

BIO WORKSHOP

# TRANSFORMATION

--- HIGH SCHOOL 10.01.17

NYUAD iGEM 2017



# **BIOLOGY TERMS that will be covered today**

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**DNA**

**PLASMID**

**BACTERIA**

**TRANSFORMATION**

**GENE REGULATION**

**VECTOR**

**RECOMBINANT DNA**

## **CELL THEORY defines the unit of life**

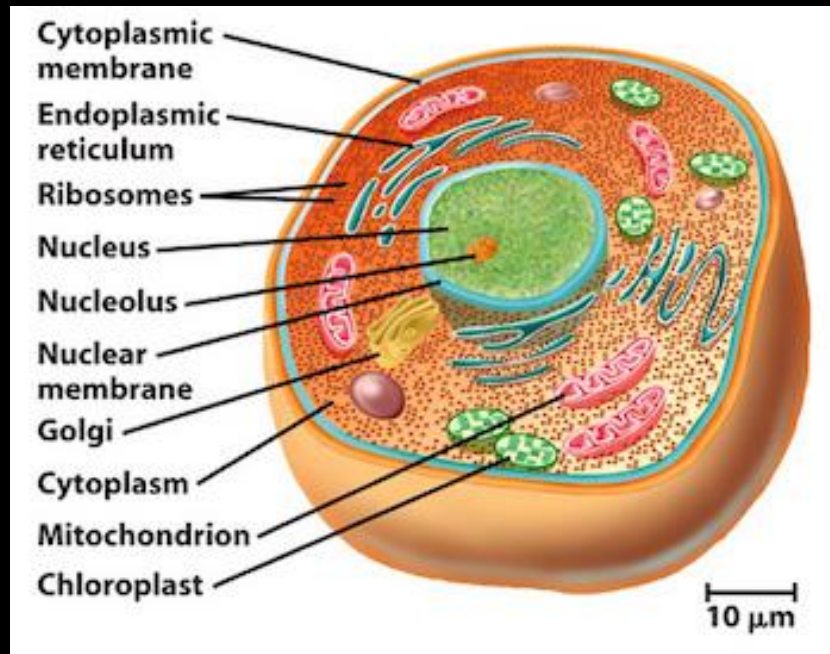
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1. Organisms are made up of cells
2. Cell is the basic unit of life
3. All cells arise from preexisting cells
  - Is genetic material transmitted only from progenitors to offspring?

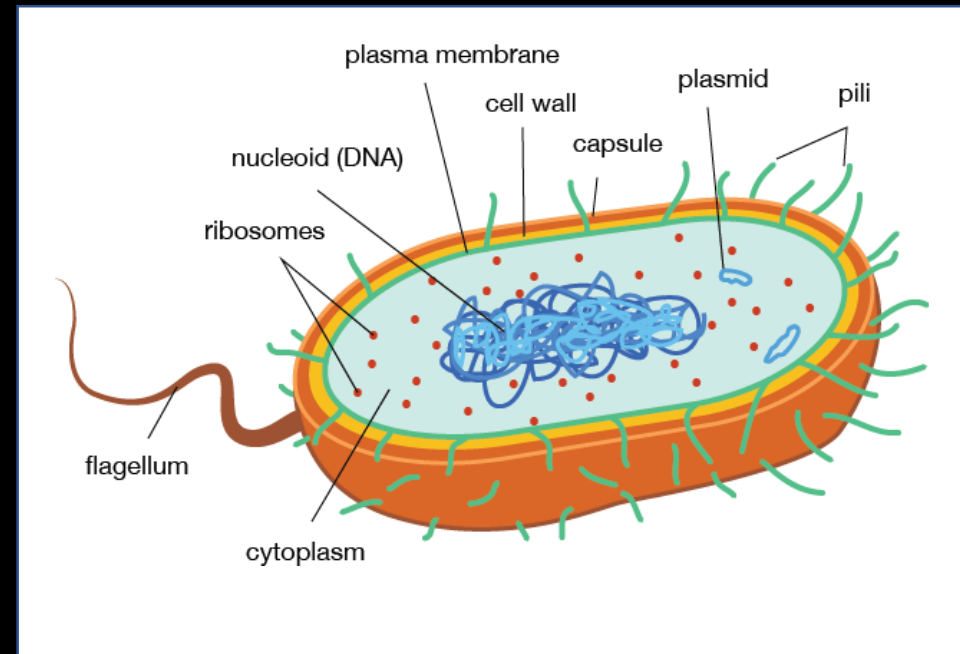
# EUKARYOTIC & PROKARYOTIC CELLS

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## EUKARYOTIC CELL

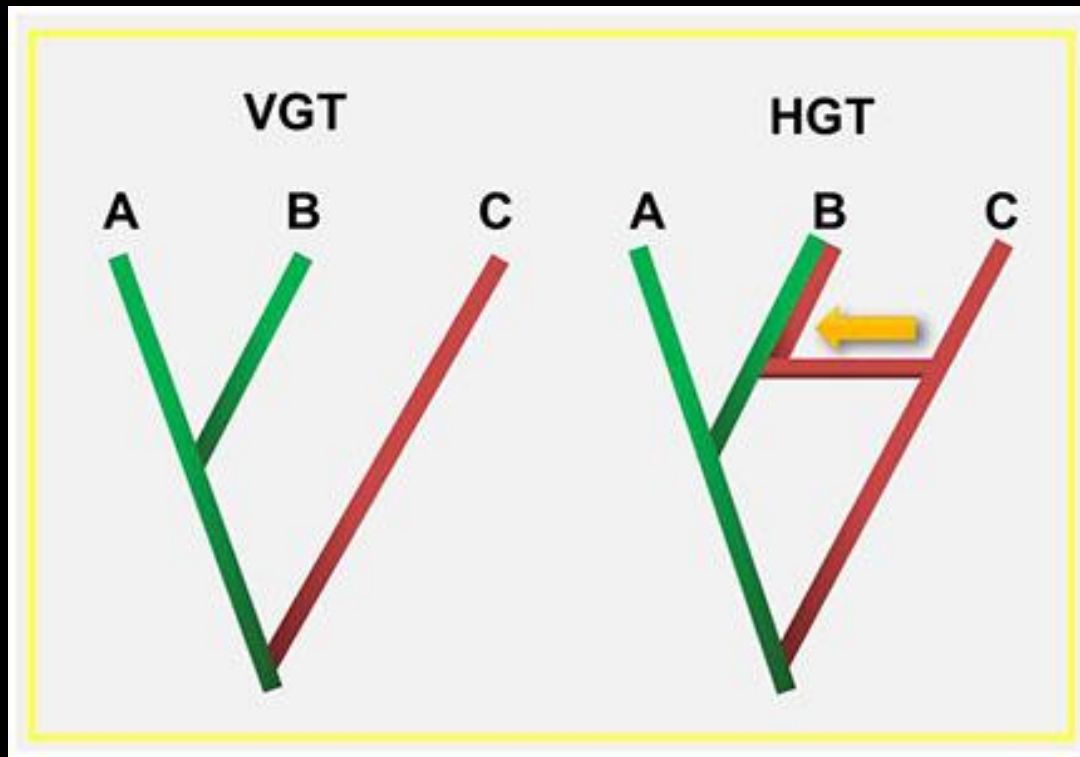


## PROKARYOTIC CELL



# HORIZONTAL GENE TRANSFER

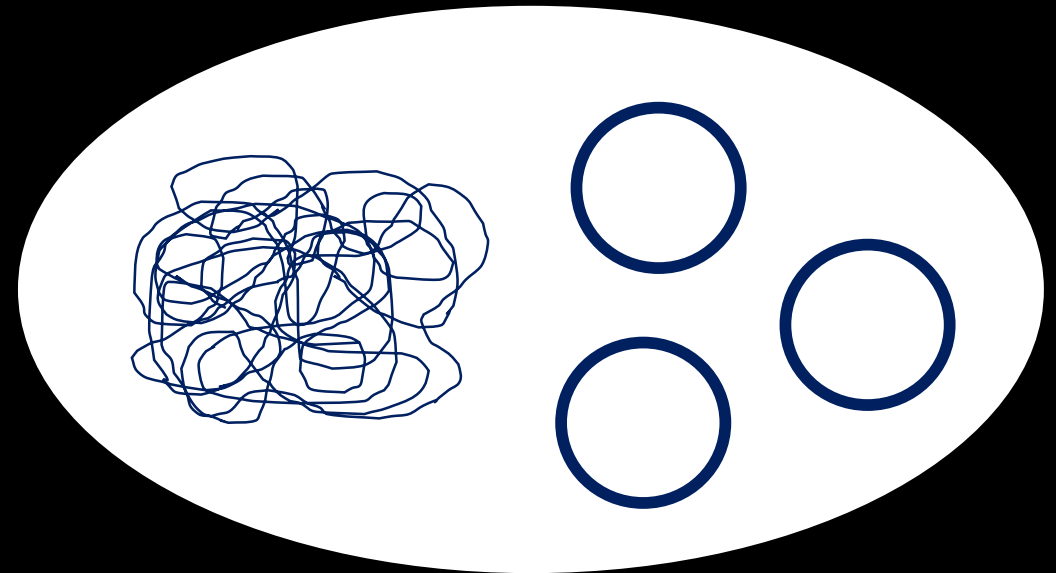
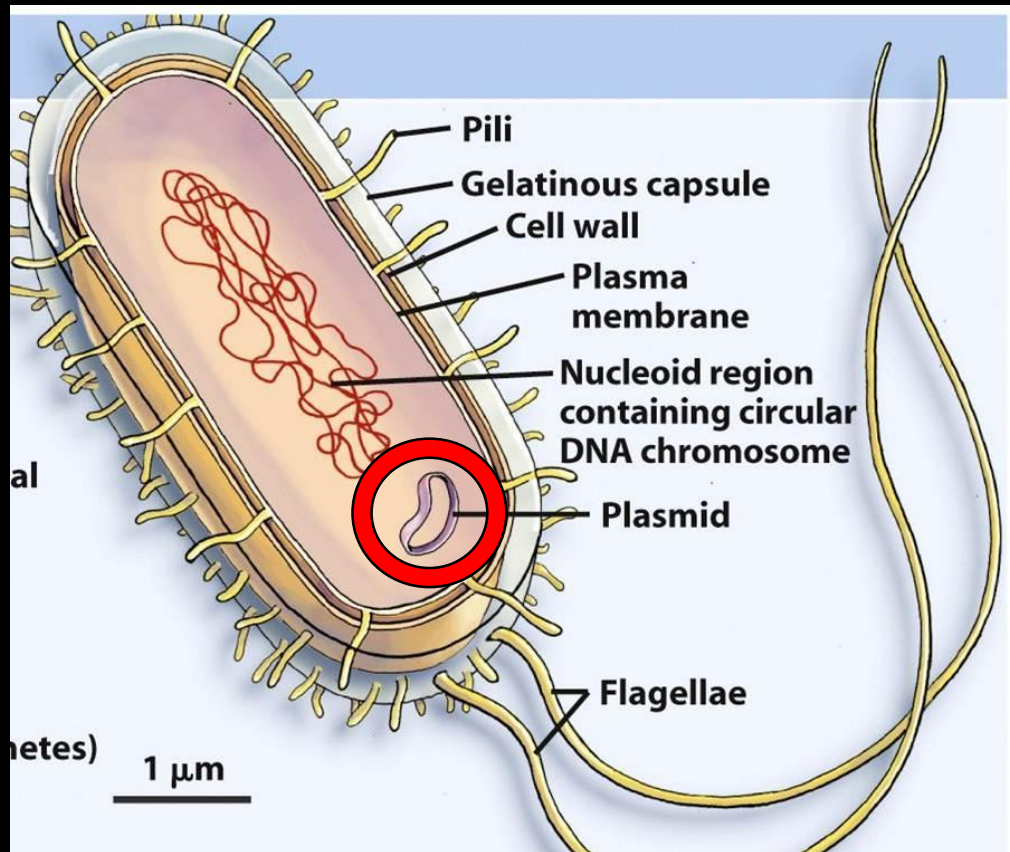
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- Bacteria can take up exogenous DNA.

# BACTERIA HAVE GENOMIC DNA & PLASMIDS

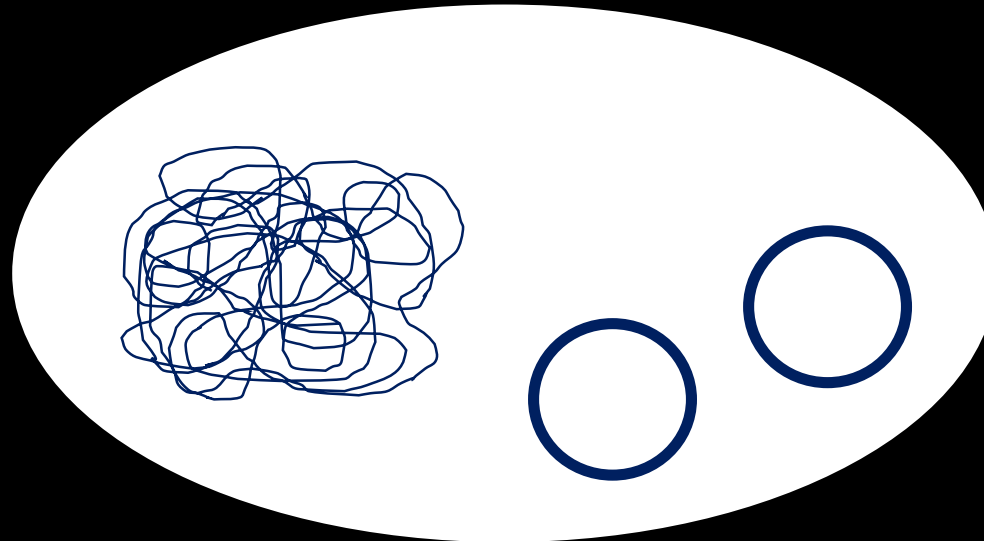
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# TRANSFORMATION

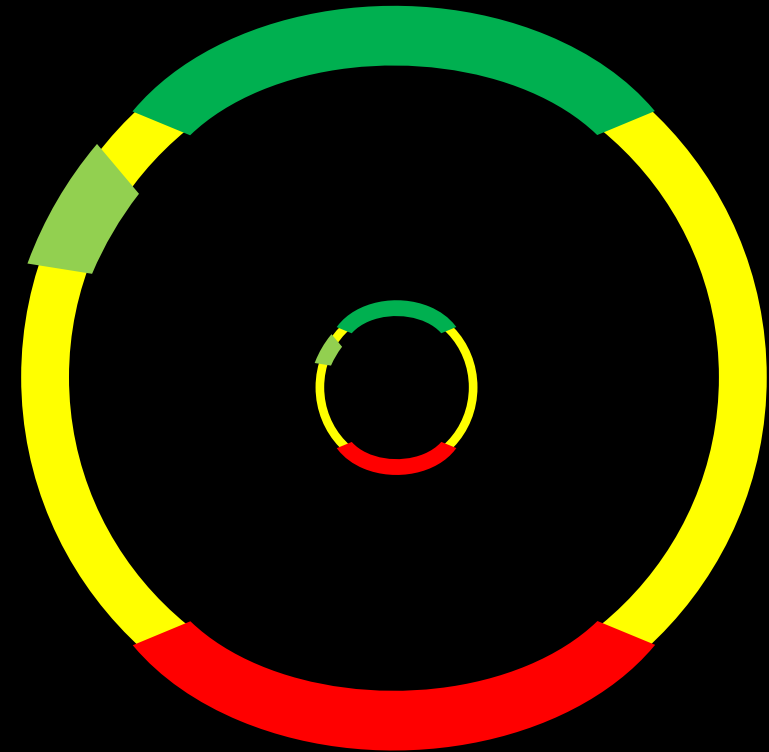
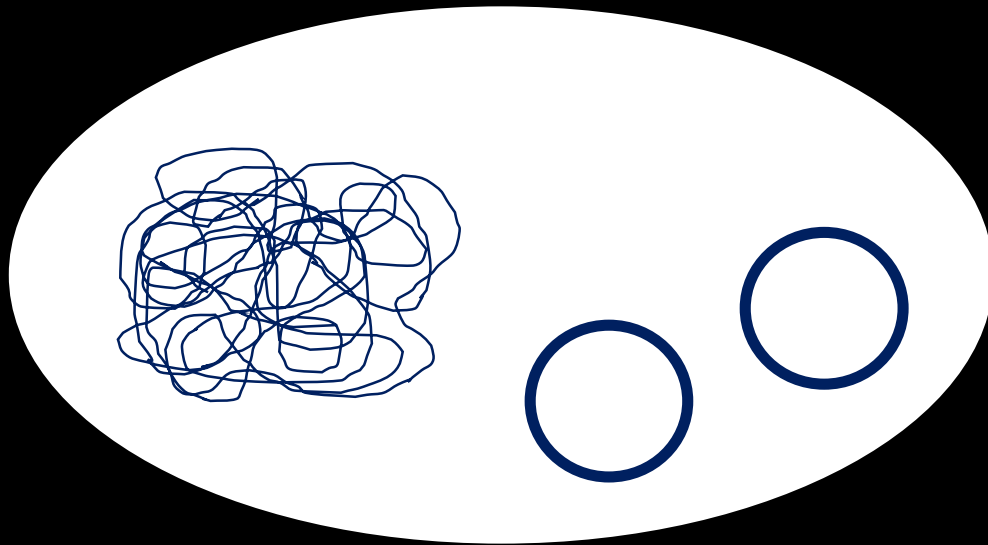
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**TRANSFORMATION** : GENETIC ALTERATION OF A CELL  
FROM THE DIRECT UPTAKE AND INCORPORATION OF  
EXOGENOUS DNA



# TODAY'S WORKSHOP – transformation with pGLO

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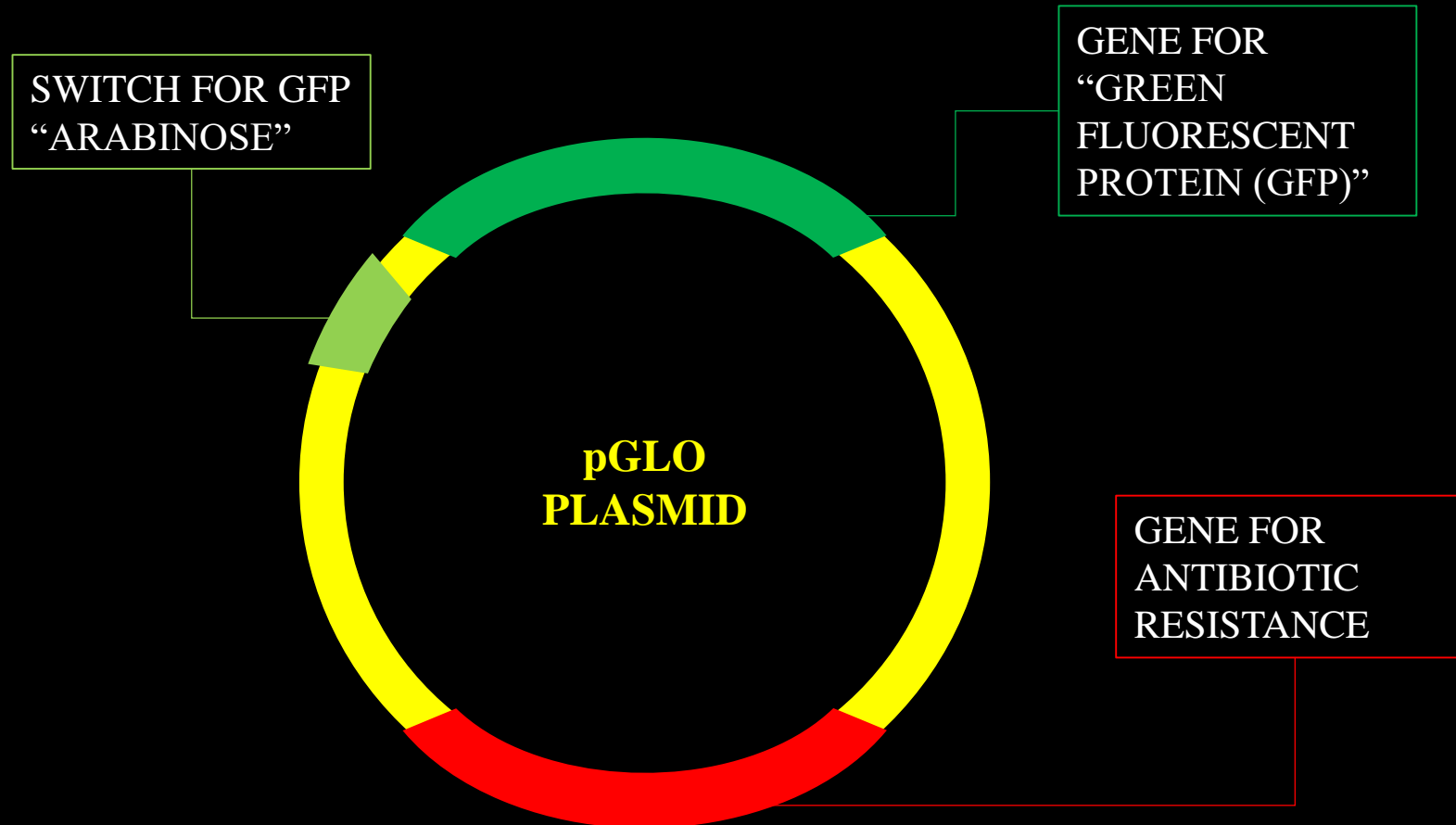


pGLO plasmid



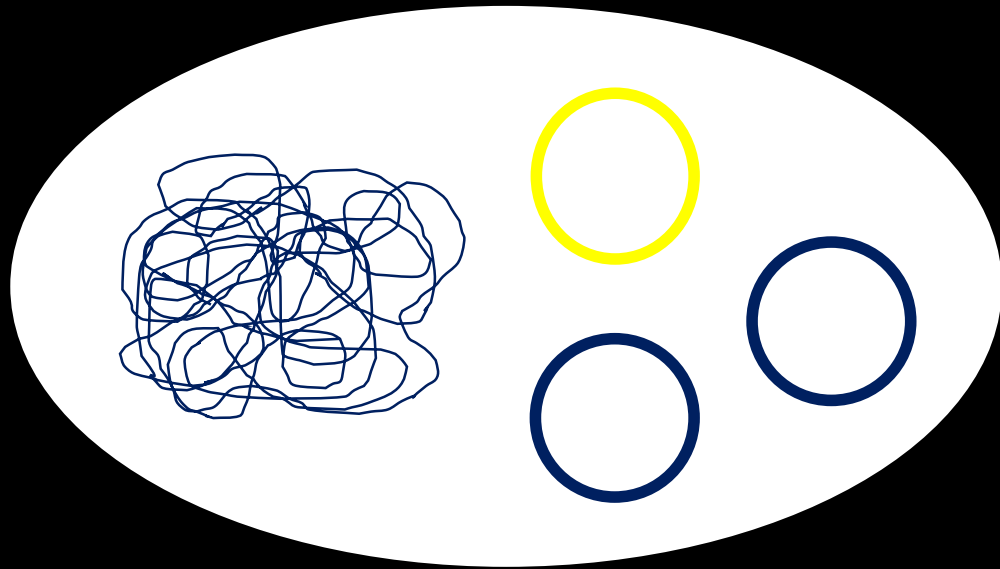
# GENES IN pGLO

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# TRANSFORMATION with HEAT SHOCK

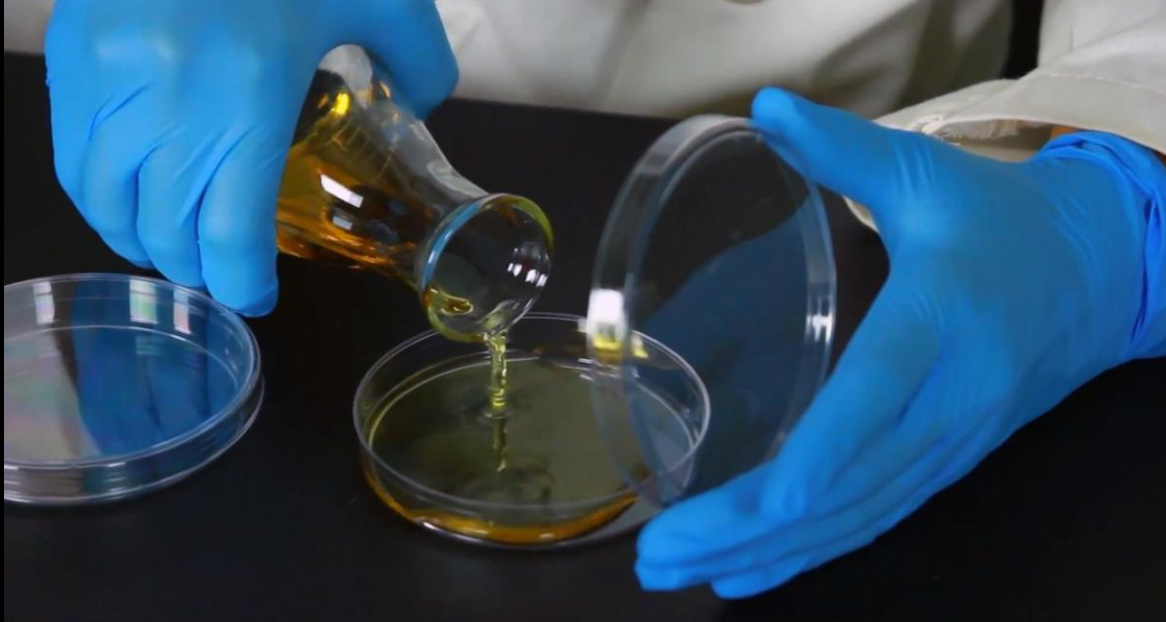
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**Transformation**

# TODAY'S WORKSHOP

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- You will be given 4 different agars (food for bacteria) for plating



LB Agar



LB Agar + Ampicillin



LB Agar + Ampicillin



LB Agar + Ampicillin + Arabinose

# TODAY'S WORKSHOP

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LB Agar

– pGLO

No Fluorescence



LB Agar + Ampicilin

– pGLO

No Colony



LB Agar + Ampicilin

+ pGLO

No Fluorescence



LB Agar + Ampicilin + Arabinose

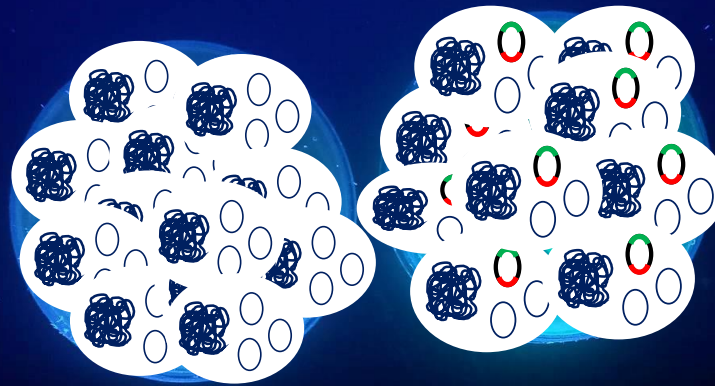
+ pGLO

Fluorescence

# TODAY'S WORKSHOP

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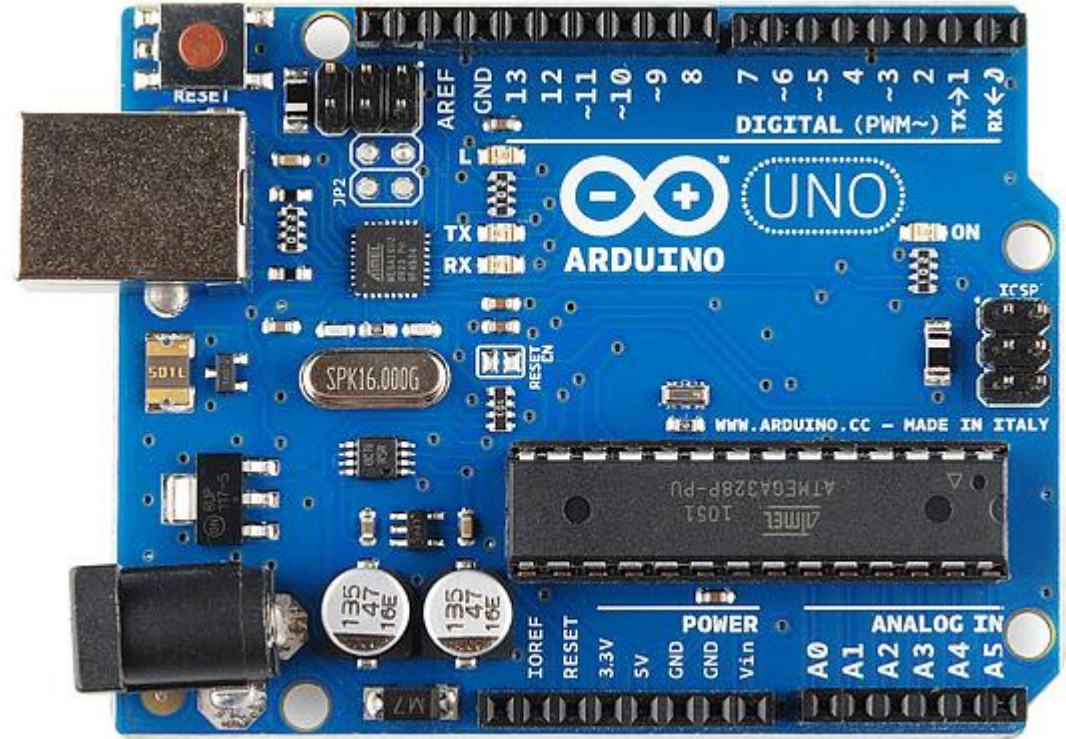
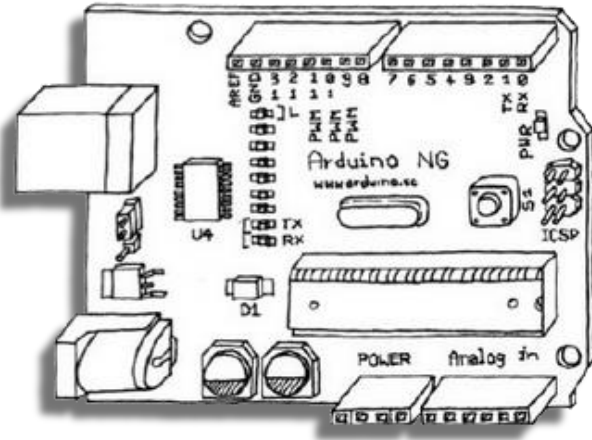
UV LIGHTING



- pGLO

+ pGLO

# Intro to LEDs with Arduino

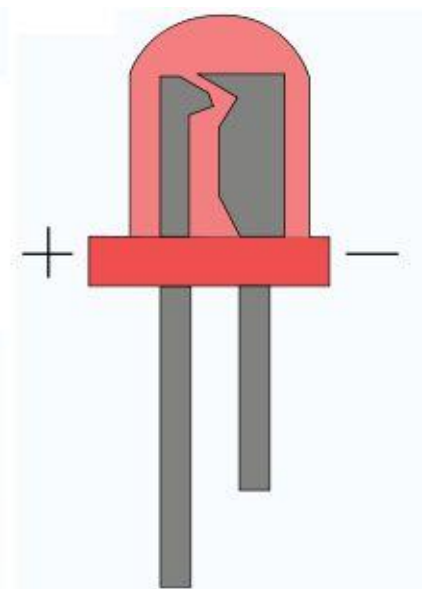
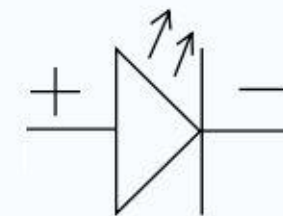
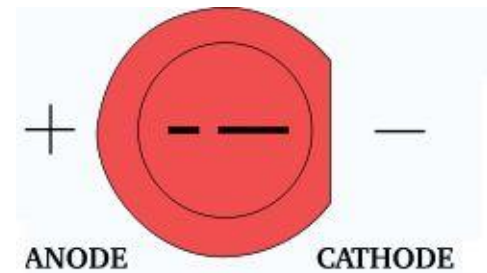
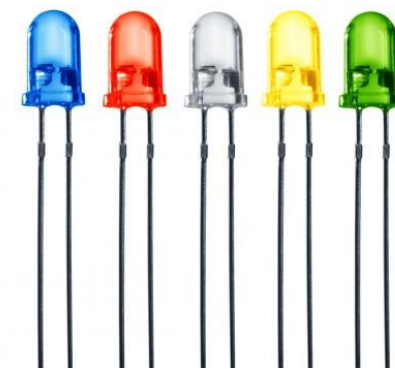
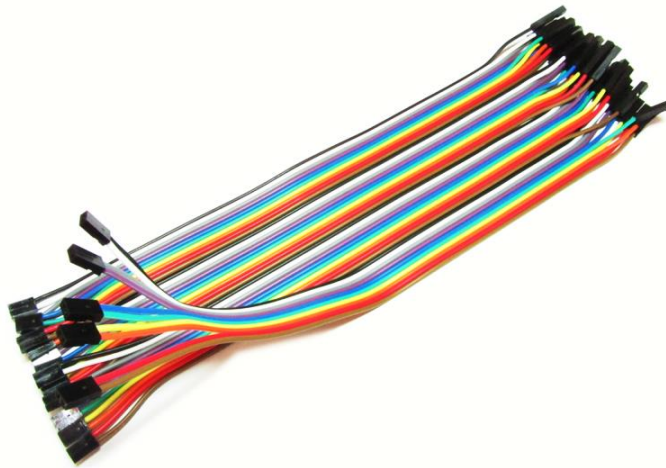


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E.coLAMP

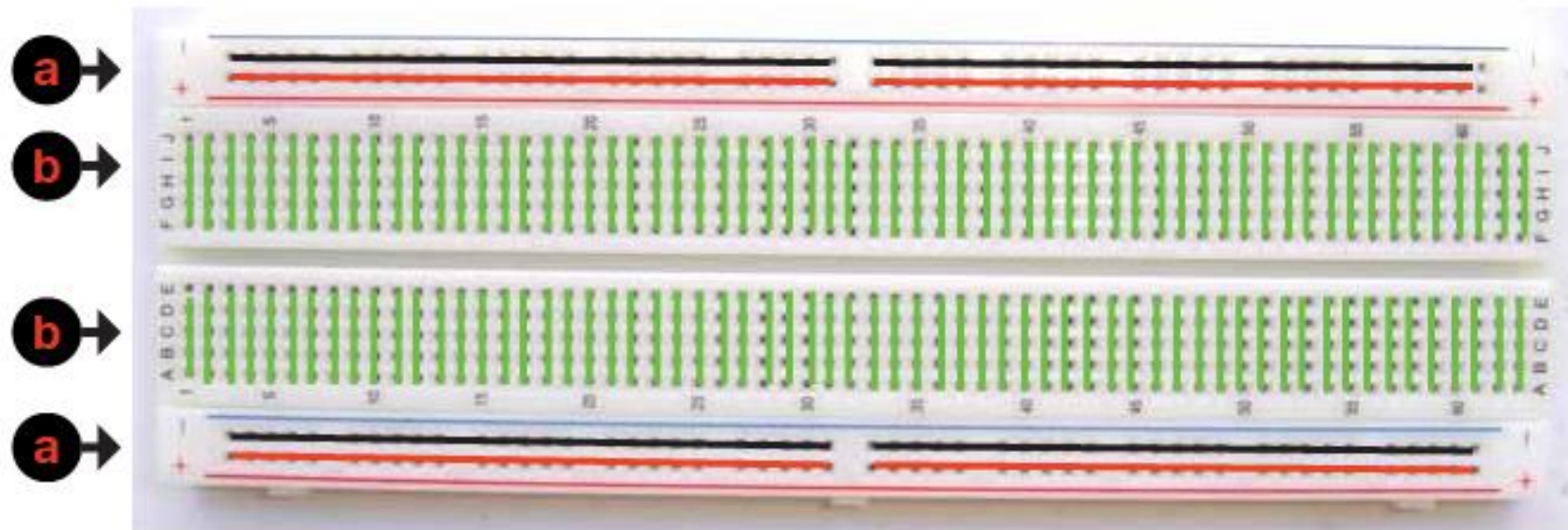
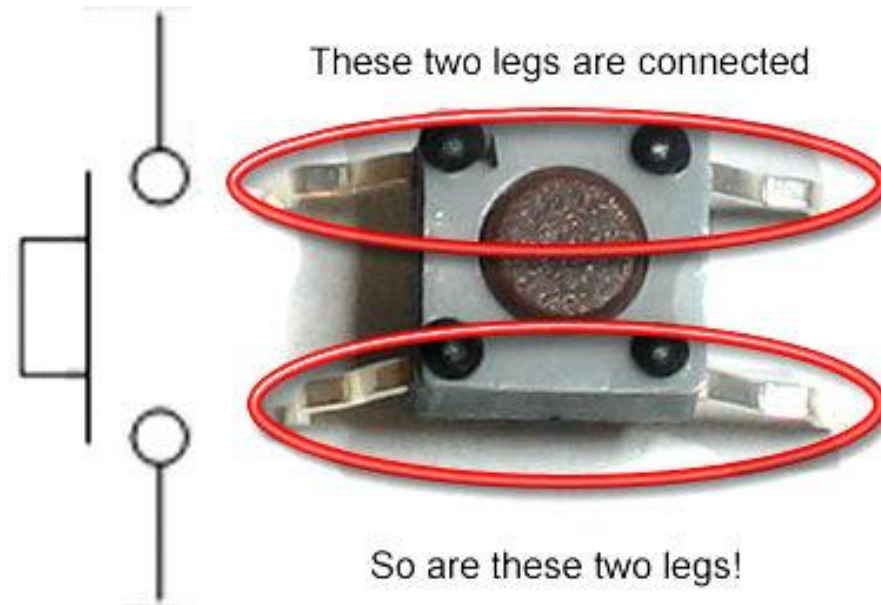
# Overview

- Introduction to electronics. Check out the kits
- Exploring the Arduino
- Blink Code!
- Time to add the pushbutton
- Stop it Game!

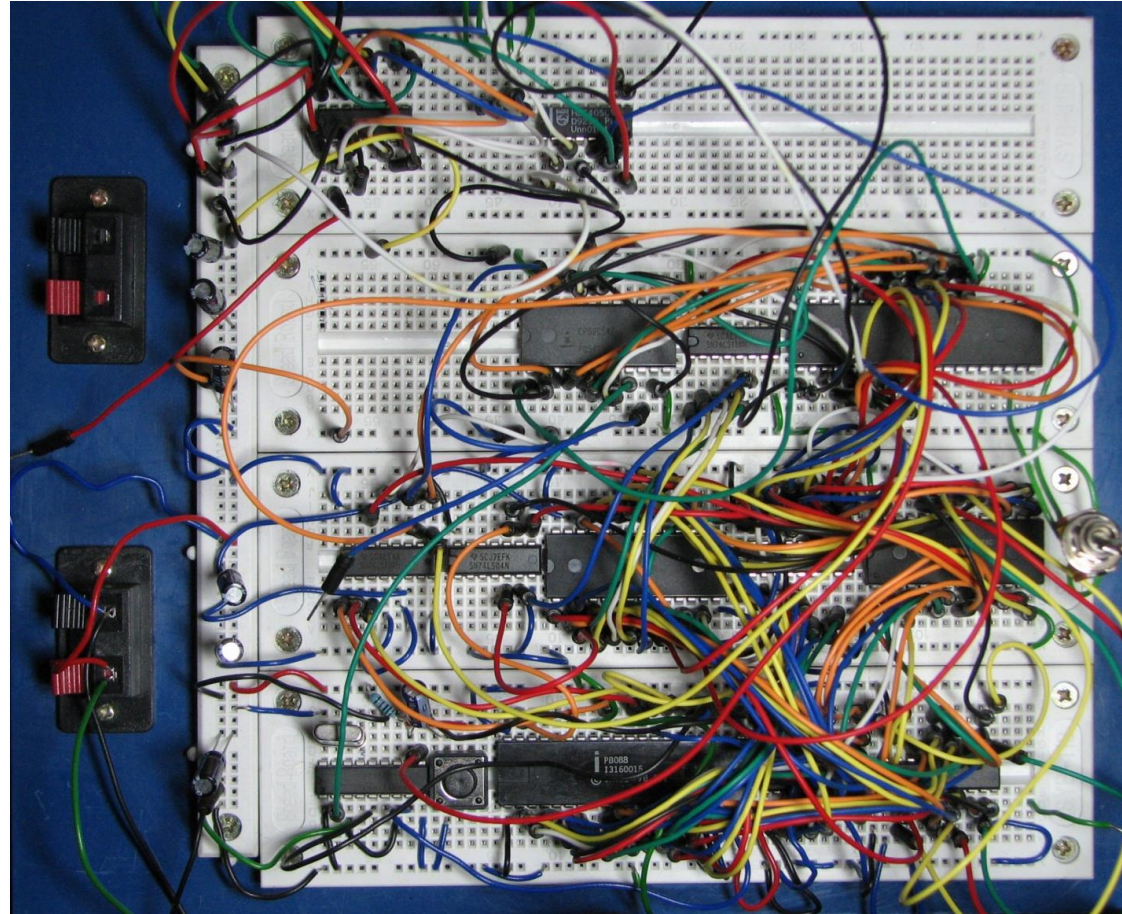
# Circuit components







# Now this is a Breadboard!



# So...what is Arduino?

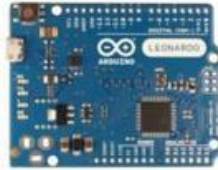
- Open source electronics platform for electronics projects
- Able to read inputs and turn them into outputs
- Combines hardware(microcontroller) and software (IDE)
- Uses simplified version of C++
- Can be used for a HUGE variety of projects



# Arduino Boards



Arduino Uno



Arduino Leonardo



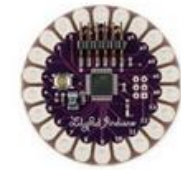
Arduino Mega ADK



Arduino Ethernet



LilyPad Arduino  
SimpleSnap



LilyPad Arduino



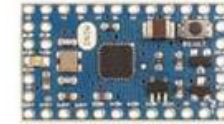
Arduino Due



Arduino Yún



Arduino Mega 2560



Arduino Mini



Arduino Nano



Arduino Pro Mini



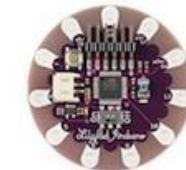
Arduino Tre



Arduino Micro



LilyPad Arduino USB



LilyPad Arduino  
Simple

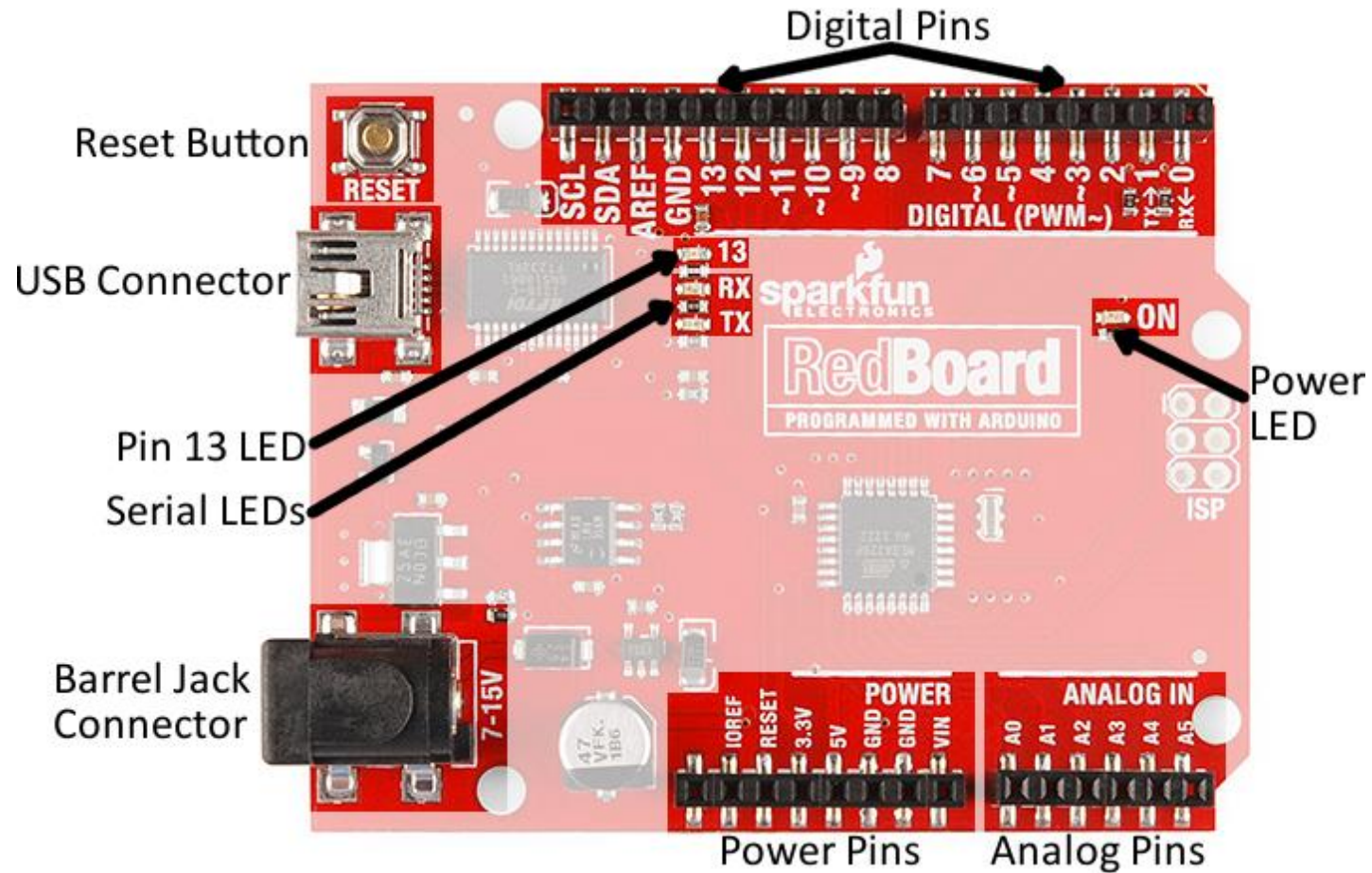


Arduino Pro



Arduino Fio

# Arduino Anatomy



# More than a board...!



The screenshot shows the Arduino IDE interface with the file 'ESP8266\_Simple\_Button\_Light' open. The code is written in C++ and controls an LED based on a button press. The IDE status bar at the bottom indicates the upload is complete and shows the target hardware details: NodeMCU 1.0 (ESP-12E Module), 80 MHz, 115200, 4M (3M SPIFFS) on /dev/cu.wchusbserial1410.

```
ESP8266_Simple_Button_Light | Arduino 1.6.8

ESP8266_Simple_Button_Light

// constants won't change. They're used here to set pin numbers:
const int buttonPin = 10;    // the number of the pushbutton pin; note pin 10 here is pin SD3
const int ledPin = 2;        // the number of the LED pin; note pin 2 here is pin D4 on ESP8266

// variables will change:
int buttonState = 0;         // variable for reading the pushbutton status

void setup() {
  // initialize the LED pin as an output:
  pinMode(ledPin, OUTPUT);
  // initialize the pushbutton pin as an input:
  pinMode(buttonPin, INPUT);
}

void loop() {
  // read the state of the pushbutton value:
  buttonState = digitalRead(buttonPin);

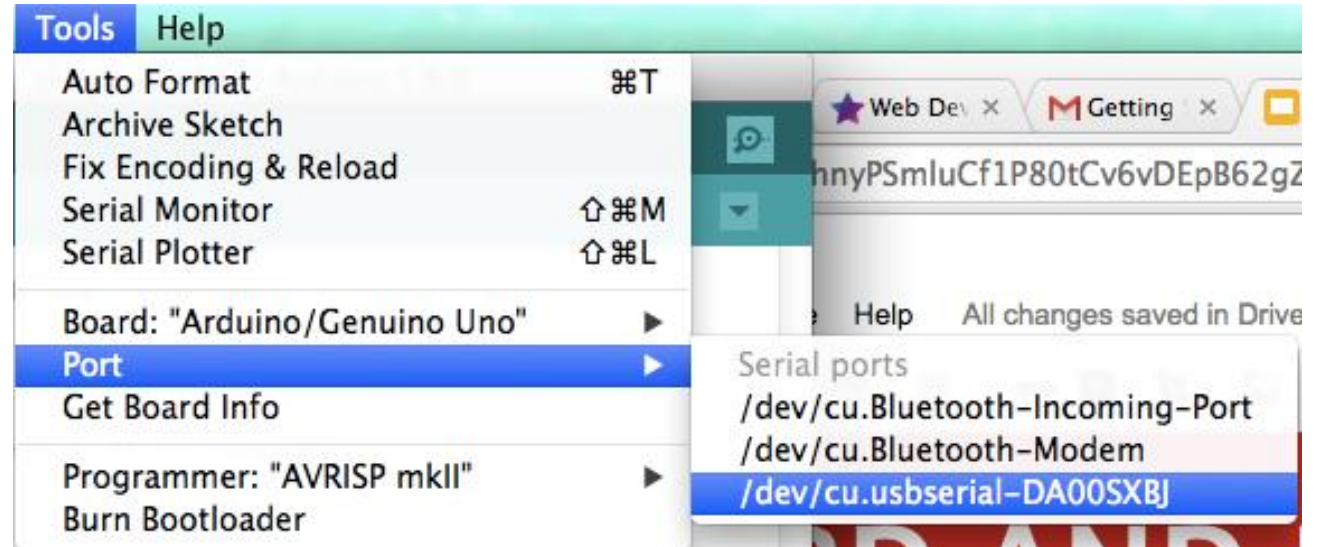
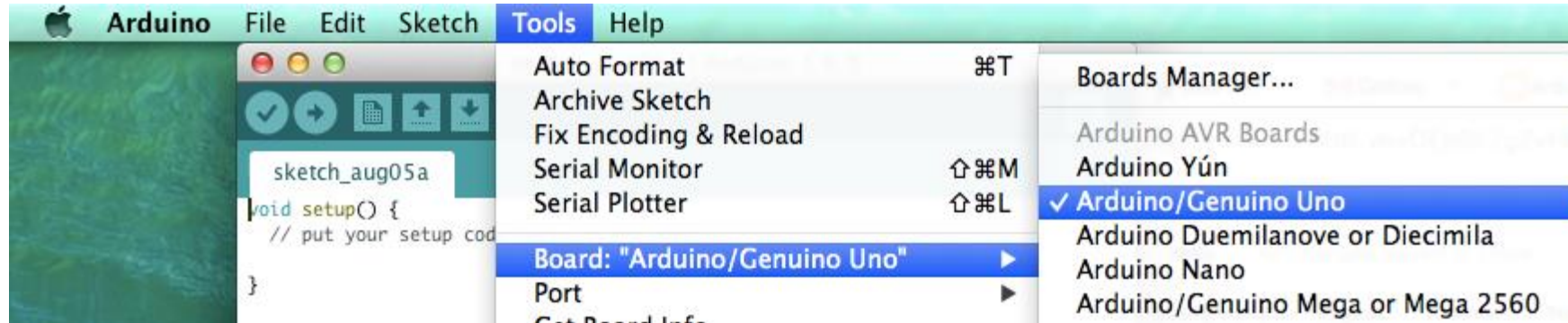
  // check if the pushbutton is pressed.
  // if it is, the buttonState is HIGH:
  if (buttonState == HIGH) {
    // turn LED on:
    digitalWrite(ledPin, HIGH);
    delay(1000); // this will leave the light on for 1 second after the button is pressed
  } else {
    // turn LED off:
    digitalWrite(ledPin, LOW);
  }
}

Done uploading.

at java.net.AbstractPlainDatagramSocketImpl.join(AbstractPlainDatagramSocketImpl.java:
at java.net.MulticastSocket.joinGroup(MulticastSocket.java:323)
at javax.jmdns.impl.JmDNSImpl.openMulticastSocket(JmDNSImpl.java:463)
at javax.jmdns.impl.JmDNSImpl.<init>(JmDNSImpl.java:420)

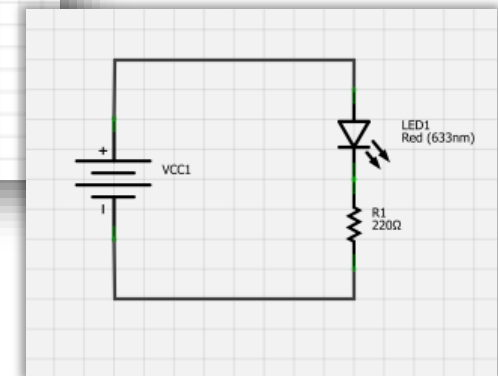
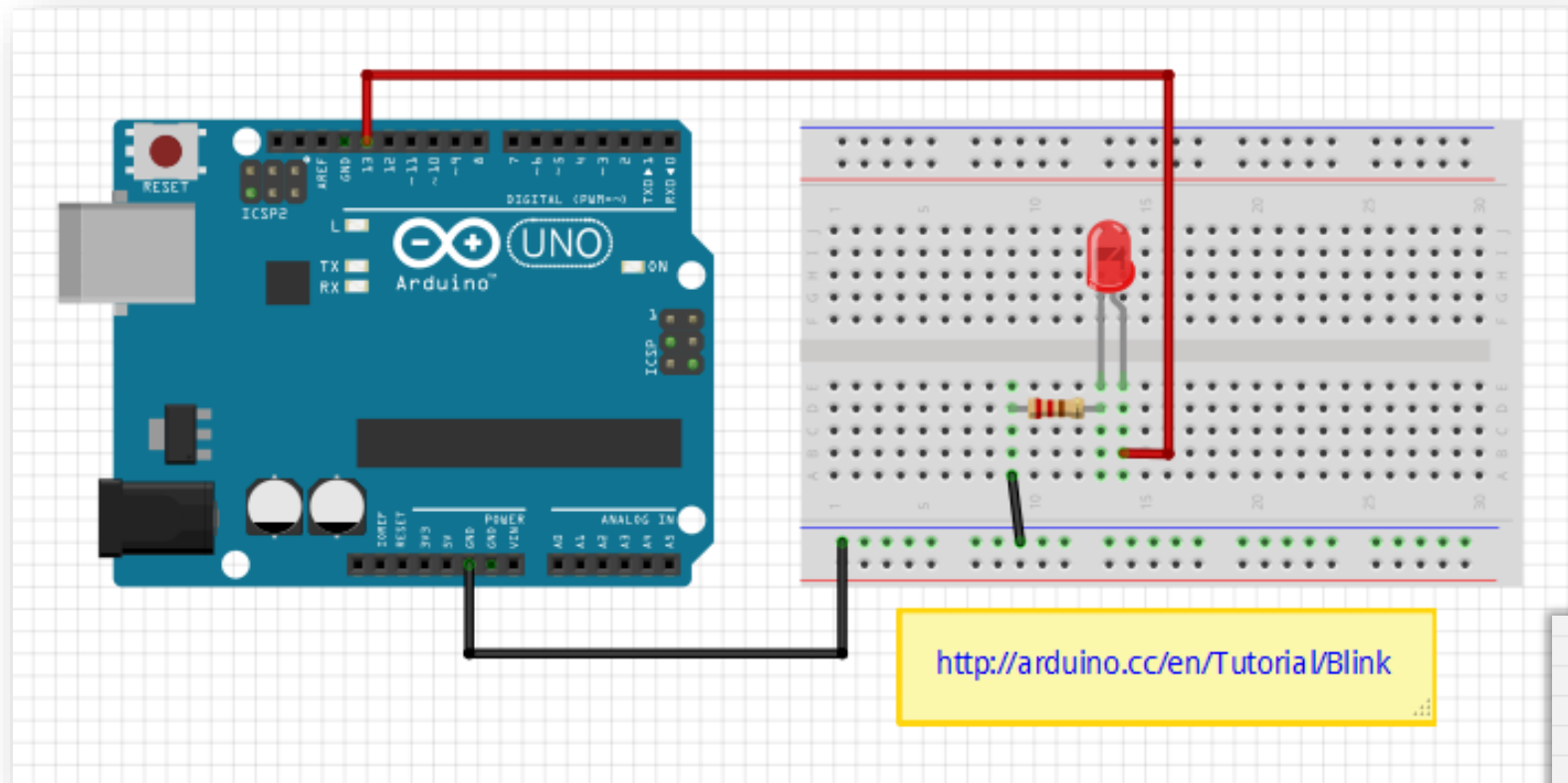
NodeMCU 1.0 (ESP-12E Module), 80 MHz, 115200, 4M (3M SPIFFS) on /dev/cu.wchusbserial1410
```

# Board and port





# Blink Circuit



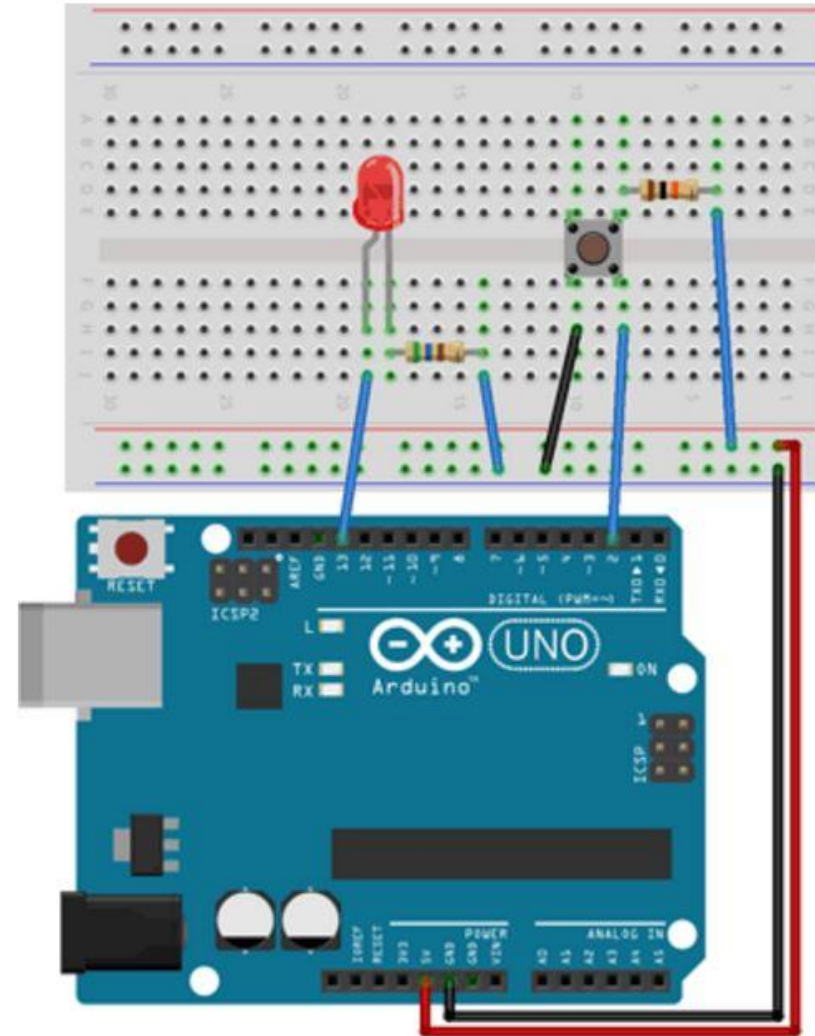
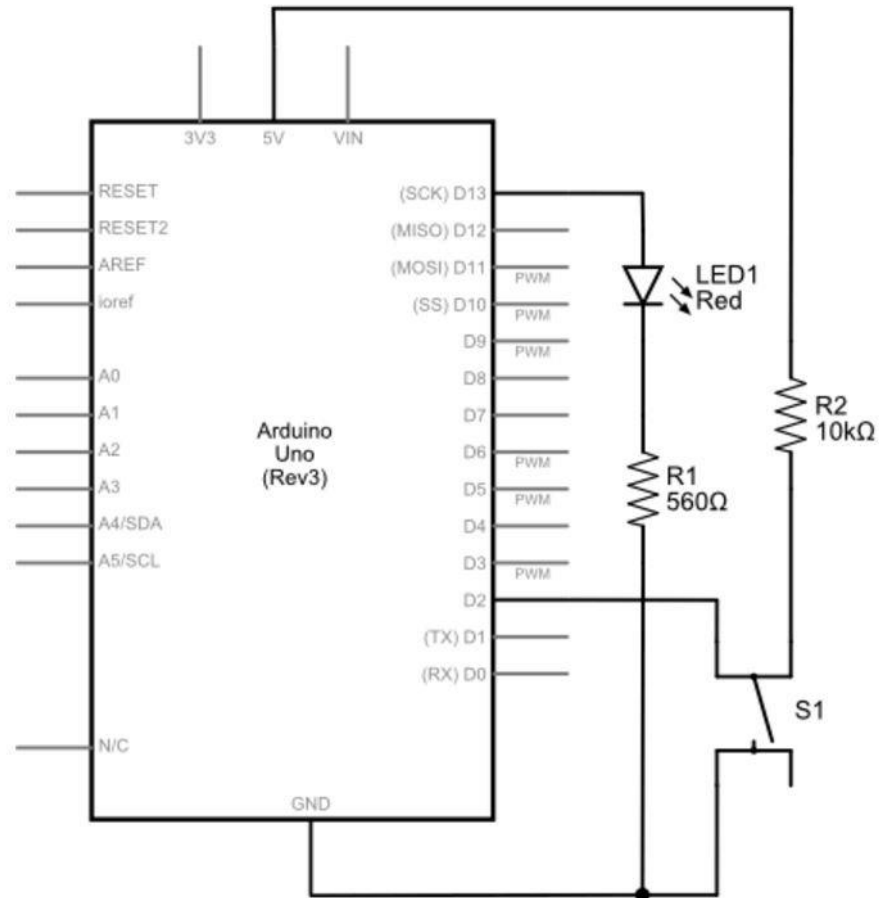


# Blink code, line by line

```
// the setup function runs once when you press reset or power the board
void setup() {
    // initialize digital pin 13 as an output.
    pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
    digitalWrite(13, HIGH);    // turn the LED on (HIGH is the voltage level)
    delay(1000);               // wait for a second
    digitalWrite(13, LOW);     // turn the LED off by making the voltage LOW
    delay(1000);               // wait for a second
}
```

# Add the pushbutton



# Basic On/Off Signal

```
// Turn on LED while the button is pressed

const int LED = 13;  // the pin for the LED

const int BUTTON = 7; // the input pin where the
                        // pushbutton is connected
int val = 0;          // val will be used to store the state
                        // of the input pin

void setup() {
  pinMode(LED, OUTPUT); // tell Arduino LED is an output
  pinMode(BUTTON, INPUT); // and BUTTON is an input
}

void loop(){
  val = digitalRead(BUTTON); // read input value and store it

  // check whether the input is HIGH (button pressed)
  if (val == HIGH) {
    digitalWrite(LED, HIGH); // turn LED ON
  } else {
    digitalWrite(LED, LOW);
  }
}
```

# Stop It!

- Materials:
- Arduino Metro
- Micro USB cable
- Breadboard
- 6 LEDs (2 different colors)
- Push button Switch
- Couple of >400 ohms resistors
- Wire cutters
- Scissors
- Cardboard

# Try Building your own Game!

