# FIGURES

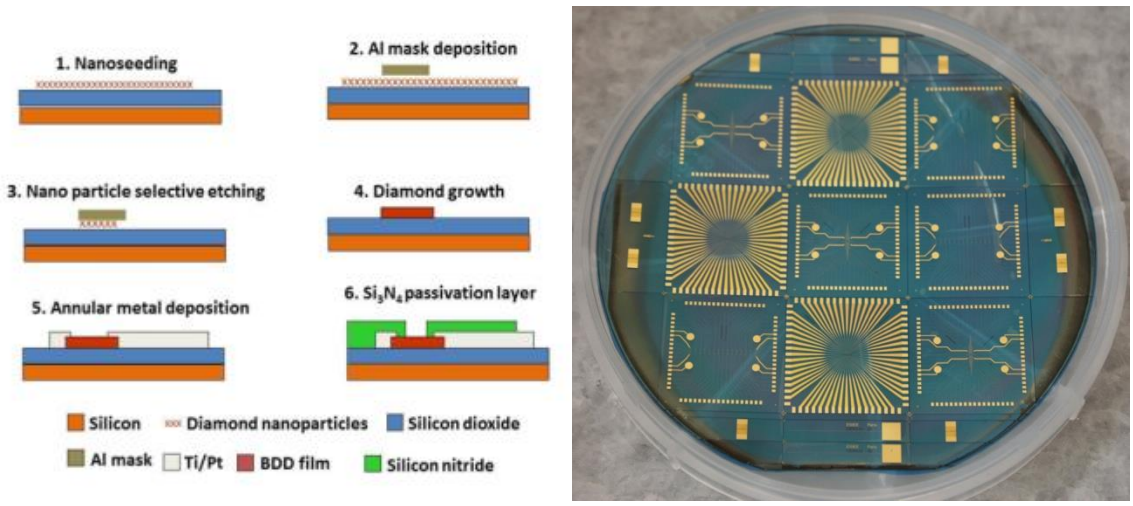


**Figure 1:** (left) Schematics of diamond MEA fabrication process, (right) picture of one of the first NeuroCare series MEA samples.

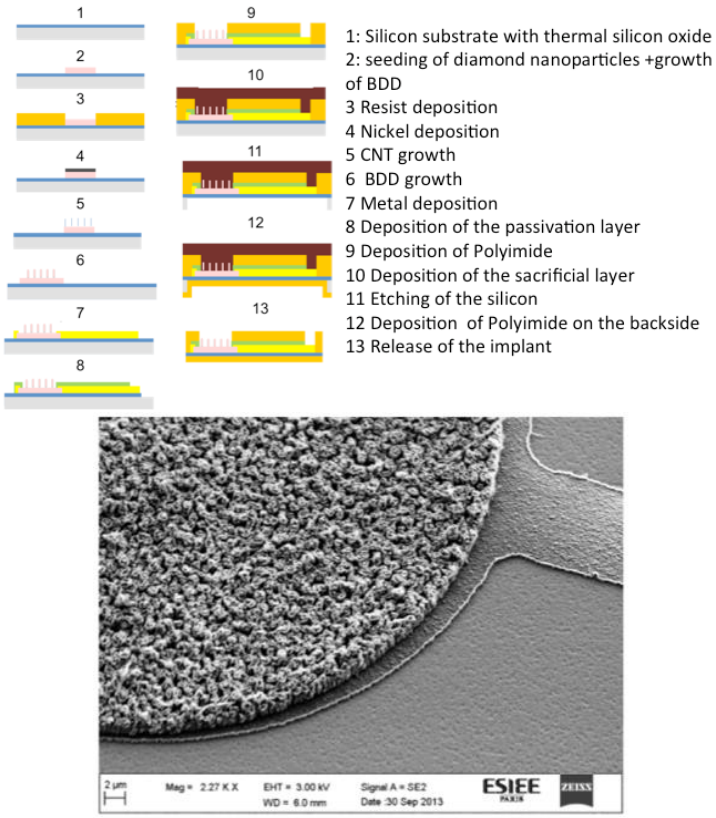


**Figure 2:** (left) Step flow process for flexible implant fabrication with high 3D conformation. (right) 3D nanostructured Processed diamond electrodes

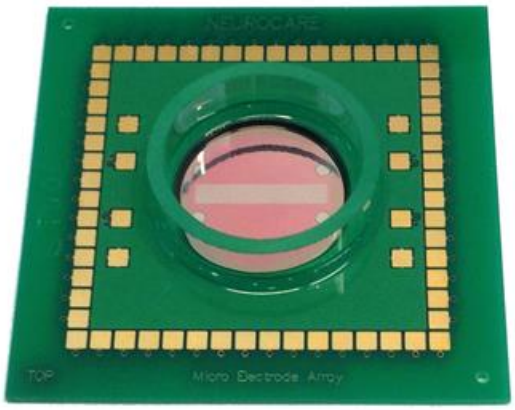


**Figure 3:** Picture of assembled diamond MEA including internal counter electrode.

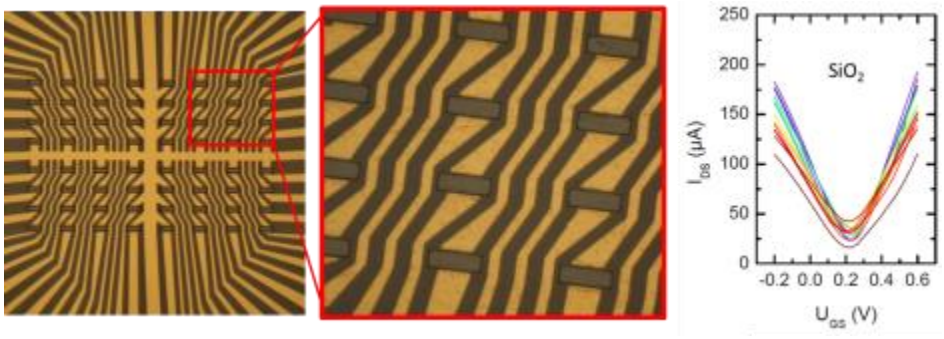


**Figure 4:** Optical micrographs of a 8x8 array of graphene SGFETs, together with the transistor curves (Ids-Ugs) of some of the devices prepared on a $SiO_2$ substrate.


**Figure 5:** Left: 4-inch wafer with several implants during the fabrication process. Right: Finished devices showing the head of the implant with 16 transistors and the tail with the bond pads

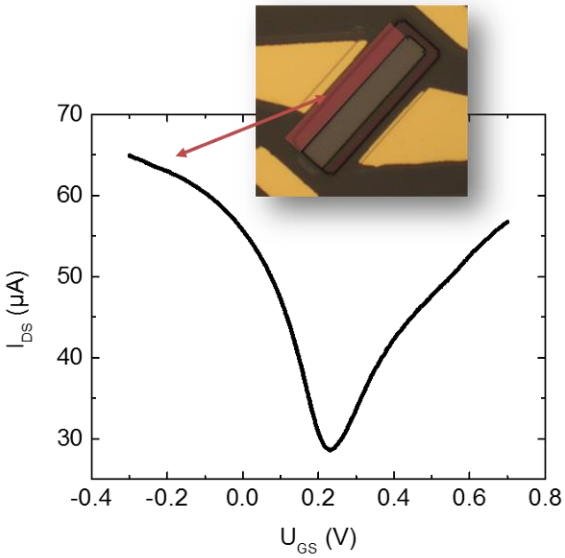


**Figure 6:** Drains-Source current as a function of the gate voltage of a flexible graphene SGFET on a sample in the implant design. The insert shows a microscope image of transistor, the access area is marked in red

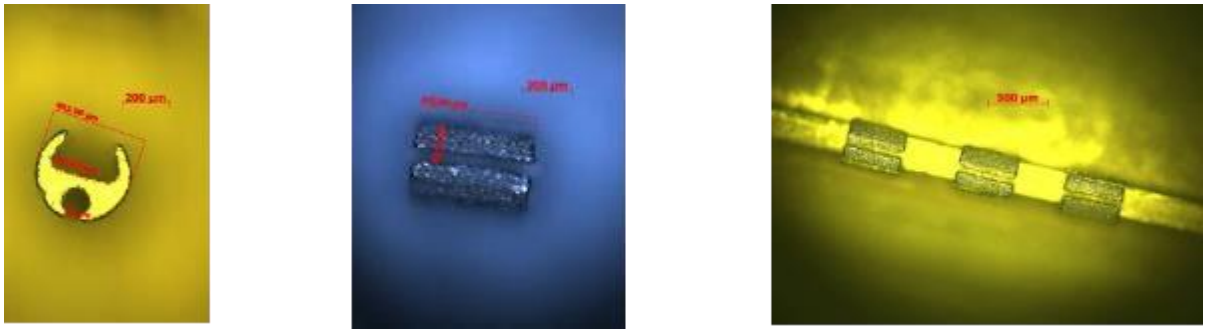

**Figure 7:** cochlear electrodes as received from MXM (left), then coated with diamond (middle), and three electrodes mounted on the specific tool for diamond nanoseeding and growth (right)

**Figure 8**: Cochlear electrode arrays. Left: (Top) PtIr electrodes, (Bottom) Nanocrystalline diamond. Right: zoomed image of the Nanocrystalline diamond

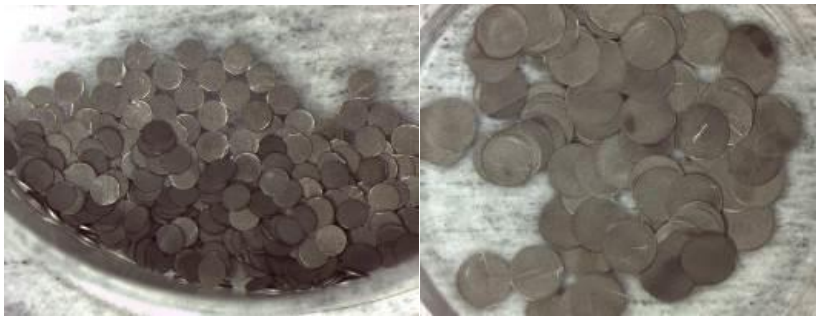

**Figure 9:** Pt90Ir10 disks, diameter Left: 1mm, Right 3mm

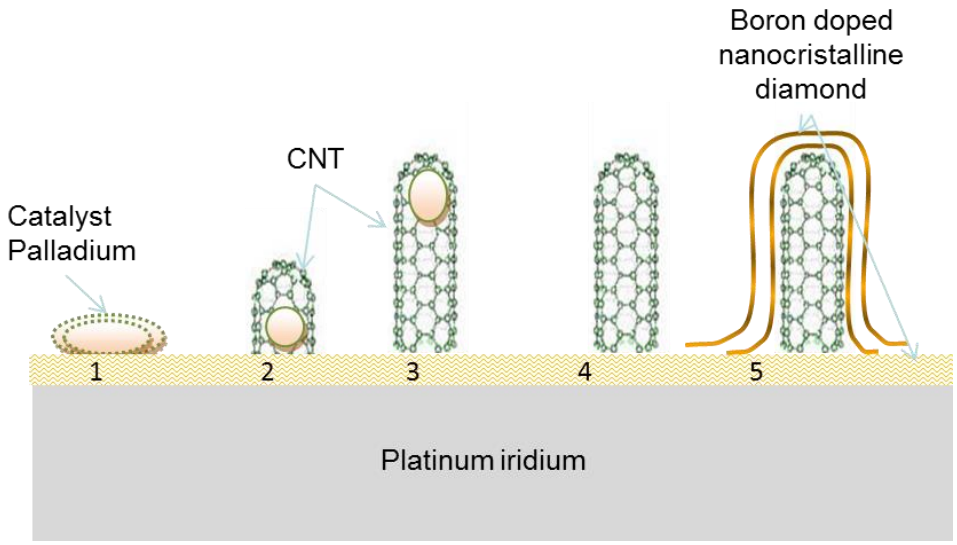


**Figure 10:** Principle of nanocarbon coating on Pt90Ir10

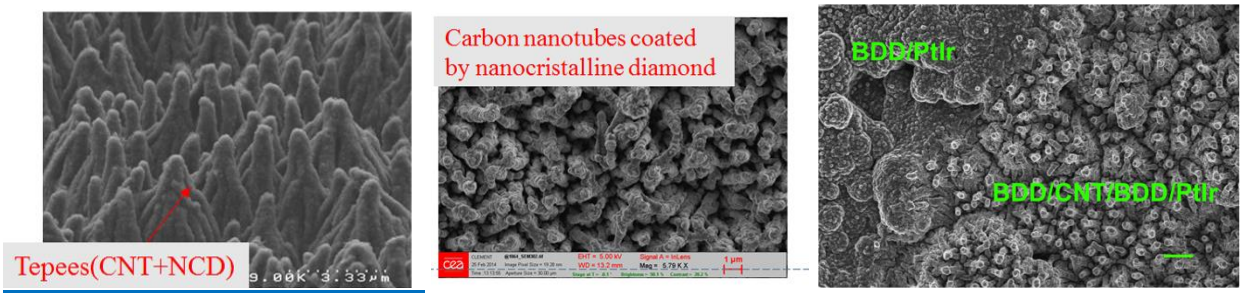


**Figure 11:** SEM characterization of Tepees and welding of the electrode. (right) 3D nanostructured diamond coating on the PtIr chips (Scale bar: 2µm)

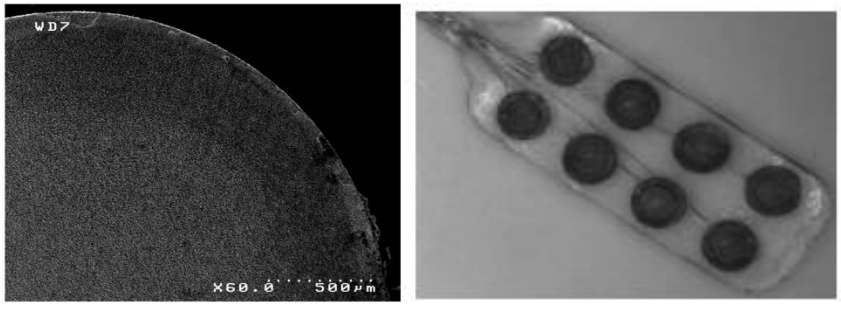

**Figure 12:** (left) NCD coated PtIr chip for cortical implant fabrication (cortical NCD arrays of 8 electrodes, as implanted on the minipig cortex

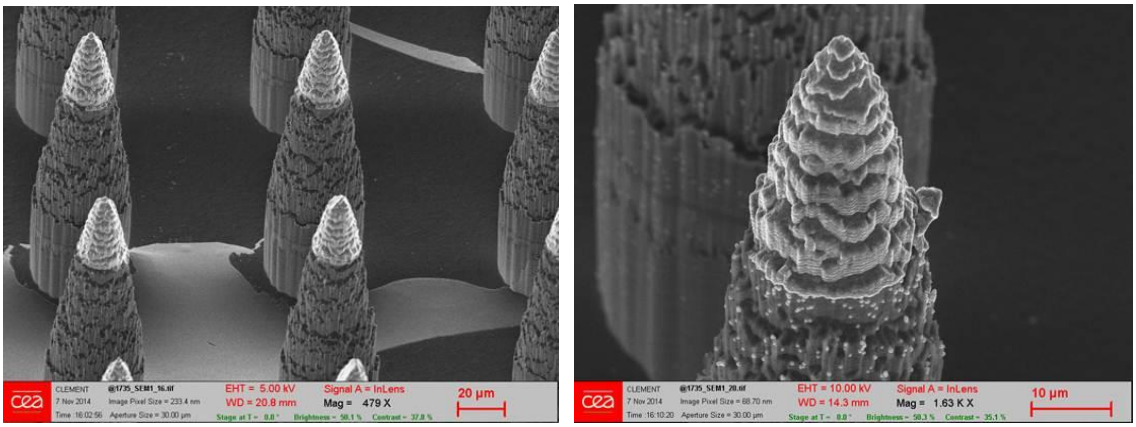


**Figure 13**: SEM photography of NCD coated 3D electrodes only at the tip.

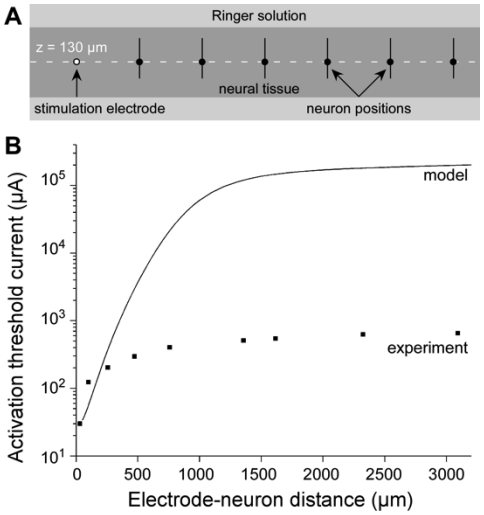


**Figure 14:** Model and experimentally determined activation threshold in spinal cord. A) Chip and tissue layout. B) Activation threshold at various distances. (Joucla et al. 2012)

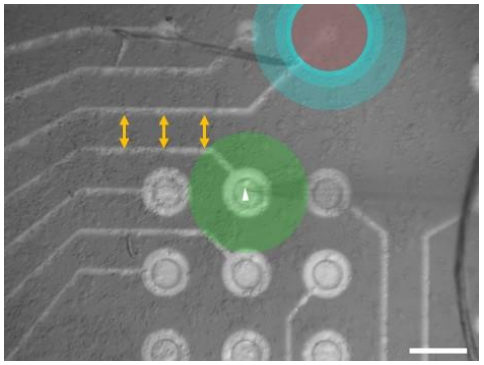

**Figure 15:** Stimulation by crosstalk. Triangle – cell, Red – stim. point (6 µm), Blue – failure zone for 6 µm electrodes, Green range of 48 µm electrode, Yellow arrows - neighboring feedlines. Scalebar = 100 µm.

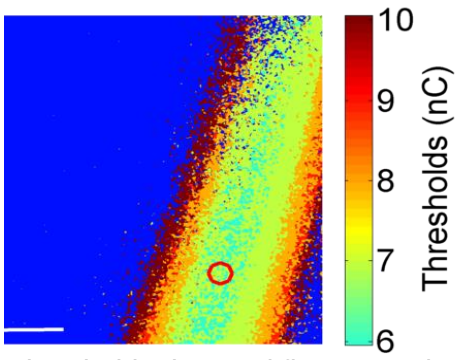


**Figure 16:** Retinal stimulation thresholds detected fluorescently using a calcium indicator, when stimulation is applied to the electrode marked by the red circle.

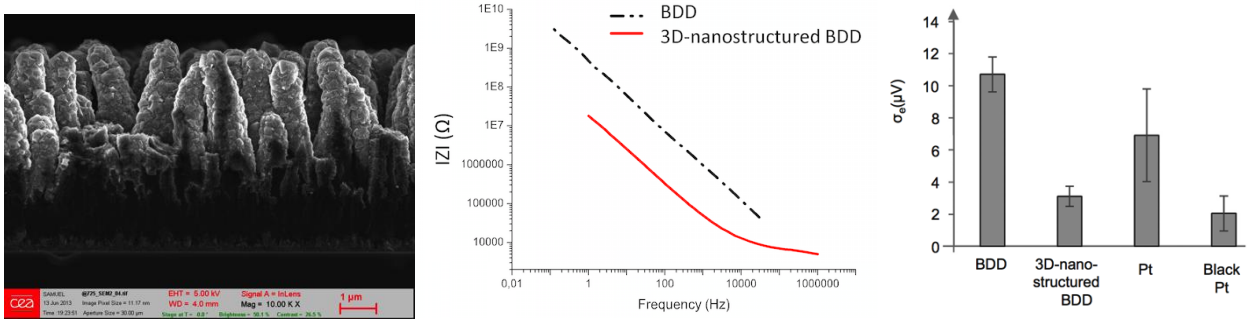


**Figure 17**: (left) cross section of 3D nanostructured diamond (centre) Bode representation for one BDD microelectrode (black dotted) and one 3D-nanostructured BDD microelectrode (red) in $LiClO_4$ of the typical impedance spectra. (right) Reduction of the impedance to equivalent levels of Black Platinum, a reference for electrophysiology.

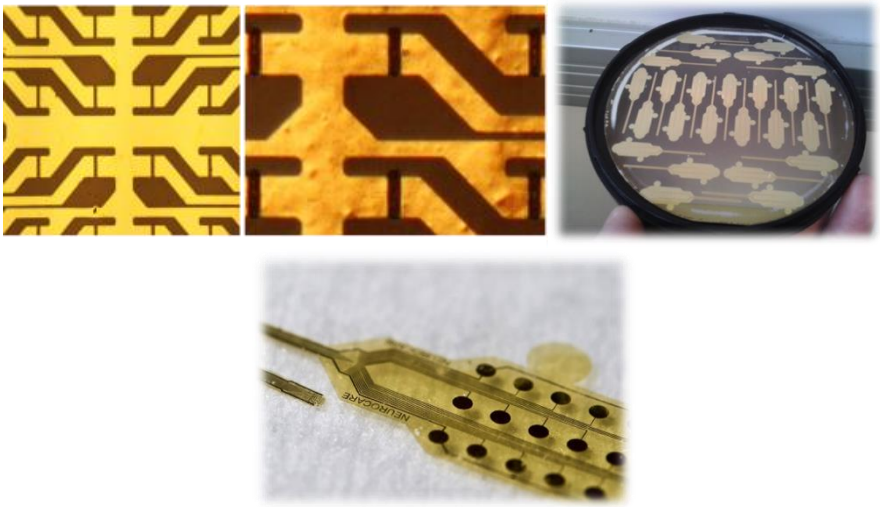

**Figure 18**: Technology of graphene SGFETs on kapton foils. From left to right : 1- after drain and source lithography. 2- SGFETs with polyimide insulating layer revealing the non-successful opening of the active gate area. 3- substrate technology prior to flexible array release, 4- one individual implant. Such prototypes were used for cell recording applications

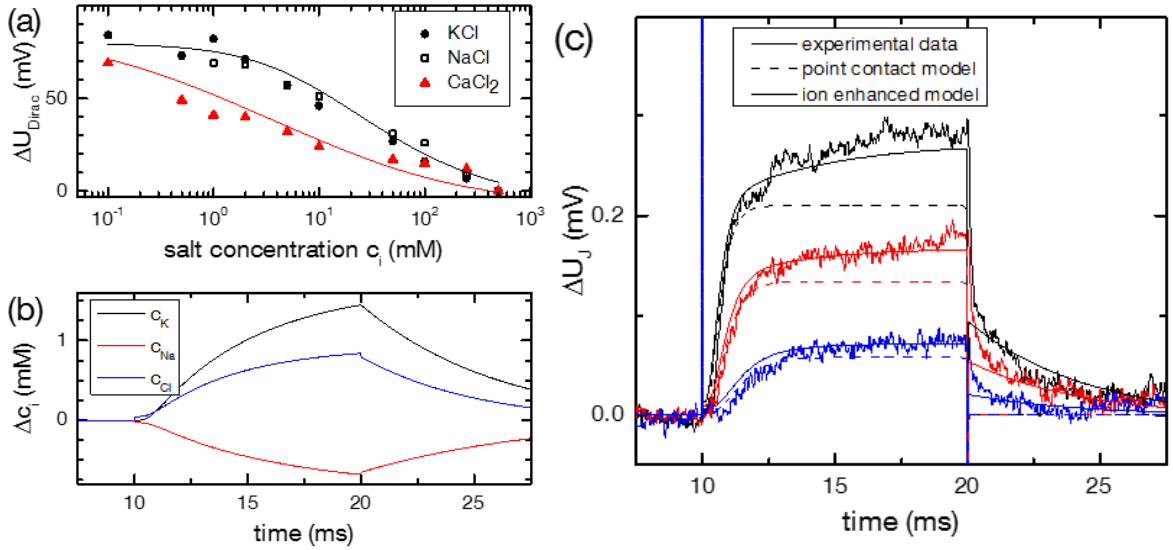


**Figure 19** Ion enhanced model. a) Ion sensitivity of graphene SGFETs show a Dirac point shift with increasing ion concentration. b) An increase in the concentration of potassium and chloride ions is predicted for a potential step of 80 mV in the cell. c) Accounting for ion sensitivity our model agrees well with experimental data (blue, red, and black curves are potential pulses of 40, 60, and 80 mV, respectively).

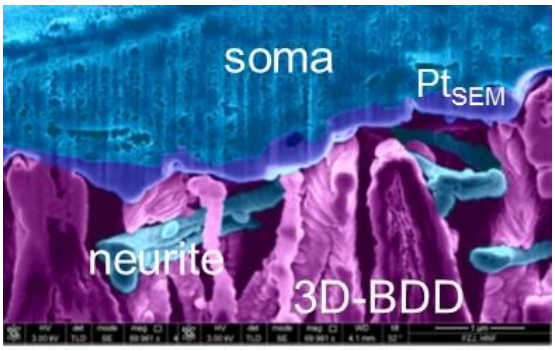


**Figure 20**: Cross-section of a neuron on 3D-BDD. The neuron (blue) grows with its cell body on top of the 3D-BDD structures (pink), while some neurites weave between the structures.

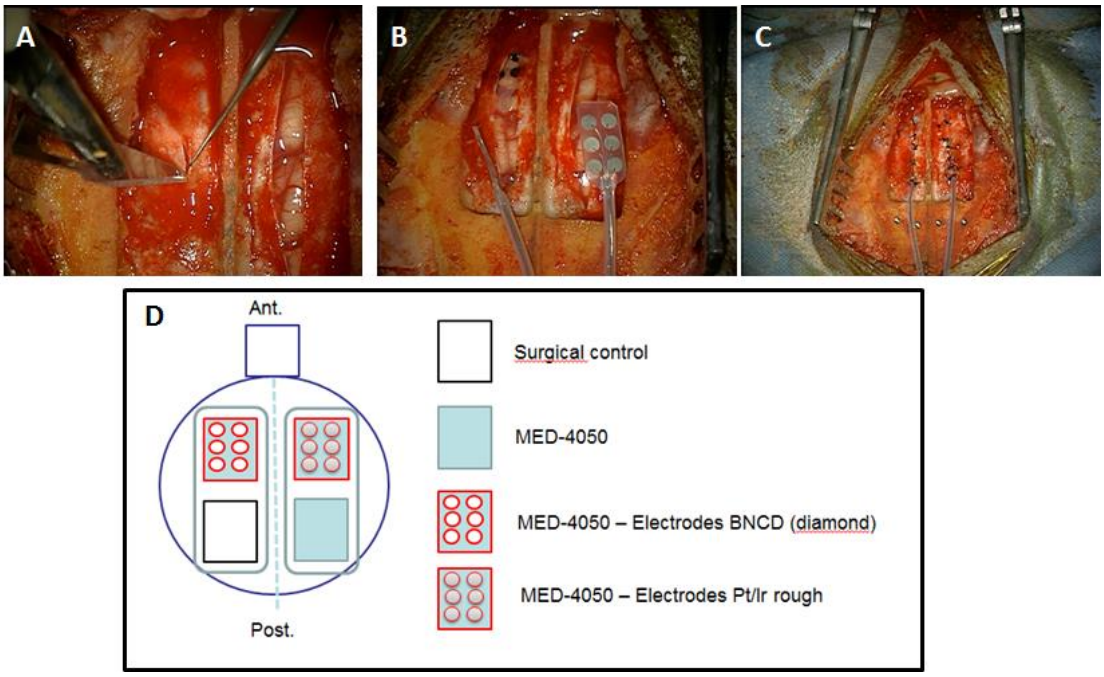


**Figure 21:** A, B and C: macroscopic views of the surgical procedure during implantation of MEA samples on mini-pig brain cortex; D: implantation map

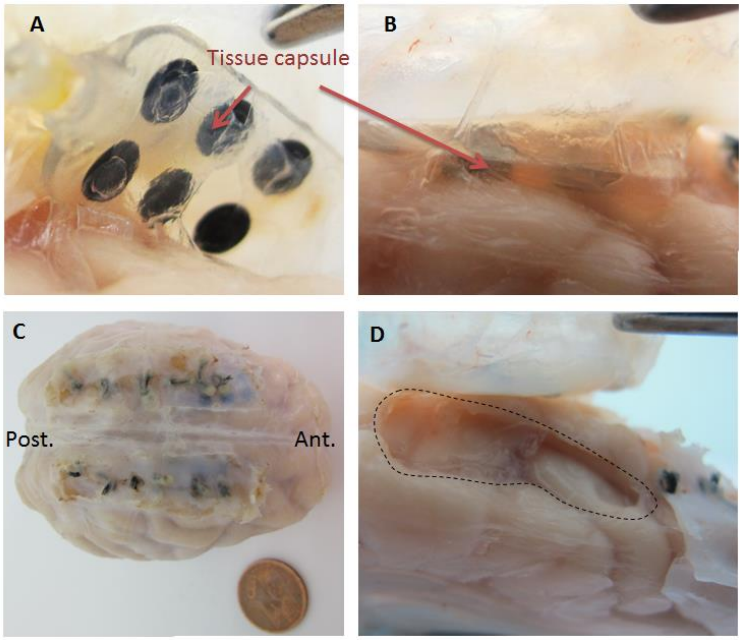


**Figure22:** A – Multielectrode array with Diamond electrodes after 13 weeks, embedded in a neoformed tissue. B – h/iridium electrodes after 13 weeks, embedded in a reactive tissue. C – The mini-pig brain with the dura mater after 13 weeks of contact with the multi-electrode arrays. D – iridium/rough platinum-MEA-covered brain cortex

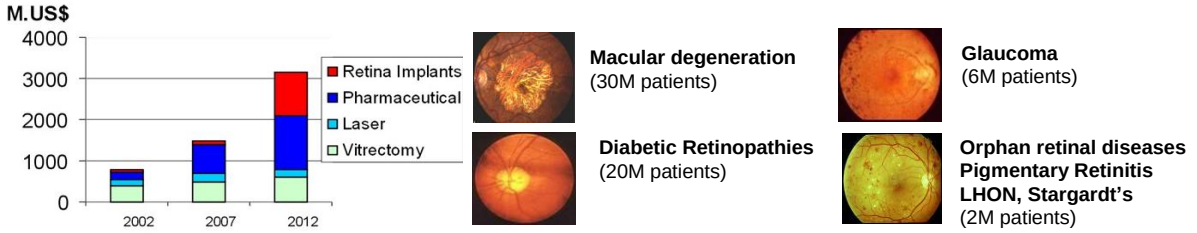


**Figure 23**: In the case of ocular pathologies, implants are expected to occupy a rising position (left). The most frequent eye pathologies and predicted number of patients in EU+US in 2012 (right).

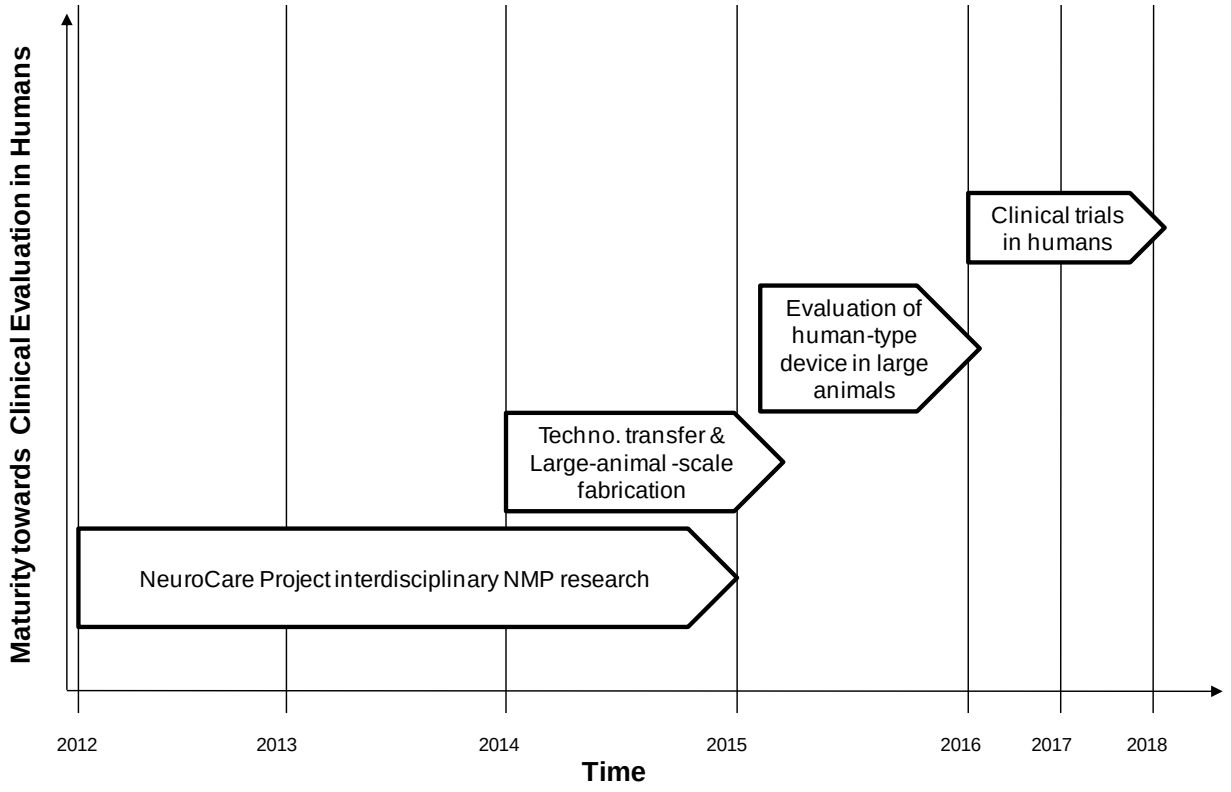


**Figure 24:** NeuroCare Clinical Roadmap