

Diabeloop and CEA LETI are perfecting insulin delivery by integrating AI into a closed-loop system that alleviates the decision-making burden on patients.

Researchers and doctors working in a joint research lab have revolutionised the lives of people suffering from Type 1 diabetes. They have moved from one-shot blood sugar measurements and manual insulin injections, with all of the related decision-making and risks, to continuous measurement with personalised, secure insulin delivery.

Supporting Innovation

Day-to-day living conditions for insulin-dependent diabetics have improved regularly over the past ten years. From insulin pens to pumps with continuous monitoring, controlling blood glucose and delivering insulin have become much more straightforward but are still largely dependent on constant decision-making by diabetics. The risk of hypoglycemia — particularly at night or after strenuous physical effort — are a constant worry for those concerned. “Automatic insulin delivery systems” provide a completely safe means of genuinely reducing these day-to-day stresses. Thanks to a specific algorithm in a dedicated terminal, Diabeloop’s DBLG1 system regulates insulin delivery using continuous glucose monitoring and communicates directly with the insulin pump. Local algorithms calculate the required insulin dose and the terminal uses Bluetooth to connect to a miniature pump patch and continuous glucose monitoring device. This alleviates the decision-making burden on patients who simply need to inform the system about what they eat as well as any sports activities.



The client needs

Erratic insulin production characteristic of Type 1 diabetes can lead to serious complications in treatment. For diabetics who are often diagnosed before the age of 30, this means a lifetime of monitoring their blood sugar levels several times a day. In 2011, the founders of Diabeloop began to focus on preventing hypoglycemia and controlling glucose, and on the factors for patient adoption of a three-component, closed-loop system. This comprises a continuous glucose monitoring (CGM) device, a patch-type insulin pump and an operating system, and combines miniaturisation, reliable measurement, responsiveness to events and secure digital data. Carnot CEA LETI research institute, which is highly committed to societally-impactful digital transition projects, threw its weight behind the idea from the outset. Development of the DBLG1 system focused on the insulin regulation algorithm: for greater confidentiality and efficiency, the algorithm needed to run locally and not on the Cloud, while at the same time sending data to a medical monitoring service during the clinical trial phase. The system has been CE-certified since 2018 and deals very effectively with reducing the risks of hypoglycemia between meals and during sleep-induced fasting periods. But it also needs to “learn” from the patient’s day-to-day life to tailor the response to their specific needs and come up with a personalised automated glucose monitoring system. This requires improved knowledge of how insulin sensitivity varies over the day (and night) and the impact of meals, physical activity, emotion and stress.

Partnership

Carnot CEA LETI seeks to showcase disruptive tech innovations, especially in the healthcare arena. Thanks to its investment in research into automated solutions for treating Type 1 diabetes since 2011, along with CERITD (French institute tasked with stepping up research into diabetes treatment), it has helped to validate the project, leading to the creation of Diabeloop, which it has been partnering since 2015 within the scope of a joint research laboratory. Carnot CEA LETI drew upon its data science expertise for the creation of the algorithm that controls the insulin dose based on continuous glucose monitoring (bio-control algorithm). It also leveraged its extensive experience of IoT technologies to develop the app that liaises with the patient.

After successful clinical testing and CE certification, the system is now being marketed in France and Europe: the dossier has been submitted to the French social security system, roll-out is scheduled in Germany and initial contacts have been made with the FDA in the United States. The Diabeloop team — comprising more than 80 people working in Grenoble, Paris and Germany — is now focusing on the considerable challenge of postprandial glucose “spikes”. In 2019, the Company carried out the largest AI-related round of funding in Europe. But it is the number of patients who declare that “this has changed my life” by alleviating their decision-making burden that is the real testament to the long-term success of this partnership.