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Carnivorous mushroom reveals human immune trick

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A carnivorous oyster mushroom defends itself against pest roundworms and can eat them too. One of the tricks it has is a hole-punching protein, just like one used by our immune system. Scientists say the humble oyster mushroom could tell us how our bodies fight disease.

Published today in *PLOS Biology*, the study opens the way to new drug targets and new tools for use in medicine, because human immune cells also use the hole-punching trick to protect the body, destroying virus-infected cells, cancerous cells, and bacteria.

The international team of researchers, led by the ARC Centre for Advanced Molecular Imaging based at Monash University and Birkbeck College, London, visualised for the first time the action of one of the pore-forming proteins - pleurotolysin - found in the edible oyster mushroom.

Lead researcher, Dr Michelle Dunstone from Monash University, said humans, animals, plants, fungi, and bacteria all use pore-forming proteins as lethal, cell-killing weapons, but she never believed they would be able to see these proteins in action.

"This is an amazing mechanism, and also amazing that we now have the technology to see these hole-punching proteins at work," she said.

"Now we've uncovered this process, we can look at how to block the hole-punching mechanism," Dr Dunstone said.

Specialist instruments including synchrotron light and cryo-electron microscopy, allowed the team to take molecular snapshots and observe the hole-punching protein as it latches onto, and puts a hole in the target cell. Along with biophysical and computational experiments, the team were able to show the way the pleurotolysin protein moves, unfolding and refolding to punch the hole in the target cell.

Dr Dunstone said that by uncovering this fundamental process they've also found its Achilles heel.

"The next step is to take what we've learnt from the oyster mushroom proteins and compare them with equivalent proteins across nature," she said.

"We're particularly interested in this family of proteins in humans, especially perforin, which we believe will behave in the same way." Dr Dunstone said.

The molecular process could potentially be developed to dampen immune responses in people with autoimmune disease; stop listeria escaping our immune cells; and preventing malaria from infecting the liver.

The proteins could also benefit agriculture to fight attacks from pests, reducing the need for pesticides and be applied to genetic engineering and nano-engineering.

Provided by Monash University