



GEORGETOWN UNIVERSITY

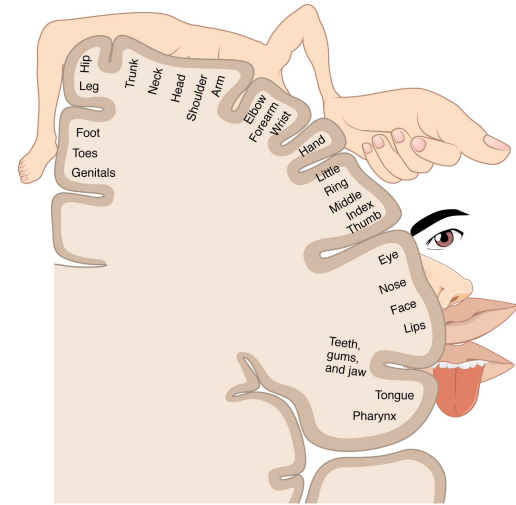
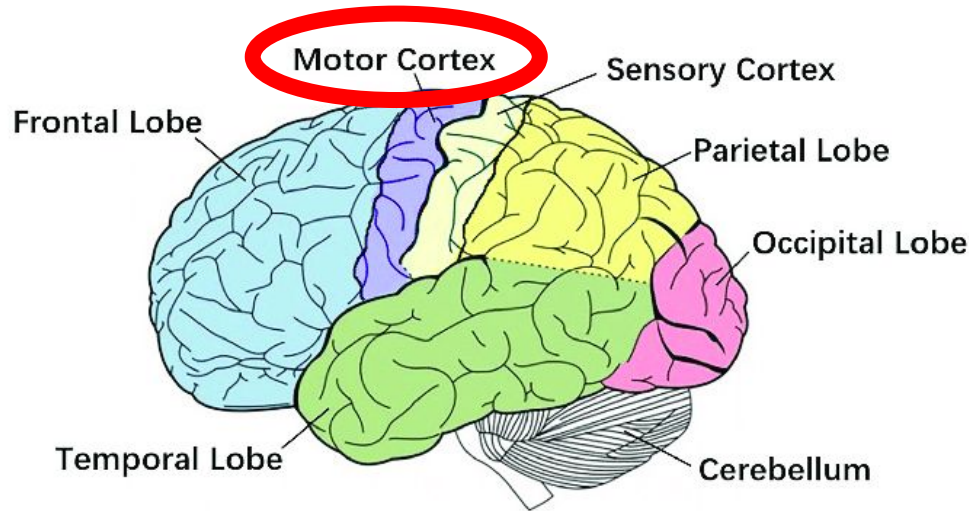


SENSORY AND MOTOR  
— PLASTICITY LAB —

# Function-Based Representations in the Brain's Sensorimotor System

**Calla Doh**  
**SAMP LAB 2022**

# Background Information

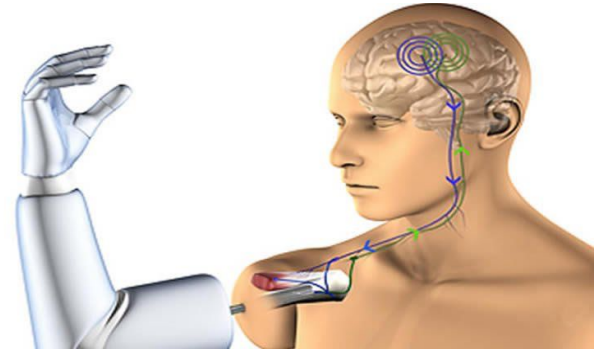


Two types of organizational methods:  
**somatotopic (body part)**  
representation and **function-based**  
representation

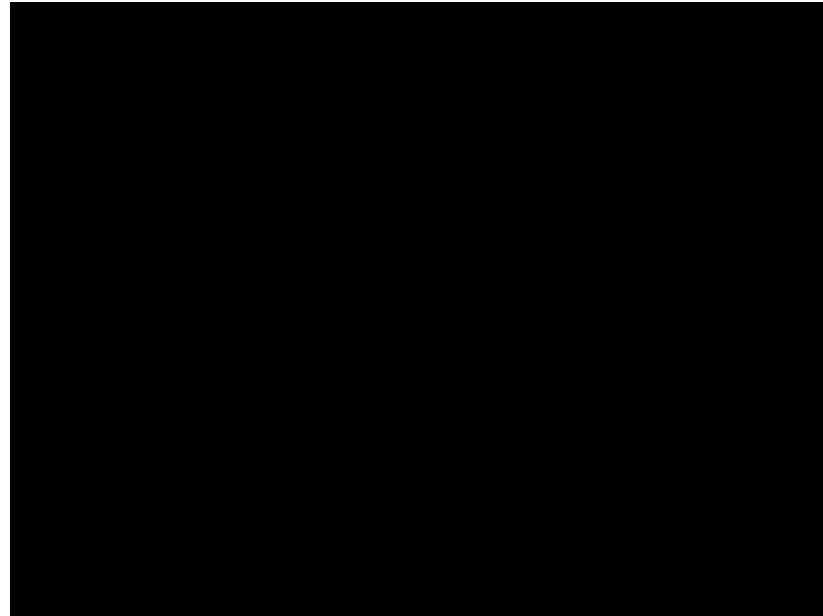
## Research Question:

Which brain motor regions are organized by function and not by body part?

Why is this research  
important?  
**Cognitive models!**



## Focus of the Study: Individuals Born Without Hands (IDs)

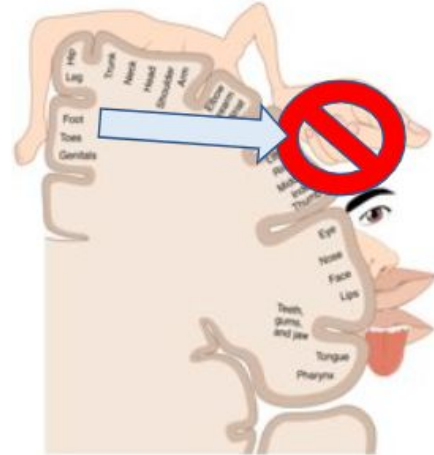


# Motor Region Reorganizes in People Born Without Hands (IDs)

**Somatotopic organization:** organized by  
body part



**Function-based representation:** organized  
by how the body part is used



# Functional Magnetic Resonance Imaging (fMRI) Neuroimaging Experiment

**Participants:** 14 controls + 3 individuals born without hands (IDs)

## **Experimental procedure:**

- Whole-brain fMRI scanning
  - Flex R/L hand/foot, move R/L shoulder, move whole stomach, move whole mouth



# My Role at the Internship

## Weeks 1-5

- Comprehend existing literature on sensorimotor systems
- Learn how to use Brain Voyager and Matlab (coding)
- Edit and process the controls' and IDs' data
- Present a paper from a journal to the lab

## Weeks 6 - present

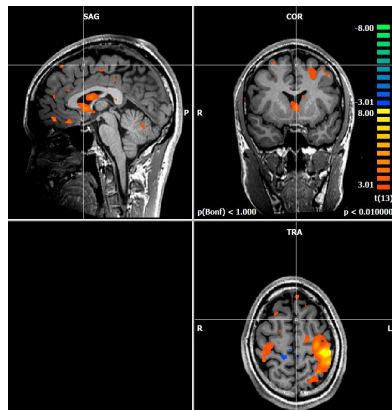
- Perform analysis on the data
- Compare regions of activation between controls & IDs
- Compose a scientific paper on my findings



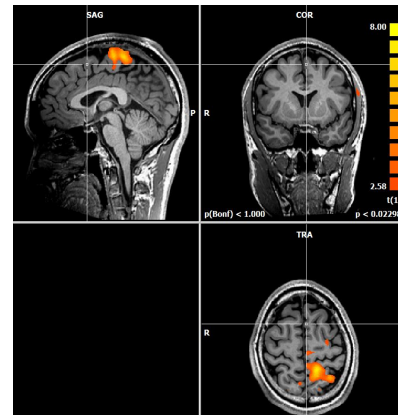


# Data Analysis

1. Identify regions of hand-selectivity in the controls
2. Identify regions of foot-selectivity in the IDs
3. Overlap = function-based representation

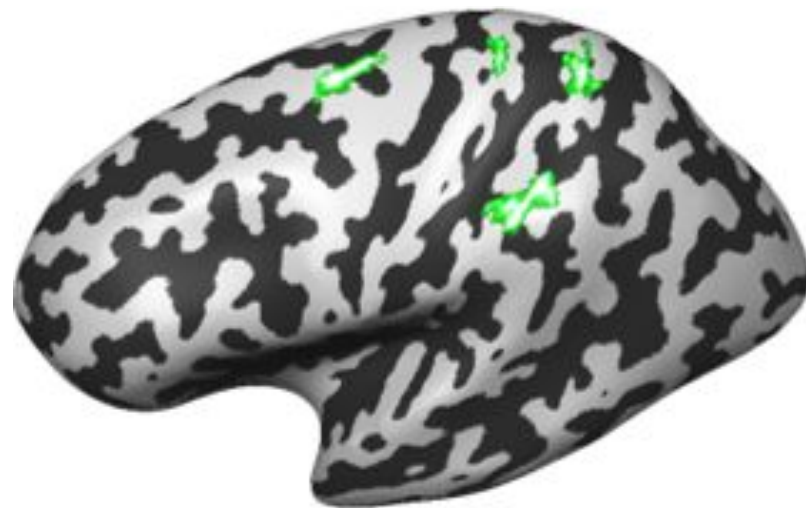
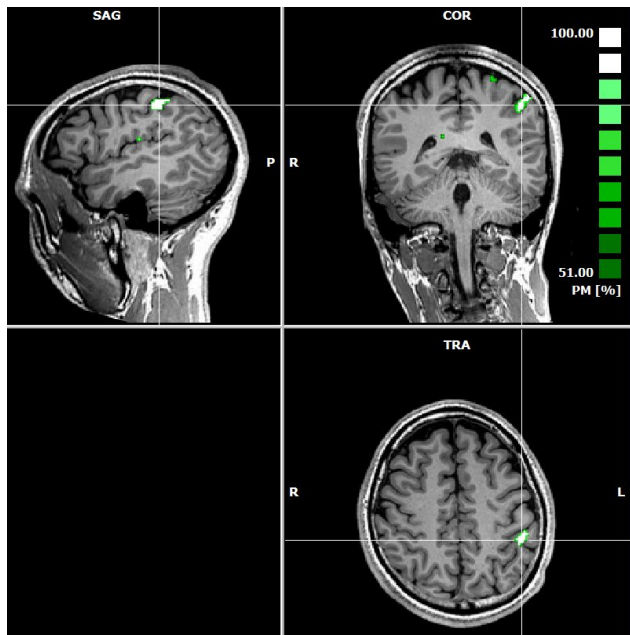


Hand selectivity in  
controls  
Hand > other body  
parts



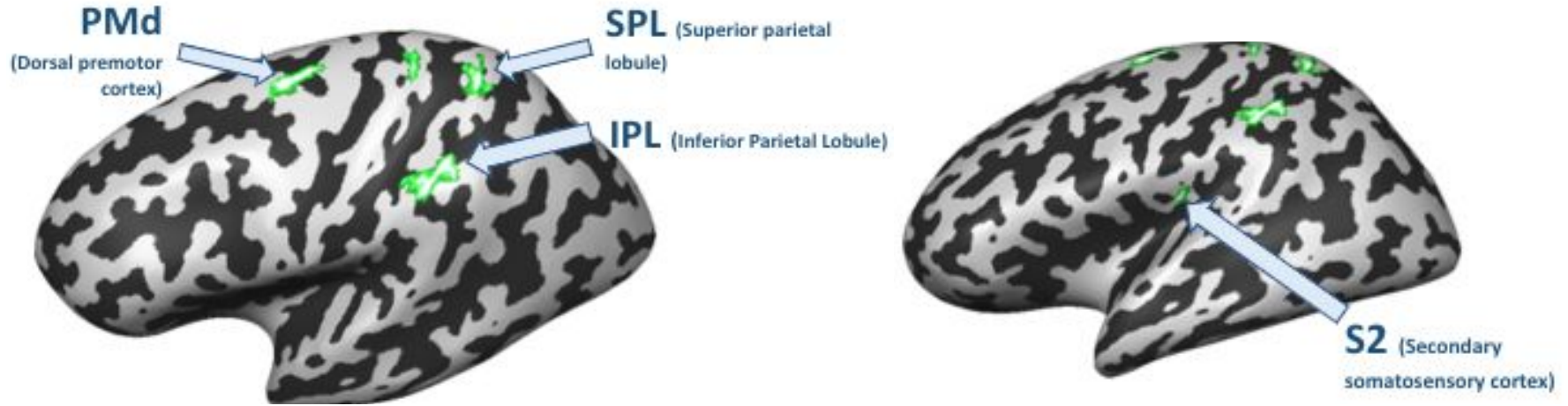
Foot selectivity in IDs  
Foot > other body parts  
(excluding hand)

# Data Analysis



Overlap map

# Regions of Function-Based Representations



The dorsal premotor cortex, PPC (Superior & inferior parietal lobule), and secondary somatosensory cortex

# Lessons I Learned

1. When reading papers and analyzing data, remain SKEPTICAL! Ask questions.
2. Explore literature from all perspectives when researching a scientific question.
3. Mistakes will happen; it's how you respond to a mistake that determines the outcome.
4. Learn to code - it is a highly versatile and essential skill.

# THANK YOU!!!!

From the SAMP Lab:

- Dr. Ella Striem-Amit
- Flo Martinez Addiego
- Viveka Sinha
- Sam Namian

Dr. Krug

My parents:)



# Preparing the Data for Analysis

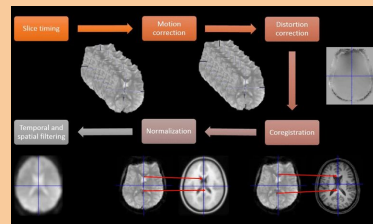
## COREGISTRATIONS

Transforming a  
participant's  
brain to a  
template brain



## PREPROCESSING

cleaning up a  
photo by  
separating noise  
from the BOLD  
signal



## CREATING VTCs

Used in analysis  
“Checkpoint” for  
coregs +  
preprocessing

Functional slice-based data file (FMR):

FMR -> VMR coregistration file 1, i.e. header-based (.JA\_TRF):

FMR -> VMR coregistration file 2, i.e. intensity-based fine-tuning (.FA\_TRF):

AC-PC translation/rotation file - Talairach, step 1 (.ACPC.TRF):

Cerebrum border file for scaling - Talairach, step 2 (.TAL):

Resulting VTC file:

## MATLAB SCRIPTS

## Final steps before statistical analysis

[illegible]

# Statistical Analysis

- Testing the relative significance of a task to brain activation within a particular region
  - GLM (general linear model)

