Building Reliable Advances and
BRAIN
Innovations in Neurotechnology

NSF AWARD RELI SUPP #1650536
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BRAIN

THE FUTURE OF NEUROTECHNOLOGY

ADRIANA LOPEZ

THE BRAIN CENTER DEVELOPS SAFE, EFFECTIVE AND AFFORDABLE PERSONALIZED NEUROTECHNOLOGIES FOR DIAGNOSTICS, RESTORATION, ENHANCEMENT, AND REHABILITATION OF SENSORY, MOTOR, AFFECTIVE AND COGNITIVE FUNCTIONS. THE THE ULTIMATE GOAL IS TO IMPROVE THE QUALITY OF LIFE OF PEOPLE WITH DISABILITIES.

WINTER 2019

CULLEN COLLGE OF ENGINEERING

COLLEGE OF TECHNOLOGY

DEDICATION

TO ALEXA, MY FAMILY AND THE BRAIN-MACHINE INTERFACE LAB

PURPOSE

CREATE AN ACCESSIBLE COMIC BOOK TO INFORM CHILDREN ABOUT THE NEUROTECHNOLOGY PROJECTS DEVELOPED BY THE BRAIN CENTER AND HOW THEY BENEFIT SOCIETY , AND DESCRIBE SOME OF THE STEM OUTREACH PROJECTS IN THE HOUSTON AREA.

HI THERE, I AM DR. PEPE! AND THIS IS MY THOUGHT BUBBLE!

I AM THE DIRECTOR OF THE NSF IURC BRAIN CENTER. I MENTOR ALL THE RESEARCHERS THAT APPEAR IN THIS COMIC! I APPEAR A COUPLE OF TIMES TO TEACH YOU ABOUT IMPORTANT THINGS RELATED TO BRAIN! PLEASE ENJOY IT!

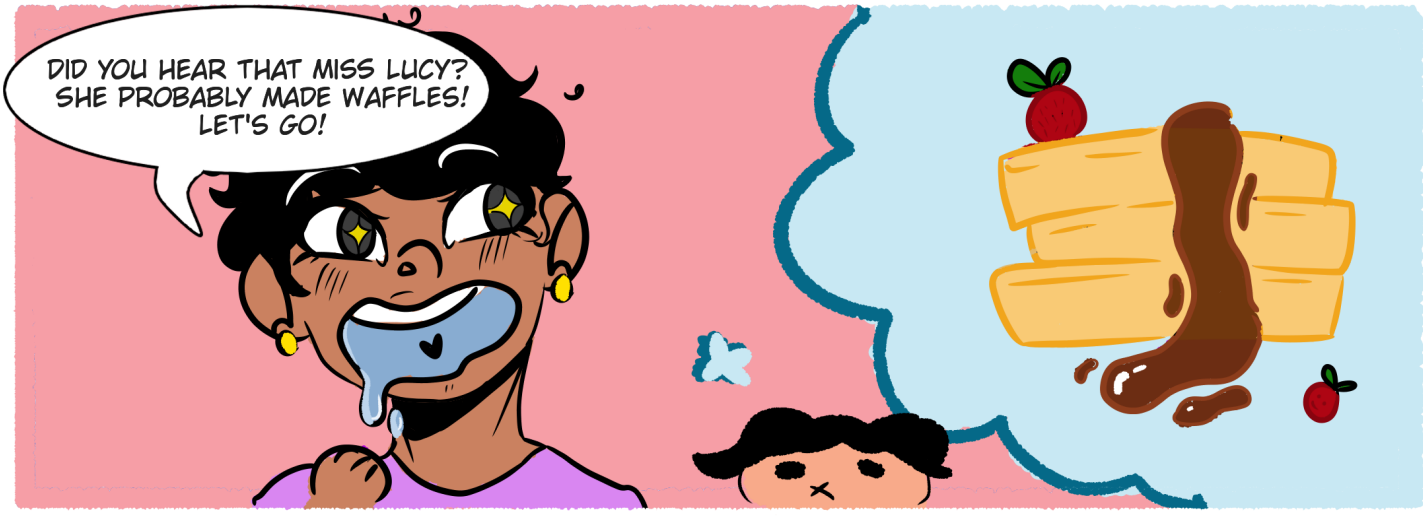
I CAN BE REACHED AT: JLCONTRERAS-VIDAL@UH.EDU

ABOUT THE ARTIST/AUTHOR!

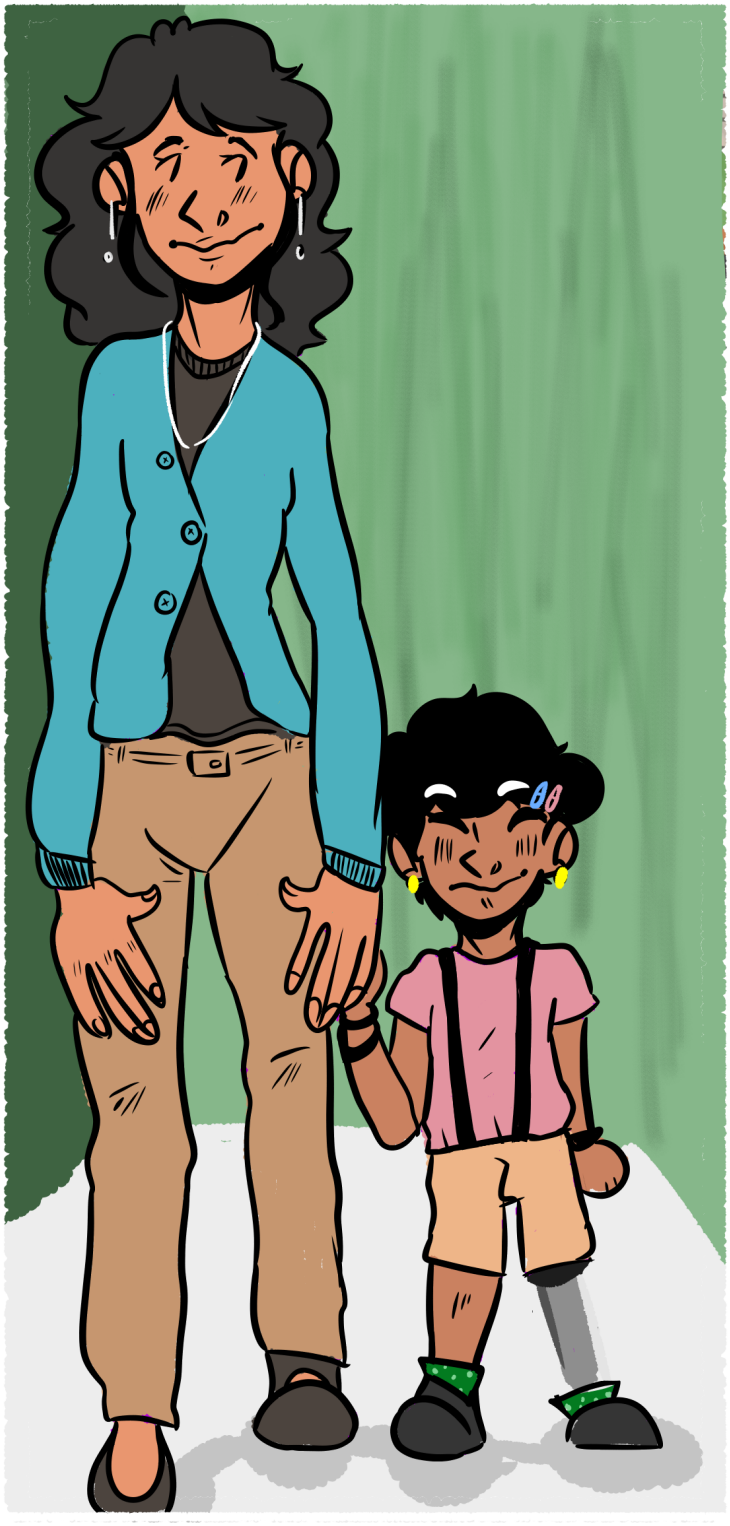
ADRIANA LOPEZ CAJIGAS IS A PUERTO RICAN ARTIST WHO CONCENTRATES MOST OF HER WORK IN BLENDING ART AND SCIENCE TOGETHER. SHE CURRENTLY STUDIES AT THE COLLEGE OF THE ARTS IN UNIVERSITY OF HOUSTON.SHE BELIEVES THAT ART FACILITATES THE UNDERSTANDING OF SCIENCE,ESPECIALLY FOR YOUNGER AUDIENCES. ONE OF HER MAIN PROJECTS IS "SYSTEM" A PROJECT TEACHING ABOUT THE PLANETS.
RECENTLY SHE HAS BEEN WORKING ON "BRAIN: THE FUTURE OF NEUROTECHNOLOGY", TO TEACH GENERAL AUDIENCES ABOUT NEW PROJECTS INT HE FIELD OF NEUROTECHNOLOGY. THIS IS HER FIRST COMPLETED PROJECT AND SHE HOPES YOU ENJOY IT!

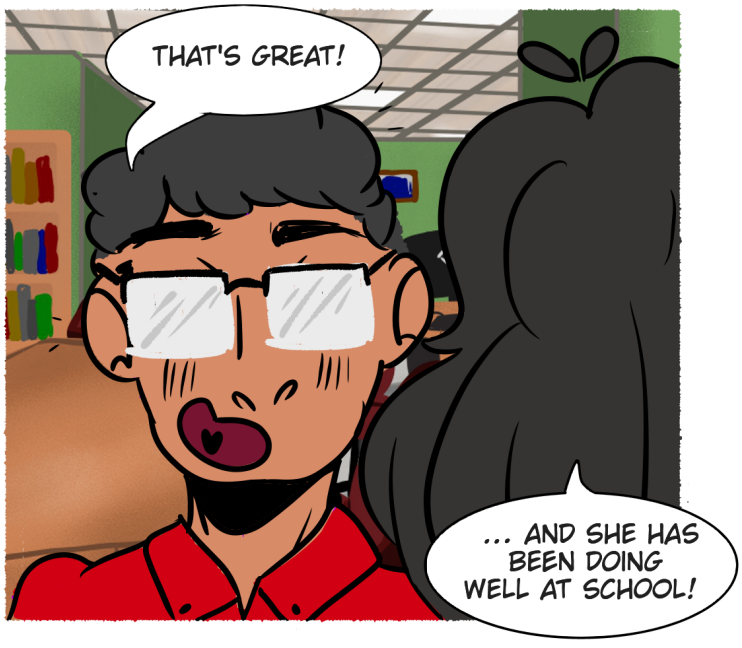
CONTACT HER: ADRIANALCAJIGAS@GMAIL.COM

CHAPTER 1: INTRODUCTION



TRANSITION TO THE BRAIN-MACHINE INTERFACE (BMI) LAB!



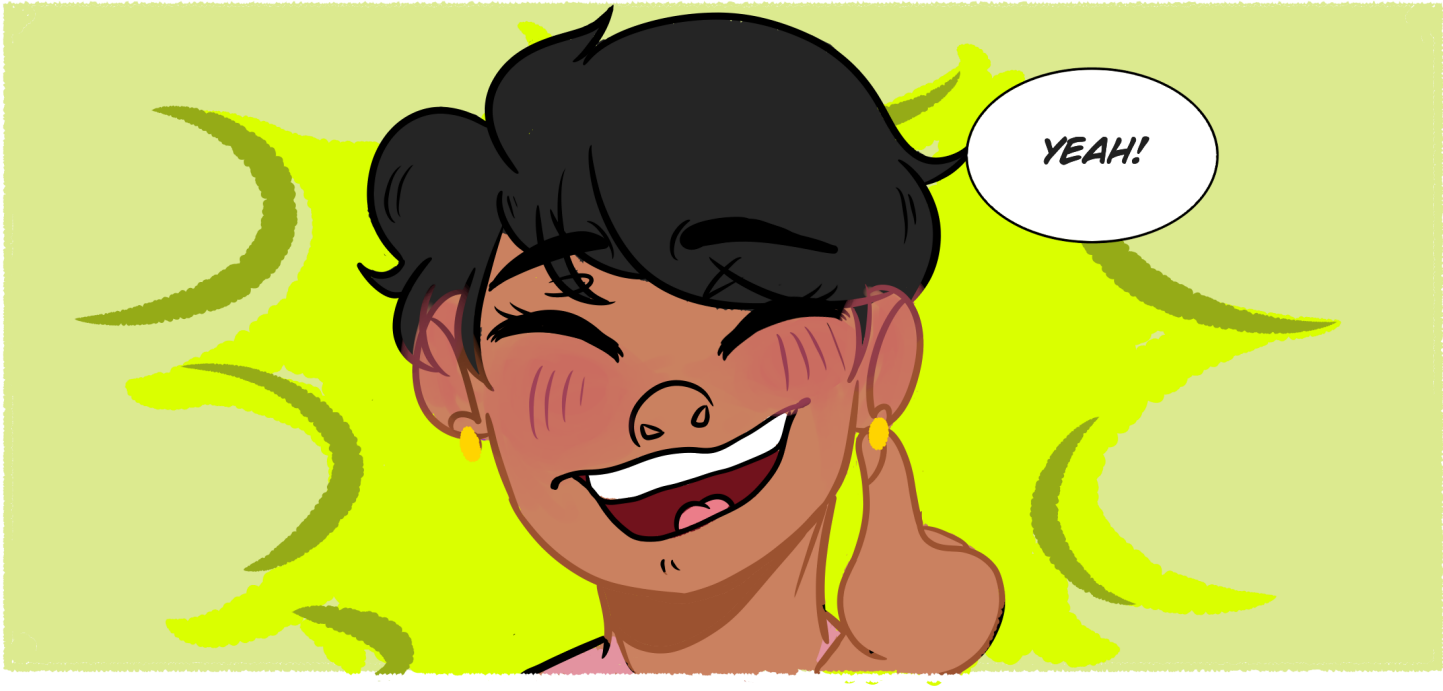


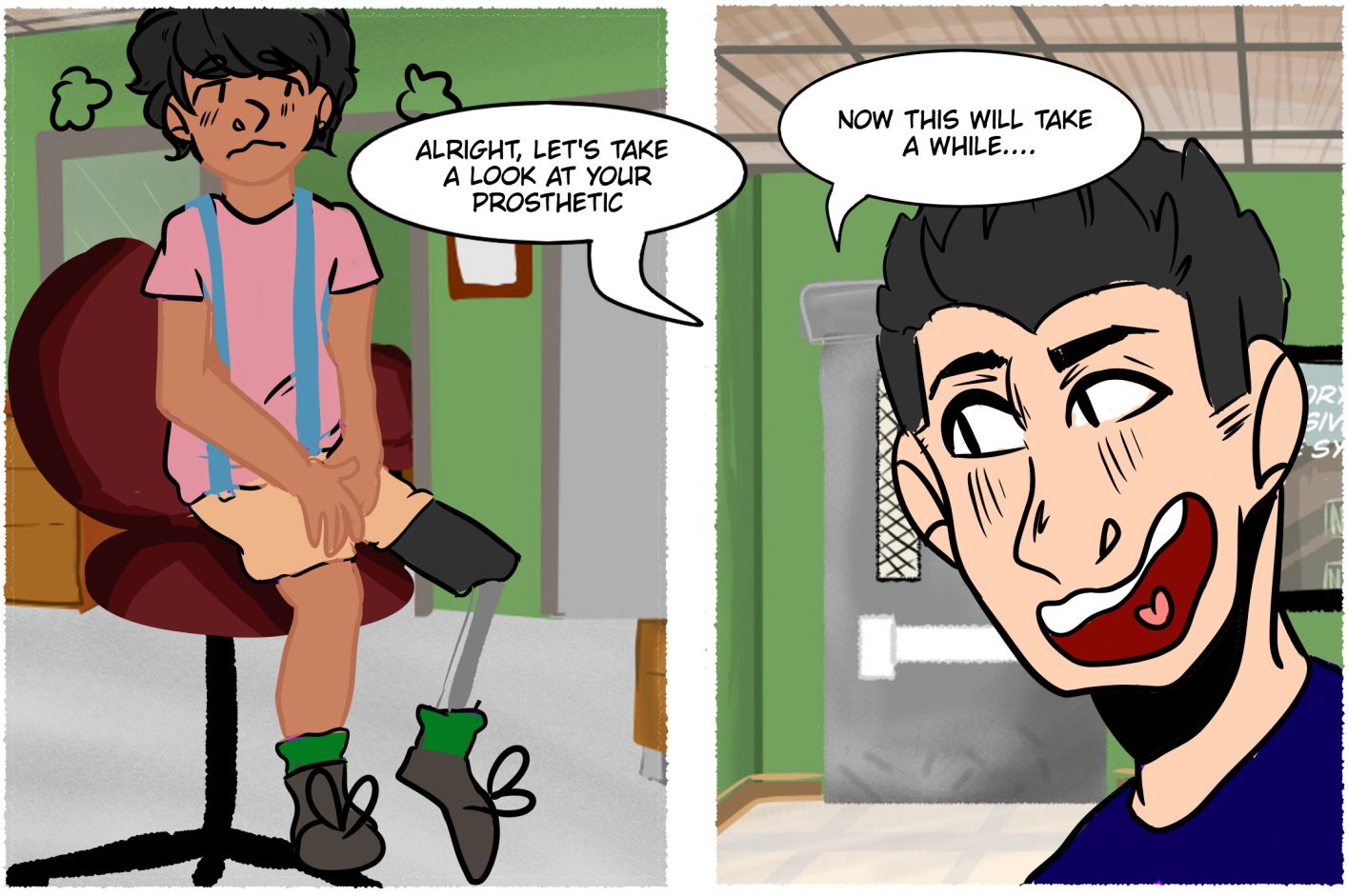

clouches
NOW BEHAVE FRANNY, I'LL BE BACK TO PICK YOU UP AT AROUND 1 OK?


OKAY!


ALRIGHT BYE BYE!
KISS


Mother leaves
SO ARE YOU READY?


YEAH!


ALRIGHT, LET'S TAKE A LOOK AT YOUR PROSTHETIC
NOW THIS WILL TAKE A WHILE....


FRAN'S IMAGINATION RUNS WILD AND SHE STARTS THINKING ABOUT THE LAB AS A FUTURISTIC CARTOON WITH ALL THE BRAIN CENTER RESEARCHERS BEING DIFFERENT CHARACTERS...

INFO BOX: THE NEURAL CONTROL OF A POWERED LIMB

BY: JUSTIN AND DANA

THE PURPOSE OF THIS PROJECT IS TO UNDERSTAND WHAT HAPPENS TO THE BRAIN AFTER SOMEONE LOSES A LIMB AND TO BUILD BETTER PROSTHETIC DEVICES THAT WORK AND FUNCTION LIKE THE REAL THING. WE RECORD SIGNALS OF THE BRAIN AND MUSCLES OF AMPUTEES WHILE WE ASK THEM TO IMAGINE MOVING THEIR MISSING LEG. WE USE THESE DATA TO BUILD A MODEL THAT ALLOWS THE AMPUTEE TO CONTROL A ROBOTIC LEG PROSTHESIS DIRECTLY FROM THEIR BRAIN SIGNALS BY ONLY THINKING ABOUT MOVING THEIR MISSING LEG!

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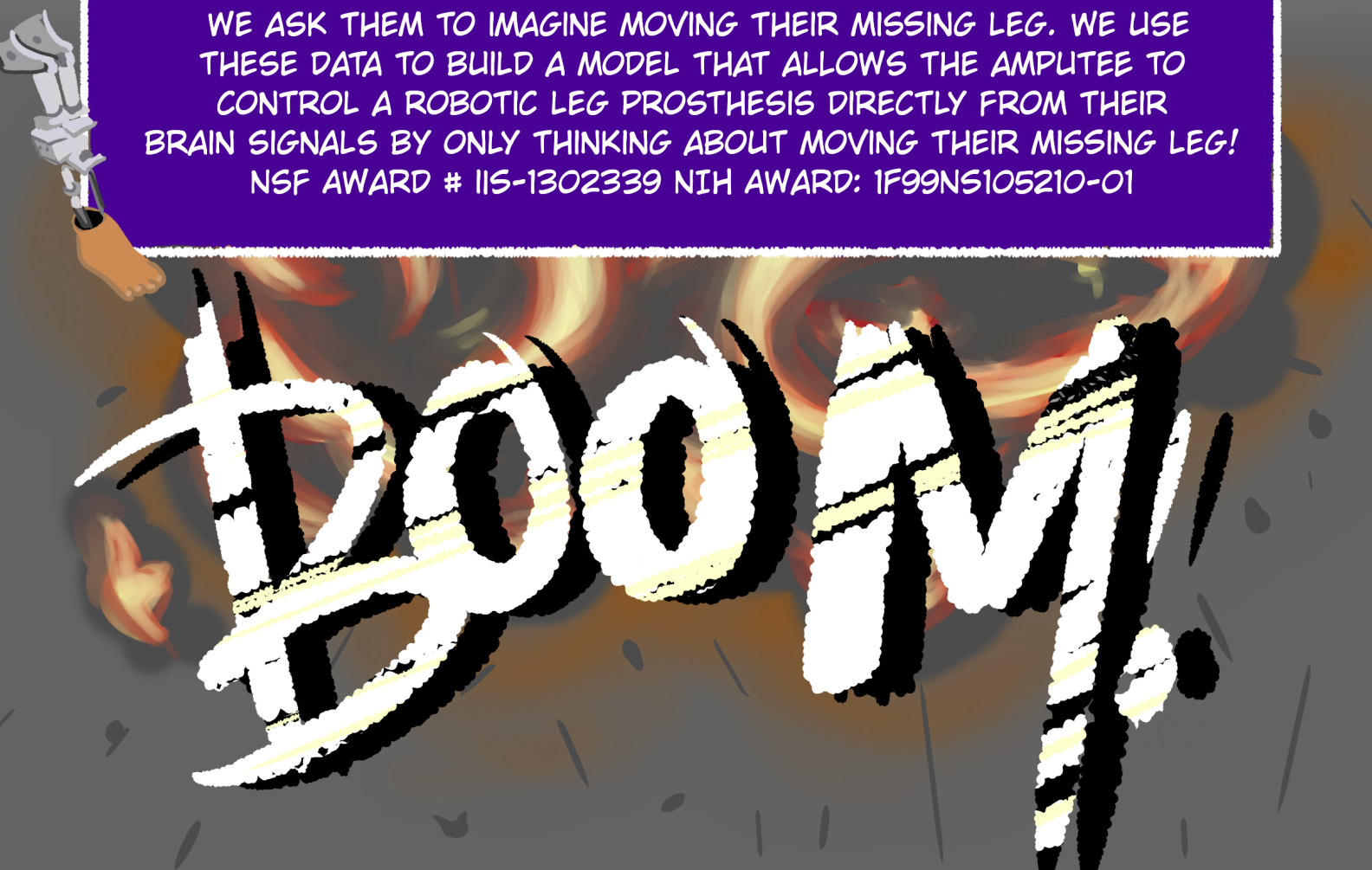
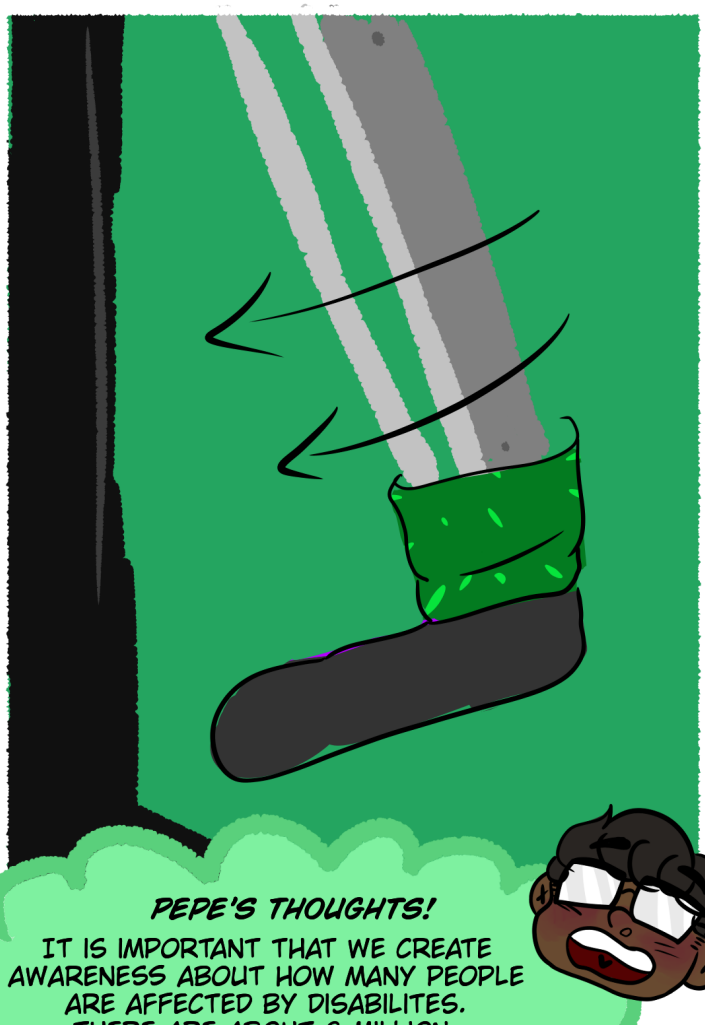


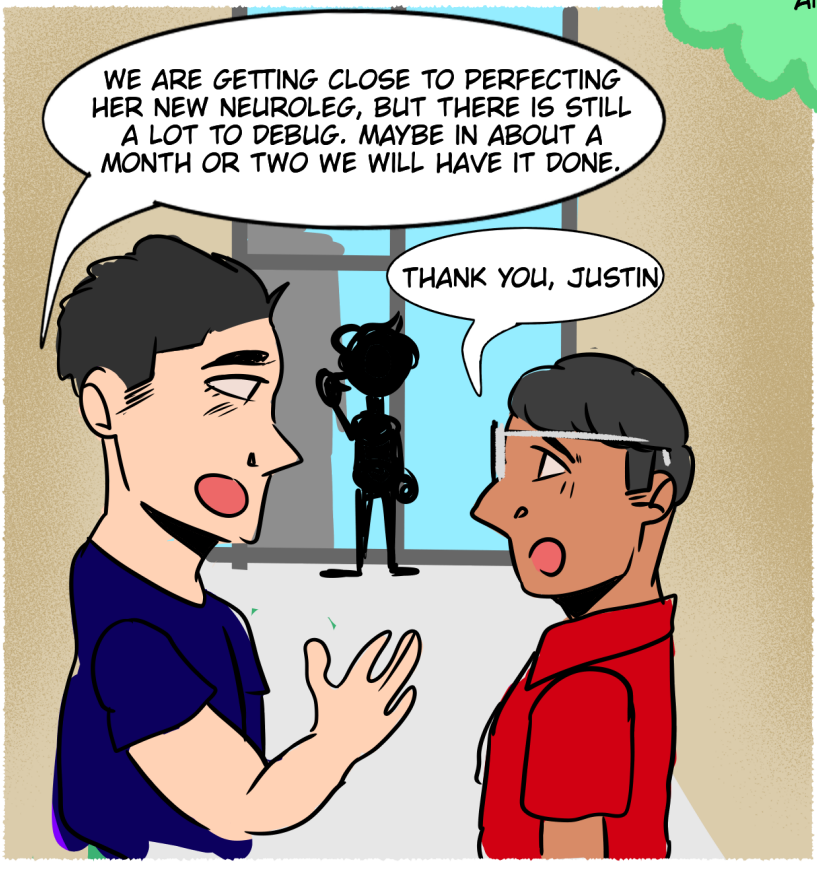

AHHHHH!
THE EVIL SHADOW MAN IS ARRIVING SOONER THAN WE EXPECTED! WE NEED TO GET F.R.A.N. READY!
YOU MEAN THE FUNCTIONING REACTING ANIMATRONIC NETHUMAN?!
F.R.A.N. SOUNDS BETTER!
THERE WE GO, DONE!



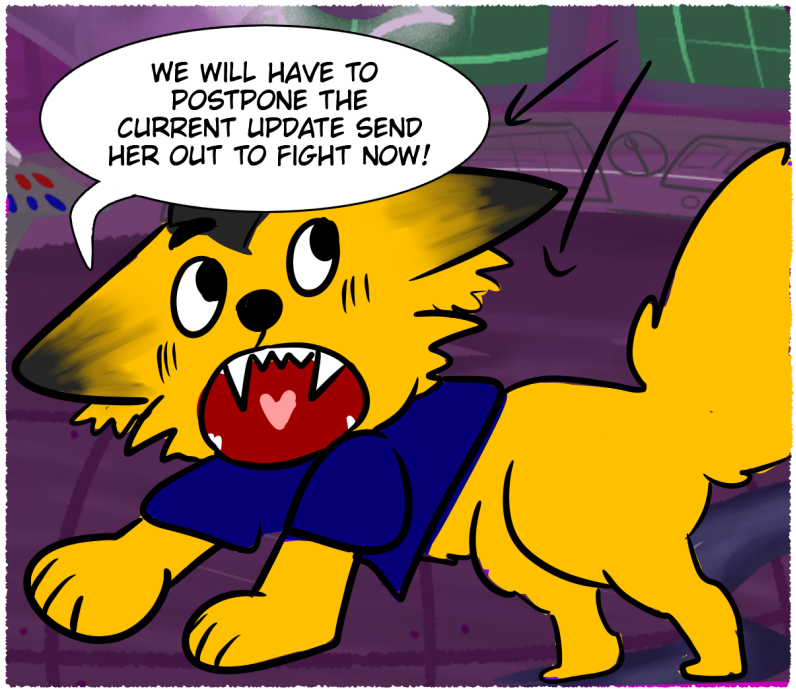
PEPE'S THOUGHTS!

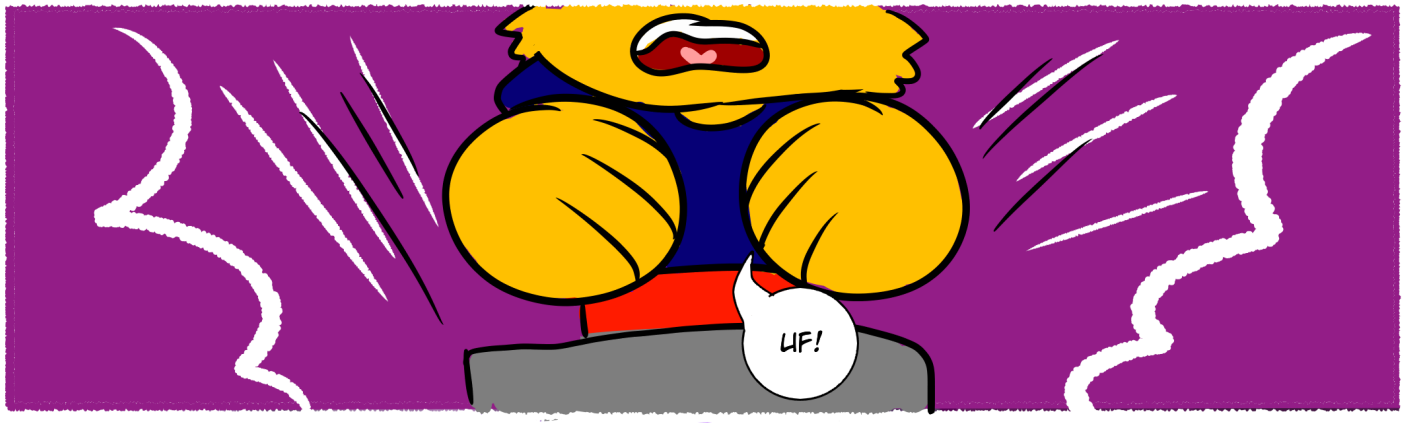
IT IS IMPORTANT THAT WE CREATE AWARENESS ABOUT HOW MANY PEOPLE ARE AFFECTED BY DISABILITES. THERE ARE ABOUT 8 MILLION PEOPLE IN THE USA WITH PARALYSIS AND ABOUT 2 MILLION MORE WITH LIMB LOST.

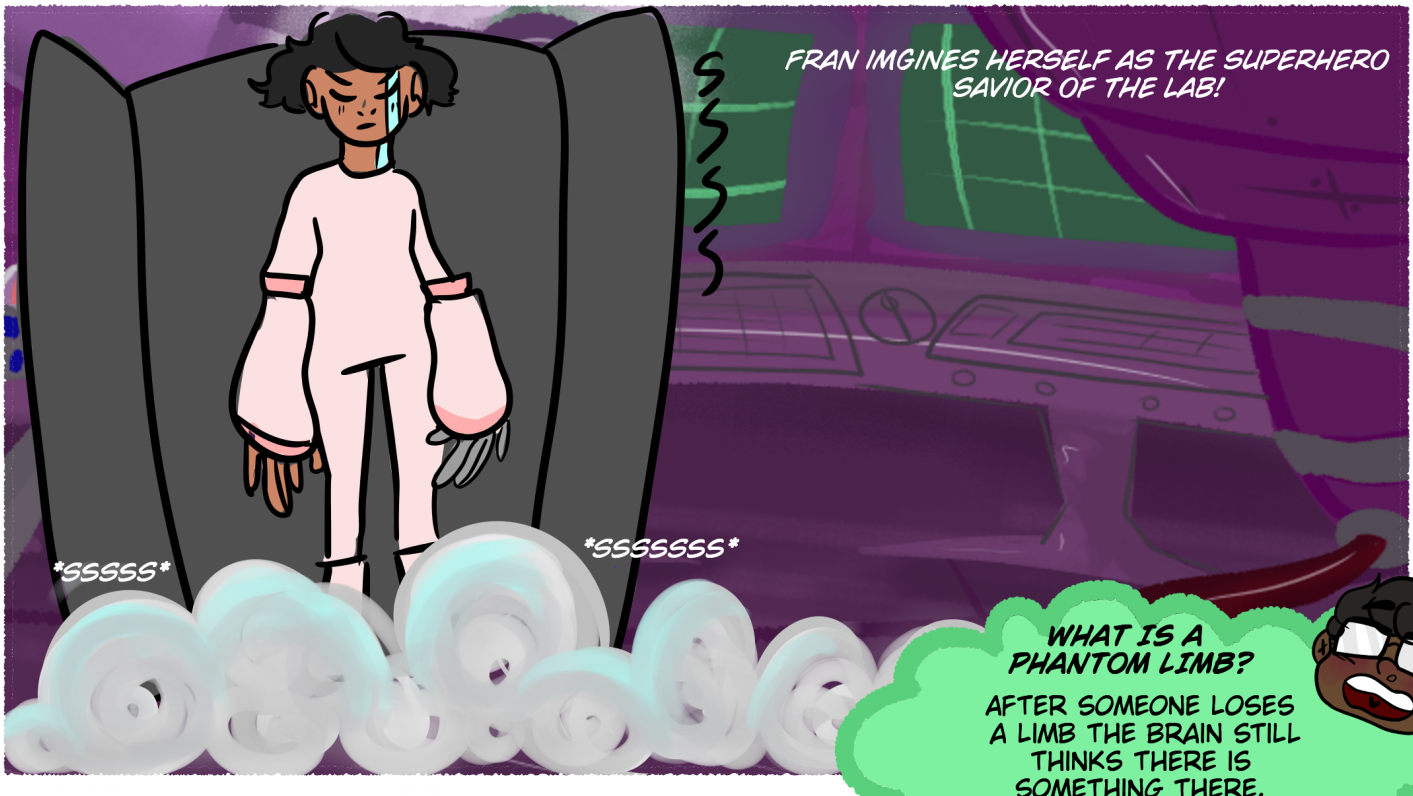
TIME SKIP!

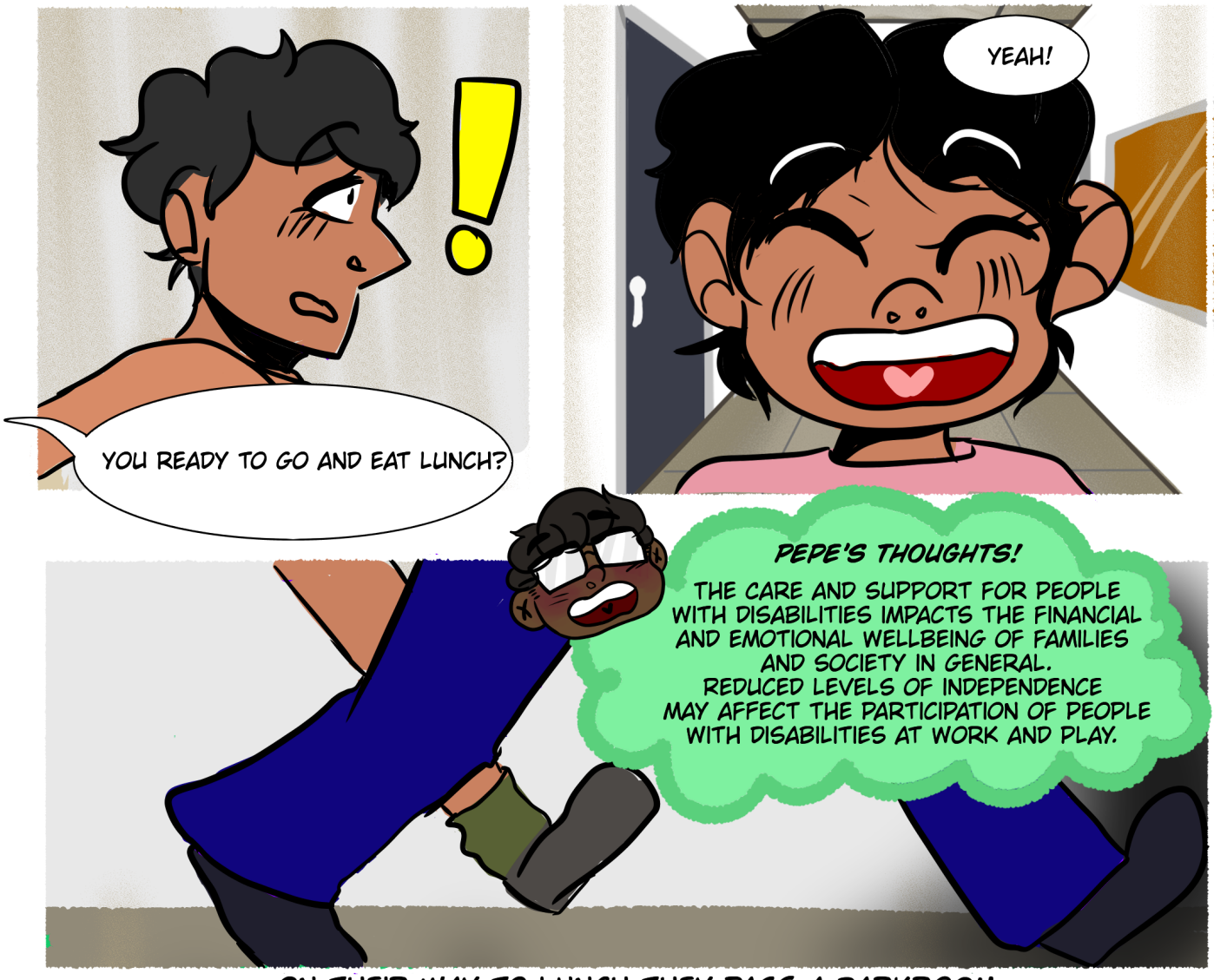



SOUR GUMMY
ATTACK!

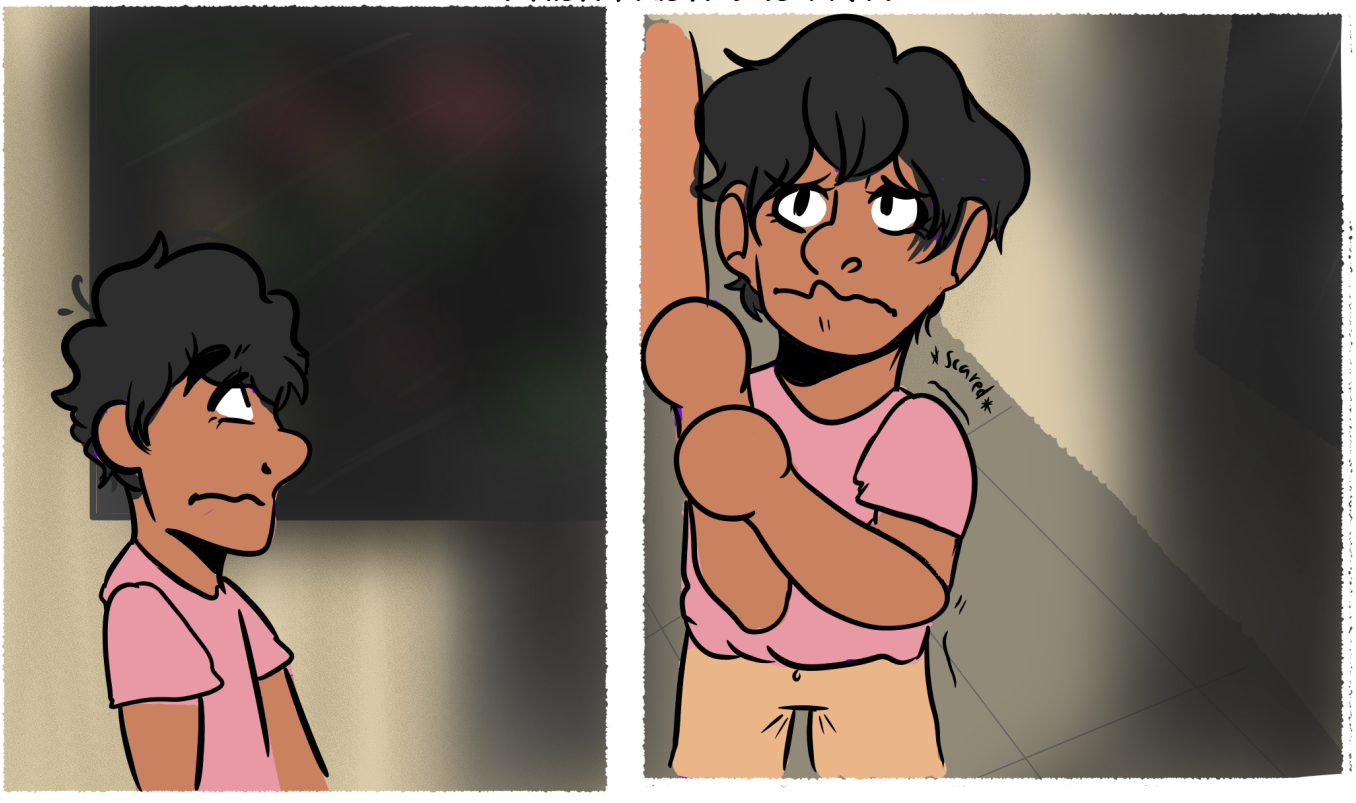

WE WILL HAVE TO POSTPONE THE CURRENT UPDATE SEND HER OUT TO FIGHT NOW!


UF!


FRAN IMGINES HERSELF AS THE SUPERHERO SAVIOR OF THE LAB!
SSSSS
SSSSSSS
WHAT IS A PHANTOM LIMB?
AFTER SOMEONE LOSES A LIMB THE BRAIN STILL THINKS THERE IS SOMETHING THERE.

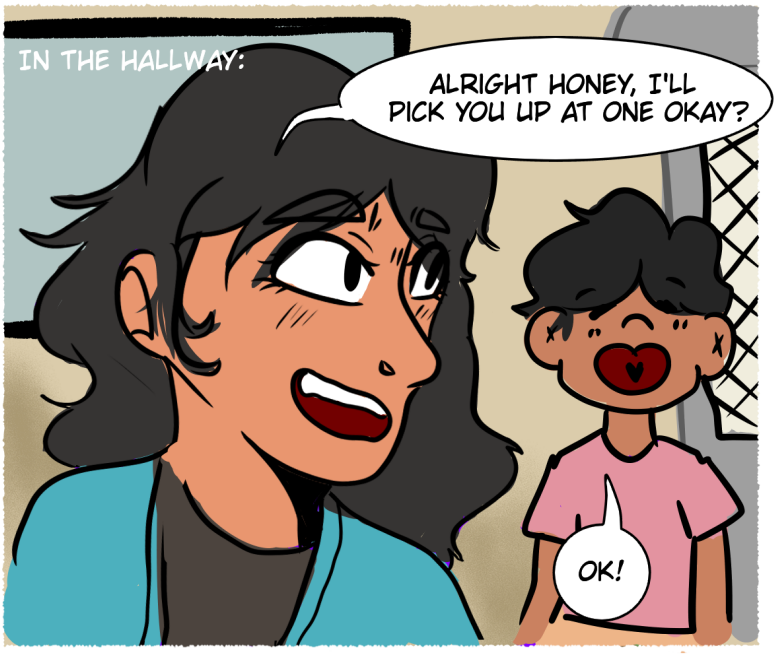


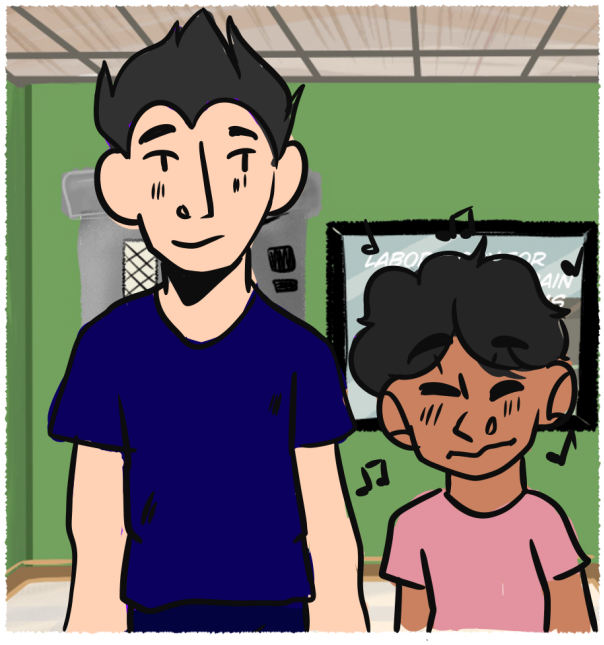
ON THEIR WAY TO LUNCH THEY PASS A DARKROOM, WHICH FRIGHTENS FRAN.

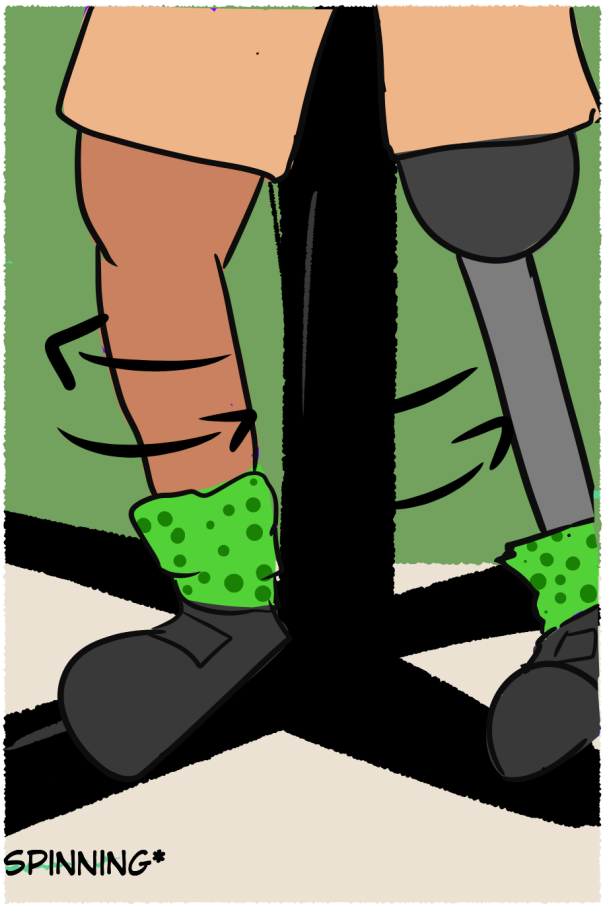


CHAPTER 2: THE SPINAL TAP

IT IS A DIFFERENT DAY NOW WHERE FRAN IS BEING DROPPED OFF ONCE MORE FOR HER NEUROLEG MEASUREMENTS. FRAN IS BACK IN THE LAB AND SHE IS BREWING UP MANY NEW IDEAS!





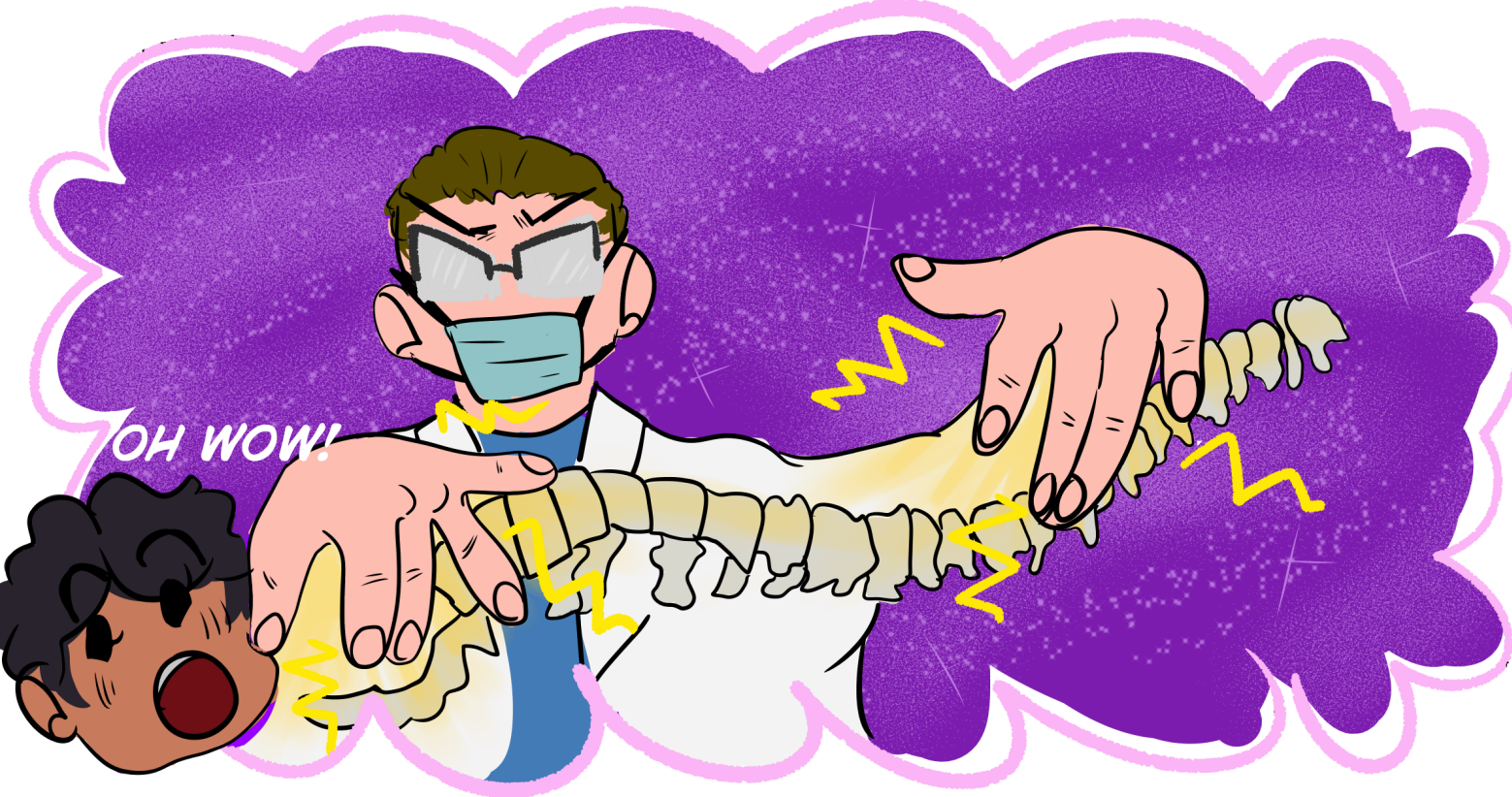



HOW ARE YOU FRAN?
I'M GOOD ALEX! I'M SO EXCITED!
HAHA, WHY?
NEXT WEEK SUMMER STARTS! AND THAT MEANS I CAN GO AND PLAY AS MUCH AS I WANT!
THAT'S COOL!
WHAT ABOUT YOU? WHAT ARE YOU DOING THIS SUMMER?
OOOO LIKE JUSTIN?
HOW SO?
WORKING ON MY PROJECT!
YES! JUST LIKE HIM! BUT MINE IS DIFFERENT


MINE IS ABOUT TREATING SPINAL CORD INJURY DIFFERENTLY AND UNLOCKING NEW WAYS TO RESTORE FUNCTION TO THEM!


HUH?

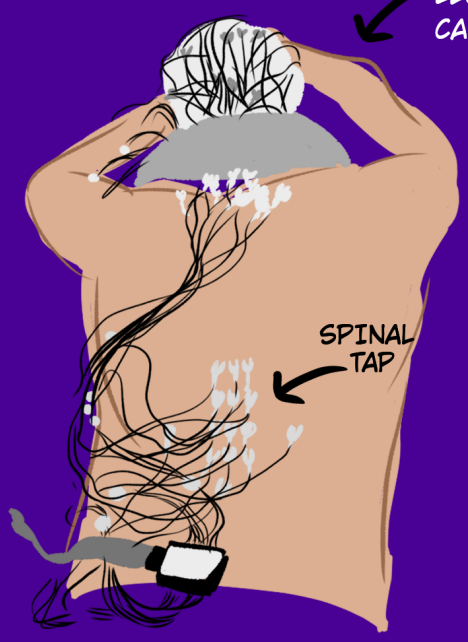

OH!...UMMMM... LET ME PUT IT IN A SIMPLER WAY! I AM TREATING THE DAMAGE IN PEOPLE'S SPINES!


OH WOW!

INFO BOX: "EEG* ASSESSMENT OF CENTRAL SENSORY NETWORK CODING DURING SPINAL STIMULATION

BY: ALEX DAVID AND JUSTIN

THE PURPOSE OF THIS PROJECT, A COLLABORATION WITH HOUSTON METHODIST, IS TO MEASURE BRAIN CHANGES WHEN WE ELECTRICALLY STIMULATE THE SPINAL CORD. THE IDEA IS TO PROVIDE A DIRECT COMMUNICATION CHANNEL BETWEEN THE SPINAL CORD AND A COMPUTER IN ORDER RESTORE MOVEMENT. THIS IS FUNDED BY IUCRC BRAIN IAB.

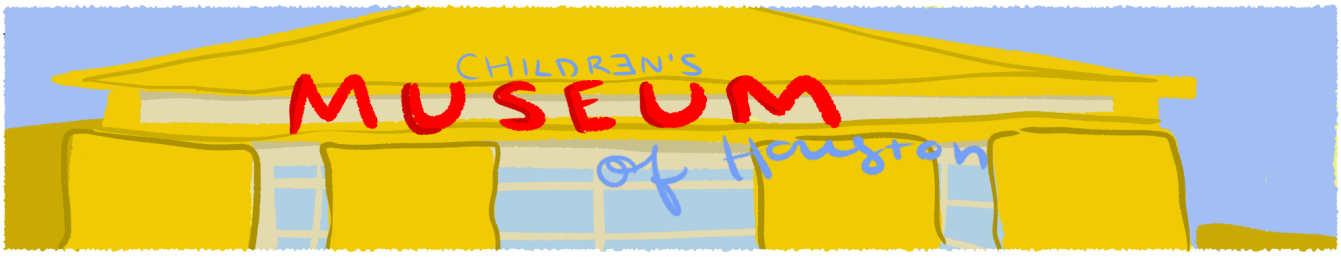


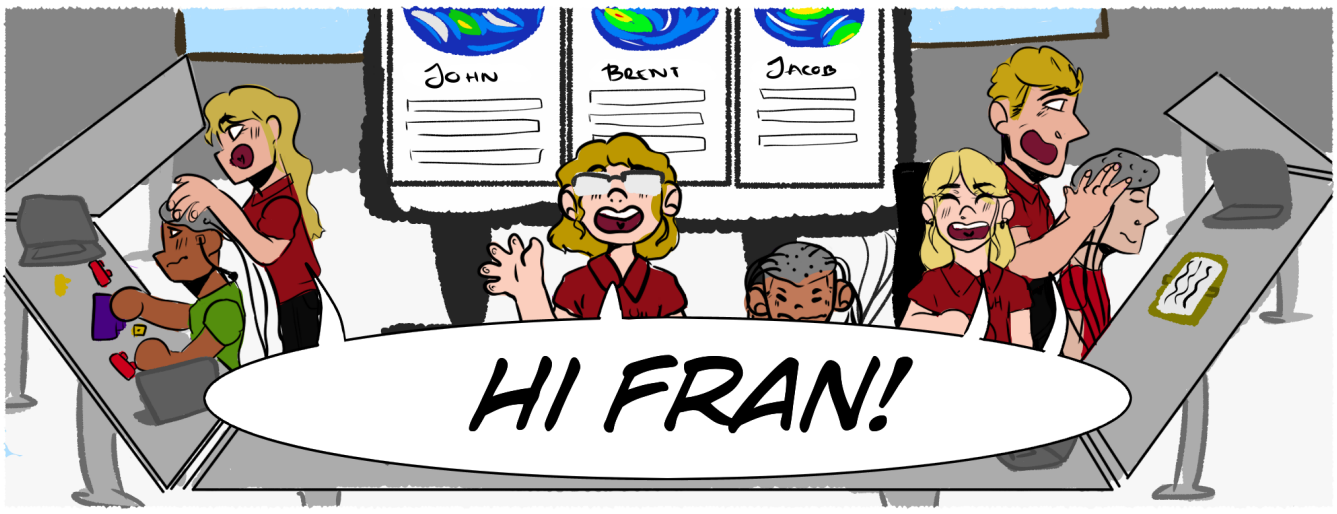
ARTISTIC RENDITION OF THE PROJECT

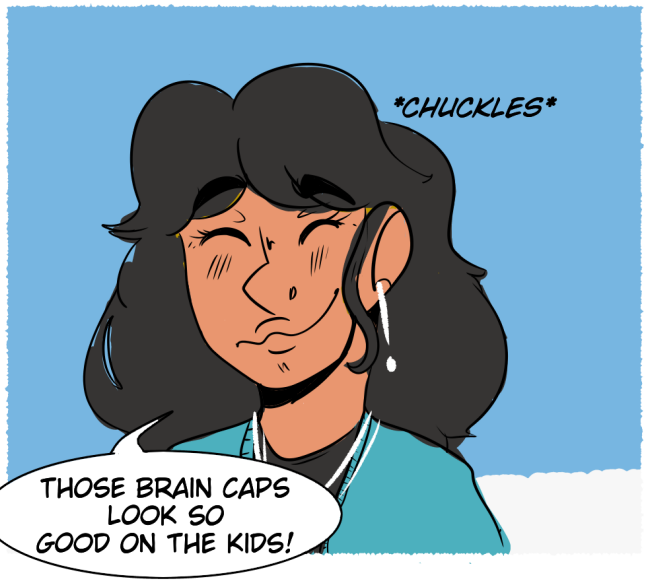
PEPE'S THOUGHTS!

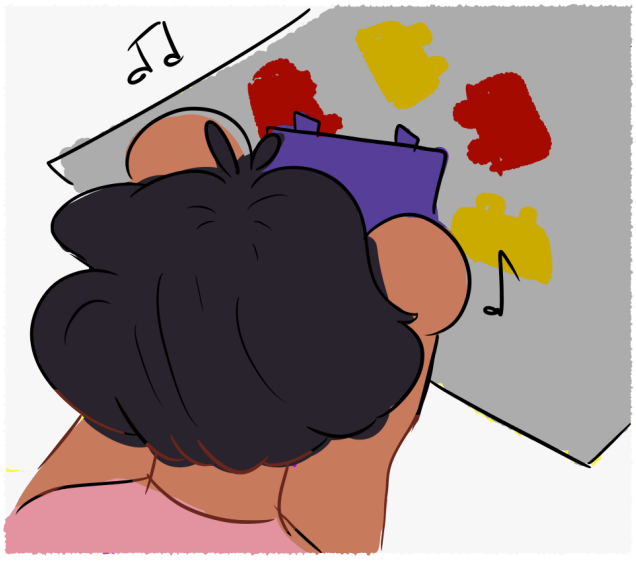
WHAT IS AN EEG*?
AN ELECTROENCEPHALOGRAM (EEG) IS A TEST THAT DETECTS ELECTRICAL ACTIVITY IN YOUR BRAIN USING SMALL, METAL DISCS (ELECTRODES) ATTACHED TO YOUR SCALP.

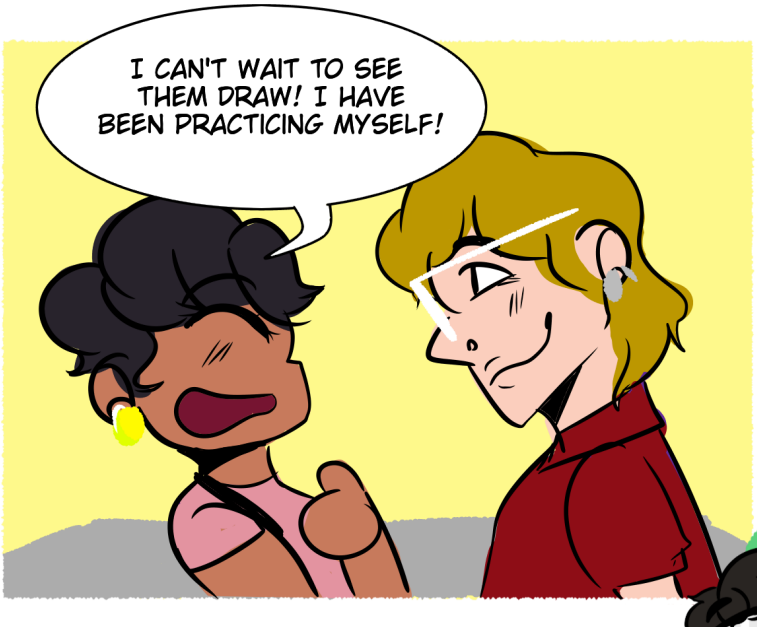
CHAPTER 3: BRAIN ON ART











INFO BOX: BRAIN ON ART

BY: JESUS

THIS PROJECT INVESTIGATES HOW CHILDREN'S CREATIVITY WORKS IN REAL LIFE. THIS IS DONE BY RECORDING BRAIN WAVES THROUGH NON-INVASIVE EEG CAPS. ONE OF THE GOALS OF THIS PROJECT IS TO SHOW THE PUBLIC HOW BRAIN ACTIVITY OCCURS AND HOW IT CHANGES DURING ART MAKING .

THE INTERNS THAT ASSIST EVERY SUMMER AT THE CHILDREN'S MUSEUM ARE PART OF THE RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU) PROGRAM FUNDED BY THE NATIONAL SCIENCE FOUNDATION.

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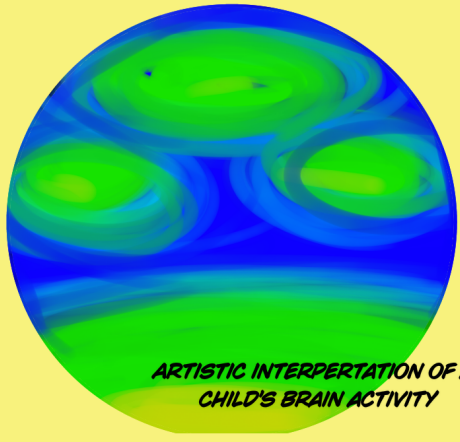
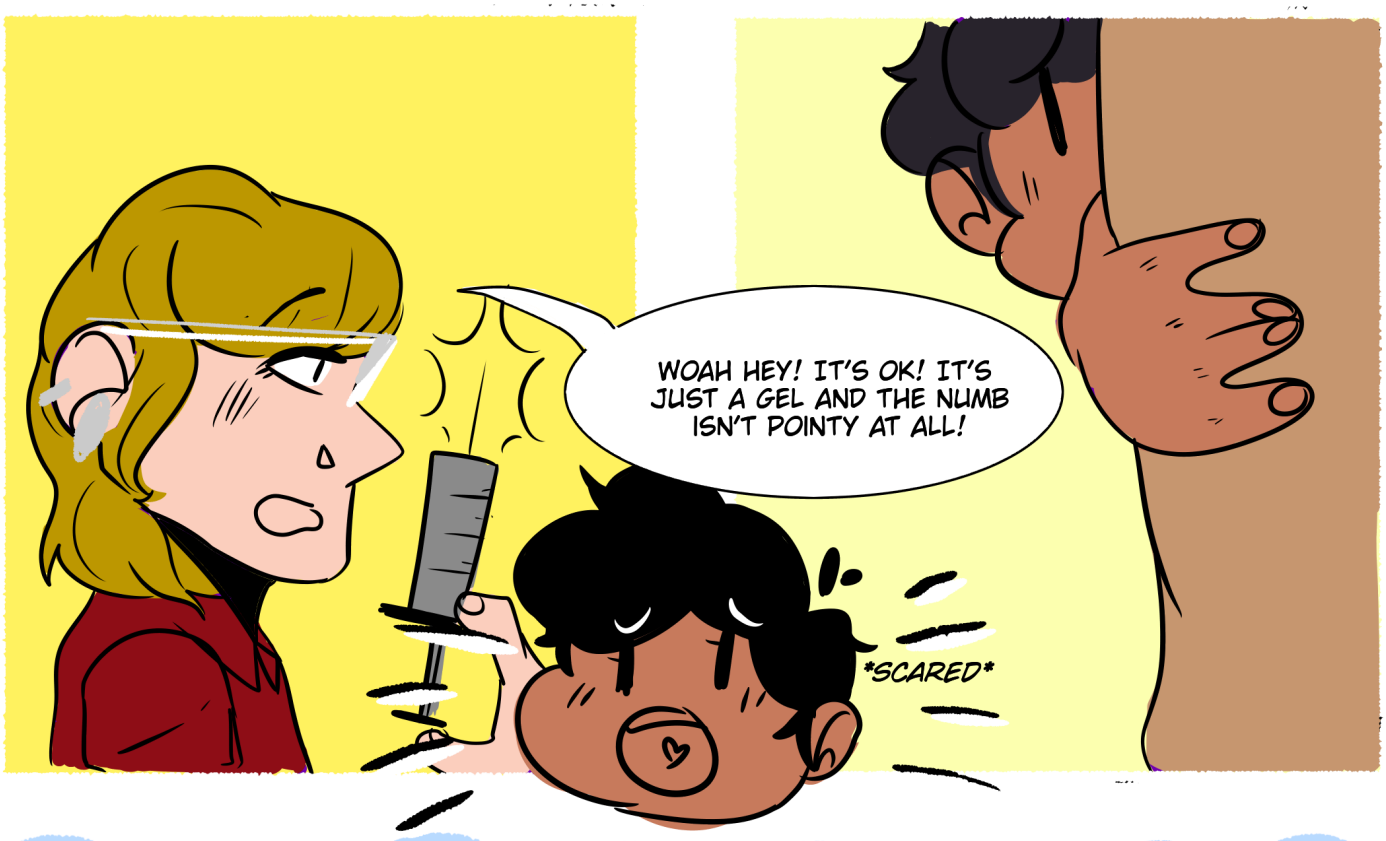
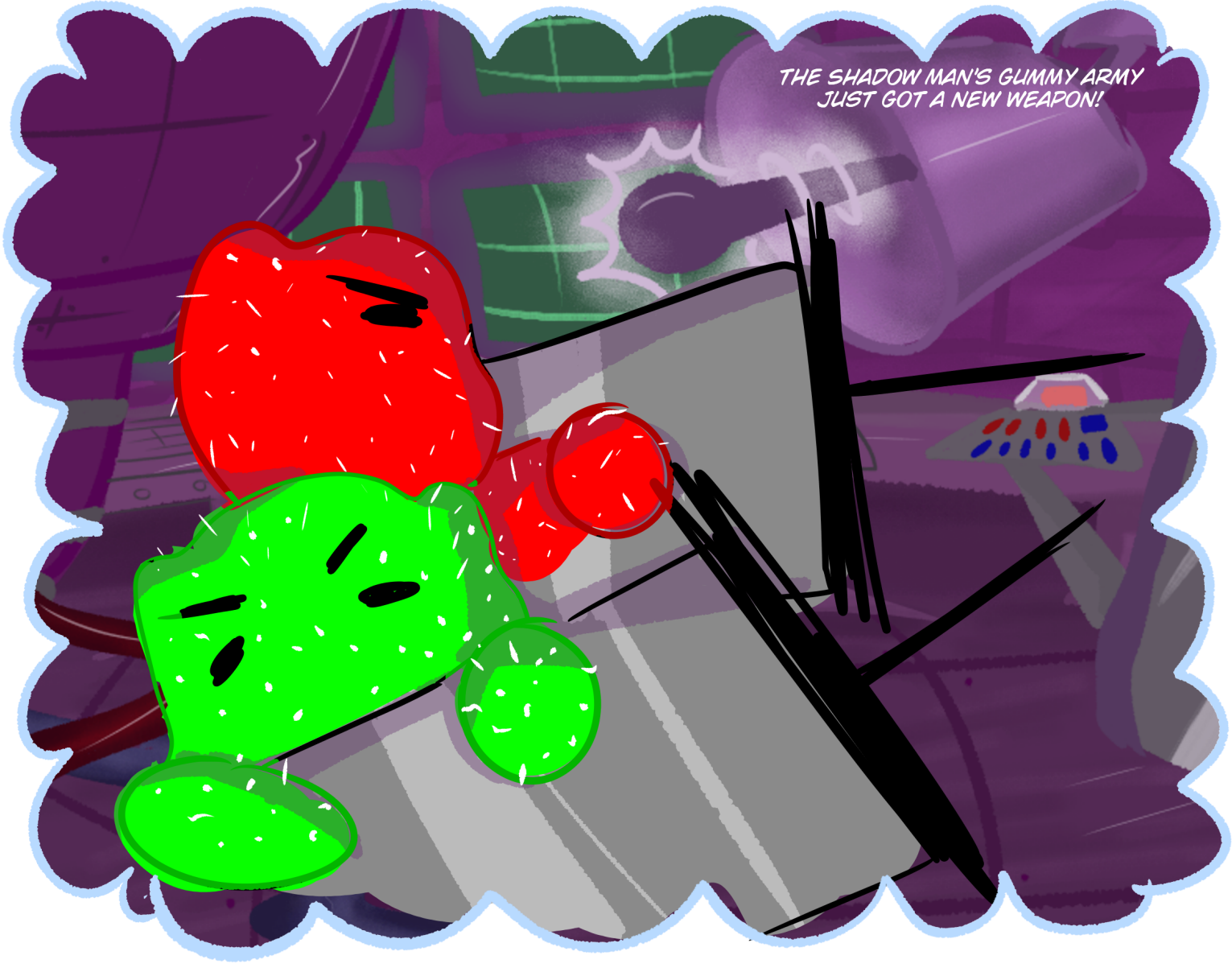


ARTISTIC INTERPERTATION OF A CHILD'S BRAIN ACTIVITY

PEPE'S THOUGHTS!

EVENTS LIKE THESE ARE CALLED STEAM OUTREACH! STEAM STANDS FOR SCIENCE, TECHNOLOGY, ENGINEERING, ART AND MATH. THESE ACTIVITIES PROMOTE STEAM LEARNING AND PARTICIPATION IN RESEARCH BY THE GENERAL PUBLIC.


WOAH HEY! IT'S OK! IT'S JUST A GEL AND THE NUMB ISN'T POINTY AT ALL!
SCARED


THE SHADOW MAN'S GUMMY ARMY JUST GOT A NEW WEAPON!


I'LL TAKE CARE OF THIS GUYS!


SEE?
OHHHHH... THAT'S SO COOL! BUT WHY?


THE GEL IS TO ENSURE THAT THE SCALP AND THE SENSORS ON THE BRAIN CAP ARE WELL CONNECTED TO RECORD THE BRAIN WAVES.
UH!


YOU THINK YOU HAVE FOOLED ME! NO! I HAVE WAY MORE UP MY SLEEVE!