What do you notice?
What are some things in the world that have a rhythm?

• Steps
What are some things in the world that have a rhythm?

• Steps

Why do they have a rhythm?

• In order to move forward efficiently, a person needs to coordinate their leg movements
What are some things in the world that have a rhythm?

• Steps

What dictates the rhythm?

• A person’s size; why they are moving
What (if anything) can we learn from rhythms?

- The manner in which rhythmic objects move/coordinate/interact
- Basic physical properties of rhythmic objects
- The current state of the rhythmic objects
Neural Oscillations

1Hz = 1 cycle per second

~ 8Hz, or 8 cycles per second

~ 40Hz, or 40 cycles per second
Brain waves result from the summation of many simultaneously occurring ionic processes, mainly transmembrane currents. Any excitable membrane (e.g., spines, dendrites, somas, axons, and axon terminals) and any type of transmembrane current contributes to the extracellular field.
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Measuring Brain Waves

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Any excitable membrane (e.g., spines, dendrites, somas, axons, and axon terminals) and any type of transmembrane current contributes to the extracellular field.
Measuring Brain Waves
Electroencephalogram - EEG

resting state Alpha (8-12 Hz)
Generating Dynamic Brain Waves

As we process information, brain waves evolve from:

- The population of active cell types, each with distinct physical properties
- The interactions between neurons
- The cognitive or behavioral state of the organism
Deciphering Dynamic Brain Waves

What changes in the brain to produce such different EEG profiles?

- **Phase 1**
- **Phase 2** (vegetative state, coma)
- **Phase 3**: Burst suppression (coma)
- **Phase 4**: Isoelectric (coma, brain death)

COGS 160: Brain Waves

Course Learning Outcomes:

• Describe rhythmic activity that occurs at microscopic (spiking neurons), mesoscopic (local field potential), and macroscopic (electroencephalogram) scales and the mechanisms through which rhythmic coordination is achieved.

• Interpret rhythmic data in order to gain information about the neurobiological underpinnings of cognitive processes or neurological disorders.

• Describe experimental methods used to study rhythmic brain activity, and incorporate these methods into the design of new experiments.

• Refute or defend theories as to the importance of rhythmic coordination in the brain.

Course Website: http://neuralcrossroads.ucsd.edu/courses/160-brain-waves/

- Weekly learning outcomes
- Slides
- Pre-reading (if any)
- Exams

Instructor: Lara Rangel, lrangel@ucsd.edu
Office Hours: Wednesday 2:00-3:30pm

Grading:
* Participation: 20%
  Take-home Midterm 1: 20%
  Take-home Midterm 2: 20%
  Take-home Final: 40%

* Based on the completion and submission of in-class worksheets