Smart insulin nanostructures pass feasibility test

September 20 2007

Biomedical engineers at The University of Texas School of Health Information Sciences at Houston have announced pre-clinical test results in the September issue of the International Journal of Nanomedicine demonstrating the feasibility of a smart particle insulin release system that detects spikes in glucose or blood sugar levels and releases insulin to counteract them.

Designed to mimic functions of the pancreas which produces the blood-sugar regulating hormone insulin, the smart particle system stabilized blood sugar levels in animal models with suppressed pancreatic functions for up to six hours, researchers reported. It is an inhalable system.

The study, “Glucose-sensing pulmonary delivery of human insulin to the systemic circulation of rats,” was conducted in the laboratory of Ananth V. Annapragada, Ph.D., an associate professor at the UT School of Health Information Sciences. Research assistant Efstathios Karathanasis was lead author and postdoctoral fellow Rohan C. Bhavane was a contributor on the article.

The smart particle system consists of a blood sugar sensing protein named concanavalin A (Con A) and bundles of tiny fat bubbles called liposomes that are loaded with insulin. “Con A binds insulin-containing liposomes that are coated with sugars, to each other, to form the inhaled particles,” Annapragada said. “When blood sugar becomes present, the Con A releases the particles to bind independently to the sugars. The released particles then release their insulin.”

Hundreds of thousands of individuals suffer Type I diabetes, a condition that develops when the body's immune system destroys pancreatic beta cells – the only cells that make insulin. High blood sugar levels can lead to serious complications and premature death.

"No one had ever shown that an inhalable smart release system was viable," said Annapragada, who describes the study as a "proof of concept" initiative. He said additional work – including the discovery of less inflammatory blood sugar sensing proteins or small molecules – will be required before its efficacy for patients can be tested in clinical trials.

The smart particle system could potentially treat other health conditions, he said.

Source: University of Texas Health Science Center at Houston