

# Bioelectronic Medicine

Ben Woodington

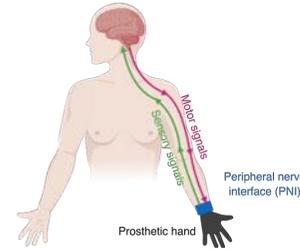
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1

## What is Bioelectronic Medicine?

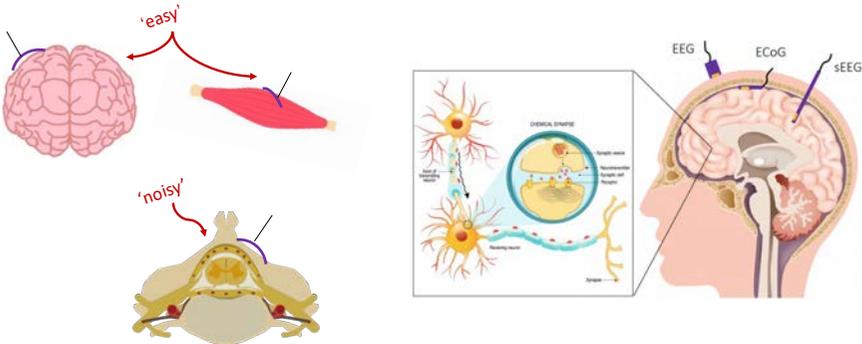
Bioelectronic medicine is a very broad term used to describe any technology which reads and/or writes to the system using electricity, it's a way of connecting to the communication system of the body - the nervous system.



NEUROMODULATION INDICATIONS	
<b>APPROVED</b>	<b>FUTURE</b>
<ul style="list-style-type: none"> <li><b>DBS / CORTICAL</b> Essential Tremor, Parkinson's, Dystonia</li> <li><b>COCHLEAR</b> Profound Deafness</li> <li><b>VNS</b> Epilepsy, Depression</li> <li><b>PKS / PMS</b> Chronic Pain</li> <li><b>SCS</b> Chronic Pain</li> <li><b>SPINAL</b> Cervical Myeloid Malignant Pain, Spasticity</li> <li><b>SNK</b> Incontinence</li> </ul>	<ul style="list-style-type: none"> <li><b>DBS / CORTICAL</b> Alzheimer's, Huntington's, Tourette's, Epilepsy, Parkinson's, Alzheimer's</li> <li><b>ARTIFICIAL RETINA</b> Retinitis Pigmentosa</li> <li><b>ONS</b> Epilepsy</li> <li><b>VNS</b> OCD, Obesity</li> <li><b>PULMONARY</b> Respiratory Support</li> <li><b>SCS</b> Chronic Pain, PHD Pain</li> <li><b>SPINAL</b> ALS, Huntington's</li> <li><b>GASTRIC</b> Gastroesophageal Reflux Disease, Irritable Bowel Syndrome</li> <li><b>VNS</b> Pain, Sexual Dysfunction</li> </ul>
<b>OTHER THERAPIES</b>	
<ul style="list-style-type: none"> <li>Hyperbaric Oxygenation</li> <li>Transcranial Magnetic Stimulation (TMS)</li> <li>Transcranial Direct Current Stimulation (tDCS)</li> <li>Transcranial Focused Ultrasound (tFUS)</li> <li>Transcranial Radiofrequency (tRF)</li> <li>Transcranial Laser (tLaser)</li> <li>Transcranial Microwave (tMW)</li> <li>Transcranial Ultrasound (tUS)</li> <li>Transcranial Vibration (tVib)</li> <li>Transcranial Waveform Stimulation (tWFS)</li> <li>Transcranial Waveform Stimulation (tWFS)</li> <li>Transcranial Waveform Stimulation (tWFS)</li> </ul>	

2

## Sensing

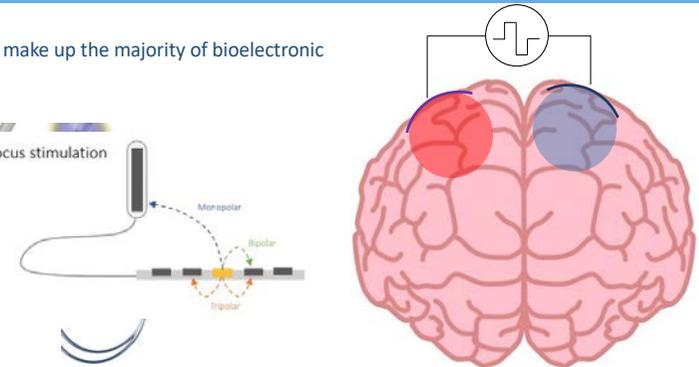


3

## Stimulating

Stimulating therapies make up the majority of bioelectronic medicines today

- Spatial schemes to focus stimulation
  - Monopolar
  - Bipolar
  - Tripolar

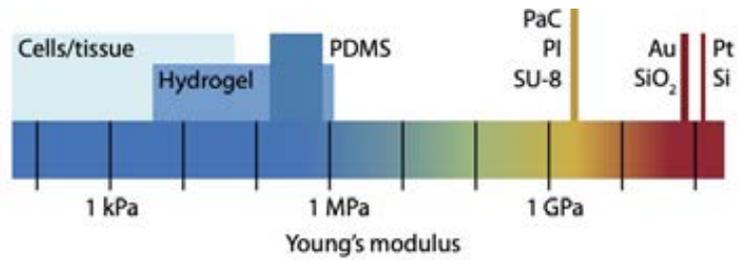


4

## Tools for *Chronically* Interfacing with the CNS

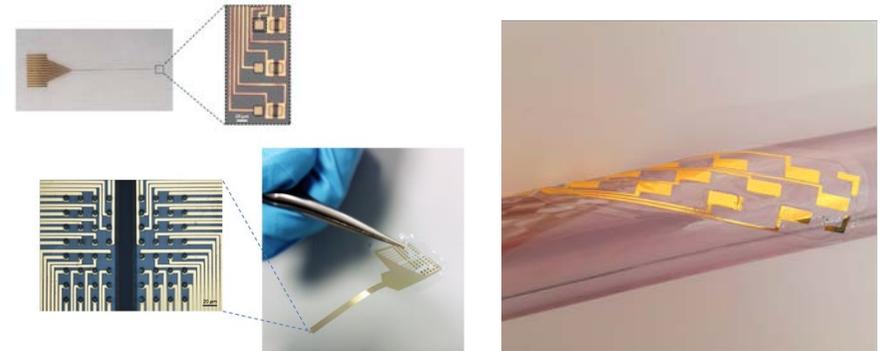
9

Is it biocompatible, is it safe, is it soft?



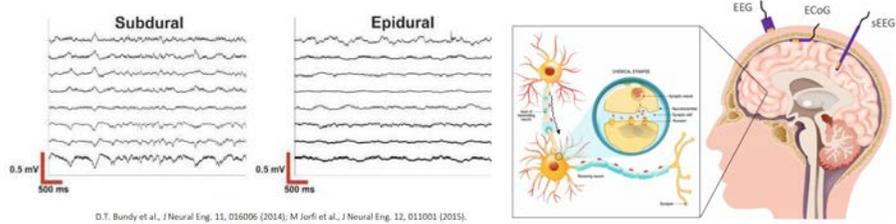
5

## Flexible Electronics



6

## How Invasive Do We Want To Be?

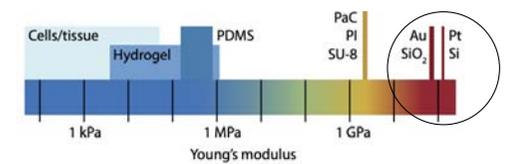


7

## Organic Electronics

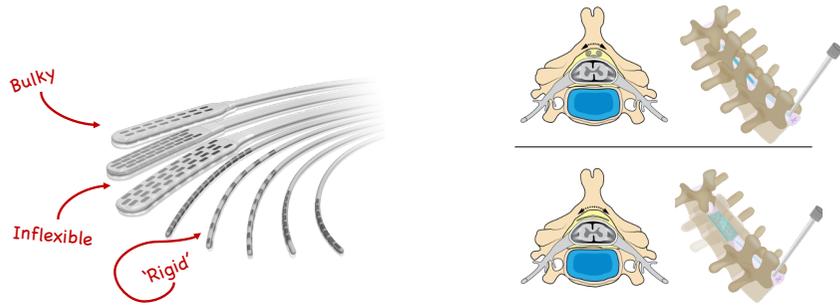
Metals are old news..

- Much less soft than the tissue
- Issues of charge injection
- They break.



8

## Soft Spinal Interfaces



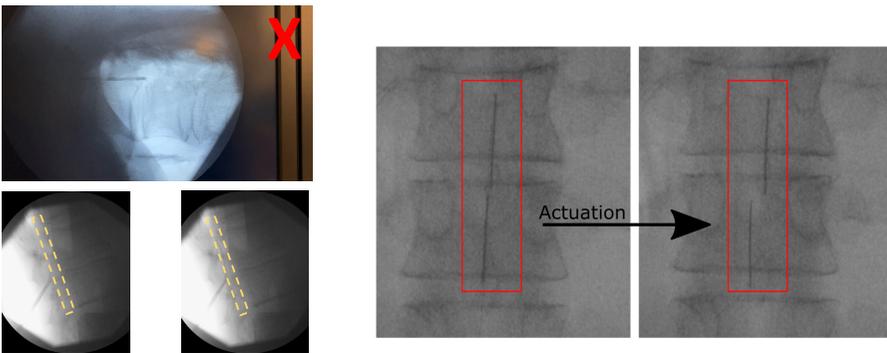
9

## Soft Spinal Interfaces



10

## Making Devices with the Clinician in Mind



11

## Soft Spinal Interfaces

The spinal cord is complex – it is an extension of the CNS, not just a bunch of communication wires  
New applications - Parkinson's and SCI related health issues?



12