Gel undergoes Peristalsis

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(PhysOrg.com) -- Large or small, machine parts only move when controlled by an external impulse. Biological systems, on the other hand, are capable of autonomous movements that continuously follow their own rhythms and spatial patterns. For example, intestinal peristalsis—a circular, constricting, unidirectional muscular contraction—depends in part on an inherent muscular rhythm.

Japanese researchers led by Shingo Maeda at Waseda University have now developed a polymer gel that can undergo peristaltic motion without an external stimulus—as though it were alive, as they report in the journal *Angewandte Chemie*.

A gel is a sponge-like three-dimensional network whose pores are filled with a liquid. The secret of the rare “living” gel is a special chemical reaction that occurs within this liquid. It is based on the Belousov–Zhabotinsky reaction, also known as the “chemical clock”.

This reaction involves a system of several coupled reactions that involve feedback, meaning that the materials in the reaction sequence influence their own rate of formation. Such systems oscillate over time, and the oscillations can manifest themselves in the form of spatial patterns.

The reaction causes ruthenium ions within the gel to periodically change their level of oxidation. The gel is constructed so that it swells to varying degrees, depending on the charge of the ruthenium ion. The oscillating chemical reaction thus causes the gel to swell up and shrink periodically.

A ribbon-shaped piece of gel is traversed lengthwise by swelling and shrinking regions. This results in peristaltic motion. If a small cylindrical object is placed on the gel, the wave motion of the gel causes it to roll forward—like a miniature conveyor belt.

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