Lab-made droplets roll themselves

Gel mimics the molecular motors inside living cells.

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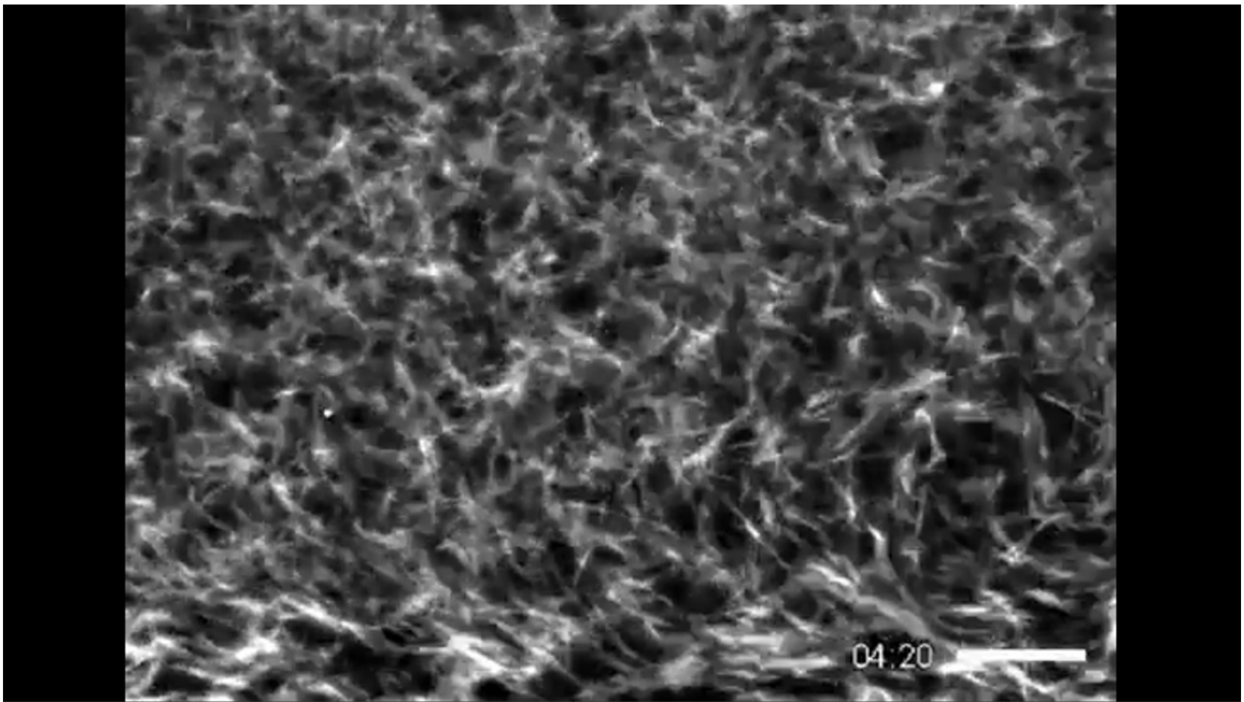
07 November 2012



Self-propelled polymers

Powered by ATP, the biological motor protein kinesin makes microtubles move around and aggregate into bundles. *Credit: Sanchez et al., Nature*

Using biological building blocks found inside a living cell, researchers have created a material that moves itself[1].

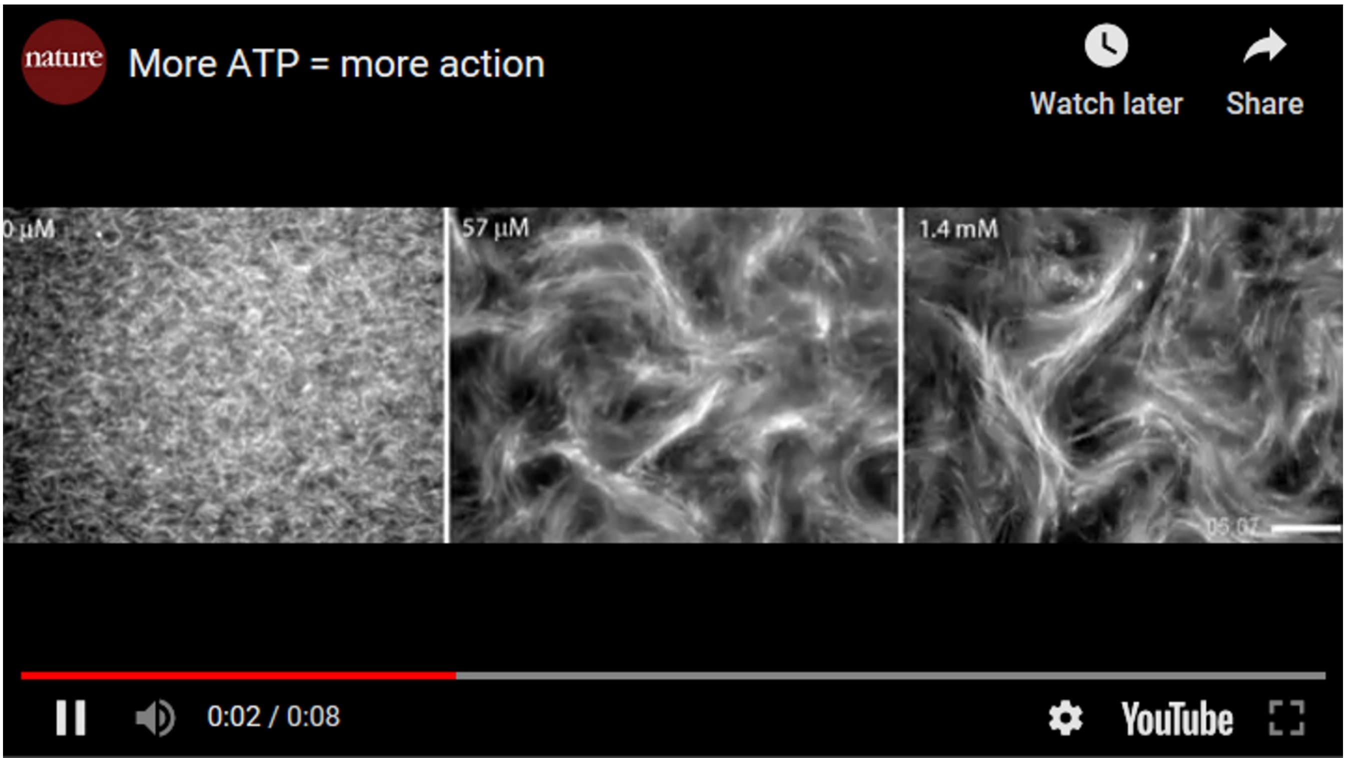
The researchers first made a gel comprising microtubules — stiff polymer filaments that, in living cells, act as guiding tracks for kinesin, a ‘motor protein’ that is propelled along the microtubule cables by the cellular fuel ATP. “It’s like a tyre,” says Zvonimir Dogic, a physicist at Brandeis University in Waltham, Massachusetts, who led the study. Adding a small polymer to the mix encouraged the microtubules to form bundles and create a moving network. Water droplets containing this gel move continuously — in an oil emulsion and on flat surfaces — without external force, the researchers found.

Each molecule of ATP propels a kinesin molecule 8 nanometres forward along the microtubule track. With thousands of kinesins rumbling along multiple microtubules, a droplet that is 100 micrometres across spontaneously begins rolling when it touches a flat surface.

“It’s a startling advance because of the macro-scale movement that it produces,” says Raymond Goldstein, a biological physicist at the University of Cambridge, UK.

In a series of videos, such as the ones above and below, Dogic and his team recorded the cyclic stages through which microtubule bundles grow, bend, buckle, break and grow again. They also found that the rate at which the fluids moved increased with increasing concentrations of ATP.

Theoretical physicists and biochemists who study such ‘active fluids’ are enchanted by the creation of a comparatively simple, real-life system on which to test the theories which they have largely confined to simulations, though some experimental model systems do exist[2, 3]. Sriram Ramaswamy, a physicist at the Tata Institute of Fundamental Research in Hyderabad, India, expects that as other experimentalists build on the Dogic team's work, this new system will support theoretical ideas about active fluids and might even "do things that we theorists hadn't anticipated".



Ramping up the speed

Adding more ATP fuel to the mixture makes the microtubules jitter faster.

Nature | doi:10.1038/nature.2012.11768

References

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2. Thoresen, T. *et al*. *Biophys J.* **100** 2698–2705 (2011).
3. Mizuno, D. *Science.* **315** 370–373 (2007).