Supporting information

In Vivo Chronic Brain Cortex Signal Recording Based on a Soft Conductive Hydrogel Biointerface

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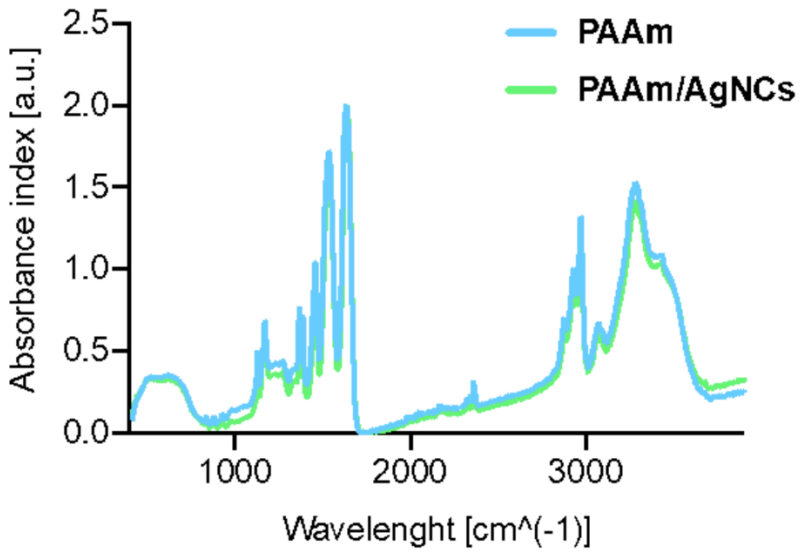

Figure S1. Characterization of the nanostructured hydrogel. FTIR of PAAm/AgNCs hydrogel compared to PAAm hydrogel.

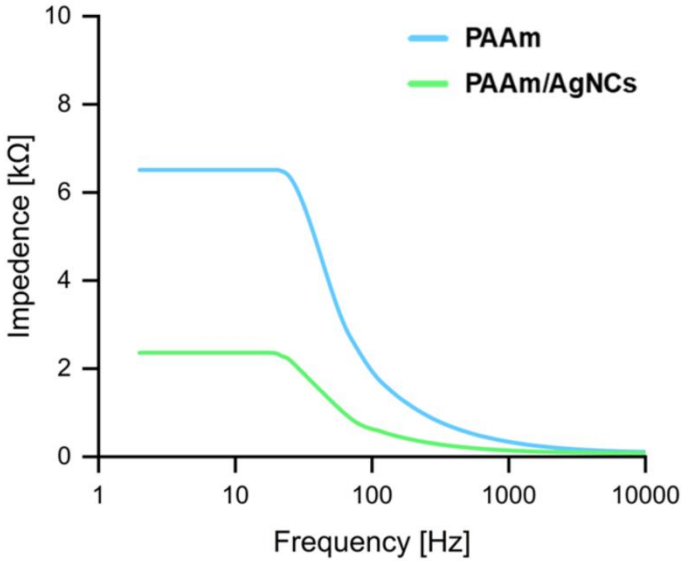

Figure S2. Representative graph of electrical impedance measurements of PAAm/AgNCs hydrogel compared to PAAm hydrogel.

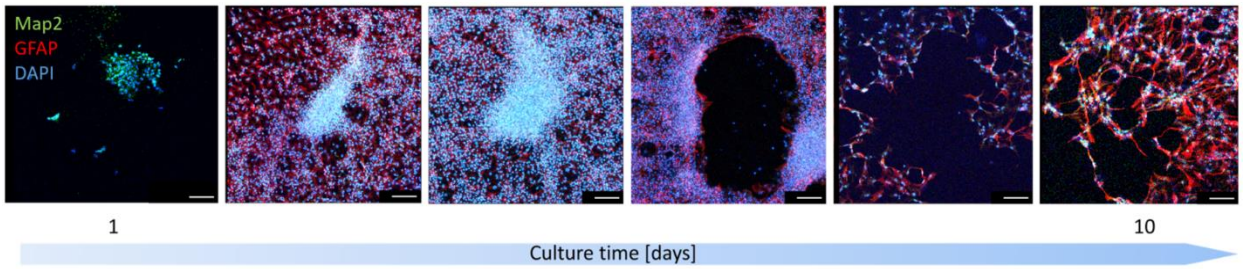

Figure S3. Confocal images of *in vitro* NPC response during the culture time. Scale bar: 100 µm.

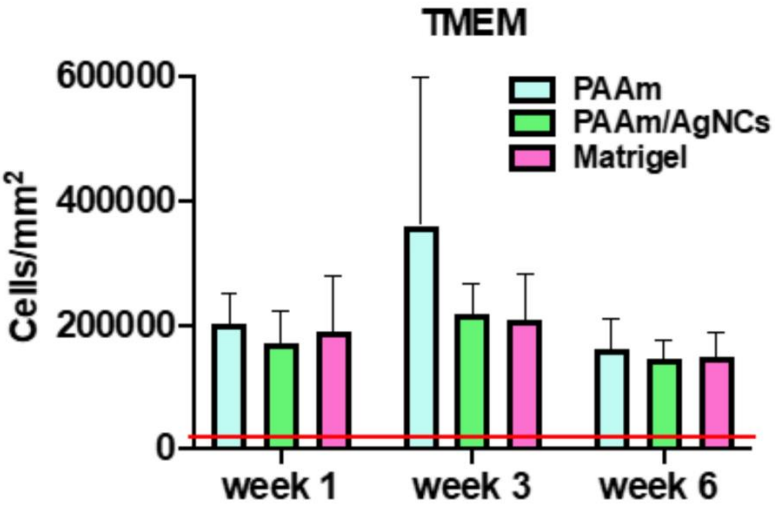

Figure S4. TMEM119 activation after *in vivo* implantation of PAAm hydrogel, PAAm/AgNCs hydrogel, and Matrigel. Levels of TMEM119 are estimated by counting the integrated intensity of AlexaFluor 568-positive pixels within the image stacks. Non-treated condition is highlighted by the red line.

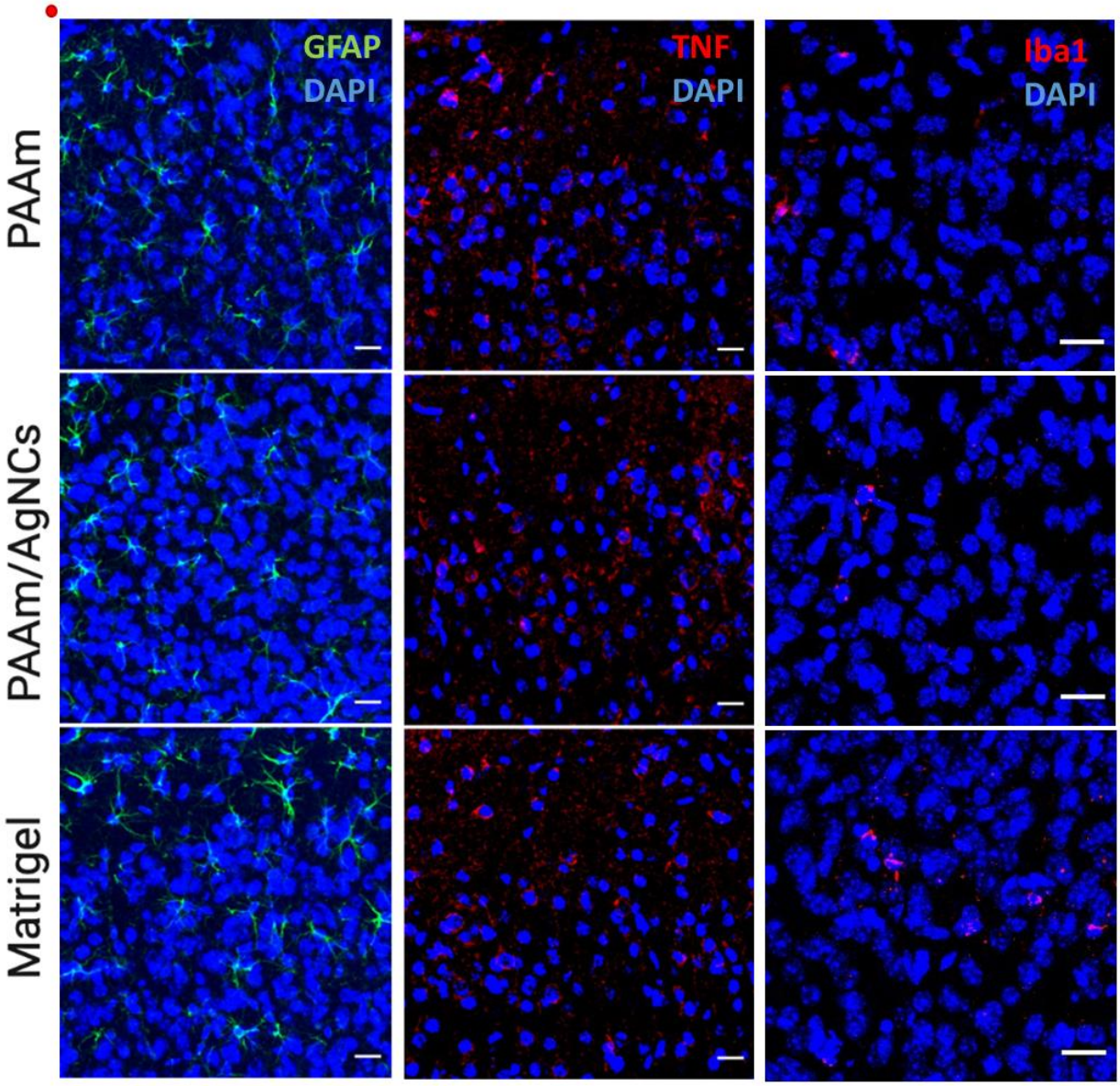

Figure S5. Confocal images of immunostained brain slices in contact with PAAm hydrogel, PAAm/AgNCs hydrogel, and Matrigel after 3 weeks of *in vivo* implantation. GFAP (green color, left), TNF-alpha (red color, center), Iba1 (red color, right). Nuclei are stained with DAPI (blue color). Scale bars: 20 μm. The exact center of the implantation site is visible in the upper left corner of each image (pointed by the red circles). All the images are oriented in the same manner.

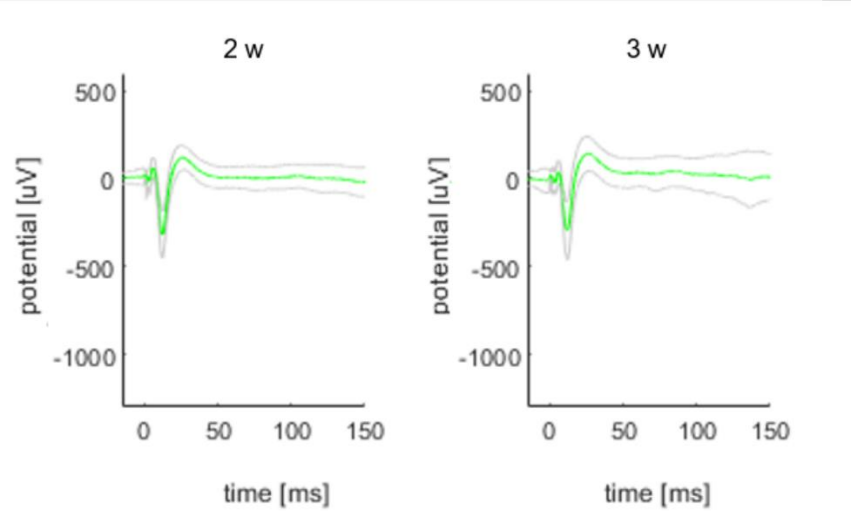

Figure S6. Somatosensory evoked potential recorded through the PAAm/AgNCs hydrogel-based neural biointerface at 2 and 3 weeks post *in vivo* implantation.

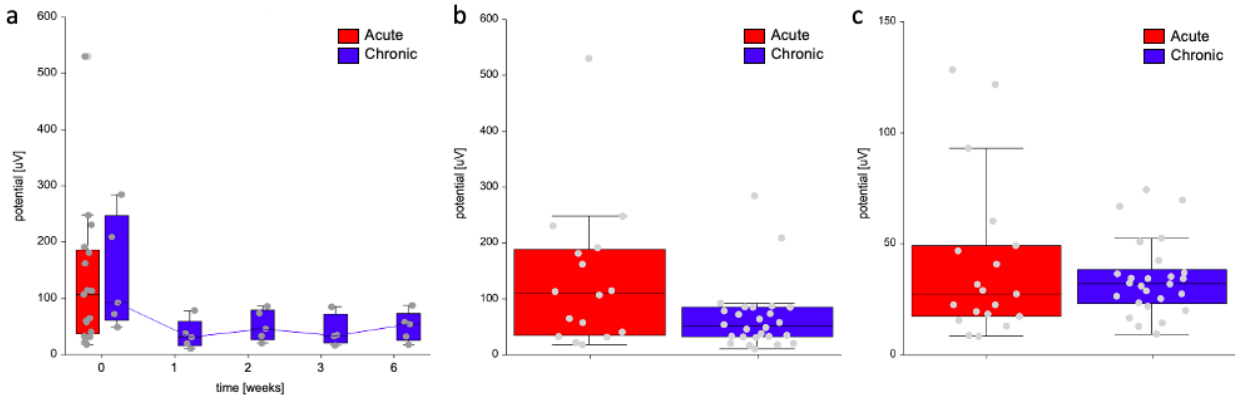

Figure S7. Evoked potential RMS amplitude. a) SEP RMS amplitude calculated for signals recorded during acute *vs.* chronic experiments up to 6 weeks. b) SEP RMS amplitude acute *vs.* chronic recordings. c) VEP RMS amplitude acute *vs.* chronic recordings.

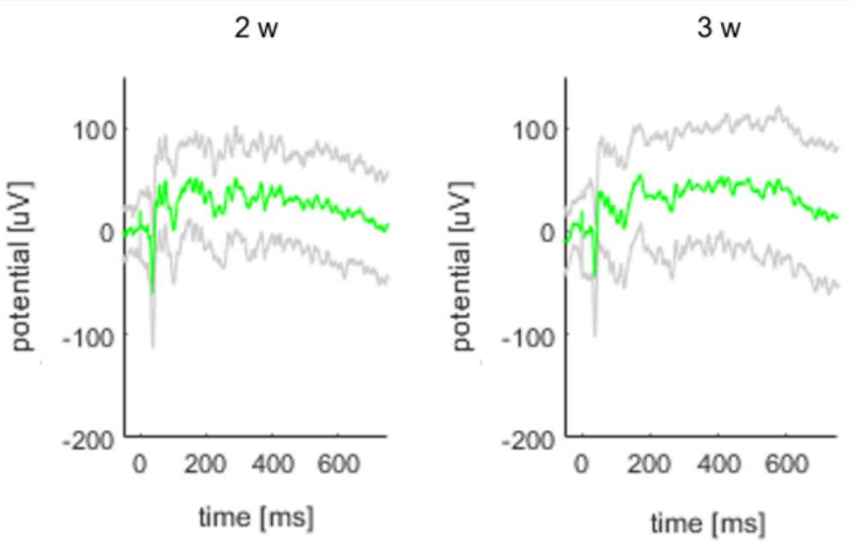

Figure S8. Visual evoked potential recorded through the PAAm/AgNCs hydrogel-based neural biointerface at 2 and 3 weeks post *in vivo* implantation.

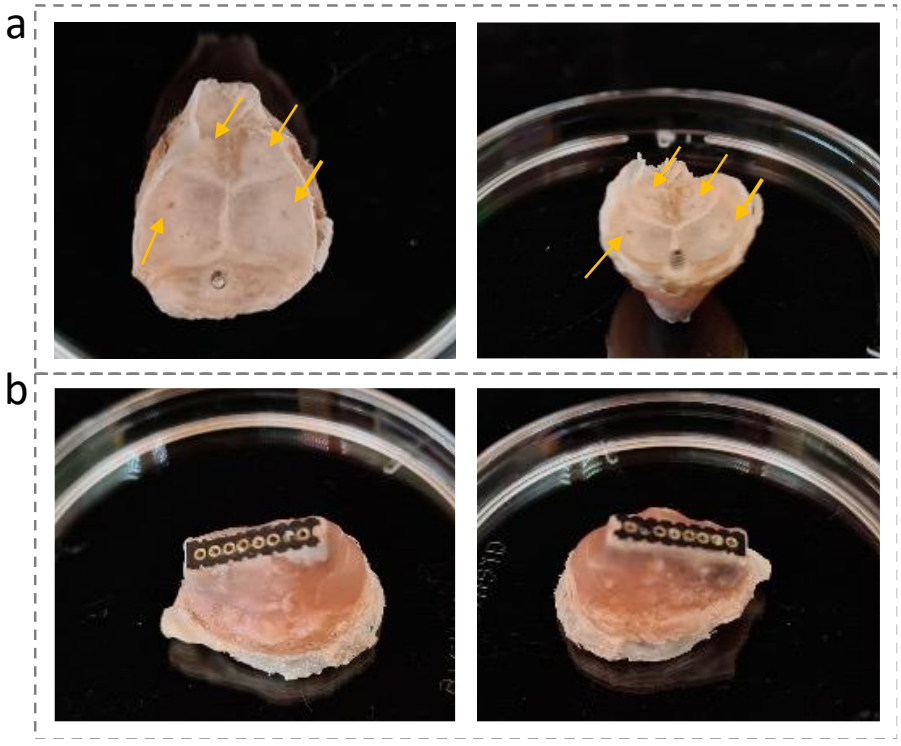

Figure S9. Integrity of the system after 6 weeks from implantation *in vivo*. a) Photos of the mouse skull showing the preserved integrity of the circular hydrogel with regular structure (pointed by the yellow arrows). b) Integrity of the socket and the medical-acrylic layer on the mouse skull.

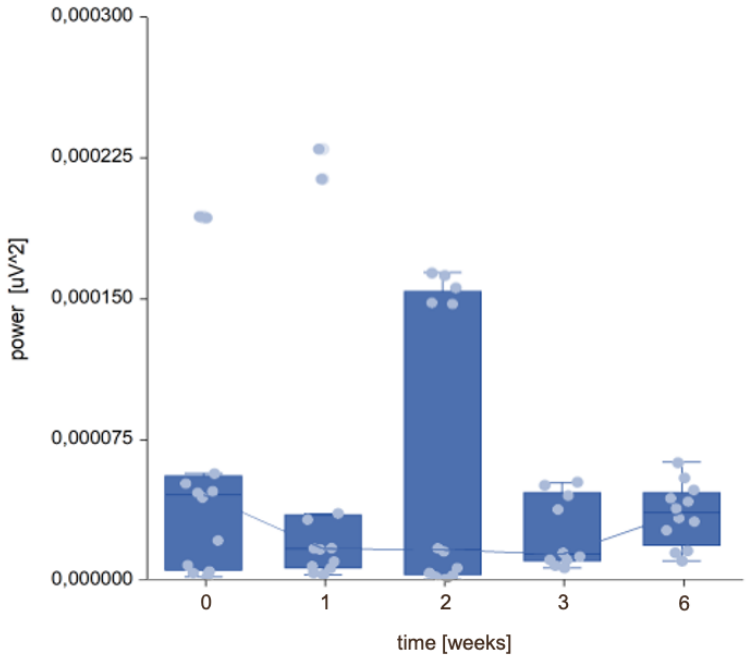

Figure S10. Power of 50 Hz artifact measured during chronic recordings for up to 6 weeks, revealing no significant changes over the time.

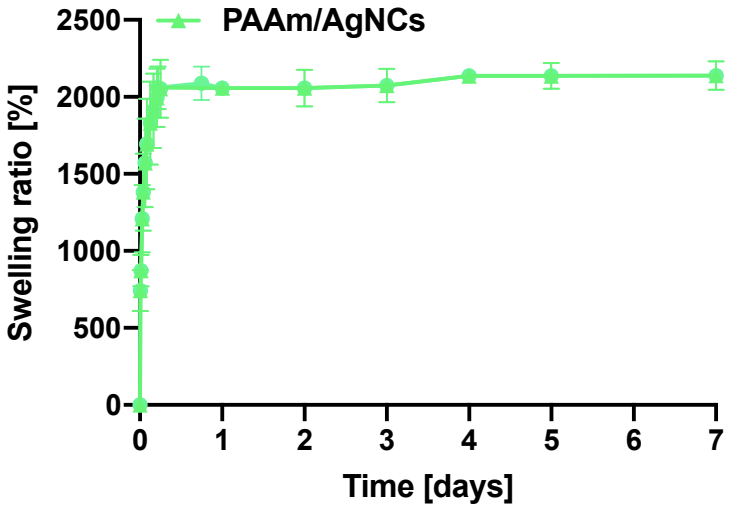

Figure S11. Swelling ratio of PAAm/AgNCs hydrogel up to 7 days of incubation in PBS, showing the high stability of the hydrogel in aqueous medium.

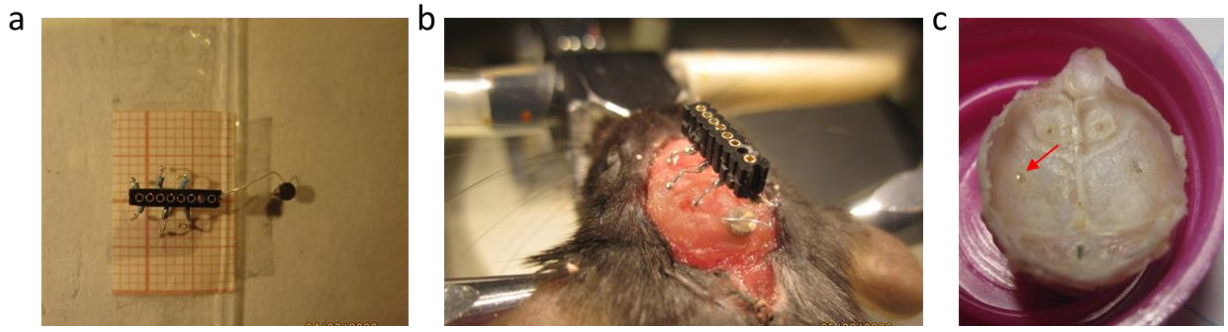

Figure S12. Stability of silver ball position during implantation. a) Implant prepared on a millimeter paper. b) Electrodes implantation. The craniotomies were filled with hydrogels (slightly opaque PAAm/AgNCs hydrogel are visible in the openings), while the reference screw was fully covered with acrylic. The connecting wire of the reference screw secures the position of the whole implant over the craniotomies, with the silver balls touching the hydrogels' surface. For chronic recordings, the liquid acrylic suspension was delicately poured over the electrodes and around and below the implant connector; c) Inner surface of the skull at 6 weeks post-implantation. A silver ball is visible in a craniotomy over the right barrel field (red arrow); the signal from this channel was excluded when studying the recording through the hydrogel-based neural interface.

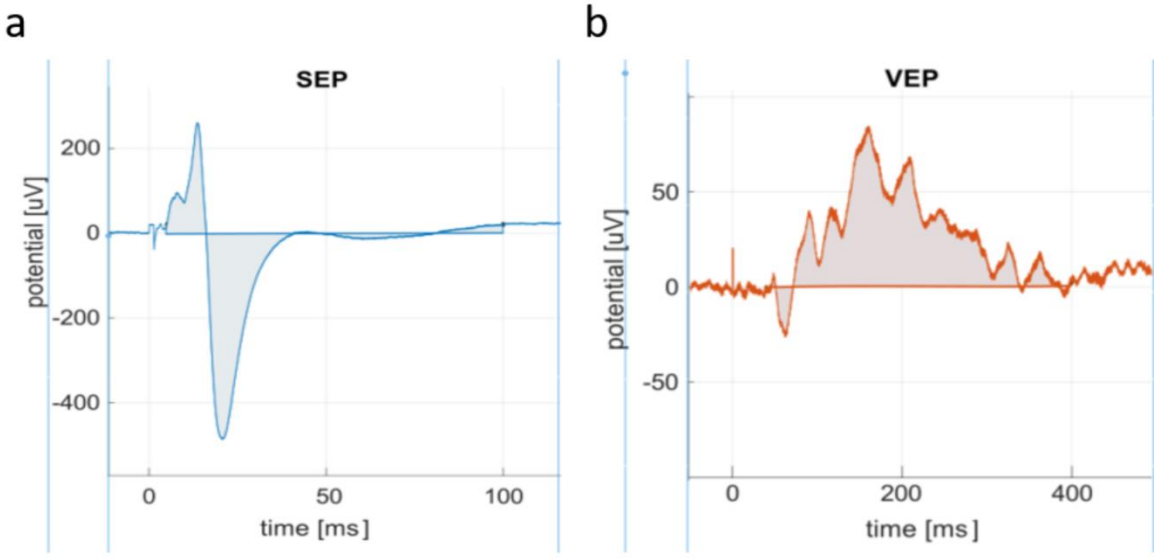

Figure S13. Example of somatosensory (SEP, a) and visual (VEP, b) evoked potentials with shading marking area used to calculate response magnitude.