

# 'Missing link' discovered in the defense mechanism of the tuberculosis pathogen

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Flemish biologists lead by Joris Messens (VIB / Vrije Universiteit Brussel) have discovered that *Mycobacterium tuberculosis* – the bacterium that causes tuberculosis – has an ingenious defence mechanism against oxygen. This knowledge is important in the search for a treatment for tuberculosis. 9.4 million people are infected with tuberculosis annually and 1.7 million people die as a result.

Joris Messens: "We have discovered how *Mycobacterium* survives the oxygen stress in our body, namely with the aid of the protein mycoredoxin-1. This opens up a whole new field of research into the role of this protein during a [tuberculosis infection](#). A better understanding of this mechanism will enable us to combat this [bacterium](#) more selectively".

## Oxygen, a necessary evil

Oxygen is essential for the [respiration](#) of nearly all cells. They use this gas to burn sugars in order to produce energy. However, oxygen is also very aggressive and can seriously affect proteins – the building blocks of the cell – in a manner similar to rust or oxidation of iron.

## Attacking essential proteins

Our immune system uses reactive oxygen molecules in the defence against [intruders](#), for example against *Mycobacterium*. Proteins are

particularly sensitive to the effects of oxygen (oxidation). Proteins with sulphur-containing components are particularly sensitive and become inactive with oxidation. Following damage by oxygen, Mycobacterium places the mycothiol molecule on such proteins. After a period of oxygen stress this molecule has to be removed again for the proper functioning of the protein. It was not known how this happened, until now.

## Protection and recovery

Joris Messens and his team have discovered that Mycobacterium tuberculosis protects sulphur-containing proteins in a unique way and actively repairs these proteins once the oxygen stress disappears. They discovered the protein mycoredoxin-1, which forms the basis of this ingenious repair mechanism. The scientists analysed the protein structure and the function of the protein and found that mycoredoxin-1 selectively removes mycothiol from affected sulphur-containing proteins and thereby ensures the activation of these proteins.

Joris Messens: "We could combat tuberculosis more effectively by searching for components that disable mycoredoxin-1. The bacterium would not be able to recover as quickly from an oxygen attack by our immune system."

**More information:** Van Laer, K., Buts, L., Foloppe, N., Vertommen, D., Van Belle, K., Wahni, K., Roos, G., Nilsson, L., Mateos, L. M., Rawat, M., Van Nuland, N. A. and Messens, J. (2012) Mycoredoxin-1 is one of the missing links in the oxidative stress defense mechanism of Mycobacteria. *Mol Microbiol* 86: 787-804.

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[onlinelibrary.wiley.com/doi/10...86.issue-4/issuetoc](https://onlinelibrary.wiley.com/doi/10.1002/med.86.issue-4/issuetoc)

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