MIPS
Molecular Imaging Program at Stanford

WELCOME TO

BIORENDER at MIPS

Getting started in BioRender

Reach out to **Lee Kozar (kozar@stanford.edu)** if you'd like to purchase a discounted license under Standford's subscription

*Need a lab affiliation through the Computational Services and Bioinformatics Facilities

Erica Seelemann

BSc, Neuroscience
Master of Science; Physiology and Biophysics
Dalhousie University

Science Communication Specialist
BioRender

Our Goal

Communicating science is **HARD.**

>1B Hours
spent building expensive visuals

Years
trying to move research through the pipeline

Countless
dollars wasted in errors and delays

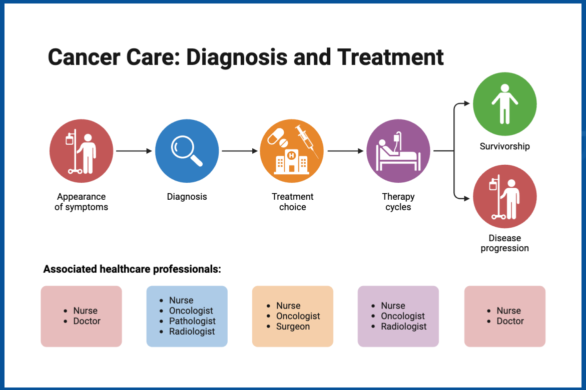
Our Goal

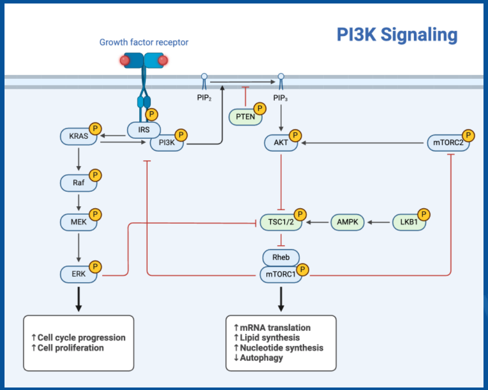
To give **everyone** the tools and practical knowledge to visually communicate their research.

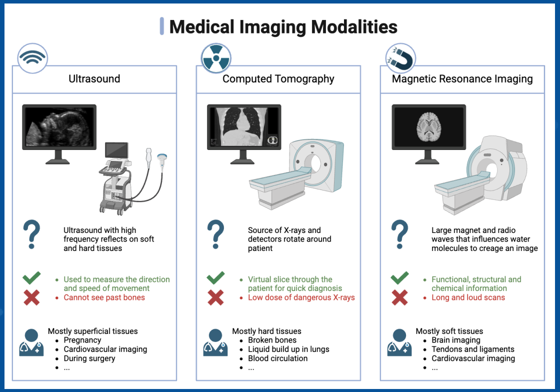
Use Cases

- Presentations
- Grant Figures
- Publications
- Protocols

- Graphical Abstracts
- Lecture Slides
- Posters
- Educational Materials

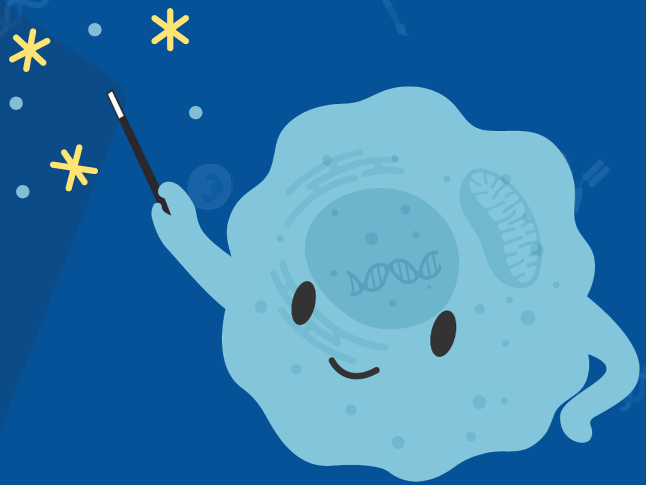






Today's Agenda

1. The Basics: Icons and Biobrushes
   - Requesting Custom Icons
   - Protein Data Bank Integration
2. Advanced Tools
   - Poster Builder
   - Graphing
3. Foundations of Design
   - Color and Contrast
   - Simple Compositions
4. Figure Makeover!



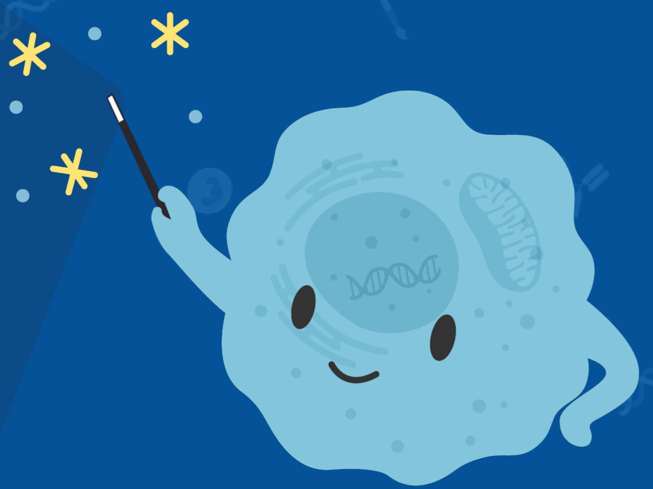
Today's Agenda

The Basics: Icons and Biobrushes
- Requesting Custom Icons
- Protein Data Bank Integration

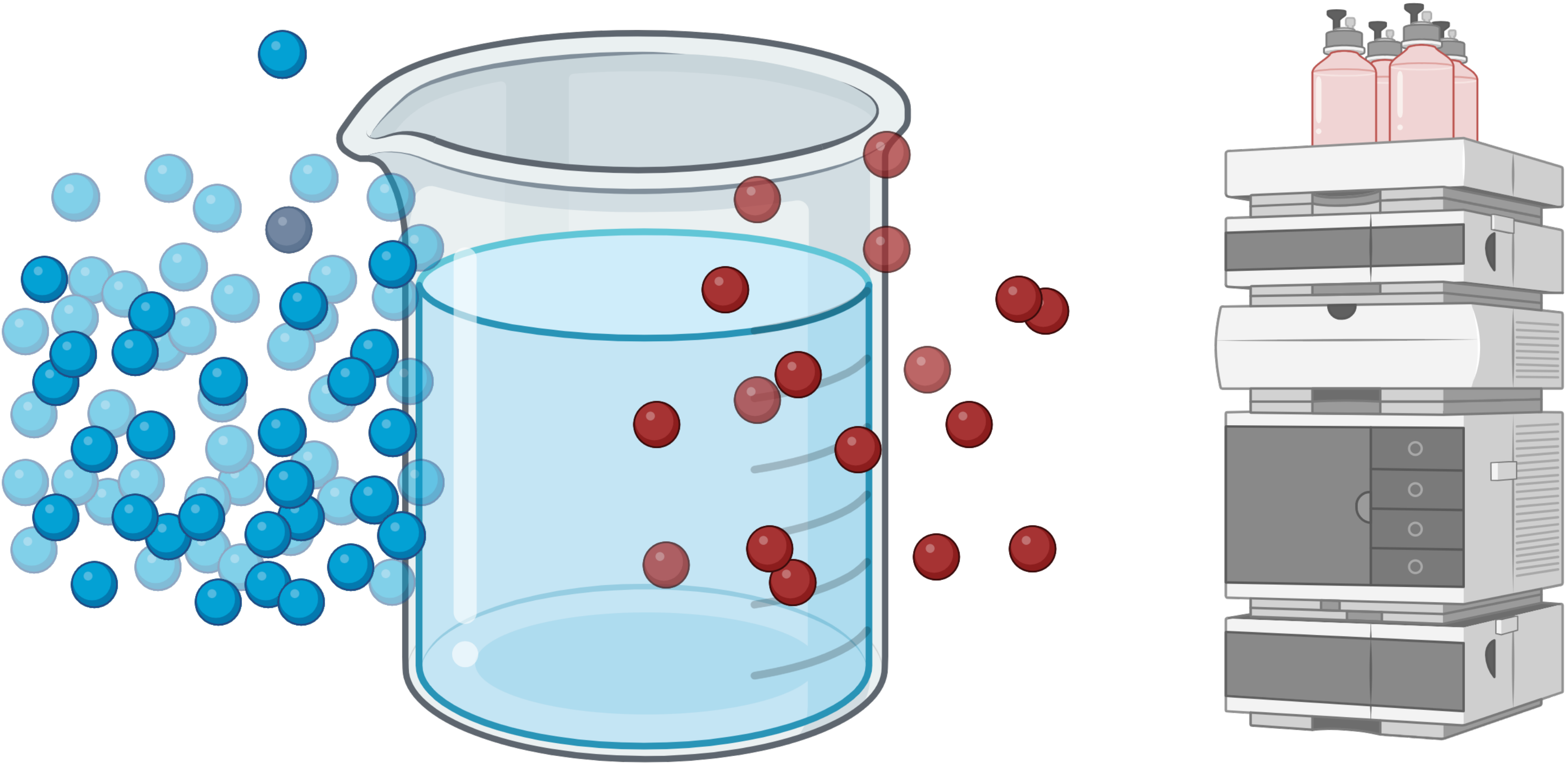
2 Advanced Tools
- Poster Builder
- Graphing

3 Foundations of Design
- Color and Contrast
- Simple Compositions

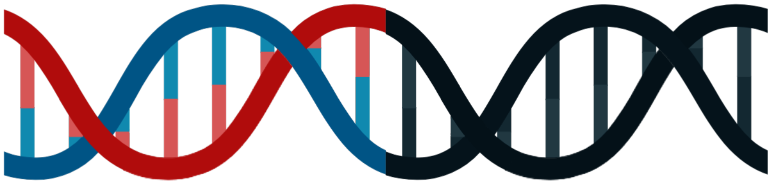
4 Figure Makeover!

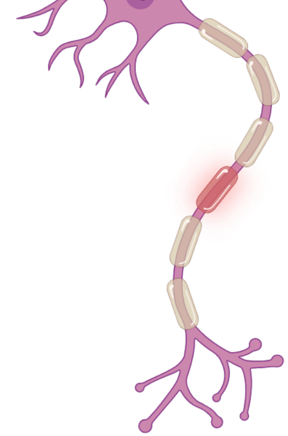


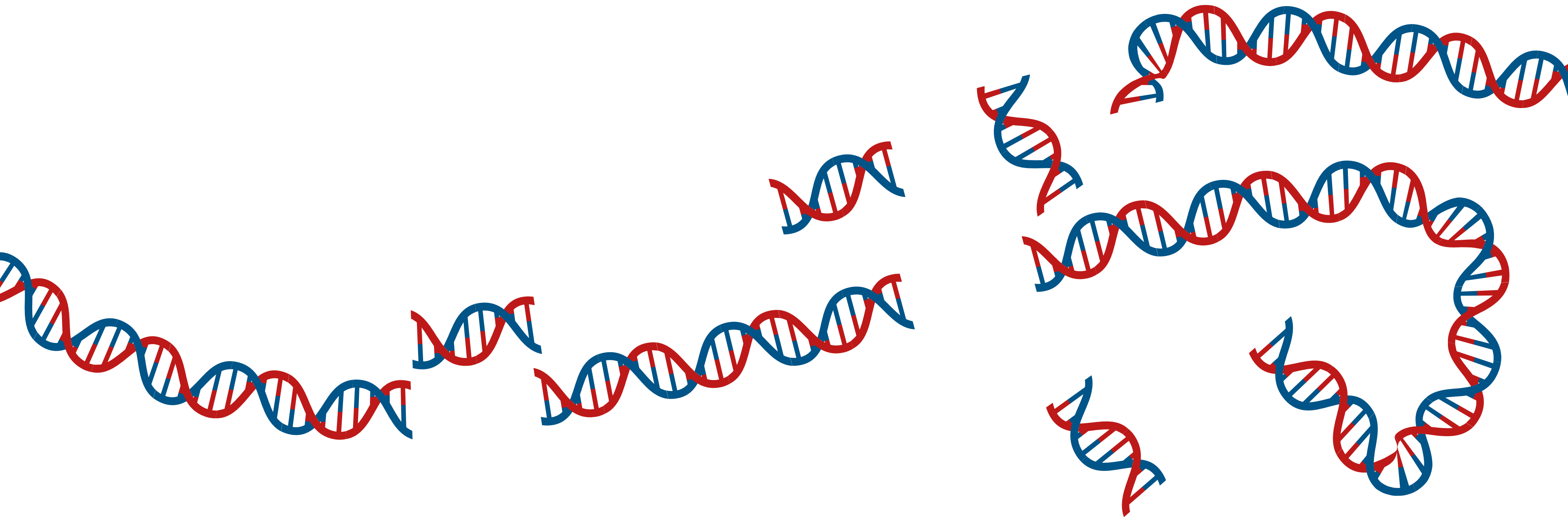
Regular and Grouped Icons



BioBrushes

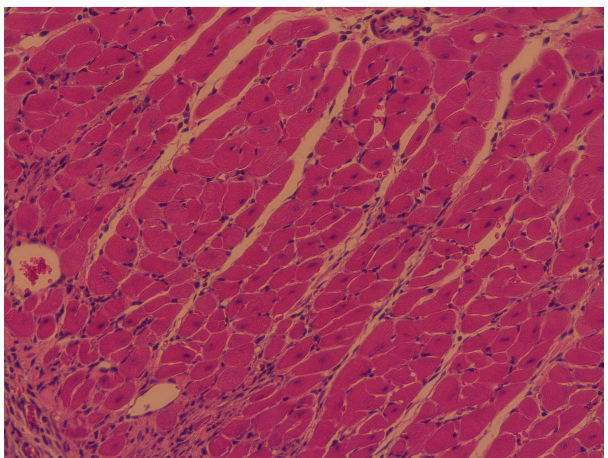


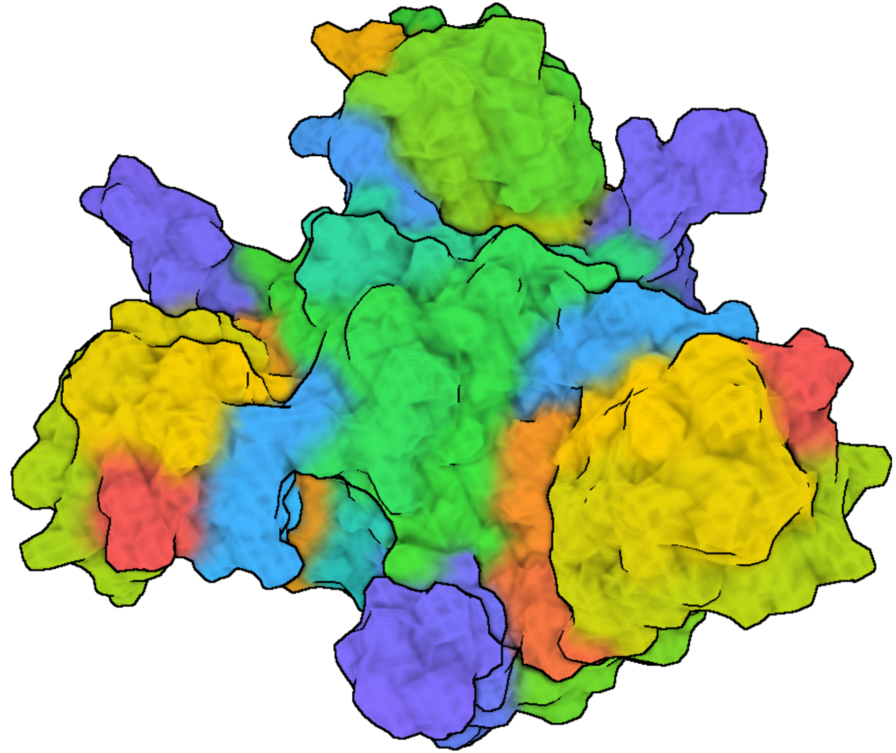




Protein Data Bank and Personal Uploads

MIPS
Molecular Imaging
Program at Stanford

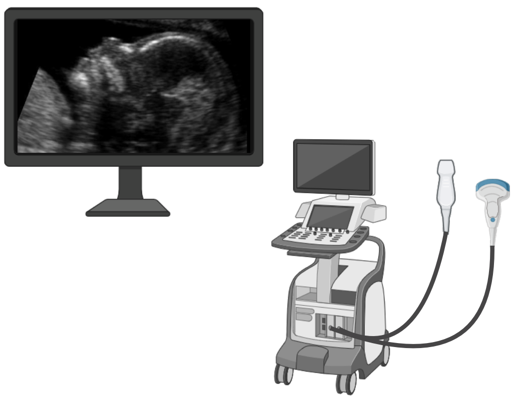




Custom Icon Requests
(2/person/year, 25-30 business day turnaround)

Medical Imaging Modalities

Ultrasound

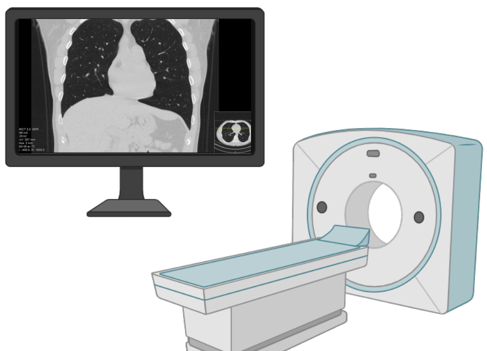


Ultrasound with high frequency reflects on soft and hard tissues

- Used to measure the direction and speed of movement
- Cannot see past bones

Mostly superficial tissues
- Pregnancy
- Cardiovascular imaging
- During surgery
- ...

Computed Tomography

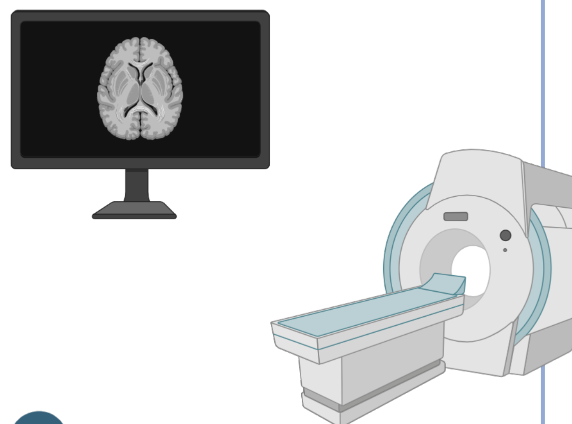


Source of X-rays and detectors rotate around patient

- Virtual slice through the patient for quick diagnosis
- Low dose of dangerous X-rays

Mostly hard tissues
- Broken bones
- Liquid build up in lungs
- Blood circulation
- ...

Magnetic Resonance Imaging



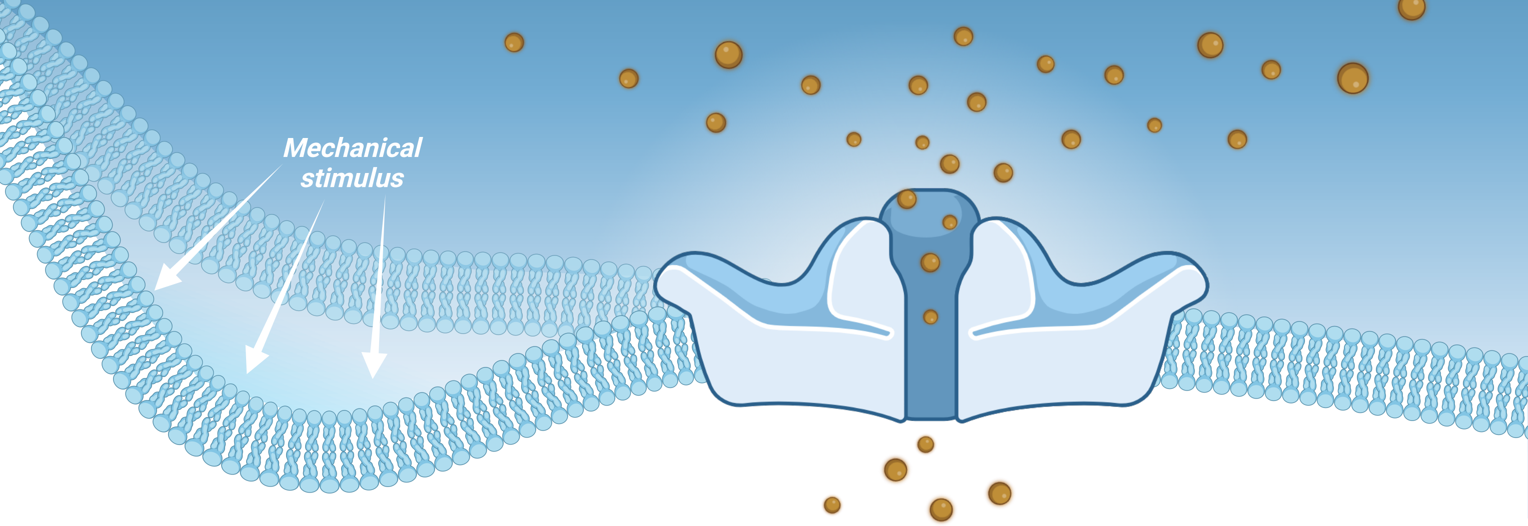
Large magnet and radio waves that influences water molecules to creage an image

- Functional, structural and chemical information
- Long and loud scans

Mostly soft tissues
- Brain imaging
- Tendons and ligaments
- Cardiovascular imaging
- ...

2021 Nobel Prize in Physiology or Medicine[1]

Essential for the Sensation of Touch: PIEZO Channels



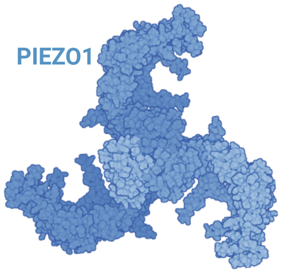
Scientist Spotlight

Dr. Ardem Patapoutian

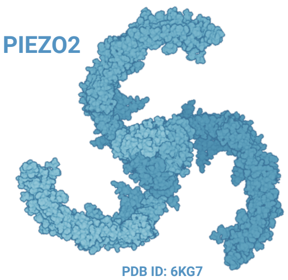
Dr. Ardem Patapoutian, PhD, is a Howard Hughes Medical Institute investigator of Scripps Research. He received the 2021 Nobel Prize in Physiology or Medicine (jointly).

His research focuses on the mechanisms underlying somatosensation - specifically ion channels that are responsible for the ability to sense heat and mechanical stress.

Molecular Structures of PIEZO Channels



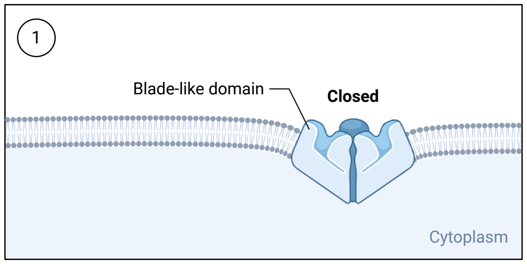
PDB ID: 6B3R
View from inside the cell

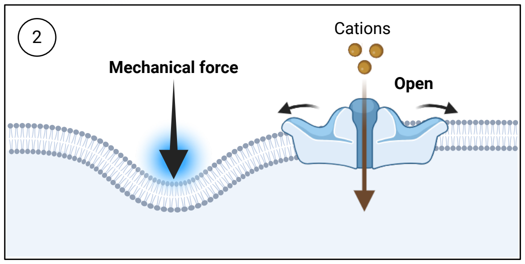


PDB ID: 6KG7
View from inside the cell

Both PIEZO1 and PIEZO2 have a three-bladed, propeller-like structure. Both are homotrimeric - the three subunits come together to form the central membrane-spanning pore. They contain nine repetitive units, each with four transmembrane helices.

PIEZO Channels: How Do They Allow Mechanosensation?





PIEZO1 and PIEZO2 are both **mechanically-activated cation channels.** Based on protein structure, it was predicted that the 'blades' of the PIEZO channels undergo a lever-like flattening motion upon application of mechanical stress. This opens up their central pore, allowing an influx on positive charge. The exact mechanism by which mechanical force leads to the central pore opening is not fully understood.

Relevance of PIEZO Channels in Physiology and Medicine

Since their discovery, PIEZO1 and PIEZO2 have been proven to be critical mechanosensors throughout the human body, contributing to multiple important physiological processes.

Lungs

PIEZO2 acts as an airway stretch sensor in respiratory tissue and is critical for normal breathing.

Blood pressure

Both PIEZO1 and PIEZO2 act as baroreceptors and are essential in blood pressure regulation.

Vascular cells

PIEZO1 is an important sensor of shear stress in vasculature and required for embryonic vascular development.

Bladder

PIEZO2 is a sensor for stretch in the bladder urothelium and innervating sensory neurons.

Malaria

Polymorphisms and mutations in PIEZO1 have been shown to protect against symptoms of malaria.

Immune cells

PIEZO1 regulates macrophage phagocytic activity and thereby facilitates erythrocyte turnover.

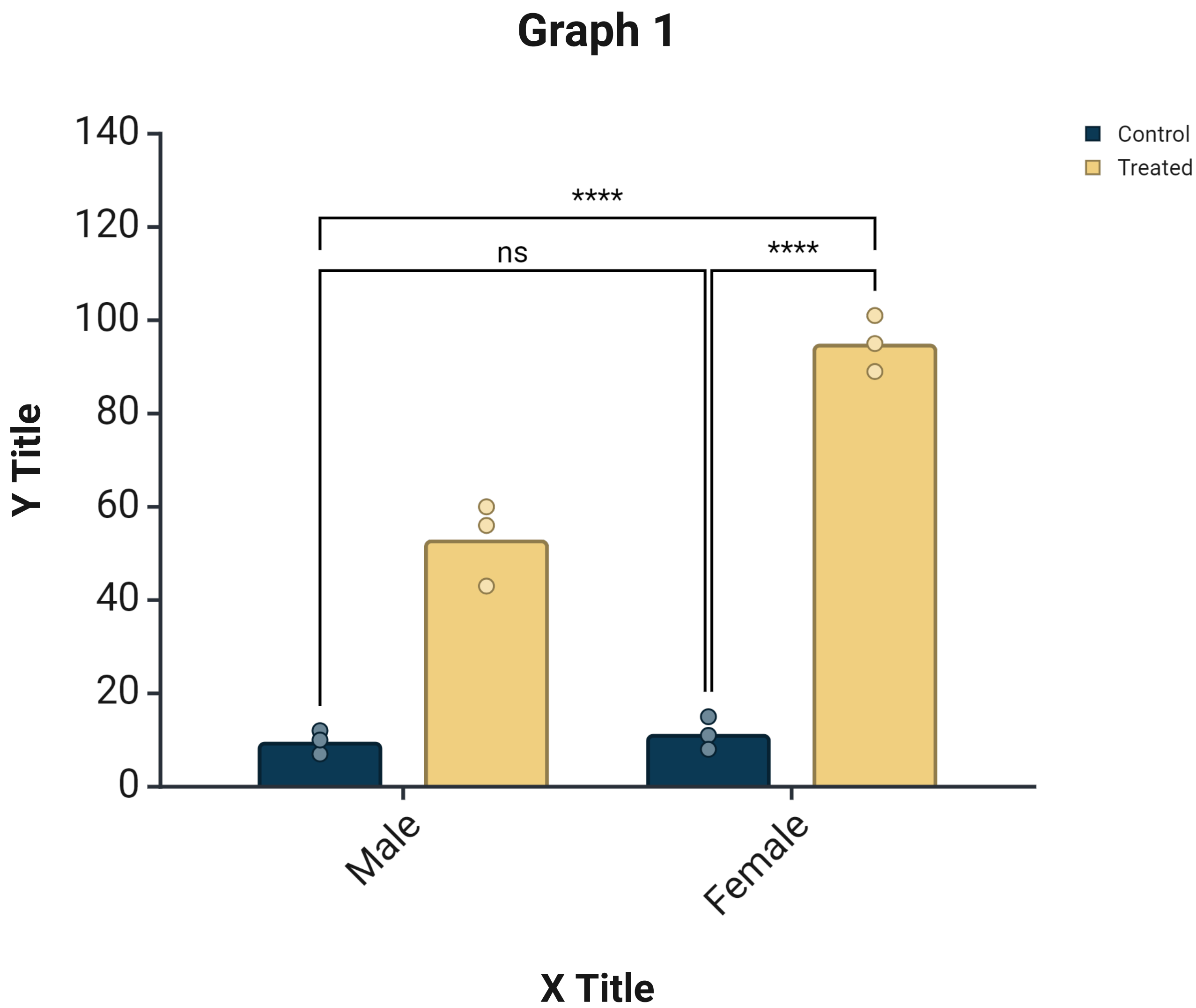
1. ®© The Nobel Foundation
2. "Lab Members." The Patapoutian Lab, https://patapoutianlab.org/people
3. Advanced information. NobelPrize.org. Nobel Prize Outreach AB 2021. Tue. 2 Nov 2021. <https://www.nobelprize.org/prizes/medicine/2021/advanced-information/>
4. Piezo1 and Piezo2 are essential components of distinct mechanically activated cation channels (2010) PMID: 20813920
5. Structure-based membrane dome mechanism for Piezo mechanosensitivity (2017), PMID: 29231809
6. Structure and mechanogating of the mammalian tactile channel PIEZO2 (2019), PMID: 31435011
7. Piezo2 senses airway stretch and mediates lung inflation-induced apnoea (2017) PMID: 28002412
8. PIEZOs mediate neuronal sensing of blood pressure and the baroreceptor reflex (2018) PMID: 30361375
9. Piezo1 integration of vascular architecture with physiological force (2014), PMID: 25119035
10. Piezo1, a mechanically activated ion channel, is required for vascular development in mice (2014), PMID: 24958852
11. PIEZO2 in sensory neurons and urothelial cells coordinates urination (2020), PMID: 33057202
12. Common PIEZO1 Allele in African Populations Causes RBC Dehydration and Attenuates Plasmodium Infection (2018), PMID: 29576450
13. A common polymorphism in the mechanosensitive ion channel PIEZO1 is associated with protection from severe malaria in humans (2020), PMID: 32265284
14. Common PIEZO1 Allele in African Populations Causes RBC Dehydration and Attenuates Plasmodium Infection (2018), PMID: 29576450
15. A role of PIEZO1 in iron metabolism in mice and humans (2021) PMID: 33571427

Today's Agenda

1. The Basics: Icons and Biobrushes
    - Requesting Custom Icons
    - Protein Data Bank Integration

Advanced Tools
  - Poster Builder
  - Graphing

3. Foundations of Design
    - Color and Contrast
    - Simple Compositions
4. Figure Makeover!

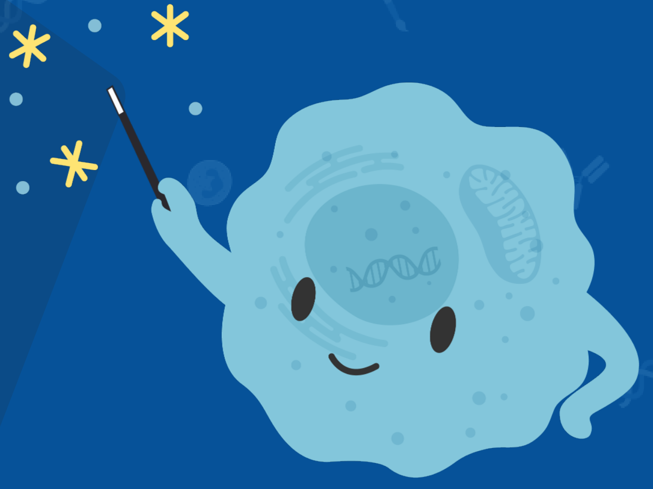

Graph 1
Y Title
140
120
100
80
60
40
20
0
Control
Treated
****
ns
****
Male
Female
X Title

Today's Agenda

1. The Basics: Icons and Biobrushes
   - Requesting Custom Icons
   - Protein Data Bank Integration
2. Advanced Tools
   - Poster Builder
   - Graphing

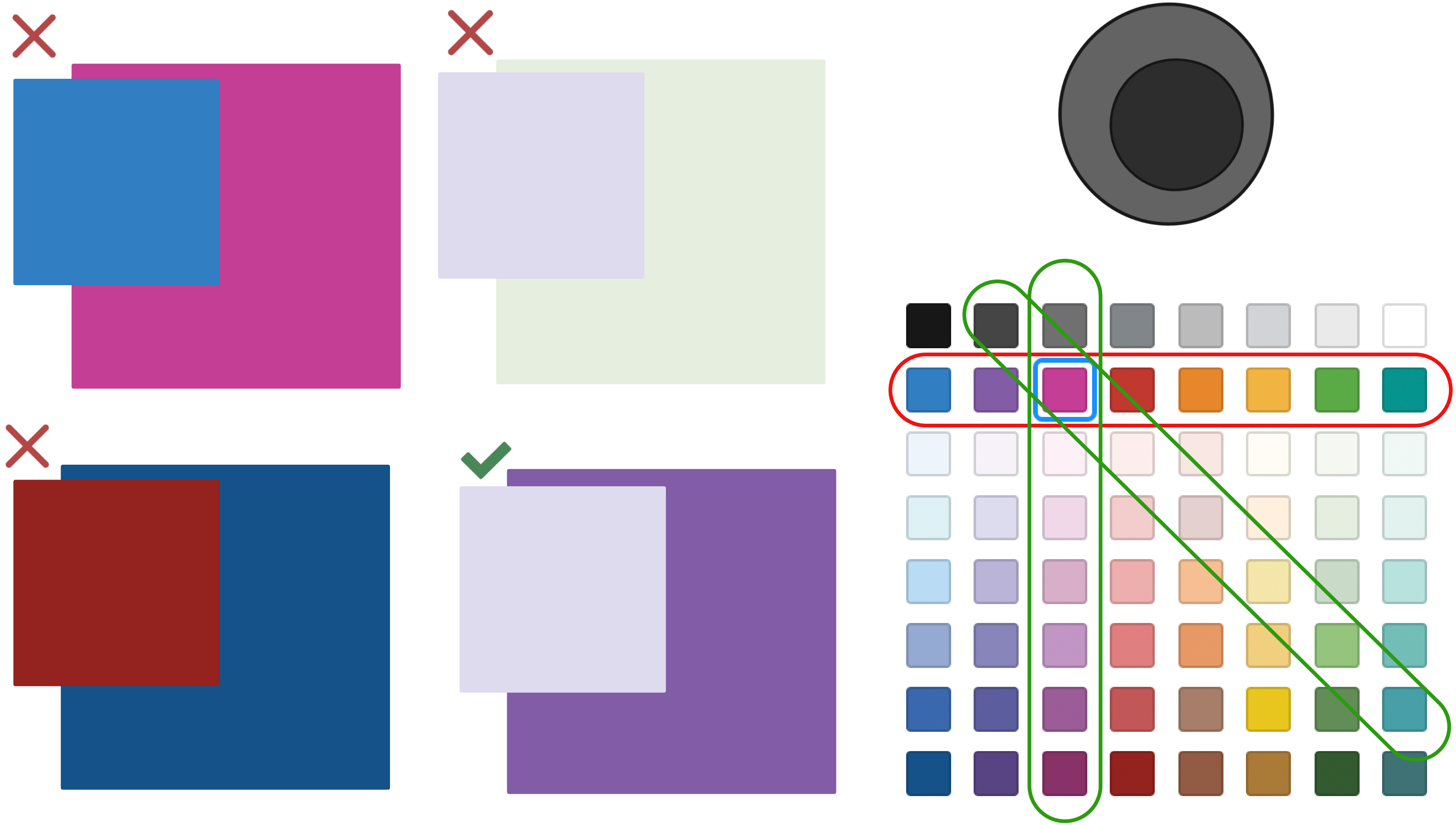
Foundations of Design
   - Color and Contrast
   - Simple Compositions

4. Figure Makeover!

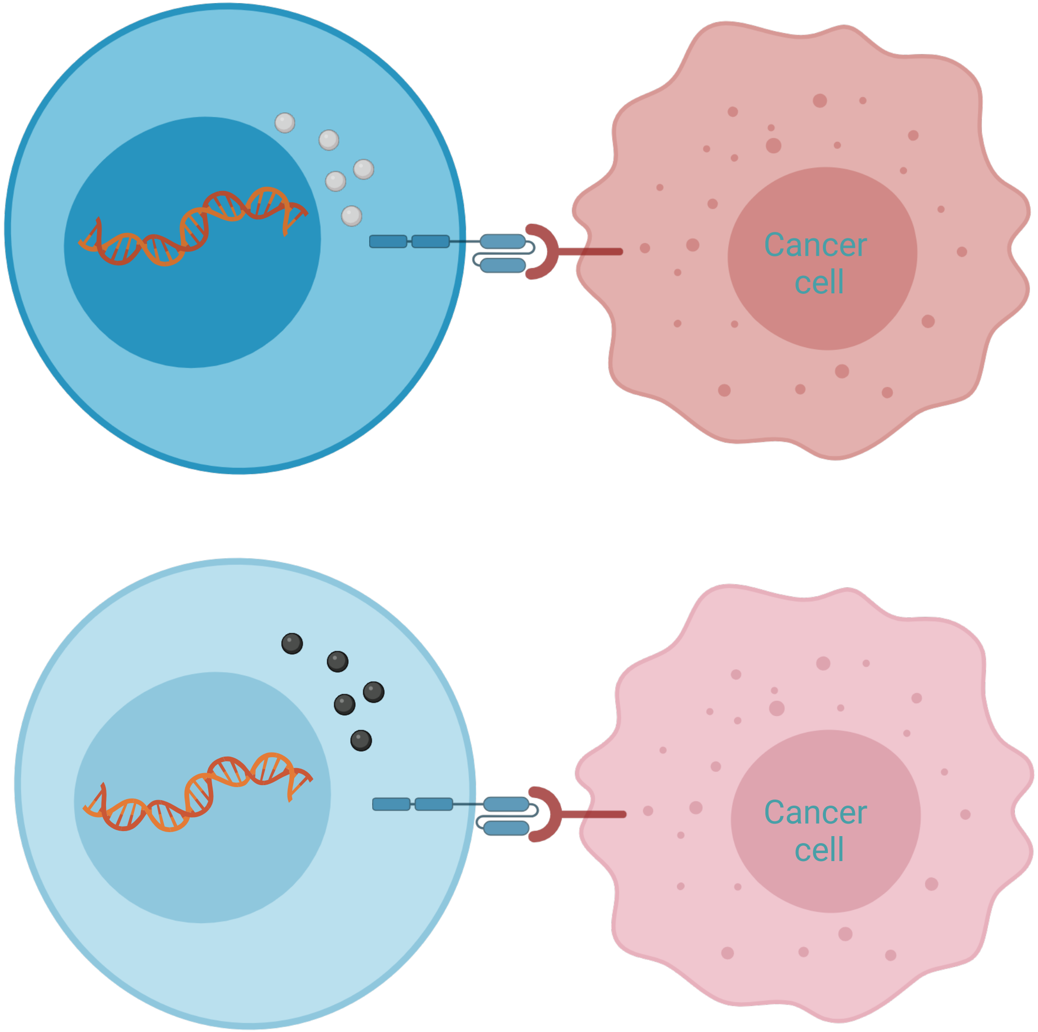


Color Contrast

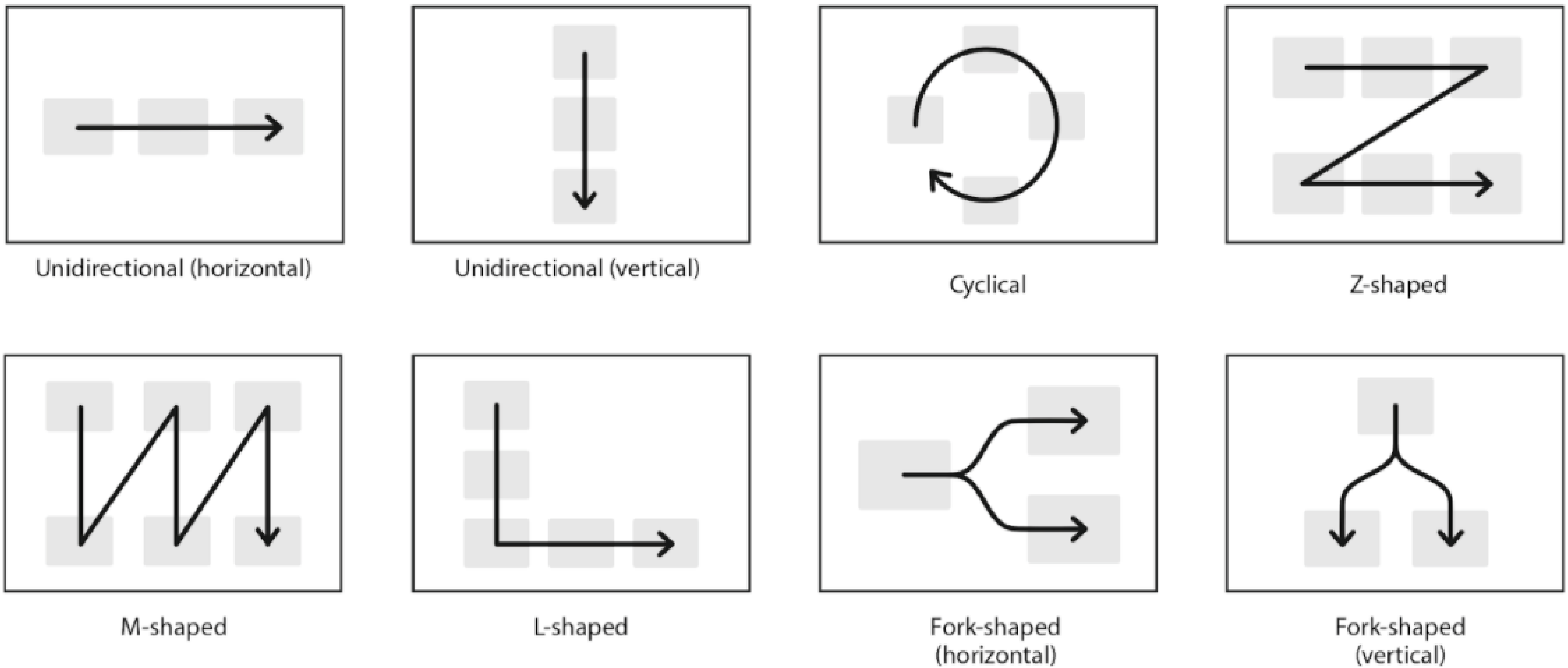
Rule of Thumb: Do not stack colors that are close in color value!

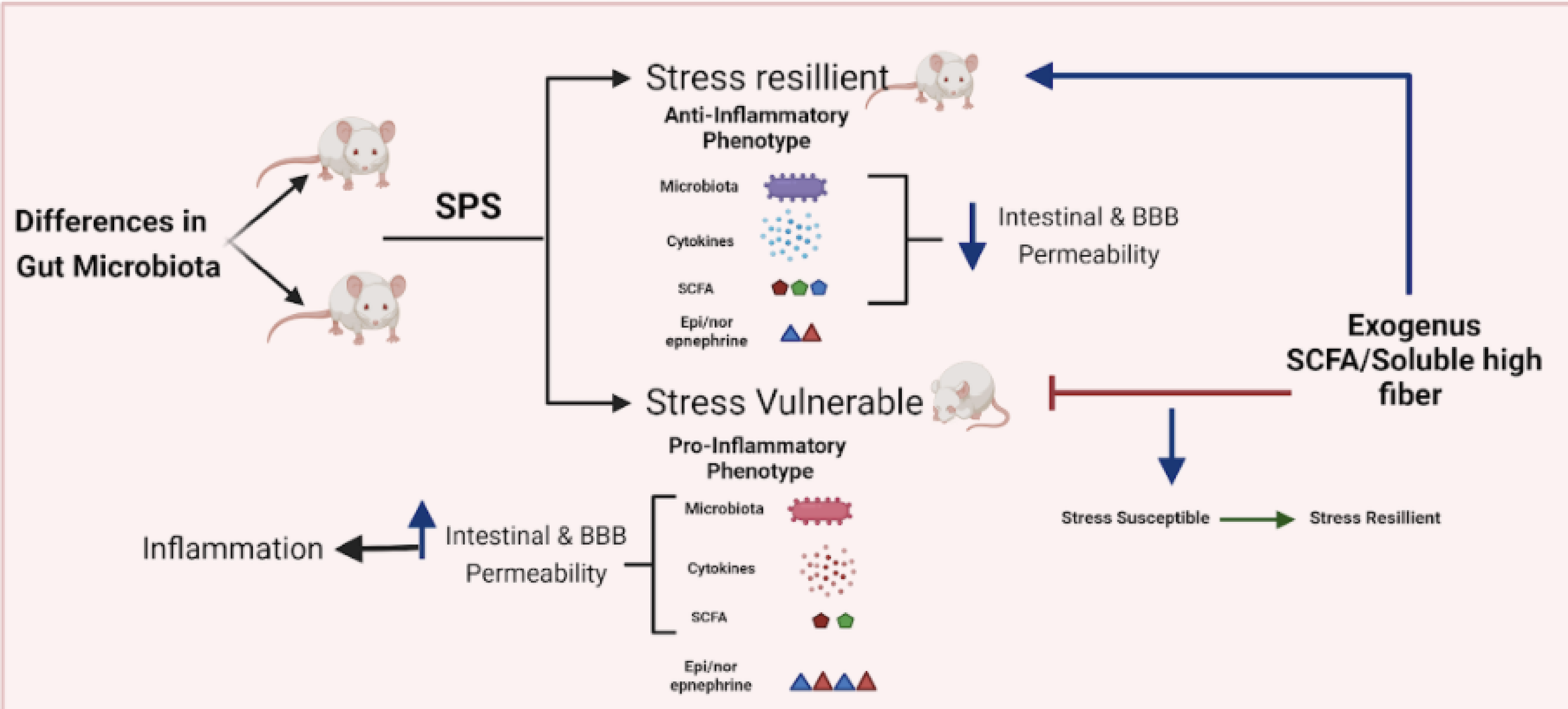


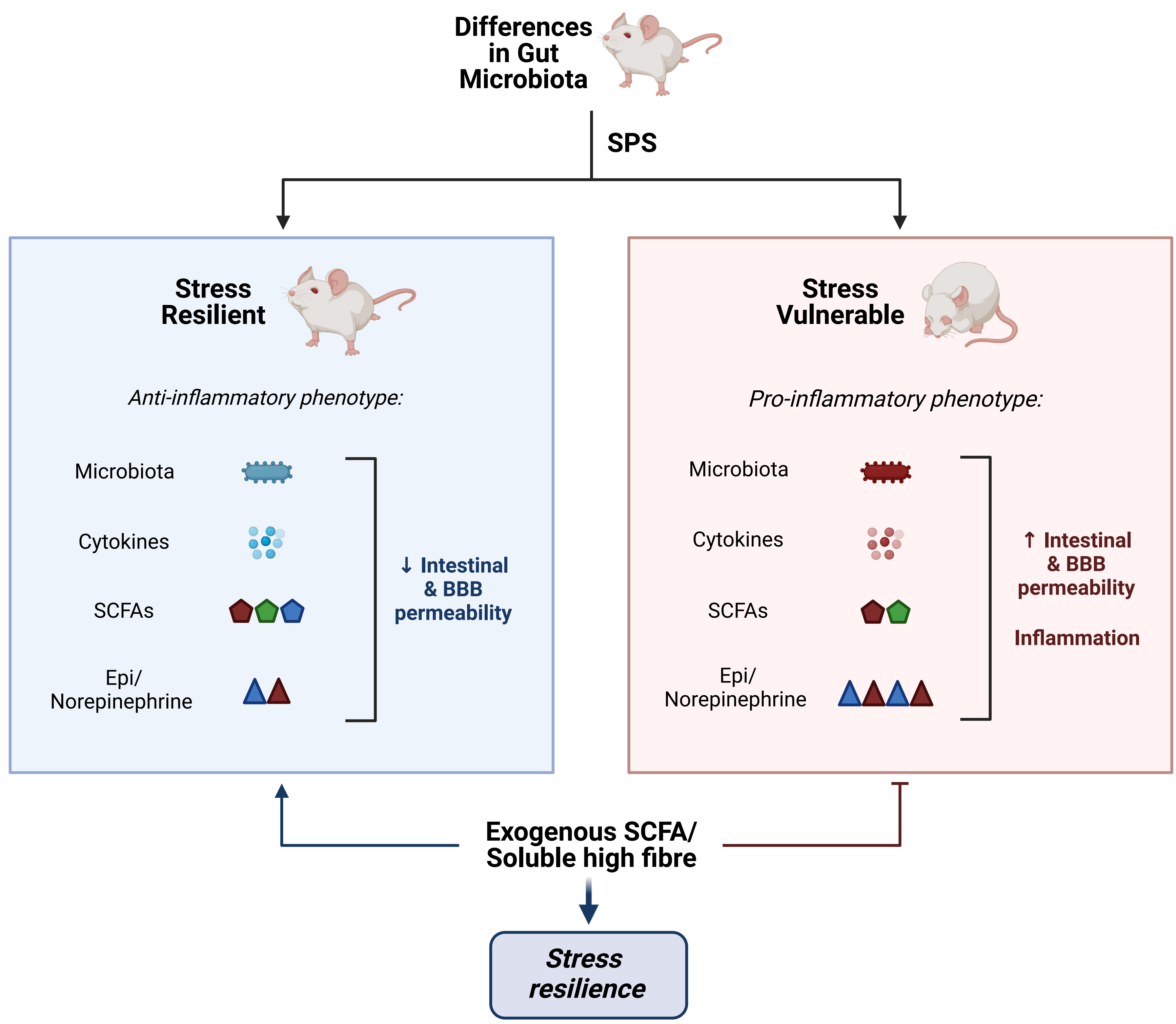
Color contrast (value)



Simple Compositions to Follow




Differences in Gut Microbiota
SPS
Stress resillient
Anti-Inflammatory Phenotype
Microbiota
Cytokines
SCFA
Epi/nor epnephrine
Intestinal & BBB Permeability
Stress Vulnerable
Pro-Inflammatory Phenotype
Microbiota
Cytokines
SCFA
Epi/nor epnephrine
Intestinal & BBB Permeability
Inflammation
Exogenus SCFA/Soluble high fiber
Stress Susceptible
Stress Resillient

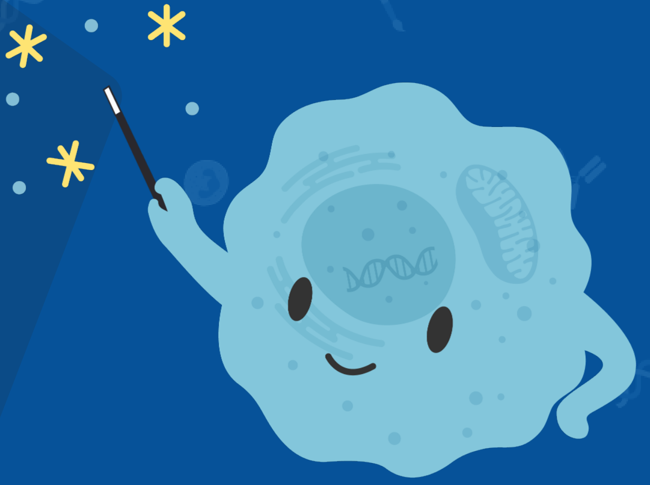


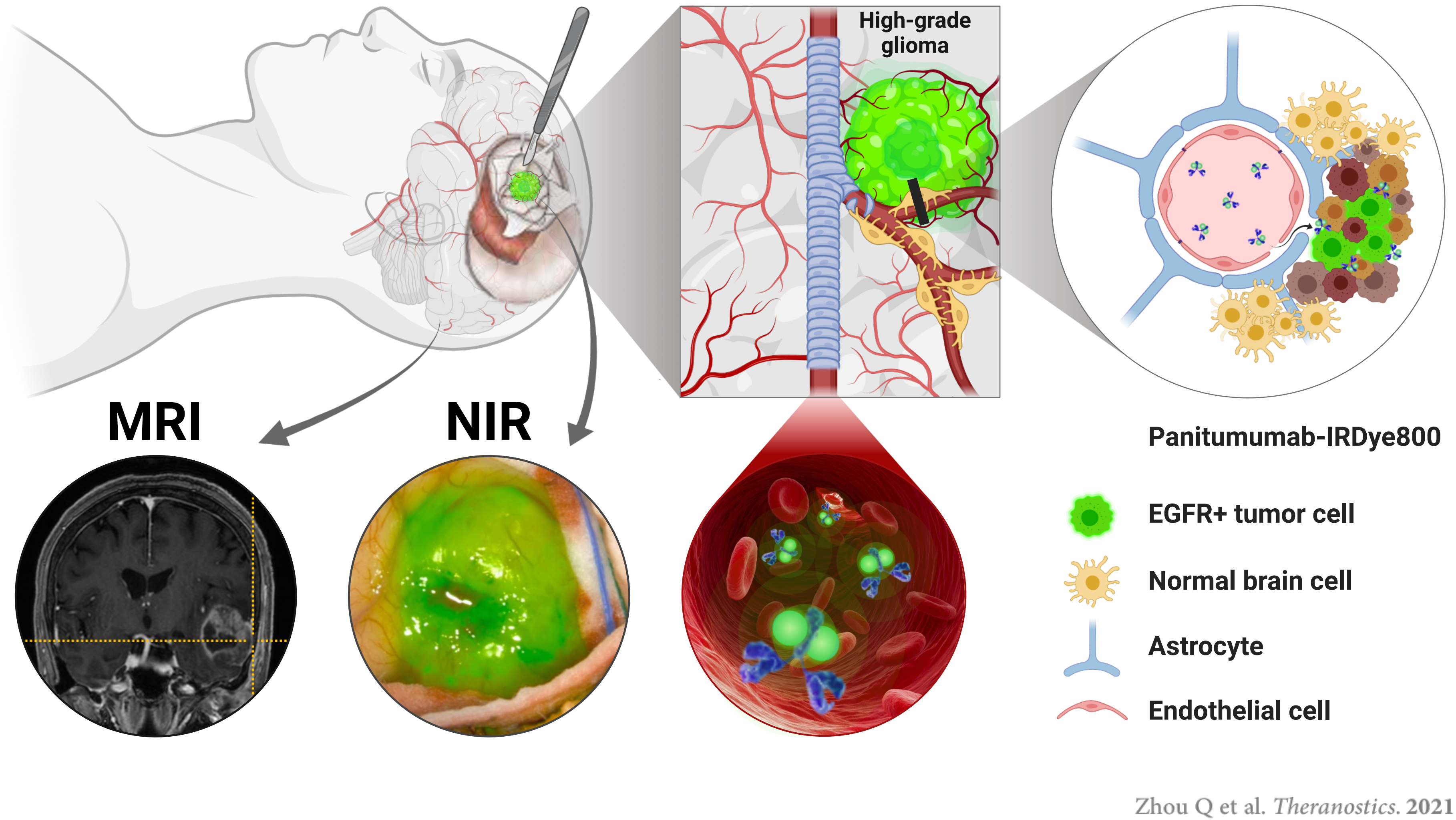
Differences in Gut Microbiota
SPS
Stress Resilient
Anti-inflammatory phenotype:
Microbiota
Cytokines
SCFAs
Epi/ Norepinephrine
↓ Intestinal & BBB permeability
Stress Vulnerable
Pro-inflammatory phenotype:
Microbiota
Cytokines
SCFAs
Epi/ Norepinephrine
↑ Intestinal & BBB permeability
Inflammation
Exogenous SCFA/ Soluble high fibre
Stress resilience

Today's Agenda

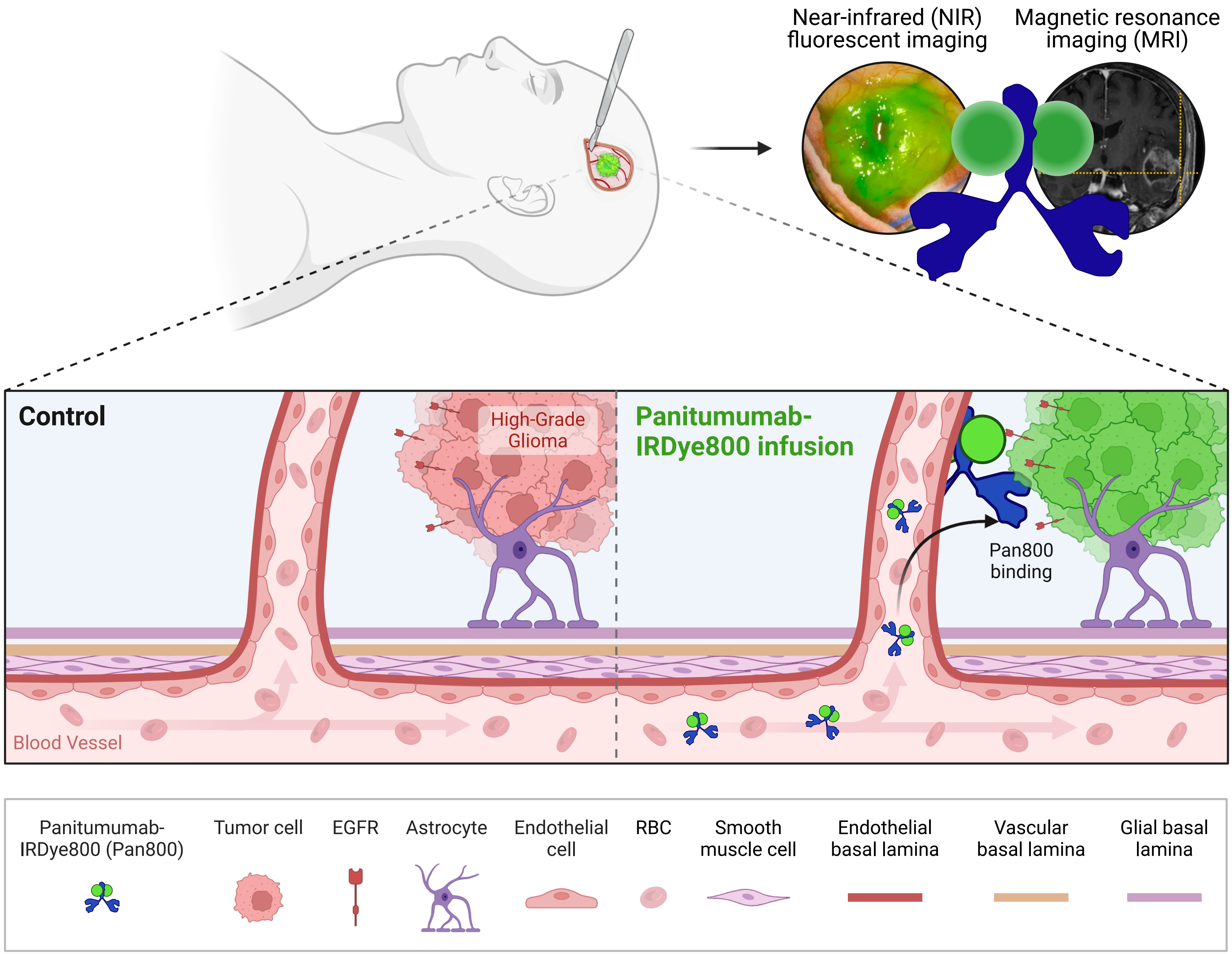
1. The Basics: Icons and Biobrushes
    - Requesting Custom Icons
    - Protein Data Bank Integration
2. Advanced Tools
    - Poster Builder
    - Graphing
3. Foundations of Design
    - Color and Contrast
    - Simple Compositions

Figure Makeover!





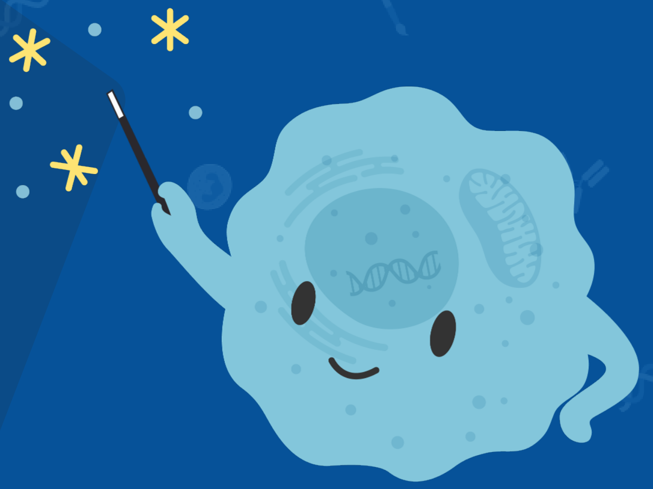
High-grade glioma
MRI
NIR
Panitumumab-IRDye800
EGFR+ tumor cell
Normal brain cell
Astrocyte
Endothelial cell
Zhou Q et al. Theranostics. 2021



Near-infrared (NIR)
fluorescent imaging
Magnetic resonance
imaging (MRI)
Control
High-Grade
Glioma
Panitumumab-
IRDye800 infusion
Pan800
binding
Blood Vessel
Panitumumab-
IRDye800 (Pan800)
Tumor cell
EGFR
Astrocyte
Endothelial
cell
RBC
Smooth
muscle cell
Endothelial
basal lamina
Vascular
basal lamina
Glial basal
lamina

Today's Agenda

1. The Basics: Icons and Biobrushes
    - Requesting Custom Icons
    - Protein Data Bank Integration
2. Advanced Tools
    - Poster Builder
    - Graphing
3. Foundations of Design
    - Color and Contrast
    - Simple Compositions
4. Figure Makeover!



Join the new MIPS LinkedIn Group!

Thank you for joining us!

Contacts: Kristy.nicholson@biorender.com
Presenter: erica@biorender.com
Organizer: qzh@stanford.edu
Reach out to **Lee Kozar (kozar@stanford.edu)** if you'd like to purchase a discounted license under Stanford's subscription