



## **Partnership between Valtronic Technologies USA and The Ohio State University**

Valtronic Technologies USA has partnered with The Ohio State University (OSU) to develop a non-penetrating micro-electrode array that will monitor and record brain activity from the surface of the brain in surgery patients. This will allow physician researchers to identify abnormal activity to more precisely determine the source and spread of an epileptic seizure.

This project originated when Valtronic began its Academic Relations Program and met with several representatives from OSU. The Academic Relations Program mission is to discover and share knowledge through collaboration, information exchange, and by applying miniaturized electronic technologies in real world situations. This project is a perfect example of this mission.

When OSU met with Valtronic two years ago OSU had developed their first prototype and were seeking expertise in micro-electronics for development of a more advanced probe. One of the challenges that OSU was looking to overcome was to create a smaller electrode with more wires for more functional arrays which would allow them to collect more data.

Valtronic collaborated on the design for an electrode to be used in craniotomies, a procedure in which a piece of the skull is partially removed to expose the brain. Patients with seizures for whom surgery might remove the source of the seizures often need hospitalization with electrodes implanted on the surface of the brain to better locate the source of the seizures. Our smaller electrodes would be implanted alongside the electrodes already being placed for that purpose. They would be placed on top of the brain below the brain's dura mater. As stimulations are applied to the patient the electrodes would record the activity in the brain associated with this stimulus. The electrodes would also be monitored for seizure activity over the next several days in the hospital and would be removed before the patients return home.

Addressing one of the obstacles discovered from the first electrode fabricated by OSU, Valtronic used printed circuitry to increase the number of electrode contacts. The solution that Valtronic provided for this application was a biocompatible flexible Kapton polyimide printed circuit board with 32 gold ball array. The microelectrode array is comprised of gold contacts (200mm squares with bidirectional pitch of 400mm in a 4 by 8 grid pattern). One end records electrical activity from the sub-dural cortical surface of the brain and the other end is connected to a biological data acquisition machine that reads the output.

Analysis of cytotoxicity tests show that using Kapton and gold electrodes on the micro-electrode grid is non-toxic to the human cortical cells, therefore the array may be suitable for use with human studies. This product has been tested on animals by a research team.

Phase II of this project for Valtronic began this last spring. The goal for this phase was to reduce the size of the electrode to allow it to be inserted through a burr hole and remain in the brain for post-surgical monitoring.



This new electrode will be modified so it can be inserted into the burr hole made in the skull during surgery. In order to leave the electrode in place after surgery an even smaller electrode needs to be built so that it can be left hanging out of the head post-surgery without risk to the patient or hindering of the monitoring process. In order to protect the brain, the electrode must be encapsulated so that it has smooth edges which cannot cause any tissue damage upon contact. Based on current evaluations Valtronic is exploring a cylindrical version that would be coated with a biomedical grade PDMS and would be completely flexible.

As a result of reading an article about the original electrode The Hebrew University - Hadassah Medical School in Israel has contacted Valtronic as they would like to use the electrode for research they are conducting monitoring brain activity in primates. We are looking forward to collaborating with them on this project and a possible new academic relationship across the globe.

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