondary Lysosomes

Lysosomes are the accidentally discovered organelles by a Belgian Scientist Christian De Duve in 1955. These single membrane vacuoles contain 50 different types of digestive acid hydrolases that can degrade biomolecules like proteins, fats, carbohydrates and nucleic acids. They usually depict spherical shape morphology. Based on the formation three distinct classes of have been described. 1. Primary lysosomes 2. Secondary lysosomes 3. Tertiary lysosomes. Primary lysosomes are formed from the Golgi apparatus (GA) while the secondary lysosomes are formed from the fusion of primary lysosome and an endocytotic/ phagocytotic vesicle (phagosome or pinosome). Tertiary lysosomes are old secondary lysosomes contain only waste materials. This can be identified as the difference between Primary and Secondary Lysosomes.

Reference:

1. Teong, Miss. "Biology matters." Clarification - primary vs secondary lysosomes, 1 Jan. 1970. [Available here](#)
2. "8 Main Functions of Lysosomes | Biology." Biology Discussion, 27 Aug. 2015. [Available here](#)

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How to Cite this Article?

APA: Difference Between Primary and Secondary Lysosomes.(2017 November 15). Retrieved (date), from <http://differencebetween.com/difference-between-primary-and-vs-secondary-lysosomes/>

MLA: "Difference Between Primary and Secondary Lysosomes" Difference Between.Com. 15 November 2017. Web.

Chicago: "Difference Between Primary and Secondary Lysosomes." Difference Between.Com. <http://differencebetween.com/difference-between-primary-and-vs-secondary-lysosomes/> accessed (accessed [date]).



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