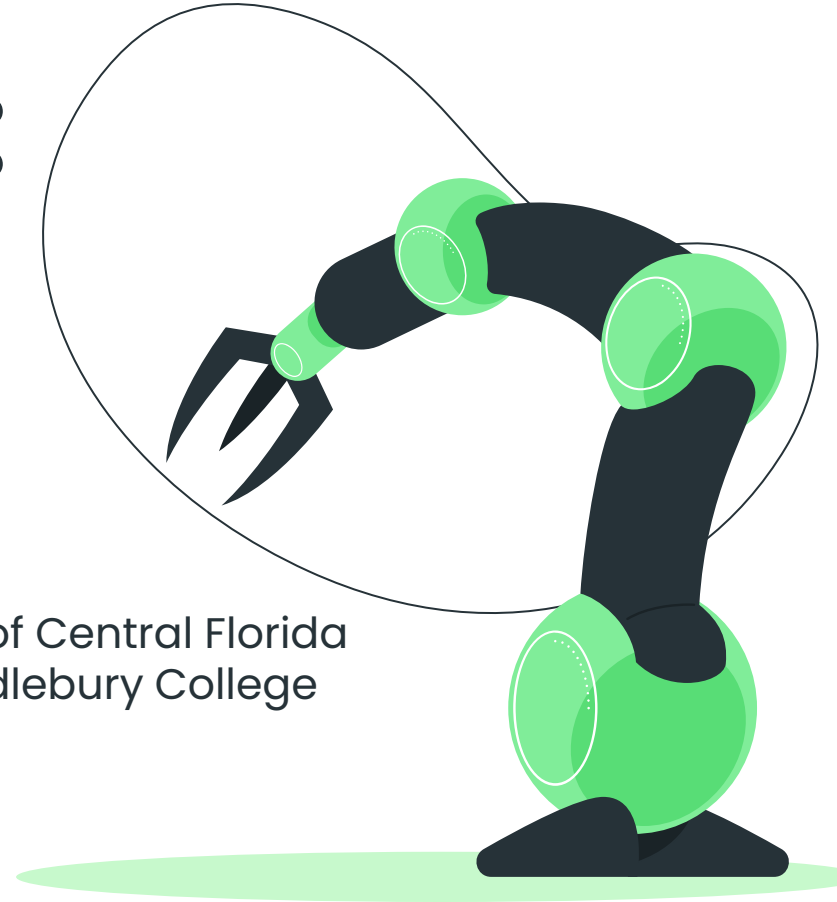


Bio Robotics: Wearable Prosthetics

Jocelyn Daniel, Biotechnology, University of Central Florida
Daniela Delgado, Computer Science, Middlebury College



Worldwide Impact



- 30 million people worldwide



- 1 in 1,900 babies in the United States

Focused Impact

Create an economical and environmentally friendly wearable device that is up to date with today's technology

Environmentally Favorable

Poly-Lactic Acid (PLA) (PETG)

- Biodegradable
- Less carbon emissions
- Easier to work with
- Long lasting



Roll over image to zoom in



PLA 3D Printer Filament, SUNLU
PLA Filament 1.75mm,
Dimensional Accuracy +/- 0.02
mm, 1 kg Spool, 1.75mm, PLA
Black

Visit the SUNLU Store

★★★★☆ 15,579 ratings

| 98 answered questions

Amazon's Choice in 3D Printing Filament by SUNLU

List Price: ~~\$27.99~~ Details

Price: **\$18.99** (\$0.54 / Ounce) **prime** One-Day

& FREE Returns

You Save: **\$9.00** (32%)

Polyethylene terephthalate glycol

- The smoke is carcinogenic
- More expensive overall
- Used in production of consumer products



Amazon Basics PETG 3D Printer Filament, 1.75mm,
Orange, 1 kg Spool

Visit the Amazon Basics Store

★★★★☆ 5,382 ratings | 14 answered questions

\$24.69 (\$0.70 / Ounce)

prime

& FREE Returns

Save up to 11% with business pricing. Sign up for free Amazon Business account

Color: **Orange**



Brand	Amazon Basics
Material	Polyethylene Terephthalate Glycol
Color	Orange
Item Weight	1 Kilograms
Item Diameter	1.75 Millimeters

Compare, Contrast & Cost



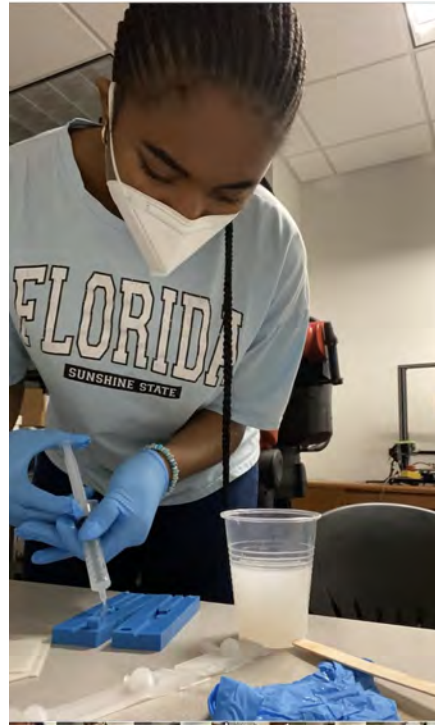
- Myoelectrical hand
- Intricate wiring, advanced technology
- Complicated surgery needed in order to connect nerve receptors and wiring
- Cost:
\$20,000-100,000 (depends)

- Enable hand
- Need a 3D printer, printing skills and experience, some flexible wiring, and metal screws
- Non invasive, still mobile
- Cost \$200-300
- Total with printer : \$1,000-1,500 (depending on printer and material chosen)

Creating Mold



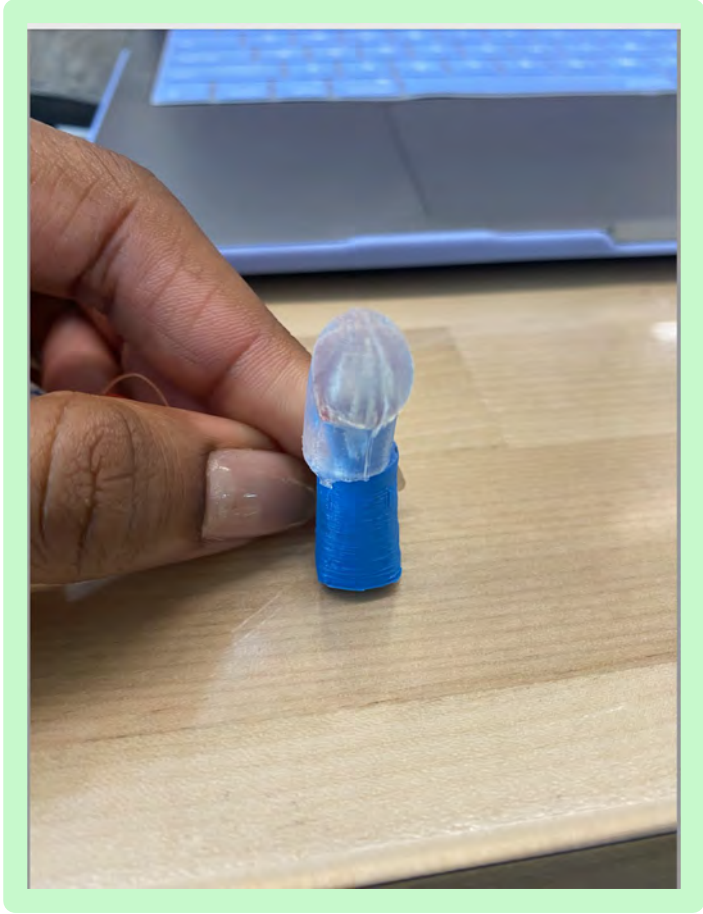
1. Using 3D printing software to create the negative mold



2. Mixing Dragon skin, vacuuming it, perfecting it

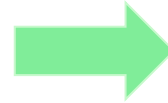
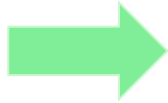


3. Critiquing, making adjustments to the final product



Challenges

- New to 3D printing (tinkercadd, solidworks)
- Molding
- Time for background research
- A lot of trial and errors



Final Product

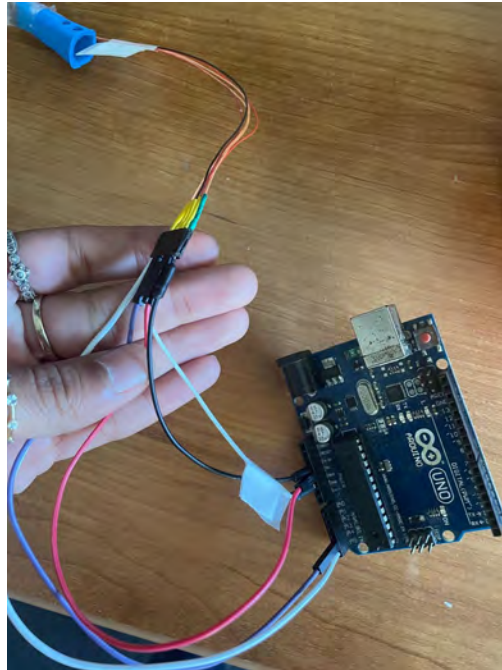


Importance of Touch

- Give the sensation of feeling to children

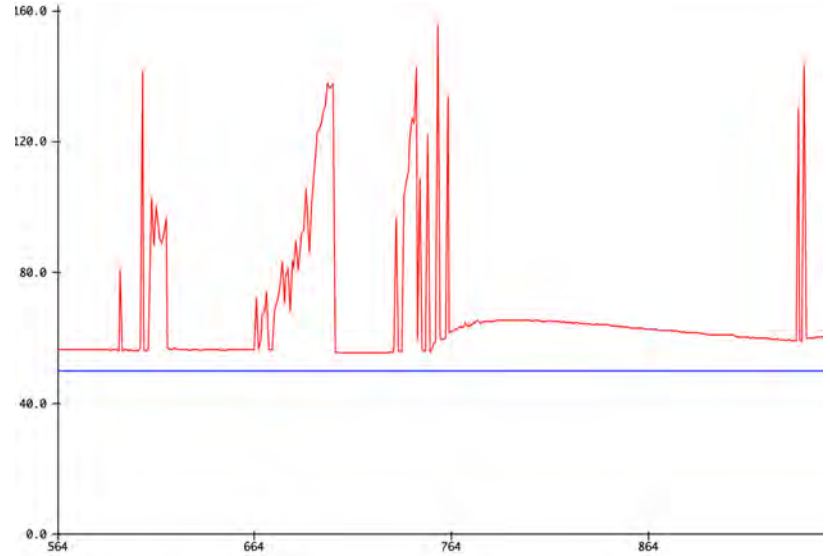
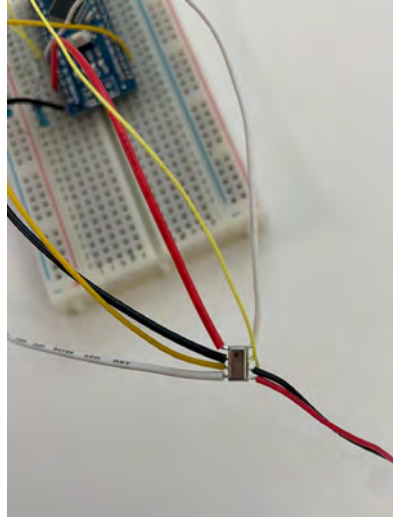


Arduino

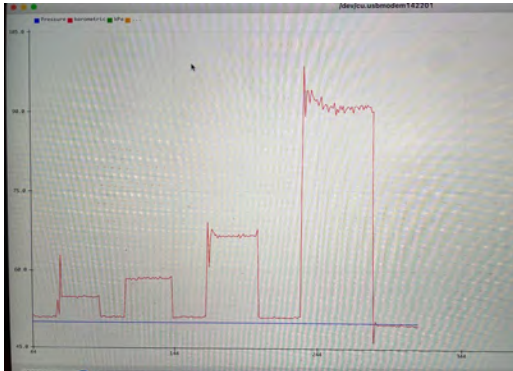
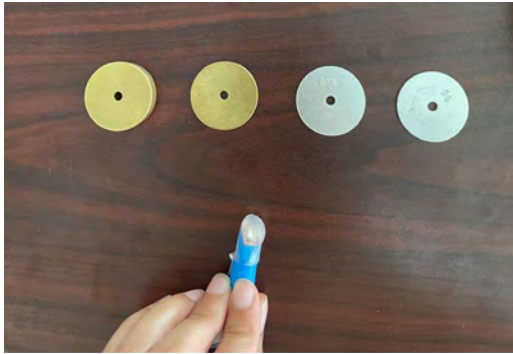


```
sketch_jul26a | Arduino 1.8.19  
sketch_jul26a  
void setup() {  
  // put your setup code here, to run once:  
}  
void loop() {  
  // put your main code here, to run repeatedly:  
}
```

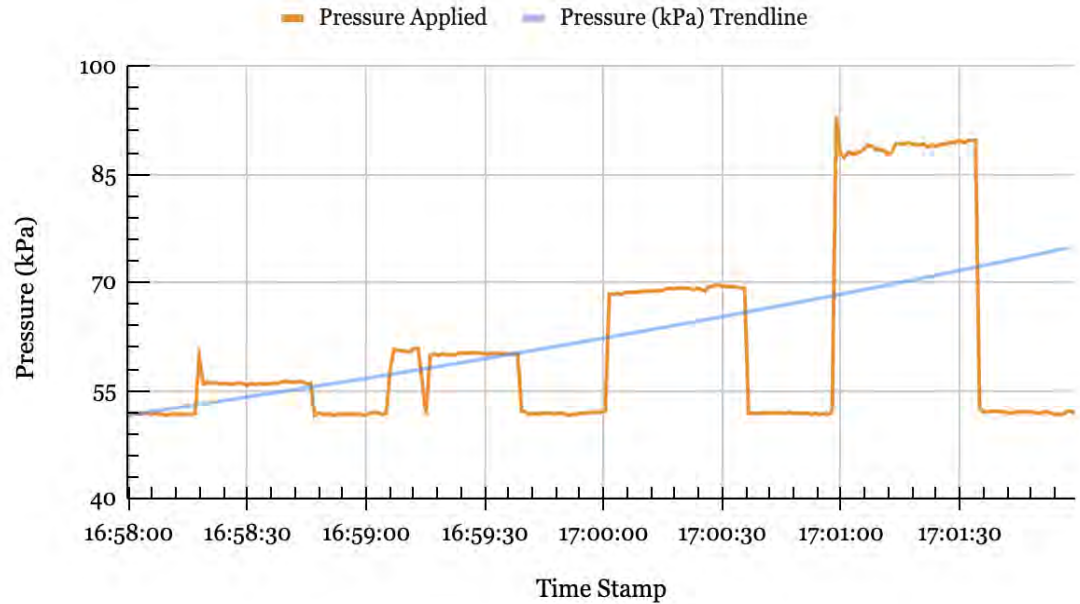
Voltage to Pressure



Calibrating the Data



Calibration Data

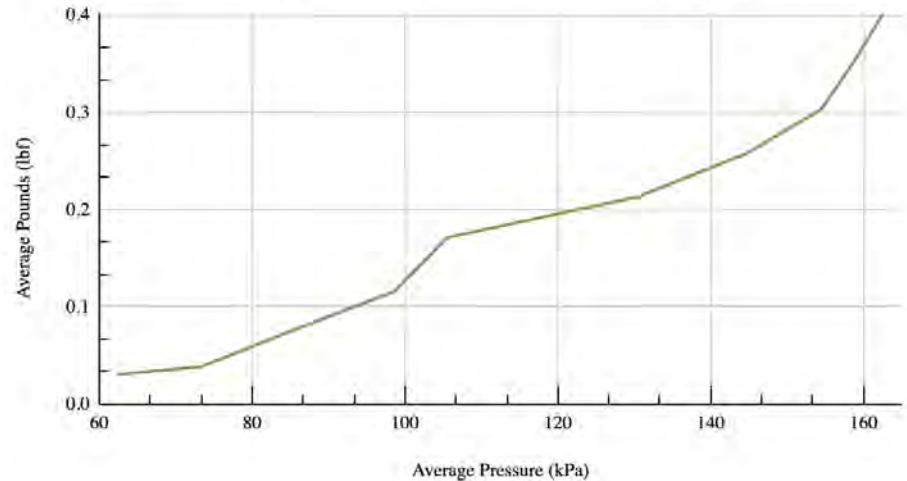


Understanding the Findings

- Challenges:
 - Sensor does not work well
 - Difficult to analyze findings
- Limiting the Sensor:
 - 0% → 55.0923 kPa at rest
 - 100% → 162.6291 kPa at 0.400 lbf
- Results:
 - The finger would have pressure reading limitations when used



Pressure Relative to the Pound-Force Applied



Future

- Mobility
 - Wiring, coding
- Have sensors for all fingers
 - Done from scratch
- A working mold
- Tests on pediatric patient
 - Hard to do

CONSTANT GOAL:

- Non-invasive
- Cost effective
- Biologically and environmentally friendly



References

- <https://www.nationwidechildrens.org/family-resources-education/700childrens/2018/04/limb-loss-adapting-to-the-challenges-and-hitting-milestones>
- https://cdn.thingiverse.com/assets/09/62/11/29/80/RAPTOR_assembly_instructions_R1.2.pdf
- <https://www.3dprintingspot.com/post/petg-vs-pla-main-pros-cons-of-both>
- https://media.istockphoto.com/photos/human-and-robotic-hand-touching-picture-id1149086253?k=20&m=1149086253&s=612x612&w=0&h=XciFpCuOAlvMlcJ2ar_yr9-mejm2F9N72p-mSkbcMWO=
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- <https://www.vmccdn.ca/f/files/airdrietoday/import/24/2018/05/GT-20180130-RVW0302-301309985-AR.jpeg>