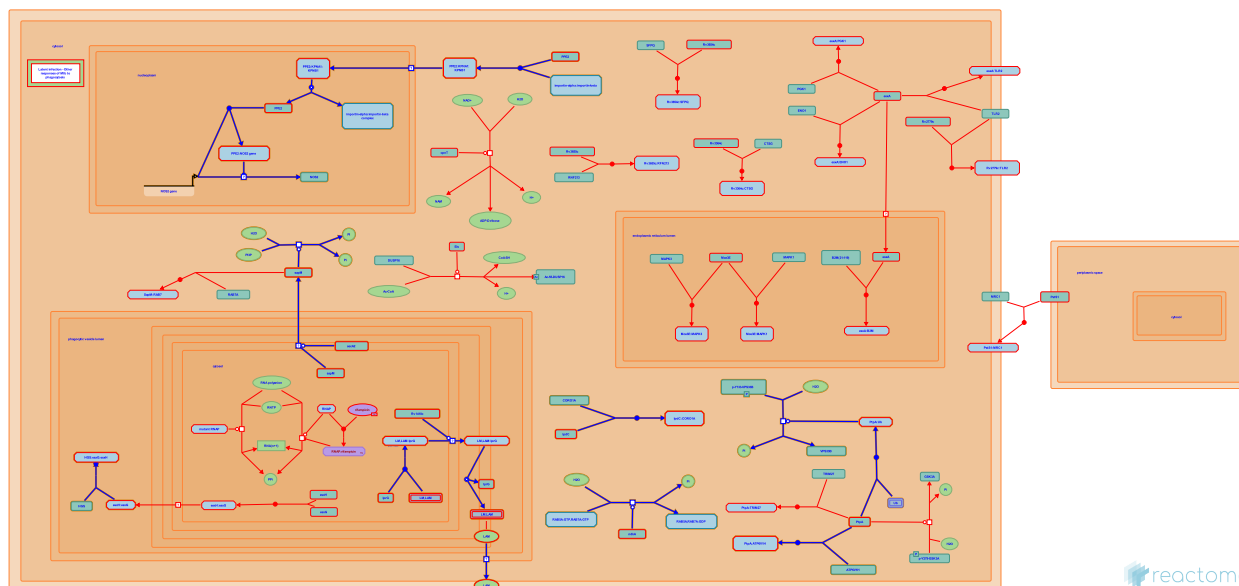


Suppression of phagosomal maturation



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This is just an excerpt of a full-length report for this pathway. To access the complete report, please download it at the [Reactome Textbook](https://reactome.org/about/reactome-textbook/).

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Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

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Literature references

Fabregat, A., Sidiropoulos, K., Viteri, G., Forner, O., Marin-Garcia, P., Arnau, V. et al. (2017). Reactome pathway analysis: a high-performance in-memory approach. *BMC bioinformatics*, 18, 142. [↗](#)

Sidiropoulos, K., Viteri, G., Sevilla, C., Jupe, S., Webber, M., Orlic-Milacic, M. et al. (2017). Reactome enhanced pathway visualization. *Bioinformatics*, 33, 3461-3467. [↗](#)

Fabregat, A., Jupe, S., Matthews, L., Sidiropoulos, K., Gillespie, M., Garapati, P. et al. (2018). The Reactome Pathway Knowledgebase. *Nucleic Acids Res*, 46, D649-D655. [↗](#)

Fabregat, A., Korninger, F., Viteri, G., Sidiropoulos, K., Marin-Garcia, P., Ping, P. et al. (2018). Reactome graph database: Efficient access to complex pathway data. *PLoS computational biology*, 14, e1005968. [↗](#)

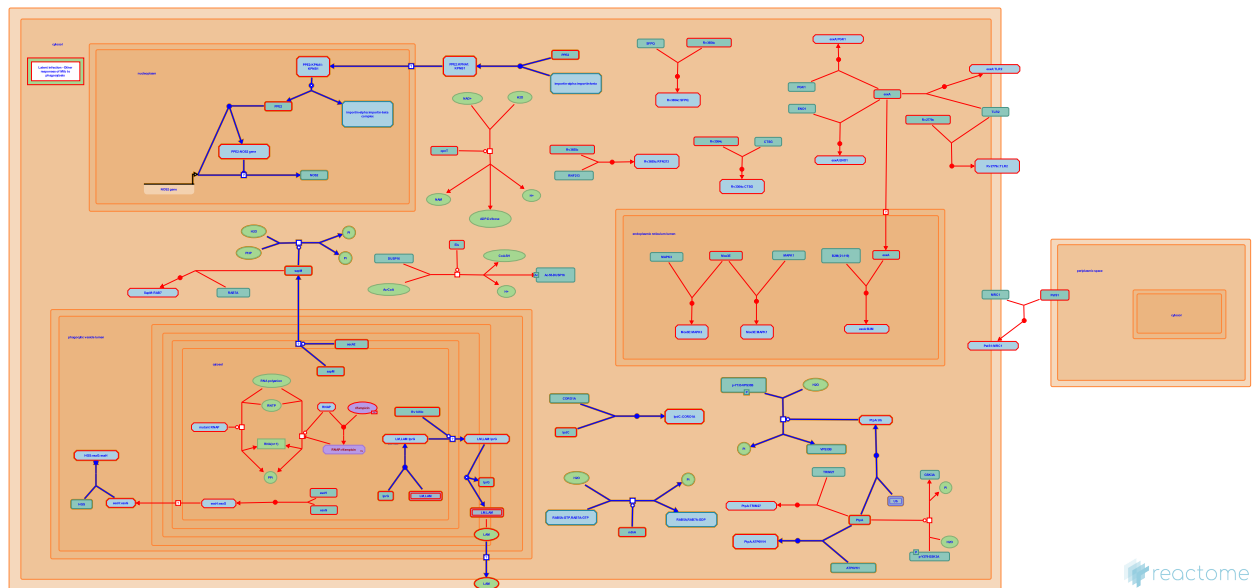
Reactome database release: 88

This document contains 4 pathways ([see Table of Contents](#))

Suppression of phagosomal maturation ↗

Stable identifier: R-HSA-9637687

Diseases: tuberculosis



The fate of phagosomes is usually directed by factors in the host phagocyte and involves flooding itself with superoxide, nitric oxide, and protons. Acidification is the prerequisite for later fusion with a lysosome. *Mycobacterium tuberculosis* (Mtb) releases substances that inhibit all of these processes, effectively arresting the phagosome in the present state and creating a protected niche for Mtb multiplication (Russell 2011, Stutz et al. 2018).

Literature references

Russell, DG. (2011). *Mycobacterium tuberculosis* and the intimate discourse of a chronic infection. *Immunol Rev*, 240, 252-68. ↗

Stutz, MD., Doerflinger, M., Pellegrini, M., Clark, MP. (2018). *Mycobacterium tuberculosis*: Rewiring host cell signaling to promote infection. *J. Leukoc. Biol.*, 103, 259-268. ↗

Editions

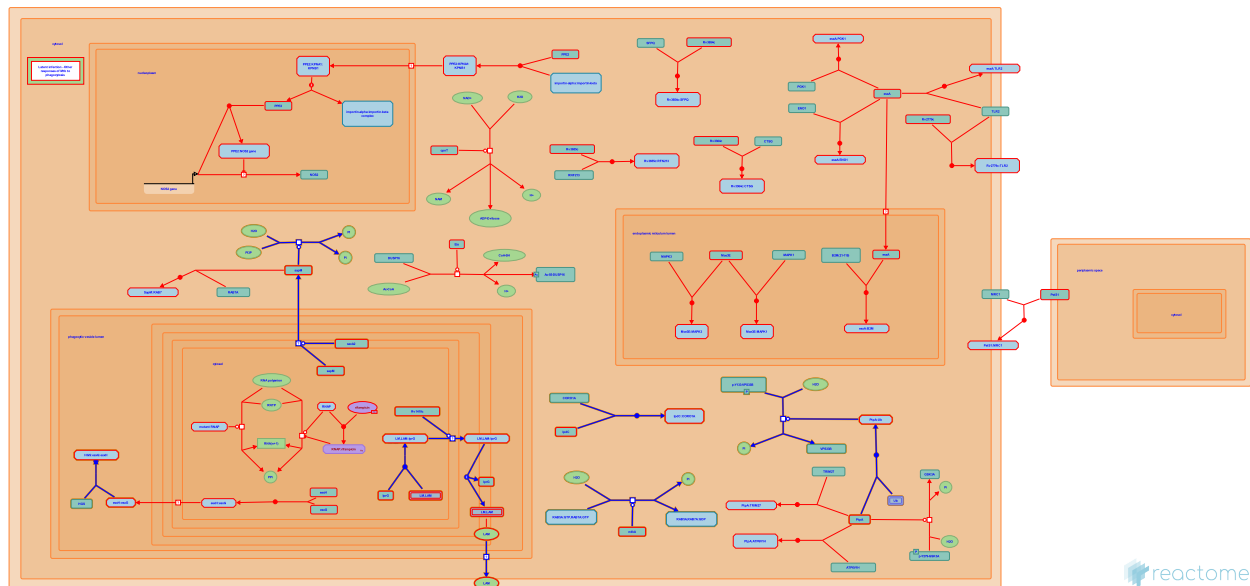
2019-02-06	Authored	Stephan, R.
2019-02-19	Edited	Jassal, B.
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Prevention of phagosomal-lysosomal fusion ↗

Location: [Suppression of phagosomal maturation](#)

Stable identifier: R-HSA-9636383

Diseases: tuberculosis



Lipoarabinomannan (LAM) is transported to Mtb's outer cell wall. When Mtb is interned by the phagocyte, LAM is shedded into the phagocyte's membrane, gets incorporated into lipid rafts of the phagosomal membrane, where it acts to prevent phagosomal-lysosomal fusion (Welin et al. 2008, Gaur et al. 2014). Other processes that get inhibited include the cytoskeletal protein coronin-1A and the fusion mediator vacuolar protein sorting-associated protein 33B (VPS33B) (Deghmane et al. 2007, Bach et al. 2008). Also the Ras-related protein (Rab5) effector phosphatidylinositol 3-phosphate (PI3P) gets enzymatically depleted (Vergne et al. 2005).

Literature references

González-Nilo, FD., Banaei, N., Ehrt, S., Ren, K., Gaur, RL., Zare, RN. et al. (2014). LprG-mediated surface expression of lipoarabinomannan is essential for virulence of Mycobacterium tuberculosis. *PLoS Pathog.*, 10, e1004376. ↗

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Hmama, Z., Av-Gay, Y., Bach, H., Wong, D., Papavinasasundaram, KG. (2008). Mycobacterium tuberculosis virulence is mediated by PtpA dephosphorylation of human vacuolar protein sorting 33B. *Cell Host Microbe*, 3, 316-22. ↗

Abdalla, H., Winberg, ME., Lerm, M., Rasmusson, B., Welin, A., Stendahl, O. et al. (2008). Incorporation of Mycobacterium tuberculosis lipoarabinomannan into macrophage membrane rafts is a prerequisite for the phagosomal maturation block. *Infect. Immun.*, 76, 2882-7. ↗

Toyoshima, S., Hmama, Z., Av-Gay, Y., Deghmane, AE., Noubir, S., Itoh, S. et al. (2007). Lipoamide dehydrogenase mediates retention of coronin-1 on BCG vacuoles, leading to arrest in phagosome maturation. *J. Cell. Sci.*, 120, 2796-806. ↗

Editions

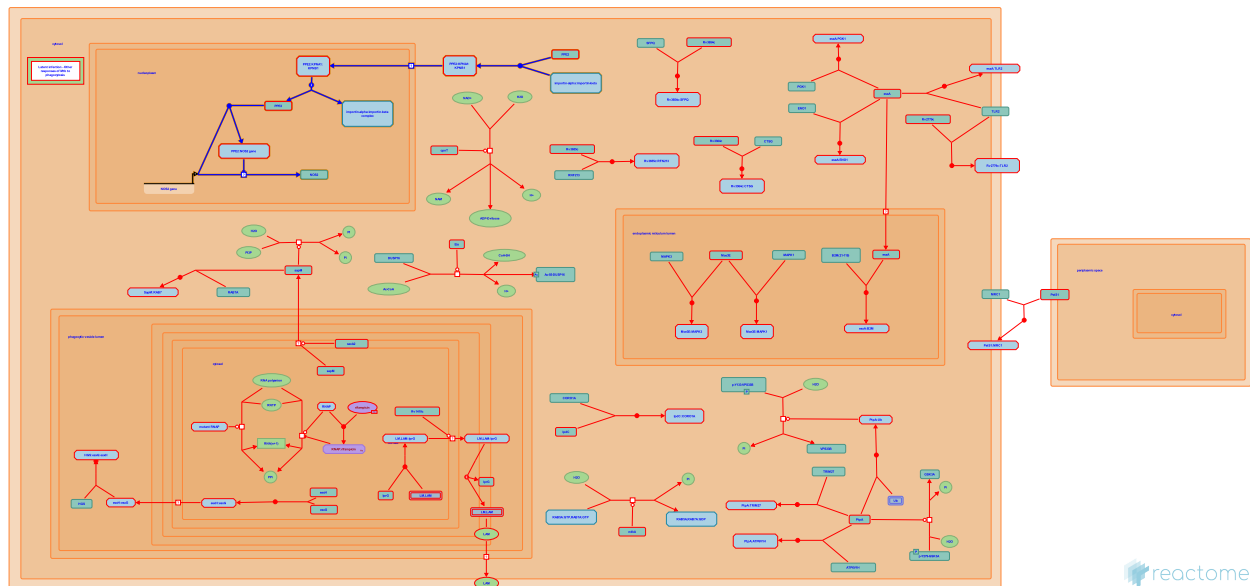
2019-02-06	Authored	Stephan, R.
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Inhibition of nitric oxide production ↗

Location: [Suppression of phagosomal maturation](#)

Stable identifier: R-HSA-9636249

Diseases: tuberculosis



Phagocytes produce nitric oxide to damage interned bacteria before fusion of the phagosome with lysosomes. While Mtb has several pathways to neutralize NO it also attempts to block the host enzymes used for NO production (Fang 2004, Bhat 2017).

Literature references

Fang, FC. (2004). Antimicrobial reactive oxygen and nitrogen species: concepts and controversies. *Nat Rev Microbiol*, 2, 820-32. ↗

Ghosh, S., Mukhopadhyay, S., Kotturu, SK., Bhat, KH., Srivastava, S. (2017). The PPE2 protein of Mycobacterium tuberculosis translocates to host nucleus and inhibits nitric oxide production. *Sci Rep*, 7, 39706. ↗

Editions

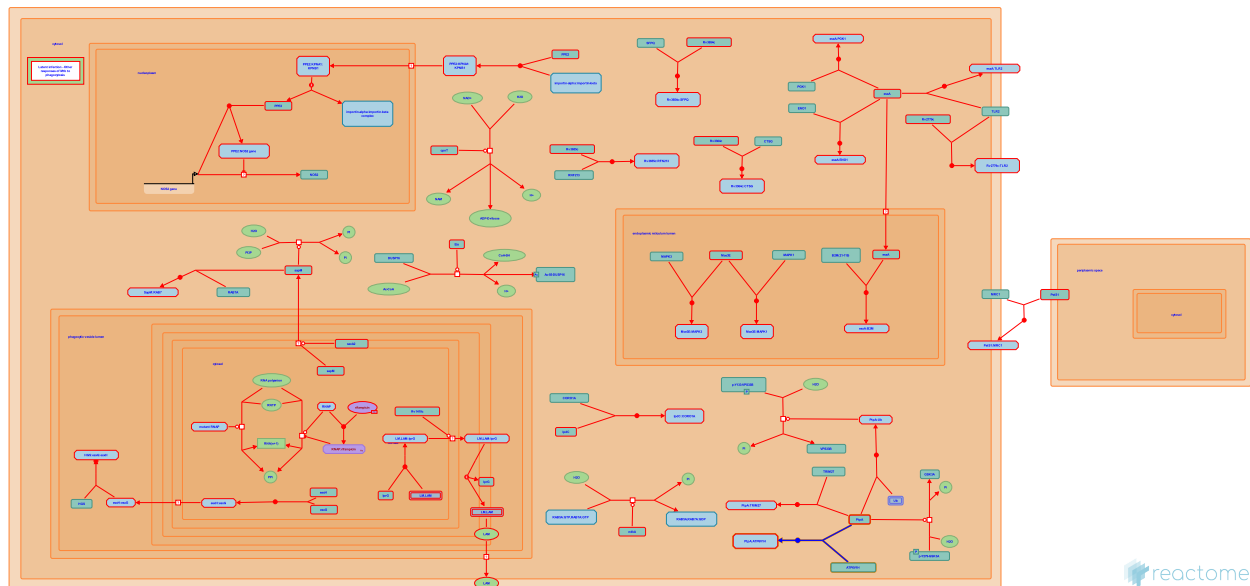
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Blockage of phagosome acidification ↗

Location: [Suppression of phagosomal maturation](#)

Stable identifier: R-HSA-9636467

Diseases: tuberculosis



Acidification of the phagosome occurs by insertion of ATPases into the phagosomal membrane in preparation for fusion with lysosomes. The pH of phagosomes containing Mtb never drops below 6.5 due to Mtb interfering with several acidification mechanisms (Queval et al. 2017).

Literature references

Queval, CJ., Deboosère, N., Tomavo, S., Yeramian, E., Debie, AS., Song, OR. et al. (2017). Mycobacterium tuberculosis Controls Phagosomal Acidification by Targeting CISH-Mediated Signaling. *Cell Rep*, 20, 3188-3198. ↗

Editions

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Table of Contents

Introduction	1
❖ Suppression of phagosomal maturation	2
❖ Prevention of phagosomal-lysosomal fusion	3
❖ Inhibition of nitric oxide production	4
❖ Blockage of phagosome acidification	5
Table of Contents	6