Liquid breathing moves a step closer thanks to measurement study

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Liquid ventilation –breathing a liquid instead of air – has long been the stuff of science fiction, and despite experimental clinical use, its potential for treating severe pulmonary or cardiac trauma, and use in deep diving and space travel, it is still not widely used or understood.

However, thanks to the work of German researchers from TU Bergakademie Freiberg, that may be about to change.

The researchers, Thomas Janke and Dr Katrin Bauer, published their work this week in the journal *Measurement Science and Technology*.

Lead author Mr Janke said: "In clinical liquid ventilation, the lung is filled with liquid, rather than air. The liquid perfluorocarbon (PFC), which is used for liquid ventilation, has proven perfectly suitable as a breathing medium, as it not only dissolves high amounts of oxygen but also acts as anti-inflammatory for human tissue.

"However, very little is known about the long term outcome of liquid ventilation; the right ventilation frequency; and the volume that is breathed in and out. The challenge is in the measurement of dissolved oxygen concentrations during liquid ventilation, which is limited to averaged concentrations of the liquid entering or leaving the body. Our aim was to extend the available measurement techniques in the research of liquid ventilation."

To gain a greater insight into airway oxygen transport during liquid ventilation, the researchers used an in-vitro model of the human lung bronchial tree to measure the effect of oxygen quenching of a fluorescent dye, which has high fluorescence at low oxygen concentrations.

Because the dye's fluorescence intensity is reduced by oxygen quenching, the higher the concentration of dissolved oxygen, the lower the fluorescence intensity of the dye became.

They then imaged the flow using a digital CCD-camera, a blue LED, an optical filter and a mirror.

Using this technique, they were able to 'map' for the first time how the airway absorbed and transported the oxygen, revealing distinctive concentration patterns during inspiration and expiration.

Dr Bauer said: "Our results showed high potential for this technique to visualize the oxygen transport in a human airway model. We now plan to employ the same technique to look at more complex and realistic human airways."

More information: "Visualizing dissolved oxygen transport for liquid ventilation in an in-vitro model of the human airways." *Meas. Sci. Technol*. doi.org/10.1088/1361-6501/aa60aa

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