ENFUSE ENGAGING FUNDAMENTALS & SYSTEMS ENGINEERING

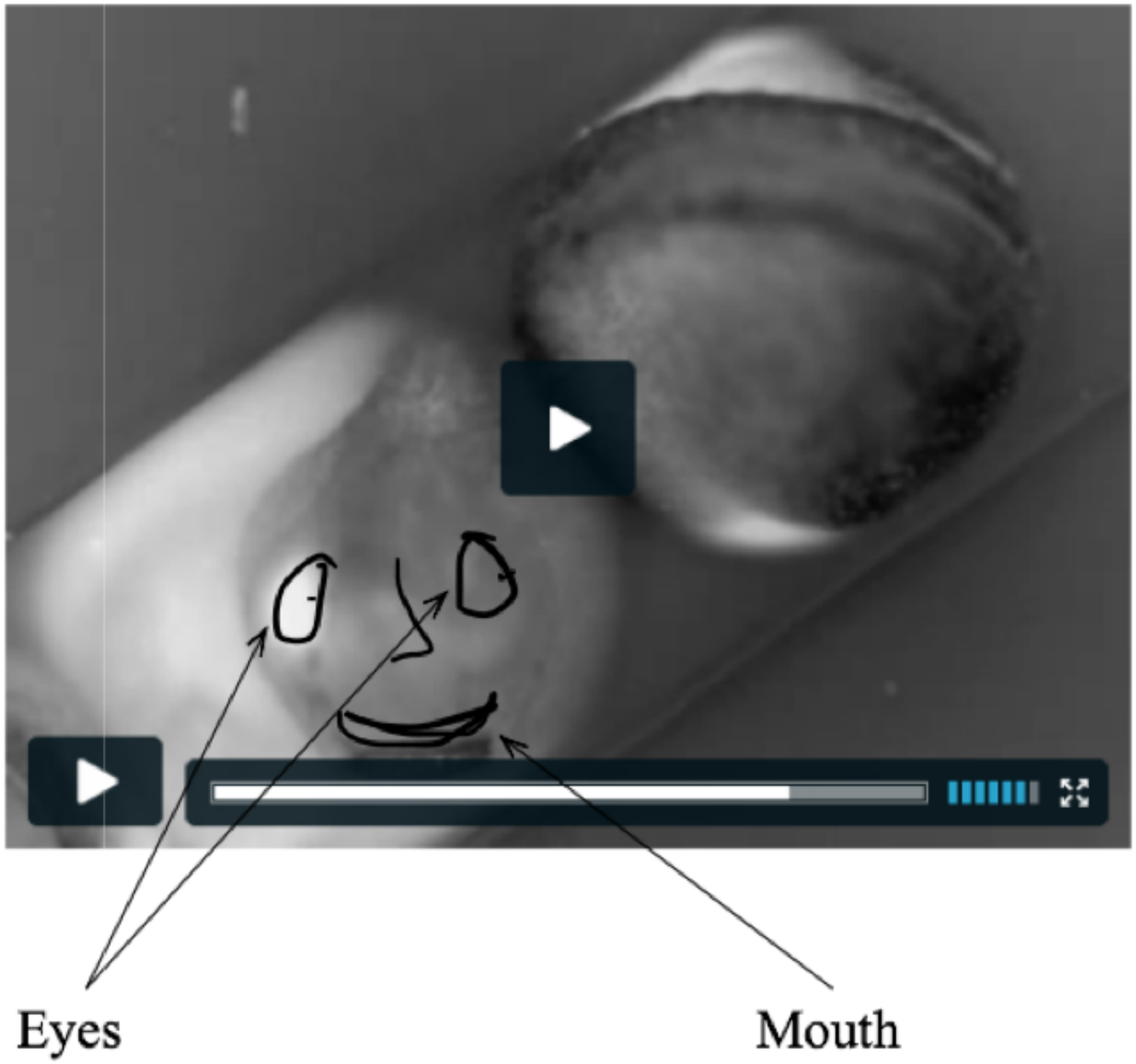
Bioelectrical Signals & Systems

Bioelectricity Module
Part 2

NAU·UH·UM·USF·UVM··NSF

Generation and Measurement of Bio-Electrical Signals

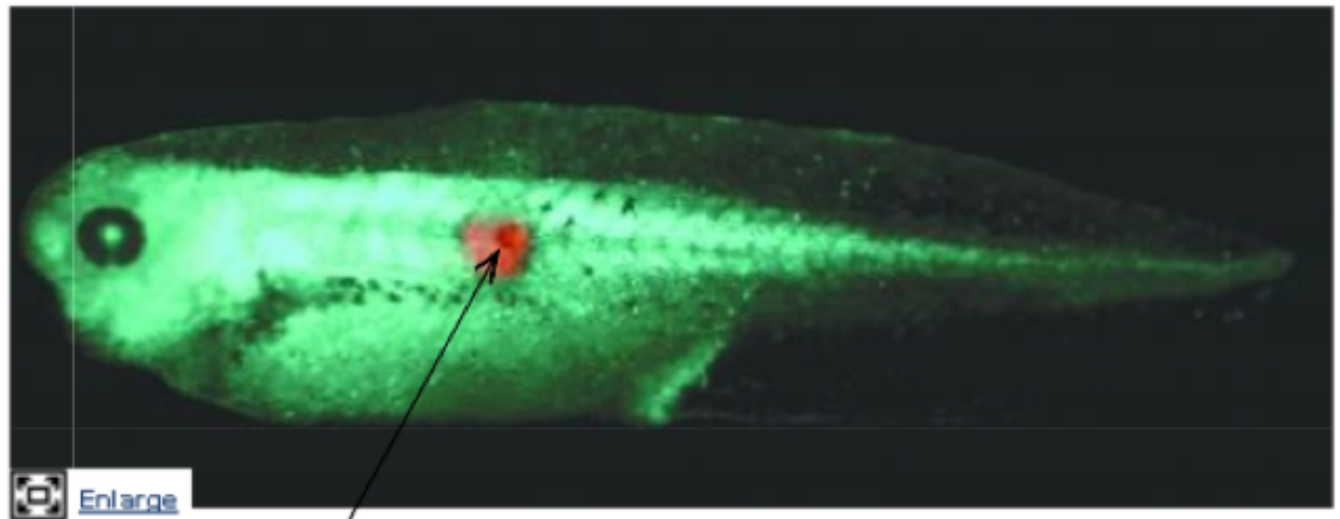
- (July 18, 2011) *For the first time, Tufts University biologists have reported that bioelectrical signals are necessary for normal head and facial formation in an organism and have captured that process in a time-lapse video that reveals never-before-seen patterns of visible bioelectrical signals outlining where eyes, nose, mouth, and other features will appear in an embryonic tadpole.*



http://phys.org/news/2011-07-frog-time-lapse-video-reveals-never-before-seen.html

Generation and Measurement of Bio-Electrical Signals

- (February 1, 2013) ***Bioelectric signals can be used to detect early cancer***: *"The news here is that we've established a bioelectric basis for the early detection of cancer,"*



Tumor in a tadpole

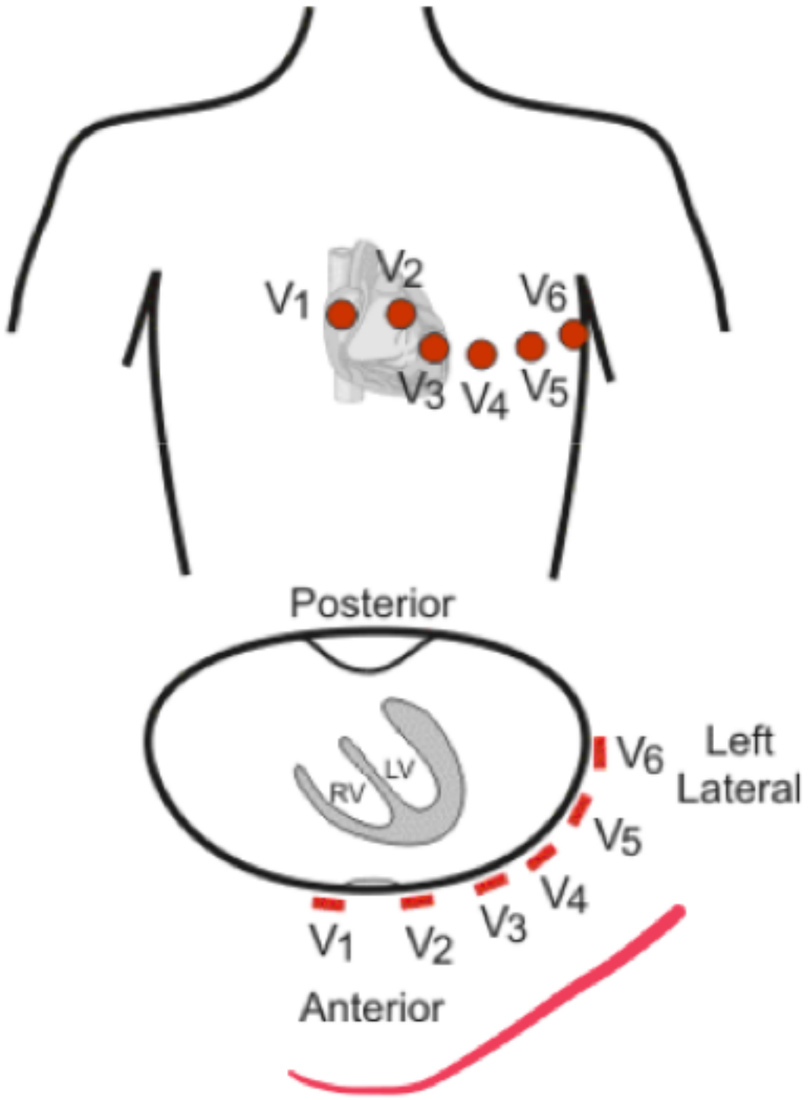
http://medicalxpress.com/news/2013-02-bioelectric-early-cancer.html

Generation and Measurement of Bio-Electrical Signals

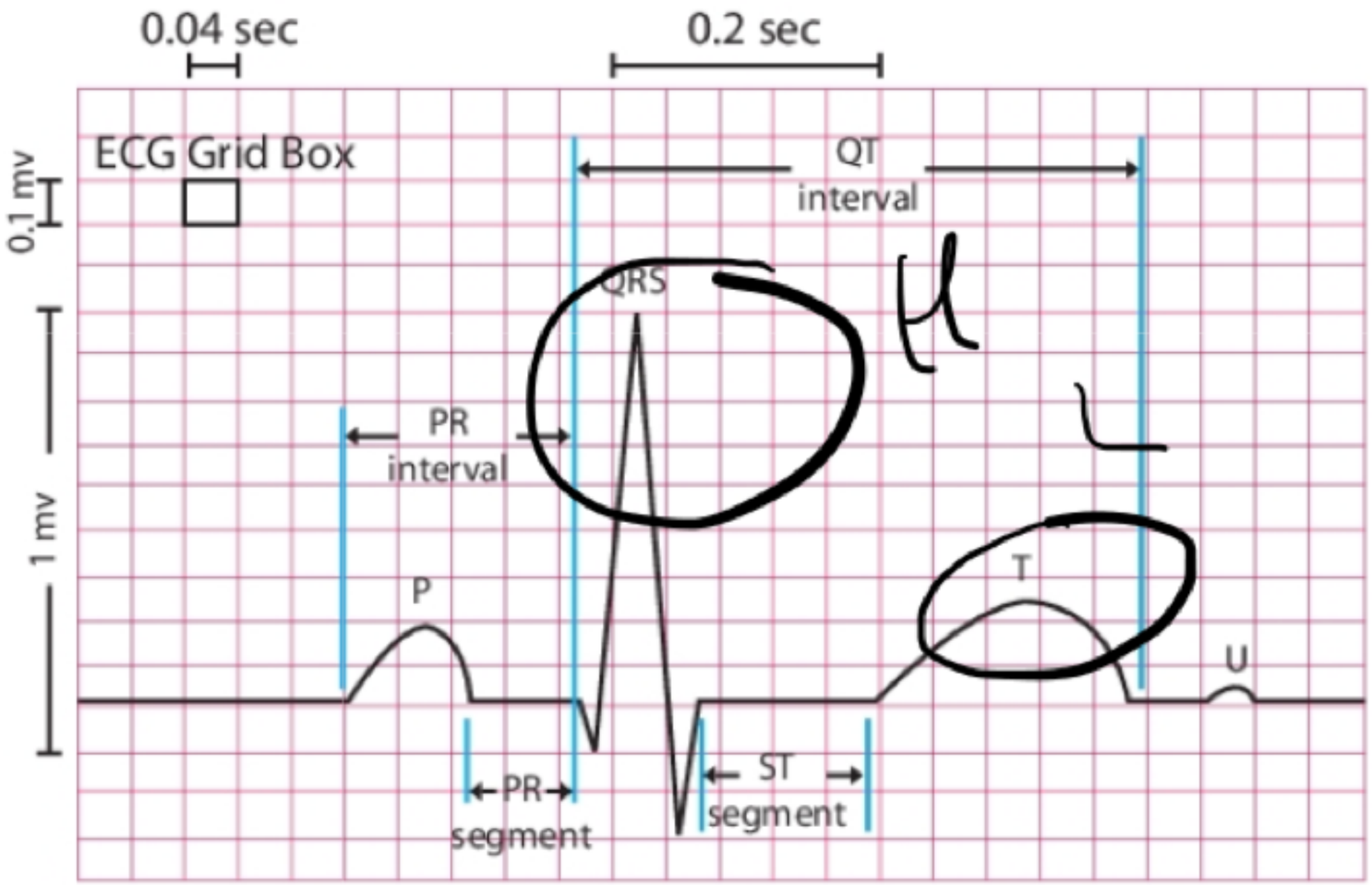
- Bio-electrical signals are produced by biological beings and can be detected by measuring current (I), voltage (V) or resistance (R)

- Galvanic Skin Response (GSR):
  - A measurement of the electrical conductance (G=1/R) of the skin
  - Used in lie detection
- Electrocardiogram (ECG or EKG):
  - A measurement of the electrical activity of the heart
  - Frequency (f) content in the 0.05 – 40 Hz range

Generation and Measurement of Bio-Electrical Signals

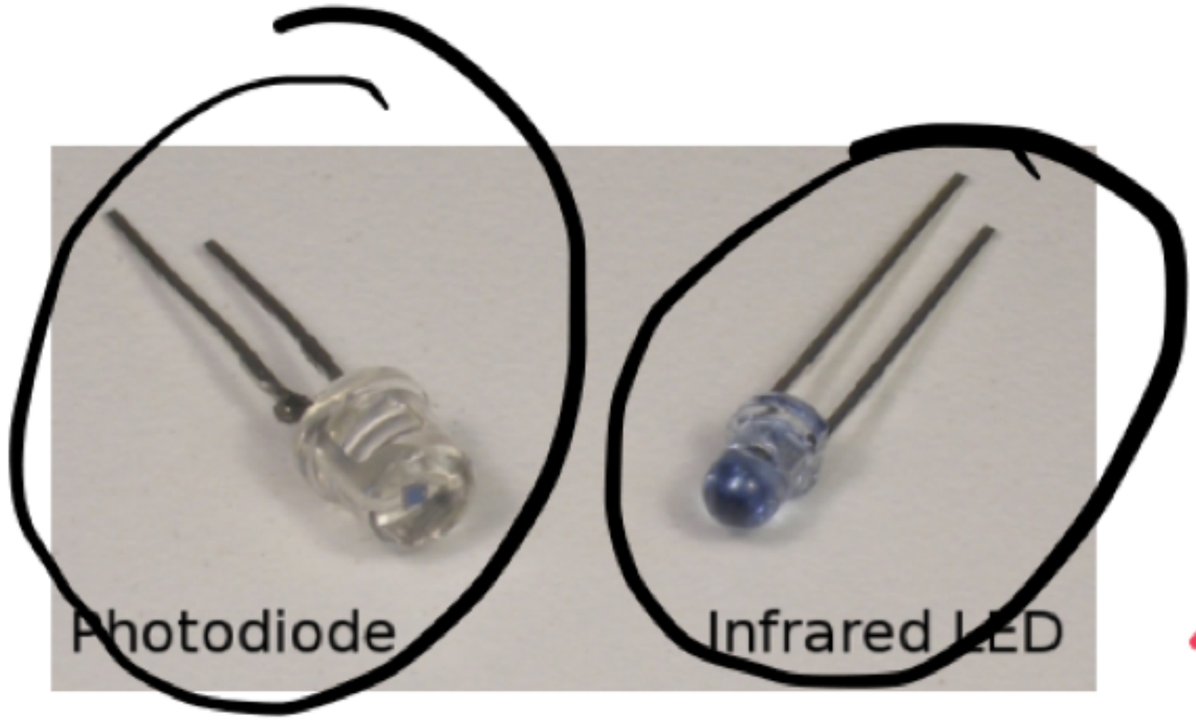


ECG Recording of a Healthy Heartbeat



Generation and Measurement of Bio-Electrical Signals

- Pulse Sensor – Possible ways to measure
  - A piezoelectric device that converts pressure from the pulsing blood into electrical signals
  - A photodiode that measures the difference in light that is reflected from blood in the capillaries, which fluctuates as the heart beats.



http://pulsesensor.com/category/the-long-blurb/diy-monitors-the-long-blurb/

https://docs.google.com/document/d/1FVFffuKD9OnkTOwxs3dVaxp5LYb4S1aj65MS6lvIZbA/edit?hl=en_US

Generation and Measurement of Bio-Electrical Signals

- References
  - http://phys.org/news/2011-07-frog-time-lapse-video-reveals-never-before-seen.html
  - http://medicalxpress.com/news/2013-02-bioelectric-early-cancer.html
  - http://en.wikipedia.org/wiki/Biosignal