

NeuroIntegrated Upper Extremity Prosthetics

J. Robert Anderson, MD

Cleveland VAMC – Case Engineering

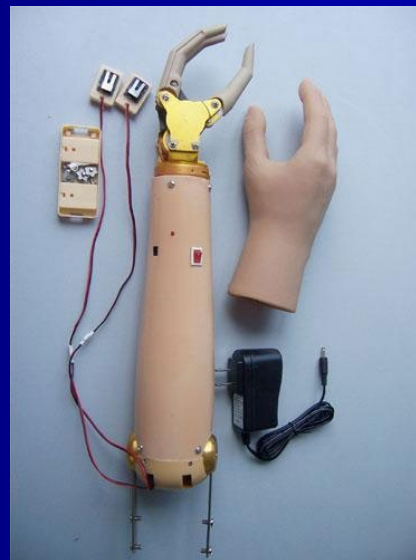
October 6, 2018

Demographics

- 1.7 Million in US
- 1 : 200 Adults
- Lower Extremity
 - 56,132 in 2009
 - 82 % Vascular / Diabetes
- Upper Extremity
 - 1,908 in 2009
 - 65 % Traumatic
 - 15 % Oncologic
 - 10 % Congenital
 - 8 % Dysvascular

UE Prosthetic Types

- Passive
- Body-Powered
 - Activity-Specific
- Myoelectric
- MDoF Myo



UE Prosthetics



- Tool for the task
- Limited by sight
- Just a tool

Current Project

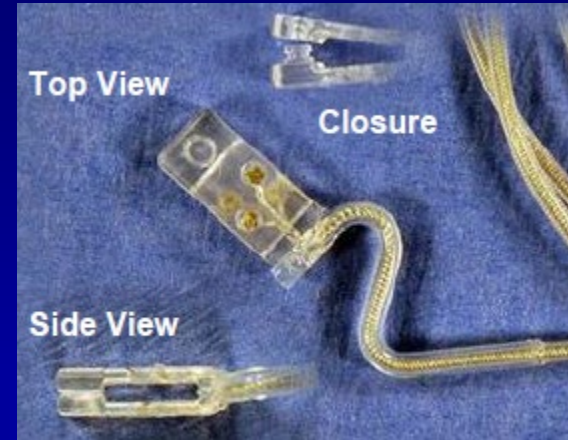
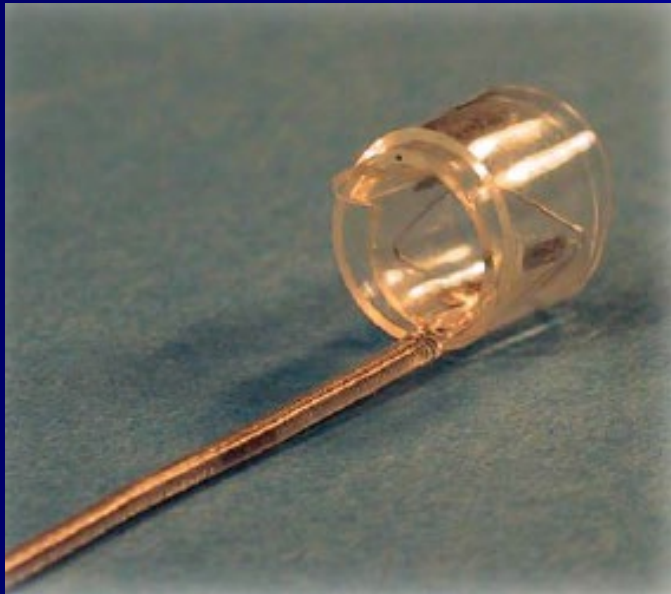


- Michael Keith, MD
- Dustin Tyler, PhD
- Ron Triolo, PhD

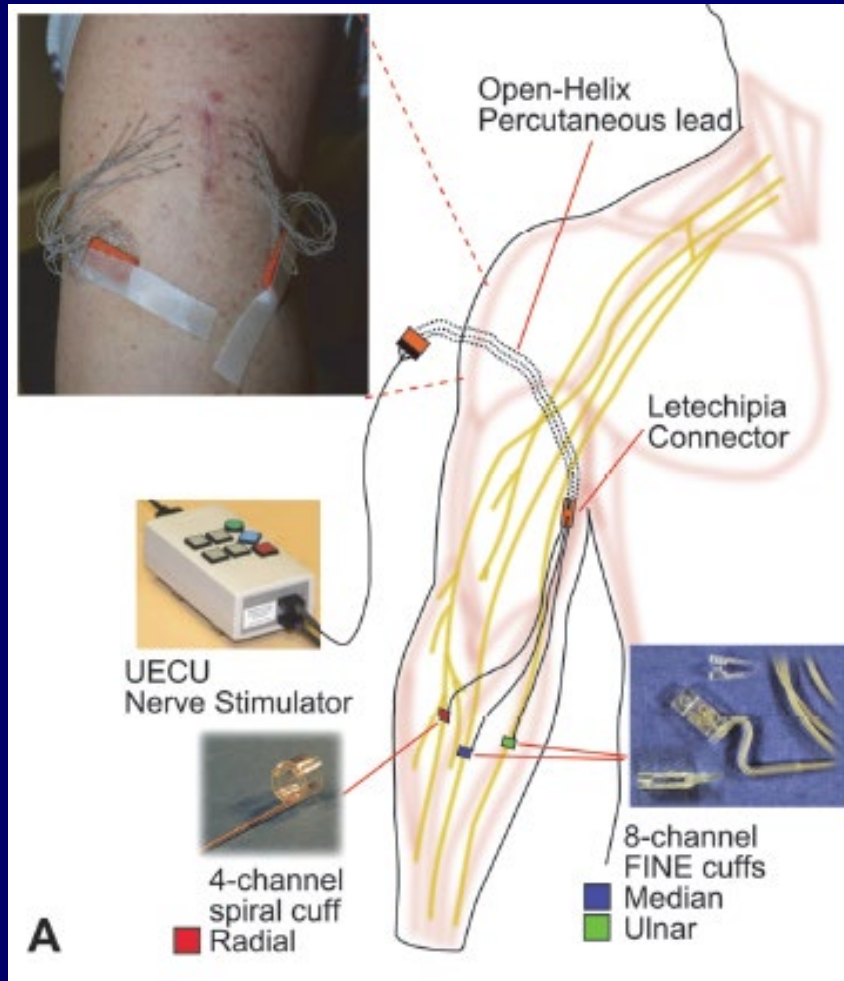
Non-Noxious

- Previous Intraneural / Intrafascicular
 - Paresthesia
 - Increasing threshold
- Pattern Matching
- Nerve Surface Electrode
 - Nearby constant
 - More distant only at peaks

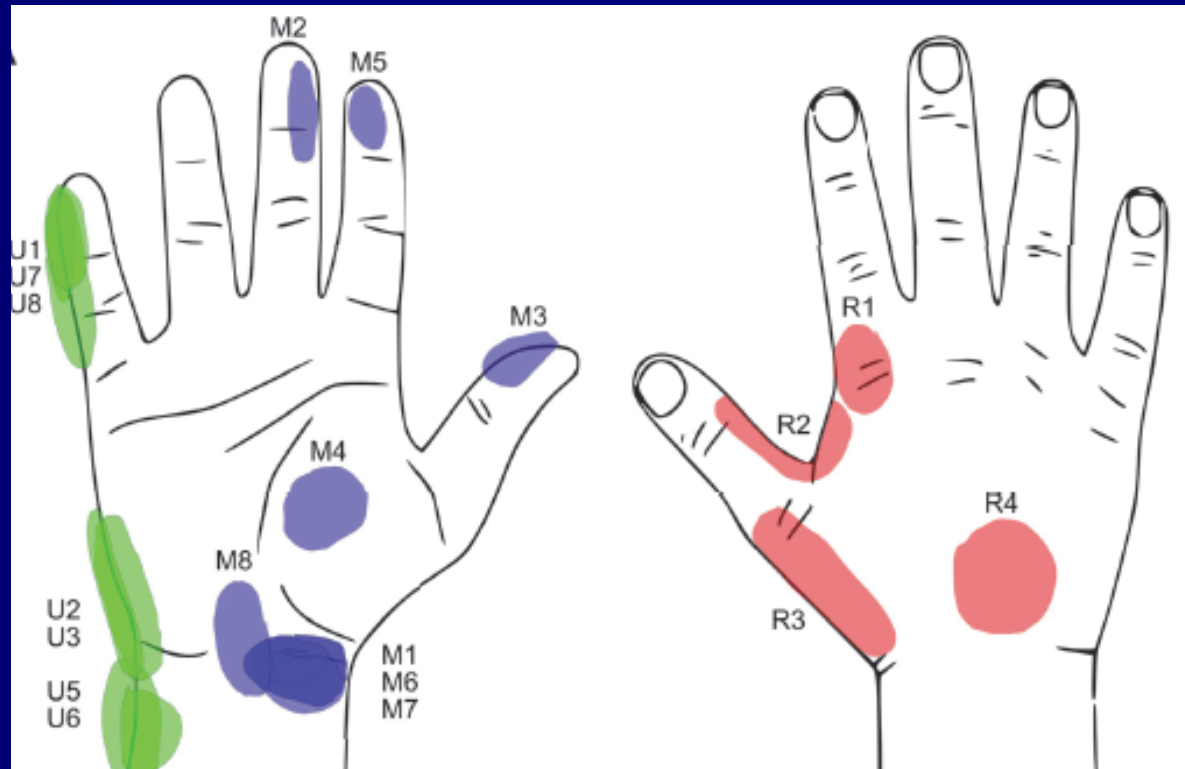
Current Project



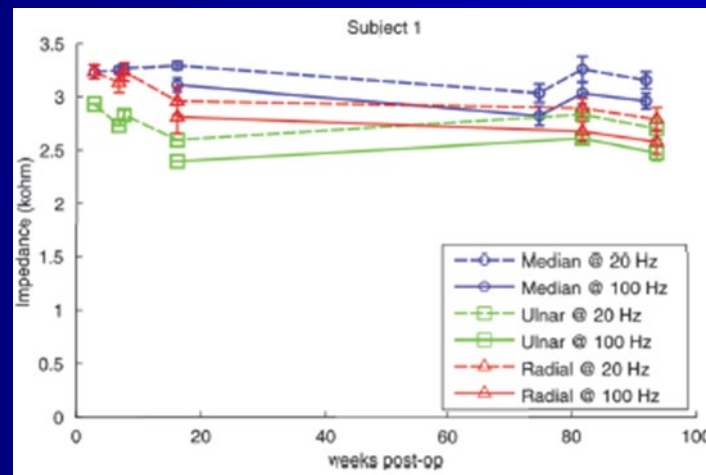
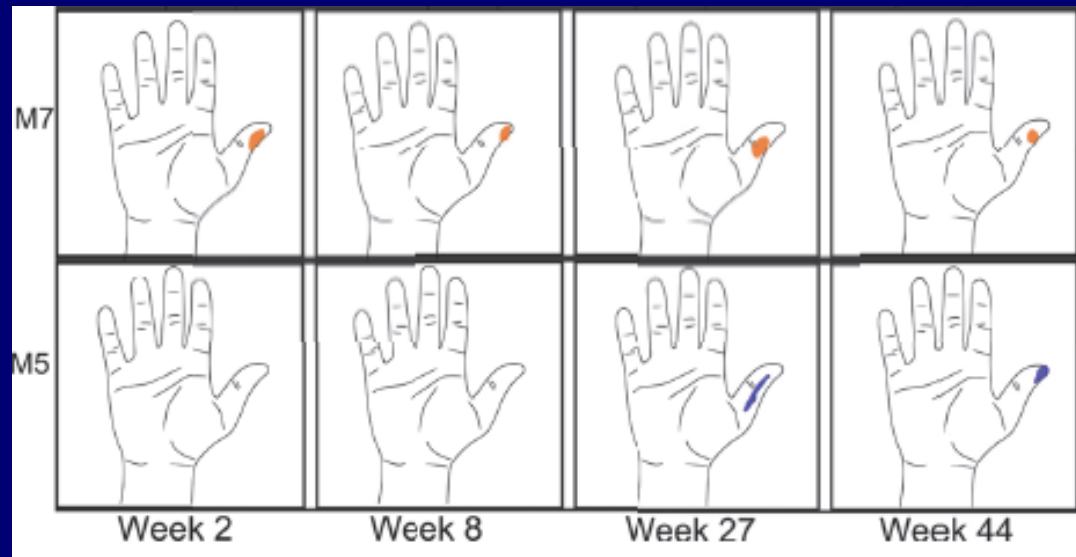
Implanted System



Localization

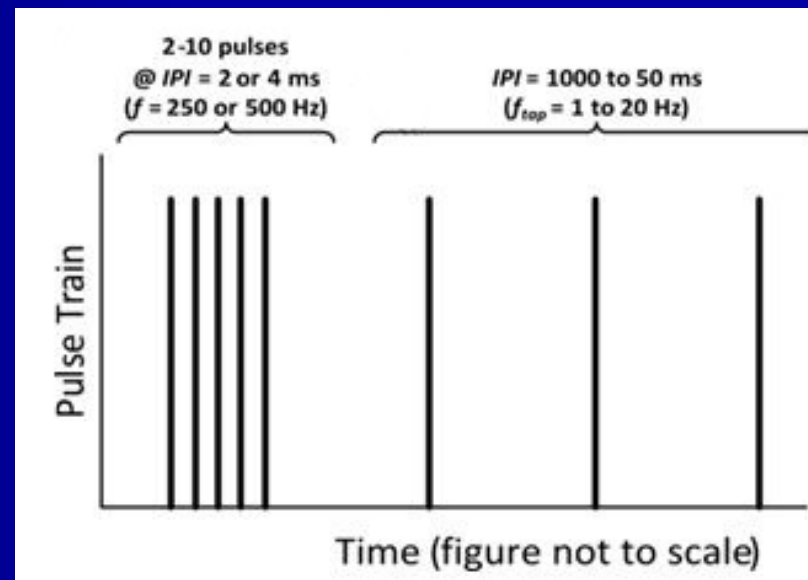
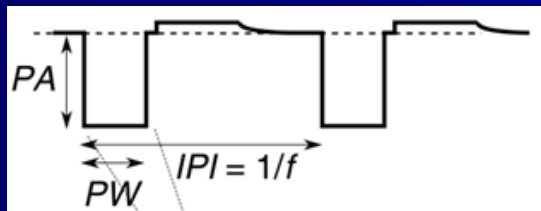


Stability Over Time

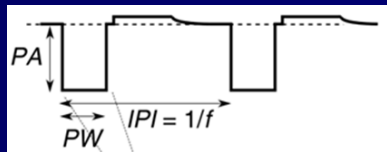
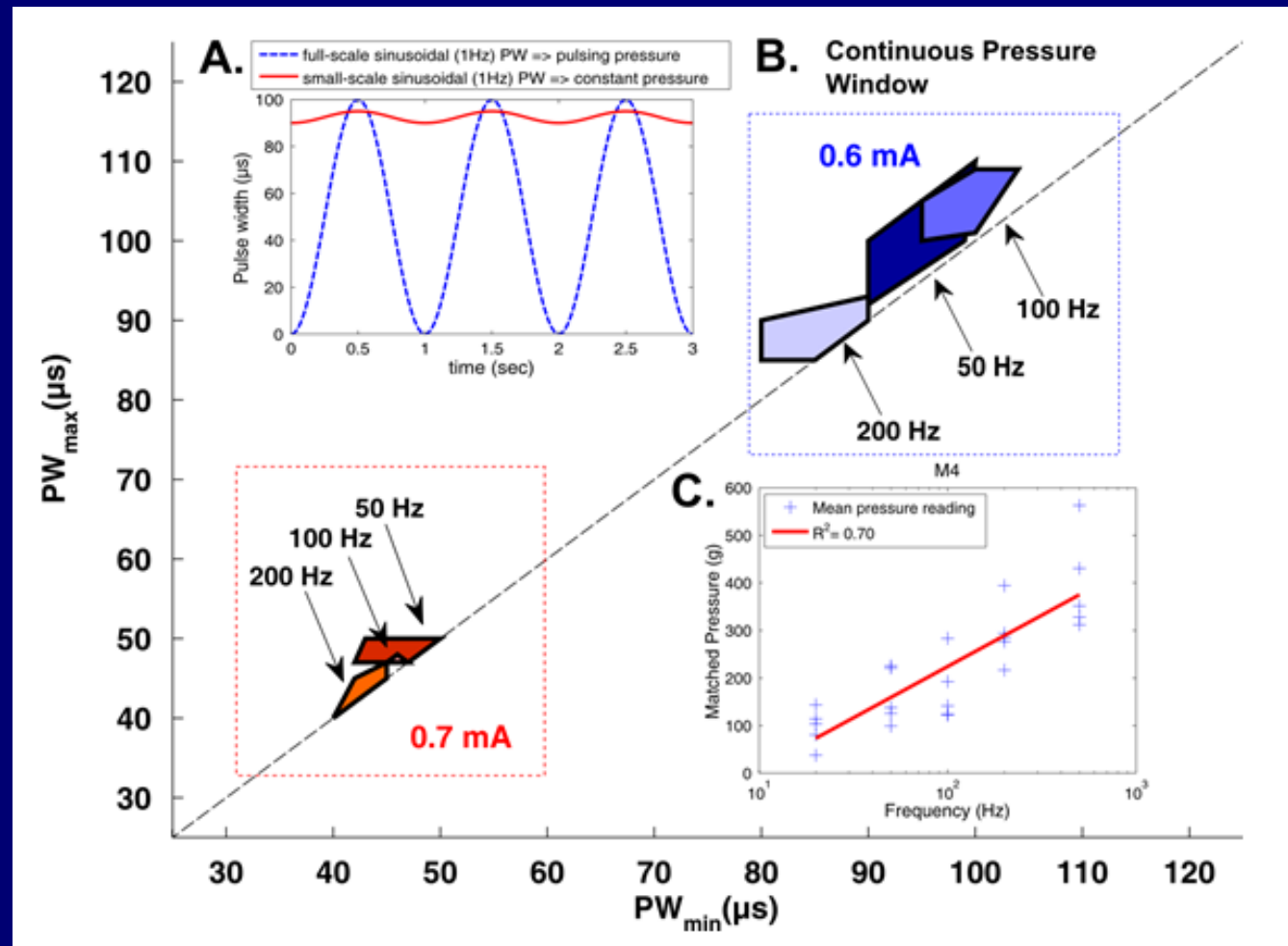


Multiple Modality Encoding

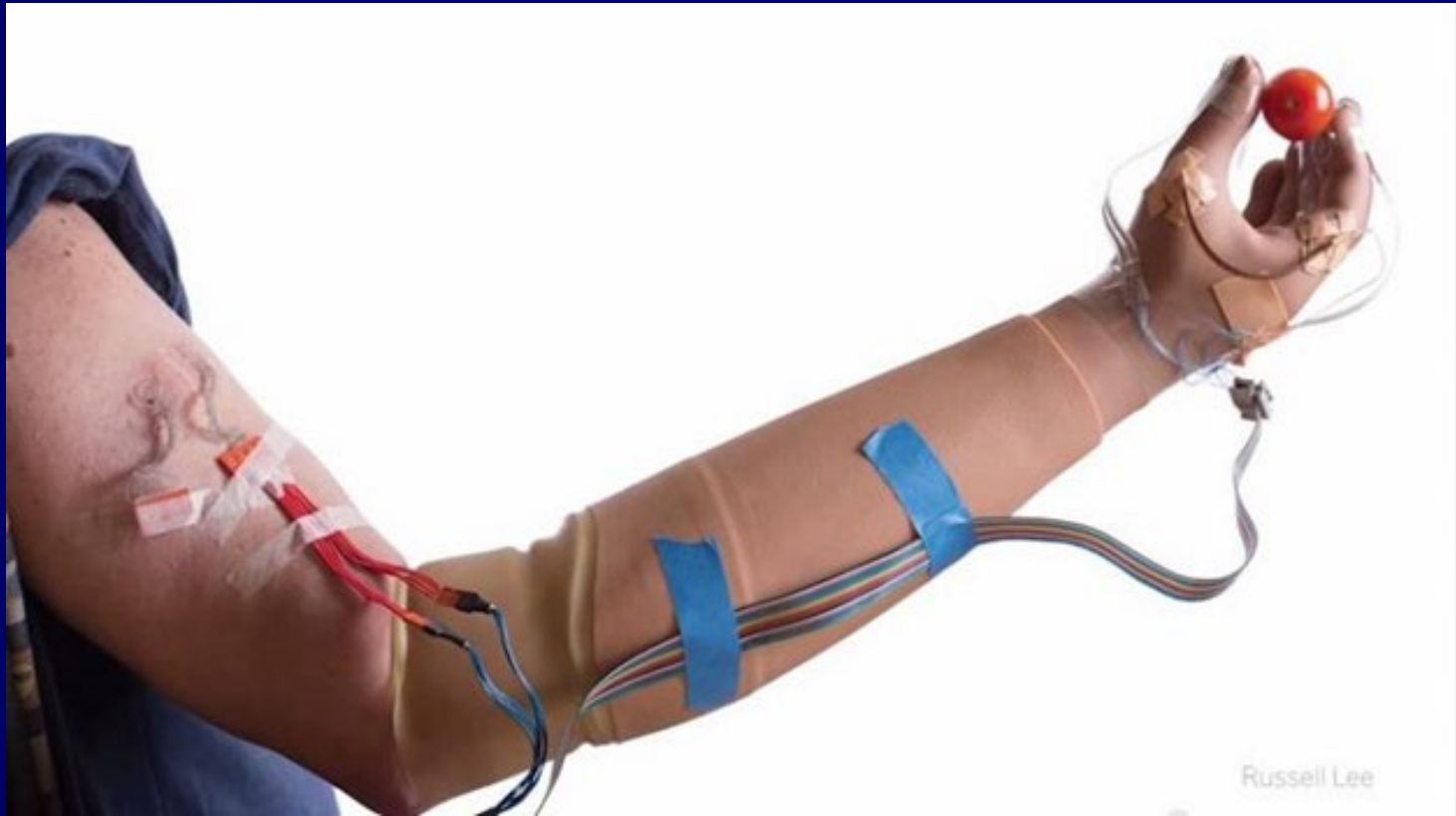
- Constant pulse train (1 Hz – 1 kHz)
 - Paresthesia (95.9%)
- Burst, then constant (2-10 in 4 ms, then 2-20 Hz)
 - “Running a comb”



Multiple Modality Encoding



Functional Demonstration



Functional Demonstration

- Pulling stem from cherry
 - Too loose – failure
 - Too tight – juice !

In the following trial, the
Subject cannot see or
hear the prosthesis



Sensation is
OFF



- 6 of 15 undamaged

Functional Demonstration

- Pulling stem from cherry
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Sensation is

ON

Note: Sensation is provided through devices permanently implanted in the arm, above the amputation.



- 14 of 15 undamaged

Future Goals

- Increased channels
 - Multiplexer
- Fully implanted
 - Home use
- Integrated sensors
- EMG / Control

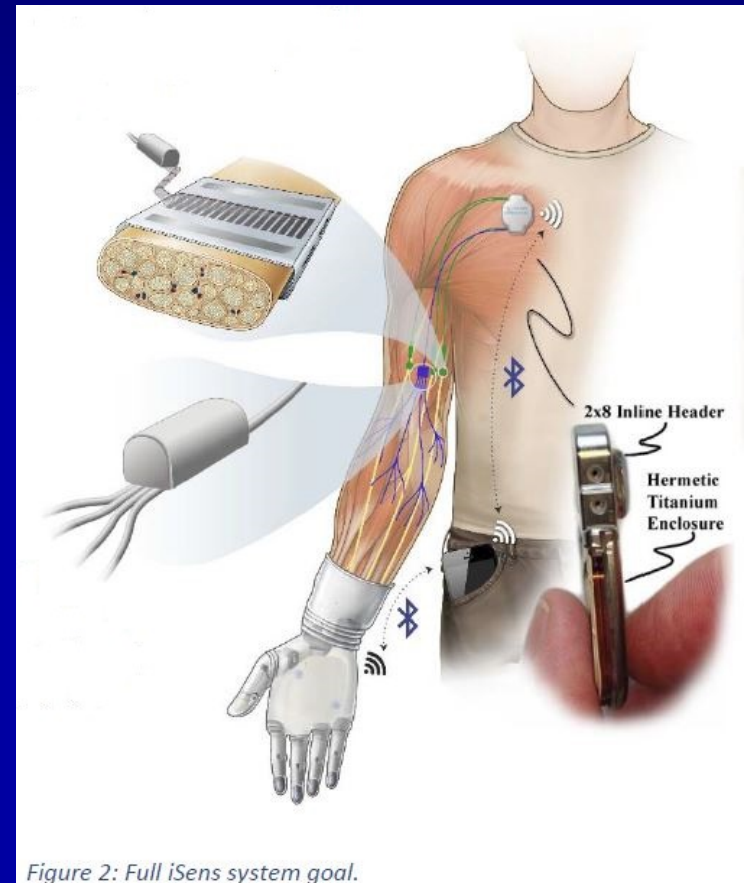


Figure 2: Full iSens system goal.

Thank You

