New technology delivers sustained release of drugs for up to 6 months

Cambridge Enterprise

A new technology which delivers sustained release of therapeutics for up to six months could be used in conditions which require routine injections, including diabetes, certain forms of cancer and potentially HIV/AIDS.

Researchers from the University of Cambridge have developed injectable, reformable and spreadable hydrogels which can be loaded with proteins or other therapeutics. The hydrogels contain up to 99.7% water by weight, with the remainder primarily made up of cellulose polymers held together with cucurbiturils - barrel-shaped molecules which act as miniature 'handcuffs'.

"The hydrogels protect the proteins so that they remain bio-active for long periods, and allow the proteins to remain in their native state," says Dr Oren Scherman of the Department of Chemistry, who led the research. "Importantly, all the components can be incorporated at room temperature, which is key when dealing with proteins which denature when exposed to high heat."

The hydrogels developed by Scherman, Dr Xian Jun Loh and PhD student Eric Appel are capable of delivering sustained release of the proteins they contain for up to six months, compared with the current maximum of three months. The rate of release can be controlled according to the ratio of materials in the hydrogel.

Not only do these hydrogels double the window of content release, they use far less non-water material than current technology. The extra material serves as a type of scaffolding holding the hydrogel together, but it can affect performance of the cargo contained within it, so the less structure-forming material contained within the hydrogel, the more effectively it will perform.

As drug therapy moves away from small molecule drugs toward protein-based therapy, applications such hormone therapy, wound healing and insulin treatment would all be ideal applications for the hydrogels.

For example, more than a quarter of the 2.9 million individuals in the UK who have diabetes have to inject themselves daily with insulin in order to control blood glucose levels. Containing the insulin within a hydrogel could potentially reduce the number of annual injections from 365 to just two.

The long-term sustained release would be especially useful in resource-deprived or rural settings where patients requiring daily medication may not have regular access to a doctor. "There's been a lot of research that shows patients who need to take a pill each day for the rest of their lives, especially HIV patients in Africa who do not show any obvious symptoms, will take the pills for a maximum of six months

before they stop, negating the point of taking the medication in the first place," says Appel. "If patients only have to take one shot which will give them six month's worth of medication, we'll have a much greater chance of affecting an entire population and slowing or stopping the progression of a disease."

The team is currently working with researchers from the Brain Repair Centre in the Department of Clinical Medicine on how the technology might be used as a possible treatment for brain cancer.

The research was published recently in the journal Biomaterials and has been patented by Cambridge Enterprise, the University's commercialization group.

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