News Release

Title

Microneedle-Array Patch Fabricated with Enzyme-Free Polymeric Components Capable of On-Demand Insulin Delivery

Key Points

- **Microneedle (MN) - array patch based “closed - loop” artificial pancreas that is “electronics-free”, “enzyme-free” and “nanoparticle-free”**
- **The first successful material engineering addressing both sustained and acute glucose-responsive insulin delivery**
- **It offers a candidate for a next-generation diabetes therapy that is remarkably stable, safe, economically efficient, and user-friendly**

Summary

Achieving persistent glycemic control in a painless and convenient way is the ultimate goal of diabetes management. Herein, an “enzyme-free” polymeric microneedle (MN)-array patch composed of a boronate-containing hydrogel semi-interpenetrated by biocompatible silk fibroin is developed. Consistent with the previous reports, the presence of the boronate-hydrogel allows for glucose-responsive diffusion-control of insulin, while the crystalline fibroin component serves as a matrix-stiffener to validate skin penetration. Remarkably, this “enzyme-free” smart artificial on-skin pancreas prototype remains stable for at least 2 months in an aqueous environment. Furthermore, it establishes sustained as well as acute glucose-responsive insulin delivery, and is to the authors’ knowledge, the first successful material design addressing such two technical challenges at once on an MN format. This long-acting, on-demand insulin delivery technology may offer a candidate for a next-generation diabetes therapy that is remarkably stable, safe, economically efficient, and capable of providing both acute- and continuous glycemic control in a manner minimally dependent on patient compliance.

Publication

S. Chen, H. Matsumoto, Y. Moro-oka, M. Tanaka, Y. Miyahara, T. Suganami, A. Matsumoto.
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