Lab-on-a-Chip: Continuous Glucose Monitoring Antenna Sensors

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The development of a reliable continuous glucose monitoring technology, which would lessen the complications associated with diabetes through optimal glycemic control, is a key to improving the quality of lives of patients living with the disease. In recent years, considerable progress has been made in developing implantable biosensors that can continually monitor glucose levels. These biosensors rely on the interstitial fluid within the dermis to measure the interstitial glucose (IG) levels. However, to be truly beneficial, the implanted sensor must be able to function properly for an extended period of time. The biosensors developed thus far can only remain functional up several weeks after their implantation in the body. Contributing factors for this loss of functionality include the degradation and fouling of the sensor, and the changes in the tissue surrounding the sensor such as fibrosis and inflammation. While researchers explore potential solutions to improve the current implantable biosensors, there is an urgent need to investigate alternative technologies. Unless a reliable technology for long-term glucose monitoring is developed, continuous glucose monitoring is expected to remain problematic, and patients will continue to face the life-threatening complications associated with poor glycemic control. In order to provide a potential solution to this problem, in this study, we propose a lab-on-chip antenna sensor for continuous monitoring of the glucose concentration in the interstitial fluid. Unlike biosensors that require direct contact with the interstitial fluid in order to trigger necessary chemical reactions to operate, the new sensor works on an electromagnetic energy propagation principle. Thus, it does not need direct interface with the interstitial fluid and can be fabricated using biocompatible materials allowing it to remain functional in the body for years.