Master of Science in Biomedical Communications
Viewbook 2021

“Nothing in life is to be feared, it is only to be understood ...”

MScBMC
Viewbook 2021

MScBMC Viewbook 2021

Showcasing work by the graduating class of 2021 from the Master of Science in Biomedical Communications at the University of Toronto.

Edited by Alexander Young, Jenny (Zhen) Bai, Nitai Steinberg, and Shirley Long

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Foreword

With the publication of the fourth annual Viewbook, we celebrate the achievements of the BMC Graduating Class of 2021. In what was one of the more challenging years our program has faced, this group persevered through a year of uncertainty by rapidly adapting to the many changes brought on by the COVID-19 pandemic. It's fair to say that this Viewbook is far greater than the sum of its parts. The work contained in this volume exemplifies creativity and resilience in as much as it does excellence in visual communication, for the past year has challenged us to be more innovative in order to survive the inherent technical challenges of working remotely.

It has been almost two years since the first outbreak of COVID-19 brought the world screeching to a halt. One of the greatest lessons that this pandemic has taught us is how essential clear and accurate communication are for building trust and fostering an understanding of science. This is exemplified repeatedly throughout the Viewbook. This graduating class is uniquely positioned and very well equipped to take on the challenge of bridging the many gaps that exist along the science communication continuum.

We are, as ever, very thankful for the energetic and generous community that is the BMCAA. These wonderful volunteers shepherded us through the past year with a series of virtual events and mixers around BMC's 75th anniversary, bringing everyone together in a celebration of our profession. In particular, we would like to express our gratitude to the BMCAA Viewbook team, lead by Alex Young for their continued hard work in designing and producing this wonderful volume.

A heartfelt congratulations to the many fertile and creative minds that comprise the class of 2T1.

— Jodie Jenkinson and Michael Corrin, October 2021

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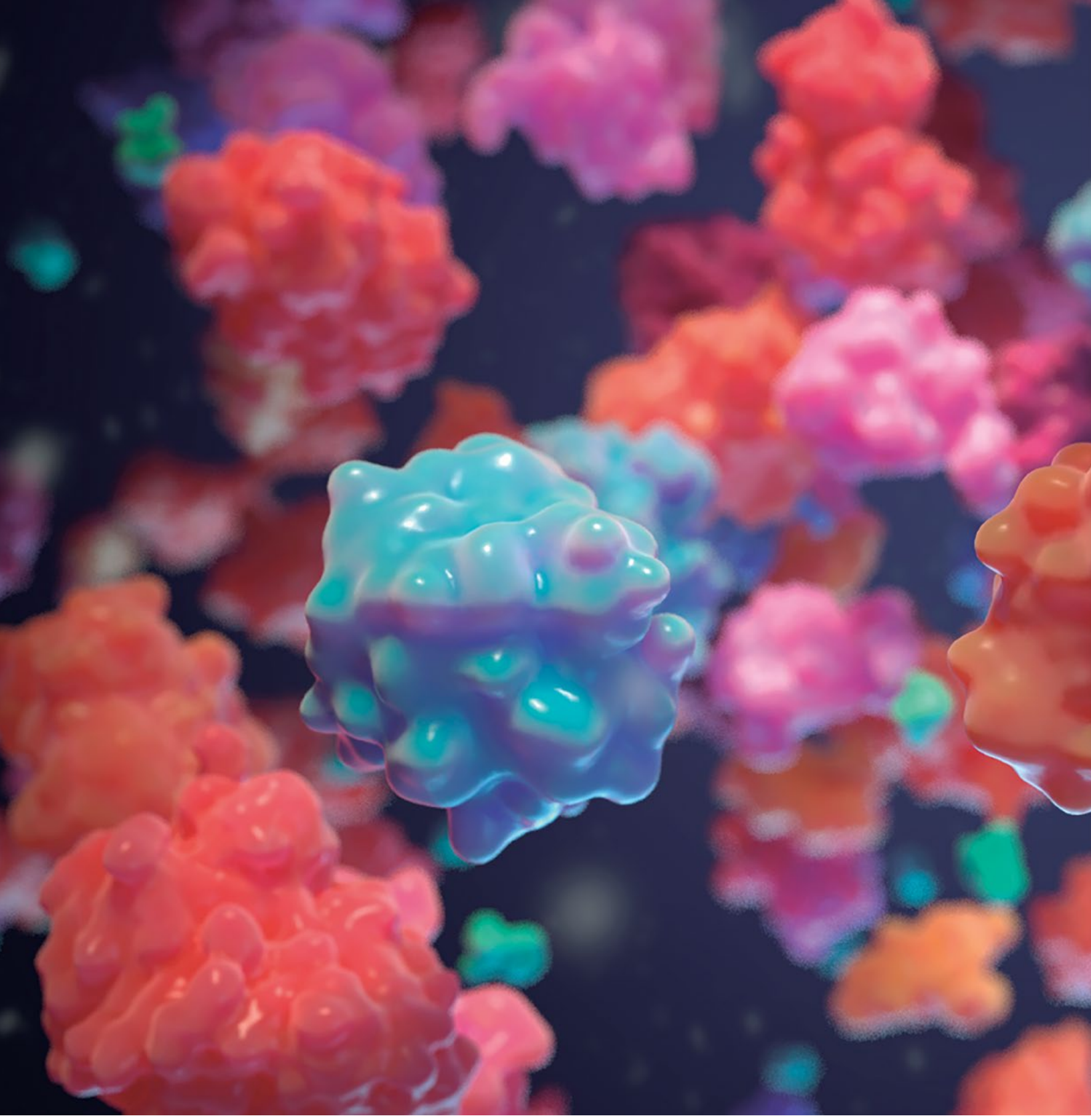

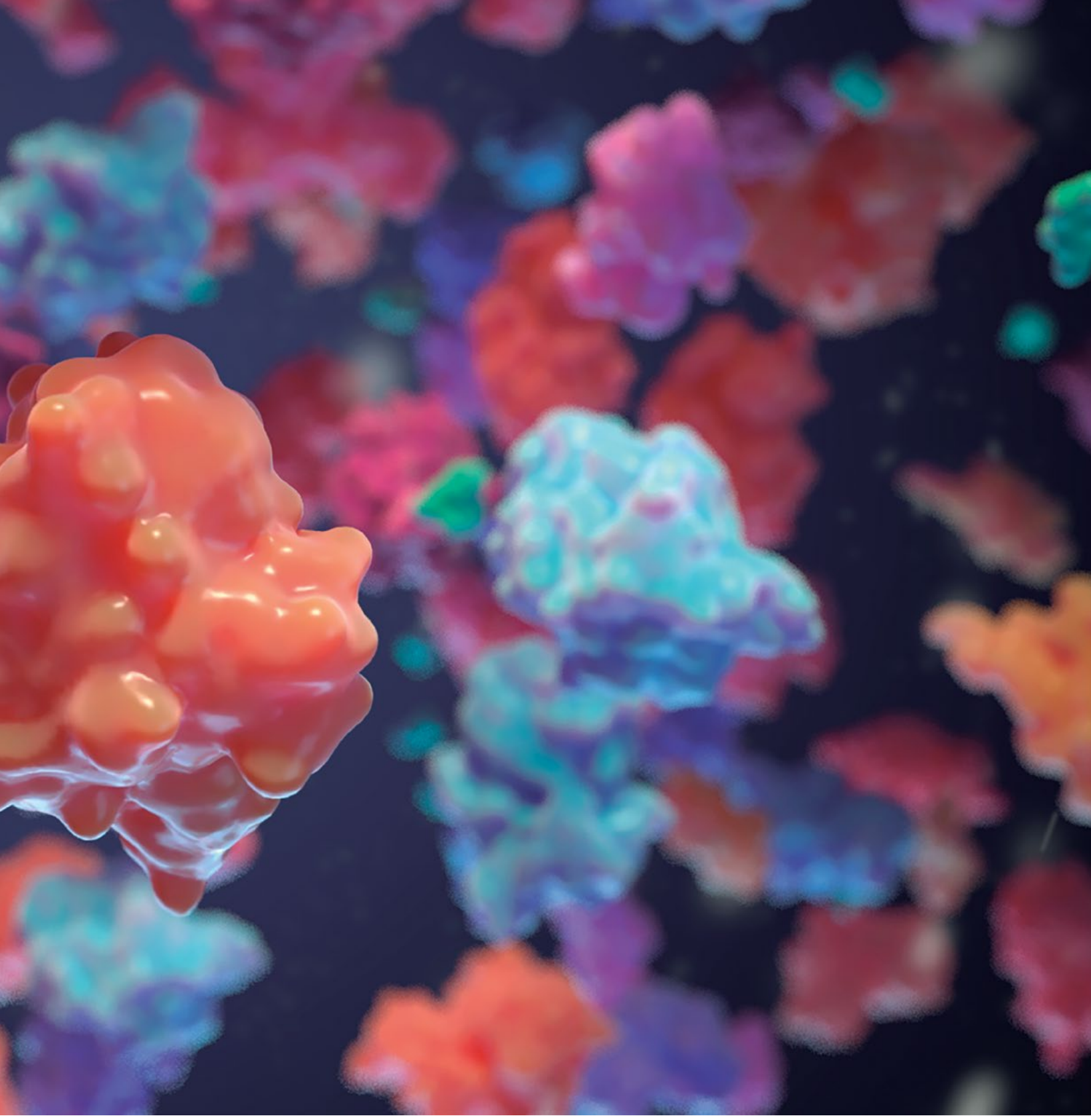

Ariadna Pomada Villalbi

I am a visual thinker and creative problem-solver with a great interest in bringing science and society closer together.
I specialize in storytelling, using 2D and 3D animation to successfully communicate complex concepts in science to a lay audience. With a background in biochemistry, I am especially fascinated by the intricacies of the molecular and cellular world, and their role in human pathology.

Editorial Illustration

This mock cover journal is for an article about bionic organs. The idea behind this cover was inspired mainly by car commercials. My goal was to create a model that preserved the anatomical structures of a human heart and used a futuristic and elegant look to transmit the idea of top-level performance.

1. Sketch. Initially, I experimented with different visual metaphors to communicate the key message in the article, the creation of artificial organs.

2. Final illustration. The final cover was created in *Maya* and edited in *Photoshop*. It was the visual complexity and technical challenge of this idea that brought me to create this anatomically accurate yet imaginary heart model.

Previous spread. Final animation. An animation still from my Master's Research Project: Visualizing Different Models for Molecular Binding and Interactions.

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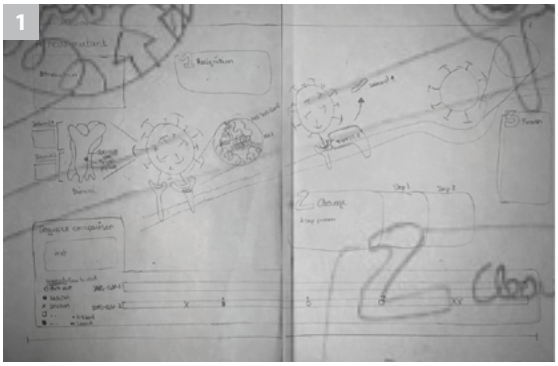

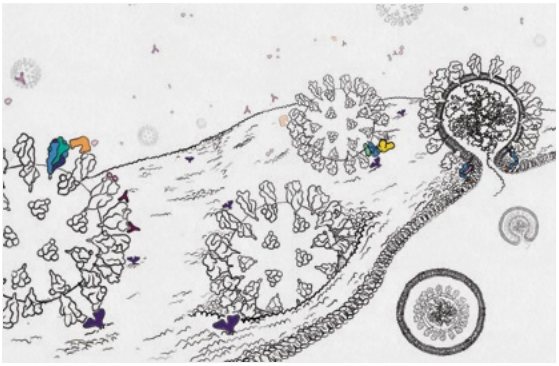

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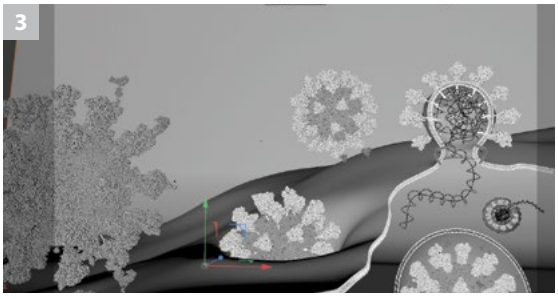

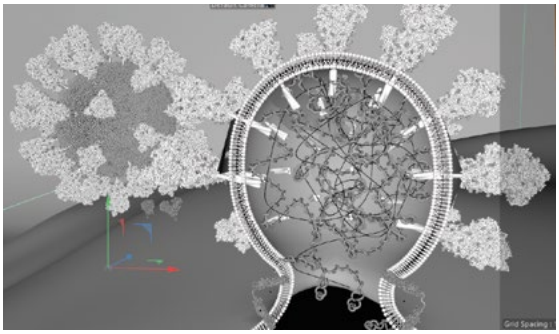

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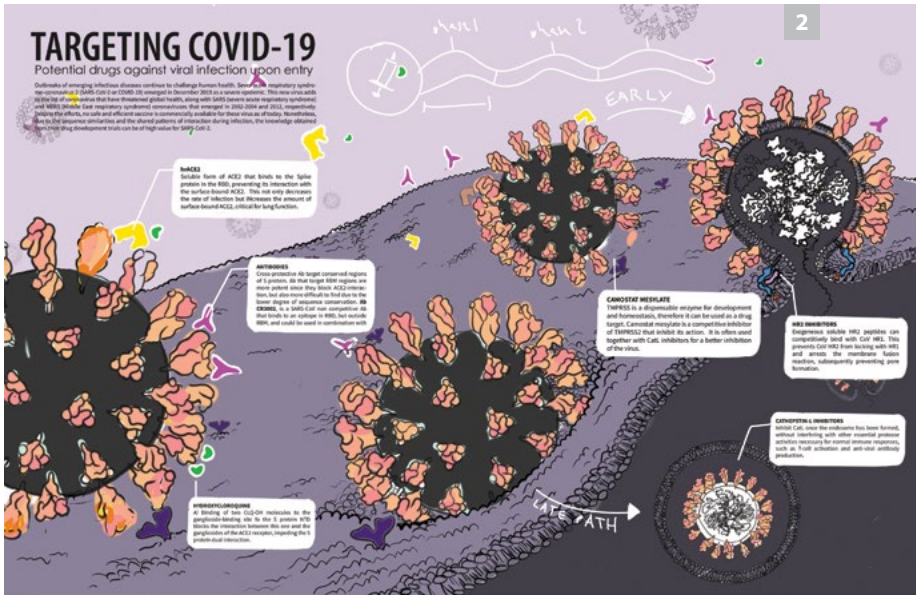

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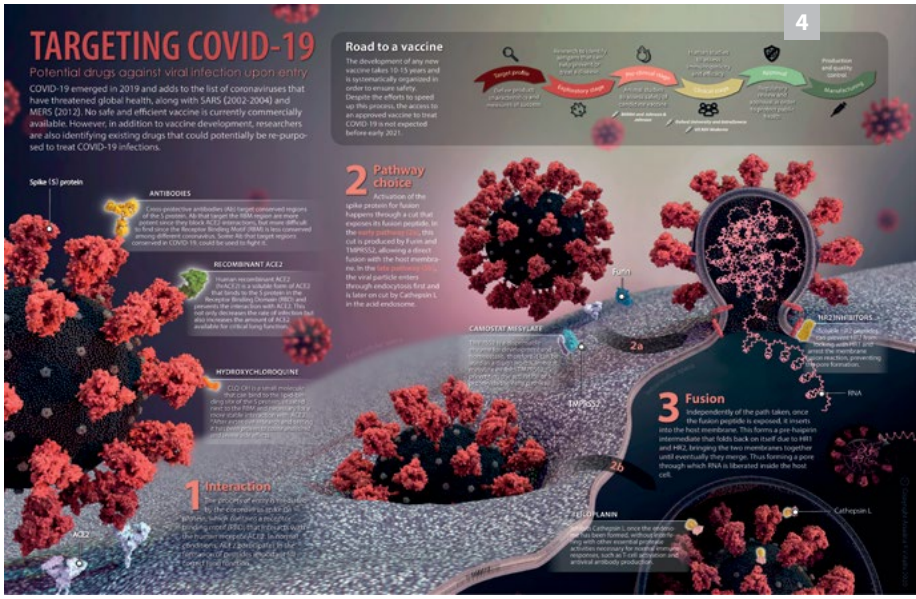

Molecular Visualization

At the beginning of the COVID-19 outbreak, with no safe and efficient vaccine commercially available, some drugs were being re-purposed to treat severe coronavirus infections. This piece aims to visually represent the mechanism of action by which those drugs can stop the entry of the virus into the human cell.

1. Sketch. Thumbnails were created to explore different ways of illustrating the process. I went with the designs that depicted a more immersive molecular environment and allowed me to guide the audience dynamically through the process.

2. Final draft. I organized the information in a hierarchy and separated the elements of the re-purposed drugs into groups depending on the stage of infection in which they inhibit COVID-19. I then experimented with the arrangement of all the visual and text elements to create a narrative composition that easily guided the audience through the information.

3. 3D modelling. I referred to the most recent papers for the structure of COVID-19 and the molecules involved in its entry to human host cells. The protein models used were imported from the Protein Data Bank and used to create the 3D models of the virus.

4. Final illustration. Final two-page spread. Created in *Maya*, *Photoshop,* and *Illustrator*.

Pathological Illustration

The goal of this project was to create a two-page spread demonstrating etiology, pathogenesis, and the clinical consequences of cystic fibrosis.

1. Sketch. An important part of this piece are the illustrations of children, not only to add a sympathetic human element but also to represent the genetic basis of the disease and the progression through age of the lung pathogenesis.

2. Study. Conducting studies to familiarize myself with the landscape of the airways, their structure, and the disease progression was a crucial part in creating this piece.

3. Final illustration. Final two-page spread. Created in *Procreate*, *Photoshop,* and *Illustrator*.

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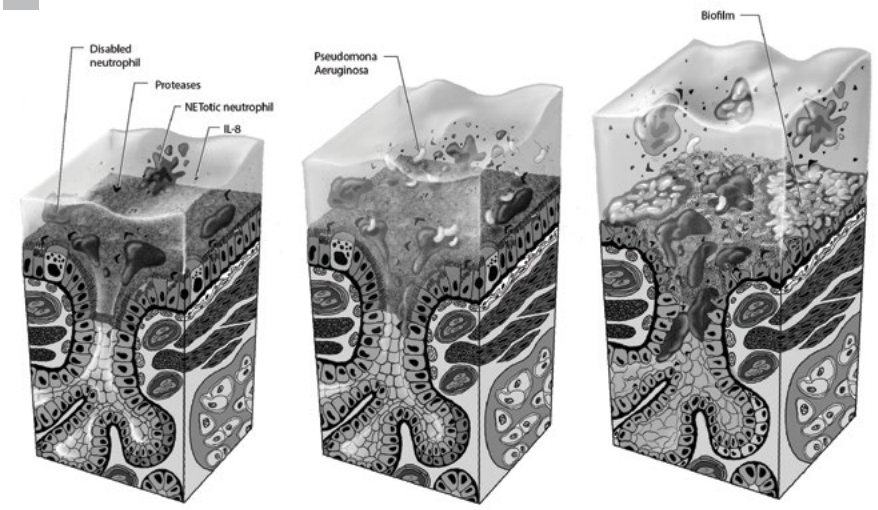

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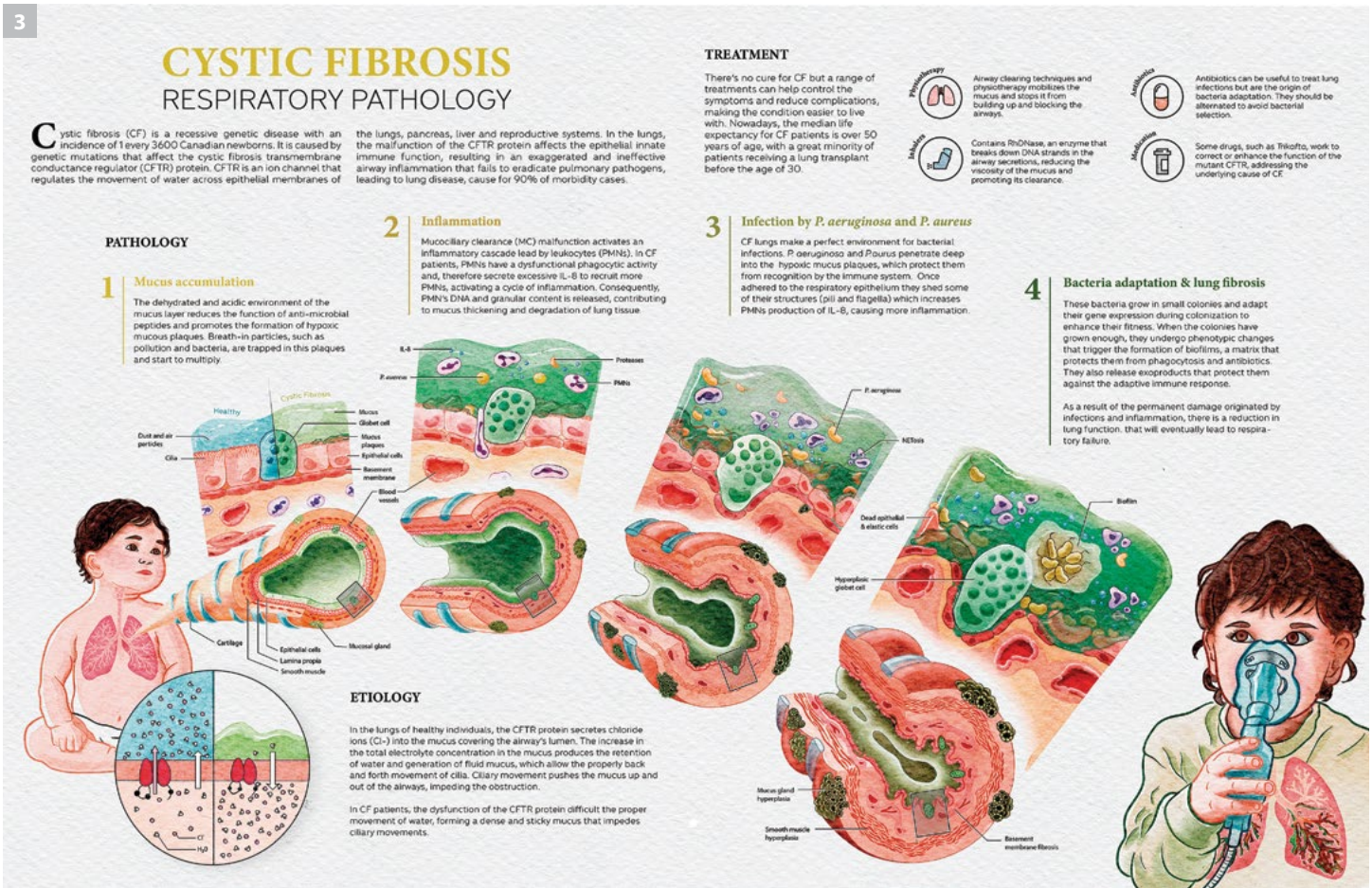
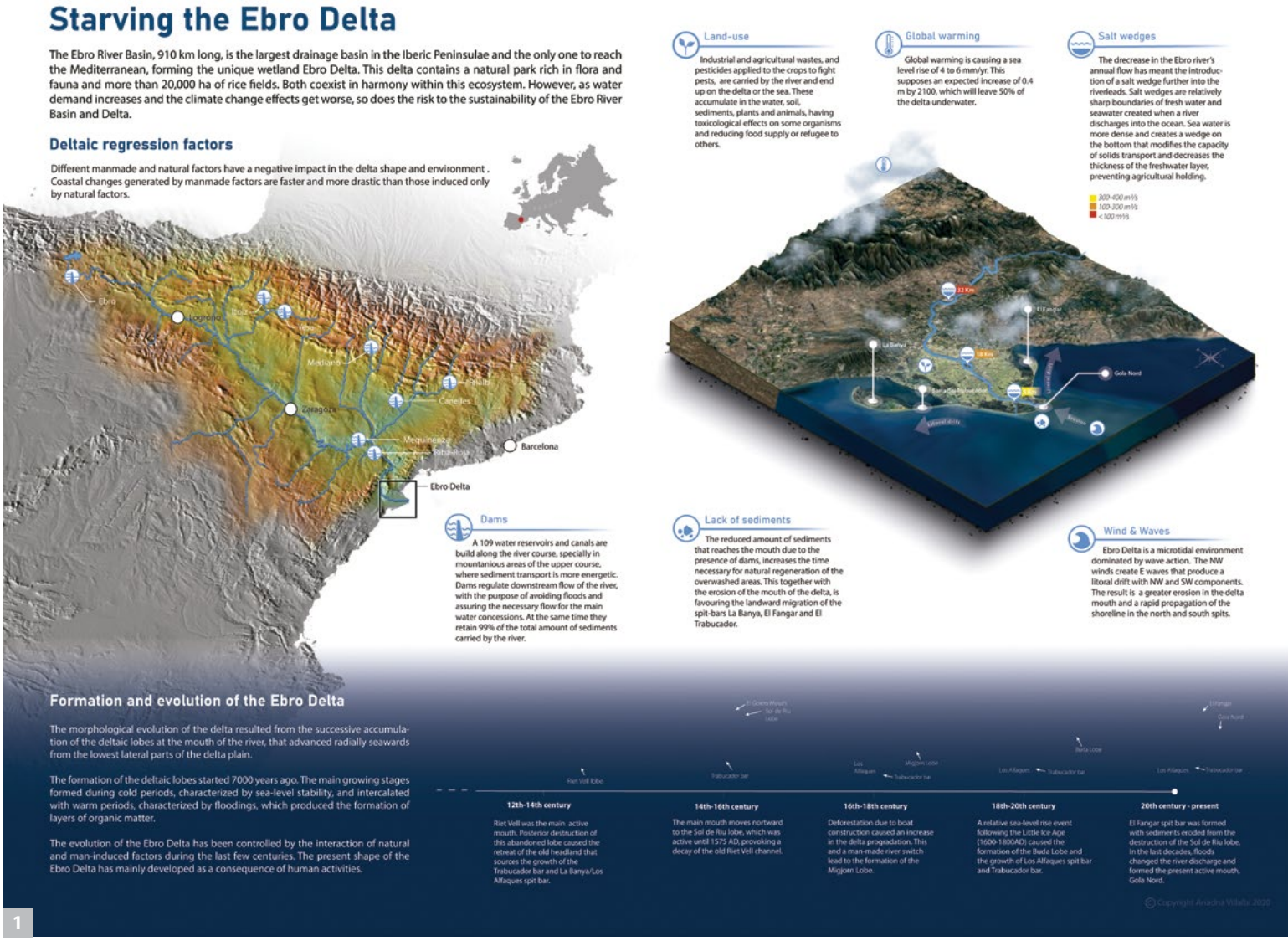
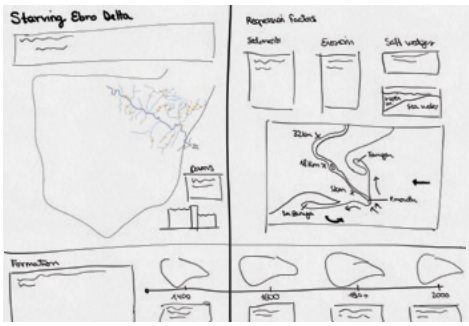






Data Visualization

The goal of this project was to create a two-page spread to represent a scientific subject matter in a way that is eye-catching and clear.

1. Final illustration. Final two-page spread. Created using *Photoshop* and *Illustrator*.

2. Sketch. I created thumbnails depicting the different parts of my research and experimented with the arrangement of the thumbnails to create different narrative compositions. I decided on the composition which better supported the data and story I wanted to tell.

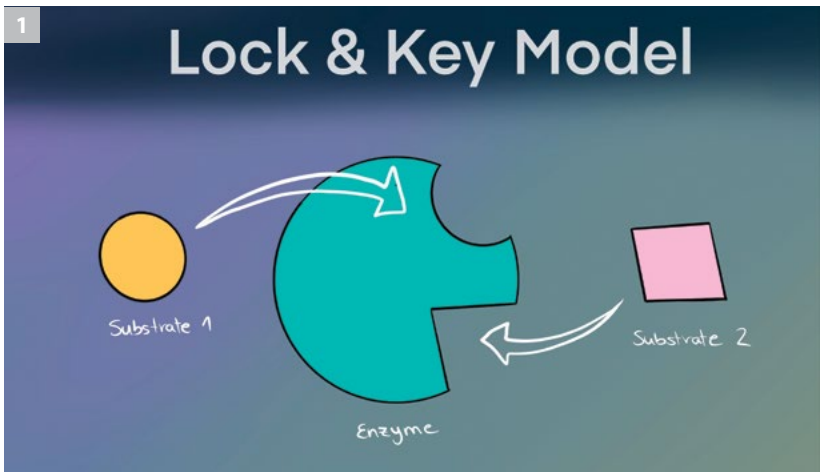
Visualizing Different Models for Molecular Binding and Interactions

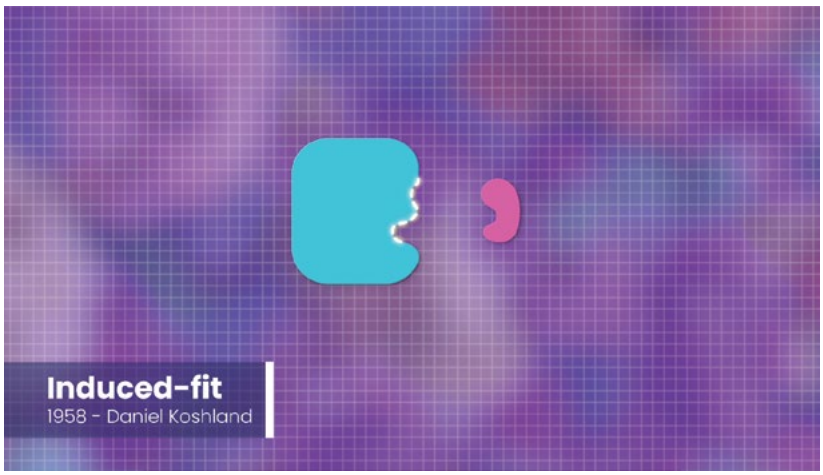
Different mental models are used to explain how protein conformational change drives binding and interactions. However, these models don't reflect the complexity and wide variety of protein interactions. With this project, I aim to help students clarify misconceptions about the fundamentals of molecular binding and interactions.

1. Production process. These snapshots show the evolution, from sketch to final animation, of two scenes used to draw a connection between the representation of the lock and key model (top two images) and the more accurate representation of the induced-fit model (bottom two images).

2. Sketch. These three images show my initial sketches of three different scenes.

3. Final animation. These three images, shown on the right and the bottom, correspond to the three sketches on the top left of the page.





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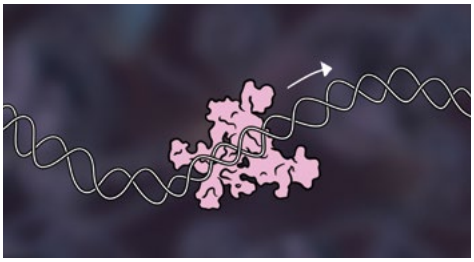

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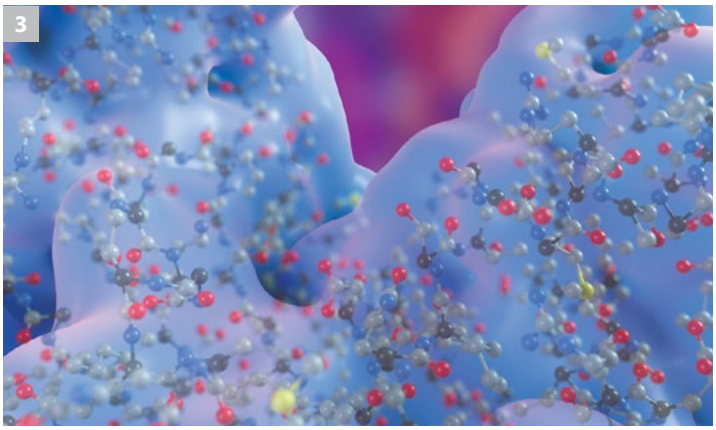

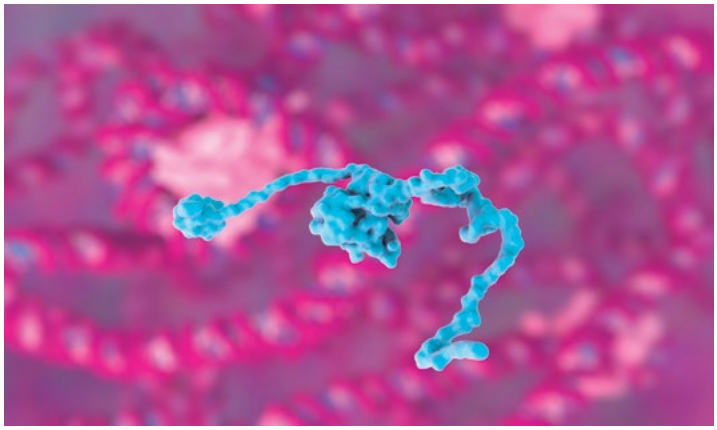

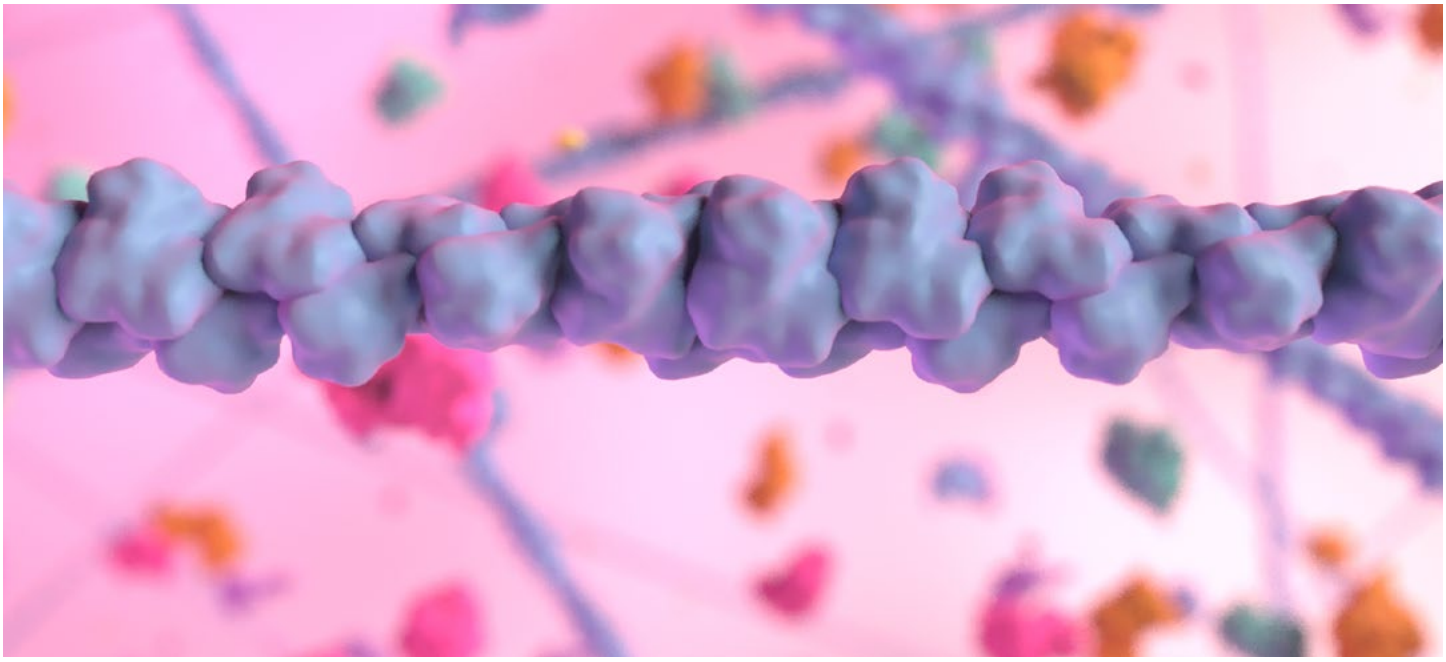

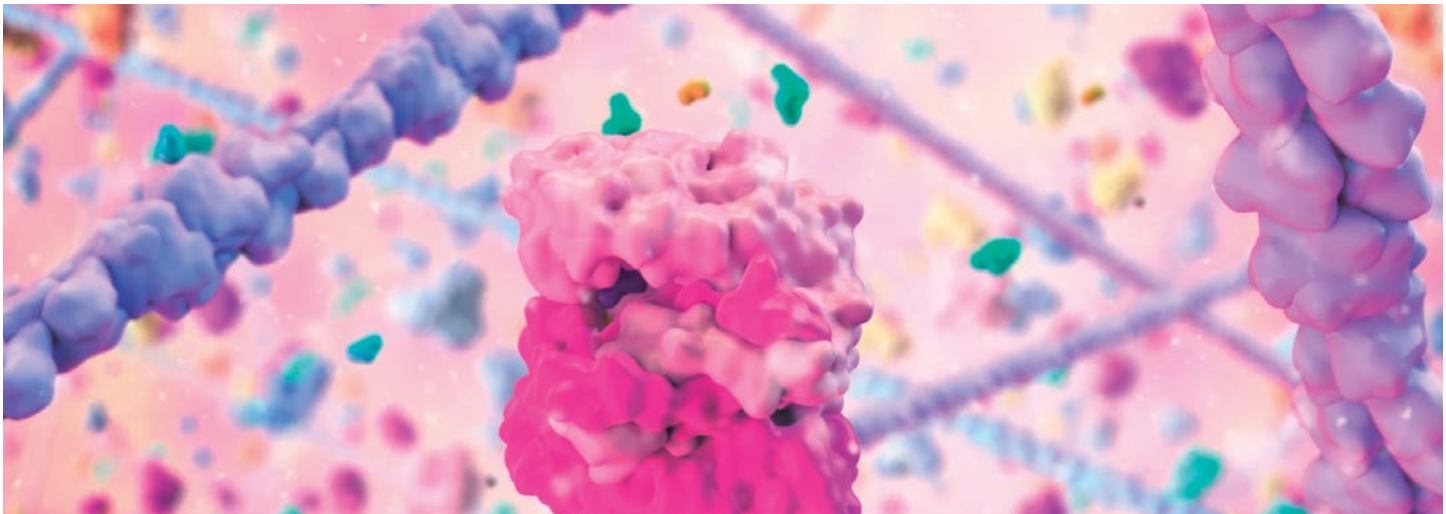

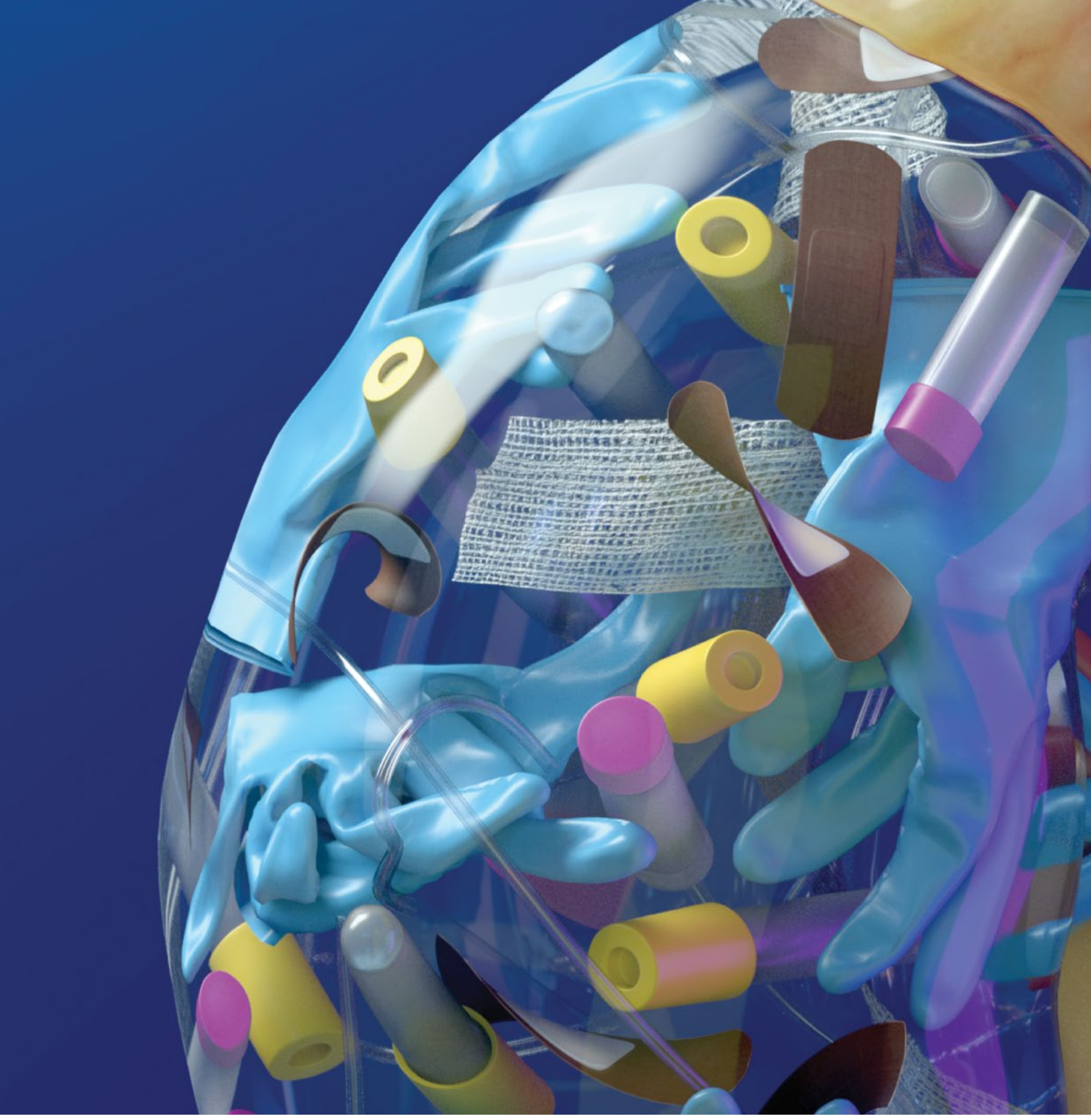

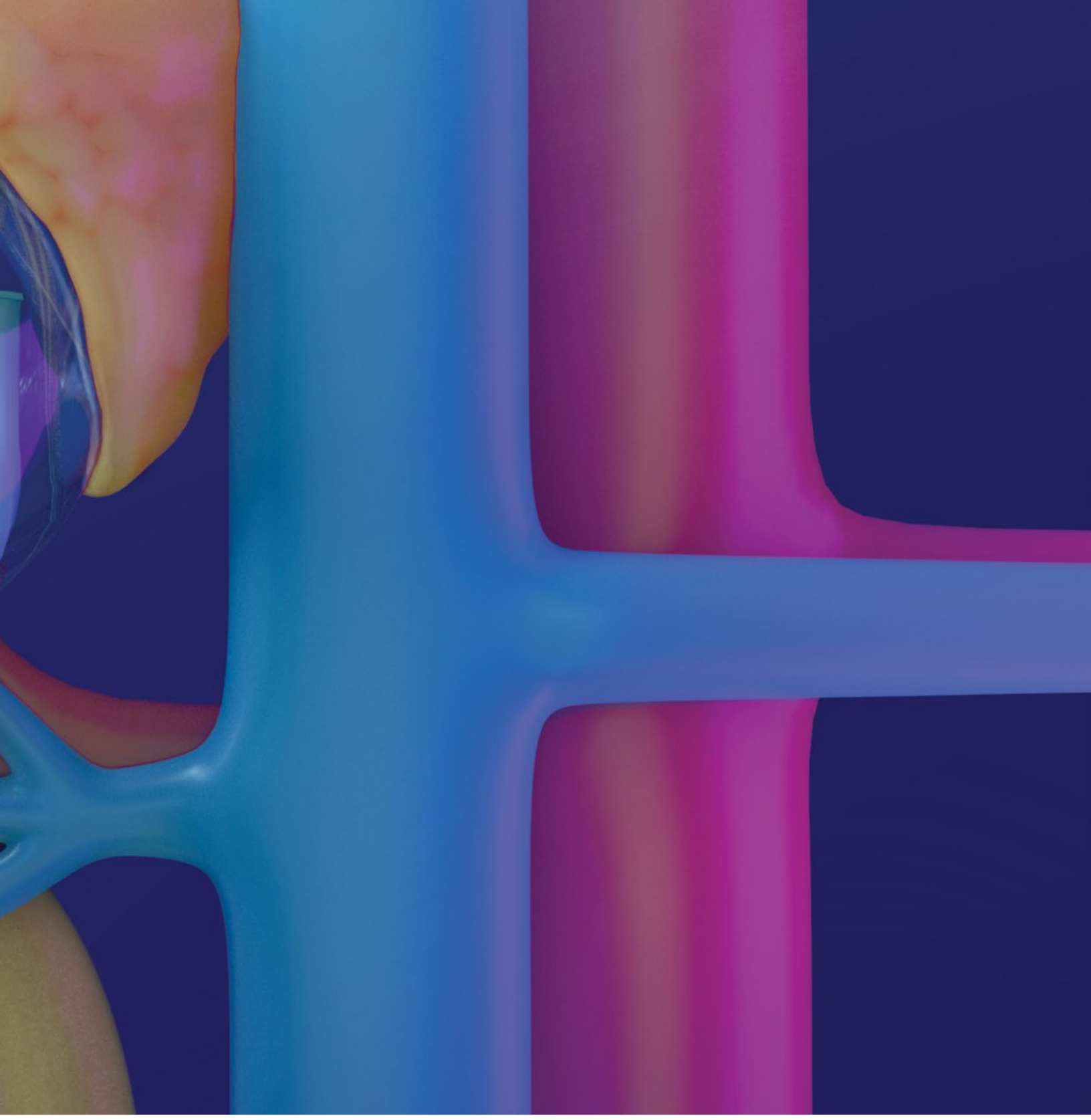

Ava Schroedl

With a passion for equity, I specialize in creating biomedical visuals that serve our communities. Through data visualization, editorial illustration, motion graphics, and more, I strive to communicate complex concepts for a targeted audience. Since my first undergraduate course in Biological and Pre-Medical Illustration, I have continuously challenged myself to learn about biomedical sciences and visual communication. I am bringing this same curiosity to every step of my career.

Editorial Illustration

This mock cover illustration for *Nature* calls attention to the intersection of climate change and medicine, specifically the complex bidirectional relationship seen in nephrology.

1. Sketch. This early stage thumbnail sketch loosely describes the concept I chose to develop further for this editorial piece.

2. Sketch. This mid-stage thumbnail sketch incorporates the concept seen in the earlier thumbnail and builds up my vision for the final piece by adding colour.

3. Final illustration. The final illustration has updated graphical elements, a revised title, and visuals generated in *Maya* and enhanced in *Photoshop*. This 3D render was created with advanced modeling, lighting, and material knowledge.

Previous spread. Final illustration. A close-up of my mock journal cover.

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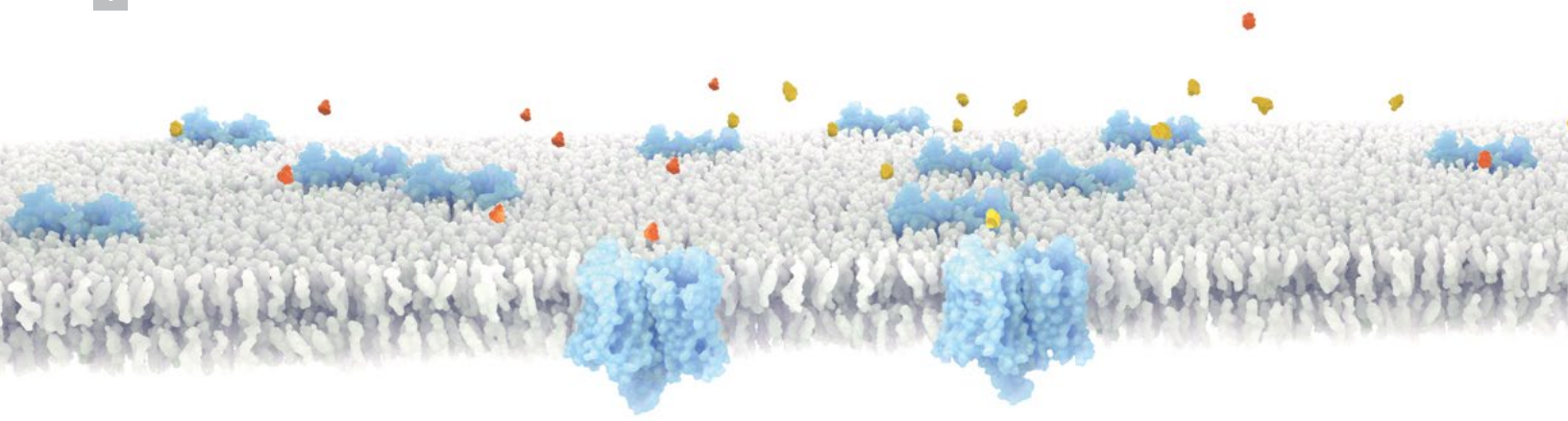

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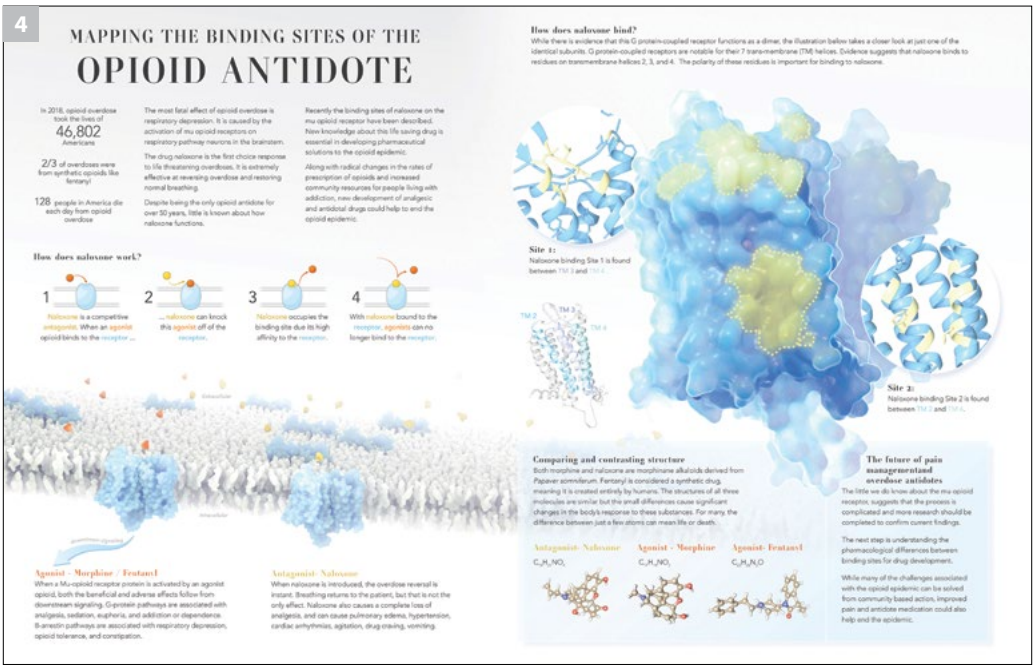

Molecular Visualization

Despite being the only opioid antidote, little is known about how Naloxone functions at the molecular level. In this magazine spread, I visualized recent research that maps the mu opioid receptor binding sites of Naloxone.

1. 3D modelling. *Cinema 4D* render of neuronal membrane with informed phospholipid choices.

2. 3D modelling. *Cinema 4D* render of ribbon diagram I used for insets.

3. Sketch. In my thumbnails, I prioritized concepts and mapped out their, often times complex, relationships to one another. Connecting small chunks of information was important in maximizing curiosity and comprehension in my target audience.

4. Final illustration. This is the final layout of the two-page mock magazine spread. The copy text and graphic design was carefully refined over many drafts.

Graphic Medicine

This comic uses personal narrative to educate the reader on the history of the speculum and trauma-informed care. In this piece I use visual metaphors, patterns and colour, and a well drafted story arc to tactfully engage the reader.

1. Production process. I went through an iterative development process, highlighted by the differences and similarities between a rough draft (left) and my final layout (right).

2. Study. In this study, I explored an alternative set of colours and patterns before deciding on the final style.

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Data Visualization

The following visualization looks at birth patterns seen in the CDC's 2018 Division of Vital Statistics data. This data visualization piece is meant to spark curiosity and could be adapted to be an exciting interactive module for expecting individuals.

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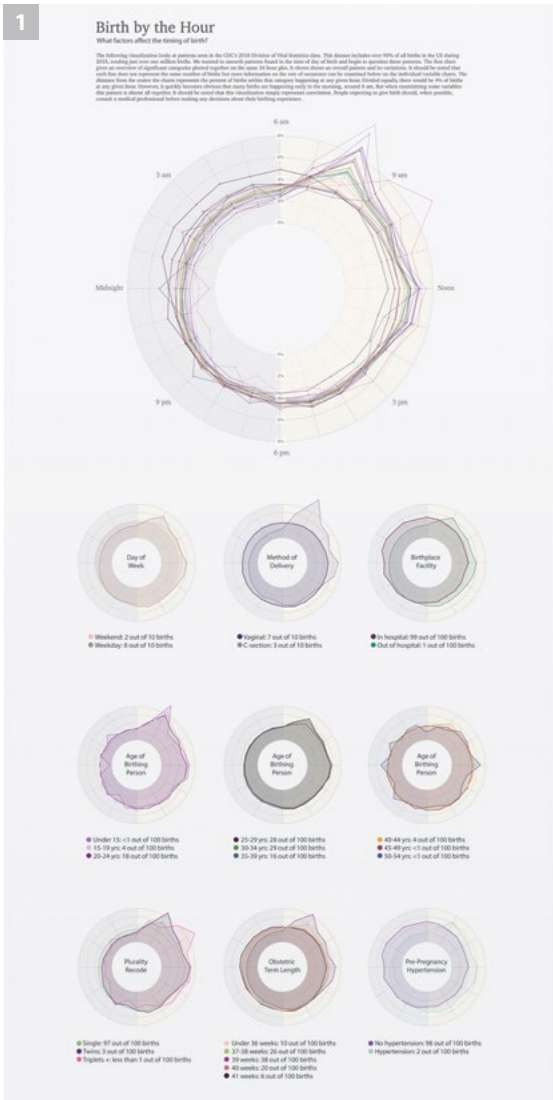

1. Final illustration. I designed the full layout to be vertical and long because of web-based scrolling considerations.

2. Study. An example of radar/spider chart I made in *Illustrator* before applying style modifications. I processed data from over one million births in order to be able to display the information in this format.

3. Final illustration. These multi-variable charts show general birth patterns with an intricate and almost woven aesthetic. They are inspired by Edward Tufte's small multiples theory, and allow the viewer discern patterns more easily.

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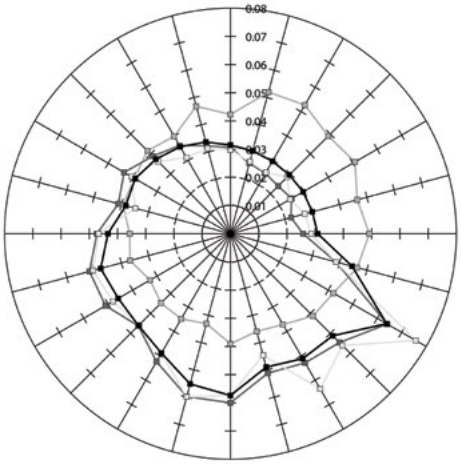

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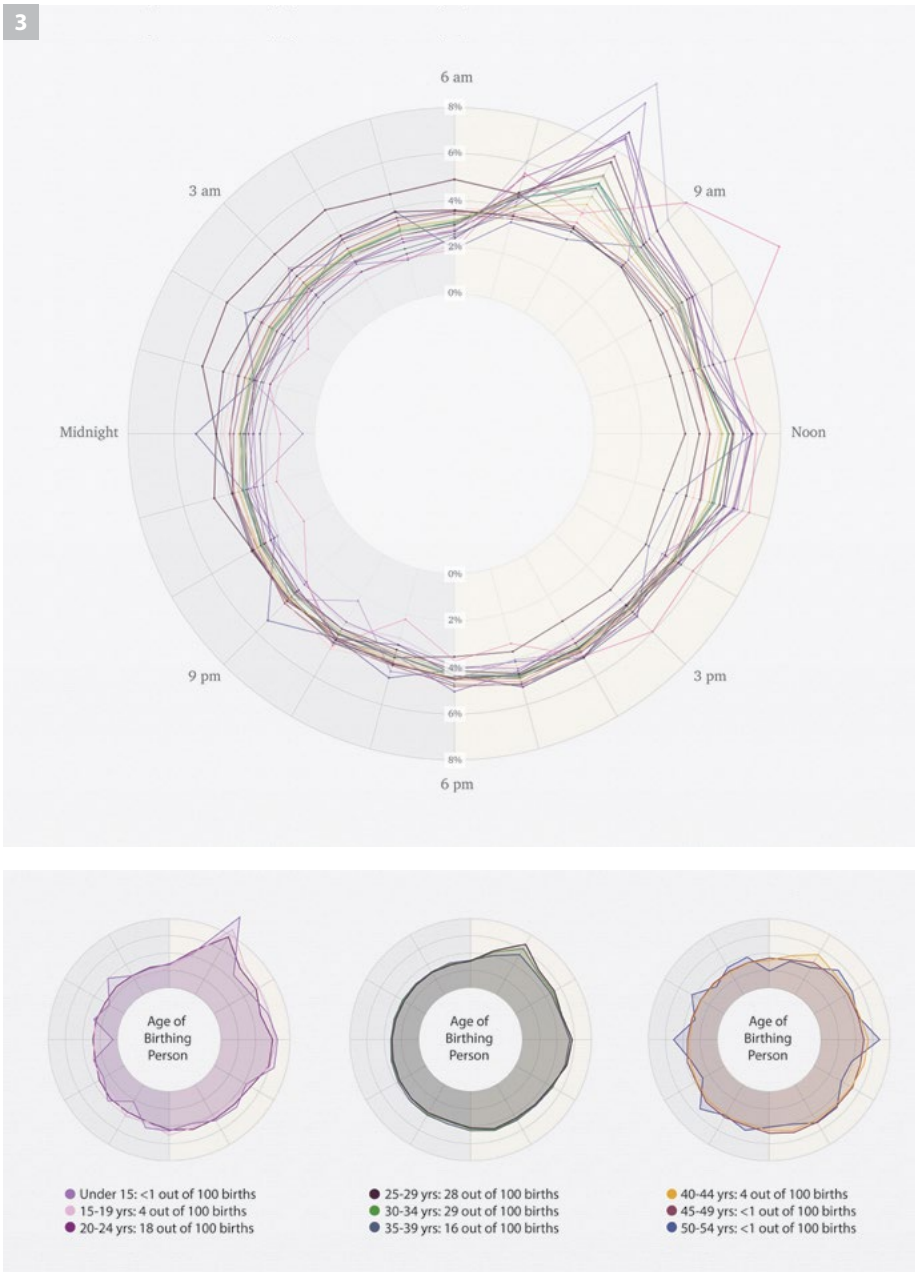

HIV Self-Tests

HIV self-tests reduce the barriers associated with traditional point-of-care testing. My animation tackles some of the remaining barriers to HIV testing, notably psychological information avoidance, by promoting the benefits of HIV self-tests while decreasing the viewer's results-related anxiety.

1. Sketch. My pre-production work explored character development with a focus on generating diverse and representative characters. My graphical abstract served as an early document that helped me organize and prioritize information shortly after collecting my research.

2. Storyboard. Storyboards were very helpful for showing my content advisor and my community advisory committee how I would be explaining complex and sometimes confusing scientific topics such as the false negative window period. Their feedback was instrumental to the success of my Master's Research Project (MRP).

3. 3D modelling. My MRP allowed me to practice hard surface modeling. I created the HIV testing device in *Maya* and utilized the MNPRX watercolour renderer.

4. Final animation. These are frames from the final animation in the water colour style. Also pictured is an HIV antibody render (3D asset) that's used in a number of scenes throughout the animation.

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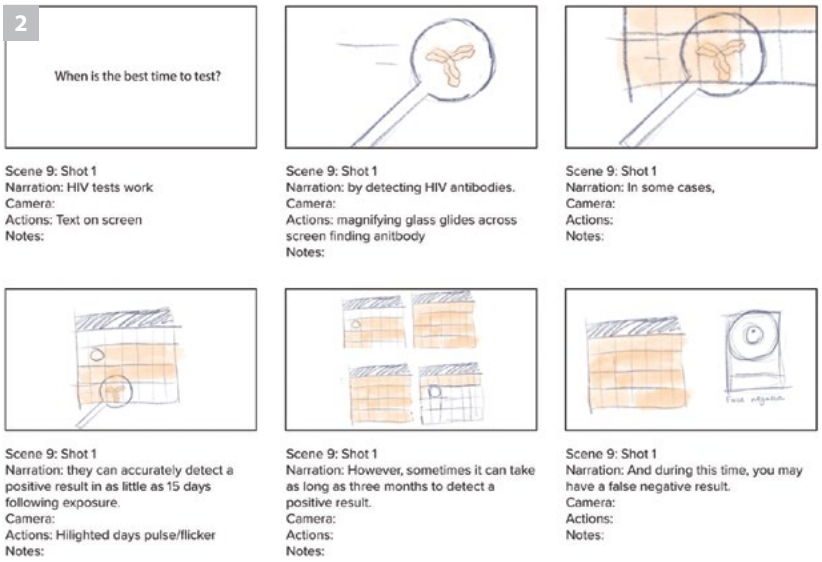

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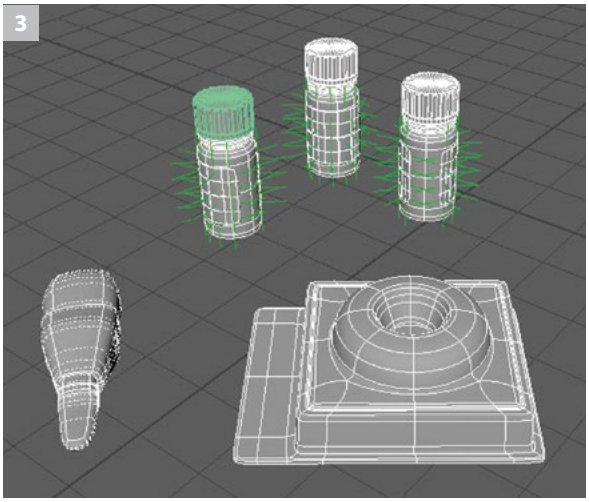

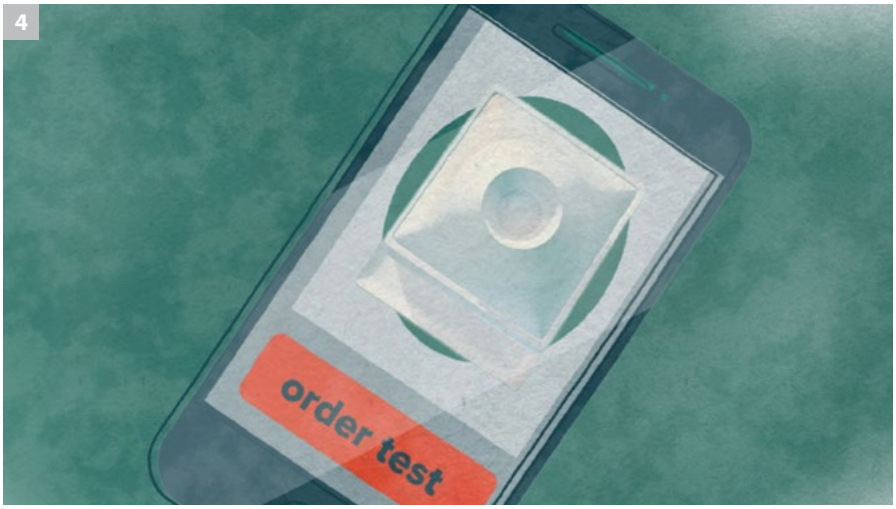
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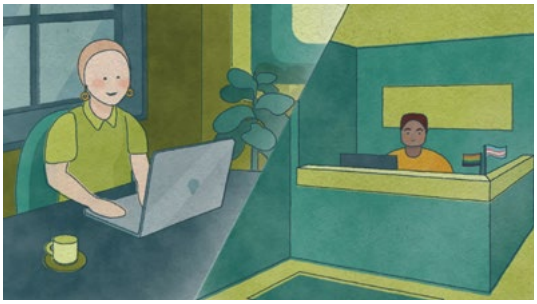

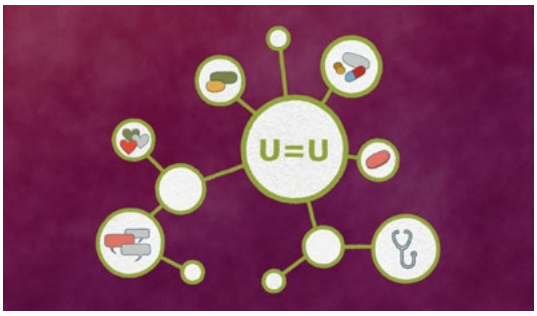
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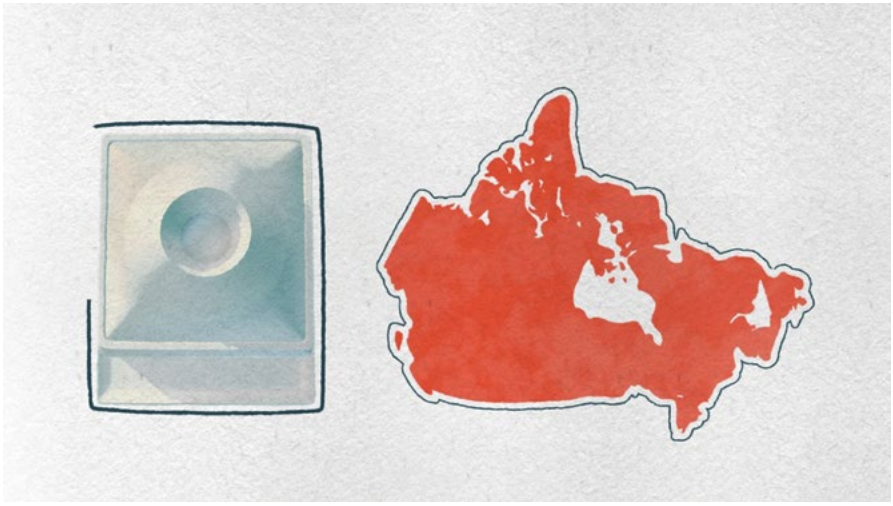

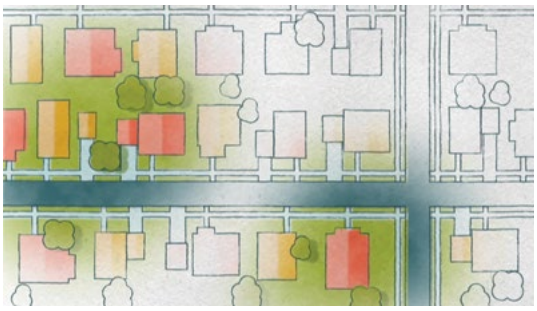

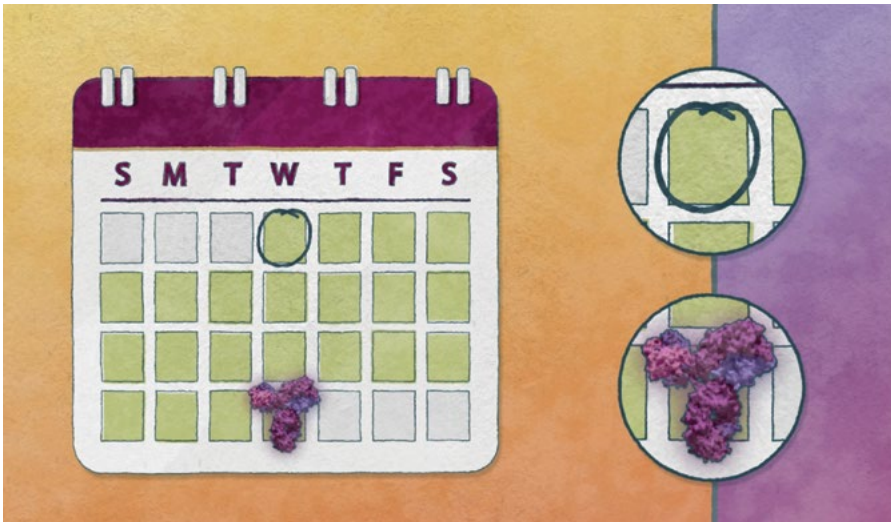
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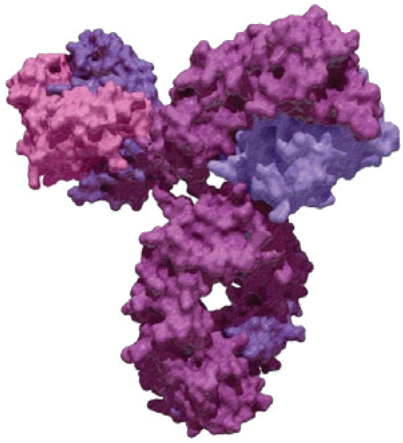

Brittany Cheung

I am a biomedical illustrator and visual storyteller who is endlessly curious about science and wants to share this sense of wonder with everyone. While studying in the BMC program, I found my passion and voice by researching exciting and meaningful topics. My goal is to share what I have learned by creating compelling, easy-to-understand visuals that connect with the target audience.

Anatomical Illustration

Depicting anatomy with unconventional cuts from an unconventional view is a unique challenge. To accomplish this, I used multiple sources of data including textbooks, CT scans, and cadaver dissections to show the inside of the left ventricle of the heart.

1. Sketch. These preliminary sketches from cadaver and museum specimens helped me understand how to draw heart tissue and set the stage for the final illustration.

2. Production process. To ensure clean shapes, I blocked in the major structures in *Illustrator*. I also roughly shaded the sketch in grayscale to determine if the values would read well before I started using colour.

3. Final illustration. The final piece peers into the left ventricle from a posterolateral view. The cut reveals the papillary muscles, tendinous cords, and part of the mitral valve, as well as the pulmonary and aortic cusps. The epicardial fat is pushed back to reveal the course of the left coronary artery.

Previous spread. Final illustration. A close-up from an infographic on emperor penguins.

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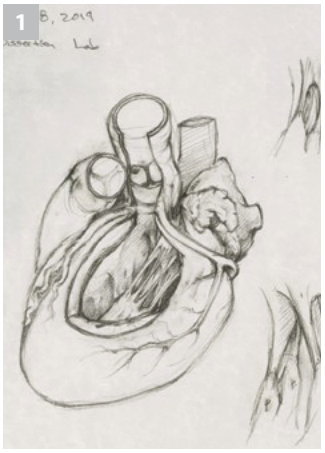

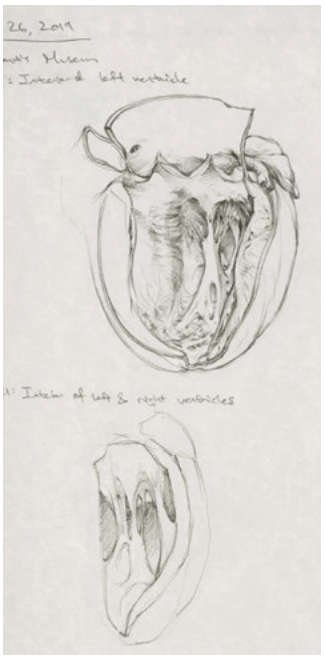

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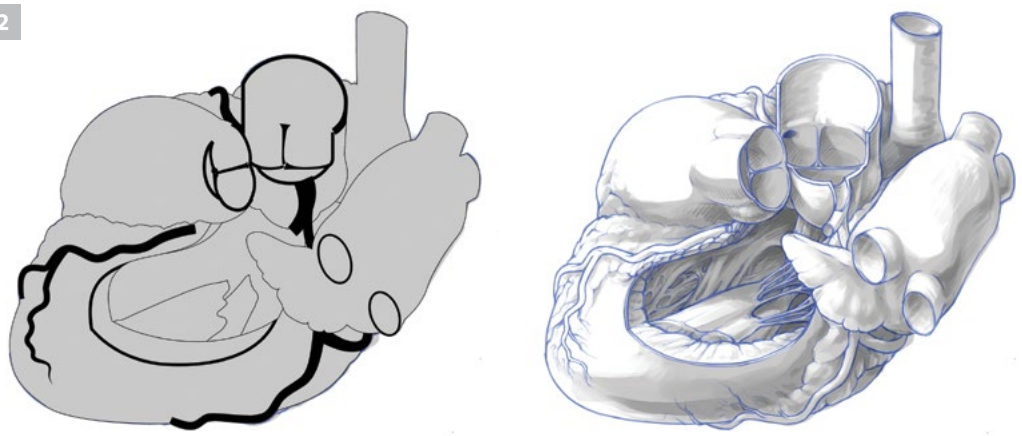

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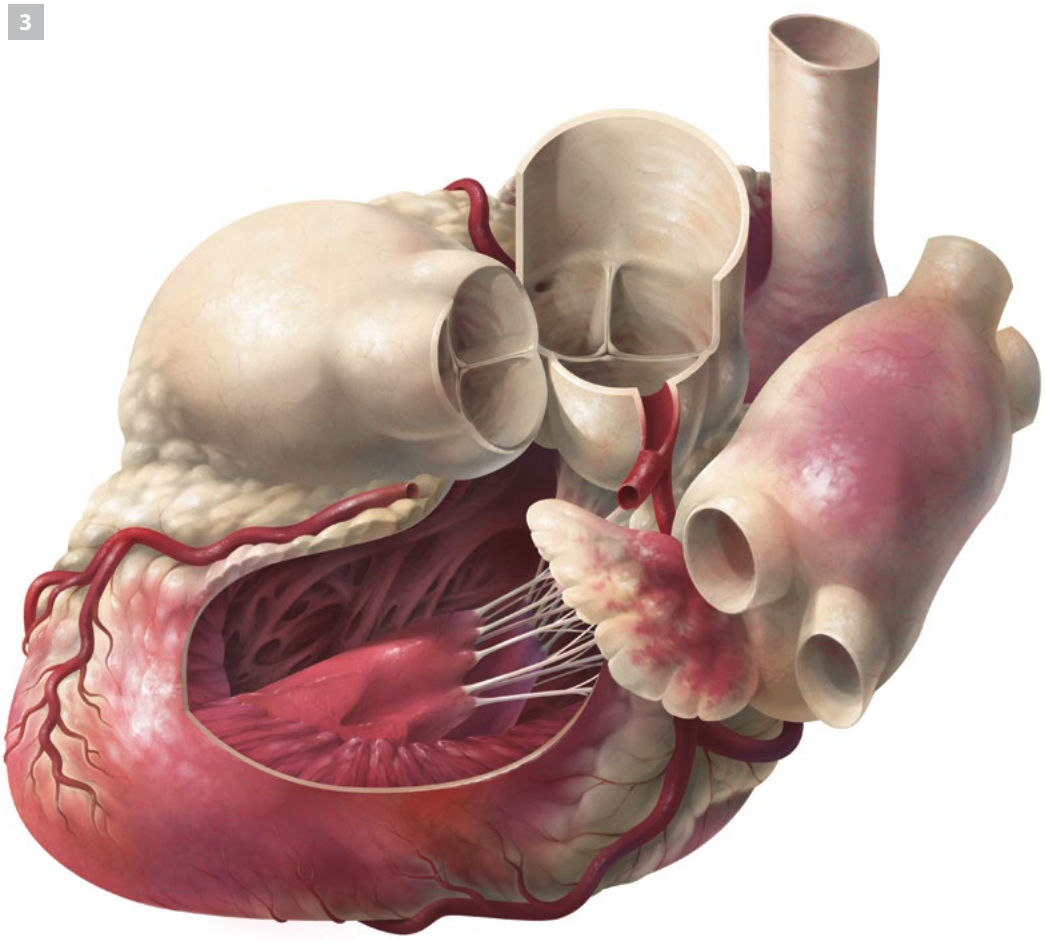

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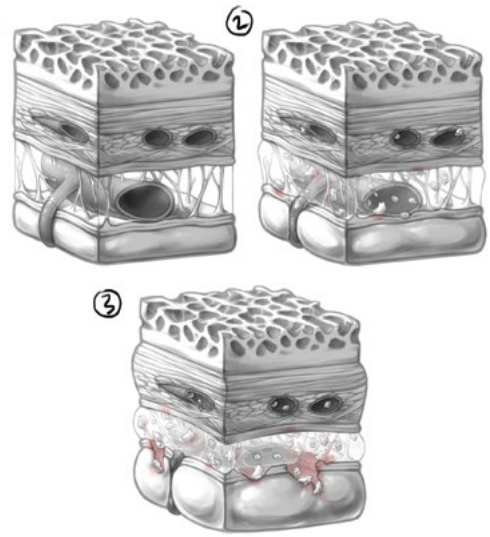

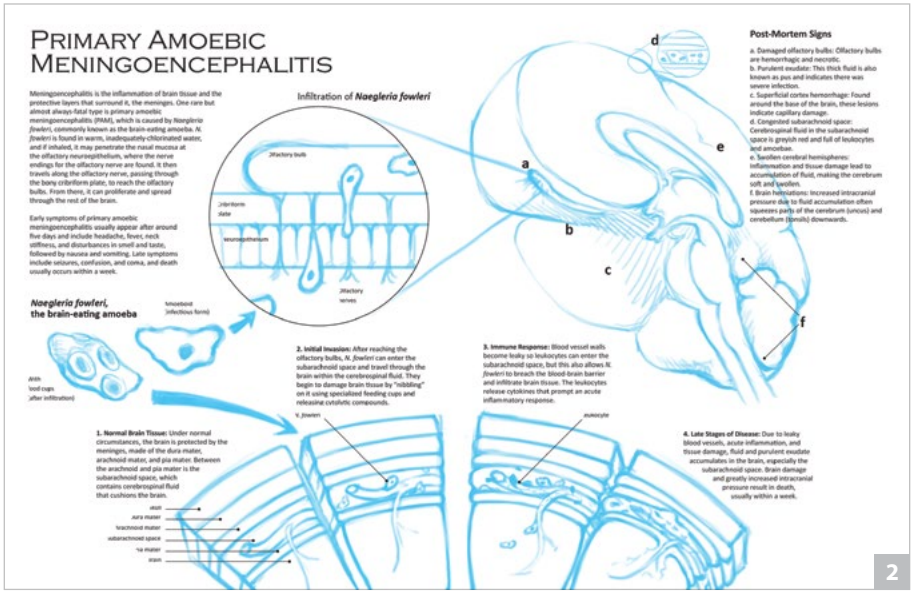

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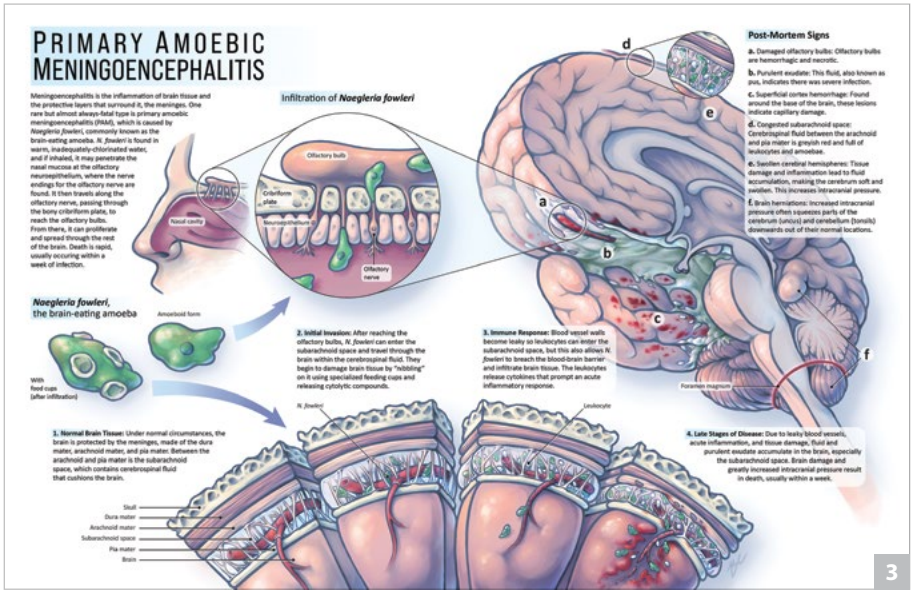

3

Pathological Illustration

Pathological processes occur on multiple scales and are difficult to understand without visual aids. This infographic describes primary amoebic meningoencephalitis, which is caused by *Naegleria fowleri*, colloquially known as the brain-eating amoeba.

1. Study. These studies allowed me to get a feel for important post mortem signs, such as pus on the inferior brain surface, and signs of disease progression, such as cloudy cerebrospinal fluid and swollen brain tissue.

2. Production process. The first draft of the layout involves *Naegleria fowleri*; the nasal cavity, which is the site of infiltration; tissue cubes to show disease progression; and a cerebral hemisphere with the underside visible to show post-mortem signs.

3. Final illustration. The final illustration is rendered in a palette dominated by soft pinks, with *Naegleria fowleri* emphasized by complementary green and tissue damage emphasized by saturated red.

Editorial Illustration

A science journal cover should be eye-catching, yet informative. This mock cover is for an article on the "Photonic Fence", a computer vision and laser system that may be a promising method of insect control.

1. Sketch. These clean orthographic sketches of the mosquito are the basis of the 3D model.

2. 3D modelling. This is the completed 3D model in *Maya*, rigged and ready for posing.

3. Final illustration. The final cover shows a mosquito being identified and targeted by a computer based on time of day, size, and wingbeat frequency. Other mosquitoes are being successfully shot down in the background.

4. 3D modelling. A render of the final mosquito model, which I created created using *Maya* and *ZBrush*.

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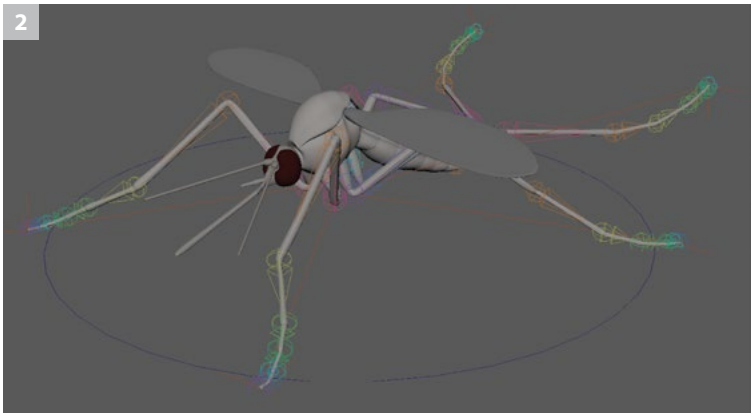

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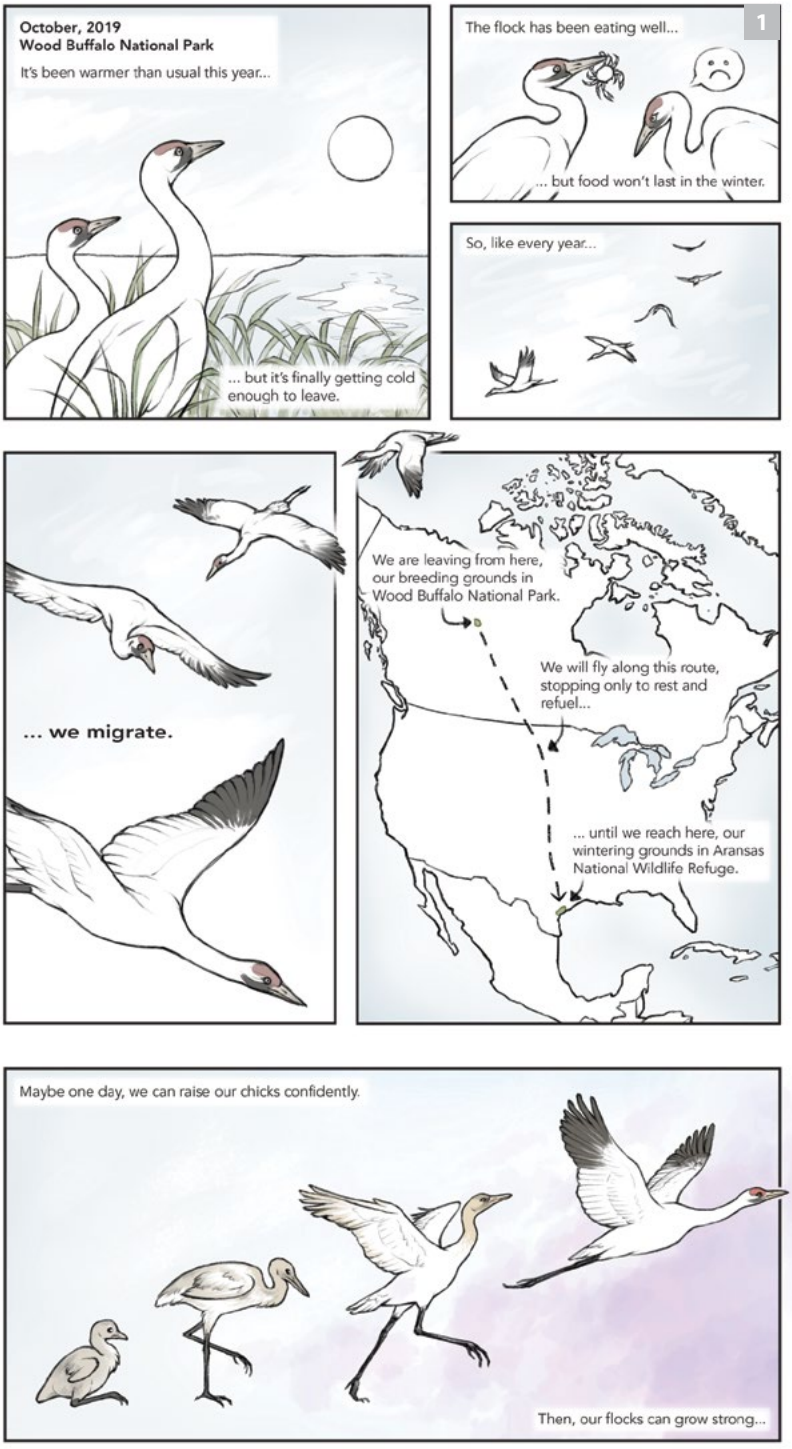
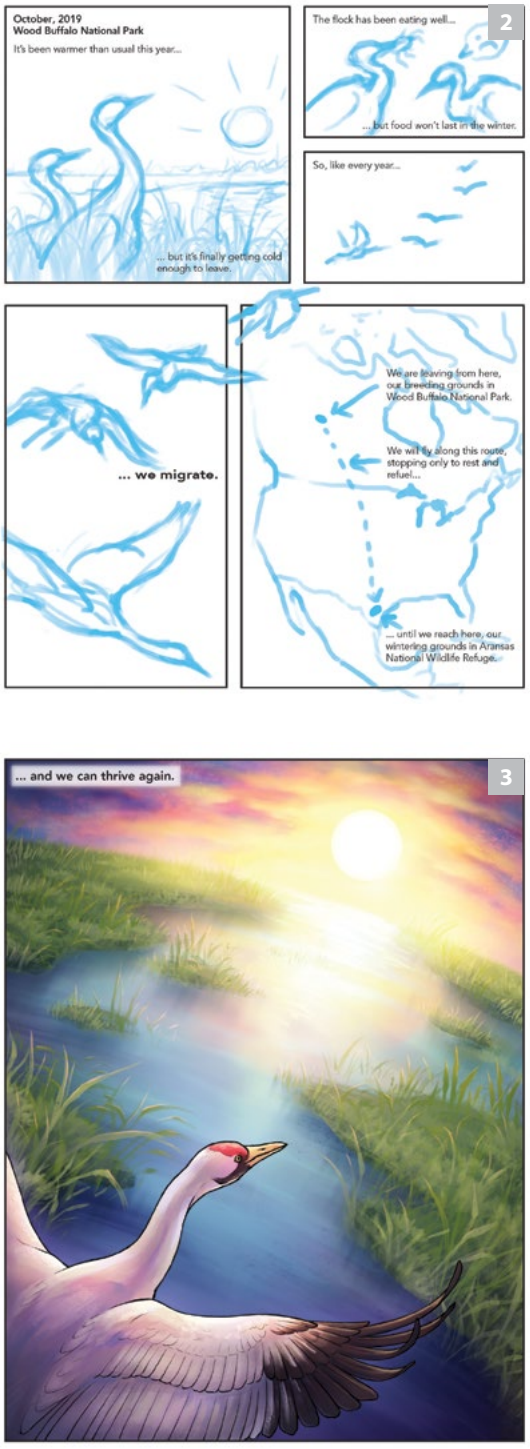




Graphic Biology

Comics are well-suited for connecting with audiences on a deeper level. This comic looks at migration through a bird's perspective to show the importance of conserving their breeding and wintering grounds as well as their migration route.

1. Final illustration. The finished panels are rendered in a delicate style reminiscent of ink and watercolour. The colour palette is muted and shifts to grayscale during bleaker parts of the story (not shown here).

2. Production process. Drafting the comic involved placing panels, text, and visuals in a way that facilitated reading order. One way I did this was to leverage flight's dynamic nature to lead the eye to another panel or to the next page.

3. Final illustration. In contrast to the rest of the comic, the final page is rendered in a wide range of saturated colours to instill a sense of wonder and yearning for a more hopeful future for whooping cranes.

The Impacts of Road Salts on Freshwater Ecosystems

My Master's Research Project is an animation that informs the general public about the impact of road salts on freshwater ecosystems. It also aims to encourage pro-environmental behaviour by cultivating appreciation for freshwater ecosystems, encouraging hope and self-efficacy instead of fear, and presenting concrete solutions.

1

1. Storyboard. The storyboard is where I experiment with and determine shot composition. This panel shows the mosquito larva moments before it is captured by the dragonfly larva.

2. 3D modelling. The shot in *Maya* before rendering and compositing. At this stage, the insect larvae have been fully modeled and animated.

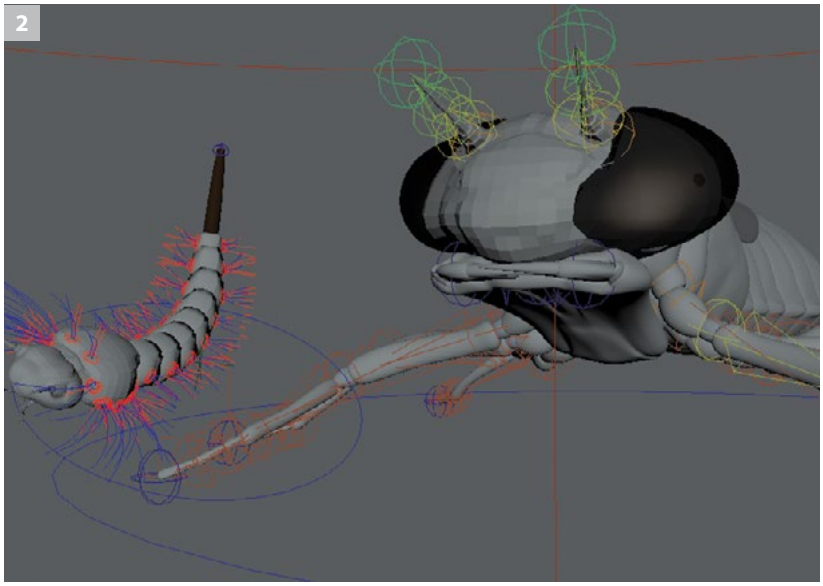
3. Final animation. While modeling, texturing, and lighting was done in *Maya*, I completed many visual effects, such as particles, colour grading, and depth of view, in *After Effects*.

4. 3D modelling. Shown here are orthographic views of the dragonfly larva model in *Maya*. There is also the fully rigged model and the painted UV-unwrapped model of the head.

5. Storyboard. The story is much bigger than just the insect larvae. Shown here are other storyboard panels which describe ecosystem services, food webs, the effects of high salinity, and ways to reduce salt usage.

6. Final animation. This animation incorporated 2D along with 3D elements. These scenes describe ecosystem services, food webs, salt application, and the effects of high salinity.

2



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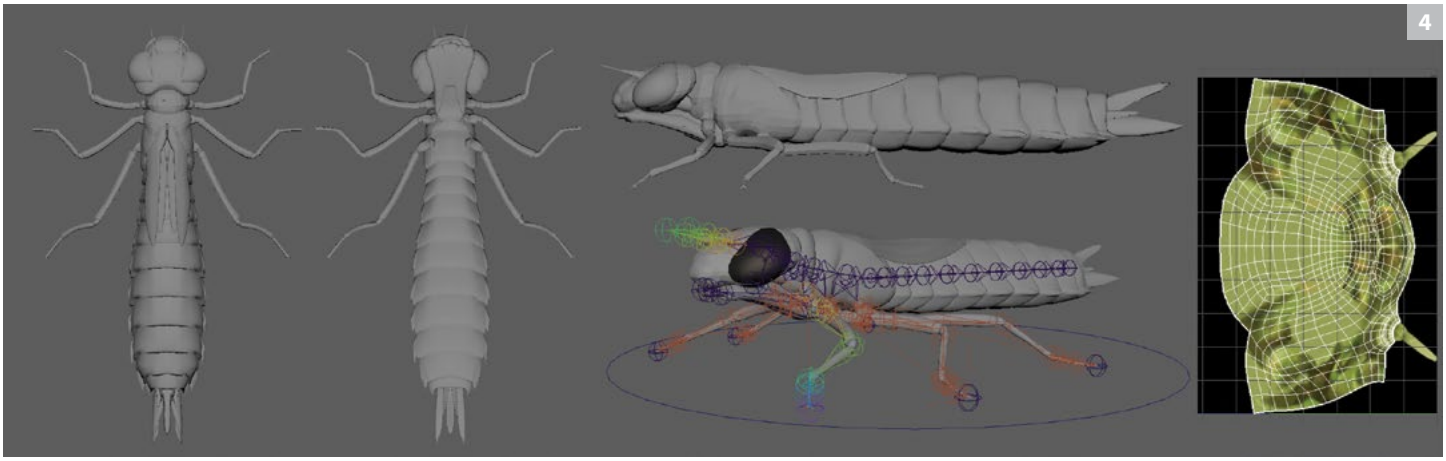
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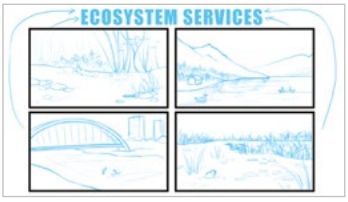
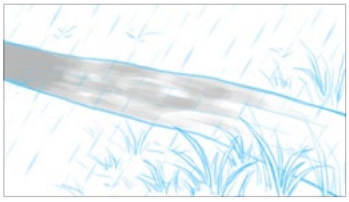
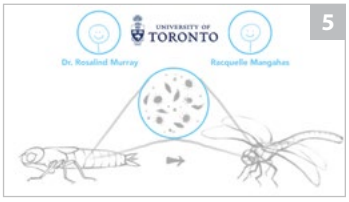

ECOSYSTEM SERVICES

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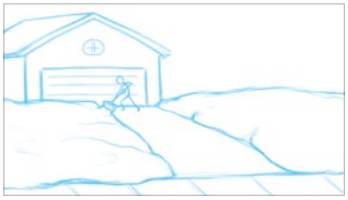
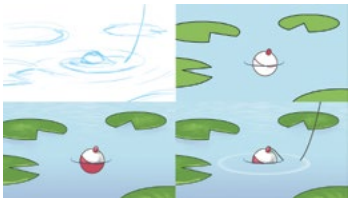
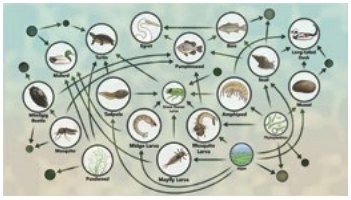
UNIVERSITY OF TORONTO
Dr. Rosalind Murray
Racquelle Mangahas



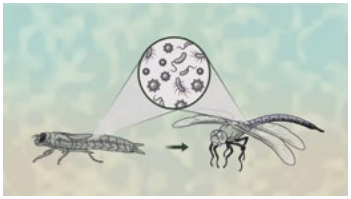


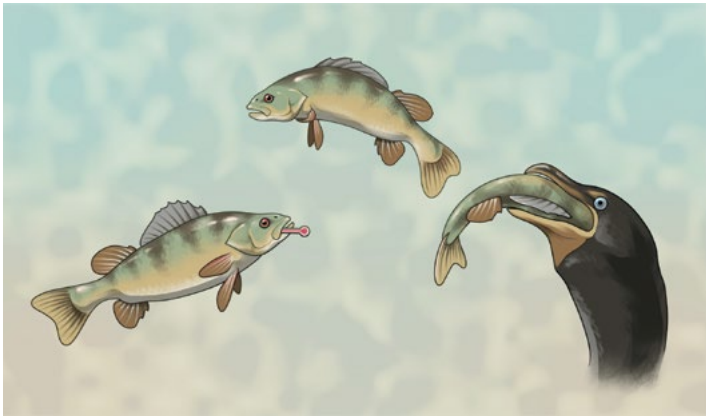

Ecosystem Services
Green Space
Food
Pest Control
Water Detoxification

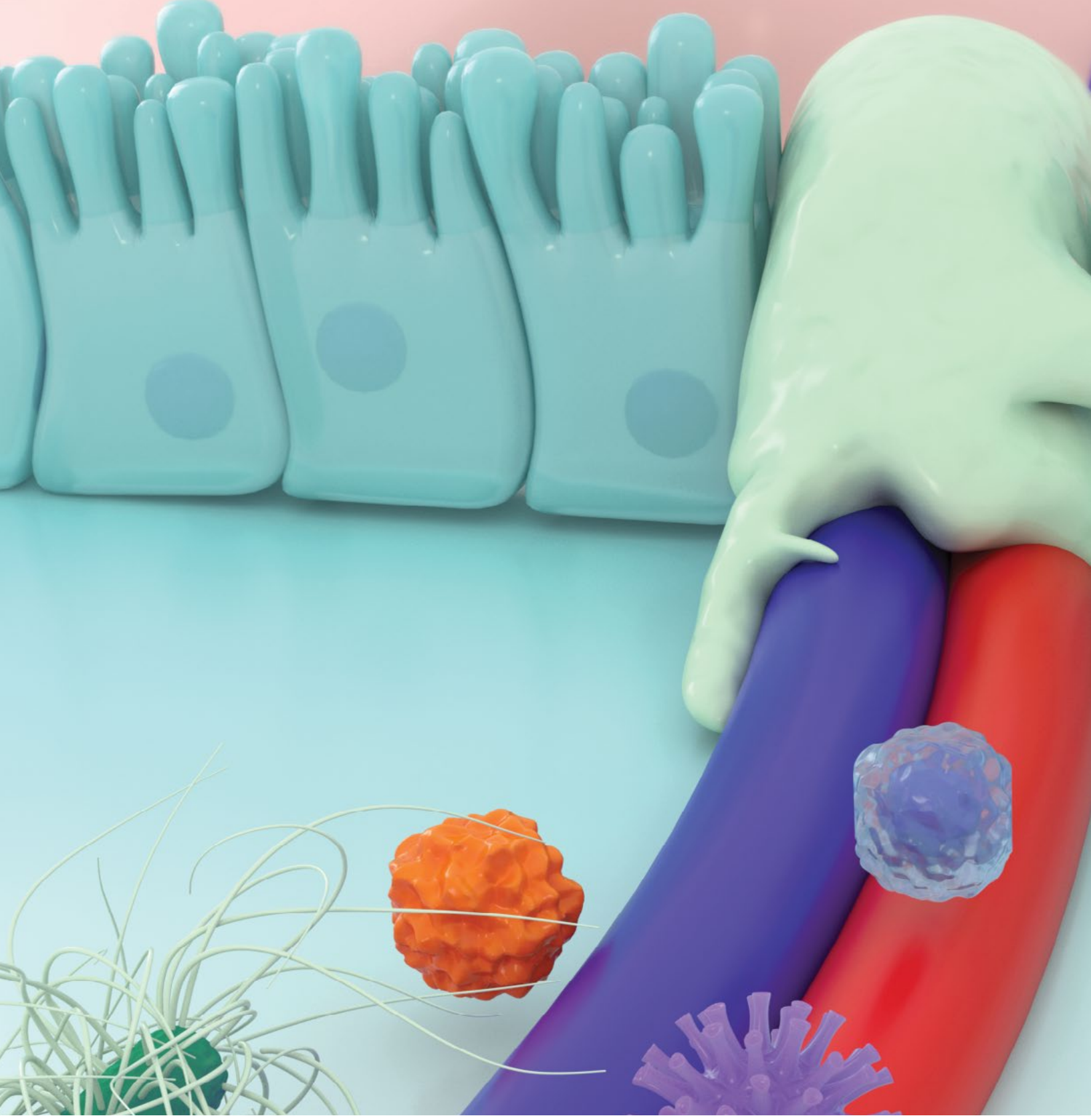

6

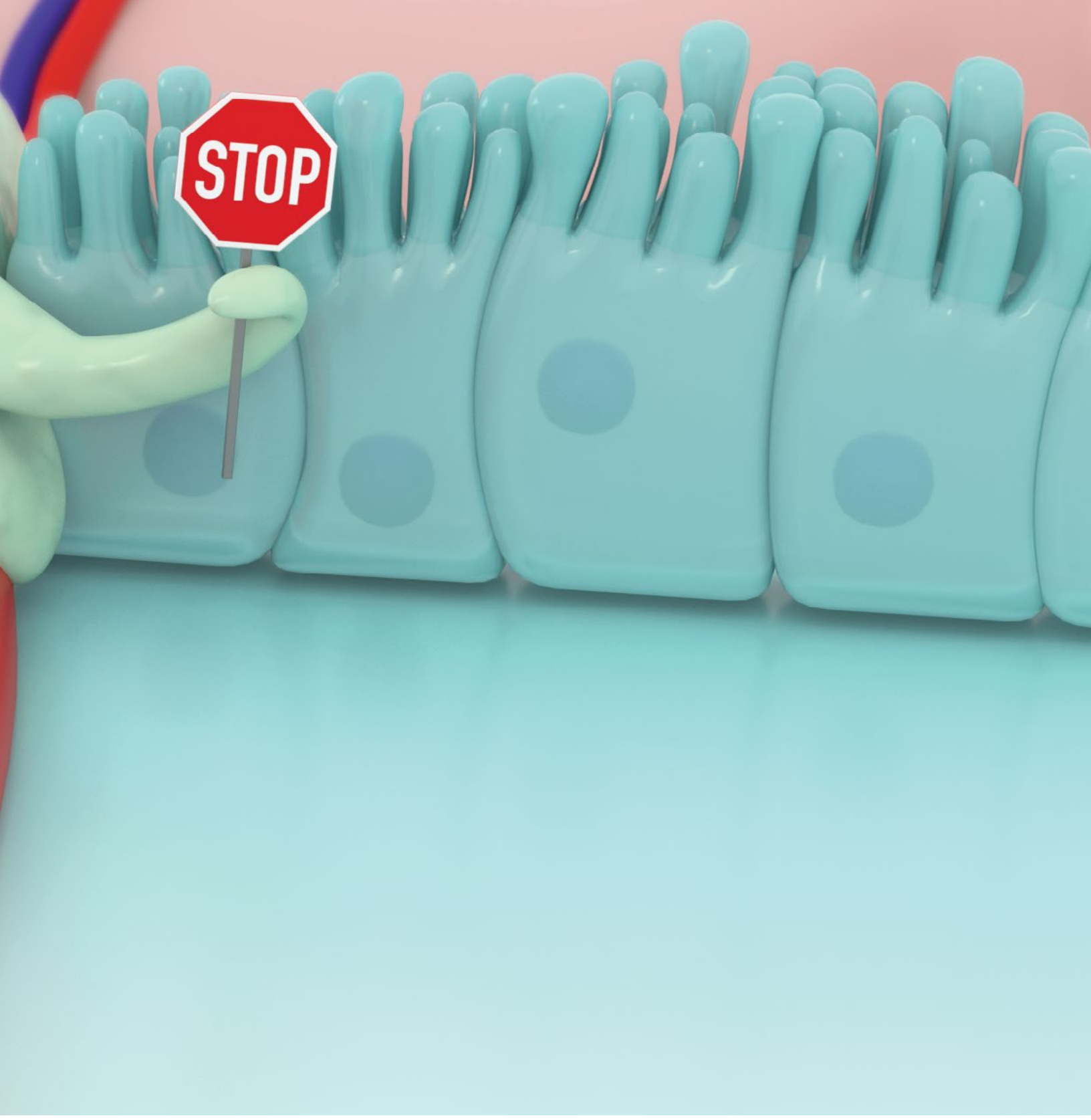



Ecosystem Services









Cassie Hillock-Watling

I am a medical and scientific illustrator who has a passion for communicating ideas to the public. I personally love anything relating to anatomy or pathology. My time at BMC allowed me to grow as an artist and explore many new techniques, though I specialize in 2D work. My love for pathology did not fade as I went through my master's degree, so I am currently a student again, pursuing another master's degree in health science, training to become a pathologists' assistant.

Editorial Illustration

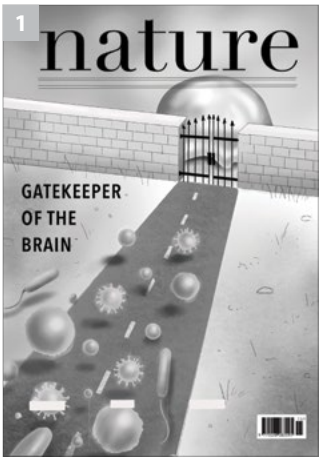
My goal here was to create a journal cover using 3D modelling to visualize a research article about the choroid plexus in a creative way.

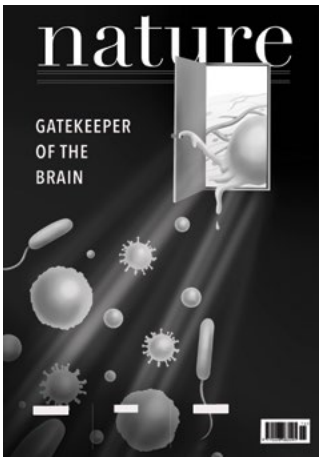
1. Sketch. The first image was one of the first sketches I did to try and work out my ideas. The second image was another version of the cover, but I ended up pursuing the other idea, as it communicated the idea of the article better. The third image shows the final layout before moving on to 3D modelling, where I though about colours and placement; however, it still ended up being changed. Getting the right image takes lots of edits!

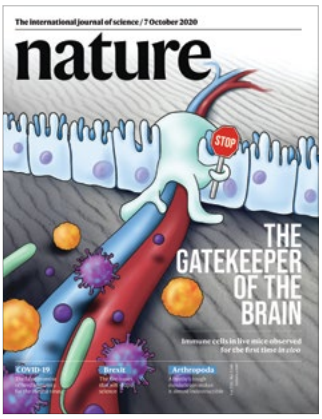
2. Final illustration. I created everything in *Maya*, edited the piece in *Photoshop,* and completed the layout in *Illustrator*. Elements still changed from the final draft and I am very happy with how it turned out! This was one of my favourite illustrations from BMC.

Previous spread. Final illustration. A close-up of the choroid plexus from my mock journal cover.

1





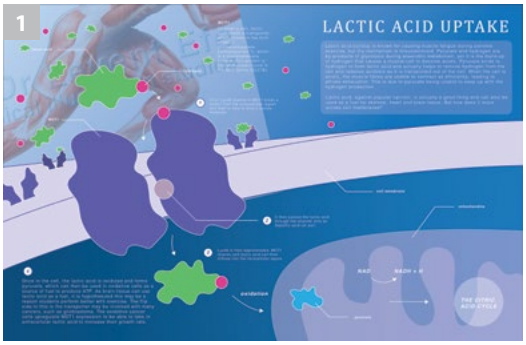


2

Molecular Visualization

The goal of this visualization was to explain a biomolecular concept/process, and this attempts to show how lactic acid is taken in by a cell.

1



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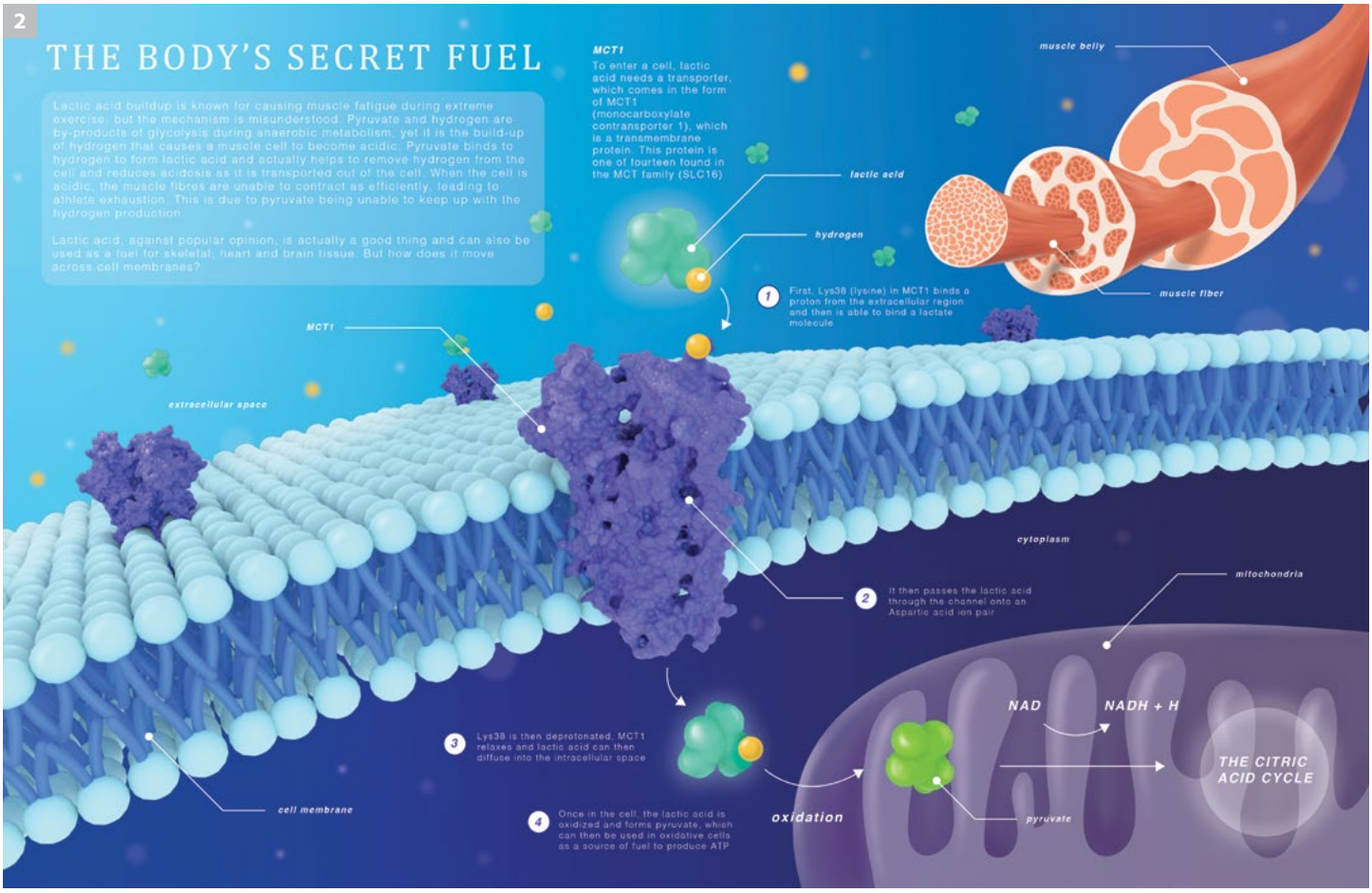

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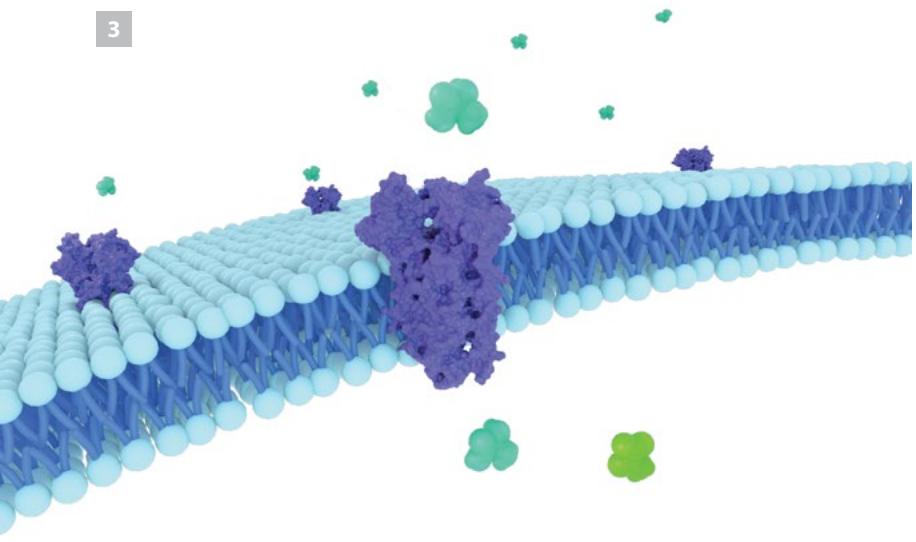


1. Sketch. This was a first attempt at content layout, which allowed me to see what would and would not work. As you can see, it is quite different from the final piece.

2. Final illustration. This is the final piece! I enjoyed combining 2D and 3D elements for the completed spread.

3. 3D modelling. This is the cell membrane with molecules that I rendered in 3D using *Cinema 4D*.

Pathological Illustration

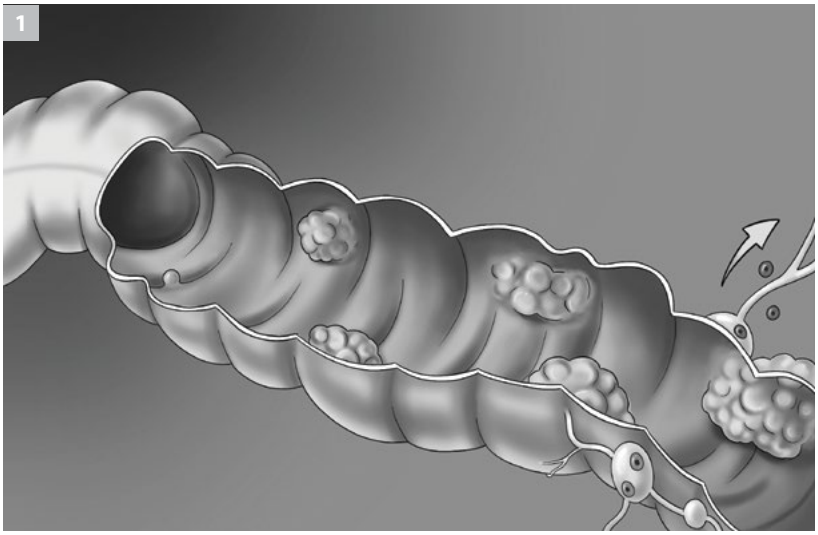
The goal of this project was to visualize the progress of colorectal cancer through its different stages.

1. Sketch. This was the first sketch of how I wanted my intestine to look and where I might place the tumours.

2. Sketch. This was a sketch of the inside of a colon to get a feel for the texture of the tissue.

3. Production process. This was my first attempt at a layout, which helped me work out where I wanted different elements to go.

1



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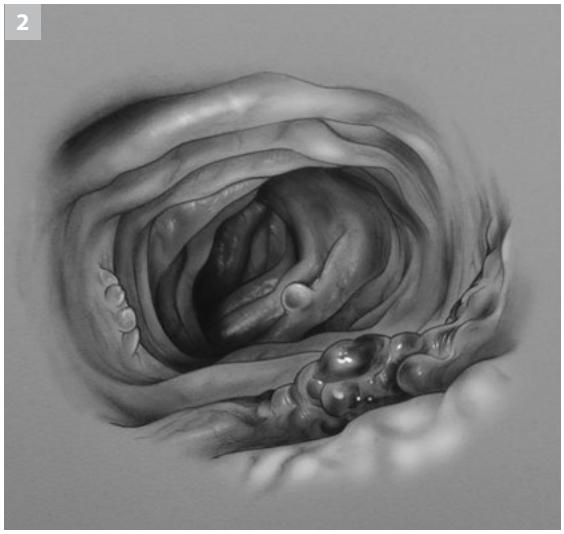

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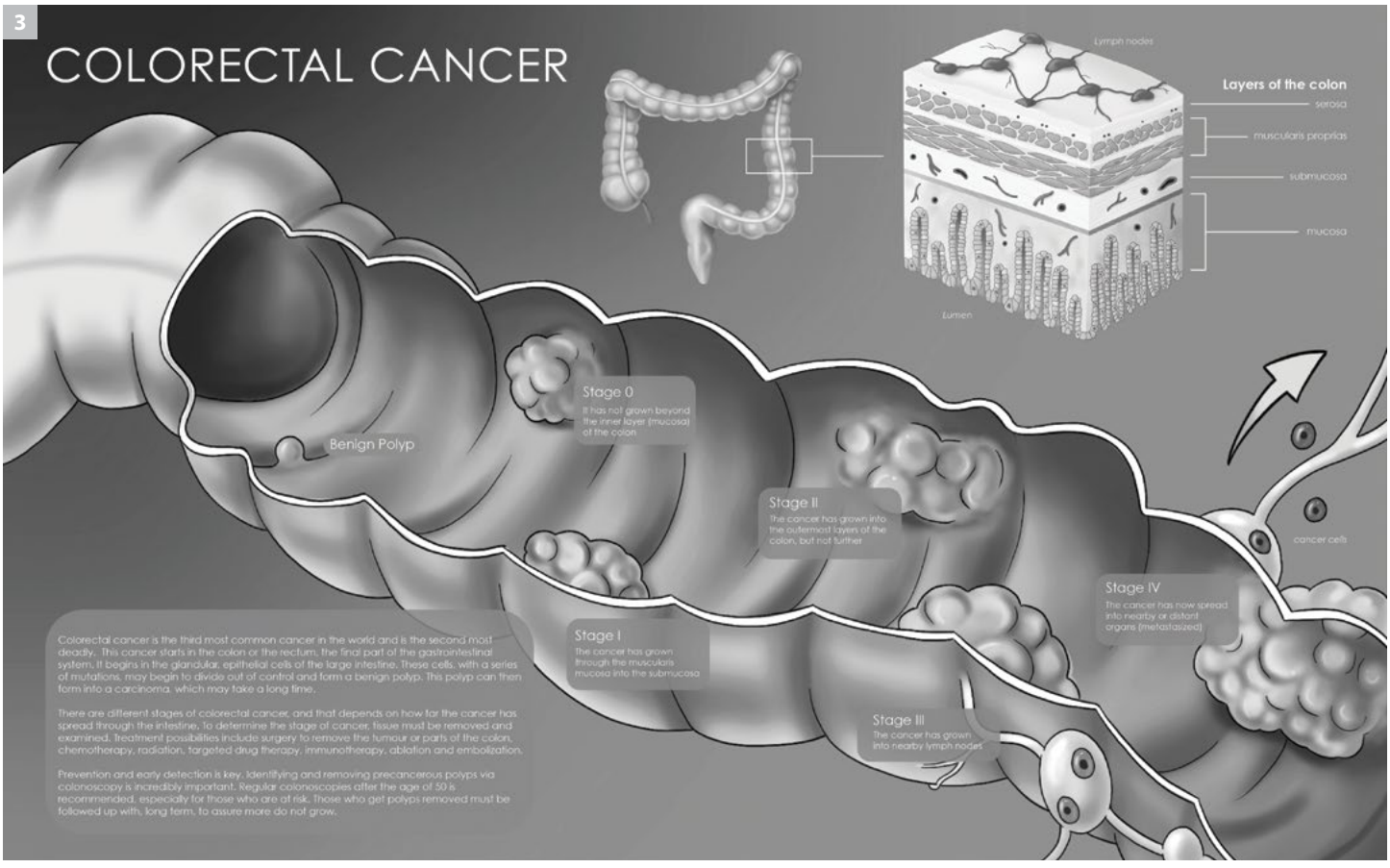
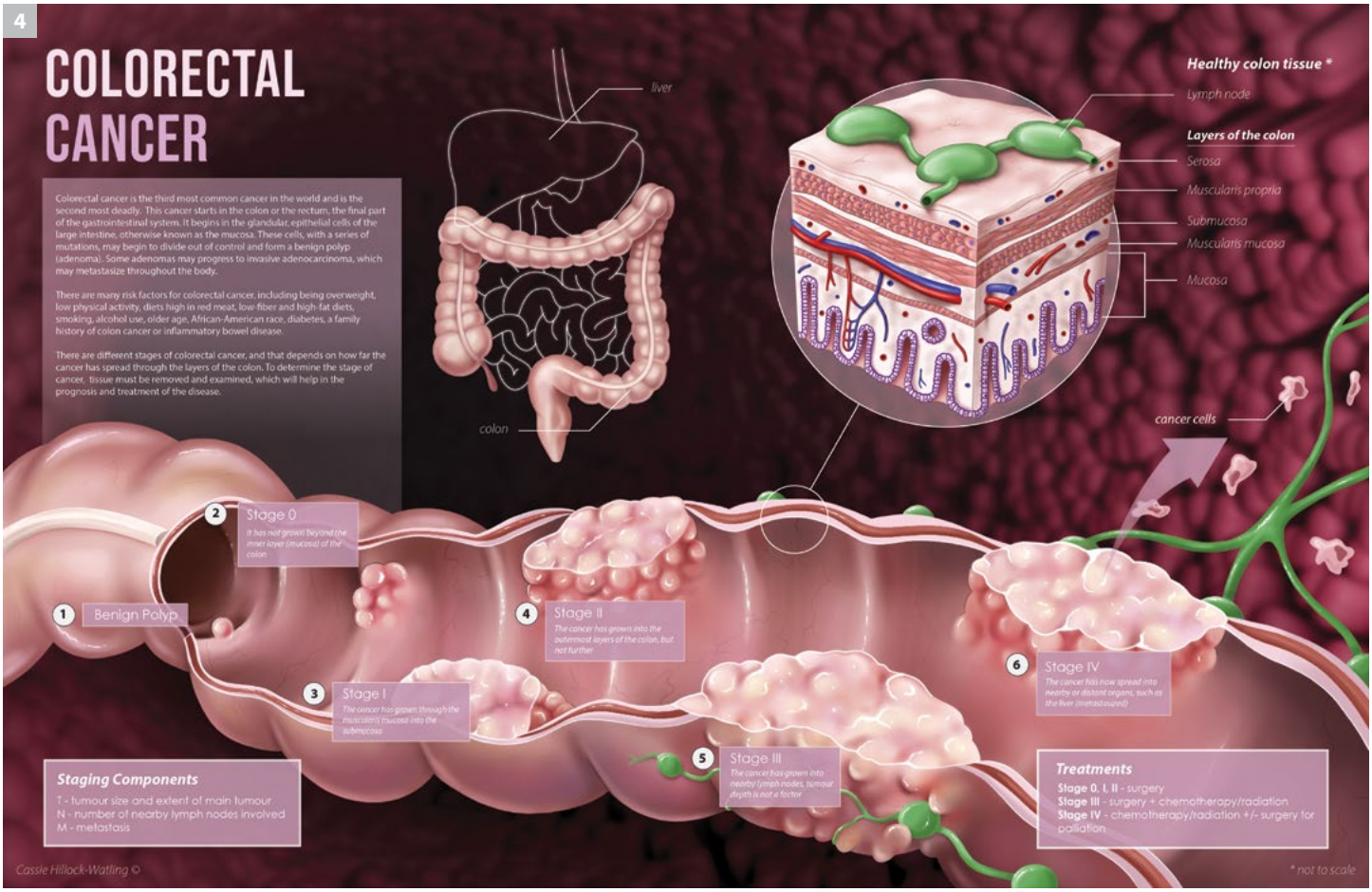
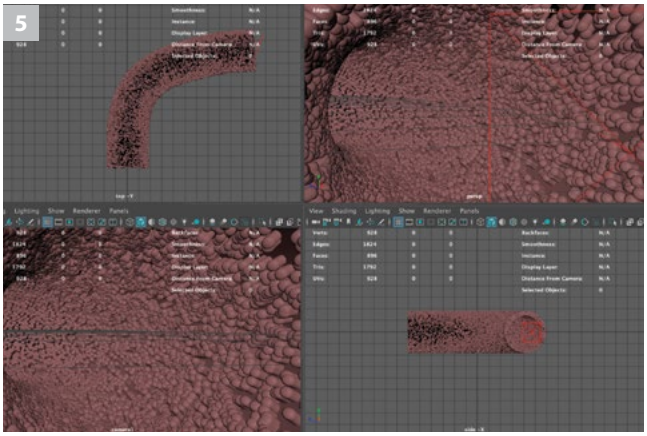
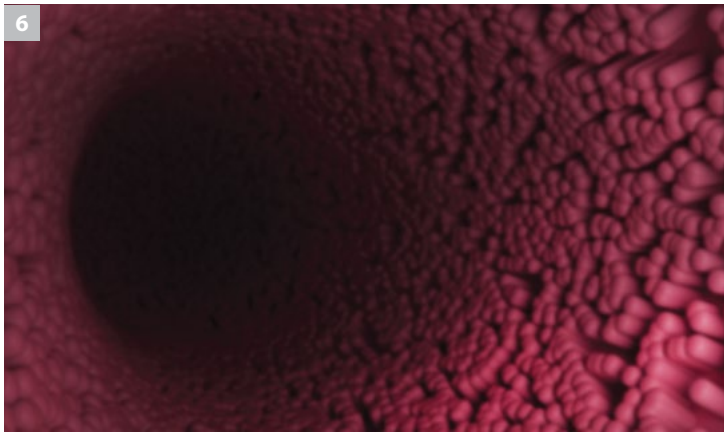








4. Final illustration. I was quite happy with the final piece, which evolved significantly from the first draft thanks to many rounds of editing.

5. 3D modelling. I wanted to create a background that looked like intestinal villi, so I modeled a "tunnel" in *Maya.*

6. 3D modelling. This was the final render of that the tunnel, which I edited in *Photoshop* and used as the background in my final piece.

Pachycephalosaurus: New Evidence for Tripodal Posturing Behaviour in a Dinosaur

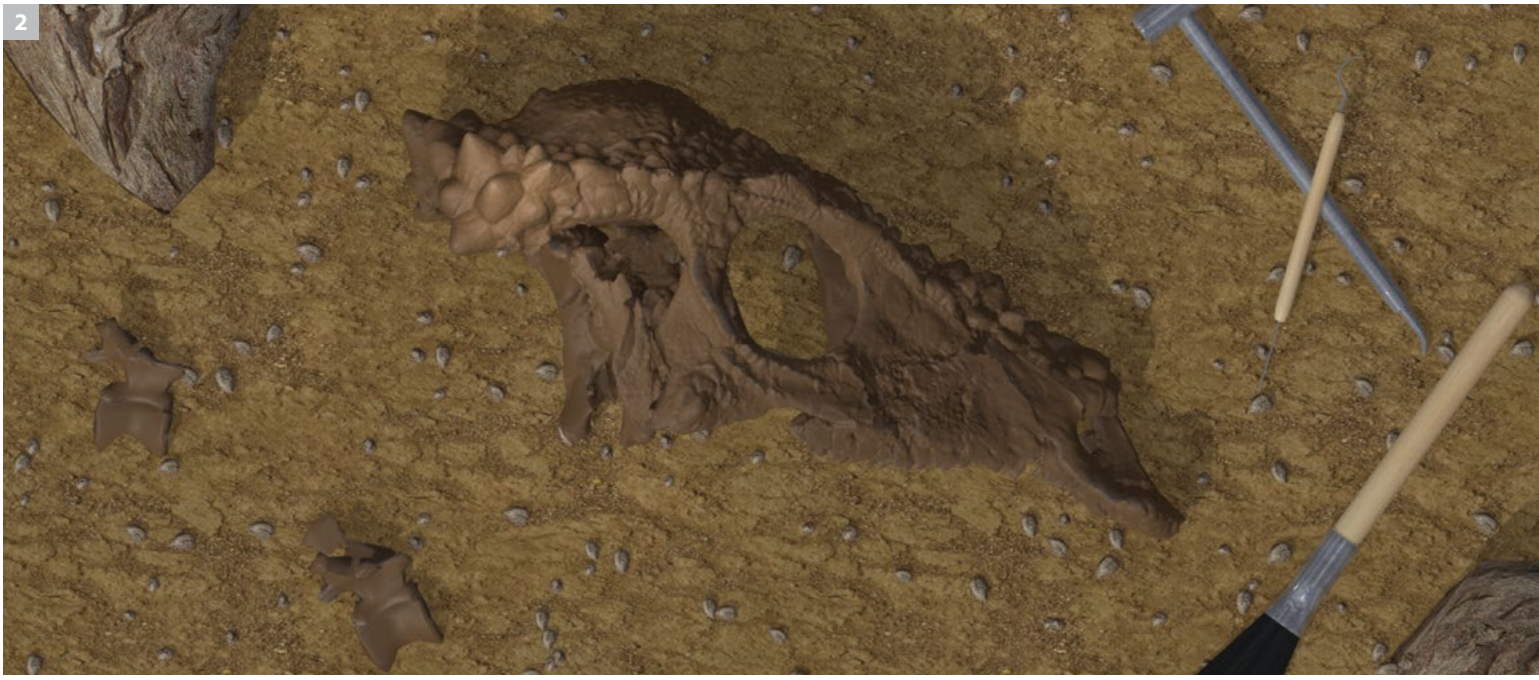
My Master's Research Project (MRP) was an animation for the general public that visualized fossil evidence suggesting that the dinosaur *Pachycephalosaurus* may have used its tail as a tripod, or a "third-leg".

1. Final animation. The top right image is an animation still from the opening scene. The bottom still is taken during the "boxing scene". The animation was created in *Procreate* and *After Effects*.

2. 3D modelling. I used a 3D model of the skull and vertebrae and then built the scene and tools around it.

3. Final animation. This is a series of animation stills from my final MRP. As shown in the first images of the series (top left), I used a 3D fossil model from CT scan data and animated it rotating in *Maya*. The second animation still (top right) shows a kangaroo tail, highlighting similarities to the dinosaur tail. The last still (bottom) shows the large leg and tail muscle of *Pachycephalosaurus*. The latter two images were created in *Procreate*, *After Effects,* and *Illustrator*.

2



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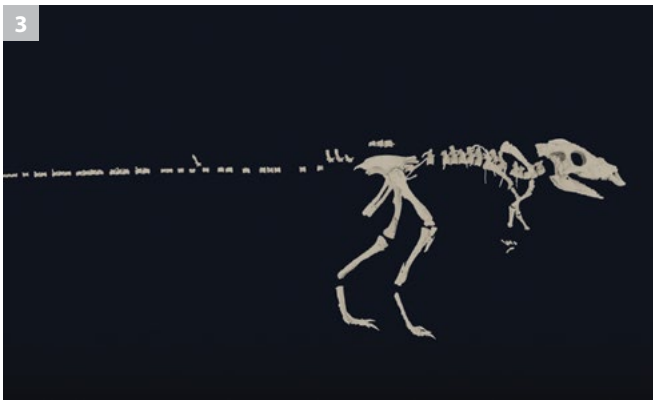
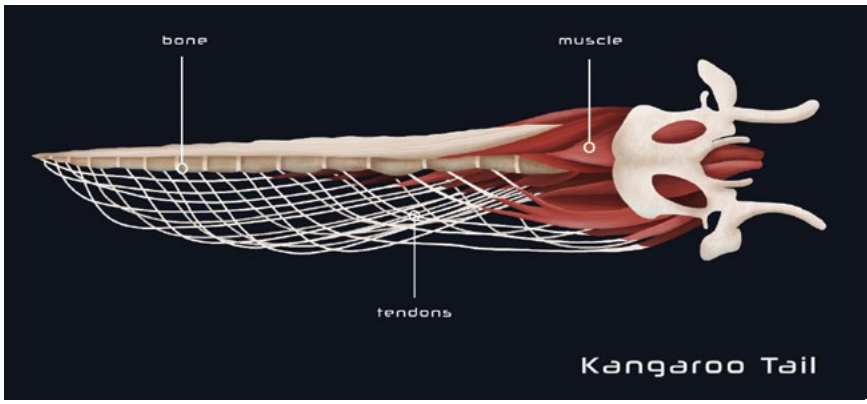
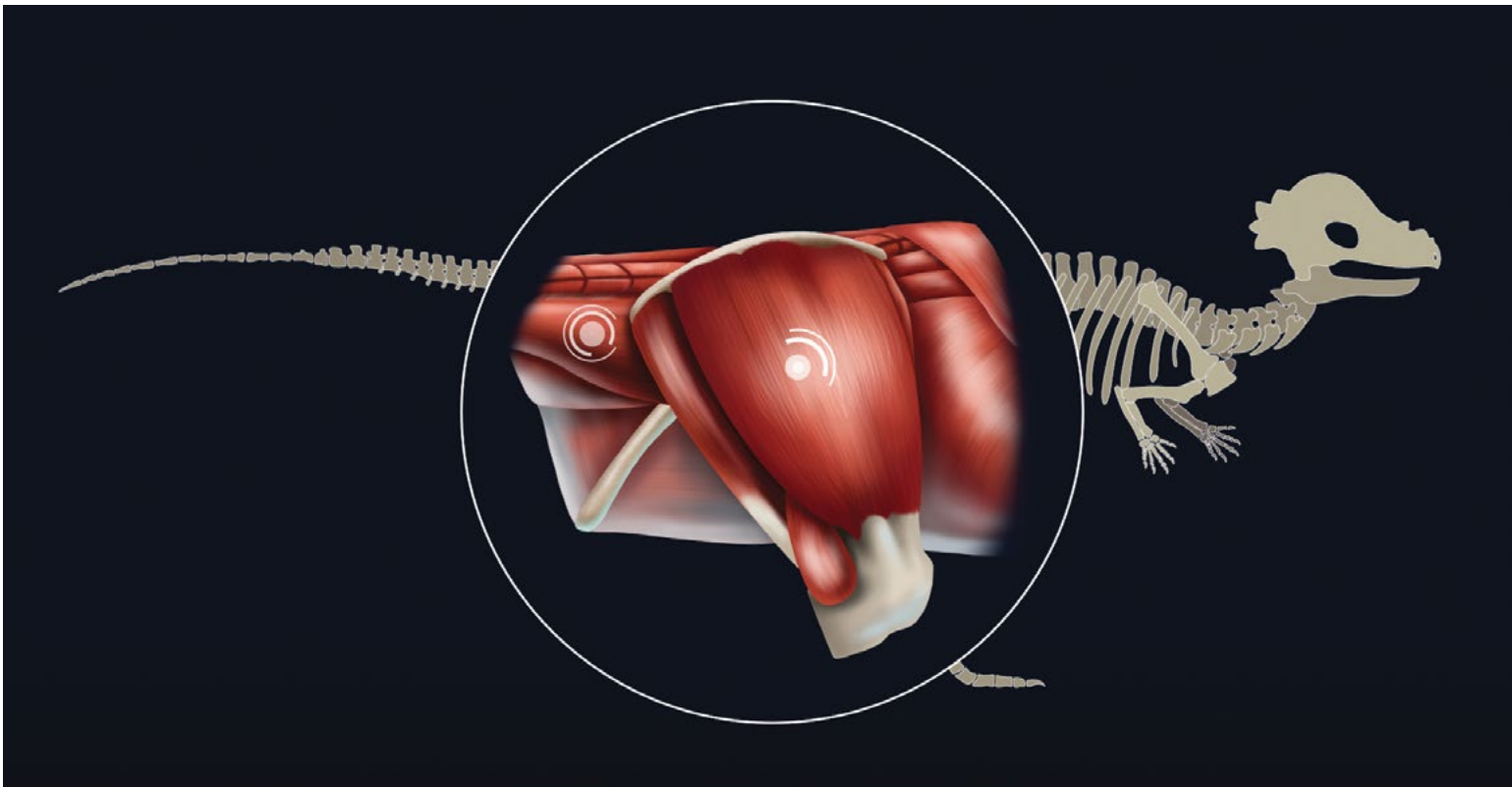
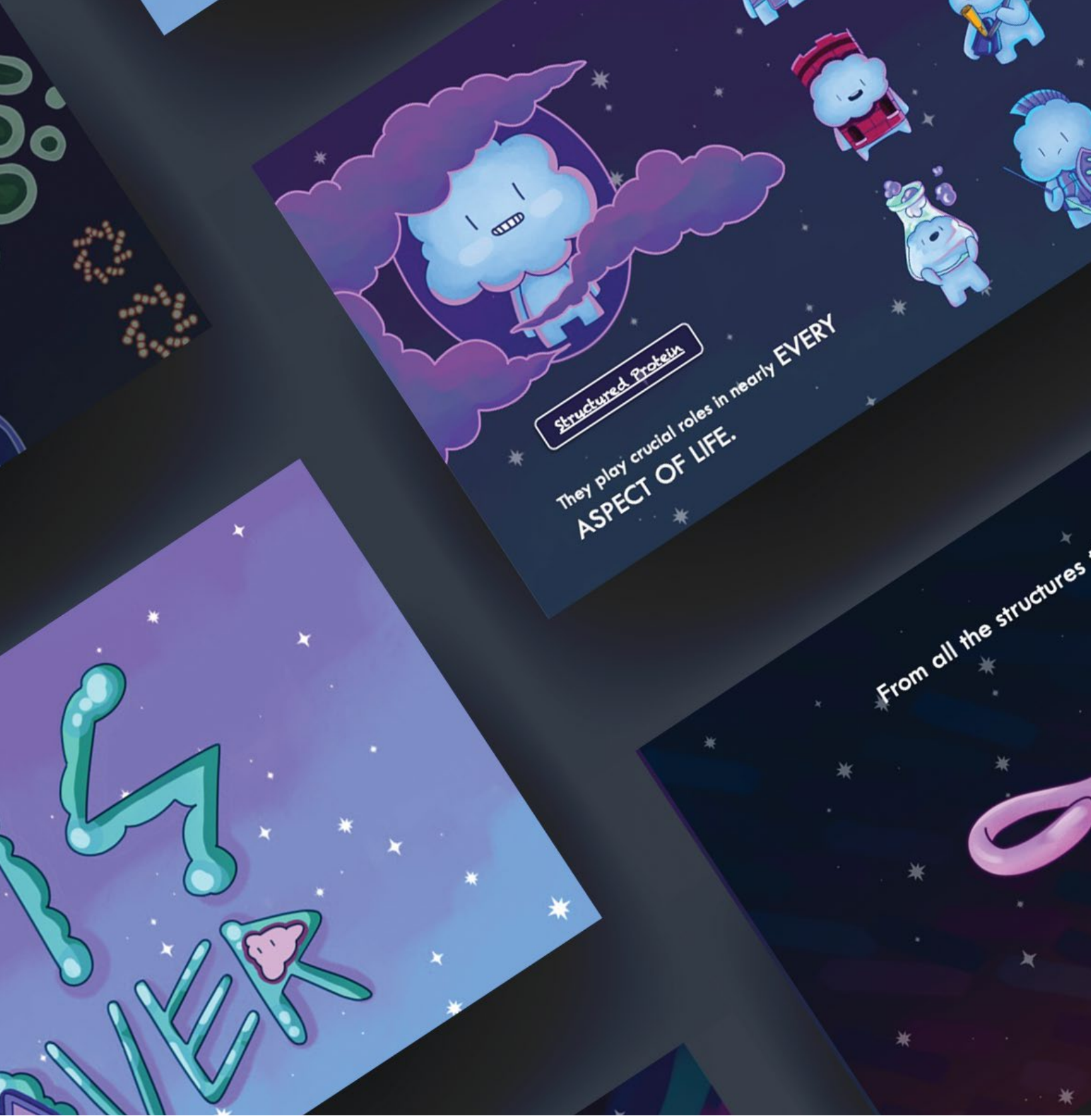







Inside our cells
are millions
of tiny molecules called
PROTEIN.
This protein is an enzyme
d LYSOZYME.

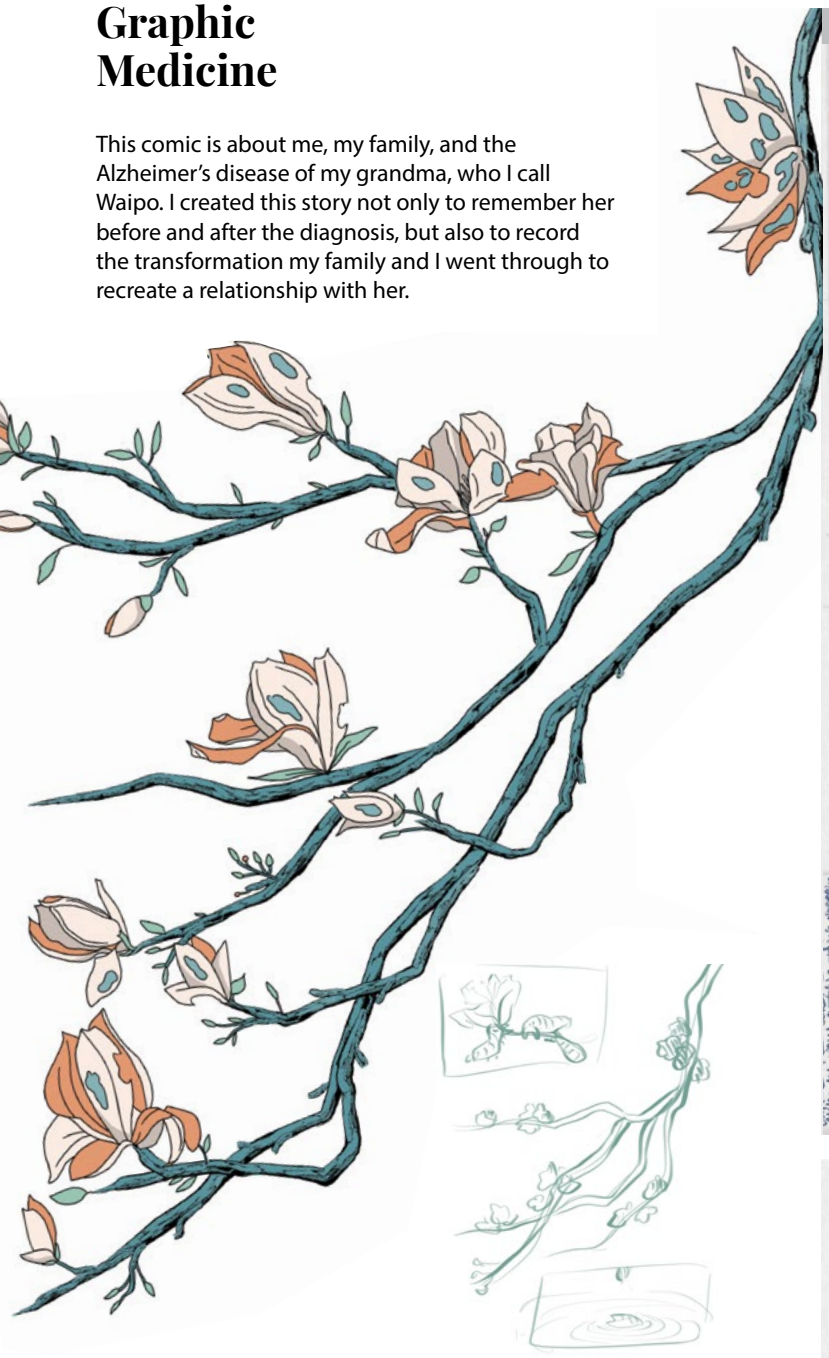


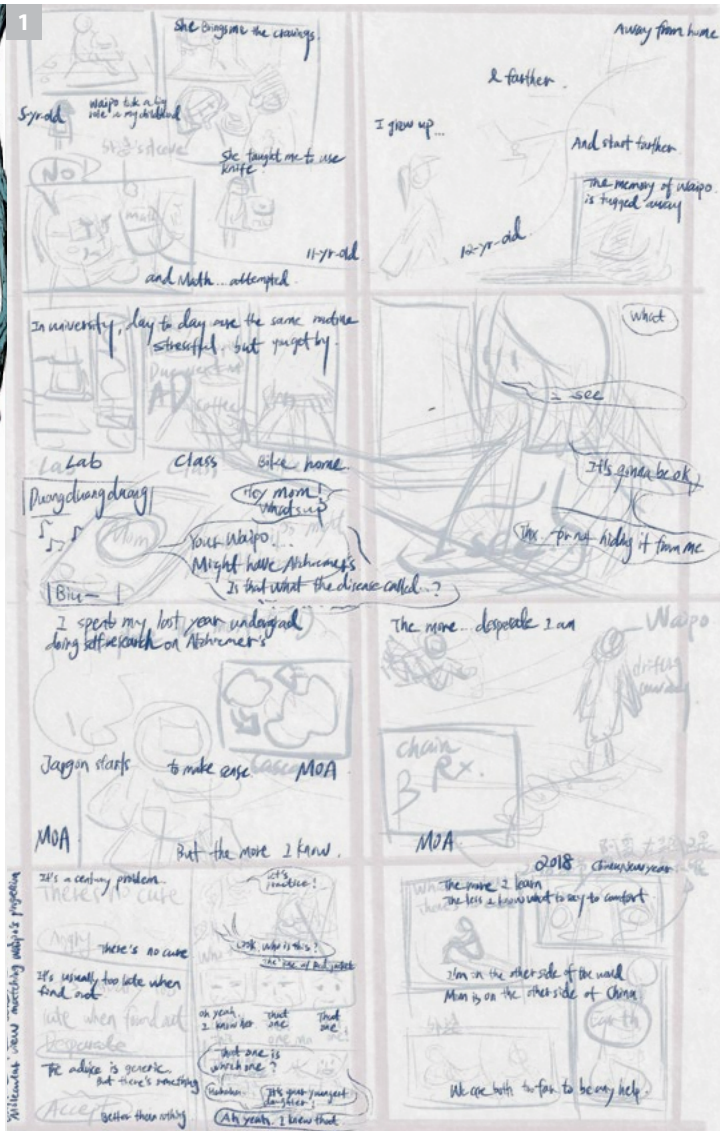
Chloe Ma

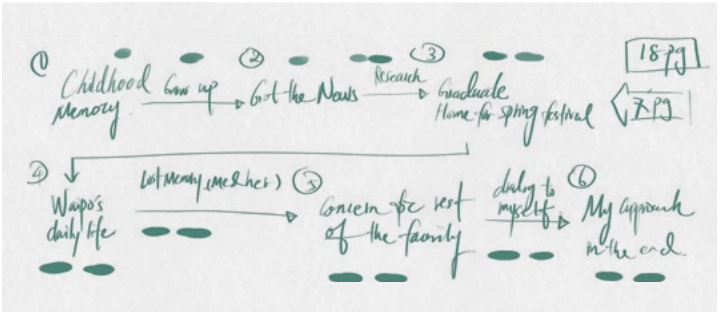
Hi, it's Chloe! Magic happens in BMC where hidden potentials are eager to surface. I am a highly goal-oriented problem solver, and I plan to leverage my creative thinking in the healthcare field where I can use my visual toolkit to the fullest. I have explored many possibilities during my BMC journey and found my passion in strategic design, UI/UX, and storytelling—all of which contribute to my belief in bettering the world through visual communication.

Graphic Medicine

This comic is about me, my family, and the Alzheimer's disease of my grandma, who I call Waipo. I created this story not only to remember her before and after the diagnosis, but also to record the transformation my family and I went through to recreate a relationship with her.





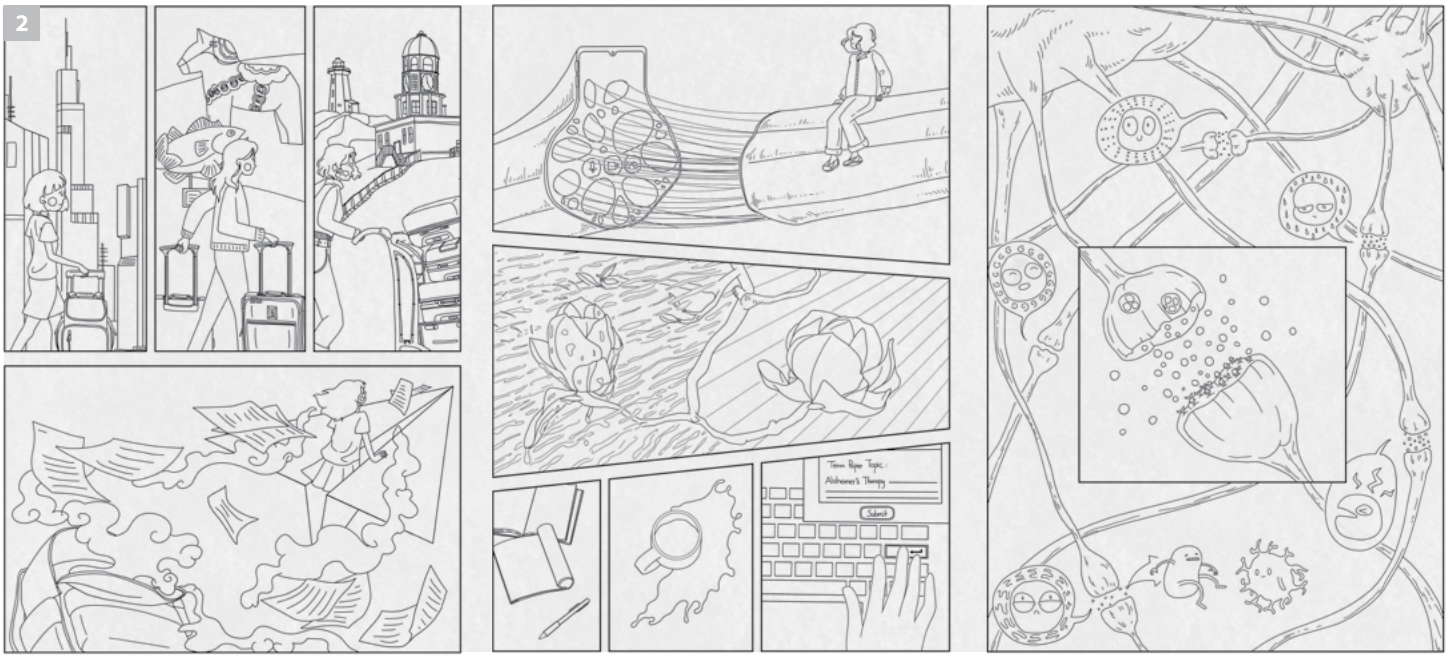


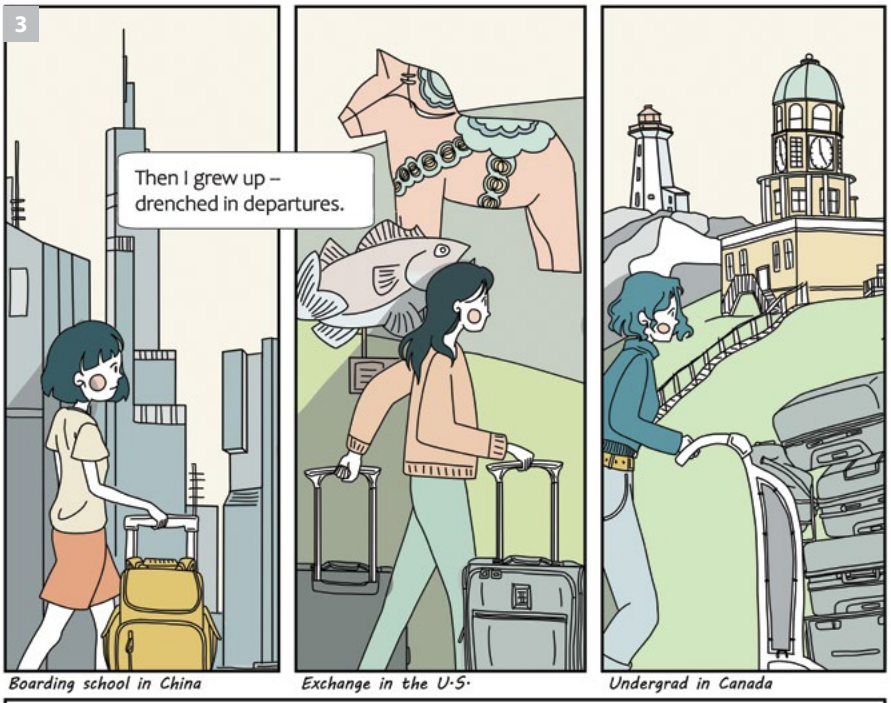
1. Sketch. Thumbnail sketches with a rough layout, text boxes, and a plot timeline with page numbers so that I ensured the best pace for the story. The magnolia branch symbolizes the family tree and the genetic inheritance aspect of Alzheimer's disease.

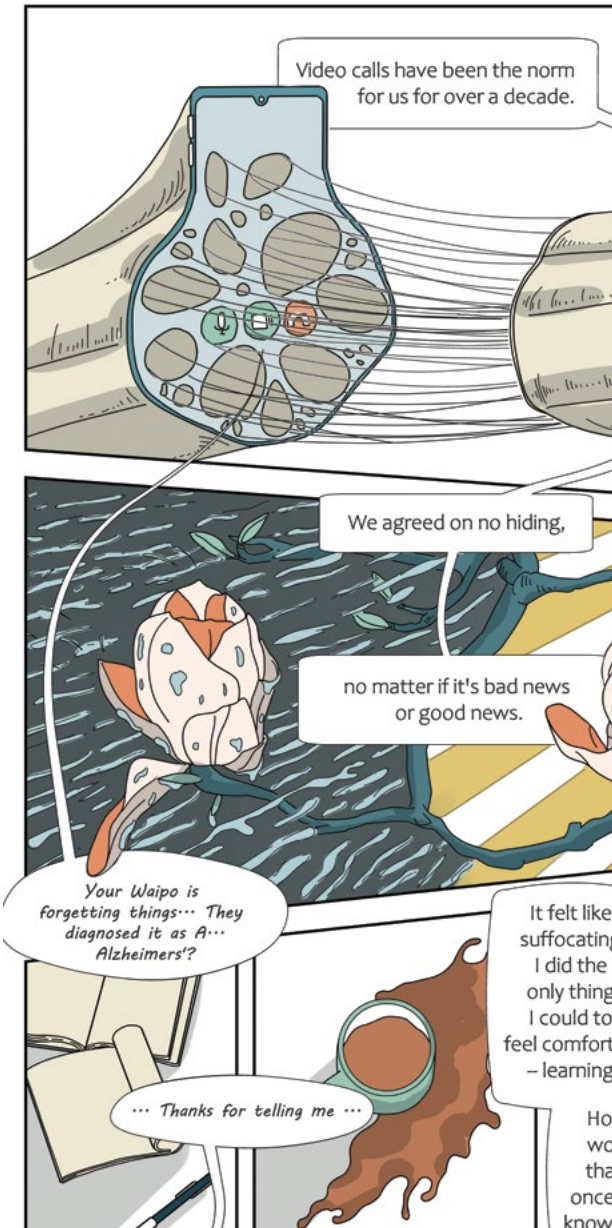
2. Production process. Line art of select pages. I choose a uniform line weight for visual literacy and consistency.

3. Final illustration. The final look of the select pages. I used analogies to express my feelings and light up the daunting topic. The backpack is used to represent life experience and memory, the paper plane is the restless travels that brought me away from family, and the lotus root symbolizes my family relationship—we are physically apart, yet still connected by internet.

Previous spread. Final interactive. A collection of screenshots from my Master's Research Project: DIScover.


2
Term Paper Topic:
Alzheimer's Therapy
Submit


3
Then I grew up –
drenched in departures.
Boarding school in China
Exchange in the U.S.
Undergrad in Canada
What I didn't know was
once you're on the road,
you're always on the go.
And it comes with a price.


Video calls have been the norm
for us for over a decade.
We agreed on no hiding,
no matter if it's bad news
or good news.
Your Waipo is
forgetting things··· They
diagnosed it as A···
Alzheimers'?
··· Thanks for telling me ···
It felt like
suffocatin
I did the
only thing
I could to
feel comfort
– learning
Ho
wo
tha
once
know

Chloe Ma

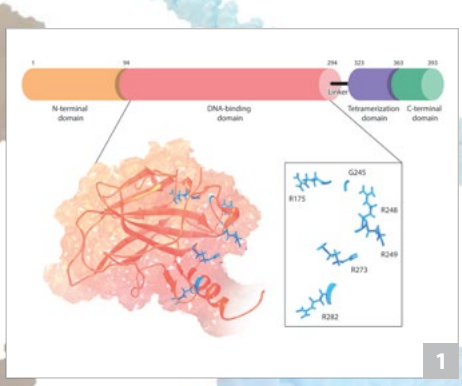
Molecular Visualization

I created this two-page illustration to visualize how the disordered C-terminal domain of the tumor-suppressor protein p53 interacts with DNA at the molecular level in response to cellular stress via post-translational modifications.

1. Final illustration. Full-length p53 tetramer model in complex with DNA and the hot-spot cancer mutations in p53 DNA-binding domain.

2. Production process. Thumbnails of my layout experiments.

3. Final illustration. Final deliverable for the course (left) and later for the AMI submission (right). I integrated both 3D renderings of p53 alongside 2D schematic representations in order to visually communicate the molecular functions of the protein in the context of its atomic structure. The new layout and render was tested for better readability.



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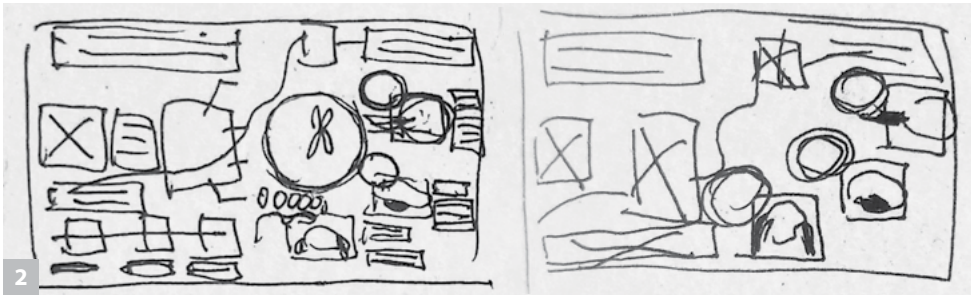

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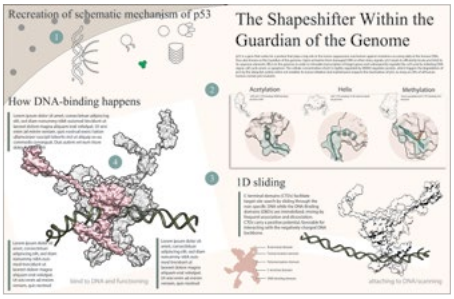

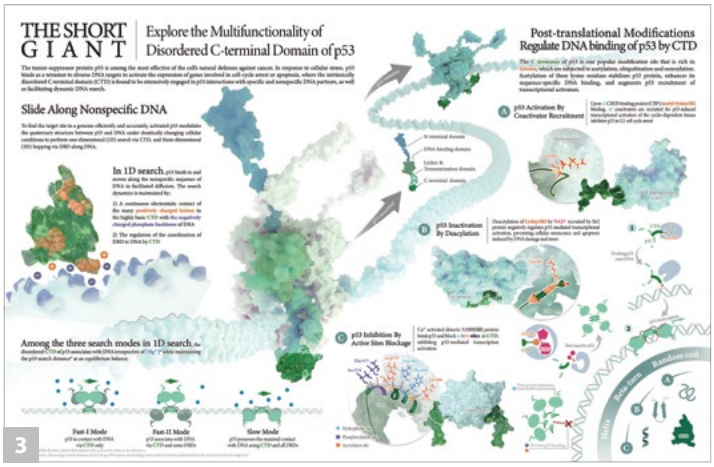

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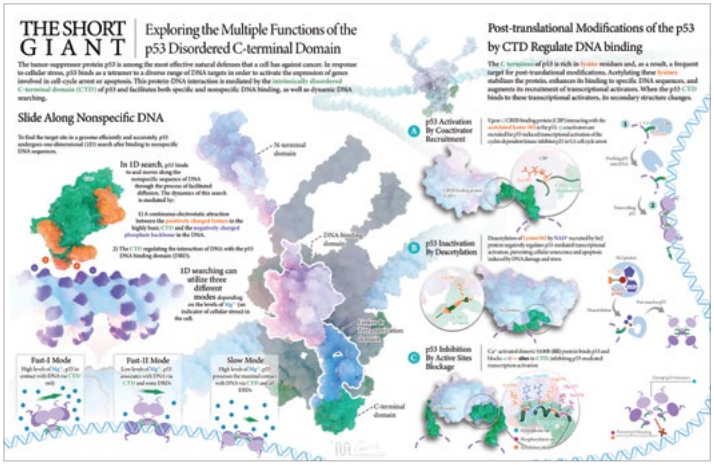
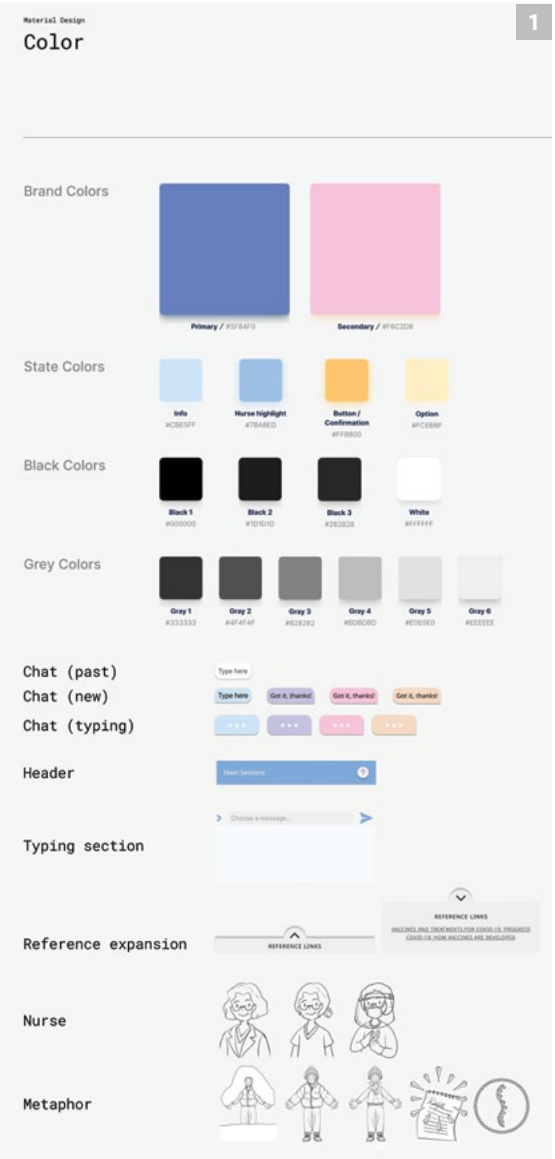


UI/UX Design

Working with Willow Yang and Yu Xiang Ren, we wanted to keep our loved-ones safe. We decided to help with the vaccine hesitancy issue by delivering an interactive mobile-first website that addresses misinformation surrounding COVID-19 vaccines via a chatbot format.

1



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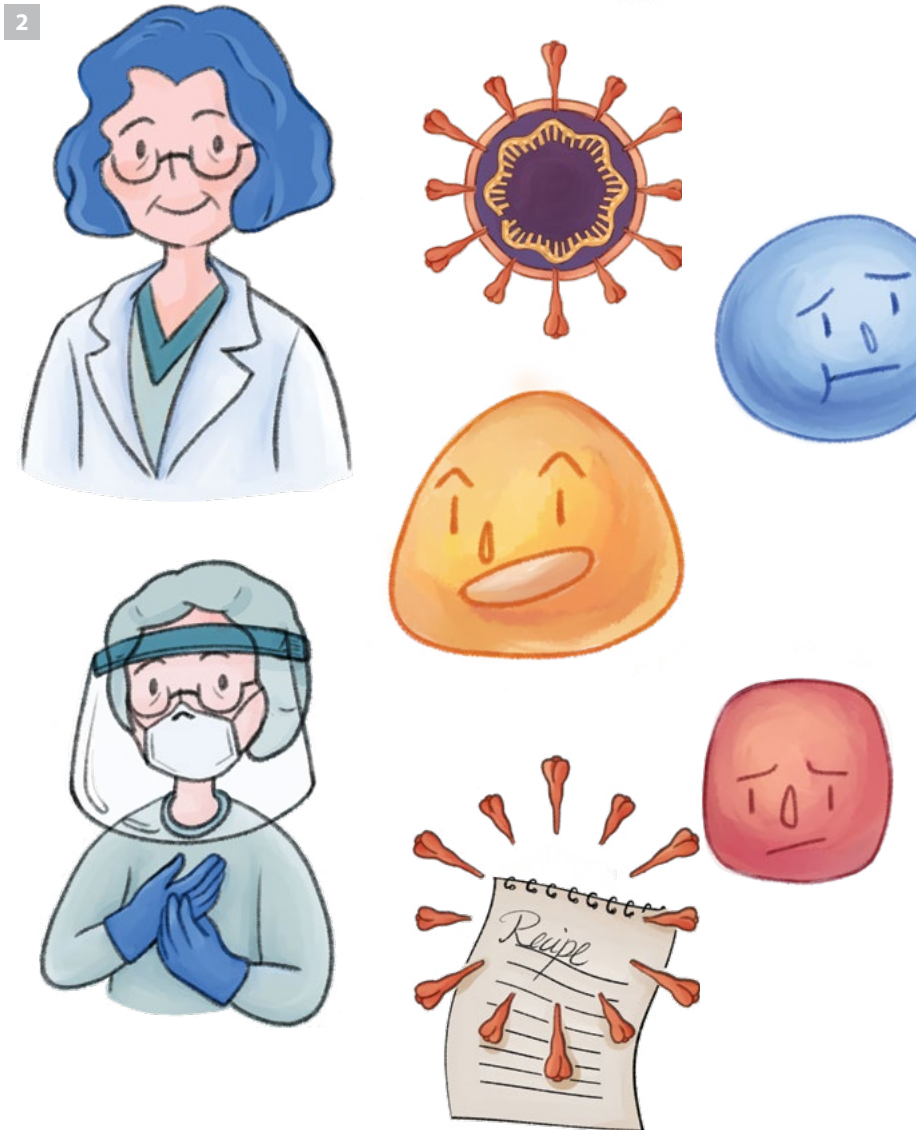

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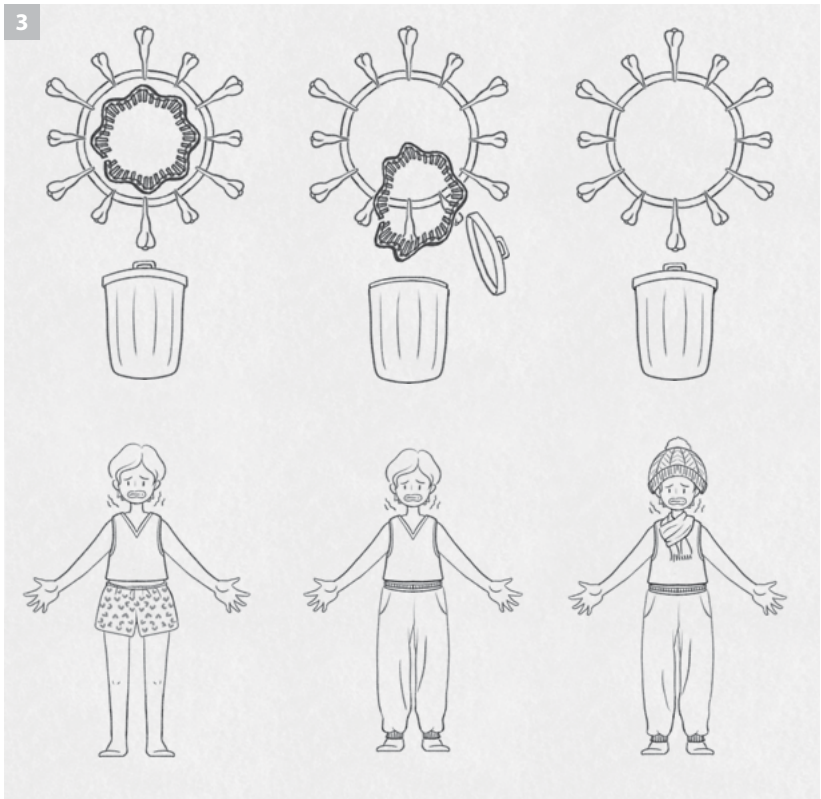


1. UI design. UI design examples. We used a plain background to reduce clutter, and vibrant and contrasting colour to ensure readability for all populations. Only essential features are included on the screen, and every button was designed to have text describing its function.

2. Final draft. Examples of rendered assets used in the chatbot.

3. Final draft. Example visuals of the mRNA vaccine mechanism and our core analogy. We compared the process to a winter storm in which you need to put layers on in order to stay safe and warm.

DIScover: A Visual and Interactive e-Learning Module of Intrinsically Disordered Proteins (IDPs)

In my Master's Research Project, I invited readers to voluntarily explore and acquire a high level understanding of structured proteins and disordered proteins. Additionally, I worked to offer engaging visuals and multi-depth content to address short attention spans and discourage the use of jargon.

1. Sketch. Rough drafts for character design.

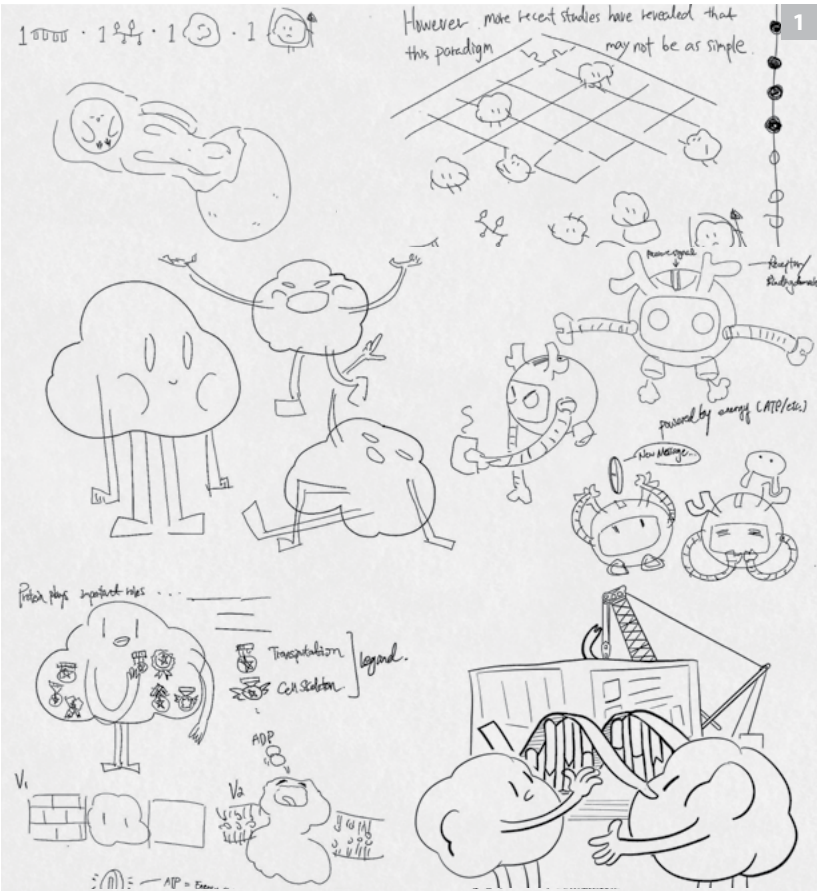
2. UI design. UI design including typography and colour guide.

3. Final interactive. Slides from the final deliverable *PowerPoint* module with customized character designs and comic stories.

4. Final interactive. Slide from the final deliverable *PowerPoint* module using a puzzle analogy to show the complexity of the referred protein paradigm.

5. Final interactive. Slide from the final deliverable *PowerPoint* module, demonstrating the use of game card wayfinders, which give the audience an opportunity to choose their own protein adventure to explore.

6. Final illustration. Character design of the selected protein functions, from left to right, top to bottom we have: structured protein (main character), gate keeper, cell killer, tumor suppressor, transporter, building block, protein builder, defender, signal transmission (control panel), and catalyst.



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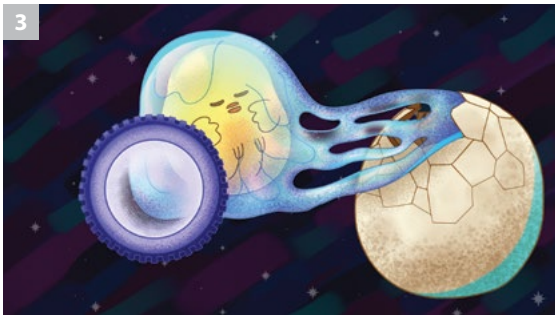

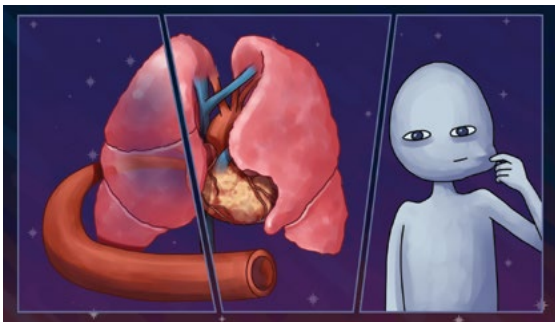

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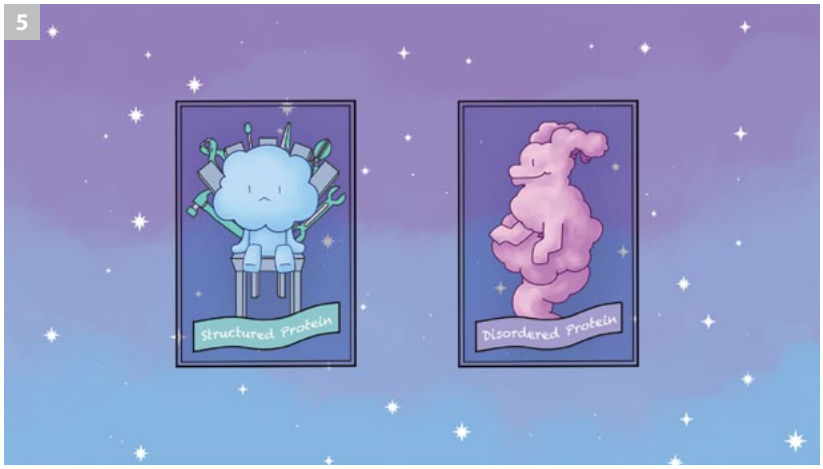

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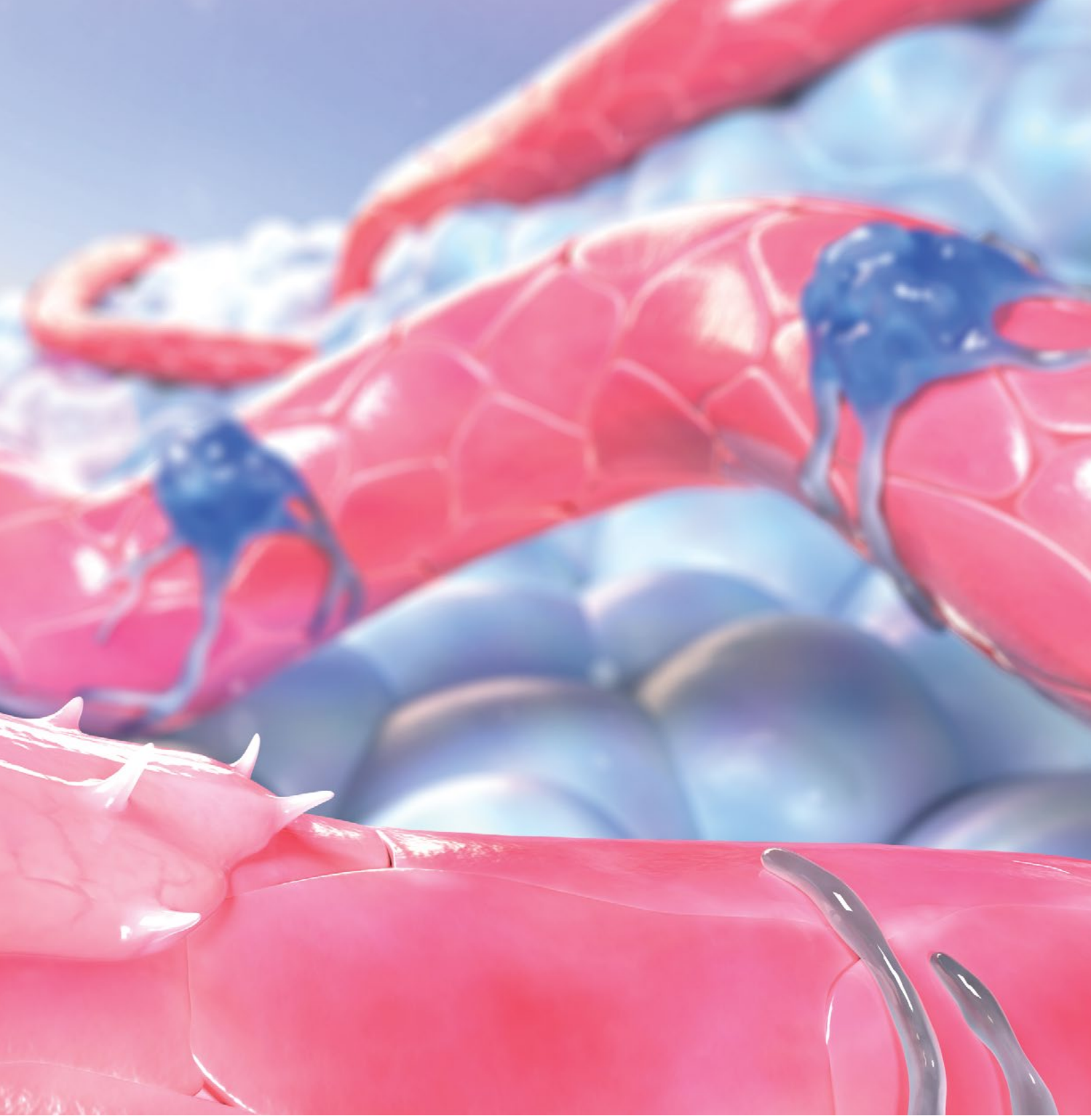
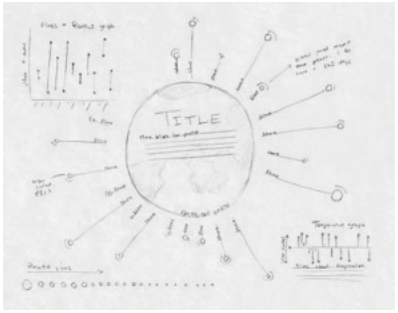


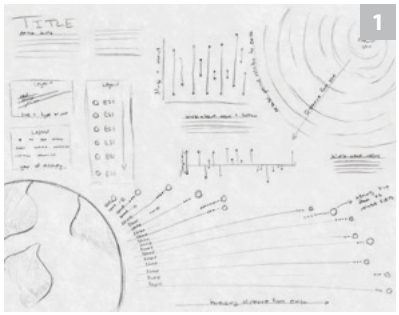
Colleen Paris

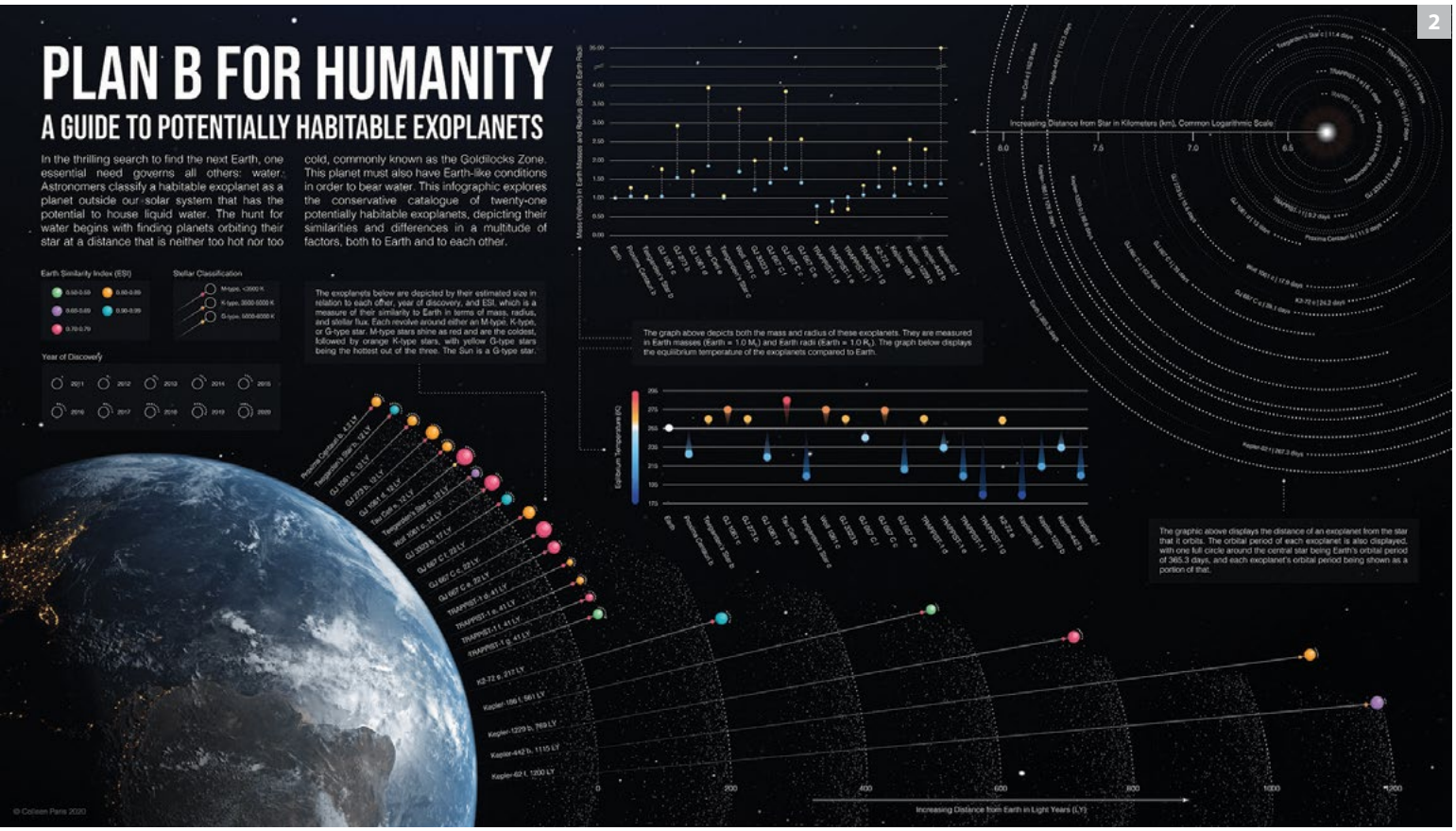
I am a medical illustrator, animator, and designer who is endlessly fascinated by the art of science. After earning a BSc in Life Sciences and an MSc in BMC, I truly appreciate the role that visualizations hold in scientific communications. Whether it's a 2D illustration, a 3D animation, or a data visualization, I strive to create beautiful and meaningful art to effectively communicate the intricate world of science.

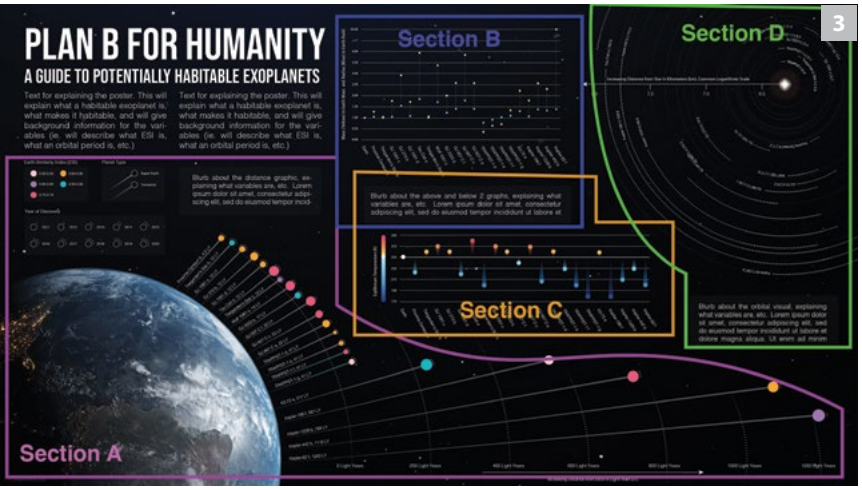
Data Visualization

Using data from NASA and the Planetary Habitability Laboratory, I created this poster to inform audiences about the classification of habitable exoplanets, and to serve as an educational piece on the many differences between these exoplanets.









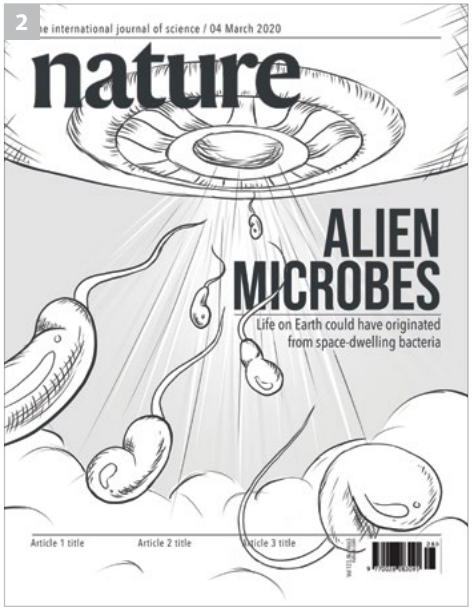
1. Sketch. After deciding on the significant variables in my piece, I explored various ways to show this data in a compelling way.

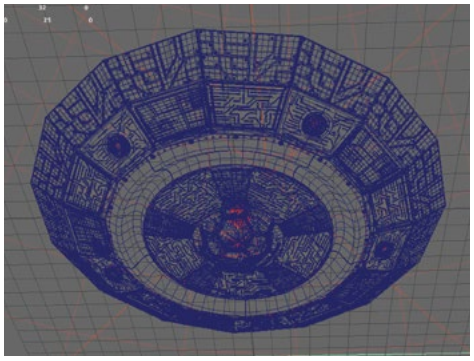
2. Final illustration. The final illustration features an Earth graphic created in *After Effects* and design components created in *Illustrator*.

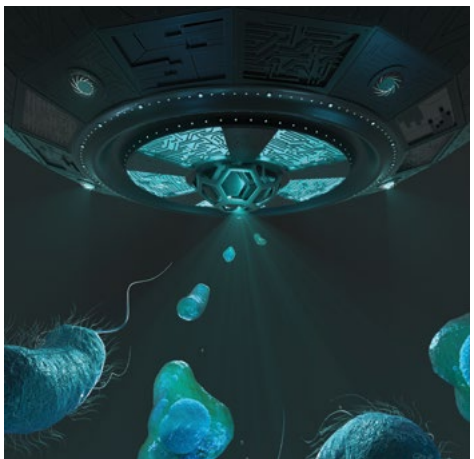
3. Production process. I decided to showcase the information in four major parts: the first part focuses on Earth Similarity Index (ESI), stellar classification, year of discovery, and distance from Earth; the second part focuses on mass and radius; the third part depicts equilibrium temperature; and the fourth part visualizes distance from respective star and orbital period.

Editorial Illustration

Panspermia is the theory that interplanetary transfer started life on our planet. This mock journal cover depicts this theory in a clever and compact way, playing on the idea that microbes are aliens that travel to and invade Earth.







1. Final illustration. The final cover was created in *Maya*, *ZBrush*, *Photoshop*, and *Illustrator*.

2. Production process. I started with a sketch that conveyed the concept for the cover, exploring various ideas playing on the alien theme. I then created all the 3D assets, focusing on both hard-surface and organic modelling. Finally, I rendered and composited the cover.

Previous spread. Final animation. A screenshot from my Master's Research Project: The Pathogenic Manipulation of Actin.

Pathological Illustration

People with multiple sclerosis (MS) have an immune system that attacks the nerves in their body. I created this two-page spread to educate on the role of the immune system in MS, and how it contributes to the pathological change of the disease over time.

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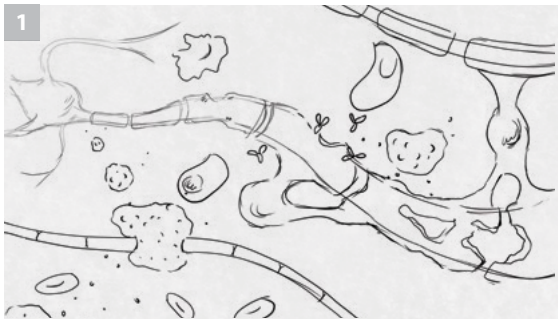

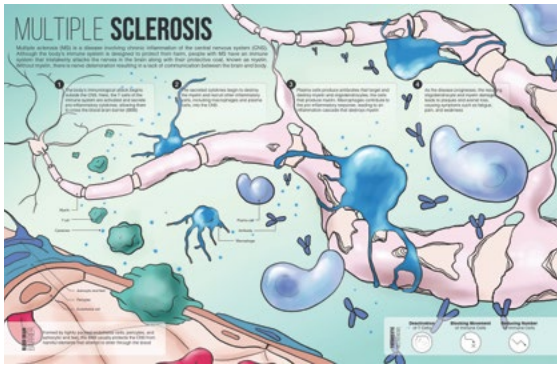

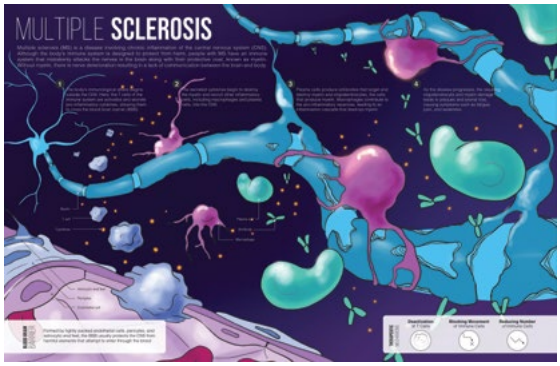

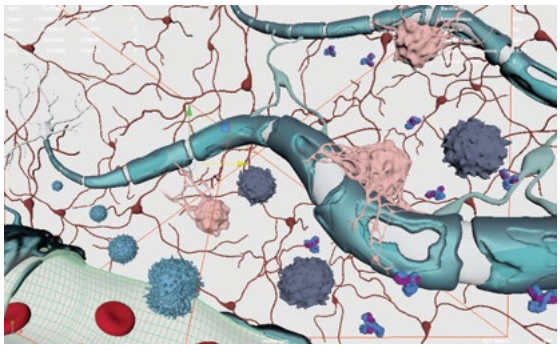

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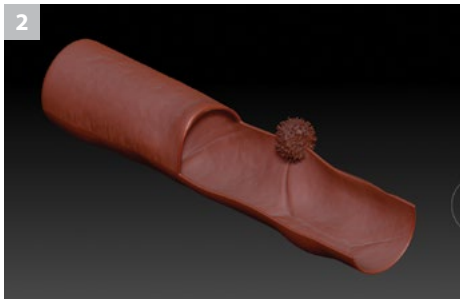

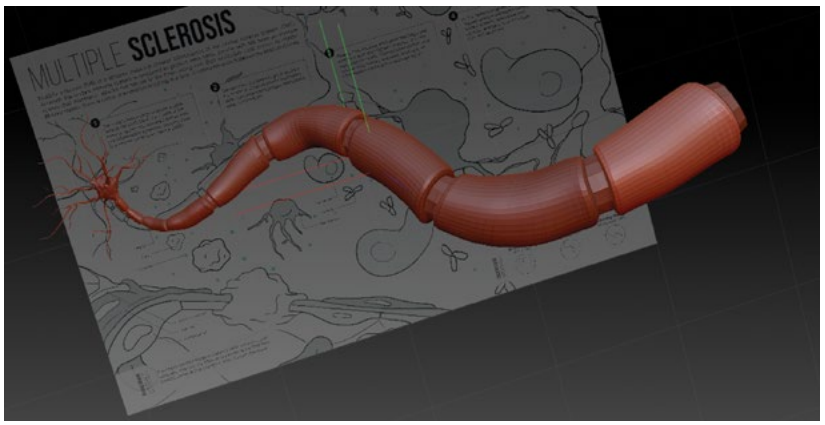

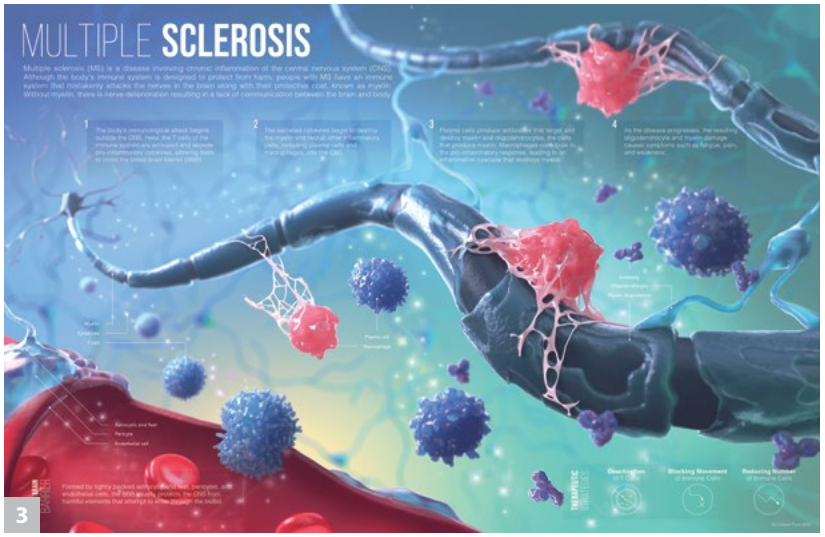

3

1. Production process. I created a concept sketch and various colour thumbnails that focused on telling a comprehensive story about the progression of MS over time.

2. 3D modelling. Organic 3D models were created in *ZBrush* before being imported into *Maya* where they were textured.

3. Final illustration. The final spread was created in *Maya*, *ZBrush*, *Photoshop*, and *Illustrator*.

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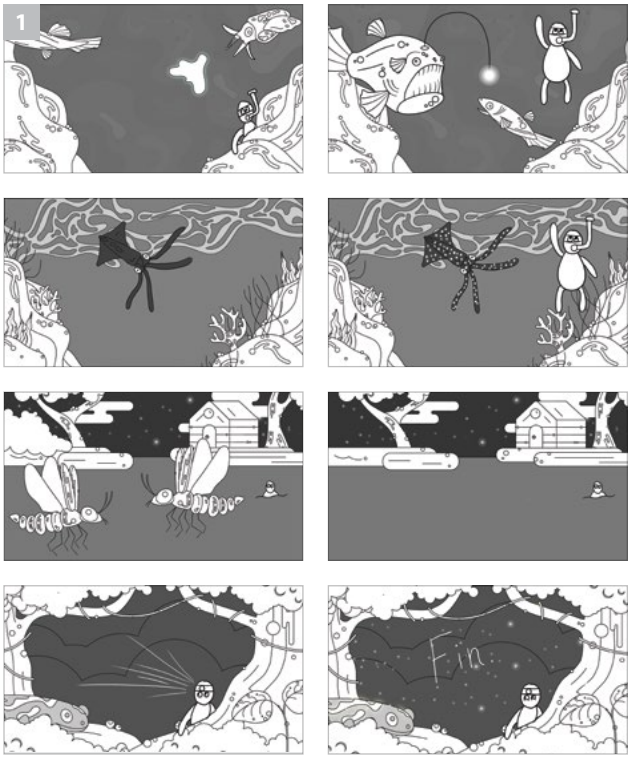

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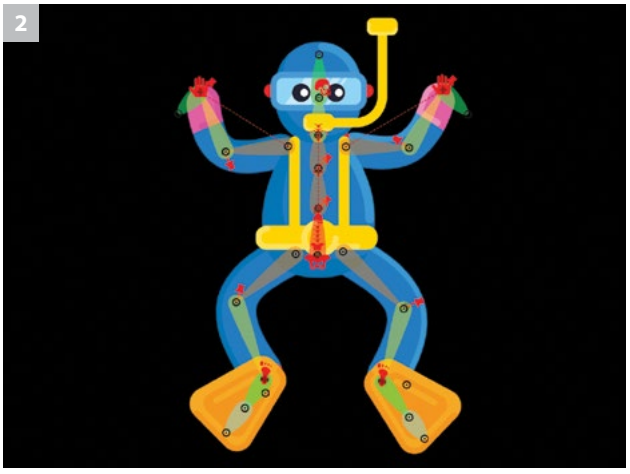

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Scientific Animation

Animals all over the world have evolved ways to harness and create their own light. This 2D animation explores the various ways that creatures utilize light, and aims to educate the general public on the basics behind biofluorescence and bioluminescence.

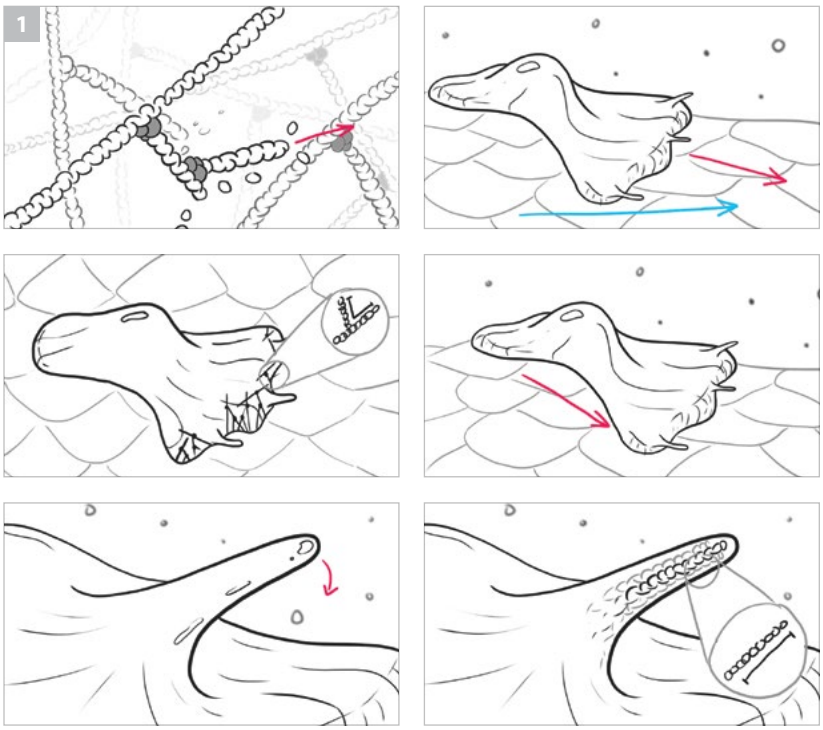
1. Storyboard. The storyboard for this animation features playful cartoon characters and simplistic graphics. I decided to create a personable character to guide the audience through the story and provide a human aspect.

2. 3D modelling. As part of production, I rigged the characters to create seamless and fluid motion.

3. Final animation. The final animation was created using *Illustrator* and *After Effects*.

The Pathogenic Manipulation of Actin

Actin is an essential protein for numerous cellular processes, and the actin cytoskeleton is a key player in the invasion and spread of infectious pathogens. The aim of this 3D animation is to communicate the importance of actin by relating it to the compelling topic of pathogenic invasion.



1. Storyboard. The storyboard was created to map out my visual ideas and to get a sense of the overall narrative story, so I could visualize how the animation would be presented. I accounted for both character movements as well as camera movements.

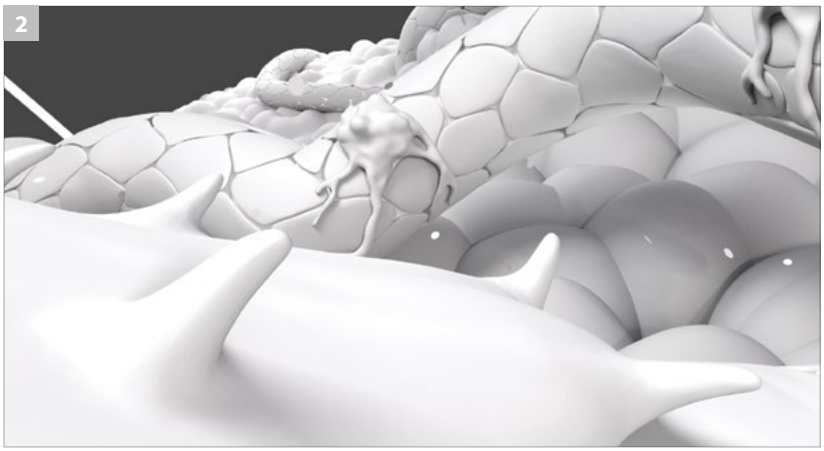
2. 3D modelling. I created several organic models on both the cellular scale as well as the molecular scale. This frame features a close-up of the central crawling cell in its environment.

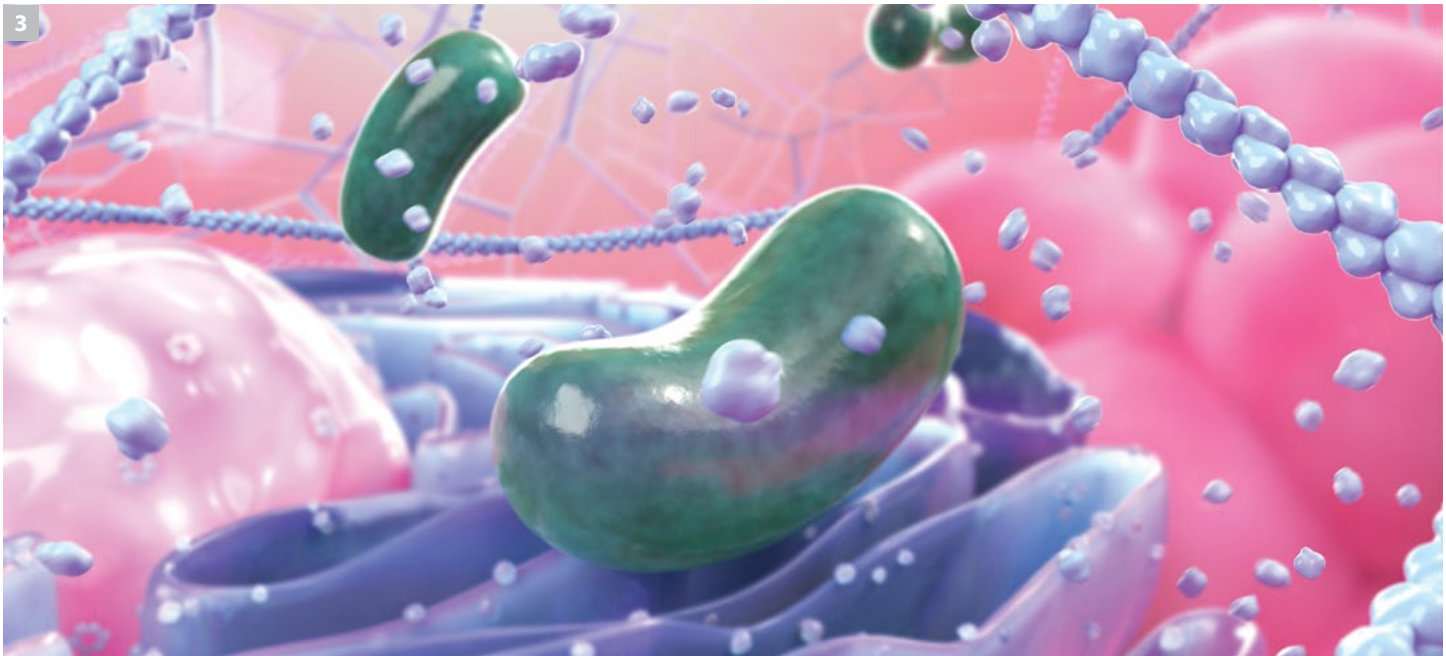
3. Final animation. A still from the final animation. The final piece was created using *Maya*, *ZBrush*, and *After Effects*.

4. Production process. The opening shot of the animation featuring the actin cytoskeleton, featuring the storyboard image and production shot without lighting and texture.

5. Production process. A shot showcasing the role of actin in the interaction between a T cell and its antigen presenting cell. The storyboard image and production shot are featured.

6. Production process. A shot featuring a *Chlamydia* bacterium injecting effector proteins into the cytosol of the host cell. The accompanying storyboard image and untextured production shot are also included.





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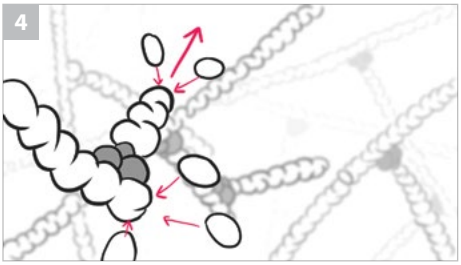

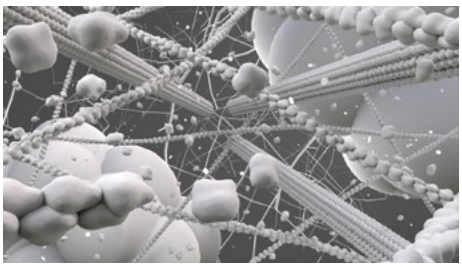

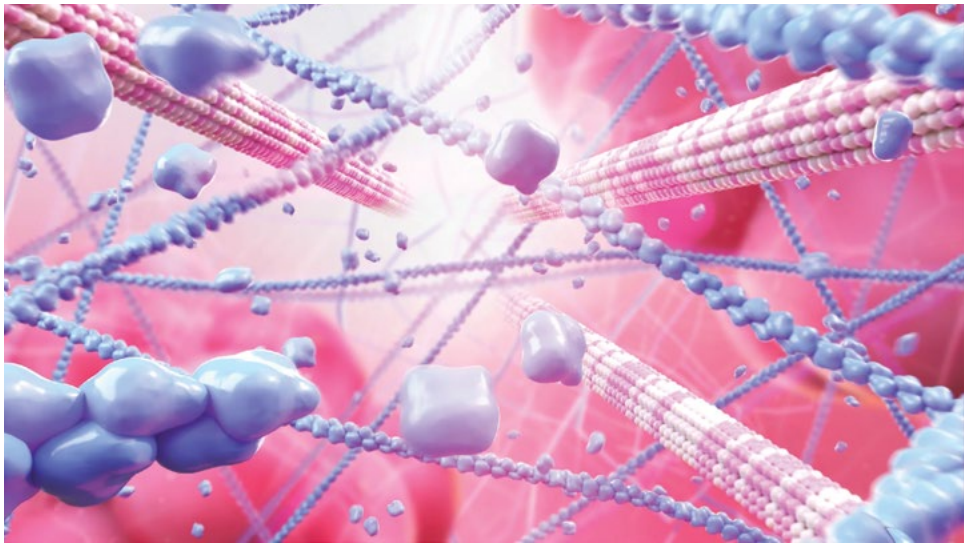

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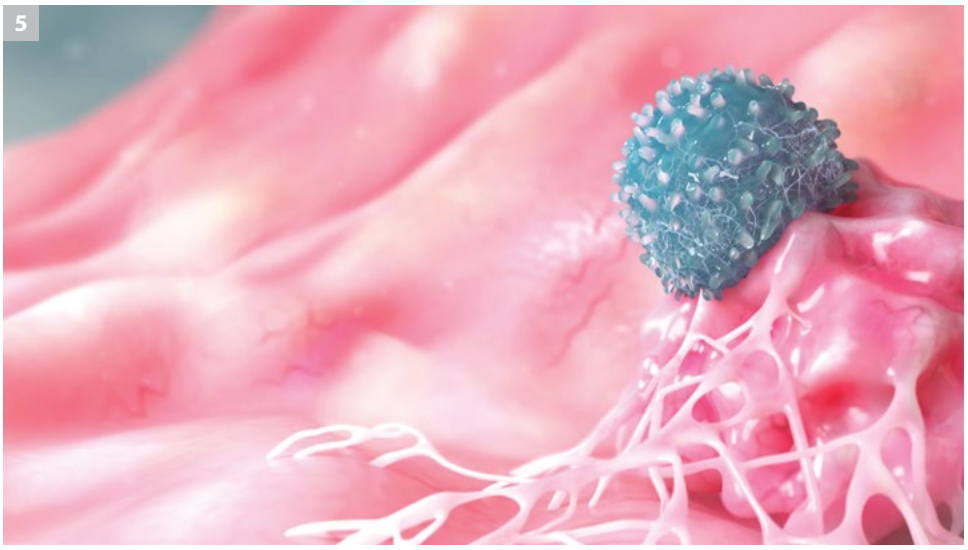

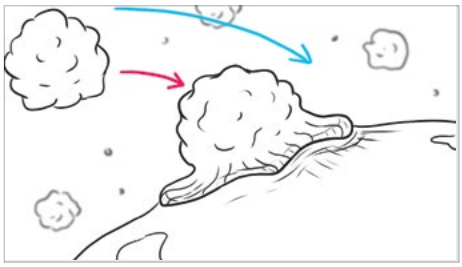

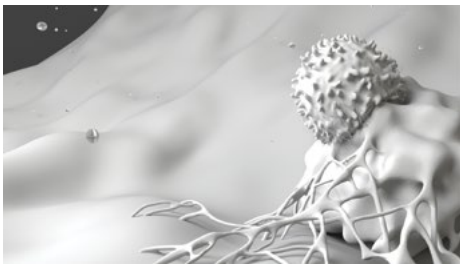

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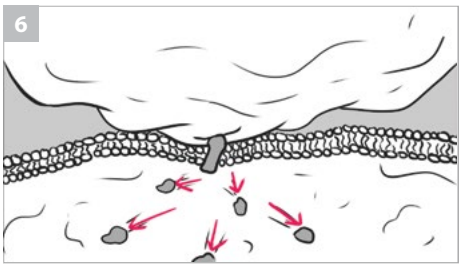

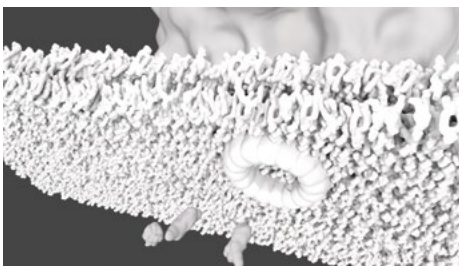

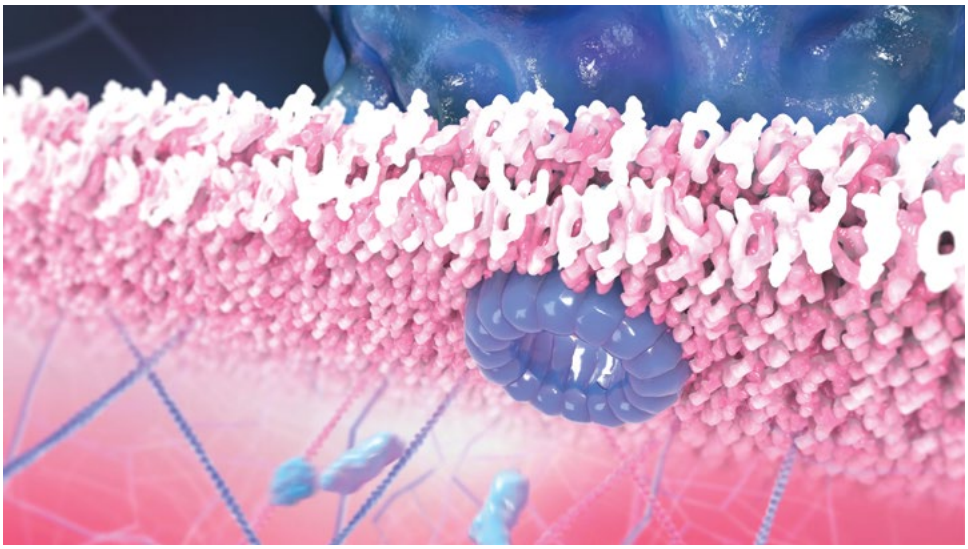

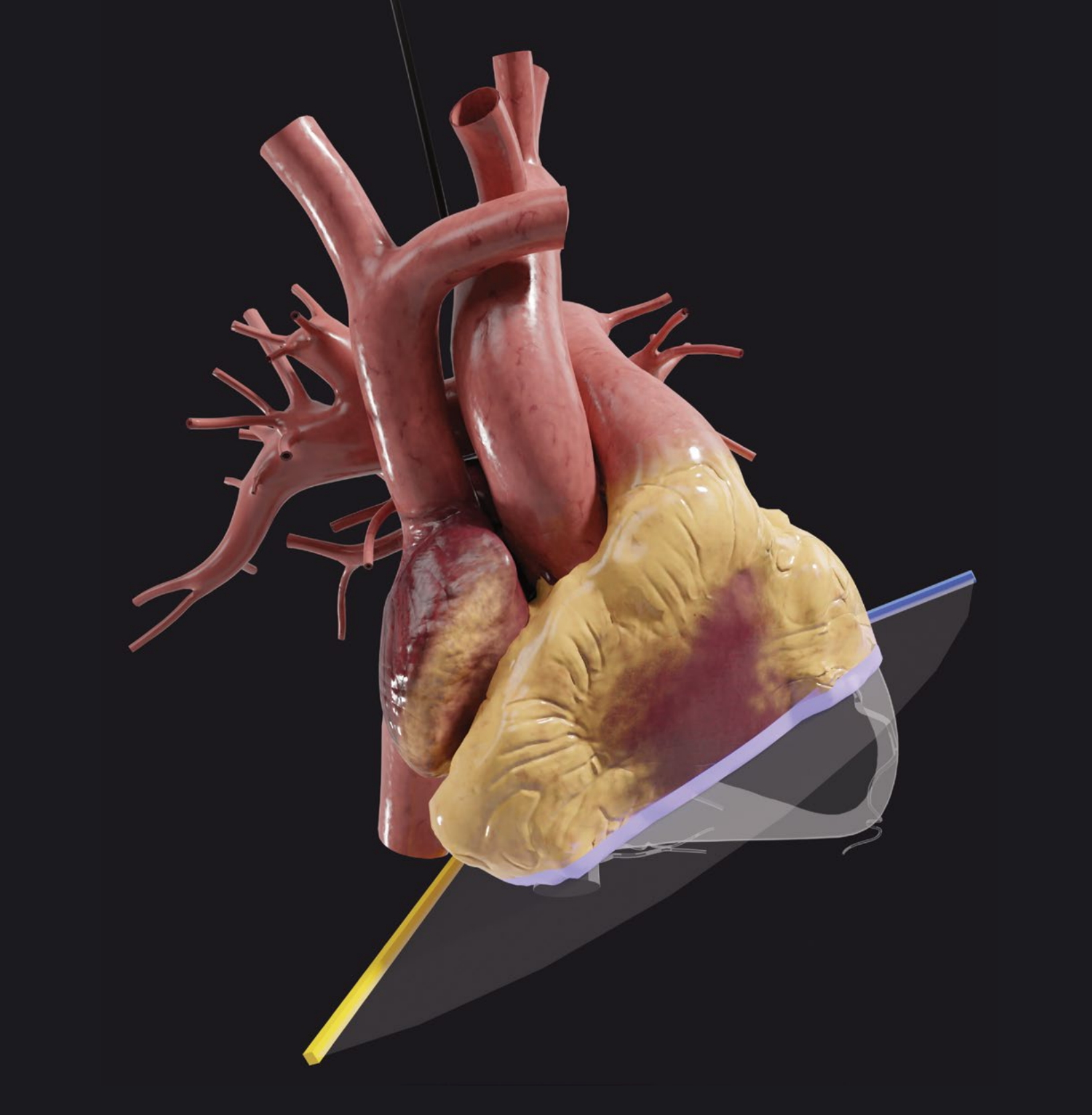

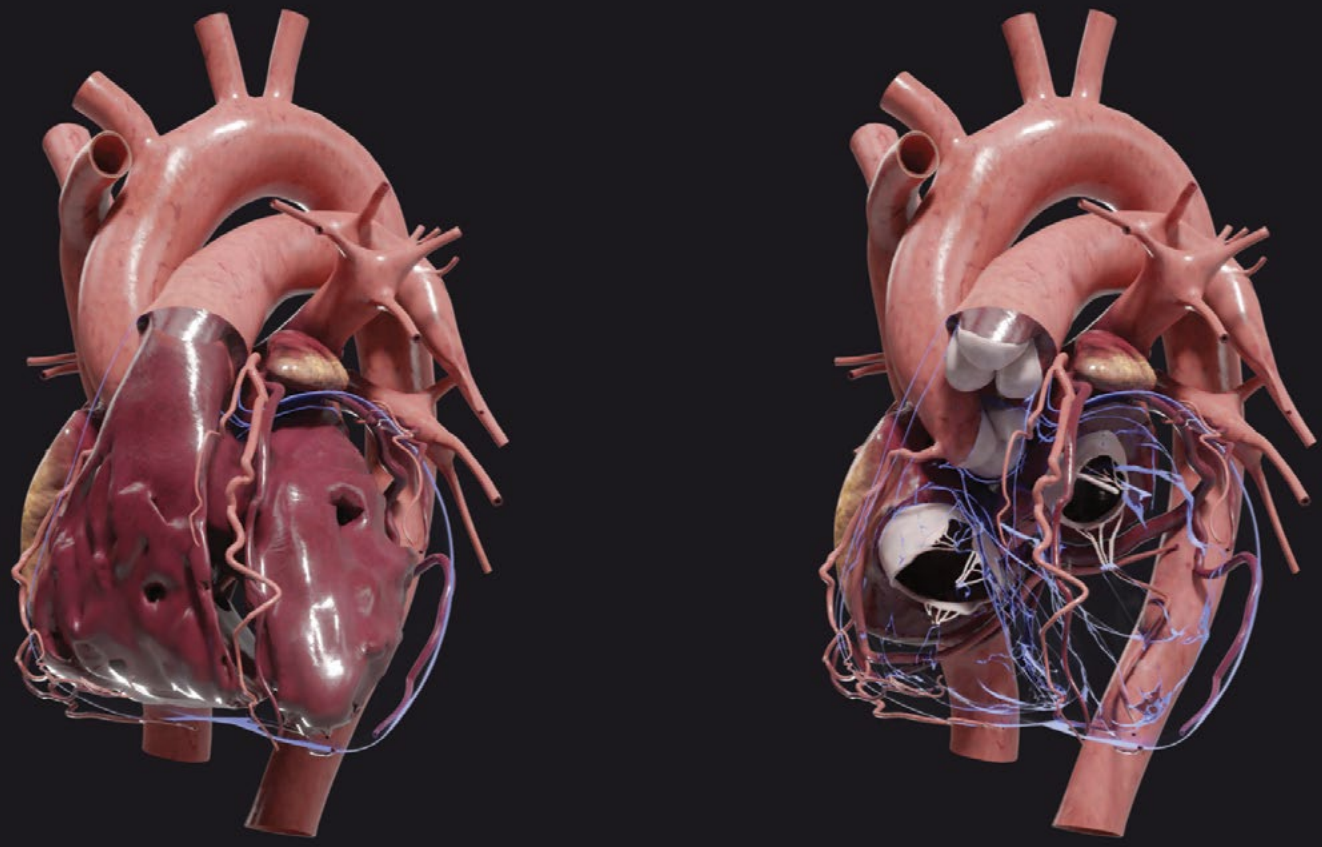

Eric Chung

I specialized in 3D animation and interactive media design during my time at BMC. While many of my projects leveraged my pre-BMC 3D experience, my UX interests also extend to general creative coding and web design, industrial design of medical devices, and digital health and the Internet of Things (IoT). I am always curious to experiment and learn new technology stacks to more creatively tackle visualization challenges

3D Modelling

The purpose of this project was to reconcile and apply digital sculpting techniques with knowledge of anatomy, anthropology, and osteology to produce an informed forensic facial approximation of Peking Man (*Homo erectus pekinensis*).

1. Study. Bony landmarks for tissue depth markers were referenced from forensic literature for placement on the scanned skull.

2. Production process. Early test renders of the standalone figure. These were done to test lighting and material, as well as the facial rig and blendshapes.

3. Final illustration. Final three-page foldout intended for a magazine such as *National Geographic*. By fleshing out the face and supporting it with the anatomical reasoning involved I intended to help better communicate paleoanthropological data to a lay audience.

Previous spread. Final interactive. These are closeups of the heart model from my Master's Research Project: Transesophageal Echocardiography (TEE) Simulator.

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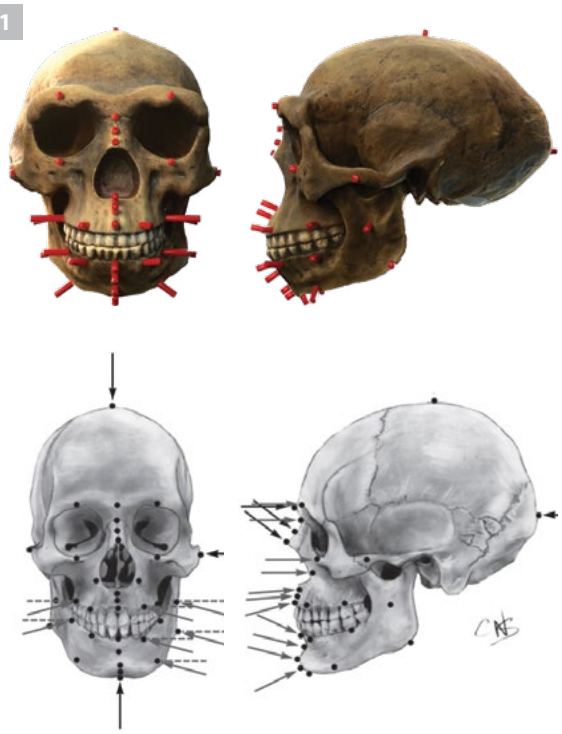

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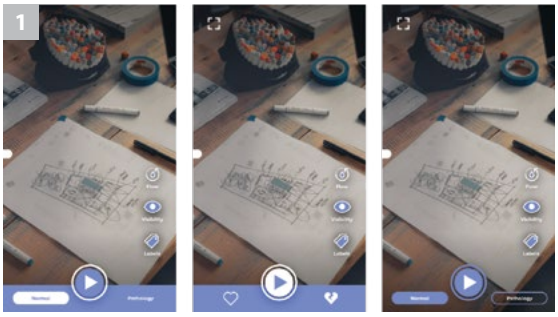

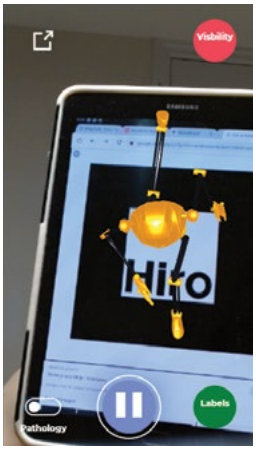

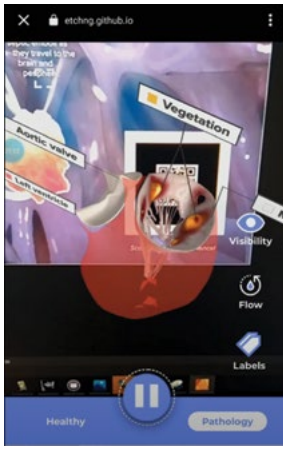

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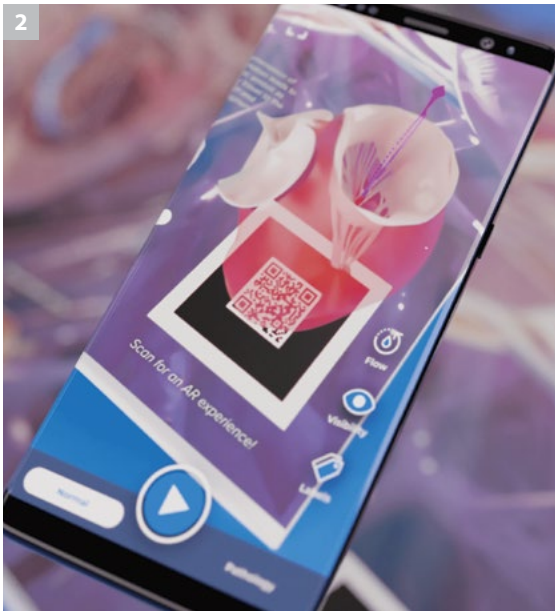

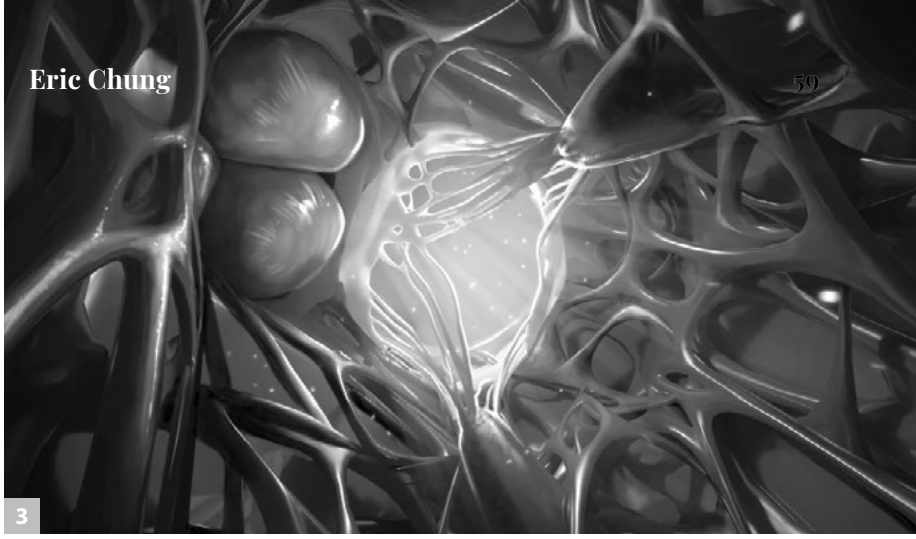

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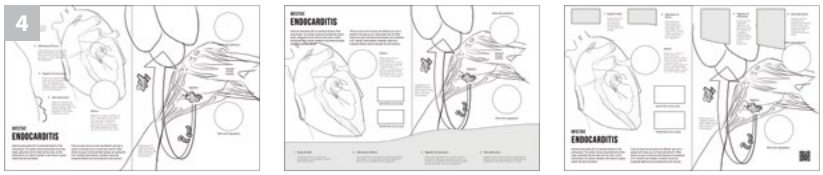
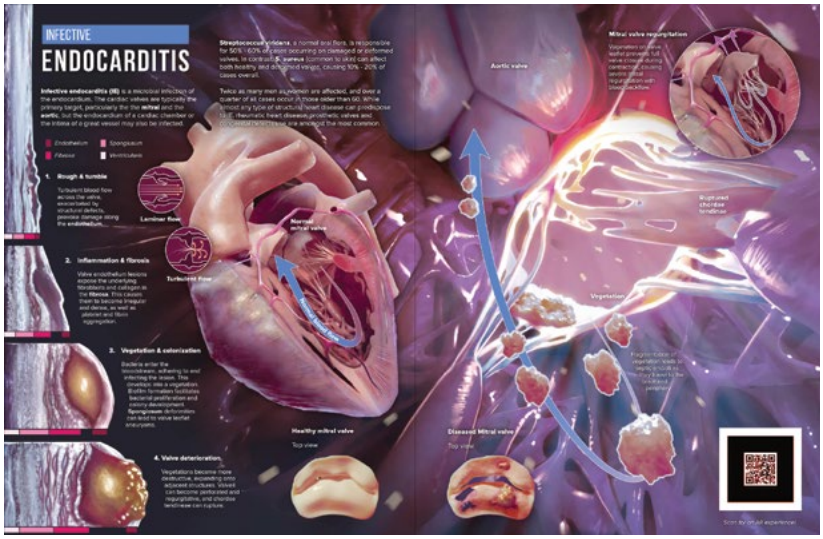




Pathological Illustration

Infective endocarditis is a microbial infection of the endocardium, particularly around the valves. This multimedia experience was framed as a science engagement tool for an educated lay audience, while delivering key facts about the disease.

1. Prototype. Interface prototyping, and eventual coding of the accompanying WebAR app. Several interface iterations were designed and tested with placeholder assets, using the Three.JS and A-Frame Javascript libraries.

2. Final interactive. Mockup of the WebAR app in use. As it was intended to be for casual engagement, a web-based format, in which the QR code for the link doubled as the AR marker, was preferred over a downloadable app.

3. Study. A tissue landscape study of the left ventricle's trabeculae and valves was done to establish mood and lighting. This was used as the bases of the final spread.

4. Production process. Several design compositions were done before moving on to rendering. This then became a colour palette challenge of warm versus cool. I ultimately compromised for a mix of both.

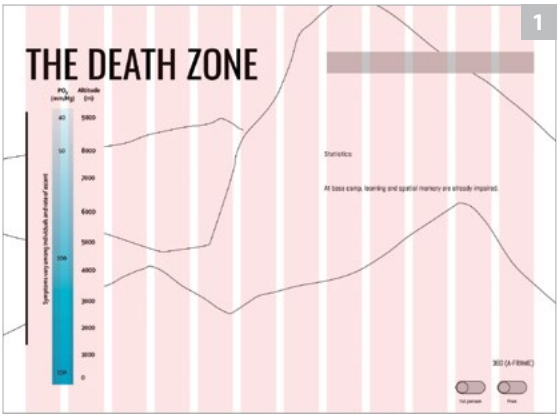
Interactive and UX/UI Design

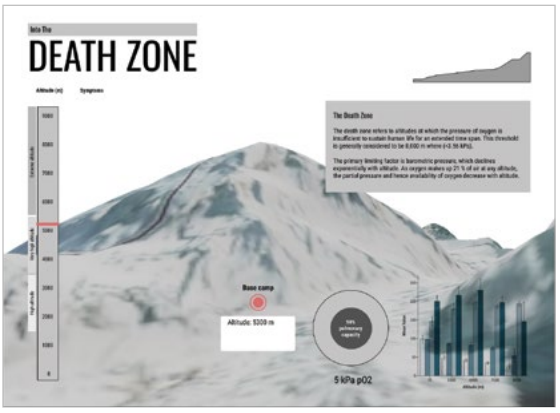
These projects were explorations of my interactive development interests in WebGL, data visualization, and game engines. This included a 3D scrollytelling microsite on high-altitude physiology, as well as an interactive visualization on Martian astrobiology.

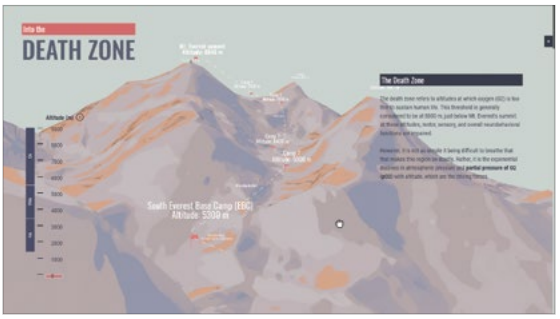
1. Production process. This data visualization is intended to communicate the physiological challenges encountered when climbing Mt. Everest. WebGL elements were aided with Three. JS, while animations used GSAP and the Intersection Observer API.

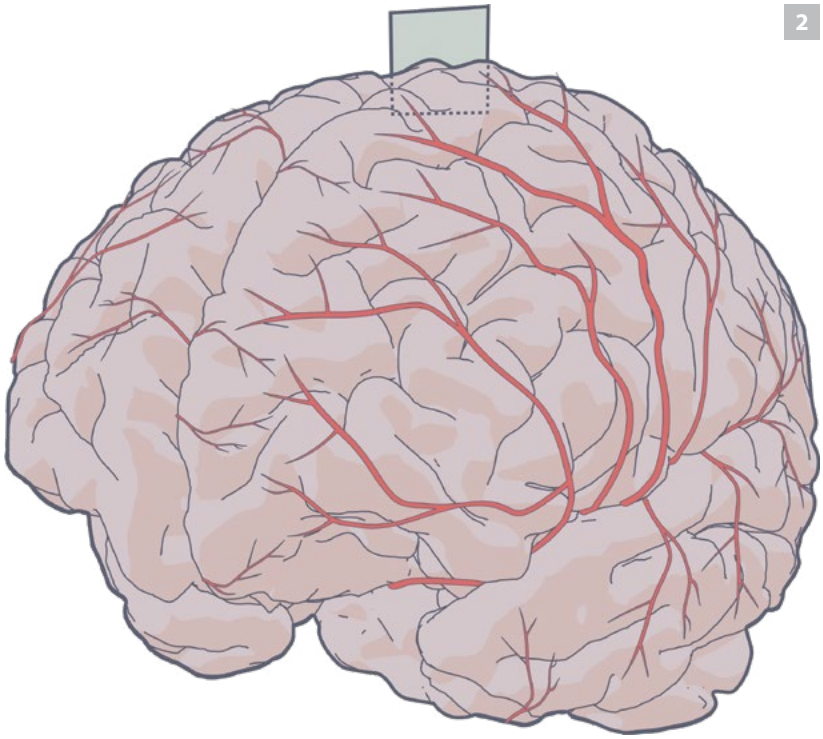
2. Production process. Illustrated SVGs were used to facilitate easier scroll-driven animation of outline and fill properties.

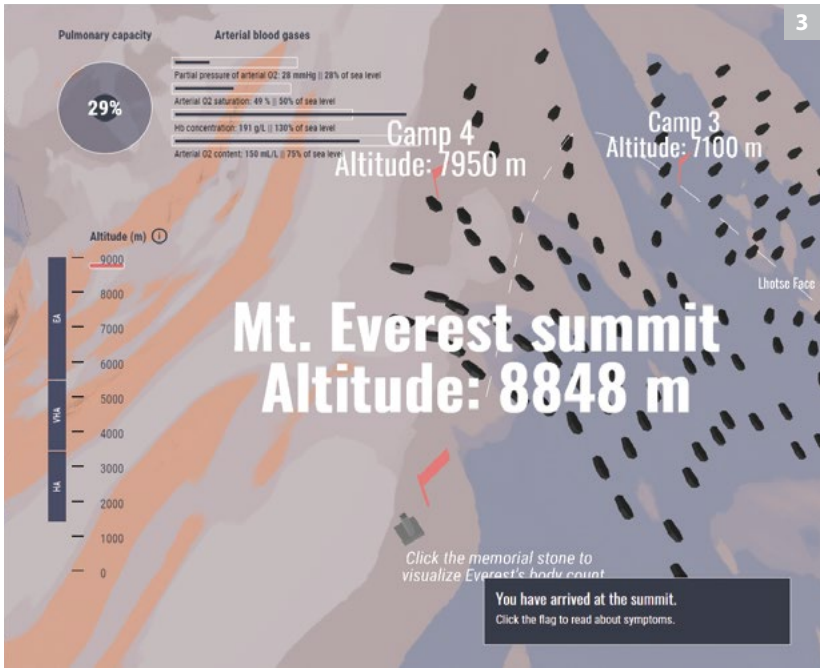
3. Final interactive. Physiological data is animated as the user ascends, with call to actions to reveal additional information.

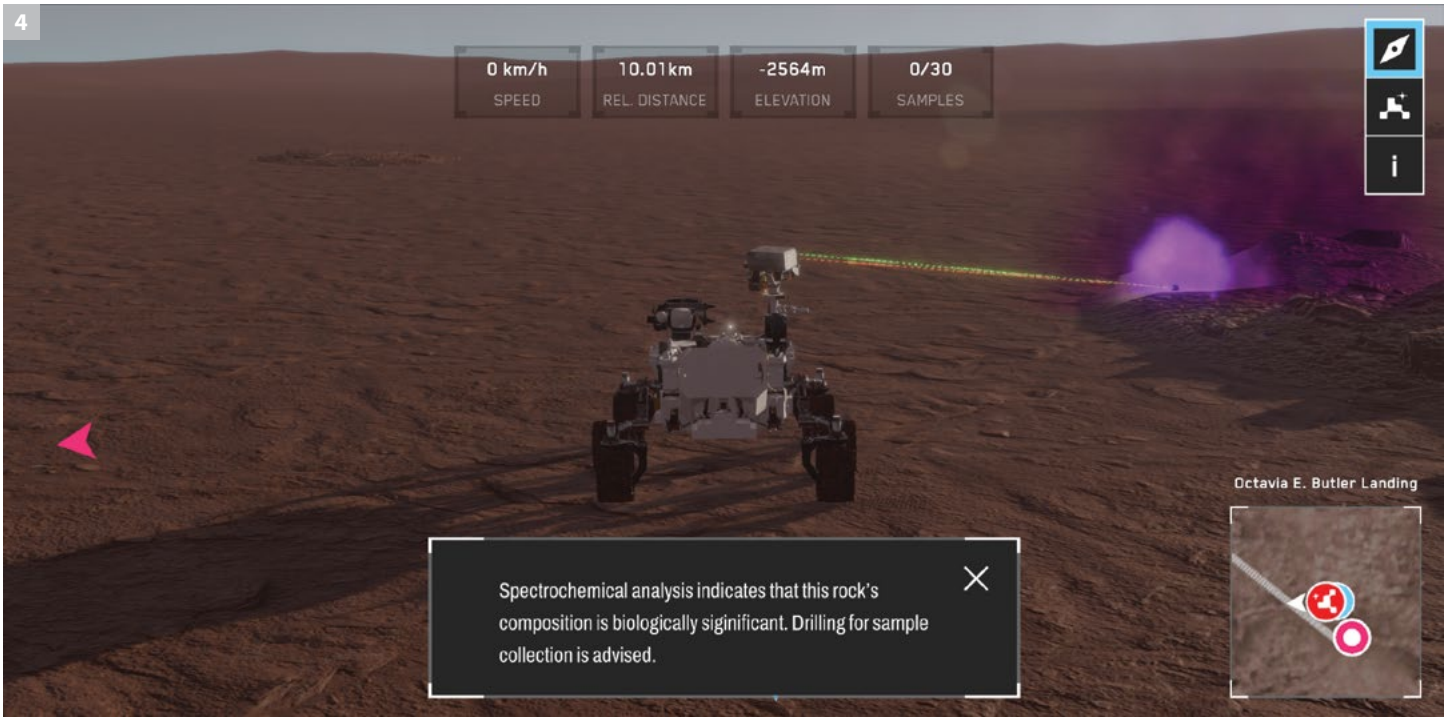


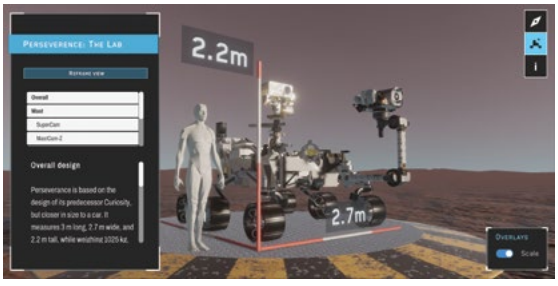


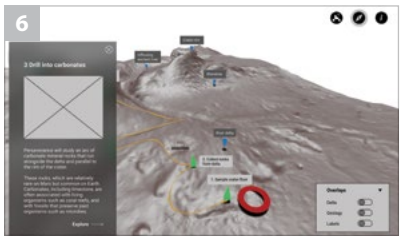


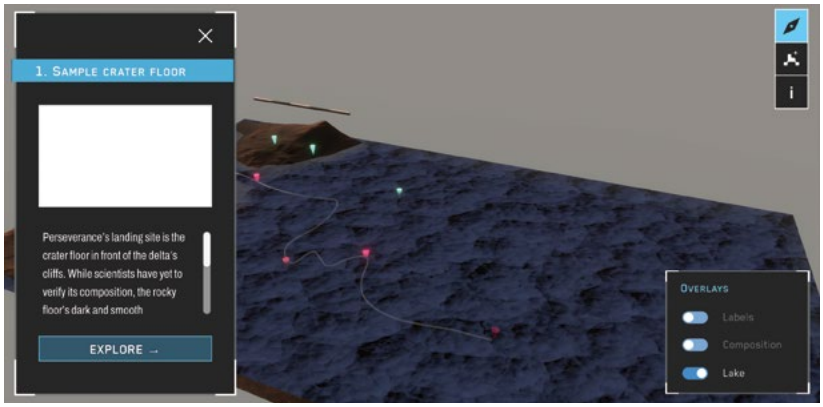


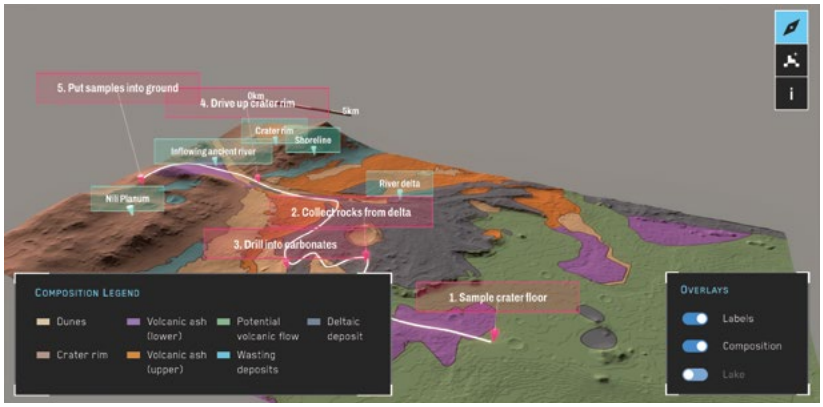












4. Final interactive. This experience of Mars allows users to control the Perseverance rover to navigate the topography and collect samples from the landing site to the drop-off destination. Waypoints include information on their biogeological significance.

5. Final interactive. This is supplemented with information on the rover itself and its research equipment. Many users thought that the rover was the size of a dog (I blame Wall-E), despite being comparable to a small truck.

6. Production process. Users can learn about the formation of Jezero crater, and why it is biologically relevant. This includes its composition and lake, and potential for fossils. Geographic modeling was derived from Mars' GIS data.

Transesophageal Echocardiography (TEE) Simulator

TEE is a perioperative imaging procedure used to visualize the heart using ultrasound. The primary goal of this project was to develop a Web-based simulator to provide a scalable and easily accessible solution for novice echocardiographers in a low-stakes environment.

1. Notes. This is an affinity map to organize interview insights, from users who had used a previous simulator. These were grouped into comments about the UI/UX, probe interaction, heart model, and overall product delivery and scaling.

2. Production process. A CT scan was used as the basis for the model, supplemented with literature and content advisor feedback to fill in gaps; the vena cavae, valves, part of the aorta, and small vessels were fully remodeled due to low data resolution.

3. UX design. Iterations of probe controls as well as visual representations for the clipped portion of the heart. It was important the clipped portion was still visible, but not distracting, to highlight how the TEE plane intersected the heart.

4. Final interactive. High-fidelity designs of the simulator. Core functionality includes general 3D manipulation of the model, probe interaction and visualization control, clipping of the opaque structures, and changing structure visibility.

5. 3D modelling. In addition to biomechanical accuracy, the lumenal and tissue spaces needed to be fully manifold and independent to accommodate highlighting interactions Michael had designed. These sections were further divided to be toggled on and off.

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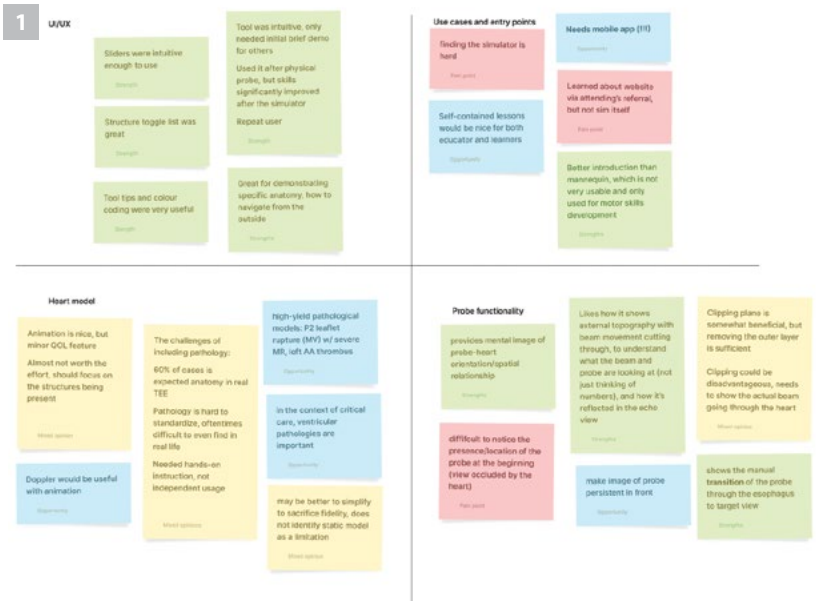

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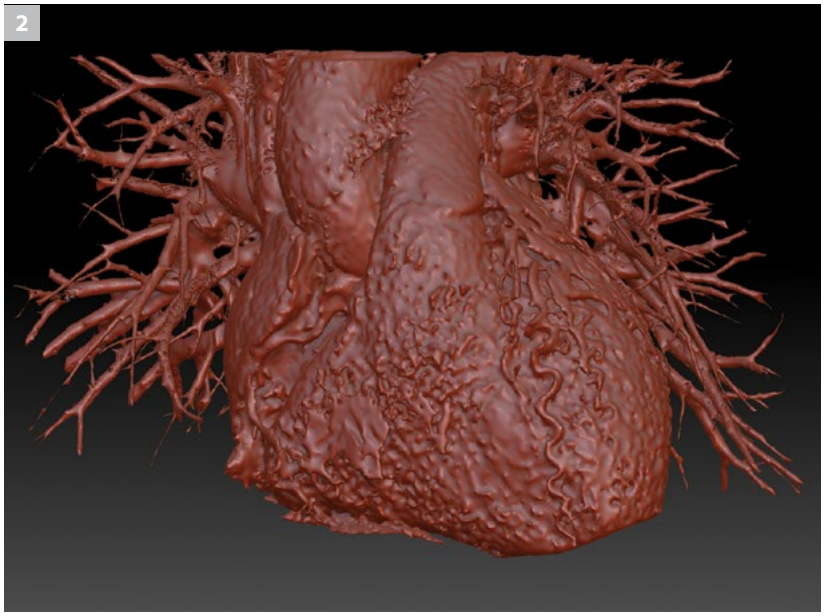

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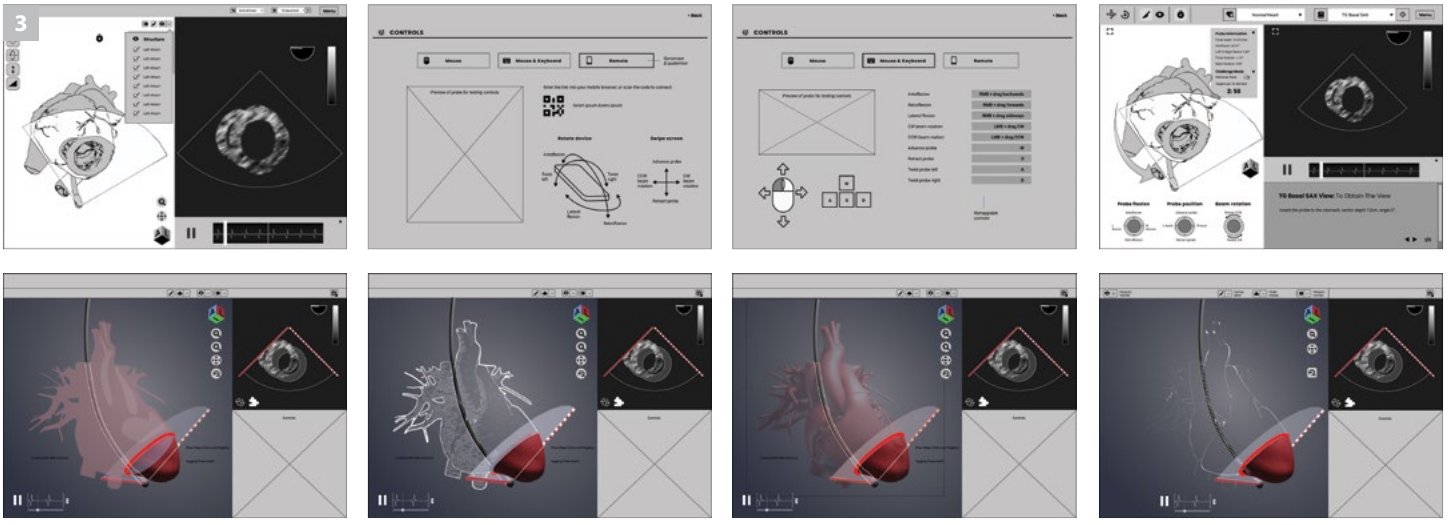

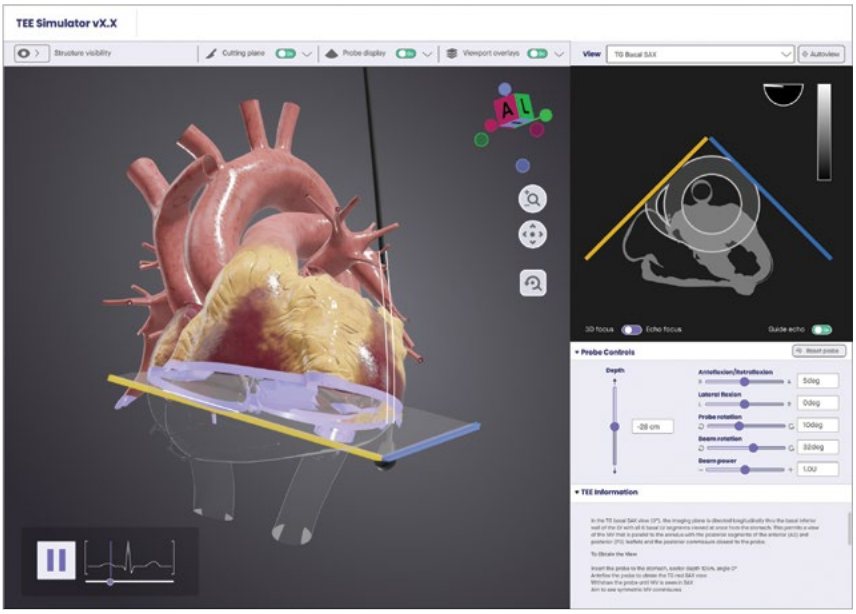
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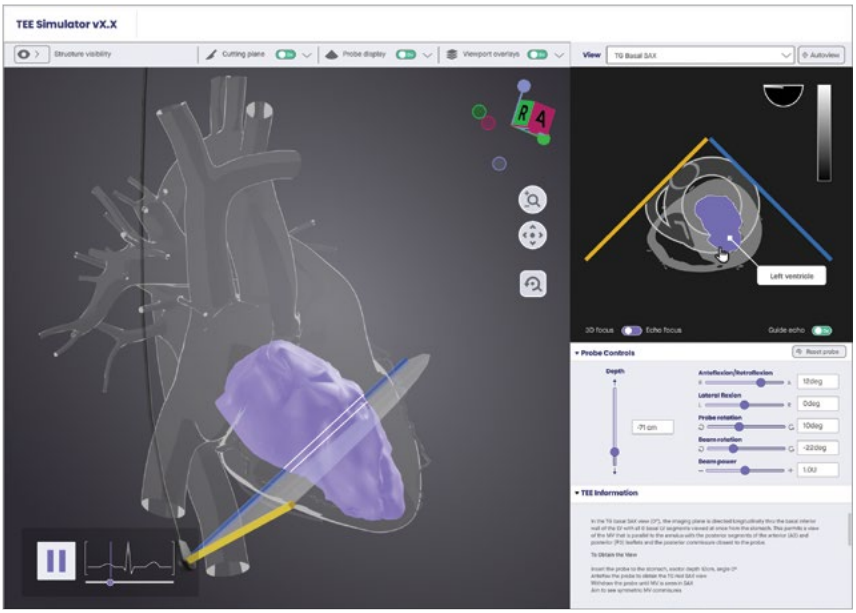
Structure visibility
Cutting plane
Probe display
Viewport overlays
View
Autoview
3D focus
Echo focus
Guide echo
Probe Controls
Depth
Anteflexion/Retroflexion
Lateral flexion
Probe rotation
Beam rotation
Beam power
TEE Information


TEE Simulator vX.X
Structure visibility
Cutting plane
Probe display
Viewport overlays
View
Autoview
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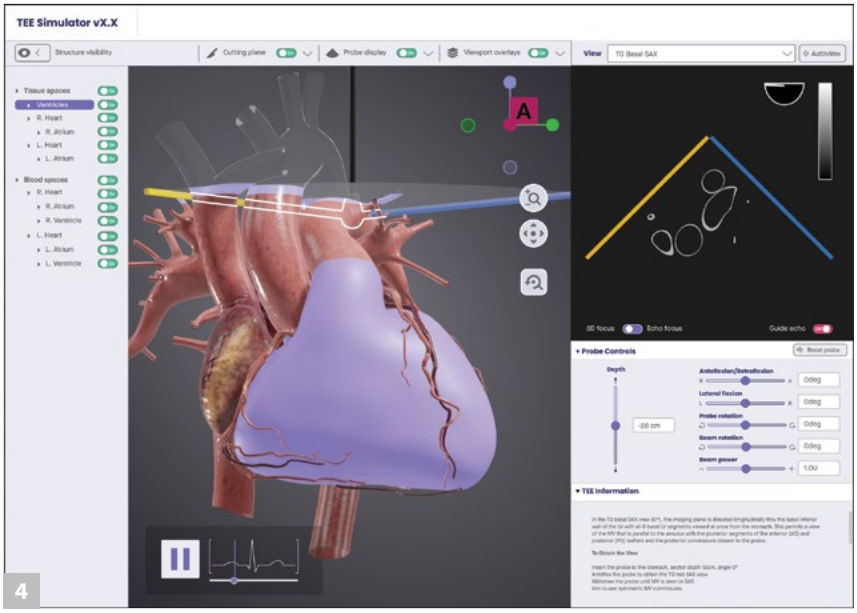
TEE Simulator vX.X
Structure visibility
Cutting plane
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Autoview
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Ventricles
R. Heart
R. Atrium
L. Heart
L. Atrium
Blood spaces
R. Heart
R. Atrium
R. Ventricle
L. Heart
L. Atrium
L. Ventricle
3D focus
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Depth
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TEE Information

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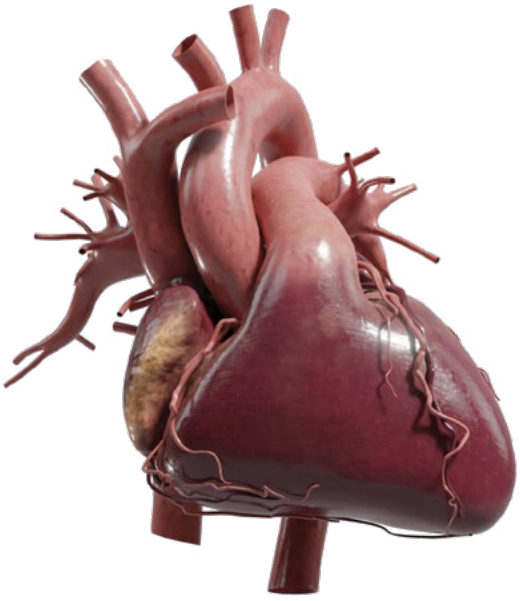

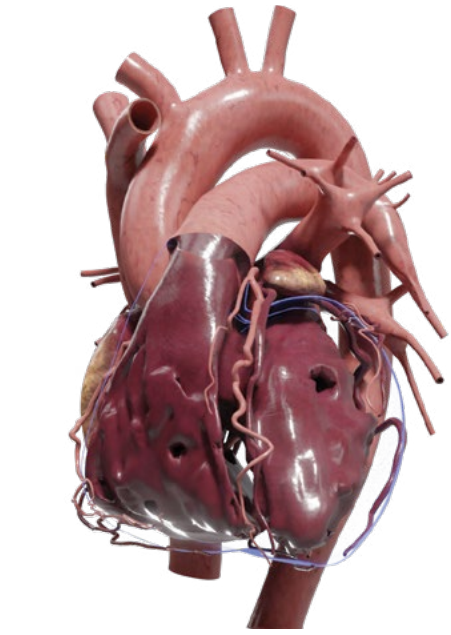

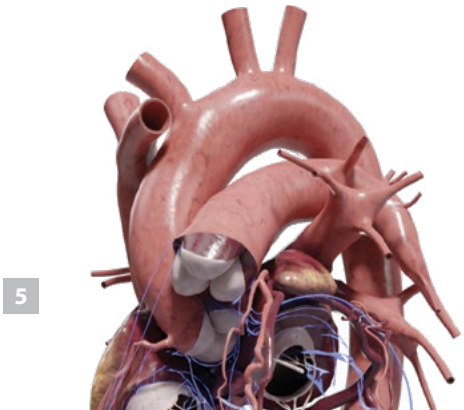

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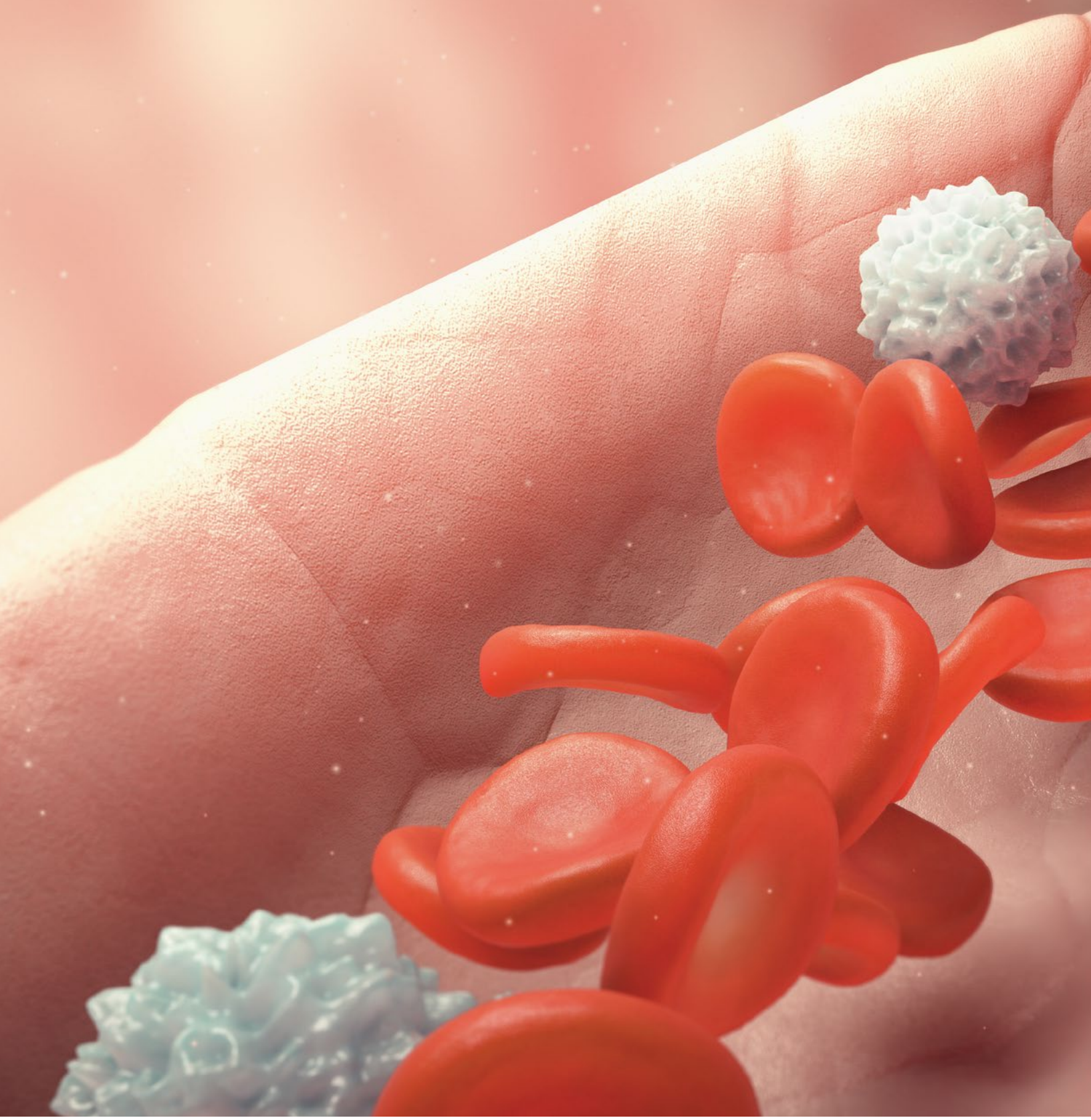

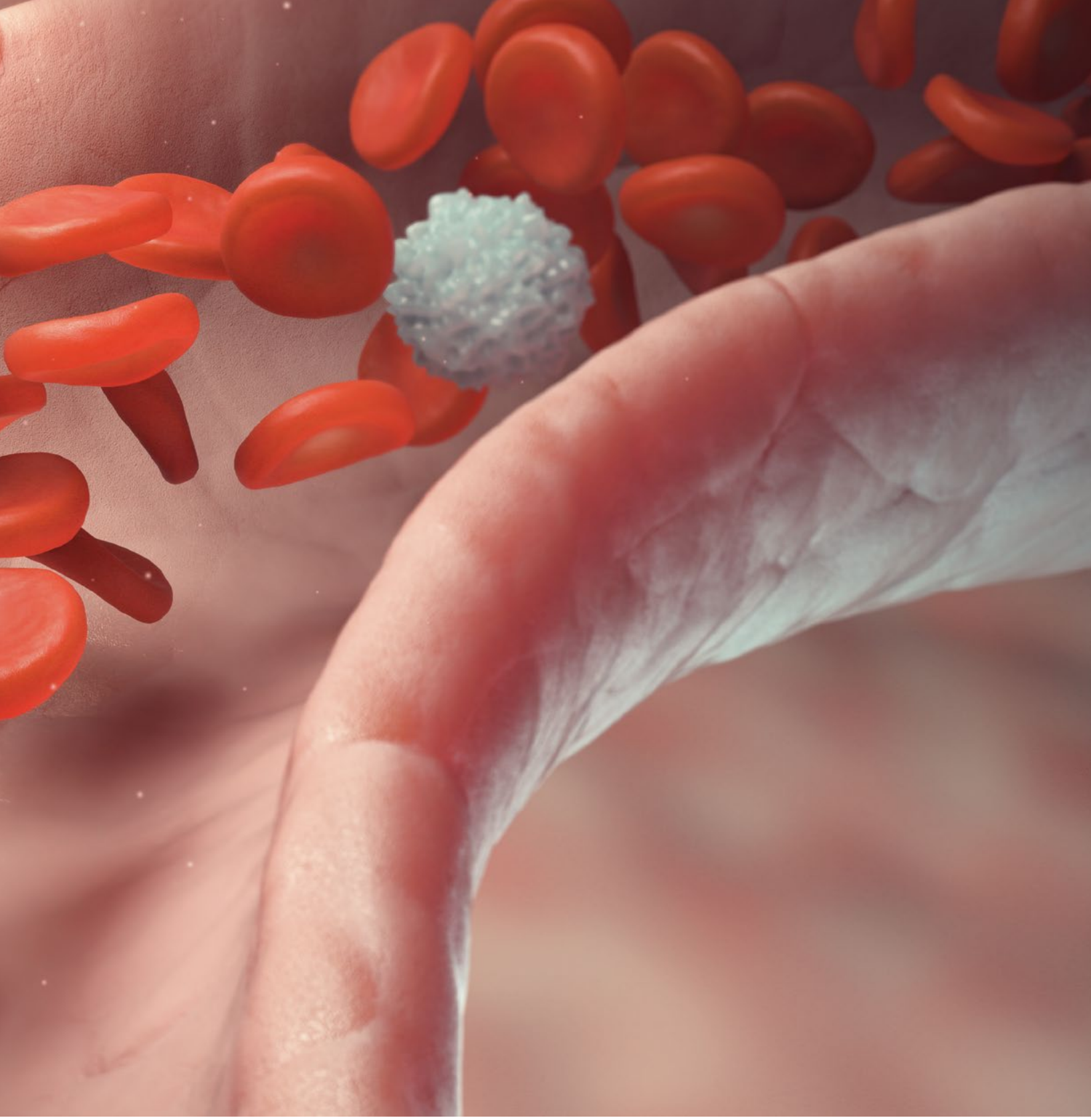

Ingrid Barany

My philosophy as a biomedical communicator is about finding the perfect balance between aesthetics, accuracy, and function. Creating this harmonious relationship between the arts and sciences is the challenge that fuels my passion for storytelling in medicine and pushes me to expand my creative potential. My interests lie in 3D animation paired with graphic design to educate a variety of audiences about immunology, health and disease, and reproductive health.

Surgical Illustration

The purpose of this piece is to create a sequence of illustrations depicting cardiac bypass surgery. The surgical procedure involves harvesting the radial artery to perform an end-to-side distal anastomosis to the obtuse marginal coronary artery.

1. Sketch. During surgical observation, I sketched out the tools involved in the retraction and exposure of the radial artery. I also took notes of the tissue stabilizer positioned on the heart.

2. Final illustration. I chose to depict the harvesting of the radial artery as the main illustration in this sequence. I placed careful emphasis on the hands, which is uncommon as usually only the tools are displayed. I did this to highlight the positioning of the surgeon's hands in relation to the patient's which are an important part of the procedure.

3. Sketch. This piece shows the pericardium opened and secured to the edge of the sternum with a suture. I wanted to draw attention to the tissue stabilizer which allows this procedure to be performed off-pump on a beating heart.

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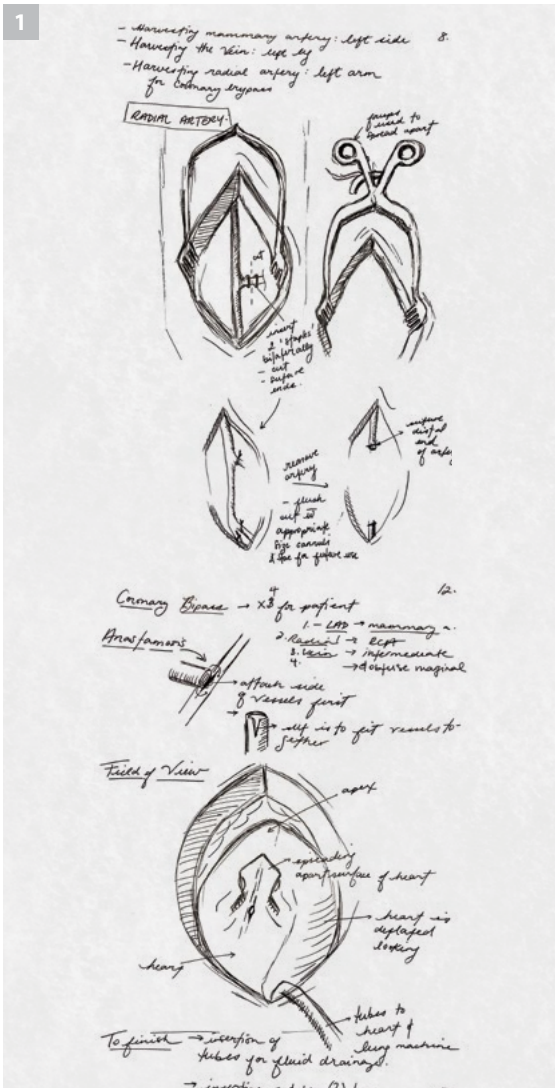

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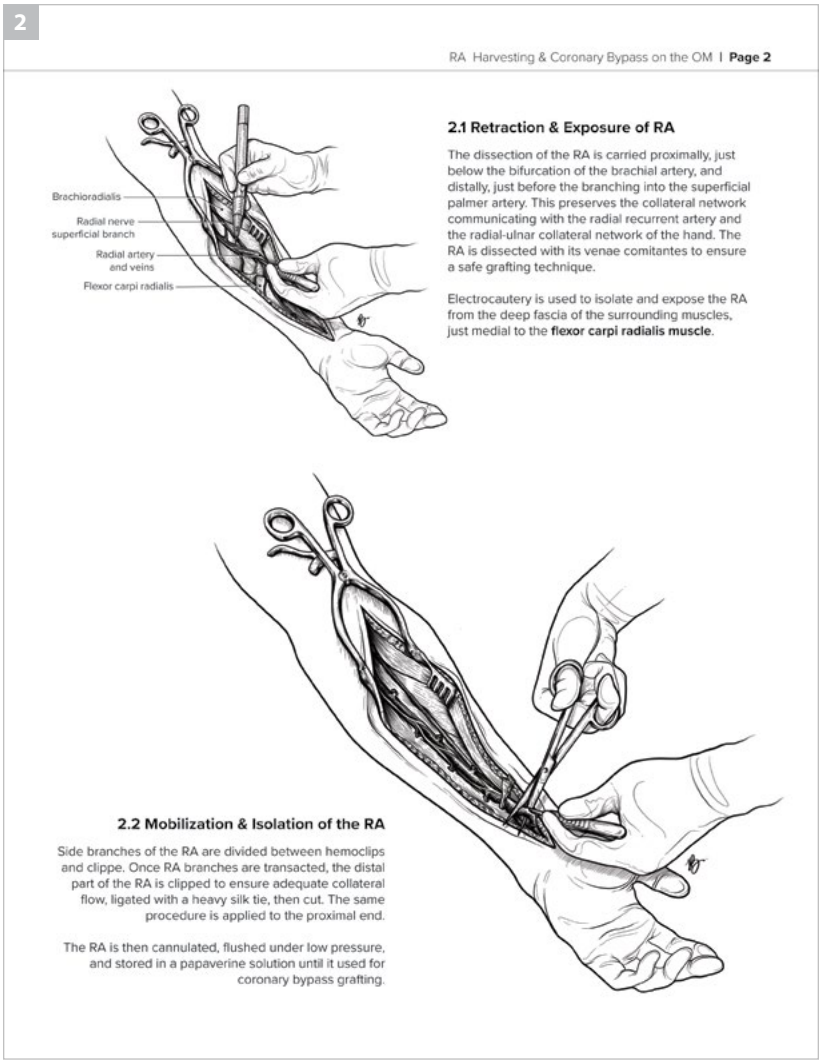

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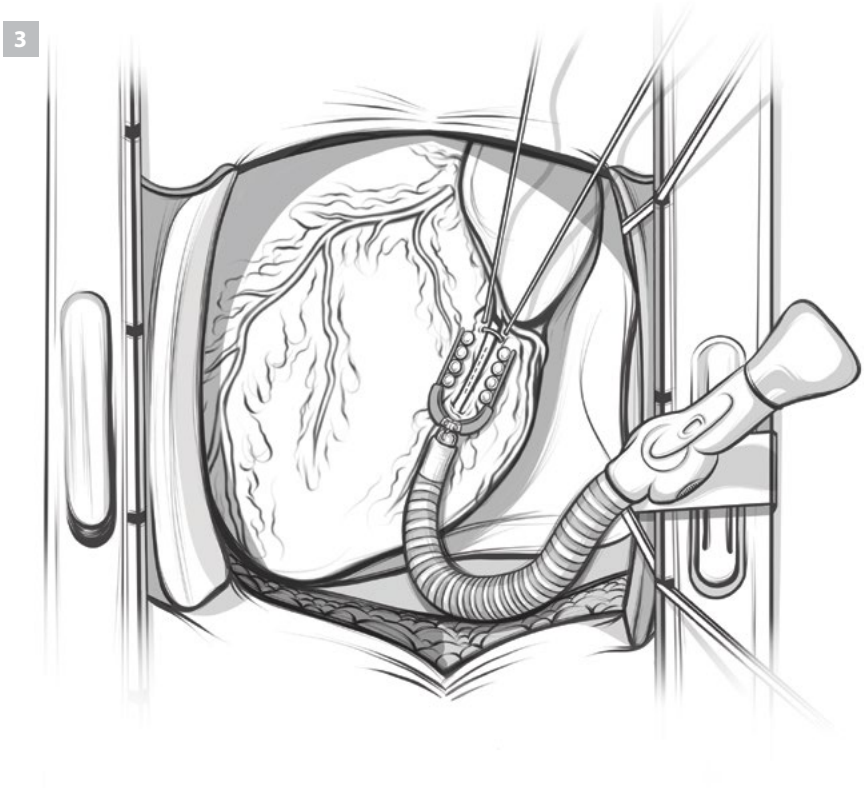

Editorial Illustration

The article of interest talks about the use of electroceutical materials that wirelessly generate electric fields across the surface of fabrics to repel pathogens. I wanted to play off the 'zapping' metaphor to communicate the futuristic qualities of this novel technology.

1. Sketch. I played around with different visual metaphors showing the concept of constructing the perfect mask.

2. Final draft. At first, I wanted to exaggerate the 'zapping' technology behind the mask. However, this produced too much of an 'apocalyptic' vibe that strayed form the original idea. Instead, I went for a cleaner look that was more in line with the technology.

3. Final illustration. I modelled the mannequin head from scratch. I added a glowing circuit texture to the fabric material. I chose teal and pink colours for the lighting to echo the futuristic vibe of the mask technology. The wiring colours were kept yellow and red to be more easily identifiable and stand out to the eye.

Previous spread. Final animation. A still from my Master's Research Project depicting immune cells travelling through a blood vessel.

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Pathological Illustration

During pathological cases, the placenta abnormally adheres and invades too deeply into the uterus. This piece illustrates placental villi invasion into the various layers of the endometrium and the cells involved in the disease process of Placenta Accreta Spectrum Disorders (PAS).

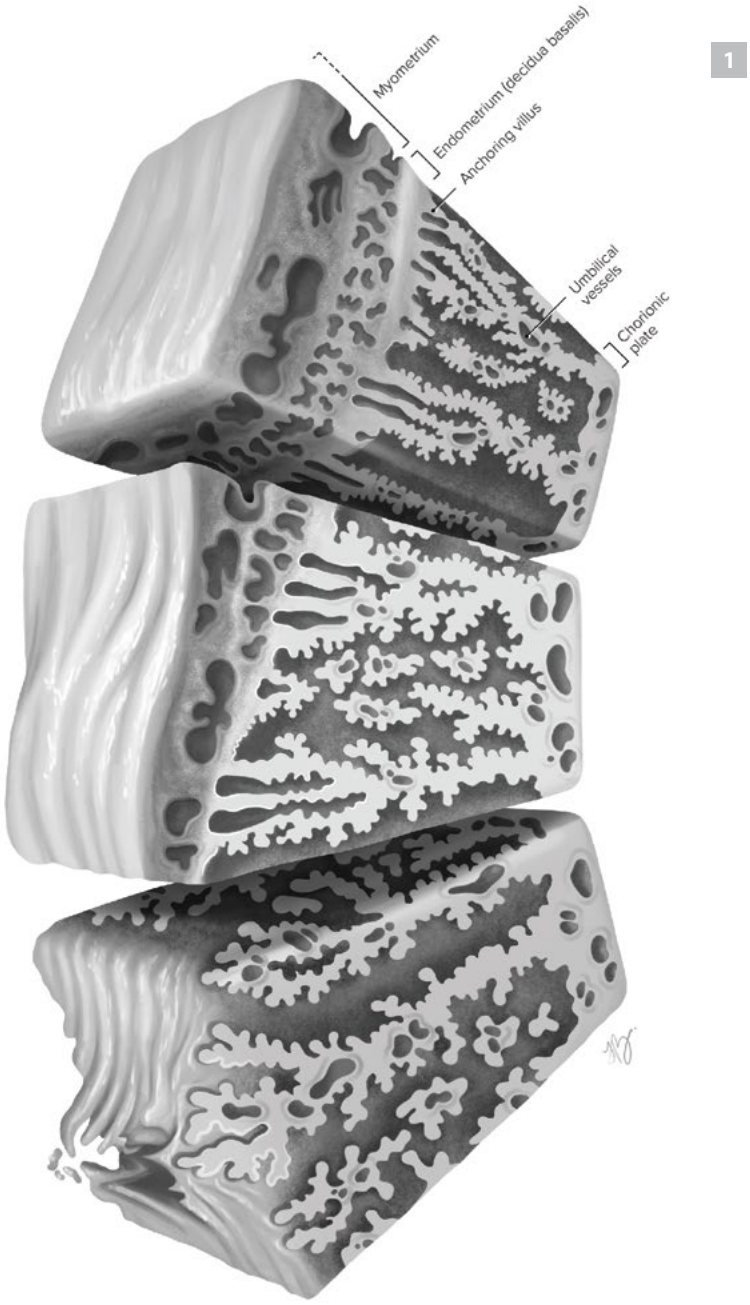
1. Study. This tissue cube study shows the various degrees of PAS. The diagnostic feature of these diseases is the loss of the decidual layer.

2. Sketch. Iterations to the tissue cubes were made to emphasize that placental abnormalities fall under a spectrum and aren't necessarily 'hard' delineations. I wanted to mirror the curvature of the placenta to show their relation in macroscopic and microscopic scale.

3. Study. In my tissue landscape study of a placental villus, I placed emphasis on the anatomy of the fetal capillaries from a wide angle view as if they are reaching out towards the viewer.

4. Production process. I explored two versions of colour palettes - 'light mode' and 'dark mode', both skewed to a warm and cool tint. Eventually, I opted for the lighter, peachy colour palette as I felt it was more suitable for the sensitive subject matter pertaining to maternal and fetal health.

5. Final illustration. The final illustration communicates the spectrum of PAS while also providing insight into the anatomy of chorionic villi and the normal process of placental invasion.



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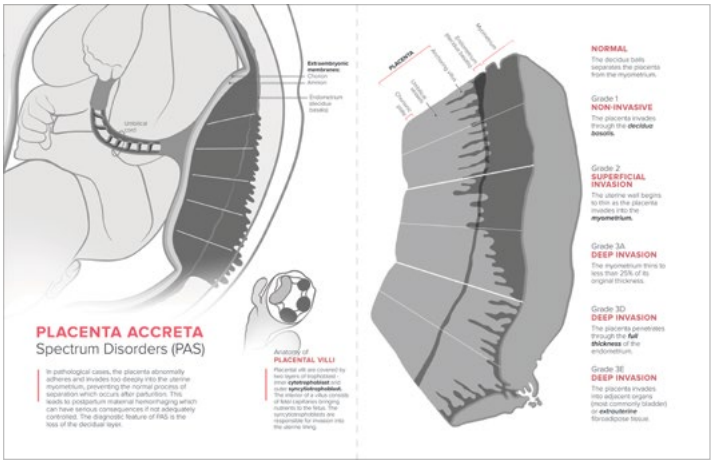

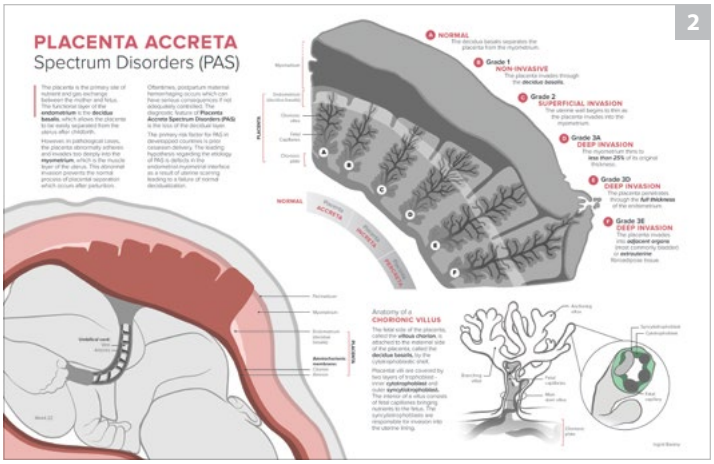

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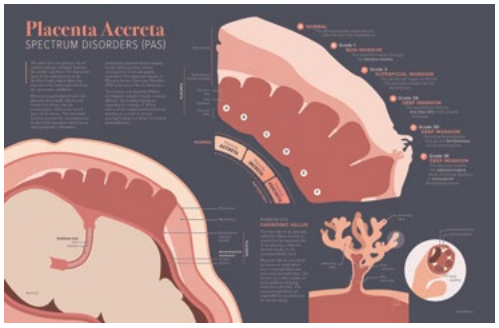

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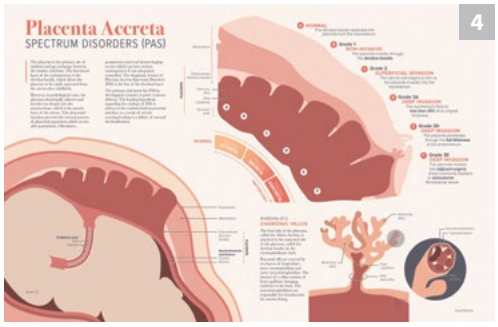

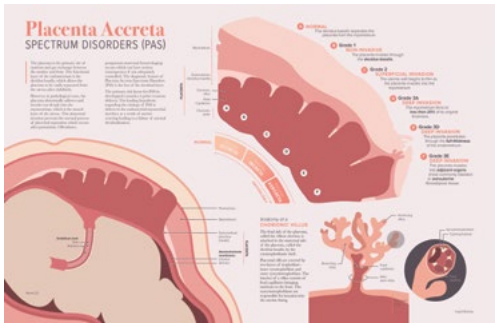

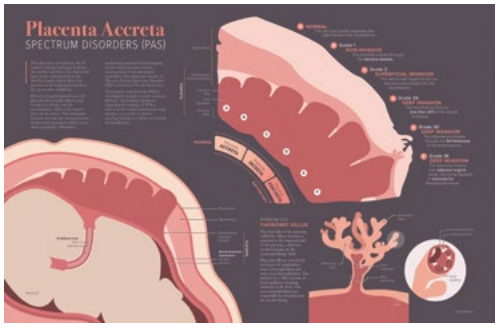

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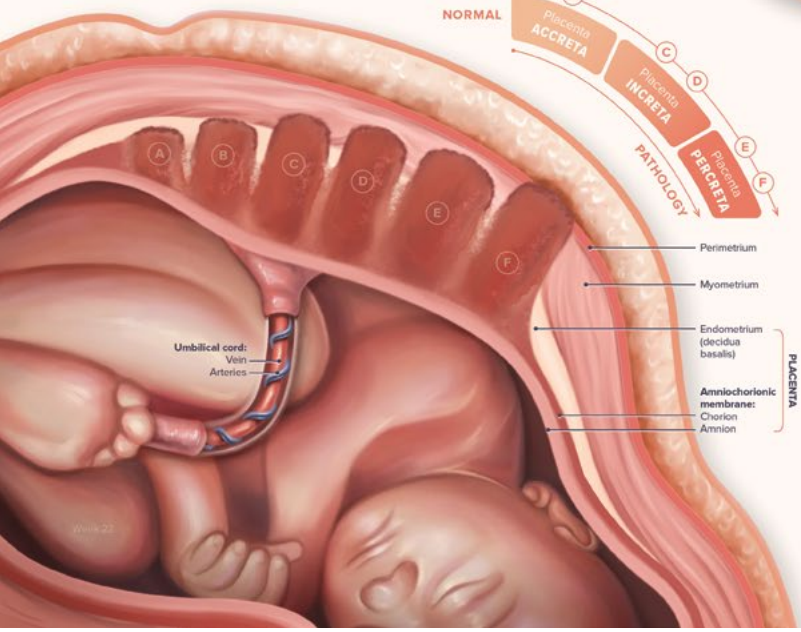
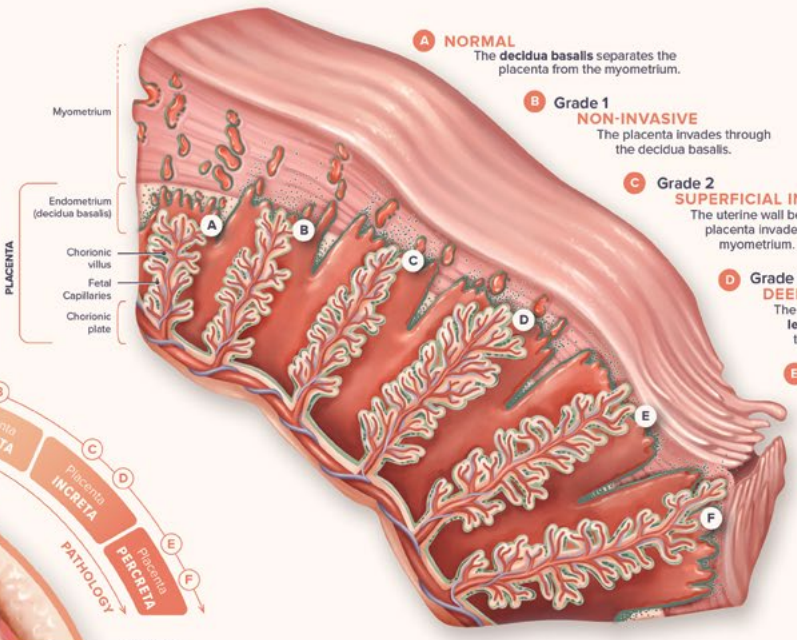
Placenta Accreta
SPECTRUM DISORDERS (PAS)

The placenta is the primary site of nutrient and gas exchange between the mother and fetus. The functional layer of the endometrium is the decidua basalis, which allows the placenta to be easily separated from the uterus after childbirth.

However, in pathological cases, the placenta abnormally adheres and invades too deeply into the myometrium, which is the muscle layer of the uterus. This abnormal invasion prevents the normal process of placental separation which occurs after parturition. Oftentimes, postpartum maternal hemorrhaging occurs which can have serious consequences if not adequately controlled. The diagnostic feature of *Placenta Accreta Spectrum Disorders (PAS)* is the loss of the decidual layer.

The primary risk factor for PAS in developed countries is prior cesarean delivery. The leading hypothesis regarding the etiology of PAS is defects in the endometrial-myometrial interface as a result of uterine scarring leading to a failure of normal decidualization.

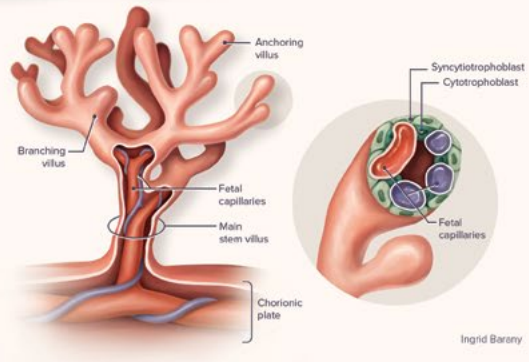




Anatomy of a CHORIONIC VILLUS

The fetal side of the placenta, called the villous chorion, is attached to the maternal side of the placenta, called the decidua basalis, by the cytotrophoblastic shell.

Placental villi are covered by two layers of trophoblast - inner cytotrophoblast and outer syncytiotrophoblast. The interior of a villus consists of fetal capillaries bringing nutrients to the fetus. The syncytiotrophoblasts are responsible for invasion into the uterine lining.



Ingrid Barany

Shedding Light on Cancer Medicine: Photodynamic Therapy for Cancer Treatment

Photodynamic Therapy, or PDT, is a light-activated cancer therapy that shows advantages over current cancer treatment methods. However, these therapeutic benefits are not widely known by the general public. Therefore, the goal of this project is to create an animation that educates and visualizes the mechanism of PDT as a treatment option in oncology.

1. Production process. This scene shows the photosensitizer being taken up by the tumor cells. The size of the molecule was exaggerated in order to visualize this process to a non-scientific audience.

2. Production process. This scene depicts an unclassified tumor located somewhere in the body. The reason for keeping this scene ambiguous and open-ended is that I didn't want to hone in on one specific cancer, but rather promote the versatility of the technology that can work on many different types of cancers.

3. Final animation. This scene shows the many types of cancers that can be targeted by PDT. I wanted to draw on the futuristic nature of the technology by using a clean and minimal design for the labels.

4. Final animation. Because the look and feel of my Master's Research Project (MRP) is more on the clinical side, I designed this scene specifically to bring in warmth and evoke empathy. PDT uses light as a tool to destroy tumor cells, and so I wanted to play off the light metaphor in a cinematic way.

5. Final animation. A large part of my MRP was making sure the PDT machine was accurately depicted. I also balanced this with a timeless look and feel such that when the technology changes, this video will still be relevant.

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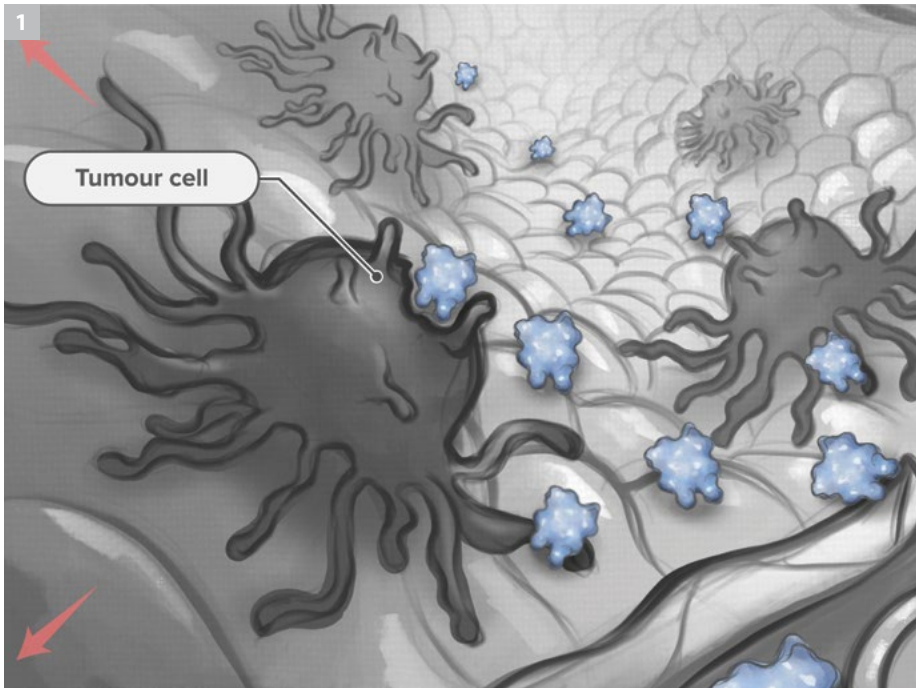

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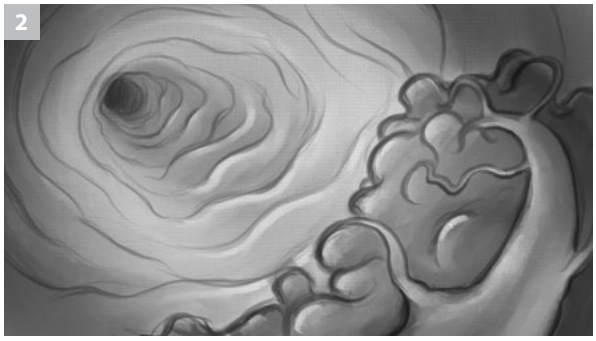

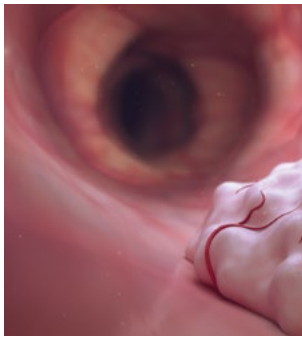

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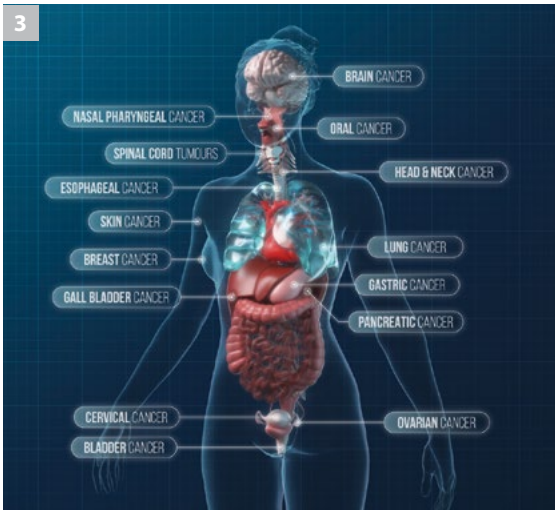

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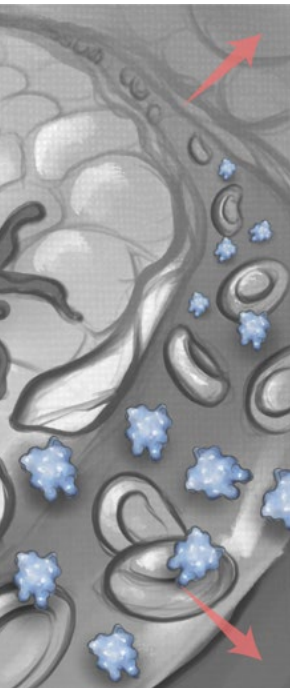
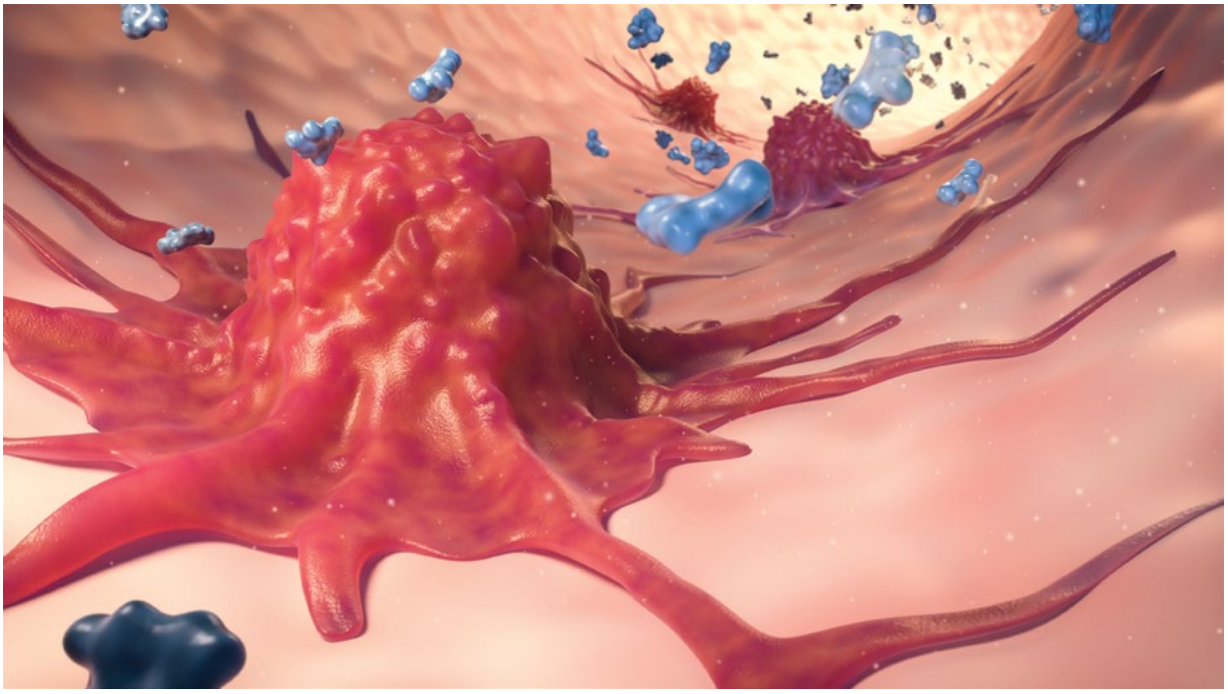
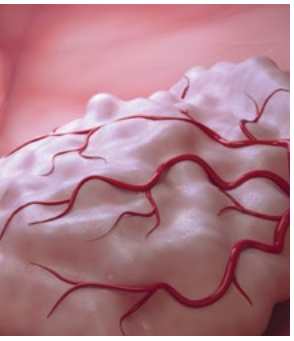




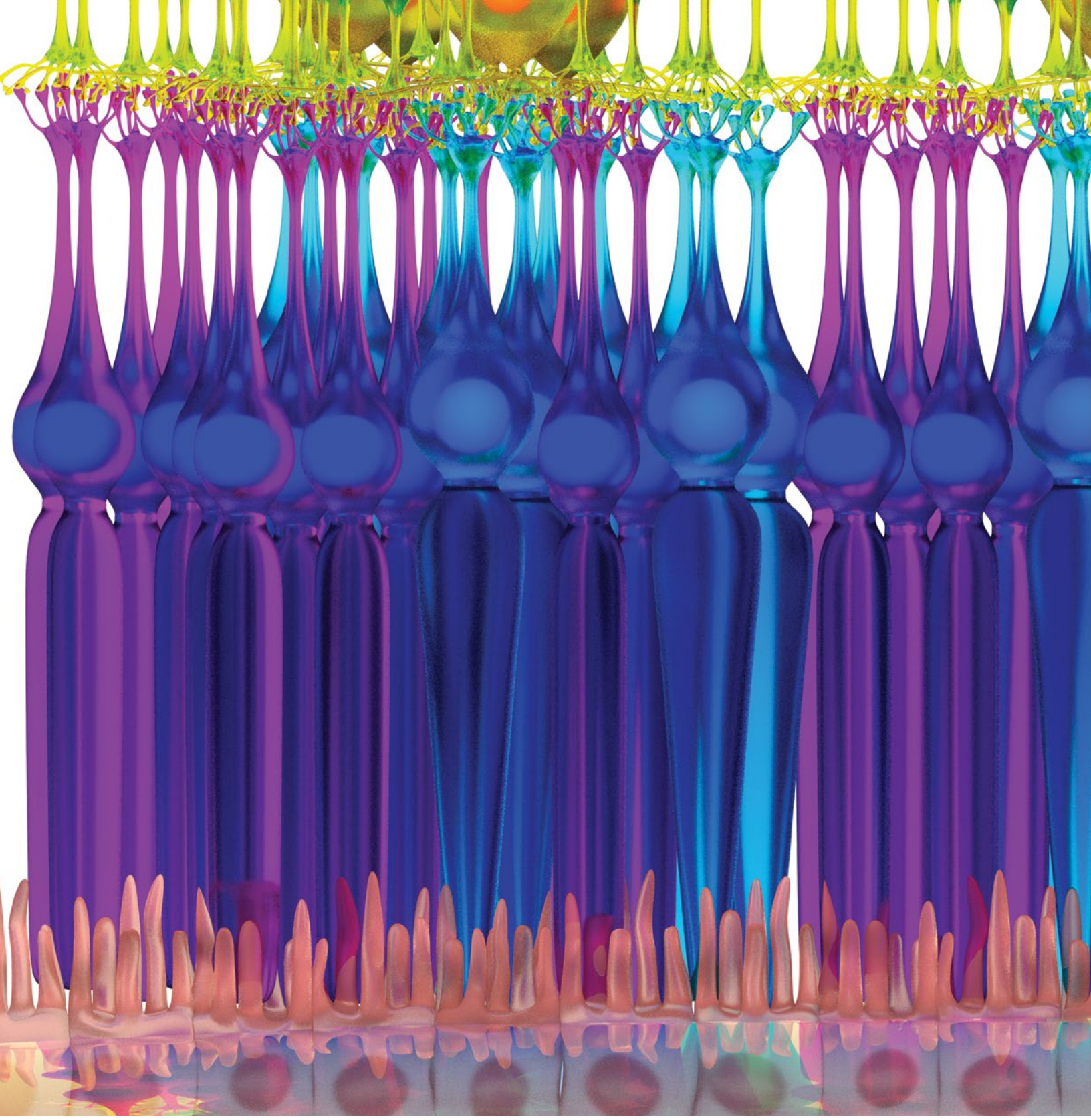


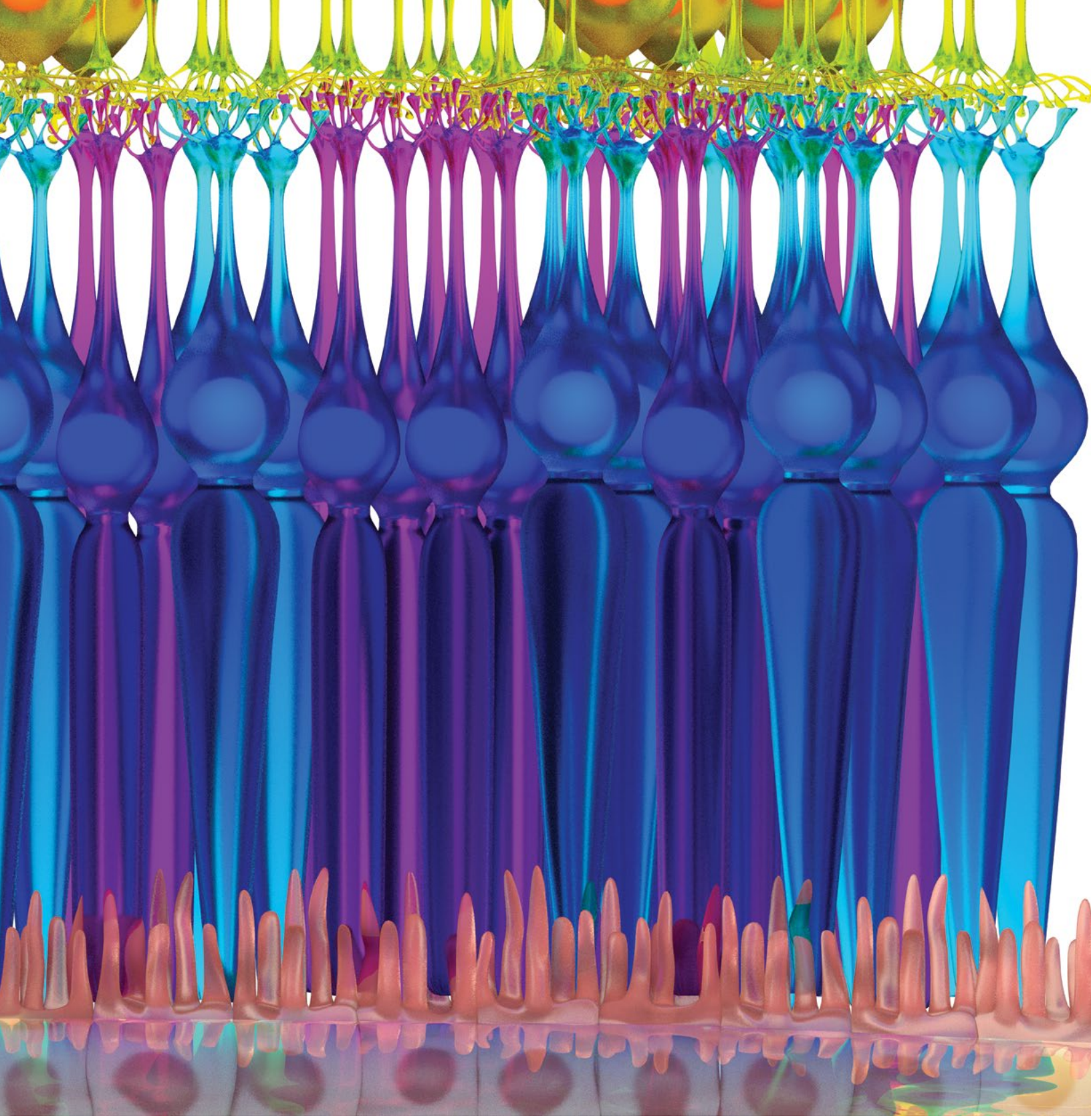

5
PDT
TREATMENT SETTINGS
START
PHOTOSENSITIZ


CAUTION
500 ML
CHEMOTHERAPY
CHEMOTHERAPY


RADIATION THERAPY


SURGERY





Jennifer Barolet

I specialize in 3D modelling, animation, and visual storytelling to successfully communicate biomedical, science, and technology information. I am a Professional Engineer with a Bachelor of Applied Science in Chemical Engineering, and Master of Engineering in Civil Engineering from the University of Toronto, with considerable experience in both industry and academia.

Molecular Visualization

"Two of a Kind" is an illustration depicting the key similarities and differences between SARS-CoV and SARS-CoV-2 and the affinity of SARS-CoV-2 for ACE2.

1. 3D modelling. Molecular structures of the spike protein and ACE-2 created using *Protein Imager*.

2. Sketch. Preliminary sketches were created to plan the content and layout, ensuring that I included the biomolecular structure, key interactions, and key amino acid sequencing similarities and differences.

3. Production process. Common features at the RBD-ACE2 interface were highlighted, illustrating similar biochemical properties within and outside the RBM. 3D biomolecular structure models (left) were simplified as 2D illustrations (right).

4. Final illustration. The final spread, visualizing the 3D structure of the spike protein in its partial open conformation trimeric configuration in line with ACE-2.

Previous spread. Final animation. Photoreceptor cells I modelled and animated in *Maya* to simulate normal alignment of the retina with the retinal pigment epithelium (RPE) cells for my Master's Research Project.

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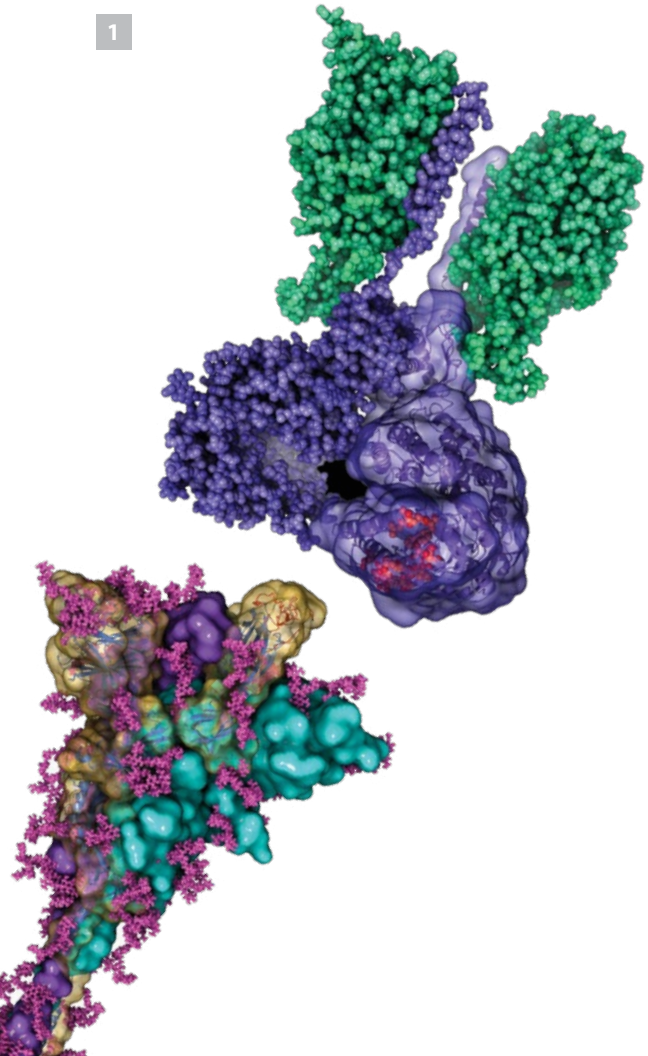

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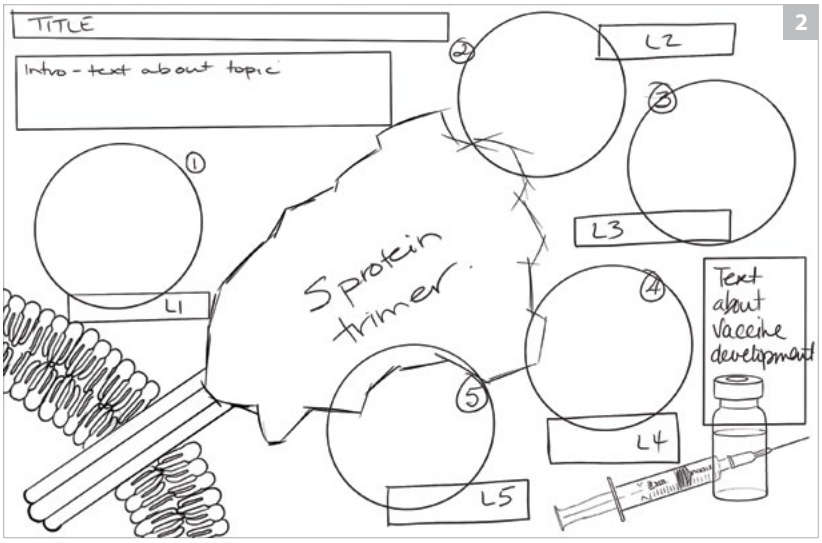

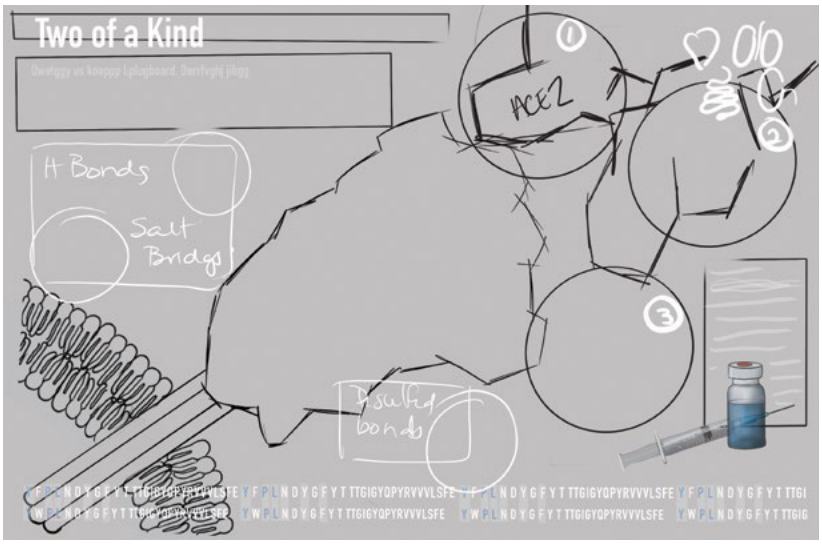

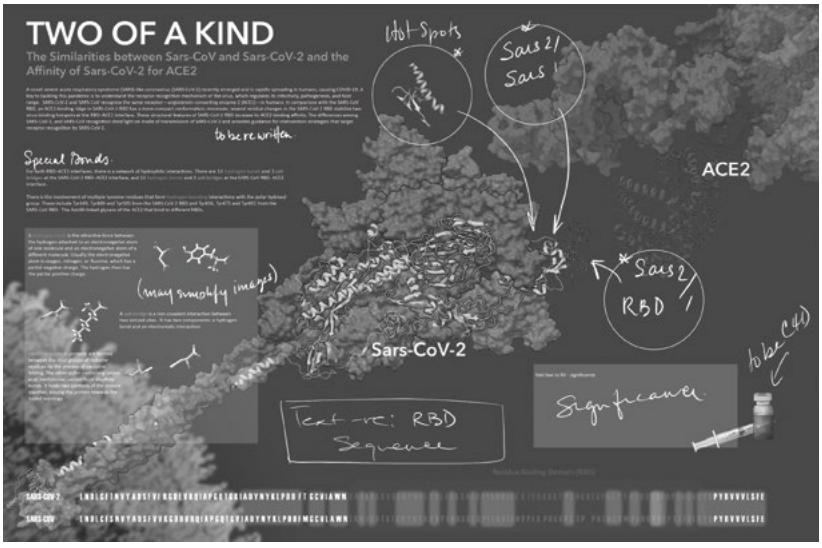

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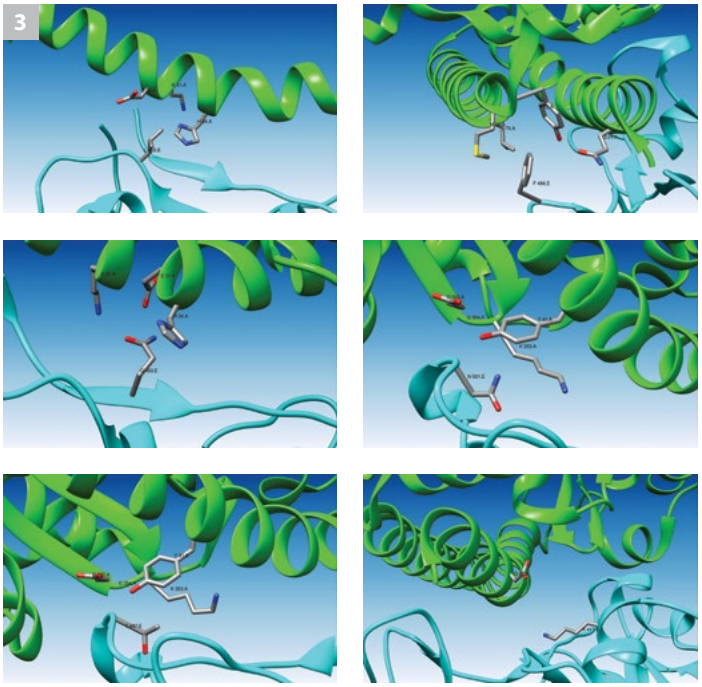


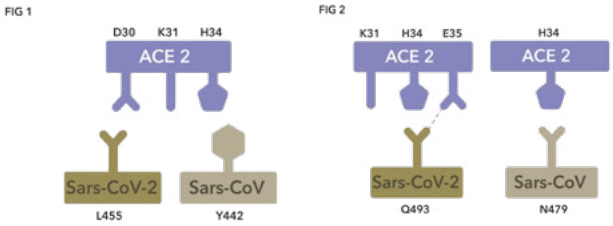


FIG 1
D30 K31 H34
ACE 2
Sars-CoV-2
Sars-CoV
L455
Y442
FIG 2
K31 H34 E35
H34
ACE 2
Sars-CoV-2
Sars-CoV
Q493
N479

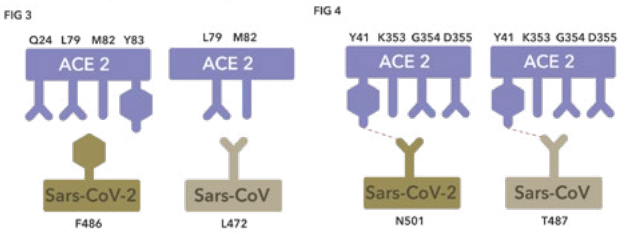


FIG 3
Q24 L79 M82 Y83
L79 M82
ACE 2
Sars-CoV-2
Sars-CoV
F486
L472
FIG 4
Y41 K353 G354 D355
ACE 2
Sars-CoV-2
Sars-CoV
N501
T487

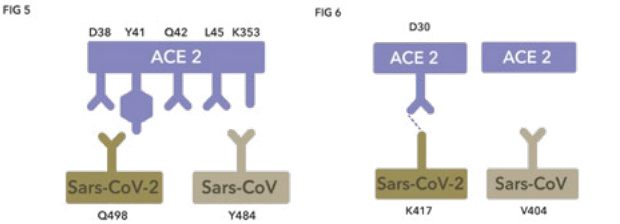
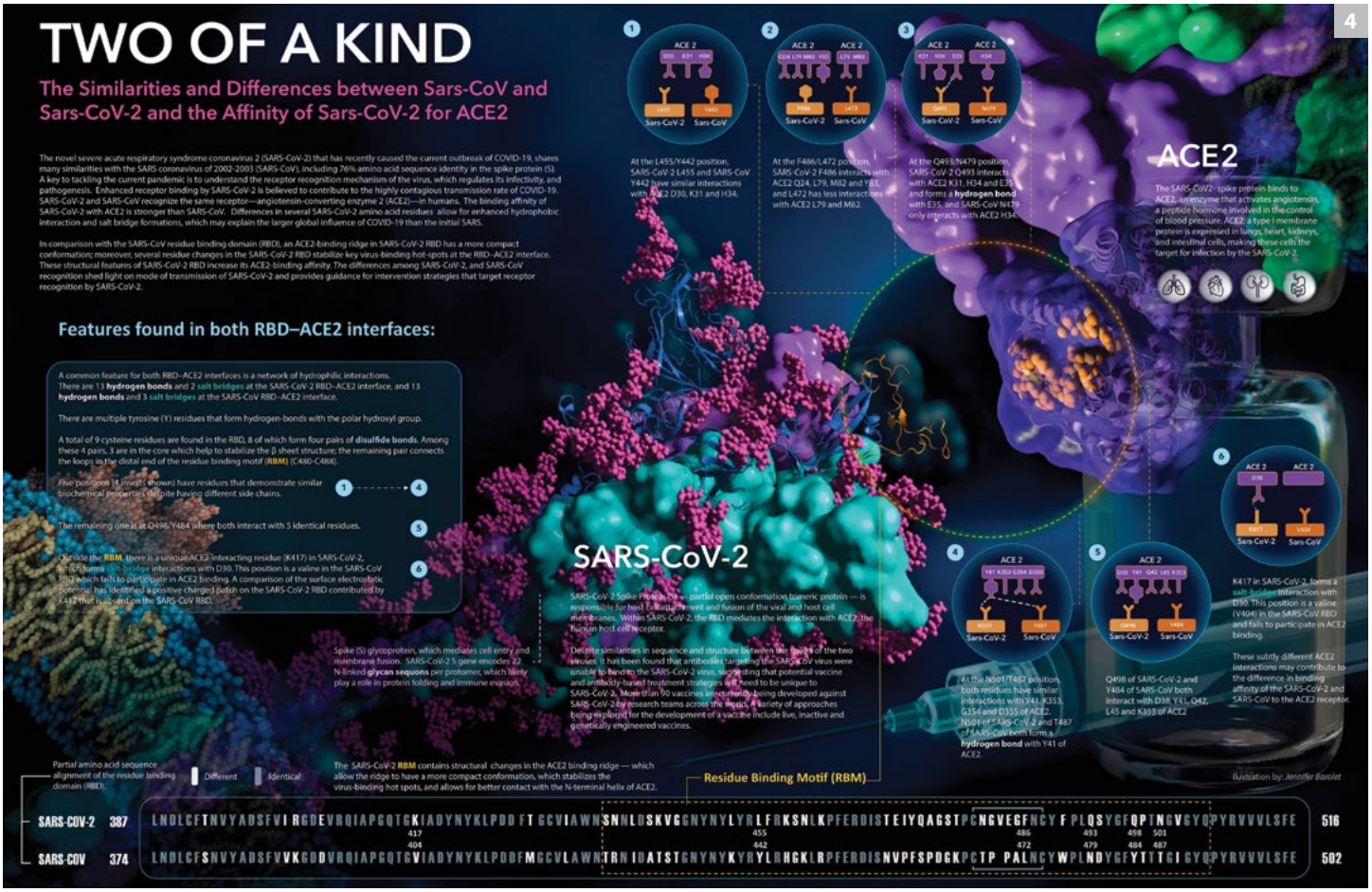


FIG 5
D38 Y41 Q42 L45 K353
ACE 2
Sars-CoV-2
Sars-CoV
Q498
Y484
FIG 6
D30
ACE 2
Sars-CoV-2
Sars-CoV
K417
V404

4


TWO OF A KIND
The Similarities and Differences between Sars-CoV and Sars-CoV-2 and the Affinity of Sars-CoV-2 for ACE2
The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that has recently caused the current outbreak of COVID-19, shares many similarities with the SARS coronavirus of 2002-2003 (SARS-CoV), including 76% amino acid sequence identity in the spike protein (S). A key to tackling the current pandemic is to understand the receptor recognition mechanism of the virus, which regulates its infectivity, and pathogenesis. Enhanced receptor binding by SARS-CoV-2 is believed to contribute to the highly contagious transmission rate of COVID-19. SARS-CoV-2 and SARS-CoV recognize the same receptor—angiotensin-converting enzyme 2 (ACE2)—in humans. The binding affinity of SARS-CoV-2 with ACE2 is stronger than SARS-CoV. Differences in several SARS-CoV-2 amino acid residues allow for enhanced hydrophobic interaction and salt bridge formations, which may explain the larger global influence of COVID-19 than the initial SARS.
In comparison with the SARS-CoV residue binding domain (RBD), an ACE2-binding ridge in SARS-CoV-2 RBD has a more compact conformation; moreover, several residue changes in the SARS-CoV-2 RBD stabilize key virus-binding hot-spots at the RBD–ACE2 interface. These structural features of SARS-CoV-2 RBD increase its ACE2-binding affinity. The differences among SARS-CoV-2, and SARS-CoV recognition shed light on mode of transmission of SARS-CoV-2 and provides guidance for intervention strategies that target receptor recognition by SARS-CoV-2.
Features found in both RBD–ACE2 interfaces:
A common feature for both RBD–ACE2 interfaces is a network of hydrophilic interactions. There are 13 hydrogen bonds and 2 salt bridges at the SARS-CoV-2 RBD–ACE2 interface, and 13 hydrogen bonds and 3 salt bridges at the SARS-CoV RBD–ACE2 interface.
There are multiple tyrosine (Y) residues that form hydrogen-bonds with the polar hydroxyl group.
A total of 9 cysteine residues are found in the RBD, 8 of which form four pairs of disulfide bonds. Among these 4 pairs, 3 are in the core which help to stabilize the β sheet structure; the remaining pair connects the loops in the distal end of the residue binding motif (RBM) (C480-C488).
Five positions (4 insets shown) have residues that demonstrate similar biochemical properties despite having different side chains.
The remaining one is at Q498/Y484 where both interact with 5 identical residues.
Outside the RBM, there is a unique ACE2-interacting residue (K417) in SARS-CoV-2, K417 forms salt bridge interactions with D30. This position is a valine in the SARS-CoV RBD which fails to participate in ACE2 binding. A comparison of the surface electrostatic potential has identified a positive charged patch on the SARS-CoV-2 RBD contributed by K417 that is absent on the SARS-CoV RBD.
At the L455/Y442 position, SARS-CoV-2 L455 and SARS-CoV Y442 have similar interactions with ACE2 D30, K31 and H34.
At the F486/L472 position, SARS-CoV-2 F486 interacts with ACE2 Q24, L79, M82 and Y83, and L472 has less interactions with ACE2 L79 and M82.
At the Q493/N479 position, SARS-CoV-2 Q493 interacts with ACE2 K31, H34 and E35, and forms a hydrogen bond with E35, and SARS-CoV N479 only interacts with ACE2 H34.
ACE2
The SARS-CoV2- spike protein binds to ACE2, an enzyme that activates angiotensin, a peptide hormone involved in the control of blood pressure. ACE2, a type I membrane protein is expressed in lungs, heart, kidneys, and intestinal cells, making these cells the target for infection by the SARS-CoV-2.
SARS-CoV-2
SARS-CoV-2 Spike Protein (S) — partial open conformation trimeric protein — is responsible for host cell attachment and fusion of the viral and host cell membranes. Within SARS-CoV-2, the RBD mediates the interaction with ACE2, the human host cell receptor.
Despite similarities in sequence and structure between the RBDs of the two viruses, it has been found that antibodies targeting the SARS-CoV virus were unable to bind to the SARS-CoV-2 virus, suggesting that potential vaccine and antibody-based treatment strategies will need to be unique to SARS-CoV-2. More than 90 vaccines are currently being developed against SARS-CoV-2 by research teams across the world. A variety of approaches being explored for the development of a vaccine include live, inactive and genetically engineered vaccines.
Spike (S) glycoprotein, which mediates cell entry and membrane fusion. SARS-CoV-2 S gene encodes 22 N-linked glycan sequons per protomer, which likely play a role in protein folding and immune evasion.
At the N501/T487 position, both residues have similar interactions with Y41, K353, G354 and D355 of ACE2. N501 of SARS-CoV-2 and T487 of SARS-CoV both form a hydrogen bond with Y41 of ACE2.
Q498 of SARS-CoV-2 and Y484 of SARS-CoV both interact with D38, Y41, Q42, L45 and K353 of ACE2.
K417 in SARS-CoV-2 forms a salt-bridge interaction with D30. This position is a valine (V404) in the SARS-CoV RBD and fails to participate in ACE2 binding.
These subtly different ACE2 interactions may contribute to the difference in binding affinity of the SARS-CoV-2 and SARS-CoV to the ACE2 receptor.
Illustration by: Jennifer Barolet
Partial amino acid sequence alignment of the residue binding domain (RBD).
Different
Identical
The SARS-CoV-2 RBM contains structural changes in the ACE2 binding ridge — which allow the ridge to have a more compact conformation, which stabilizes the virus-binding hot spots, and allows for better contact with the N-terminal helix of ACE2.
Residue Binding Motif (RBM)
SARS-COV-2 387 LNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIADYNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPCNGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFE 516
SARS-COV 374 LNDLCFSNVYADSFVVKGDDVRQIAPGQTGVIADYNYKLPDDFMGCVLAWNTRNIDATSTGNYNYKYRYLRHGKLRPFERDISNVPFSPDGKPCTPPALNCYWPLNDYGFYTTTGIGYQPYRVVVLSFE 502

Editorial Illustration

"Turning Back the Clock" is a mock journal cover illustration for *Nature*. I designed it to draw the reader's attention to editorial content about the myths surrounding anti-aging supplements by incorporating a playful idea in visual form.

1. 3D modelling. 3D models of the gears of the clock, hands of the clock, and clock casing were created using *Maya*.

2. Study. A 2D illustration I created in *Procreate*, and 3D rigged model variations of the pill character I created in *Maya*.

3. Production process. Preliminary sketches and layout designs were created to determine the optimal composition with the complexity of the gears representing the complexity of anatomical systems.

4. Final illustration. The final composition was created starting with modeling, texturing, and lighting in *Maya*, followed by creating a background in *Photoshop* and final text and the *Nature* publication cover format using *Illustrator*.

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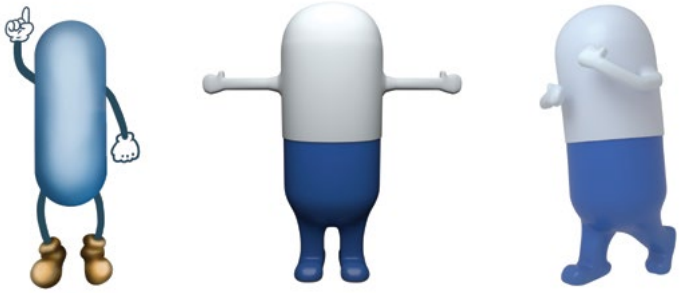

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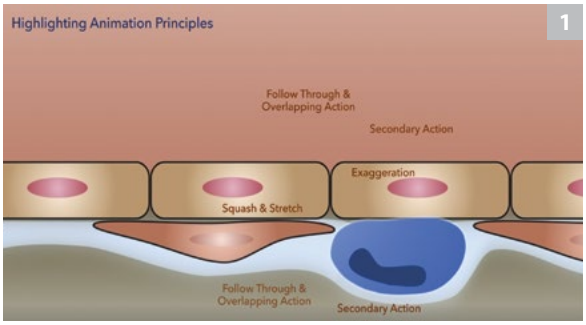
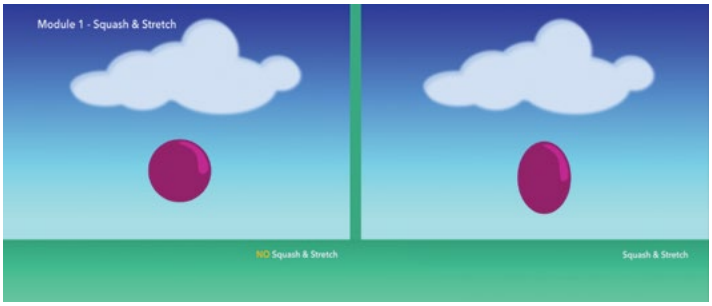
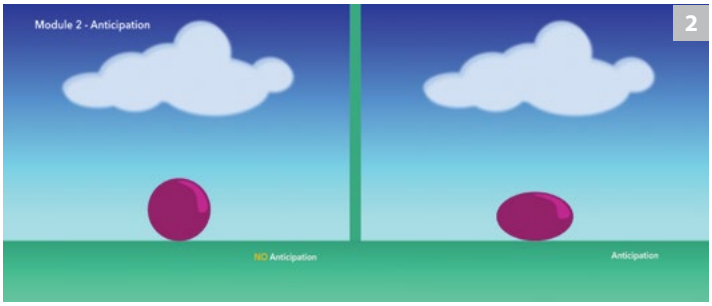
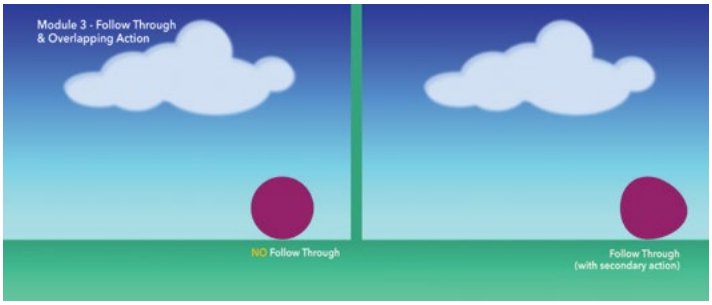
2D Animation

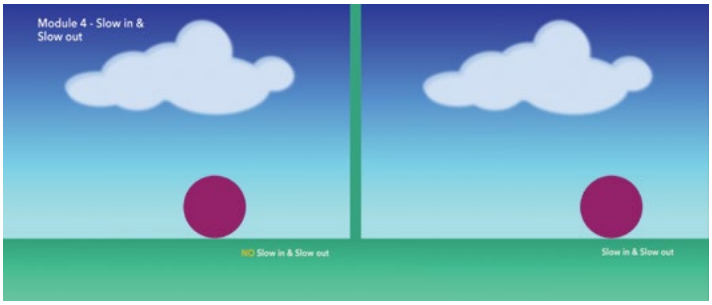
A study and application of the principles of animation in order to document exercises for use as teaching aids, and to create demo videos that incorporate key principles in 2D which can then be applied in the field of biomedical communication.

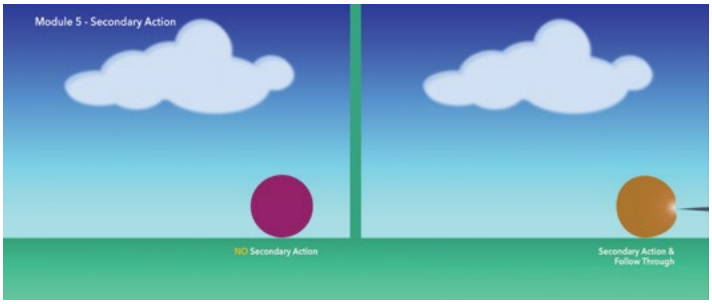


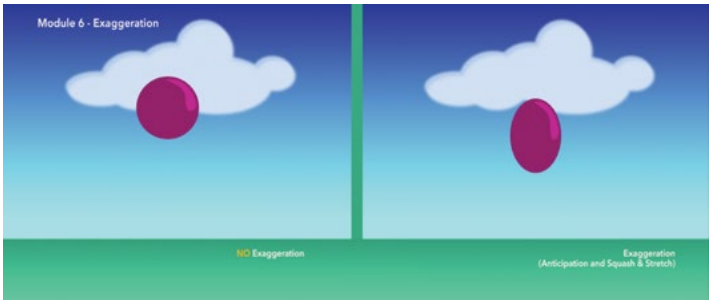








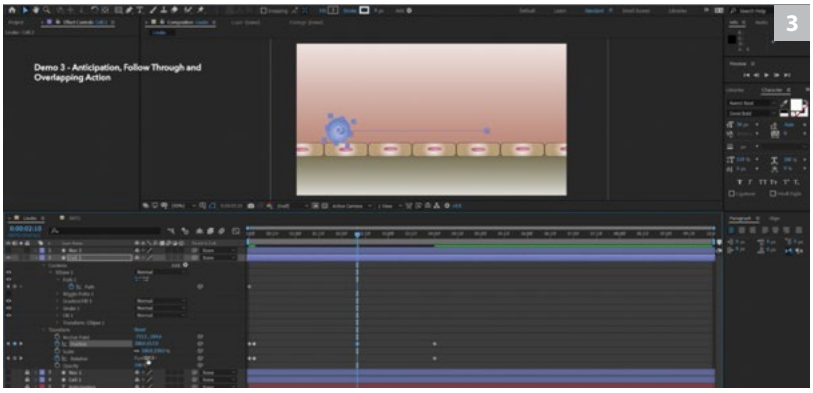




1. Study. Application of animation principles in biomedical communications. The process of LE was animated in *After Effects* communicating the key steps. The application of the principles of animation were also highlighted throughout the animation.

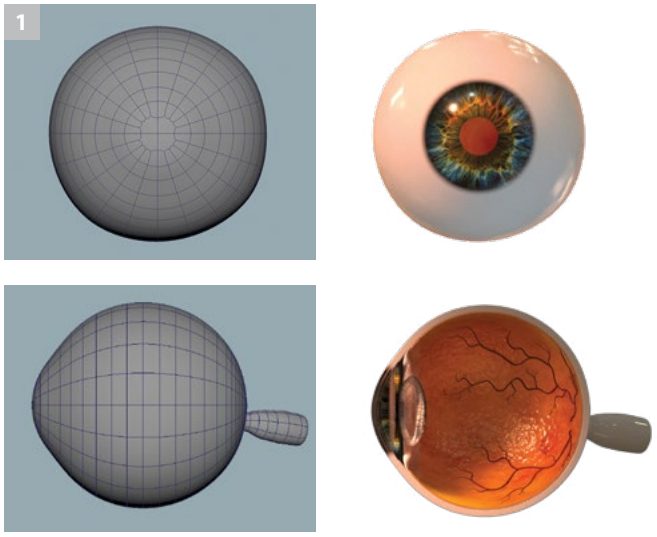
2. Final animation. Short animation clips were created in *After Effects* for six animation principles. These clips highlight the effects of the principles by comparing each with and without the principle applied as demonstrated by a bouncing and rolling inflated ball.

3. Production process. Short demo videos were created demonstrating how to use *After Effects* to incorporate select animation principles to a bouncing/rolling ball and leukocyte cell.

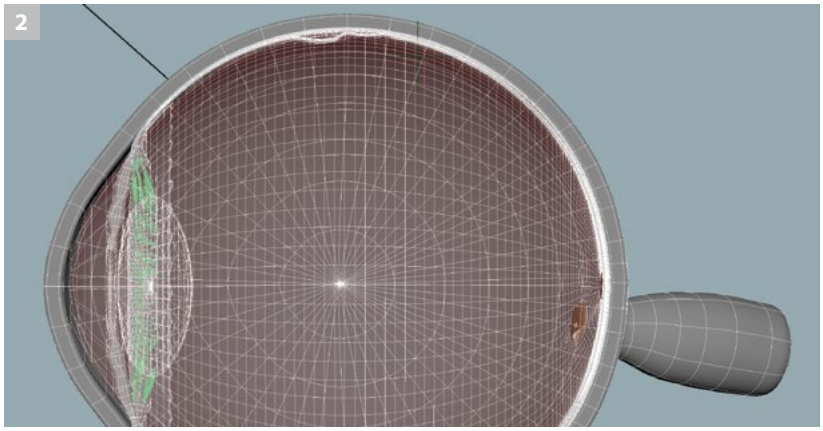


Visualizing the Mechanism of Unintentional Retinal Displacement Following Retinal Detachment Repair

My Master's Research Project involved visualizing the complexities of unintentional postoperative retinal displacement using 3D animation to inform retinal surgeons in support of selecting a preferred treatment method. Visual cues were incorporated to focus on the forces exerted on the retina and the complex mechanisms involved during reattachment experienced with both Pars Plana Vitrectomy and Pneumatic Retinopexy surgical procedures, ultimately causing postoperative retinal displacement.



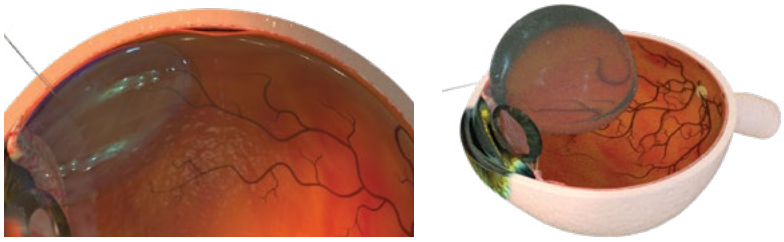
1. 3D modelling. Full exterior eye and cross-sectional eye models were created, textured, and animated using *Maya*.



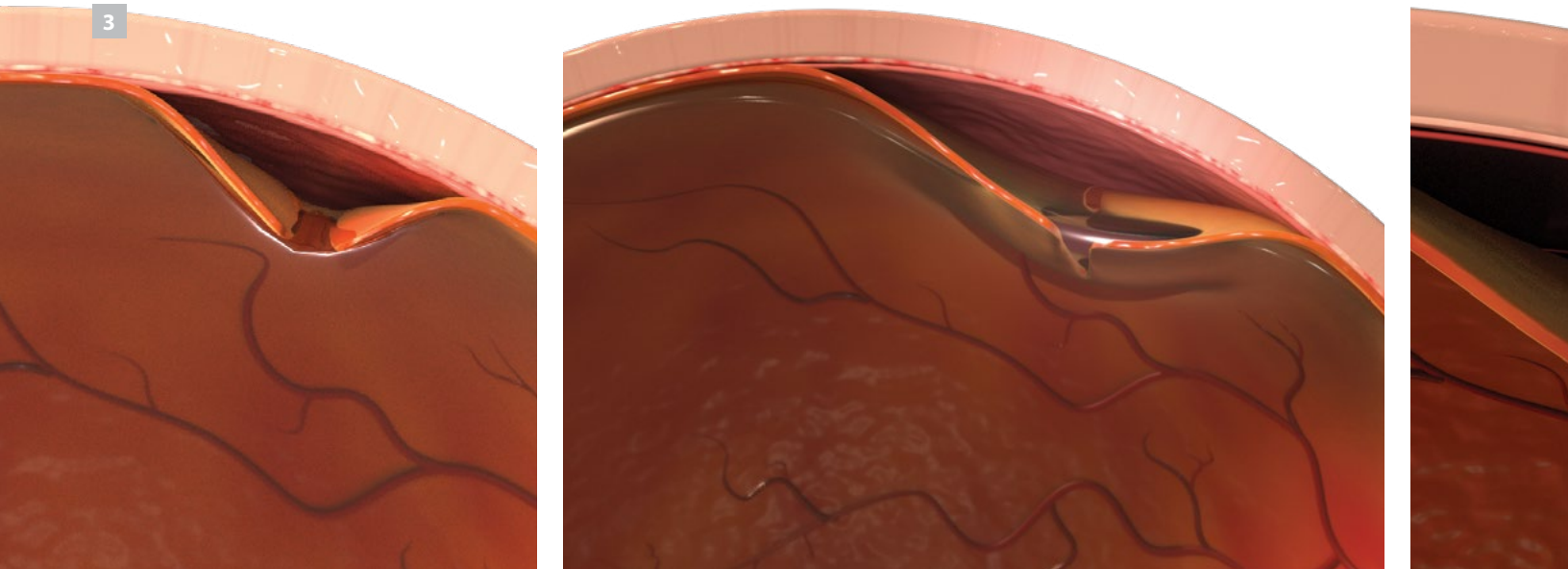
2. Production process. Wire frame and textured models showing the internal structures while simulating the injection of the gas bubble during a Pars Plana Vitrectomy procedure.

3. Final animation. 3D cross-sectional models showing a retinal tear and flow of vitreous fluid into the subretinal space.

4. Production process. Photoreceptor cones, rods and bipolar cells in mesh, and textured form in *Maya*. The photoreceptor layer and flow of sub-retinal fluid in relation to the proximity to the retinal pigmented epithelium was animated following retinal detachment surgery, showing normal alignment and a case of misalignment resulting in retinal displacement.



5. Production process. Multiple wave deformers and ncloth applications were used to simulate and animate the shift of the retinal artery that can occur following retinal detachment surgery resulting in displacement of the retinal layer and associated arteries due to the buoyant force of the gas bubble and the movement of trapped sub-retinal fluid.



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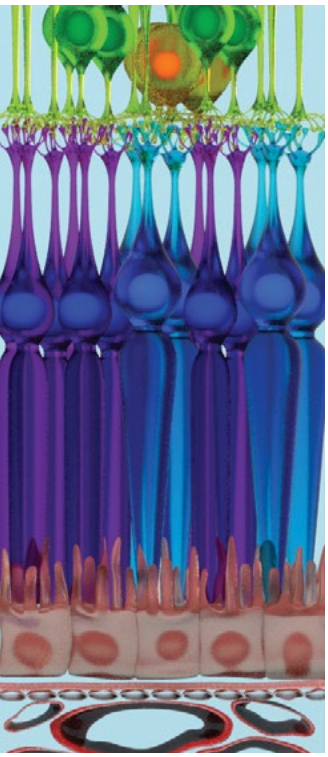

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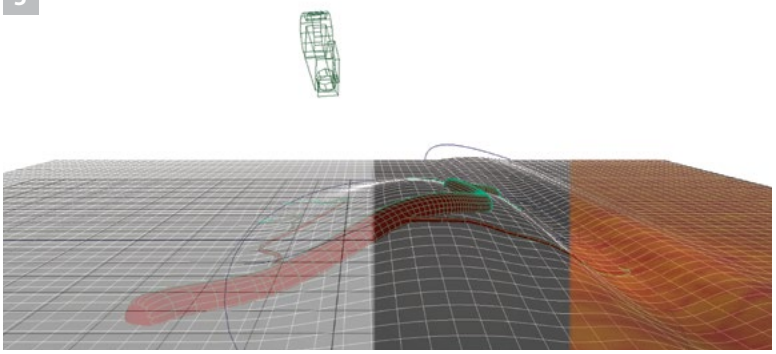

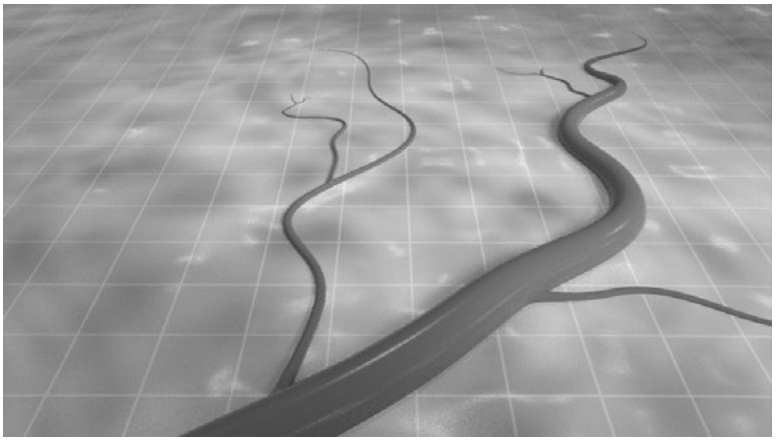

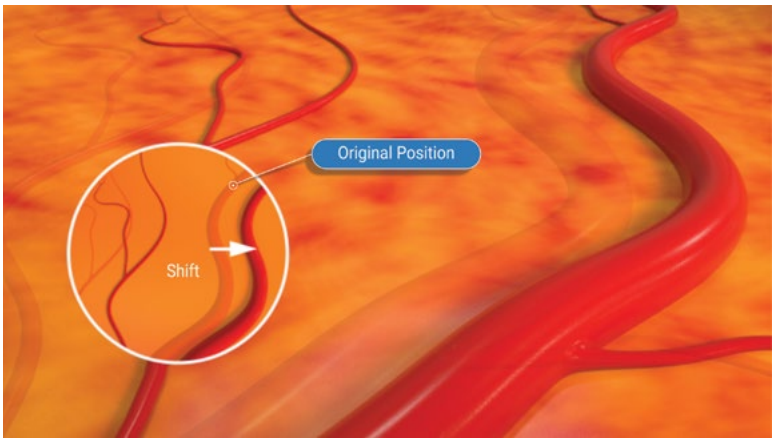

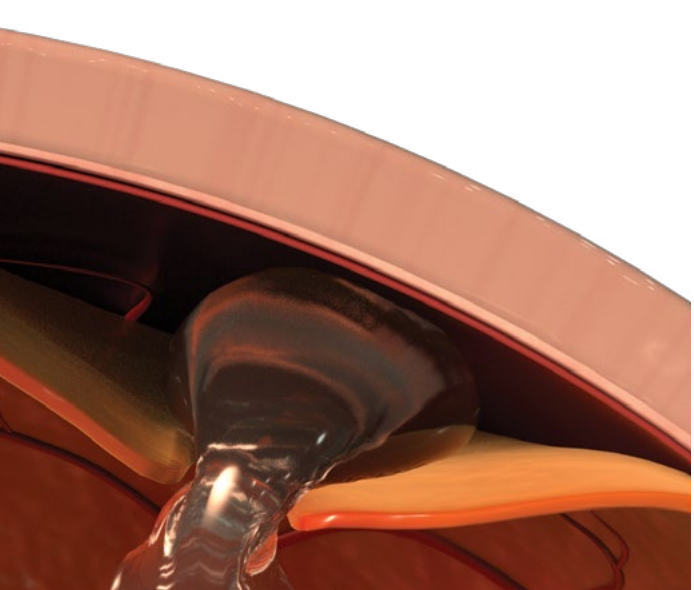

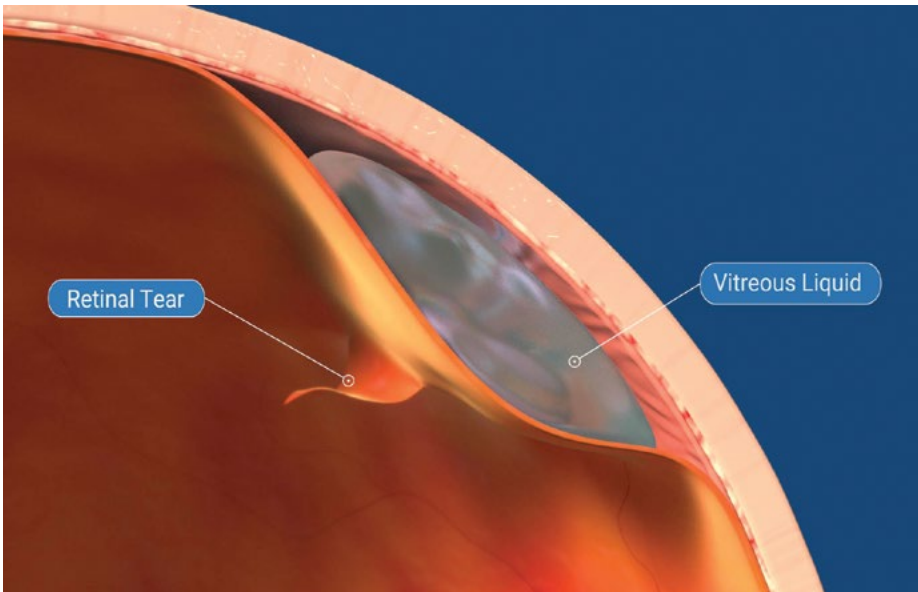

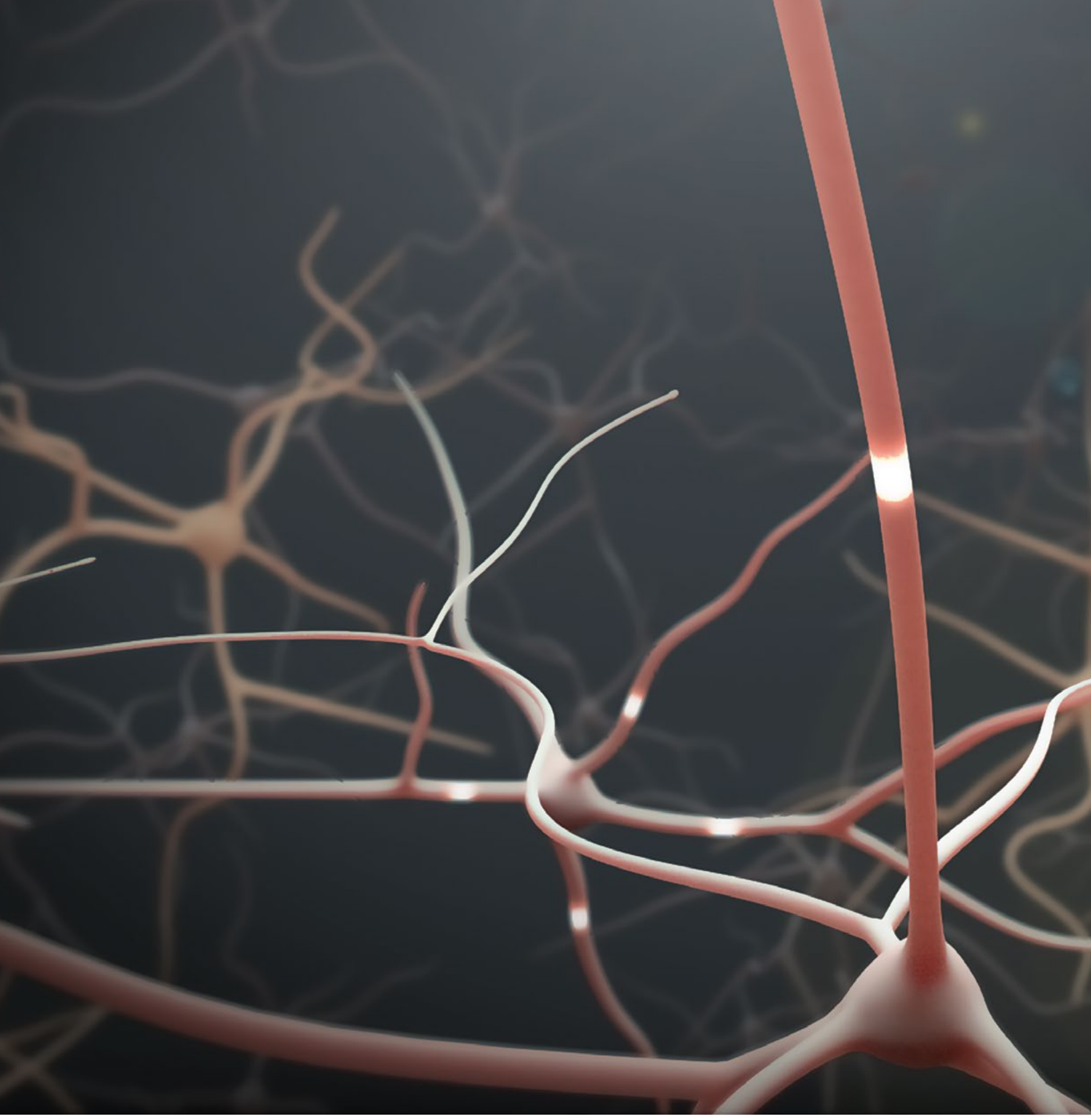

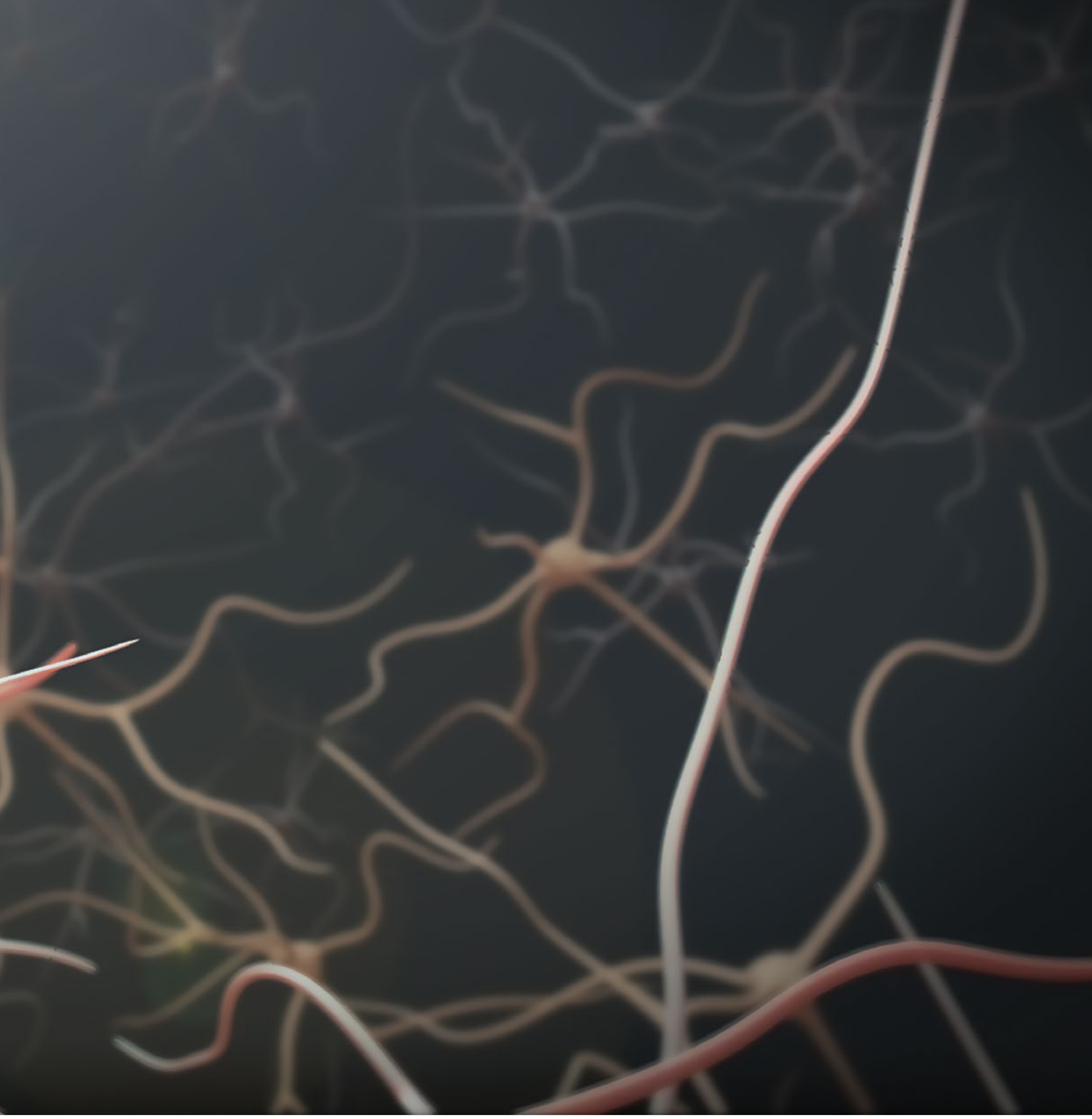

Jennifer Gu

After my undergraduate studies in Biological Sciences at the University of Alberta, I decided to pursue my passion in combining art and science in the BMC program. I am enthusiastic about creating didactic, aesthetic pieces that tell an effective narrative for the intended audience.

Pathological Illustration

Ovarian cancer is one of the leading deadly cancers in North America. In addition to illustrating the pathological process of high-grade serous ovarian cancer, I also wanted to explore the fascinating landscape of the ovaries in this project.

1. Study. After research and copy was set, I played around with different layouts and colour schemes for the infographic. This was the most iterative stage, as I needed to take into consideration composition, storytelling, and reading flow.

2. Final illustration. Once the main rendering was complete, I made some further iterations on layout and design, which led to the final infographic.

3. Production process. I completed two versions of the ovary tissue cubes. For the final rendering of this particular piece, I decided to go for a slightly more realistic style in depicting the ovarian tumour (bottom row). As focus fades away from the focal point of the tumour, I wanted to also shift the style towards a more illustrated, pencil sketch look.

Previous spread. Final animation. Screen capture from my Master's Research Project: An Introduction and Overview on the Study of Engrams.

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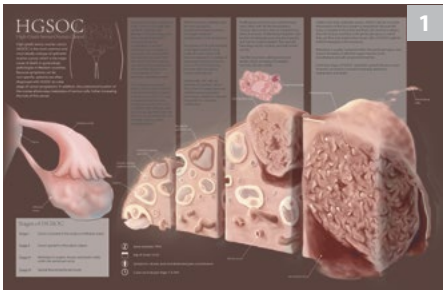

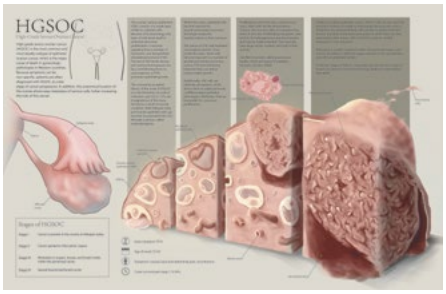

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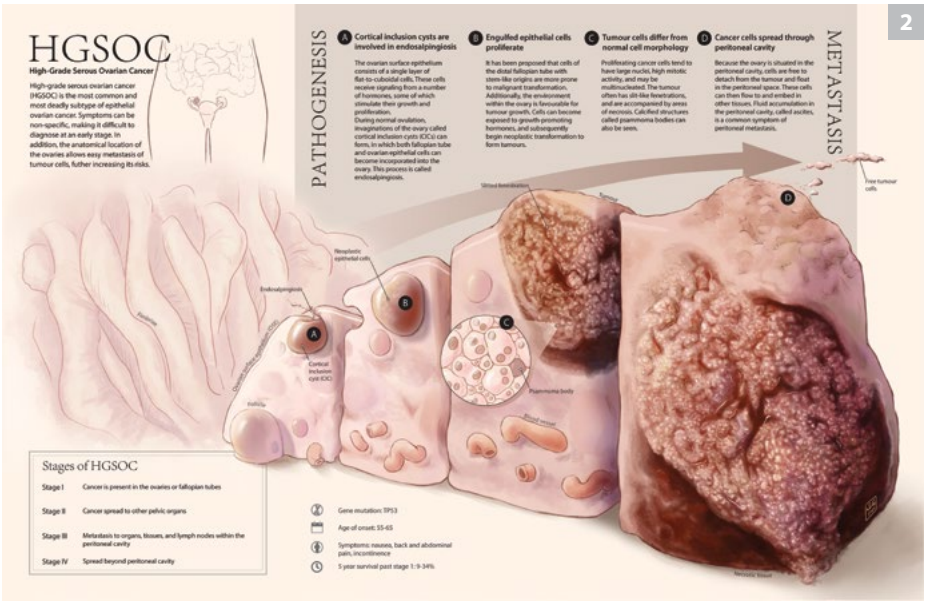

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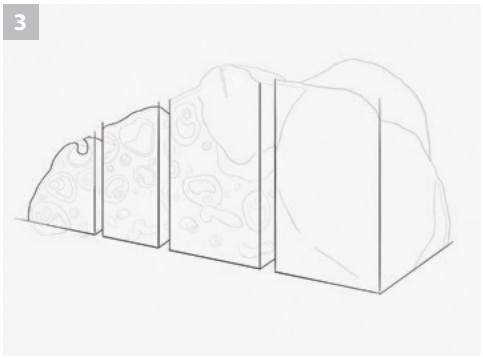

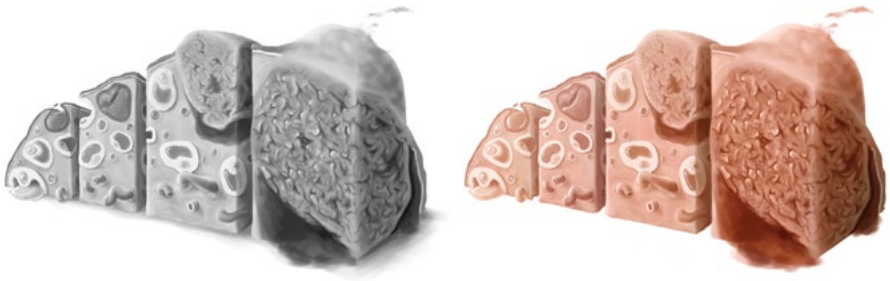

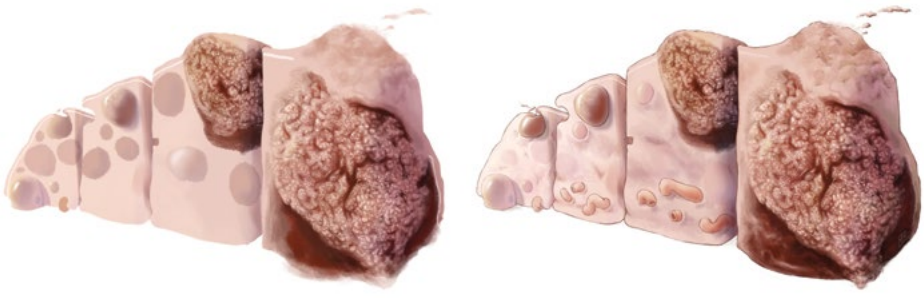

Anatomical Illustration

The main goal of this project was to illustrate an organ from an unconventional view, in order to help better understand an aspect of the anatomy. I chose to visualize a superior view into the right atrium and showcase the tricuspid valves.

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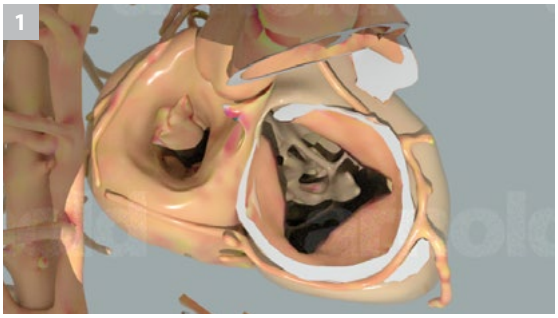
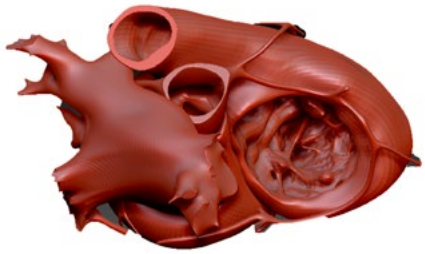


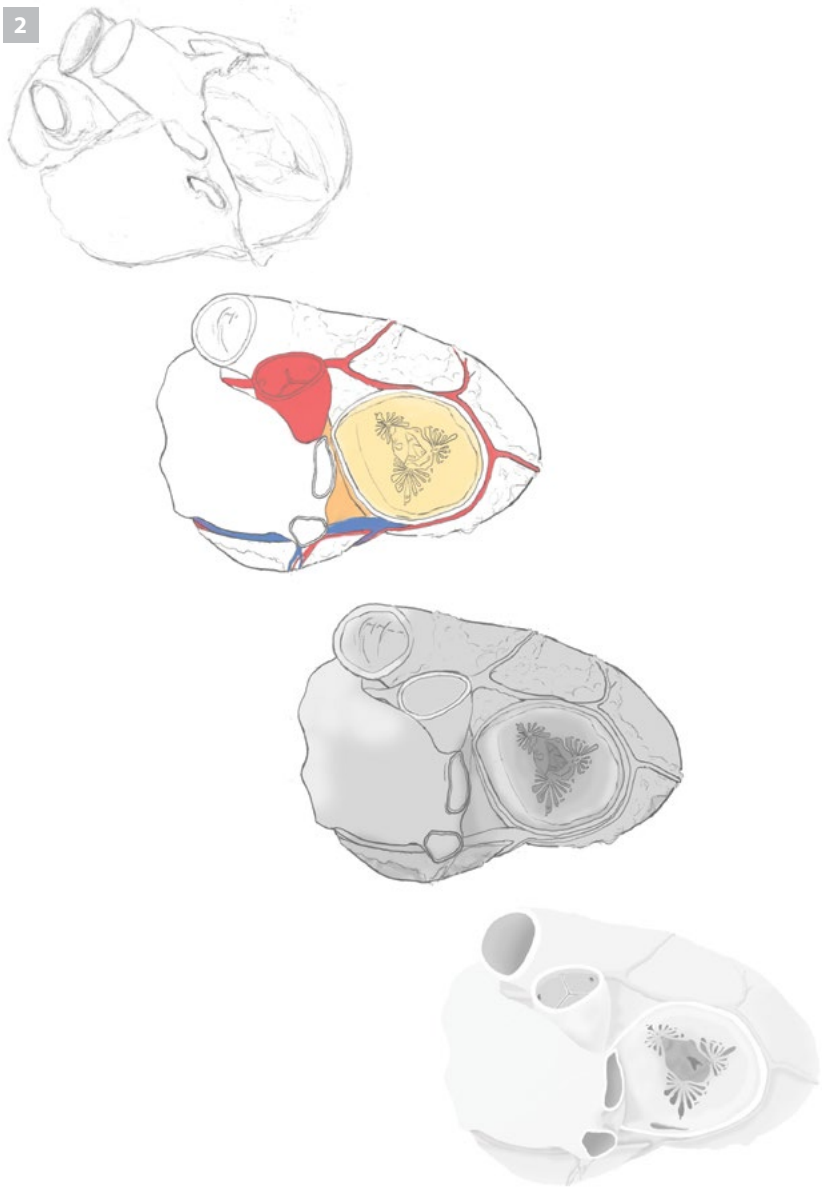


1. 3D modelling. In order to better visualize the view I wanted to depict, I cleaned up 3D maquettes obtained from CT scans and *Anatamography* to get a sense of how the cut surface of the right atrium should look like, as well as the opening of the right ventricle.

2. Production process. To better understand the tissue landscape leading up to the final line drawing, I created sketches referenced from human hearts in the anatomy lab. The final sketch was then based on a combination of the 3D maquettes and these study sketches. I then rendered the piece tonally in black and white.

3. Final illustration The final illustration was created by applying colour over the tonal rendering. My goal in this step was to render realistically and to accurately depict live tissue. I referenced a number of textbooks and surgical videos to match the colour and texture of a live human heart.

2



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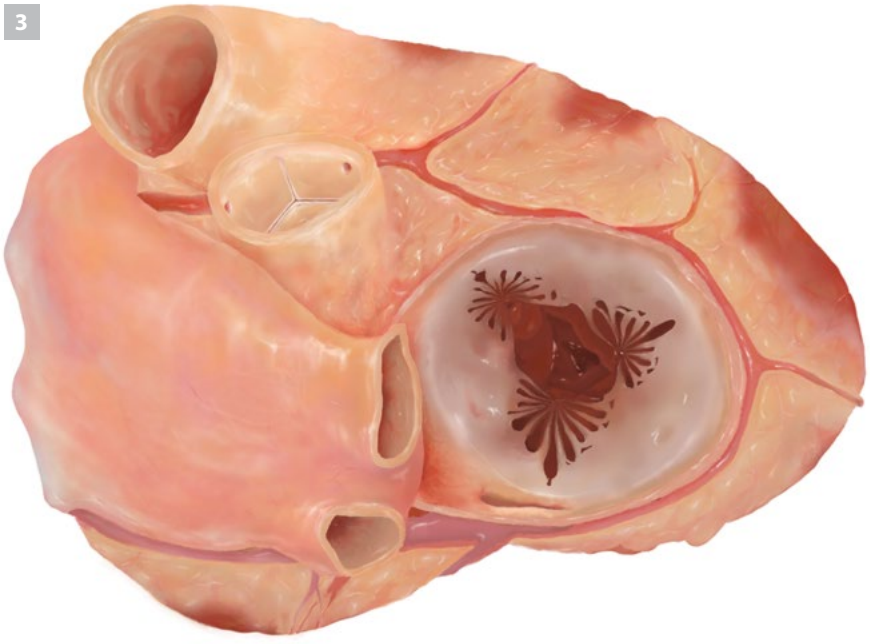

Molecular Visualization

Cyclic nucleotide-gated channels (CNGs) are membrane channels found on the surface of photoreceptor and olfactory cells. In this infographic, my goal was to explain and visualize their actions in the visual system.

1. 3D modelling. I obtained the PDB file of a human CNG channel and visualized it in *Chimera*. Since I was going for a 2D, illustrated style, I traced and rendered over the 3D model to achieve my CNG channel depiction.

2. Sketch. I explored multiple layout iterations for this piece to find a composition that would best convey the flow and story of CNG channels. Considering the setting of this piece (the eyes) and how light plays an important role in vision, I also experimented with including light.

3. Final illustration. The final piece was rendered in *Photoshop*, and the layout was completed in *Illustrator*.

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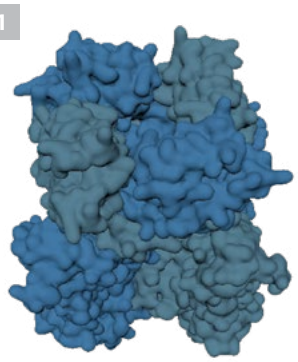

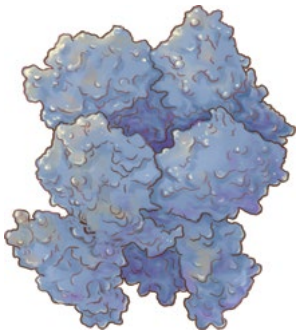

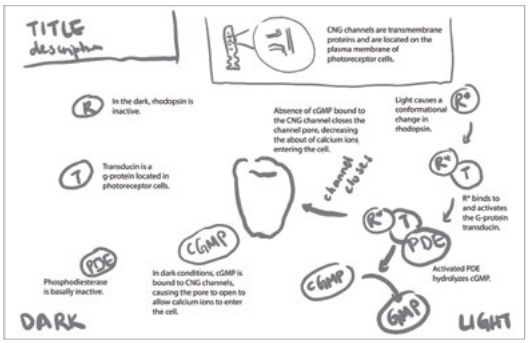

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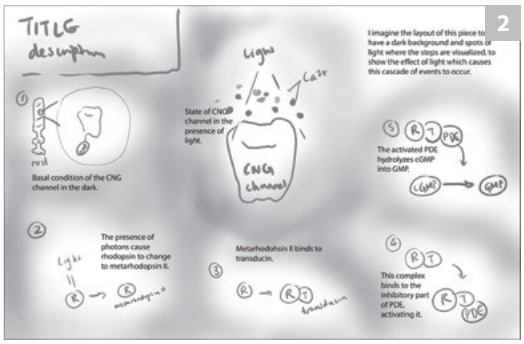

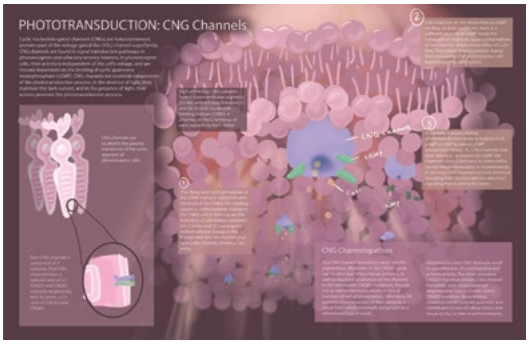

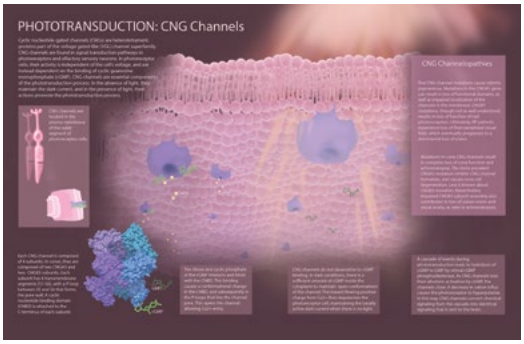

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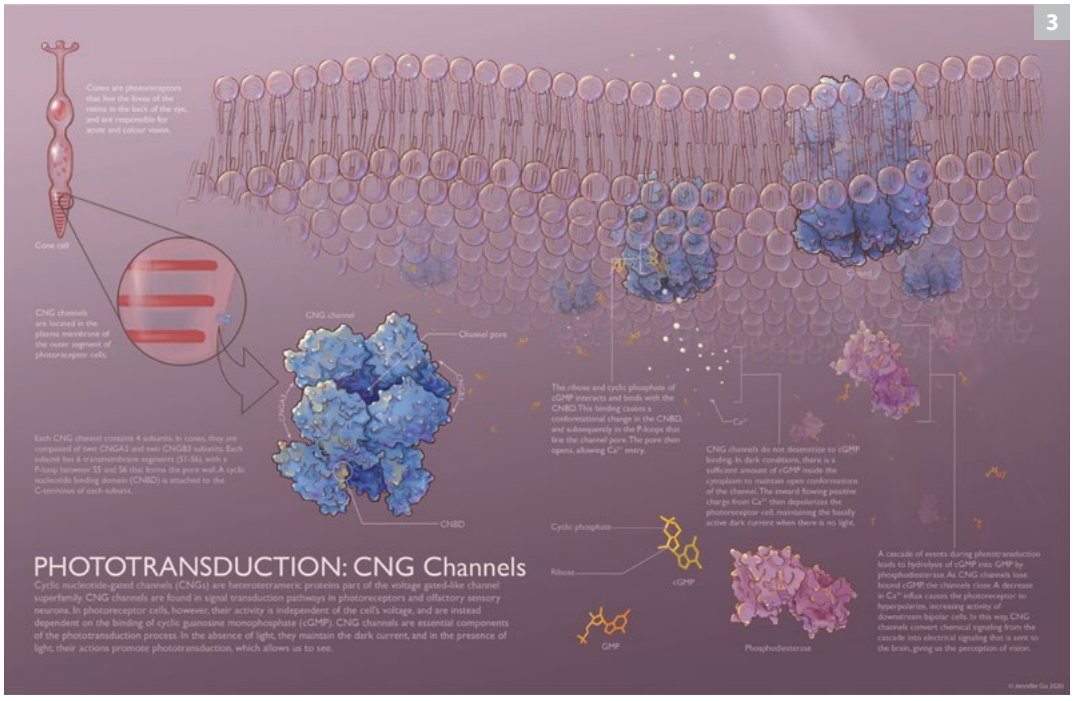

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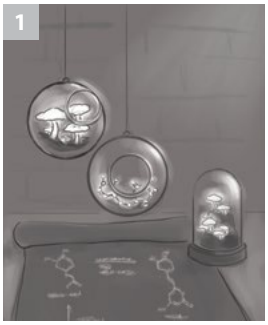

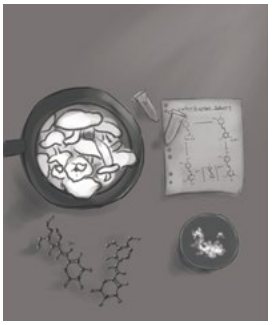

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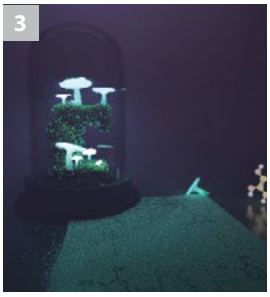

Editorial Illustration

Luciferins are molecules responsible for bioluminescence. Elucidation of the biosynthesis pathway of eukaryotic luciferin lends itself to a number of applications in biomedicine and bioengineering. The goal of this piece is to create a visually engaging cover that will bring attention to the research article it features.

1. Sketch. I started off with rough sketches to get a sense of the composition as well as content of the piece. I was looking to create a visual that was engaging for the educated lay public and that would garner their interest for the article.

2. Sketch. After deciding on composition, I completed the comprehensive sketch in *Photoshop*.

3. 3D modelling. I modeled the scene in *Maya* using the comprehensive sketch as reference. I made a number of iterations on composition and lighting in order to achieve the desired mood and sense of atmosphere.

4. Production process. Another challenge was modeling the texture of the mushrooms, which in the end were created using displacement maps.

5. Final illustration. The final layout was organized in *Illustrator*.

4

5

An Introduction and Overview on the Study of Engrams

Though the topic of memory is widely discussed and studied, "engrams" are seldom seen in the everyday dialogue. The goal of my animation is to provide students and researchers alike an introductory overview on engrams, and its great potentials in leading us to discover more about human memory.

1. Sketch. This sketch is the very first visualization of how I had organized and imagined the story in my head. Translating abstract ideas into slightly more concrete sketches was the first sprout in the Master's Research Project process.

2. 3D modelling. This row shows a progress thread of one scene in the animation: dendritic spine growth. From storyboard to final compositing, each step is iterative as I adjust the camera angle, composition, and colours in the scene.

3. Production process. I went through a number of drafts on depiction of the human figure, in order to find a style that would fit in with the 3D portions of the animation.

4. Production process. Similar to the human figure, the depiction of the optogenetic mouse also went through multiple drafts as I was looking for overall coherency in the animation.

5. 3D modelling. 3D modelling for this project was completed in *Maya*. The most challenging and important scene to create was the neuronal environment, as this was the setting for most of the animation.

6. Final animation. Compositing was completed in *After Effects*. In this stage, I was able to create the neuronal environment that was pictured in my head from early conception stages. I experimented with different depths, perspective, and focus in this step.

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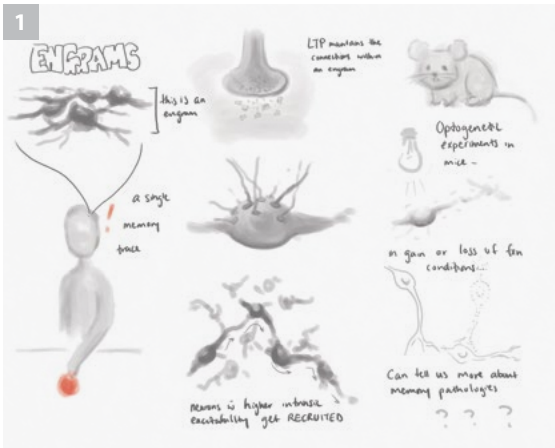

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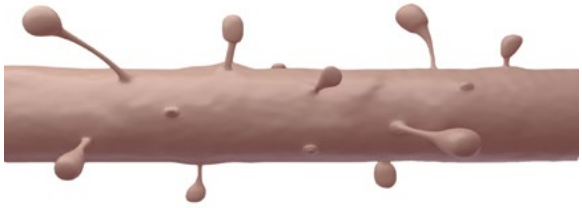

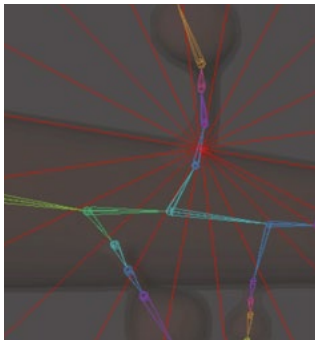

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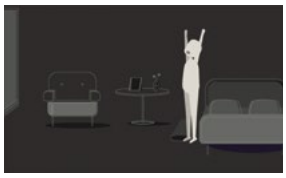

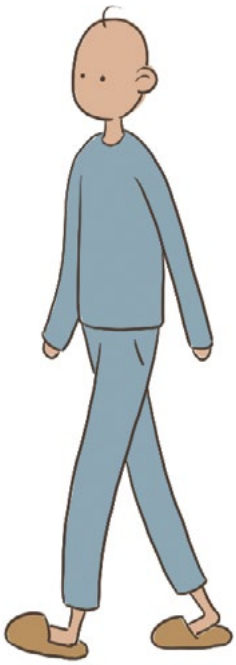

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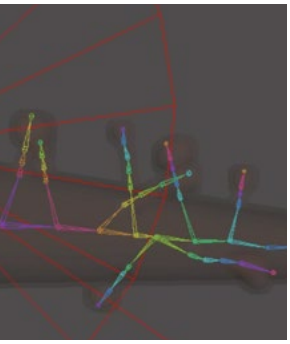

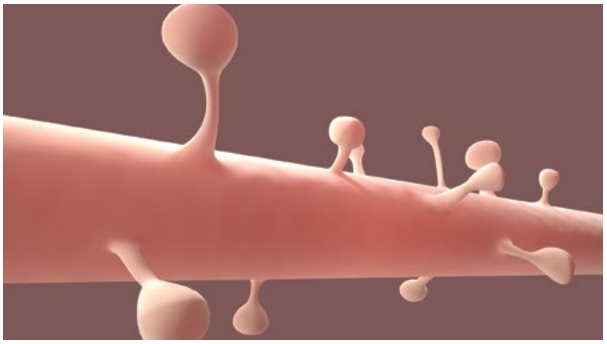

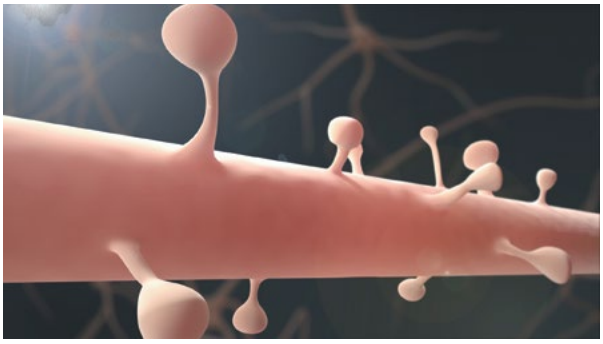

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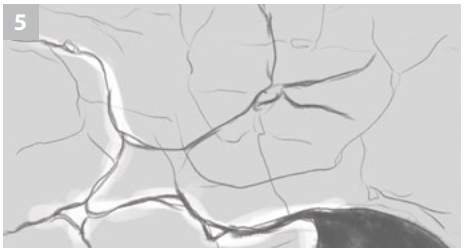

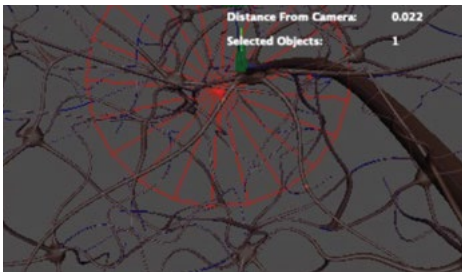

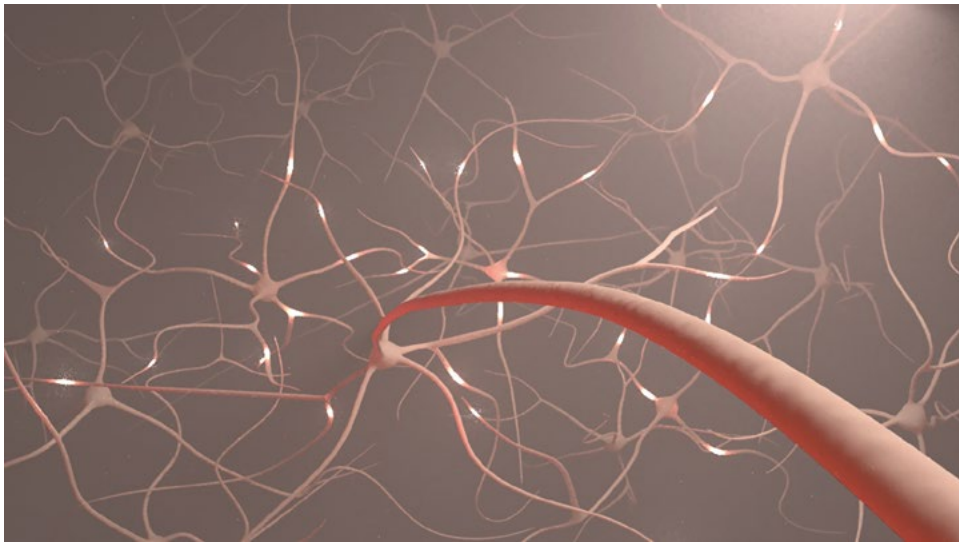

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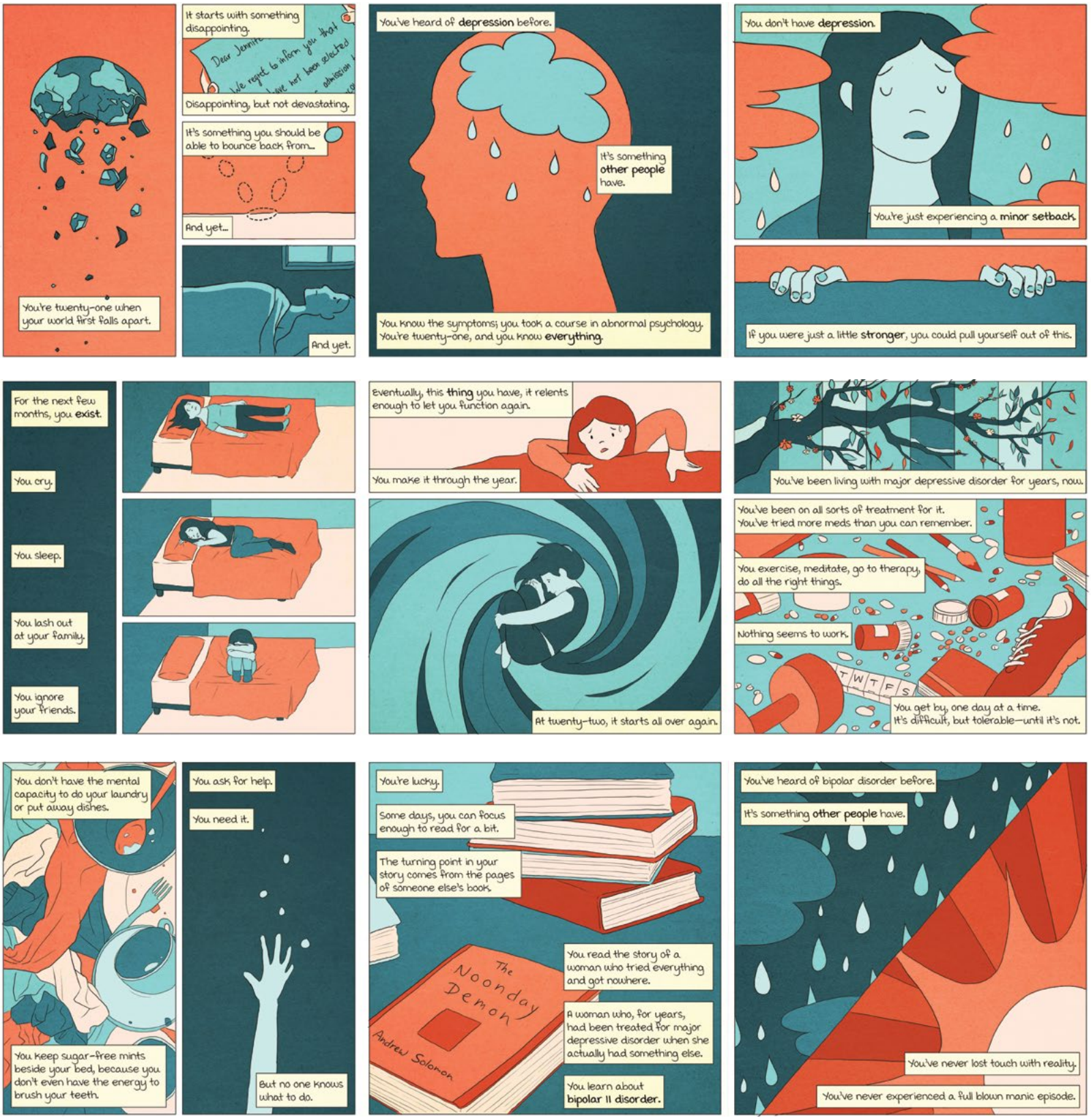
You're twenty-one when your world first falls apart.
It starts with something disappointing.
Dear Jennifer
We regret to inform you that
Disappointing, but not devastating.
It's something you should be able to bounce back from...
And yet...
And yet.
You've heard of depression before.
It's something other people have.
You know the symptoms; you took a course in abnormal psychology. You're twenty-one, and you know everything.
You don't have depression.
You're just experiencing a minor setback.
If you were just a little stronger, you could pull yourself out of this.
For the next few months, you exist.
You cry.
You sleep.
You lash out at your family.
You ignore your friends.
Eventually, this thing you have, it relents enough to let you function again.
You make it through the year.
At twenty-two, it starts all over again.
You've been living with major depressive disorder for years, now.
You've been on all sorts of treatment for it. You've tried more meds than you can remember.
You exercise, meditate, go to therapy, do all the right things.
Nothing seems to work.
T W T F S
You get by, one day at a time. It's difficult, but tolerable—until it's not.
You don't have the mental capacity to do your laundry or put away dishes.
You keep sugar-free mints beside your bed, because you don't even have the energy to brush your teeth.
You ask for help.
You need it.
But no one knows what to do.
You're lucky.
Some days, you can focus enough to read for a bit.
The turning point in your story comes from the pages of someone else's book.
The Noonday Demon
Andrew Solomon
You read the story of a woman who tried everything and got nowhere.
A woman who, for years, had been treated for major depressive disorder when she actually had something else.
You learn about bipolar II disorder.
You've heard of bipolar disorder before.
It's something other people have.
You've never lost touch with reality.
You've never experienced a full blown manic episode.

Jenn Lee

I am passionate about using visuals to make health-related information more accessible, improving health equity, and promoting better health for all. Before BMC, I did a BSc (Hons) in Life Sciences at McMaster University and a Master's in Public Health at the University of British Columbia. I am a storyteller at heart and have always enjoyed writing and drawing. I love 2D animation (particularly character animation) and all that goes into it, from script writing to storyboarding to making things move.

Surgical Illustration

The objective of this project was to create a clear narrative that accurately describes aspects of a surgery that could be used as part of instruction. This was based on a thyroidectomy I observed in the operating room.

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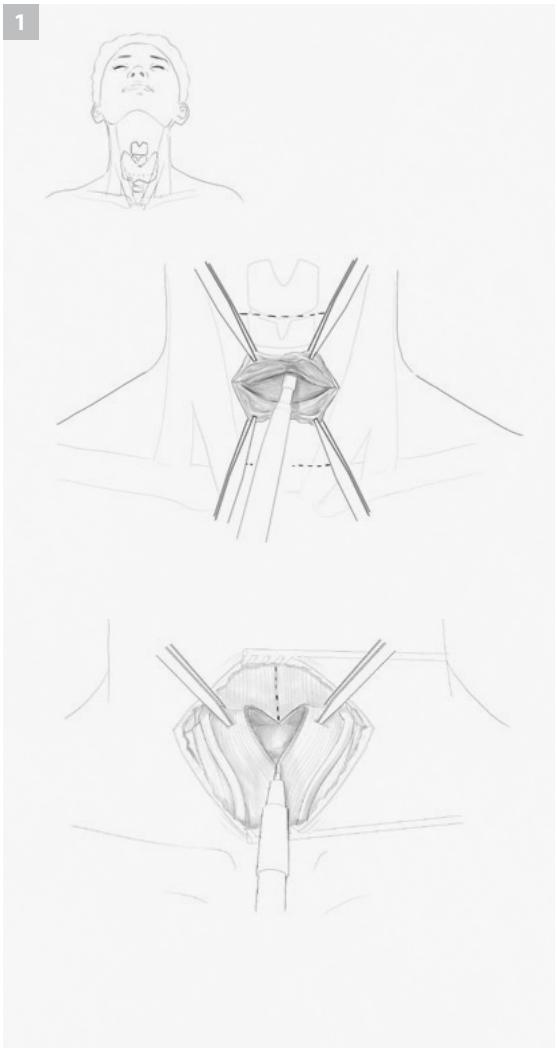

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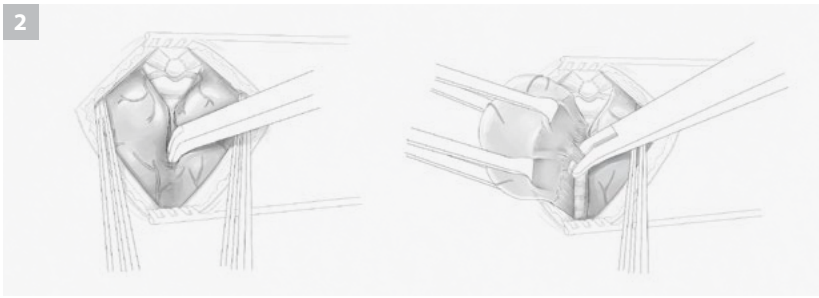

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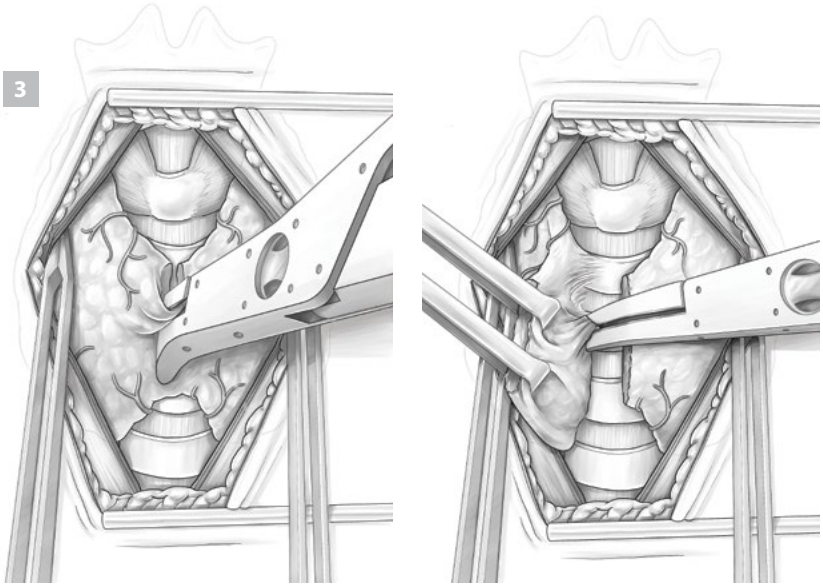

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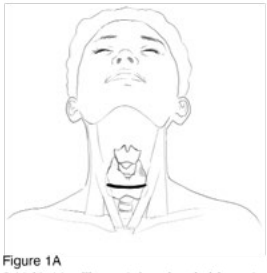

Figure 1A
Initial incision. Tumour is located on the left superior pole of the thyroid.

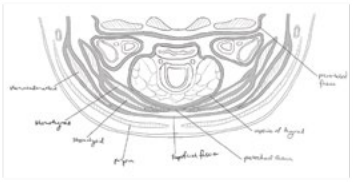

Figure 1B
Superior view of transverse section of the neck (C7 vertebra), illustrating the layers of fascia in the neck anterior to the vertebrae.

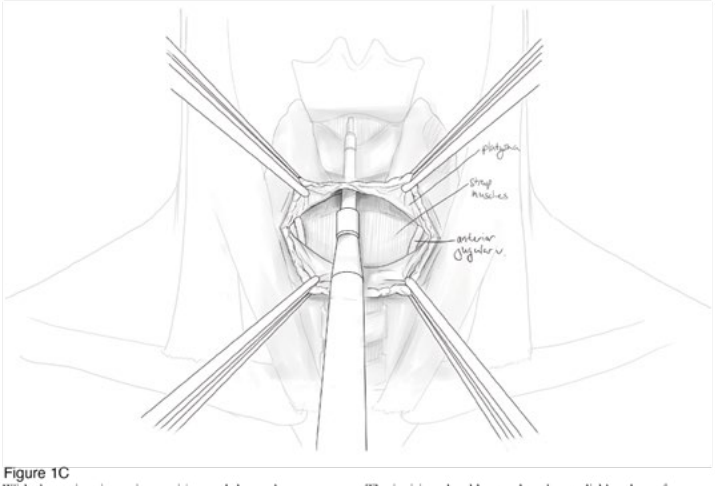

Figure 1C
With the patient in supine position and the neck extended, make a horizontal incision through the skin and platysma along the natural skin crease, approximately two finger breadths superior to the level of the clavicles.

The incision should extend to the medial borders of the sternocleidomastoid. Using electrosurgery, create subplatysmal planes superiorly to the level of the thyroid cartilage, and inferiorly to the level of the clavicles.

1. Final draft. Steps one and two of the intermediate draft, after five rounds of iteration.

2. Sketch. Steps three and four from an intermediate draft, after five rounds of iteration.

3. Final illustration. Steps three and four of the final illustration, refined and rendered in *Clip Studio Paint*.

4. Final illustration. Steps one and two of the final layout, after nine painful but helpful rounds of iteration.

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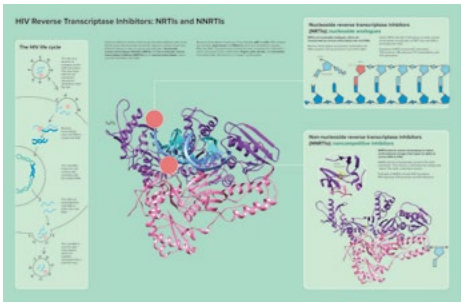

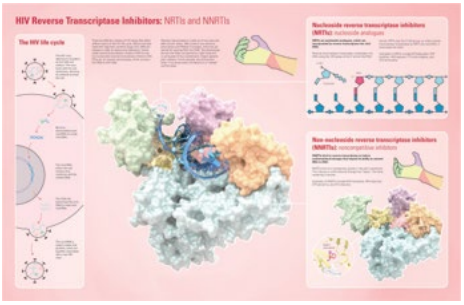

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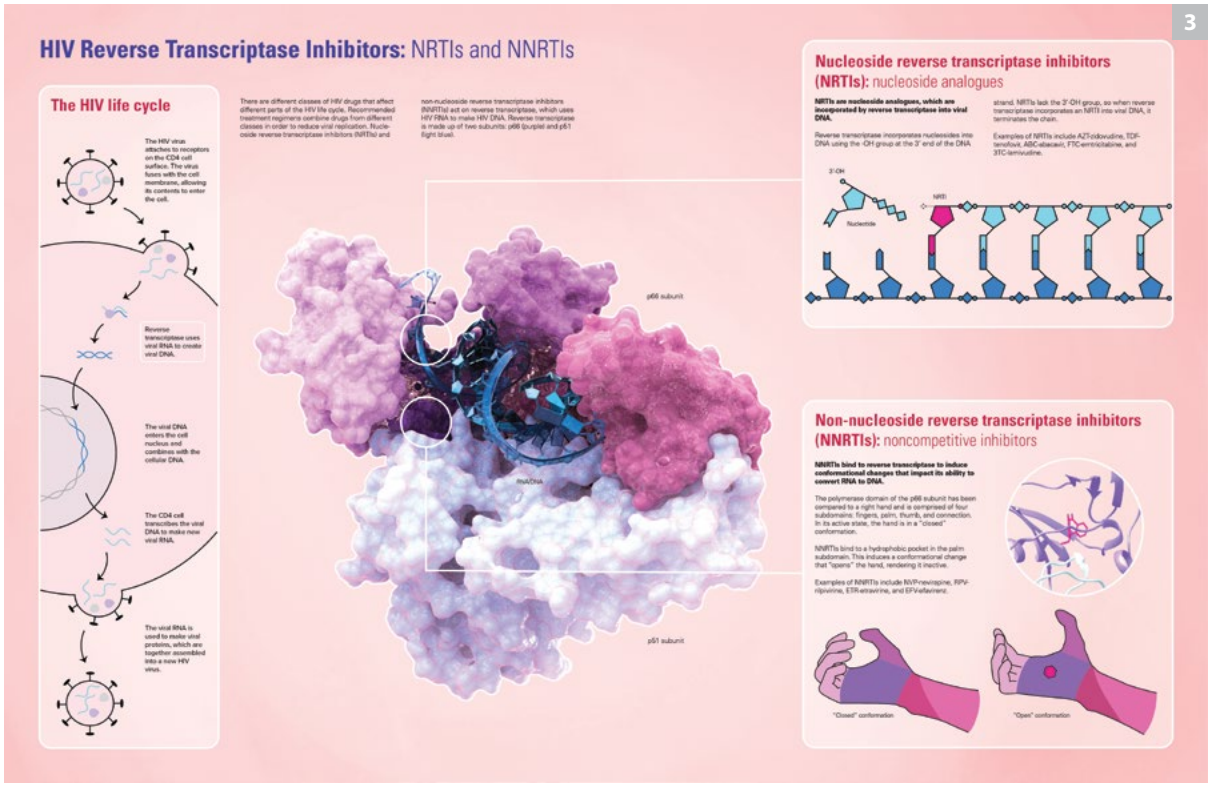

Molecular Visualization

This project, aimed at an educated lay audience, shows the mechanism of two types of HIV drugs that act on the same molecule but work in different ways. Both NRTIs and NNRTIs are an important part of standard HIV treatment.

1. Sketch. Thumbnail sketches showing different possible ways of presenting information.

2. Production process. Progressive refinement of the project. I experimented with showing secondary versus tertiary structure of the molecule, as well as different colour palettes.

3. Final illustration. Final double-page spread featuring a nice, juicy molecule modified in *Chimera* and textured/lit in *Cinema 4D*. I used *Illustrator* for the vector illustrations and *InDesign* for the final layout.

Previous spread. Final Illustration. A spread from my graphic medicine piece, which combines text and illustrations in a visual narrative to share a story about depression and bipolar disorder.

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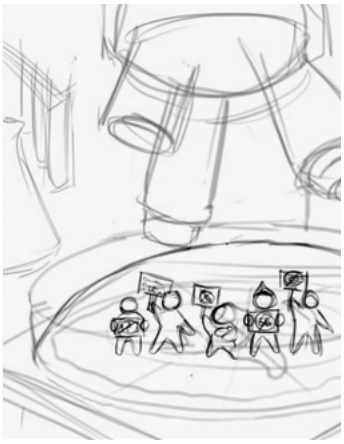

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Editorial Illustration

This project was to create an editorial illustration for the cover of a journal based on an article. I chose an article about the cognitive reasoning behind anti-scientific thinking.

1. Sketch. Some thumbnail sketches testing out different ways I could portray the concept of anti-science.

2. Sketch. Comprehensive "sketch", planning out the scene for modelling in 3D. It was higher fidelity than was necessary, but it was fun.

3. Final illustration Final cover modelled in *Maya*. My favourite part is the flat earth petri dish.

Pathological Illustration

The objective of this piece was to explain a particular disease process, demonstrating pathological change in a tissue over time. This spread shows how plaque psoriasis presents at both a micro and macro scale.

1. Sketch. Trying different poses to determine the best way of showing the disease at the macro level.

2. Study. Part of a tissue study of skin I did to get acquainted with the landscape at the micro level.

3. Production process. I used the figure's gaze and the arc of the tissue cubes to direct the viewer's eye through the piece.

4. Final illustration. While I drew the assets in separate files, I finished rendering them on the same canvas to harmonize colours and style.

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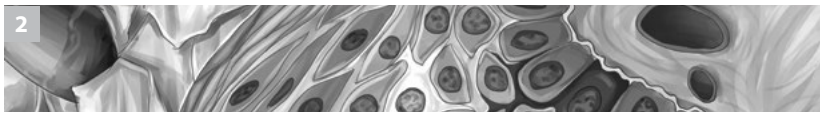

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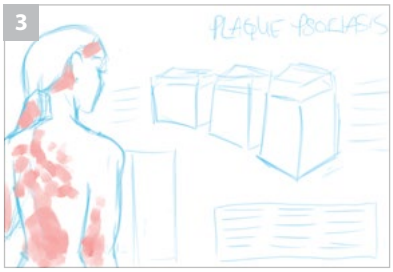

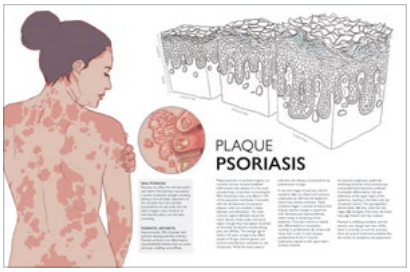

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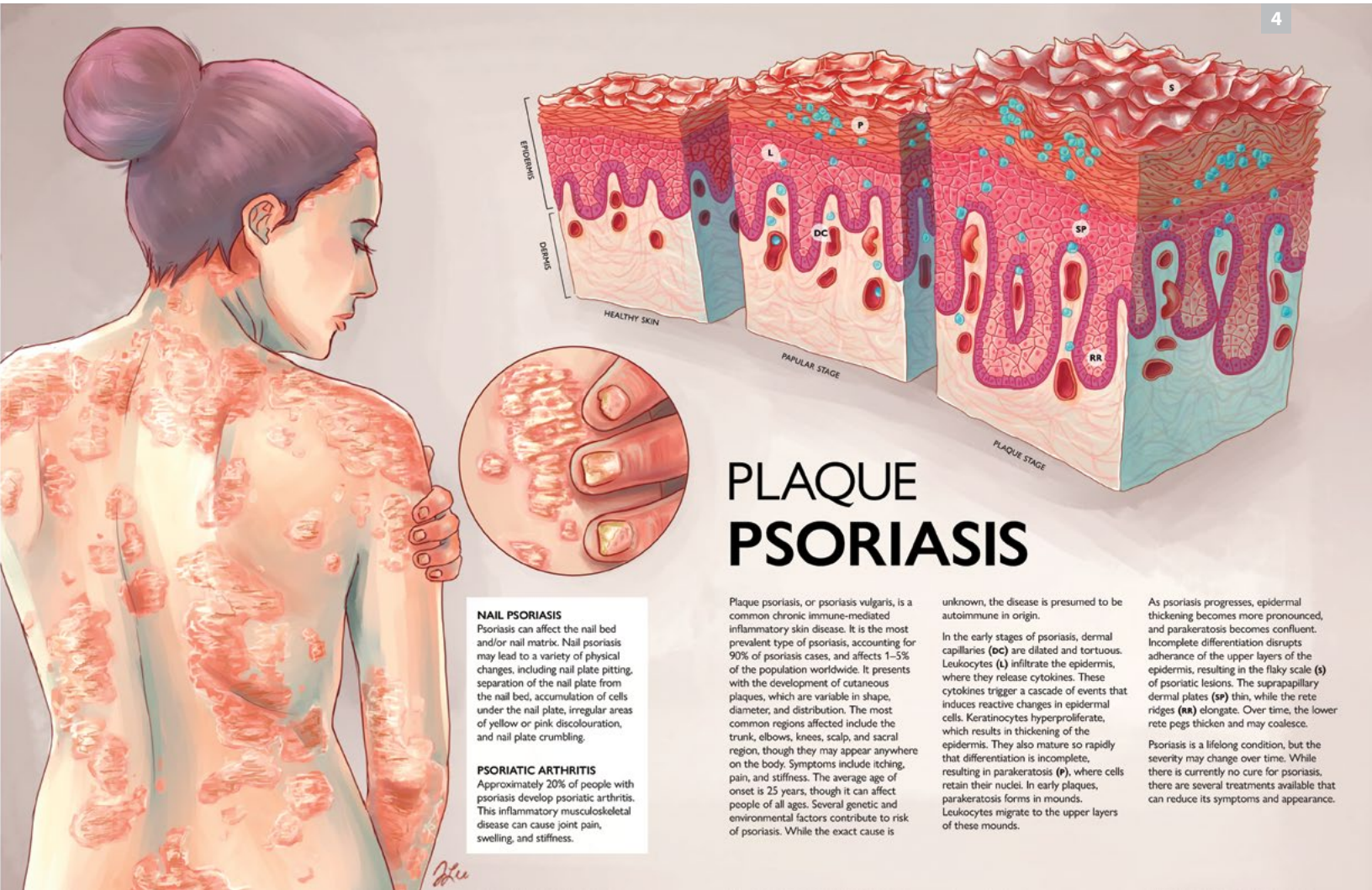

HIV Stigma

My Master's Research Project (MRP) uses 2D animation to explain HIV-related stigma, making a complex and abstract topic approachable and easy to understand. In addition to my MRP committee, I had a community advisory committee comprised of people living with HIV to help inform the project throughout development.

1. Sketch. Concept art, visually representing stigma as monsters. They are all different shapes and colours, as stigma looks different for everyone. Using fun blobby shapes makes the concept of stigma more approachable.

2. Storyboard. Storyboards for a scene depicting enacted stigma. I had a lot of storyboards (275!). Planning out all the details in advance made animation a much more straightforward process.

3. Storyboard. Storyboards showing how stigma has many components and can be broken down into different dimensions. Having a rough idea of how this would be animated in advance helped me figure out how I should set up the assets.

4. Study. Colour study to develop a colour palette for the animation. A refined colour palette keeps the animation cohesive and aesthetically pleasing.

5. Sketch. Some character designs, after developing an overall style. I wanted my cast of characters to be diverse, though the designs had to be fairly simple for animation.

6. Final animation. A still from the final animation. I used both frame-by-frame and keyframe animation, working in both *Animate* and *After Effects*. I used a paper cut-out style and added texture to give it a more hand drawn feel.

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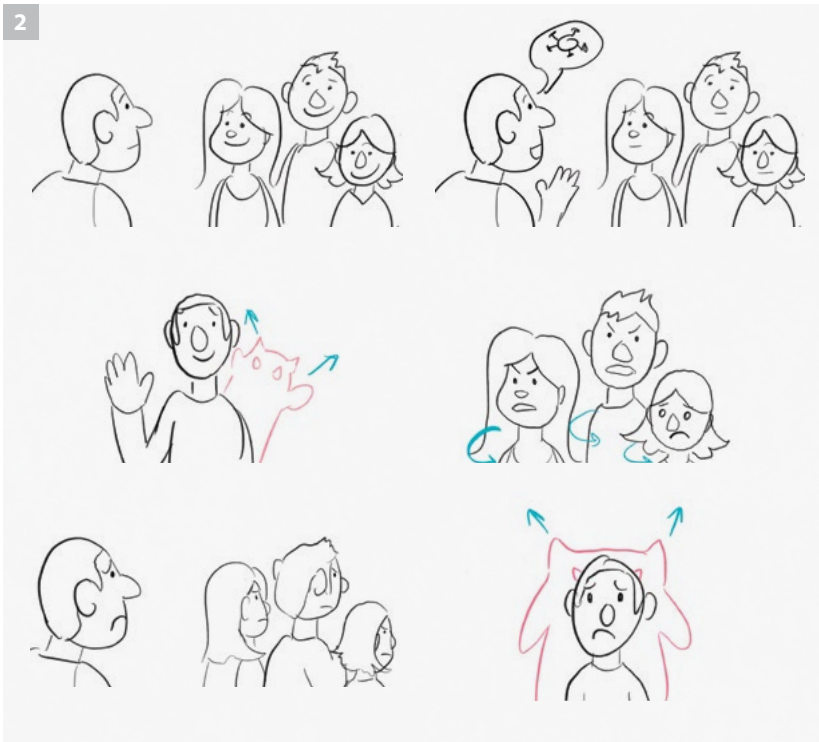

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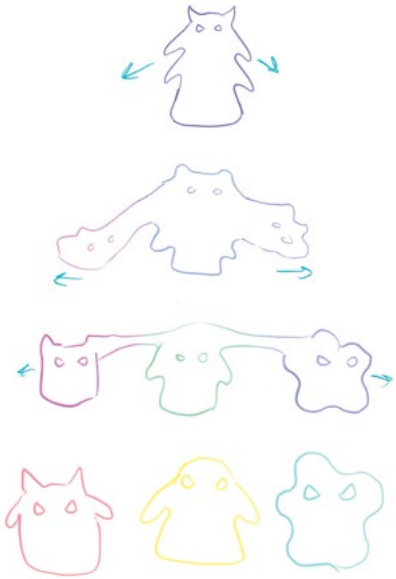

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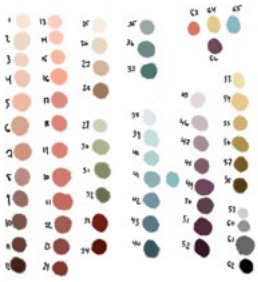

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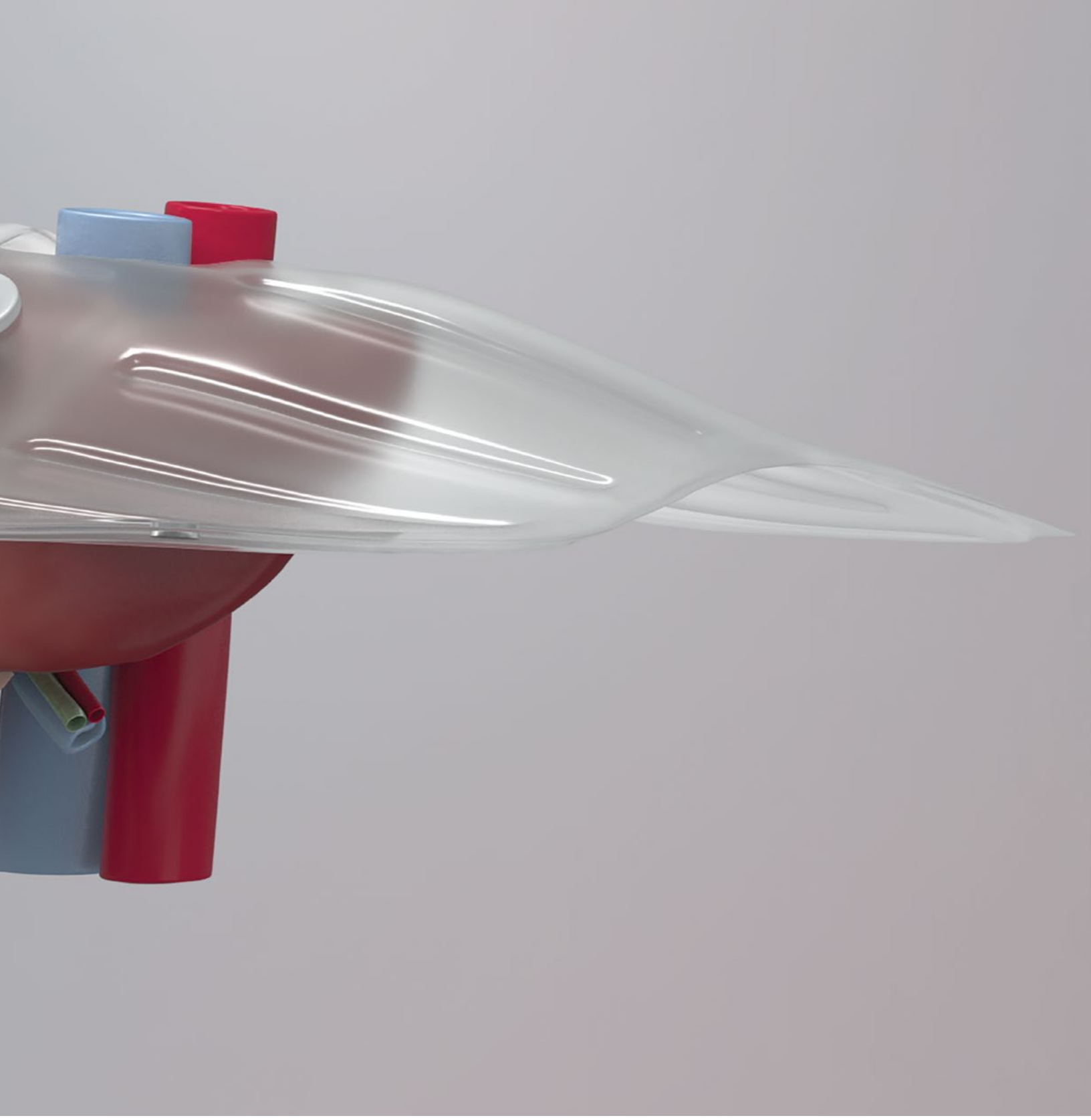

Katrina Hass

I am a biomedical communicator specializing in visualization design. While earning my BSc (Hons) in Health Sciences at McMaster University and even during my time in the BMC program, I always gravitated towards projects that aim to simplifying information for a specific audience. One of my main goals when I am in the process of creating is to understand and incorporate audience perspectives into my work.

3D Modelling

The goal of this project was to create a 3D sculpt of the Dumbo Betta fish. This fish is named after the unique shape of its pectoral fins which resemble the ears of the fictional character, Dumbo the elephant.

1. Sketch. I created various sketches of the betta fish to better understand their anatomy. I knew I wanted to capture the natural look of their fins flowing through water. These sketches were used as my image reference planes in *ZBrush*.

2. 3D modelling. *ZBrush* was used to digitally sculpt, texture, and polypaint the betta fish. I created a scale brush to texture the betta fish's body.

3. Final illustration. The model was then brought into *Cinema 4D* for lighting, environment construction, and rendering. *Photoshop* was used to add final touches such as creating a field of depth effect and adding small water particles to the environment.

Previous spread. Final animation. Screenshot from my Master's Research Project: The Liver Airbag.

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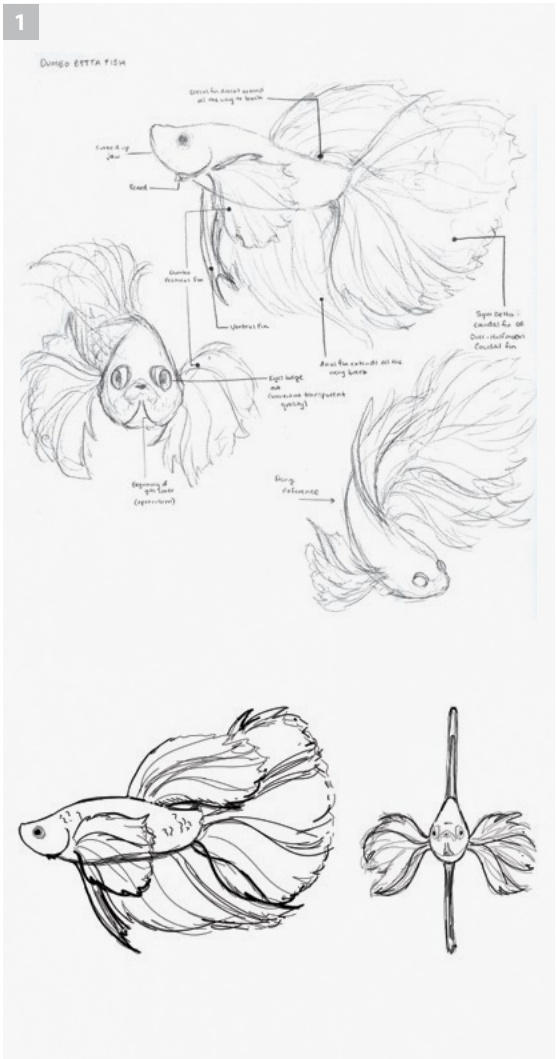

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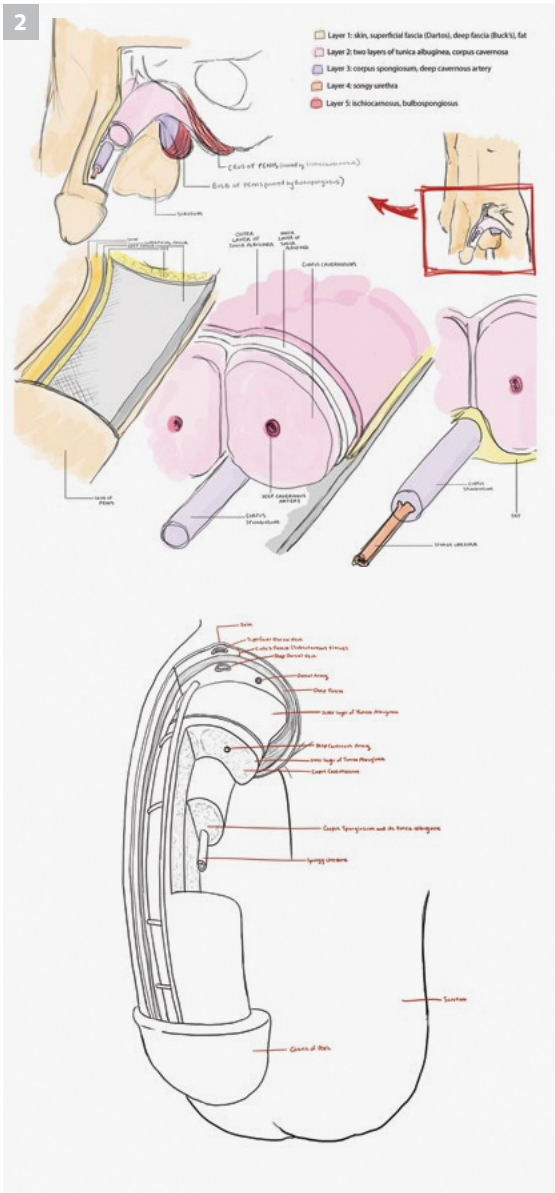

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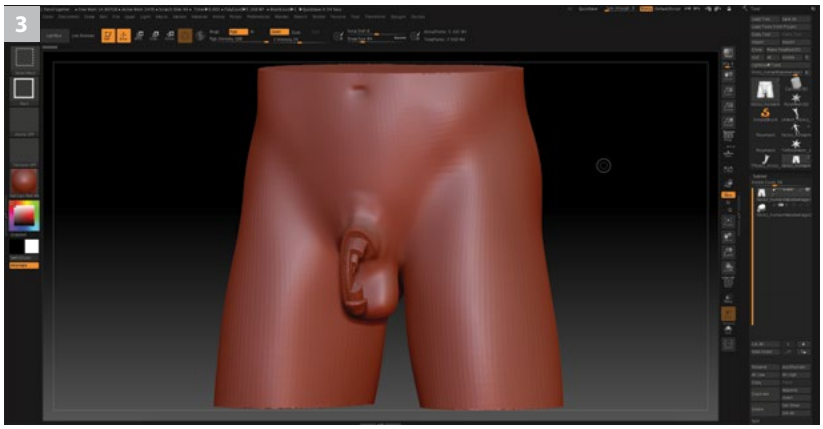

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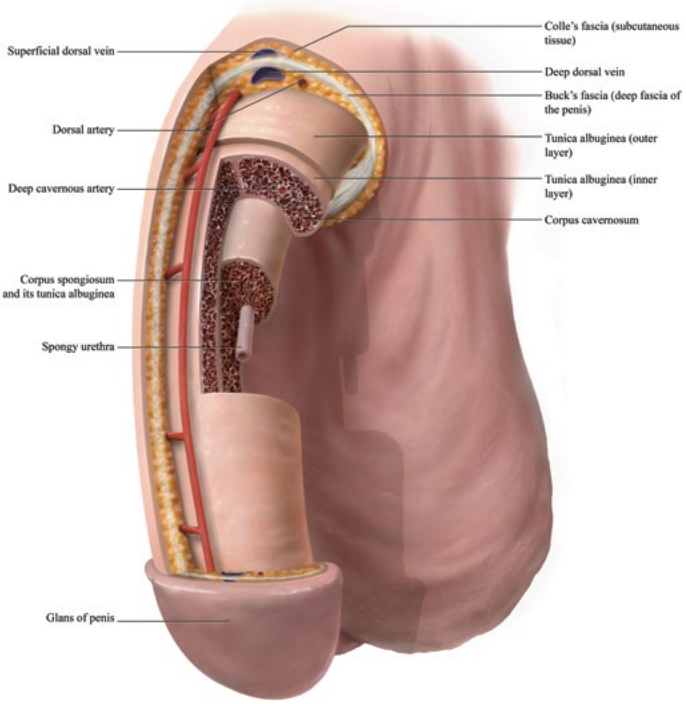


Anatomical Illustration

The spatial relationship of the internal contents of the penis is difficult to understand. Many anatomy atlases only have illustrations with coronal or sagittal cross-sections. I wanted to create an illustration that combined the two viewpoints.

1. Production process. Painting was done in *Photoshop*, first with a tonal rendering and then with colour.

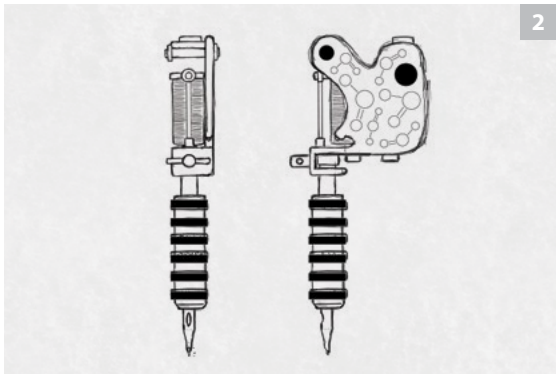
2. Sketch. Originally I wanted to illustrate the relationship of the bulb and crus of the penis with its overlying muscles to the rest of the penis. Ultimately, I decided to focus on communicating only the internal layers of the penis.

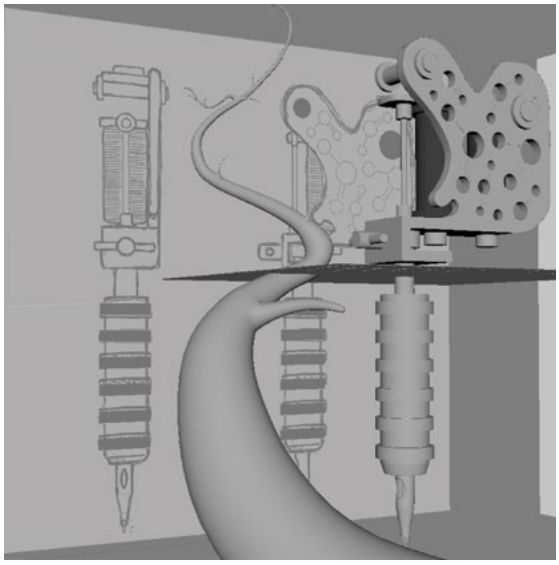
3. Production process. Using 3D data extracted from MRI images, I built a maquette in *ZBrush* and created cross-sections through the various layers of the penis.

4. Final illustration. The final anatomical illustration.

Editorial Illustration

This visual metaphor describes research on a way to detect ozone damage to plants: monitoring electrical conductivity in the leaves through "tattooed" electrodes. The challenge was to communicate the science in a compact and effective way that invites further exploration.





1. Sketch. I liked the idea of juxtaposing the technological and natural elements. I thought it would be interesting to arrange the decorative holes in the side of the tattoo gun as the lewis structures for ozone as a subtle reference to the research.

2. Production process. Modelling, texturing, lighting, and rendering was all completed in *Maya*.

3. Final illustration. One of my goals with this cover was to create strong diagonal angles using the grape vine and tattoo gun to invite the viewer to look more closely at the circuit board tattoo.

Pathological Illustration

Barrett's esophagus occurs when stomach acidic fluids frequently flow back into the esophagus. In response, the squamous epithelium is replaced with columnar cells. The goal was to explain this process by visually showing a pathological change in tissue over time.

1. Study. This tissue cube study depicted the development of pathology over time. A 3D maquette created in *Cinema 4D* helped provide a starting point for the unique shape of the tissue "cubes."

2. Sketch. I intended to introduce the viewer at the organ scale first where important contextual information is provided and as the viewer moves to the other scales, additional information about the pathology is added each time.

3. Final illustration. Rendering was completed in *Procreate* and *Photoshop*.

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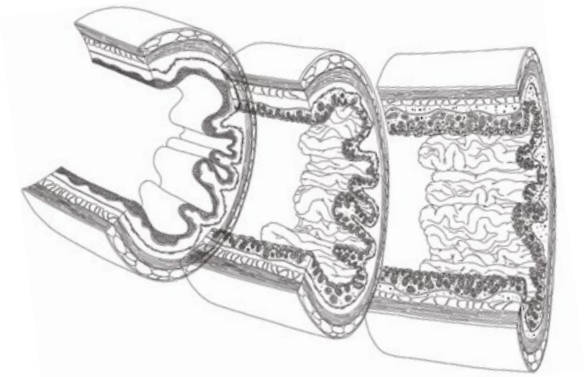

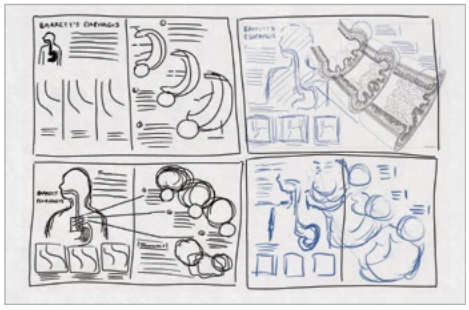

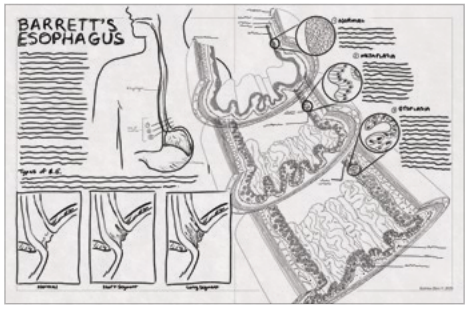

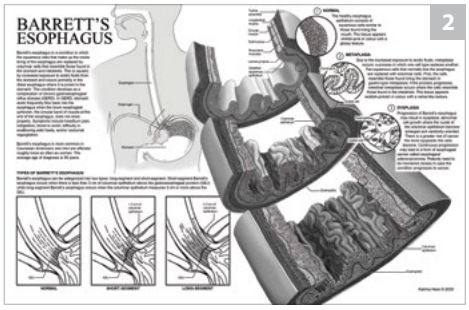

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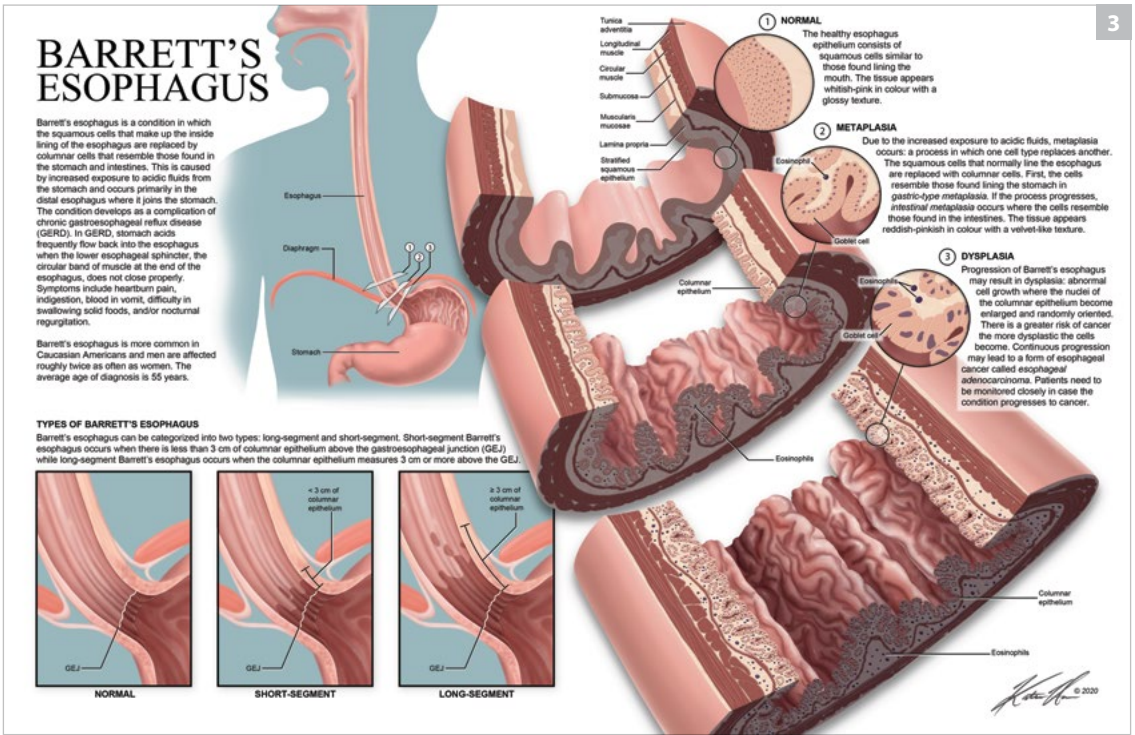

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The Liver Airbag: A Novel Surgical Tool for Liver Trauma Management

The new surgical device known as the Liver Airbag is a transparent, non-adherent inflatable bag designed to surround the liver and control bleeding. My Master's Research Project used a 3D animation to inform and compel surgeons to adopt the Liver Airbag device. My project was awarded the Vesalius Trust Research Grant 2021.

1. Storyboard. It was important for the animation storyline to include the problems faced during traditional liver trauma management methods. A comparison between the new device and traditional methods helps further the goal of convincing surgeons to adopt the device into their own practice.

2. Study. A mock physical version of the Liver Airbag created by Dr. Joao Rezende-Neto. It was awarded the Keenan Bio-medical Innovation Award by Angels Den in 2019.

3. Production process. The most challenging aspect of this project was creating a 3D version of the Liver Airbag itself. Many attempts were made including using a bend deformer and a complicated joint system. The problems encountered were lack of control and lack of fluidity with the model. The final solution to creating the Liver Airbag was a version of the airbag that could be easily edited and simulated fluid wrapping and inflating motions.

4. Production process. The final animation was modelled and animated in *Maya*. There was a lot of experimentation in regards to the models' shaders.

5. Final animation. Still shots from the final animation.

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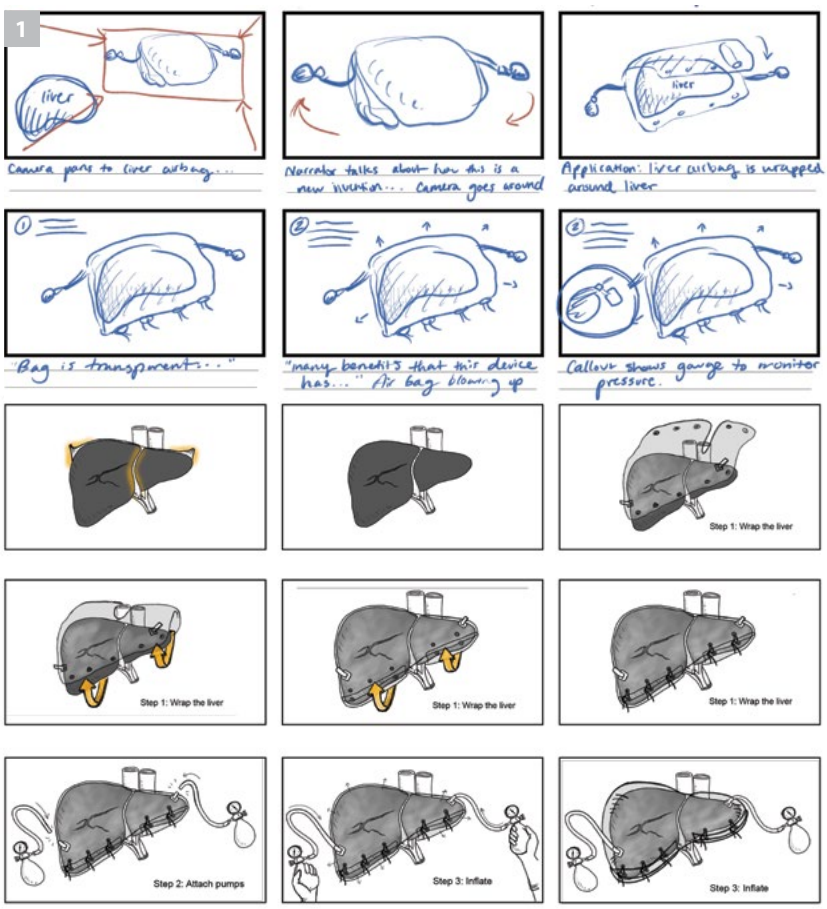

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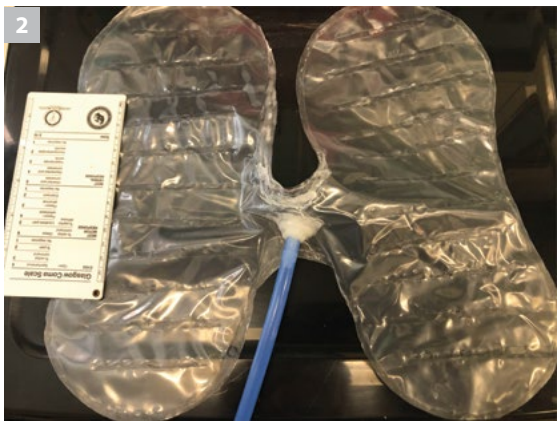

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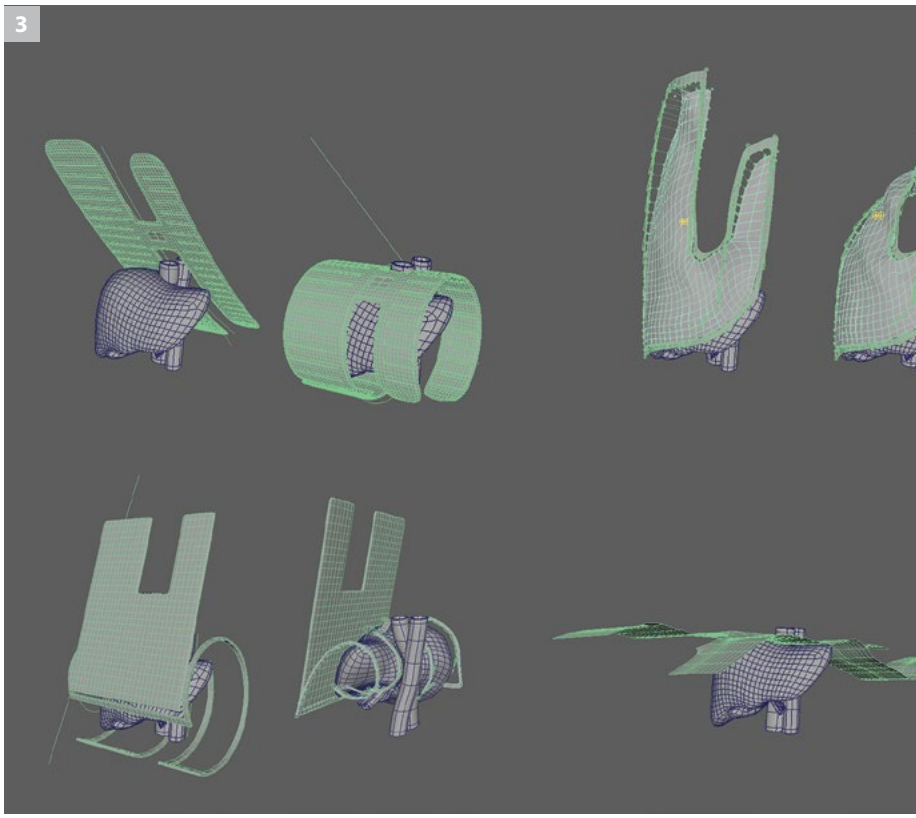

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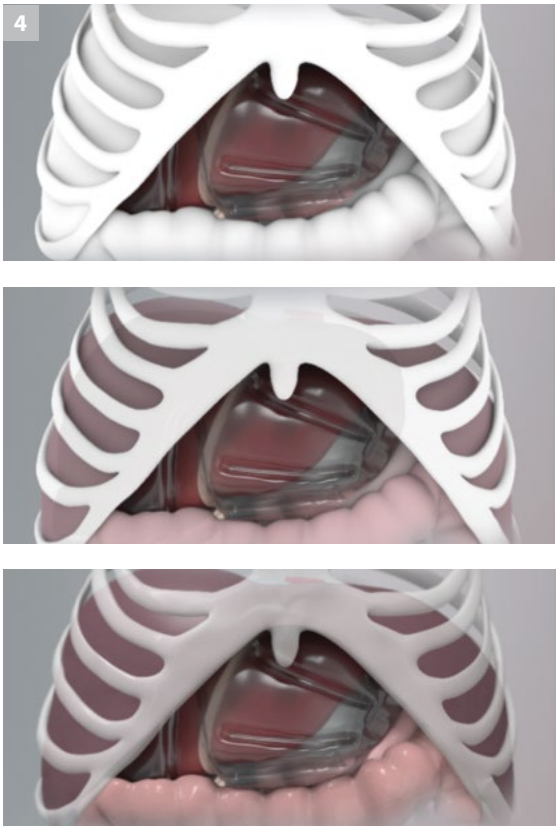

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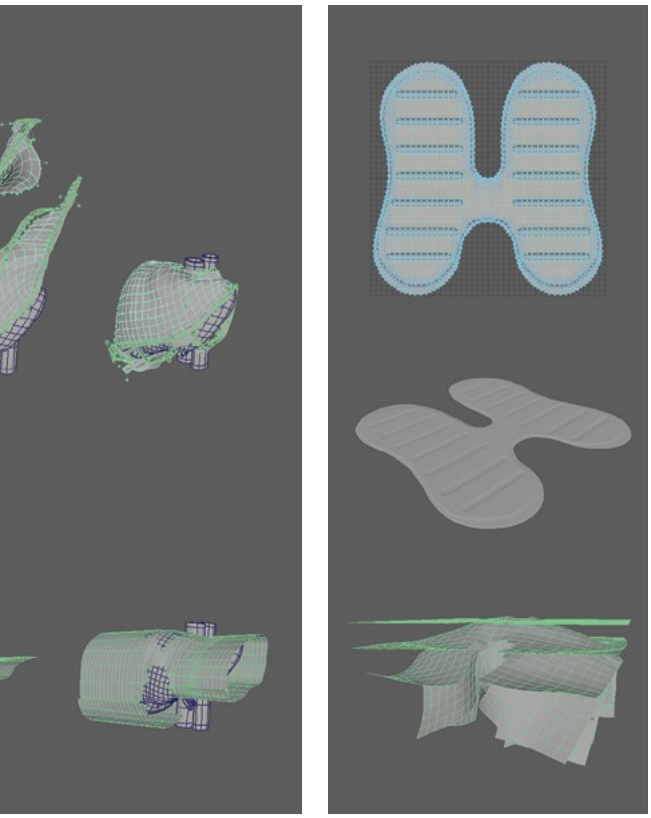

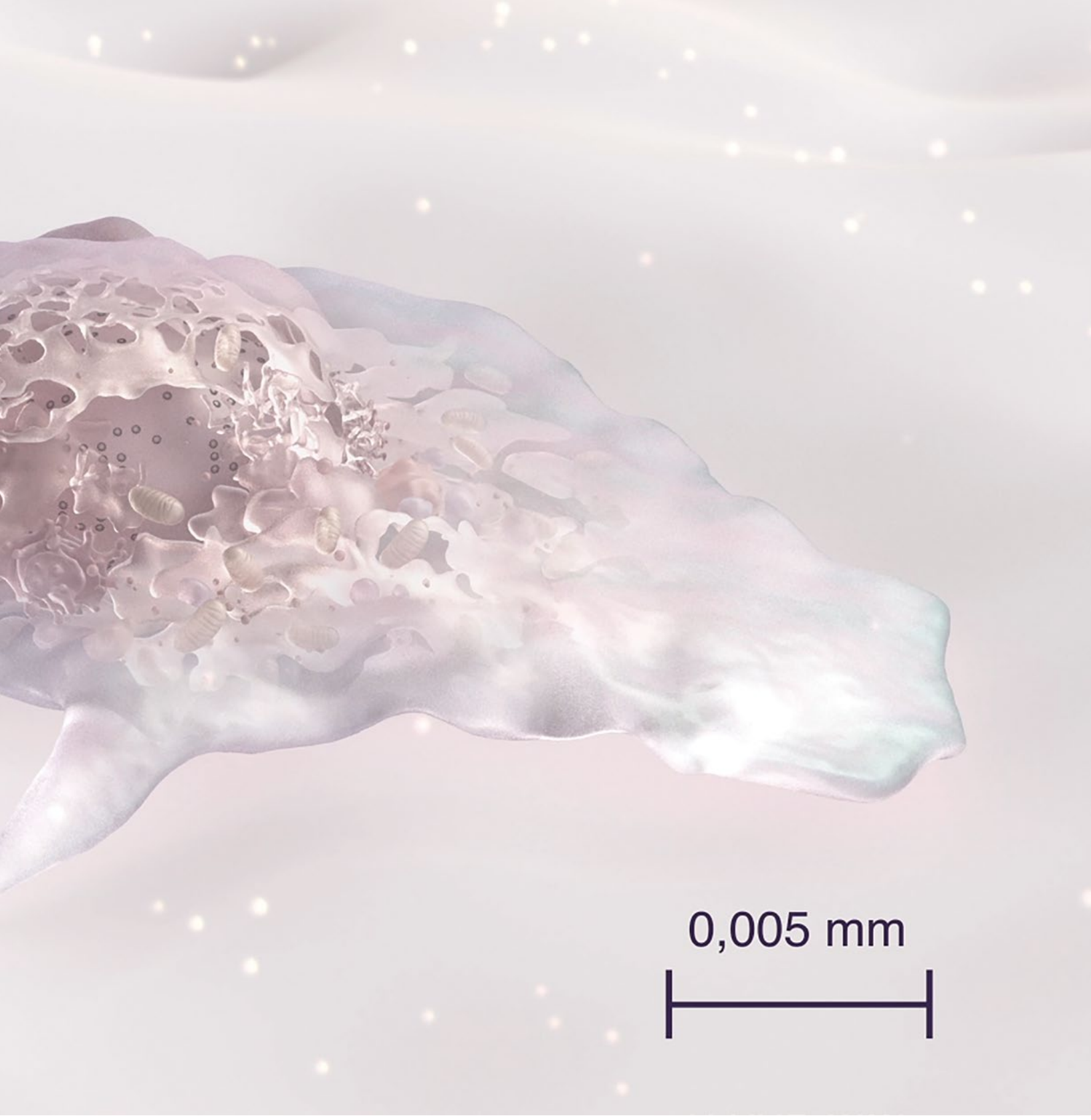

Margot Riggi

Trained as a Molecular Biologist, it was during my PhD that I became fully aware of the power of visualization for communication, but also for hypothesis generation in scientific research. The BMC program helped me gain the conceptual and technical skills to translate complex scientific data into information-rich media that is clear and compelling. I am currently a postdoc in Janet Iwasa's Animation Lab, where my work mostly focuses on the visualization of cellular and molecular processes.

Editorial Illustration

This editorial depicts how a new anti-cancer drug combines direct anti-tumor activity with more recently discovered immune-mediated mechanisms.

1. Sketch. I played around with different visual metaphors, one mostly showing how looking at things from a new perspective can bring new ideas, the other emphasizing the fact that one single molecule has two different targets.

2. Production process. Screenshot of the *Maya* user interface where all modelling, texturing, lighting, and rendering was completed.

3. Final illustration. Finalized with the text elements of the journal cover.

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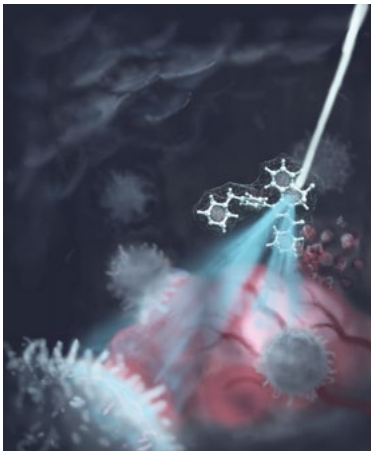

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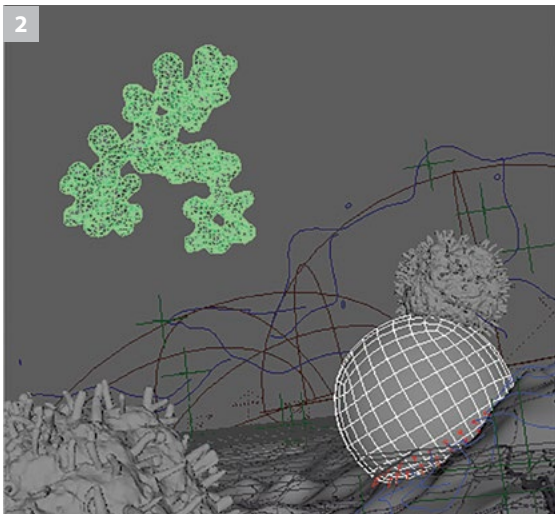

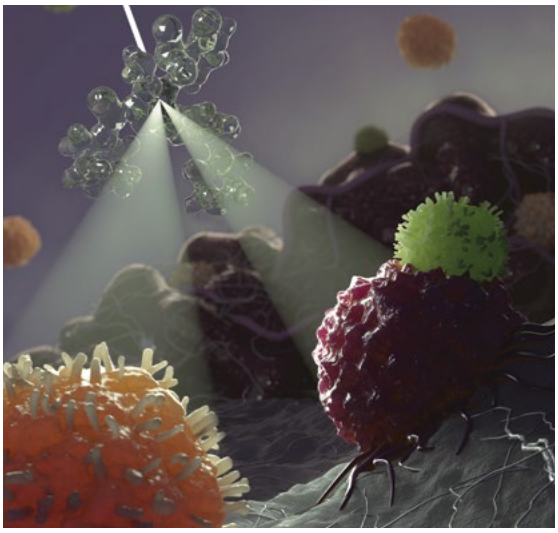

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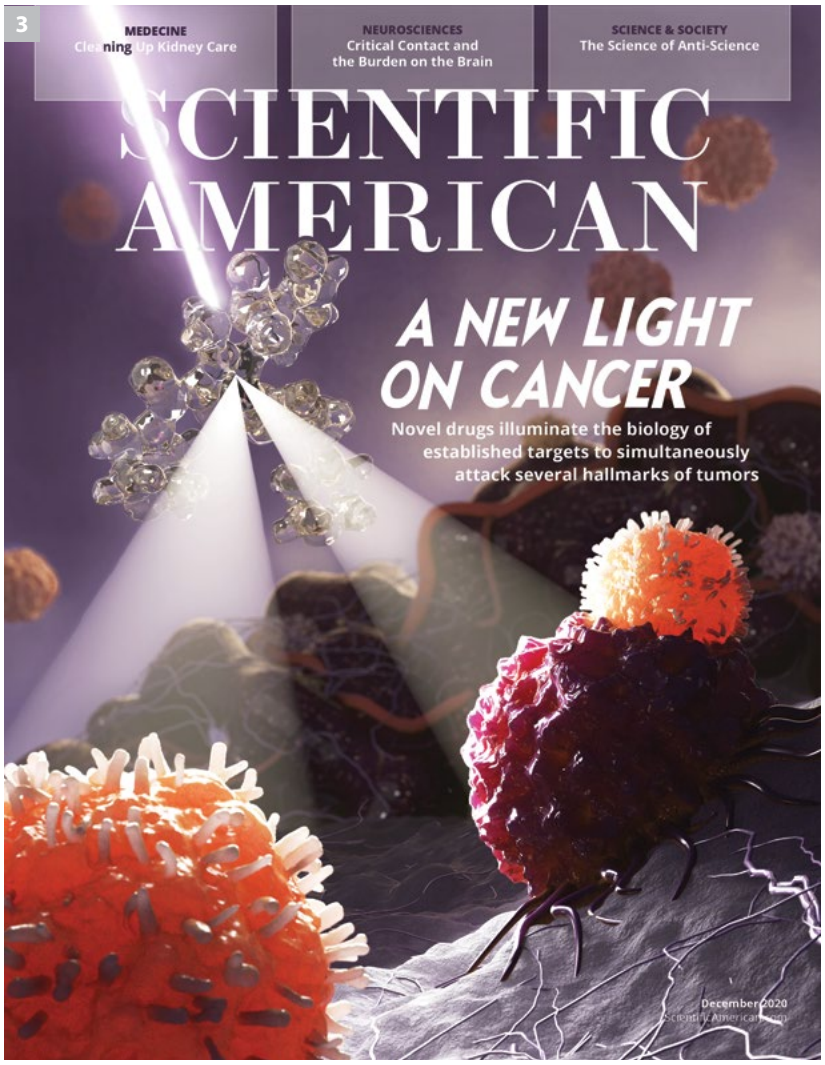

Molecular Visualization

The goal was to visually represent the structure-function relationship and mechanism of action involved in a molecular process. This spread was created to educate a lay audience on elegant nanomachines called pyocins, produced by *Pseudomonas aeruginosa* to recognize and attack competing bacteria.

1. Final illustration. The 3D reconstruction of a pyocin was used to engage readers, while 2D schematics helped simplify the molecular complexity of the story and avoid overwhelming them.

2. Sketch and notes. Design of an engaging but clear layout (top), and summary of the characteristics of the major molecular characters to be depicted (bottom).

3. Final draft. The final composite sketch, where I explored layout and text placement.

4. 3D modelling. Example of a Protein Data Bank file as viewed in *Chimera*.

Previous spread. Final illustration. All structures featured in this 3D fibroblast model were sculpted in *Maya*, based on a stack of microscopy pictures acquired by a new technique called "Focused Ion Beam milling combined with Scanning Electron Microscopy".

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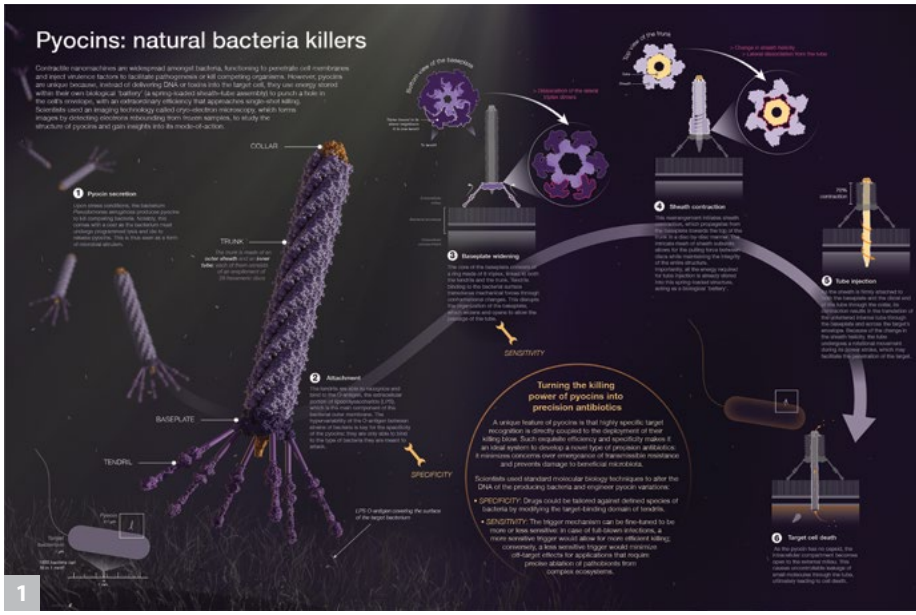

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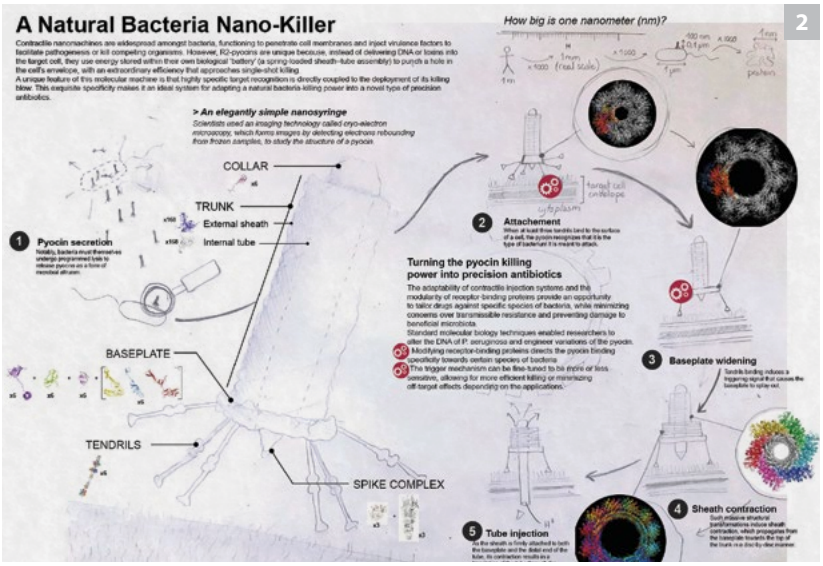

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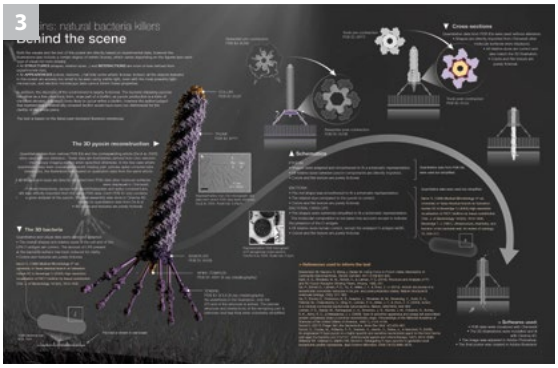

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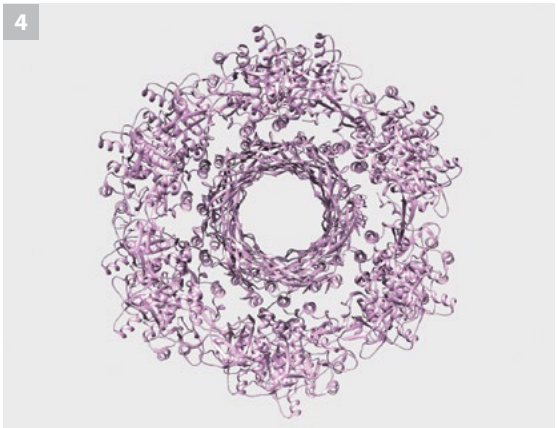

	PROPERTIES	DESCRIPTION	REFERENCES	REFERENCE USE
CHARACTERS				
COMPLETE R2-PYOCIN	Structure	Length: 120nm precontraction axial six-fold rotational symmetry considered to be made of 28 discs (each 6 P 6 tendrils bound to the baseplate See below for details about each part	Ge, P., et al. Nat Struct Mol Biol, 2015 (cryo-EM) Ge P et al. Nature. 2020 (cryo-EM) Buth, S.A et al. Viruses, 2018	Adaptation of quantitative (sizes measured in cryo El Adaptation of quantitative (sizes measured in cryo El Adaptation of visual data (graphic abstract)
	Interaction	Killing unit almost one to one (i.e. only one p	M. Kageyama, K. Ikeda, F. Egami Studies of a pyocin. III. Biological properties of the pyocin J. Biochem. (Tokyo), 55 (1964), pp. 59-64	Adaptation of quantitative data
TRUNK		Length: 100nm precontraction, 30nm postcon	Cryo-EM map: EMD-20526 Ge P et al. Nature. 2020 (cryo- EM)	Smoothing of quantitative data Adaptation of quantitative (sizes measured in cryo El
Sheath subunit: PA0622 (x168)	Structure	Sheath: displays large globular protrusions, c large N-ter domain, a smaller C-ter domain, c	PDB ID: 6PYT (pre-contraction)/6U5J (post-contraction) Ge, P., et al. Nat Struct Mol Biol, 2015 (cryo-EM) Ge P et al. Nature. 2020 (cryo-EM)	Direct import of quantitative data Adaptation of qualitative and visual (Fig3) data Adaptation of qualitative data
	Appearance	TBD	-	Artistic license: color and surface properties chosen f
	Interaction	Subunits form an interwoven 2D mesh, held interacts with the internal tube through electr Connected to the baseplate through the shea	PDB ID: 6PYT (pre-contraction)/6U5J (post-contraction) Ge, P., et al. Nat Struct Mol Biol, 2015 (cryo-EM) Ge P et al. Nature. 2020 (cryo-EM)	Direct import of quantitative data Adaptation of qualitative and visual (Fig3, 5) data Adaptation of qualitative and visual (Fig2, S3, S5) dat
	Motion	Contracts by 70% & detaches from the tube, Gross subunit movement=translation along a The contraction propagates disc by disc from ~2,000 kcal/mol of energy released during th	Ge, P., et al. Nat Struct Mol Biol, 2015 Ge P et al. Nature. 2020	Adaptation of quantitative, qualitative and visual (Fig Adaptation of qualitative and visual (Fig 4) data
Tube subunit: PA0623 (x168)	Structure	Tube: smooth and devoid of any prominent s 2 antiparallel β-sheets with an angle of ~90°	PDB ID: 6PYT (pre-contraction) the postcontraction structure is missing Ge, P., et al. Nat Struct Mol Biol, 2015 (cryo-EM)	Direct import of quantitative data Interpolation of data for post-contraction state Adaptation of qualitative and visual (Fig2) data
	Appearance	TBD	-	Artistic license
	Interaction	6 subunits create a ring-like structure with a Interacts with the external sheath through ele connected to the spike complex through Rip	PDB ID: 6PYT (pre-contraction) the postcontraction structure is missing Ge, P., et al. Nat Struct Mol Biol, 2015 (cryo-EM) Ge P et al. Nature. 2020 (cryo-EM)	Direct import of quantitative data Interpolation of data for post-contraction state Adaptation of qualitative and visual (Fig2, 5) data Adaptation of qualitative and visual (Fig2, S3, S5) dat
	Motion	Extends beyond the plane of the baseplate u	Ge, P., et al. Nat Struct Mol Biol, 2015 (cryo-EM) Ge P et al. Nature. 2020	Adaptation of qualitative data Adaptation of qualitative and visual (Fig 4) data
COLLAR			Cryo-EM map: EMD-20644	Smoothing of quantitative data
PA0615 (x6)	Structure	globular & β-hairpin domains, joined by an e The globular domain is similar to the tube su	PDB ID: 6U5F (pre-contraction)/ 6U5J (post-contraction) Ge P et al. Nature. 2020 (cryo-EM)	Direct import of quantitative data Adaptation of qualitative and visual (Fig2) data
	Appearance	TBD	-	Artistic license
	Interaction	65 Å hexamer globular domain extends the inner tube and	PDB ID: 6U5F (pre-contraction)/ 6U5J (post-contraction) Ge P et al. Nature. 2020 (cryo-EM)	Direct import of quantitative data Adaptation of qualitative and visual (Fig2) data
	Motion	provides mechanical stability to the tube/she	Ge P et al. Nature. 2020 (cryo-EM)	Adaptation of qualitative data
BASEPLATE		240 Å precontraction (widens to 320A), ring-	Cryo-EM map: EMD-20643 Ge P et al. Nature. 2020 (cryo-EM)	Smoothing of quantitative data Adaptation of quantitative, qualitative and visual data
Ripcord: PA0626 (x6)	Structure	C-ter β-sheet domain & N-ter helix-rich doma	PDB ID: 6U5B (pre-contraction)	Direct import of quantitative data

Surgical Illustration

The goal of this project was to create a clear and concise visual narrative that accurately describes the temporal, anatomical, and procedural aspects of a surgical procedure, to be featured in a surgical atlas.

1. Sketch. Top: Observation sketches & notes from the Operating Room used to understand the fundamentals associated with the surgery and identify the critical steps that would need the most clarification. Bottom: Excerpt from a larger illustrated sequence describing lower nerve transfers.

2. Sketch. Additional anatomical references were used to ensure the accuracy of the illustrations, whose lines were also iteratively refined.

3. Final illustration. Rendered in pen and ink.

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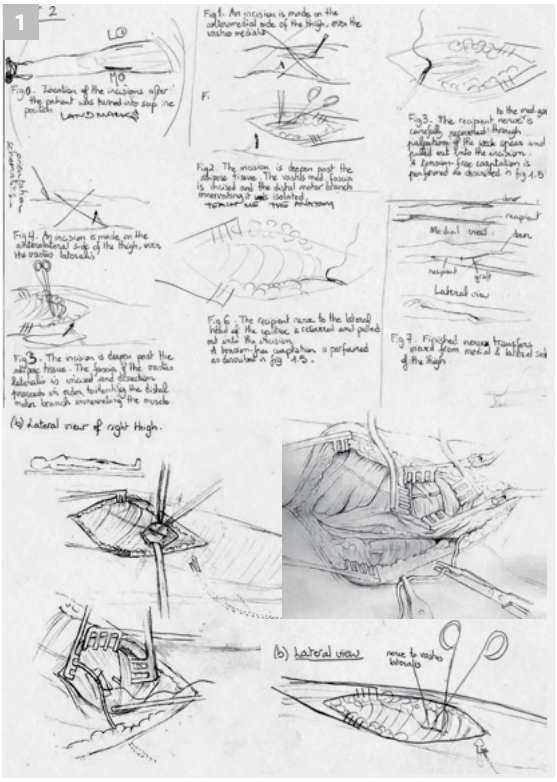

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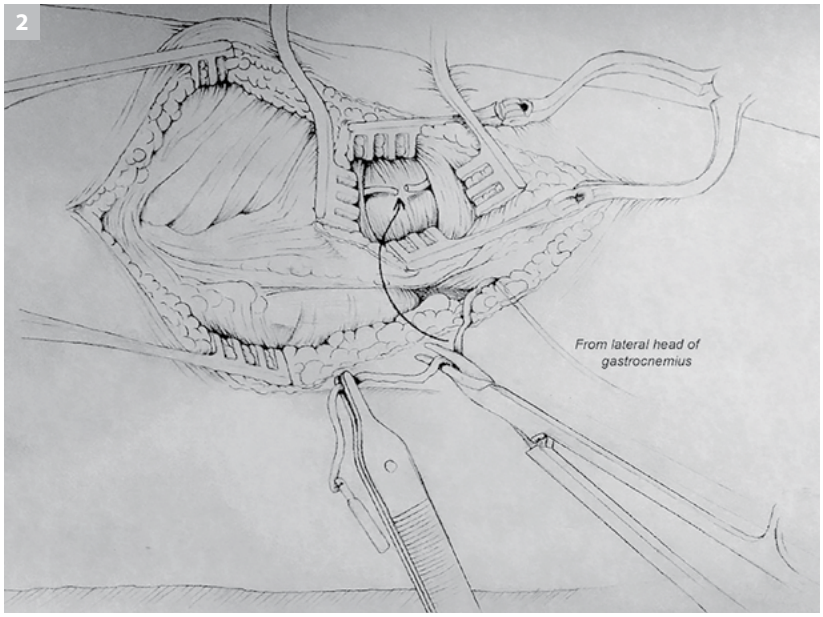

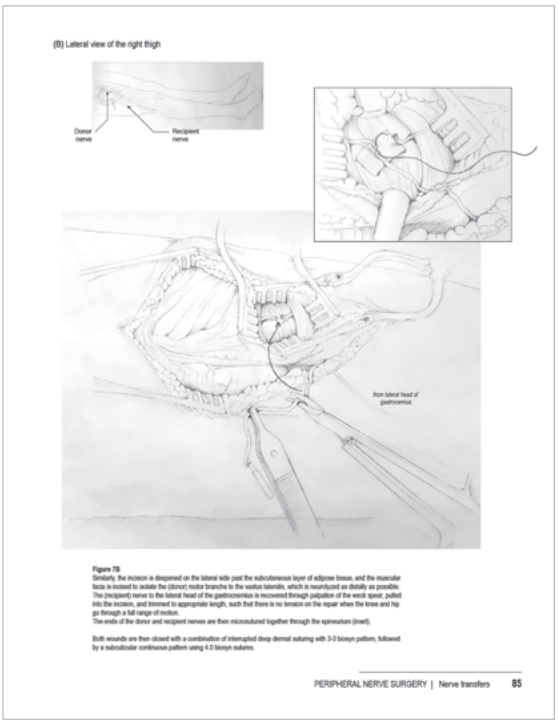

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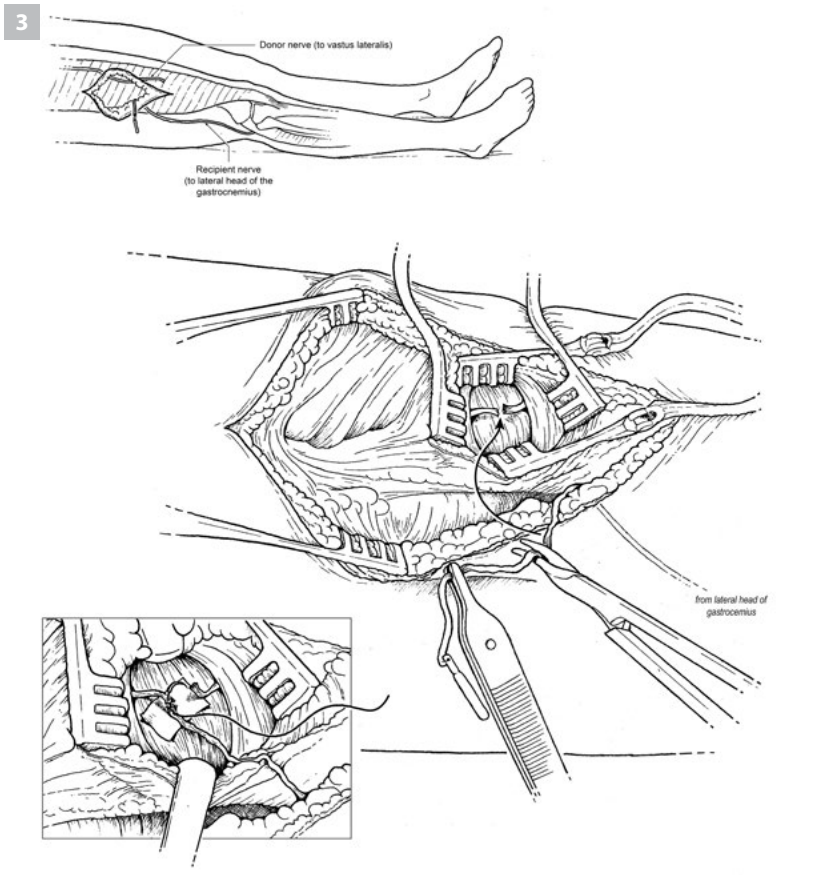
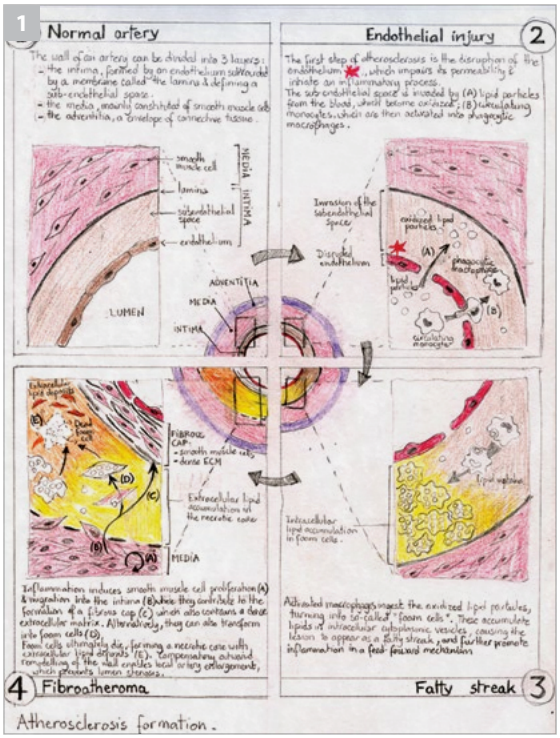
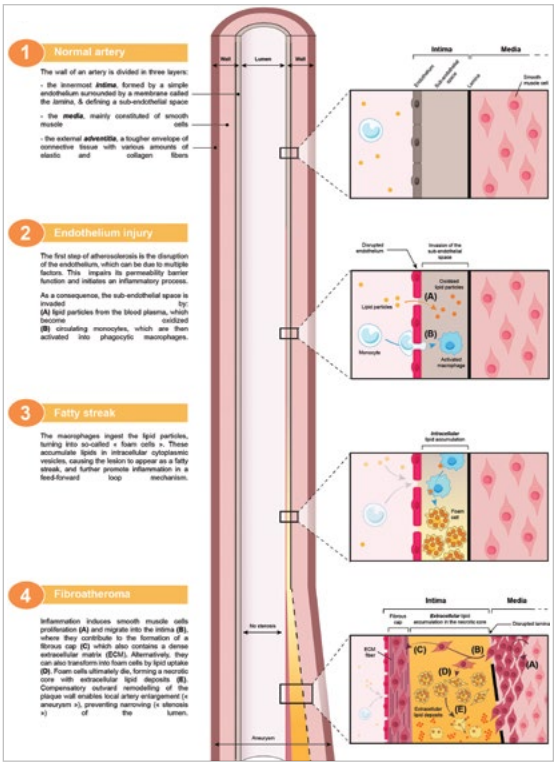
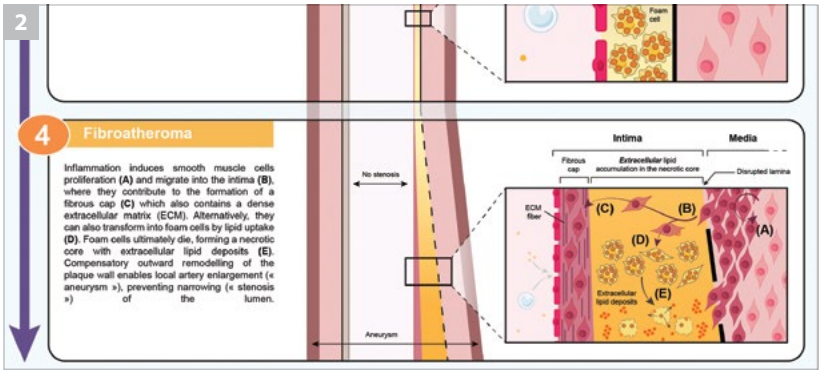
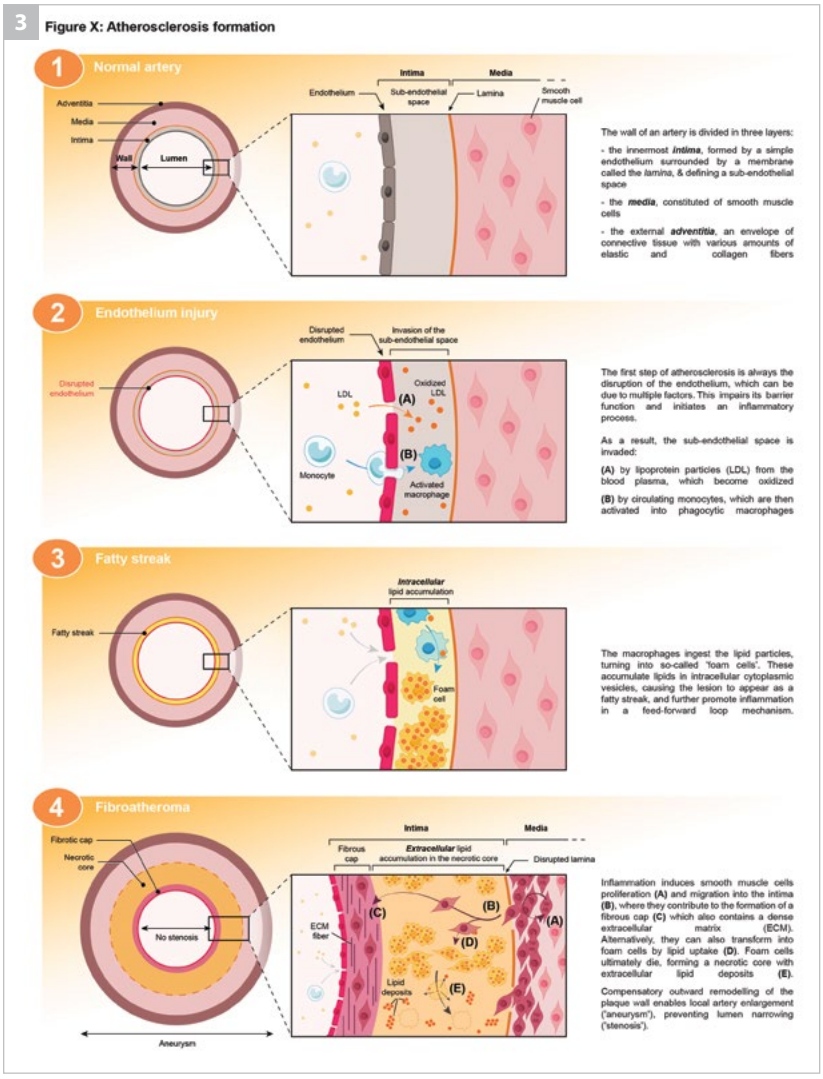










Sequential Visualization

The goal of this project was to create a sequence of images that explains a biomedical process step-by-step, rendered using a vector graphics application and suitable for an undergraduate textbook.

1. Sketch. Top: I initially used one central cross-section of an artery to highlight thickness change while avoiding repeating this element, but later had to abandon this idea for the sake of space optimization. Bottom: One key challenge of the project was to accommodate both cellular and tissue scales on the same image without losing clarity, and colour-coding proved particularly useful in that regard.

2. Production process. Detail highlighting the graphical elements of one image.

3. Final illustration. Atherosclerosis development.

Science Behind the Scenes: How the First Universal Tool to Image a Physical Force was Born

My goal was to create a 3D animation to engage the lay public about Chemical Biology through the story of one specific research project, which aimed at developing probes to measure cellular membrane tension. It was developed in collaboration with the Swiss National Center for Competence in Research in Chemical Biology.

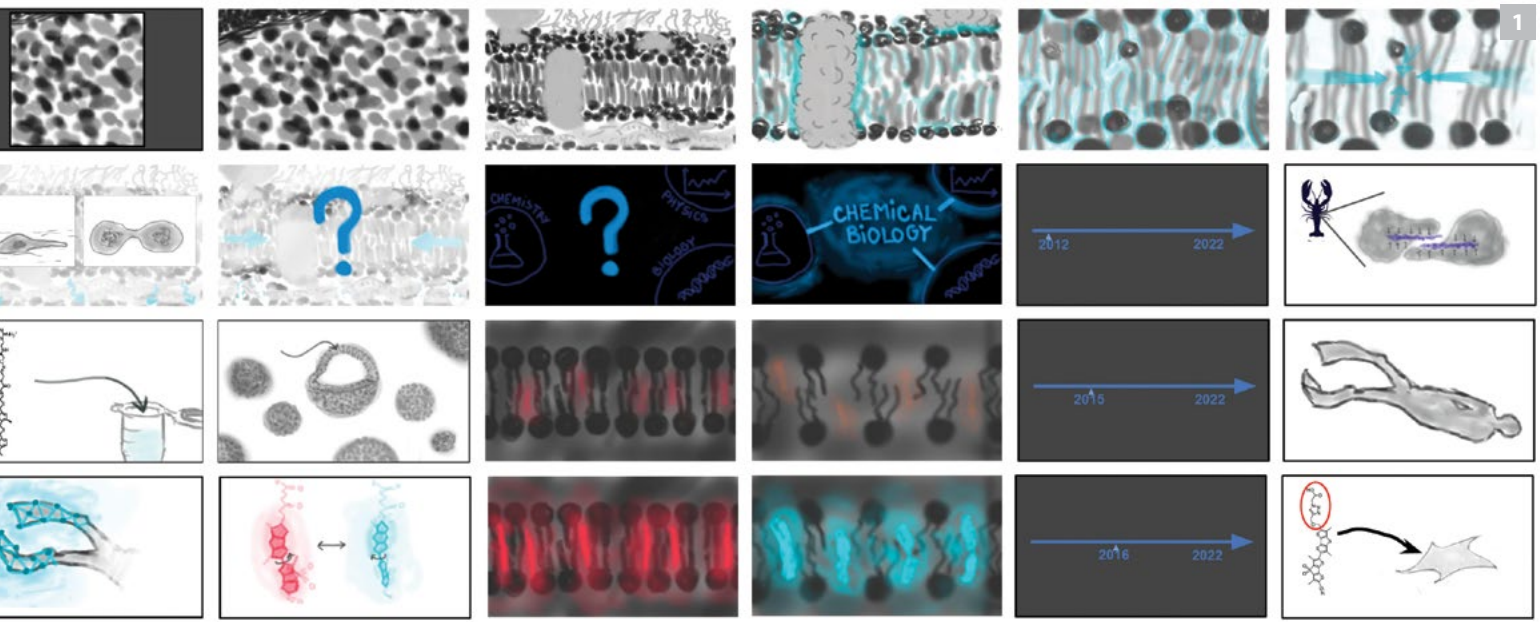
1. Storyboard. Used to map out visual ideas following script development.

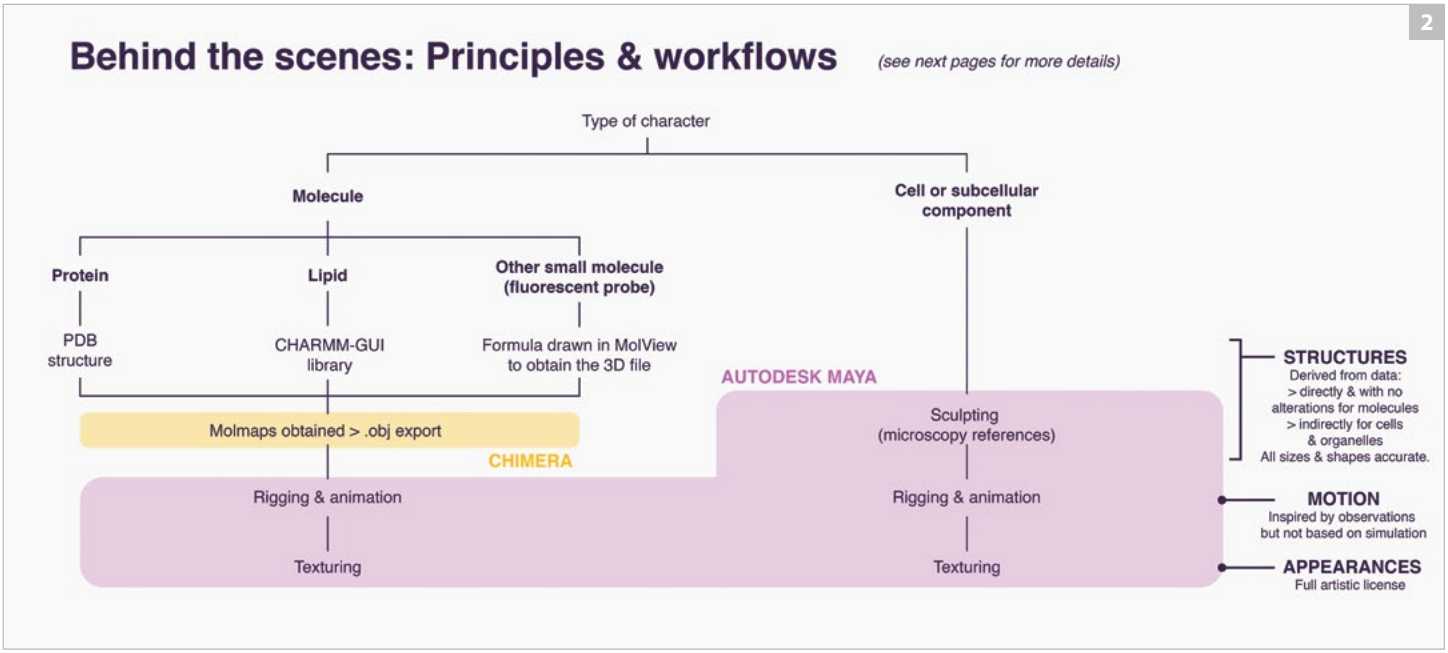
2. Notes. One specific objective of this project was to increase the transparency of the creative process through a visually compelling document explaining how I used scientific data to build this animation.

3. Final animation. 2D and 3D elements were carefully balanced depending on the communication goal of each scene, in order to ensure an engaging value without losing clarity and overwhelming the audience with unnecessary complexity.

4. Final animation. Scientists involved in my project were featured in short videos throughout the animation to highlight diversity in science and minimize the potential feeling that the public can't reach them.

5. Final animation. A series of selected stills from my final animation.





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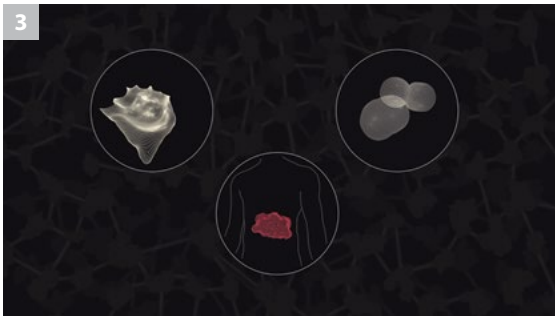
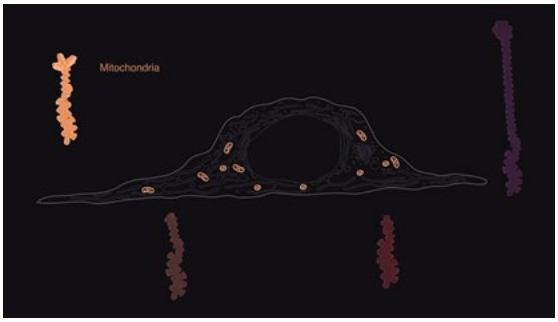
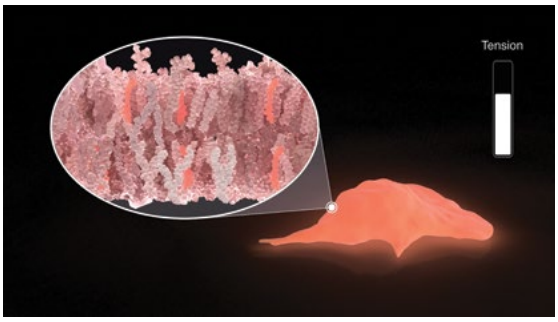


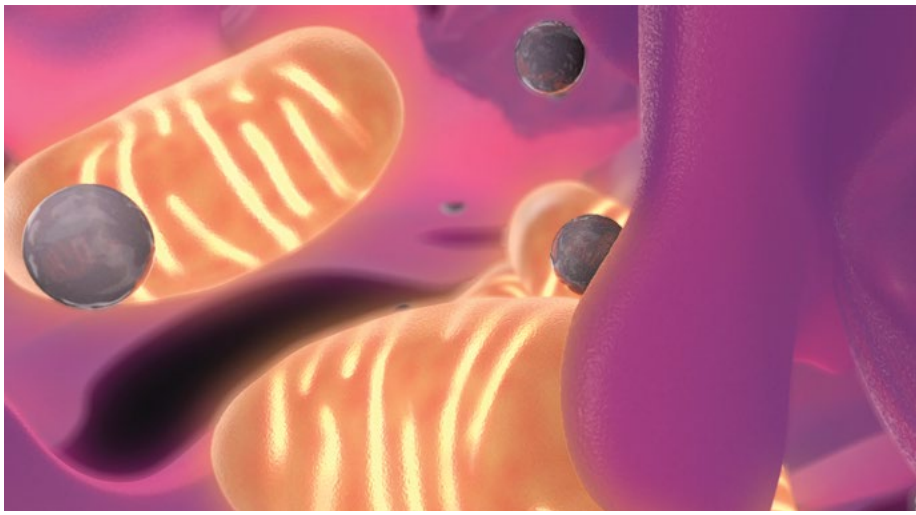

Mitochondria

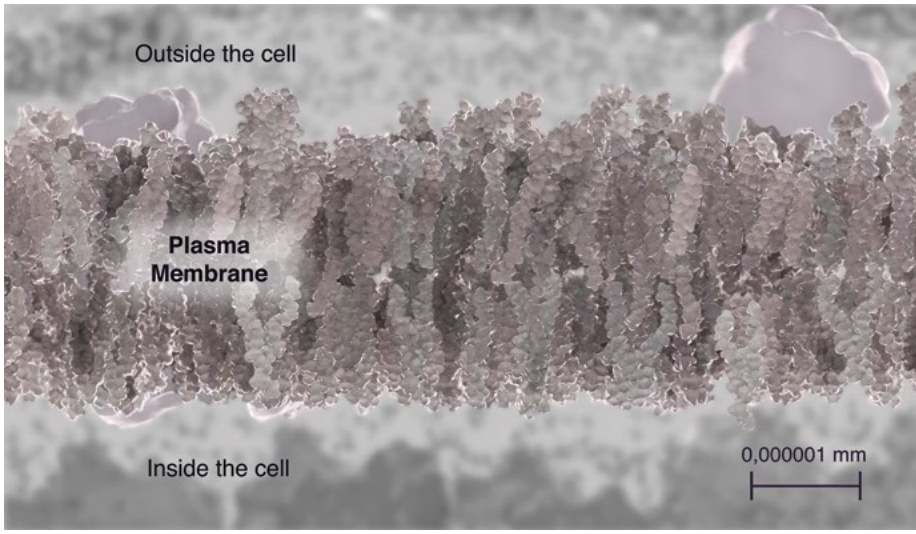

Tension

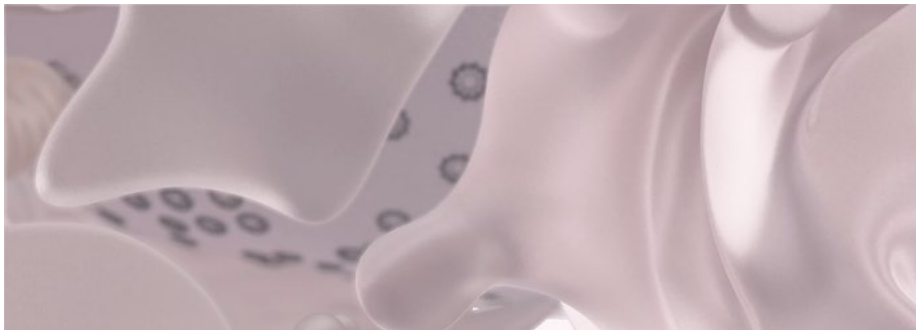
4

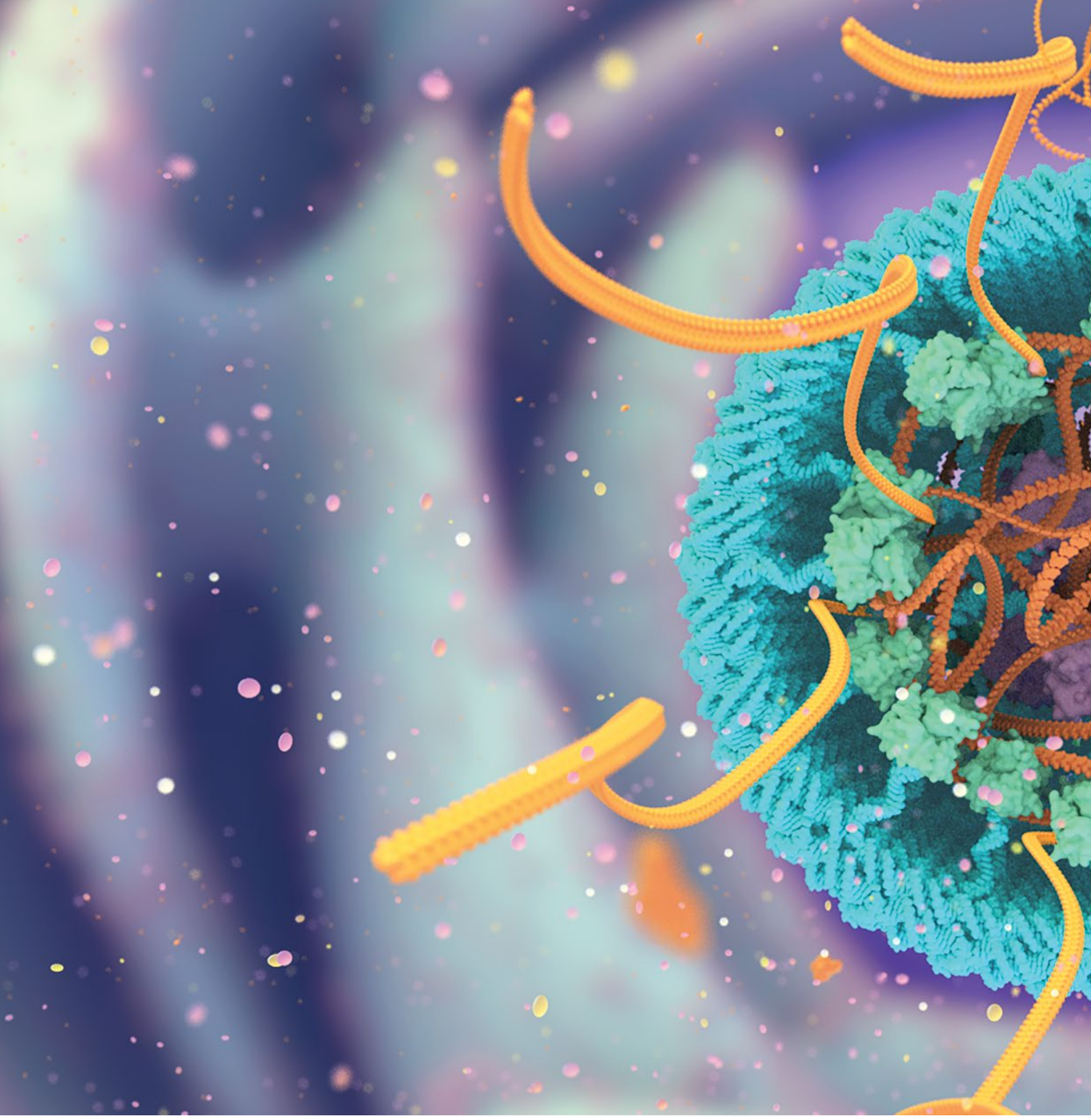
5

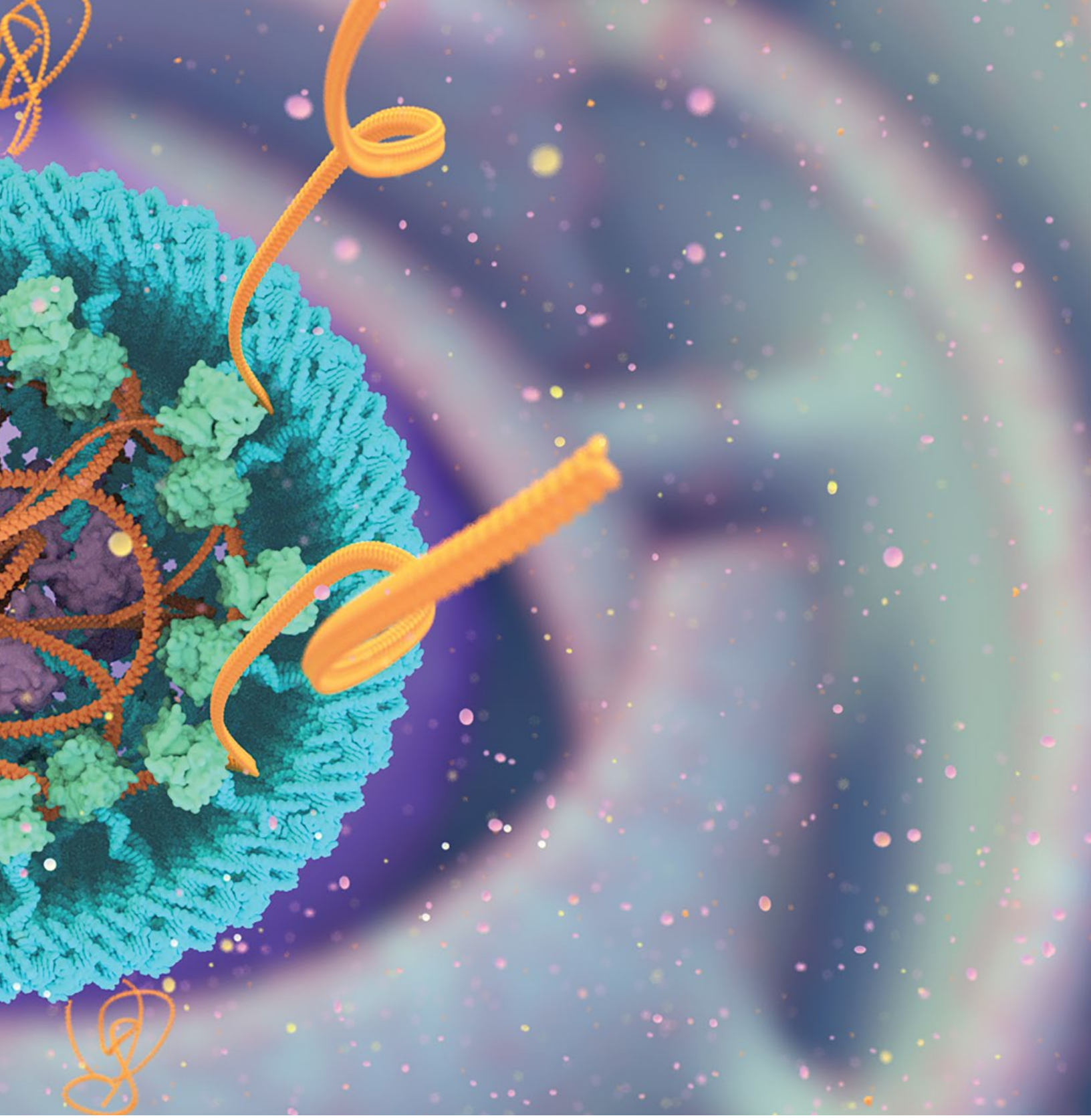

0,005 mm




Outside the cell
Plasma Membrane
Inside the cell
0,000001 mm







Marty Shook

I am a multi-media designer whose work explores medical marketing, communication, and education. Currently, I am employed at Maven Medical Marketing, designing marketing collateral for pharmaceutical industries. In the fall of 2021 I will be working with Maven to foster a subsidiary agency focused on medical education.

Pathological Illustration

The journal spread "The Great Imitator: Syphilis & Stroke" sequentially visualizes the pathology of meningovascular syphilis connected with ischemic stroke.

1. Sketch. A visual exploration of the progression of meningovascular syphilis with the integration of enlarged cellular actors.

2. Sketch. A refined sketch of a potential viewpoint of the middle cerebral artery swollen from syphilis.

3. Final illustration. My finalized journal spread detailing meningovascular syphilis and ischemic stroke.

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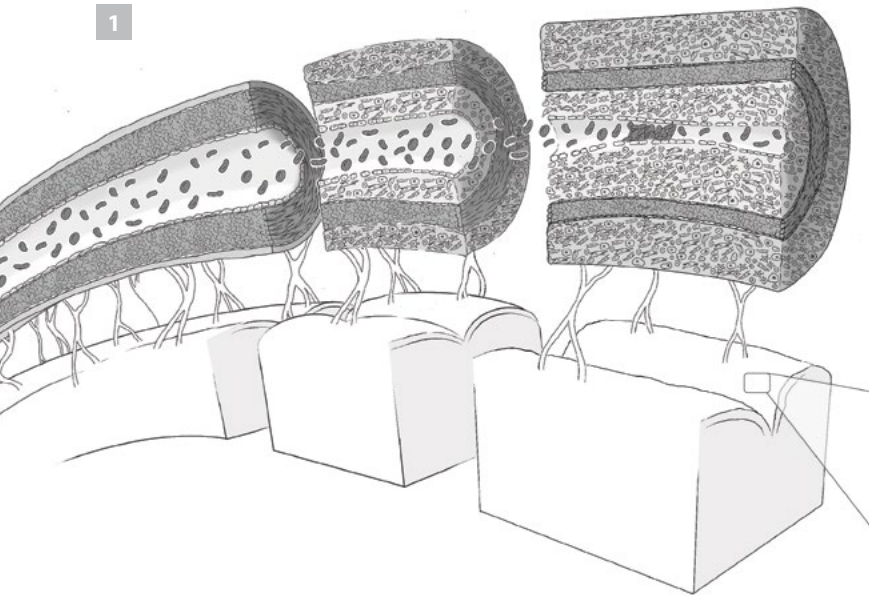

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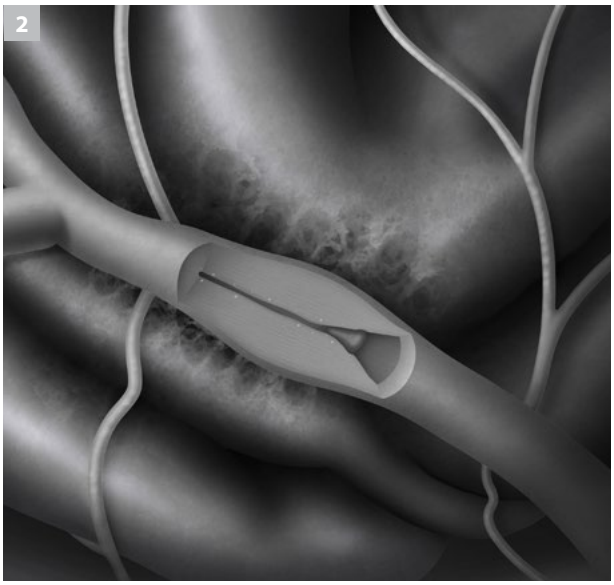

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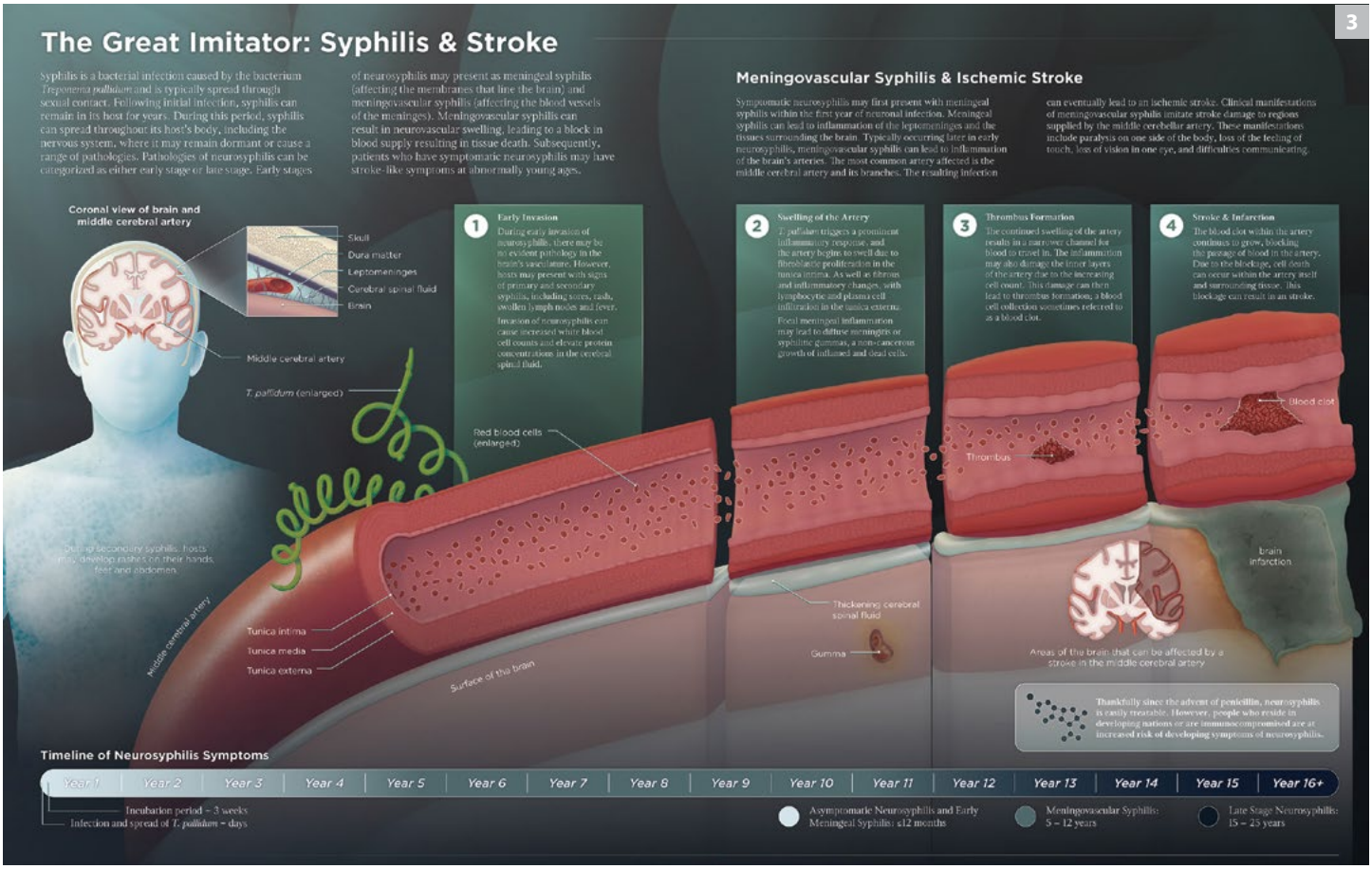
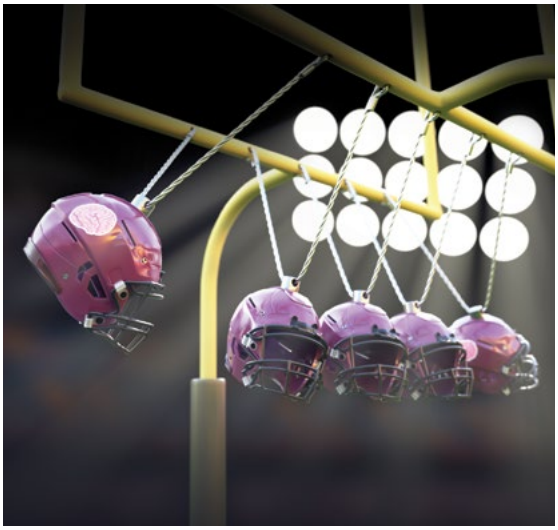
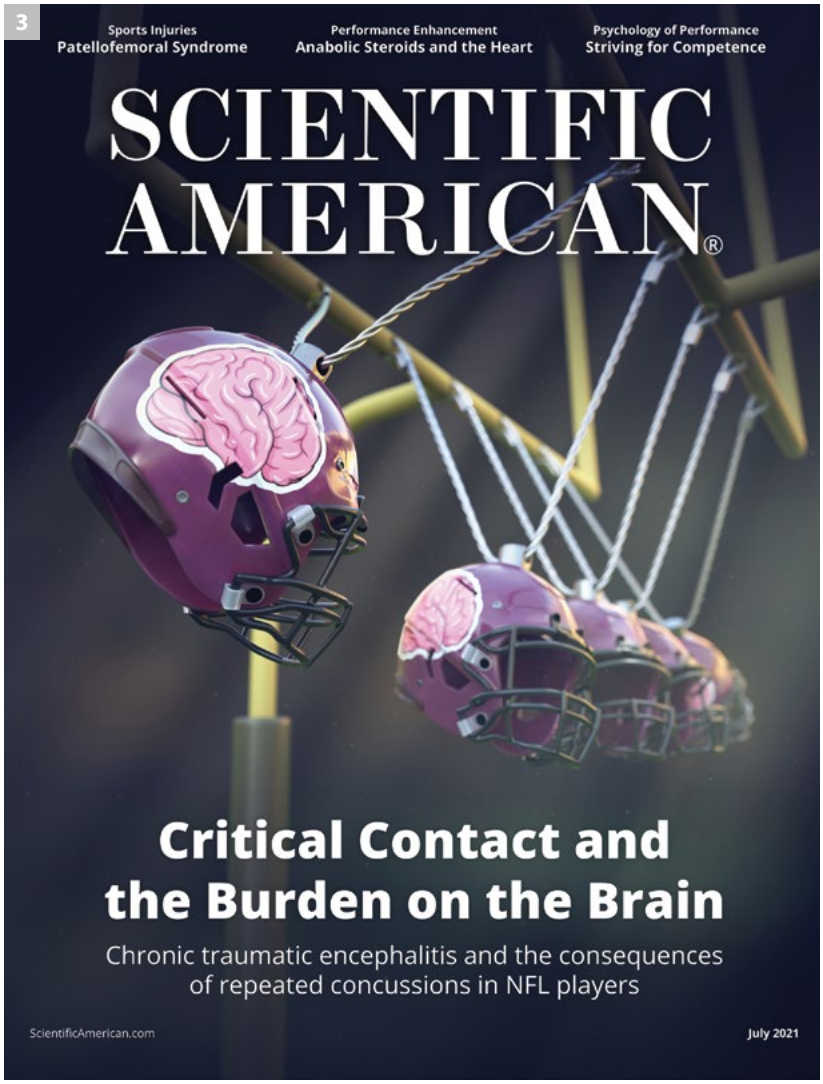


Editorial Illustration

In the mock journal cover "Critical Contact and the Burden on the Brain" I emplyed visual metaphors to communicate the featured article on chronic traumatic encephalitis (CTE) in NFL players.





1. Sketch. My initial sketches exploring different visual metaphor concepts to communicate CTE. The left sketch utilizes Plinko as a metaphor showing the player or puck connecting with objects on the board. The middle sketch is the initial idea that was selected. Finally, the right image shows a lone football helmet on a field.

2. Sketch. Examples of further exploration of the Newton's cradle metaphor to visualize CTE.

3. Final illustration. The finalized mock journal cover with accompanying text and logos.

Previous spread. Final illustration. The anterior view of the RNA-Extracting Nanofactory taken from my Master's Research Project: Form, Function and Future — The RNA Nanofactory.

Data Visualization

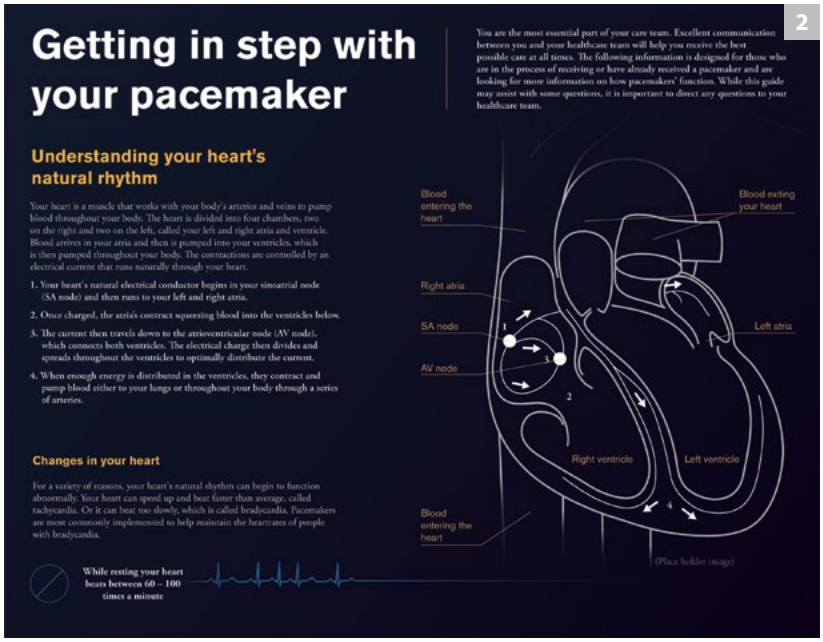
The brochure "Getting in Step with Your Pacemaker" is a proof of concept for a detail aid (a booklet containing product information) explaining the functionality of pacemakers.

1. 3D modelling. An initial maquette I used as a reference to illustrate the placement of the pacemaker near the clavicle.

2. Sketch. Further refined sketches of the cover of the brochure, which included a diagram of the heart explaining normal heart rhythms.

3. Final illustration. My finalized brochure mock-ups, the left image showing the front and back cover, which explains the heart's natural rhythm (front cover) and methods of reading the data within a pacemaker (back cover). The right mock-up shows the interior of the brochure, which details the parts and functions of the pacemaker.

2



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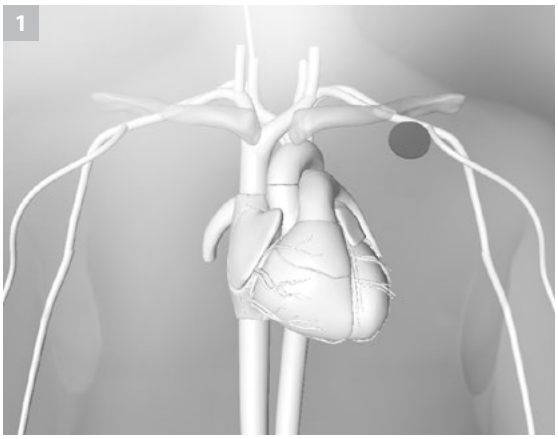

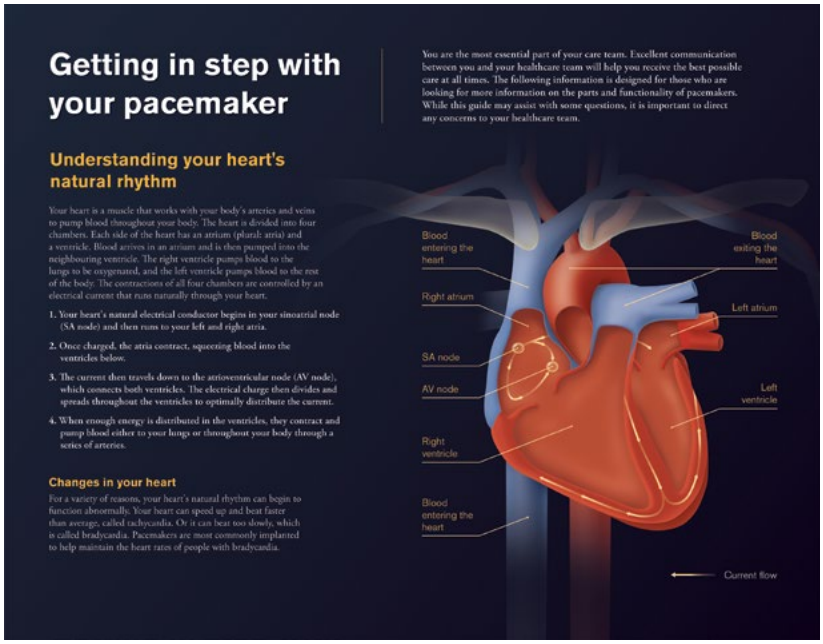

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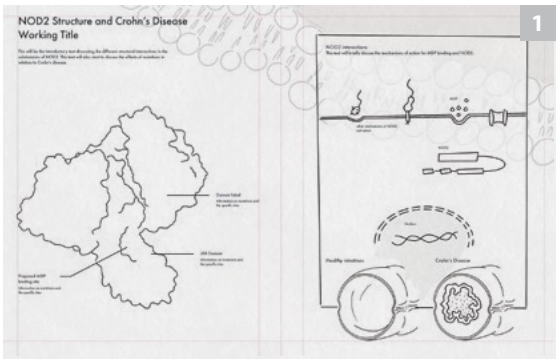
Molecular Visualization

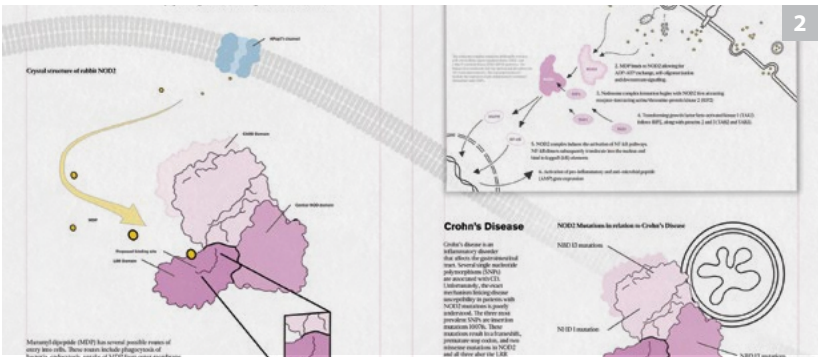
In the journal spread "A Binding Proposal" I illustrated the hypothesized binding site of MDP to the NOD2 protein and discuss its potential relationship to Crohn's Disease.

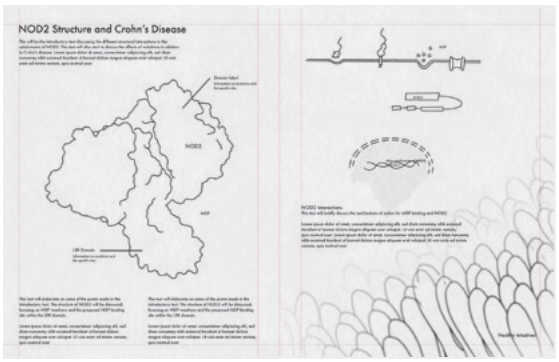
1. Sketch. A series of thumbnail sketches in which I explored different spread concepts for the journal.

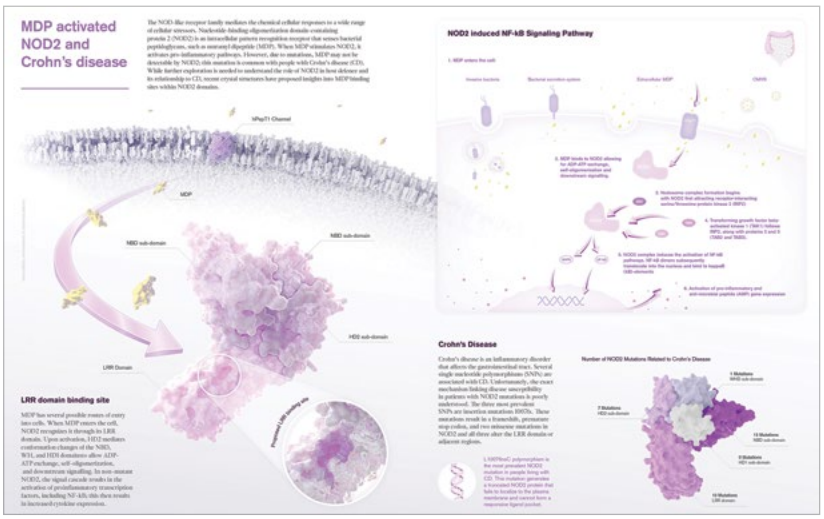
2. Sketch. Refined sketches of the journal spread with copy applied.

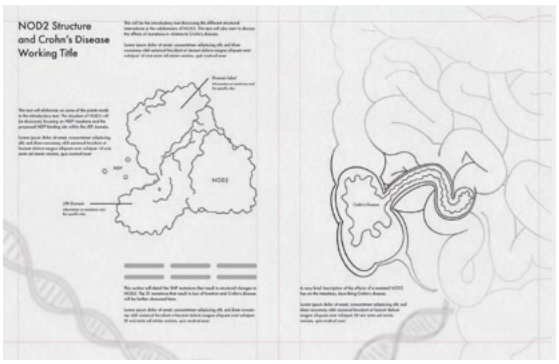
3. Final illustration. The finalized journal spread details NOD2 and the theorized MDP binding site, as well as potential sites of mutations and its relationship to Crohn's Disease.

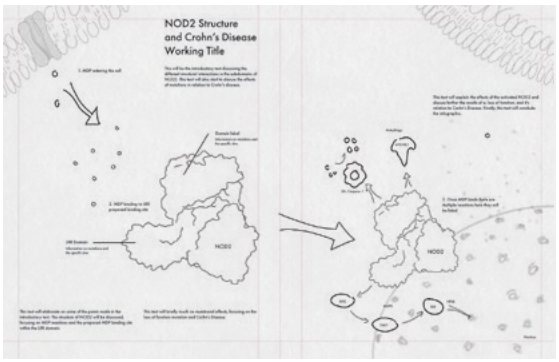


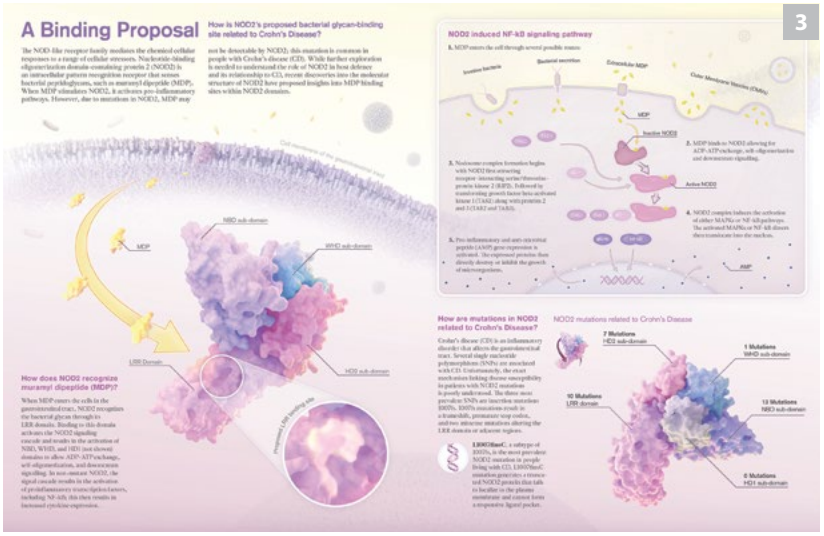












Form, Function and Future: The RNA Nanofactory 3D Animation

My Master's Research Project visualizes the work of Dr. Leo Chou and his lab at the University of Toronto. The RNA Nanofactory is a DNA nanodevice constructed using DNA origami that has demonstrated the ability to produce and process RNA.

1. Sketch. A sketch visualizing the different acts within the animation: RNA production & processing, functional molecular units, and DNA origami & construction.

2. Storyboard. Storyboards describing the introduction of the animation as the camera and viewer transition from the exterior of a cell to its interior, where the nanofactory is then introduced and explained.

3. Final animation. A series of still images from my animation that show the description of the factory shell, the functional molecular units, DNA origami and the factory producing RNA.

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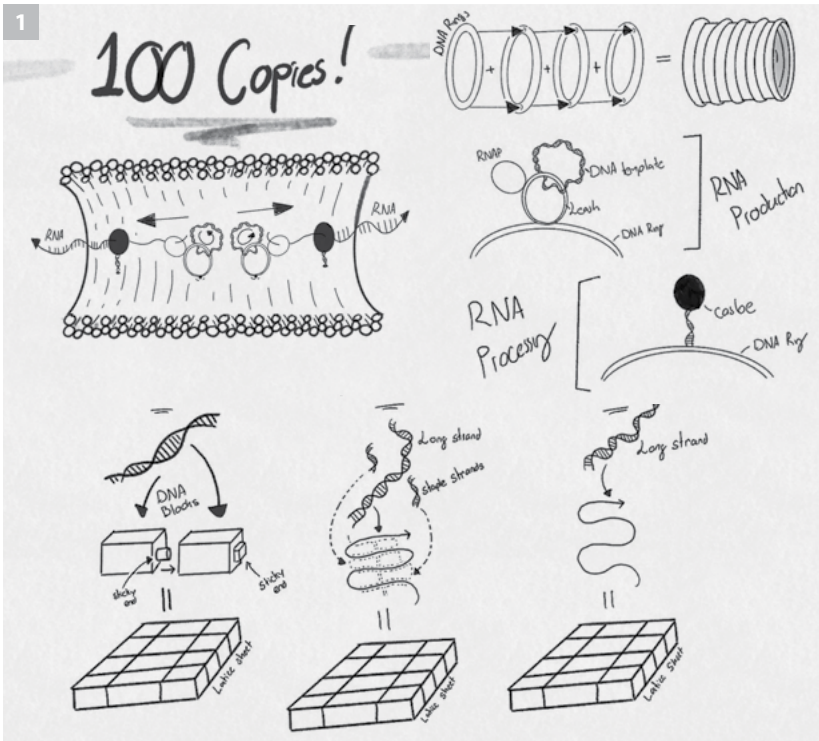

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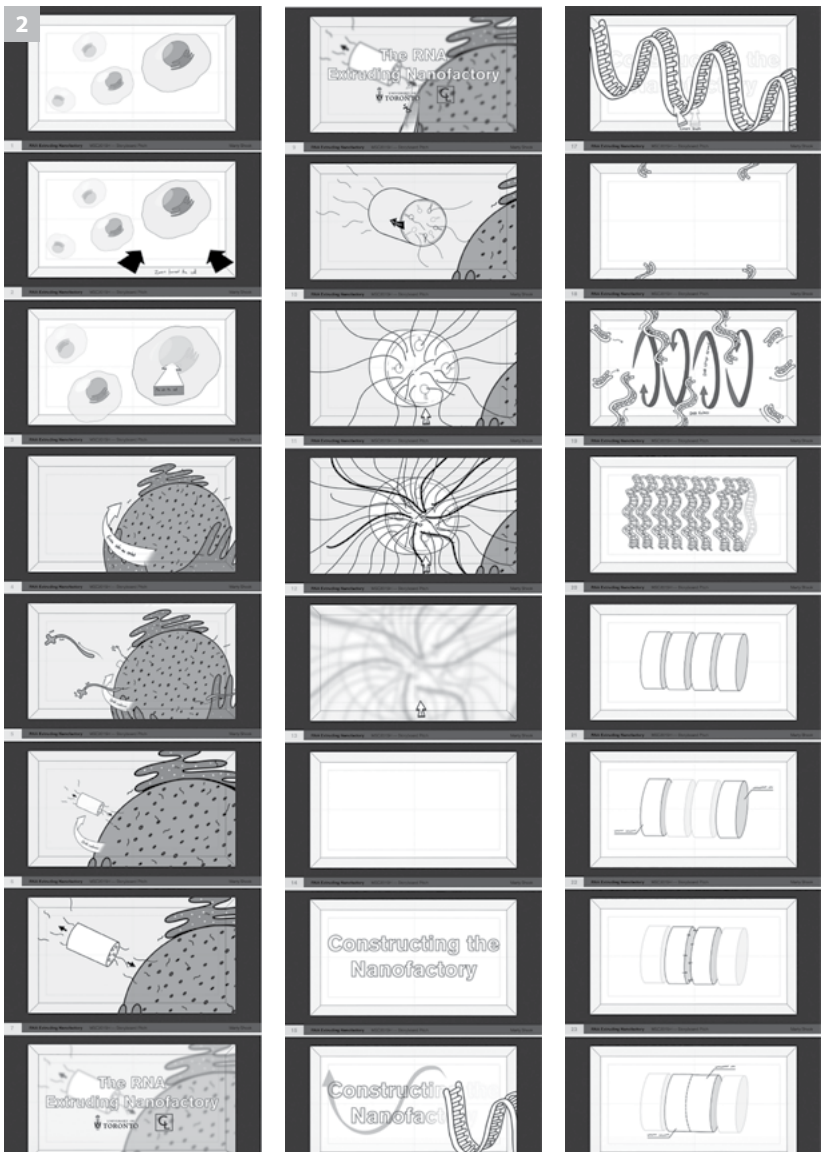
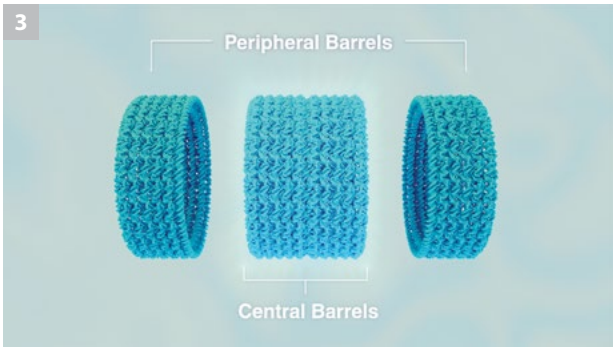
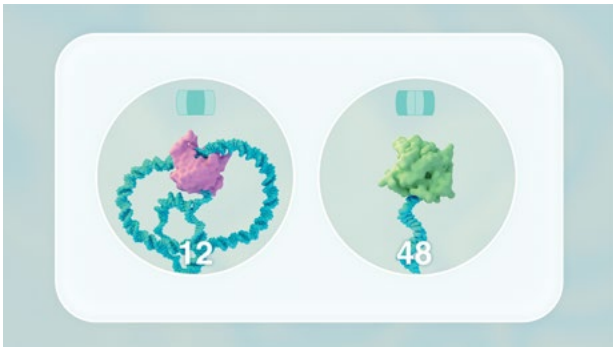
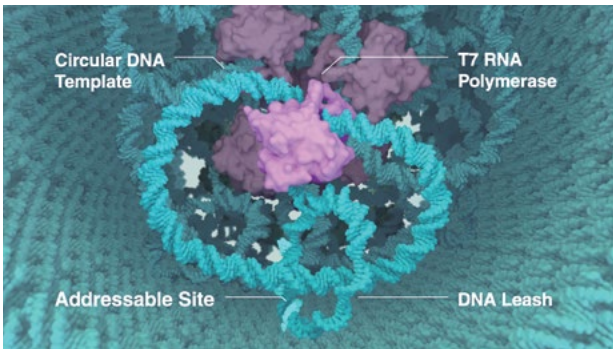
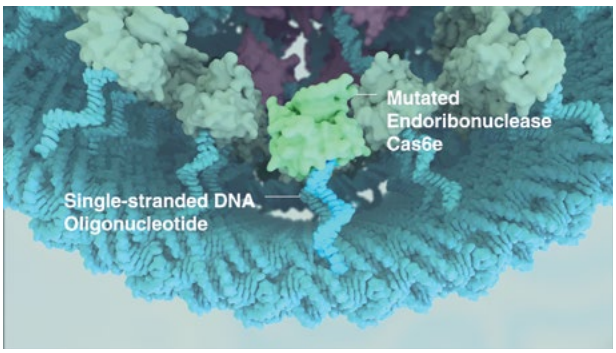
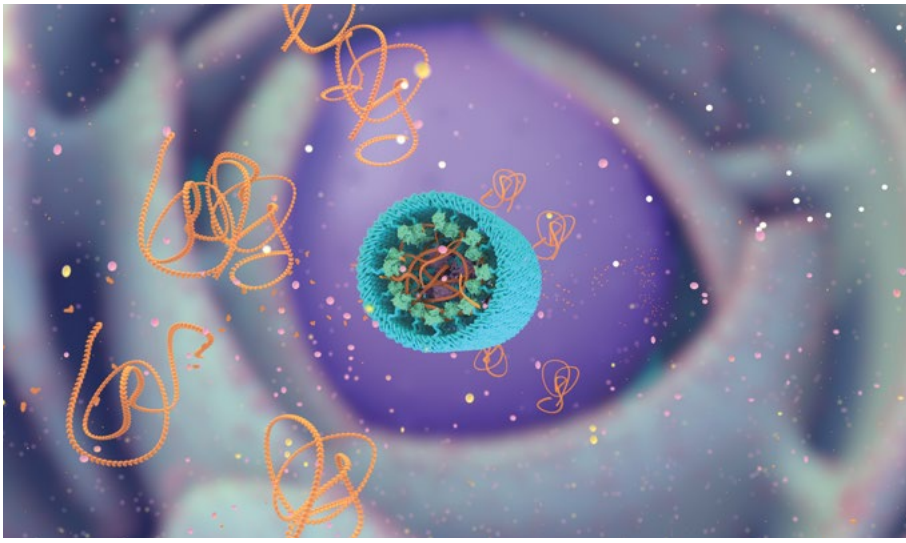


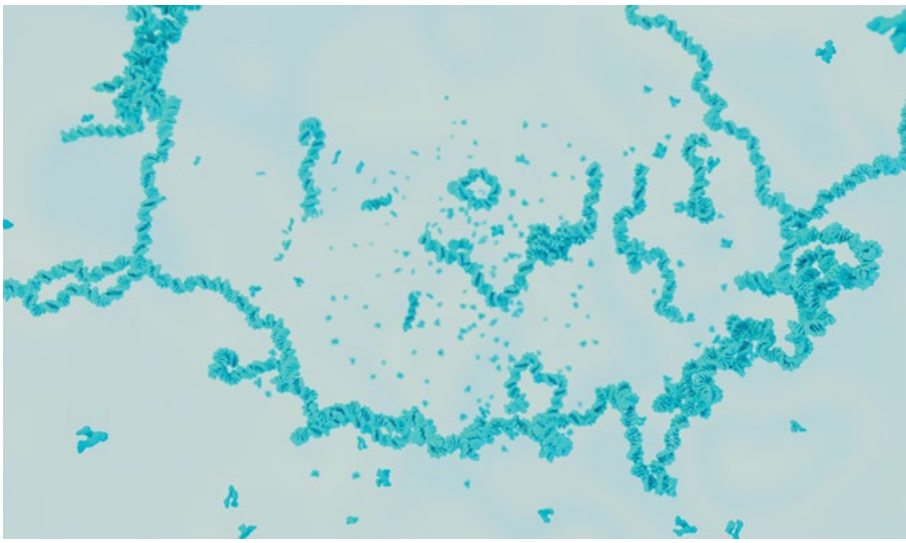

3
Peripheral Barrels
Central Barrels

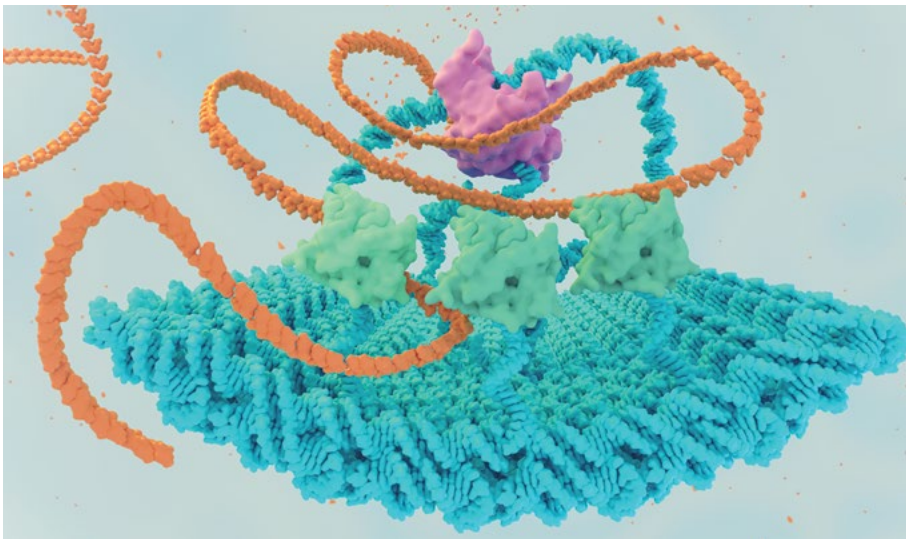

12
48

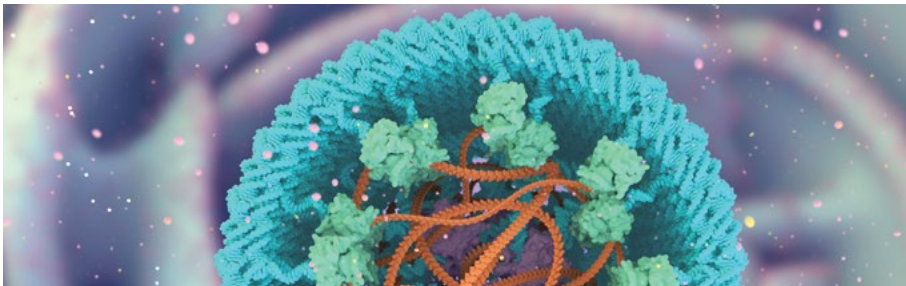

Circular DNA Template
T7 RNA Polymerase
Addressable Site
DNA Leash


Mutated Endoribonuclease Cas6e
Single-stranded DNA Oligonucleotide









Willow Yang

I am a designer with a passion for storytelling and I aim to help make health and science more approachable for everyone. Originally, that meant using graphic design and illustration to help communicate what words on their own couldn't. BMC introduced me to another avenue, and now I also leverage UI/UX skills and coding knowledge to include interactive experiences in my efforts. My core philosophy has remained the same: to design with the intent of improving people's everyday lives.

Information Visualization

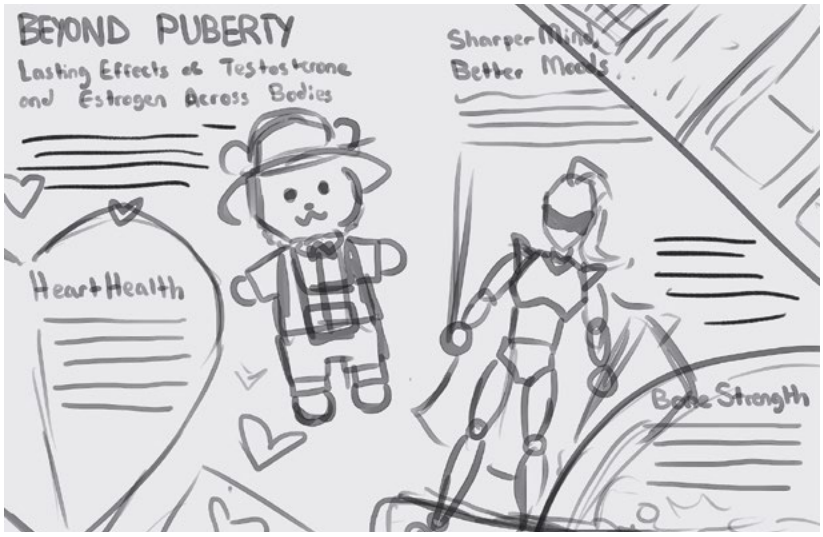
Communication challenges include not only teaching new concepts, but also changing pre-existing conceptions. This piece aims to clear up the misconception of testosterone and estrogen as strictly "male" and "female" hormones.

1. Sketch. Wanting the final piece to be eye catching and welcoming, I drafted a more modern, editorial layout of an artfully cluttered desk, with non-human characters for a cuter charm.

2.Sketch. To keep the theme of "effects across gender and time," I didn't portray a specific age or human body. I drew toys to tie in the "puberty" that people tend to associate with these hormones.

3. Final illustration. To aid in instinctive reading based on societal associations, I used blue and pink across the piece and within the characters to depict the effects of testosterone and estrogen respectively. However, I flipped the usual gender-associated toys in their depictions, so as to convey the spectrum of genders affected by the hormones covered.

1



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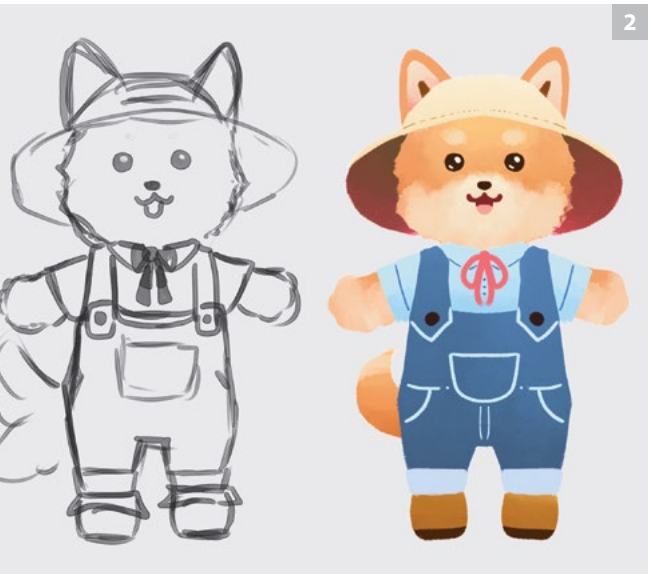

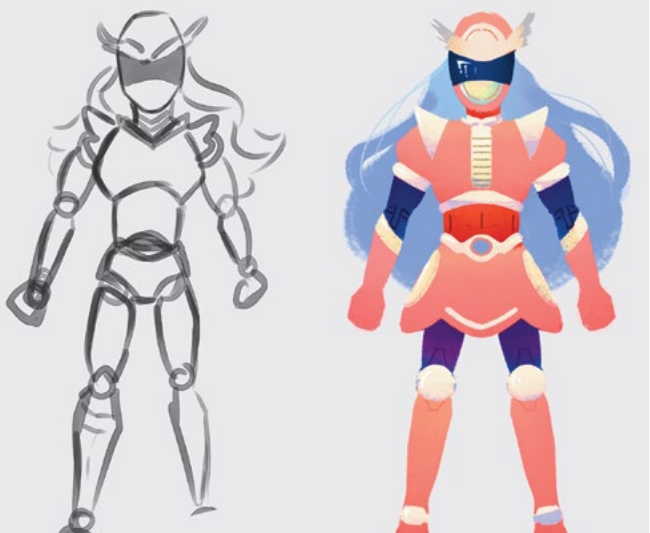

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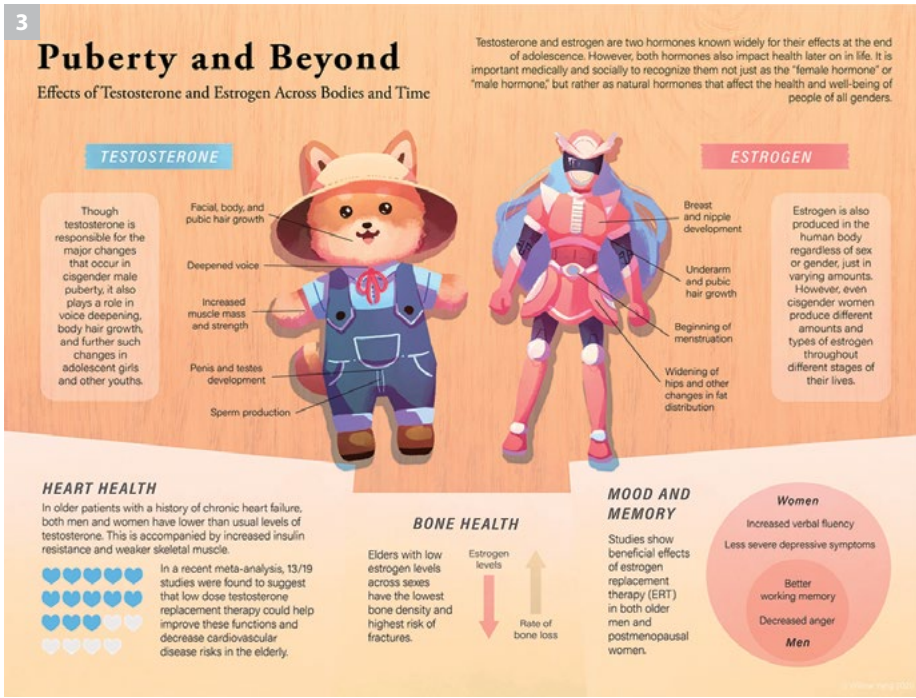
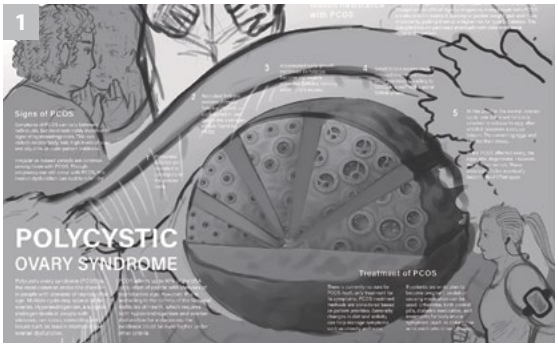
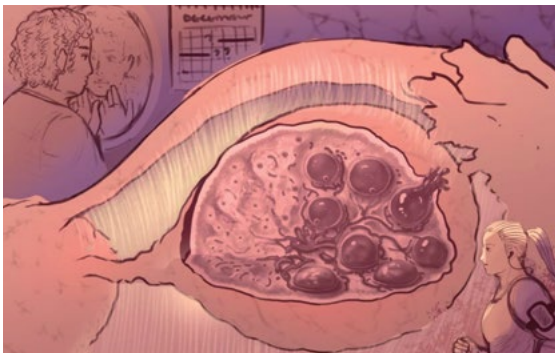
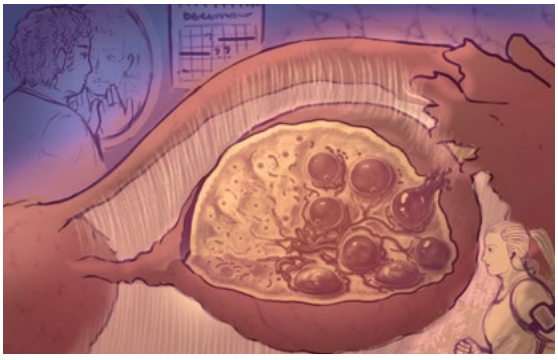
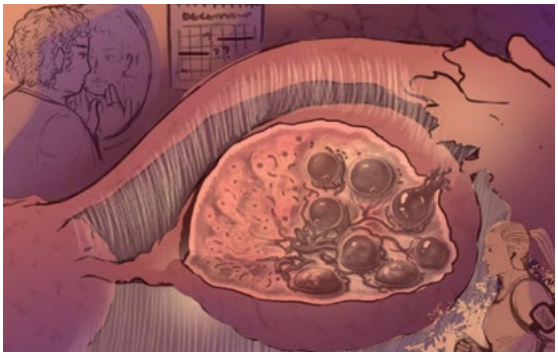
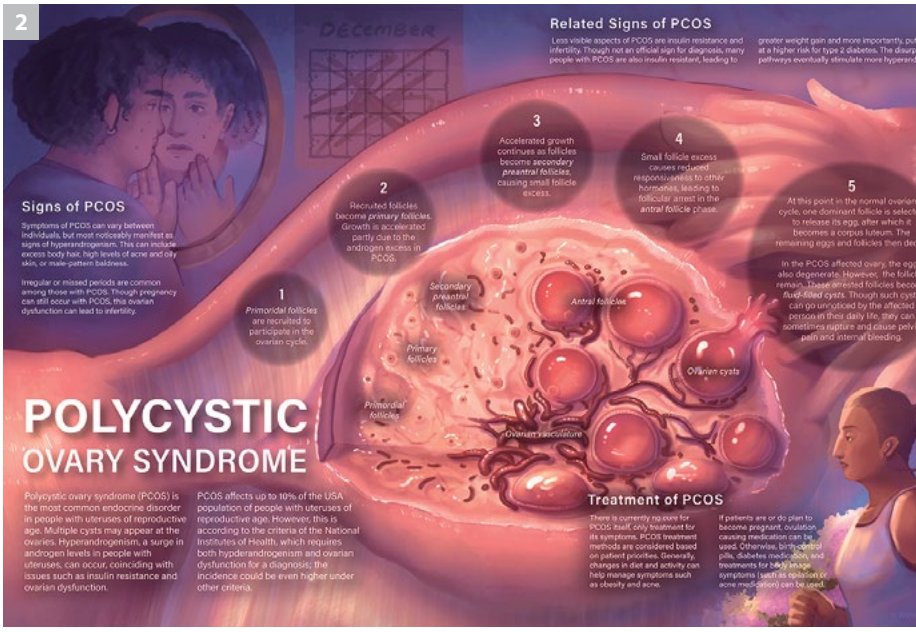


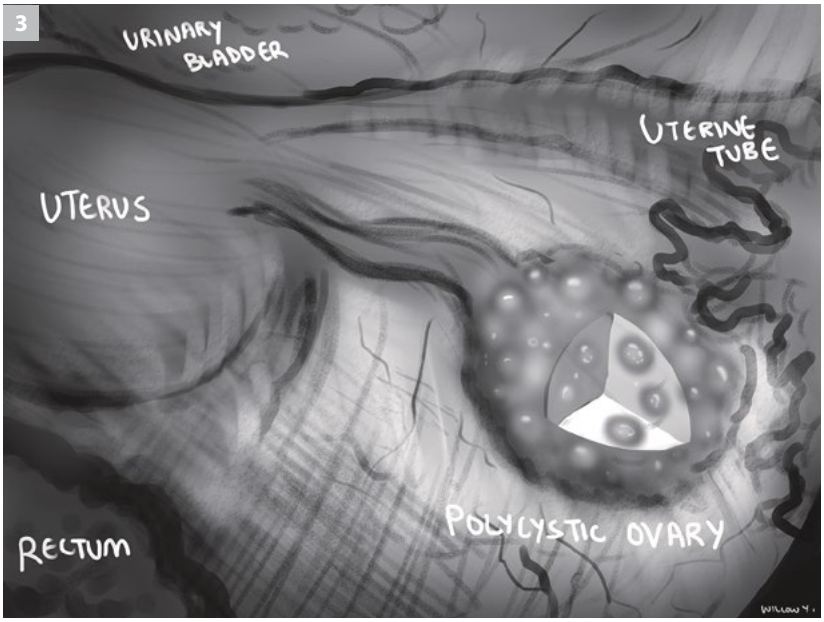












Pathological Illustration

The goal was to produce an original, conceptual medical illustration demonstrating pathological change in a tissue over time. I chose polycystic ovary syndrome (PCOS), a common endocrine disorder that is less commonly known among the general public.

1. Sketch. I used a tissue study I had done directly in the first draft to aid the layout process, and then made edits based on peer and supervisory feedback. I tested various colour palettes, combining two for the final, using a gradient to guide the viewer's eye and a softer pink to harmonize.

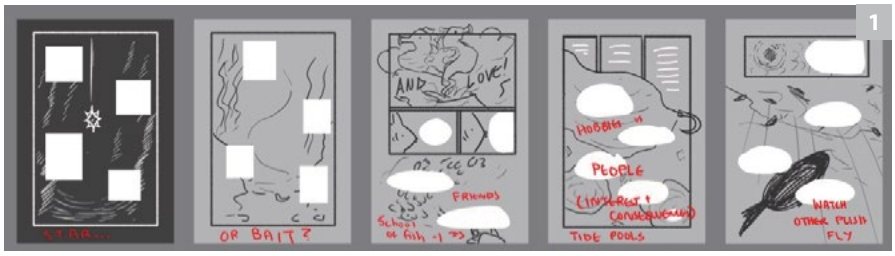
2. Final illustration. I created this as an introductory piece for a lay audience. Rather than focusing only on the pathological changes, I wanted to highlight the struggles and solutions that people living with PCOS may face, and to raise awareness for those who may not even know they have it.

3. Study. From the start, I wanted to create a dynamic composition fit for an editorial spread to capture the lay audience's attention. Trying to orient the viewers while doing so was a challenge.

Previous spread. Final illustration. An illustrated scene from my Master's Research Project: Adventure Down Hidden Depths.

Graphic Medicine

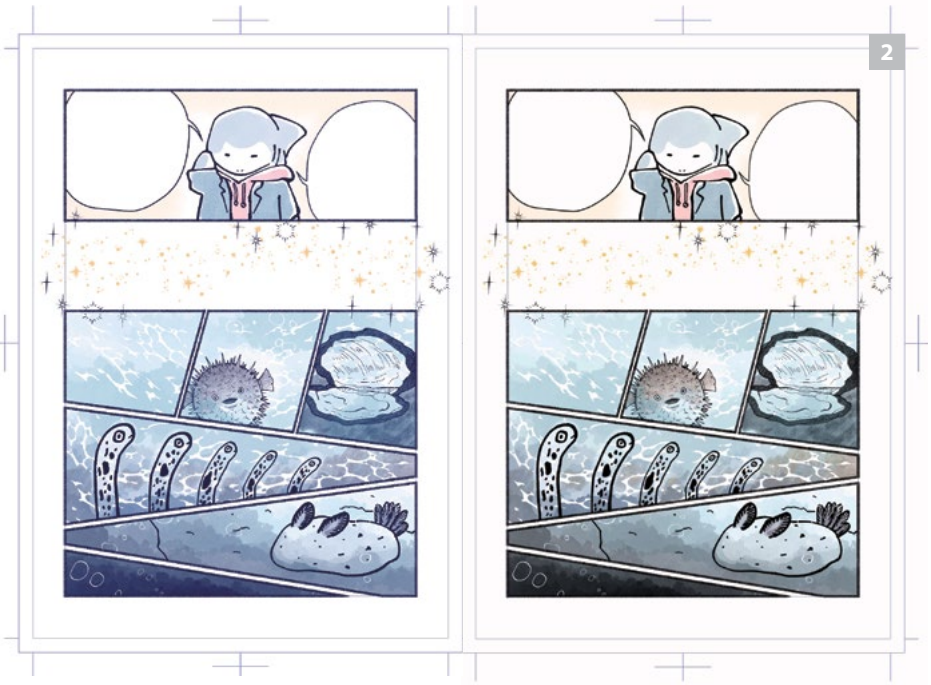
Comics can be a greatly effective form of health communication, especially when empathy is involved. This comic was created as a personal exploration of mental health on paper.

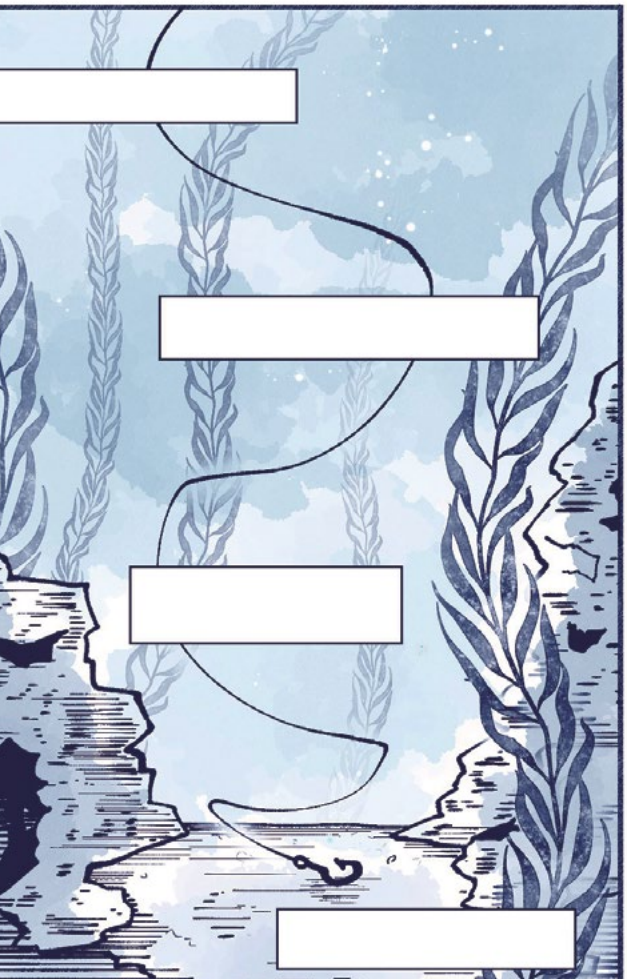


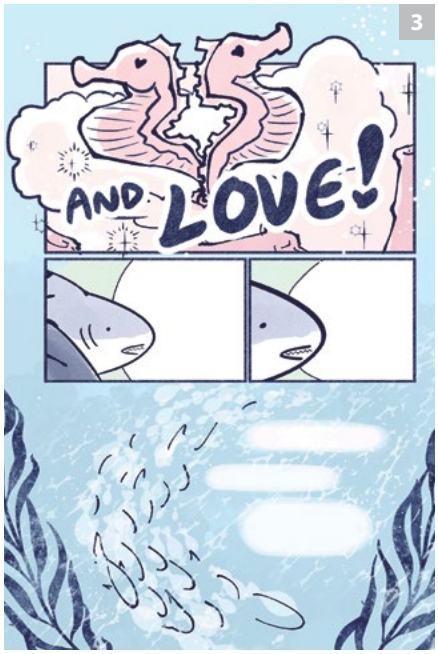
1.Sketch. Draft created from cleaning up rough thumbnails, with white blobs and bubbles to layout the text placement in the final. I marked it up in red for my own reference later.

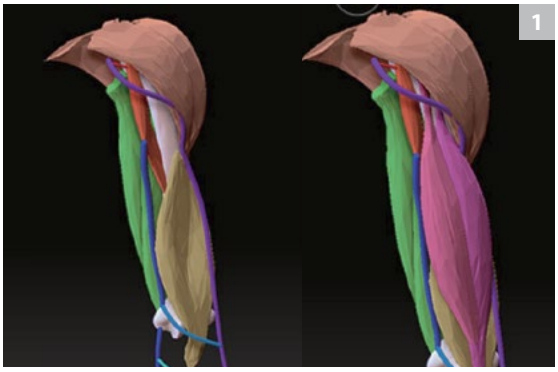
2. Final draft. A nearly complete page in two versions. I knew I wanted to use a more limited colour palette for a casual yet melancholic mood, and ended up choosing to use a blue overlay to further convey that.

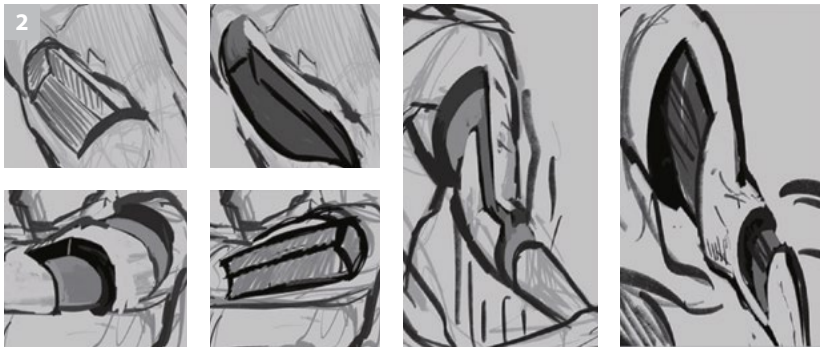
3. Final illustration. Excerpts from the final comic, without text. I chose a more simplistic style to make a heavy topic more approachable. I originally chose an oceanic theme due to the concept of "drowning before you know it" in terms of mental health, which then created many opportunities to try interesting visual metaphors and more fluid paneling techniques to emphasize that.

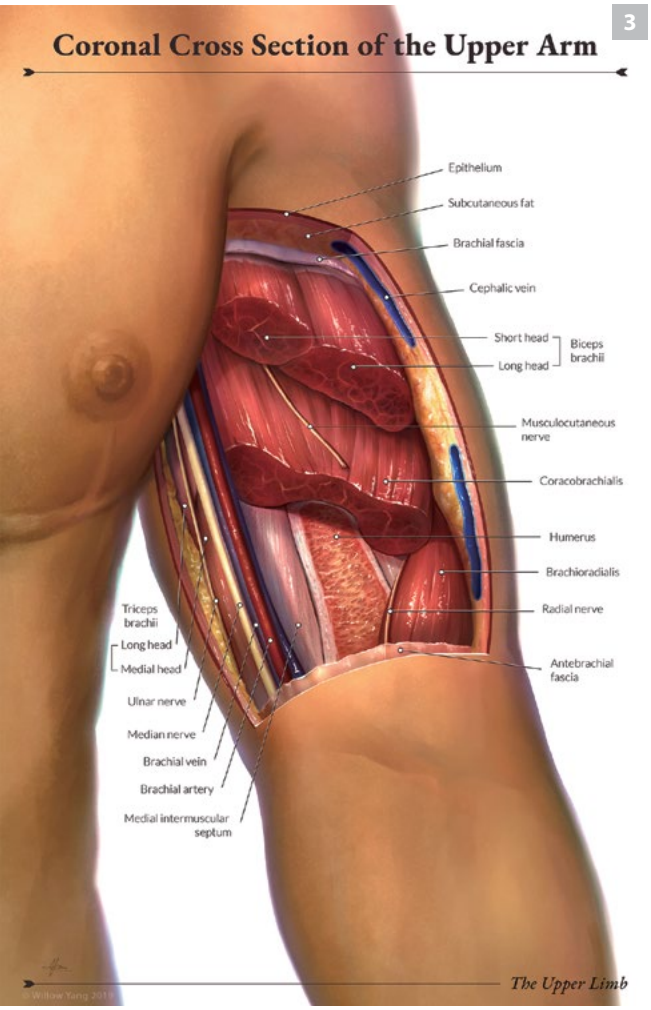


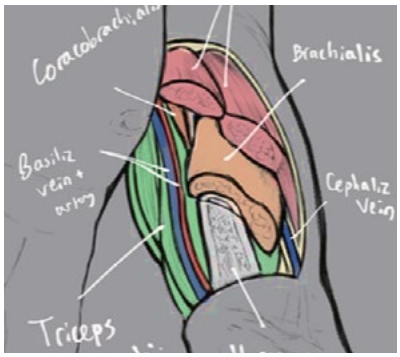


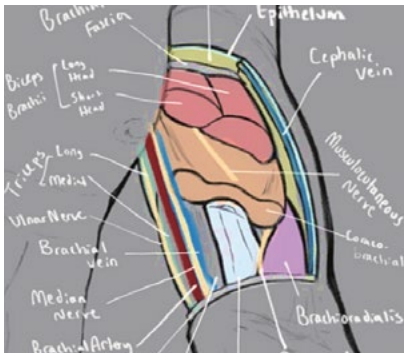


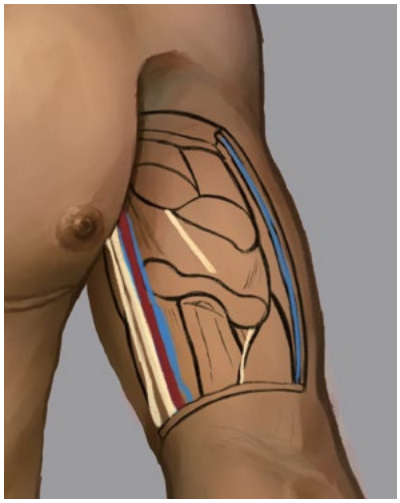












Anatomical Visualization

This project's main goal was to depict a life-like, anatomically correct structure that could not be directly observed in real life.

1. 3D modelling. Using model data from *Anatomography*, I set up a 3D maquette to approximate the locations of the internal anatomy at different layers.

2. Production process. Initial concepts varied in body angle and cross section shape. I weighed the ease of anatomical understanding against aesthetics. To make the piece come to life, I paid special attention to the cut ends of the muscles, and slightly exaggerated the sheen and colours of the internal structures.

3. Final illustration. Keeping in mind the need for more normalized LGBTQ+ representation in the biomedical field, I added a top surgery scar to the subject. Following peer feedback, I made changes to the cephalic vein and chest area for better readability.

Adventure Down Hidden Depths

AdventDHD is a self-directed, interactive, visual narrative that provides ADHD coaching for young adults. Accessing traditional coaching can be difficult. Featuring an original narrative reviewed by Dr. Nicole Koziel, AdventDHD aims to make adult ADHD coaching more approachable and engaging—and fun!

1

1. Final interactive. Mockup featuring a screencap of a full-screen illustration that can be unlocked based on the player's choices. I chose to show the characters at their triumphant moments to both immerse and empower players.

2. UX design. User personas created to keep the target audience in mind.

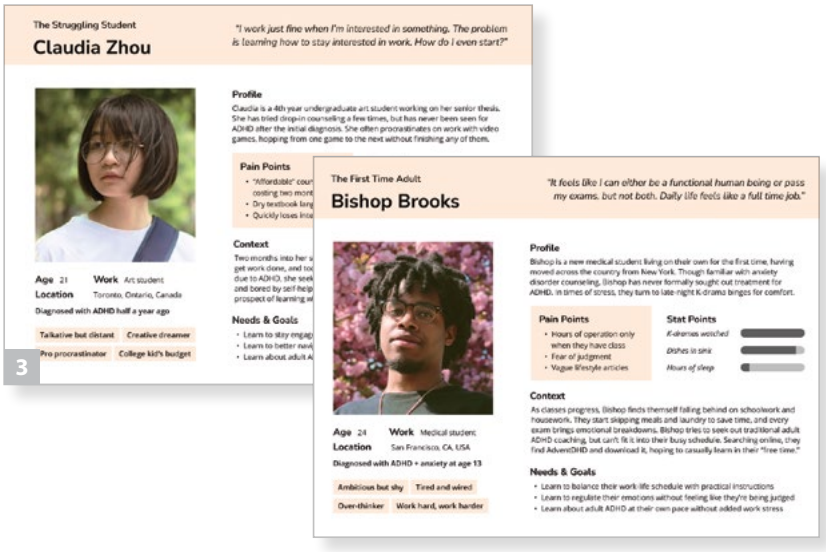
3. UX design. Content flow. The narrative and educational material were intertwined from the start. AdventDHD was inspired by the accounts of close friends and family members, which I reflected within the story.

4. Study. Characters were inspired by the original cast of Lewis Carroll's *Alice's Adventures in Wonderland*, as well as *Jabberwocky*, a poem included in *Through the Looking-Glass*.

5. UX design. The top figure is a mock-up of the in-game journal that allows players to keep track of characters and review lesson information at a glance. The images that follow are stills from the opening sequence, styled like a nostalgic fairytale to quickly set up the narrative structure without subjecting players to a wall of text.

6. Prototype. Screenshots of two prototypes of AdventDHD. The top displays the very first demo: sketches in the basic UI that the Ren'Py engine comes with. The version that follows features updated art, with a font later changed for readability.

3



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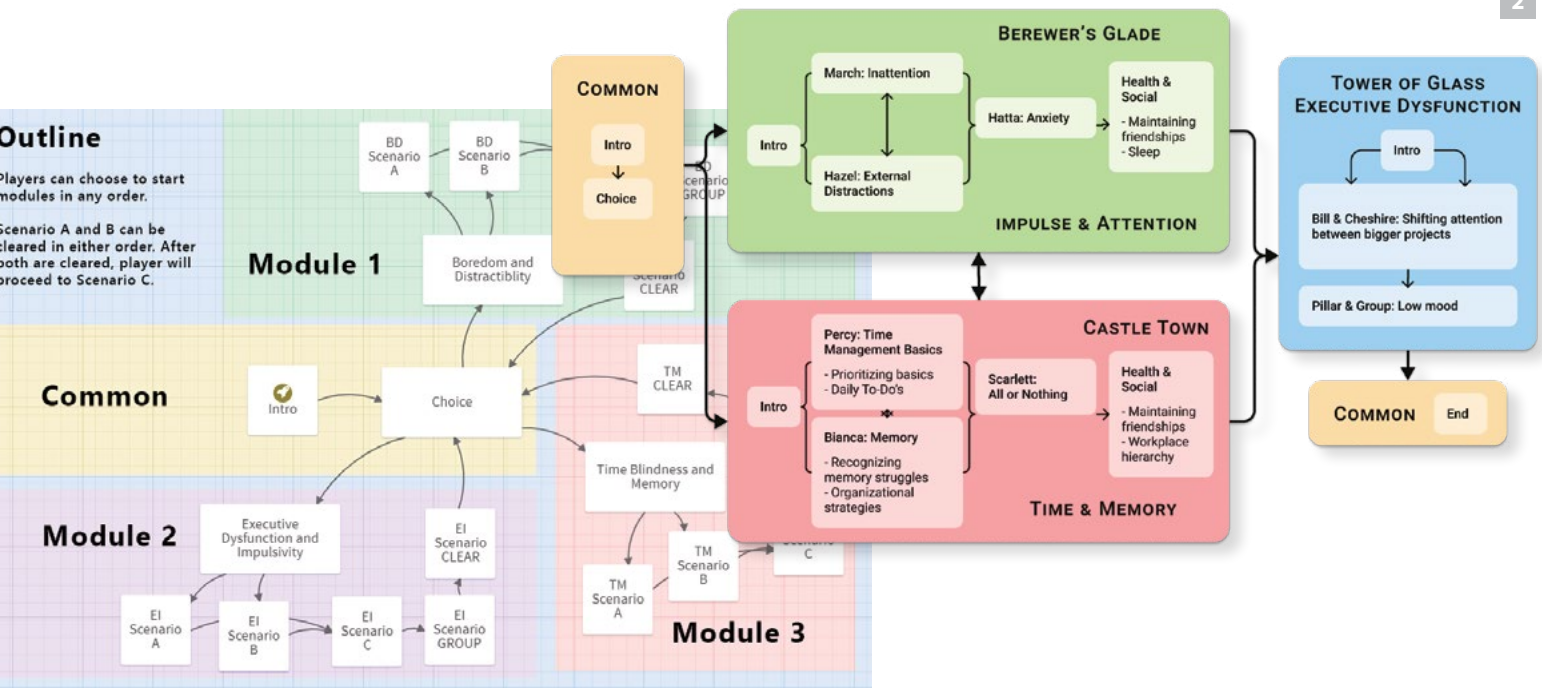


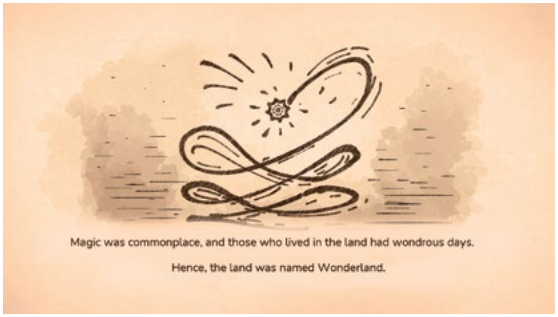
4


WHITE RABBIT
HATTER
MARCH HARE ♀
DORMOUSE ♀
BILL THE LIZARD ♂

5


Lessons
People
Places
01. Timed Work Sessions
Locked
Locked
Locked
Locked
Locked
Distractibility
Timed Work Sessions
Back
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed eget scelerisque ut feugiat aliquam tellus, sit.
Vitae donec ultrices velit egestas lacus, ac. Egestas diam iaculis ante luctus tincidunt.
Viverra lobortis tincidunt iaculis sem tortor condimentum nisi, in purus.


Long ago, a world was formed from the dreams of others.


Magic was commonplace, and those who lived in the land had wondrous days.
Hence, the land was named Wonderland.

6


Kuniklo
I'm glad to hear that new of Wonderland has reached far and wide! That makes my job much easier. But yes, we're currently at the center of Wonderland.
Back History Skip Auto Save Q.Save Q.Load Prefs


Kuniklo
Hey now, I believe that's a good place to start already.
Back History Skip Auto Save Q.Save Q.Load Prefs


Fatigue
Brain fog
Bowel movement
Stomach pain
Quality of life
Ferritin
Hemoglobin
Hematocrit
Blood tests
Input
Tracking
Reminders
Oral iron pills
EVERY 2 DAYS - 9:30PM
Data input
EVERY SUNDAY - 6:30PM
IV iron
JULY 15TH - 9:30AM
Dr. Pavenski
JULY 16 - 2:00PM
Appointments
Notification
Sync to calendar
Info center
Without sufficient iron, your red blood cells will get smaller, paler and misshapen. Healthy red blood cells have a donut shape.
Feb 2019
Nov
Jun
Jan 2021
Oral iron was missed constantly causing iron stores to get lower. This made the IDA symptoms worse.
•VIEW DISCLAIMERS
Feb
Mar
Apr
May
Dec
Jan
Brain fog

Yu Xiang Ren

Hi, I'm Ren! I'm an illustrator and designer that specializes in the visual communication of scientific and medical concepts. My area of focus is on patient-oriented healthcare, UX design. I'm passionate about leveraging storytelling, visuals, and informed design to make complex information digestible for anyone.

Editorial Illustration

This journal cover aims to capture the idea of the "humanization of yeast" a process by which human genes are engineered into yeast cells in order to conduct higher fidelity disease modeling.

1. Sketch. Initial thumbnails I used to explore how to best showcase the humanization of yeast in an editorial style.

3. Final illustration. This piece was created using 3D modeling and lighting in *Maya* with editing in *Photoshop*. The human figure was made by freezing the animation of strands of chromosomes.

2. Production process. The final design leverages the chromosomes strands by weaving them into a human figure. With white being the yeast genes and blue being the human genes.

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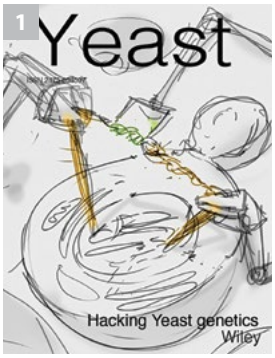

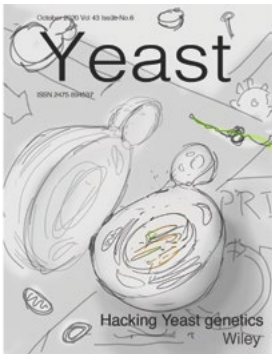

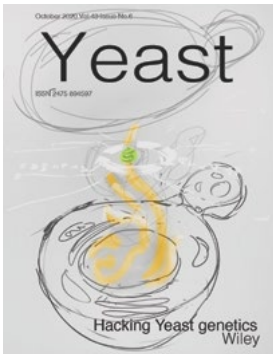

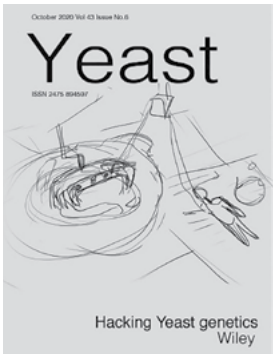

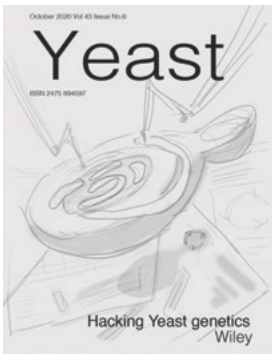

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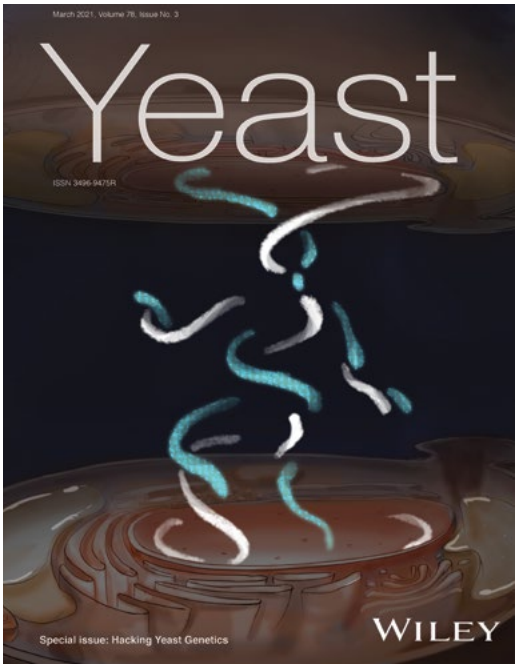

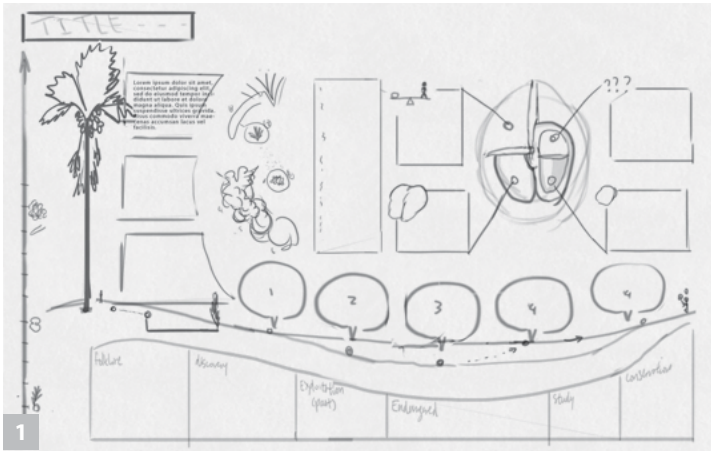

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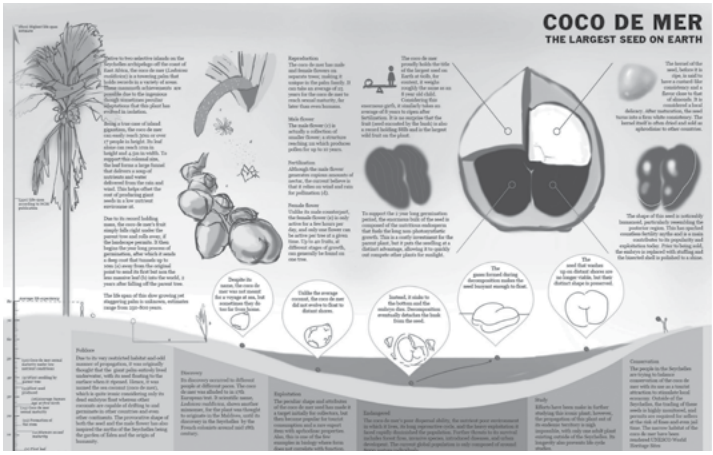

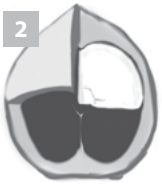

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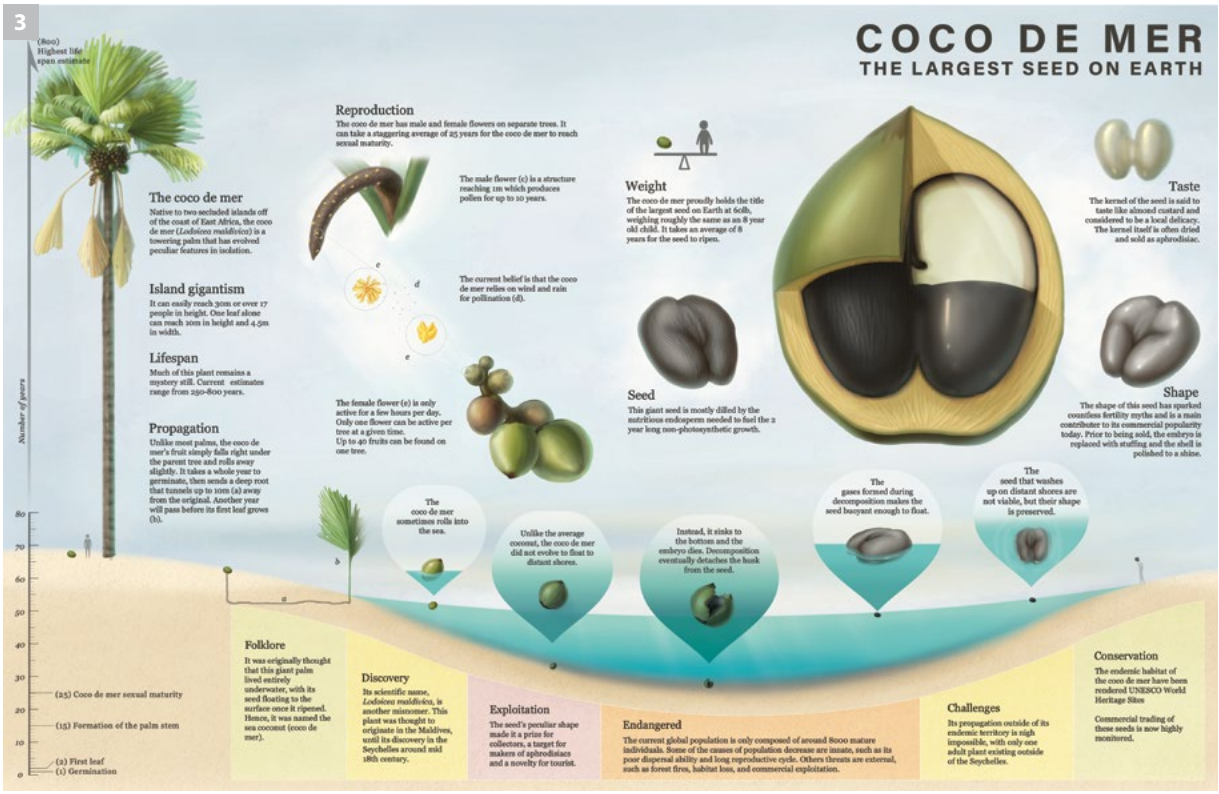


3

Data Visualization

A two-page spread infographic that presents an overview of the largest seed on Earth called 'coco de mer'. The landscape is leveraged and integrated into the storytelling process to highlight its endemic habitat and history.

1. Sketch. I wanted to use the landscape of its habitat to tell the story of its sea voyage and to lead the reader's eye across the page. The curve of the beach was also used to show the highs and lows of its population through history.

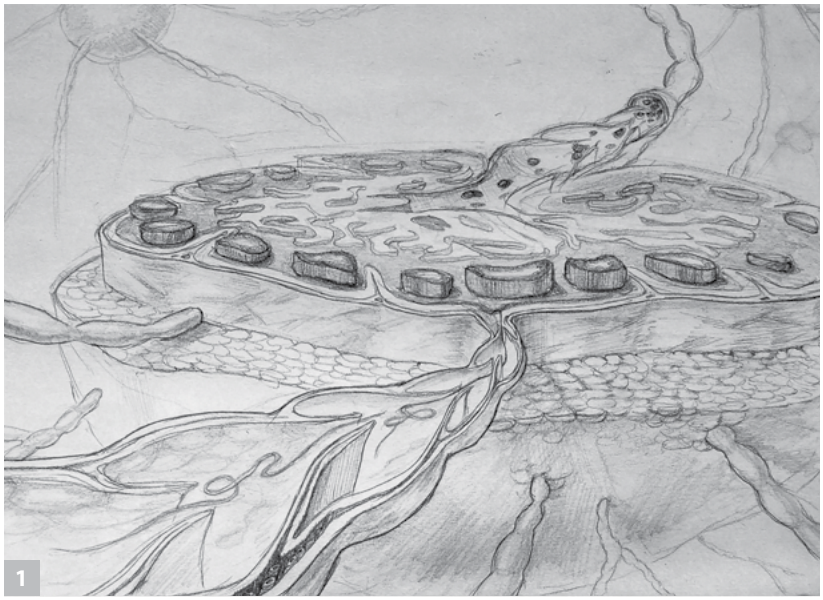
2. Production process. The production workflow I used to render this piece starts with a tonal sketch which is then colour blocked. Basic lighting is then added to ensure proper volume building before the final texture and details are incorporated.

3. Final illustration. Individual renderings share the same lighting conditions to create a unified look. The story flows along the visual elements to create a comprehensive snapshot of what we know about the coco de mer.

Previous spread. Final interactive. This wireframe spread showcases the key screens and visual design of my Master's Research Project: mHealth App for Iron Deficiency Anemia Support.

Pathological Illustration

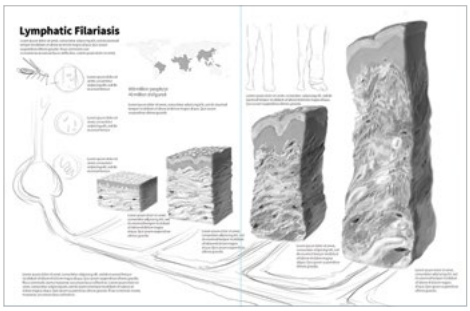
Lymphatic filariasis affects hundreds of millions of people worldwide, but few in North America know of this neglected tropical disease. The goal of this project is to create a comprehensive summary of the disease mechanism, progression, and impact.

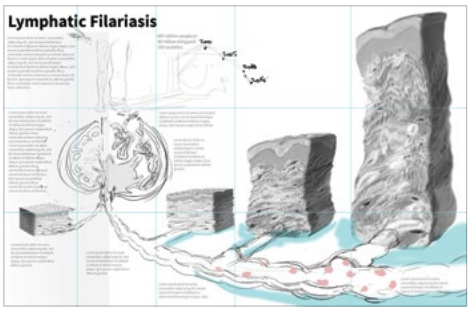

1

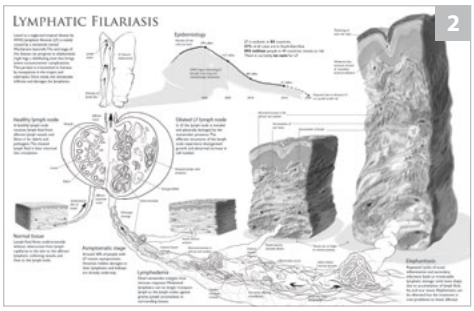
1. Sketch. I used this study to better understand the different layers of the lymph node and the afferent to the efferent flow of the lymph.

2. Sketch. I wanted to convey the growth in tissue height and the obstruction of lymph flow that occurs as the disease progresses.

3. Final illustration. This was designed with the audience's knowledge level in mind by showing the healthy and disease state side by side; this offers a baseline for comparison and teaches the audience the progression of pathology.







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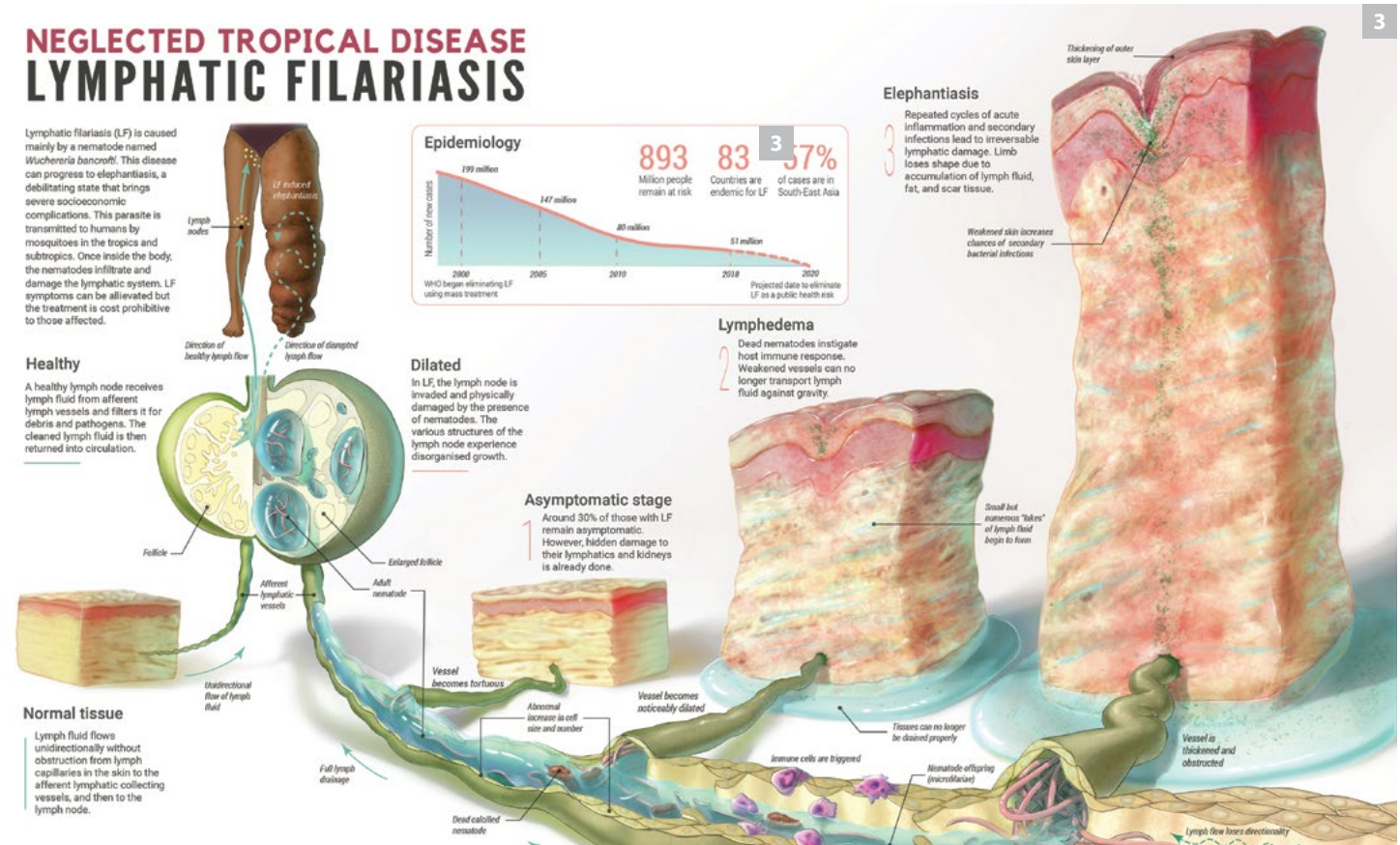


3

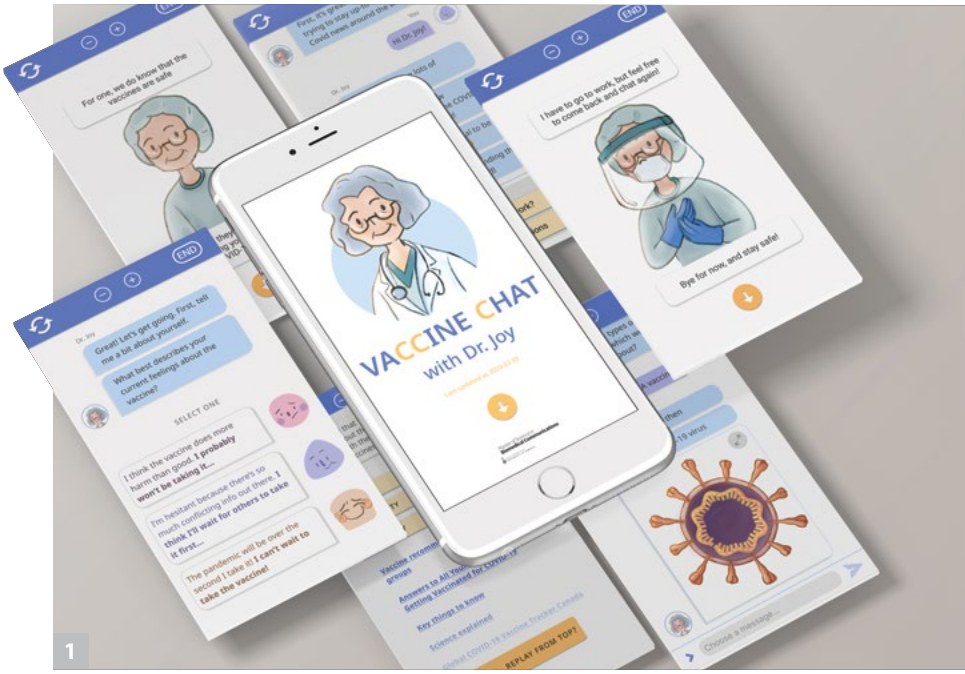
UX/UI Design

Designed with Willow Yang and Chloe Ma, the goal of this interactive project is to address common questions about the COVID-19 vaccine at a high level and to give users curated resources for in-depth learning. The overarching aim is to educate users.

1. Sketch. Picking an appropriate style for lay audience education was an important step of our design. I wanted the visuals to be approachable without being trivializing.

2. Production process. I started with quick ideation sessions that where refined and translated into wireframes. Once the flow was established, a high-fidelity prototype was built as a proof of concept.

3. Final interactive. This project mimics a basic chat application to ease users in the platform from their ubiquitous mobile experiences, thus lowering the barrier of use while increasing engagement.



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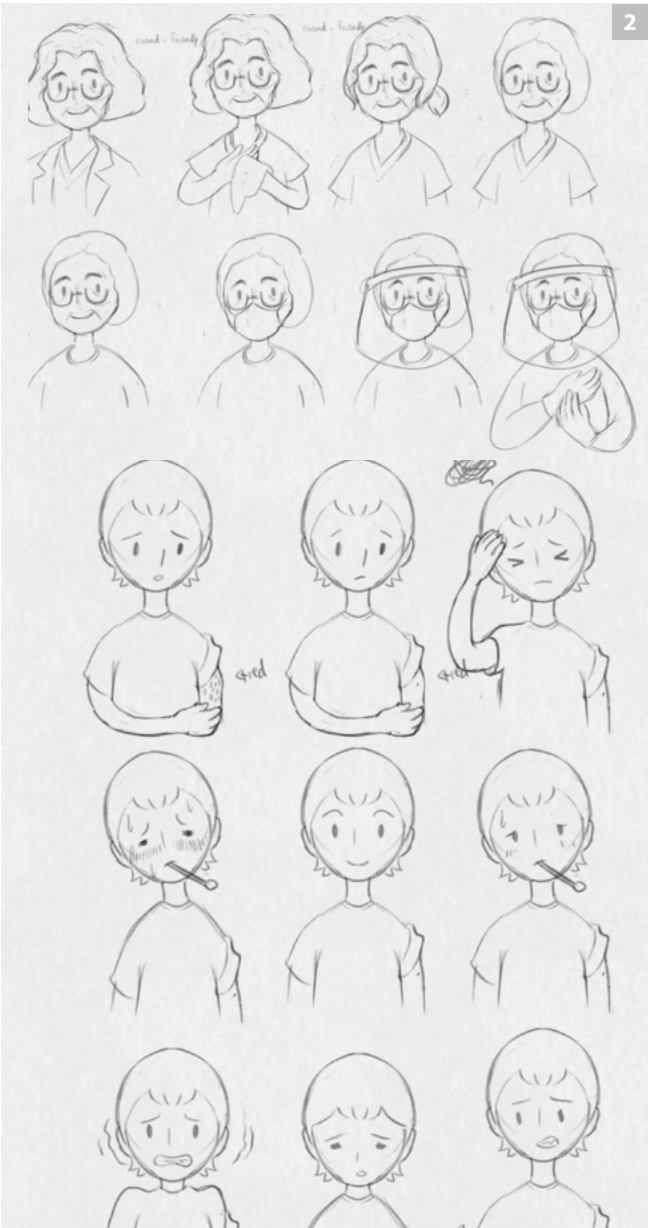
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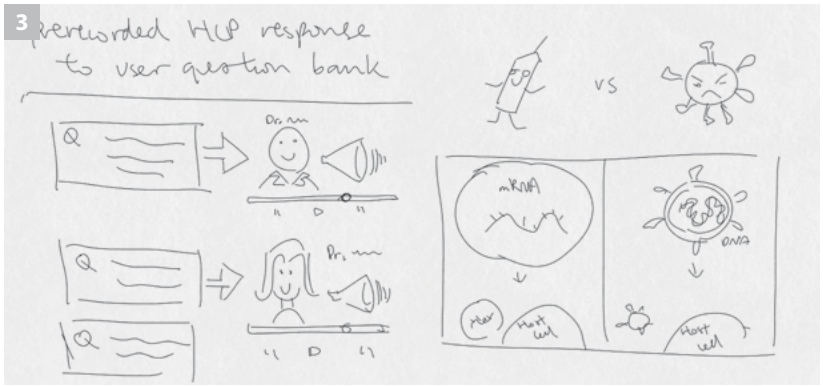

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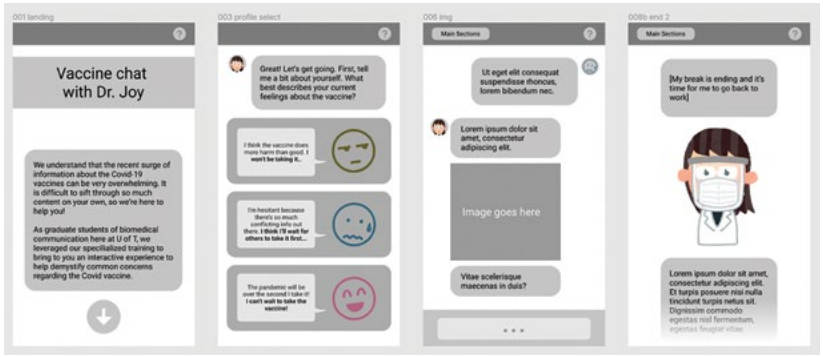
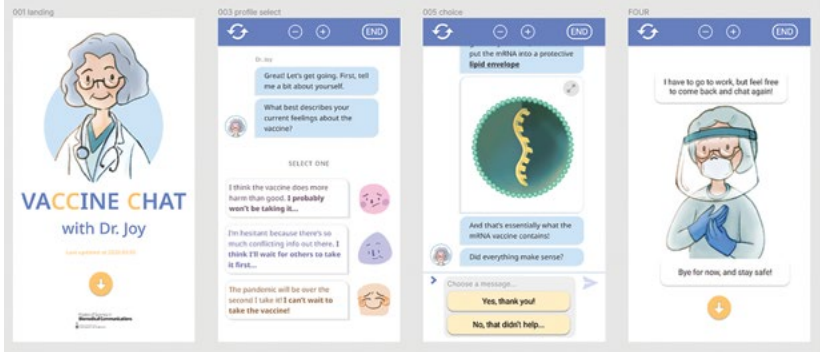
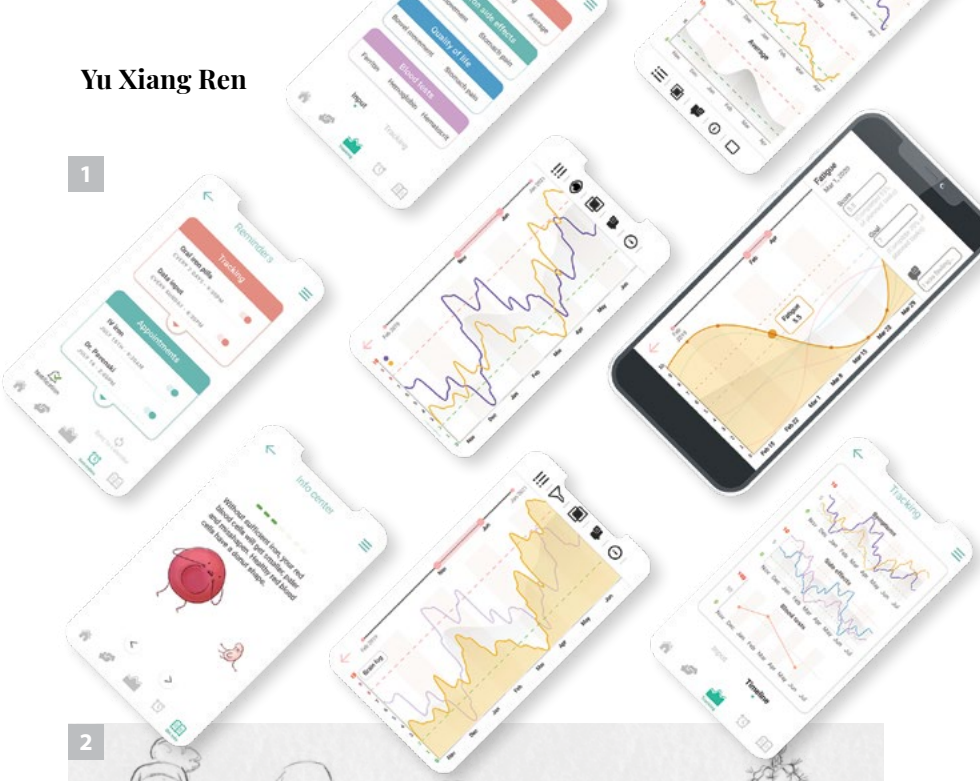




mHealth App for Iron Deficiency Anemia Support

The goals of this Master's Research Project are to explore the design of an iron deficiency anemia (IDA) mHealth app and to help those with IDA track their well-being, learn about their condition, and provide support for their journey to recovery.



1. Final interactive. A mockup of the final design of this mobile app as individual screens. I chose a light and bright colour scheme to establish a lighthearted and hopeful mood.

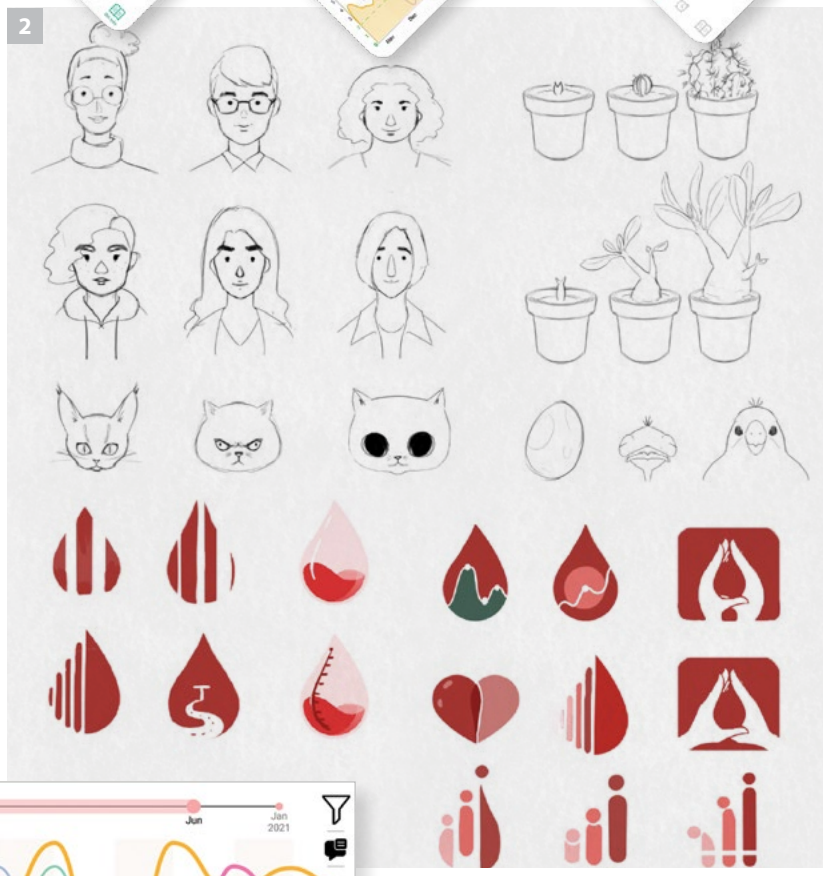
2. Sketch. Visual explorations of characters, iconography, and illustration style. The challenge is to find a distinctive vector style that is both friendly and trustworthy.

3. Production process. The design of this app underwent many cycles of iterations that were informed by committee discussions and user evaluation.

4. Production process. Personas of potential users were built to inform the design process. While the target audience likely has high tech literacy, this app was designed to accommodate all levels of users.

5. UX design. Given that patients with IDA experience brain fog and fatigue, care was taken to reduce the app architecture complexity and to leverage progressive disclosure to minimize information overload.

6. Prototype. An example of the final prototype. This customizable character serves as a guide who helps the user identify problems and directs them into the appropriate education module that can help inform the user.



4

Application

In this section I will show how the critiques and insights from the needs assessments affected the design process. Once the design challenges were clear, exploration and ideation of solutions began. Starting with prioritization of user groups and how their needs might differ.

PRIMARY USER

Brain fog Brittany

Help me help myself

Age 18 | Occupation Student

Cause of IDA

Heavy menstruation and active growth

Tech literacy

Internal motivation

English literacy

Goals

- Noting down health history or relevant events before forgetting or losing focus
- To have external pressure to keep up good IDA habits
- Being able to answer the doctor's questions with concrete information rather than vague recollections

SECONDARY USER

Proactive Paula

Give me an IDA assistant

Age 45 | Occupation Sales Manager

Cause of IDA

Bleeding disorder

Tech literacy

Internal motivation

English literacy

Goals

- Have a quick and easy way to jot down health history, journaling takes too long
- To be reminded of medication and appointment times when life gets too busy

TIERTIARY USER

Tenacious Thea

I can do this myself

Age 65 | Occupation Recent retiree

Cause of IDA

Cancer therapy side effects

Tech literacy

Internal motivation

English literacy

Goals

- Gain autonomy and self-confidence by learning and caring for her own health
- Learn relevant information at her own pace and overcome the language barrier

5

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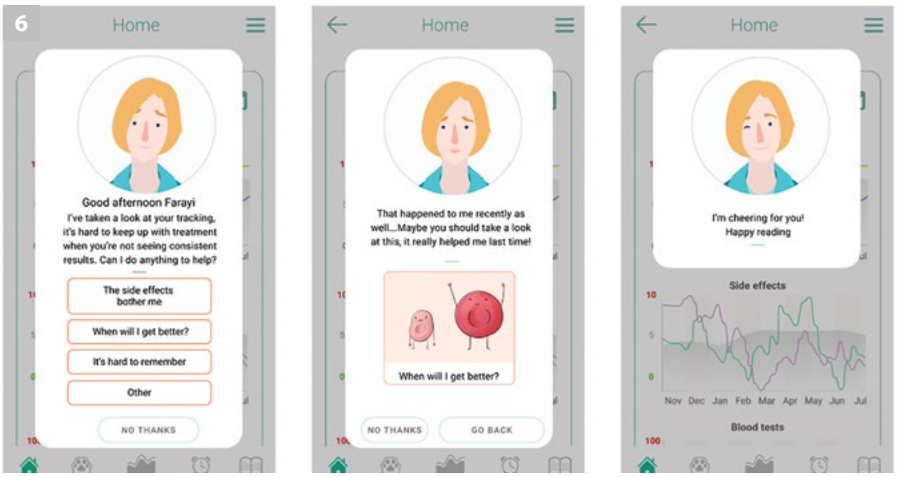

Acknowledgments

Four years ago when I began my time in the BMC program, the Viewbook was only an idea in the mind of its creator (and our original Head Media Editor), Geoffrey Cheung. During my time at BMC and now, during the first few years of my post-BMC life, I've been privileged to see the Viewbook evolve from a nascent idea into a tradition that celebrates the hard work and inspired accomplishments of BMC graduates.

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– Alexander Young

"... Now is the time to understand more, so that we may fear less."

— Dr. Marie Curie

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