Webinar Q&A Report:

Measuring EEG in vivo for Preclinical Evaluation of Sleep and Alzheimer's Disease

1. **When re-implanting the transmitters, do you change the leads every time? And how do you inspect the leads on insulation damage? In our lab, we encounter a lot of ECG contamination in the EEG signals when re-implanting the transmitters, even when checking the leads under a dissection microscope.**

   DSI: Biopotential leads are fixed to the body of the telemetry implant. They may be trimmed to the appropriate length and sometimes need to be trimmed during explant dissection. If you need to extend the leads, DSI offers a lead coupler kit. DSI's surgical services team offers free consultation and may be able to assist with making surgical recommendations to avoid ECG contamination. ECG contamination can often be contributed to the insulation of the electrodes being compromised or if the EEG sensing region is also not properly isolated and is near enough in proximity to detect ECG.

2. **Dr. Teske, could you share your electrode placement for EEG with F40 EET transmitters?**

   Stereotaxic coordinates for the EEG electrodes (3.1 mm posterior to bregma and +/-1.5 mm lateral to bregma) were determined from the rat brain atlas of Paxinos and Watson

3. **What surgical microscopic resolution do you need to implant the electrode to the same area?**

   Marco: Actually, we do not necessarily need a surgical microscope any more as we use automated 3D stereotaxic system.

4. **How much does electrode placement influence the Theta readings? Variability within group?**

   Marco: I can't tell. We did not do systematic evaluation of that. When the electrode position is not correct in post mortem analysis the animals are not included into analysis. But there are publications on this in literature using methods different from telemetry.

5. **How do you filter artefacts on EMG or EEG while animals are experiencing seizures?**

   Marco: The telemetry software provides automated artefact detection which marks artefacts and allows to exclude them from analysis. In addition, we perform simultaneous video recording that allows to detect motor artefacts in EEG, e.g. from eating, grooming, running or even seizuring.

6. **Is analysis done using in house automated scoring or manual scoring? If the former, do you ever validate the scoring selection between transgenics before 'trusting' the scored data output?**

   Marco: For seizure we use the Neuroscore seizure module from DSI, for theta oscillations a self-made system. The latter has been described in detail in Müller R et al. (2012) and Müller R et al. (2017). We do not use manual scoring (neither for seizure nor for theta).

7. **Is it possible to also record EOG while recording EEG and EMG?**

   DSI: Although EOG measuring the dipole of the eye can be achieved, DSI's surgical services team does not have proficiency in this method and cannot offer assistance. Due to the small area of a rodent skull, some researchers measure EMG of the ocular muscles governing the eye instead.

8. **What software can we use for EEG analysis - ponemah, neuro score or sleepsign?**

   DSI: Ponemah acquires EEG data and NeuroScore provides analysis capabilities.

9. **Marco - Would you have any advice about the use of super glue to secure the connection between the electrodes and F20 in animals?**

   Marco: I guess you mean the connection between the sensing lead of the F20EET transmitter and the deep electrode. We think the best way is to mechanically attach them (e.g. with a tiny clip etc.). I would not recommend glue, as this can move between both metals and increase impedance.

10. **In the case that I will use the same implant for different animals (i.e. 2 weeks of recording per animal) - how do you recommend I clean and keep this device between use? Have you experienced any damage to the implant? What is the sterilization technique in order to re-use the device between animals?**

    DSI provides technical notes using Actril or Cidex here:
    https://www.datasci.com/resources/technical-notes

11. **We too are trying to find EEG biomarkers of a viral encephalitis in NHPs as part of an effort to find a trigger to treat. Are there any suggestions as to what waveforms to look for or analyses to carry out?**

    Marco: This is hard to tell. In AD disease it is known which frequency bands, and which brain areas, are likely to be affected. It would make sense to see if any such information is available for encephalitis.

12. **We would like to know if the synced video has been helpful in identifying aberrant behaviors and how you have used this in your publication efforts?**

    Marco: Yes, it's helpful. It helps to identify artefacts in the EEG and to exclude them for analysis.

13. **Jennifer, did the DSI activity measure correlate with the locomotion measured with the beam break system?**

    The answer to this question likely depends the they type of activity from beam break systems (e.g. walking, rearing, stereotypic movement) and the placement of the EMG lead for the DSI transmitter. We place our EMG leads in the neck musculature. We have published that the DSI activity counts do correlate with walking and rearing detected from a beam break system (Teske et al. Methodological considerations for measuring spontaneous physical activity in rodents. Am J Physiol Regul Integr Comp Physiol. 2014 May 15;306(10):R714-21. PMID: 24598463. doi: 10.1152/ajpregu.00479.2013).

14. **Marco, did you ever use skull screws? Does inserting the electrode lead in the craniotomy result in better signal than skull screws?**

    Marco: No, we never used skull screws. So, I cannot comment whether the signal is better. We did not use skull screws as this would mean coupling the sensing lead to the screw. This can increase the risk of introducing noise to the system and you also have to take care of the impedance.

15. **Marco, could you please let us know how the Gamma power change in CA3 or DG recording site in AD mouse models compared with WT?**

    Marco: We did not record from CA3 or DG, but CA1 only and motor cortex M1.
    Our gamma analysis is described in detail in Papazoglou et al. (2017)

16. **Marco: Are you happy with the frequency range provided by the transmitter or would you go higher if possible? If yes, how high and would you implant animals also for a reduce time if you have higher bandwidth?**

    Yes, of course the best thing would be a bandwidth of up to 250 Hz for example. Yes, I would also use an implant with higher Bandwidth if the lifetime is reduced.

17. **How do you connect the sensing lead of the electrode to the deep electrode?**

    Marco: mechanically, by clipping. Do not solder, as this might induce noise to the system

18. **Which cement works best for fixation of the electrodes on the skull?**

    Marco: In my experience, Glas ionomer cement (Kent Dental®)

19. **Dr. Teske, do you experience artifact when you use DSI equipment with other equipment?**

    Yes, we experience artifact when we use the DSI equipment alone or in combination with other equipment and the amount of artifact does not change when we pair other equipment with the DSI equipment.

20. **In your experience, how long can one record high quality EEG recordings from an implanted mouse?**

    Marco: 4- weeks in average, sometimes 8 weeks, from our experience and quality criteria.

21. **Dr. Teske, in your experience is the animal's behavior influenced by the implanted transmitter?**

    Our physical activity measurements for rats that are implanted with the transmitter are similar to non-implanted rats, although we have never published this. Also, I have never directly tested animals before and after surgery to verify that the implanted transmitter does not affect locomotor behavior.

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