# Multi-electrode Recordings 101

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## Talk format

Interrupt me with questions!

- 1. General best practices for neural recordings
- 2. Tips and tricks when using OmniPlex
- 3. A few specifics of our setup at RNEL



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Our general best practices for multi-electrode recordings

### BASICS









## Ground

- **One** single ground in the animal – Immobile, large and stable
- That ground is distributed to all recording equipment (without loops)

(Try to) keep it isolated from earth/power ground









### References

- As similar as possible to recording electrodes
  - Tip size, impedance, material, etc.
  - Including location!
- Give yourself options







# **Channel Mapping**

• Figure it out ASAP!

• Validate maps as much as possible

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## Reproducibility

- Make your setup as easy to reproduce as possible
- Use a checklist to ensure the same setup every time
  - Even better if you can put together automated tests
- Automatically generated metadata are best









#### Applying our best practices to the OmniPlex software stack

## **OMNIPLEX SOFTWARE**









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## Server Topology

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		Cancel
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## Server Topology: Referencing





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# Server Topology: Global filters

Global Filters #4: WB (Sof Edit Device Edit Device Options Show Device Characteristics Add New Source To Device Remove Device	Global Filter Settings
Don't enable unless you're having trouble	Notch Filter (50,60 Hz Removal)
May cause dropouts at high channel counts	OK Cancel





## Server Topology: Filtering







### Server: Save metadata

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### PlexControl: Expand the toolbars!



### Make it yours

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### PlexControl: Data views









## PlexControl: Be a digital pack rat

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3	SPK003	3	4	-0.450	0	4	4	4	(***)	
4	SPK004	4	4	-0.450	0	4	4	4	(***)	
5	SPK005	5	4	-0.450	0	4	4	4	(***)	
6	SPK008	6	4	-0.450	0	4	4	4	(***	
7	SPK007	7	4	-0.450	0	4	1	4	P*1	
8	SPK008	8	4	-0.450	0	4	1	4	P*1	
9	SPK009	9	4	-0.450	0	4	2	<b>v</b>	PT	
10	SPK010	10	-	_0_450	0	1	4	<b>v</b>	1	
11	SPK011				0	1	2	<b>V</b>	1	
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PITT

## PlexControl: Save metadata

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★ New in 1.7.1	OK Cancel







A few general tips on using the OmniPlex hardware and lab setup

### **OMNIPLEX HARDWARE**







#### HARDWARE

## Grounding



 Ensure any secondary systems are grounded before connecting them to the subject





## Use off-the-shelf cabling

 Standard D-sub connectors and cables are widely available — use them!







#### HARDWARE

## Make adapter **boards**, not cables

 Printed circuit boards are small, cheap, verifiable and reliable







#### HARDWARE

### Protect your headstages









Our setup for recording from multi-electrode arrays with OmniPlex

### **REHAB NEURAL ENGINEERING LAB**



4/30/2013





# 50,000 foot overview of our lab



 Focus on the dorsal and ventral roots of the spinal cord

- Researching the science of the sensory and motor systems
  - Engineering interfaces for neural prosthetics





### **Neural Arrays**

 Two 32-channel Microprobes Floating Micro-electrode Arrays (FMAs)



RNE EHAB NEURAL ENGINEERING AB





RNEL

### **Nerve Cuff**

 5-pole Ardiem spiral nerve cuff records whole-nerve ENG at two points









# Electromyography (EMG)



 8-10 Bi-polar intramuscular electrodes measure muscle activity







### 80 signals, 3 headstages, 2 preamps



### Backpack connector













### **Backpack connector**



- Routes up to 130 signals and securely connects up to 4 headstages
- Jumpers for a variety of grounding and referencing configurations





### Example treadmill session







### Ventral root axon example



 Record wellisolated action potentials in the ventral root

 Follow the signal propagation along the axon





#### http://rnelab.com



**Doug Weber** 

### Rob Gaunt

Tim Bruns Lee Fisher Rebecca Parker Jim Hokanson Chris Ayers Shubham Debnath

Tyler Simpson Erin Garia



DARPA Reliable Peripheral Interfaces project