A smart choice for diabetes monitoring

Development of an implanted biosensor for continuous care and monitoring system of diabetic patients: the P.Cezanne project

Development of an Implanted Biosensor for Continuous Care and Monitoring System of Diabetic Patients: the P.Cezanne Project Our project (FP6-031867) is developing an implantable device for glucose monitoring, integrating engineered proteins with fluorimetric detection and hydrogel waveguide technology. The implant feeds a stream of interstitial fluid glucose values into a telemedicine system and can eventually integrate an insulin pump, thus fulfilling the goal of an "artificial pancreas". The sensor is based on a bacterial Glucose Binding Protein (GBP), fused with a fluorescence donor-acceptor pair, Cyan and Yellow Fluorescent Proteins. Between the fluorescent proteins Fluorescence Resonance Energy Transfer (FRET) occurs. On glucose binding GBP undergoes a conformational change of FRET. Mutant derivatives of GBP were designed to achieve glucose sensitivity between 2 and 30 mM, the range of clinical utility. Sensor proteins are embedded in a hydrogel matrix, which serves as a waveguide for single-wavelength excitation by a blue laser diode. Fluorescence is monitored at two separate wavelengths. The FRET signal is processed inside the implant and wirelessly transmitted to a personal mobile device.

When fully developed, our implantable system may provide an autonomous solution for continuous glucose monitoring.

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Submitted by:
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Further project partners:
Fraunhofer Institute,
Polymer Institute of the Slovack Academy of Sciences Research
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Making change possible

MIRSURG

The MIRSURG project, comprising researchers from 9 European institutes and companies, is focused on development of a laser source that will enable minimally invasive neurosurgery. The laser should emit at a wavelength near 6.45 µm and provide high single pulse energy and average power. The penetration depth at this wavelength will be comparable to the cell size (several micrometers), which will make it possible to avoid collateral damage when ablating the tissue. Earlier tests carried out in the USA with free electron lasers (FELs) have proved that brain surgery performed at a wavelength of 6.45 µm leads to good results. Such lasers generate coherent radiation with very high brilliancy. For applications in biomedicine however, FELs are not practical since they are coupled to huge and expensive accelerators. Therefore, it is important to develop new technologies to replace the FELs with table-top solid-state photonic sources. The main strategy is to exploit nonlinear optical techniques (OPO) in combination with novel near-IR laser pump sources (near 1 and 2 µm) and new materials (e.g. orientation patterned GaAs) to obtain an unprecedented energy level (10 mJ) near 6.45 µm at a repetition rate of 100 Hz (an average power of 1 W). The systems will provide improved control and higher accuracy for treatment and prevention either at individual cell level or cellular structures depending on the pulse shapes utilized.

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