# Novel polymers release their drug cargo in response to body temperature

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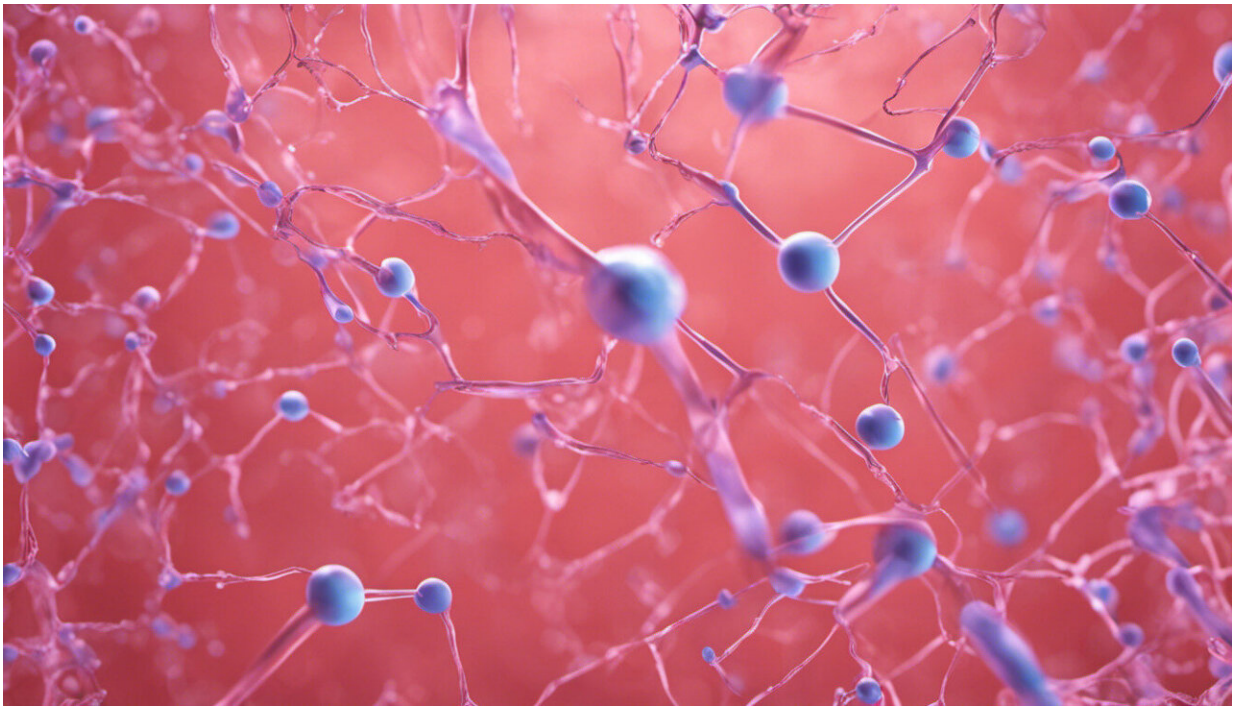

Credit: AI-generated image (disclaimer)

A critical step in advancing medical treatment is the development of novel drug delivery methods. While a simple tablet, taken by the patient with a sip of water, may be the easiest way to administer a drug, this may not always be the most suitable. Some drugs are subjected to degradation by the body, while others, such as cancer medications, can be more

effective if they are delivered directly to the diseased tissue site. Such a delivery could improve the effectiveness of the treatment and potentially reduce side effects.

Yiyan Yang and Jeremy Tan from the A*STAR Institute of Bioengineering and Nanotechnology, working in collaboration with researchers from the IBM Almaden Research Center and Stanford University in the USA, have reported the preparation of biodegradable, water-soluble polymers that can be loaded with the cancer drug Paclitaxel and injected directly into tumor tissues. Warming to body temperature causes the release of the therapeutic cargo with the system showing improvement in killing cancer cells over treatment with the drug alone.

Rather than being made from repeating units of a single monomer, the polymers described are a type of block copolymer—a polymer with one block that contains hydrophilic and hydrophobic groups and another block that contains hydrophobic groups. It is through the careful balance between these groups that the temperature-responsive property of the polymer is achieved.

To make the copolymers, Yang and co-workers used the process of living polymerization, which allows the polymer chains to keep growing until the supply of monomer is exhausted. When more monomers are added, polymerization will restart. The approach allows polymers with different sized blocks of hydrophilic and hydrophobic groups to be built easily to optimize the properties. It also results in polymers with a narrow distribution of molecular weights—an important factor in producing polymers with consistent properties throughout a sample.

Thermoresponsive polymers have been studied before, with one of the most intensively investigated being poly(N-isopropylacrylamide) (PNIPAAm), which was first synthesized in the 1950s. The critical

difference in the new polymers described by Yang and co-workers is that they are both non-toxic and biodegradable. “After these polymers performed their task of delivering their important cargos, they should break down and be excreted without significant additional side effects,” says Yang. “We are now planning to further work with the IBM Almaden Research Center and other industrial partners to evaluate the in vivo toxicity and efficacy of this system for the delivery of therapeutics.”

**More information:** Research article in Biomaterials

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