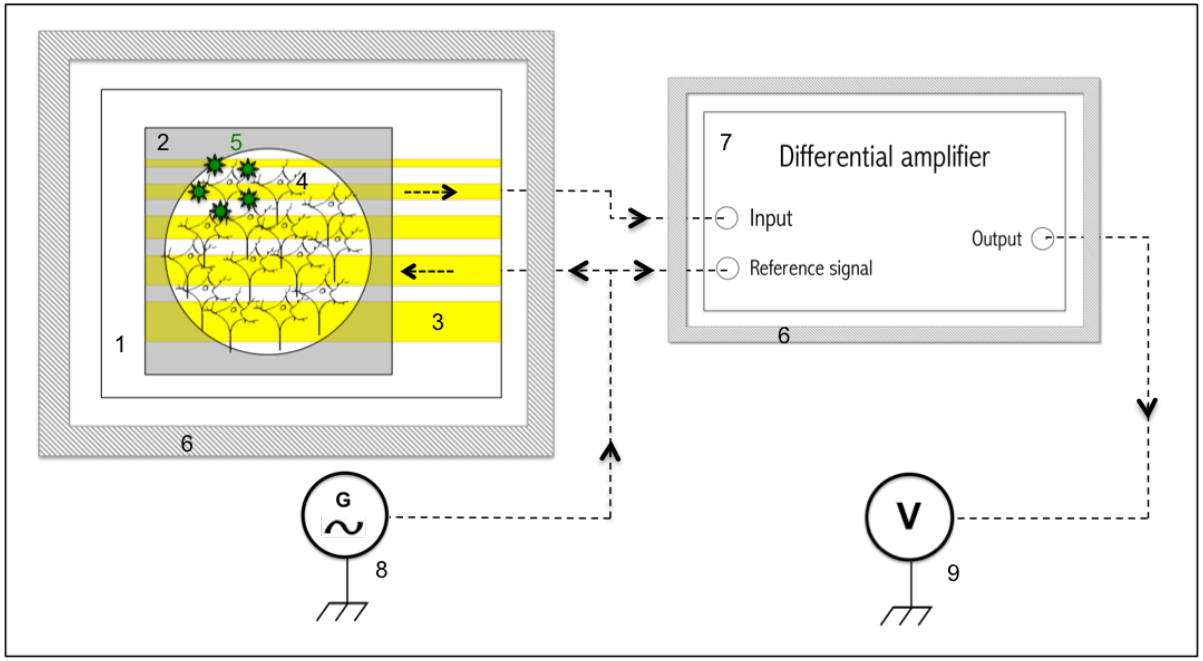
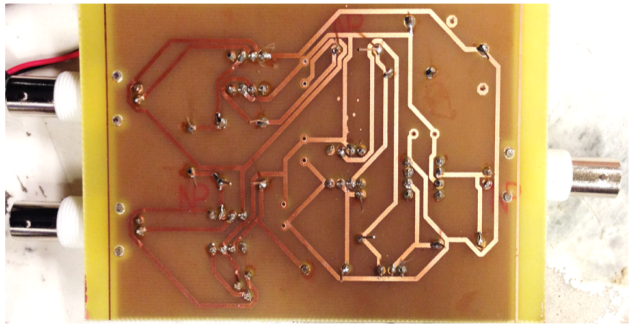
Figure 1: Experimental set-up for the measurement of electrical activity of a rat neuronal culture

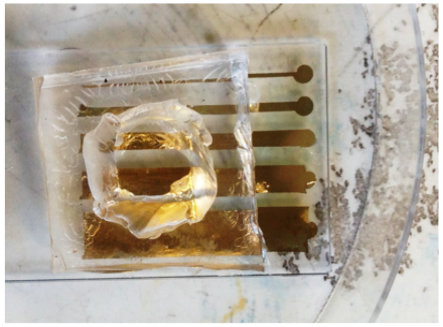
a



b

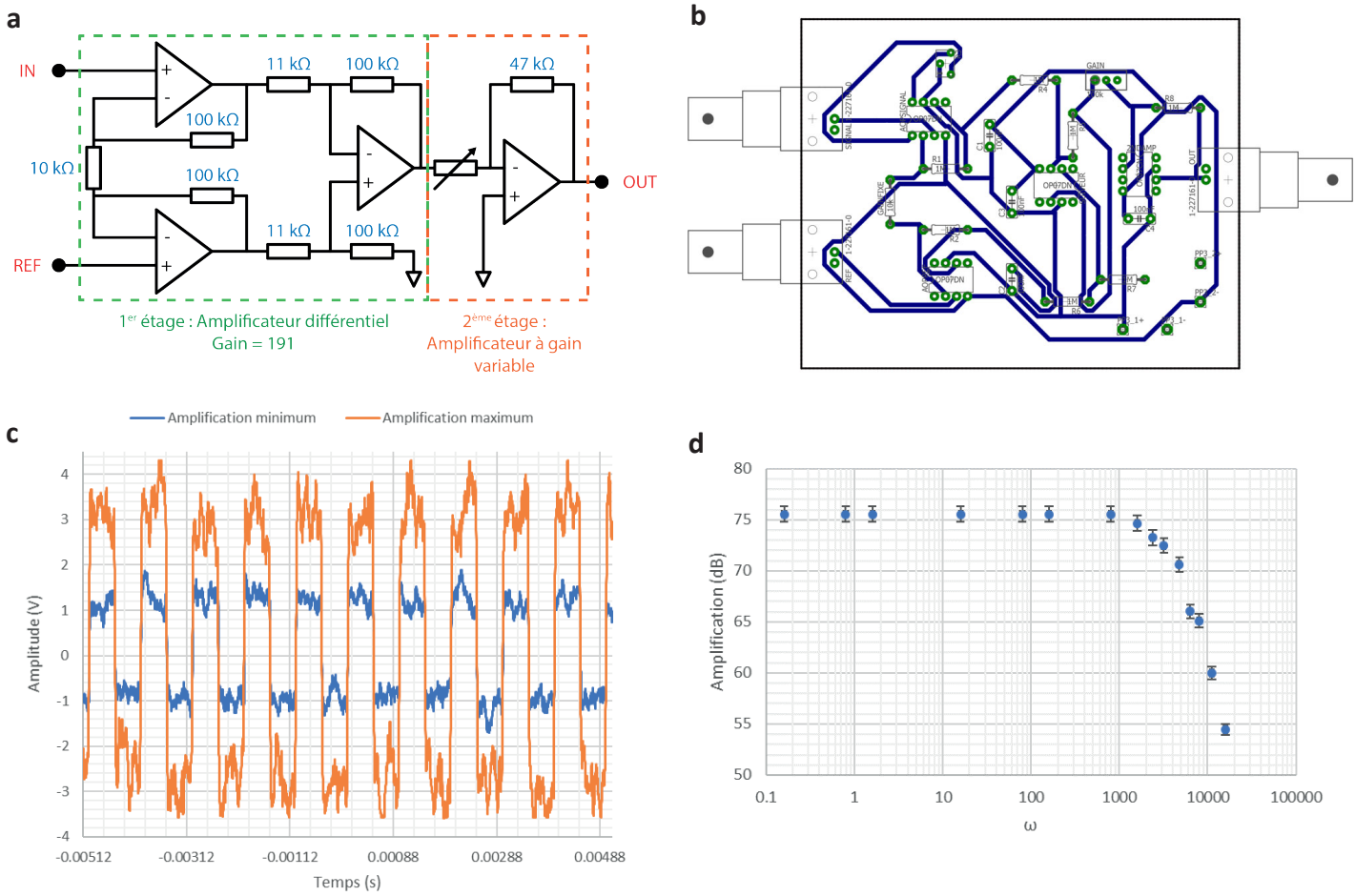


c



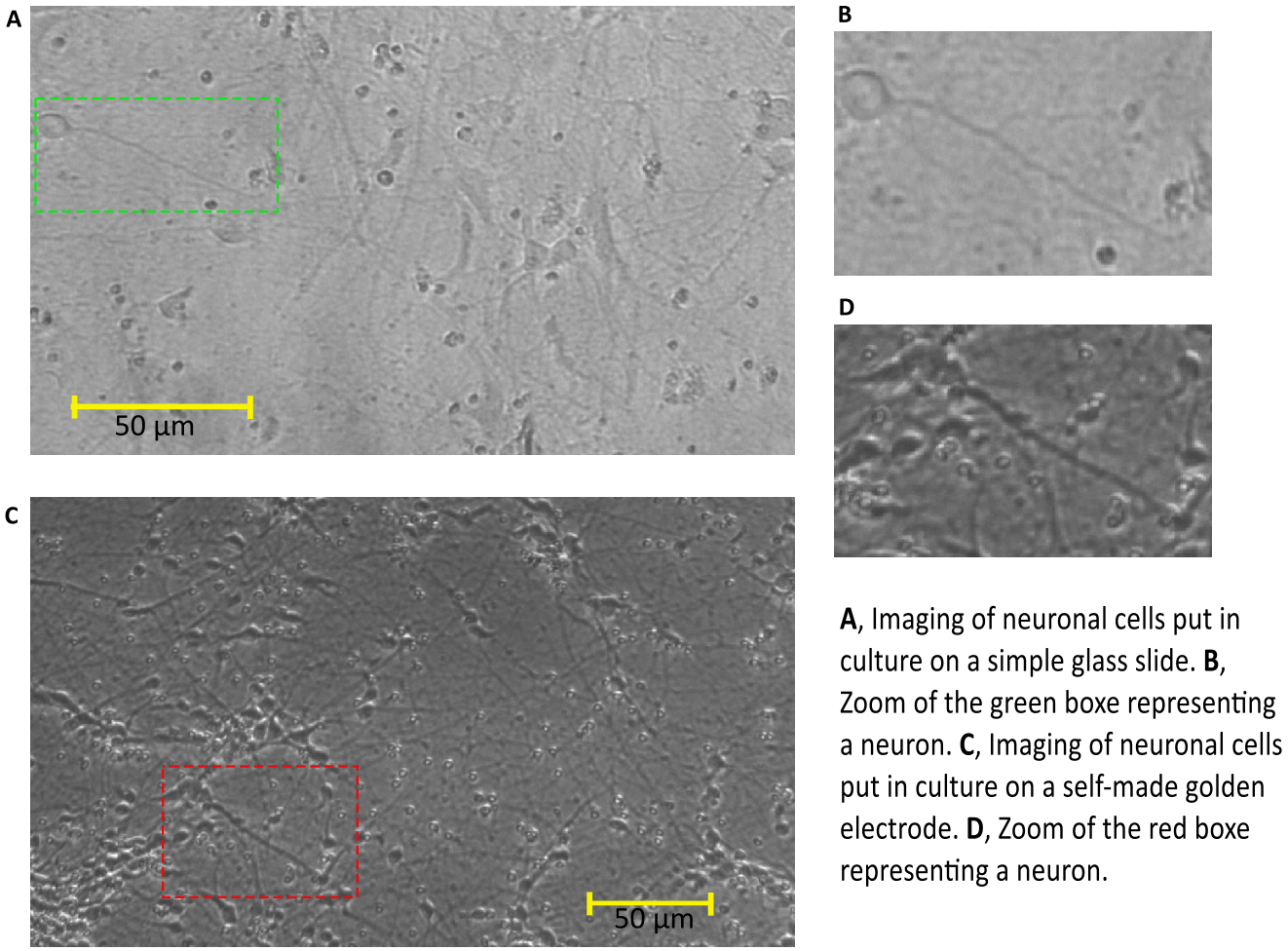
a, experimental set-up. Primary culture of rat neurons (4) within a well of PDMS (2), on an electrode made of a glass slide (microscope slide - 76mm x 26mm x 1mm) (1) with 8 nm gold-coated strips of different widths (3). The generator (8) delivers alternating current on a gold strip to stimulate the cell culture. The potential difference between the signal of the culture stimulated by the generator and the excitation signal used as a reference is operated by a variable-gain differential amplifier (7). The amplified potential difference is measured by a digital oscilloscope (9). The electrode and the amplifier are put in a Faraday cage (6) made of cardboard and aluminium to reduce the noise. Electrical activity of the neuronal culture can be matched with chemical activity of the neurons with a calcium sensor (5), tracked on an inverted microscope. **b,** printed circuit board of the differential amplifier (7). **c**, PDMS well bounded to gold electrode thanks to silicone grease.

Figure 2 : Differential amplifier for golden electrode



a, Differential amplifier symbolic schematic. Amplifier is divided into two stages to avoid flow rate saturation. **b**, Complete printed circuit diagram. **c**, Amplifier response to a 500 µV signal at 1 kHz. The noise is mainly due to the generator (Digilent Analog Discovery 2) wich has a low signal to noise ratio for low signals. **d**, Amplifier transfert function for a 75 dB amplification. The cut-off frequency (around 10 kHz) is above the neuronal signal frequency range (500 to 5000 Hz).

Figure 3 : Imaging of primary culture of rat neurons on inverted microscope 20X magnification



A, Imaging of neuronal cells put in culture on a simple glass slide. **B**, Zoom of the green boxe representing a neuron. **C**, Imaging of neuronal cells put in culture on a self-made golden electrode. **D**, Zoom of the red boxe representing a neuron.