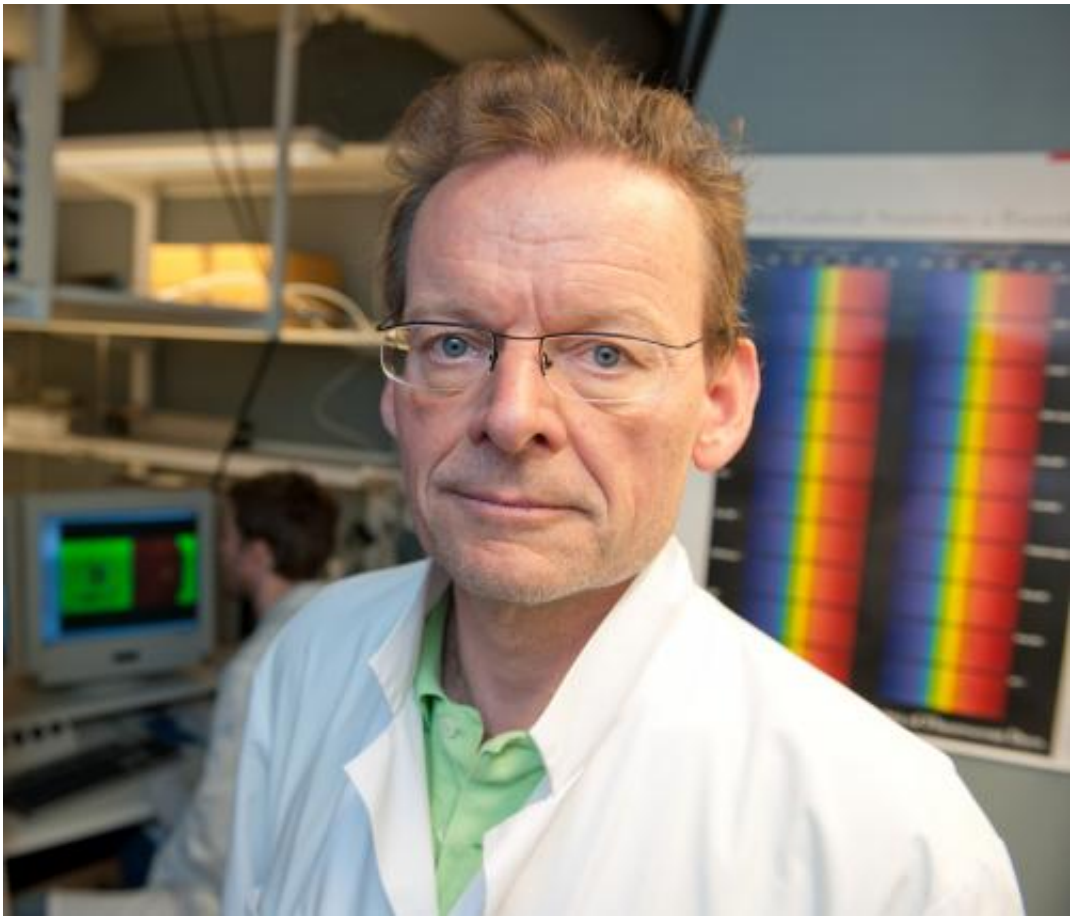
Reading the pancreas through the eye: Researchers describe innovative way to study body glucose regulation

November 18 2013



Dr Per-Olof Berggren at Karolinska Institutet in Sweden suggests an innovative method to study body glucose regulation through the eyes. The findings are published in the November 18-22, 2013 online issue of *PNAS*. Credit: Ulf Sirborn

Researchers at Karolinska Institutet in Sweden have found an innovative way to study glucose regulation in the body: by transferring the vital insulin-producing cells from the pancreas to the eye, the latter can serve as a kind of window through which health reports can be obtained from the former. The results, which are expected to have a significant impact on diabetes research, are published in scientific journal *PNAS*.

The endocrine part of the pancreas, the Islets of Langerhans, produces and secretes insulin, the hormone that regulates blood sugar levels. After a meal, the hormone is released into the blood at an amount that is in direct proportion to the amount of food ingested; blood insulin levels therefore vary from one meal to the next and between individuals. In the case of conditions such as obesity, large amounts of insulin are needed to compensate for the high consumption of food and insensitivity to the hormone.

The Islets of Langerhans try to adapt themselves to this condition by increasing the number of insulin-producing beta-cells and/or modulating their individual secretion of insulin in response to the intake of sugar. This plasticity is essential to the maintenance of normal blood sugar levels, and its dysfunction leads to diabetes, a serious disease that has reached pandemic proportions.

The greatest obstacle to studying the exact workings of the Islets of Langerhans and how they adapt to individual conditions is their relative inaccessibility, in that they lie deeply embedded in and are distributed throughout the tissue. Now, however, researchers have found a new way to study the insulin-producing beta-cells: by transferring the Islets of Langerhans to the eye.

"What we've done is made the cells optically accessible by grafting a small number of 'reporter islets' into the eyes of mice, which allows us to monitor the activity of the pancreas just by looking into the eye," says

Per-Olof Berggren, professor of experimental endocrinology at Karolinska Institutet's Department of Molecular Medicine and Surgery, and director of the Rolf Luft Research Centre for Diabetes and Endocrinology. "We're now able to really study the insulin-producing beta-cells in detail in a way that wasn't possible before."

The eye may be used, as a kind of reporter reproducing the activity of the pancreas and allowing readings of the status of the pancreas under different conditions in health and disease.

"The Islets of Langerhans can be visualised repeatedly over a period of several months, and our work shows that during this time, functional and morphological changes occur in them that are identical to those occurring in the pancreas," says first author Dr Erwin Ilegems, researcher at the Rolf Luft Centre.

Using the new monitoring system and pharmacological treatment, the researchers have reduced food consumption in obese mice models and thus stopped the enormous growth in beta-cell population. This means that they are now able to individually tweak drug doses.

"We'll also be using the system to identify new drug substances that regulate beta-cell plasticity and function," says Professor Berggren. "In the future we may also conceive a similar use of reporter islets in humans in order to find unique, tailored treatment principles, to measure the effects of personal medication, or to diagnose problems with the pancreatic islets."

More information: 'Reporter islets in the eye reveal plasticity of the endocrine pancreas', Erwin Ilegems, Andrea Dicker, Stephan Speier, Aarti Sharma, Alan Bahow, Patrick Karlsson Edlund, Ingo B. Leibiger, and Per-Olof Berggren, *PNAS*, online 18-22 November 2013.

Provided by Karolinska Institutet