Overcoming Challenges in Producing a **Tiny Medical Device for recording the neuronal activity in the spinal cord of a mouse**

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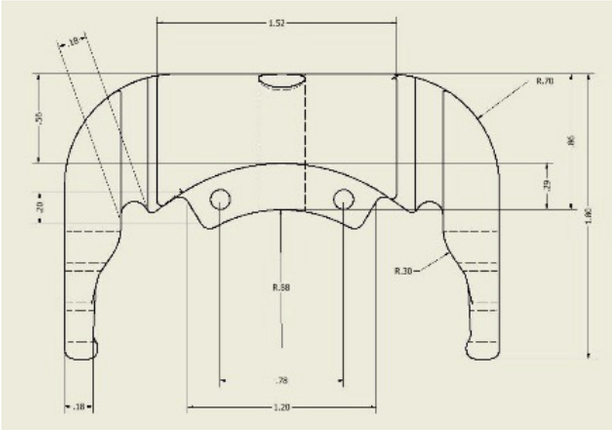
Background

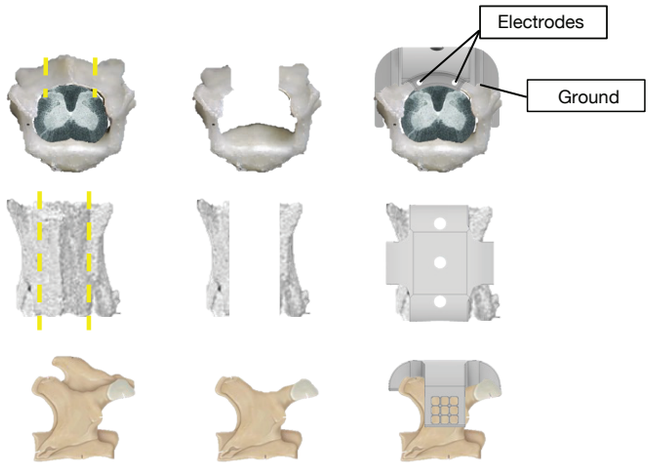
Small or micro medical devices pose significant challenges in production due to their size, dimensional requirements, and intricate features. To address this, Louison Brochoire, a PhD student at the University of Bordeaux, works under the supervision of Prof. Pascal Fossat from the IMN: Institut des Maladies Neurodégénératives UMR5293, and Prof. Yves De Koninck from the CERVO Research Center in Québec. Together with Prof. Benoit Gosselin from the University Laval, Faculty of Science and Engineering, Department of Electrical and Computer Engineering, they collaborated on developing a medical device designed to measure neuronal activity in the spinal cord of freely moving mice.

Challenge

Recording the electrical activity of neurons in the spinal cord of an awake animal presented challenges, mainly due to the movements induced by walking and breathing of the mouse, as well as the accessibility of the region. Traditional manufacturing methods struggled to produce a device that could effectively stabilize electrodes in place while maintaining accuracy and functionality. The design required precise dimensions, including 110 um holes for electrodes and a 2.7 mm width. 3d printing with off-the-shelf hobby printers also failed to achieve the required level of details and accuracy.



Schematic drawing of the application



Schematic drawing of the placement of the application

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The Solution

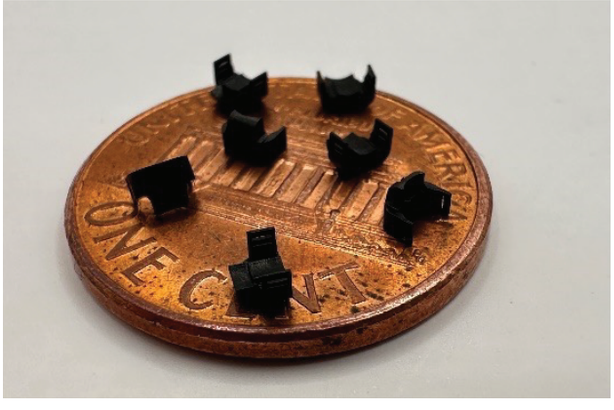
The team tackled the challenge by designing a brace capable of securely holding two electrodes on the vertebra. Nano Dimension's Fabrica printers, with their pixel size as small as 4 um and layers of 5 microns, proved to be the breakthrough solution. These printers produced accurate and functional parts with tight tolerances, enabling the creation of the brace. Within a week, the team had a functional prototype ready for use.

Material Used

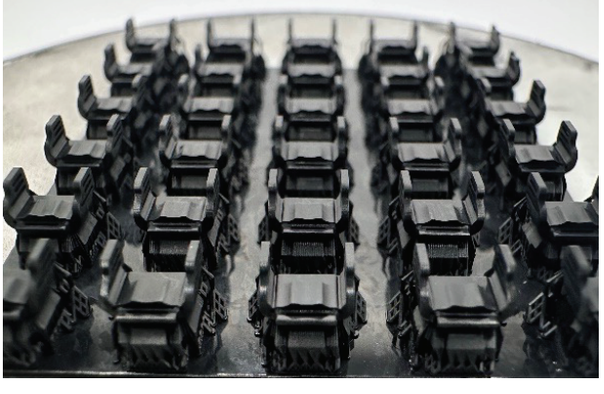
The Fabrica Medical M-810 material from Nano Dimension was selected for this project as it has clearance for cytotoxicity, ensuring it is not toxic to human cells, thus appropriate for this kind of device, that was then implanted into a mouse.

The Results

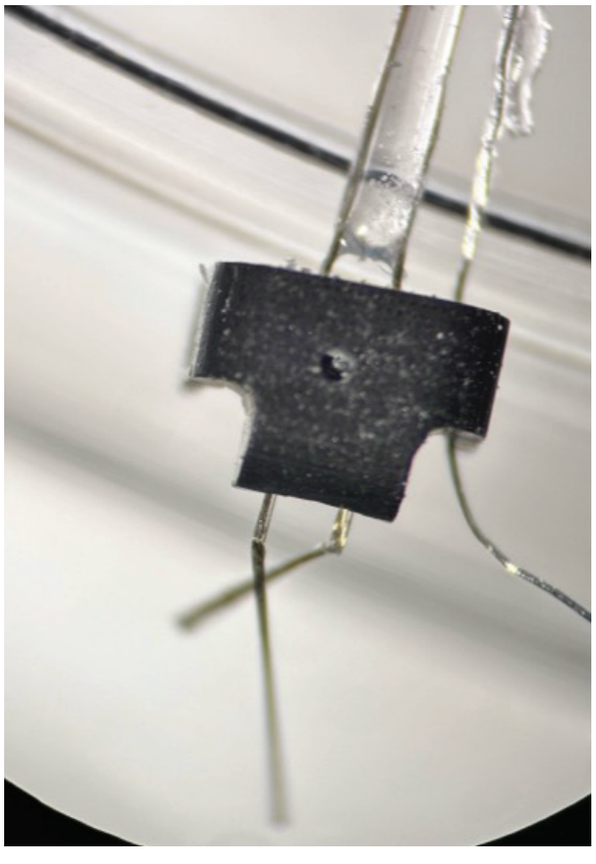
By leveraging Nano Dimension's advanced 3D printing technology, Louison successfully overcame the challenges associated with producing small medical devices for the research project. The printed brace effectively stabilized electrodes, incorporating features such as 110µm holes, which facilitated electrode movement during the animal's walking motion. This design attribute helped to minimize artifacts while recording spinal cord activity in freely moving mice. This enabled accurate measurement of neuronal activity, showcasing the importance of innovative manufacturing solutions in biomedical research and the development of cutting-edge medical devices.



Printed parts on a penny



Print from the Tera 250 (30 pieces)



Assembled 3D printed part with electrodes, 110 um holes for electrodes and a 2.7 mm width

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