

EIT data acquisition in rat sciatic nerve using stimulation of tibial and peroneal branches [↗](#)

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ABSTRACT

High-level protocol to obtain the EIT imaging dataset and reconstruct images for the paper.

EXTERNAL LINK

<http://iopscience.iop.org/article/10.1088/1741-2552/aad78e/pdf>

THIS PROTOCOL ACCOMPANIES THE FOLLOWING PUBLICATION

Kirill Aristovich et al 2018 J. Neural Eng. 15 056025

PROTOCOL STATUS

In development

We are still developing and optimizing this protocol

GUIDELINES

Please consult UCL EIT team before attempting the protocol, the complexity of the required hardware and software is such, that the collaboration will be much more effective. It is possible to create customised easy-to-operate systems and software packages which are tailored for the specific paradigm

SAFETY WARNINGS

Chemicals used during the electrode interface construction are toxic.

BEFORE STARTING

consult UCL EIT team before attempting the protocol

Hardware

1

Prepare necessary hardware:

EQUIPMENT

UCL EIT system

EIT system

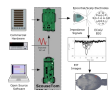
Custom n/a [↗](#)

Number of channels: up to 256

Current frequency range: DC - 20kHz

Sampling frequency: 100kHz

Onboard stimulator



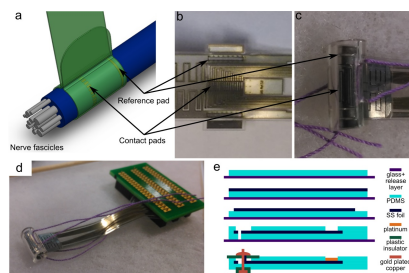
Neural Interface

- 2 Prepare neural interface:
Follow the instructions in the paper <http://iopscience.iop.org/article/10.1088/1741-2552/aac868>

⚠ SAFETY INFORMATION

Some of the chemical components are toxic
Chemical hood cabinet is required

EXPECTED RESULT



Software

3

 **UCL EIT system** 
source by UCL EIT group

Animal Preparation

- 4 Procedures were performed on a vibration isolated table (Thorlabs Inc., USA) and, throughout experiments, the core body temperature of the rat was controlled with a homeothermic heating unit (Harvard Apparatus, Kent, UK) and maintained at 37°C
- 5 Sprague-Dawley adult male rats weighing 300 to 450g.
- 6 Anaesthesia is induced with a 5% isoflurane in 100% O₂.
- 7 intubated using a small animal laryngoscope

EQUIPMENT

Small animal laryngoscope

Laryngoscope

Custom 3D printed n/a 



- 8 18G cannula and mechanical ventilation is provided, using a Harvard Apparatus Inspira Ventilator (Harvard Apparatus, Ltd, UK), with a 50/50% gas mixture of O₂ and air.
- 9 Arterial and venous access was established through cannulation (BD Insyte/Vialon, Becton, Dickinson U.K. Ltd.) of the right femoral vessels.
- 10 The arterial blood pressure should is monitored (Cardiicap 5, Datex Ohmeda) and the mean arterial pressure (MAP) kept between 90 and 110mmHg using labetalol and adrenaline as necessary.
- 11 Once intravenous access had been established, a constant infusion of propofol is initiated. Monitor the depth with pinch reflex.

Surgery

- 12 Access sciatic trunc, common peroneal nerve and tibial nerve following the guide:
<https://onlinelibrary.wiley.com/doi/full/10.1002/mus.21652>

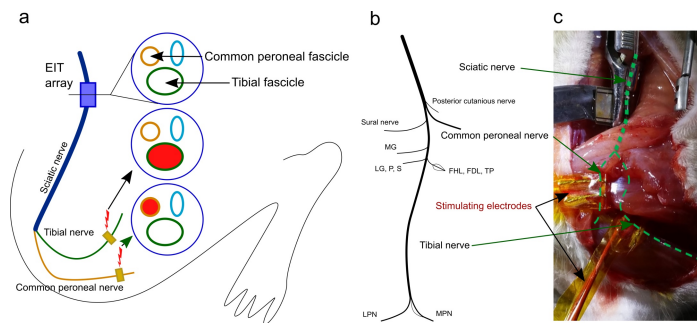
NOTE

Access to the common peroneal nerve was established through a 2mm lateral incision in biceps femoris near the knee joint.

Electrode placement

- 13 Implant the stimulation electrodes on common peroneal and tibial branches (bipolar Ag hook electrodes)
- 14 Implant the EIT array on main sciatic trunc

EXPECTED RESULT



Experimental design and setup. (a) The EIT array was placed on the main sciatic nerve running in the posterior compartment of the thigh approximately 20 mm distal to the greater sciatic foramen. (b-c) Two stimulating electrode pairs were placed on the tibial and common peroneal nerves. EIT images were recorded during the repeated activity in the sciatic nerve evoked with 5Hz stimulation of each branch at a time.

Data acquisition

- 15 For all studies, a square biphasic (positive first) constant current temporal waveform was delivered using a balanced current source (Keithley, UK model no 6221) with:
 - 1-3 mA amplitude,
 - 50 μ s pulse width,
 - 5Hz frequency (200 ms inter-stimulus time)

- 16 Program the EIT system with the following parameters:

☐ [EIT_parameters.mat](#)

- 17 Connect stimulator to the tibial stimulation electrode. Collect the data
- 18 Connect stimulator to the common peroneal stimulation electrode. Collect the data

Data Processing and Image reconstruction

- 19 Load and process the data using the following software:

SOFTWARE
UCL LoadData
 source by UCL EIT team

- 20 Forward solution

SOFTWARE
PEITS
 source by UCL EIT team

21 Inverse solution and images generation

 SOFTWARE

Image Reconstruction

[source](#) by UCL EIT team



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