Master of Science in Biomedical Communications
Viewbook 2022

“How often people speak of art and science as though they were two entirely different things, with no interconnection. That is all wrong. The true artist is quite rational as well as imaginative and knows what he is doing; if he does not, his art suffers.... ”

MScBMC
Viewbook 2022

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Showcasing work by the graduating class of 2022 from the Master of Science in Biomedical Communications at the University of Toronto

Edited by Alexander Young, Nitai Steinberg, Shirley Long, and Tracy Xiang
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Foreword

With the publication of the fifth annual MScBMC Viewbook, we celebrate the achievements of the BMC graduating class of 2022.

The class of 2T2 entered the MScBMC program in the fall of 2020. It was a challenging time to begin graduate studies and a unique moment in the history of the program. The first wave of widespread COVID-19 infection was slowly and steadily declining in Ontario, but fears of future, larger waves were growing. We had no vaccines, and uncertainty about when they might be available. The class of 2T2 had no access to the campus's physical spaces like classrooms and labs; bedrooms, home offices, and dining room tables replaced them. All lectures, labs, and orientation activities had to be delivered online. Human anatomy—traditionally the first course MScBMC students are exposed to—had to be moved back four months and fingers were crossed in hopes that some in-person instruction might be able to begin again in the winter term. To start their graduate studies under such difficult circumstances must have been very challenging, but you wouldn't have known it by watching this talented, determined group forge ahead.

Over the 18 months of online instruction and the six hybrid months that followed, the BMC class of 2T2 electrified us with their creative energy, spectacular visual media, professionalism, empathy, and humility. We know it must have been hard, but you made it look easy, class of 2T2.

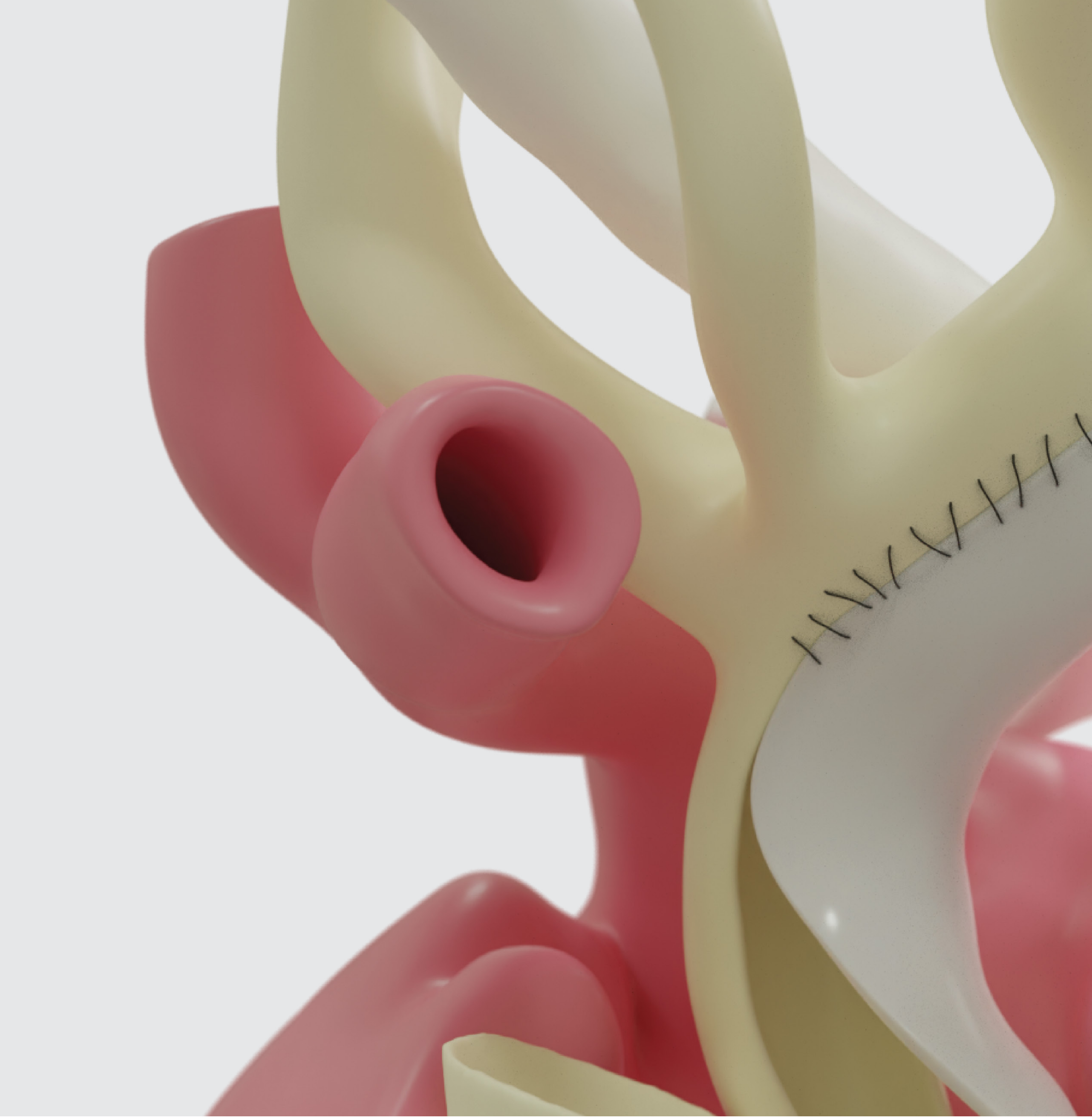
This Viewbook is filled with the exceptional work of an exceptional group of students. It is filled with the final output of many courses (17 in all) and a Master's Research Project (MRP). What does not appear in these pages are accounts of the countless hours spent on research and learning new technologies and the lengthy iterative process of design and redesign employed to reach such beautiful visual communication solutions. We see them and appreciate how hard you have all worked.

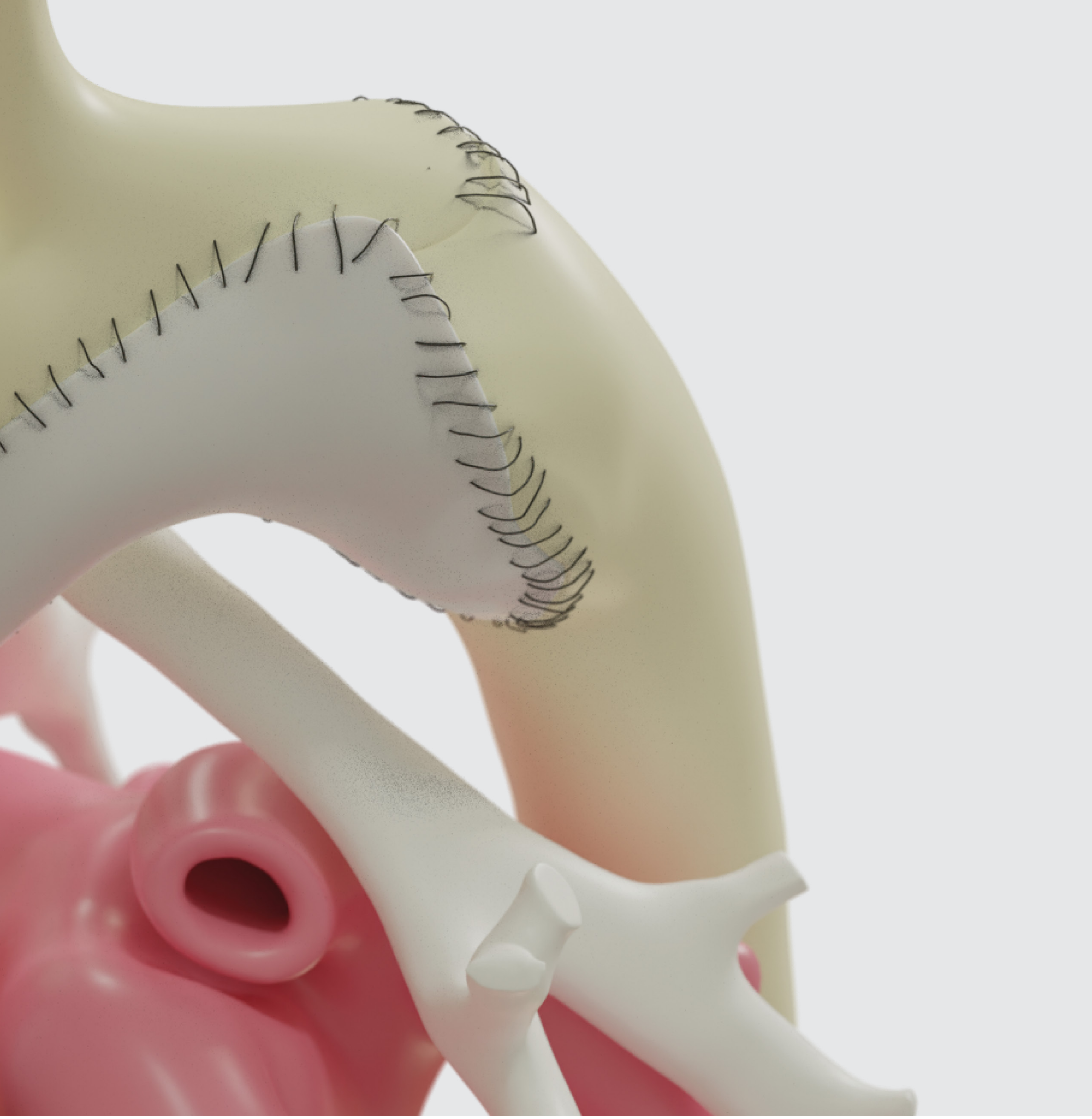
We are also very thankful for the amazing community of alumni that is the BMCAA. Your continued efforts to bring our community of practice together, especially during these difficult two years, is so appreciated. In particular, we'd like to thank the BMCAA Viewbook Team, led by Alex Young, for volunteering their time to design and assemble this gorgeous book.

We are so proud of the class of 2T2 and all they have accomplished. We feel blessed to have had the opportunity to teach and learn from such wonderful people in such a challenging time. In an era when the effective communication of science has never been more important, we feel hopeful knowing that the MScBMC class of 2T2 will bring their immense talents to this endeavour.

— Jodie Jenkinson and Michael Corrin, October 2022

Legend





Abeeshan Selvabaskaran

Hi! I am a biomedical storyteller based in Toronto, Canada. The world of science and research can seem overly complex, but communicating scientific stories is more important than ever before. In my work, I try to use visual narratives to take you into an entirely new world that can inspire imagination and new ideas. I'm a 3D specialist but am always interested in learning and trying new things that show an innovative and entertaining approach to storytelling.

Graphic Medicine

This was a short comic on the experience of burnout from the perspective of a white-collar worker. We follow his journey as he becomes engulfed by his burn-out monster, leading him to a dark depression. This comic heavily relies on the use of visual metaphors and striking imagery to portray the anxiety and anguish our main character goes through.

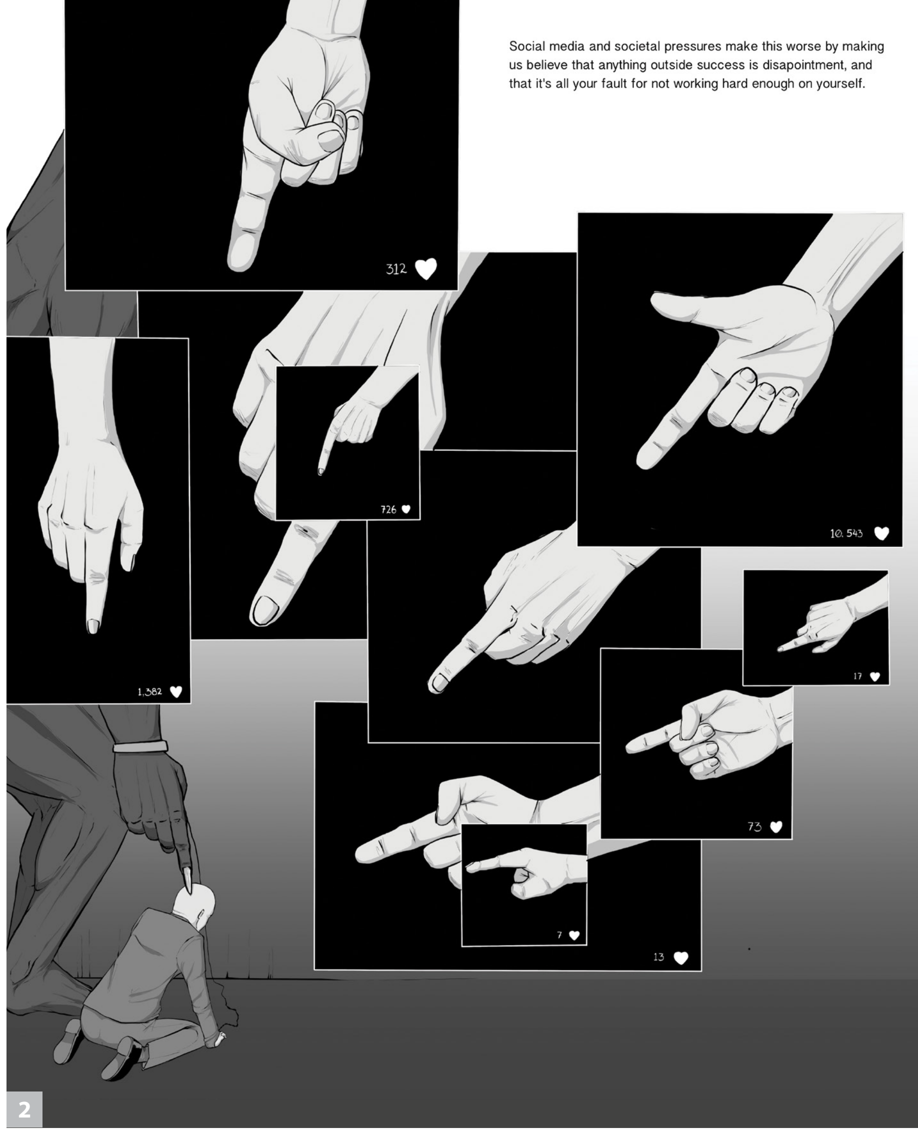
1. Notes and sketch. The script and character sketches were the heart of the storytelling process. It was extremely important that the script was medically accurate regarding common symptoms and feelings of burnout while giving me the liberty to exercise my creative freedom with visual metaphors.

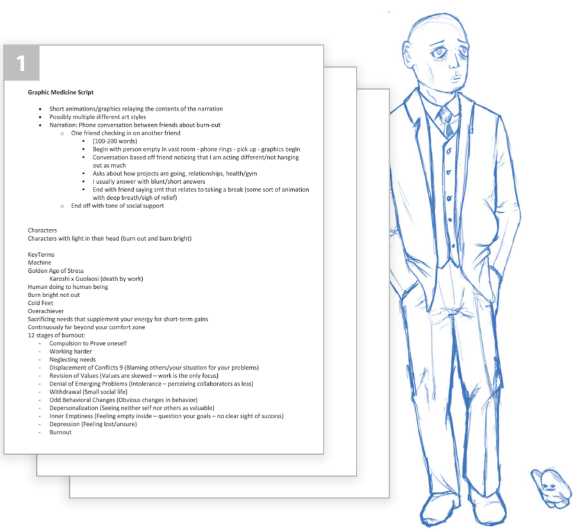
2. Final illustration. Final renders were done in a manga-inspired style using *Procreate*.

3. Sketch. Initial sketches were extremely rough to get an idea for the flow of the story, which was more or less retained for the final piece.

4. Production process. Full production process (left to right) from sketches, to line work, to block out, and final rendering.

Previous spread. A closeup of an animation still from my MRP.



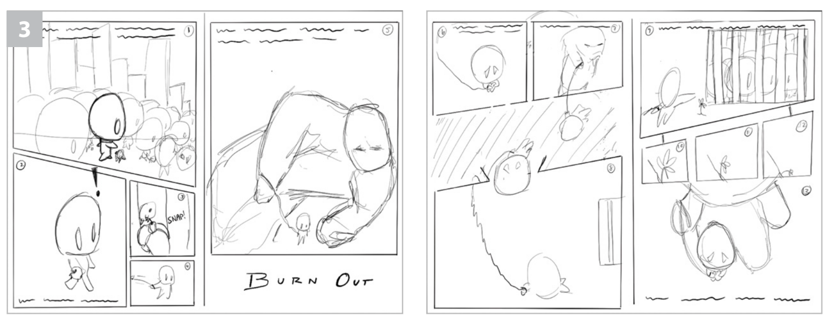


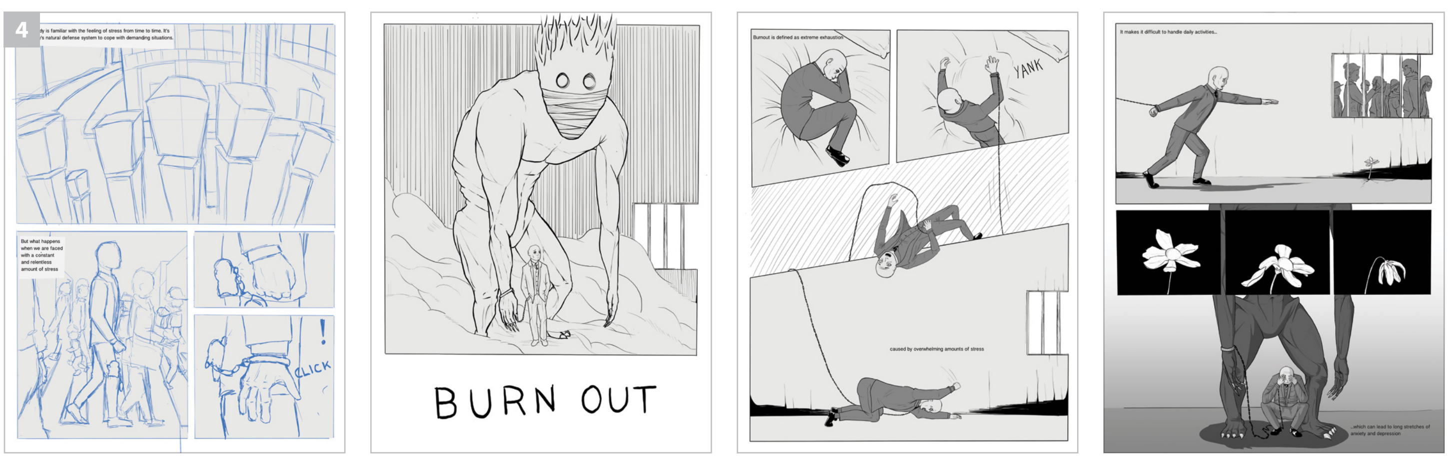
Graphic Medicine Script

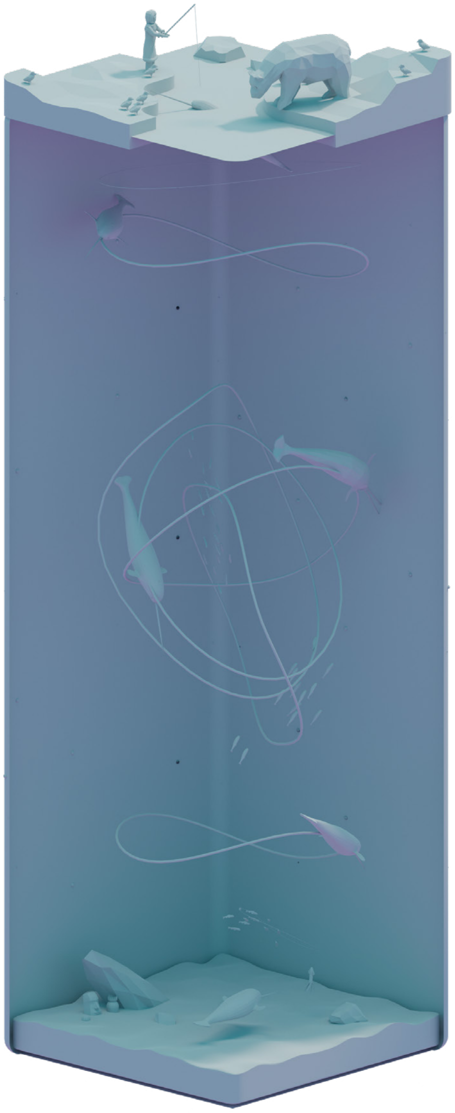
- Short animations/graphics relaying the contents of the narration
- Possibly multiple different art styles
- Narration: Phone conversation between friends about burn-out
    - One friend checking in on another friend
        - (100-200 words)
        - Begin with person empty in vast room - phone rings - pick up - graphics begin
        - Conversation based off friend noticing that I am acting different/not hanging out as much
        - Asks about how projects are going, relationships, health/gym
        - I usually answer with blunt/short answers
        - End with friend saying smt that relates to taking a break (some sort of animation with deep breath/sigh of relief)
    - End off with tone of social support

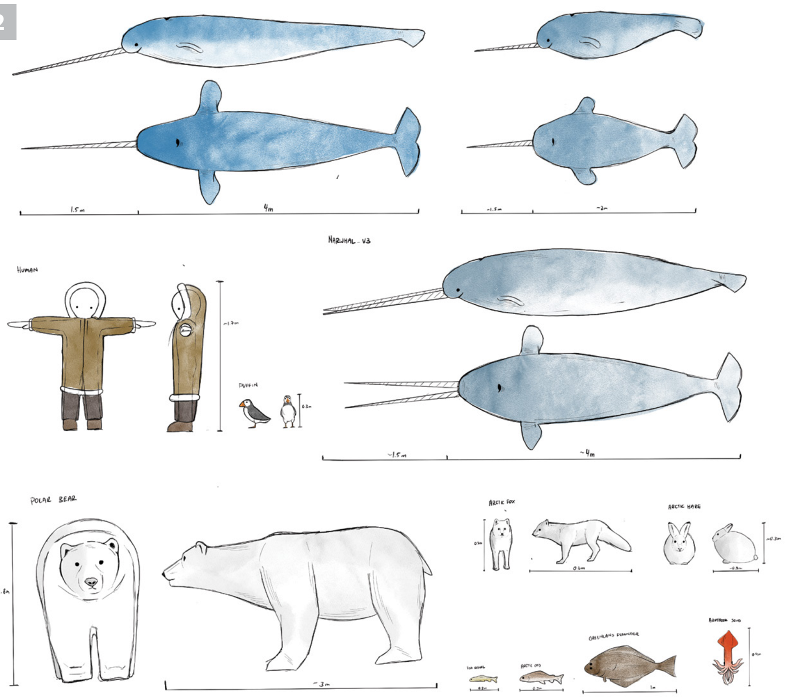
Characters
Characters with light in their head (burn out and burn bright)

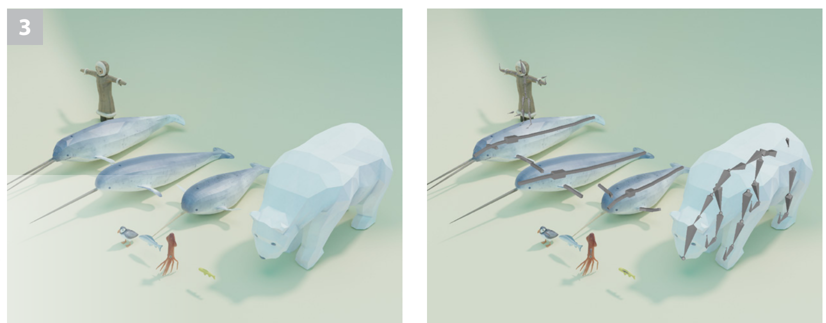
KeyTerms
Machine
Golden Age of Stress
Karoshi x Guolaosi (death by work)
Human doing to human being
Burn bright not out
Cold Feet
Overachiever
Sacrificing needs that supplement your energy for short-term gains
Continuously far beyond your comfort zone
12 stages of burnout:
- Compulsion to Prove oneself
- Working harder
- Neglecting needs
- Displacement of Conflicts 9 (Blaming others/your situation for your problems)
- Revision of Values (Values are skewed – work is the only focus)
- Denial of Emerging Problems (Intolerance – perceiving collaborators as less)
- Withdrawal (Small social life)
- Odd Behavioral Changes (Obvious changes in behavior)
- Depersonalization (Seeing neither self nor others as valuable)
- Inner Emptiness (Feeling empty inside – question your goals – no clear sight of success)
- Depression (Feeling lost/unsure)
- Burnout











Interactive Animation

Whale Box is an interactive educational web experience that lets users explore the social and physical characteristics of different whales. Created as a group project, we focused on a narwhal module and created a lively environment with animated 3D models and 2D graphics intended for wildlife conservation outreach and education.

1. 3D modelling. A 3D clay render created in *Blender* showing the lighting and animation paths of each animal in Whale Box.

2. Sketch. To ensure anatomical accuracy, orthographic character sketches were created for each animal model for reference during the modelling process.

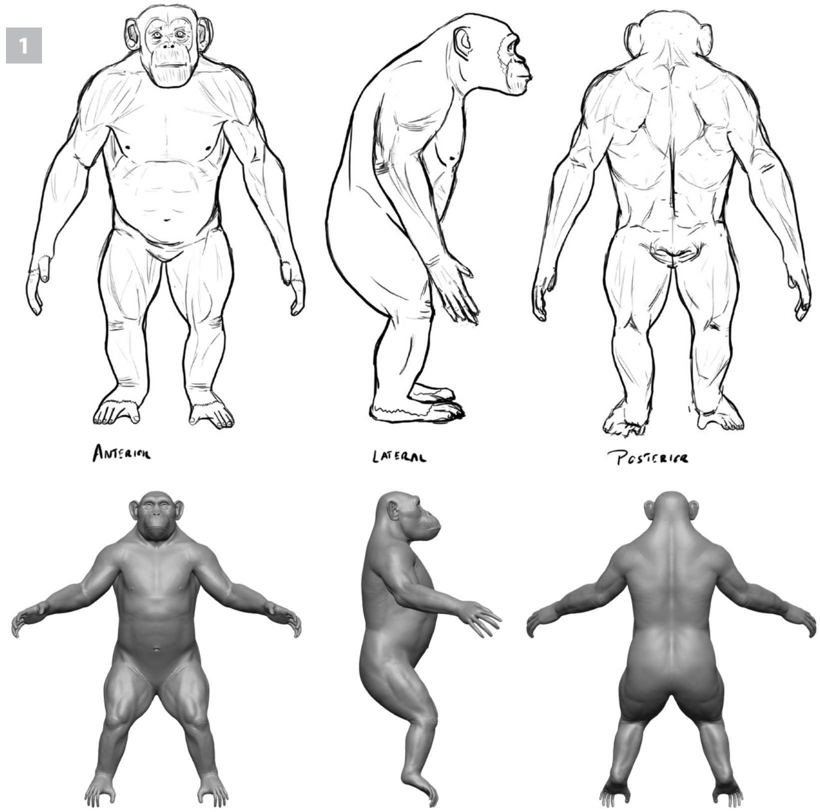
3. Production process. Models were created in *Blender* with a low-poly style, and each animal was individually rigged and animated to loop throughout the interactive walkthrough.

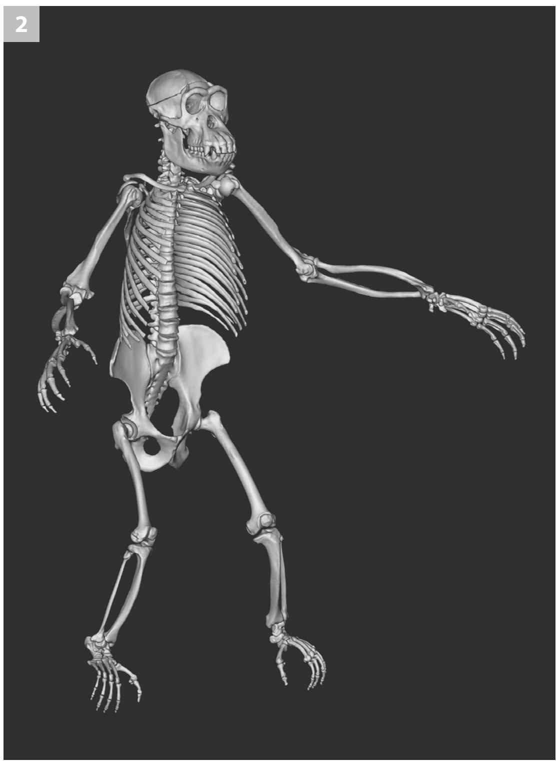
4. Final interactive. The final interactive piece was developed in *Unity*.

5. The Team. This was a 7-person collaborative project that wouldn't have been possible without these amazing people (Top left to bottom right: Jenn Shao, Shay Saharan, Amy Ke Er Zhang, Abeeshan Selvabaskaran, Viktoriya Khymych, Aimy Wang, Amy Assabgui).

3D Modelling and Editorial Illustration

The objective of these projects was to create complex 3D models with realistic texturing and lighting. My common chimpanzee sculpt (shown left) involved creating an animation-ready model, hair system, and skeletal rig. For my mock *Nature* cover (shown right), I visualized the research findings of *Riglar et al.*, which discuss how engineered probiotics offer a novel approach for non-invasive diagnostic and therapeutic tools in the gut.



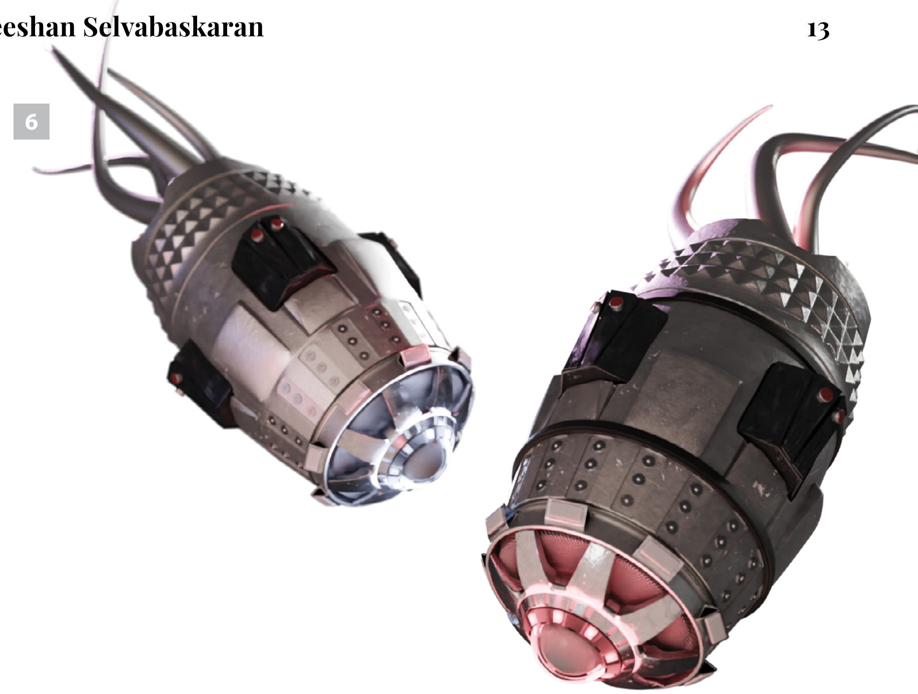


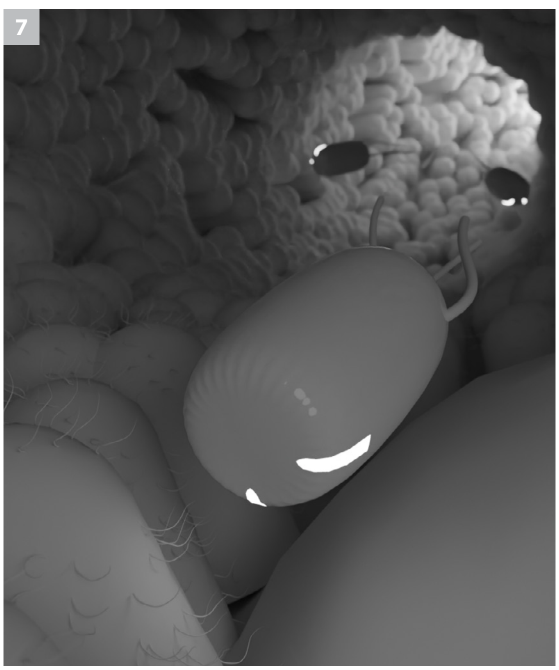
1. Production process. Orthographic sketches were used to help sculpt the chimpanzee, along with references for proportions, facial details, fingers, toes, and correct topological flow.

2. 3D modelling. A fully modular and anatomically-accurate skeleton was created based on several DICOM datasets obtained from the Kyoto University Primate Research Institute's (KUPRI) Digital Morphology Museum (DMM).

3. Final illustration. A final mock layout was created to present the chimpanzee sculpt in a magazine as a fold-out article.

4. Final illustration. Front view render of the final sculpt.





5. Sketch. Based on discussions with my peers, I combined aspects of three rough concept sketches to create a full comprehensive sketch (bottom right).

6. 3D modelling. Meticulous detail was put into the texture and design of the robotic bacteria to give them a high-tech, futuristic look while communicating that they were designed to search.

7. Production process. A rough 3D blockout in *Blender* ensured the layout was correct before modelling and texturing.

8. Final illustration. The final illustration was created with a combination of *ZBrush* (environment sculpting), *Blender* (hard-surface modelling), and *Maya* (rendering).

E-Learning Resources for Congenital Heart Disease

Surgical training resources for congenital heart disease (CHD) treatment are currently limited and require additional attention. This project aimed to create additional learning materials for the CHD surgical training of post-graduate medical students, primarily through animation and an interactive 3D web viewer.

1. UX design. The initial rough concept design of the interactive app was used to get a sense of what items would be important to include and how they could be implemented.

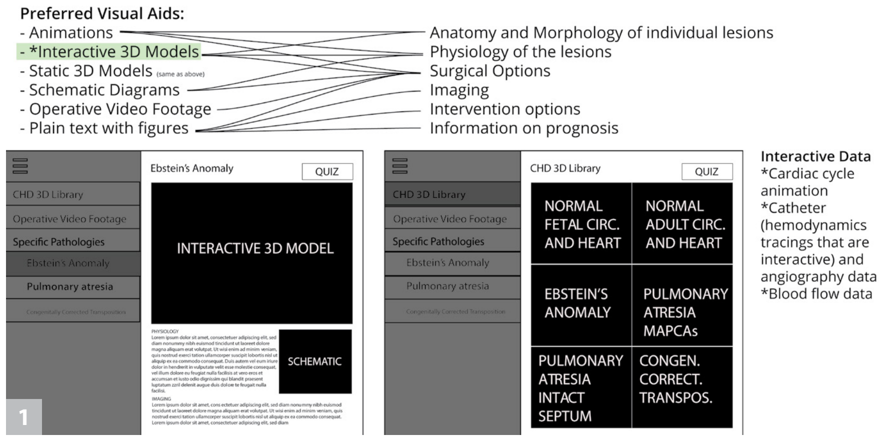
2. Study. A needs assessment survey was conducted with 22 medical professionals at SickKids hospital. One of the key takeaways from this survey was that animations and digital interactive 3D models were the preferred visual aids for this audience.

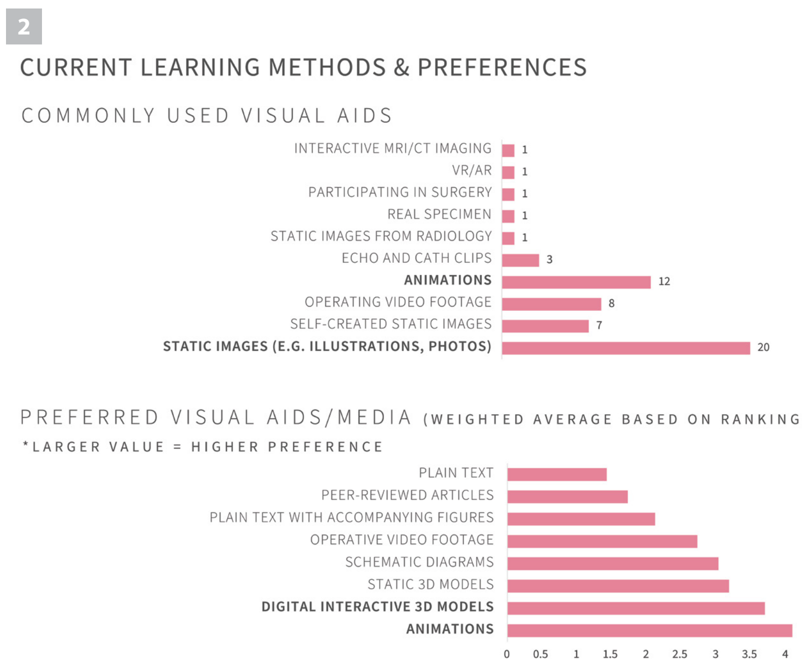
3. UX design. User personas were created for the interactive component based on the surveyed demographic: the perspective of a student and a senior attending physician.

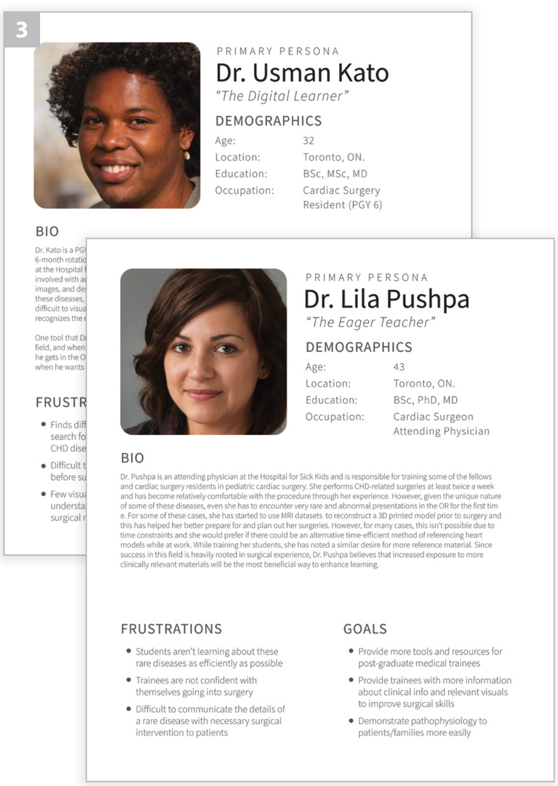
4. UI design. A minimal UI was implemented to avoid unnecessary clutter and allow surgeons to quickly learn about surgical procedures.

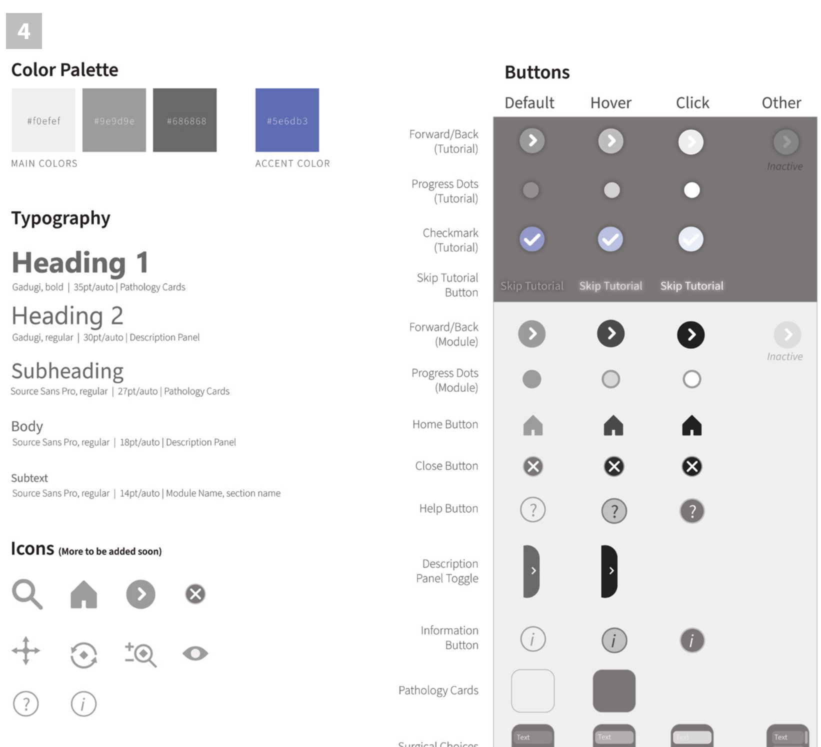
5. Final animation. An animation was created for the Norwood procedure in Hypoplastic Left Heart Syndrome (HLHS) using a combination of video footage and 3D animation.

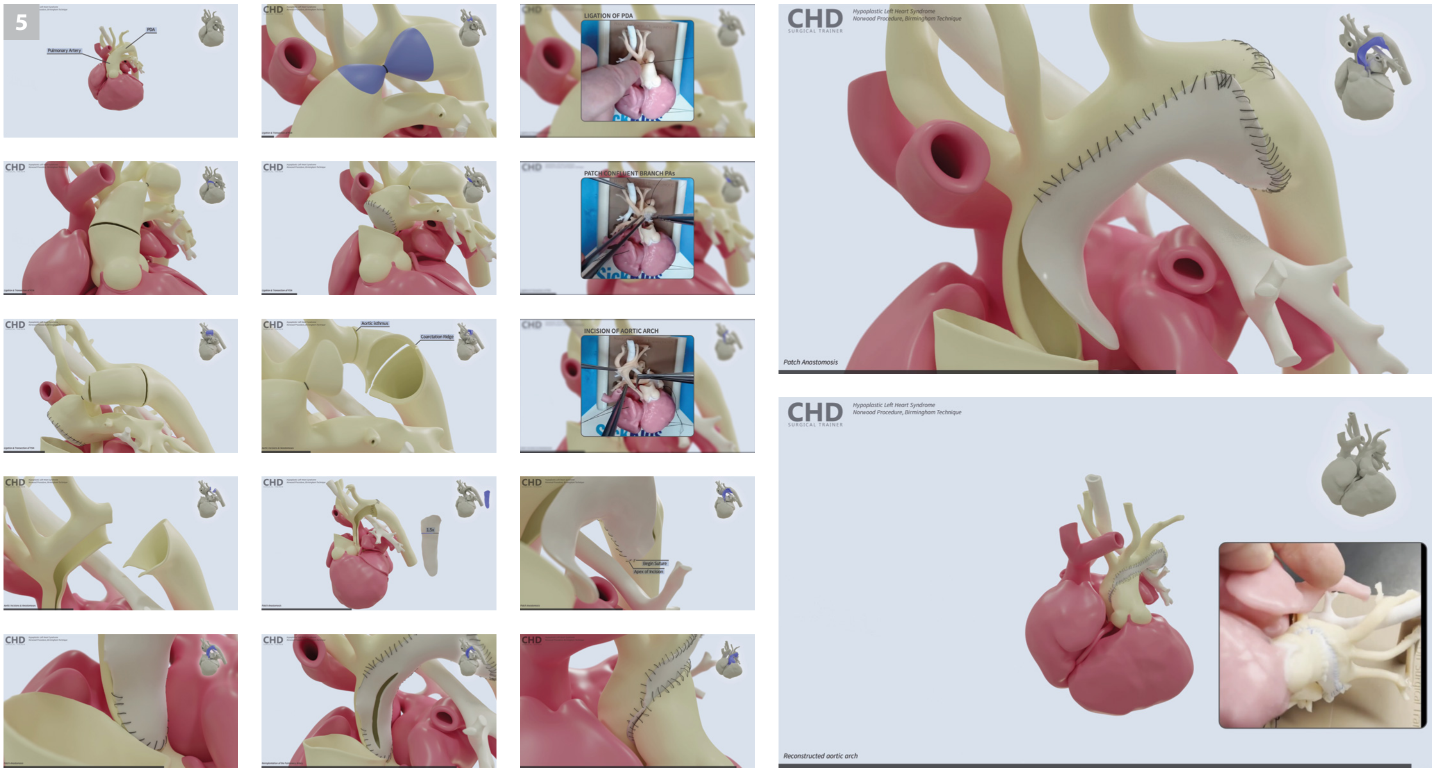
6. Final interactive. The content of the modules was based on the animation and allowed users to explore the 3D heart model at their own pace. It functions similarly to a scrollytelling platform.

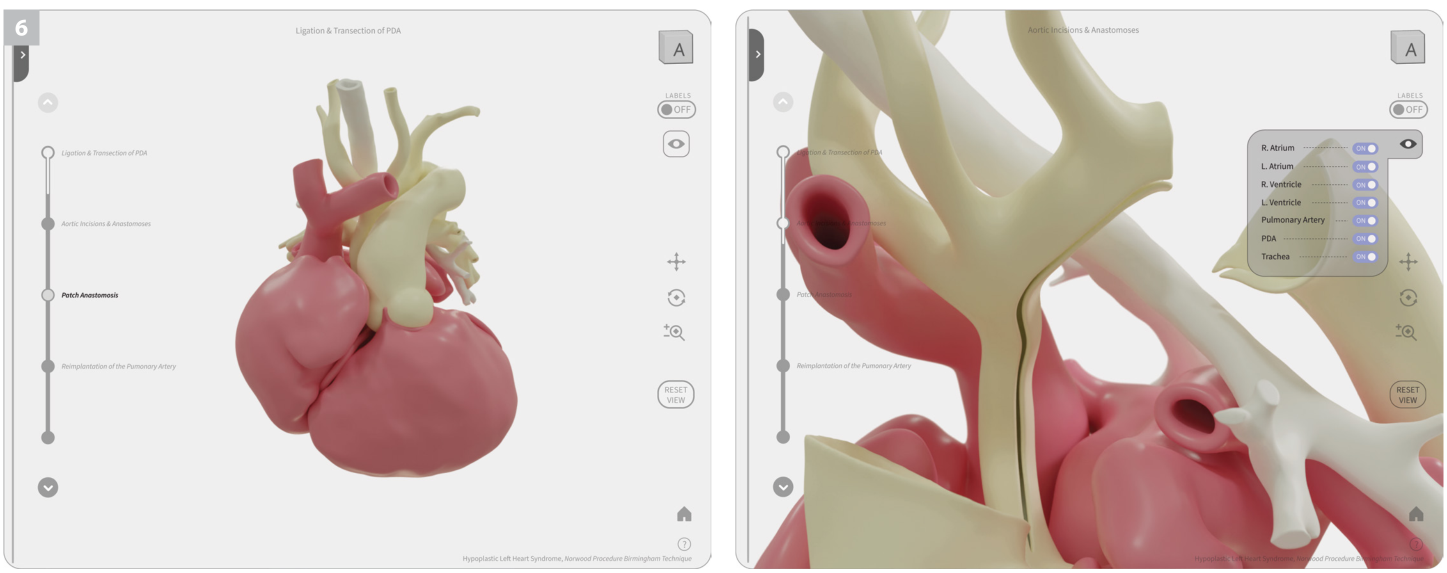


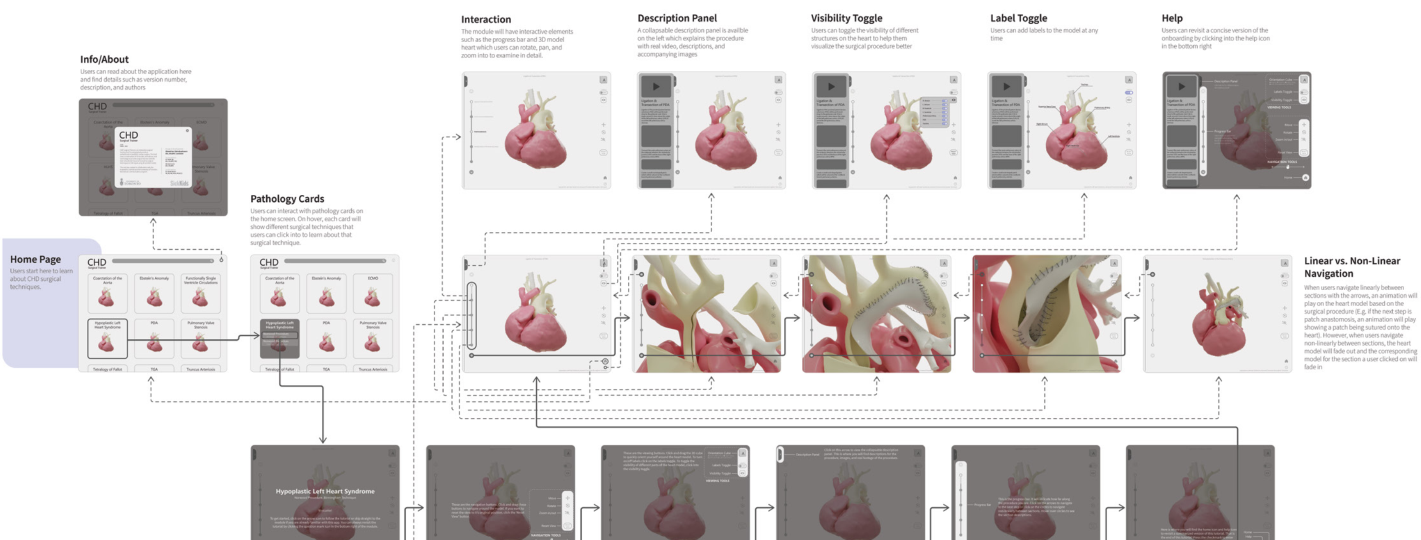






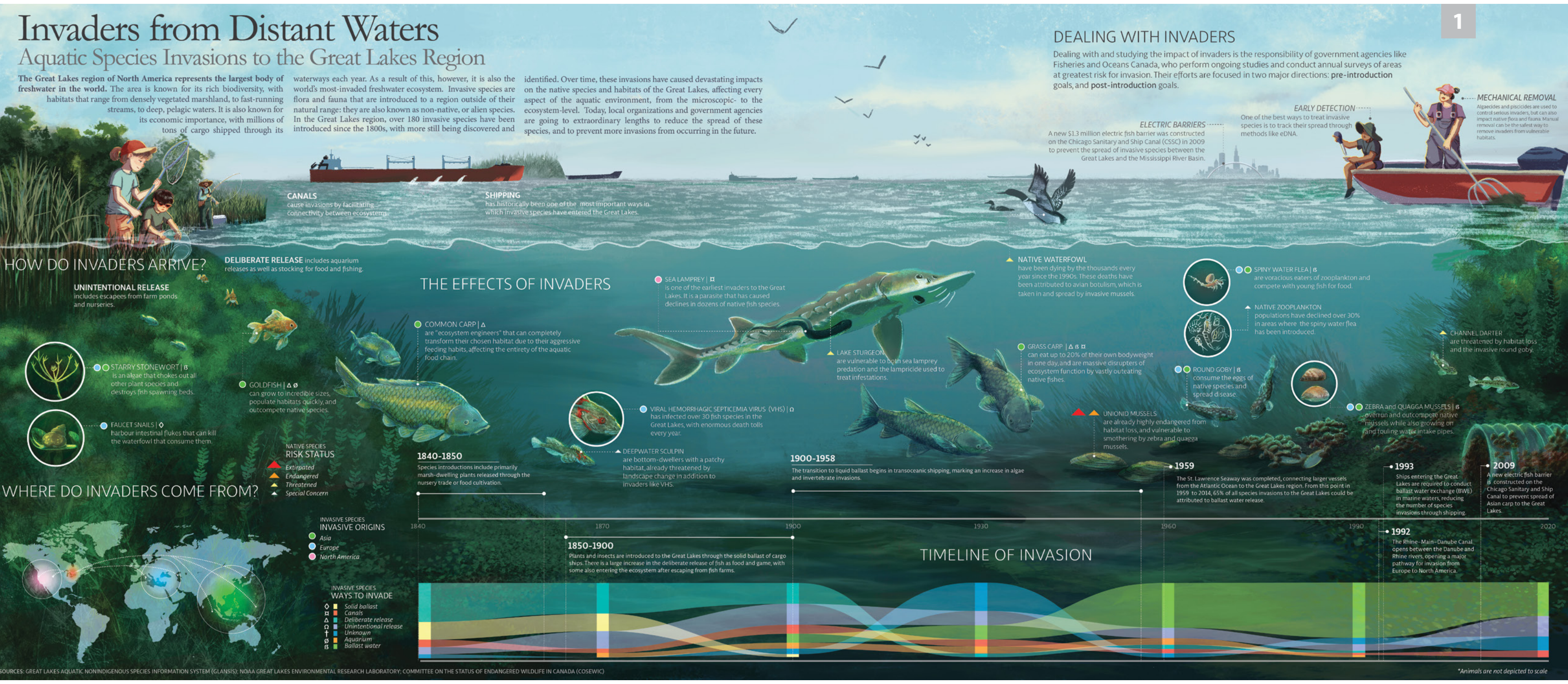

5
CHD
SURGICAL TRAINER
Hypoplastic Left Heart Syndrome
Norwood Procedure, Birmingham Technique
LIGATION OF PDA
PATCH CONFLUENT BRANCH PAs
INCISION OF AORTIC ARCH
Patch Anastomosis
Reconstructed aortic arch

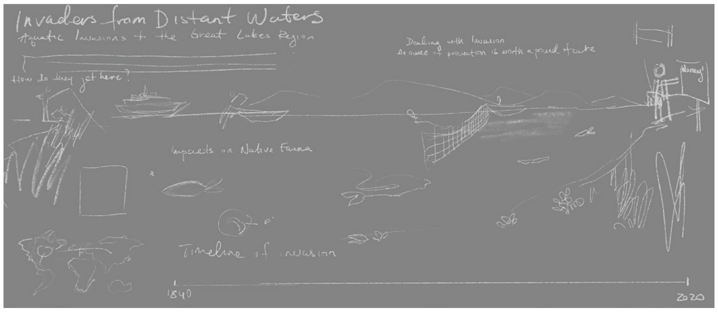

6
Ligation & Transection of PDA
Aortic Incisions & Anastomoses
Patch Anastomosis
Reimplantation of the Pumonary Artery
LABELS
OFF
RESET VIEW
Hypoplastic Left Heart Syndrome, Norwood Procedure Birmingham Technique
R. Atrium
L. Atrium
R. Ventricle
L. Ventricle
Pulmonary Artery
PDA
Trachea

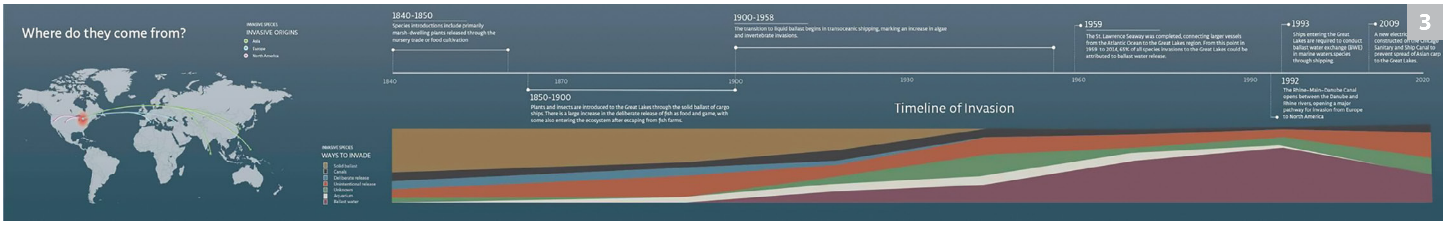

Interaction
The module will have interactive elements such as the progress bar and 3D model heart which users can rotate, pan, and zoom into to examine in detail.
Description Panel
A collapsable description panel is availble on the left which explains the procedure with real video, descriptions, and accompanying images
Visibility Toggle
Users can toggle the visibility of different structures on the heart to help them visualize the surgical procedure better
Label Toggle
Users can add labels to the model at any time
Help
Users can revisit a concise version of the onboarding by clicking into the help icon in the bottom right
Info/About
Users can read about the application here and find details such as version number, description, and authors
Pathology Cards
Users can interact with pathology cards on the home screen. On hover, each card will show different surgical techniques that users can click into to learn about that surgical technique.
Home Page
Users start here to learn about CHD surgical techniques.
Linear vs. Non-Linear Navigation
When users navigate linearly between sections with the arrows, an animation will play on the heart model based on the surgical procedure (E.g. if the next step is patch anastomosis, an animation will play showing a patch being sutured onto the heart). However, when users navigate non-linearly between sections, the heart model will fade out and the corresponding model for the section a user clicked on will fade in
Hypoplastic Left Heart Syndrome

Aimy Wang

Before embarking on my journey into illustration and design, I worked as a field assistant in an ecology lab, investigating the impacts of invasive species and microplastic pollution across North America. I became inspired to pursue a career that allows me to use my skills in art to further science communication among disparate communities.







Information Visualization

Invasive species pose a major risk to the vibrant biodiversity of the Great Lakes ecosystem, causing habitat loss, proliferation of disease, and major declines in native organisms. I created this infographic as an introduction to the history, origin, and impact of non-native species in the Great Lakes region.

1. Final illustration. The final infographic was painted with a focus on the diverse underwater ecosystem of the Great Lakes, and to show how species invasions can be both insidious and difficult to detect.

2. Sketch. The sketch and painting process involved meticulous planning of text and figure elements to integrate with the painted backdrop.

3. Production process. The timeline graphic went through several revisions before the Sankey-like chart was finalized. A main consideration included maintaining a central focus on the ecosystem rather than the overlaid graphical elements.

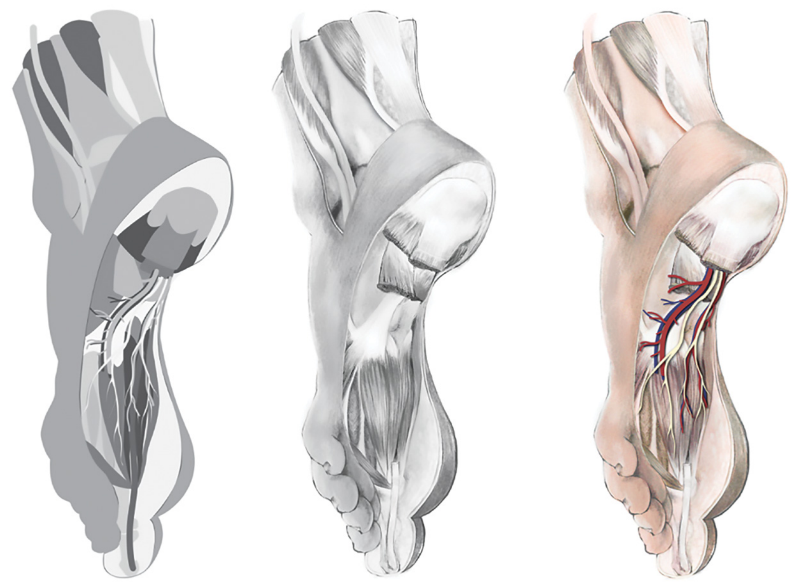
Previous spread. A close-up of the final infographic.

Anatomical Illustration

This illustration depicts the muscles, vessels, and nerves present in the third and fourth layers of the foot, with cutaways to contextualize the anatomy. It was created to demonstrate relationships between tissues that are difficult to depict with classical views.

1

2



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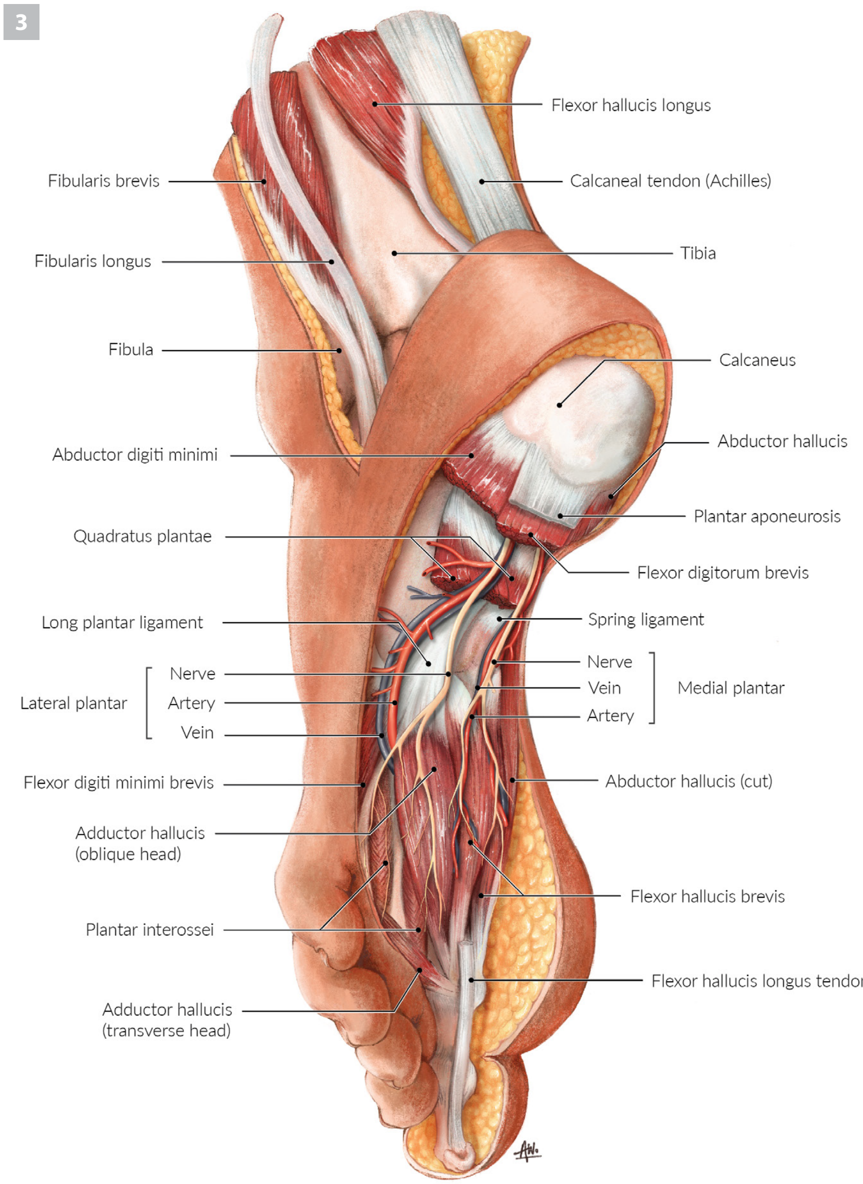


1. Sketch. Different views of the foot were rapidly sketched from live references, with a focus on non-traditional viewpoints. Once the final pose was selected, tissue layers were overlaid to understand the underlying anatomy.

2. Production process. The sketch was refined and taken to an anatomist, who was consulted for structural accuracy. Structures were outlined and refined in *Illustrator* prior to rendering.

3. Final illustration. The final illustration was completed with a focus on the deep layers of the sole. My primary consideration was balancing the visibility of vessels and nerves with the relative positions of different muscle groups.

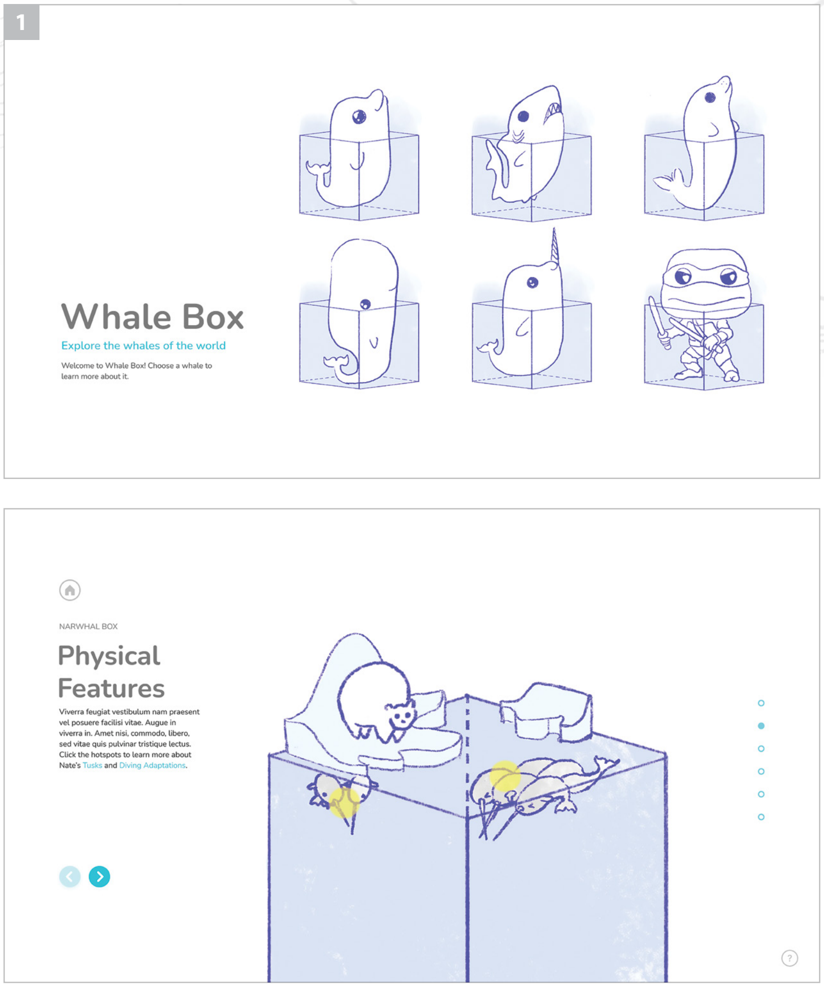
Interactive Animation

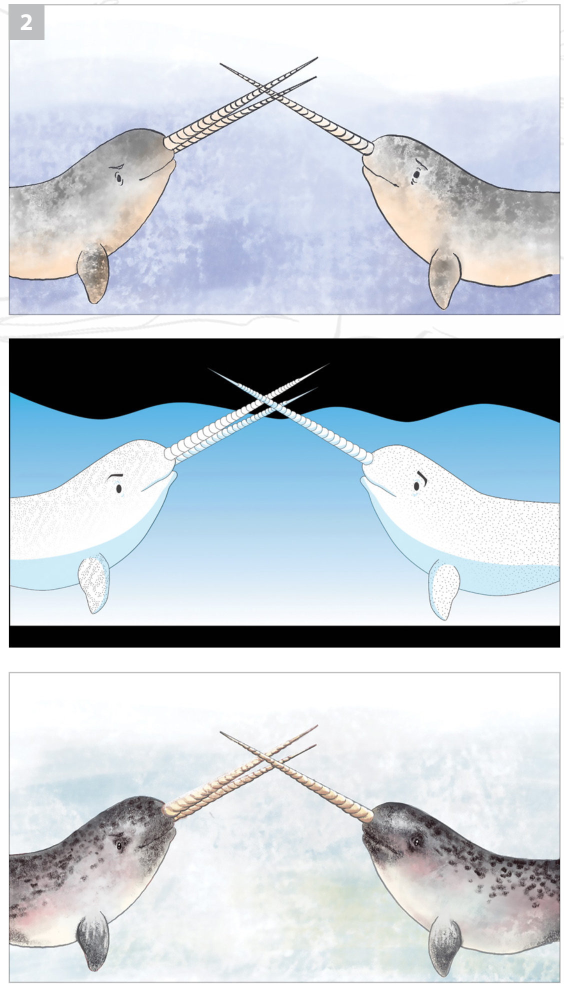
Whale Box is a web-based interactive module designed for exploration and learning about the physical and social characteristics of the narwhal. It is designed for wildlife conservation outreach and education. This was created as a group project in partnership with Jenn Shao, Shay Saharan, Amy Ke Er Zhang, Abeeshan Selvabaskaran, Viktoriya Khymych, and Amy Assabgui.

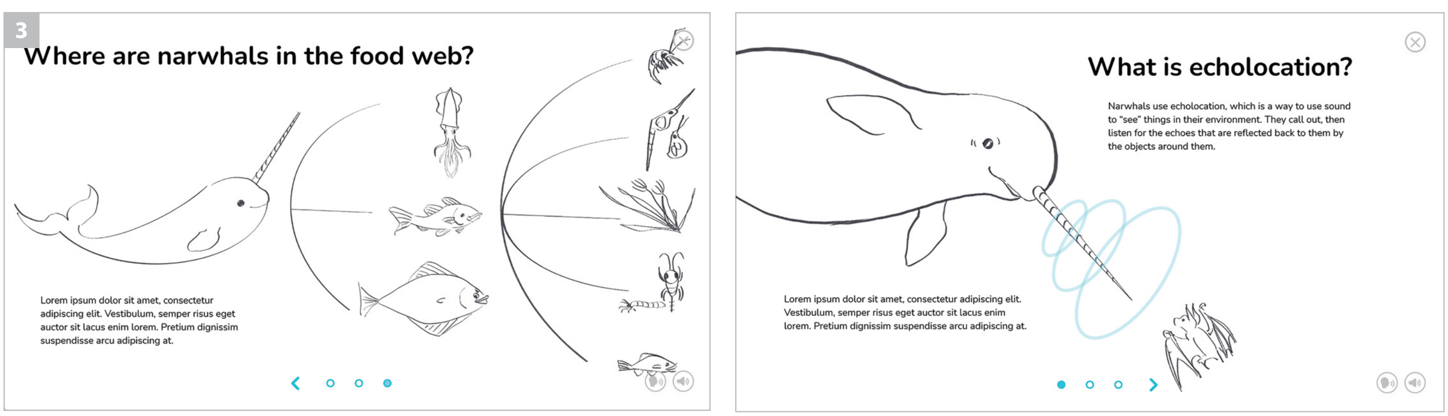
1. UI design. The original welcome page "boxes" underwent several iterations, primarily to reduce the feeling of "caging" the subjects. Conversely, the module shape itself remained quite similar throughout the production process.

2. Production process. Style explorations for 2D elements involved balancing stylistic appeal and anatomical accuracy. The final style selected prioritized overall visual appeal for a younger target audience.

3. Storyboard. Storyboards were completed for each section of the module; different types of information visualization were utilized to best represent the different characteristics and behaviours of the narwhal.







Interactive Animation

The Marks We Make is a collaborative web-based storytelling project designed to provide an immersive scrollytelling experience about the past, present, and future of human art. This was created as a group project in partnership with Shay Saharan and Amy Assabgui.

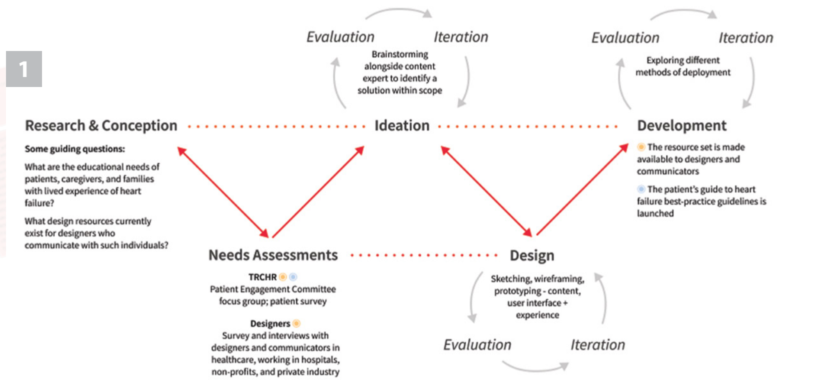
1. Storyboard. During the pre-production phase, storyboarding was fully collaborative and frequent, with remote ideation sprints between myself and my teammates. This particular sequence eventually became a 2D animation, rendered below.

2. 3D modelling. Many character iterations occurred ahead of the final designs; one of the most difficult aspects happened to be hair. 3D character building became a learning process, and many unflattering results were fortunately fixed.

3. Production process. UV maps presented a problem for textured materials, especially for wooden assets (e.g. the fireplace, pictured). The characters were left largely featureless, with 2D details integrated in post-production.

Design for the Heart

I took a human-centred design approach to establish Design for the Heart (D4H), a hub of design and communication resources focused on equity and empowerment for all patients, families, and caregivers experiencing heart failure.



1. Production process. The planned phases of this MRP underwent multiple adjustments as I honed in on my area of interest. Due to the exploratory nature of the human-centred design process, I needed to complete multiple rounds of needs assessments ahead of and during production.

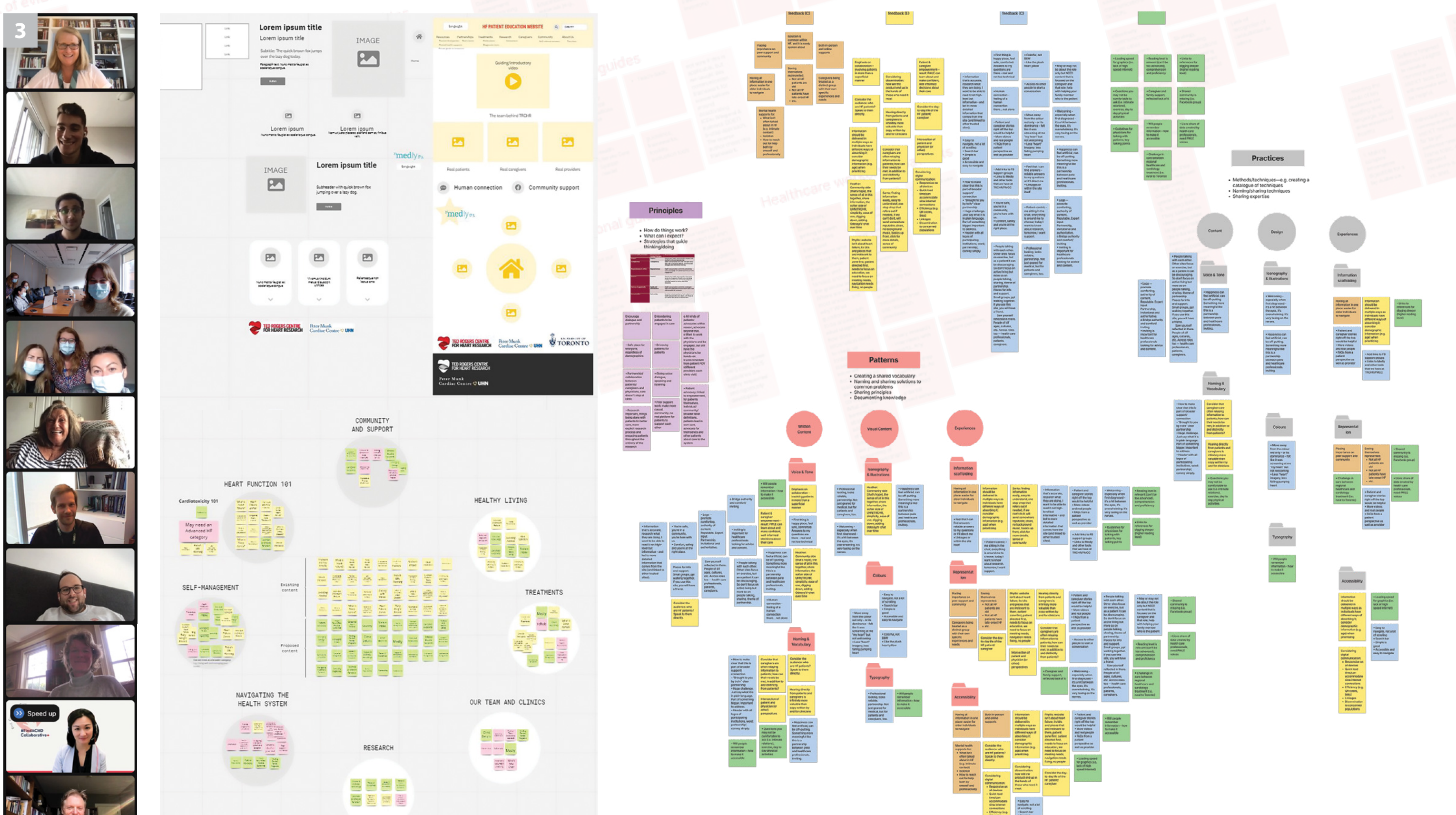
2a. UX design. During pre-production, multiple sets of potential users were created, as my many needs assessments were not yet completed. Pictured is the "designer" set: users who would benefit from design resources for heart failure. **2b. Final interactive.** These also appeared on the final website as sample users.

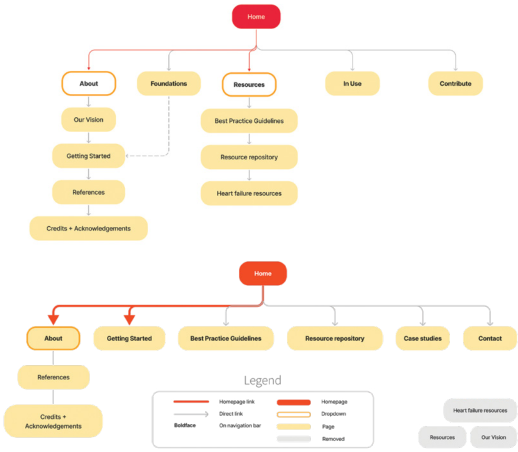
3. UX design. Some needs assessments involved focus groups, which included medical experts, patients, caregivers, and strategists. To the right is an interactive ideation activity completed with the group.

4. Production process. Multiple versions of D4H's information architecture were created, before and after quality assurance interviews with intended users.

5. UI design. A number of different logos were considered; ultimately, it was decided that a simple stylized heart was the optimal choice.

6. Prototype. The D4H prototype was created and tested on *Figma* before it was translated to a live site, built on *Webflow*.




Home
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Best Practice Guidelines
Resource repository
Heart failure resources
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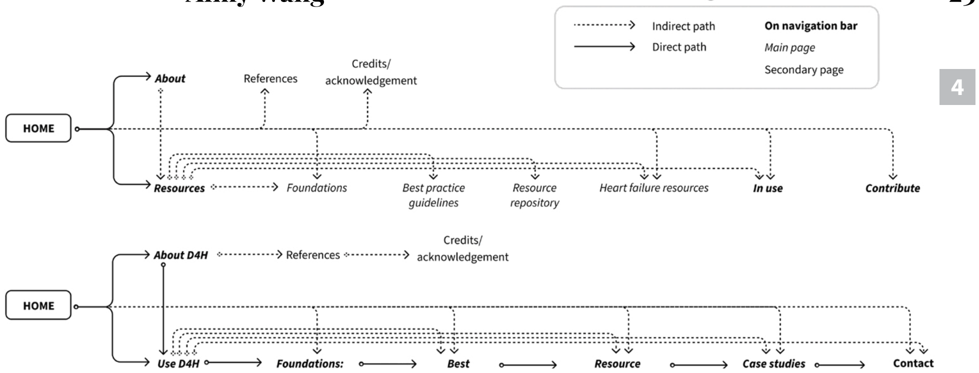
Heart failure resources
Resources
Our Vision


Indirect path
Direct path
On navigation bar
Main page
Secondary page
4
HOME
About
References
Credits/
acknowledgement
Resources
Foundations
Best practice guidelines
Resource repository
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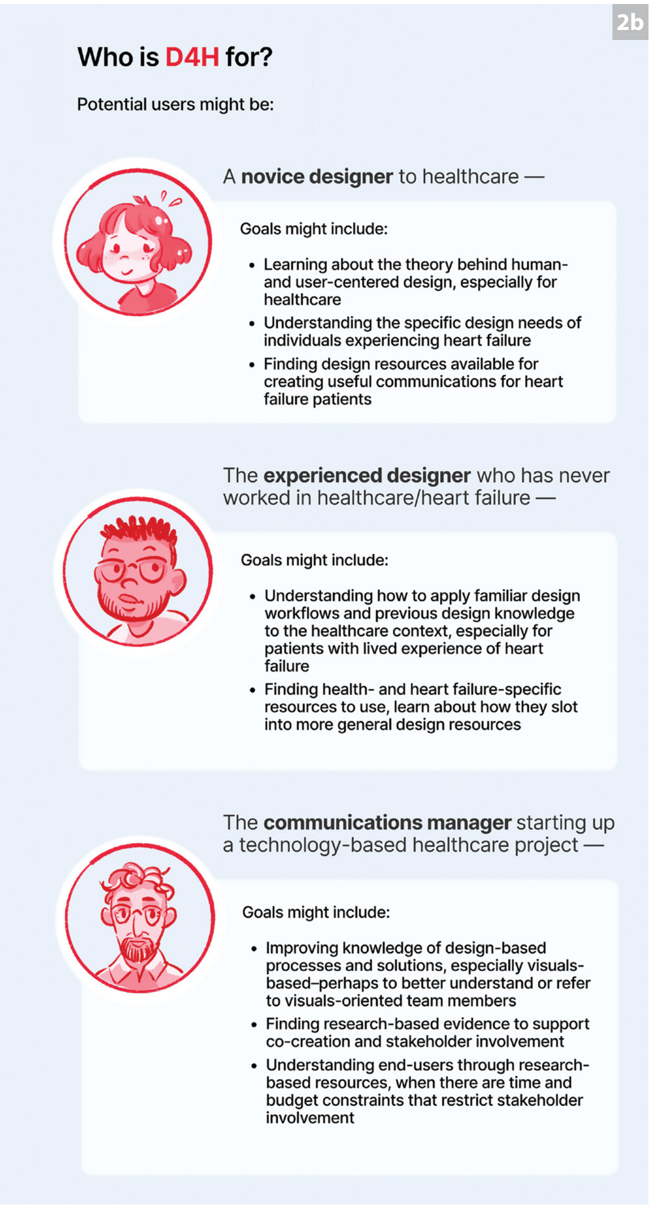
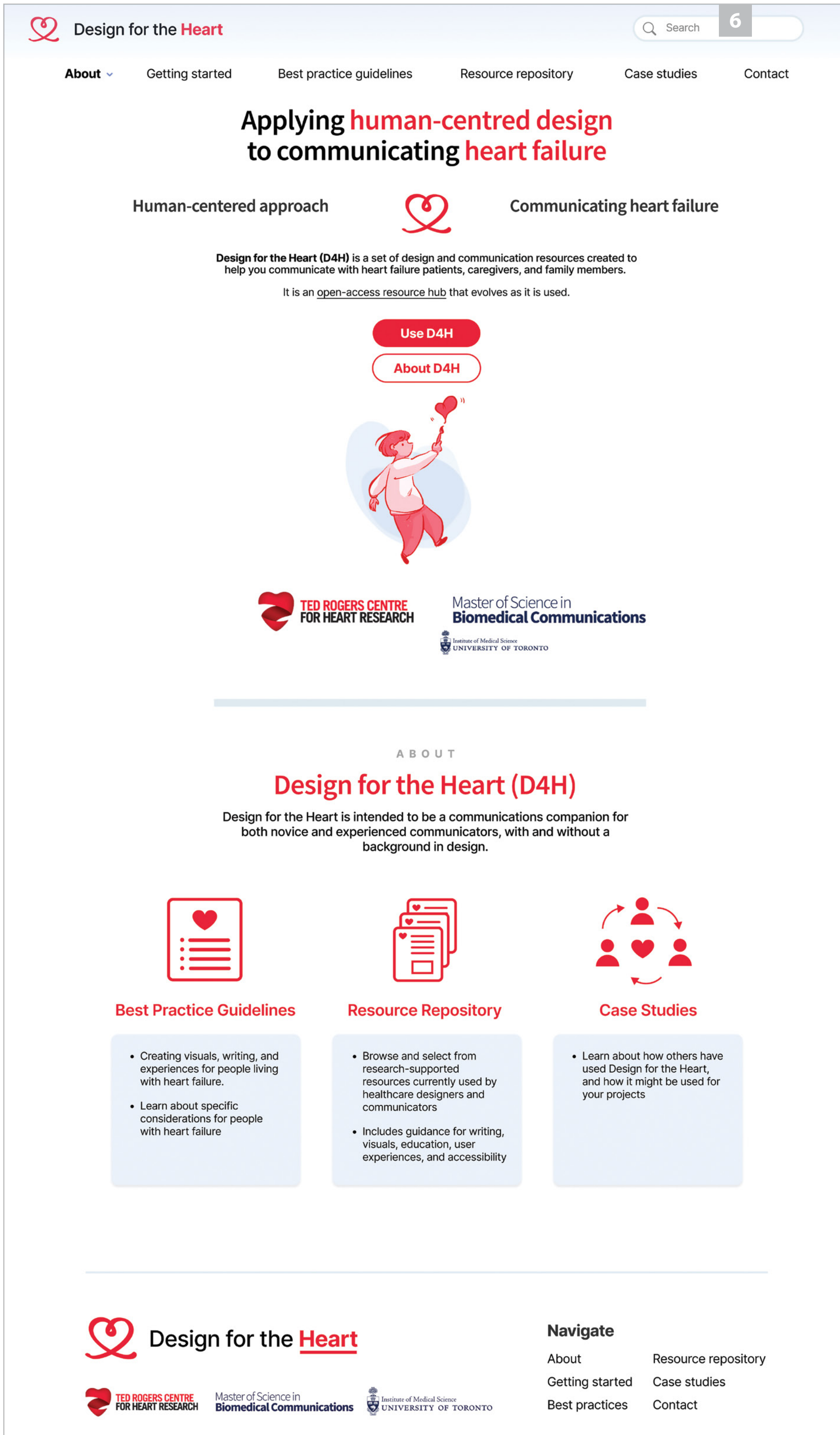

2b
Who is D4H for?
Potential users might be:
A novice designer to healthcare —
Goals might include:
• Learning about the theory behind human- and user-centered design, especially for healthcare
• Understanding the specific design needs of individuals experiencing heart failure
• Finding design resources available for creating useful communications for heart failure patients
The experienced designer who has never worked in healthcare/heart failure —
Goals might include:
• Understanding how to apply familiar design workflows and previous design knowledge to the healthcare context, especially for patients with lived experience of heart failure
• Finding health- and heart failure-specific resources to use, learn about how they slot into more general design resources
The communications manager starting up a technology-based healthcare project —
Goals might include:
• Improving knowledge of design-based processes and solutions, especially visuals-based–perhaps to better understand or refer to visuals-oriented team members
• Finding research-based evidence to support co-creation and stakeholder involvement
• Understanding end-users through research-based resources, when there are time and budget constraints that restrict stakeholder involvement


6
Design for the Heart
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Applying human-centred design to communicating heart failure
Human-centered approach
Communicating heart failure
Design for the Heart (D4H) is a set of design and communication resources created to help you communicate with heart failure patients, caregivers, and family members.
It is an open-access resource hub that evolves as it is used.
Use D4H
About D4H
TED ROGERS CENTRE FOR HEART RESEARCH
Master of Science in Biomedical Communications
UNIVERSITY OF TORONTO
ABOUT
Design for the Heart (D4H)
Design for the Heart is intended to be a communications companion for both novice and experienced communicators, with and without a background in design.
Best Practice Guidelines
Resource Repository
Case Studies
• Creating visuals, writing, and experiences for people living with heart failure.
• Learn about specific considerations for people with heart failure
• Browse and select from research-supported resources currently used by healthcare designers and communicators
• Includes guidance for writing, visuals, education, user experiences, and accessibility
• Learn about how others have used Design for the Heart, and how it might be used for your projects
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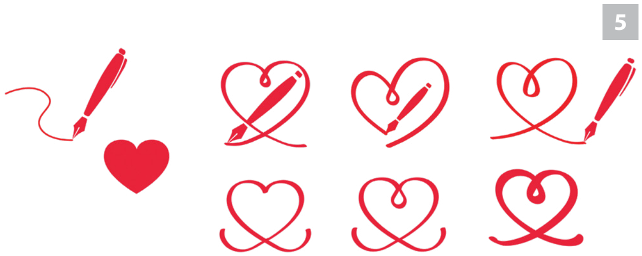
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Alexandra Ho

I am a biomedical illustrator and animator who is passionate about creating accessible resources that improve patient health literacy. With a background in neuroscience and physiology, I combine my research and design skills to create accurate and fun visual solutions, simplifying complex biomedical content for various audiences through animations, comics, infographics, and more.

Pathological Illustration

This piece depicts the pathological process of seborrheic dermatitis, a skin condition associated with the overpopulation of *Malassezia spp*. yeast on human hosts, at the tissue and macro level.

1. Final illustration. Final rendered tissue cubes showing the normal, inflammation, and hyperproliferation stages of seborrheic dermatitis. Illustrated in *Procreate*.

2. Sketch. Skin tissue cube sketches showing seborrheic dermatitis progression.

3. Final illustration. Layout sketches and colour studies with final spread (bottom).

Previous spread. A still from my MRP animation on nerve transfer surgery.

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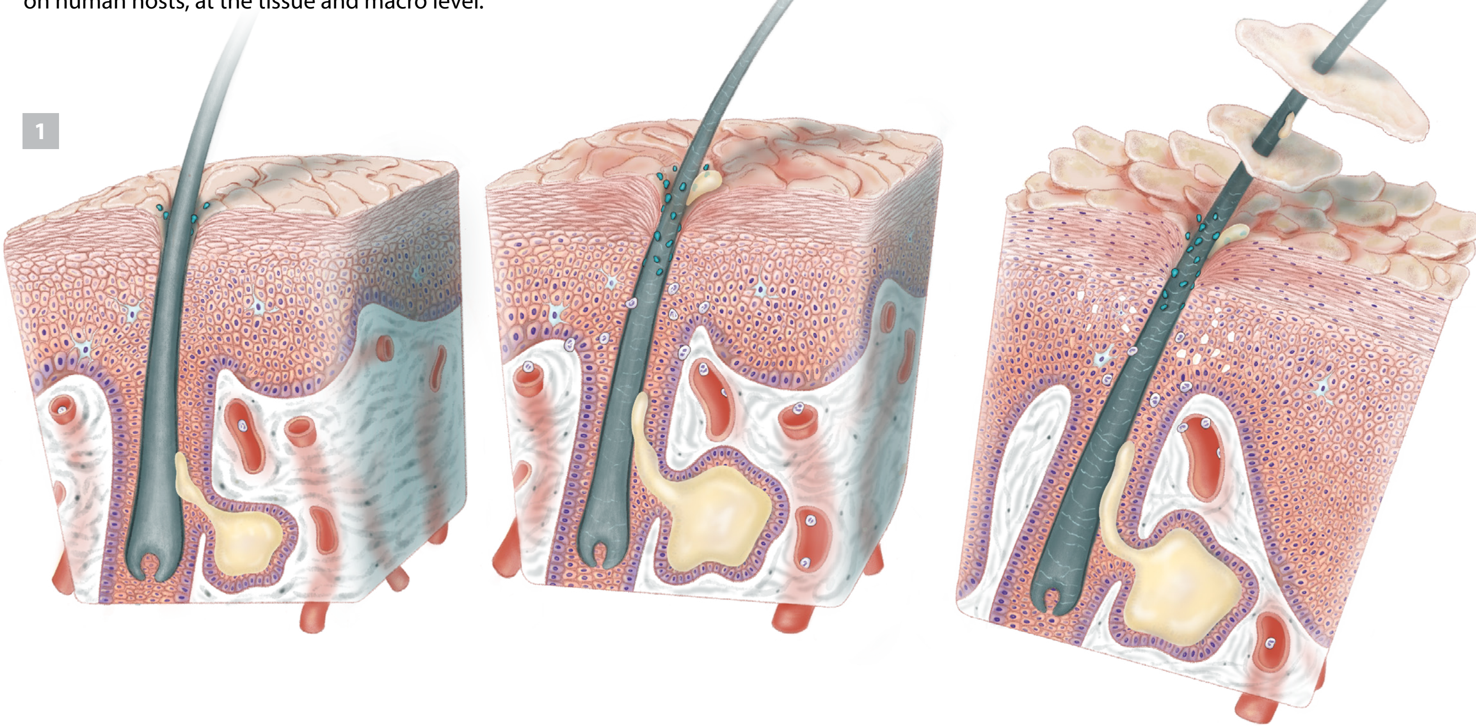

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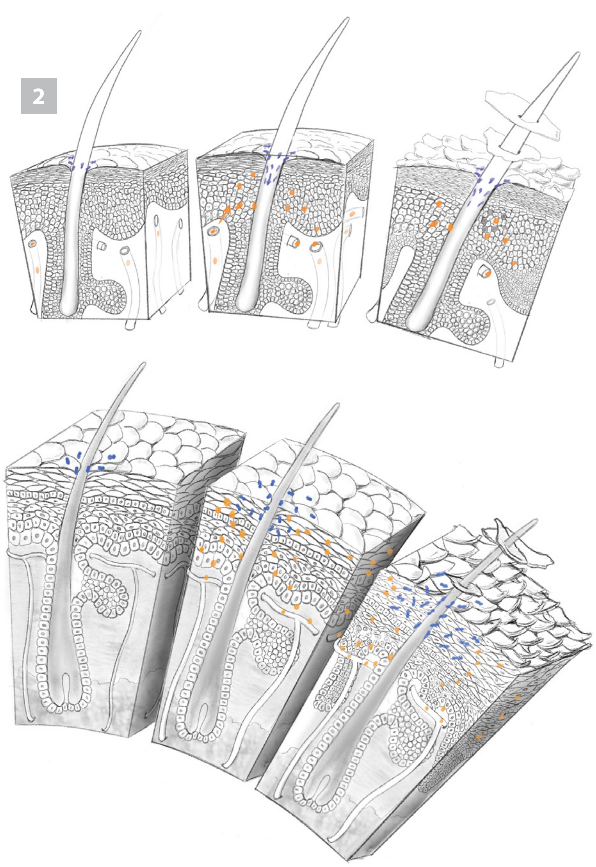

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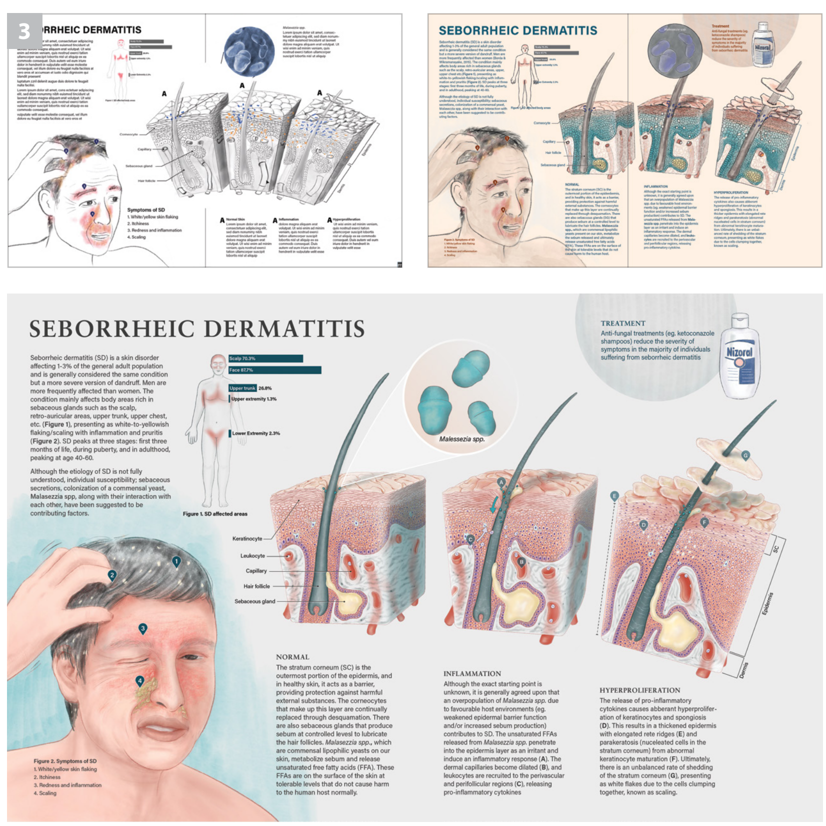
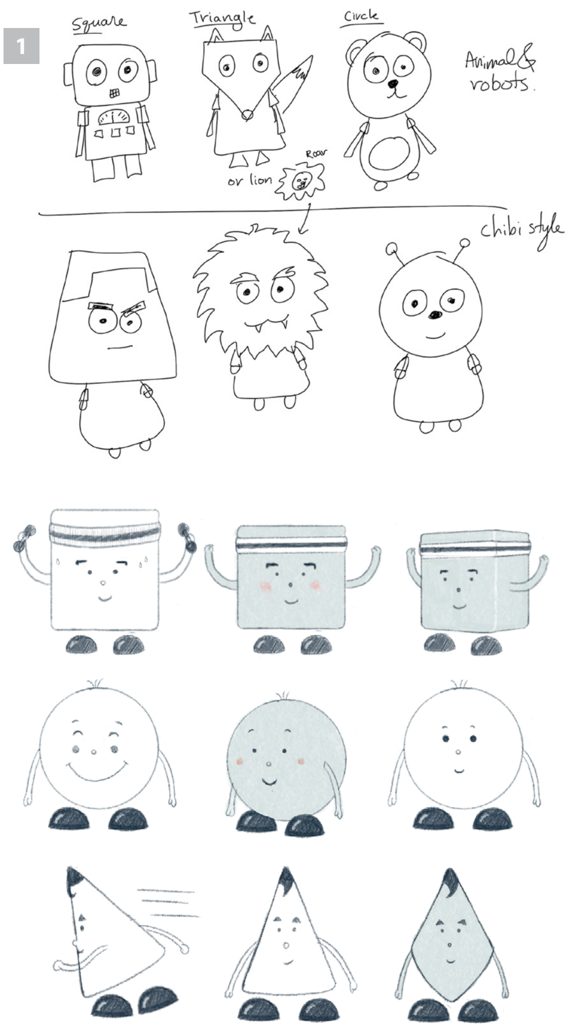
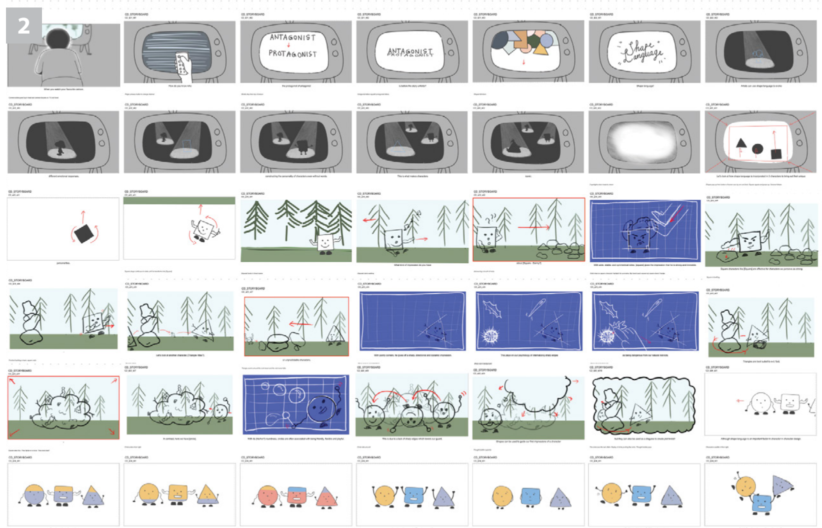
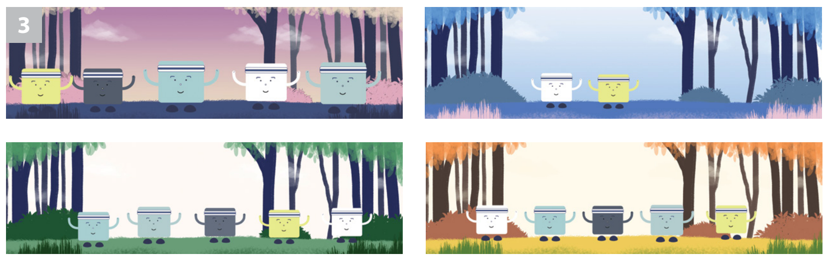


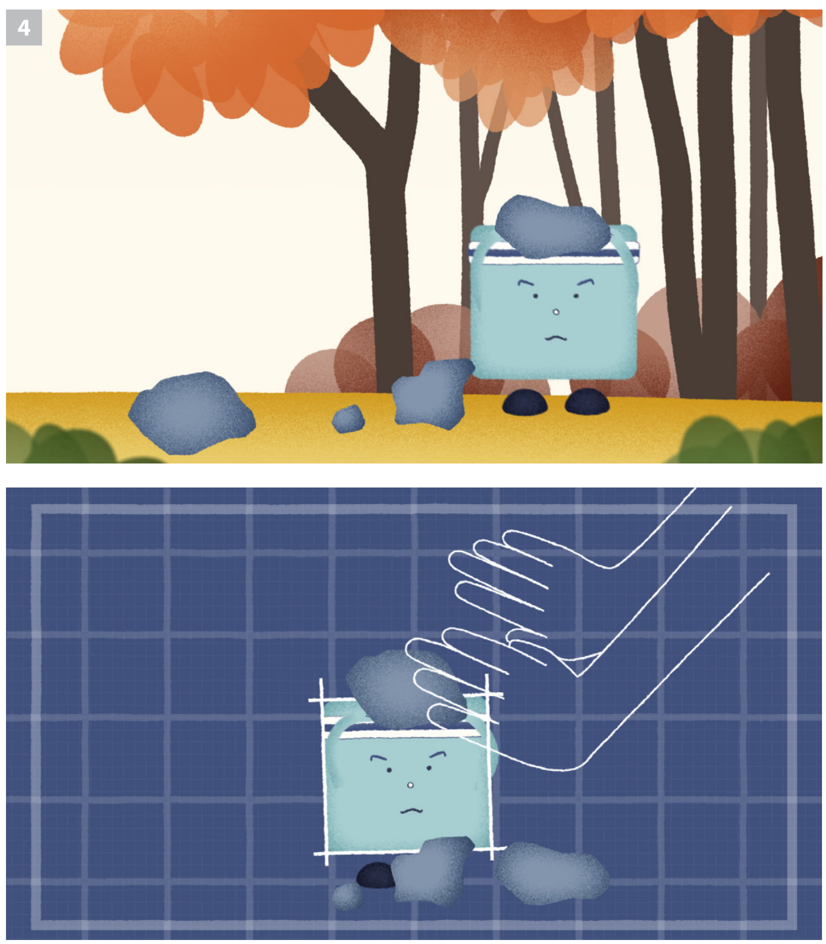
2D Animation

Various visual elements such as shape language, colour, and posture influence how characters are perceived by an audience. This animation introduces the concept of shape language through a simple and playful story with three unique characters. The project was completed in partnership with Min Jee Kim.









1. Sketch. Several character sketches that convey square, triangle, and circle shape language characteristics were explored.

2. Storyboard. The main storyline follows three characters that interact with each other because a rock tower is knocked over. Within this narrative, the three shapes are analyzed based on their unique personalities.

3. Study. Several colour studies were explored. In the end, a warm-toned background was chosen to contrast the cool blue characters, evoking a warm and playful mood.

4. Final animation. The animation style consists of vector graphics with rough edges and grainy shading to add dimension.

Graphic Medicine

Just Shy is a comic that follows Lola, a character living with social anxiety, revealing what she goes through on a daily basis from her perspective. This graphic novel uses the materiality of the printed piece to reveal the character's inner thoughts.

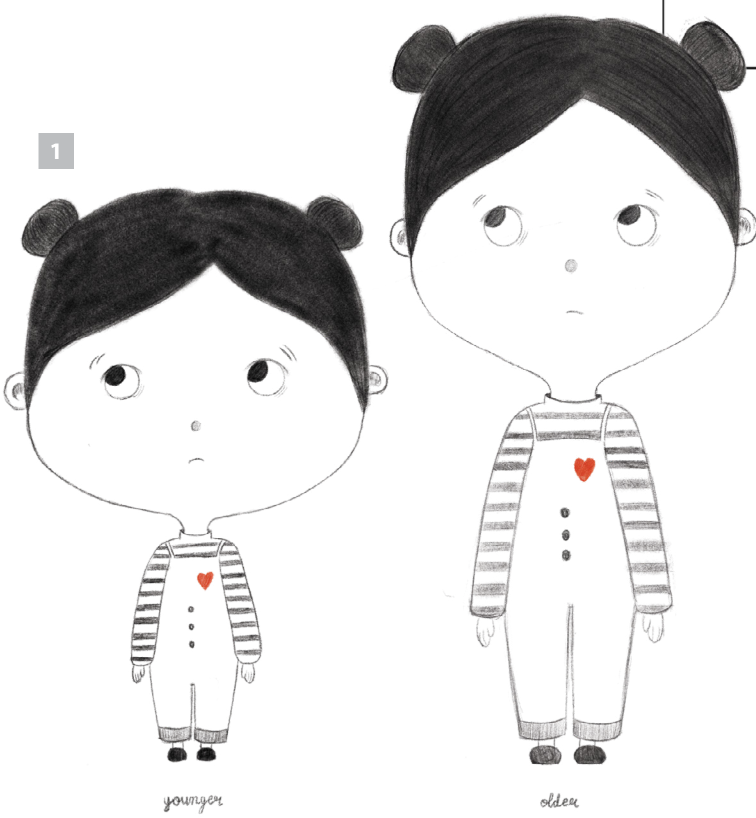
1. Sketch. Main character sketch of a younger and older Lola. To ensure that Lola would be recognizable from all angles, she was designed with unique hair buns and clothing.

2. Sketch. Thumbnail sketches were used to plan the layout and interactive elements. The beginning and middle of the narrative were designed so that Lola would mainly be in her own panel, physically isolated from others. Towards the end, Lola can be seen with another character in the same panel, representing the improvement of her social anxiety.

3. Sketch. Sketches showing the interactive elements with cutouts and foldouts.

4. Final illustration. Final rendering created in *Procreate*.

5. Prototype. Hand-bound book showing transparencies and pullouts that were integrated to reveal Lola's inner thoughts.



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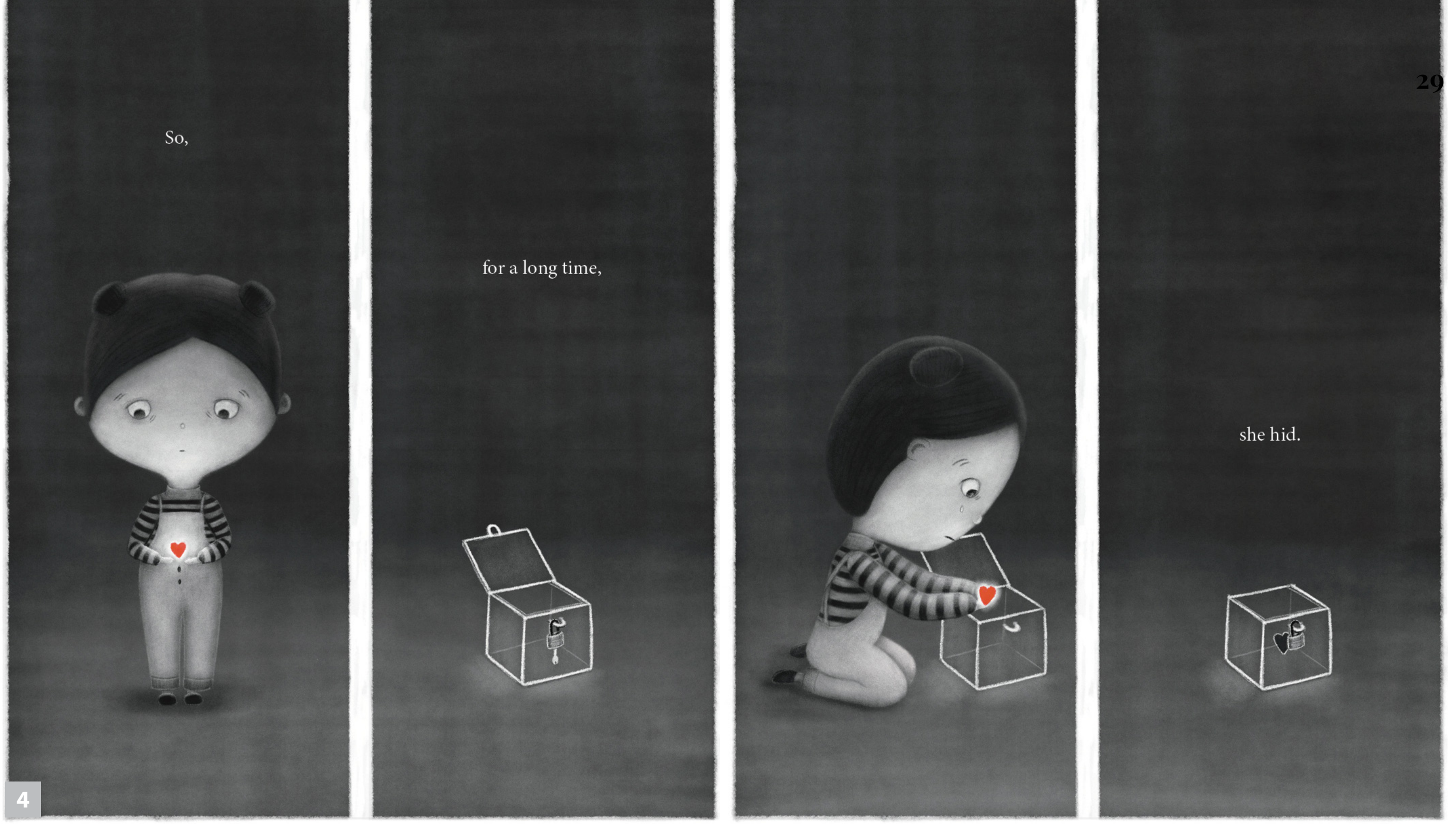
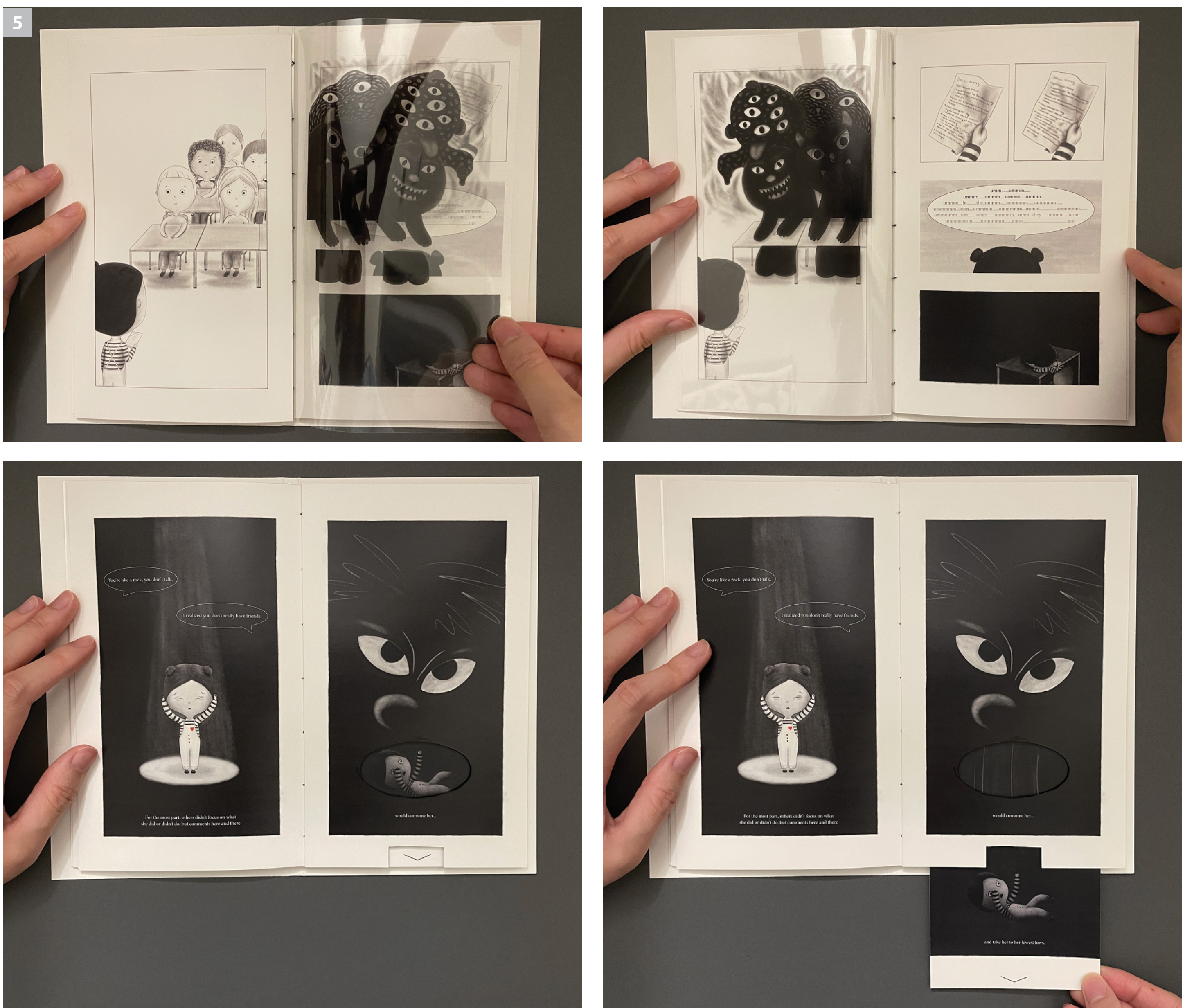

So,
for a long time,
she hid.

5


You're like a rock, you don't talk.
I realized you don't really have friends.
For the most part, others didn't focus on what she did or didn't do, but comments here and there
would consume her...
and take her to her lowest lows.

Nerve Transfer Surgery for Peripheral Nerve Injuries

A mixed 2D and 3D patient-centred animation meant to educate patients and healthcare providers on modern options to restore function after a peripheral nerve injury. A friendly, non-triggering visual style was integrated with simple language and visual metaphors to create an engaging online resource.

1. Sketch. Initial character sketch of the doctor.

2. Sketch. Coloured character designs of "muscle city" citizens, construction workers, a doctor, and a patient. The characters or their clothing have a cool blue colour to contrast the main warm pink background used in the animation.

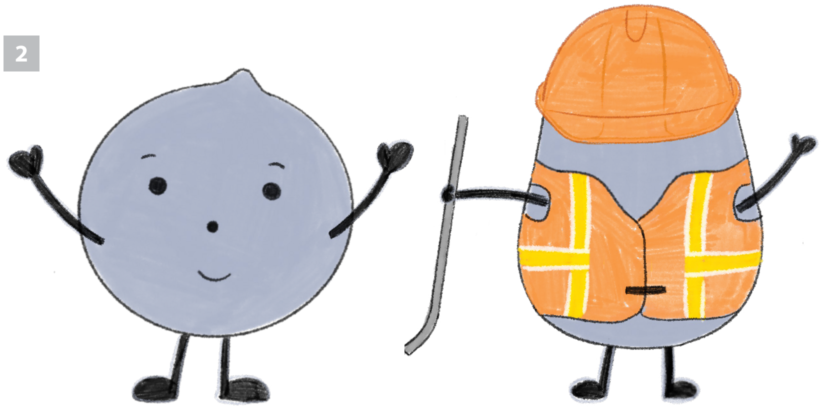
3. 3D modelling. Models of doctor and patient characters created in *Maya*.

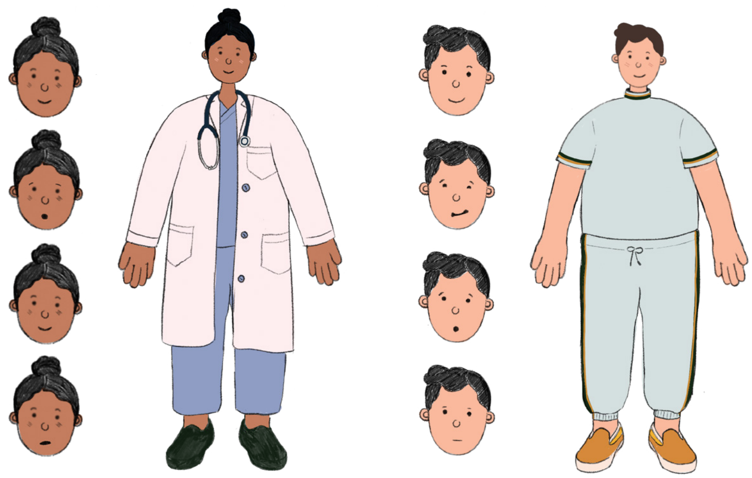
4. Storyboard. Storyboard segment depicting patient and doctor interaction.

5. Production process. Comparison of storyboard, animatic, and final animation frames of the "muscle city" visual metaphor. The metaphor was incorporated to simplify the explanation of a nerve transfer surgery and the time-sensitivity concept.

6. Final animation. "Time is muscle" phrase is repeated throughout the animation to emphasize the importance of talking to a nerve surgeon early.

2





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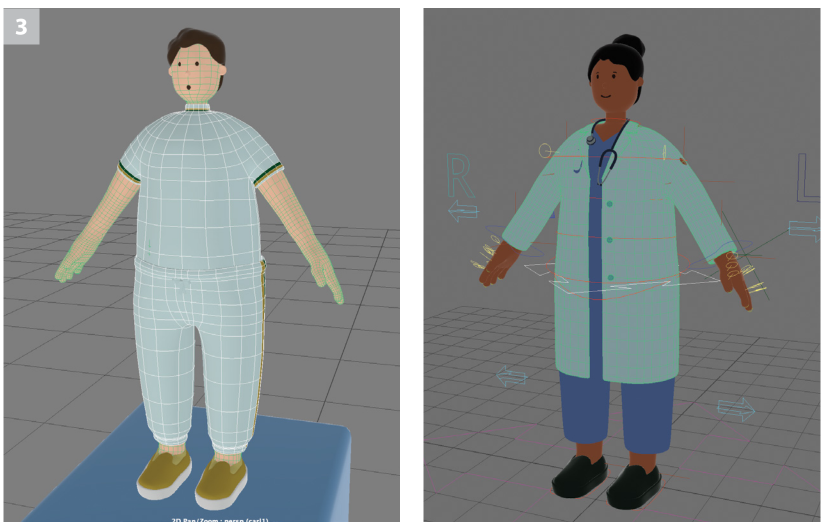

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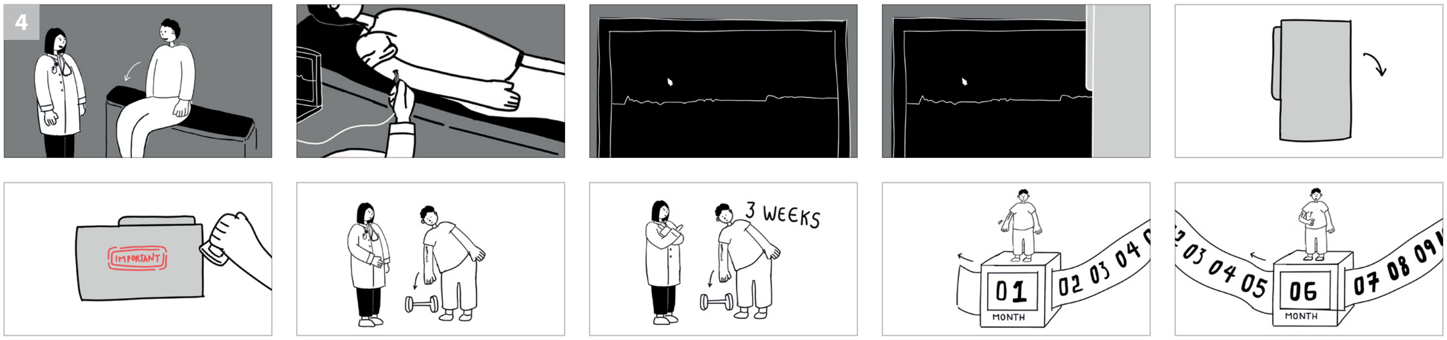
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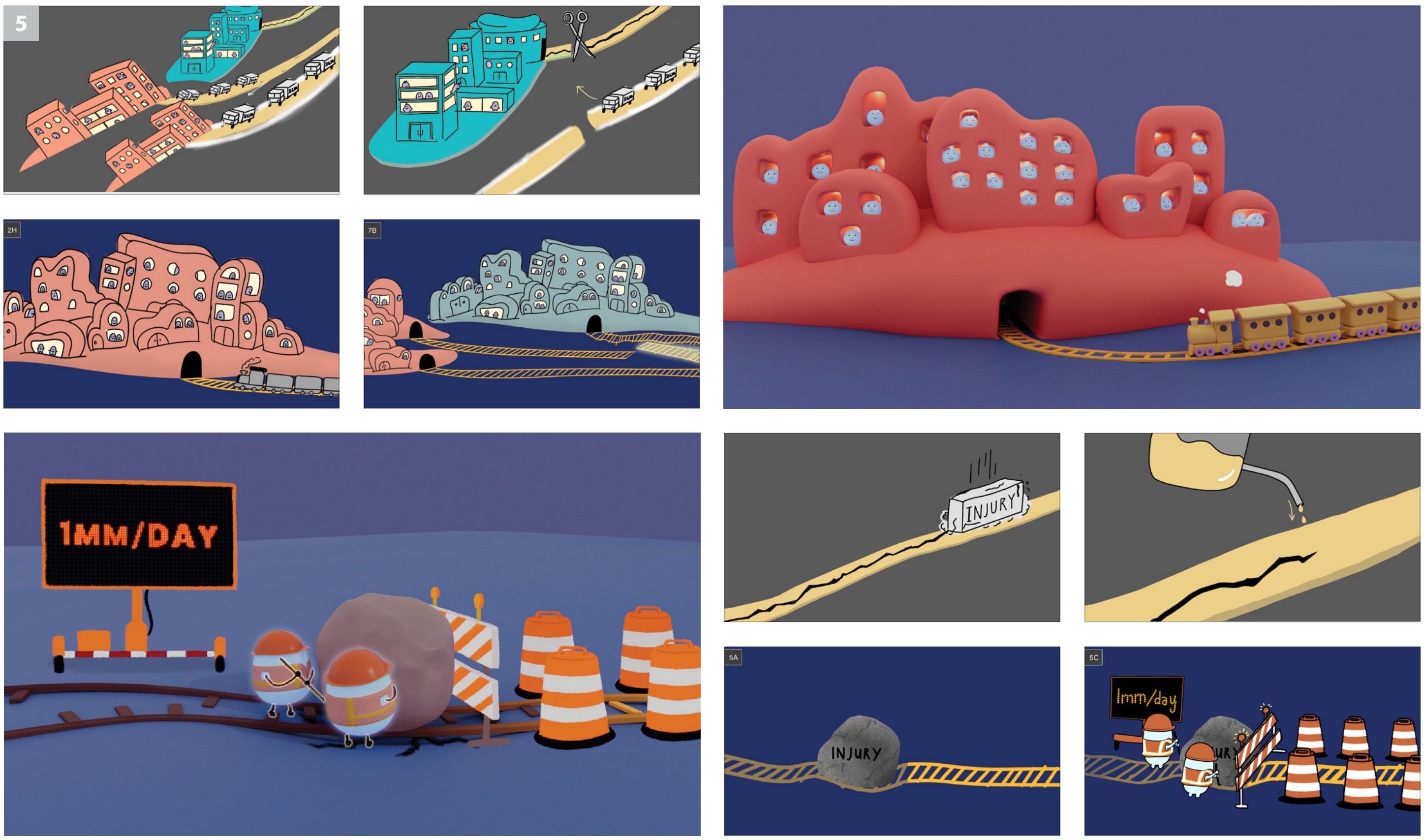
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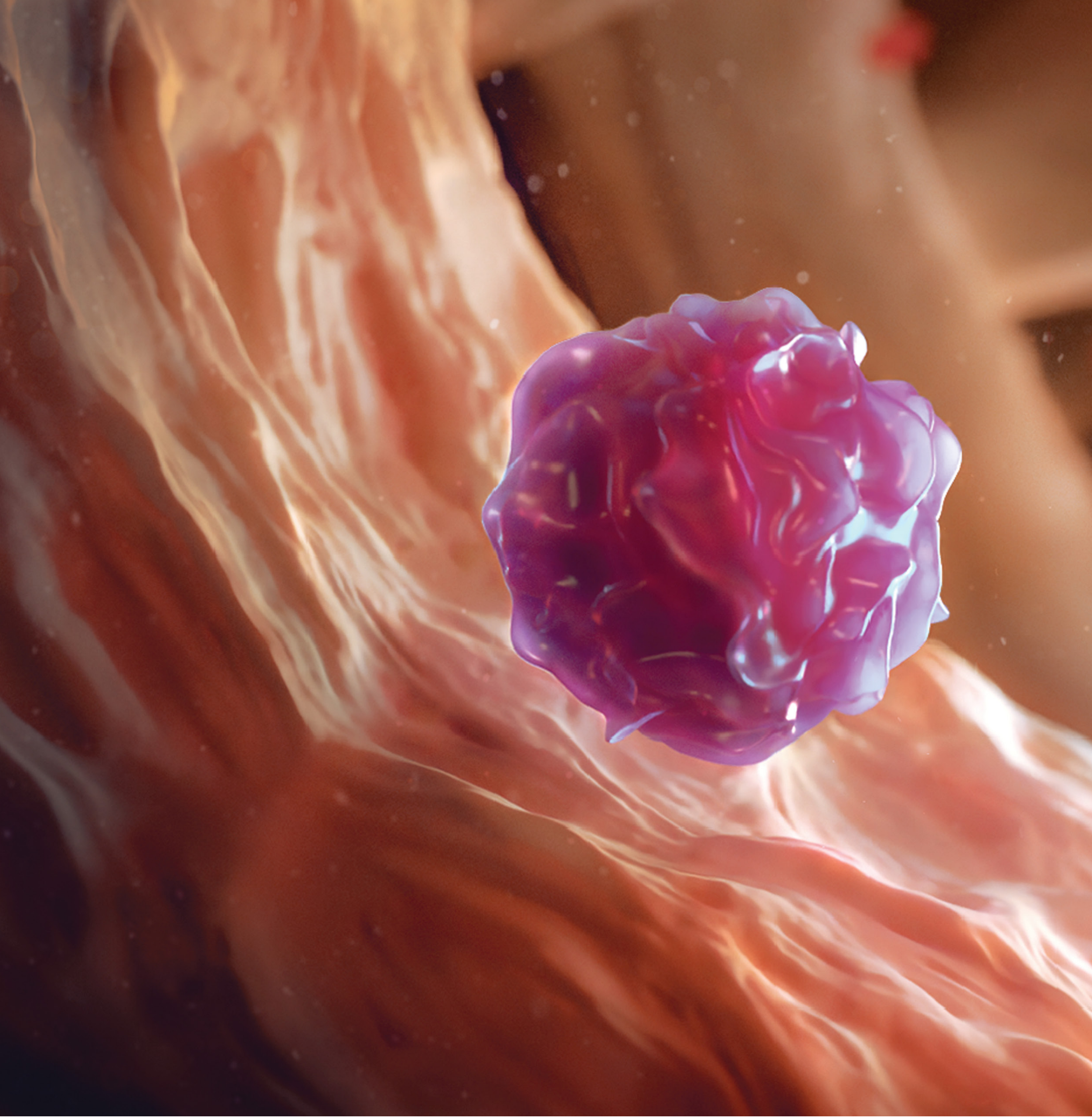


Amy Assabgui

I grew up in a family of creators, makers, and artists who inspired me to explore unique ways of solving problems and constantly challenged my understanding of design. Now, as a biomedical illustrator and designer, I love to find novel ways to use art and visual storytelling to address communication gaps within the fields of science, medicine, and healthcare.

Editorial Illustration

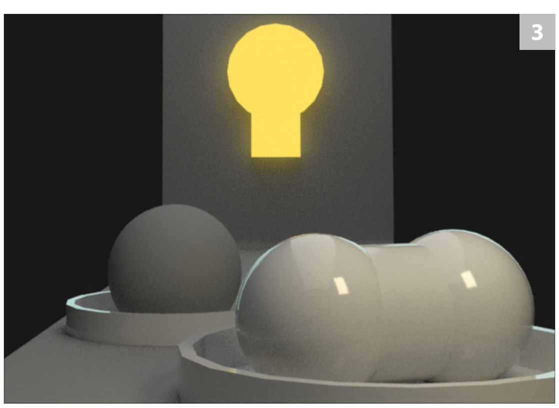
Novel research has shown that genetically engineered yeast and bacteria co-cultures can be used to create biosensing materials. To illustrate this concept in a playful way, I created an editorial cover that uses knitting as a visual metaphor.

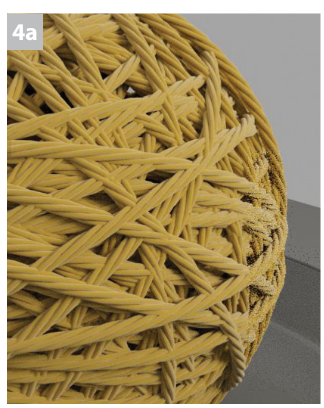
1. Sketch. I began by exploring different compositions that used colours and shapes to represent bacteria (rod-shaped, blue) and yeast (spherical, yellow).

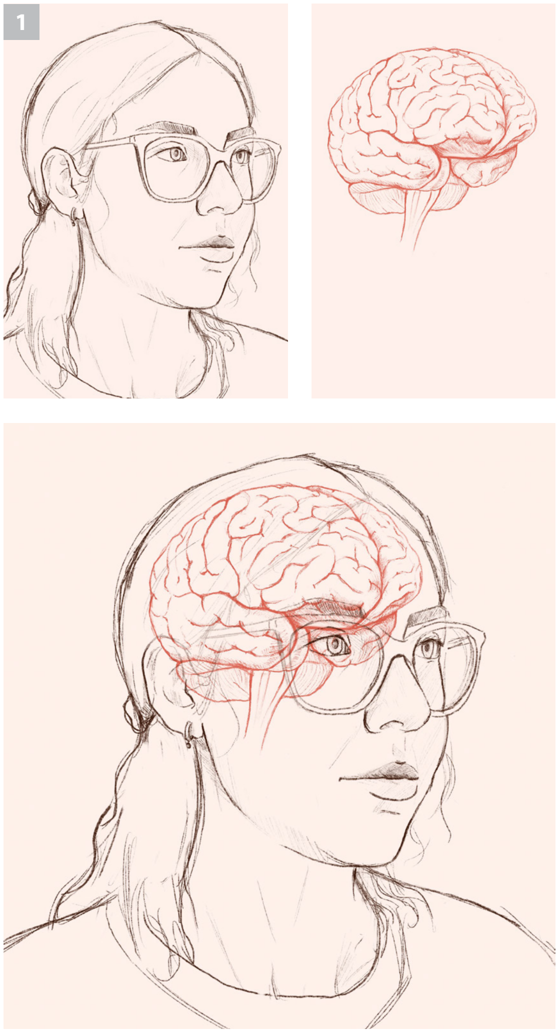
2. Final draft. A final comprehensive sketch I created to act as a roadmap once I began working in 3D.

3. Production process. Before beginning to create my 3D models, I made a draft layout in *Maya* with basic shapes as placeholders.

4. Final illustration. In *Maya*, *MASH* was used for the balls/skeins of yarn and *XGen* was used to add a fuzzy texture throughout. **4a. 3D modelling.** Hours were spent experimenting with *MASH* to mimic real balls and skeins of yarn. **4b. Production process.** I used my own knitting projects as a reference for the backdrop of the piece and played around with using *MASH* and texture maps to replicate it in *Maya*.







Neuroanatomical Illustration

This 3/4 view self-portrait depicts the anatomy of the brain in situ from a unique viewpoint. To add a personal touch to this piece, I used a vibrant palette and painterly style.

1. Sketch. A draft sketch was created using many different types of references, from illustrations to 3D models.

2. Production process. I began by blocking in colours and shadows, slowly adding more detail to the piece as different areas were becoming more fleshed out. Once the portrait was complete, I played with selective transparency to show the brain while keeping certain regions, such as the eyes and glasses, more opaque.

3a. Final illustration. A close-up of the final piece, focusing on the selective use of transparency to show the brain within the cranium. **3b.** A zoomed in view of the brain.

Previous spread. A 3D render of a granulocyte among the trabeculae seen in red bone marrow.

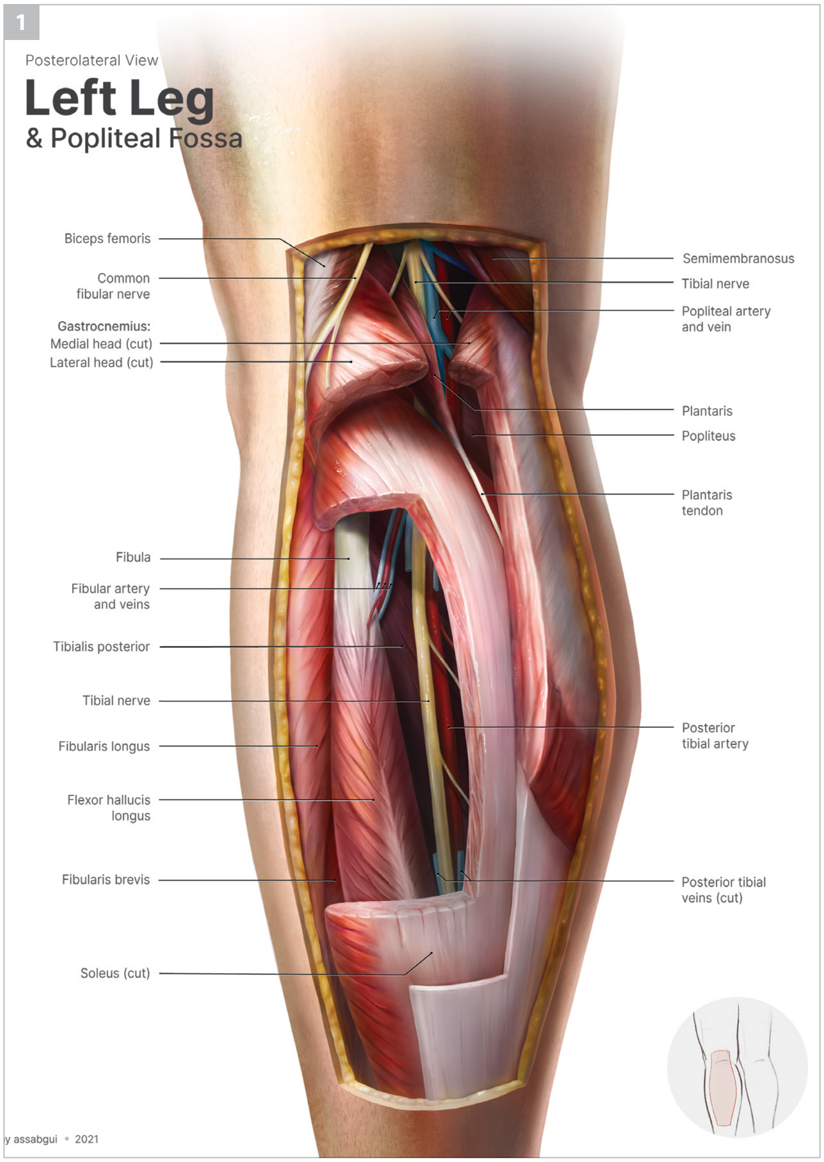
Anatomical Illustration

The posterior compartment of the leg contains superficial and deep layers which are typically depicted separately. I created this illustration to show the relationship between both layers and their respective structures from a unique viewpoint.

1. Final illustration. Final illustration with labels.

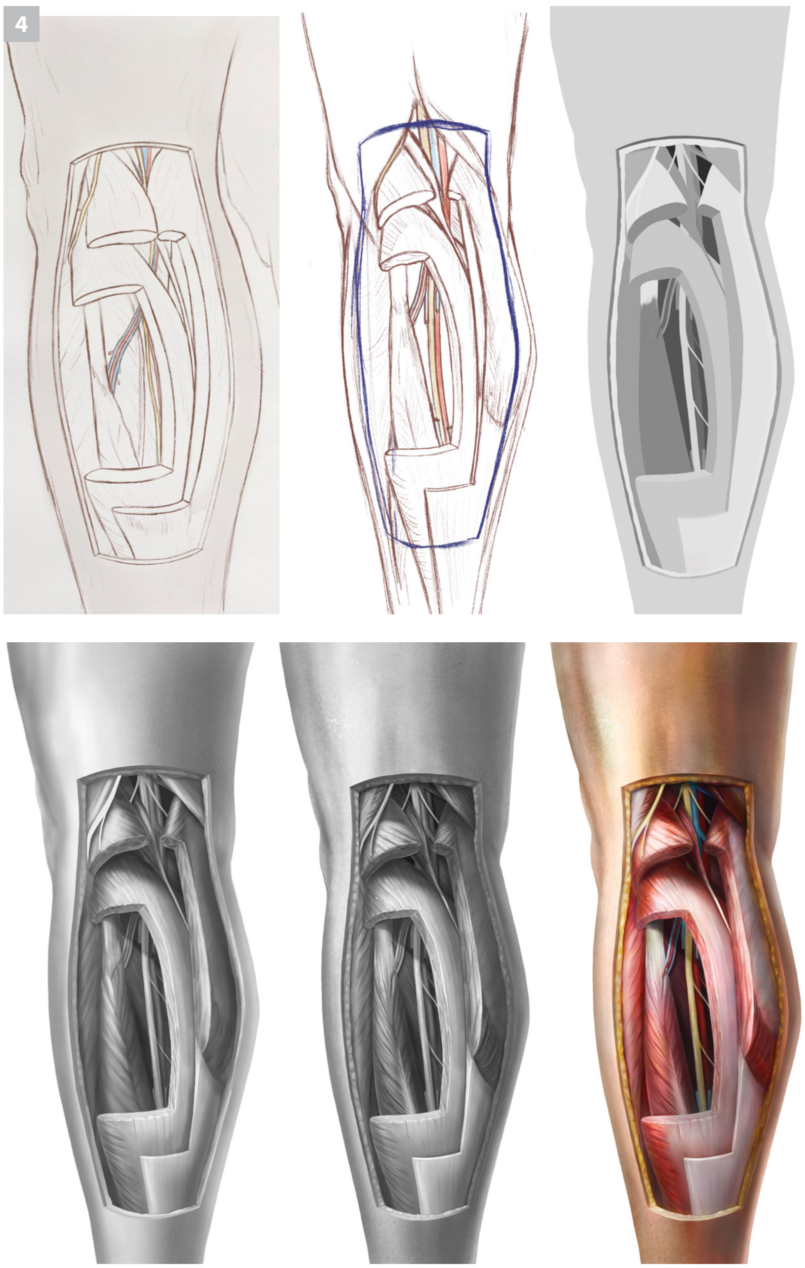
2. Production process. A key step when creating this piece was making a 3D maquette out of clay. It was a quick and efficient way to understand how the cut structures and forms would interact with different lighting.

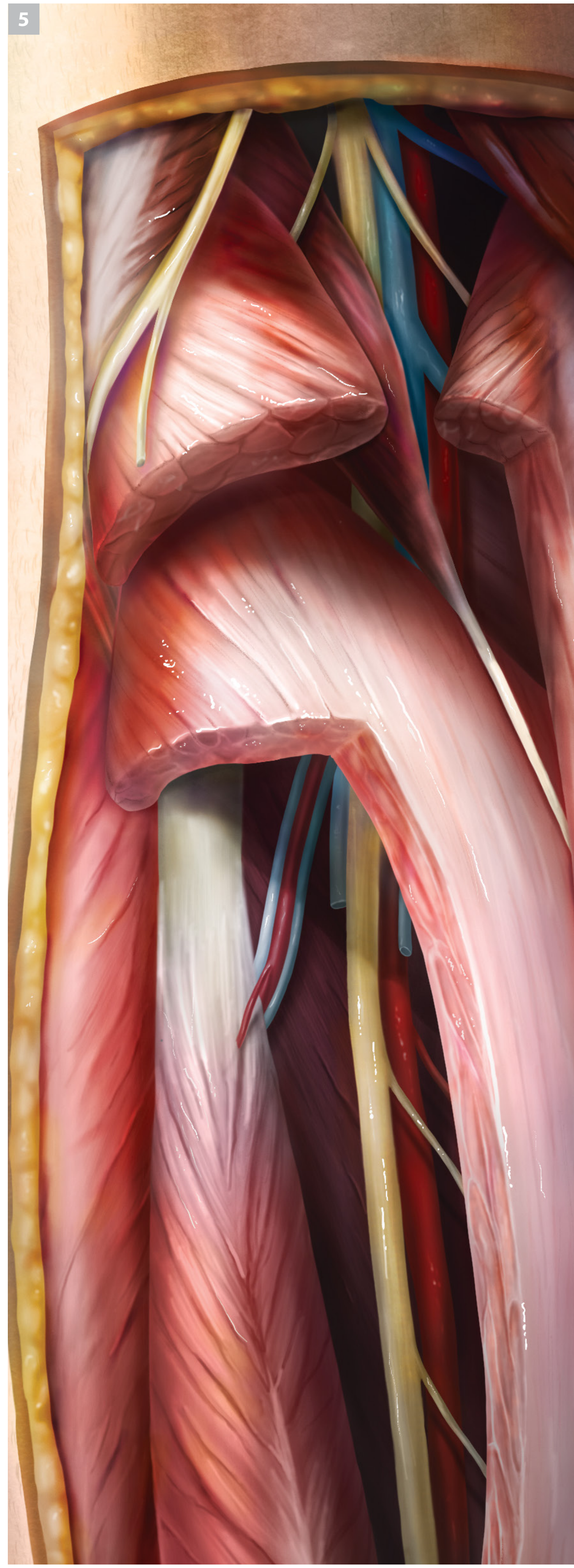
3. Study. I took several reference images of my family members' legs, as well as used the *Melanix* dataset to help determine the underlying anatomy from a posterolateral viewpoint.



4. Production process. After creating a refined sketch, I went on to blocking in all of the structures in different shades of grey. Once I added in light and shadow, I went on to adding details across the piece. Once the greyscale piece was complete, I colourized it and added final touches.

5. Final illustration. A close-up of the final piece, showing some of the details across the cut layers.





Bone Bio

Bone Bio is a web-based bone biology learning tool for undergraduate forensic anthropology students enrolled in the Human Osteology course at the University of Toronto Mississauga (UTM). It combines free exploration of 3D models with animation and is paired with a physical worksheet that guides students and allows them to test their knowledge along the way.

1. Final interactive. A screenshot of the website landing page where students can use the Bone Bio prototype.

2. UX design. The project began by conducting user research. An anonymous questionnaire was used to tailor the learning experience around the student's needs.

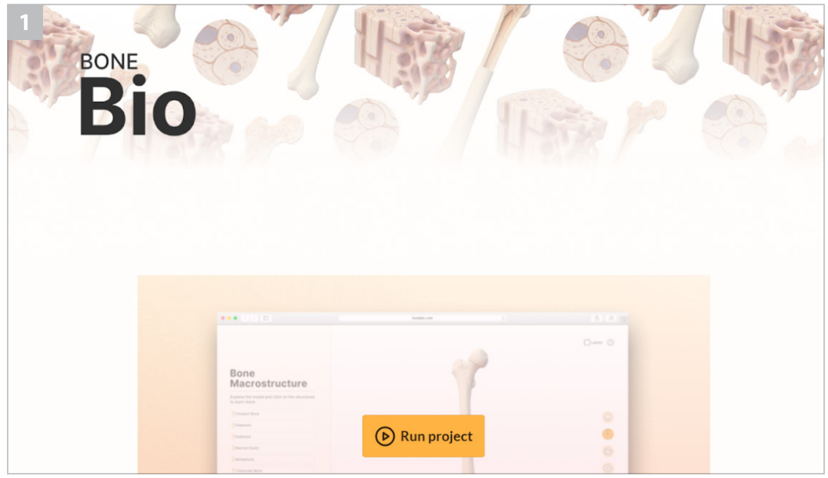
3. UI design. A flow diagram was created to show user navigation. An interactive mockup was created based on the flow diagram for user testing and facilitating feedback.

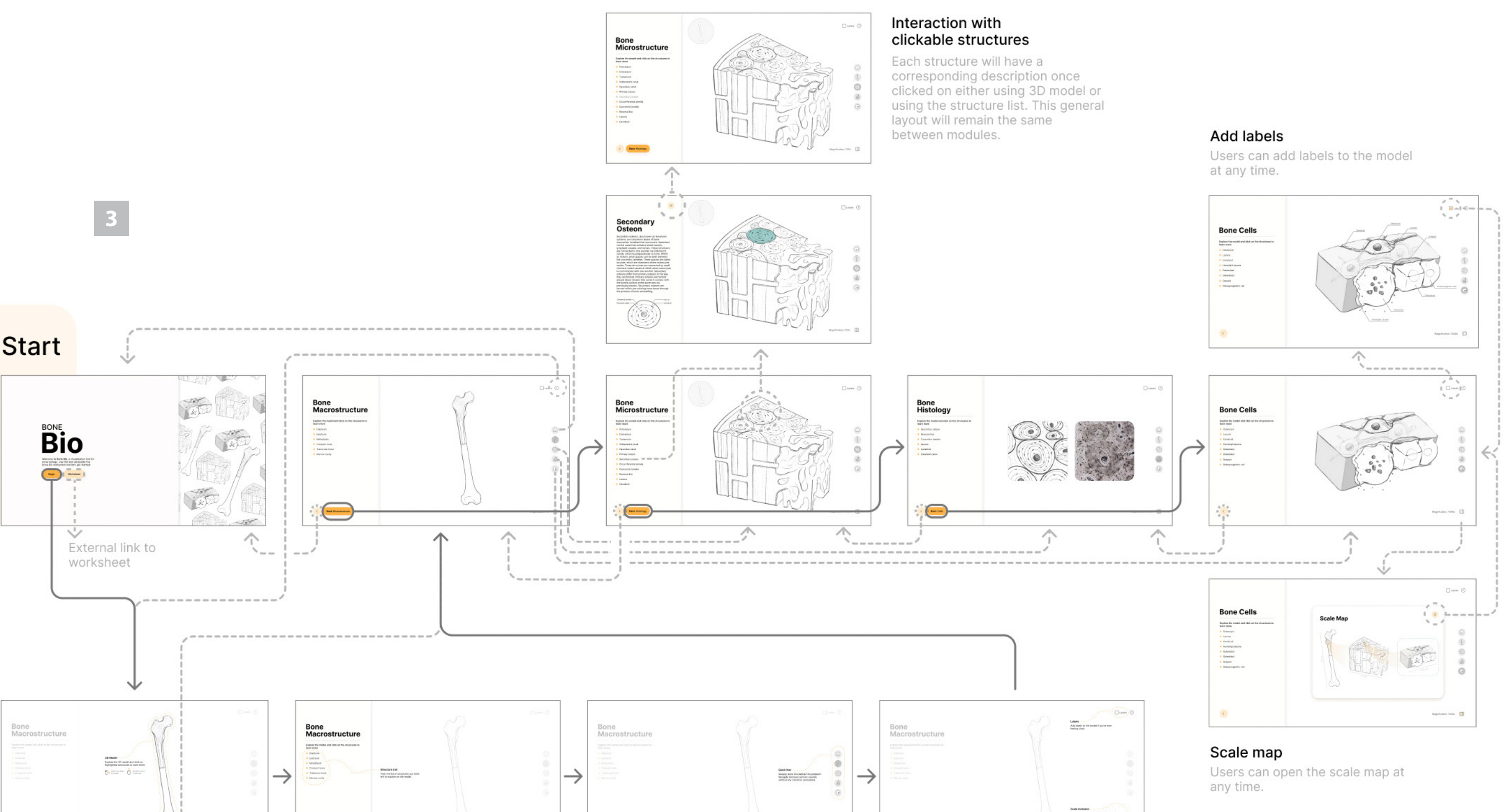
4. 3D modelling. Using the mockup sketches, I created web-optimized 3D models of a cut femur and bone tissue cube to implement into the final prototype in *Unity*.

5. Final interactive. Bone Bio is accompanied by a physical worksheet that contains drawings, labels, and short answer questions for students to test their knowledge.

6. Final interactive. A close-up of the final prototype mid-animation.

7. Final interactive. Screens showing the bone macrostructure, microstructure, and histology sections.





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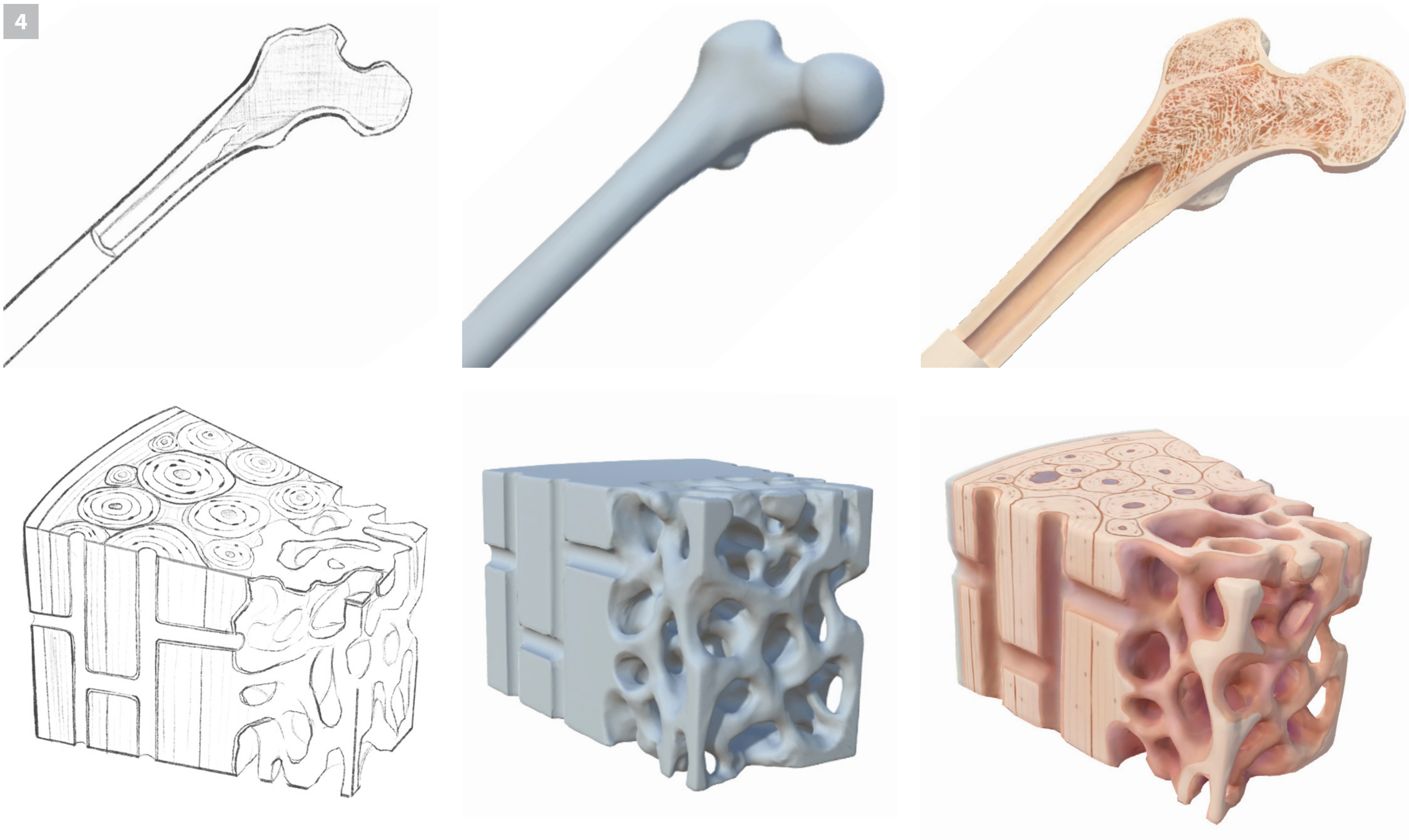

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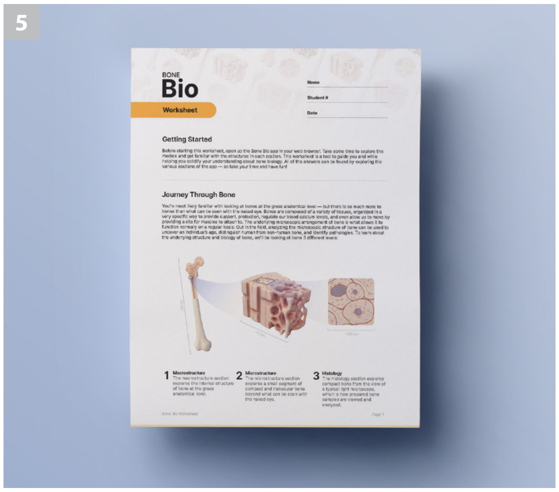
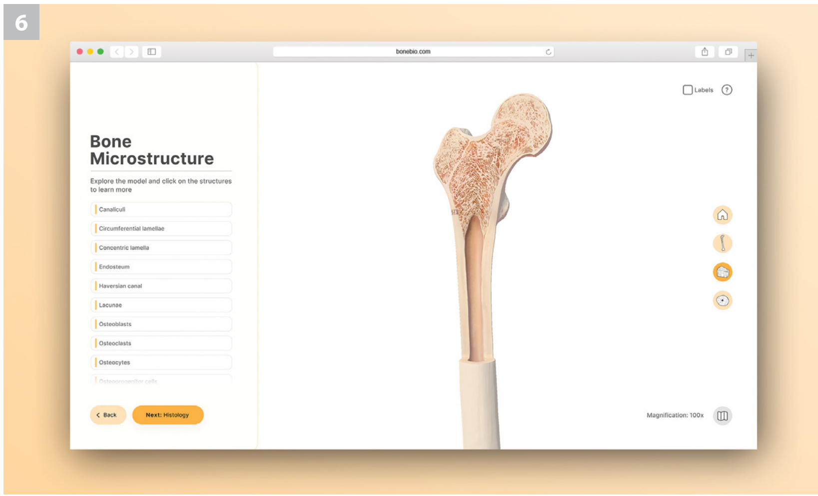

BONE
Bio
Worksheet
Getting Started
Journey Through Bone

6


bonebio.com
Labels
Bone Microstructure
Explore the model and click on the structures to learn more
Canaliculi
Circumferential lamellae
Concentric lamella
Endosteum
Haversian canal
Lacunae
Osteoblasts
Osteoclasts
Osteocytes
Back
Next: Histology
Magnification: 100x

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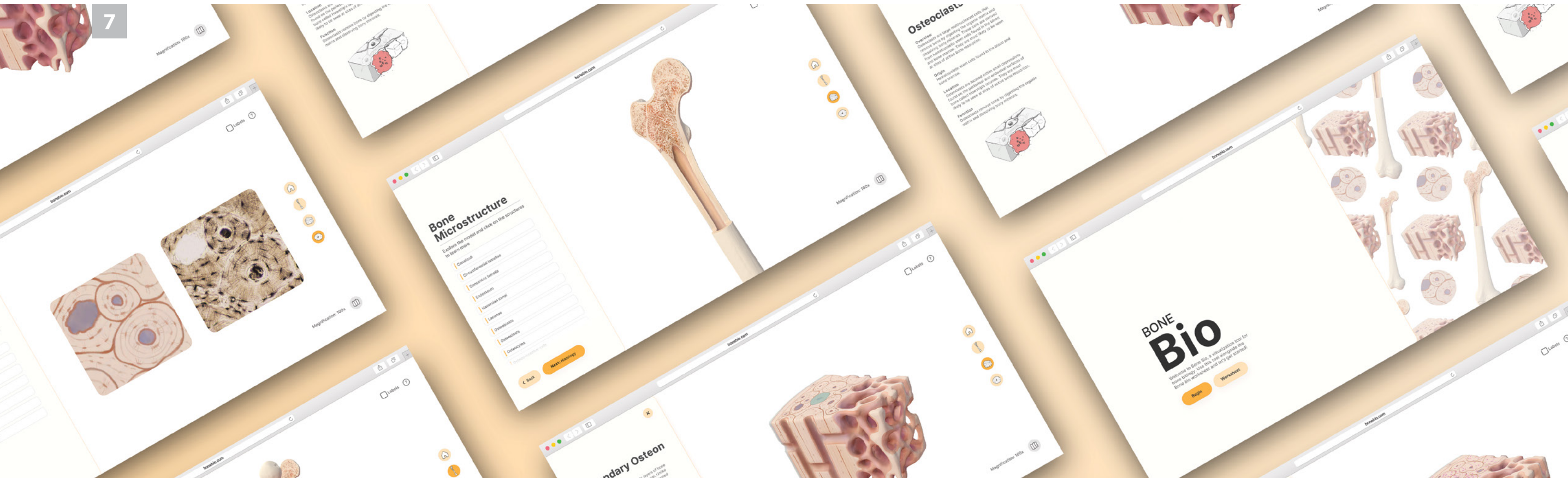
Bone Microstructure
Osteoclasts
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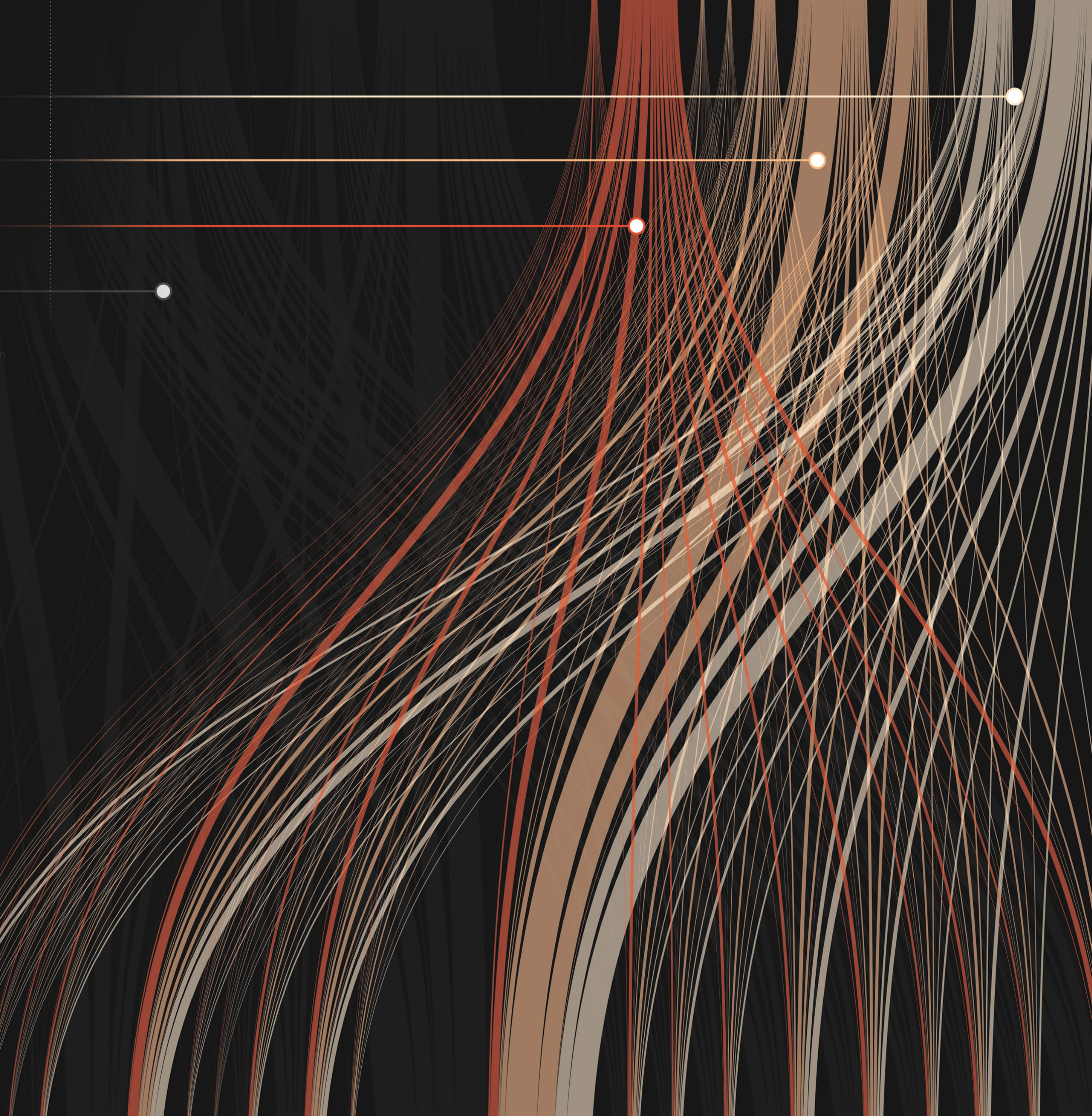
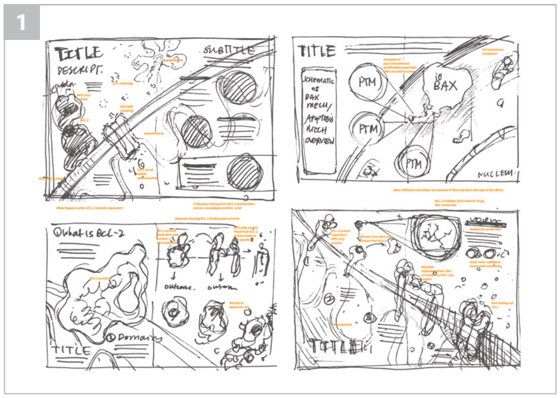


Amy Ke Er Zhang

There are some flowers you only see when you take detours, and the intersection of art, design, and science was one that coloured my world and changed my way of thinking. Now, as a visual science communicator and human-centred designer, I happily contribute to visual projects that foster an understanding and appreciation of science.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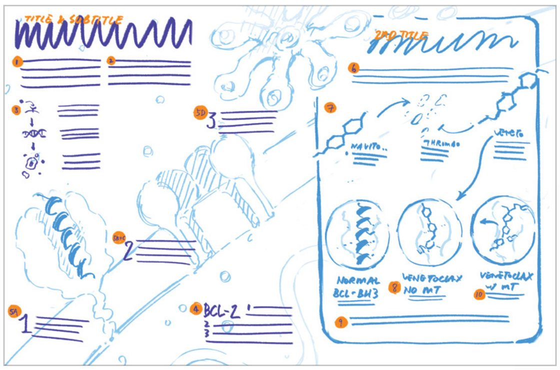
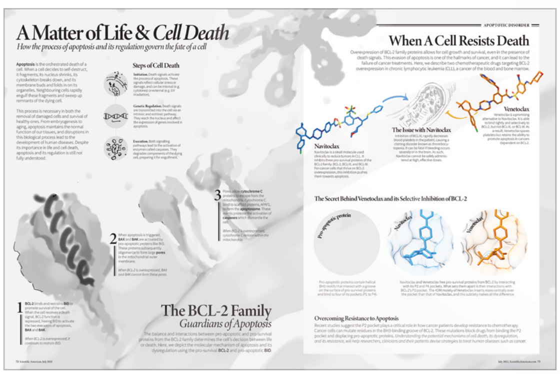
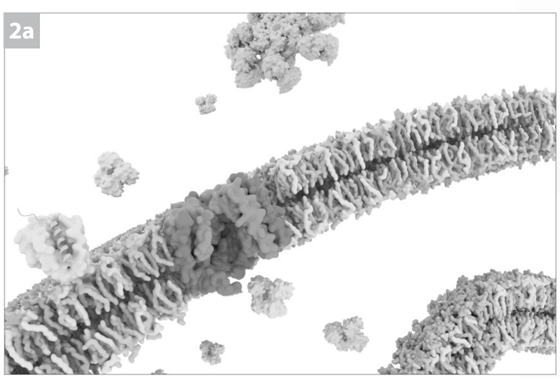



A Matter of Life & Cell Death
When A Cell Resists Death
The BCL-2 Family
Guardians of Apoptosis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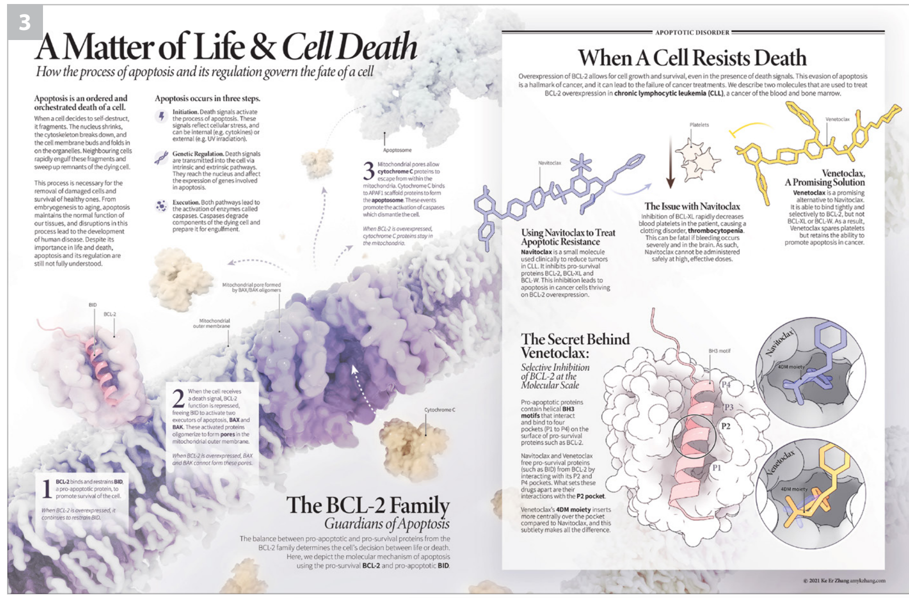
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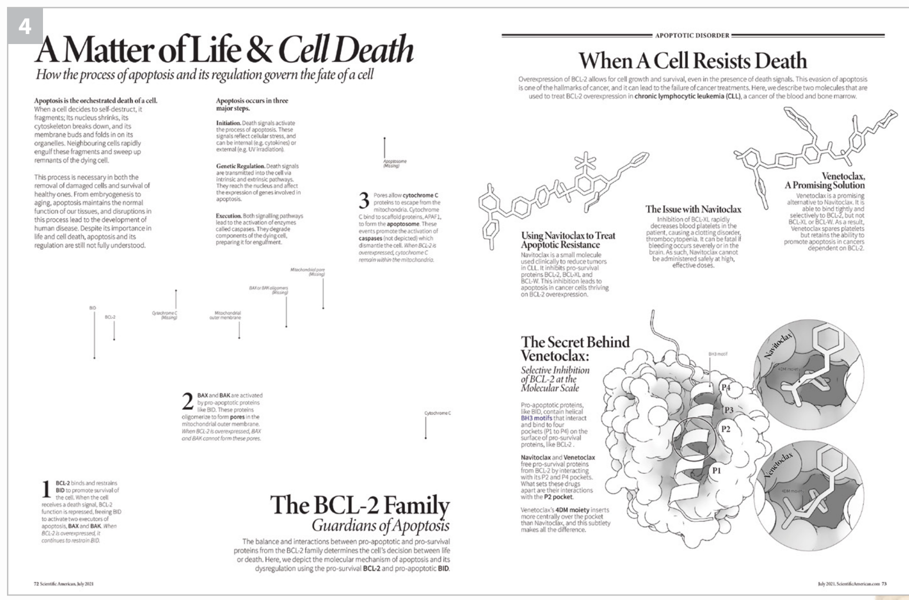
A Matter of Life & Cell Death
How the process of apoptosis and its regulation govern the fate of a cell
When A Cell Resists Death
The Secret Behind Venetoclax:
Selective Inhibition of BCL-2 at the Molecular Scale
The BCL-2 Family
Guardians of Apoptosis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A Matter of Life & Cell Death
How the process of apoptosis and its regulation govern the fate of a cell
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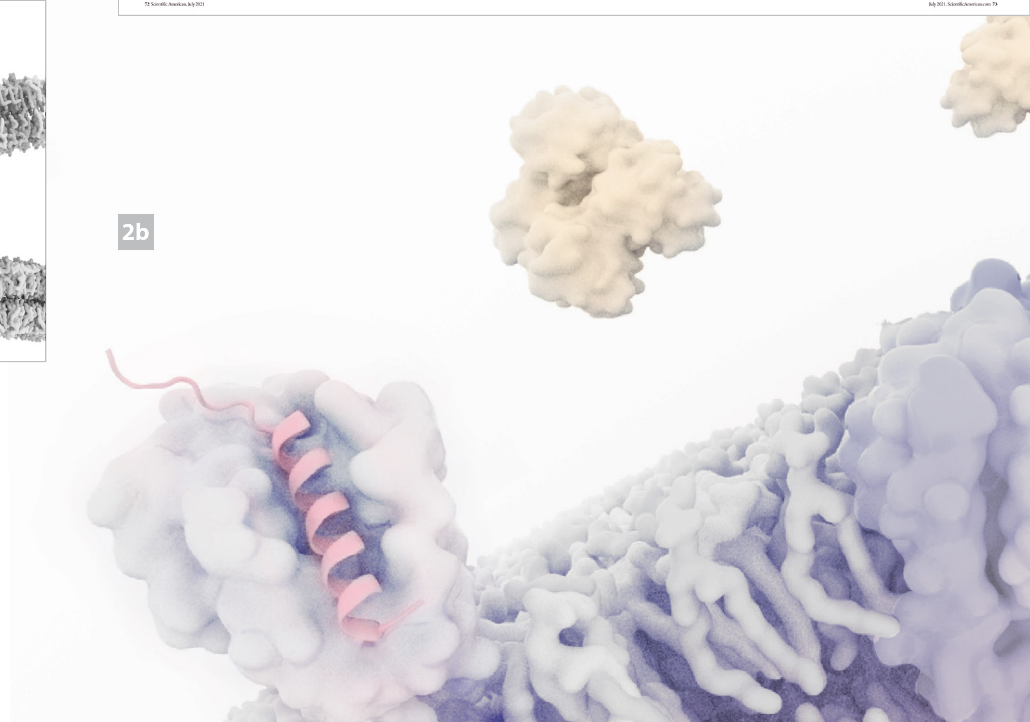
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Molecular Illustration

Apoptosis is a cellular process vital for human function. This spread illustrates how the overexpression of a particular protein alters apoptosis and leads to the development of cancer.

1.Sketch. Thumbnails to plan the flow and visual style of the piece. The cellular landscape illustrates the environment in which apoptosis occurs. Toon-shading was used to illustrate the drug mechanism in order to separate the two stories.

2a. 3D modelling. I integrated molecular data from multiple sources (e.g., PDB, UniProt, and more) to create a 3D cellular landscape in *Maya*. **2b.** A close-up, colourized view of the cellular landscape.

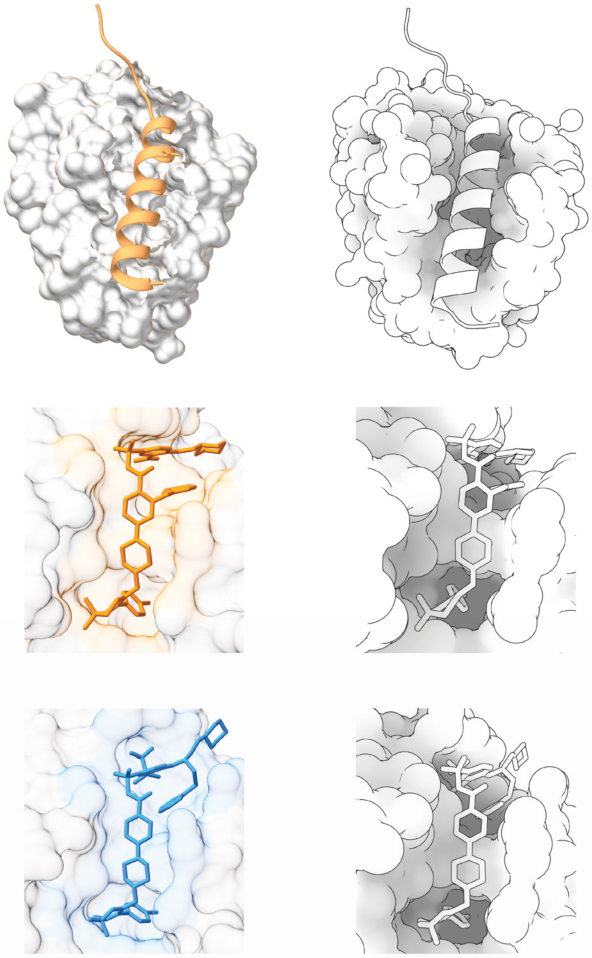
3. Final illustration. Once I had greyscale versions of the 3D and 2D assets ready, I colourized them in *Photoshop* and compiled them in *Illustrator*.

4. Production process. Before creating 3D assets, I edited the layout until I was happy with the text-visual balance.

5. Study. I experimented with the style of the molecules in *3D Protein Imager* and *UCSF Chimera*. The 2D toon-shaded assets stood out against the 3D cell-scape.

Previous spread. A graphic visualization illustrating trends in global health development in the 21st century.

5



Anatomical Illustration

This visual aid was designed for students learning head and neck anatomy. I created an interactive opacity slider that faded between images/illustrations drawn from serial dissections I performed of the parotid region and the infratemporal fossa.

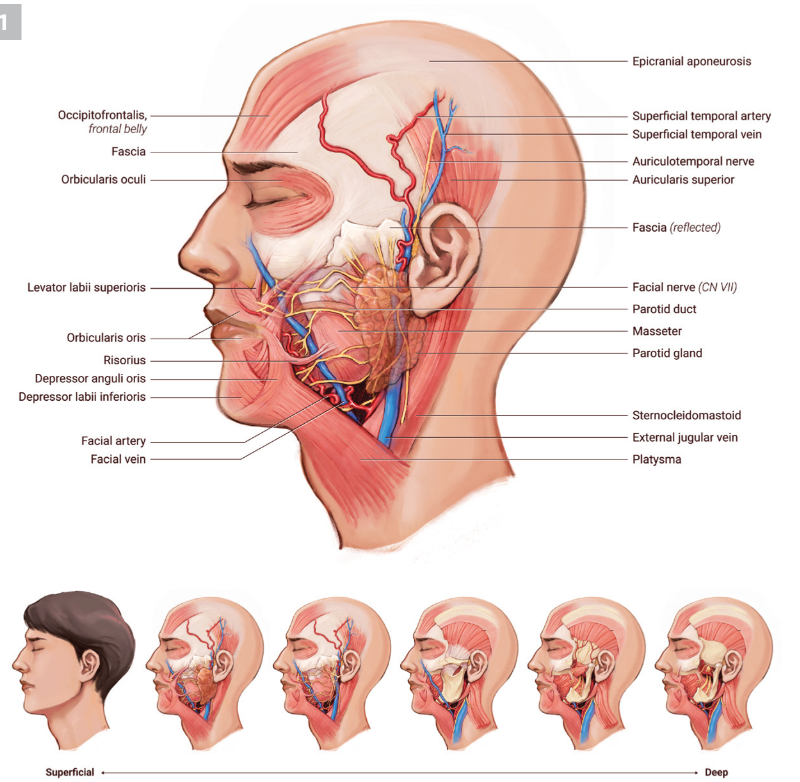
1. Final illustration. Illustrations of each layer of the face from superficial to deep. Students can scrub through the layers and see the relationships between structures.

2. Final illustration. Close-ups of the final illustrations.

3. Production process. Each illustration started with a sketch of the dissection. I went back and forth on the rendering style, and ultimately found inspiration in the vibrant work of Frank Netter. I painted over my sketches directly with colour.

4. Production process. This project took two semesters to complete. The first half was dedicated to dissection, and the second half to illustration. Consultations with my content expert occurred after each milestone.

1



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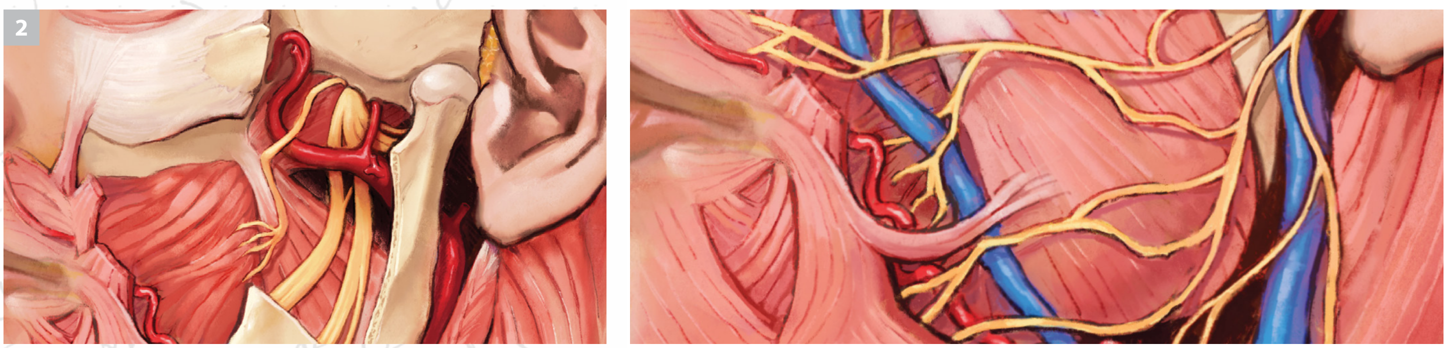

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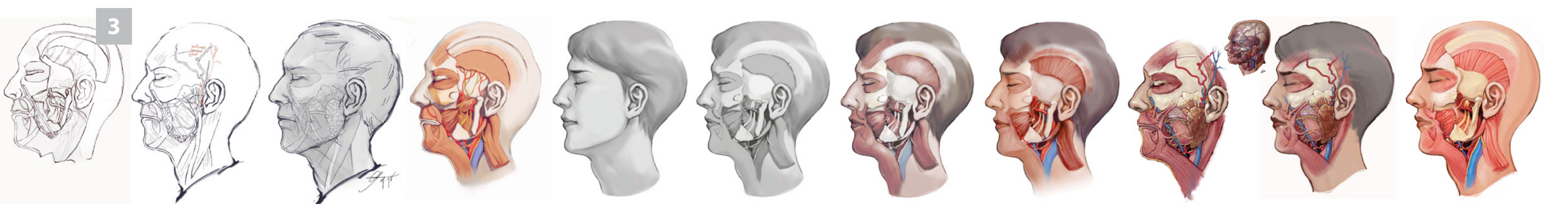

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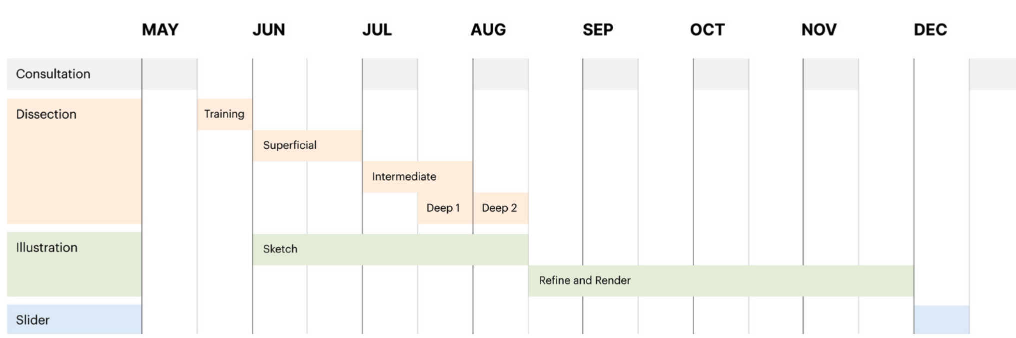

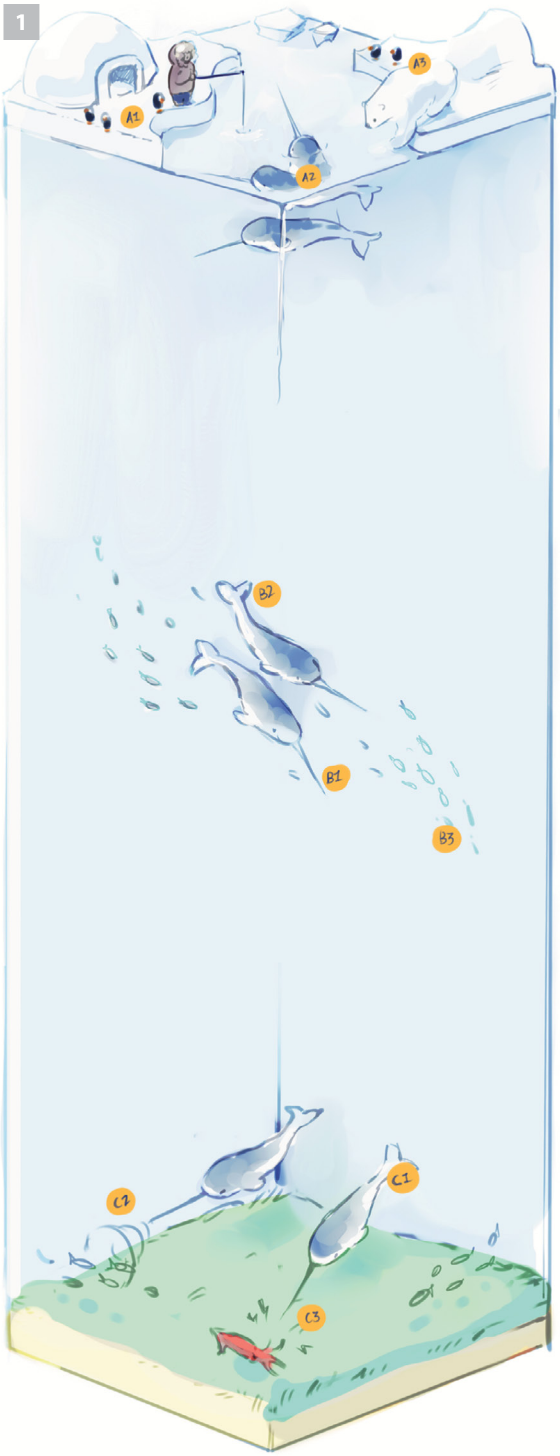

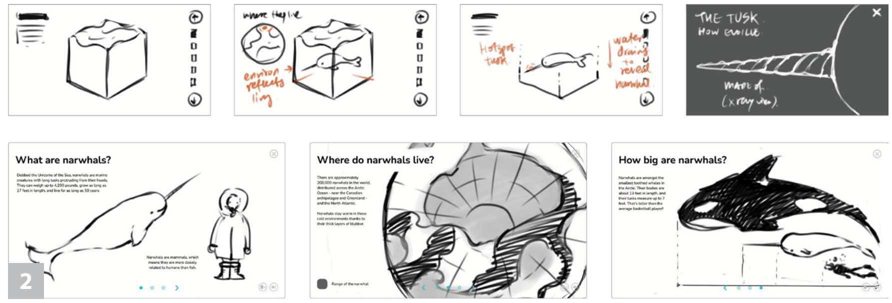

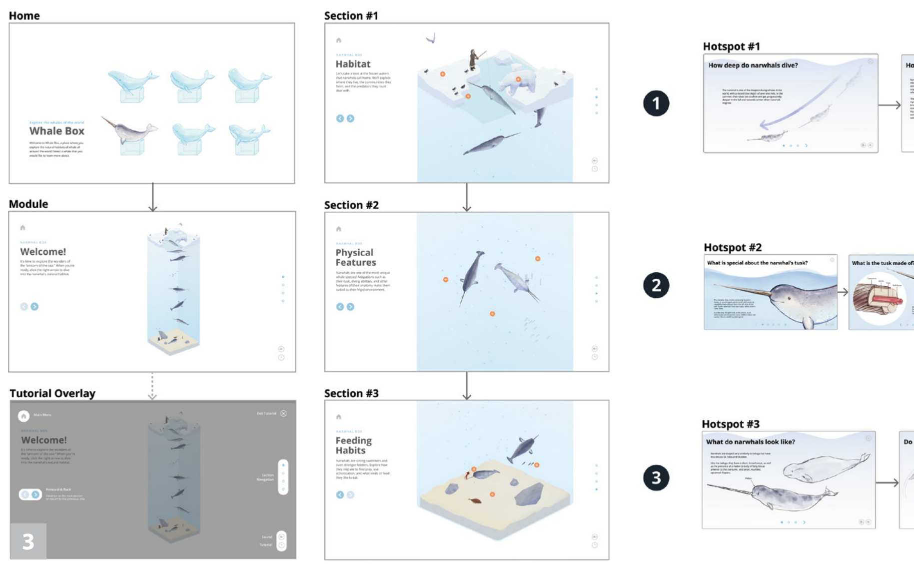

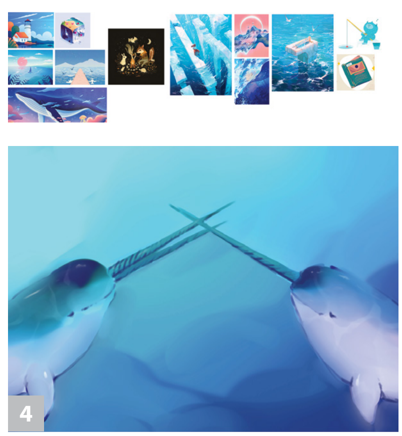

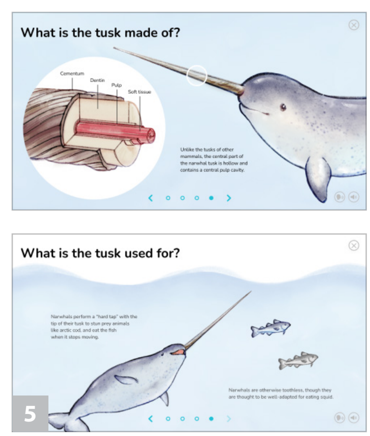

Interactive Animation

Whale Box is an interactive web app that invites users to learn about the life of a narwhal. Its characteristics were playfully brought to life using animated 3D models and 2D illustrations, designed and developed by a seven-member team including: Abeeshan Selvabaskaran, Aimy Wang, Amy Assabgui, Jenn Shao, Shay Saharan, and Viktoriya Khymych.

1. Sketch. Whale Box concept art. Each layer of the box contains a group of 3D assets that interact with one another to animate a story found within a hot spot.

2. Storyboard. At the start of the project, we brainstormed ideas for the application. We also created rough storyboards for the stories. These interactive groups are called hot spots.

3. Storyboard. Final storyboards/user journey for the application.

4. Study. 2D style experiments we used for the stories found within each hot spot.

5. Final illustration. In the end, I chose an illustration style that complemented the 3D assets while maintaining a distinct style of its own.

Visual Science Communication Toolkit

The Visual Science Communication (SciComm) Toolkit is a website housing guidelines and resources on the best practices of visual science communication for undergraduate biology students and instructors. I created a module that uses two 2D animations and an interactive activity to educate users in the principles of design.

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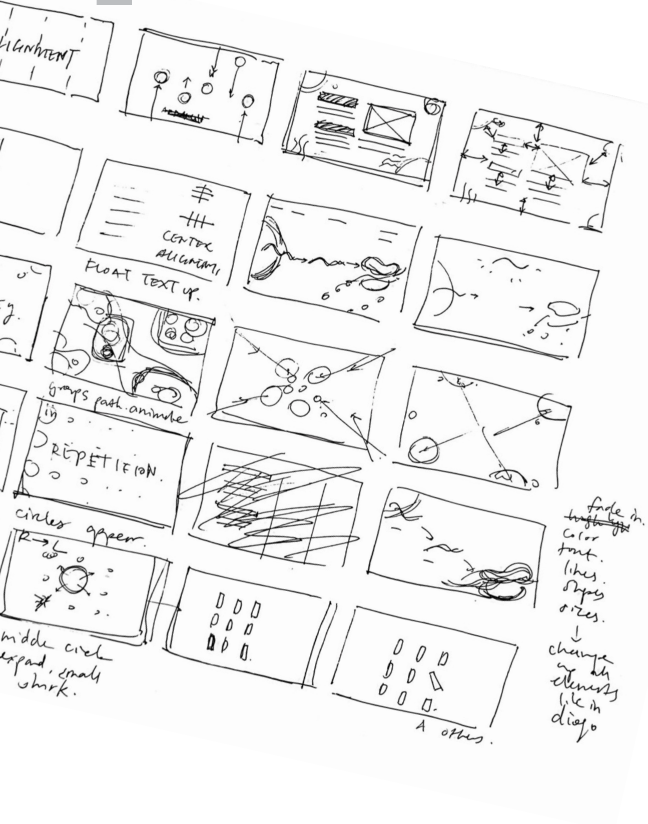

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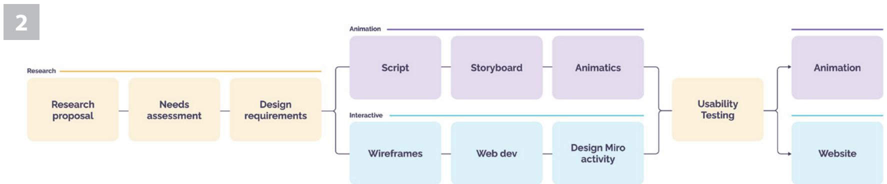

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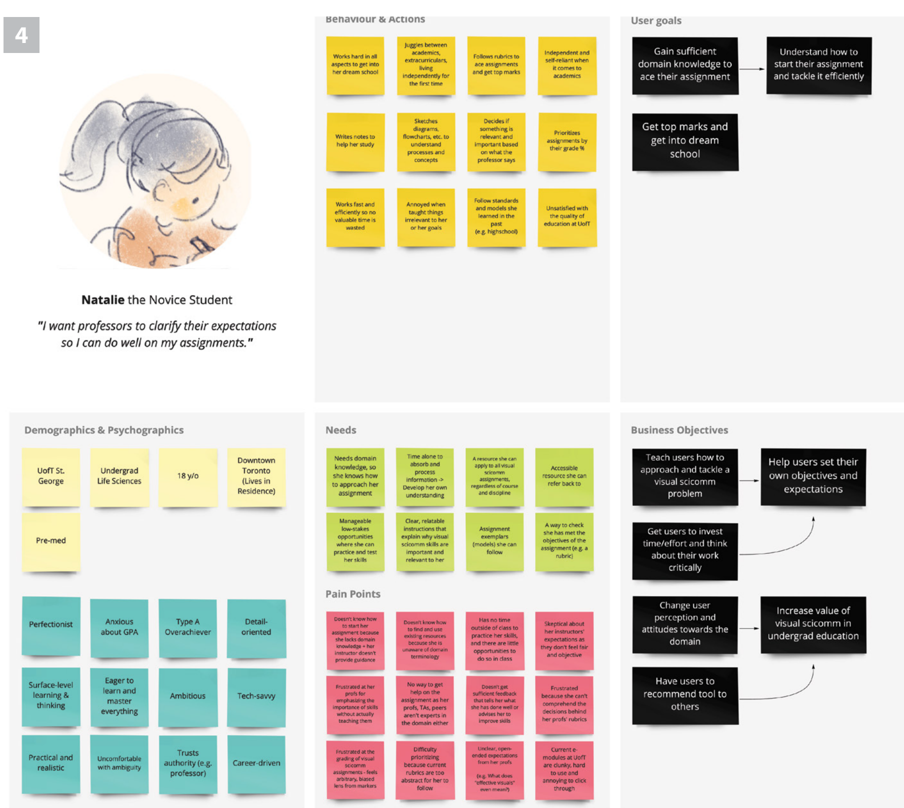
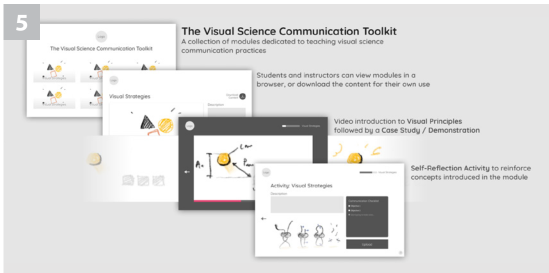


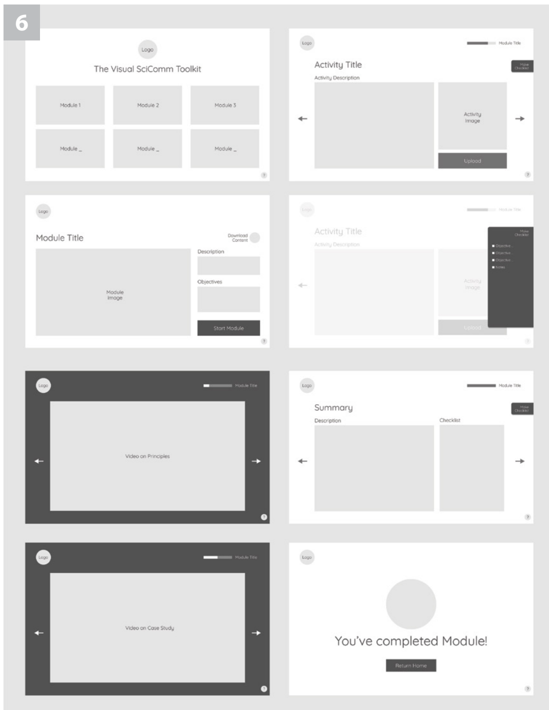
1. Sketch. I made a rough storyboard for *The Design Principles* animation on pen and paper.

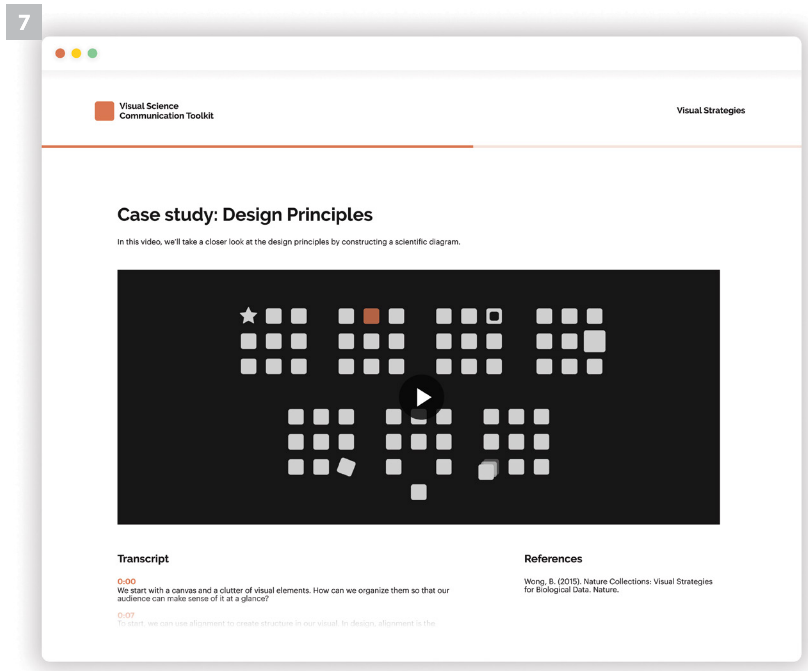
2. Production process. After user research and needs analysis, the project branched into an animation component and an interactive component. These were brought together for usability testing.

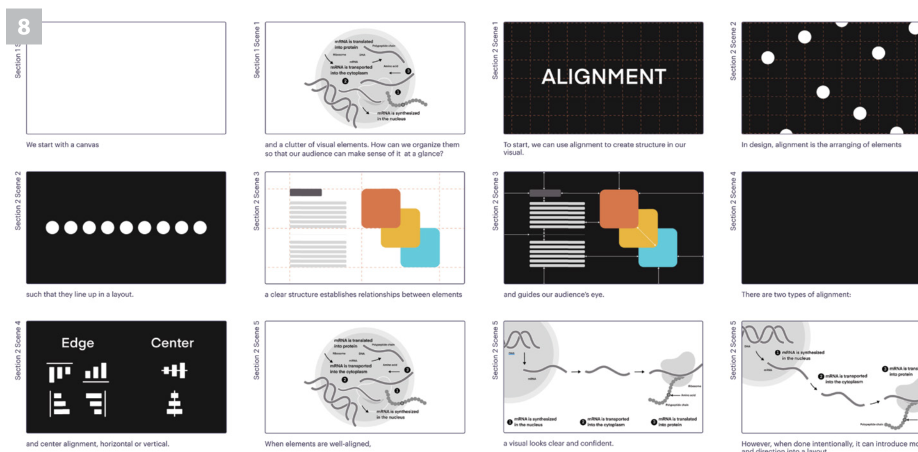
3. UX design. I organized findings from my usability testing sessions with an affinity diagram and used these insights to improve the product.

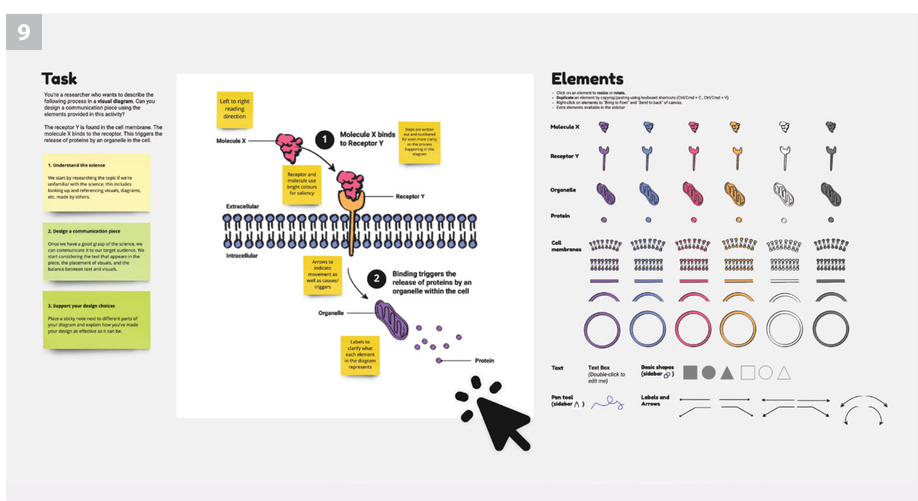
4. UX design. I created personas and other UX artifacts using data from my needs assessment. These artifacts helped me stand in my users' shoes and better understand their needs.











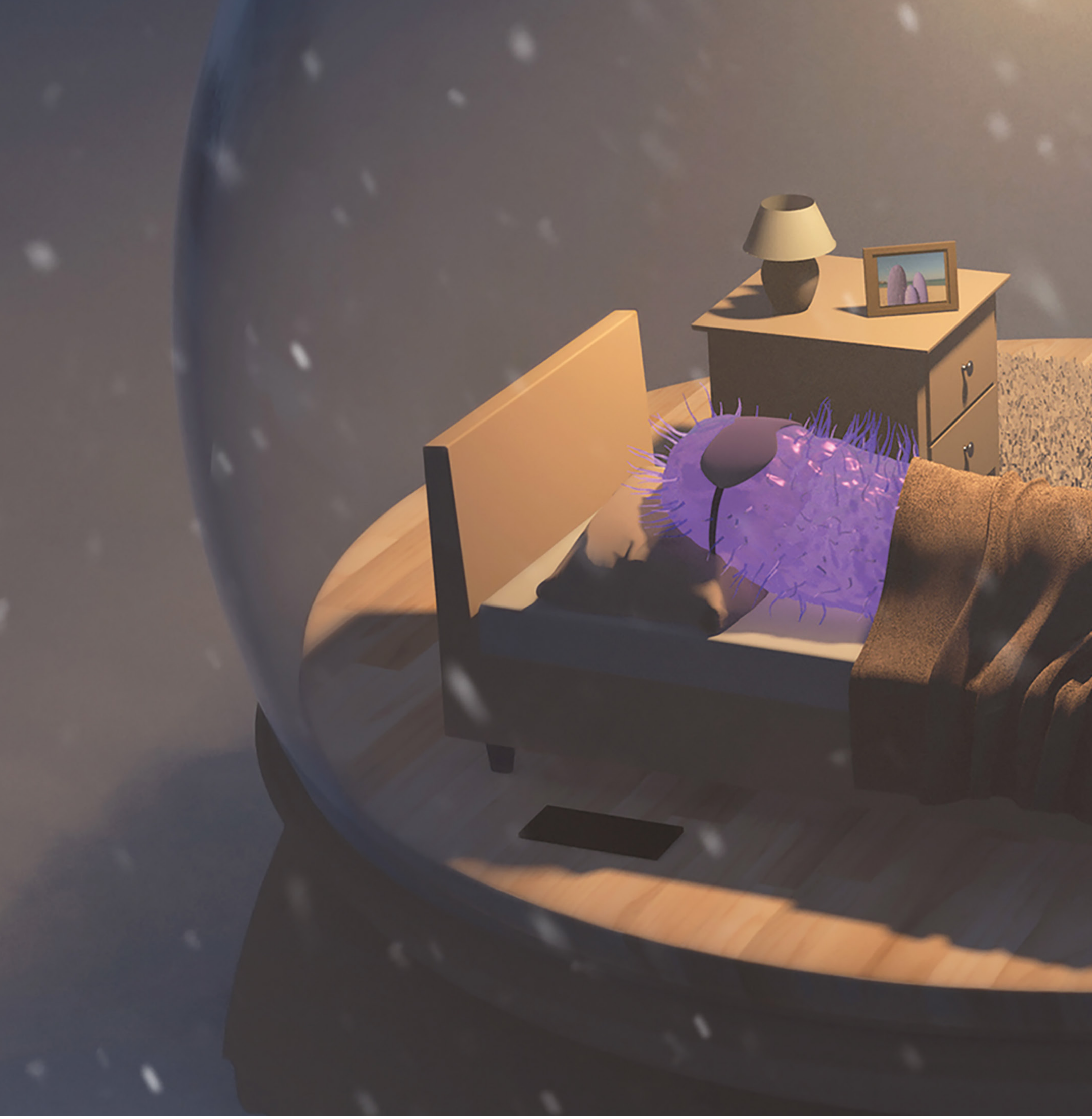
5. UX design. Based on my needs assessment findings, I created a concise visual that detailed my design concept.

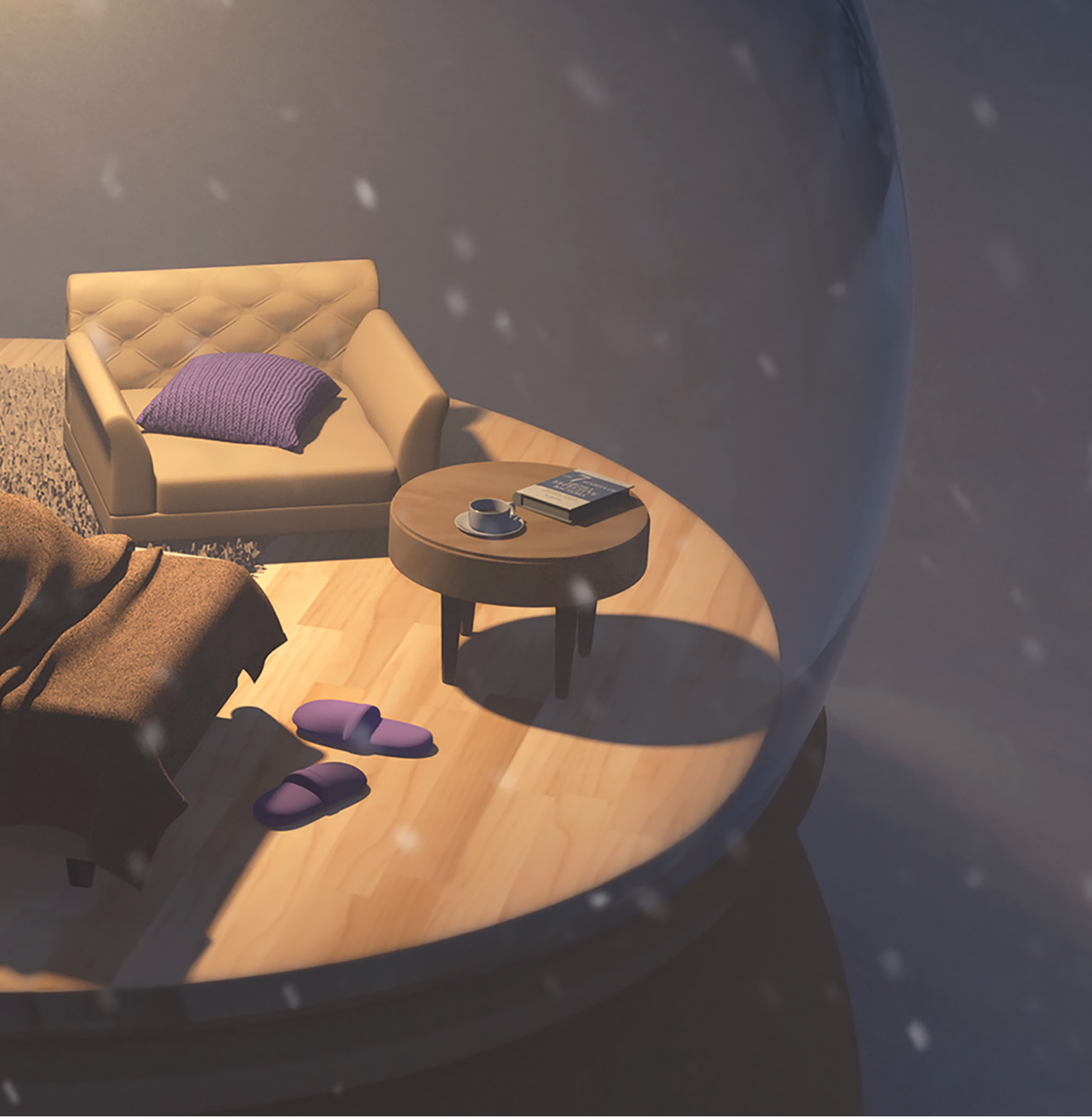
6. UI design. I created wireframes for the module using *Figma*. This allowed me to better understand the flow of the module and helped me code the webpage as well.

7. Final interactive. A mockup of the module webpage.

8. Final animation. The final storyboard for the Design Principles animation was created in *Figma*. Assets were exported from *Figma* and animated in *After Effects*.

9. Final interactive. The interactive *Miro* activity asks users to construct a diagram of a scientific process using pre-illustrated elements.





Cassie Ren

I am a biomedical communicator and illustrator passionate about translating science into engaging visuals for the public. I love exploring how stories can be told visually and how colours, characters, and symbolism can be used to engage audiences. In my work, visual metaphors have become my favourite tool to introduce unfamiliar issues or explain complex ones. They make topics such as mental illness more approachable and can potentially reduce stigma.

2D Animation

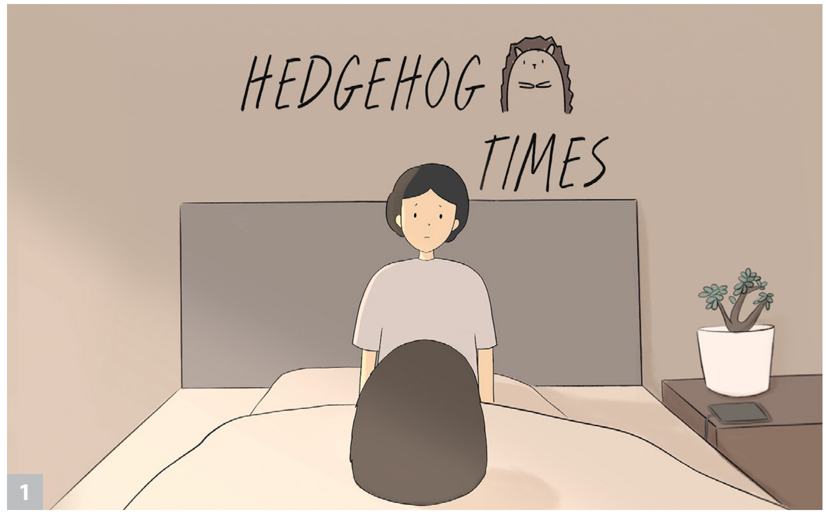
This frame-by-frame animation is created using tools of comic art, visual narratives, and visual metaphors to reflect the experience of living with anxiety and panic attacks, and overcoming them.

1. Final animation. A scene introducing the main characters and the title.

2. Sketch. Inspired by *I Had A Black Dog, His Name Was Depression* and *In Between*, I created a character named Spike, who is a visual metaphor for anxiety.

3. Final animation. I decided to do a frame-by-frame animation so the overall style is more like a comic and the movements of the characters are more natural.

Previous spread. A close-up of an editorial illustration highlighting how some bacteria survive extreme environments by establishing a dormant, non-replicating state.

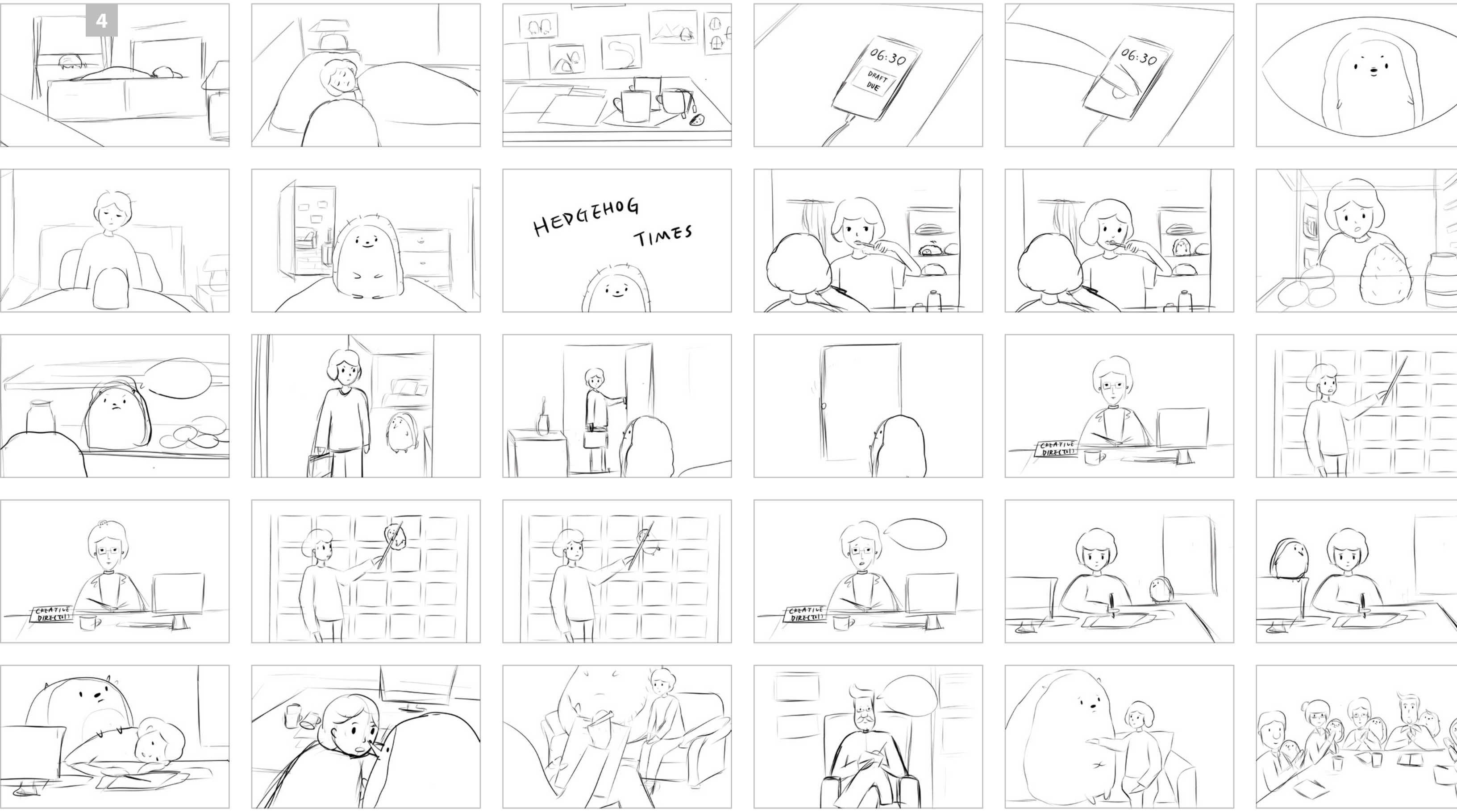


4. Storyboard. Rough storyboards are first created to plan out the scene.

5. Sketch. People with anxiety disorders often experience intense worry and fear about everyday situations. The idea is conveyed through Spike's questions that make Emi feel self-conscious and anxious.

6. Study. I experimented with different lighting after creating coloured storyboards.

4



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Molecular Illustration

This mock spread for *Scientific American* focuses on melatonin synthesis, melatonin's effects on circadian rhythms, and how melatonin binds with receptors to trigger cellular events.

1. Production process. I experimented with different compositions and chose the layout with the most logical information flow.

2. Final illustration. I positioned the melatonin molecules such that the audience's attention is directed towards the binding of melatonin on the right side of the spread.

3a. Production process. The rendering process of the sagittal view of the brain.
3b. The brain illustration is further adjusted to fit the colour scheme of this spread.

4. 3D modelling. The molecular structures (MT1, MT2, phospholipase C, G-proteins, adenylyl cyclase) were isolated and edited using *VMD* and *USCF Chimera*. They were then exported to *Maya* for compositing and rendering. A lipid bilayer was created using *Blender*.

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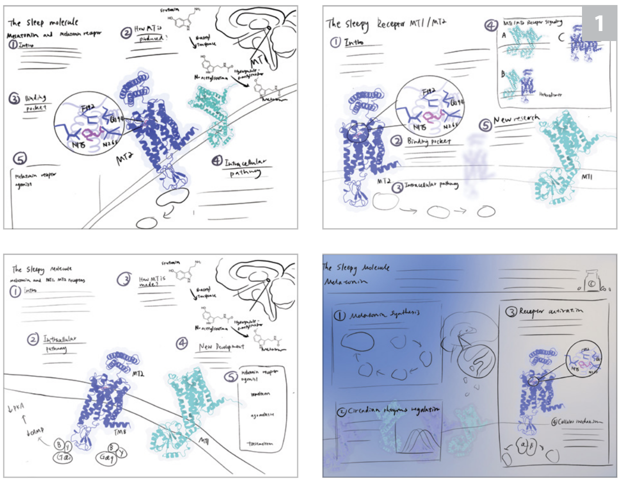

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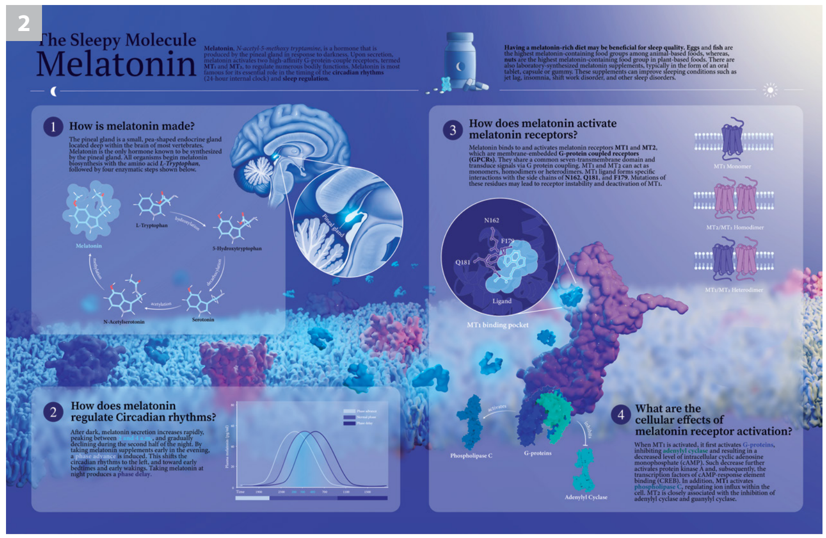

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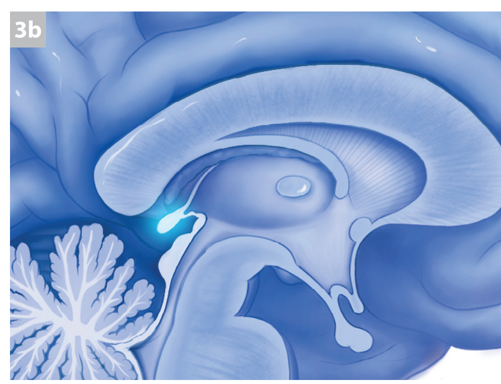

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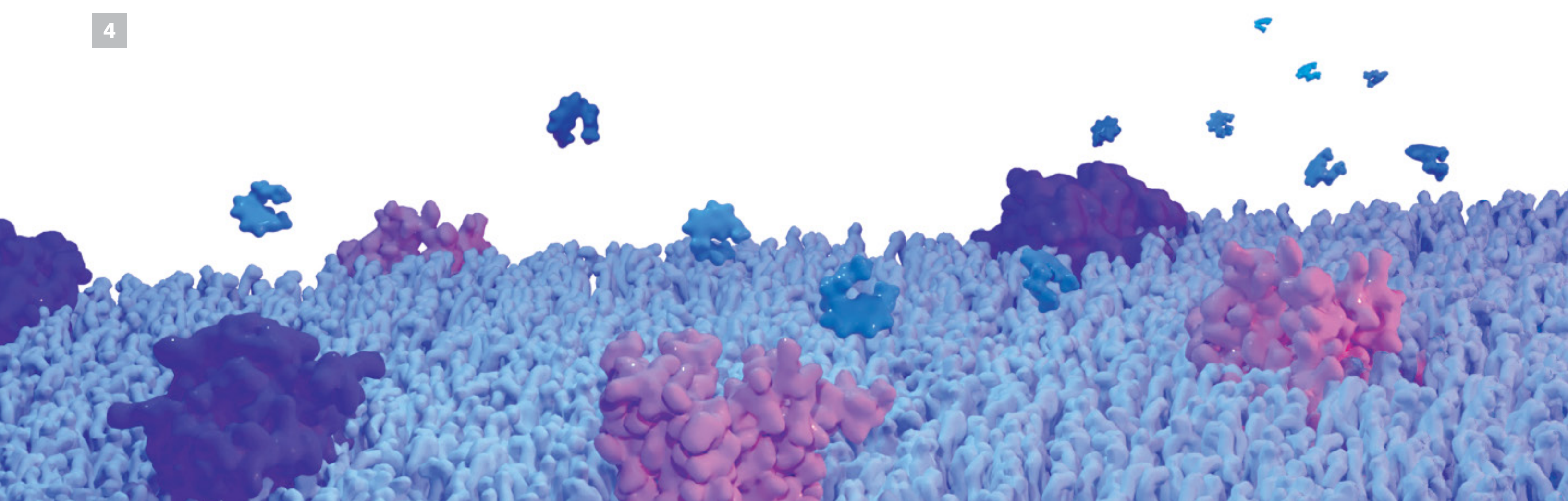
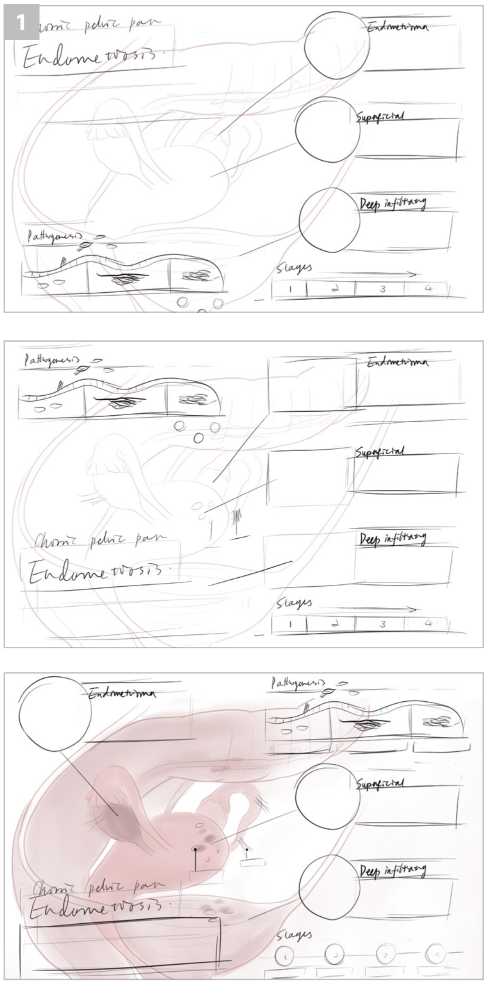
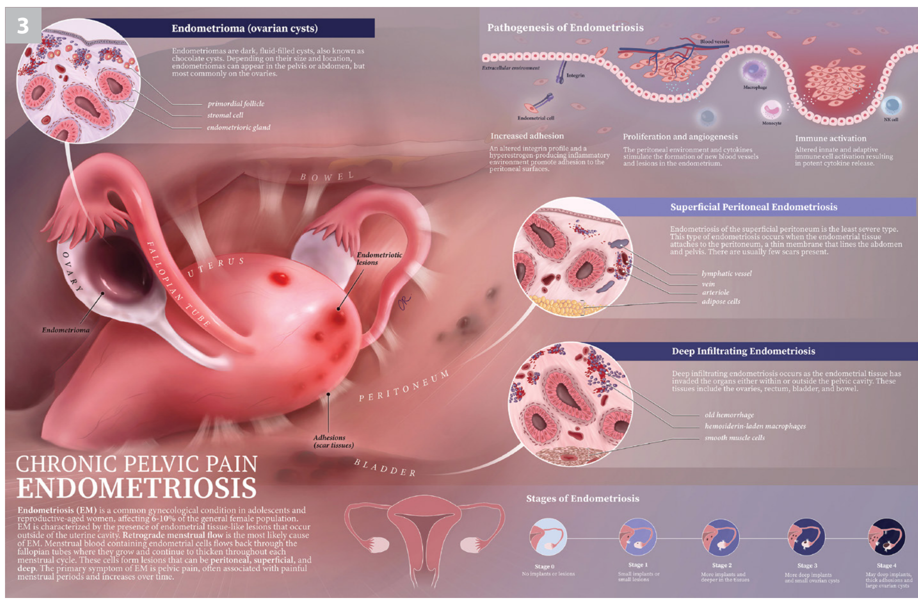
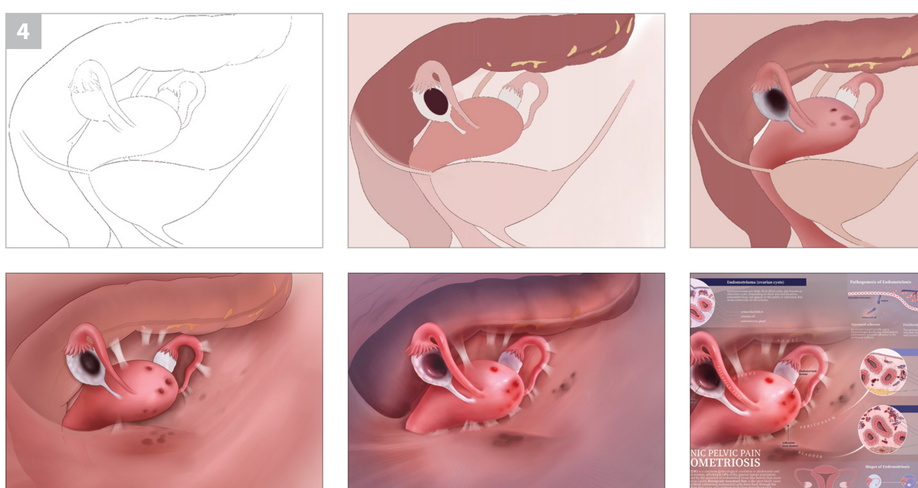


Pathological Illustration

This editorial illustration depicts the pathology of endometriosis. It focuses on the pathogenesis, stages, and types of endometriosis in various tissues. This piece is created for an educated lay audience in a popular science magazine.





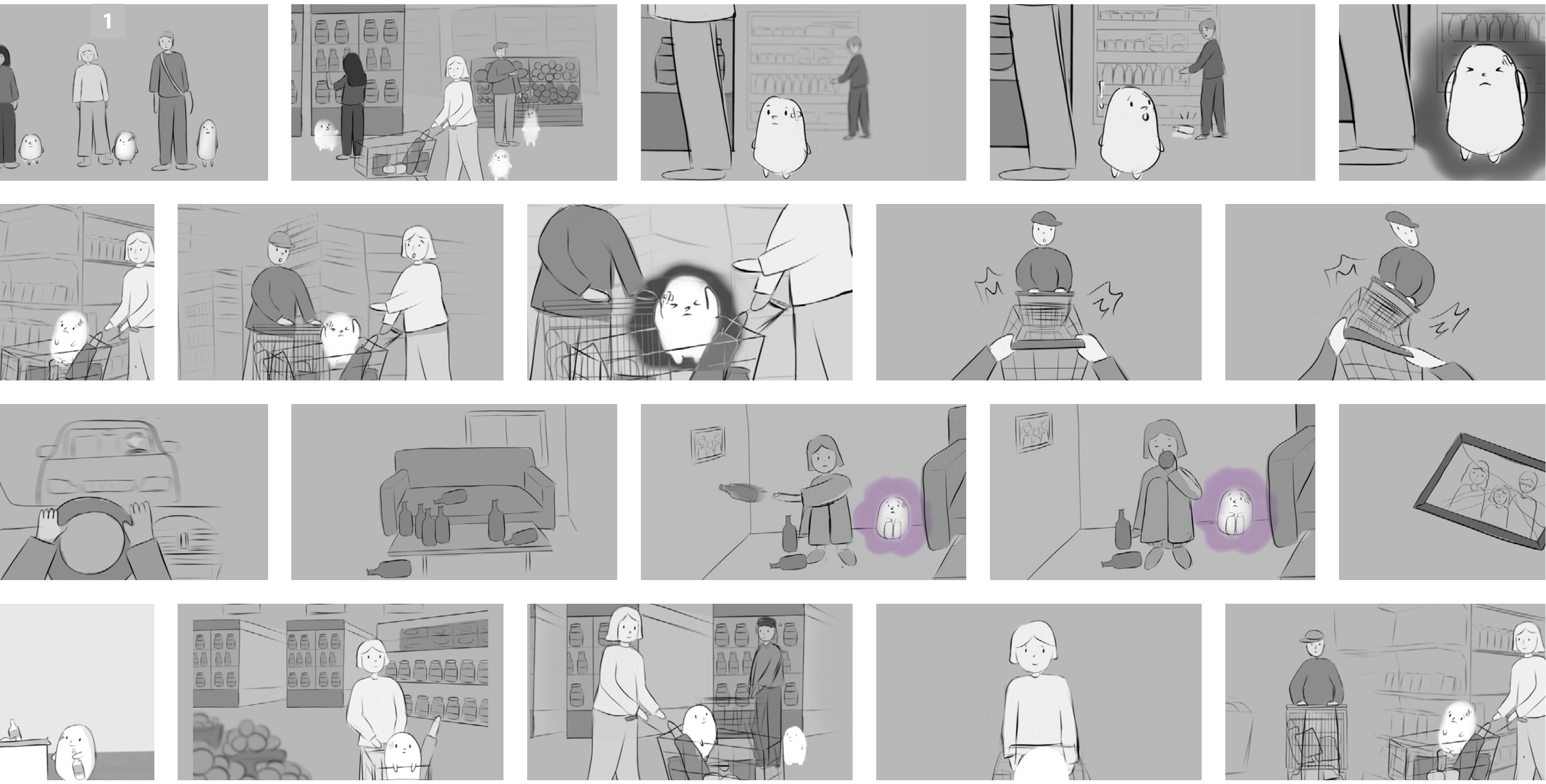


1. Production process. I started by laying out different graphical elements and texts. A quick colour test was created after deciding on a layout.

2. Study. Tissue cube studies were made to understand the cellular changes in different organs when endometriosis occurs.

3. Final illustration. I decided to render the main illustration realistically while keeping the other graphical element more schematically to avoid visual clutter.

4. Production process. The rendering process of the main illustration, from linework to final product.



A 2D Animation on Substance Use Disorder (SUD) for PTSD Patients

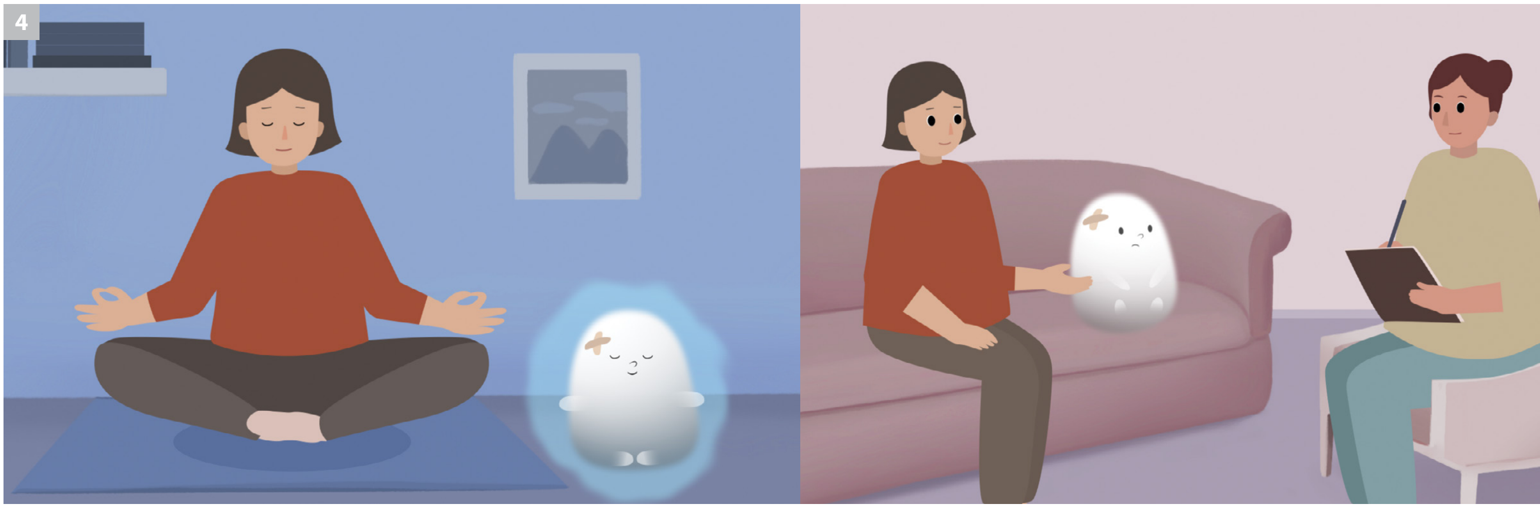
An educational animation to guide PTSD patients on informed substance use. Through visual metaphors and narration, this animation follows a PTSD patient's substance recovery journey using non-triggering visual graphics.

1. Storyboard. Creating a consistent visual language for traumatic triggers was challenging in this project. In the final version of the storyboards, the traumatic triggers were things that could be found in a grocery store, e.g., the bumping of shopping carts.

2. Study. I created some rough colour tests to test out the colour palette. I selected a desaturated colour palette suitable for the subject matter. Several versions of the character design were also created.

3. Production process. For the background production, 3D models were first created in *Maya* as perspective references. Then, 2D renderings were created in *Procreate* to match the style of the characters.

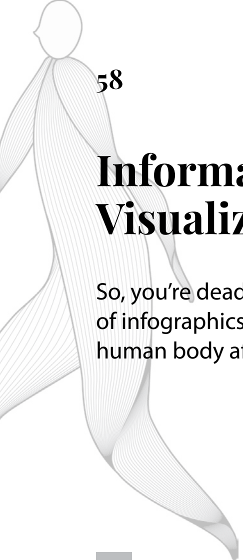
4. Final animation. Selected shots from the final animation.



Mucosal edema
Longitudinal and transverse ulcers
TISSUE
MUCOSAL LESIONS
Crypt inflammation leads to the formation of tiny focal aphthoid ulcers in the mucosa of the intestinal wall.
TRANSMURAL LESIONS
Mucosal lesions develop into longitudinal and transverse ulcers, interspersed by mucosal edema and healthy skin. This appearance is akin to cobble-stone.
HYPERTROPHY
Progressive transmural inflam-mation causes lymphedema, thickening of the bowel wall and mesentery, and hypertro-phy of the smooth intestinal muscle. Subsequent stricture formation leads to bowel obstruction.
DON'T PANIC
Scientists are actively investigating the relationship between how a baby was delivered, their gut microbiota, and their future health.
An emergency c-section can save the life of both mother and newborn 14.
The gut microbiota is only one factor in a much larger decision made between the mother and their doctor.
PRENATAL
Healthy diet
Farm exposure
Vaginal health
Diabetes
Antibiotics
Obesity
A
B
C
D
You are born.

Jenn Shao

I once wanted to be an astronaut. Space was beautiful and unknown and exhilarating. But what I loved most was the stories you could tell about space. I view narrative as the gravity that pulls together facts, data, and ideas. My goal is to turn scientific and complex knowledge into effective, engaging, and accessible tools to reach a wider audience. Let's tell a great story together!



Information Visualization

So, you're dead. What happens now? This is a series of infographics that describes what happens to the human body after brain death to years after.

1. Sketch. One of the biggest challenges of this project was wrangling with the timescale. I explored different layouts to visually convey the timeline of different events that happen post-mortem.

2. Sketch. A rough draft of a potential layout that I was exploring. I was playing with time-lines to convey events that happen very quickly and concurrently.

3. Sketch. The human body decays differently in different environments, such as the hot Texas sun or when submerged underwater.

4. Study. Instead of a realistic style of illustration, I decided to create a simplified, stylistic version of the human body. I would still be able to illustrate events such as bloat, or the purging of internal body contents, without evoking a feeling of disgust.

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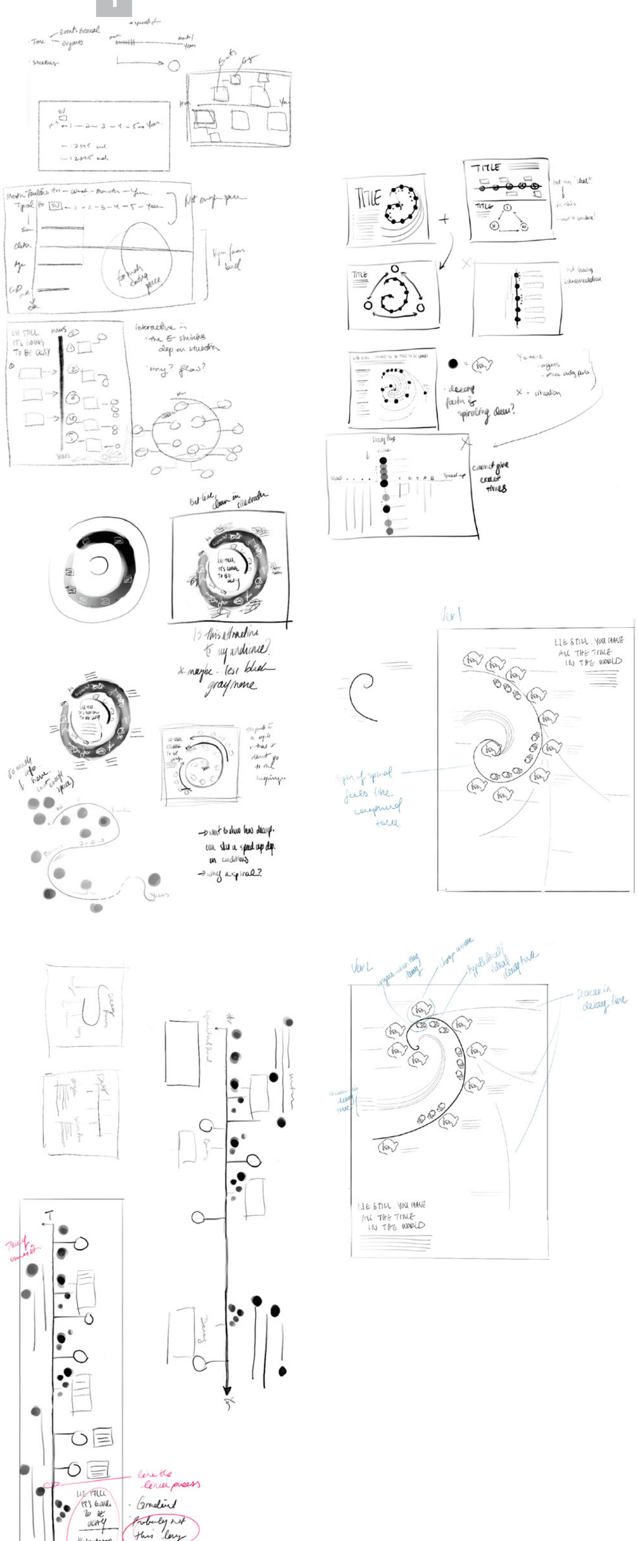

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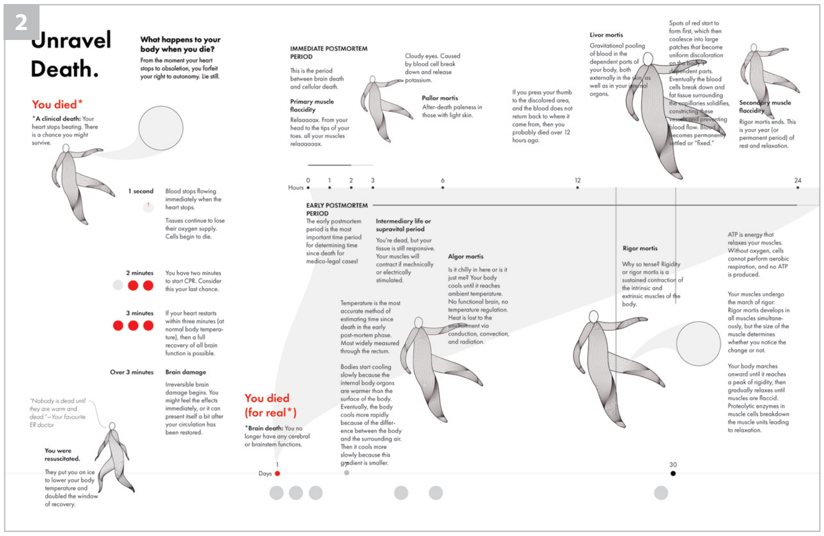

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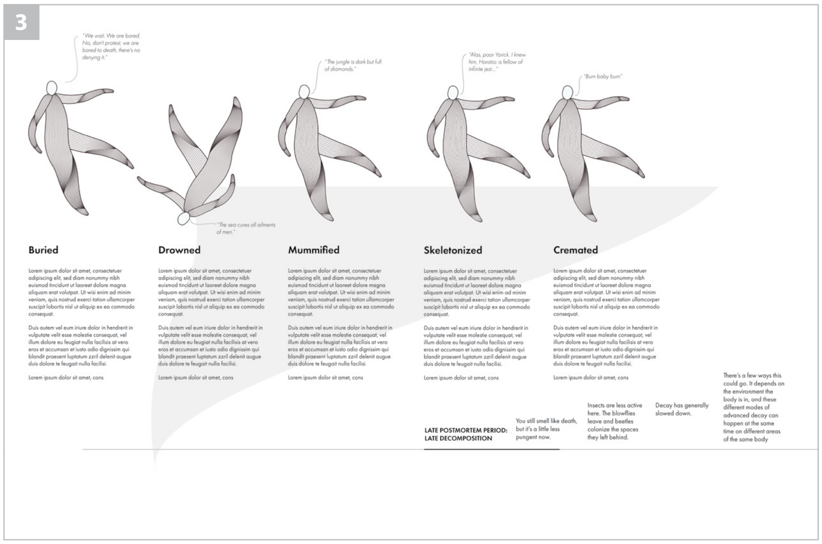

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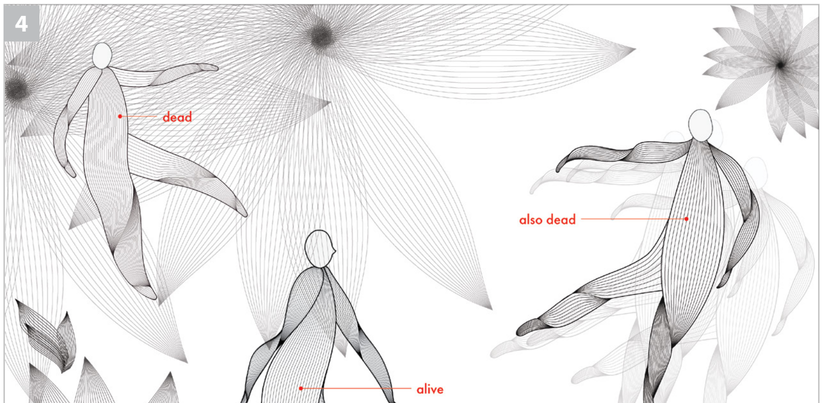
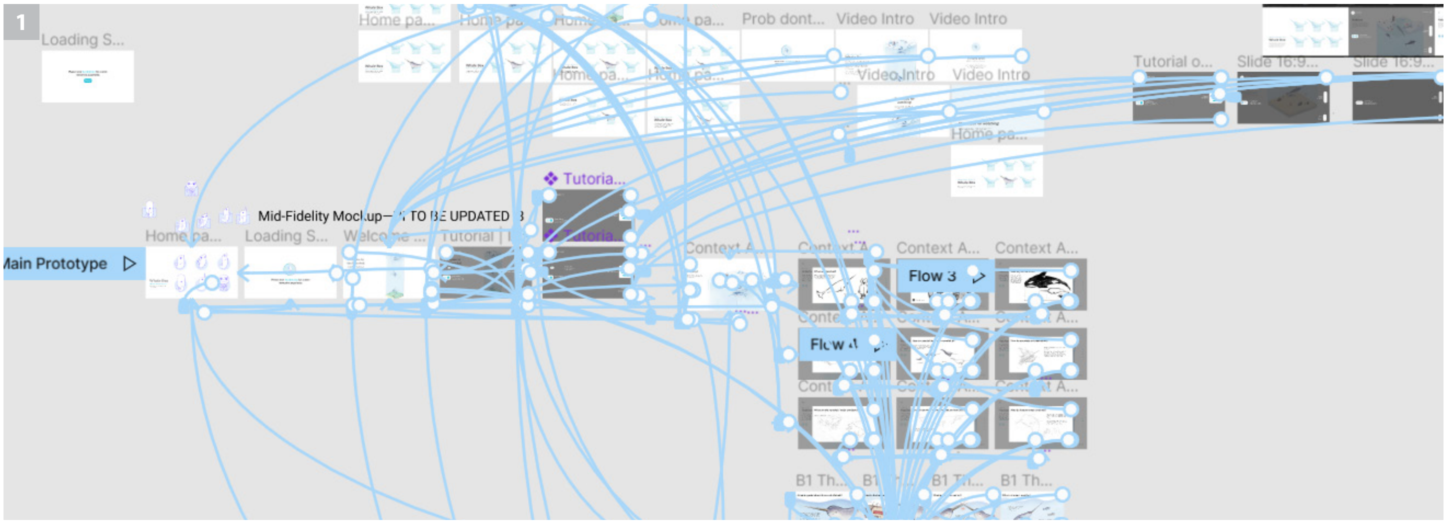
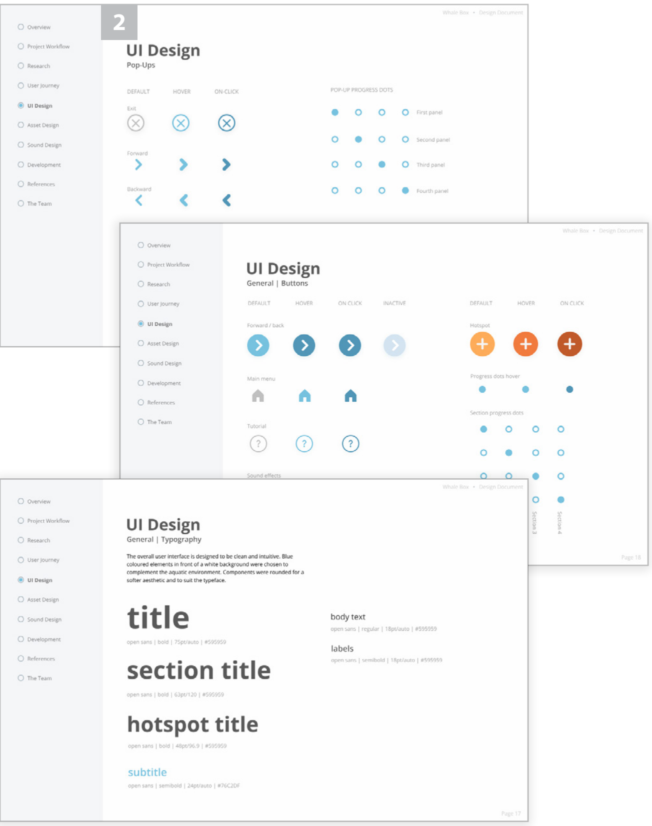
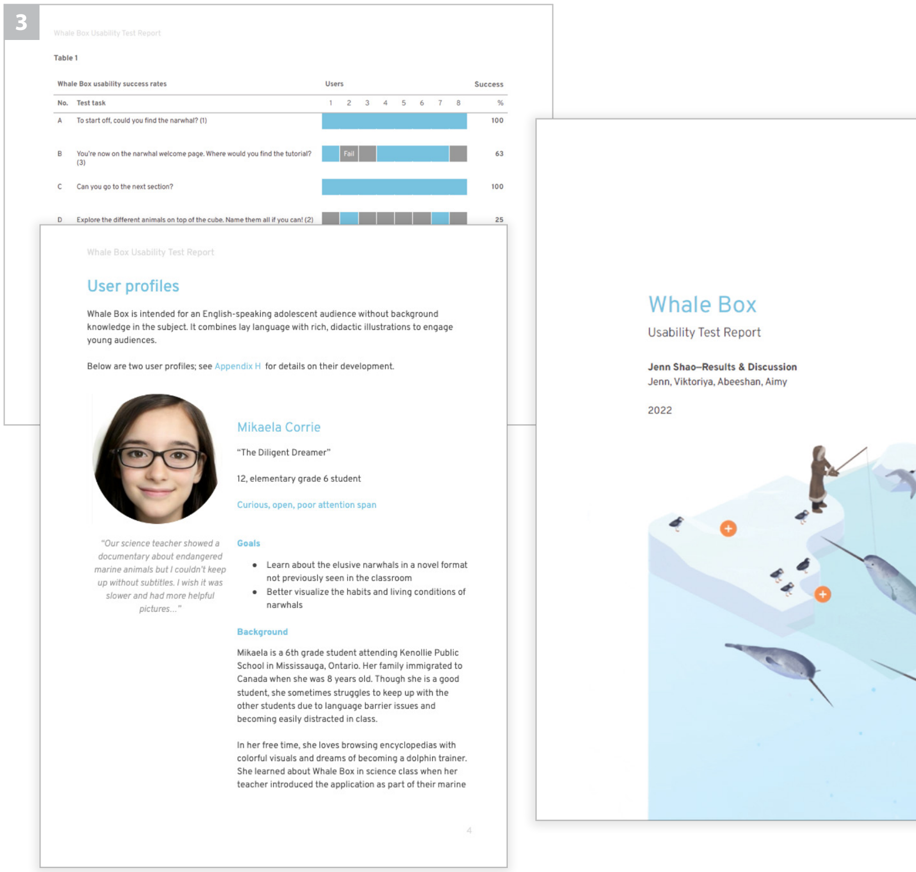








UI/UX Design

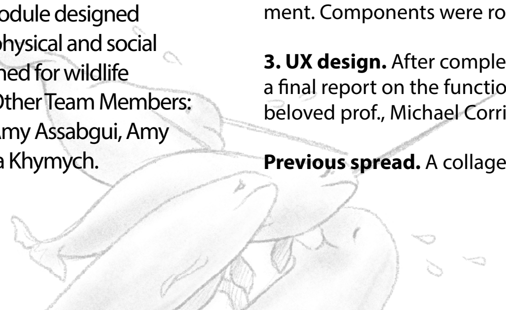
Whale Box is a web-based interactive module designed for exploration and learning about the physical and social characteristics of the narwhal. It is designed for wildlife conservation outreach and education. Other Team Members: Abeeshan Selvabaskaran, Aimy Wang, Amy Assabgui, Amy Ke Er Zhang, Shay Saharan, and Viktoriya Khymych.

1. Prototype. This mid-fidelity prototype involved designing the microinteractions and animations while navigating the app to create an experience that feels good.

2. UI design. The overall user interface is designed to be clean and intuitive. Blue coloured elements in front of a white background were chosen to complement the aquatic environment. Components were rounded for a softer aesthetic and to suit the typeface.

3. UX design. After completing our demo video, I conducted usability testing and wrote a final report on the functionality of the app. Here you can see Mikaela Corrie, a twist on a beloved prof., Michael Corrin.

Previous spread. A collage depicting some of the project work I completed during BMC.



Pathological Illustration

A two-page magazine spread investigating the pathological changes in gastrointestinal tissue in Crohn's disease, an inflammatory disease of the bowel. During the completion of this project, I learned how to find and tell an engaging story when overloaded by research.

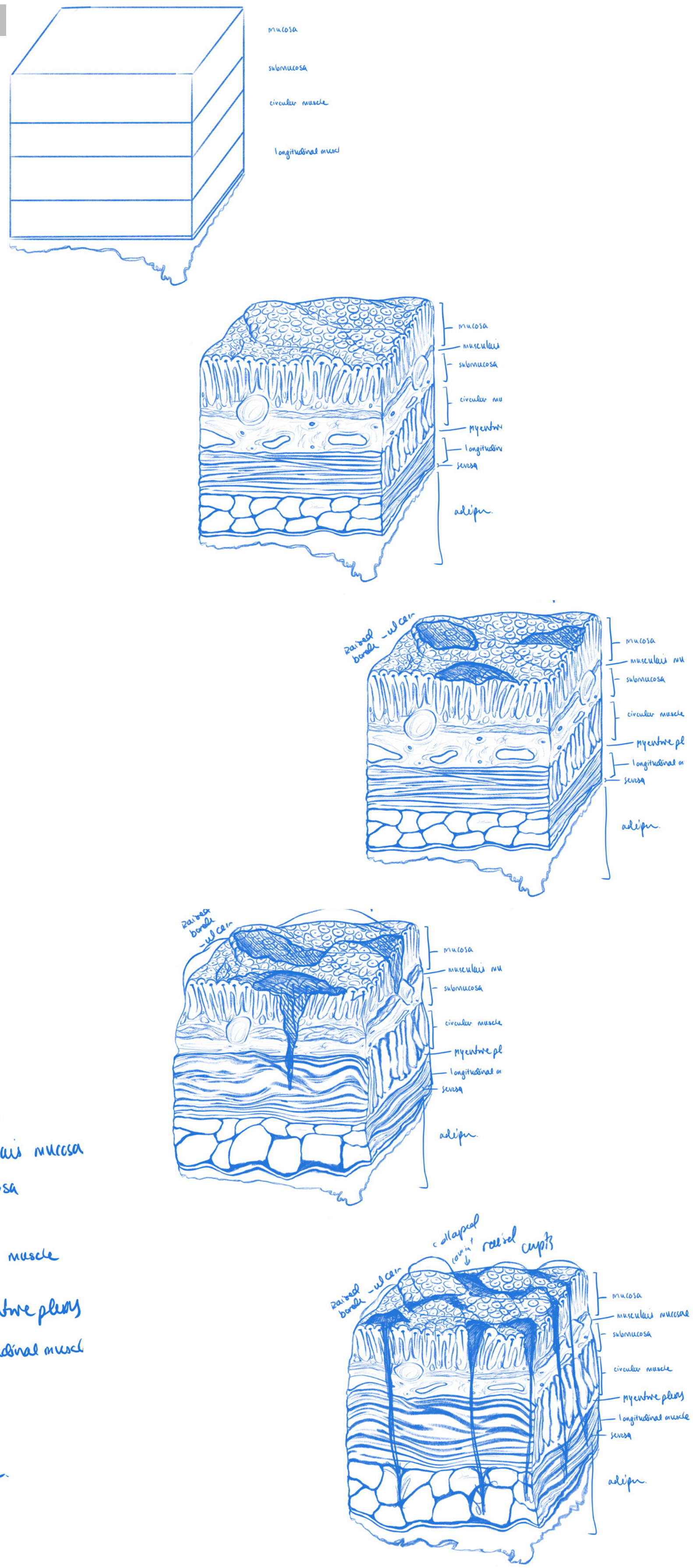
1. Sketch. Tissues cubes were the focal point of the narrative. My goal was to show the microscopic spatiotemporal changes to the gastrointestinal tract, which are often absent from information pieces on Crohn's disease.

2. Sketch. Colonic tissue cubes deteriorating at various stages of pathology.

3. Final illustration. I focused on creating a line-driven, minimalist style to better highlight the microscopic tissue changes, as opposed to using a painterly style.

4. Sketch. One of my biggest struggles was figuring out the story I wanted to tell. These are just a few sketches from a larger pile of the different routes I wanted to explore. What helped me to trim the fat was writing down a single sentence that conveyed the message I wanted my audience to take away. Everything else became irrelevant.

2



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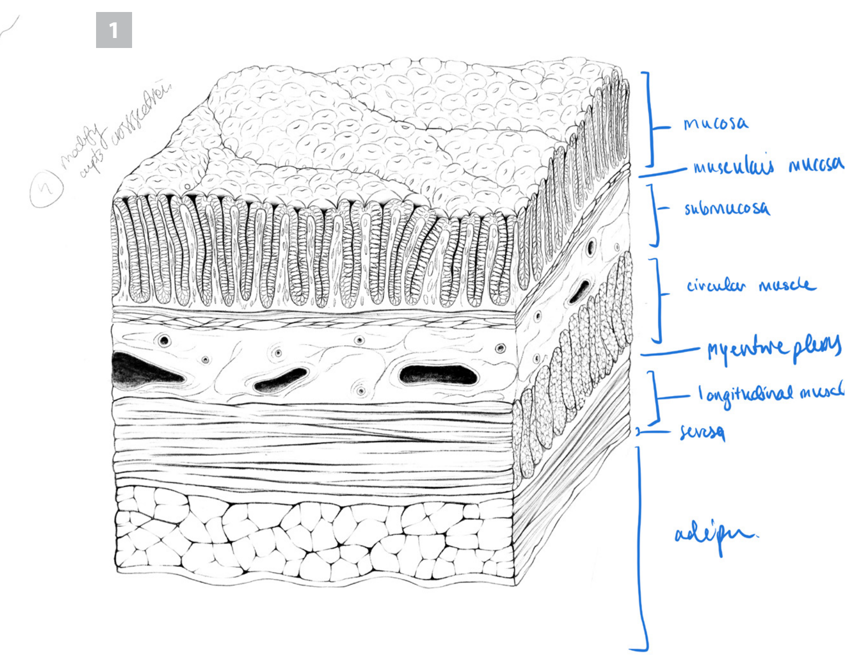

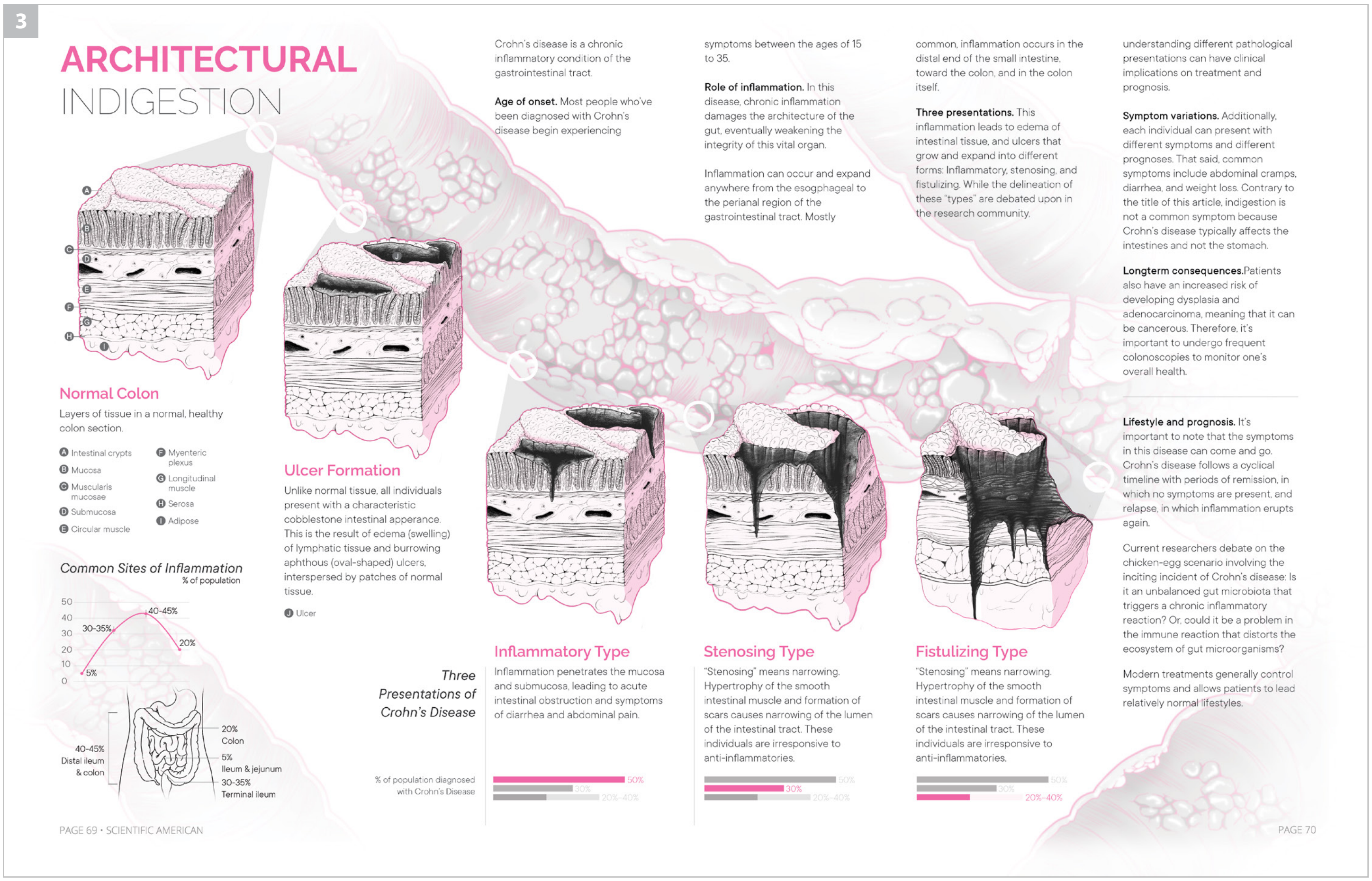
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ARCHITECTURAL INDIGESTION

Crohn's disease is a chronic inflammatory condition of the gastrointestinal tract.

Age of onset. Most people who've been diagnosed with Crohn's disease begin experiencing symptoms between the ages of 15 to 35.

Role of inflammation. In this disease, chronic inflammation damages the architecture of the gut, eventually weakening the integrity of this vital organ.

Inflammation can occur and expand anywhere from the esogphageal to the perianal region of the gastrointestinal tract. Mostly common, inflammation occurs in the distal end of the small intestine, toward the colon, and in the colon itself.

Three presentations. This inflammation leads to edema of intestinal tissue, and ulcers that grow and expand into different forms: Inflammatory, stenosing, and fistulizing. While the delineation of these "types" are debated upon in the research community, understanding different pathological presentations can have clinical implications on treatment and prognosis.

Symptom variations. Additionally, each individual can present with different symptoms and different prognoses. That said, common symptoms include abdominal cramps, diarrhea, and weight loss. Contrary to the title of this article, indigestion is not a common symptom because Crohn's disease typically affects the intestines and not the stomach.

Longterm consequences. Patients also have an increased risk of developing dysplasia and adenocarcinoma, meaning that it can be cancerous. Therefore, it's important to undergo frequent colonoscopies to monitor one's overall health.

Lifestyle and prognosis. It's important to note that the symptoms in this disease can come and go. Crohn's disease follows a cyclical timeline with periods of remission, in which no symptoms are present, and relapse, in which inflammation erupts again.

Current researchers debate on the chicken-egg scenario involving the inciting incident of Crohn's disease: Is it an unbalanced gut microbiota that triggers a chronic inflammatory reaction? Or, could it be a problem in the immune reaction that distorts the ecosystem of gut microorganisms?

Modern treatments generally control symptoms and allows patients to lead relatively normal lifestyles.

Normal Colon
Layers of tissue in a normal, healthy colon section.

A Intestinal crypts
B Mucosa
C Muscularis mucosae
D Submucosa
E Circular muscle
F Myenteric plexus
G Longitudinal muscle
H Serosa
I Adipose

Ulcer Formation
Unlike normal tissue, all individuals present with a characteristic cobblestone intestinal apperance. This is the result of edema (swelling) of lymphatic tissue and burrowing aphthous (oval-shaped) ulcers, interspersed by patches of normal tissue.

J Ulcer

Common Sites of Inflammation
% of population
50, 40, 30, 20, 10, 0
40-45%
30-35%
20%
5%

40-45% Distal ileum & colon
20% Colon
5% Ileum & jejunum
30-35% Terminal ileum

Three Presentations of Crohn's Disease

Inflammatory Type
Inflammation penetrates the mucosa and submucosa, leading to acute intestinal obstruction and symptoms of diarrhea and abdominal pain.

Stenosing Type
"Stenosing" means narrowing. Hypertrophy of the smooth intestinal muscle and formation of scars causes narrowing of the lumen of the intestinal tract. These individuals are irresponsive to anti-inflammatories.

Fistulizing Type
"Stenosing" means narrowing. Hypertrophy of the smooth intestinal muscle and formation of scars causes narrowing of the lumen of the intestinal tract. These individuals are irresponsive to anti-inflammatories.

% of population diagnosed with Crohn's Disease
50% 30% 20%-40%
50% 30% 20%-40%
50% 30% 20%-40%

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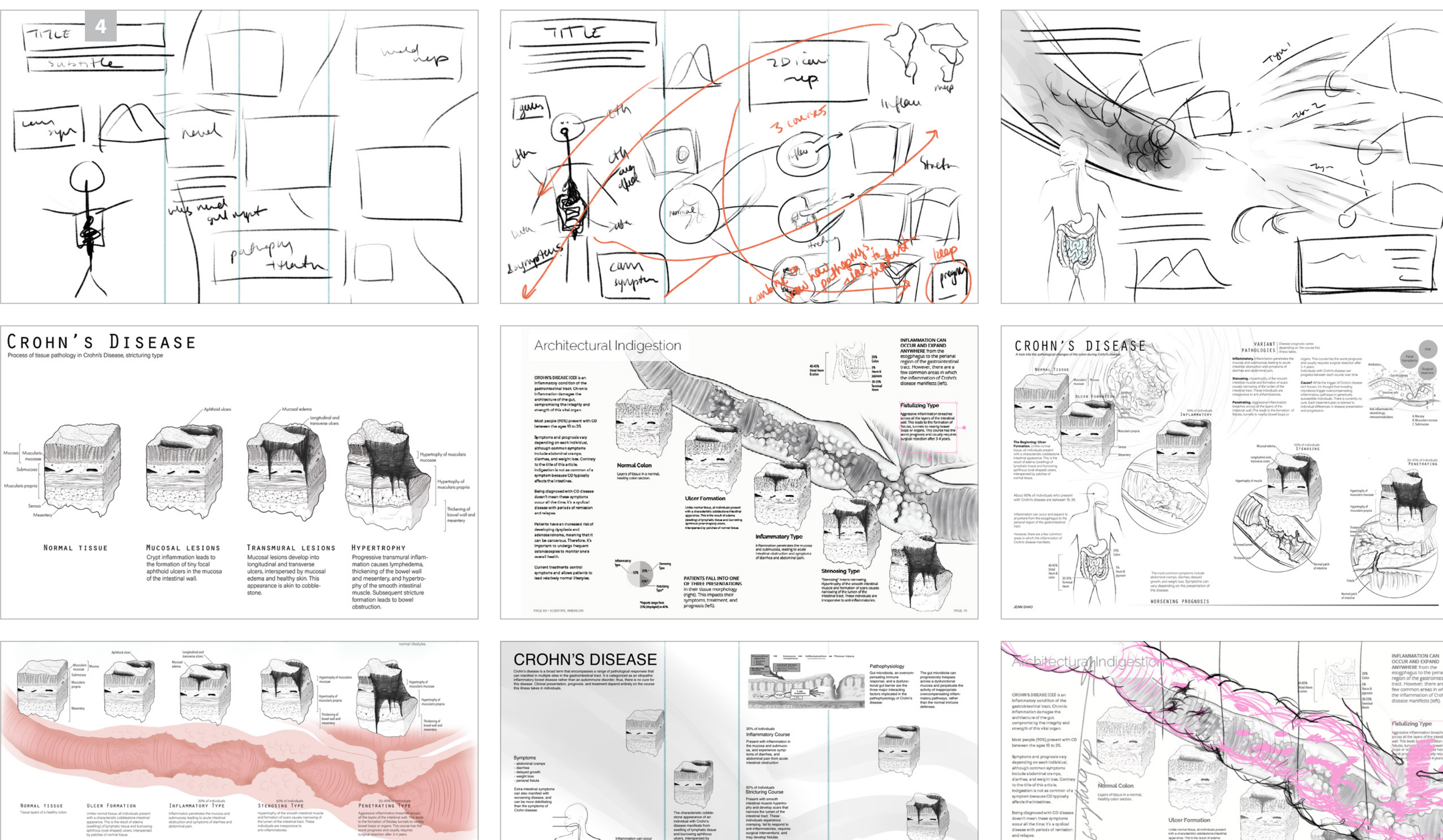

Don't Kill Your Neighbours: A Data Story

You need your gut microbes alive. This is a data story and visual primer on the role of the gut microbiota throughout a human's entire life. It connects research findings with the people that it represents.

1. Sketch. Preliminary thumbnail sketches created while researching and developing content on the gut microbiota.

2. Final illustration. You and your other half! A black and white version of a visual asset representing you and your microbial cells.

3. Notes. I created three potential narratives. My supervisor and I eventually chose one that put the research in the context of a person's lifespan, by starting with data on the gut microbiota at birth, all the way to death.

4. Sketch. A two-page spread on different environmental factors that can shape your gut microbiota throughout your life.

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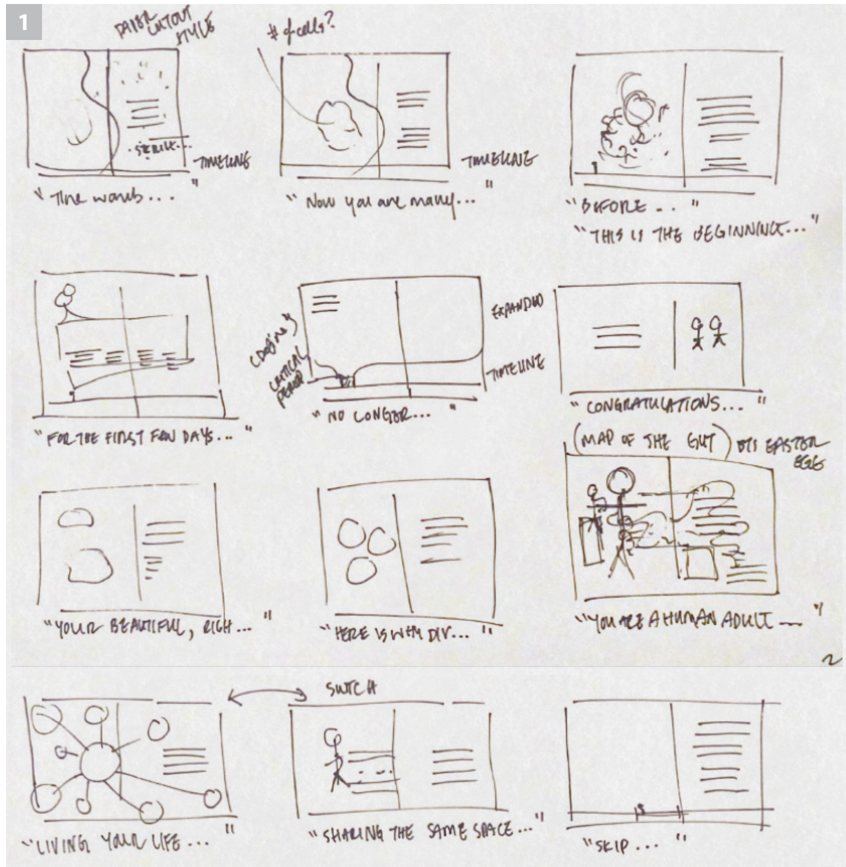

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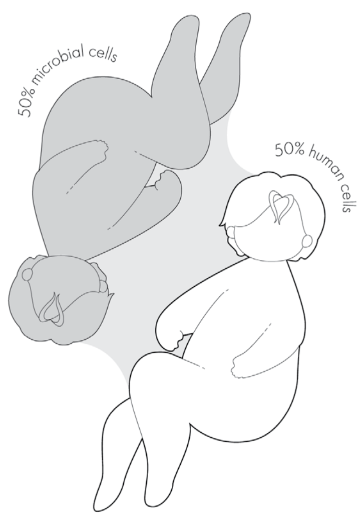

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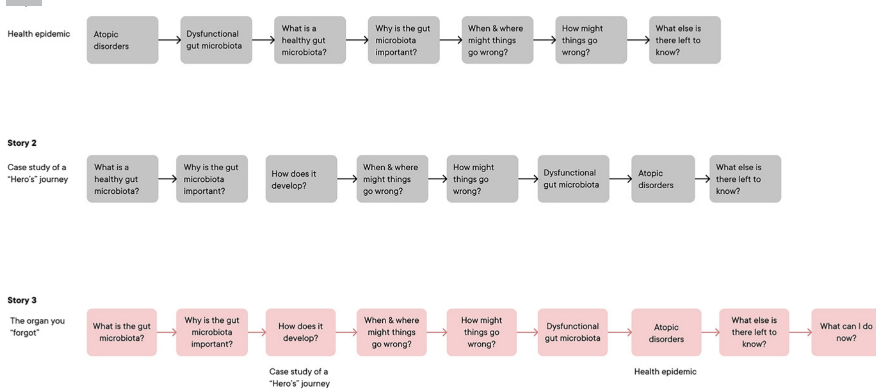

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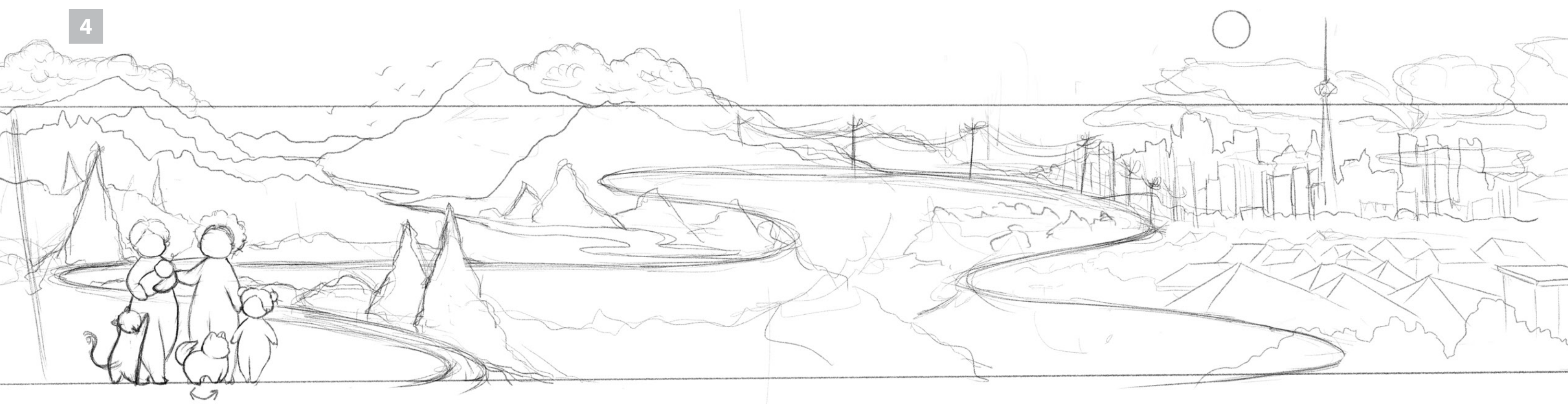

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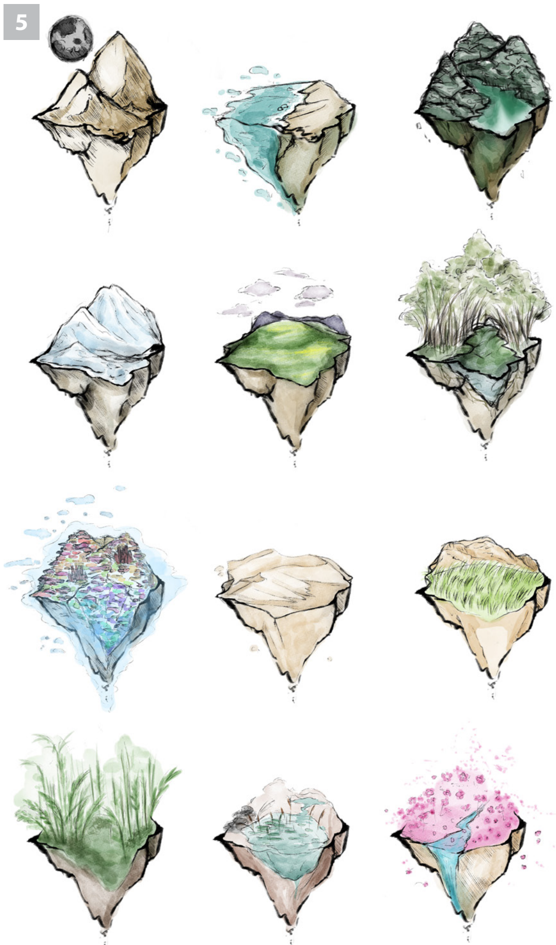

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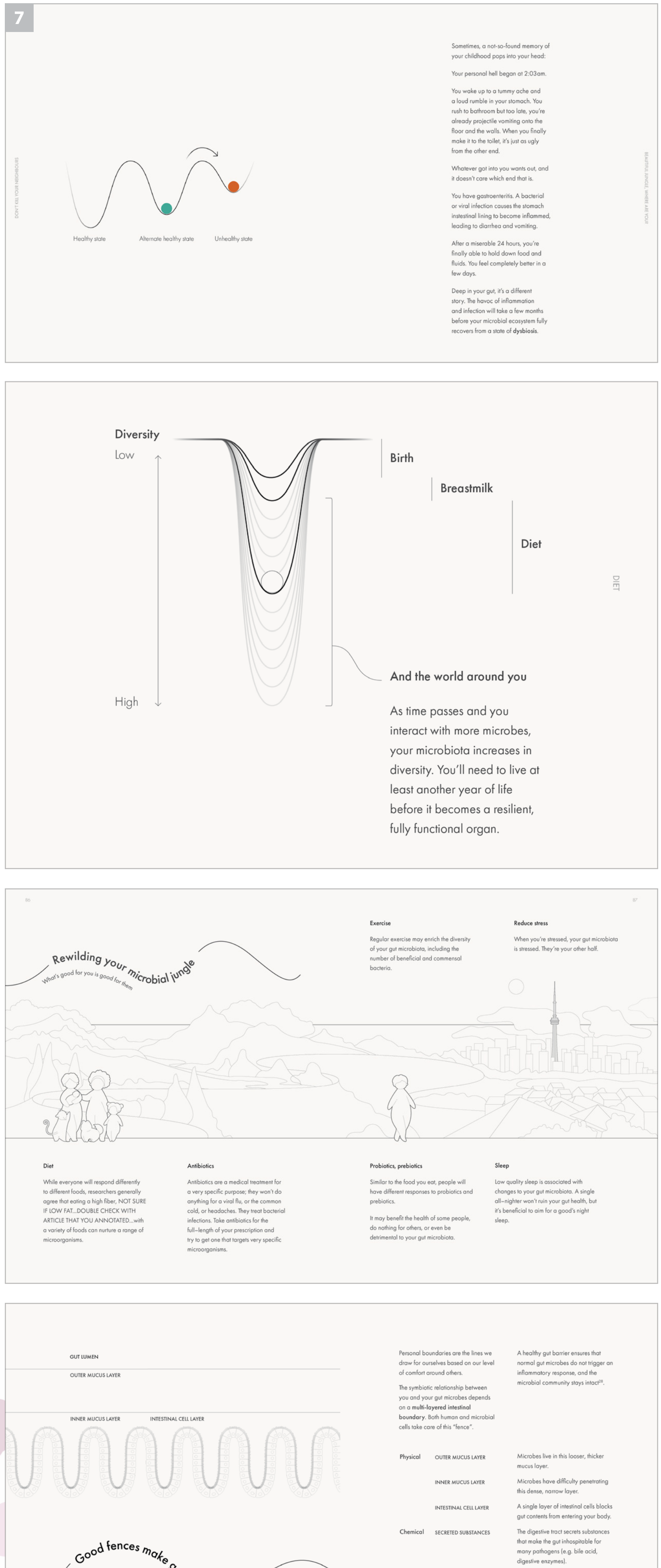
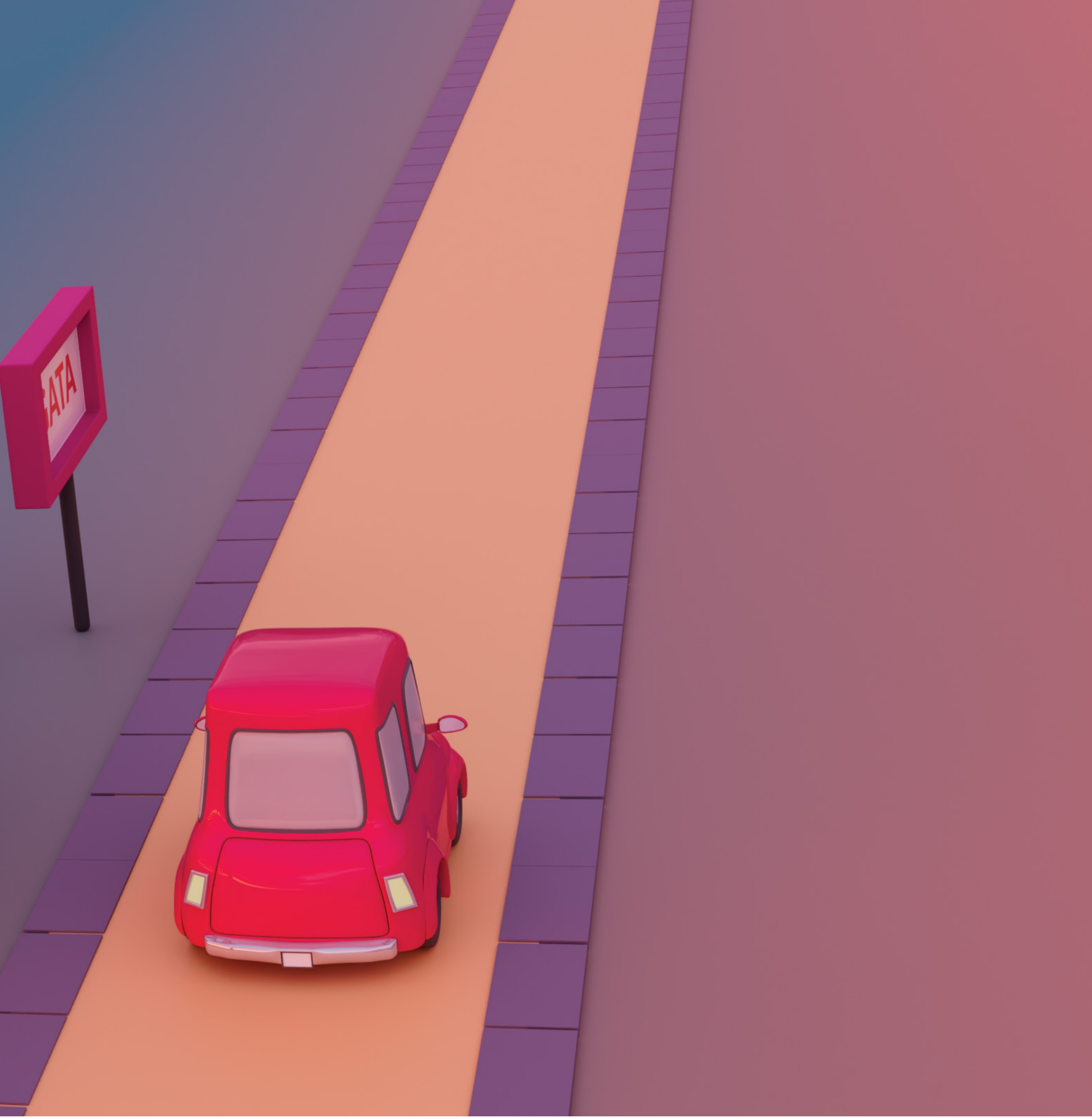


5. Sketch. A visual metaphor for the function and structure of your gut microbial ecosystem.

6. Final illustration. The cover of the book. I chose accessible colours that are actually made of tiny little dots, to represent all the microbes around us.

7. Sketch. Black and white draft of spreads throughout the book.



Michie Wu

(Michelle Xingyu Wu)

I am a biomedical communicator and designer specializing in digital illustration. I view every scientific communication piece like telling a story, which I aim to visualize accurately and aesthetically. Having utilized both 2D and 3D mediums during my studies in the MScBMC program, I have a diverse skill set that allows me to choose the best tool to help fill any communication gap. My main passions are the natural sciences and medical legal visualization.

Michie Wu

Information Visualization

Cephalopods, a group of marine animals including the cuttlefish, octopus, and squid, have the unique ability to change the colour of their skin and exhibit extraordinary patterns. I created an infographic that dives deeply into the science behind this ability.

1. Final illustration. I chose a vertical layout to present the information hierarchies as if guiding the viewer into the depths of the ocean. A combination of raster and vector render style differentiated between schematic and realistic elements.

2. Sketch. Keeping in mind negative space, I made rough thumbnails using a loose grid format.

3. Production process. I chose simplified vector icons to represent the major functions as a way of giving information at a glance without the need for reading the accompanying text.

Previous spread. A still from my MRP animation, using a car and road as a visual metaphor.

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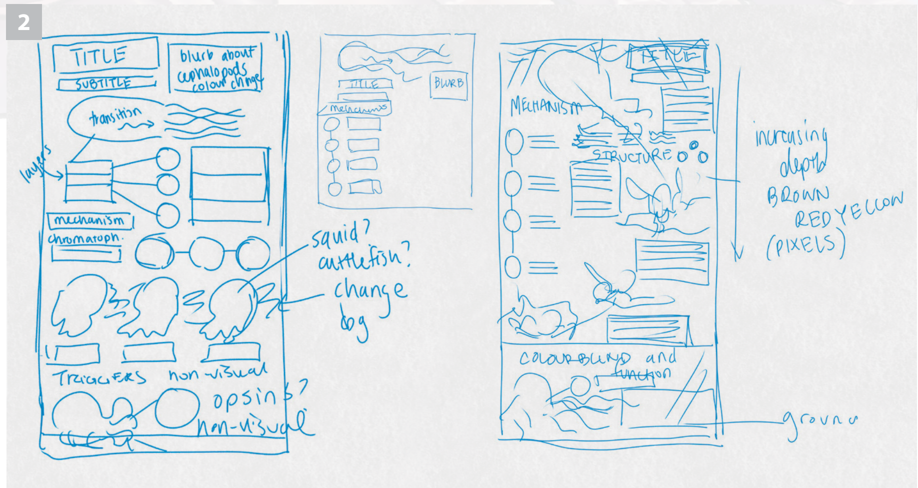

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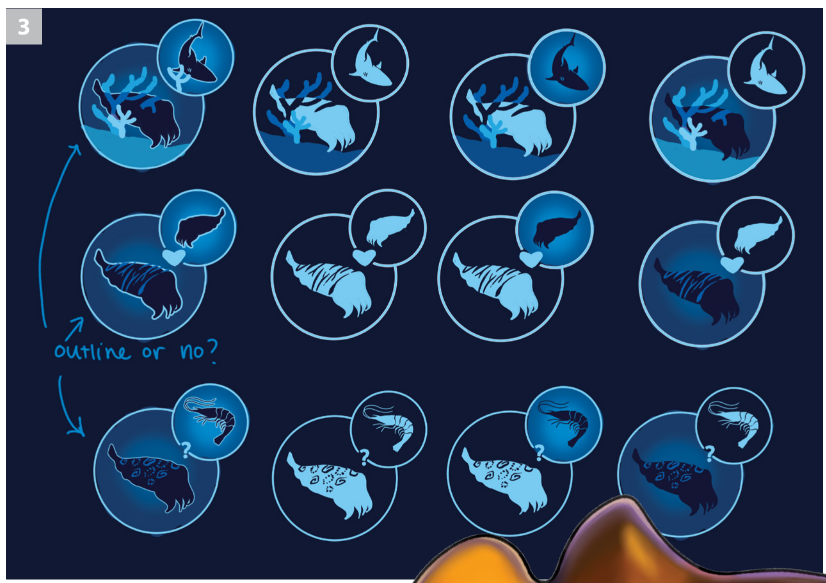

Surgical Illustration

The human body is fascinating to visualize. Throughout my studies, I developed a love for surgical illustration. I had the exciting opportunity to illustrate my own craniotomy, working closely with the very surgeon who operated on me.

1. Sketch. I used various neuroanatomy resources to clearly show the boundaries and location of the hematoma as it pertained to my particular case.

2. Production process. I used pen and ink style for the final piece. The line art served as a base for colour to be added.

3. Sketch. I created sketches based on my observation of a live craniotomy in the operating room, consultation with my surgeon, and operating notes from my own surgery.

4. Final draft. The visual treatment employs a selective colour palette, accompanied by detailed linework which showcases subtle differences in texture.

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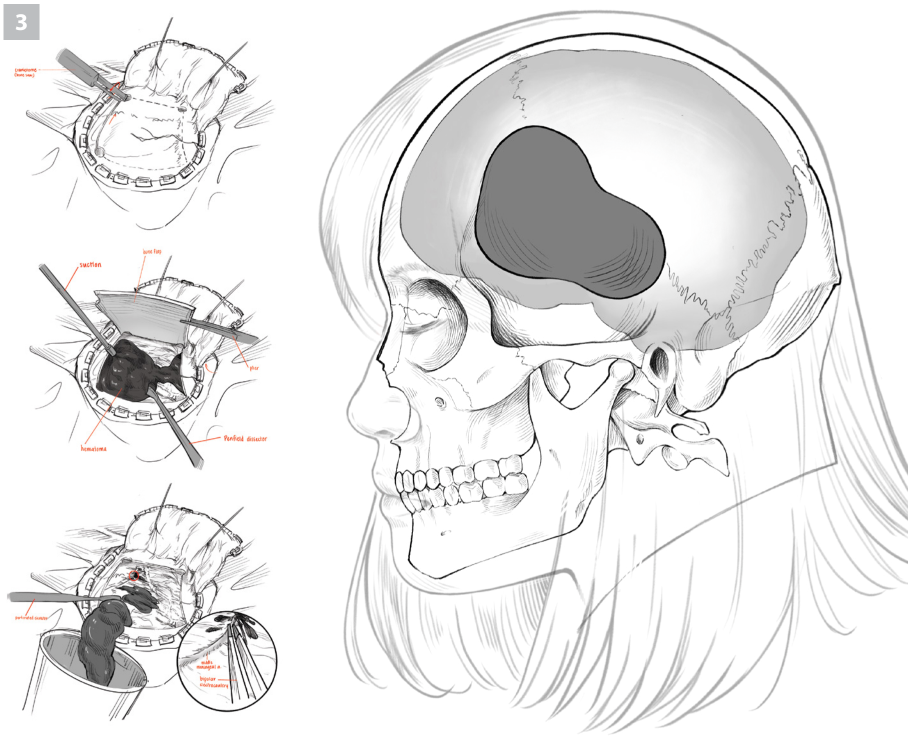

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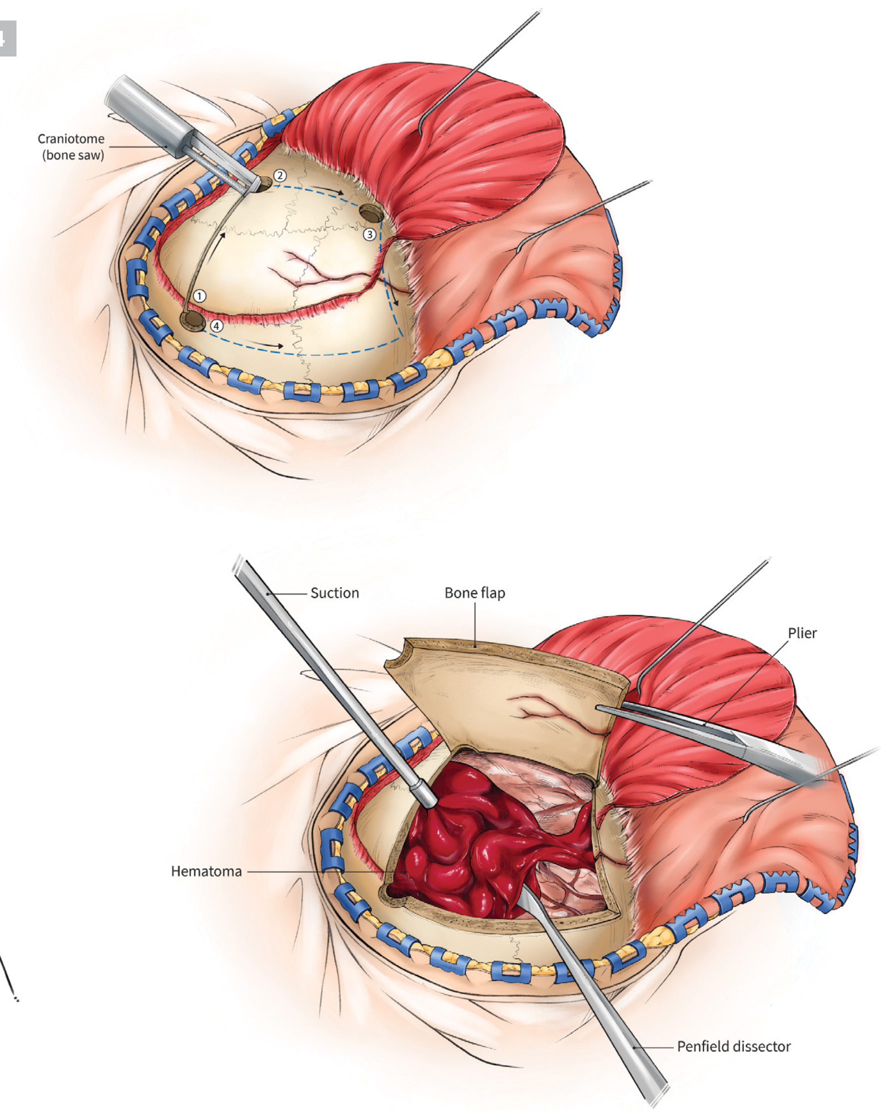

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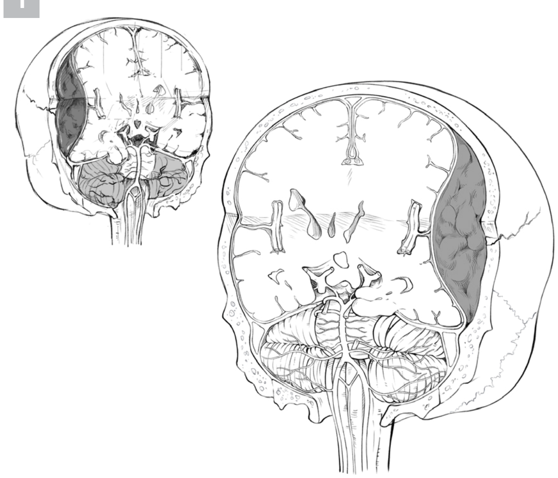

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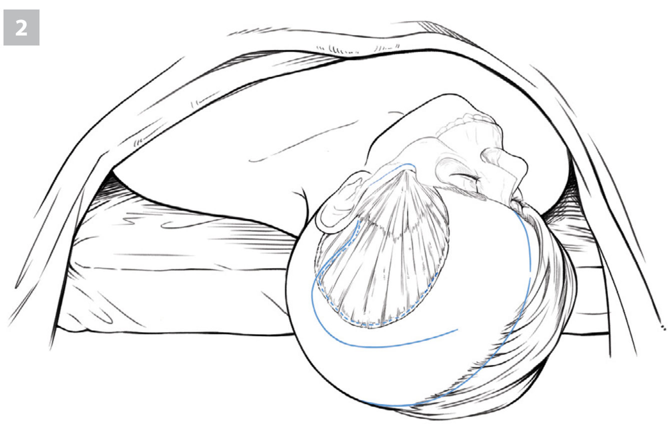

Editorial Illustration

In the midst of a declining bee population, a research team developed an effective soap-bubble pollination method based on the physicochemical properties of a bubble. I created a visual metaphor to represent this research in a mock journal cover.

1. Sketch. Rough thumbnail sketches were made to explore composition and concept. I used defining keywords to decide on the focus elements in the narrative.

2. Production process. At the modelling stage, I experimented with different shader settings in *Maya* to achieve a salient and realistic bubble texture for the bee.

3. Final illustration. I used warm lighting to enhance the reflectiveness of the bubble surface and bring the bee to the forefront. The final piece makes use of the background, middle ground, and foreground.

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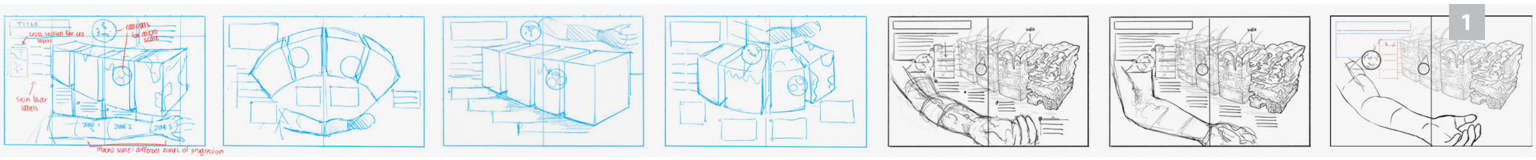

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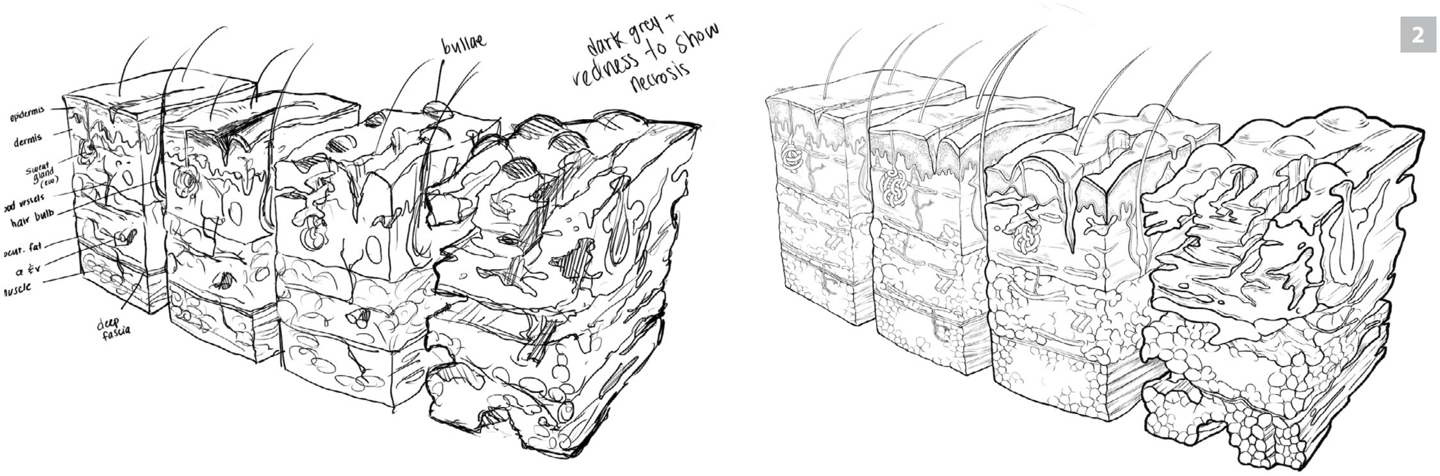

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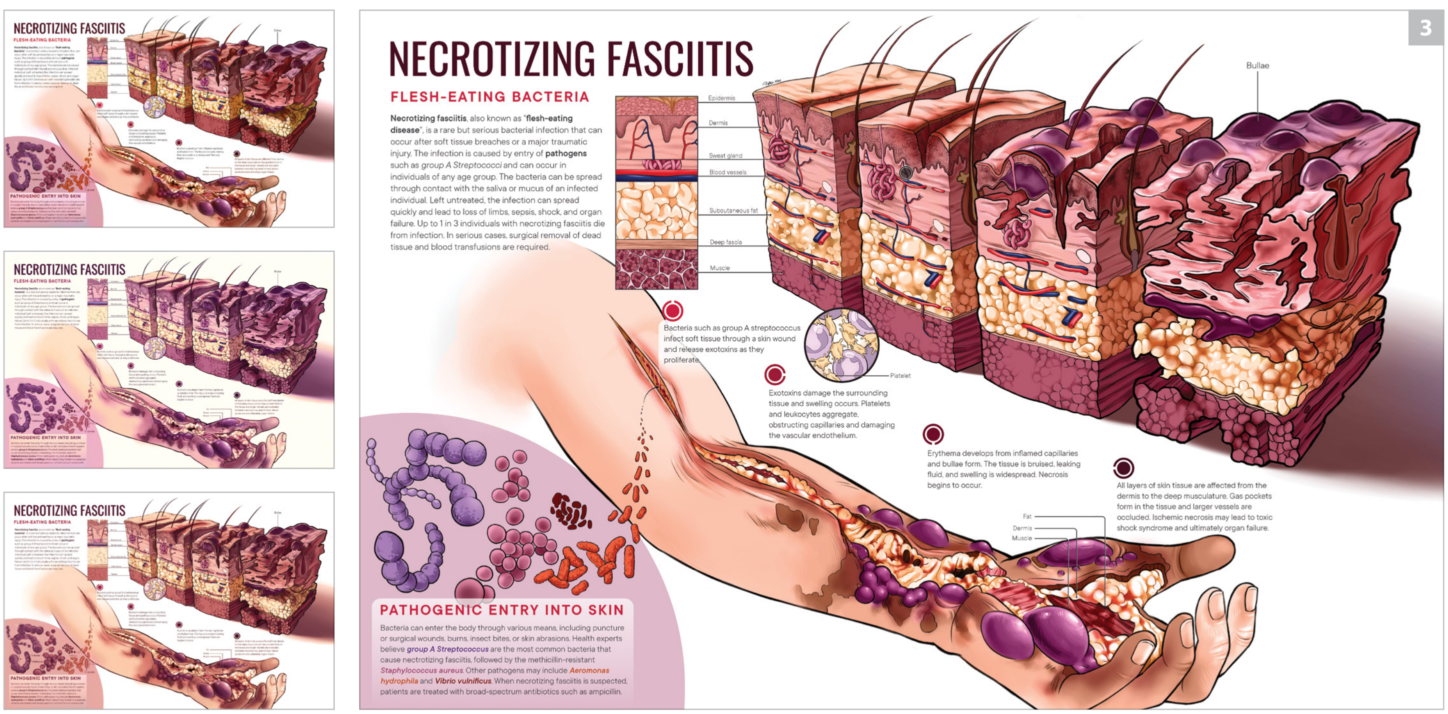


Pathological Illustration

Sometimes it is important to visualize conditions on multiple scales. Necrotizing fasciitis is one such pathology, involving an infection of the skin caused by a group of "flesh-eating" bacteria.

1. Sketch. I created rough sketches to determine the layout. I experimented with the placement and perspective of the tissue cubes and reading order for linear communication.

2. Production process. Once I determined the layout, I made the final line art of the tissue cubes. I showed the disease progression affecting all layers of the tissue and used various line widths to detail the structure.

3. Final illustration. I experimented with warmer and cooler palettes before choosing a more neutral mimetic scheme of pinks and purples. The darker purple was used to contrast healthy skin with later stages of the disease.

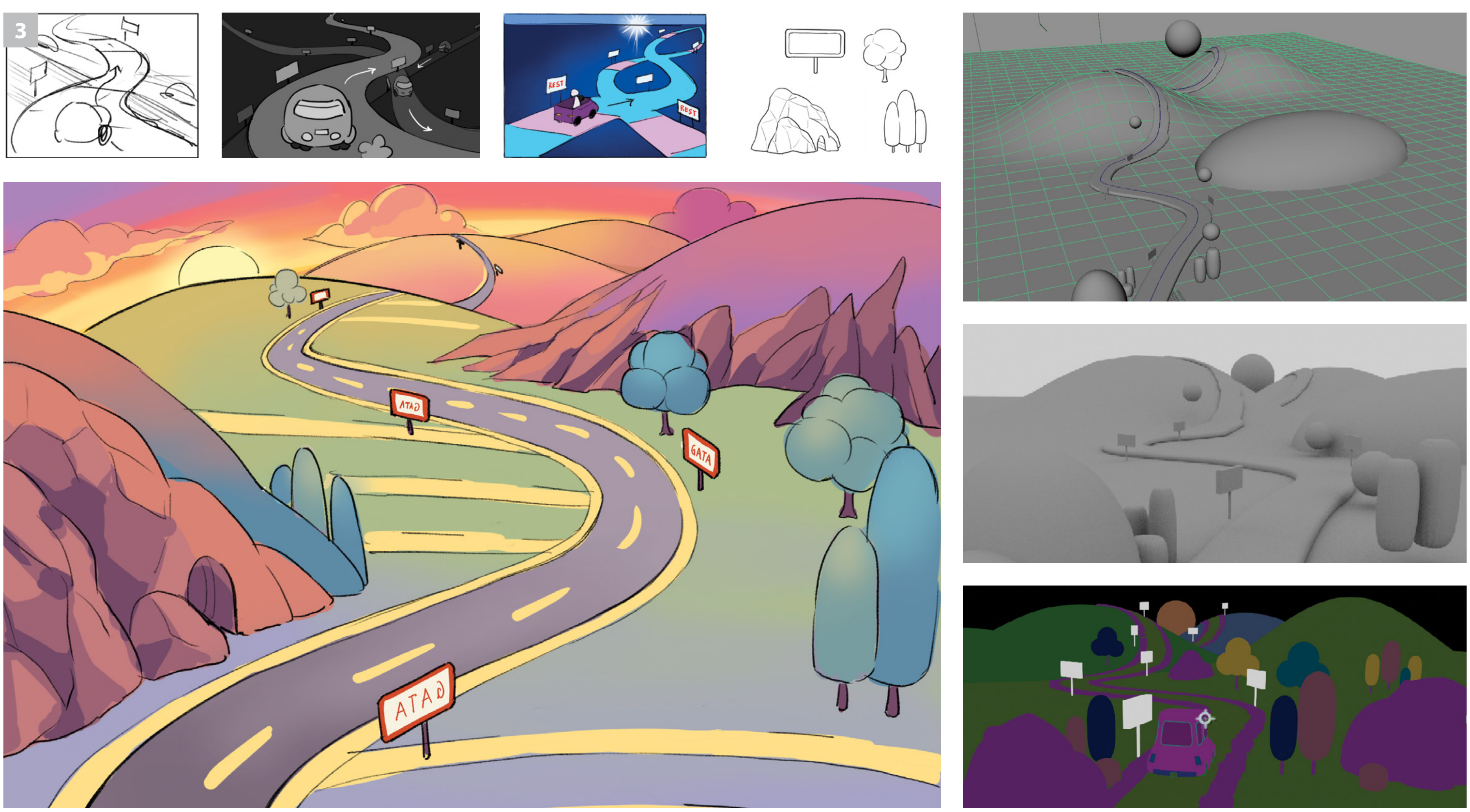
Forensic DNA Mixture Deconvolution

A DNA mixture occurs when two or more sources contribute to a single evidence sample. DNA mixtures currently pose one of the greatest challenges in forensic science. I created an educational animation guiding the viewer through the steps in DNA profile interpretation, from obtaining a crime scene sample to determining a probable contributor.

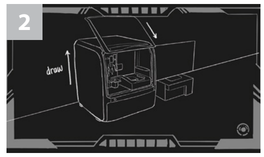
1. Production process. I designed each stylized asset and the look and feel of the whole scene before beginning 3D work. I accounted for as much detail as possible in the early stages.

2. 3D modelling. The visual look and feel of the animation was made to resemble a "CSI-style" investigation, with a dark, sci-fi theme throughout. This decision was made with the target audience of students in mind to engage their interest and help with recall later on.

3. Final animation. The final animation uses a visual metaphor to help explain short tandem repeats (STRs), a biological concept that is tricky for students to understand. A car driving along the highway is used to define and explain the role of STRs.




STR
GATA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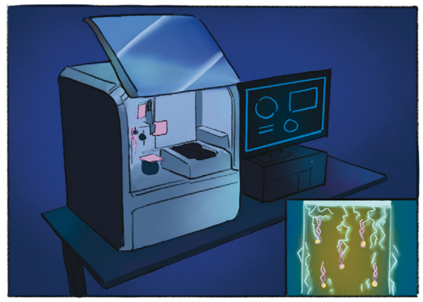

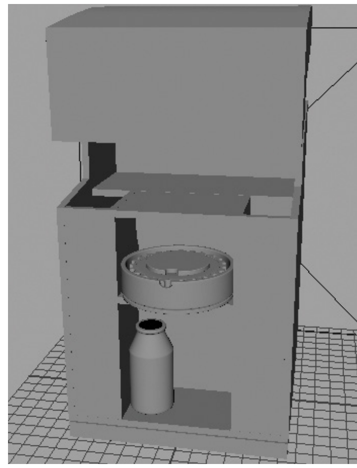

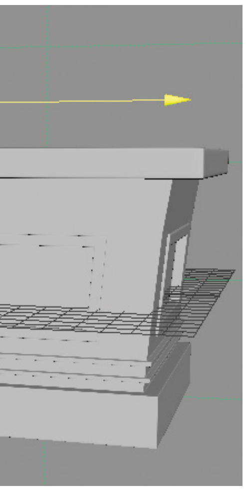

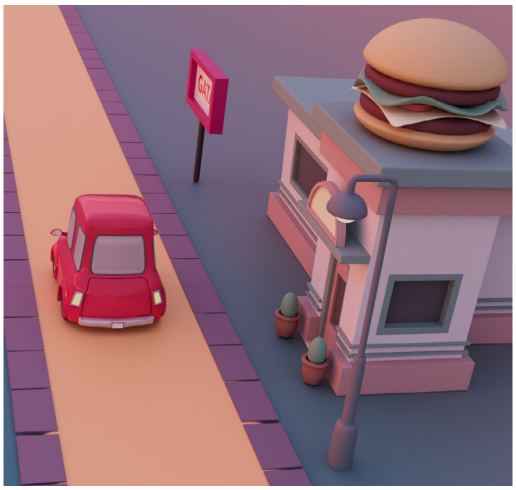

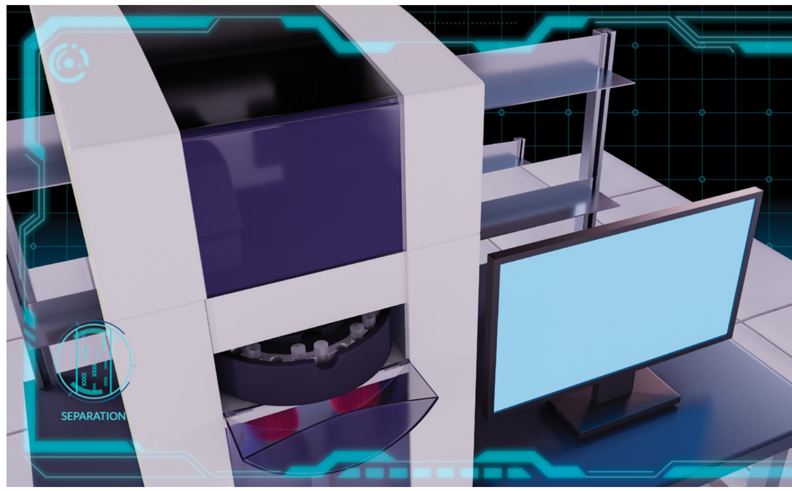
SEPARATION


GATA
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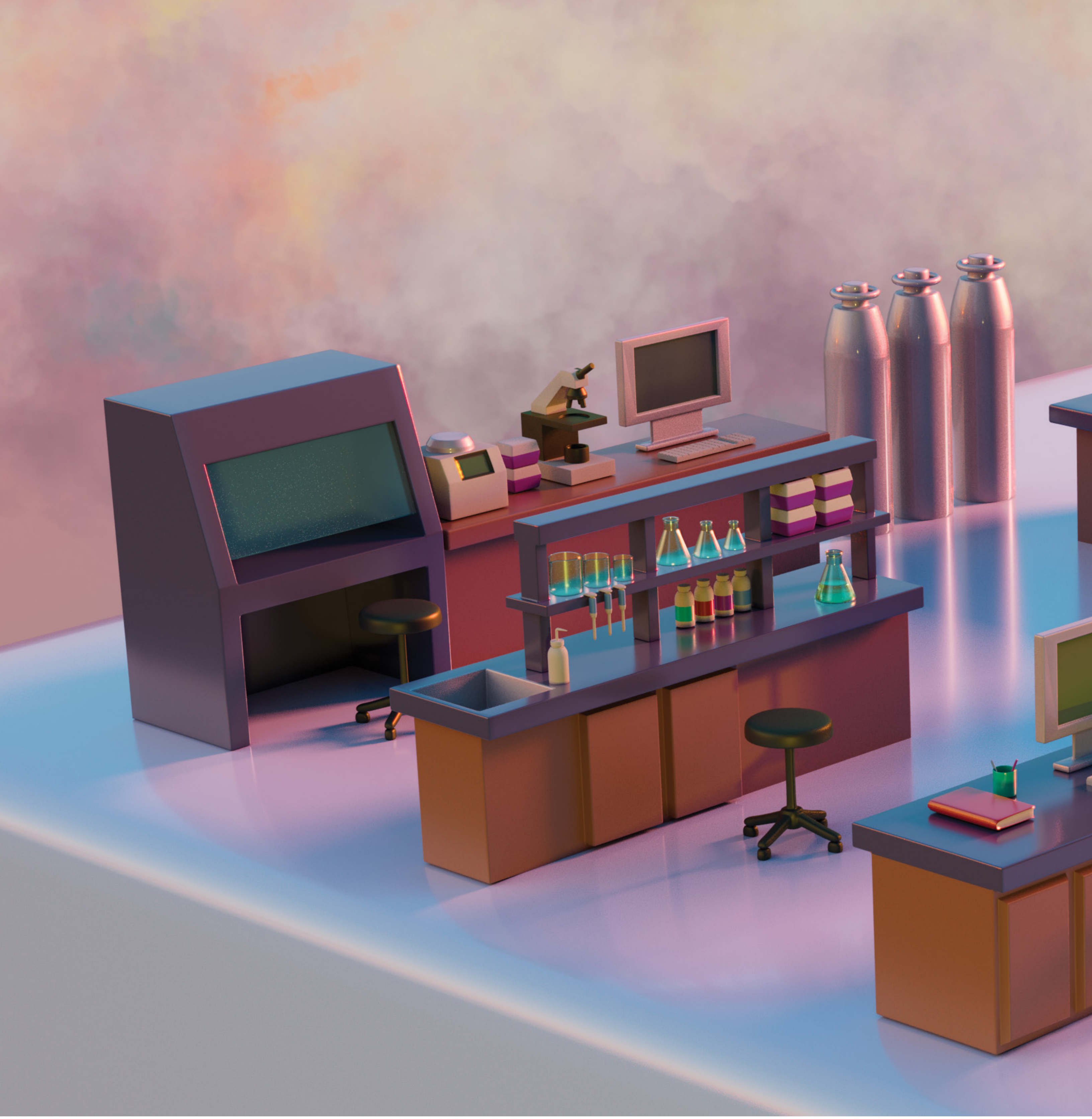

Mimi Guo

(Yuejun Guo)

Hi, I'm a scientific animator, illustrator, and designer. I create beautiful visuals and storytelling videos to explain complex health and science concepts. I believe science can be made engaging and easy to understand. My work builds a bridge between health and science professionals and their audience, making information more approachable for an impactful change.

Neuroanatomical Illustration

This project combines my self-portrait with an anterolateral view of the brain to create an anatomically-accurate illustration highlighting the brainstem and cranial nerve roots. To explore the combination of traditional and digital media, I created this illustration in carbon dust, acrylic, and *Photoshop*.

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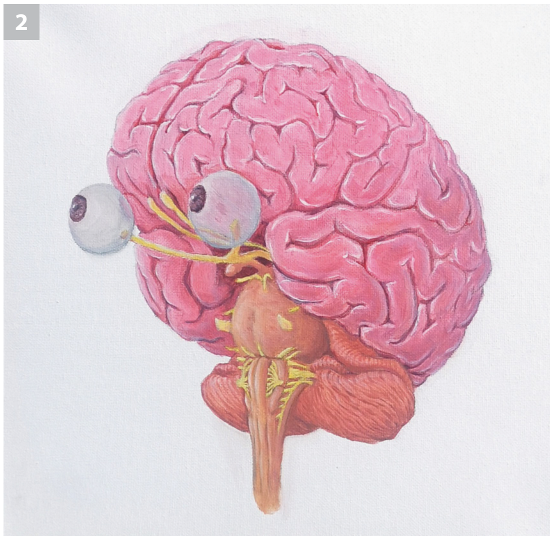

3

1. Sketch. During the ideation and line draft stage, I listed the structures I wanted to show and found an appropriate perspective in 3D software. Using a reference photo of myself, I positioned a 3D brain at the same angle to complete a line draft.

2.Study. Once the accuracy of the draft was corroborated, I rendered out the illustration of the brain in acrylic and my portrait using carbon dust. The contrast between the nature of these two media allowed for increased salience of the brain.

3. Final illustration. The two traditional drawings were superimposed in *Photoshop*. Additional attention was paid to the portrait drawing to give transparent properties.

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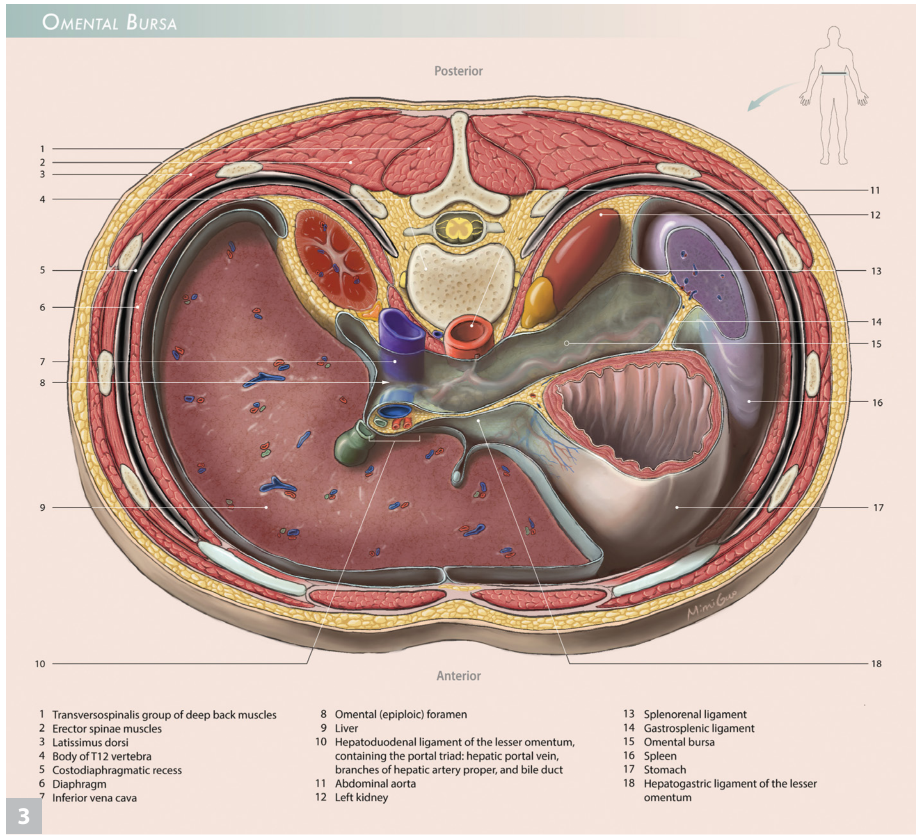

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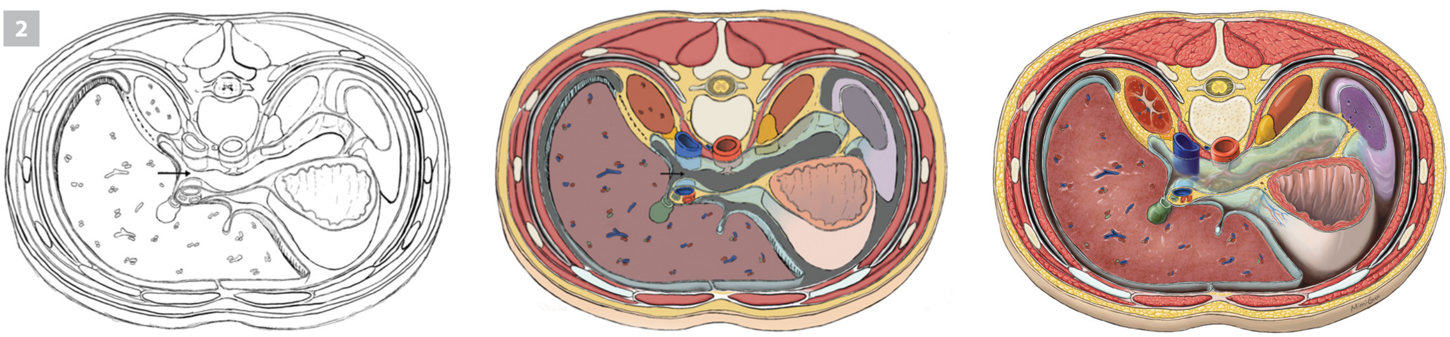

Anatomical Illustration

When learning human anatomy, students usually find it hard to understand the peritoneal relationship between abdominal viscera. This illustration elucidates the structural complexity surrounding the omental bursa by providing a cross-sectional view of the abdomen.

1. Sketch. I experimented with different 3D perspectives to compare results and arrive at the optimal view of the omental bursa and its surrounding structures.

2. Production process. I decided to use a cross-sectional view reconstructed from a CT scan at the T12 vertebra, as this can be a more clinically-useful illustration for students. Structures and peritoneal relationships are clearly presented in this perspective. A refined version was achieved after adding texture and colour to the illustration.

3. Final illustration. To better replicate a textbook style for the illustration, I added a scout image (top right) to orient the audience and labelled all the important structures.

Previous spread. A still from my MRP animation. The exploratory stage of the vaccine development pipeline.

Molecular Visualization

In 2012, ivacaftor was approved by the U.S. Food and Drug Administration (FDA) with the first Breakthrough Therapy designation for cystic fibrosis. This two-page spread takes a deep dive into the pathogenesis of cystic fibrosis and visualizes how the therapy works on a bimolecular scale.

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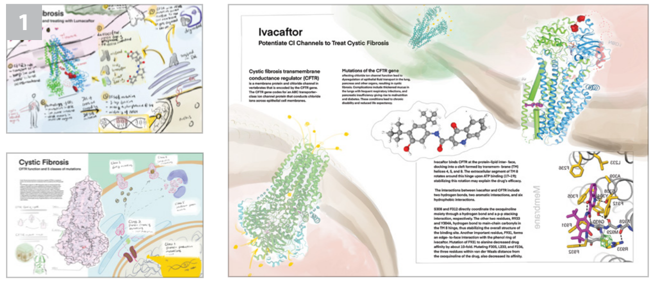

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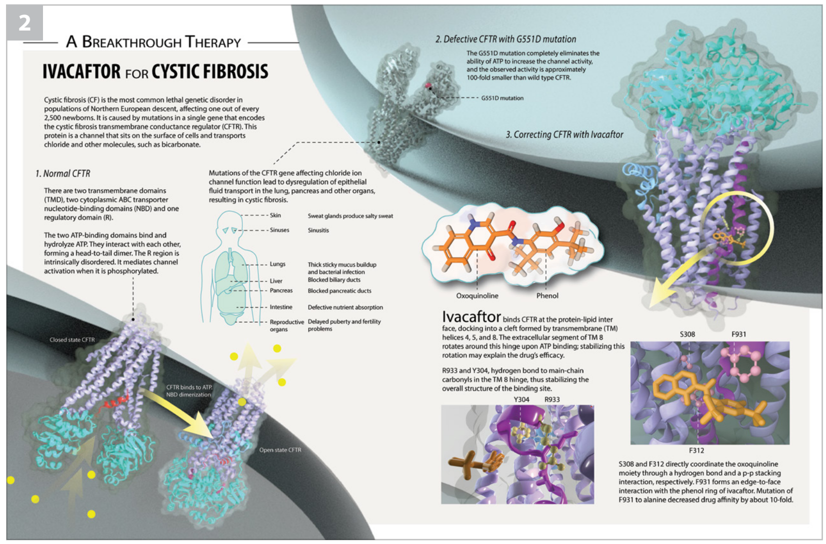

1. Sketch. Draft layouts with preliminary research to block in places for text and illustrations.

2. Production process. A comprehensive concept draft was created using a non-detailed 3D model created in *Maya*. More research was conducted to refine the content. Representations of the transmembrane protein were achieved using PDB files in combination with *VMD* software.

3. Final illustration. The 3D models were refined, lit, and textured. I explored different colour and layout options before deciding on the final design.

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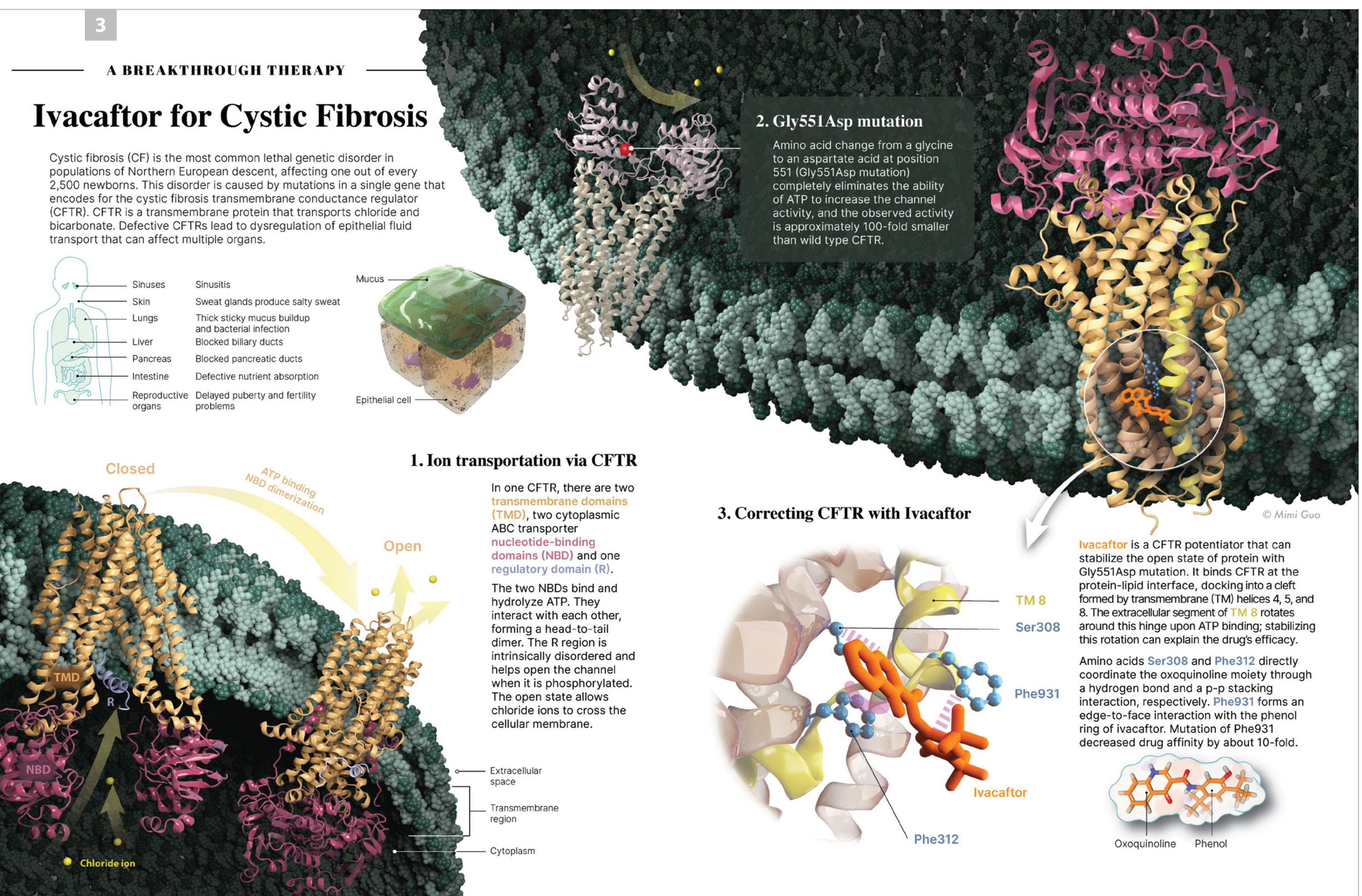


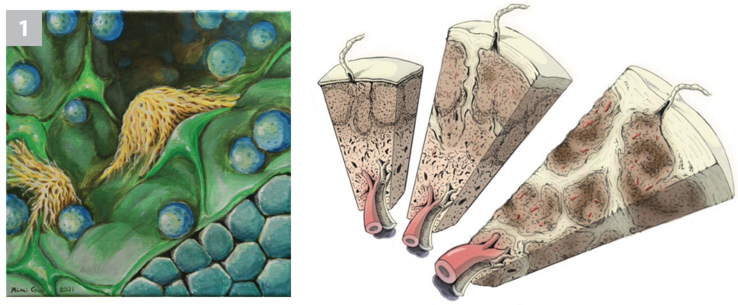
Pathological Illustration

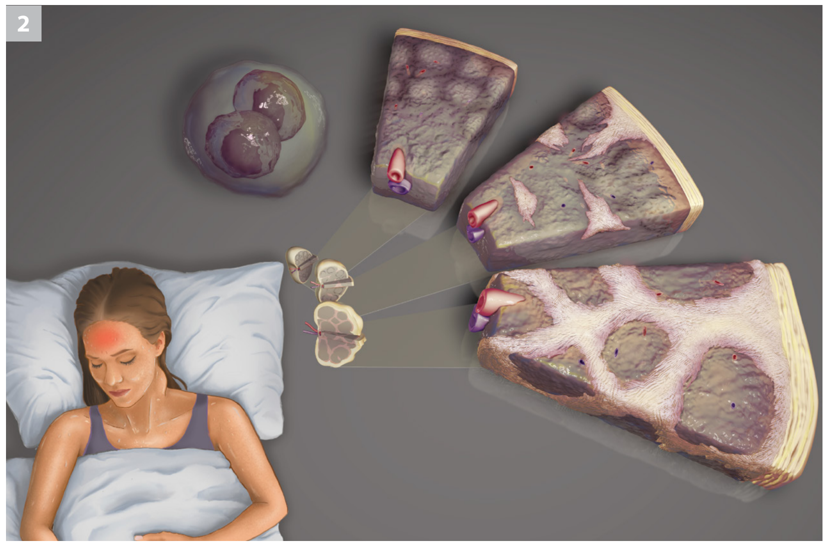
Hodgkin lymphoma is the most common cancer found in adults around their twenties. This two-page spread was created to raise awareness of this type of cancer. It illustrates the telltale symptoms of Hodgkin lymphoma, its diagnostic signs, and lymph node morphology as the disease progresses.

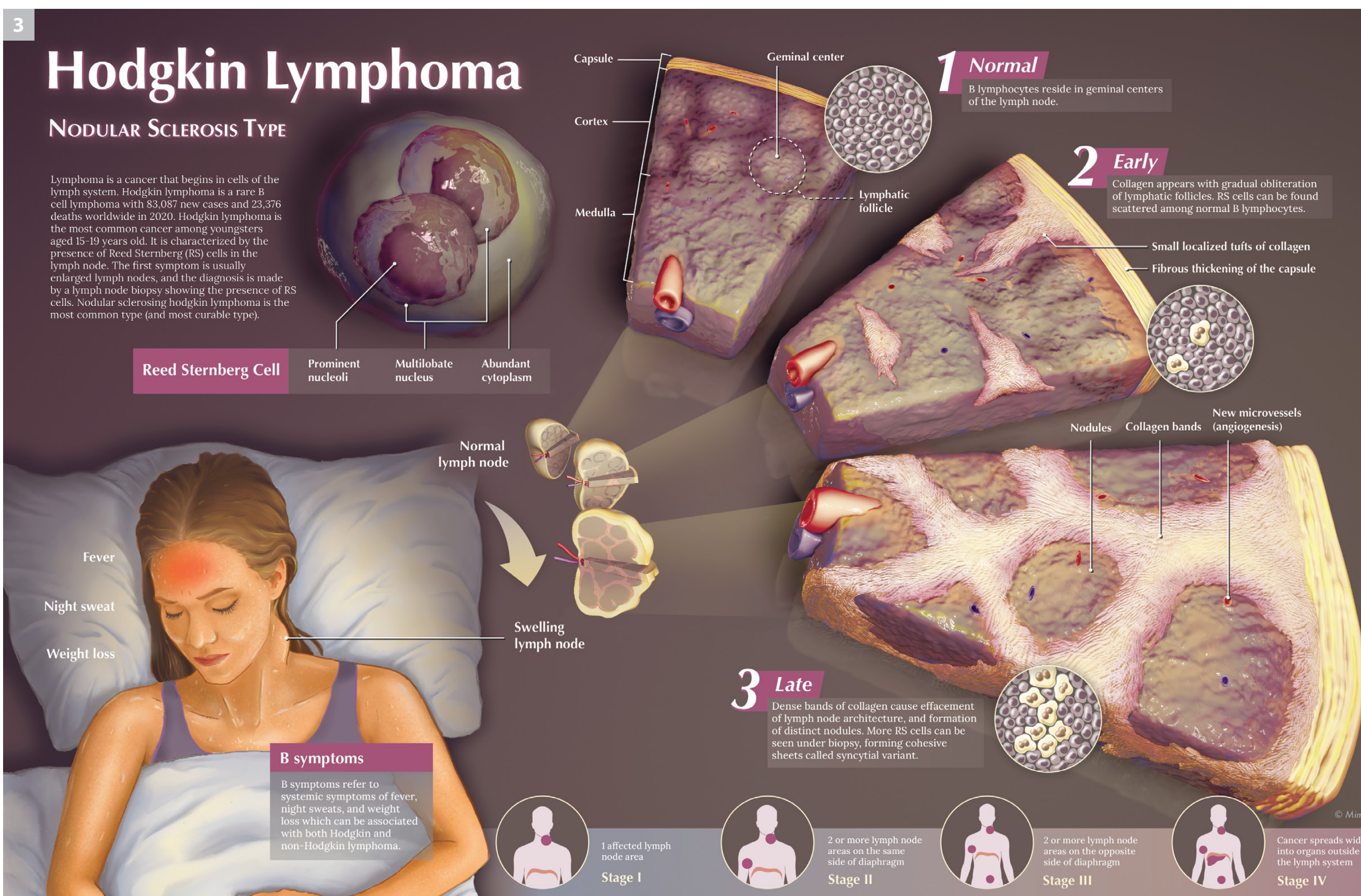
1. Study. A landscape of lymph nodes and the progression of Hodgkin lymphoma were illustrated as a preparatory study for the final illustration.

2. 3D modelling. A 3D model of three lymph node cubes was created in *C4D* and refined in *ZBrush*. After rendering with minimal colours, the models were used to create a comprehensive layout that was used in the final illustration.

3. Final illustration. Colouring was completed in *Photoshop* and the layout was finalized in *Illustrator*.







Outsmarting Infectious Diseases

Vaccine development is a long and complicated process. It is crucial to effectively communicate the tremendous amount of research and the stringent approval process required so that the public is able to build trust in the process. This animation is dedicated to addressing the concerns about vaccination, introducing the development stages, safety surveillance, risks, and benefits of a general vaccination. It uses a visually-appealing and cinematic approach, narratives, and Socratic dialogue to help inform and engage the audience.

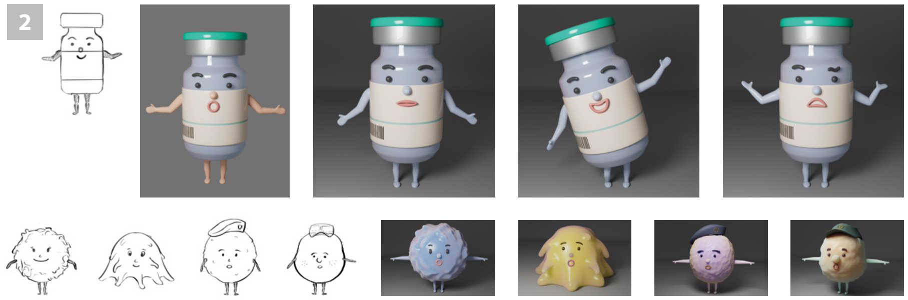
1. Storyboard. After conducting research, I wrote a script that was reviewed by the advisory committee. Then, a storyboard was created to turn texts into visuals.

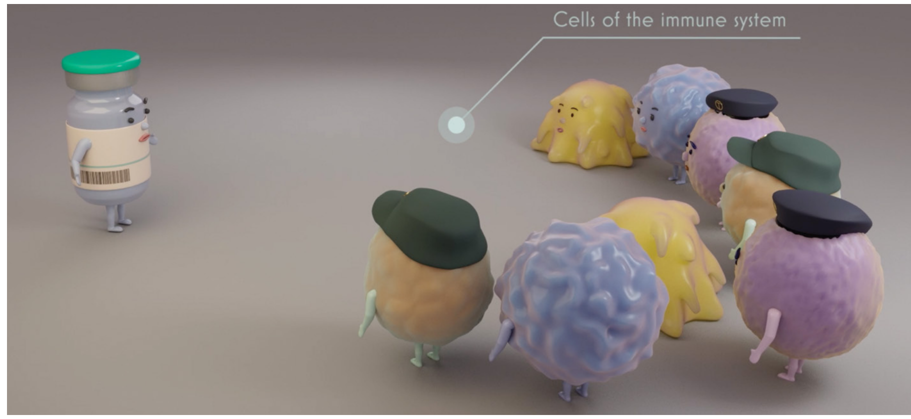
2. Character design. Multiple characters were designed, modelled, and rigged to bring liveliness into the story.

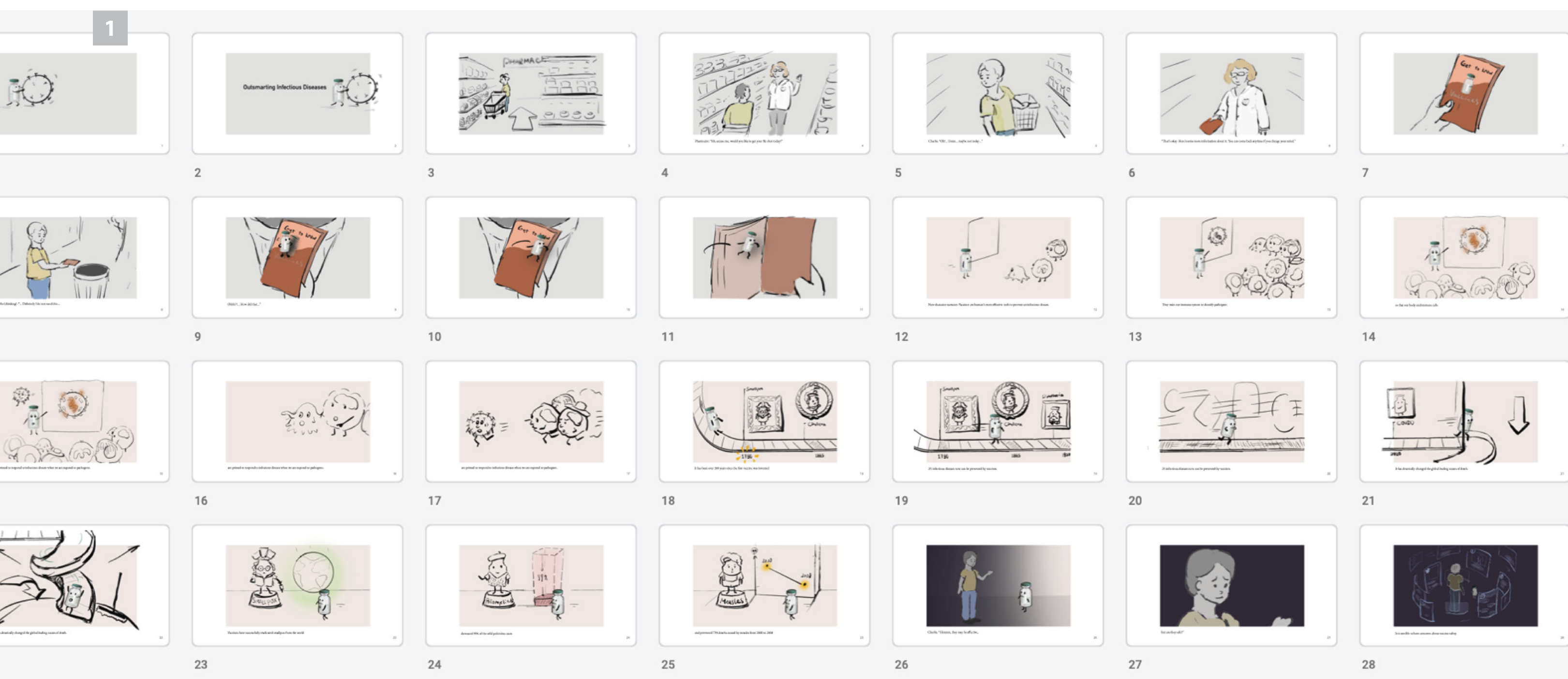
3. Production process. Historically successful vaccines are depicted using bottles dressed in the fashion corresponding to the time period they were developed. The 3D production was executed with a consistent style and attention to detail.

4. Production process. The visualization for the development pipeline was iterated to balance the complexity of the subject matter and the cognitive load for the audience.

5. Production process. Multiple studies and examples were used to address safety concerns. 2D animations were used for data visualization to avoid distortion and misinterpretation of the data.



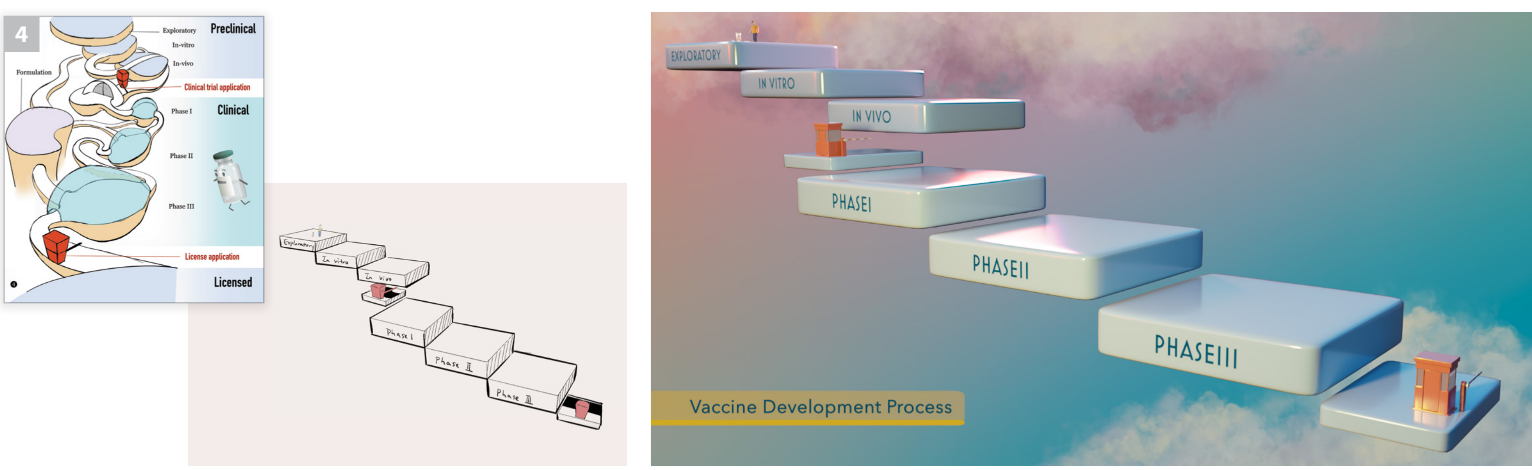




3


Vaccine for
Measles
(1963)
Vaccine for
Smallpox
(1796)
Vaccine for
Poliomyelitis
(1953)
Vaccine for
Smallpox
(1796)

4


Exploratory
Preclinical
In-vitro
In-vivo
Formulation
Clinical trial application
Phase I
Clinical
Phase II
Phase III
License application
Licensed
EXPLORATORY
IN VITRO
IN VIVO
PHASE I
PHASE II
PHASE III
Vaccine Development Process

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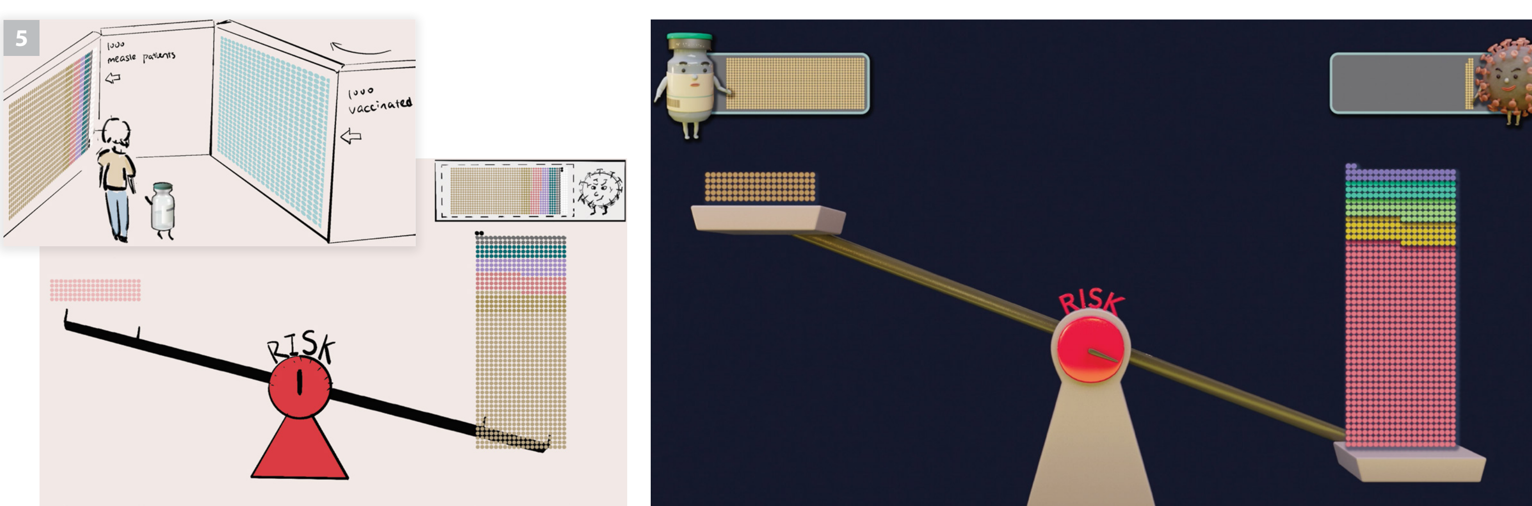
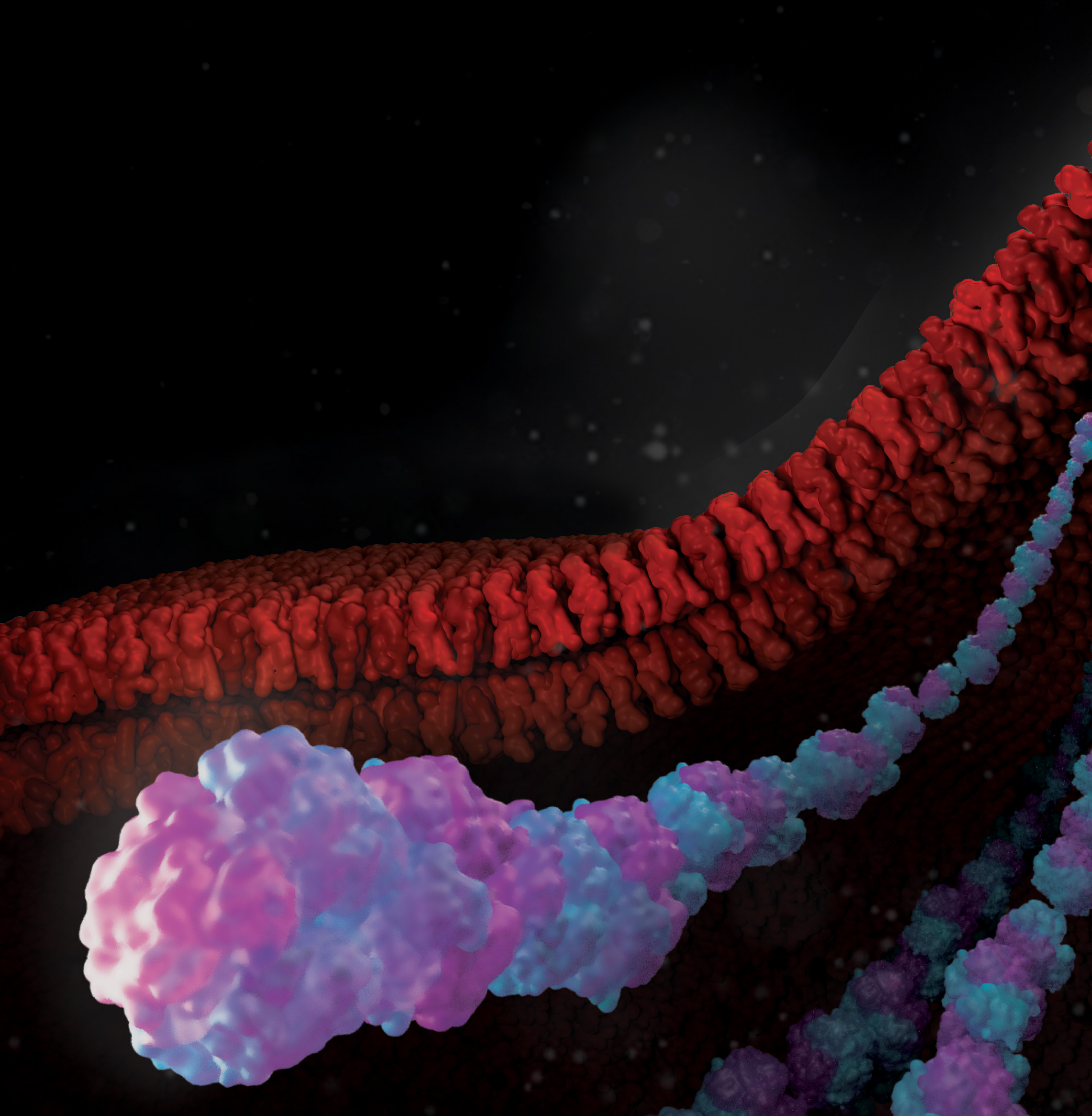
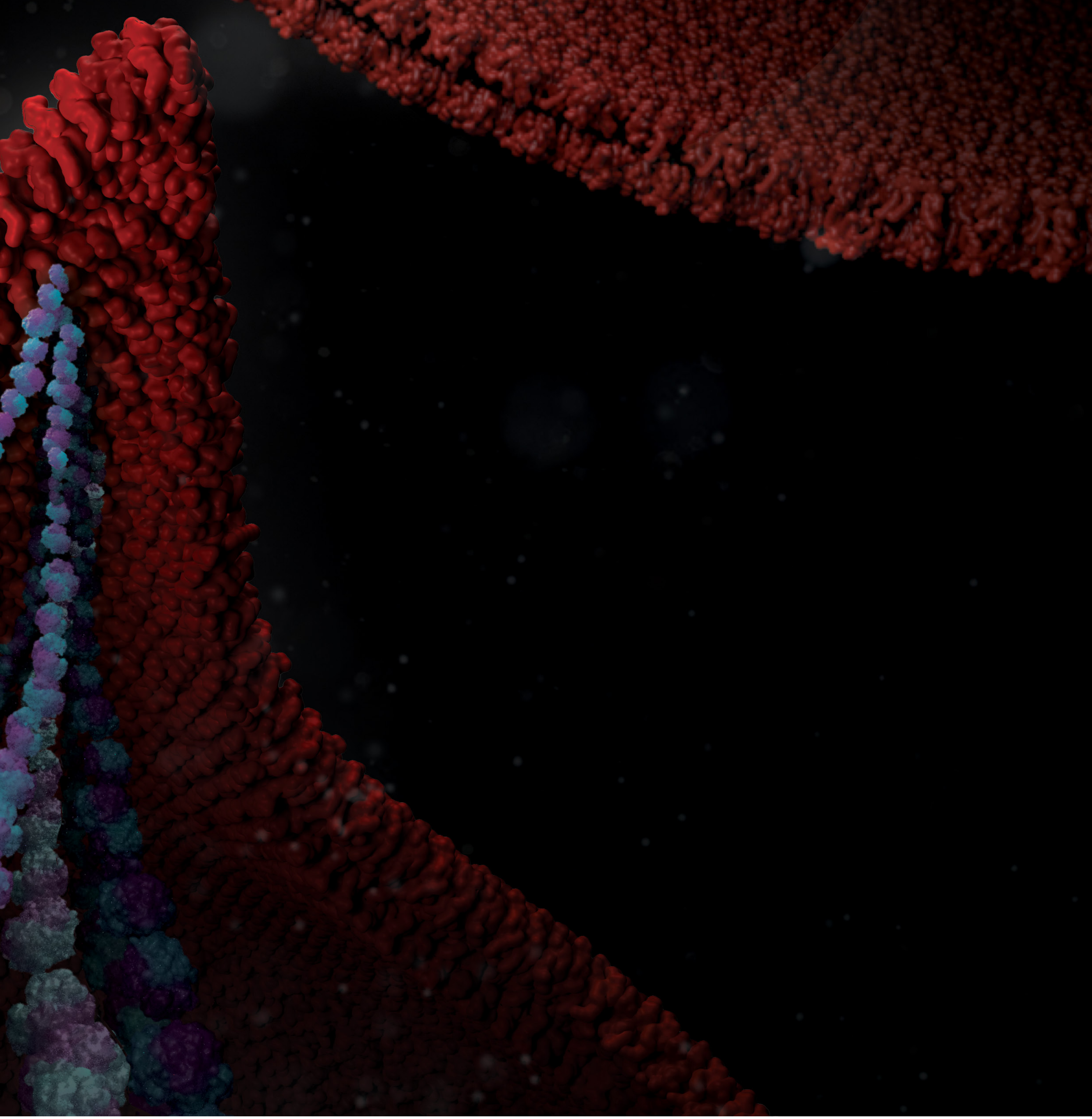

1000 measle patients
1000 vaccinated
RISK
RISK





Min Jee Kim

I am a biomedical communicator, passionate about creating positive experiences for patients in healthcare settings. I enjoy collaborating with stakeholders to break down complex medical processes into easily digestible stories. I strive to tell those stories in the form of 2D and 3D animation, 3D modelling, and illustrations. I aim to create accurate, creative, and effective ways to present biomedical information.

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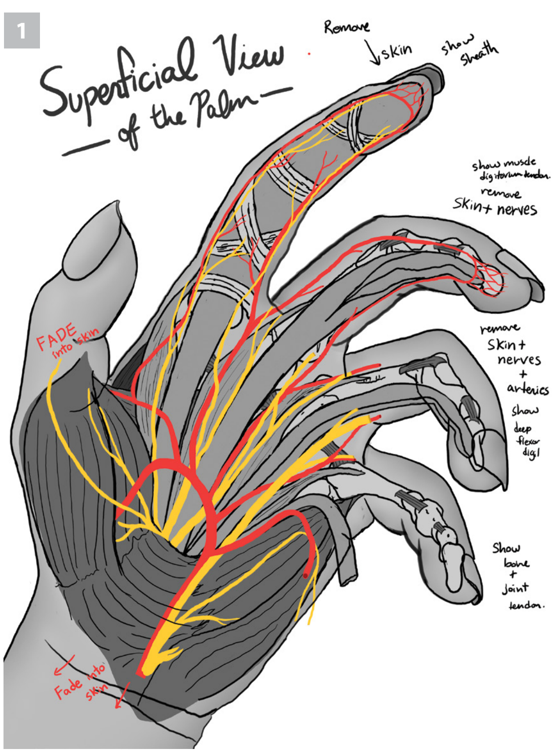

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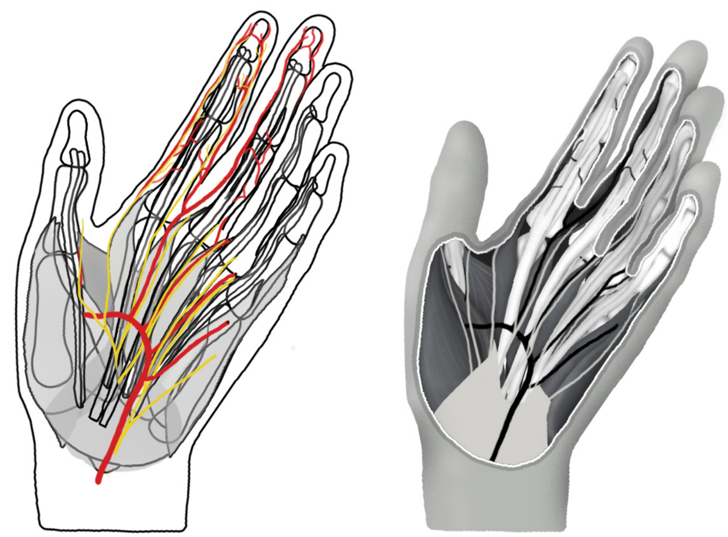

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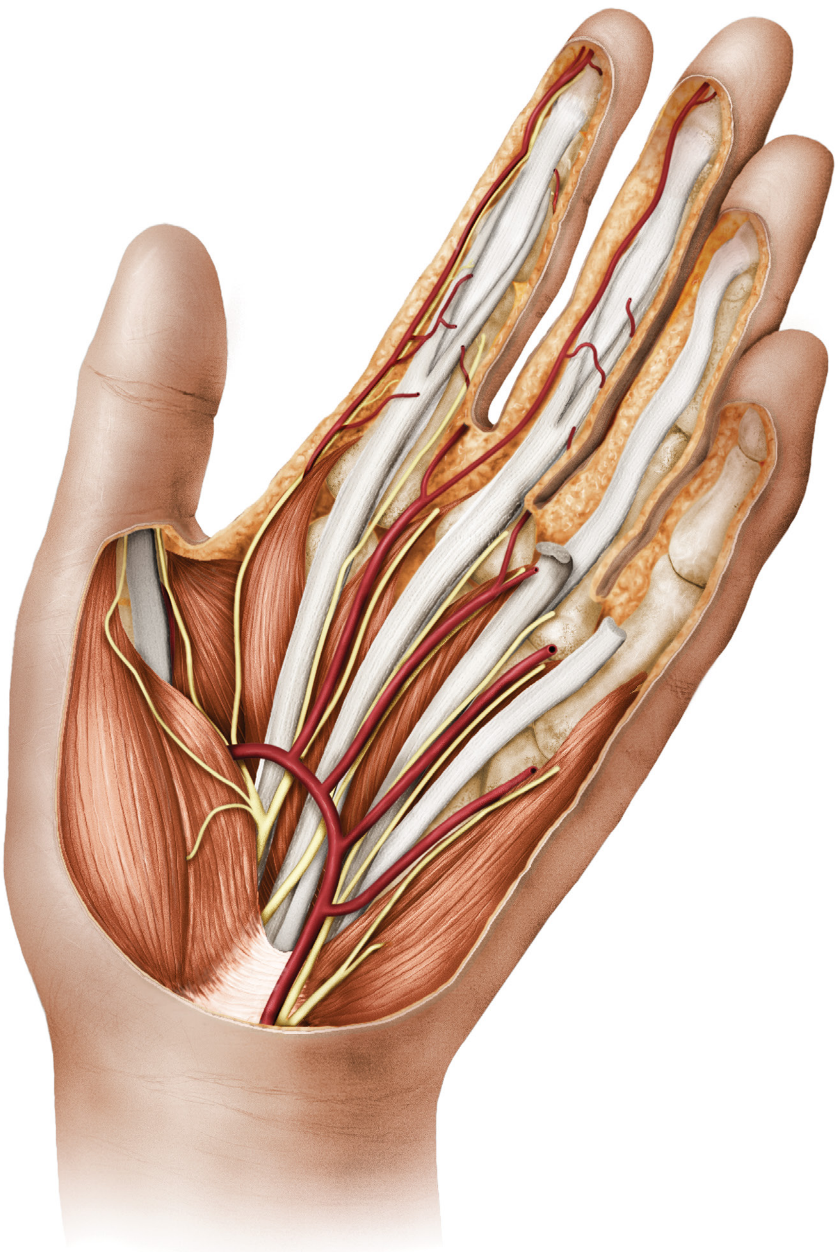


Anatomical Illustration

The goal of this project was to create an illustration of the human body in a view that is not usually used in anatomy textbooks. I envisioned the left palm rotated slightly laterally with the superficial fascia removed but with the outer edge of the skin intact. I also wanted to add an element of "peeling back the layers" by removing one level at a time from the 2nd digit.

1. Sketch. I wanted to sketch a perspective that was unique and illustrated the 3D nature of the hand. Due to difficulty finding adequate references, I was advised against continuing with this perspective.

2. Production process. The palmar view was chosen since it has more muscles and structures visible. From the 2nd digit, the layers are peeled back until the bone is exposed.

3. Final illustration. I rendered the texture of the muscle and fat to bring the hand anatomy to life. Although I changed my initial concept, ultimately, it allowed me to find references with a similar perspective which aided with the accuracy and the rendering process.

Previous spread. A close-up of my molecular visualization piece depicting red blood cell membrane stretching due to sickle cell hemoglobin (HbS) polymerization.

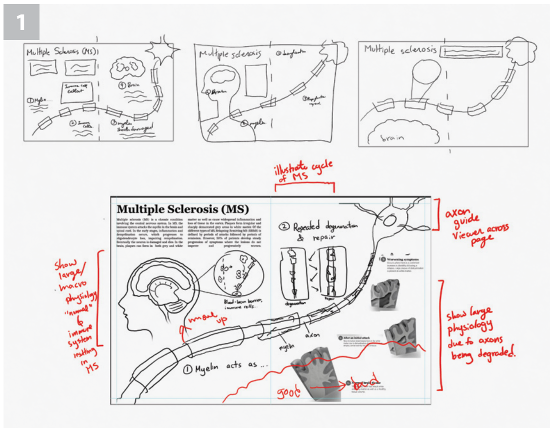
Pathological Illustration

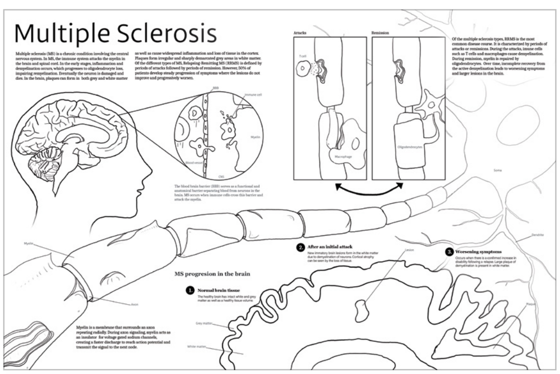
The purpose of this project was to create a magazine spread for a scientific audience that provided context about the pathology of a specific disease. I chose to focus on the mechanism and progression of multiple sclerosis (MS).

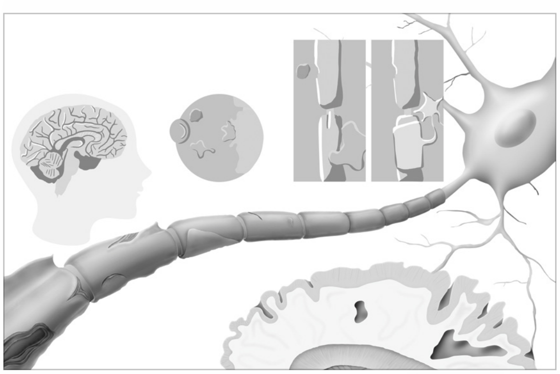
1. Production process. I intended the spread to be read from left to right, from the macroscopic scale (head) to microscopic (axons), and back to the macroscopic scale (brain).

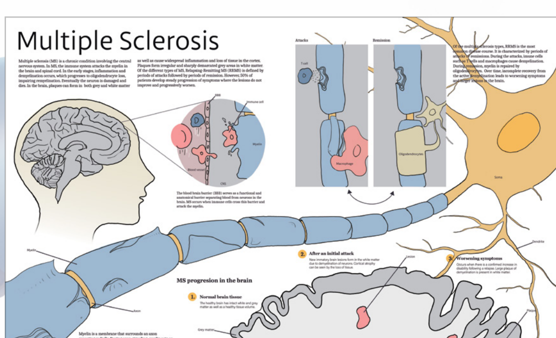
2. Study. I referenced a number of images with dynamic colour palettes and used them to experiment with a variety of different colour layouts.

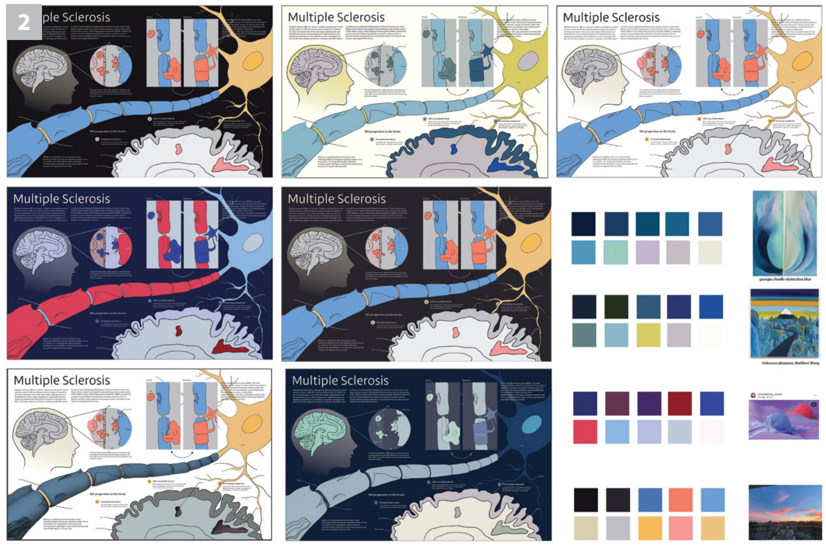
3. Final illustration. Light rays, specular highlights, and floating particles were added to the background to create the impression of being suspended in the fluid.

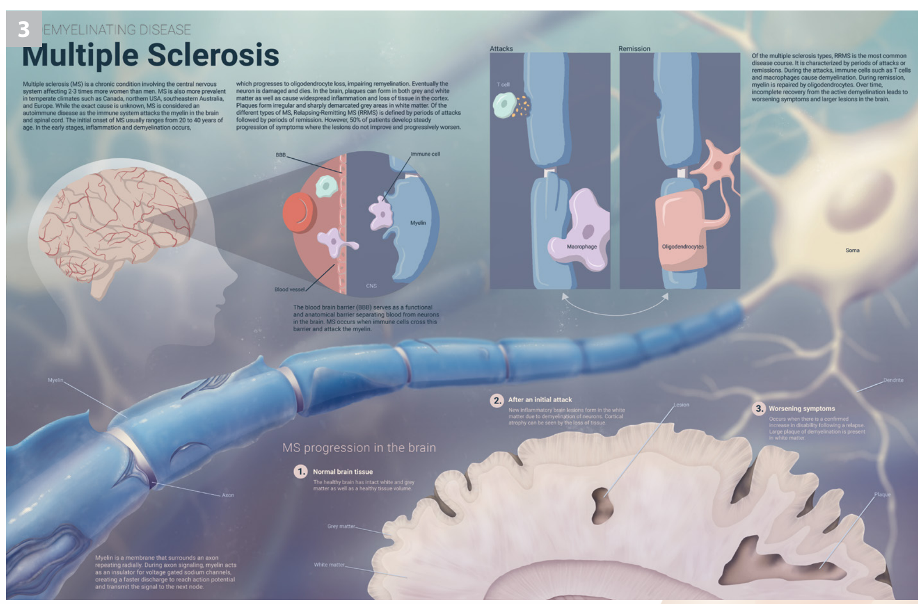


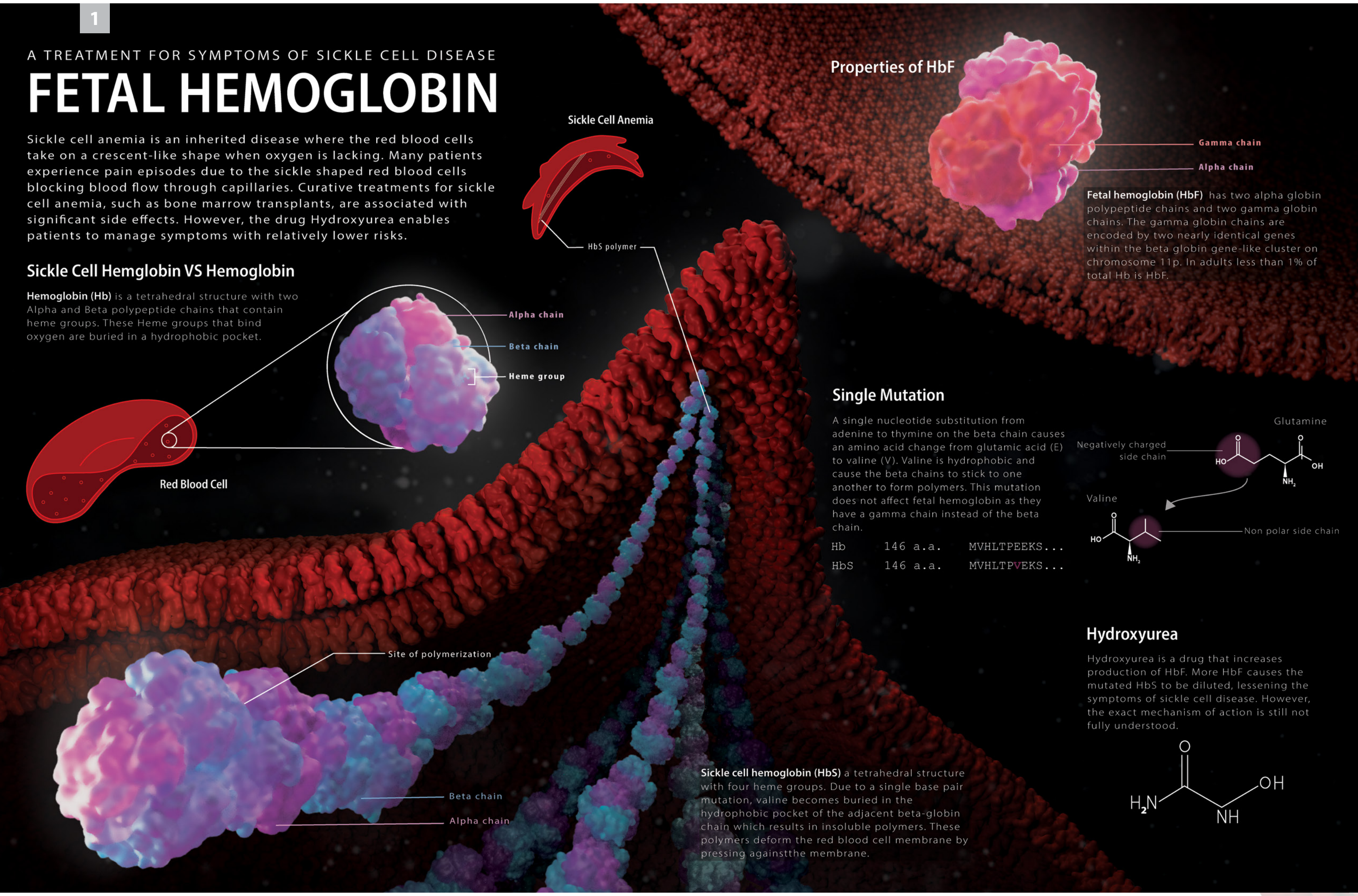


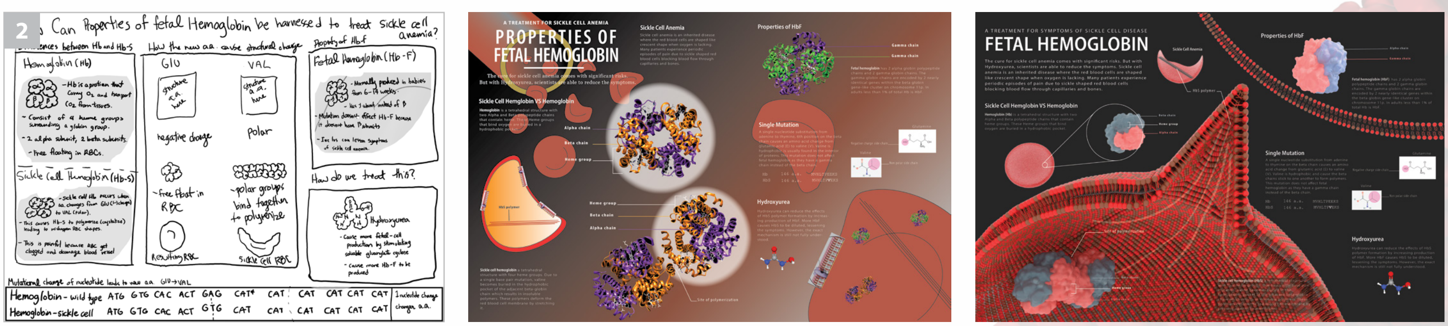












Molecular Visualization

The purpose of this poster is to highlight the molecular differences between fetal and adult hemoglobin. The difference in structure allows fetal hemoglobin to be a potential treatment for sickle cell anemia.

1. Final illustration. Membranes were generated in *Maya* and assembled in *Photoshop* and *Illustrator*. I wanted to create a sense of depth by playing with perspectives.

2. Production process. Following feedback that the previous draft was too poster-like, I revised the layout to be more dynamic. Additional changes were made to allow the reader to see the text more clearly.

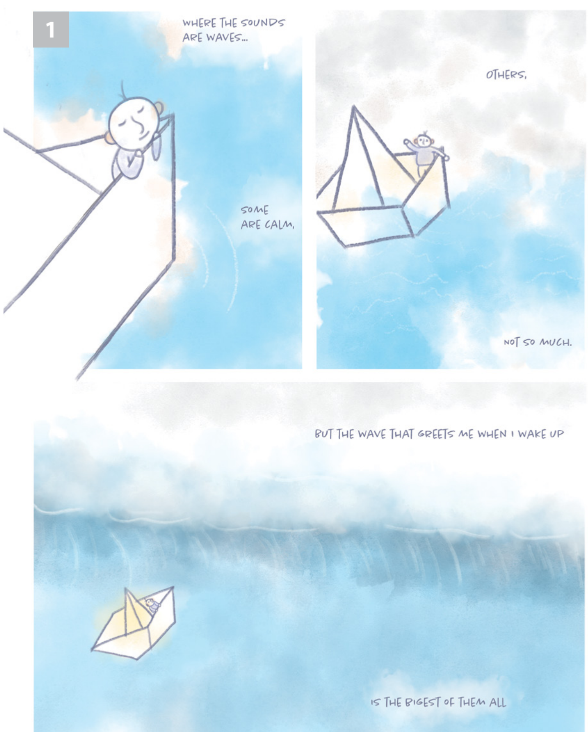
Graphic Medicine

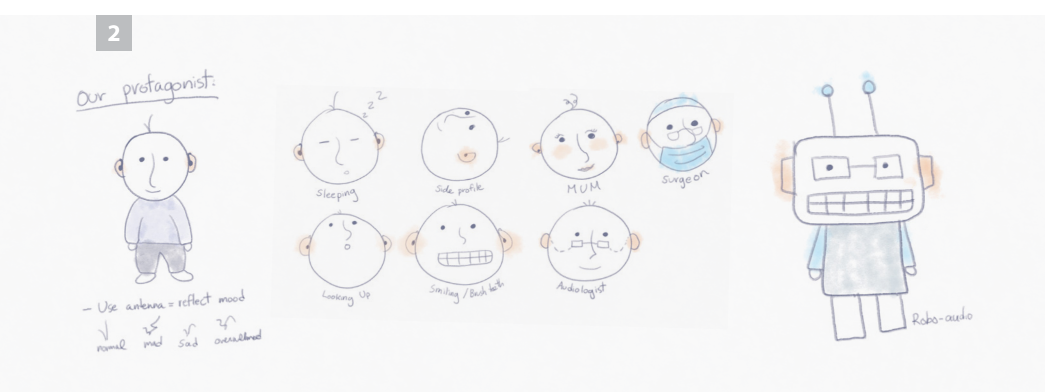
I envisioned creating a didactic patient education piece about hearing loss and cochlear implant surgery stemming from my own experiences.

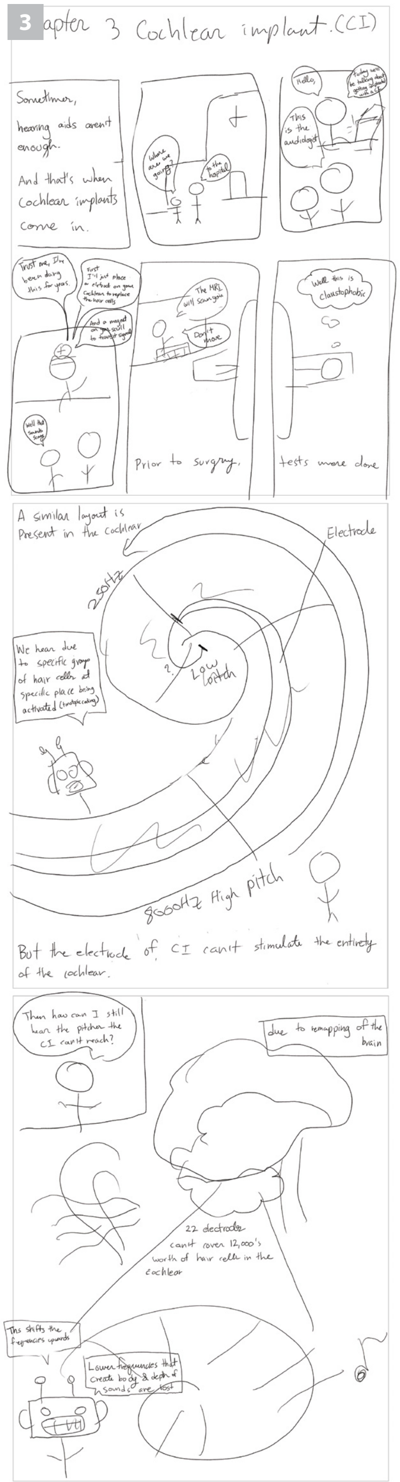
1. Production process. In my initial draft, I chose a watercolour style because it aligned with my storytelling message.

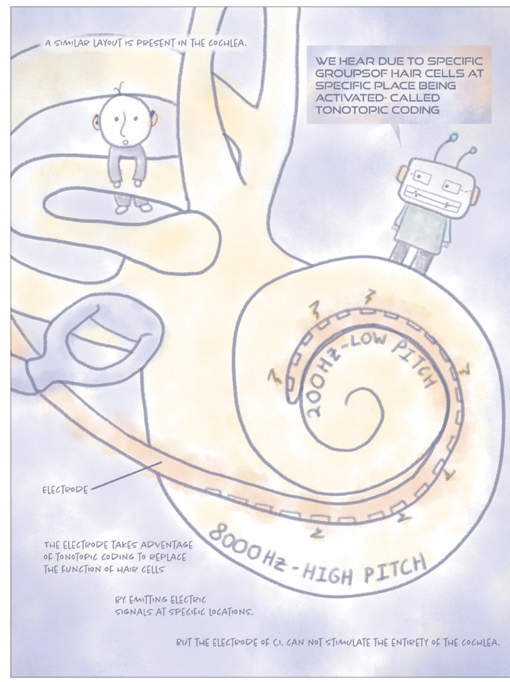
2. Study. I chose a simple character with an emphasis on the ears. The simplicity of the character enables the viewer to relate to the character.

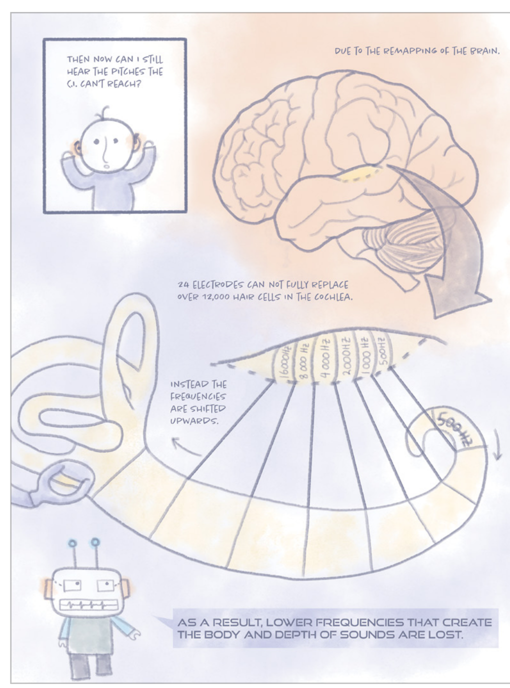
3. Sketches and final illustration. Initial sketches were roughly drawn out to determine composition and text placement. This way, I could test different layouts and the text flow. With the feedback I received, the final draft was rendered in *Photoshop*. I intentionally used purple lines and a limited colour palette to preserve the soft look of watercolours.











Pre-Consultation Patient Education in In Vitro Fertilization

I created this six-minute animation to provide condensed, simplified information about in vitro fertilization (IVF). This baseline provides context and simple visual elements that patients can recall when they meet their fertility doctor to discuss the options most relevant to their situation.

1. Production process. Keeping in mind that patients who come in for IVF consultations may not fit the traditional male-female mould, I made the design choice to keep the characters gender neutral and to show diversity.

2. Production process. I had visualized this scene since the conceptual sketches, and I knew I had to make it impactful since it would set the mood for the rest of the animation. I used a wide variety of bright colours and created a dynamic scene with movement and depth.

3. Production process. I used a mix of plug-ins and track matte in *After Effects* to achieve a cohesive style. The addition of paper texture on both the 3D image and 2D image creates depth which is accentuated by the shading on the 2D illustration.

4. Production process. A design challenge I had was animating the insertion of the egg. In the initial rendered shot, the egg was difficult to see. I took a new approach that illustrates the narrated "ultrasound guidance" and provides increased contrast that makes the egg more visible.

5. 3D modelling. Another challenge I had was 3D modelling and animating the cell division process from a single cell to a blastula. I rigged and timed the movement of each cell to stimulate the appearance of a cell dividing.

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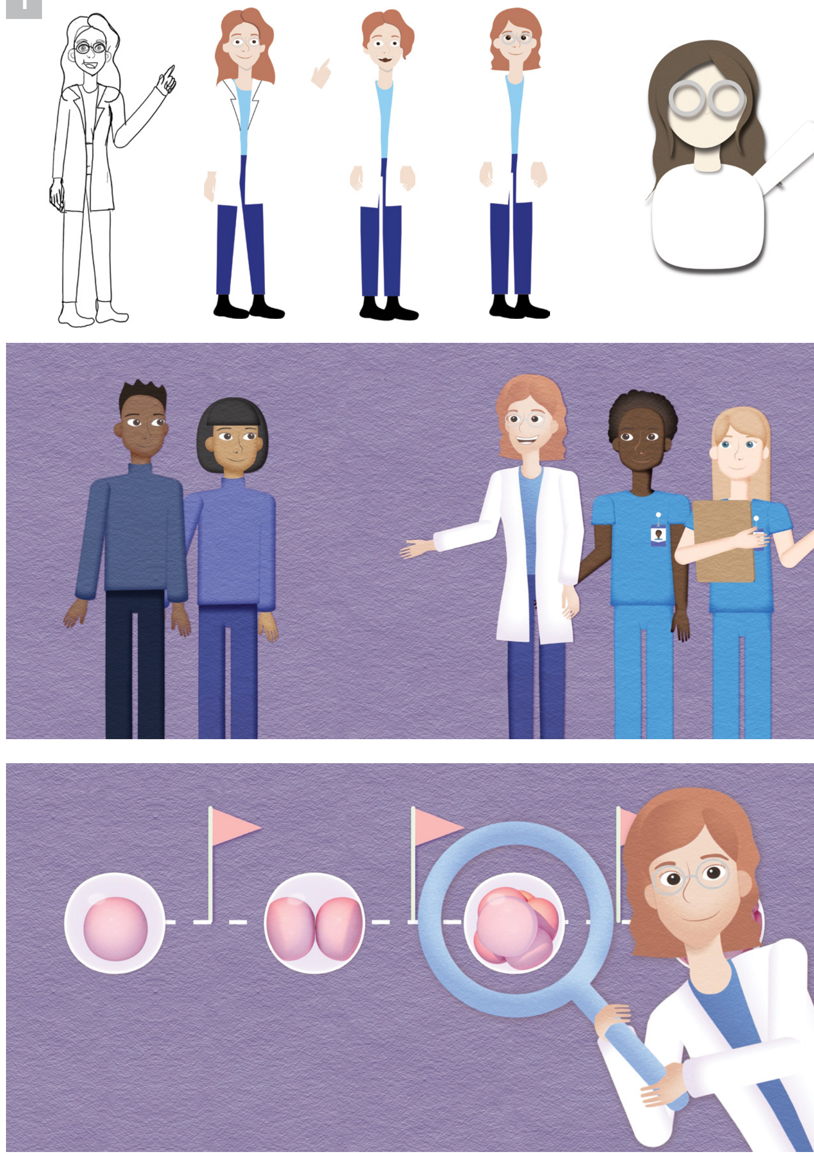

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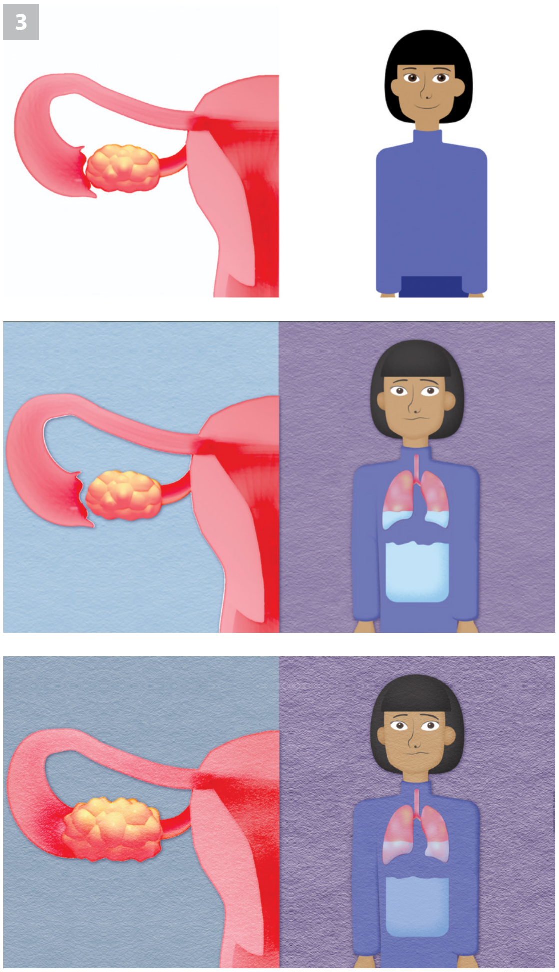
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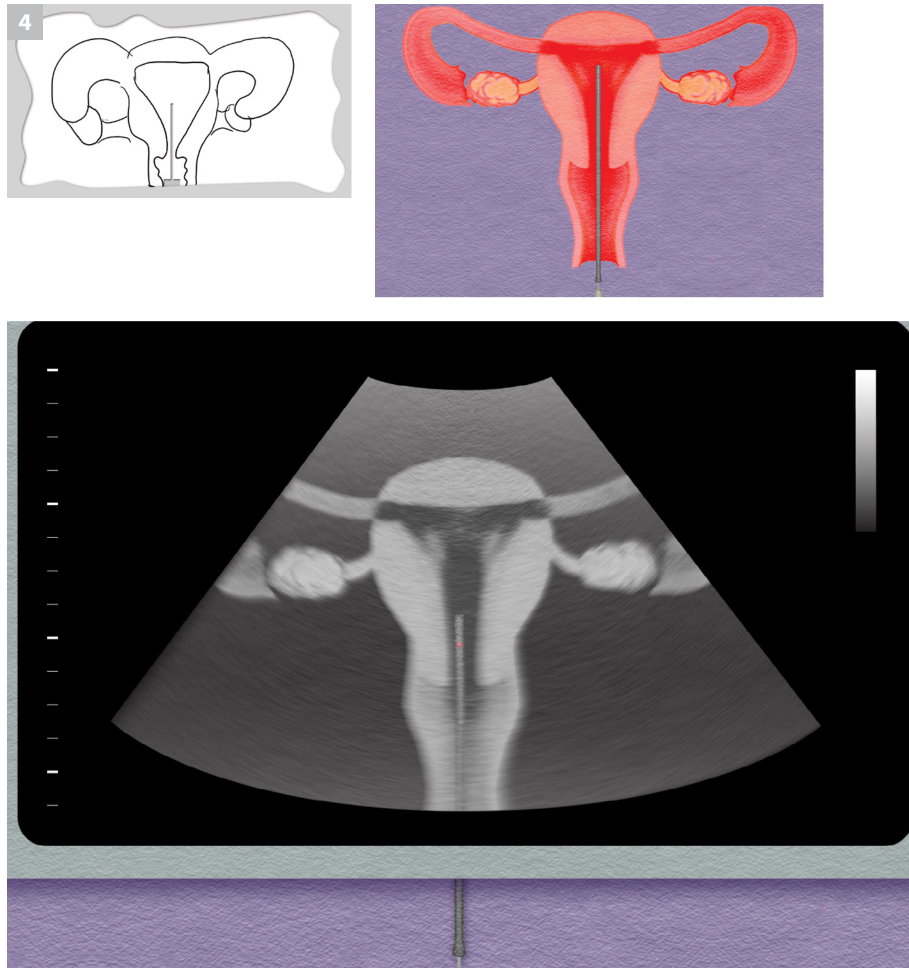
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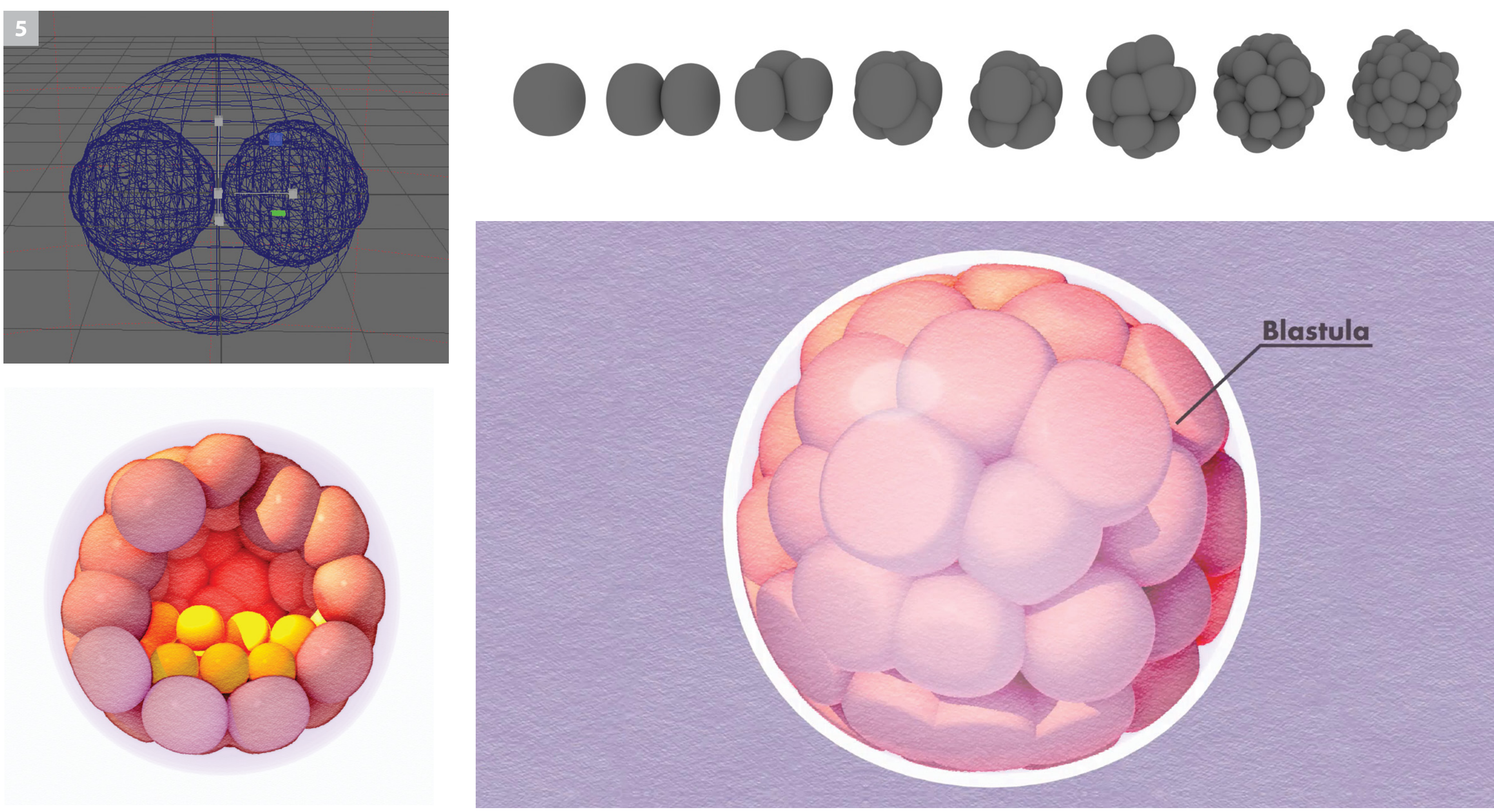

5
Blastula


process
1 Research
IDENTIFY GAPS
• Examine existing platforms
• User research
• Design brief
2 Analysis
UNDERSTAND THEM
• User personas
• User interviews
3 Design
VISUALIZATION
• Wireframing
• UI Design
• Icon Design
4 Testing
IDEATE
• Usability testing
• Update design
NAOMI ROBSON
PELVIX DESIGN DOCUMENTATION
02- ANALYSIS
User Persona
Brendan
the Busy OBGYN Resident
Personal Persona
Technology
Devices
Personal Information
Secondary Persona
User Goals
Business Objectives
03- DESIGN
Wireframing
MODEL VIEWER
The user can select the arrow on the left side panel to search and add/remove anatomical structures. When selected the category becomes highlighted and there is a dropdown listing structures within that category.
NESTED CATEGORIES
The user may add structures by category. This may be anatomical groupings (Modify by Category), anatomical function (Modify by Function), or by Treatment (Modify by Treatment).
ADJUST BY PROFESSION
Can view treatments by profession by selecting this dropdown.
TOGGLE VISIBILITY
Not visible
Visible
03- MODEL VIEWER
SELECTION TOOLS
Upon selecting this button, a shelf of selection option slides out from it to the left from it. A darker icon means it is active.
03- ABOUT PAGE
Our history
Pelvix in the literature
ABOUT PAGE
The about page provides insight about how the model was created, and publications to read to learn more about it.

Naomi Robson

I believe that scientific visualization and design solutions can bridge communication gaps and drive impact when tailored to their target audience. By understanding the individual, we can create targeted solutions that lead to positive change. This human-centred thought process was foundational to my projects. Before my time in the Biomedical Communications program, I earned a masters focusing on visualization in human anatomy education.

Editorial Illustration

This mock journal cover captures the wonder of the beginnings of personalized medicine. With the discovery of individualized vaccines for cancer treatment, the future is bright. Vivid colours and inviting characters convey this exciting beginning.

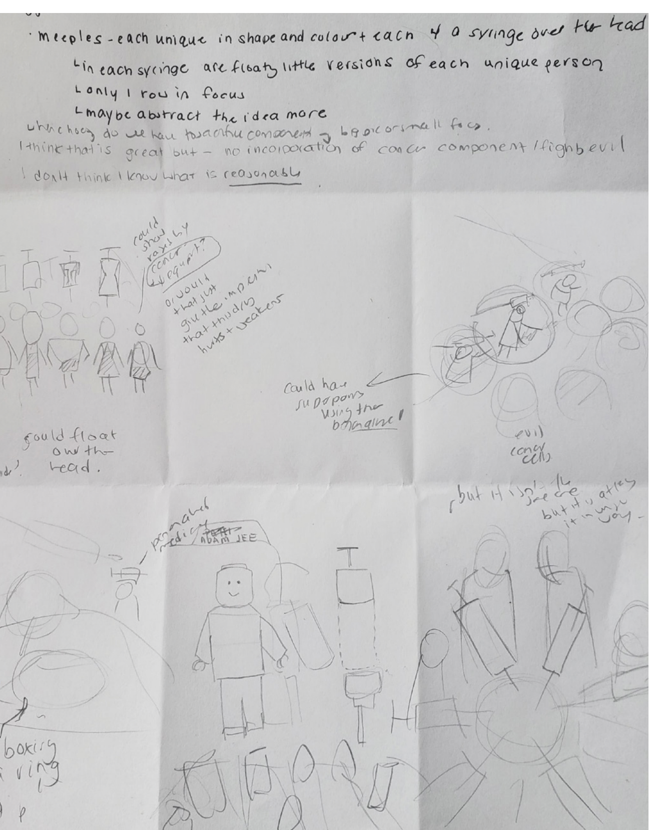
1. Sketch. I created several concept sketches and various thumbnails where I blocked dark and light values. I like to begin ideating on paper to capture as many iterations of the message as possible. Following this stage, I created a series of more refined rough drafts.

2. Production process. I considered a variety of different colour palettes and lighting styles. It was essential to capture a hopeful mood.

3. Final draft. The final cover was created using *Maya, Photoshop*, and *Illustrator*.

Previous spread. Mock-ups of the design documentation for my MRP.

1



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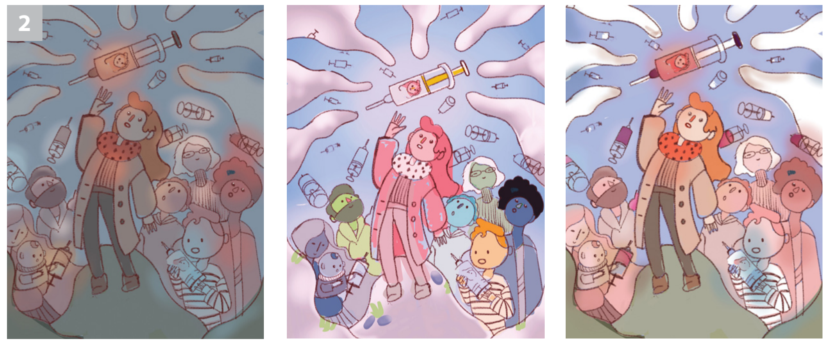

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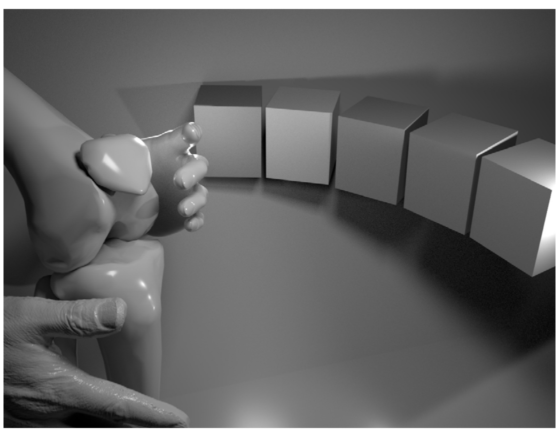
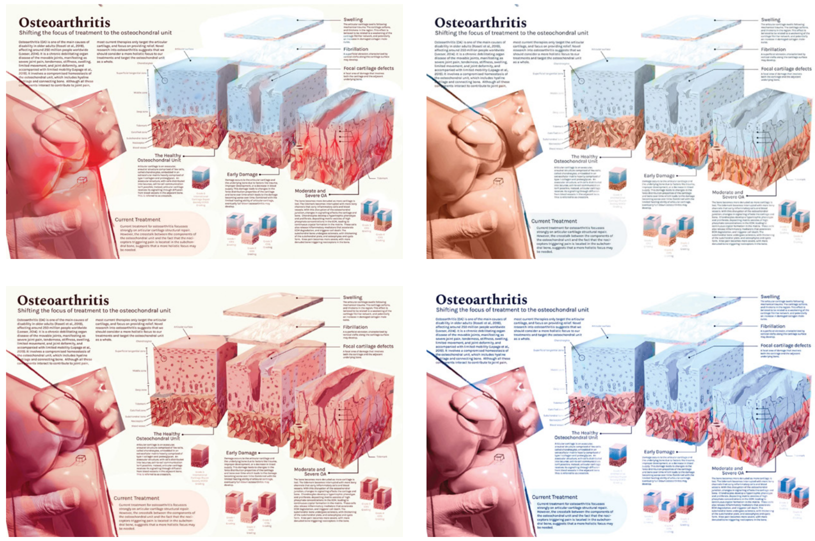
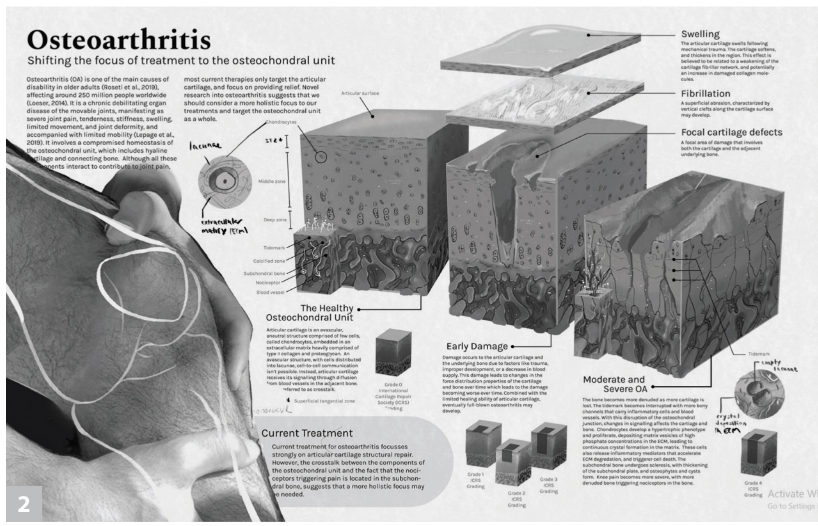
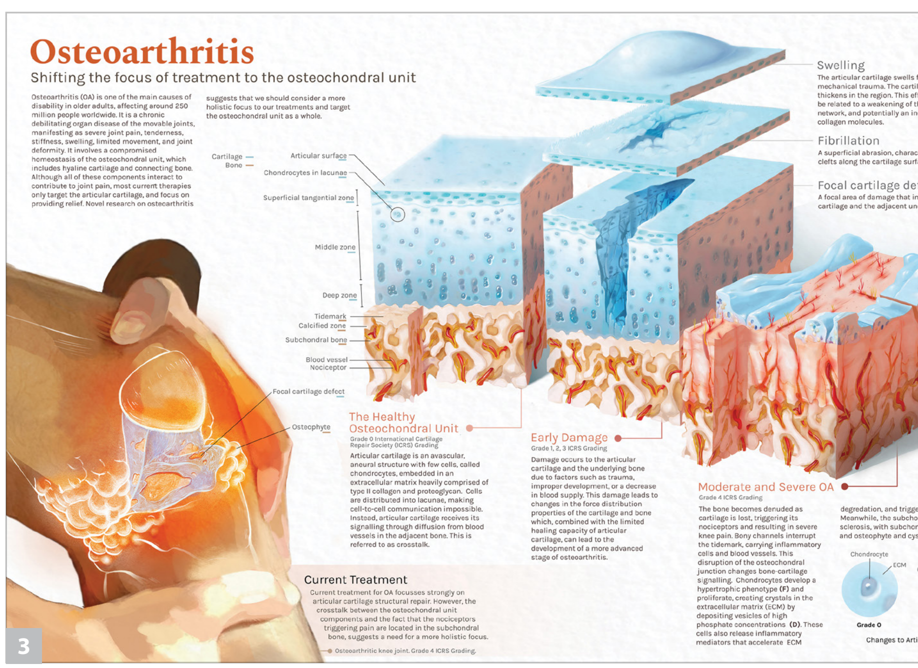
Pathological Illustration

Osteoarthritis is one of the leading causes of disability in older adults, affecting around 250 million people worldwide. Current treatments tend to focus on pain relief and articular cartilage repair. However, novel research suggests that we should shift to a more holistic approach and target the whole osteochondral unit. I created this spread to provide physicians with these new research insights.









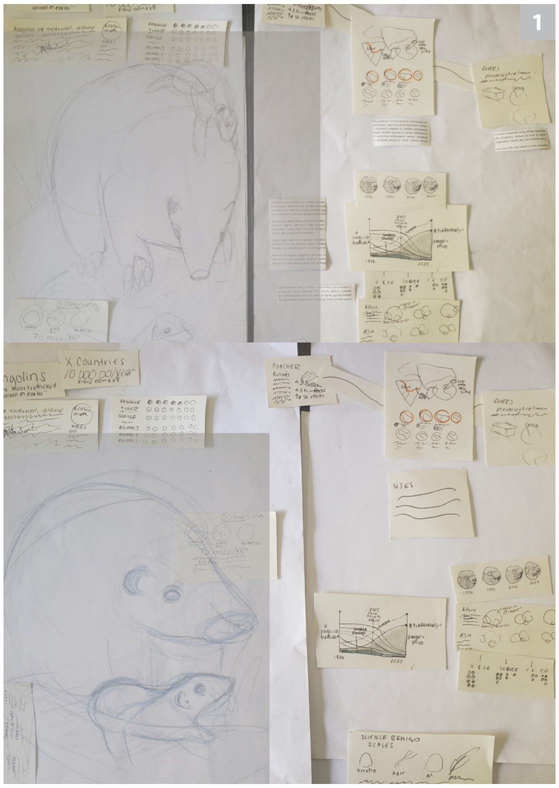
1. Sketch. After deciding which visual elements I wanted to include in the piece, I used a 3D maquette to plan the lighting and composition.

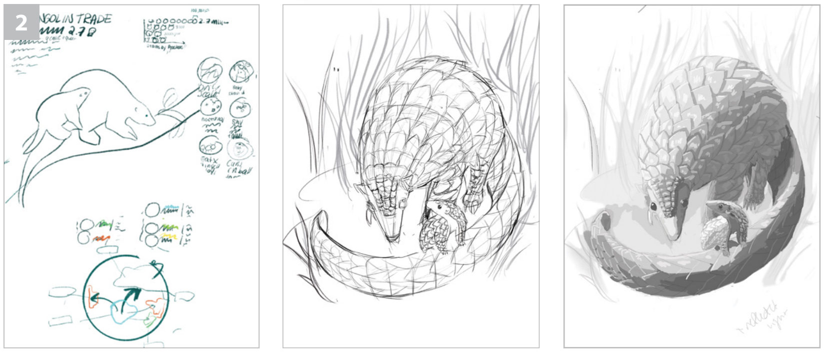
2. Production process. Different colour palettes were considered by overlaying different combinations on the black and white illustration.

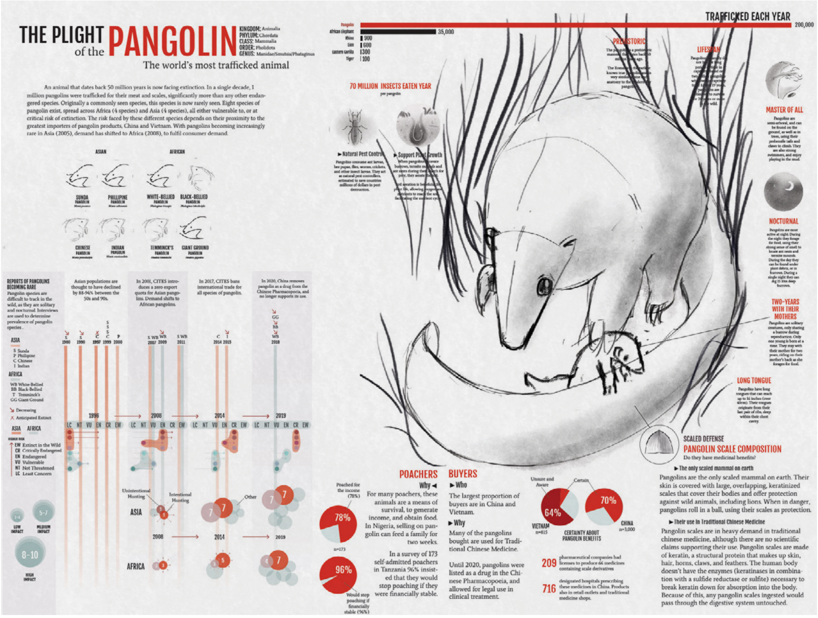
3. Production process. The final piece was created using *Maya, Photoshop, Illustrator,* and *Procreate.*

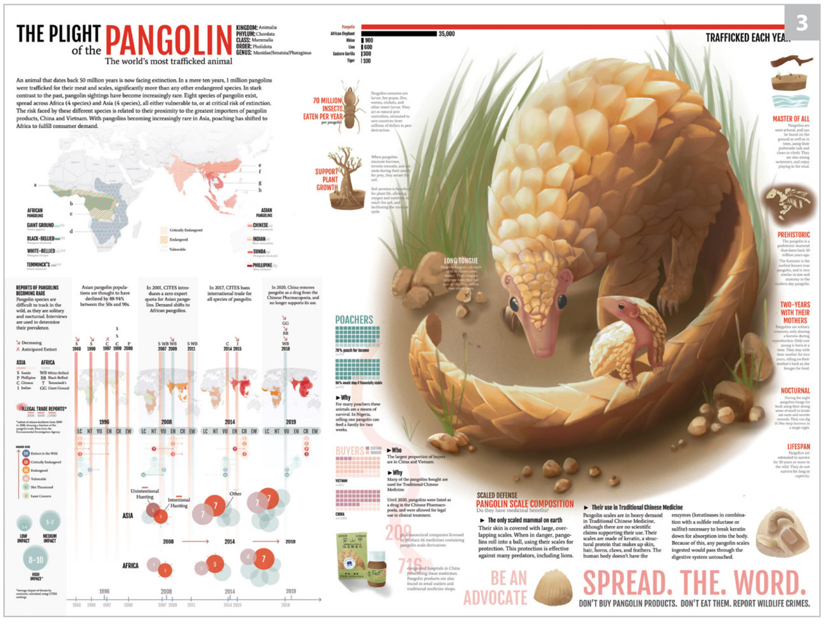
Information Visualization

The pangolin is the world's most trafficked animal, with approximately 200,000 trafficked yearly. Eight pangolin species exist, with varied risk of extinction depending on their proximity to China and Vietnam, the most significant importers of pangolin products. I created this piece to provide an overview of the factors affecting the decline of the pangolin populations.









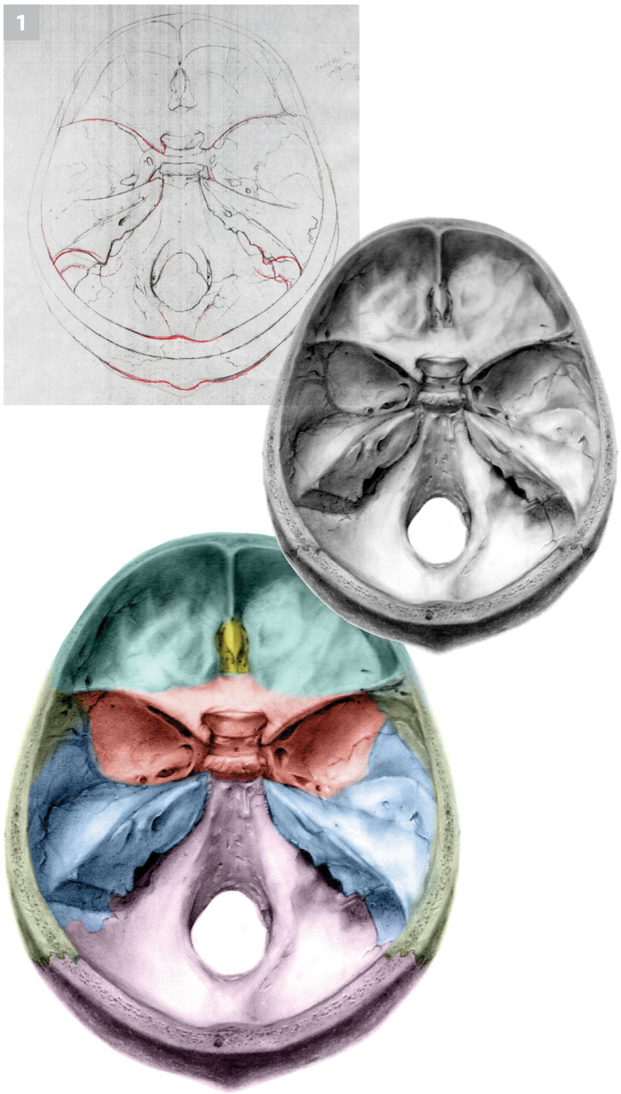
1. Sketch. I created paper cut-outs of the visual and data elements I wanted to include to visualize relationships and arrange the content.

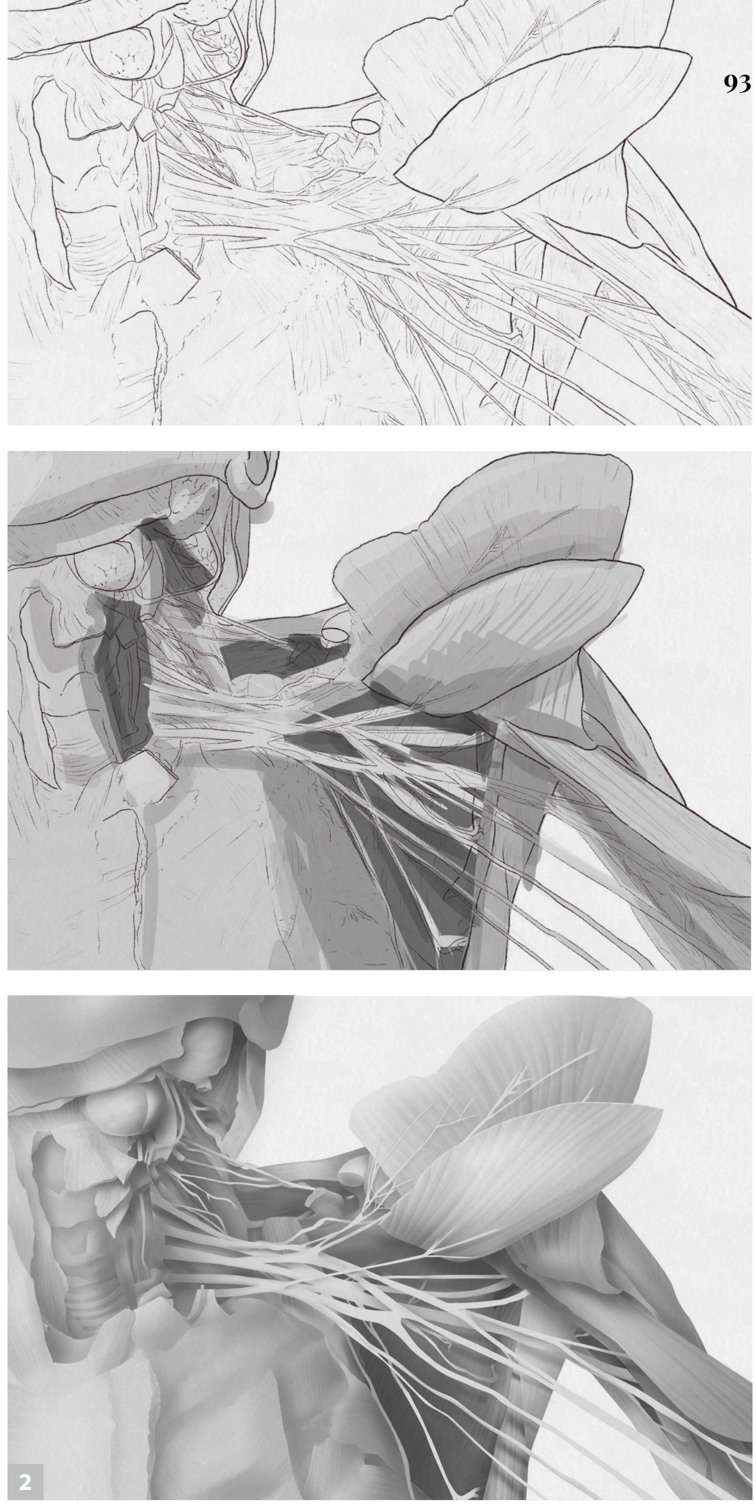
2. Production process. I created a series of more refined rough drafts, blocking elements in *Illustrator*. I sketched the line art for the pangolin, before placing dark and light values and adding colour.

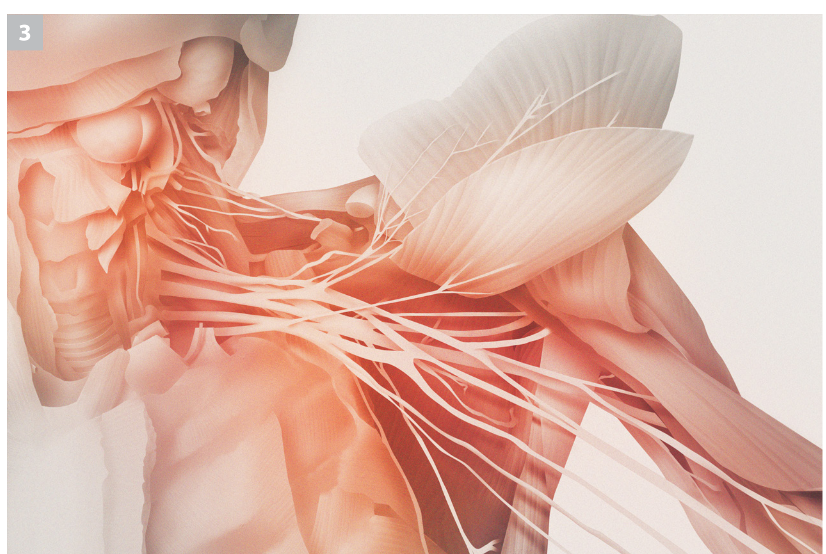
3. Final draft. The final poster was created using *Tableau*, *Illustrator*, *Photoshop*, *Excel*, and *Procreate*.

Anatomical Illustration

The brachial plexus and the foramina of the skull are complex topics for the introductory anatomist. As a teaching assistant, I have seen numerous students struggle with them. Because of that, I decided to create learning tools on these two topics.







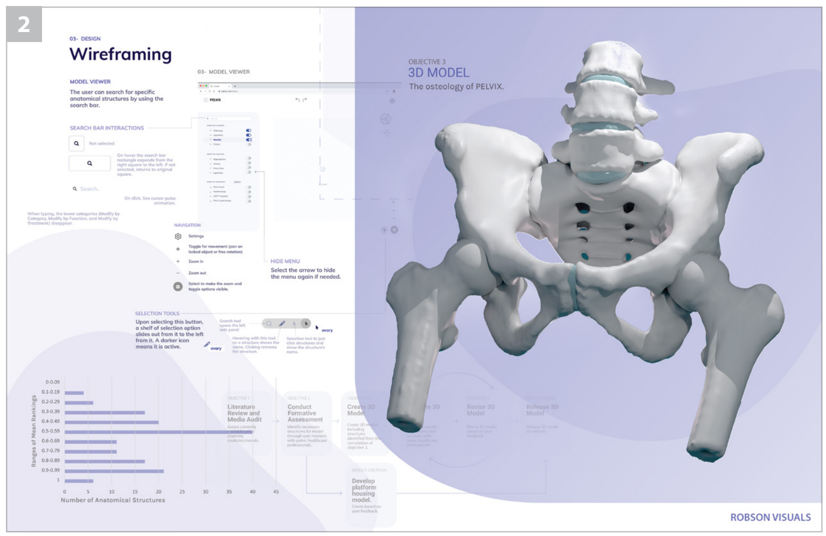
1. Production process. The foramina of the skull. I used carbon dust and *Photoshop* to create the final piece.

2. Production process. This is an illustration of a brachial plexus dissection (dissection completed by Dr. Sean C. McWatt from the University of Guelph). I first developed a sketch. Then, I placed dark and light values before creating a greyscale version of the piece in *Illustrator* and *Photoshop*.

3. Final draft. Final rendering of the brachial plexus piece. Final colours were added in *Photoshop*.

Using User-Centred Design Frameworks to Create a 3D Pelvic Anatomy Model for Physiotherapists

My MRP involved creating one of the first user-informed, expert-validated, digital 3D representations of female pelvic anatomy, designed specifically for physiotherapists. It led to the creation of a framework for learner-centred design in human anatomy educational tool development.



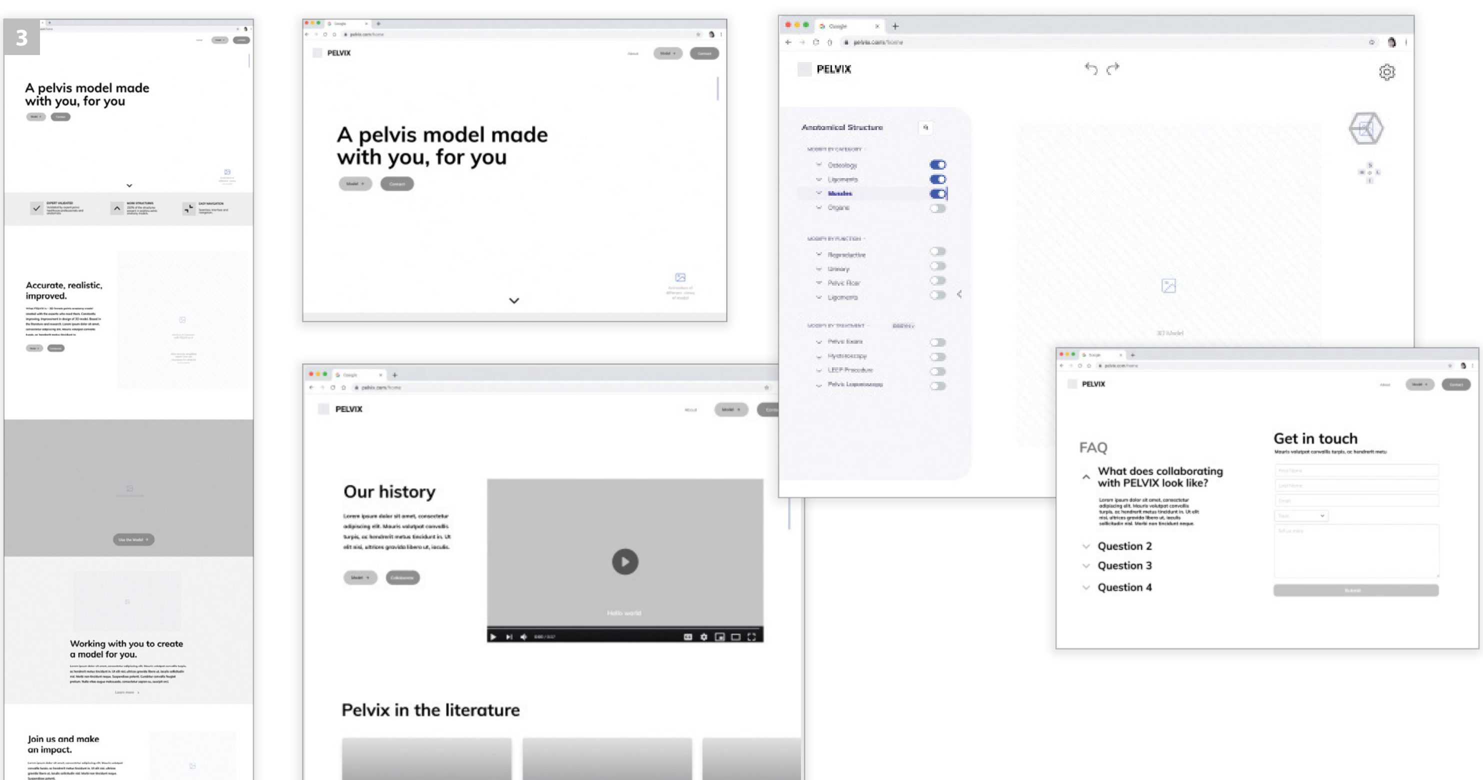
1. Final draft. The final model was evaluated for its perceived anatomical completeness in various clinical settings by physiotherapists. Employing a user-centred design focus led to the creation of a model that was perceived as more useful and complete.

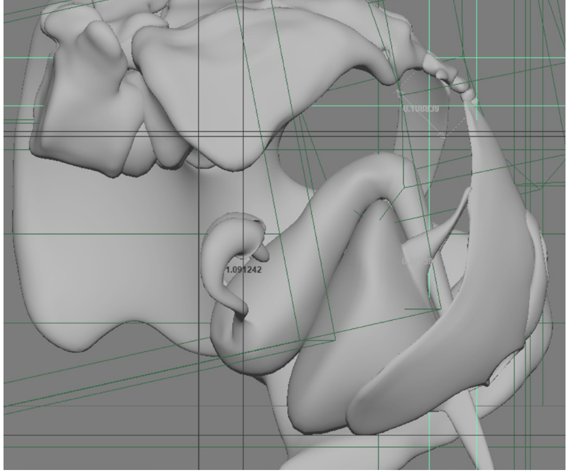
2. Production process. Physiotherapists completed an anatomical structural questionnaire to ascertain what structures were needed in the final model.

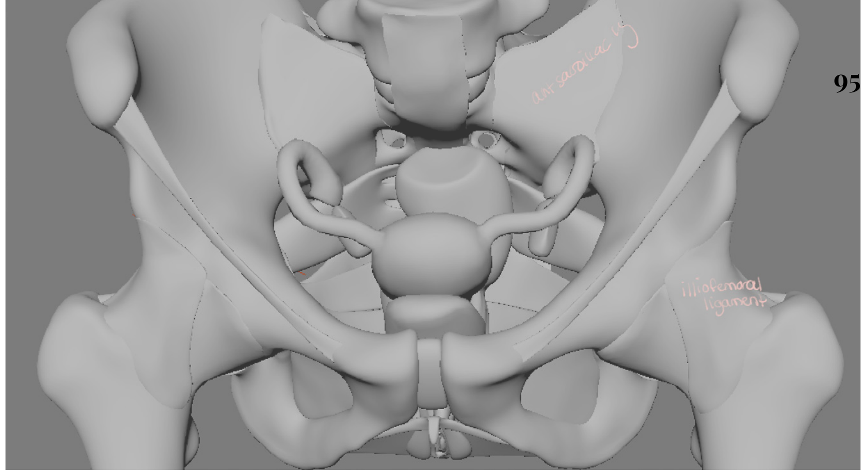
3. Production process. I researched and developed a variety of user personas and layouts.

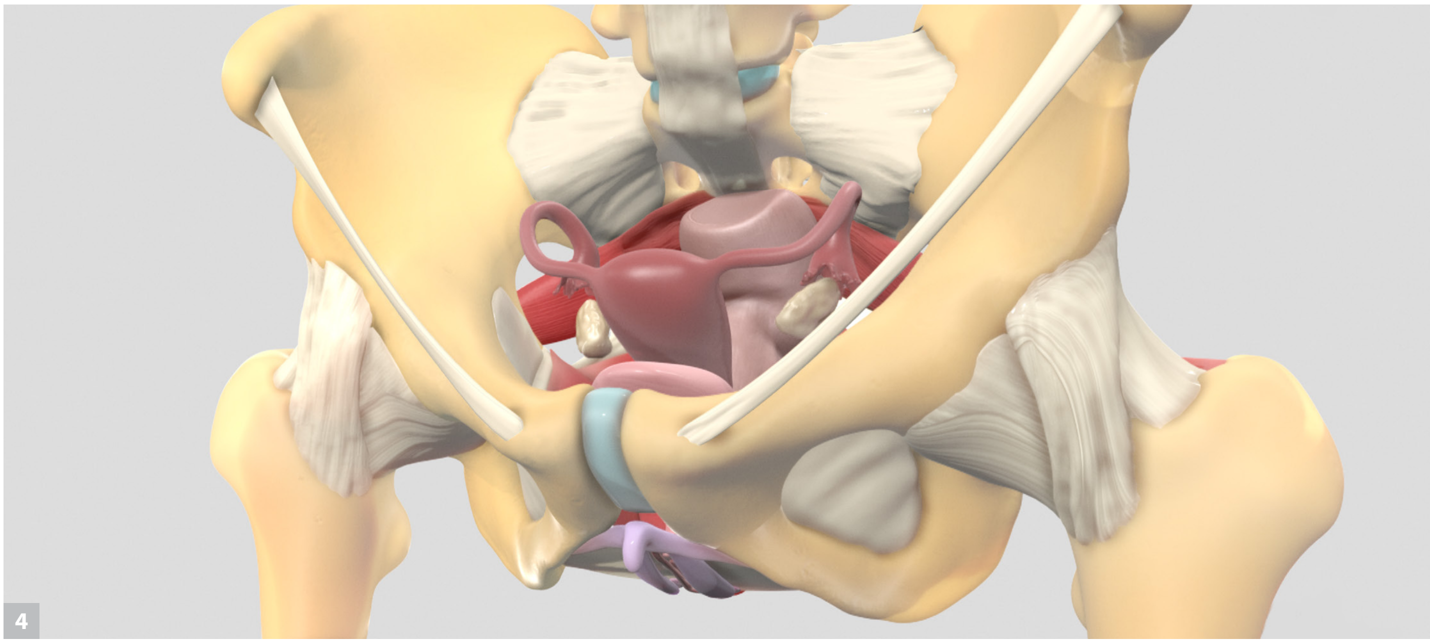
4. Production process. I sculpted 48 anatomical structures in order of priority, as determined by physiotherapists. The model underwent a quality control evaluation interview with anatomists before finalization.

5. Final animation. I developed an animatic to communicate the findings of this research study.









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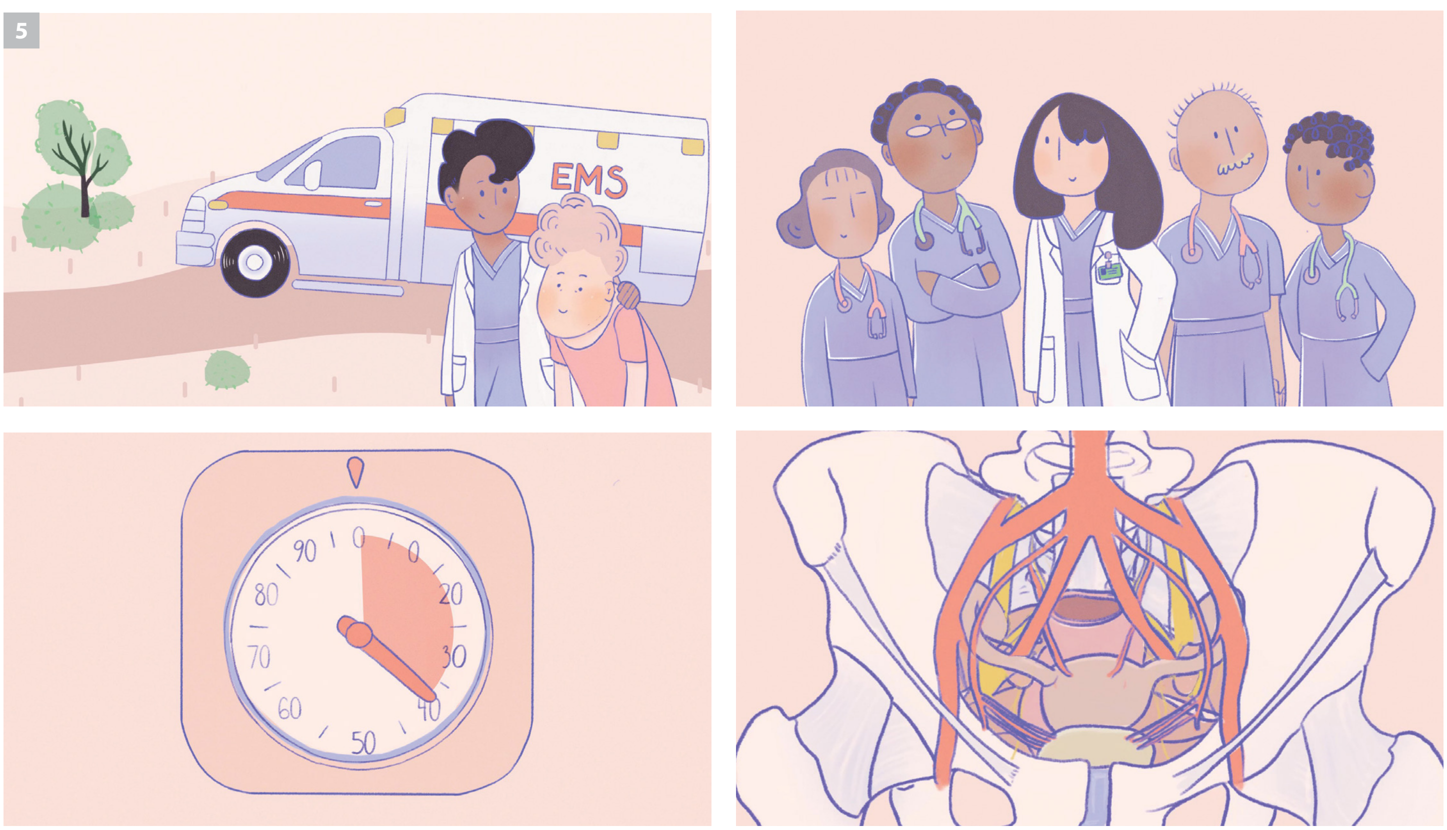

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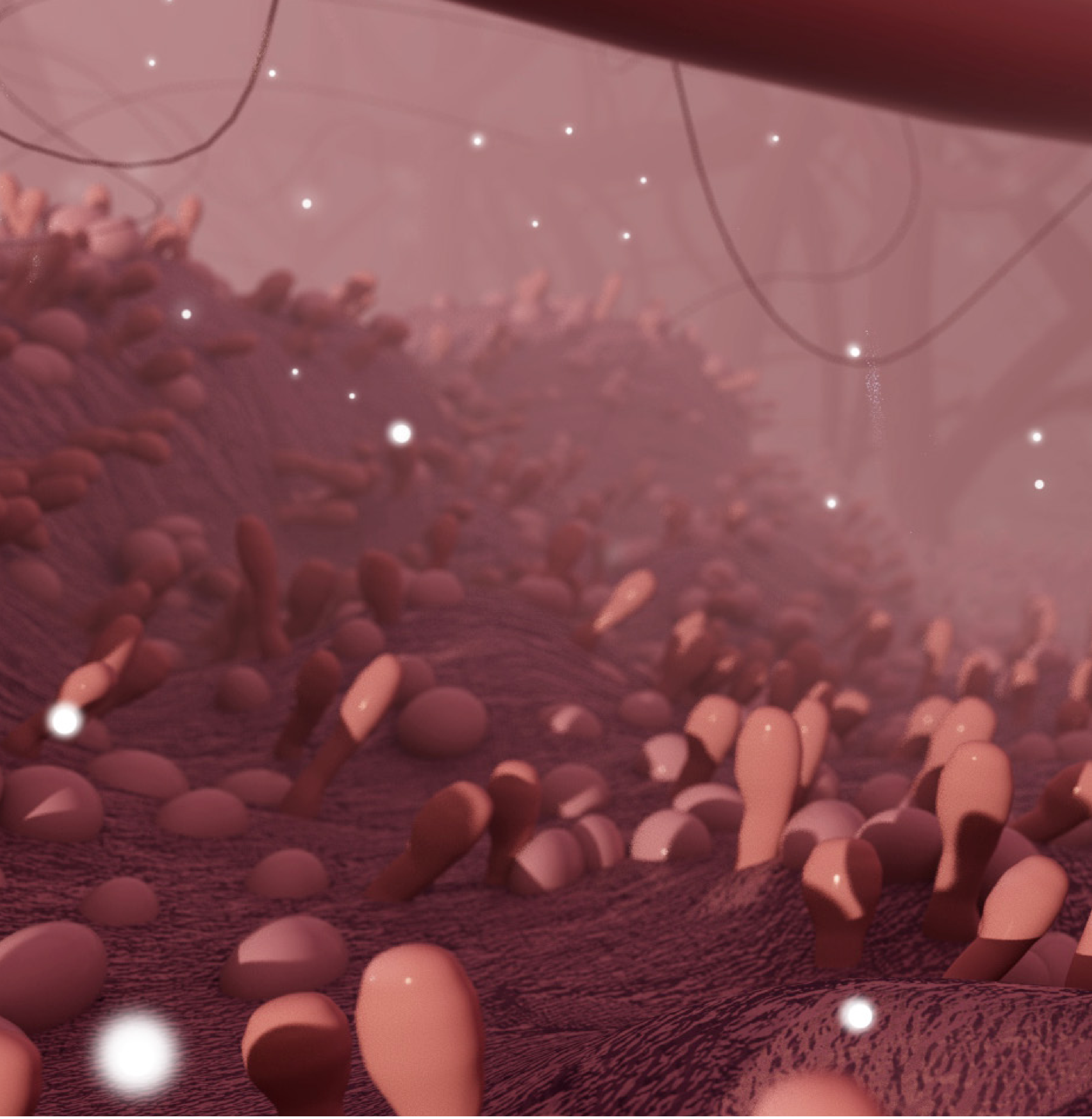
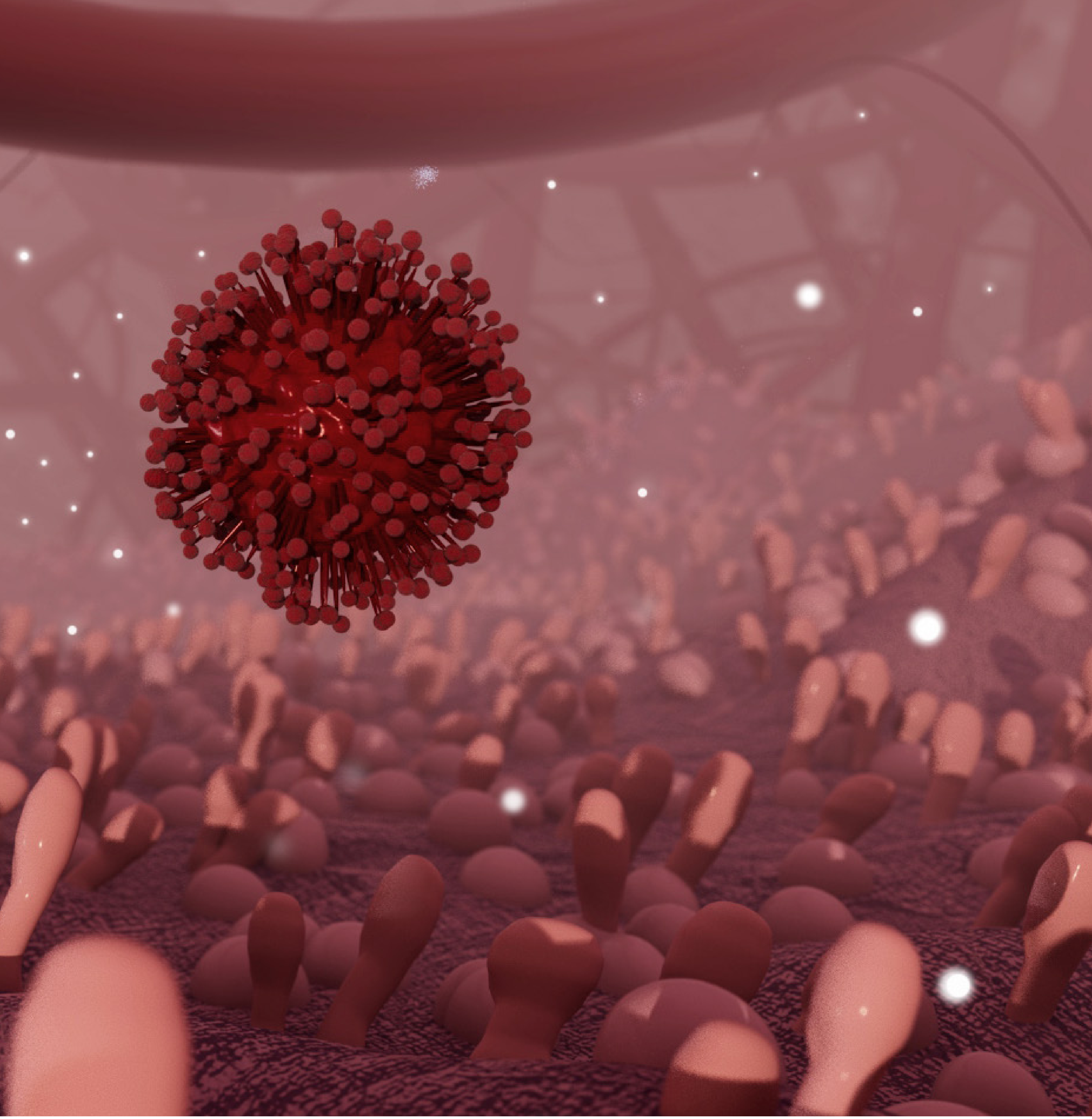




Sana Khan

I'm a biomedical and scientific illustrator with a background in neuroscience and environmental science. As a visualization specialist with advanced training in design, medicine, art, and technology, I work with healthcare professionals; editorial publications; researchers; pharmaceutical corporations; and businesses specializing in health, medicine, and scientific discovery to visually translate complex science into a clear and understandable form.

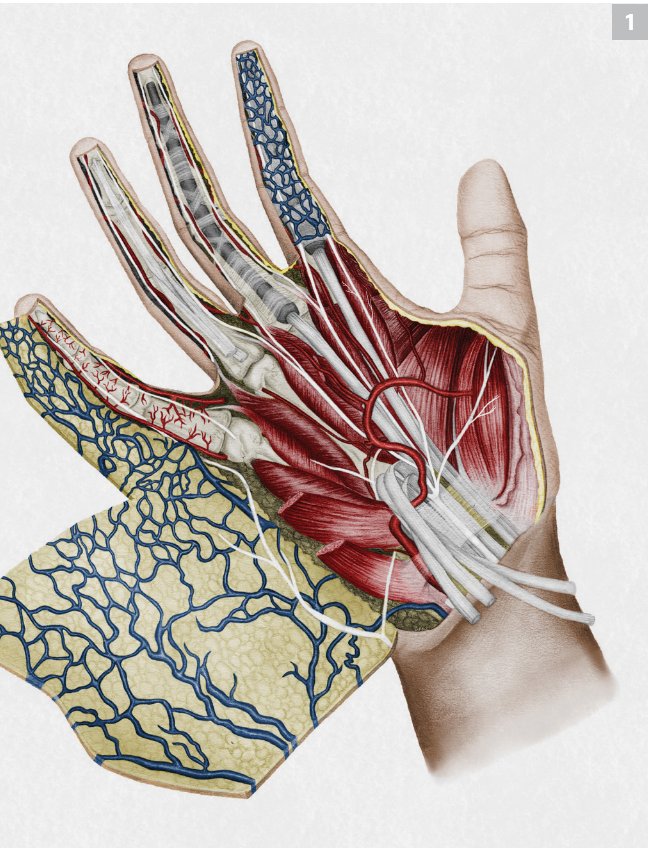
Anatomical Illustration

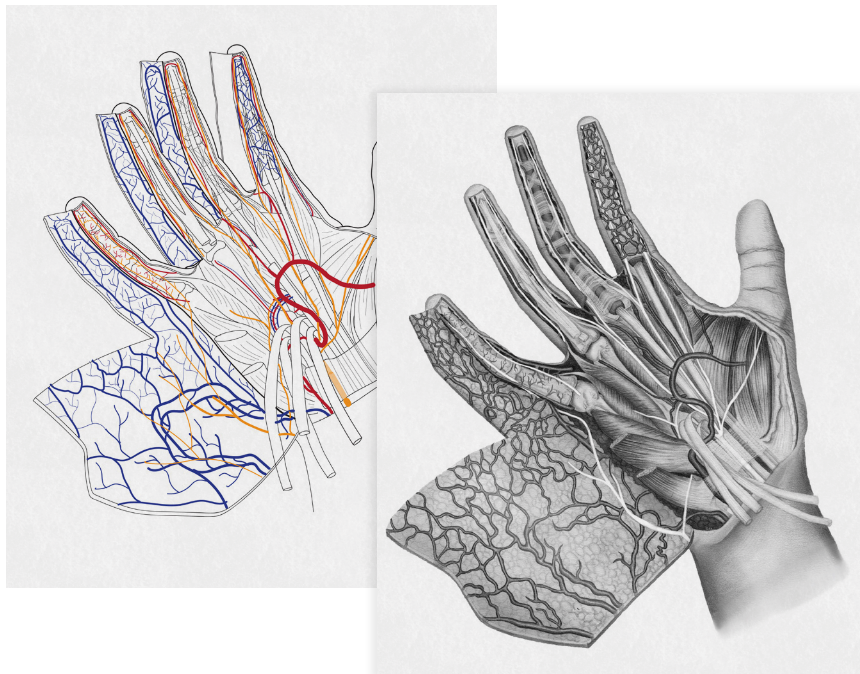
Anatomy projects demonstrating the internal structure of the hand and its anatomical features that might not be visible even with a complex dissection (top), and the orientation of the brain within the skull (bottom).

1. Production process. This project was about choosing an anatomical region and peeling away the superficial layers to reveal the anatomy underneath. The goal of this project was also to illustrate the chosen region from an unconventional view not often found in medical textbooks and atlases.

2. Production process. This was a fun and challenging illustration because of the many spatial relationships of brain and face structures that had to be considered and planned before and throughout the production process.

1





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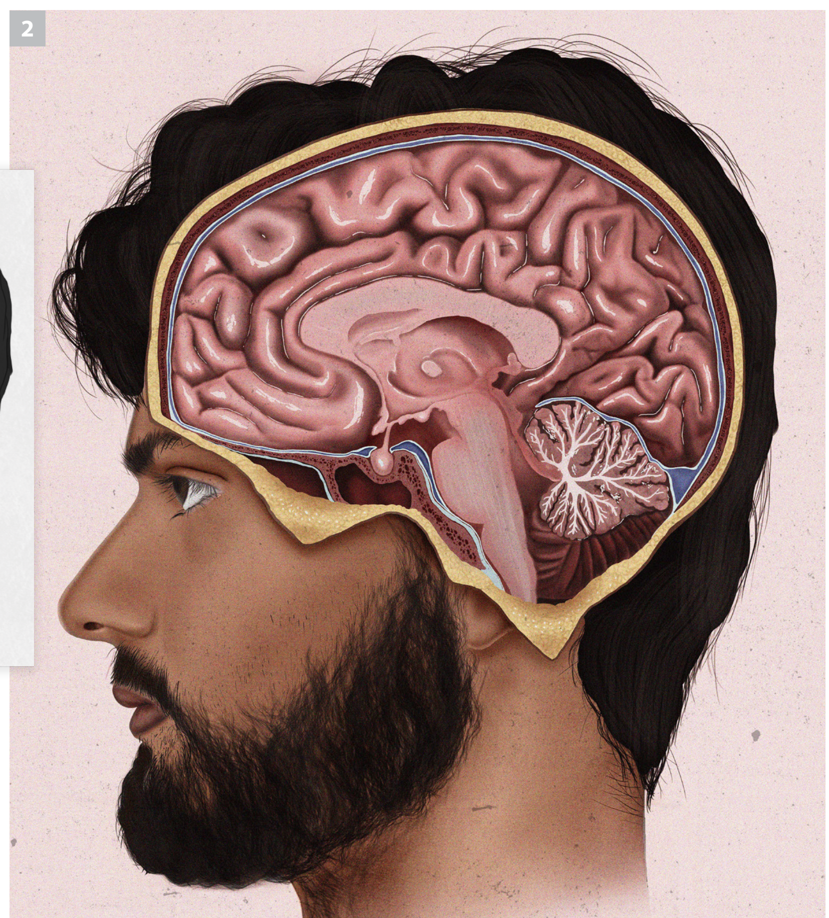
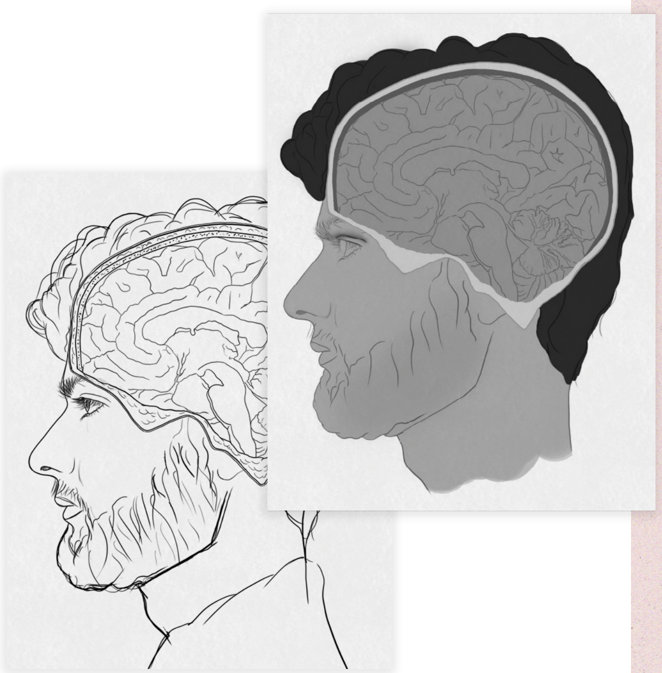




Molecular Visualization

The goal of this project was to visualize the molecular structure and function of a biologically-relevant macromolecule. I chose to illustrate the components and the mechanism of action of the SARS- COV-2 virus spike protein.

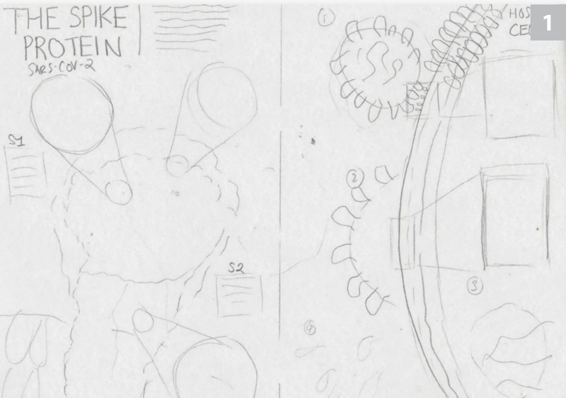
1. Sketch. A very rough sketch of the layout; on the left is a closeup for the spike protein sitting on the virus, and on the right is this protein's mechanism of action in allowing the virus to enter a host cell.

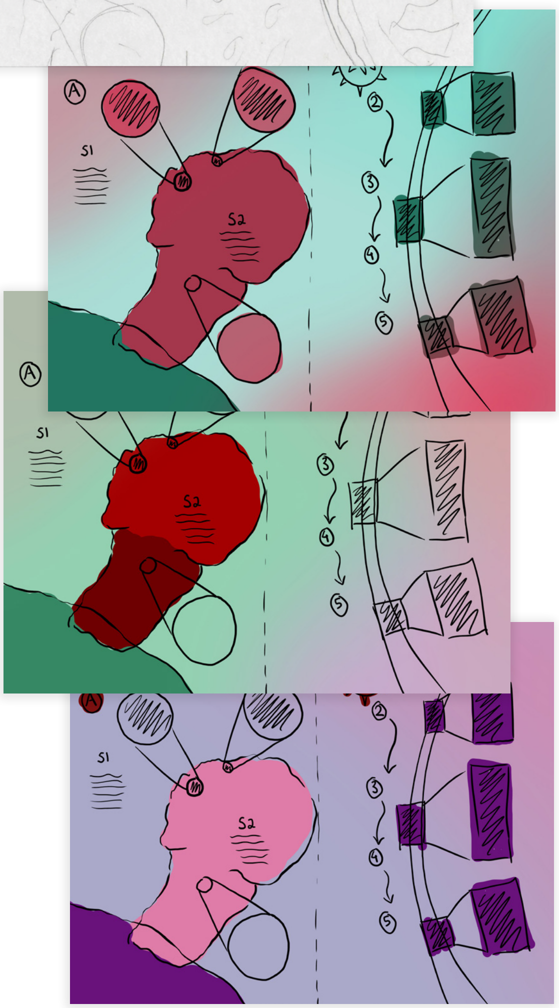
2. 3D modelling. The background of this infographic was modelled and rendered in *Maya*.

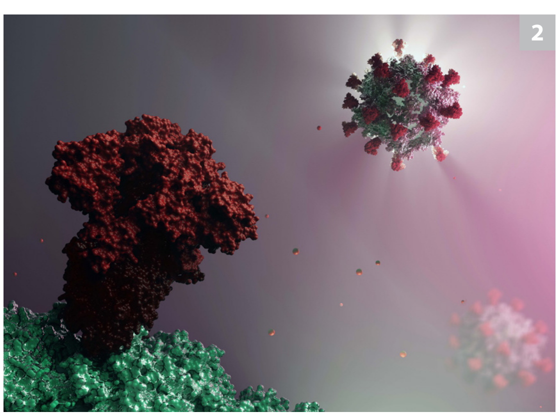
3. Sketch. I used *3D Protein Imager* to create a graphic of the spike protein based on PDB data and created another rough draft.

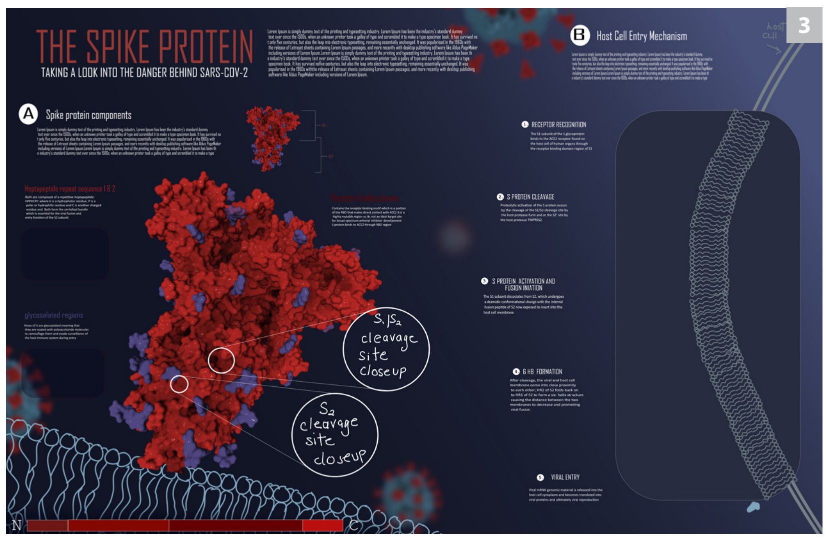
4. Final illustration. The final visualization was composited in *Illustrator*.

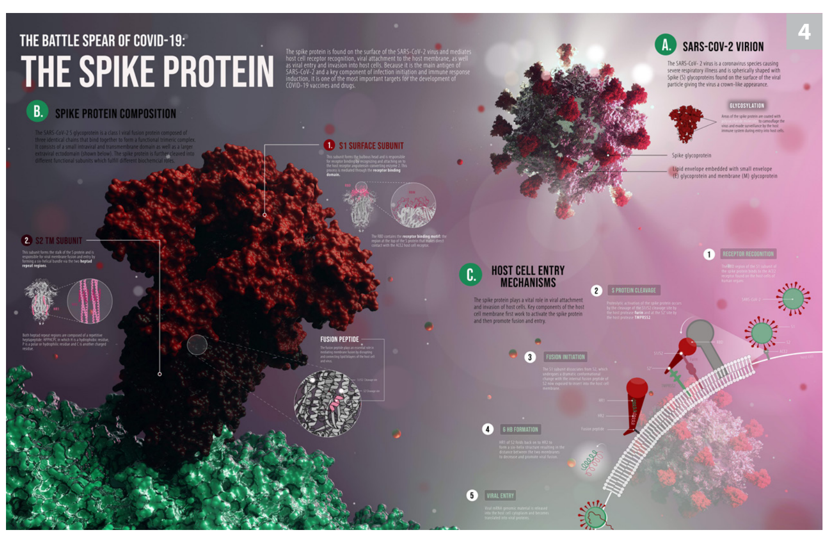
Previous spread. A still of a rendered 3D cellular environment from my MRP animation.





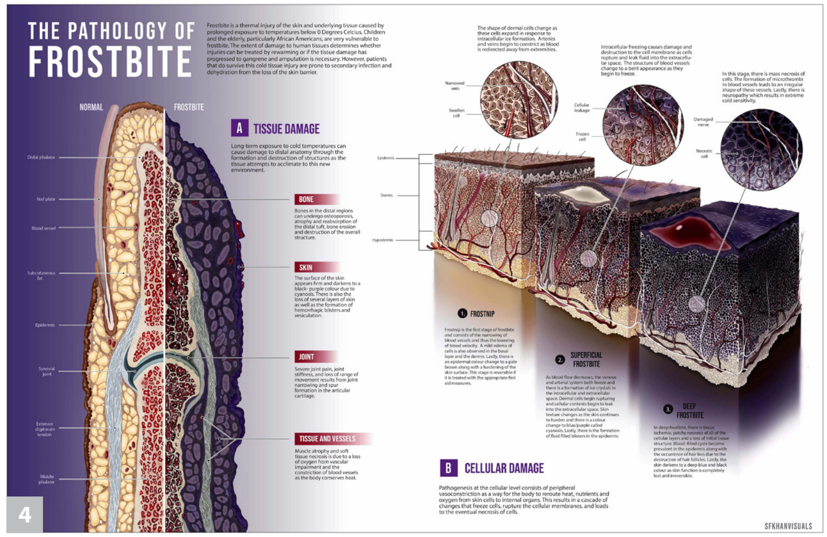






Pathology Illustration

This was an informational visualization of the pathogenesis, gross tissue damage, and microscopic cellular damage associated with frostbite.



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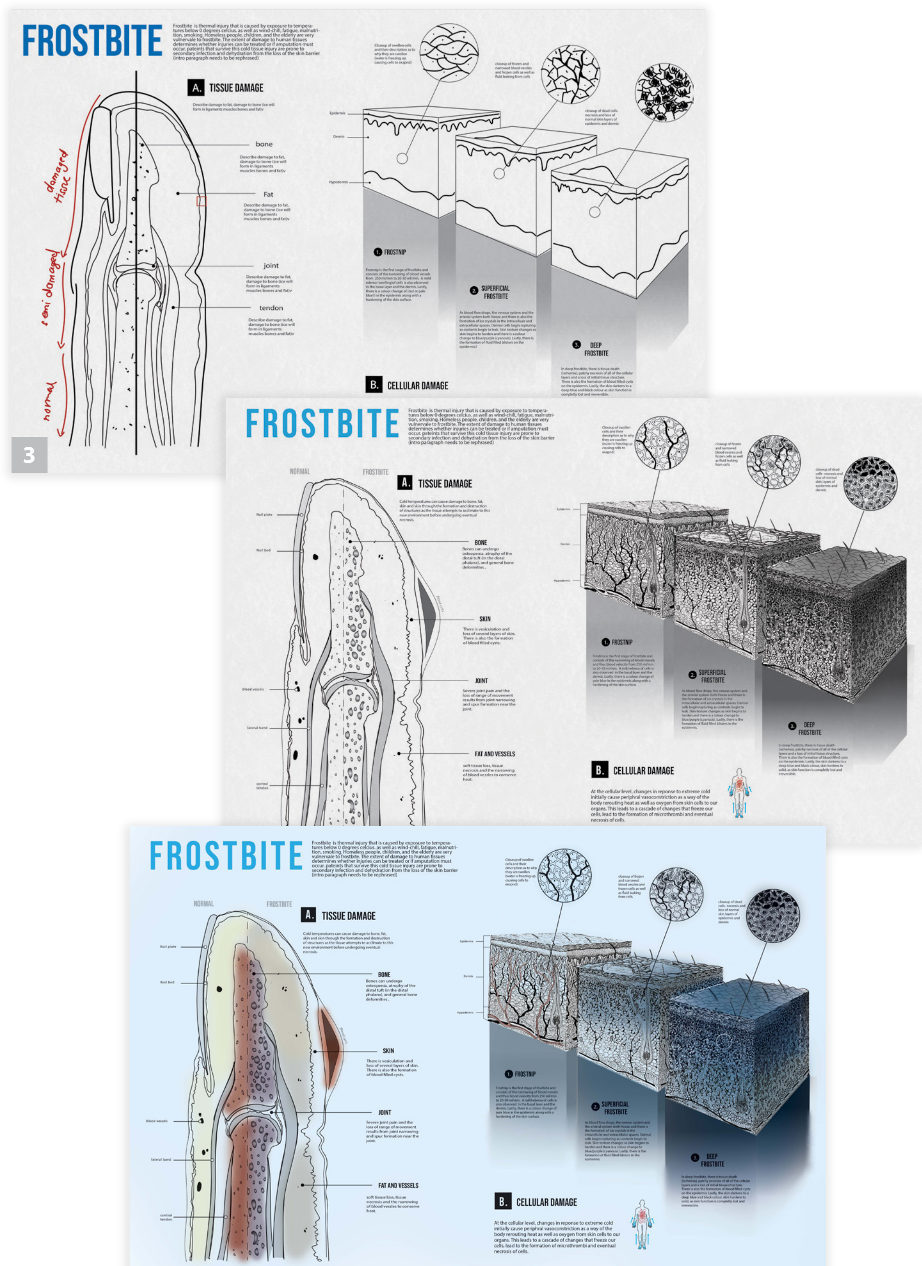
1. Sketch. I created this rough drawing of skin tissue cubes with progressive changes to the skin cells corresponding to each stage of frostbite: frostnip (left), superficial frostbite (middle), and deep frostbite (right).

2. Sketch. Before starting, I did a rough 'tissue landscape' study to get a feel for the tissue environment frostbite affects (the blood vessels of the exposed extremities).

3. Production process. A rough layout was created with the tissue damage on the left and cellular damage on the right.

4. Final illustration. The final illustration composited in *Illustrator*.



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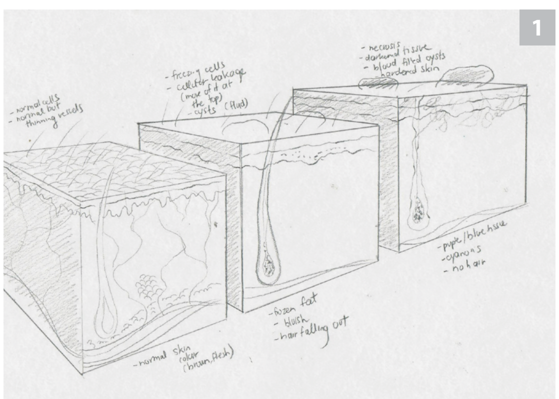
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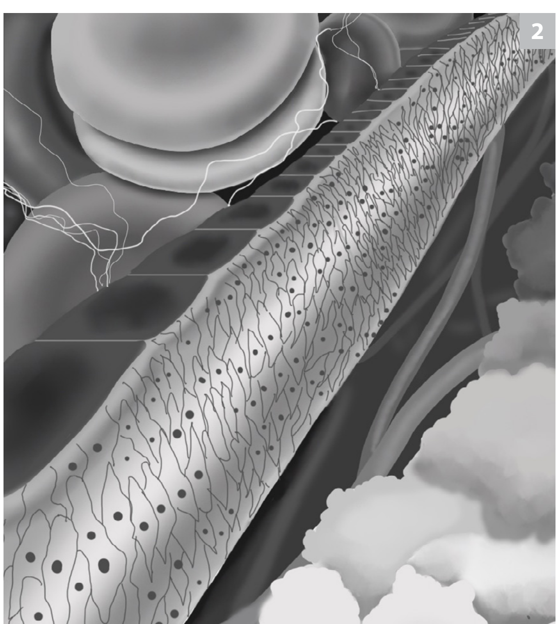
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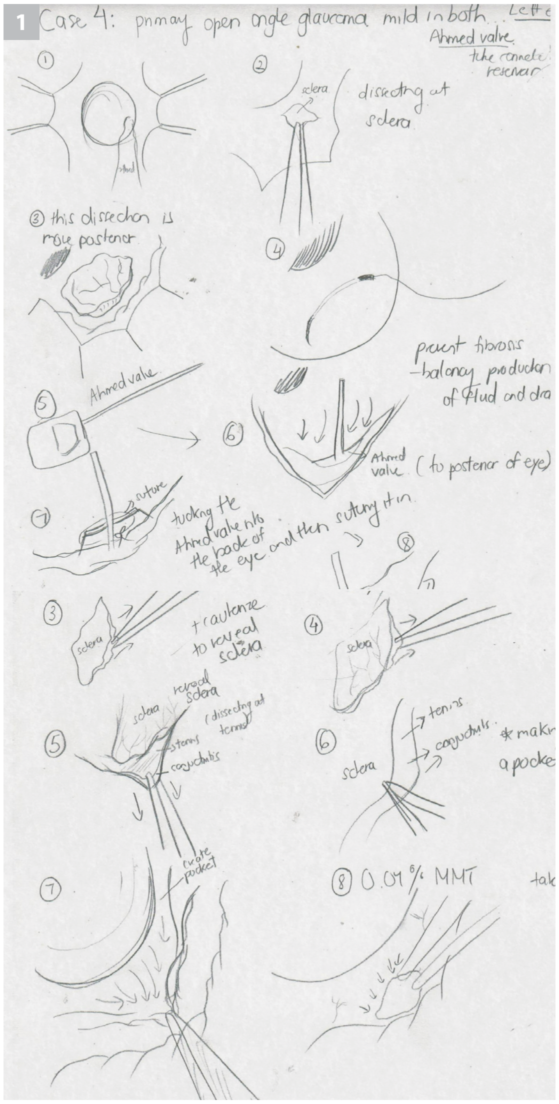
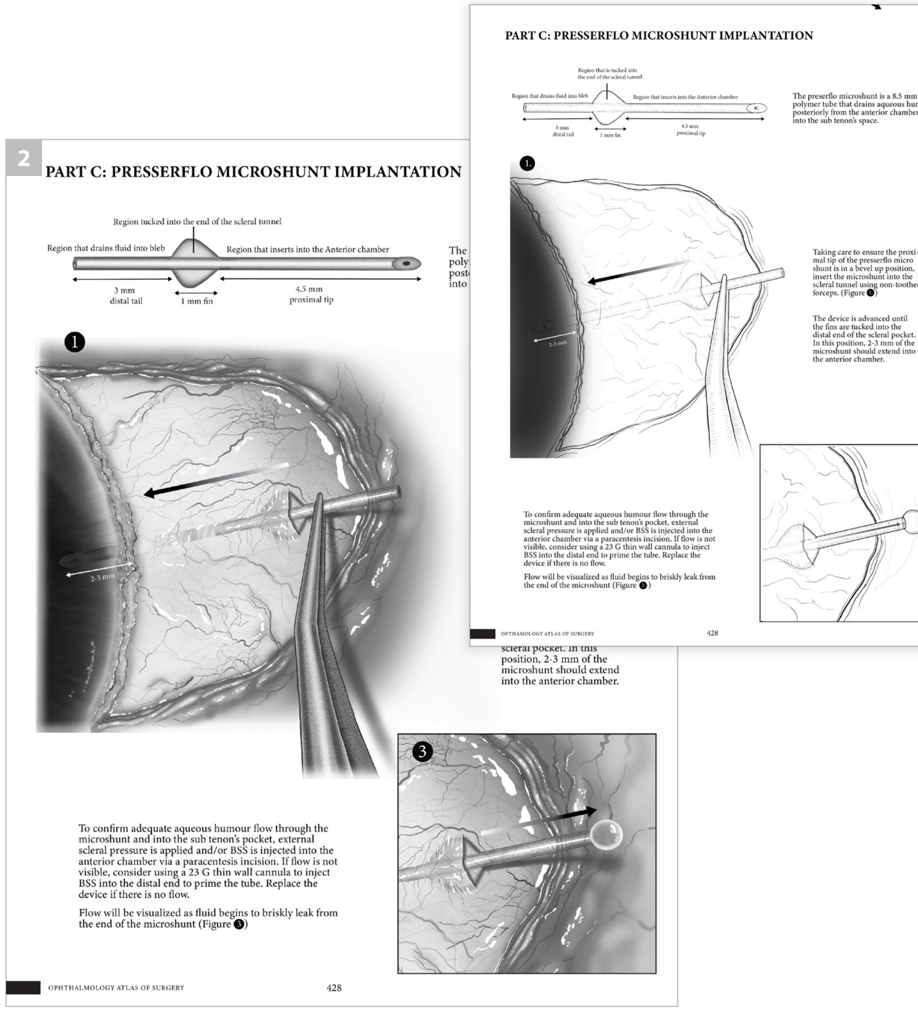
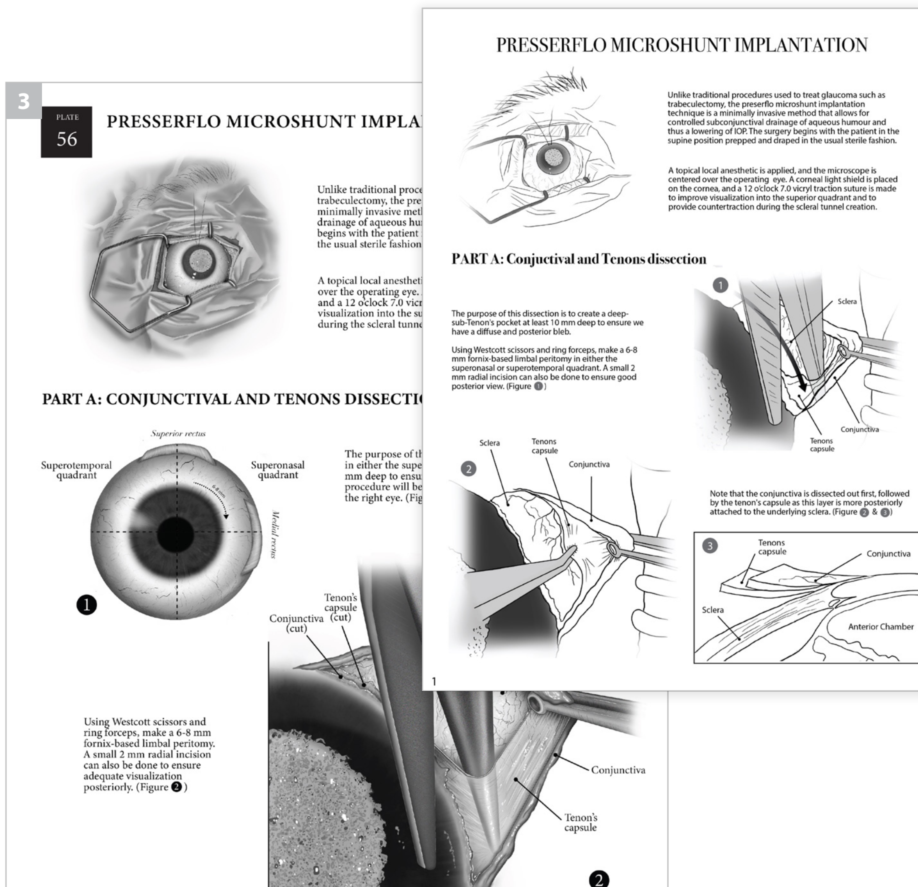
Surgical Illustration

I created this surgical sequence to communicate the implantation of a Preserflo microshunt intended to reduce intraocular pressure within the eye. This procedure is considered an alternative to trabeculectomy.







1. Sketch. Rough surgical sketches of the procedure were made directly in the operating room during observation of the surgery.

2. Production process. A rough and a final of the Preserflo microshunt insertion process.

3. Production process. A rough and final of the pre-operative and initial incision steps of the procedure.

What are Vaccines and How Do They Work?

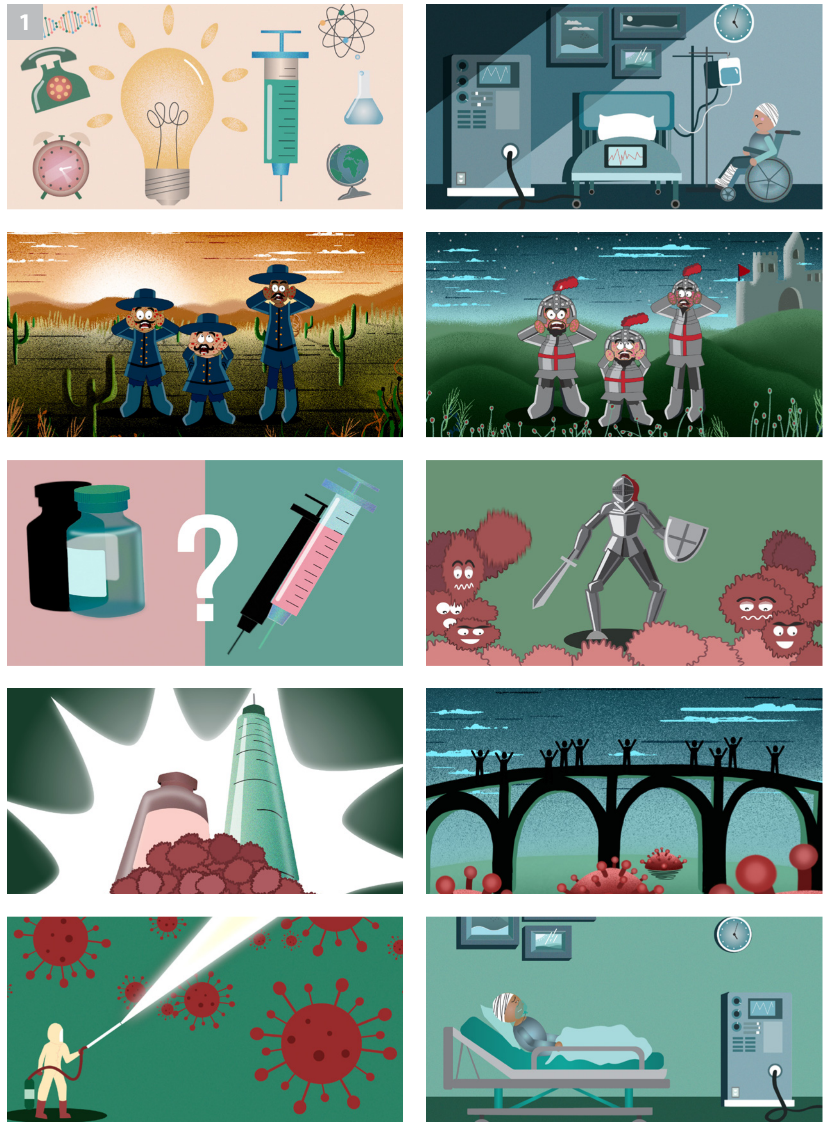
This is an educational animation visualizing the cellular mechanisms of vaccines and the significance of herd immunity in providing community protection from infectious disease. The goal of this animation is to alleviate vaccine hesitancy and demystify anti-vaccination sentiment.

1. Final animation. 2D assets were created in both *Photoshop* and *Illustrator*. Scenes that required more organic shapes and textures were made primarily in *Photoshop*, whereas shots with many objects requiring animation were made in *Illustrator*.

2. Storyboard. The planned visual narrative was broken down into a series of sketches to convey the overall vision, provide a creativity reference point, and to determine the shot-by-shot sequence of the final animation.

3. 3D modelling. 3D models of all cellular components were built and animated in *Maya*. All models were loosely based on scanning electron microscope (SEM) images as the key was to create 3D scenes as visually and stylistically similar to the simpler 2D components.

4. Final animation. Final rendered 3D cellular environments.



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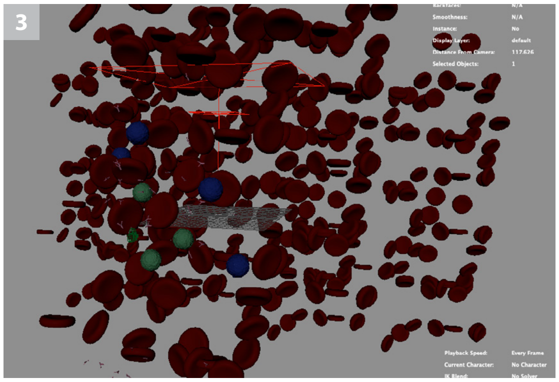
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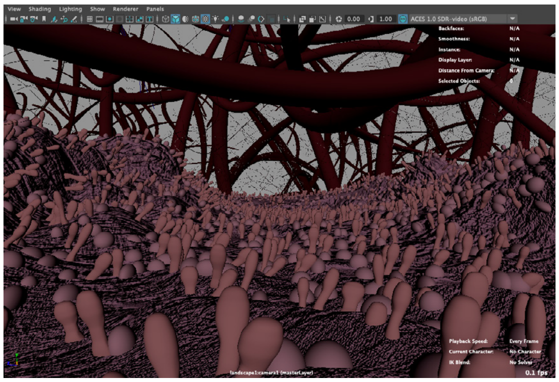

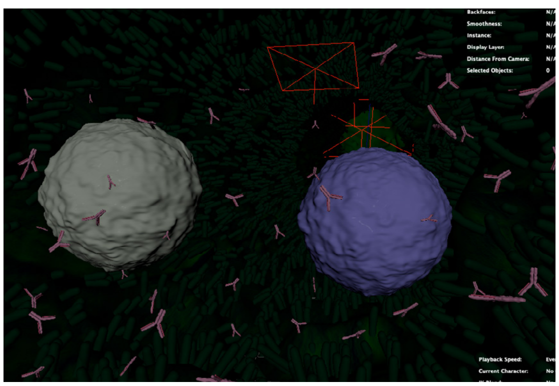

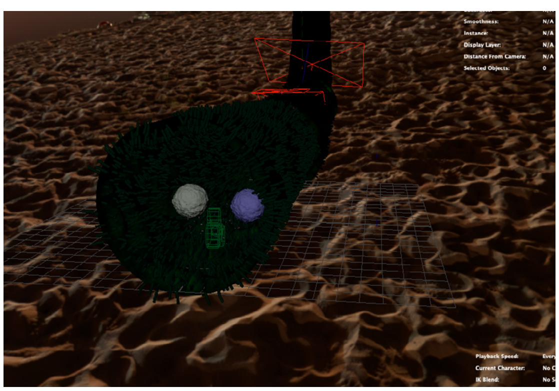

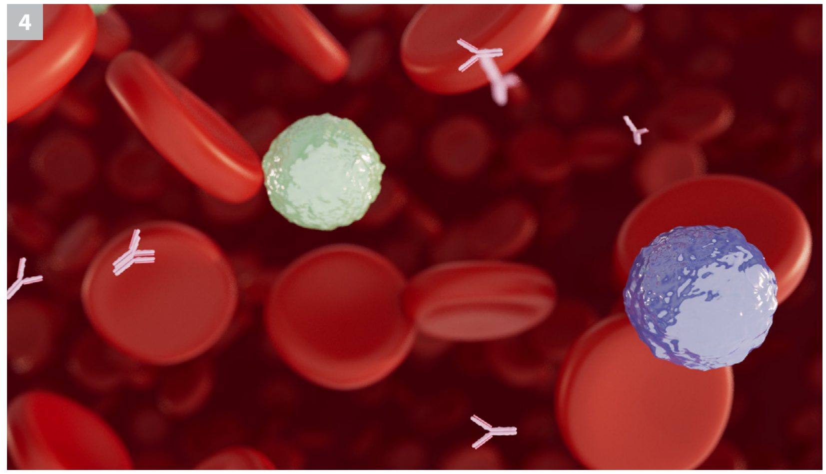
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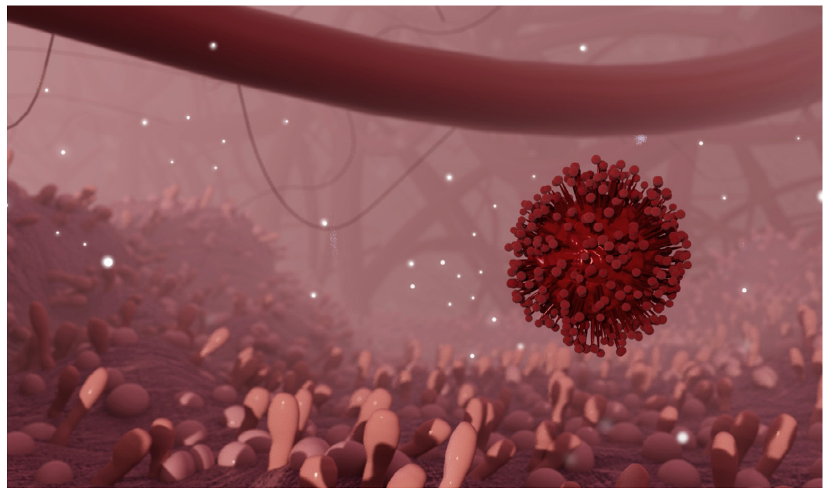
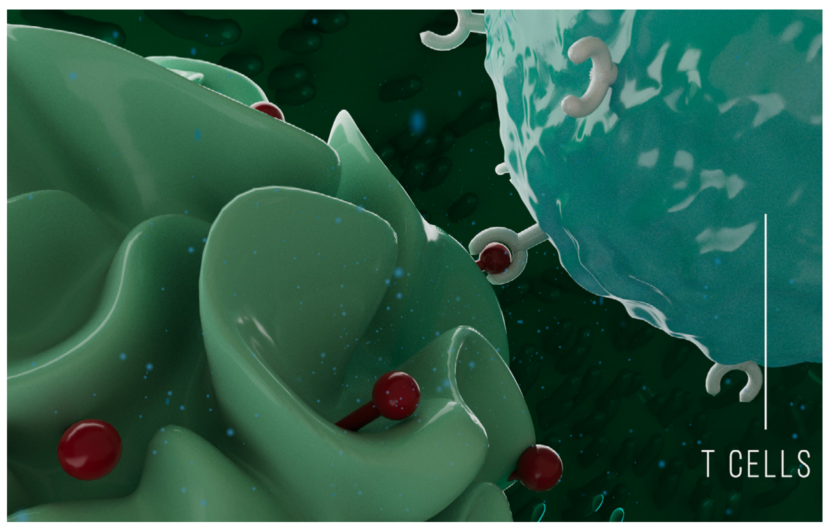
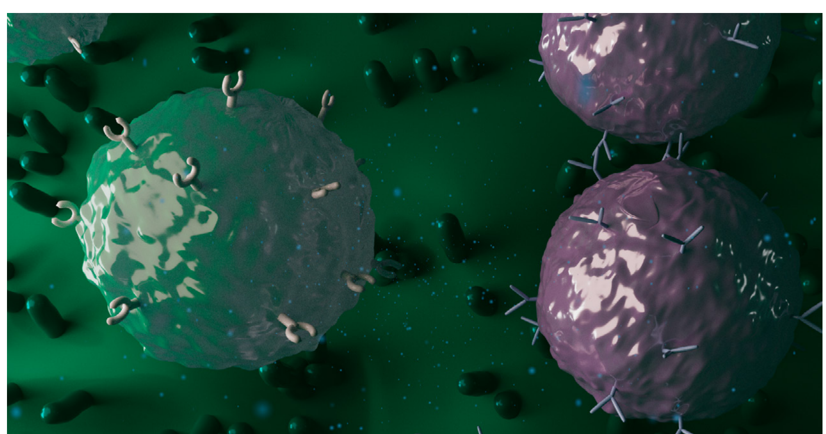
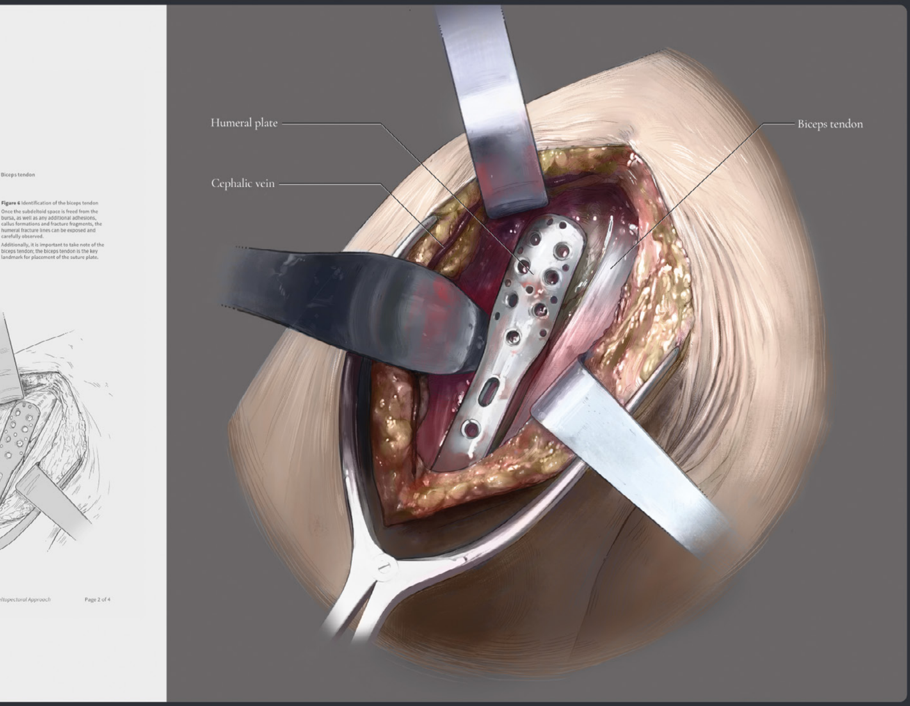
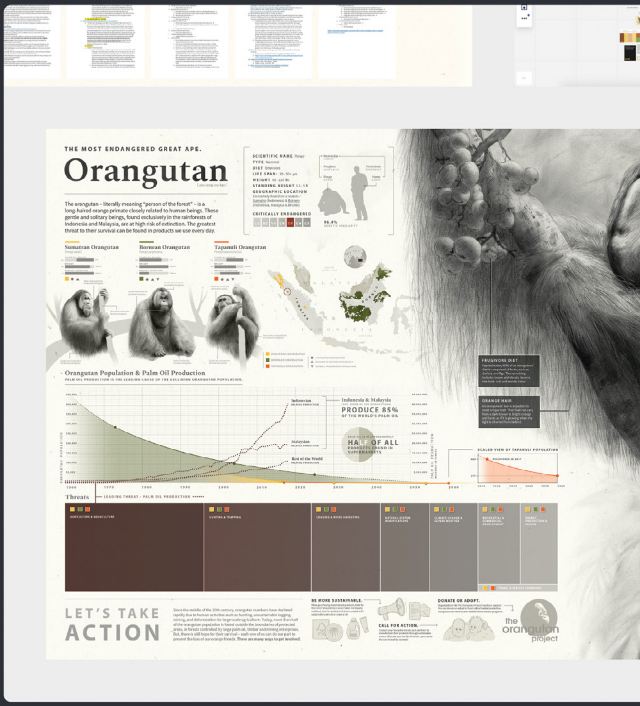
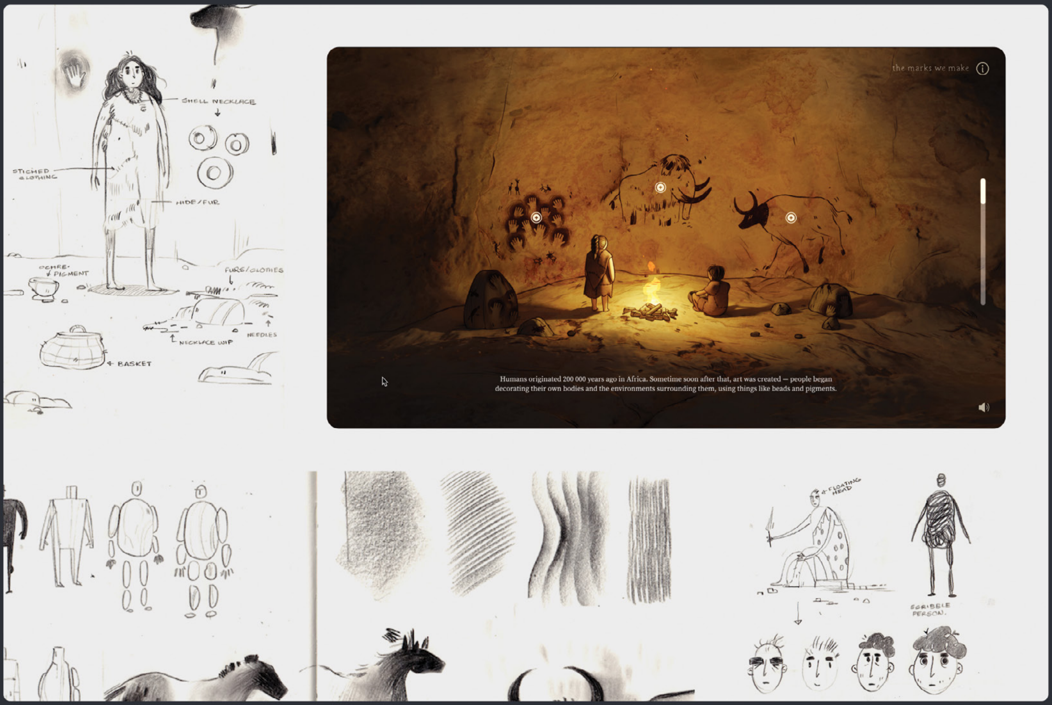


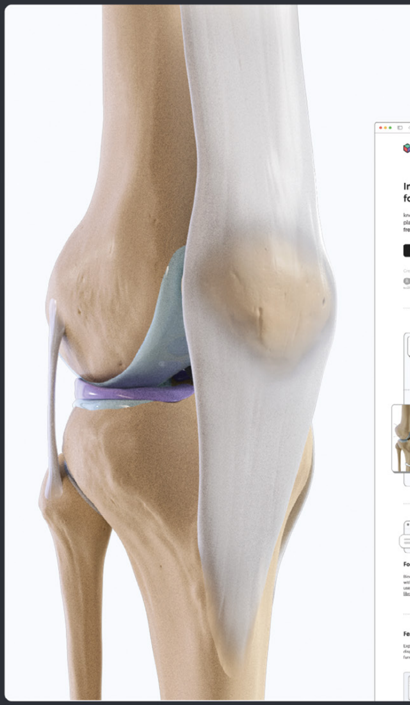

T CELLS

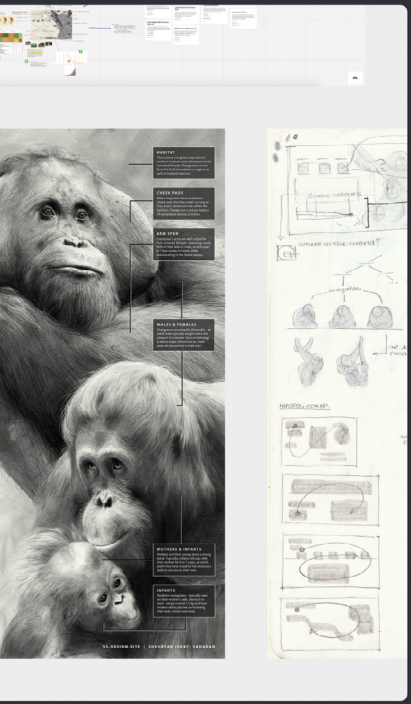


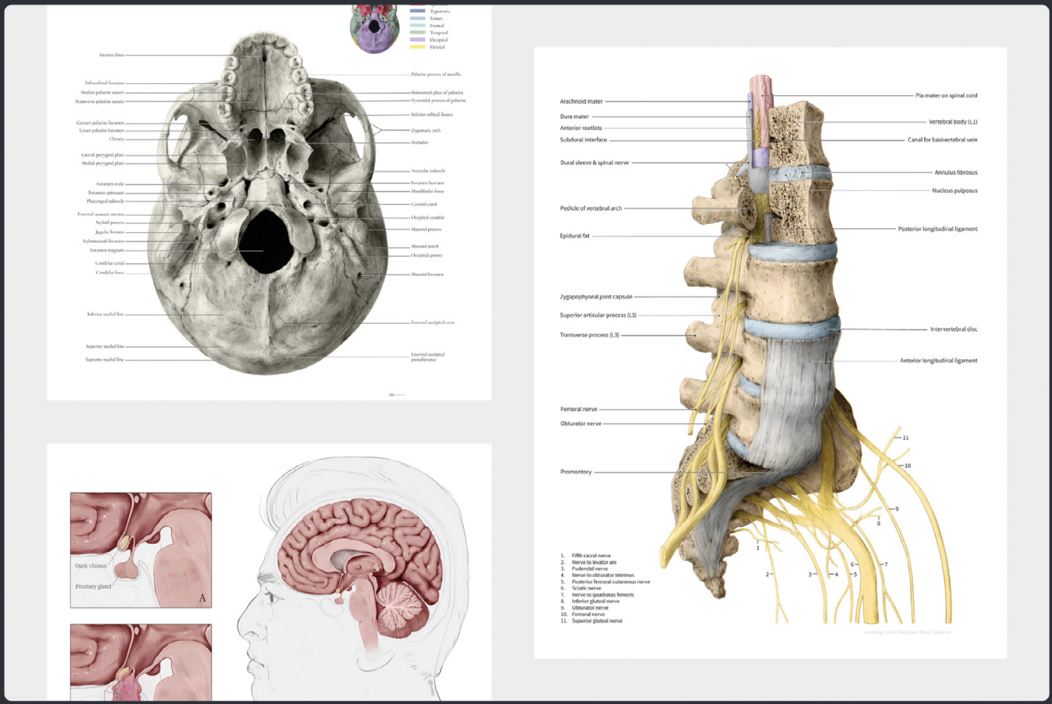

Humeral plate
Cephalic vein
Biceps tendon

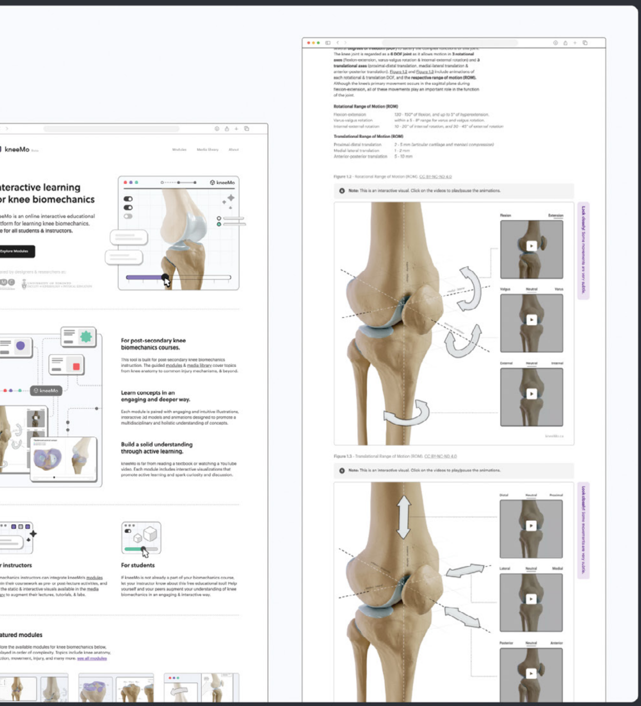

THE MOST ENDANGERED GREAT APE.
Orangutan
Sumatran Orangutan
Bornean Orangutan
Tapanuli Orangutan
Orangutan Population & Palm Oil Production
Threats
LET'S TAKE ACTION

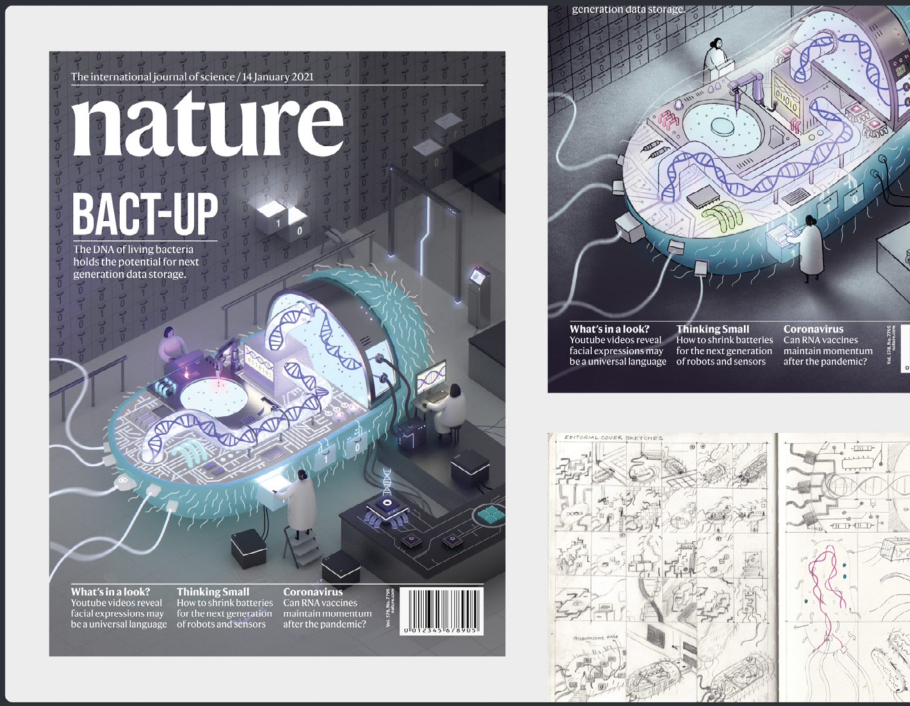

SHELL NECKLACE
BASKET
Humans originated 200 000 years ago in Africa. Sometime soon after that, art was created — people began decorating their own bodies and the environments surrounding them, using things like beads and pigments.











Shehryar Saharan

(Shay Saharan)

Hi there! I am a scientific visualizer and designer based in Toronto, Canada. I work with organizations in science, medicine, and education to communicate complex concepts through impactful and memorable visualizations and designs. Alongside my work at the studio, I am an Assistant Professor in the MScBMC program at the University of Toronto, instructing courses in visualization technologies and interactive design. Prior to BMC, I completed my undergraduate training in biomedical engineering.

Editorial Illustration

Scientists believe that storing information in the DNA of living bacteria holds the potential for next-generation data storage. I created this 3D editorial illustration to attract the interest of the educated lay public to read about the corresponding research article.

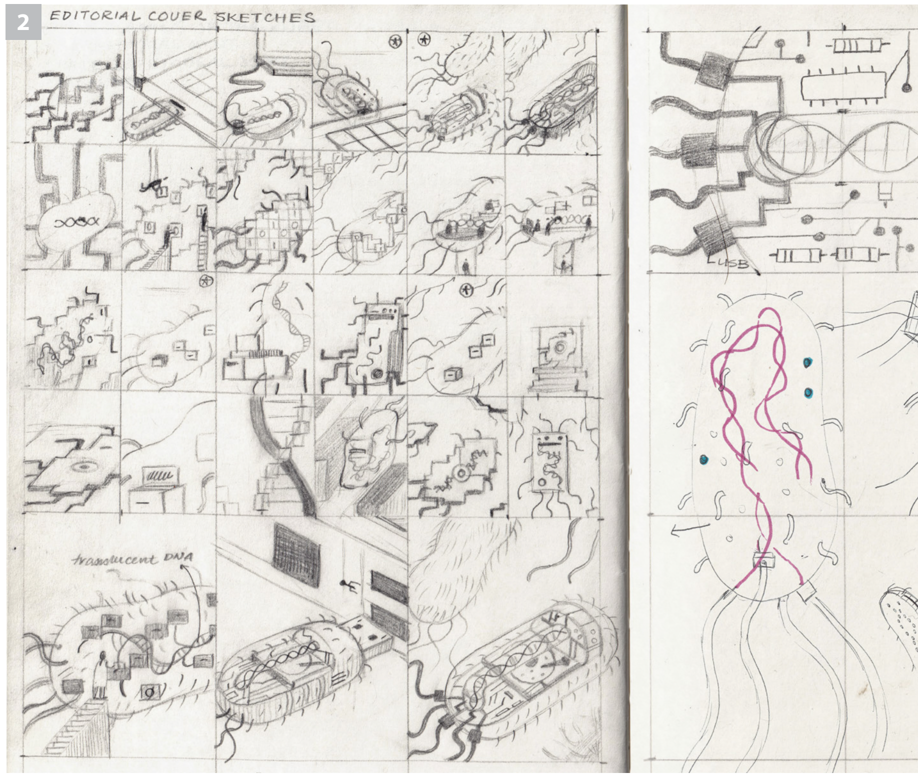
1. Final illustration. The final journey cover features an *E. coli* bacterium and several scientists in a laboratory environment. The bacterium is dissected as if the scientists are actively extracting and editing the information stored within its DNA.

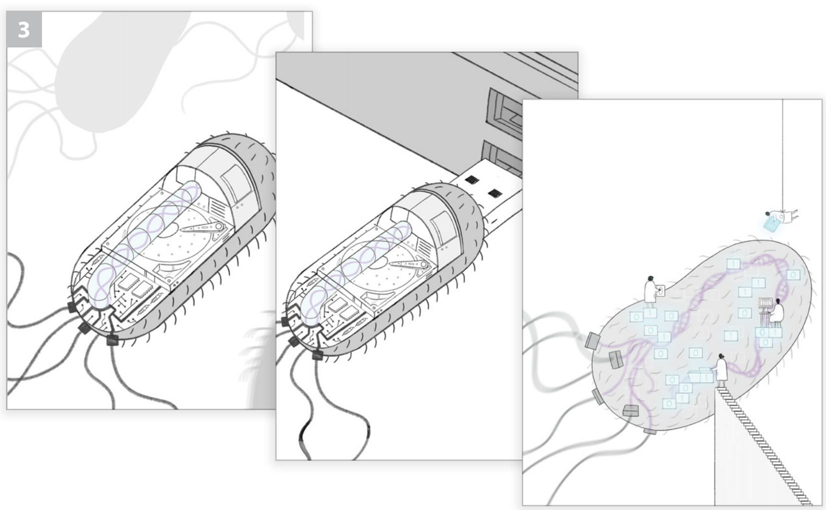
2. Sketch. Following the research phase, I began iteratively sketching possibilities for the final project, exploring different layout and communication strategies.

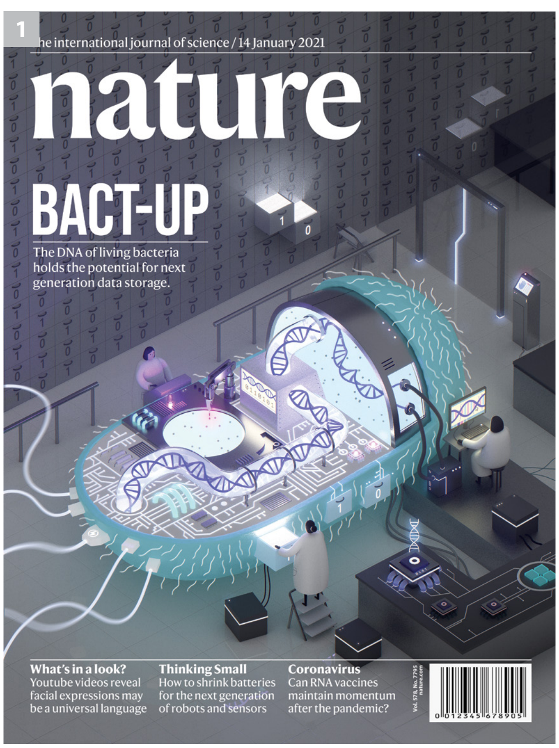
3. Sketch. Once I was happy with three potential candidates for the final project, I prepared comprehensive sketches for review and feedback.

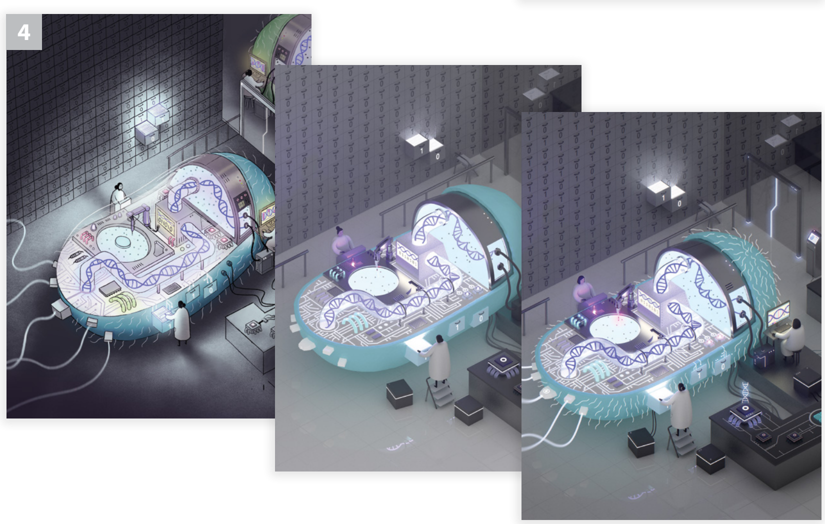
4. Production process. After deciding on a finalized layout, I created a detailed colour & lighting study as a guide for my 3D work. Once I created and rendered the work in *Maya*, I added finishing touches in *Photoshop*.

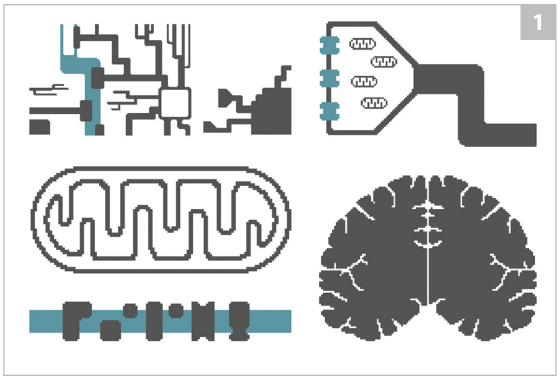
Previous spread. A collage of the projects and illustrations completed during my time in BMC.

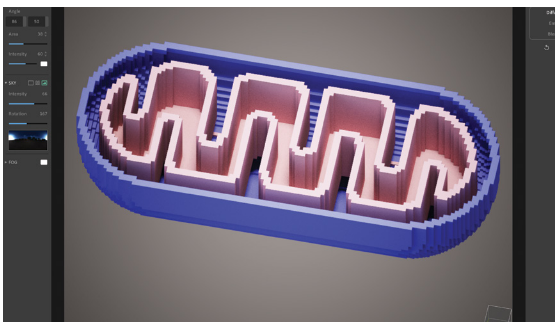


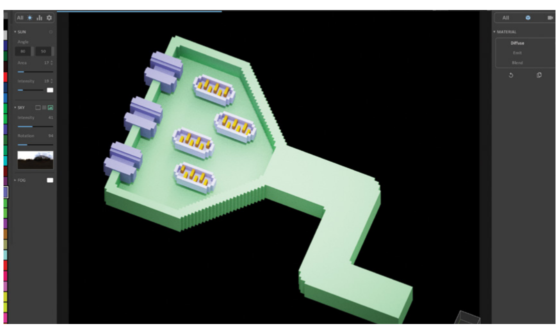


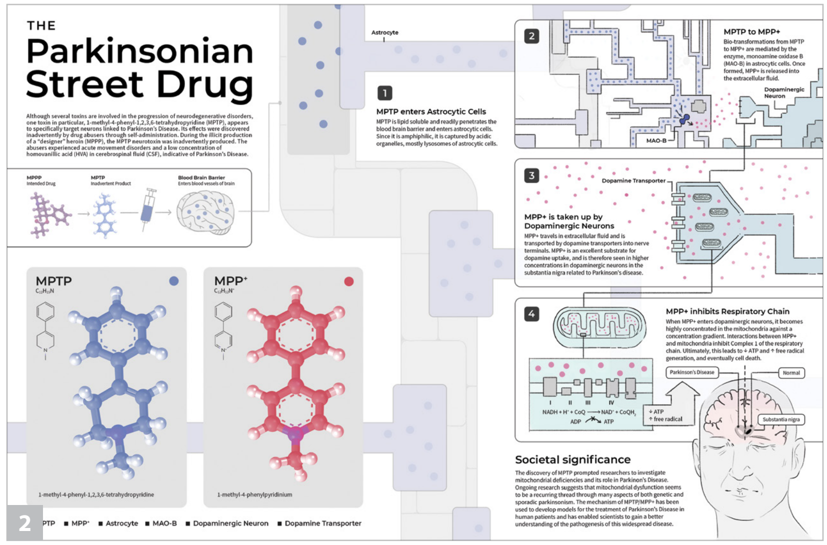


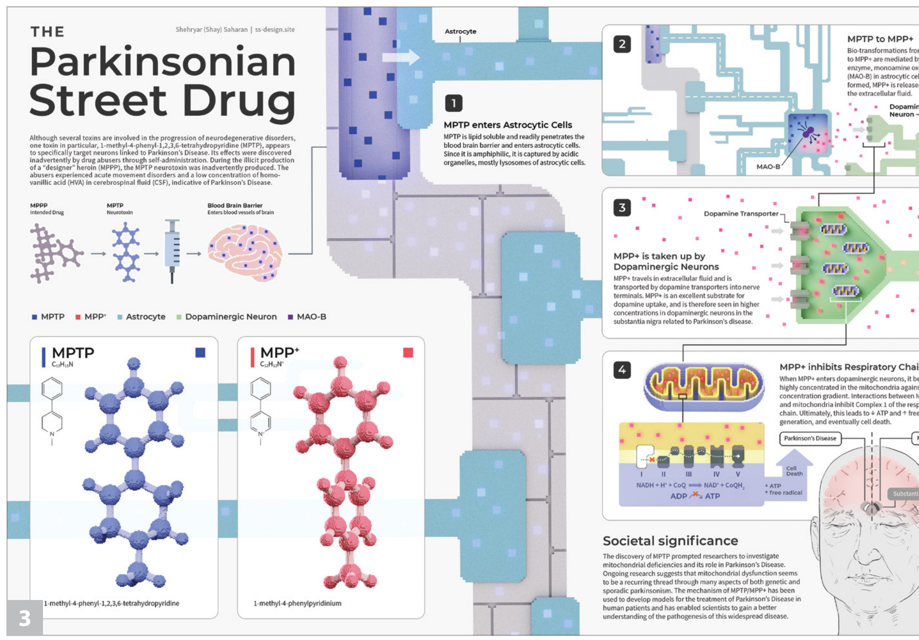












Pathological Illustration

During the illicit production of a designer drug, MPPP, the MPTP neurotoxin was inadvertently produced. Those who abused the drug experienced acute movement disorders and several other symptoms, indicative of Parkinson's Disease (PD). I created the following molecular visualization spread to illustrate the role of MPTP in causing PD.

1. Production process. I chose to employ a voxel style to reduce cognitive load for this intrinsically complex molecular process. The production stage included the development of pixel art and subsequently building assets in a 3D software called *MagicaVoxel*.

2. Final draft. I created a refined layout to guide the development of 2D and 3D assets during production. This stage involved refining information flow and style (colours and typography).

3. Final illustration. The finalized layout was compiled and composited in *Photoshop* and *Illustrator*. An animated version of this information graphic is available on my portfolio site.

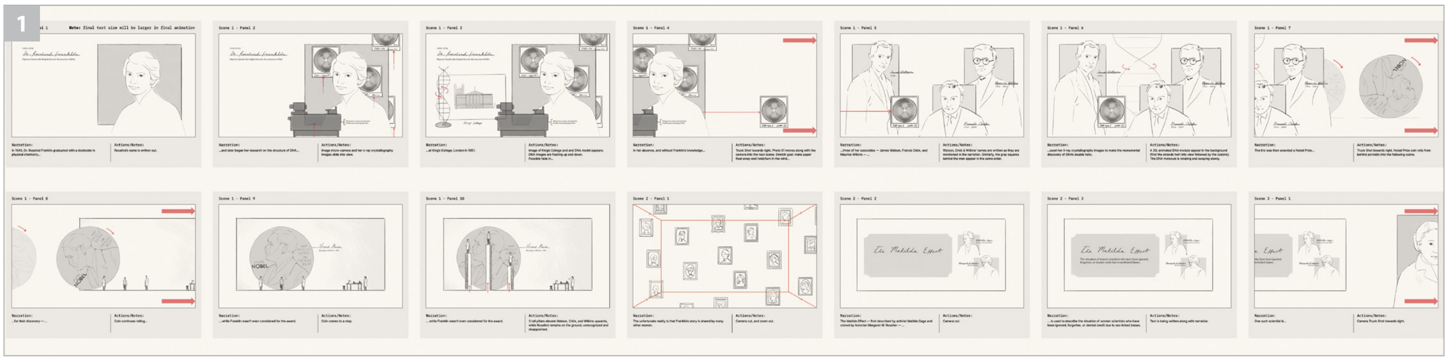
2D Animation

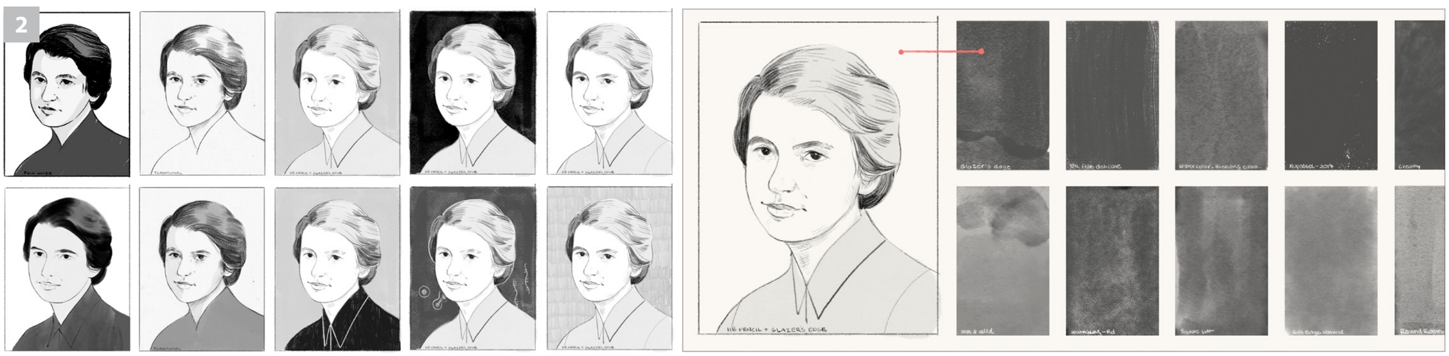
The Matilda Effect describes the situation of women scientists who have been ignored, forgotten, or denied credit due to sex-linked biases. As part of the Matilda Project, an animation was created to provide a brief overview of the topic and raise awareness of inequality and gender bias toward women in science.

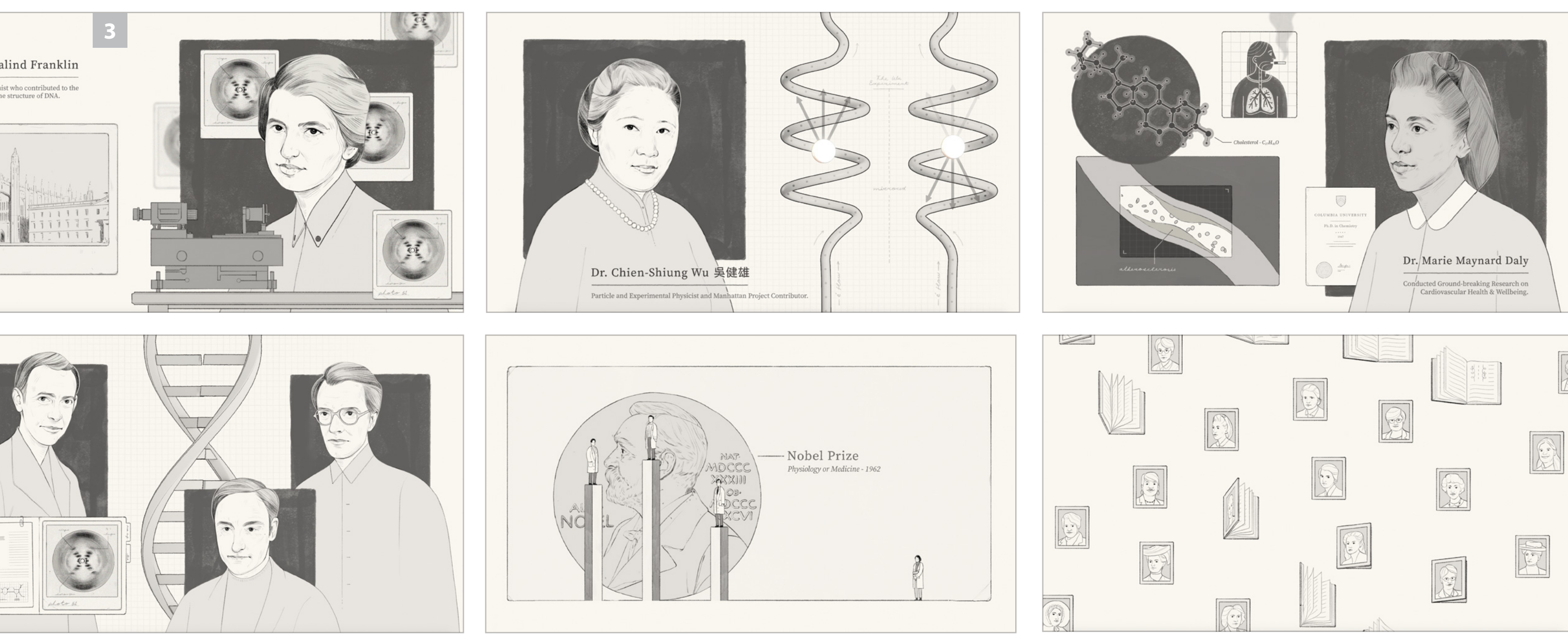
1. Storyboard. Several rounds of storyboards were created to visualize the narrative, collect feedback, and form the basis for an animatic (not shown here).

2. Production process. A critical component of the production process included visual development. In this step, I explored a variety of illustration styles, textures, and animation approaches for the final project.

3. Final animation. The final animation includes recognizable and diverse examples of brilliant scientists that drive the narrative forward and illustrate the wide reach of the Matilda Effect. Ultimately, this animation will raise awareness of inequality and gender bias toward women in science and facilitate conversations for positive change moving forward.







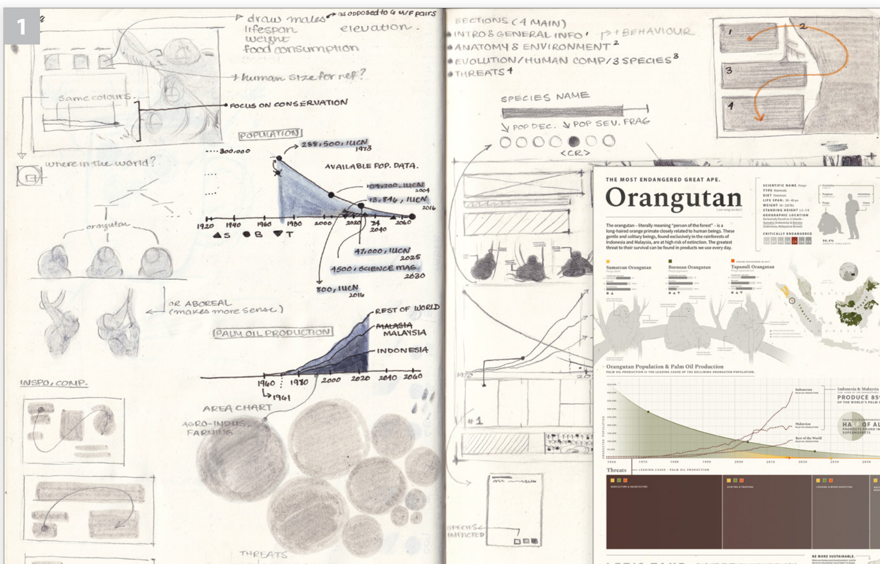
Information Visualization

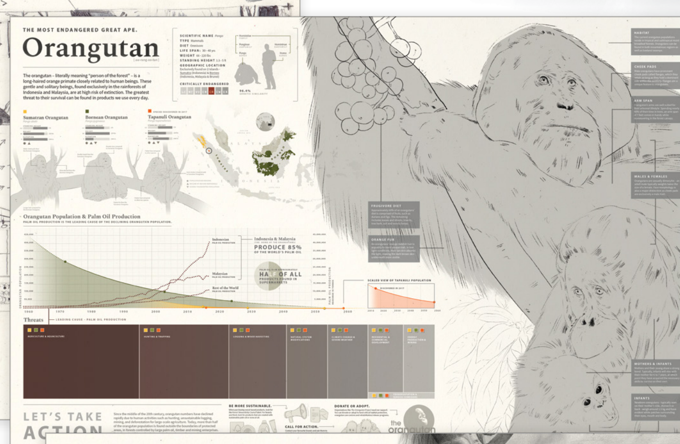
The orangutan, literally meaning "person of the forest," is a long-haired orange primate closely related to human beings. I created this information graphic to educate a general audience about orangutan biology and behaviour and the urgent need for further conservation efforts.

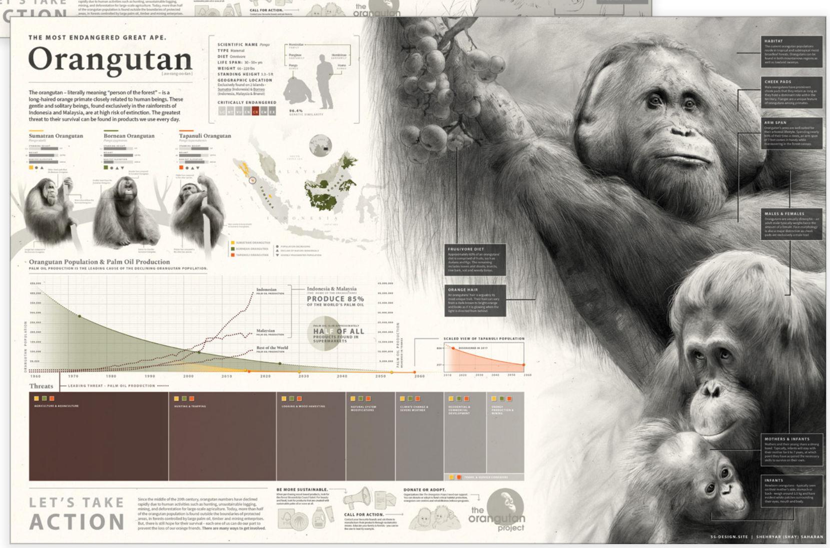
1. Production process. I spent the first part of the production process sketching and experimenting with information design and flow as well as visual layout. Once I was happy with a potential layout, I created a comprehensive layout for review and feedback. Ultimately, the final piece was produced using both traditional and digital media.

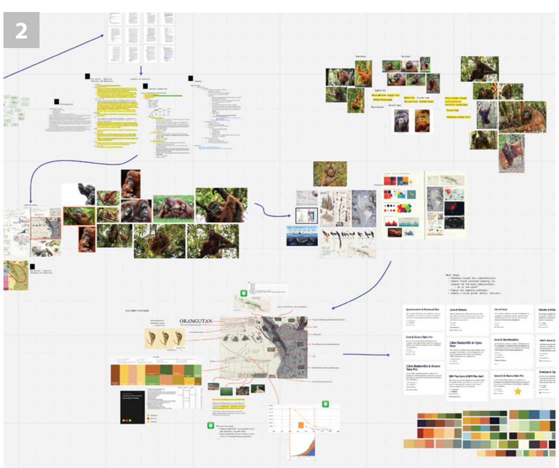
2. Notes. This snapshot includes some of my project notes for research, scope definition, visual references, inspiration, as well as style development.

3. Final illustration. The heaviest component of production was the creation of the orangutan illustration on the right-hand side of the information graphic. This illustration was produced using a combination of carbon dust, pencil crayon, and digital media.









kneeMo: an Interactive Educational Platform for Learning Knee Biomechanics

kneeMo is an online interactive educational platform for learning knee biomechanics, free for all students and instructors. The primary aim of this project is to design and develop an interactive educational resource that consolidates cross-disciplinary information and facilitates a holistic understanding of this complex subject area.

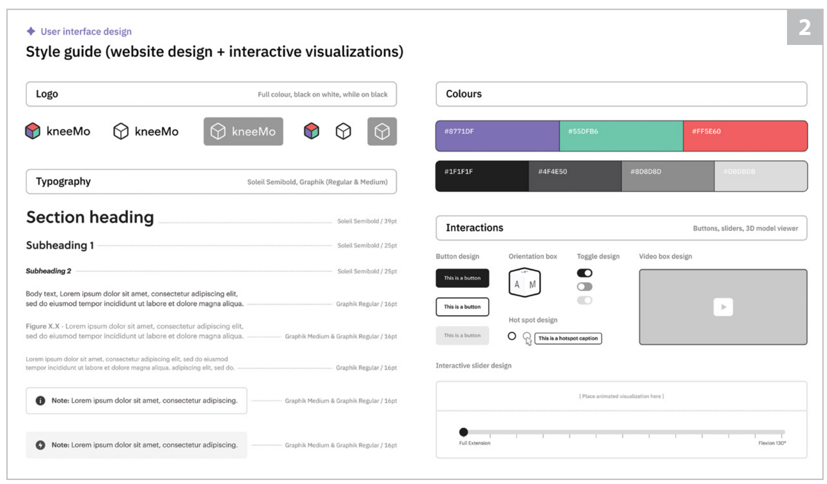
1. UI/UX design. First and foremost, wireframes for the kneeMo site were created to explore the layout and user flow possibilities for the application. Concurrently, the written content and visualization strategy was created for each section of all three modules; this process included evaluating whether or not specific written sections would benefit from a particular type of visualization (i.e., static, animated, and/or interactive).

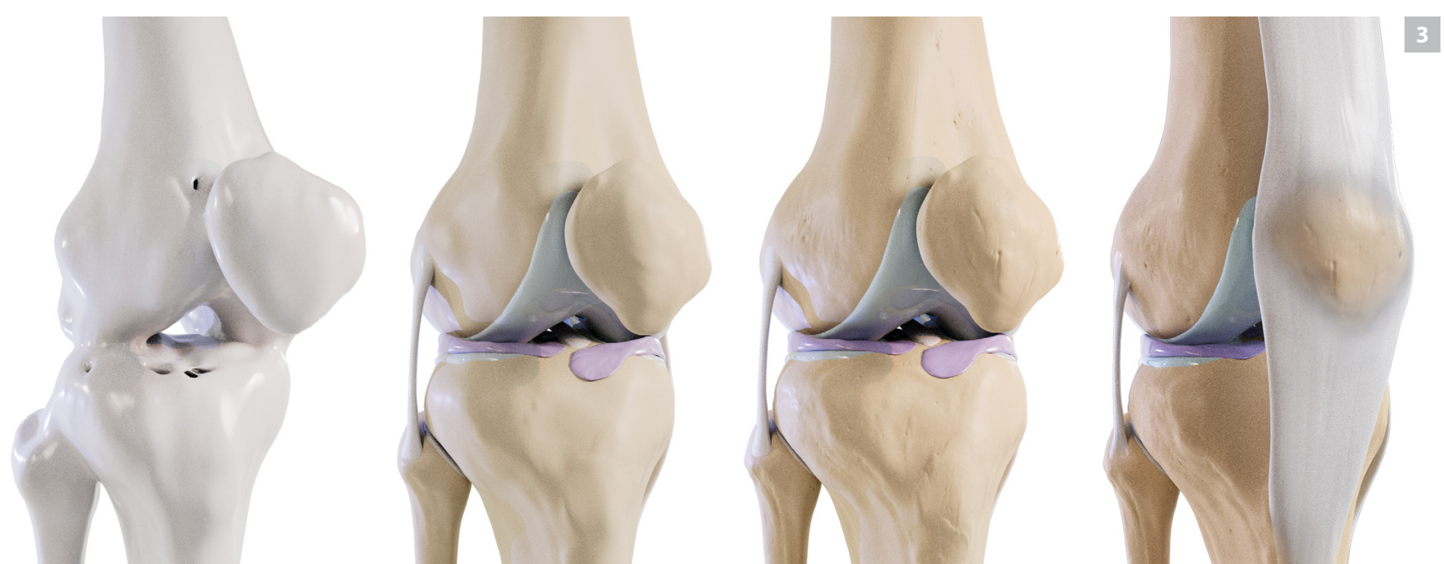
2. UI design. Next, a style guide was created for the kneeMo application (including typography and colour guidelines, logo design, and UI/interaction design).

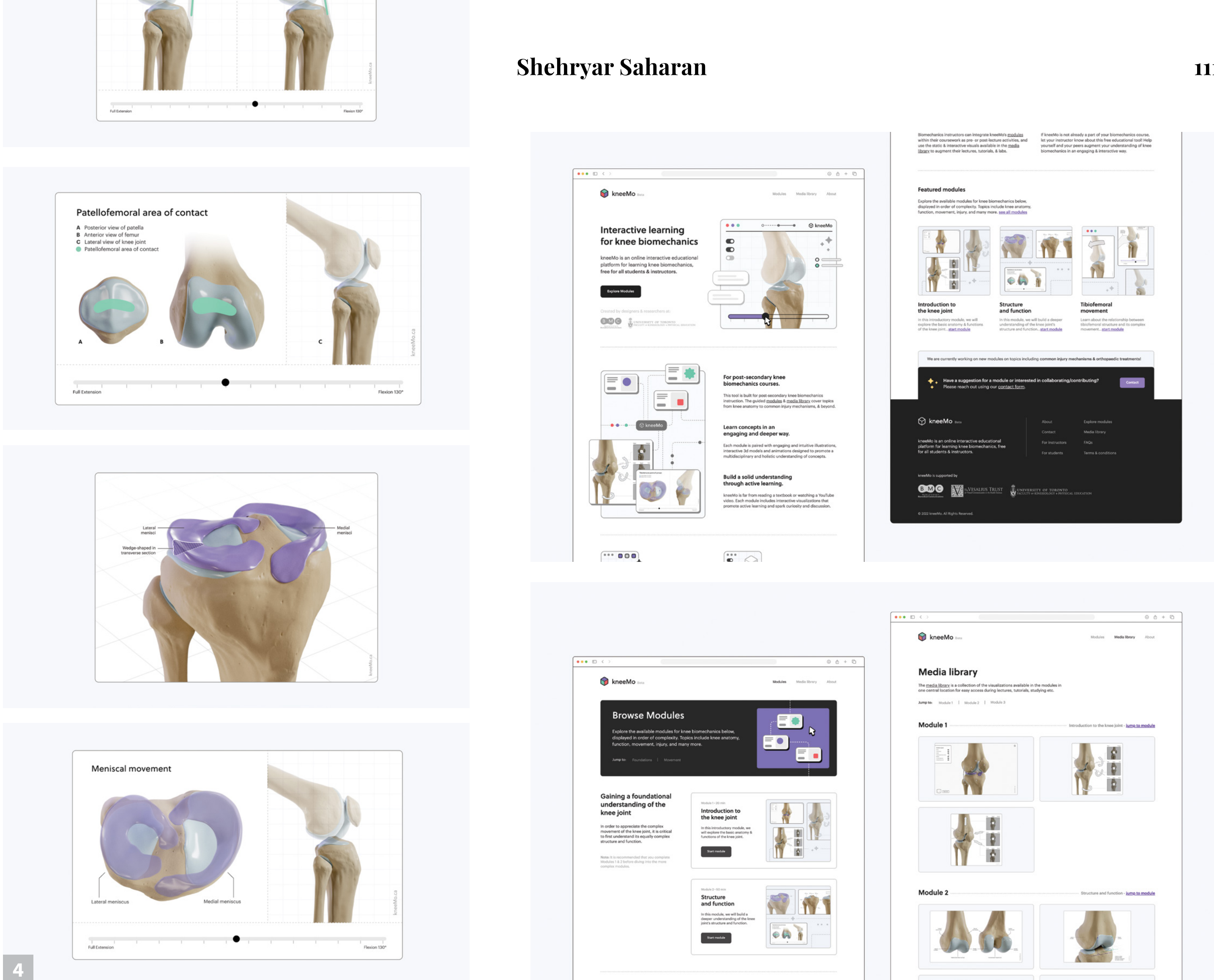
3. Production process. A key aspect of the project was the design and development of a 3D knee model. During this process, it was both critical to verify structural accuracy and ensure that the final 3D assets were not overly complex, overwhelming, or distracting to a potential learner.

4. Final interactive. Once the design of kneeMo website was complete, the development phase of the project began (which included building the website, refining the written content and rendering, animating and/or coding the visualizations). I have included the finalized design of the kneeMo website and samples of the completed visualizations here.

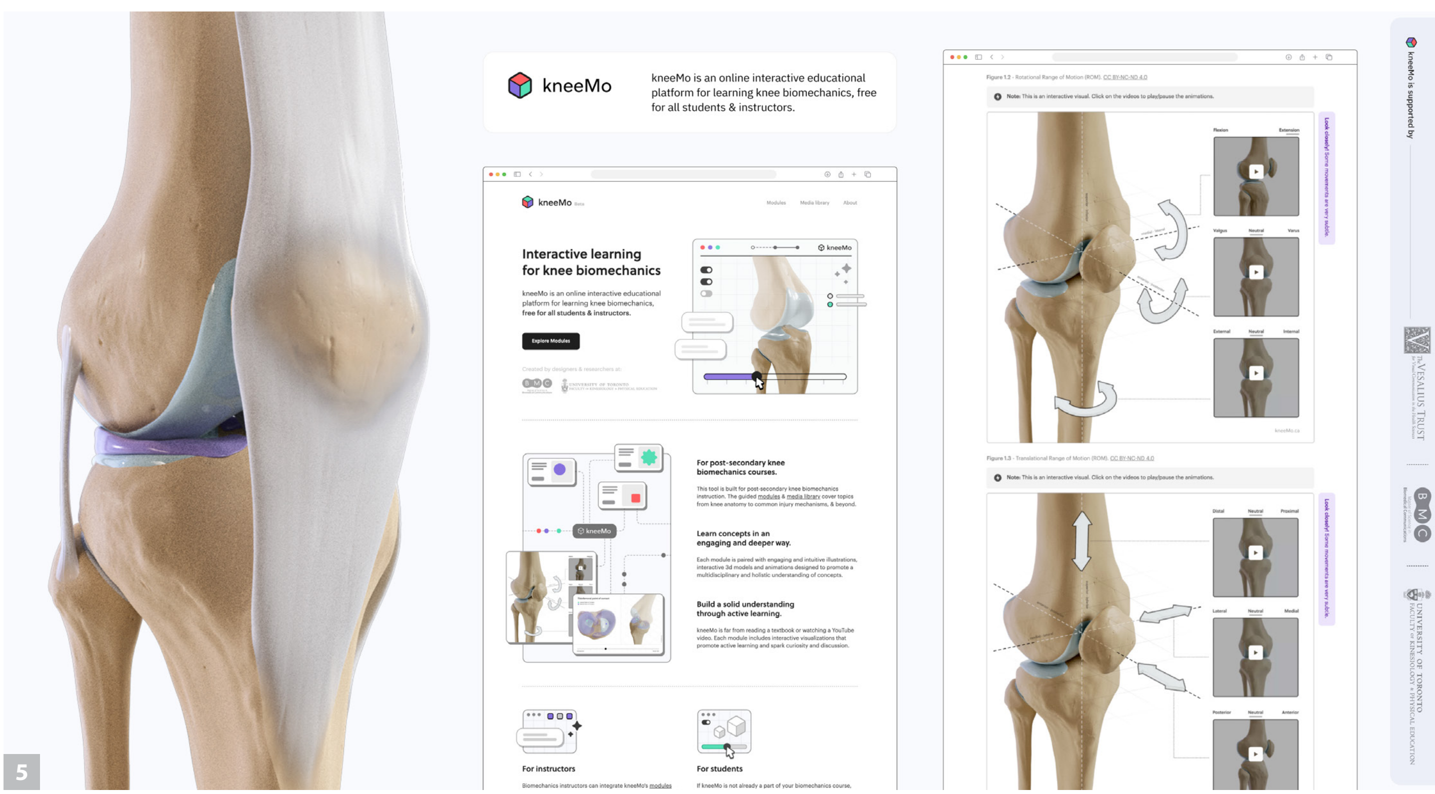
5. Final interactive. Final visualization and website examples.






Patellofemoral area of contact
A Posterior view of patella
B Anterior view of femur
C Lateral view of knee joint
Patellofemoral area of contact
Full Extension
Flexion 130°
Meniscal movement
Lateral meniscus
Medial meniscus
Interactive learning for knee biomechanics
Browse Modules
Media library
Module 1
Module 2
Featured modules

4


kneeMo
kneeMo is an online interactive educational platform for learning knee biomechanics, free for all students & instructors.
Interactive learning for knee biomechanics
For post-secondary knee biomechanics courses.
Learn concepts in an engaging and deeper way.
Build a solid understanding through active learning.
For instructors
For students

5

Sherry An

In an age where anything and everything is available at the touch of a screen, it is important to ensure that people have reliable and accessible ways to learn about science-related topics. I am very grateful for the opportunity to contribute to this cause as a biomedical communicator. I particularly enjoy illustrating and designing for a lay audience and have a passion for topics related to genetics, ecology, and the natural sciences.

Graphic Medicine

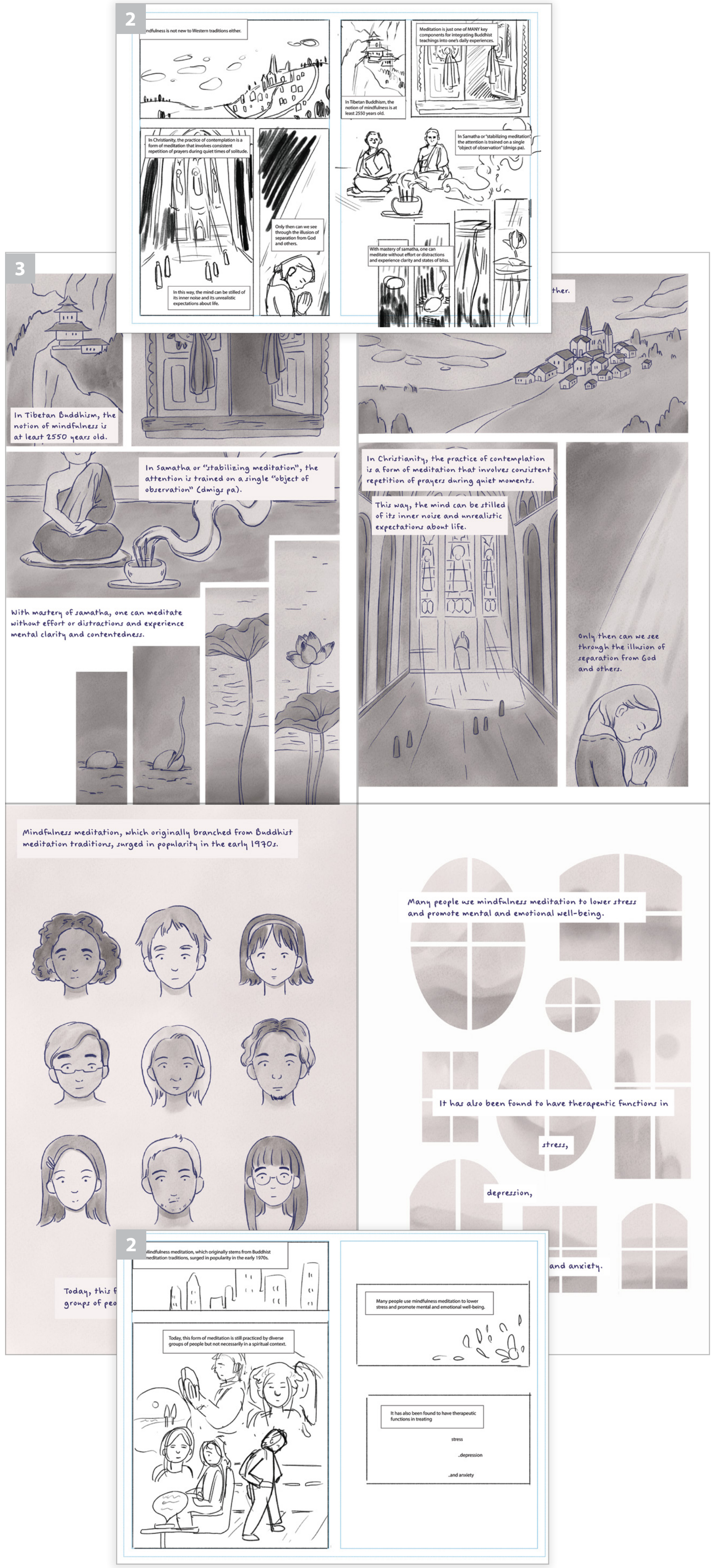
This comic aims to introduce the practice of mindfulness meditation to adolescents as a strategy to improve mental health. It uses a visual narrative to touch upon history of meditation, personal experiences, and neuroscience.

1. Sketch. Rough thumbnail sketches were created to plan out the panels and the overall pacing and flow of the story.

2. Production process. This rough draft helped to establish the final layout and how it would fit together with the text.

3. Final illustration. I used a warm greyscale watercolour brush and a pen with varying line weights to create a calming and personal visual style to suit the subject matter.

Previous spread. A still image from my final MRP animation.



Molecular Visualization

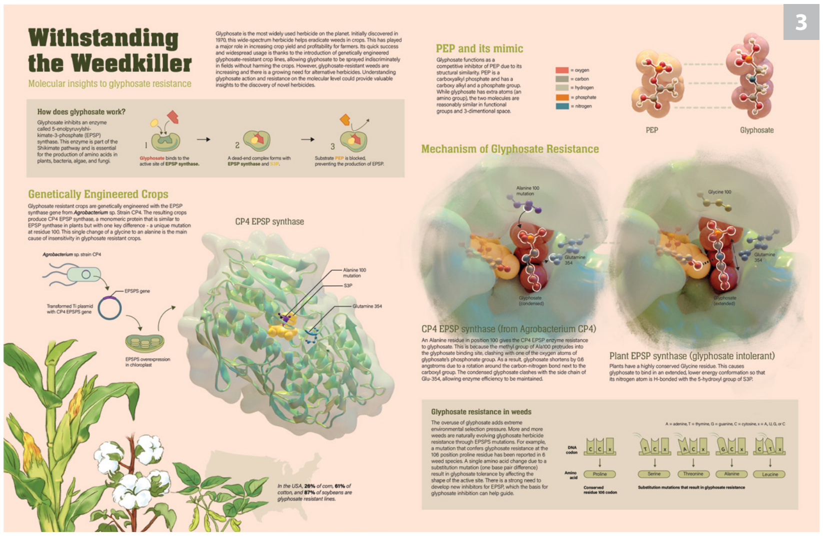
Glyphosate is one of the most widely used herbicides, partially due to the introduction of glyphosate-resistant crops. This editorial piece visualizes how these crops were engineered and the biomolecular mechanism to their herbicide resistance.

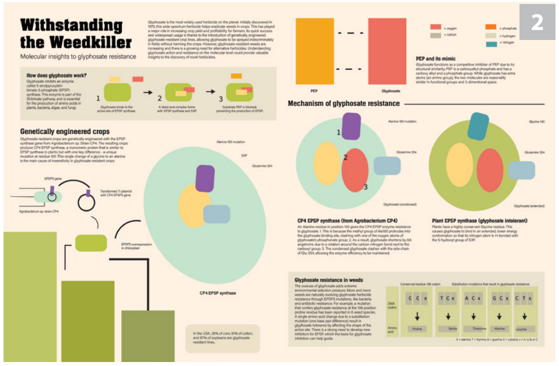
1. Sketch. I conceptualized four ways to tell the story. In the end, I decided to focus on how the herbicide works and the molecular basis for glyphosate resistance in crops. Following retrieval of 3D structural data, I created a thumbnail sketch to show the preliminary renders placed into the rough layout sketch.

2. Production process. Each key player/molecule was assigned its own distinct colour. A colour blocking method was used to see how the final piece would look.

3. Final illustration. 3D renders from *Maya* were composited with digitally-drawn elements to create the final illustrated spread.

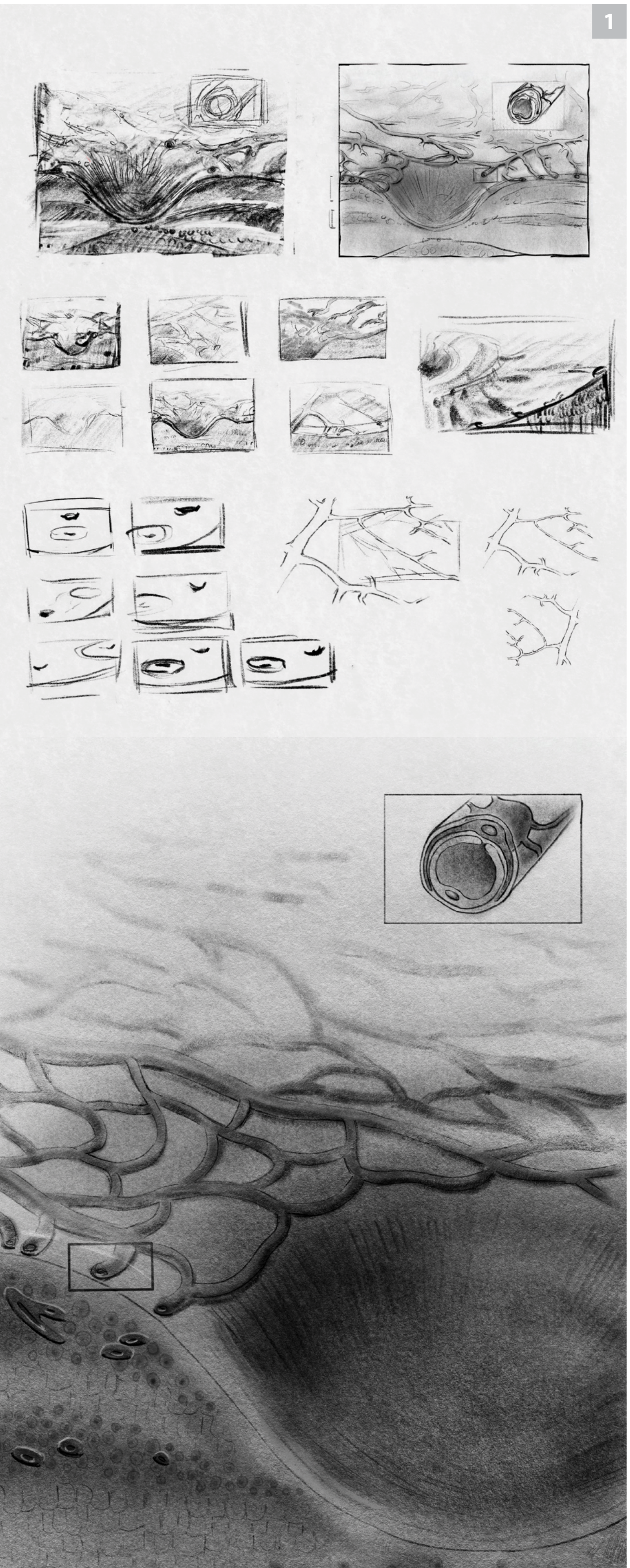
4. Final illustration. Final hand-drawn illustrations showing soybean, corn, and cotton plants.

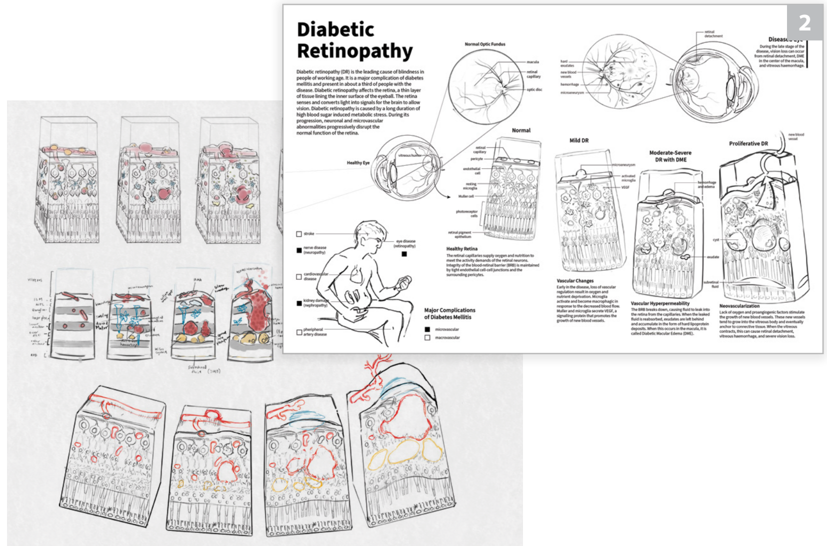


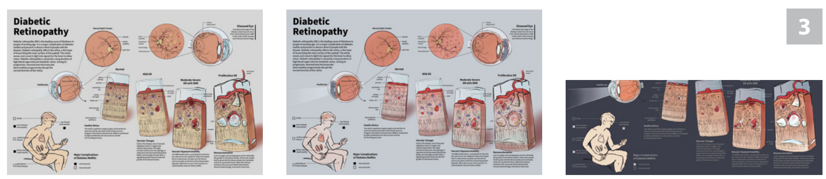


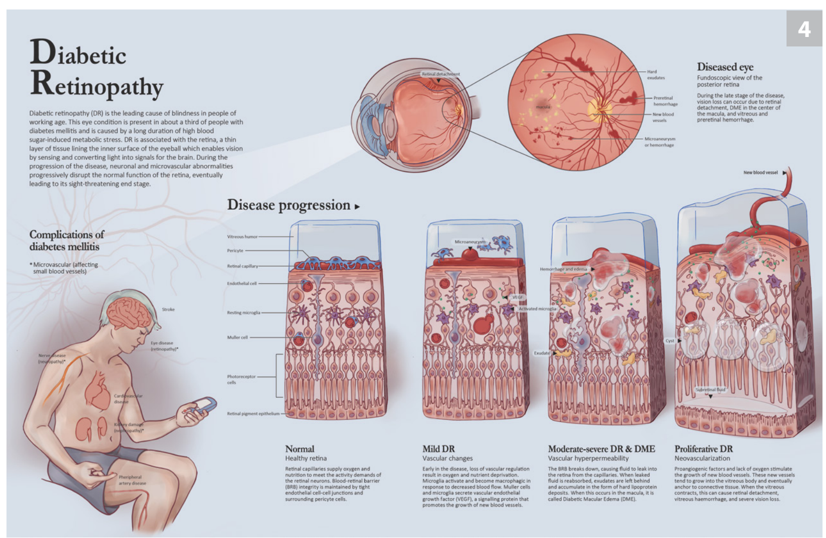
Pathology Illustration

Diabetic retinopathy is a microvascular disease affecting the small blood vessels of the human retina. This two-page spread explores the pathological change in the tissues over time at the cellular level.









1. Study. I completed a tissue landscape study of the macula and the layers of the retina to familiarize myself with normal eye anatomy.

2. Sketch. Conceptual sketches of tissue cubes depicting pathological change over time.

3. Production process. Three possible colour palettes, including a version with a dark background, were inspired by the hues found in fundoscopic images.

4. Final illustration. Final spread with an easy-to-read light background and an adjusted cleaner layout.

Surgical Illustration

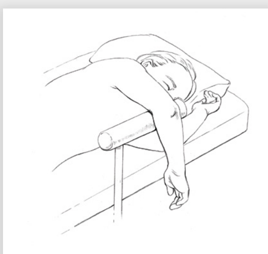
This surgical sequence was created for teaching and instructional purposes. It depicts the olecranon fracture Open Reduction Internal Fixation (ORIF) procedure involving tension band wiring.

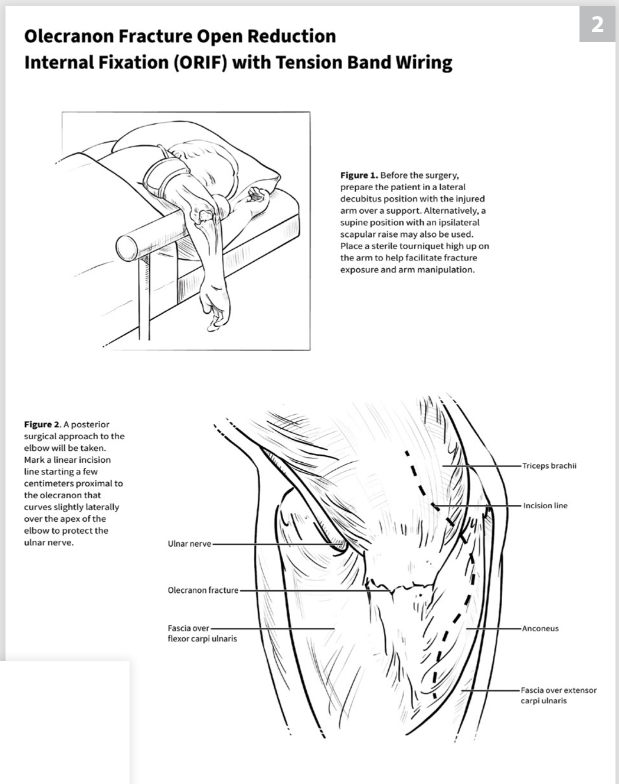
1. Production process. Sketch iterations of the patient positioning and the relevant elbow anatomy.

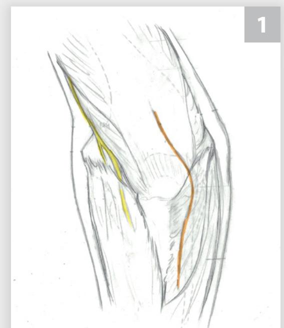
2. Final illustration. First two steps of the surgical sequence. A variety of sources helped inform this project, including first-hand observation of the surgery on a cadaveric specimen.

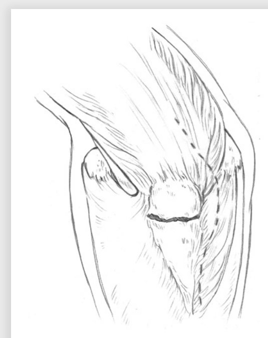
3. Production process. Rough sketches depict lifting the head of the olecranon and cleaning of the fracture site. In later drafts, drilling of the distal ulna was added to condense the information.

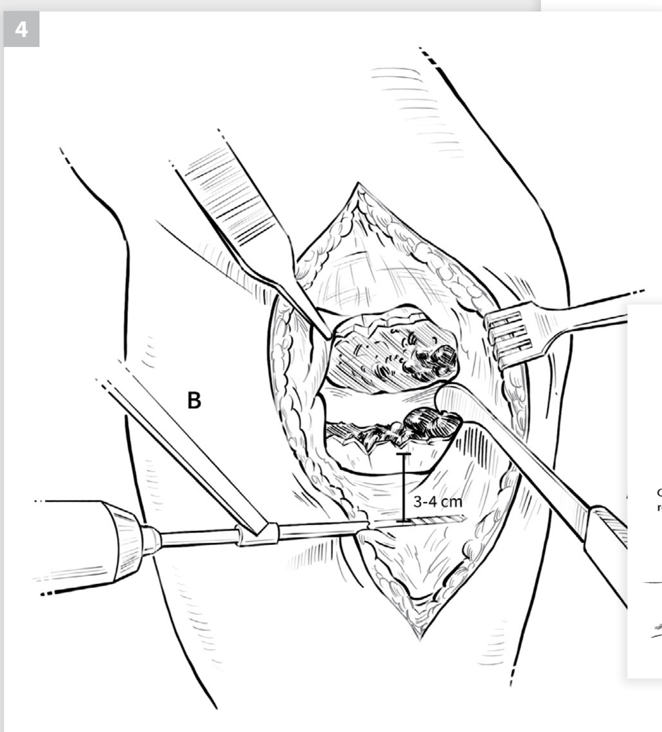
4. Final illustration. Inking was completed digitally using a pressure-sensitive pen and tablet.

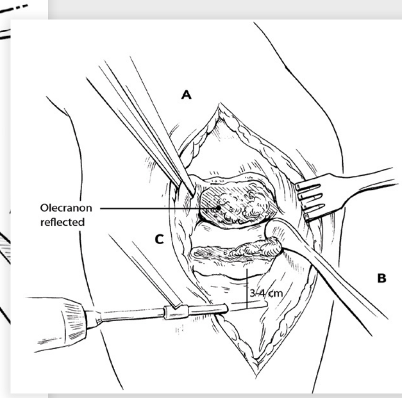


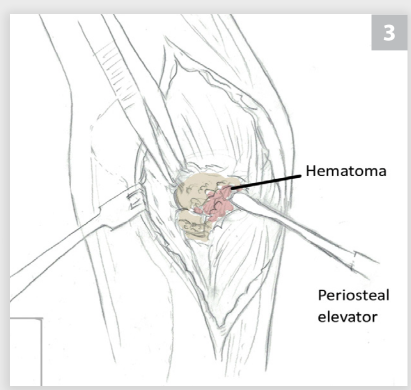












Global Urban Evolution: Parallel Adaptive Evolution in Response to Urbanization

Urbanization is causing rapid evolutionary change in all forms of life. The objective of my MRP was to help educate and engage the general public about novel research in urban evolutionary biology by developing a 3D animation.

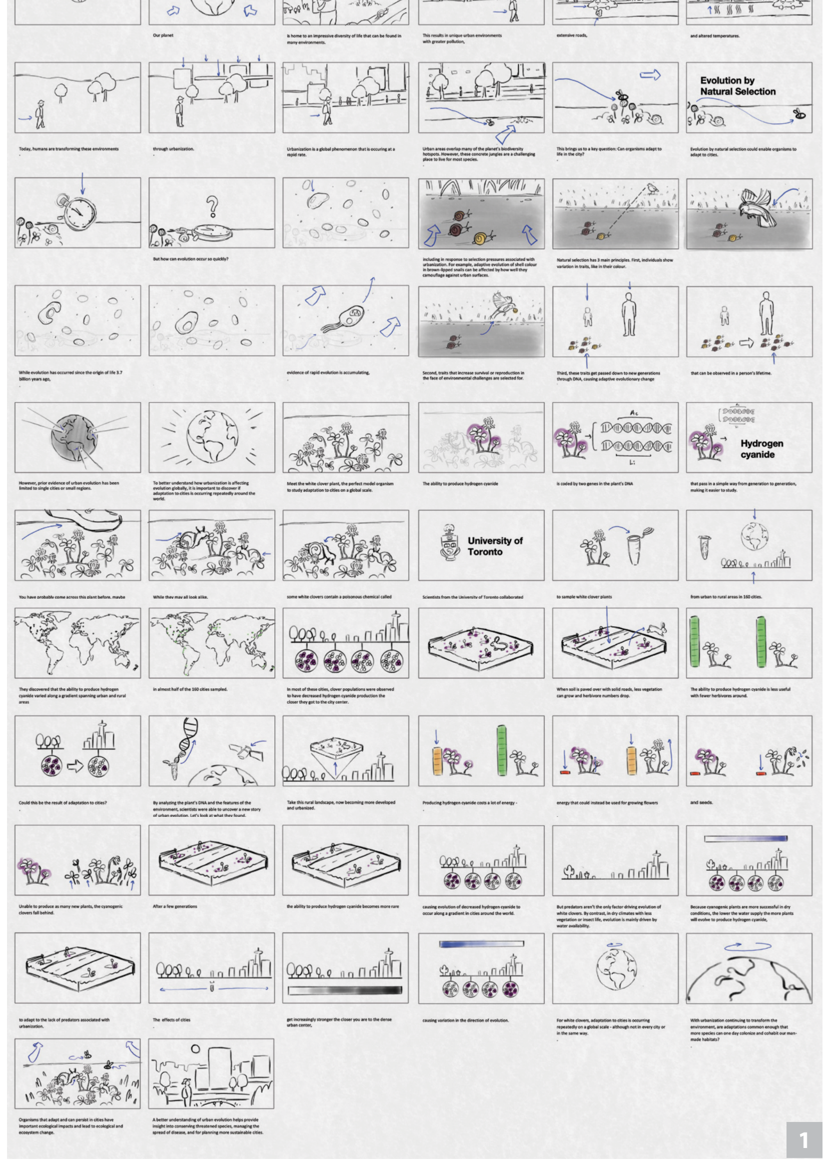
1. Storyboard. Different visualization methods were explored through storyboarding, including the use of visual metaphor. Important animations were visually indicated and helped inform the animatic.

2. Production process. Prior to production, rough visual explorations were conducted to determine an appealing graphic style and colour palette.

3. Production process. Final character designs for the human characters to be present in the film.

4. 3D modelling. *Maya* snapshots showing 3D models, rigs, and a city scene.

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



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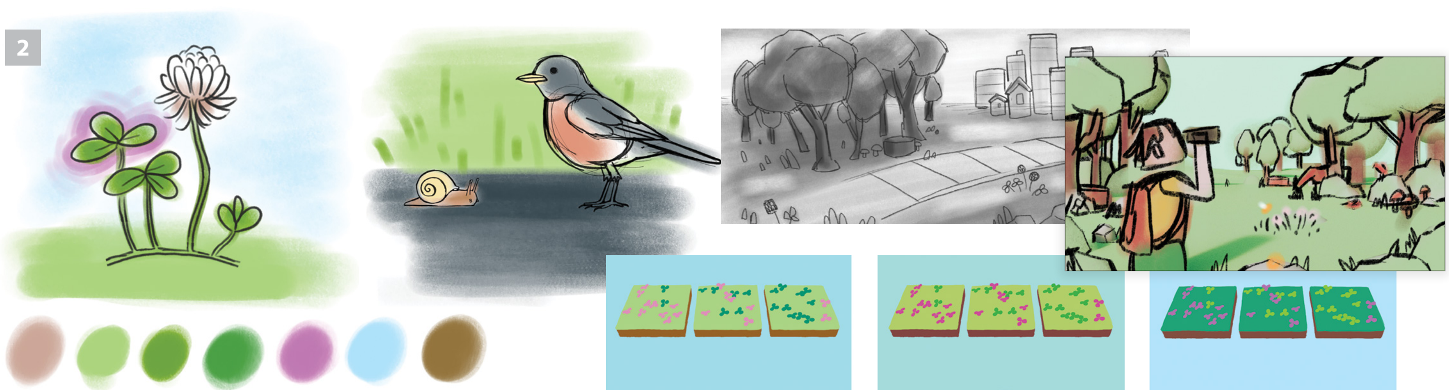

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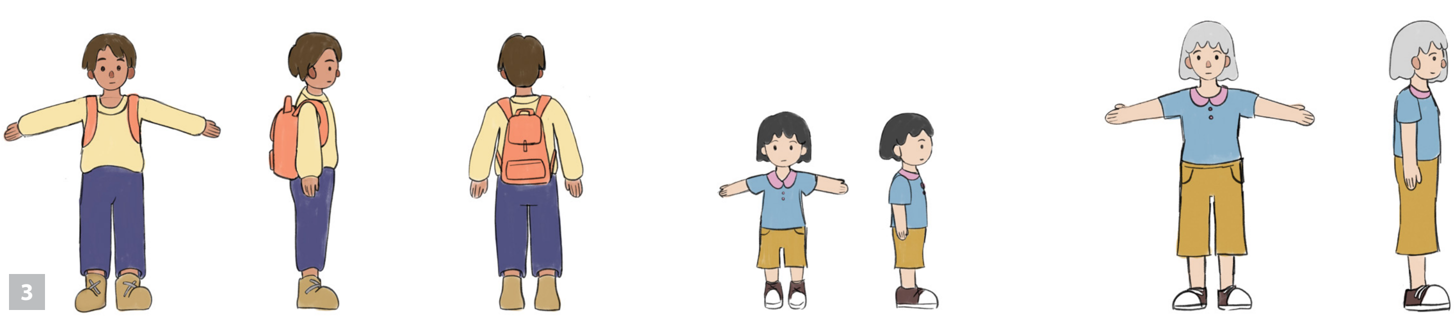

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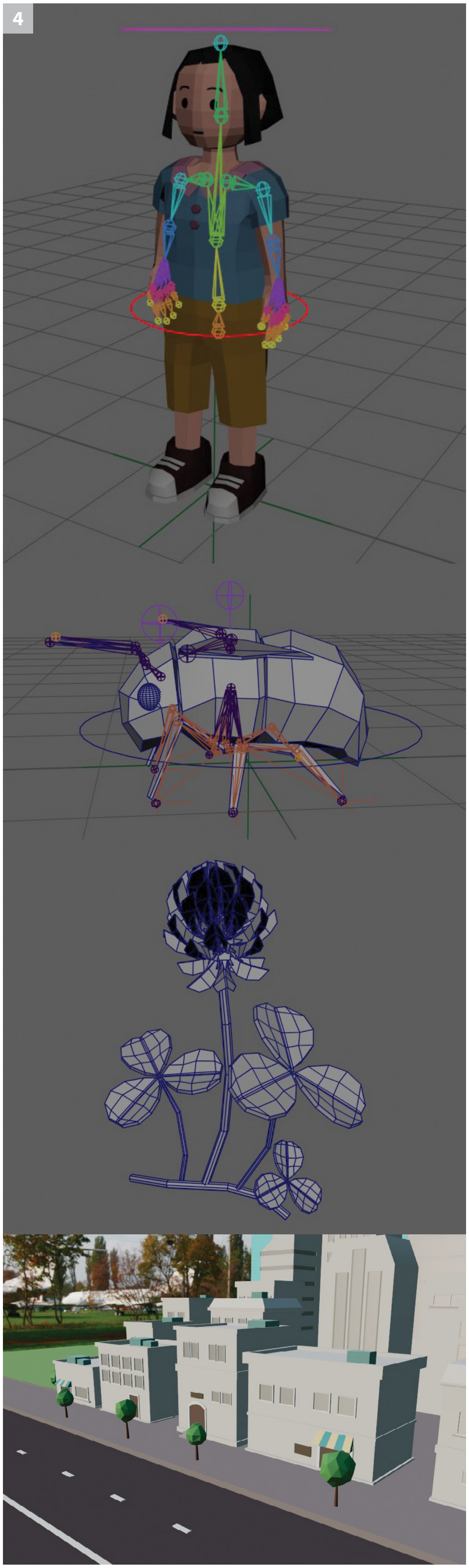
4


5
White clover
1
2
3

Project Glossary

The course descriptions listed below correspond to the project spreads found throughout the Viewbook, and are intended to provide additional context regarding the learning objectives for project work completed during the BMC program. While not an exhaustive list of BMC course requirements, these descriptions provide a glimpse of how students are taught to apply critical thinking and scientific research skills to visualize and communicate complex concepts.

MSC2001Y

Visual Representation of Medical Knowledge

(Anatomical Illustration, Surgical Illustration)

Emphasizing the theories of perspective, colour, design and storyboarding as they relate to textbook and journal illustration, this course follows a seminar format where students complete readings and applied assignments in cellular and surgical illustration. The objectives are to enhance problem solving, rendering, and time management skills.

MSC2003Y

Biomedical Communications Technology

(3D Modelling, Editorial Illustration)

The goal of this course is to provide a foundation for the use of digital 3D media technologies in the communication of scientific research and medical/health information. To start, students focus on digital organic sculpting and the extraction of anatomical data from medical imaging for use in visualization. Student then turn their attention to digital 3D modelling and rendering for the creation of editorial-style visual media.

MSC2006H

Advanced Media Design Technologies

(Interactive Animation)

Building on the principles presented in MSC2003Y, Biomedical Communications Technology, this course allows students to explore high-performance visualization and/or human-computer interaction as it applies to instructional technology and research.

MSC2011H

Special Topics in Biomedical Communications

(2D Animation)

This course is designed to cover emergent issues in the field of Biomedical Communications, providing students with the course time necessary to explore areas not covered in typical curriculum. Topics suitable for this course change from year to year but can include novel technology or software not covered in other courses; for example: 2D animation, advanced surgical illustration, ichthyology, entomology, or any other relevant areas of scientific illustration.

MSC2012H
Neuroanatomy for Visual Communication

(Neuroanatomical Illustration)

Taught by faculty members from BMC and the Department of Anatomy, this course requires students to independently produce a series of original, conceptual neuroanatomical illustrations suitable for a medical student textbook. The main objectives of the coursework are to enhance students' knowledge base, problem solving, presentation, time management, and rendering skills, while conforming to set criteria for textbook publication.

MSC2018H
Visual Representation of Processes in Pathology

(Pathological Illustration)

This course includes pathology lectures delivered by faculty from the Department of Laboratory Medicine and Pathobiology and an illustrative component supervised by faculty from BMC. Students work to produce an original, conceptual medical illustration demonstrating pathological change in a tissue over time.

MSC2020H
Visual Representation of Biomolecular Structure and Function

(Molecular Visualization)

This course explores the structure and function of biologically-relevant macromolecules and their visual representations. Key concepts include the examination and visualization of molecular structure, environment, interaction, and dynamics. The main goal of this course is to equip students with the fundamental knowledge, language, and practical skills necessary to create accurate visual depictions of these biologically-important macromolecules and associated processes for different audiences.

MSC2022H
Graphic Medicine Seminar

(Graphic Medicine)

"Graphic medicine" is a term often used to describe the growing body of creative work (graphic novels, webcomics, and hybrid forms) that deals with issues of illness and caregiving from the perspectives of patients, family members, caregivers, and healthcare professionals. In this course, students become familiar with major works of graphic medicine, science comics, and key theoretical texts related to sequential art. As their major project, students develop their own graphic narrative on a medical or scientific theme.

MSC2023H
Information Visualization

(Information Visualization)

This course addresses the fundamental principles of information visualization, including a discussion of human visual perception, cognition, and approaches to graphic representation. Practical application of course material requires students to develop visualizations that yield insight into complex biomedical subject matter and successfully communicate to a range of audiences.

Acknowledgments

It’s quite surreal that my tenure as a member of the Viewbook editorial team has spanned the entirety of the COVID-19 pandemic. When I started as an editor in the fall of 2019, we were still planning for in-person meetings and editing review sessions, but come March 2020 we all had to rethink how and where we worked. In the three years since, many things have changed, and I've had the privilege of seeing how three BMC graduating classes, two BMCAA executive cohorts, and the entire BMC faculty and staff have evolved, adapted, and continued to support the broader BMC community despite the challenges of a rapidly changing world. This evolution and support includes the Viewbook itself, which continues to celebrate the incredible work and accomplishments of BMC graduates and has grown into a tradition I'm honoured to have been a part of.

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— Alexander Young

“...The true scientist is quite imaginative as well as rational, and sometimes leaps to solutions where reason can follow only slowly; if he does not, his science suffers.”

— Isaac Asimov

Biomedical Communications
Alumni Association

Master of Science in Biomedical Communications
University of Toronto
Ontario, Canada