

Researchers ride new sound wave to health discovery

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Dr Amgad Rezk and his research colleagues at RMIT University have created a new class of sound wave -- the first in more than half a century -- in a breakthrough they hope could lead to a revolution in stem cell therapy. Credit: RMIT University

Acoustics experts have created a new class of sound wave - the first in

more than half a century - in a breakthrough they hope could lead to a revolution in stem cell therapy.

The team at RMIT University in Melbourne, Australia, combined two different types of acoustic sound waves called bulk waves and [surface waves](#) to create a new hybrid: "surface reflected bulk waves".

The first new class of sound wave discovered in decades, the powerful waves are gentle enough to use in biomedical devices to manipulate highly fragile stem cells without causing damage or affecting their integrity, opening new possibilities in stem cell treatment.

Dr Amgad Rezk, from RMIT's Micro/Nano Research Laboratory, said the team was already using the discovery to dramatically improve the efficiency of an innovative new "nebuliser" that could deliver vaccines and other drugs directly to the lung.

"We have used the new sound waves to slash the time required for inhaling vaccines through the nebuliser device, from 30 minutes to as little as 30 seconds," Rezk said.

"But our work also opens up the possibility of using stem cells more efficiently for treating lung disease, enabling us to nebulise [stem cells](#) straight into a specific site within the lung to repair damaged tissue.

"This is a real game changer for stem cell treatment in the lungs."

The researchers are using the "surface reflected bulk waves" in a breakthrough device, dubbed HYDRA, which converts electricity passing through a piezoelectric chip into mechanical vibration, or sound waves, which in turn break liquid into a spray.

"It's basically 'yelling' at the liquid so it vibrates, breaking it down into

vapour," Rezk said.

Bulk sound waves operate similar to a carpet being held at one end and shaken, resulting in the whole substrate vibrating as one entity. Surface [sound waves](#) on the other hand operate more like ocean waves rolling above a swimmer's head.

"The combination of surface and bulk wave means they work in harmony and produce a much more powerful wave," said Rezk, who co-authored the study with PhD researcher James Tan.

"As a result, instead of administering or nebulising medicine at around 0.2ml per minute, we did up to 5ml per minute. That's a huge difference."

The breakthrough HYDRA device is improving the effectiveness of a revolutionary new type of nebuliser developed at RMIT called Respite. Cheap, lightweight and portable, the advanced Respite nebuliser can deliver everything from precise drug doses to patients with asthma and cystic fibrosis, to insulin for diabetes patients, and needle-free vaccinations to infants.

The HYDRA research will be published on Thursday 7 January in the scientific journal *Advanced Materials*.

More information: *Advanced Materials*,
[onlinelibrary.wiley.com/doi/10 ... /adma.201504861/full](http://onlinelibrary.wiley.com/doi/10.../adma.201504861/full)

Provided by RMIT University

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