



David Maxwell

Making Sense of Motor Circuits

# Why Motor Systems?



To move is all mankind can do,  
whether in whispering a  
syllable, or in felling a forest...  
*Charles Sherrington.*

Movement is the output of the  
Nervous System.

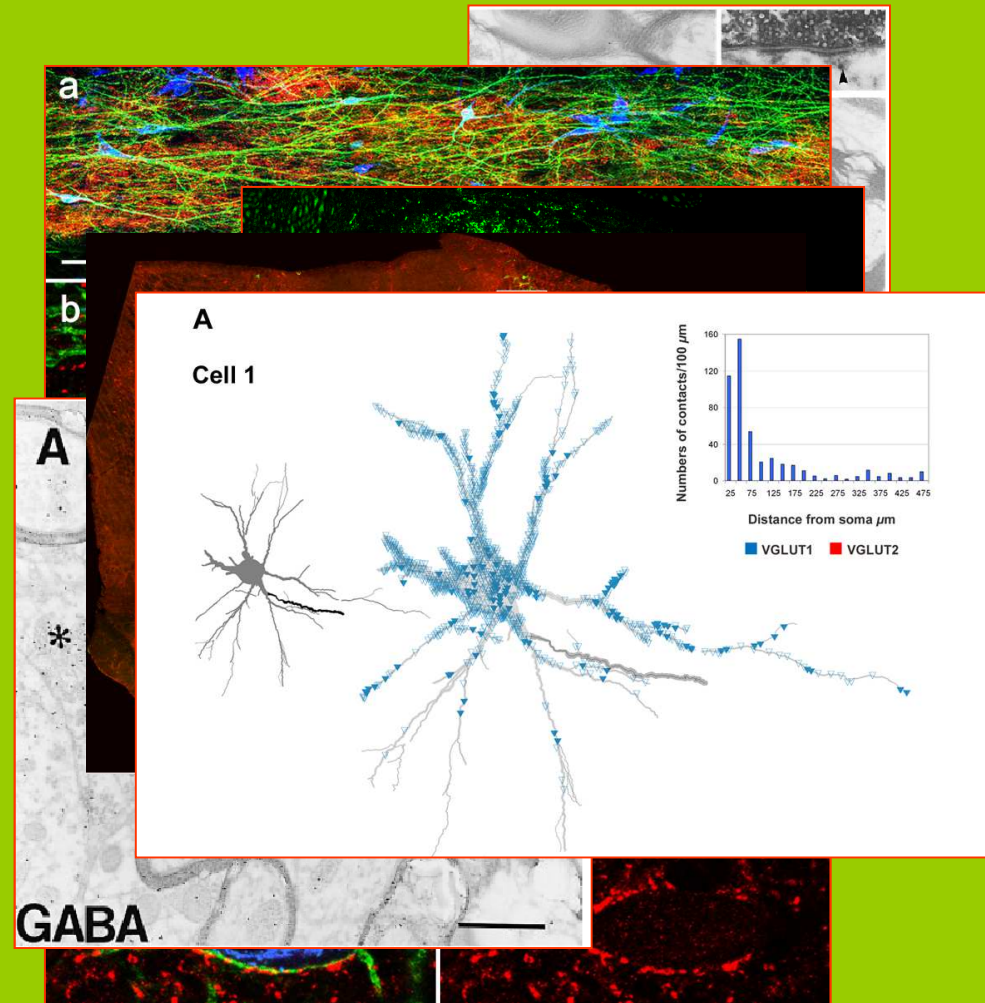
In order to understand neuronal  
networks, we need to understand  
what they produce.

The overall aim is to create a motor  
'connectome'.

# Principal Expertise

## Functional Neuroanatomy

- Electron Microscopy
- Confocal Microscopy
- Immunocytochemistry
- Tract-tracing
- Image Analysis
- **COMBINATIONS OF THE ABOVE**



# Principal Research Interests

## Motor networks of the spinal cord

- ❖ How interneurons create networks
- ❖ How descending and segmental systems control networks
- ❖ The contribution of sensory input
- ❖ How this produces motor behaviour
- ❖ How circuits may change following stroke

**The importance of being identified.....**

*In vivo veritas!*

It helps to be adult about this!

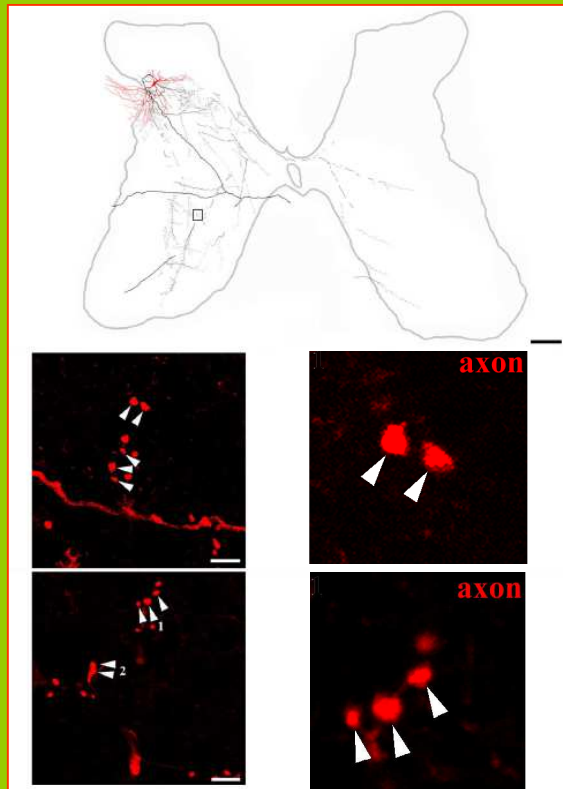
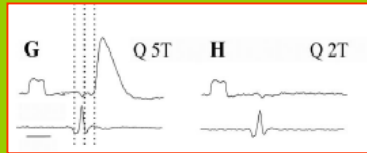
# Network building: identified pre-motor interneurons

Elzbieta Jankowska

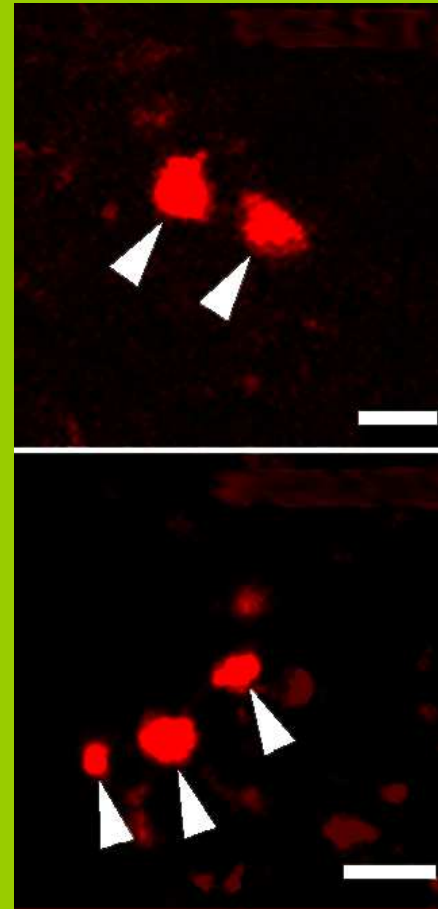
## Problem:

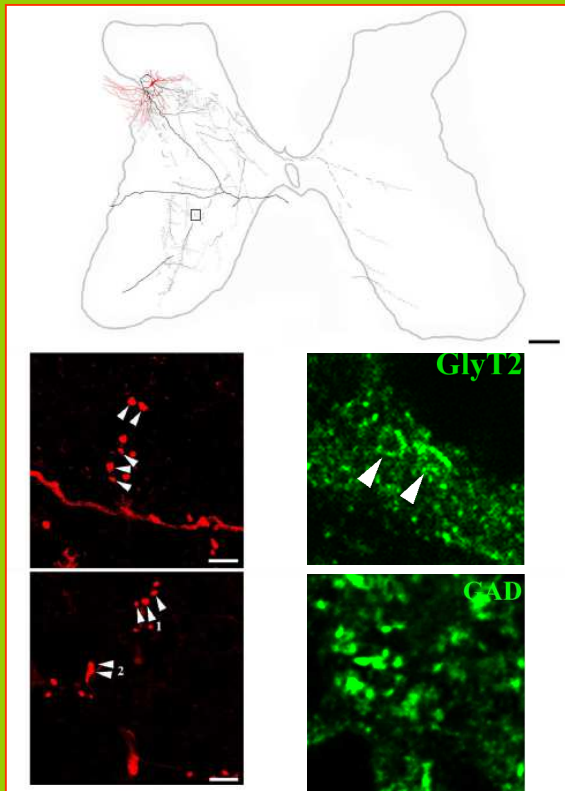
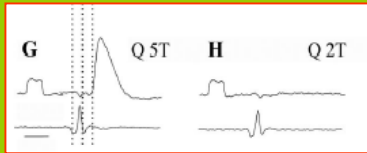
Very few interneurons in motor pathways have been fully characterised. In most cases it was not even known if their action was excitatory or inhibitory.

# Network building: identified pre-motor interneurons

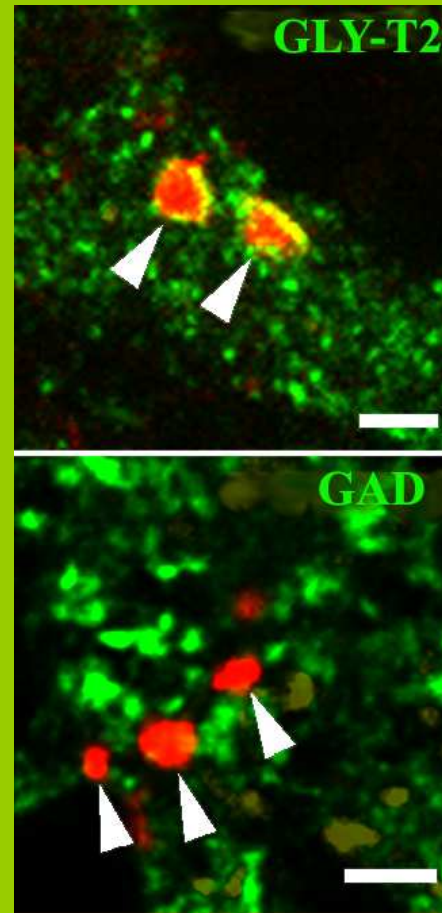


**Inhibitory GpII IN**

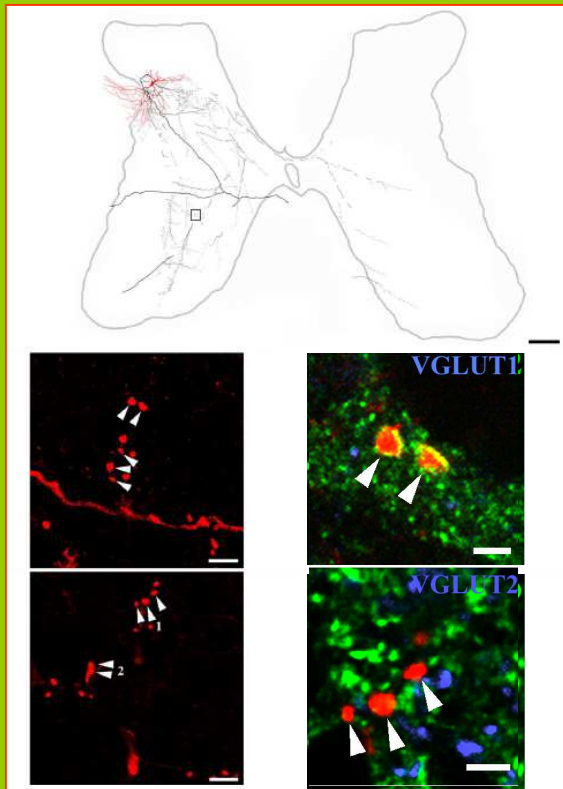
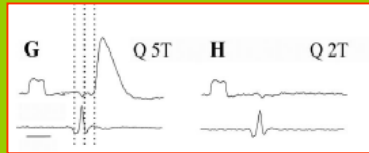




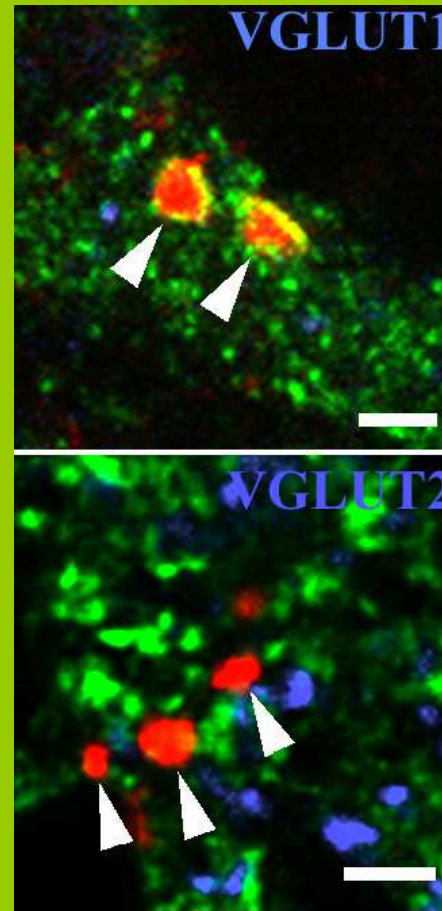
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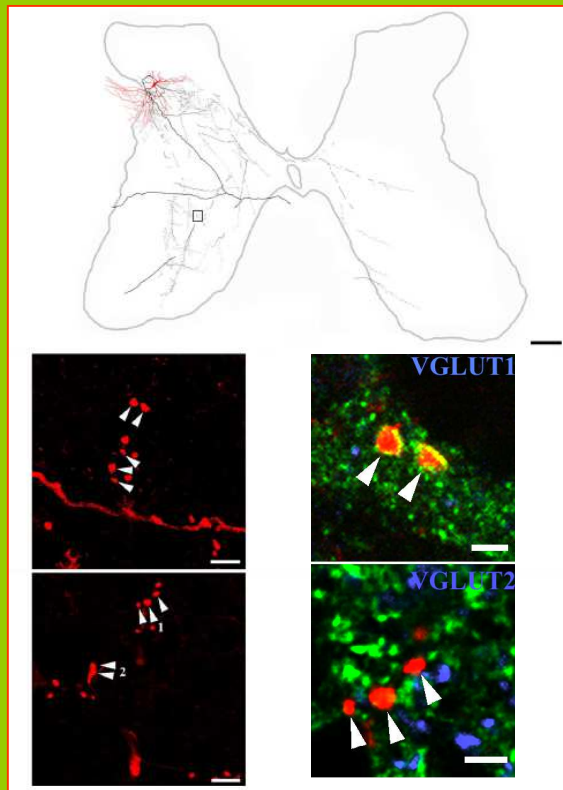
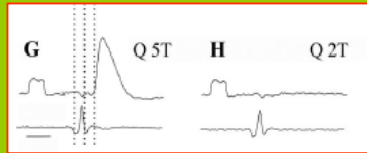




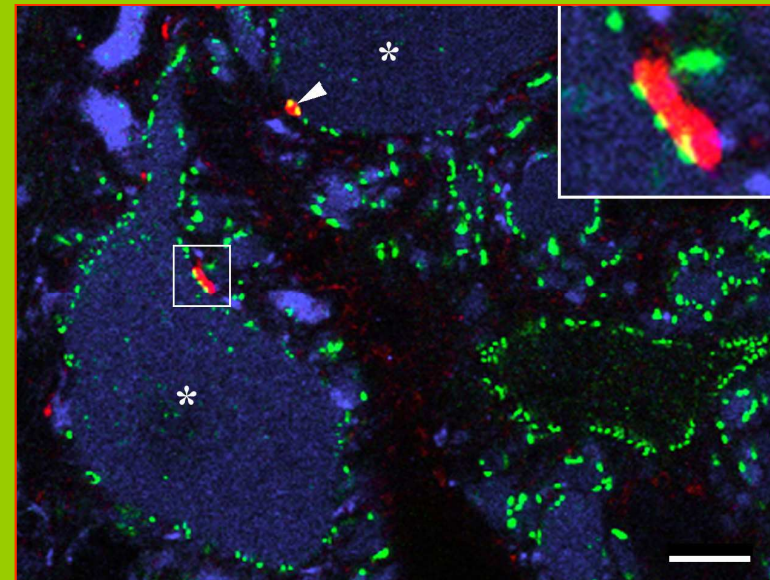


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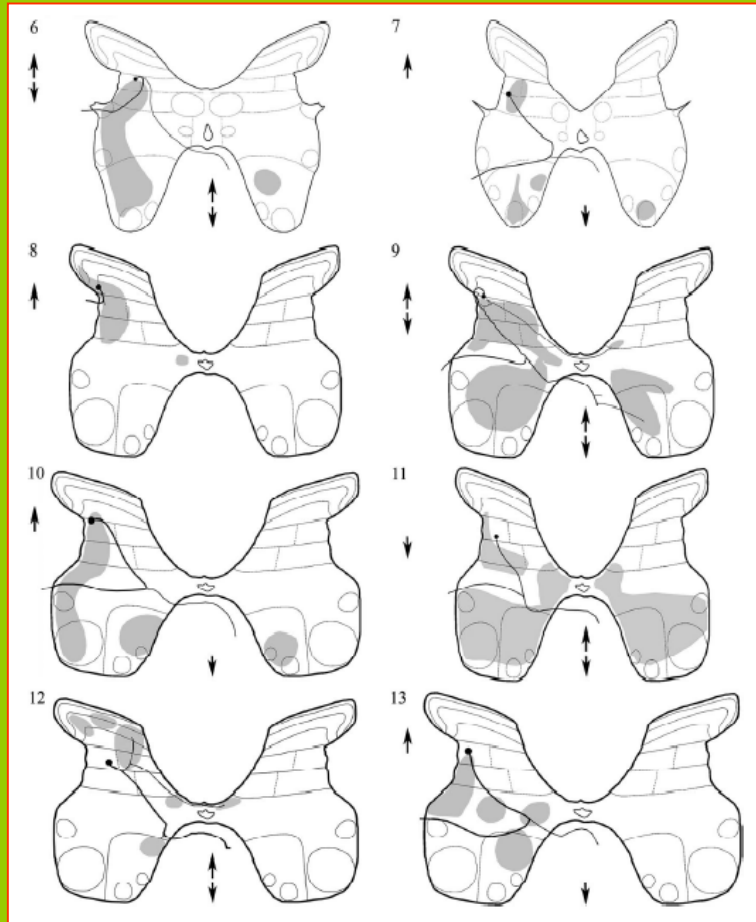


**Inhibitory GpII IN**

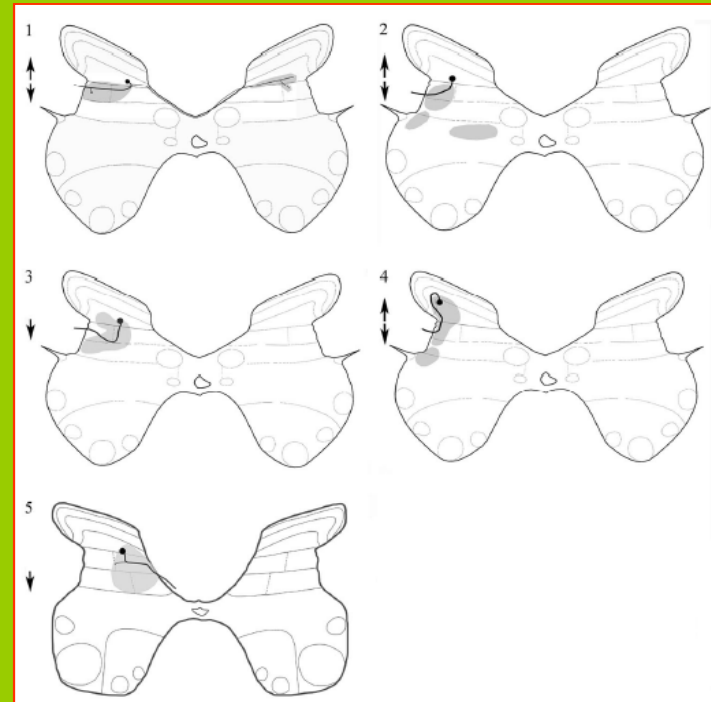


**Contacts on MN**

*Bannatyne et al., 2006*

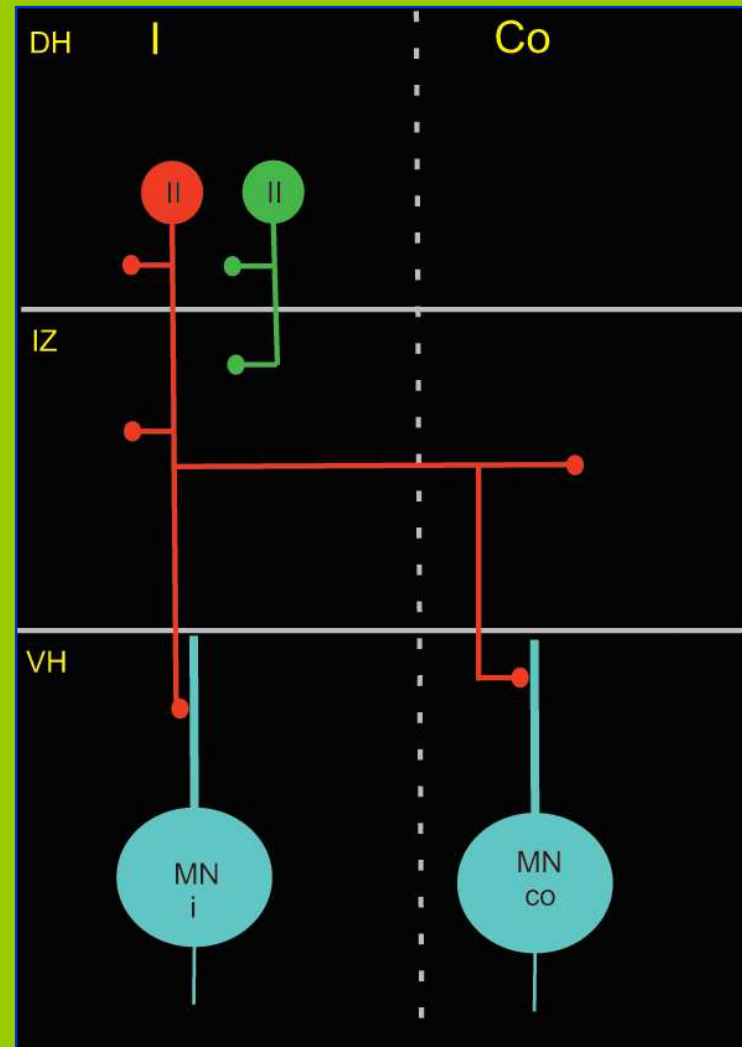


**Inhibitory cells:  
Glycinergic n=8**

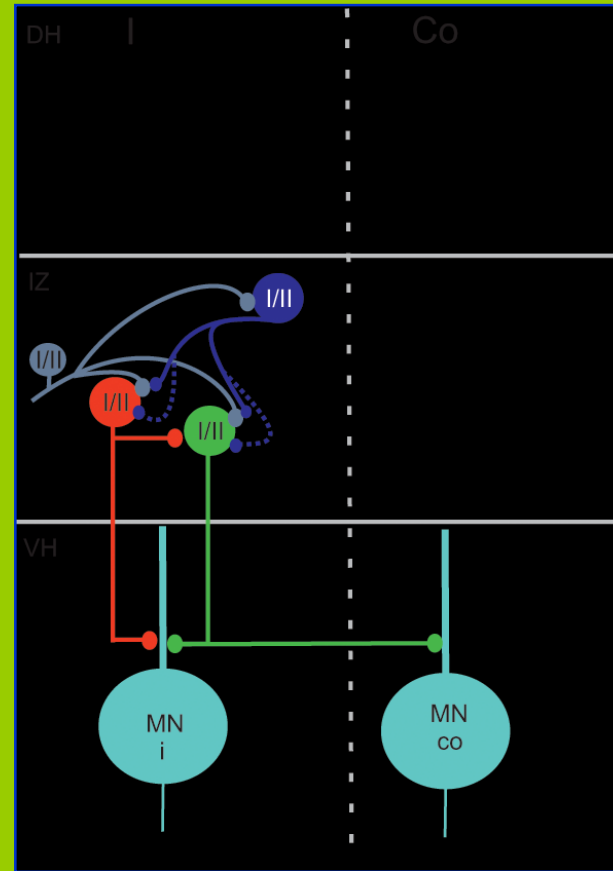
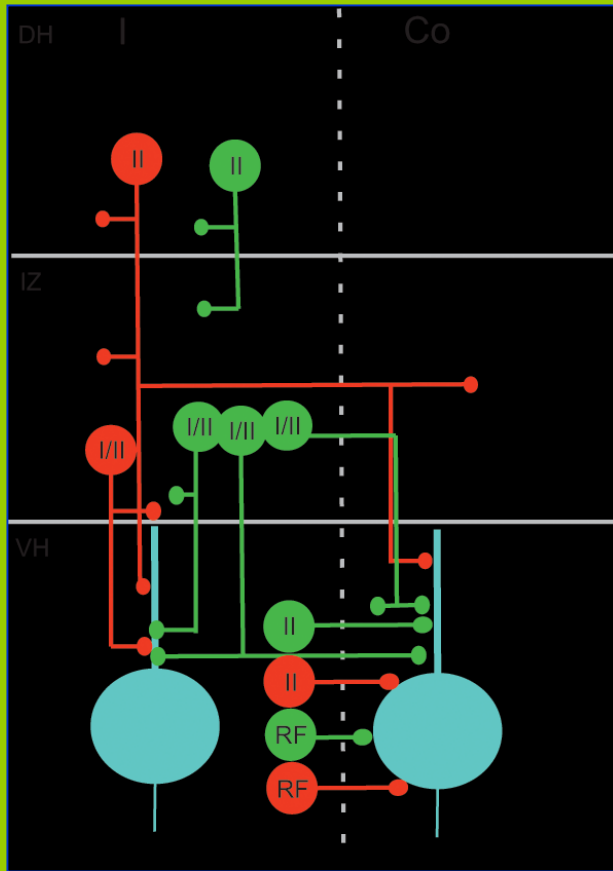


**Excitatory cells:  
Glutamatergic n=5**

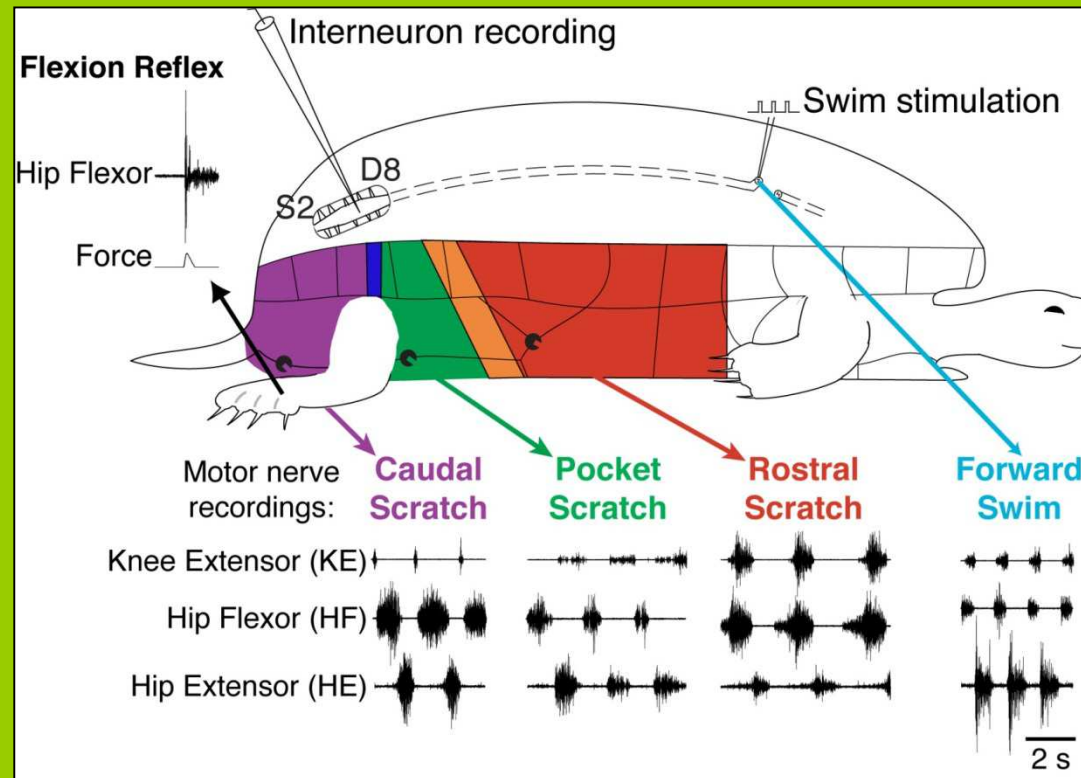
# Interneurons monosynaptically activated by group II afferents: dorsal horn



# Networks

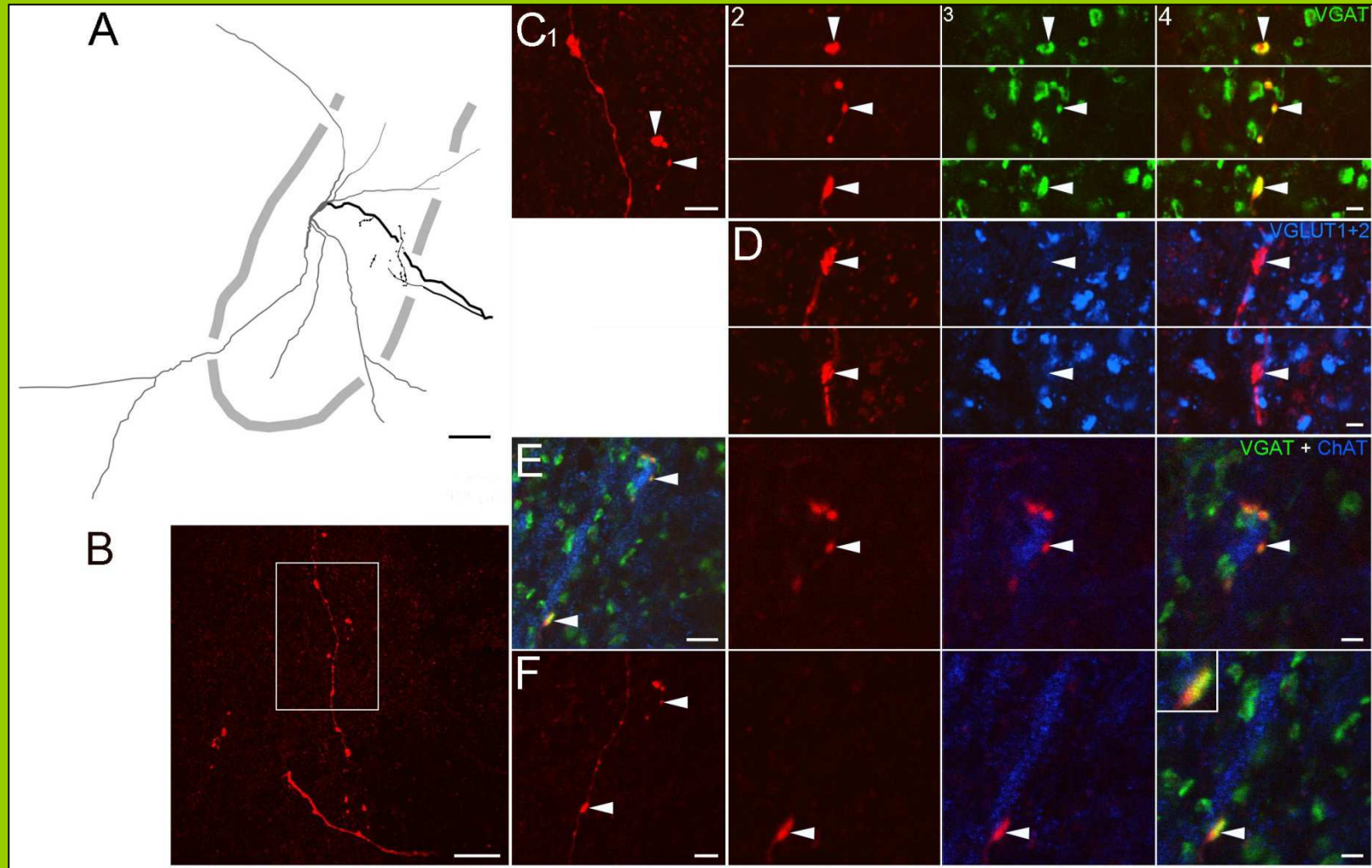


# Unusual Collaboration (?): In vivo adult turtle Ari Berkowitz



Can relate interneuron activity to  
fictive output.

# In vivo adult turtle



What I need now?

...or what can I do for you



# Acknowledgements



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