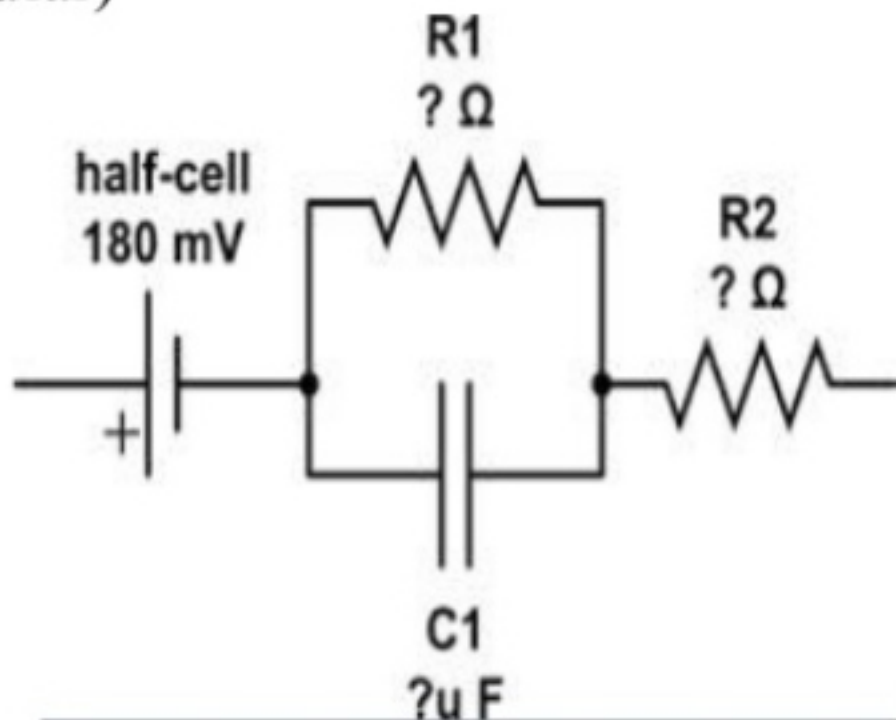


# EMG

- The bioelectric potentials associated with muscle activity constitute the electromyogram , abbreviated EMG.
- Recording muscle activity at rest and during activity (volitional activity)
- Requires a lot of cooperation and cannot be performed accurately in patients with severe weakness

# Types of EMG MEASUREMENTS

- Electrode Categories
  - Inserted
    - Fine-wire (Intra-muscular)
    - Needle
  - Skin Surface electrodes



# Fine-wire Electrodes

- Advantages
  - Extremely sensitive
  - Record single muscle activity
  - Access to deep musculature
  - Little cross-talk concern
- Disadvantages
  - Extremely sensitive
  - Requires medical personnel, certification
  - Repositioning nearly impossible
  - Detection area may not be representative of entire muscle

# Surface Electrodes

- Advantages
  - Quick, easy to apply
  - No medical supervision, required certification
  - Minimal discomfort
- Disadvantages
  - Generally used only for superficial muscles
  - Cross-talk concerns
  - No standard electrode placement
  - May affect movement patterns of subject
  - Limitations with recording dynamic muscle activity

# EMG Manufacturers

- Noraxon
- Motion Lab Systems
- Delsys



# General Concerns

- **Signal-to-noise ratio**

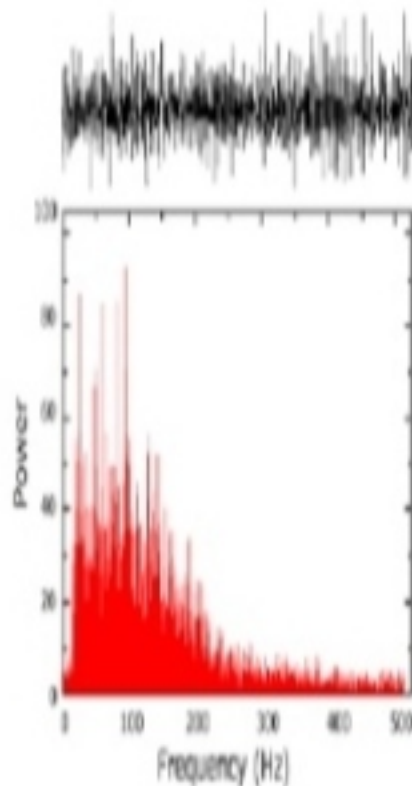
- Ratio of energy of EMG signal divided by energy of noise signal

- **Distortion of the signal**

- EMG signal should be altered as minimally as possible for accurate representation

# Characteristics of EMG Signal

- Amplitude range: 0–10 mV (+5 to -5) prior to amplification
- Useable energy: Range of 0 - 500 Hz
- Dominant energy: 50 – 150 Hz



*Figure 1: Frequency spectrum of the EMG signal derived from the 200 Hz amplifier output during a constant force isometric contraction at 20% of voluntary maximum.*

# Factors Affecting the EMG Signal

## Causative Factors – direct affect on signal

- Extrinsic – electrode structure and placement
  - Intrinsic – physiological, anatomical, biochemical
- Intermediate Factors – physical & physiological phenomena influenced by one or more causative factors
- Deterministic Factors – influenced by intermediate factors



# Maximizing Quality of EMG Signal

- Signal-to-noise ratio
  - Highest amount of information from EMG signal as possible
  - Minimum amount of noise contamination
- As minimal distortion of EMG signal as possible
  - No unnecessary filtering
  - No distortion of signal peaks