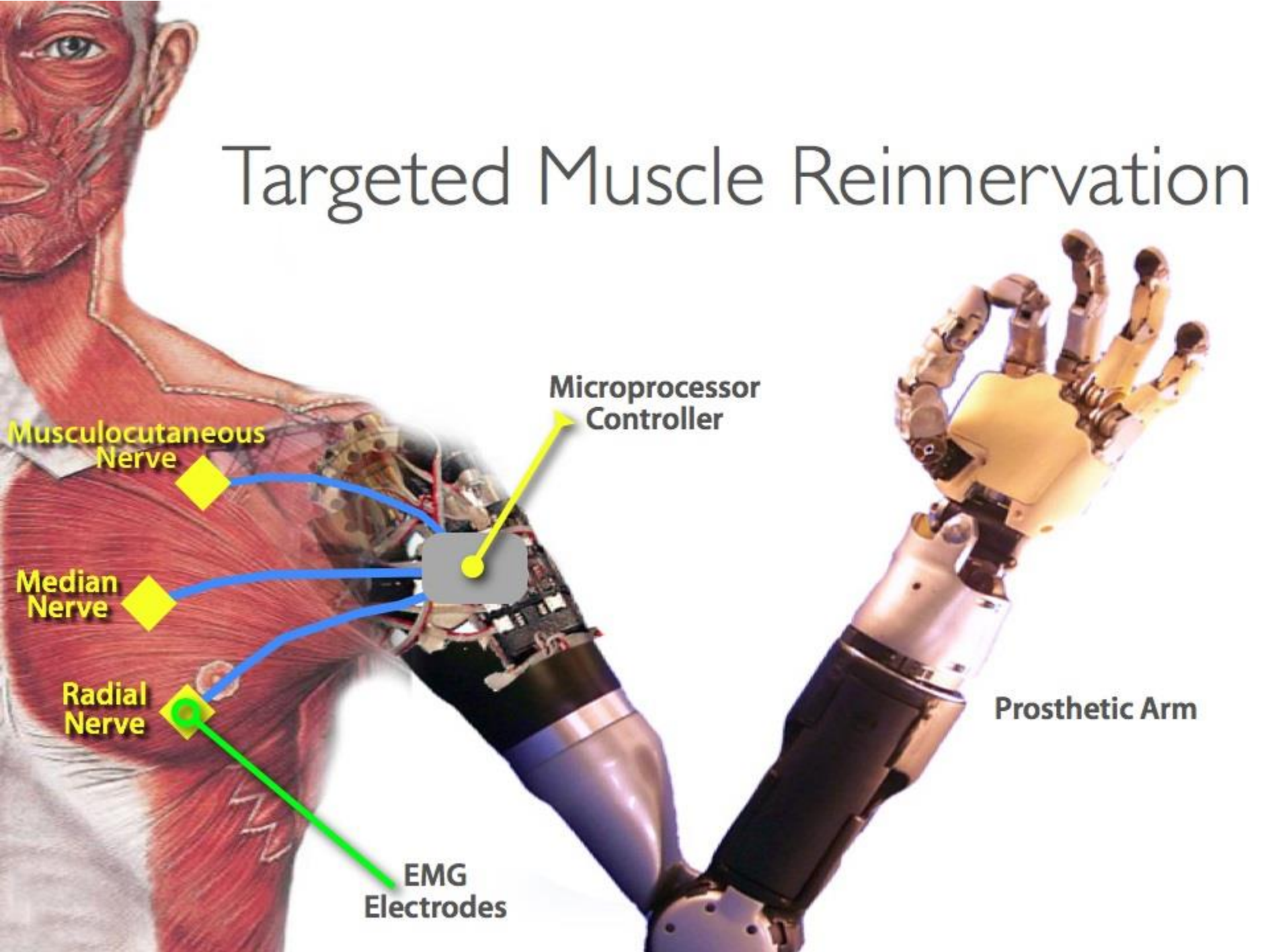


# Targeted Muscle Reinnervation



# Bionics

- Fusion of man and machine
- Nerves still exist after amputation
- How to detect the weak signal for each nerve fiber?

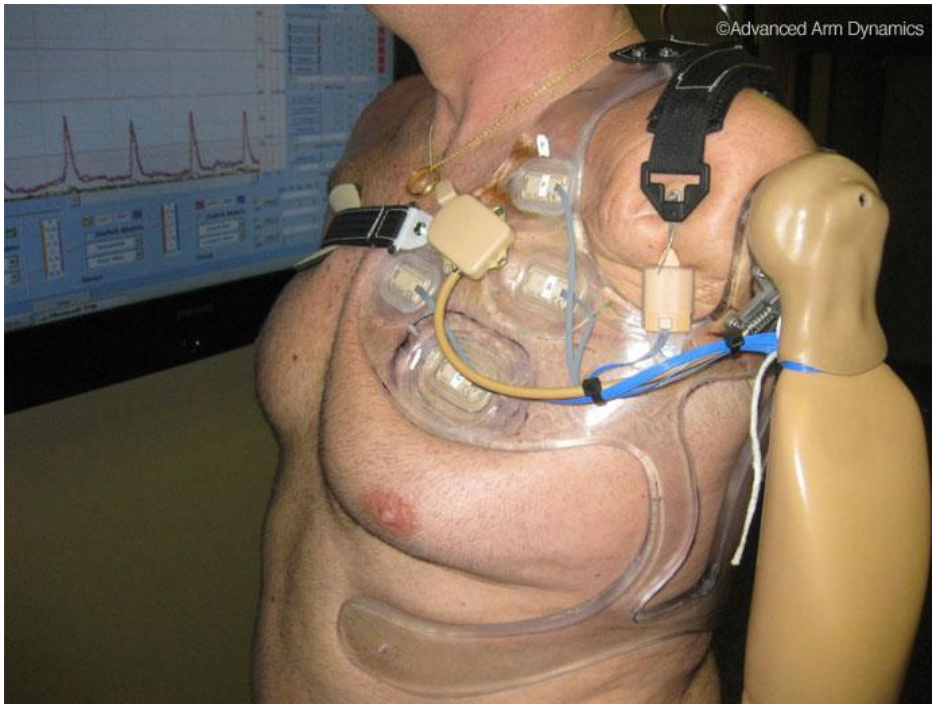
# Myoelectric Control

- Partial hand loss (below elbow)
- Sensors detect electrical signals when muscles above the wrist are used
- Skywalker hand



# TMR

- Above-elbow amputees
- Reattaching hand nerves to chest muscles



# TMR

- Muscles amplify electrical signals – easier detection
- Thinking about the arm moves chest muscles
- 3-6 months for the nerves to “grow into” chest muscles

# Arms

- Basic arms
  - 3 degrees of Freedom – elbow, wrist, hand
- More advanced arms
  - Up to ten 10 degrees of freedom
  - Expensive and/or military

# Touch sense

- Sensors in arms
- Pressure plates for feeling grip strength
- Stimulating electrodes for feeling texture



# Future challenges

- “Real-estate problems”
  - micro sensors and electrodes implants
- Finer control
- More advanced arms in “budget” sector





# If time permits

- <http://www.youtube.com/watch?v=-u8KkvZvVVI>

# Sources

- Nicholas R. Neugebauer. Dante A. Denillo. (2013). USE OF TARGETED MUSCLE REINNERVATION (TMR) TECHNOLOGY IN CONTROLLING BIONIC LIMBS
- Michael Linehan, Dylan Dufour. (2013) NEURALLY CONTROLLED PROSTHETIC ARMS: USING TARGETED MUSCLE REINNERVATION
- <http://armdynamics.com/pages/tmr>