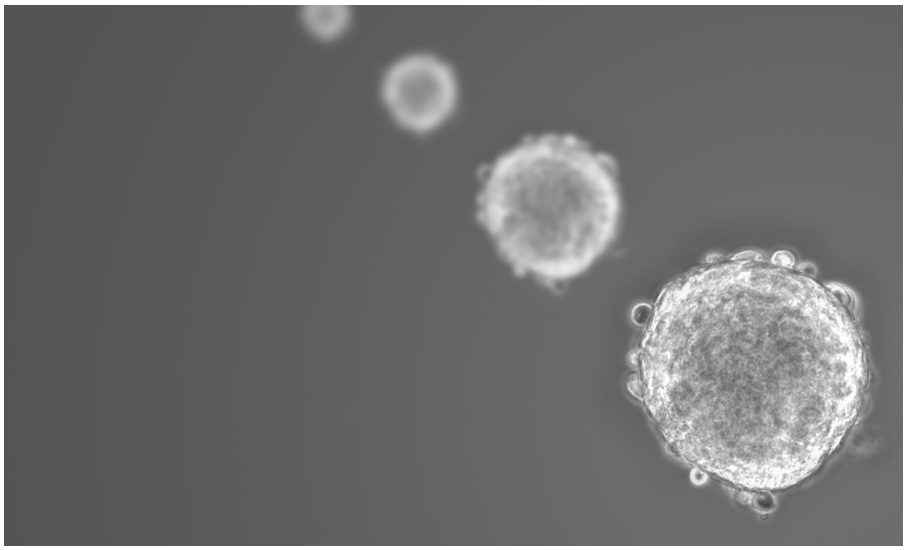

CASE STUDY

At Work in the Lab:

Deepening Insights in Diabetes Research

The NMI - Natural and Medical Sciences Institute at the University of Tübingen is an applied sciences institute under public law, and, as such dedicated to building bridges between academics and industry. Their electrophysiology group, often working with medical device manufacturers, specializes in the development of cell-based and organ-related electrophysiological test procedures to help their partners create cutting-edge solutions to keep up with the rapidly changing demands of pharmaceutical and biotechnology industries.

Using state-of-the art electrophysiological methods, they investigate mechanisms of cellular signal processing and transmission as well as intercellular communication under physiological and pathophysiological conditions and during cellular differentiation.

Next to cardiac and neuronal research be it primary or stem cell derived cells, cultures or slices, as well as retinal slices and organoids (iPSC) or organotypical slices of striated mussels, the team explores the field of diabetes looking into islets of Langerhans, which soon will also be stem cell derived. Stem cell derived beta cells as organoids and in monolayer culture may be measured against the results of native islets to confirm similar recording possibilities opening a more research driven direction. A possible future for clinical applications such as quality control for hiPS derived ß-cells or primary islets for transplantation.

> "The Beta-Screen System has simplified the handling of diabetes research. There is no alternative to record whole islets of Langerhans and the system has cut down training time for our staff due to easy plating by suction as well as increased our throughput by recording from several islets in parallel."
>
> *– Dr. Udo Kraushaar, Group Leader Electrophysiology, NMI Natural and Medical Sciences Institute at the University of Tübingen*

The Challenge

Studying islets of Langerhans, the cell conglomerate responsible for insulin secretion and finally also diabetes, is a complicated task. For one, coming across human islets is rare, and the quality of those islets acquired as donations from surgeries is relatively poor. Hence, islets from mice are used, since comparable for screening purposes, but extracting them is a tedious task. One of the NMI pharmacology customer labs working in the field of pancreas research was looking into electrical activity of pancreatic islets of Langerhans to gain a better understanding of their functionality. Facing difficulties with intracellular recordings Dr. Udo Kraushaar and his electrophysiology group, being accustomed with extracellular microelectrode array (MEA) solutions from Multi Channel Systems (MCS), introduced the idea of using MEA technology to solve the problem. The goal of both groups has been to screen compounds which will be able to help in the treatment of diabetes and lastly finding its cure. First tests with islets softly pressed on standard MEAs with a holding pipette, using a manipulator, and heavily trained lab personnel, were showing promising results for single recordings which lead to an industrial product being developed together with MCS.

The Solution

The MEA2100-Beta-Screen system was the result, being developed to easily capture and record extracellular electrical activity of islets of Langerhans, which proved to be comparable to intracellular recordings. A specially developed MEA can hold up to 5 intact islets, recording in parallel and the system scales up to 40 islets if necessary. With a strong periphery of pumps and perfusion (CVP, PPS2) as well as integrated temperature control the islets can be easily pipetted close to the electrodes and are caught by the system. Additionally, the periphery ensures they can be kept under physiological

conditions. Easily adding a Mini headstage even allows for chronic and long-term recordings. The software is on the best way to being the customer friendly, but high-performing tool MCS customers love, considering industry and academic feedback to foster functionality and ease of use. Implementing further feedback, it might be a valid solution for increased-throughput diabetes research for the pharma industry and contract research organizations.

The Outcome

The Electrophysiology group at the NMI as well as their customer can now easily record electrical activity from islets of Langerhans for their compound screening experiments. An opportunity which was not available to them before. The system reduced their need for islets due to its non-destructive nature and the possibility to uphold physiologic conditions for long periods of time resulting in multiple recordings. Training time was heavily reduced, and the task was made available to all levels of laboratory staff due to its easy-to-use hardware and software.

- Non-destructive electrophysiological recordings
- Easy catch and center of islets of Langerhans
- Full control over the pressure and flow rate for capturing and perfusion
- Performant, easy to use software for high quality data

> "The beauty of recording islets of Langerhans on MEA is that the cells are not disturbed or harmed and it can easily produce one recording per hour while if you do it intracellulary you have one recording every week ... It's a major breakthrough. Having all this in one easy to use system (Beta-Screen) is good, I like it."
>
> *– Dr. Udo Kraushaar, Group Leader Electrophysiology, NMI Natural and Medical Sciences Institute at the University of Tübingen*

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November 2021