

## Subcutaneous Biocompatible Continuous Glucose Monitoring Sensor

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Diabetes affects 371 million people globally according to the International Diabetes Federation. Commercially available devices for glucose monitoring must be sensitive enough to report small glucose concentration (mg/dL) changes in the body. Most commercially available glucose monitors only capture a snapshot of the body's glucose concentration through painful finger pricks that are performed 4-5 times a day. Implementation of continuous monitoring allows patients to anticipate hypoglycemia or hyperglycemia from rapid measurements throughout the day. Currently, there are multiple continuous glucose monitoring (CGM) systems on the market including Medtronic's Guardian Connect and Dexcom's G6. While the benefits of using these CGM's include the reduction of finger pricking with tight glycemic control throughout the day, subcutaneous CGM sensors last about a week.

In this study, we consider a nanowire-based biocompatible sensor for better accuracy for long-term implantation. In addition, utilizing multiple sensors on a platform results in substantial increase in the sensor lifetime. The designed sensor utilizes a nanostructured Zinc oxide (ZnO) material, glucose oxidase enzyme, and a protective Nafion membrane to enhance selectivity, electrochemical activity, and sensitivity. In order to verify the proper functioning of the sensor measurements were performed using an electrochemical cell, *in vitro*, and rodent models *in vivo*. For the *in vitro* study glucose concentrations from 0 mg/dL to 600 mg/dL were considered. Delayed activation of the sensor was performed and characterized *in vitro* using cyclic voltammetry and amperometric measurements. Finally, to verify the sensor *in vivo*, three sensors were implanted in diabetic rats. Three animals were administered an intraperitoneal injection of streptozotocin and was compared with both the gold standard laboratory clinical laboratory analyzer and commercially available capillary blood glucose meters OneTouch Ultra2 Meter and Dexcom Continuous Glucose Monitor 5G System.

Accuracy of the sensor was tested *in-vivo* by amperometry in the interstitial fluid of rats. An incision for the sensor was made vertically across the midline of the rats back to measure glucose data every 10 minutes for 2 hours.