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## The Engineer Online

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### Shrinking blades

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Chemists at the University of Illinois at Chicago have created a theoretical blueprint for assembling a nanoscale propeller with molecule-sized blades.

Such a device would allow liquids to be pumped at a cellular scale for applications such as targeting medicines and regulating flow into and out of cells.

Using traditional molecular dynamics simulations, Petr Král, assistant professor of chemistry at UIC, and his team were able to study realistic conditions in this microscopic environment to learn how the tiny propellers pump liquids, in particular, water and oils.

'We want to see what happens when the propellers get to the scale where it's impossible to reduce the size of the blades any more,' said Král.

The UIC researchers found that propeller pumping efficiency in liquids is highly sensitive to the size, shape, chemical or biological composition of the blades.

They also discovered that at the molecular level, unlike at the macro level, the chemistry of the propeller's blades and their sensitivity to water play a big role in determining whether the propeller pumps efficiently or just spins with little effect. If the blades have a hydrophobic, or water-repelling nature, they pump a lot of water. But if they are hydrophilic, or water attracting, they become clogged with water molecules and pump poorly.

'In principle, we could even attach some biological molecules to the blades and form a propeller that would work only if other molecules bio-compatible with the blades are in the pumped solution,' he said.

Král also highlighted, however, that the technology will not become reality for several years because of the difficulties associated with manufacturing such tiny devices.



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