



## Double-Membrane Vesicles Autophagosome Involves in the Activation, Elongation, Maturation and Fusion

Phinne Inton\*

Department of Urology, Zhejiang University, Hangzhou, Zhejiang 310003, China

### DESCRIPTION

Autophagosomes are double-membrane sequestering vesicles that are the hallmark of the intracellular catabolic process called macroautophagy. The autophagosomes don't bud off from pre-existing organelles but rather are made by a dynamic process of membrane expansion. Autophagy may be a process in which a myriad of membrane structures called autophagosomes are formed *de novo* in a single cell which deliver the engulfed substrates into lysosomes for degradation. This highly dynamic multi-step process requires significant membrane reorganization events at different stages of the macroautophagic process [1]. Autophagosome biogenesis involves the nucleation, expansion and closure of a cup-shaped membrane called a phagophore or isolation membrane to permit sequestration of cytoplasmic cargo followed by their fusion with endolysosomal compartments to facilitate degradation of the sequestered material. The autophagosomes sequester cytoplasmic materials and ultimately merge with the lysosomal compartment to make a degradative autolysosome. Specifically, the double-membrane autophagosomes in engulfing cells are recruited to the surfaces of phagosomes containing apoptotic cells and subsequently fuse to phagosomes allowing the inner vesicle to enter the phagosomal lumen [2]. Mutants defective in the production of autophagosomes display significant defects in the degradation of apoptotic cells demonstrating the importance of autophagosomes to the present process induction, formation of the isolation membrane and maturation of the autophagosomes finally fusion with a late endosome or lysosome [3]. It's well known that lysosomal defects cause cellular toxicity because all lysosome-related pathways including autophagy are dysfunctional in such conditions.

In yeast, autophagosomes are generated at one site called the preautophagosomal formation site and directly fuse with the vacuole. In multicellular organisms, autophagosomes are formed simultaneously at different sites and nascent autophagosomes fuse with vesicles originating from the endolysosomal compartments before eventually forming degradative

autolysosomes [4]. Lysosomes are regenerated after the sequestered materials are degraded.

First, an isolation membrane also referred to as a phagophore must be initiated from a membrane source referred to as the phagophore assembly site. The smooth endoplasmic reticulum could be the source of the autophagosome membrane. Under different conditions even mitochondria and plasma membranes could supply membranes for the formation of autophagosomes [5]. Autophagosome formation requires the organized action of a group of proteins known as autophagic related (ATG) proteins. It's a process of three sequential steps: initiation, nucleation and expansion, until an autophagosome fully forms and closes the autophagic membrane factor ATG16L1 on LDs and plays a task in autophagy.

### Biogenesis

Activation of the unc-51-like kinase 1 (ULK1; Atg1 in yeast) complex is crucial for the initiation of autophagy. Then, activation of the category III phosphatidylinositol 3-kinase complex which comprises PI3K (Vps34 in yeast) beclin 1, VPS15 (PIK3R4) and ATG14L (ATG14) triggers vesicle nucleation. The subsequent elongation and closure of the isolation membrane are mediated by two ubiquitin-like ATG conjugation pathways ATG5-ATG12 and LC3/Atg8.

Autophagosome elongation of membranes that evolve into autophagosomes is regulated by two ubiquitination-like reactions. First, the ubiquitin-like molecule Atg12 is conjugated to Atg5 by Atg7, which acts like an E1 ubiquitin-activating enzyme and by Atg10 which is analogous to an E2 ubiquitin-conjugating enzyme. The timing of autophagosome-lysosome fusion is extremely important, and only the closed autophagosomes can fuse with lysosomes. This raises the question of how the closure of autophagosomes is regulated.

In mammals, a defect within the ATG-conjugation system results in the accumulation of unclosed autophagosomes implying that it is likely to function in elongation and closure of

**Correspondence to:** Phinne Inton, Department of Urology, Zhejiang University, Hangzhou, Zhejiang 310003, China; E-mail: inton.pag@gmail.com

**Received:** 10-Jun-2022, Manuscript No. SCPM-22-17368; **Editor assigned:** 13-Jun-2022, Pre QC No. SCPM-22-17368 (PQ); **Reviewed:** 27-Jun-2022, QC No. SCPM-22-17368; **Revised:** 04-Jul-2022, Manuscript No. SCPM-22-17368 (R); **Published:** 11-Jul-2022, DOI: 10.35248/2168-9431.22.11.029

**Citation:** Inton P (2022) Double-Membrane Vesicles Autophagosome Involves in the Activation, Elongation, Maturation and Fusion. Single Cell Biol.11:029.

**Copyright:** © 2022 Inton P. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

autophagosomes and is vital for transition of the isolation membrane into the autophagosome. During collective elimination autophagosomes and autolysosome form within the center and are transported towards the periphery during maturation. The transport to the cell periphery of autolysosomes during maturation separates sites of lysosome reformation from sites of autolysosome fusion.

## REFERENCES

1. Reggiori F, Ungermann C. Autophagosome maturation and fusion. *J Mol Biol.* 2017;429(4):486-496.
2. Jang DJ, Lee JA. The roles of phosphoinositides in mammalian autophagy. *Arch Pharmacol Res.* 2016;39(8):1129-1136.
3. Sørensen K, Neufeld TP, Simonsen A. Membrane trafficking in autophagy. *Int Rev Cell Mol Biol.* 2018;336:1-92.
4. Chua CEL, Gan BQ, Tang BL. Involvement of members of the Rab family and related small GTPases in autophagosome formation and maturation. *Cell Mol Life Sci.* 2011;68(20):3349-3358.
5. Wang Y, Li L, Hou C, Lai Y, Long J, et al. "SNARE-mediated membrane fusion in autophagy." *Semin Cell Dev Biol.* 2016;60:97-104.