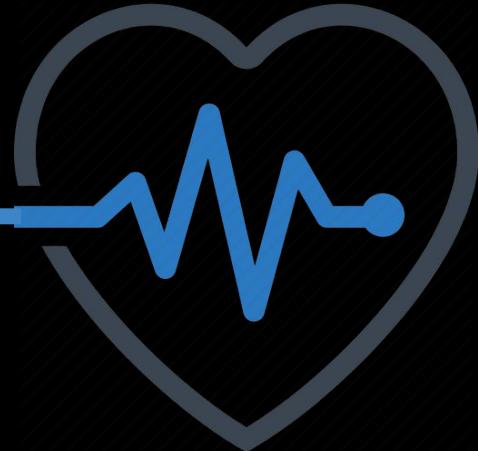

Welcome back

Recap

Biomedical Engineering

Samuel Bechara, PhD

Assistant Chair and Lecturer
Department of Biomedical Engineering
Marquette University



What is Biomedical Engineering?

What kind of questions do we ask?

Biomedical Engineering

So What?

What can we do

How can we make something?



What do we do?

Biomedical Engineering

research and DEVELOPMENT



What kind of stuff do we make?

Biomedical Engineering

Prosthetics
Instrumentation
Medical Devices
Artificial Organs
...and more



Biomechanics



Robotic Exoskeleton

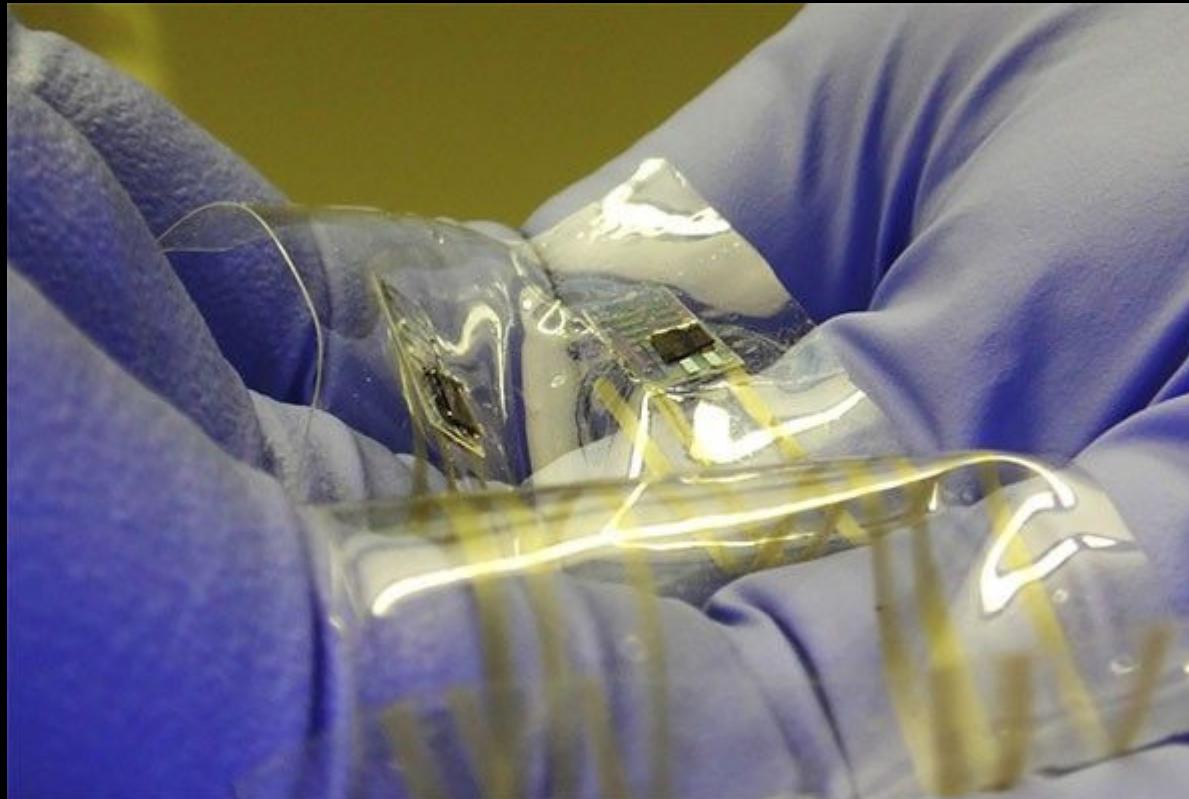




Bioelectronics



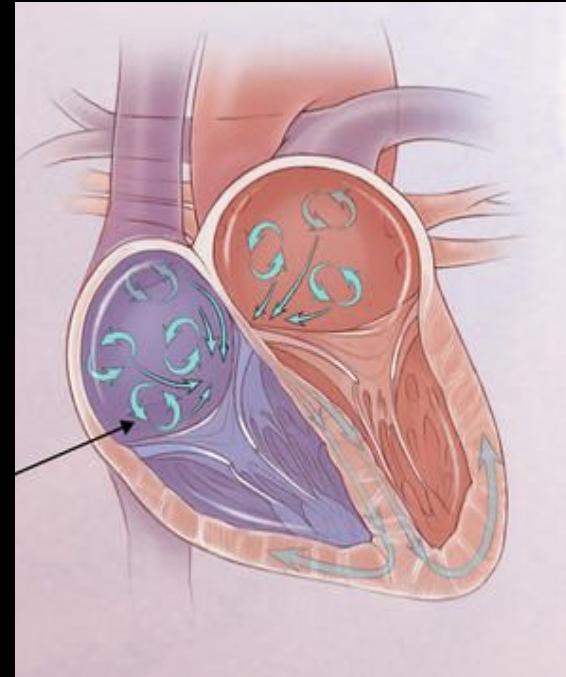
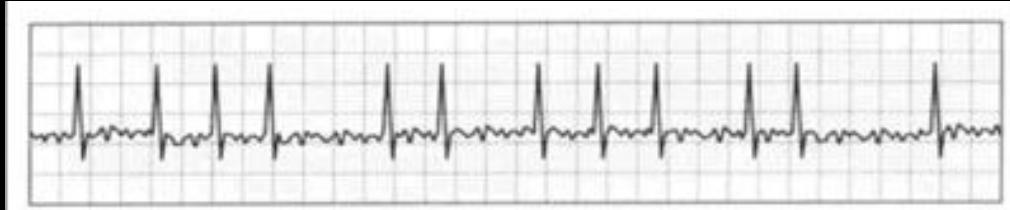
Pressure Sensitive Artificial Skin



Biocomputing



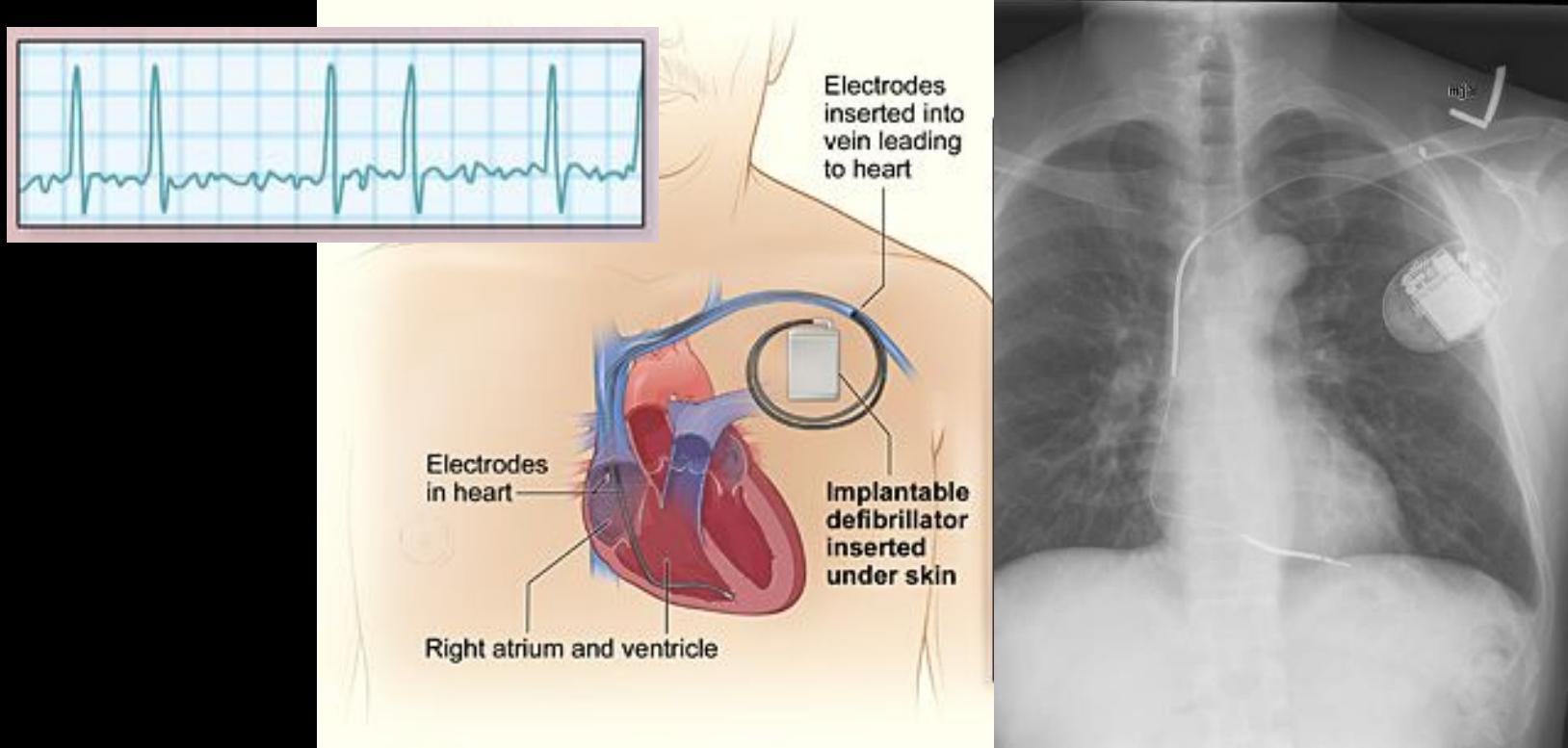
Problem: Atrial Fibrillation (AFib)



Automated External Defibrillator



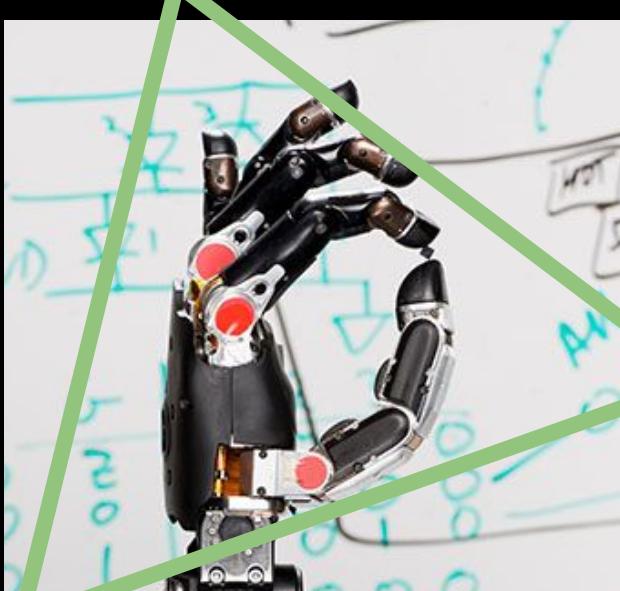
Implantable Cardioverter Defibrillator



**Distinction is not what project you will be
working on but what you will be doing...**

DARPA Built Prosthetic that can Feel

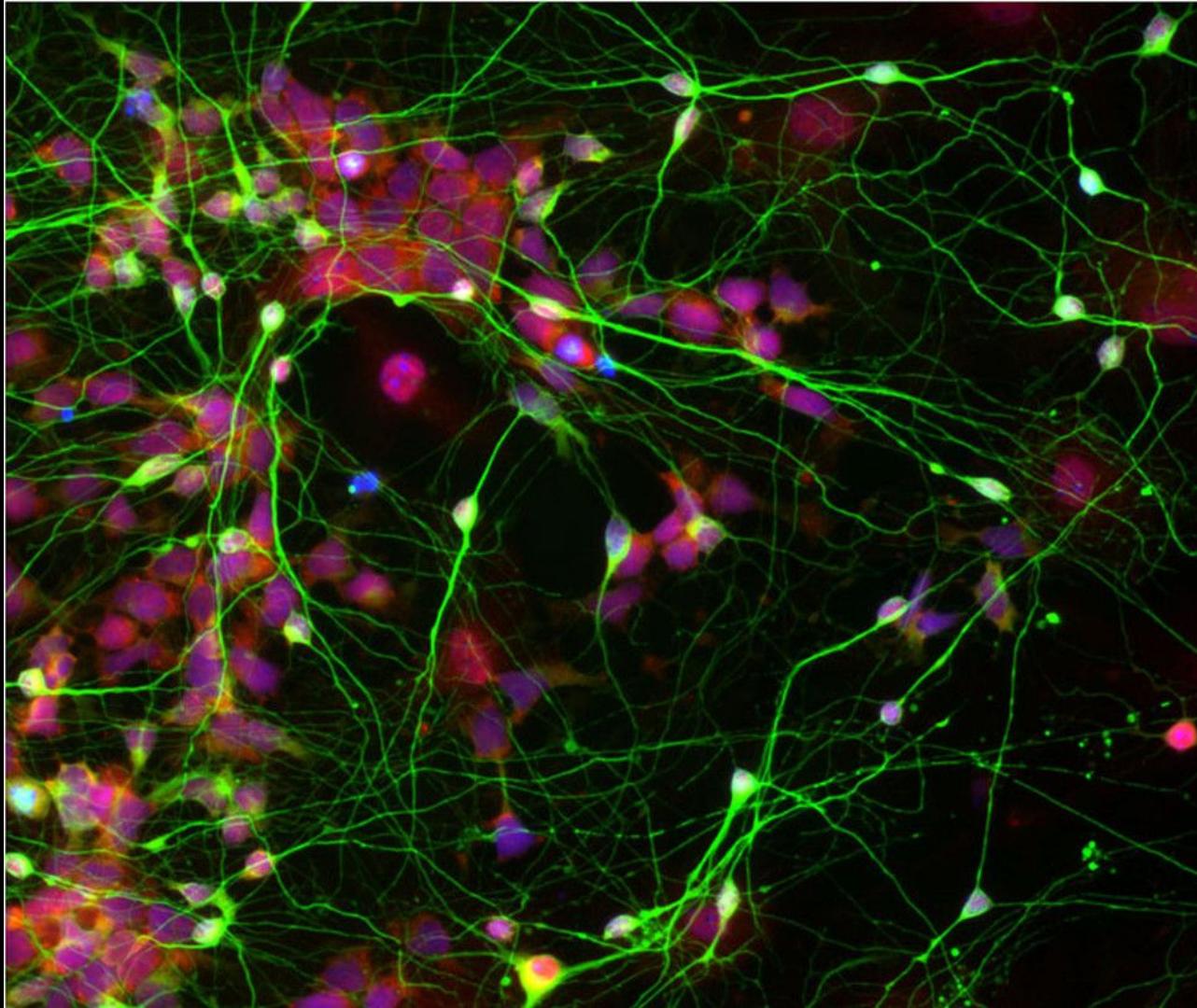
Biomechanics



Bioelectronics

Biocomputing

Tissue Engineering



Regenerative Medicine



Presentations we didn't get to yesterday

Basic Electronics

Samuel Bechara, PhD

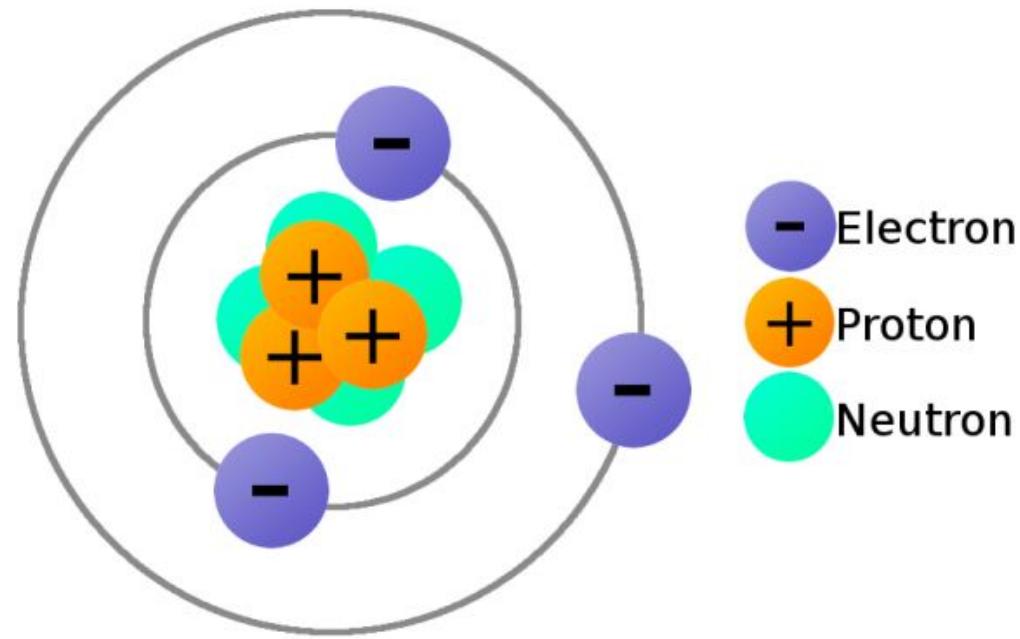
What do you
use electricity
for?



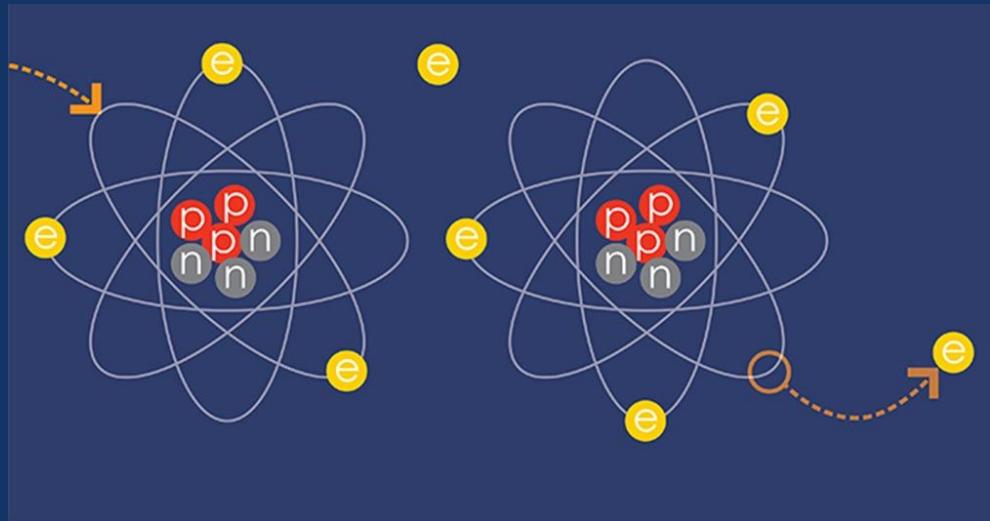
What is electricity?

THE ATOM

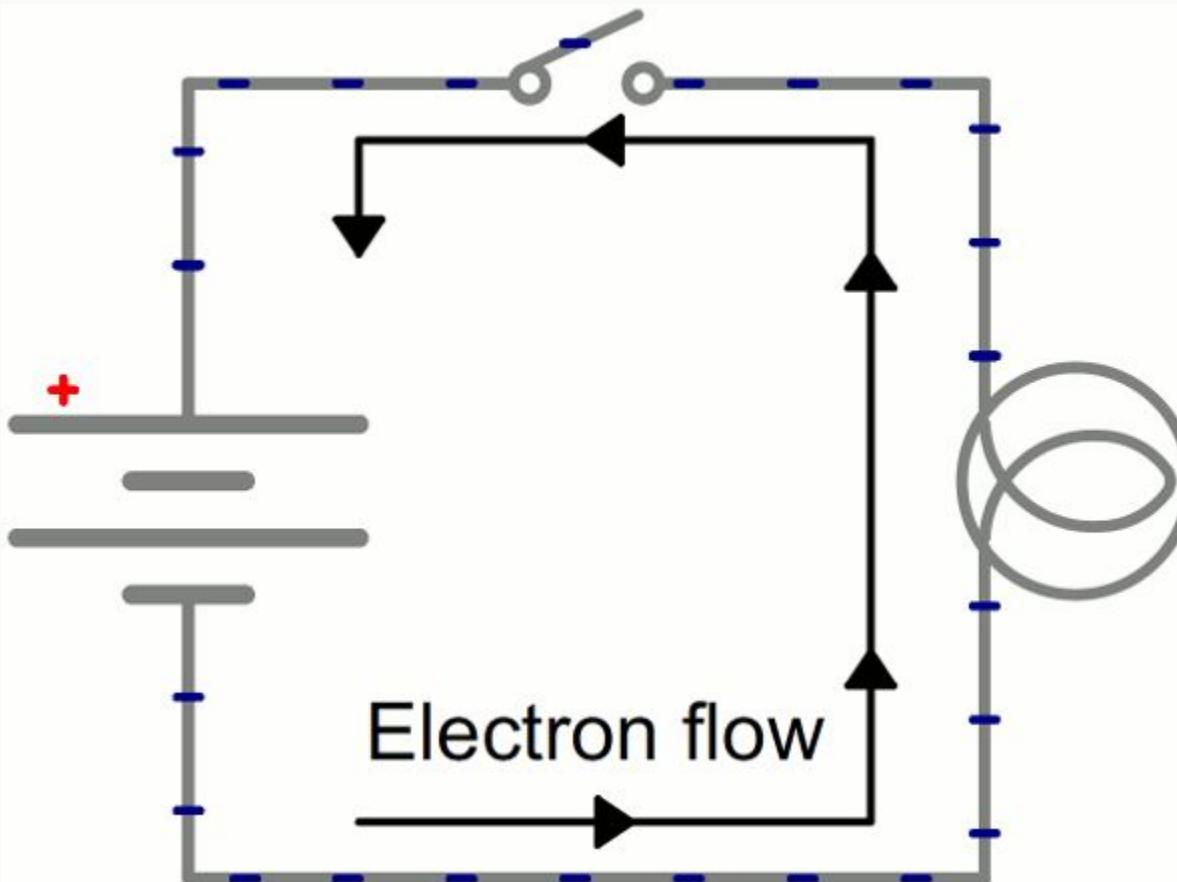
To understand, we have to dive deep into one of the smallest units of matter in the universe!



Electricity is the flow of electrons



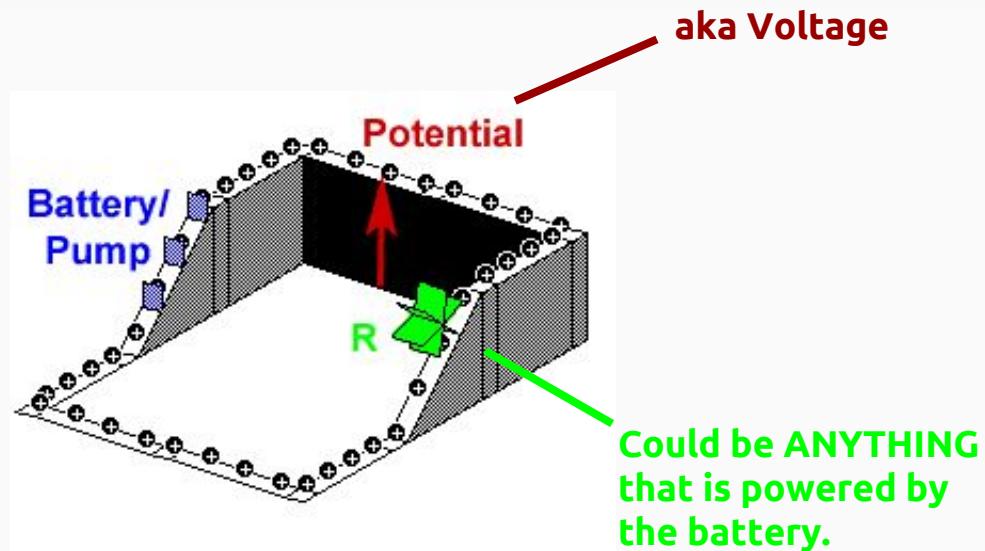
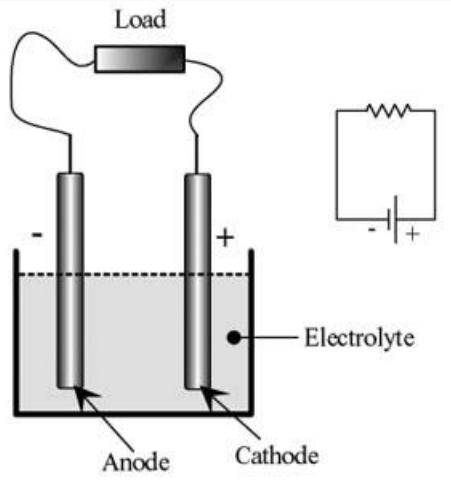
In order for electrons to flow, there needs to be a “circuit”

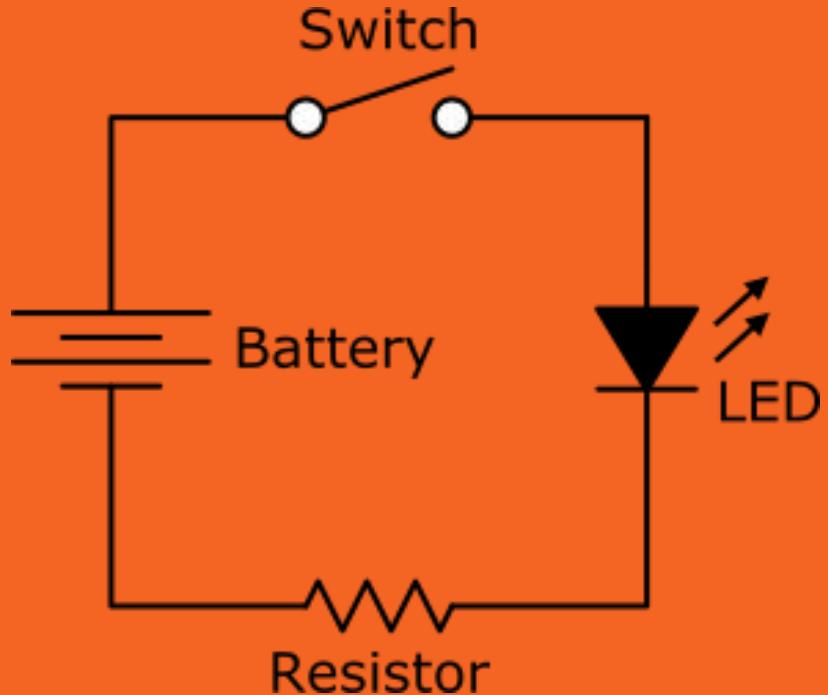


What do **you**
use batteries
for?



What does a battery do?





Circuit Drawing Basics

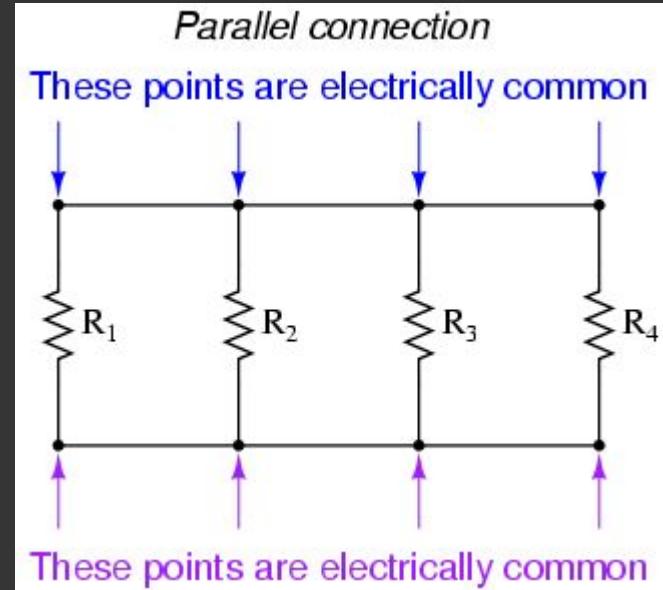
Series Connection

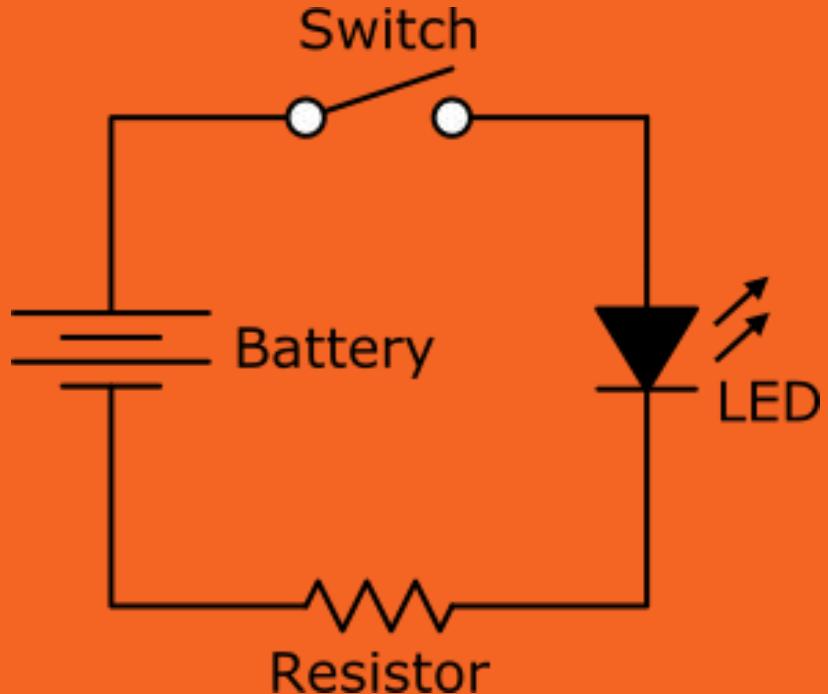
Series connection



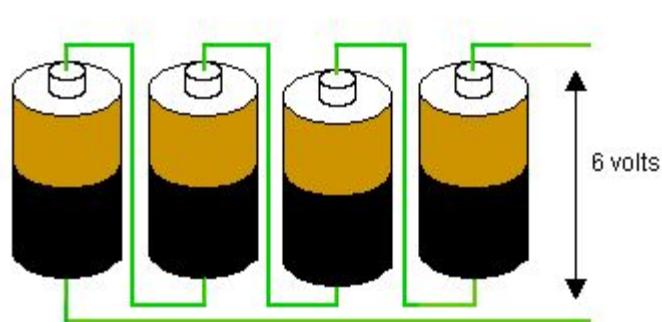
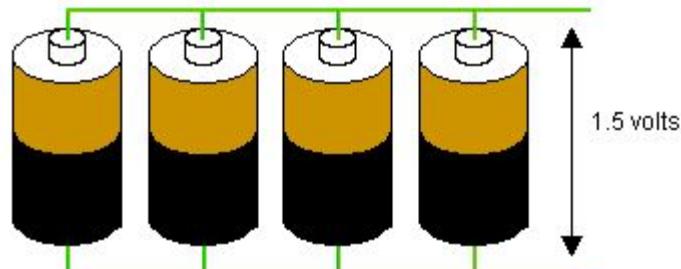
only one path for electrons to flow!

Parallel Connection





Let's look
at this
again...



Which is which?

Why put batteries in series or in parallel?

Could be any load...
like a light bulb

HINT

Dissimilar Metals
Acidic solution



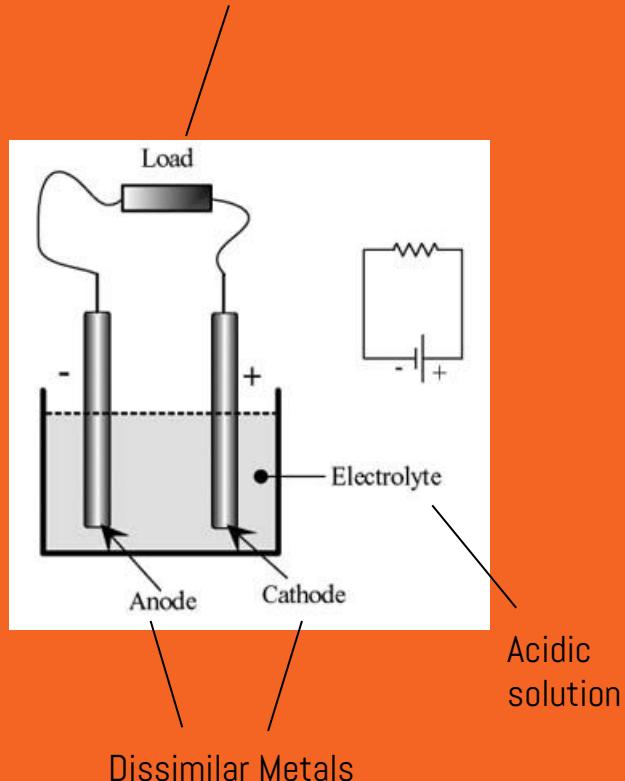
Make a battery

Now you are going to be given everything
you need to make a battery

- Lemons
- Nails
- Pennies
- Wires
- LED

Be sure to draw the circuit diagram of your
lemon battery circuit when you are done!

Could be any load...like an LED



Make a battery

Now you are going to be given everything you need to make a battery

- Lemons
- Nails
- Pennies
- Wires
- LED

Be sure to draw the circuit diagram of your lemon battery circuit when you are done!



**SUPER
BATTERY
LIGHT BULB
DEMO!!!!**

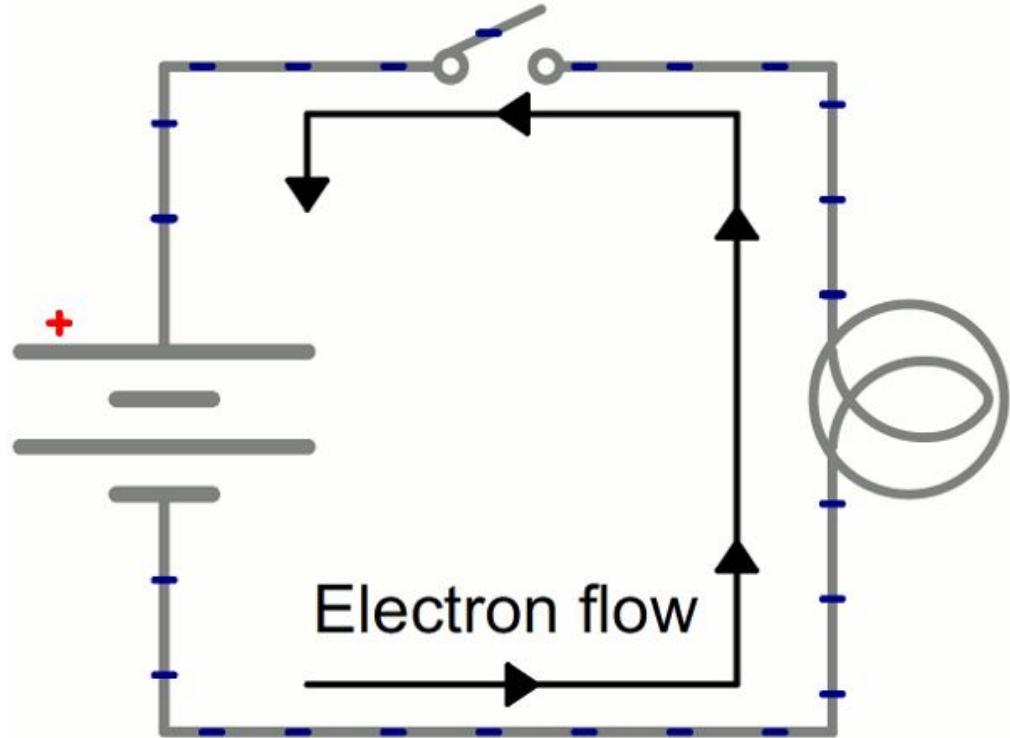


What did we learn?

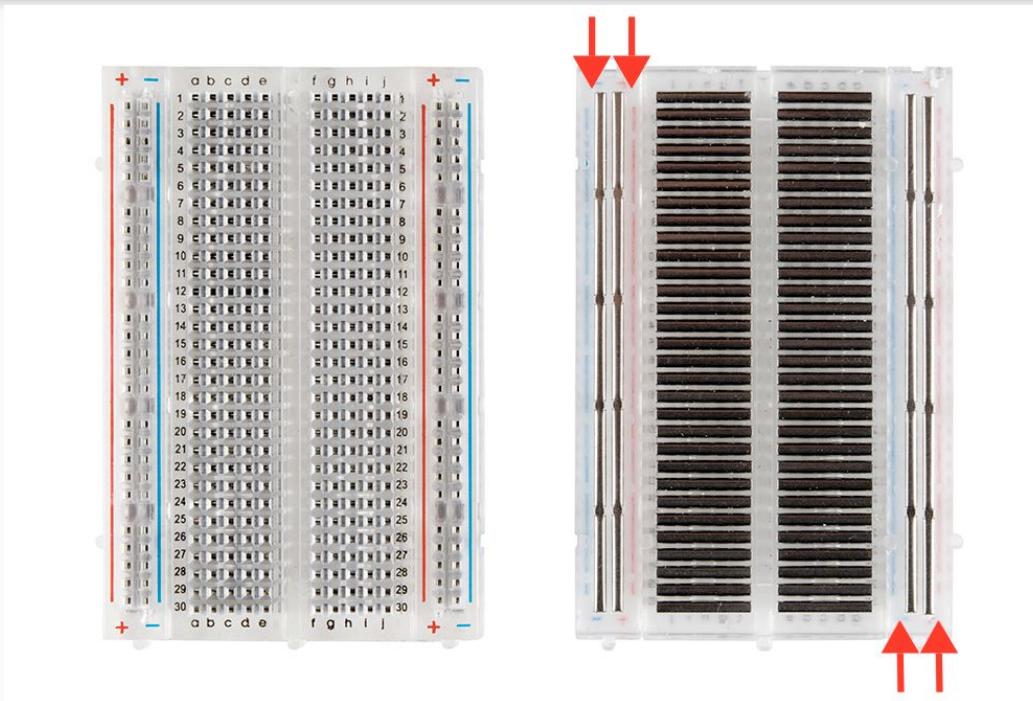
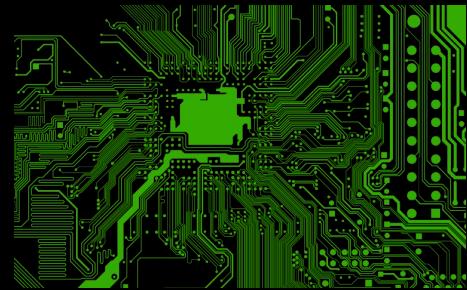
Advanced Electronics

What do we
need to
have
electrons
flow?

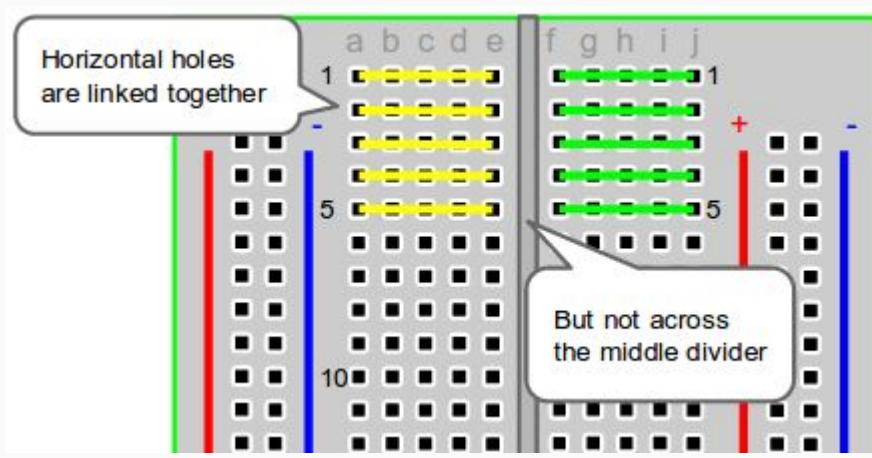
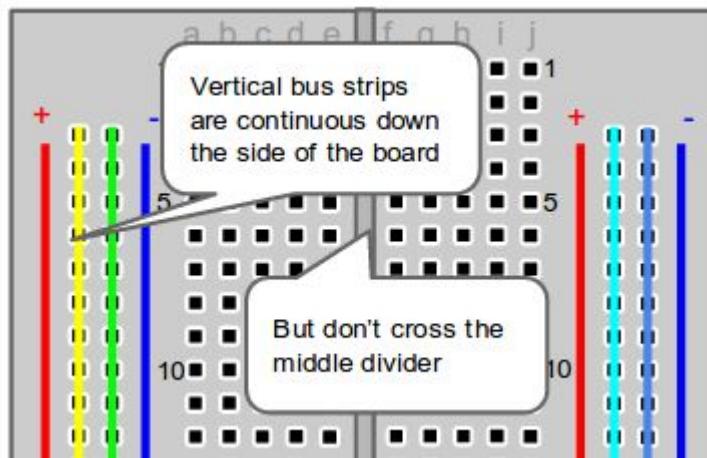
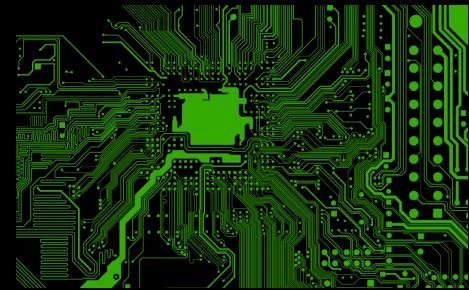
CIRCUIT!



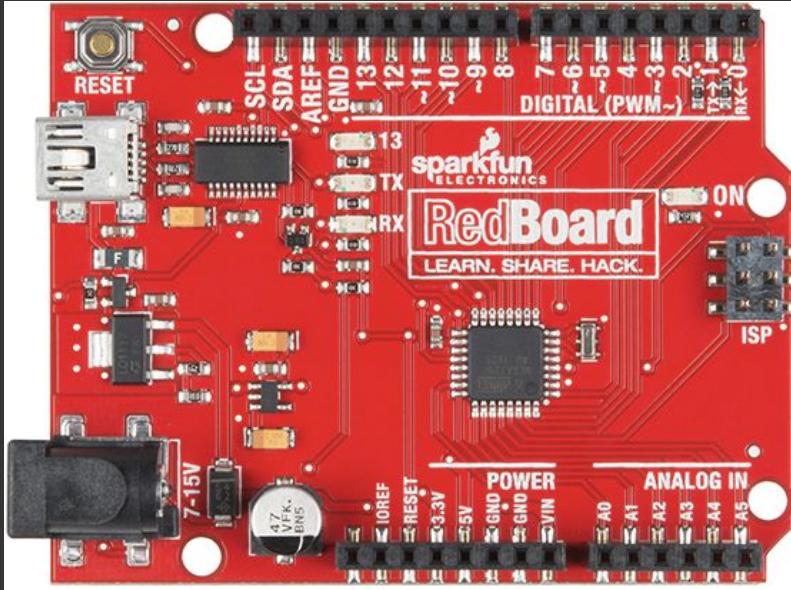
Breadboards can help!

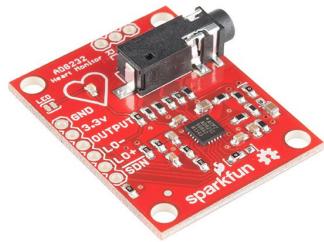


Breadboards can help!

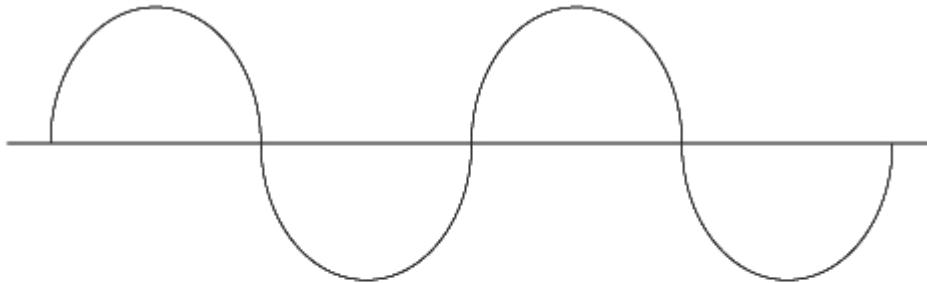


What do you need the arduino for?

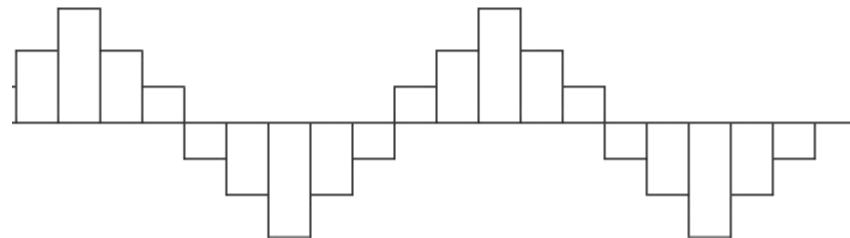
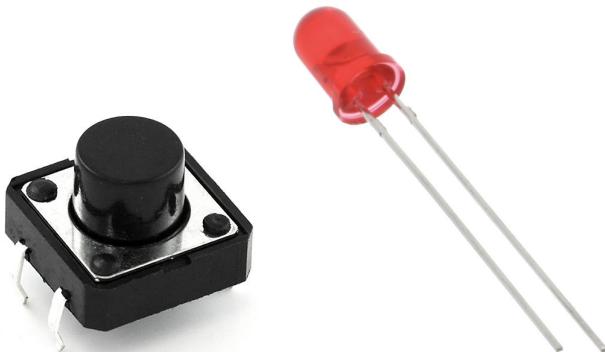




Analog

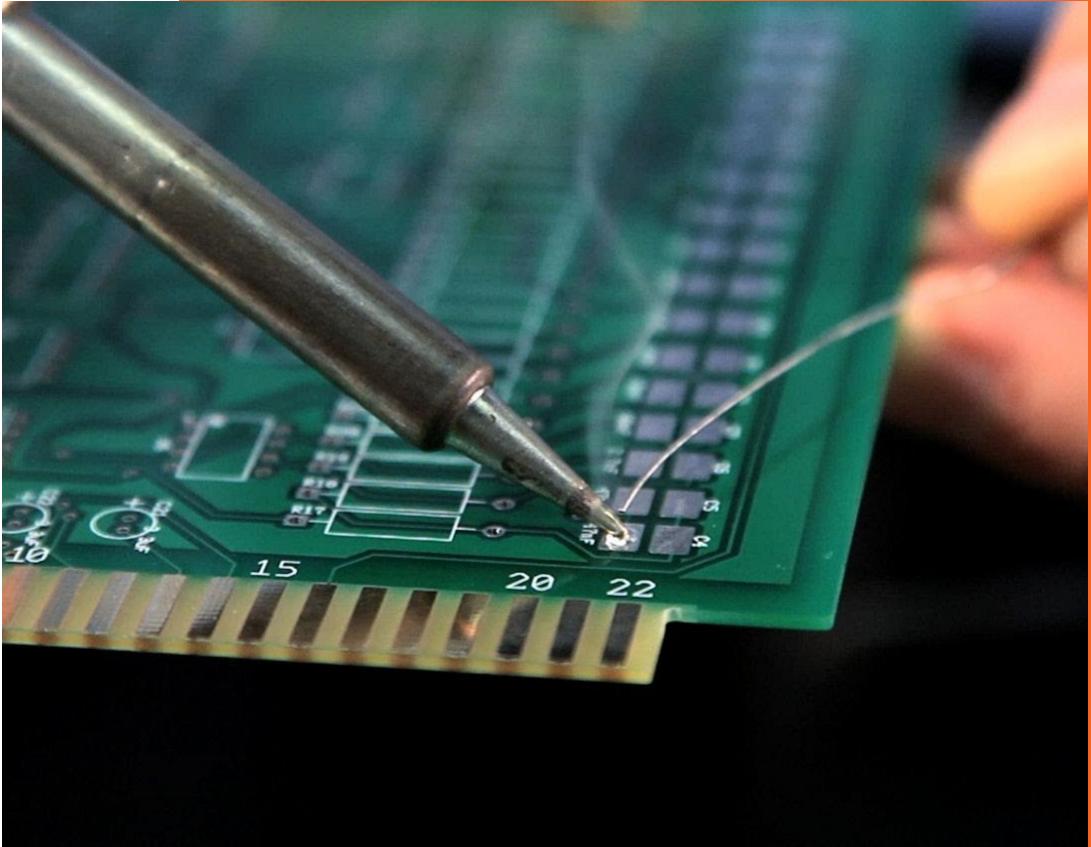


Digital



Soldering

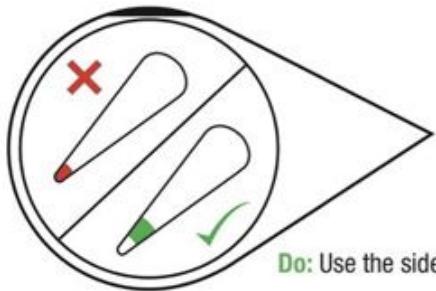
What is it for?



Solder Safety



- **Always** use **safety glasses** and **gloves**.
- **Always** place a hot soldering iron in its holder.
- **Never** solder near flammables.
- Report any burns immediately.



Don't: Use the very tip of the iron.

Do: Use the side of the tip of the iron, "The Sweet Spot."



Do: Touch the iron to the component leg and metal ring at the same time.



Do: While continuing to hold the iron in contact with the leg and metal ring, feed solder into the joint.



Don't: Glob the solder straight onto the iron and try to apply the solder with the iron.



Do: Use a sponge to clean your iron whenever black oxidation builds up on the tip.



A

Solder flows around the leg and fills the hole - forming a volcano-shaped mound of solder.



B

Error: Solder balls up on the leg, not connecting the leg to the metal ring.
Solution: Add flux, then touch up with iron.



C

Error: Bad Connection (i.e. it doesn't look like a volcano)
Solution: Flux then add solder.



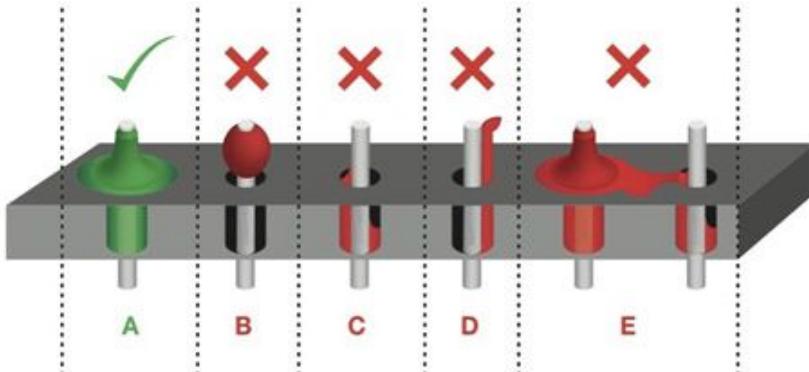
D

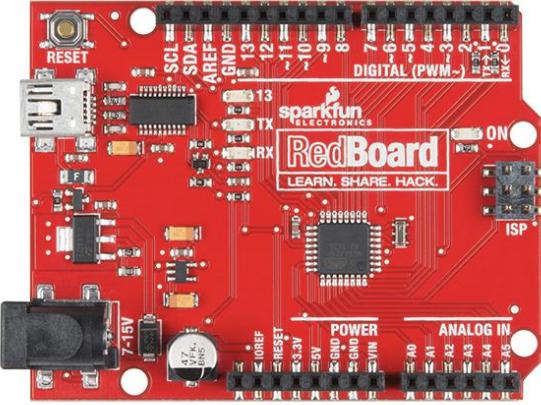
Error: Bad Connection...and ugly...oh so ugly.
Solution: Flux then add solder.



E

Error: Too much solder connecting adjacent legs (aka a solder jumper).
Solution: Wick off excess solder.

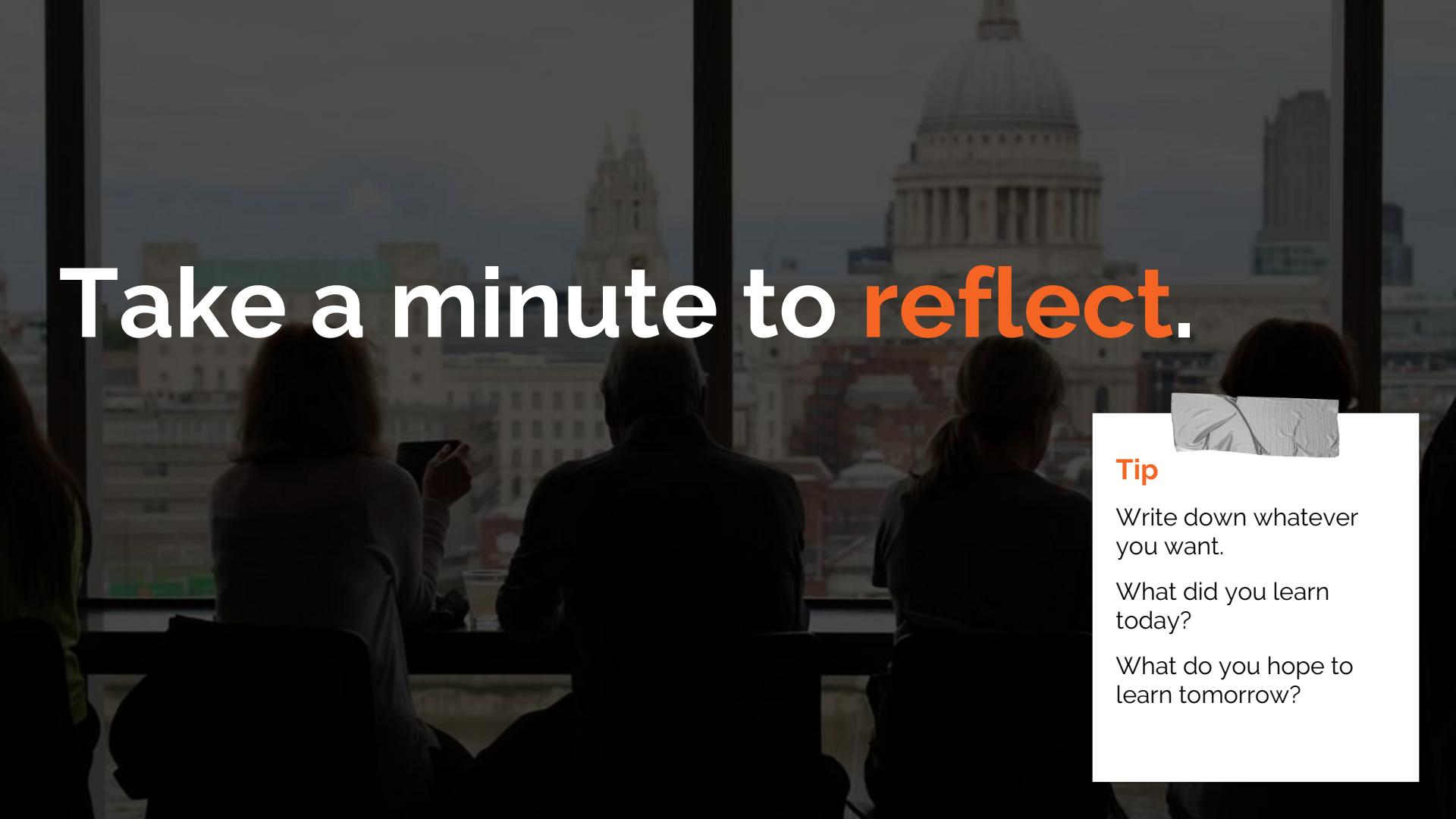




How are we
going to
connect?

Why do we
need
resistors?

Draw Diagram



Take a minute to reflect.



Tip

Write down whatever you want.

What did you learn today?

What do you hope to learn tomorrow?