Master of Science in Biomedical Communications
Viewbook 2020

“”Art is not what you see, ...”

MScBMC
Viewbook 2020

MScBMC Viewbook 2020

Showcasing work by the graduating class of 2020 from the Master of Science in Biomedical Communications at the University of Toronto.

Edited by Chelsea Canlas, Jerry Gu, Alexander Young, and Geoffrey Cheung

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Foreword

Biomedical Communications was formally established as a diploma program 75 years ago in response to a need for trained medical illustrators to contribute to anatomical and surgical publications. In the years since, our program has adapted and grown, first becoming an undergraduate degree program in 1967 and then, 25 years ago, a graduate program. As a profession, medical illustration has evolved enormously, while remaining at its core, a problem-solving activity. Represented throughout the pages of this volume of student work are wonderful examples of problems solved, and communication challenges met. With the publication of the 3rd annual Viewbook, we celebrate the achievements of the MScBMC Graduating Class of 2020.

This challenging past year has been remarkable in so many ways and is one that we will not soon forget. It is a year marked by disruption, anxiety, and hardship brought on by a pandemic that has inexorably changed the way that we communicate and interact with one another. It serves as a reminder that now, more than ever, medical illustrators have an important role to play in increasing public awareness of, and trust in, science. This year has also been marked by an increased understanding of our collective responsibility in addressing the deeply entrenched social and racial injustice that pervades our world. We have a role to play here as well, ensuring that the diverse voices within our community are heard and represented in the visualizations that we create.

The Class of 2020 has faced the many challenges of the past year with resilience and resolve. Knee-deep in their MRPs, and without missing a beat, they were forced to abruptly shift gears in mid-March. In a flash, they left the world of "in person", and entered the realm of "remote." Two new phrases, "You are muted" and "Zoom fatigue," became part of our common lexicon. The Alienware computers in the Advanced Lab hummed away, rendering MRP shots sent in from various outposts. Somehow, in spite of the many technical and physical barriers, you did it! The work on the pages of this Viewbook is a testament to the talent and perseverance of this graduating year. We are so very proud of you. You are a remarkable group of humans.

Over the past several months we've learned a great deal about the importance of community. As you embark on your professional careers, you will be joining a thriving community of MScBMC alumni. We are very grateful to the BMCAA for the many initiatives that this team organizes to bring us together and celebrate our profession. In particular, we would like to express our gratitude to the BMCAA Viewbook team, lead by Geoffrey Cheung, for the herculean effort of producing this volume.

Enjoy!

— Jodie Jenkinson and Michael Corrin, October 2020

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Legend


Beyond survival, our capacity to thrive, to enjoy our lives and to feel human relies on our ability to "unworry" and relax.

Caitlin Chang

My interest in visual design and scientific curiousity led me to join the MScBMC program. My capstone project involved the re-design of a trauma therapy module in service of supporting patient uptake of the intervention. My goal is to bridge communication gaps across various disciplines and make learning more accessible. My next step is to explore the space of user experience and design thinking.

Graphic Medicine

A Comic Guide to Understanding Hypervigilance invites the reader to ponder their experiences of anxiety and hypervigilance, while exploring a fun way to learn basic neuroanatomy principles.

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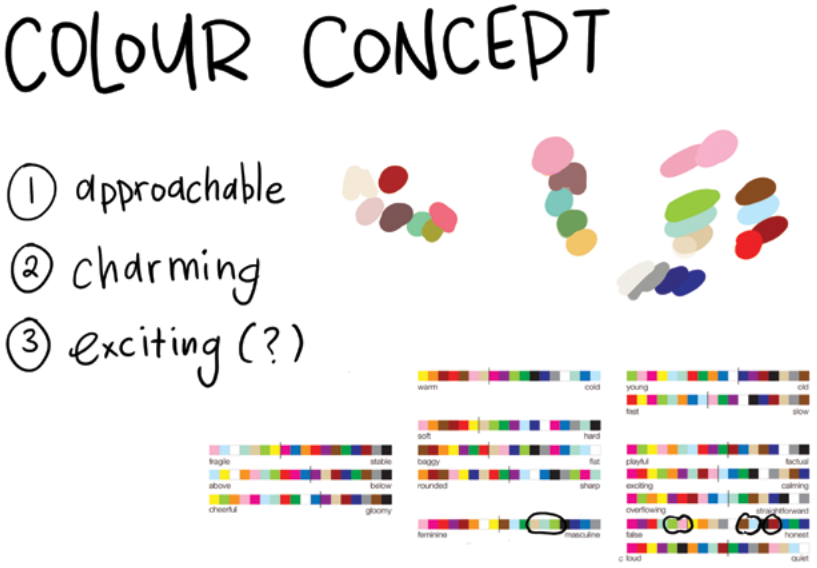

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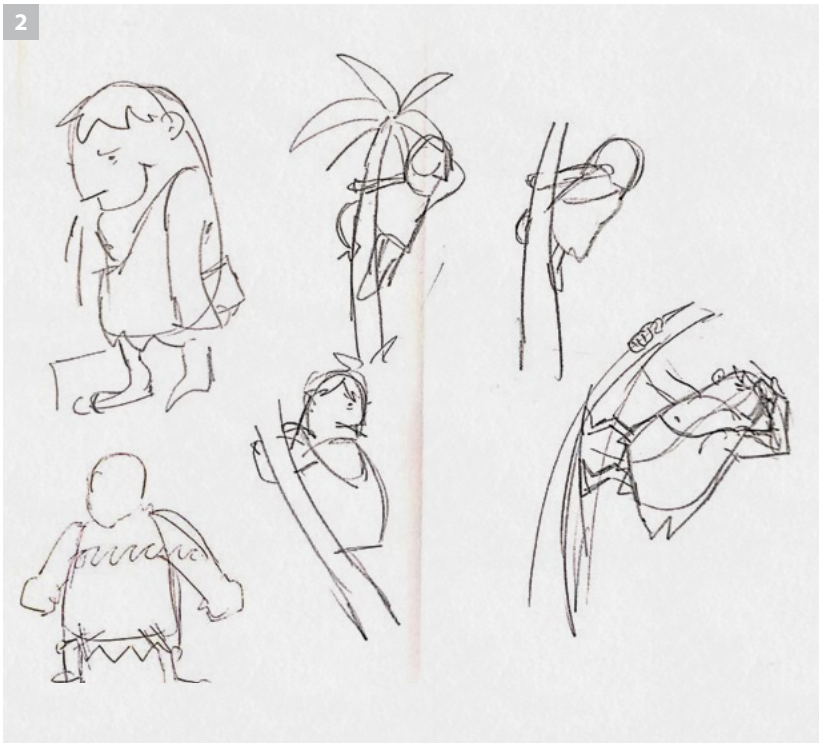

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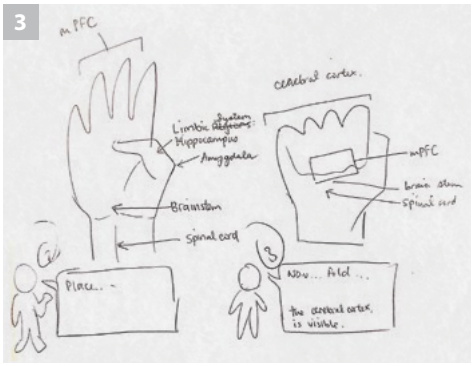
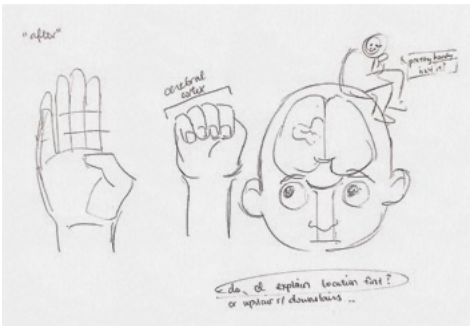
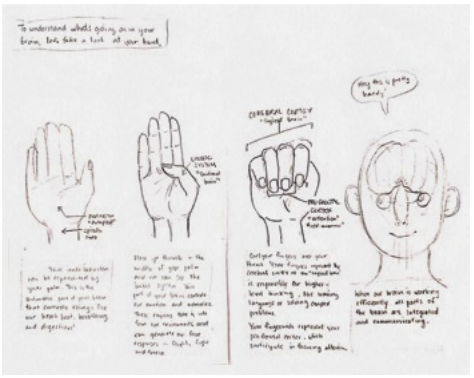
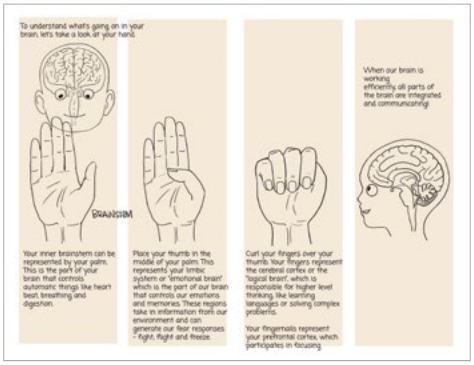




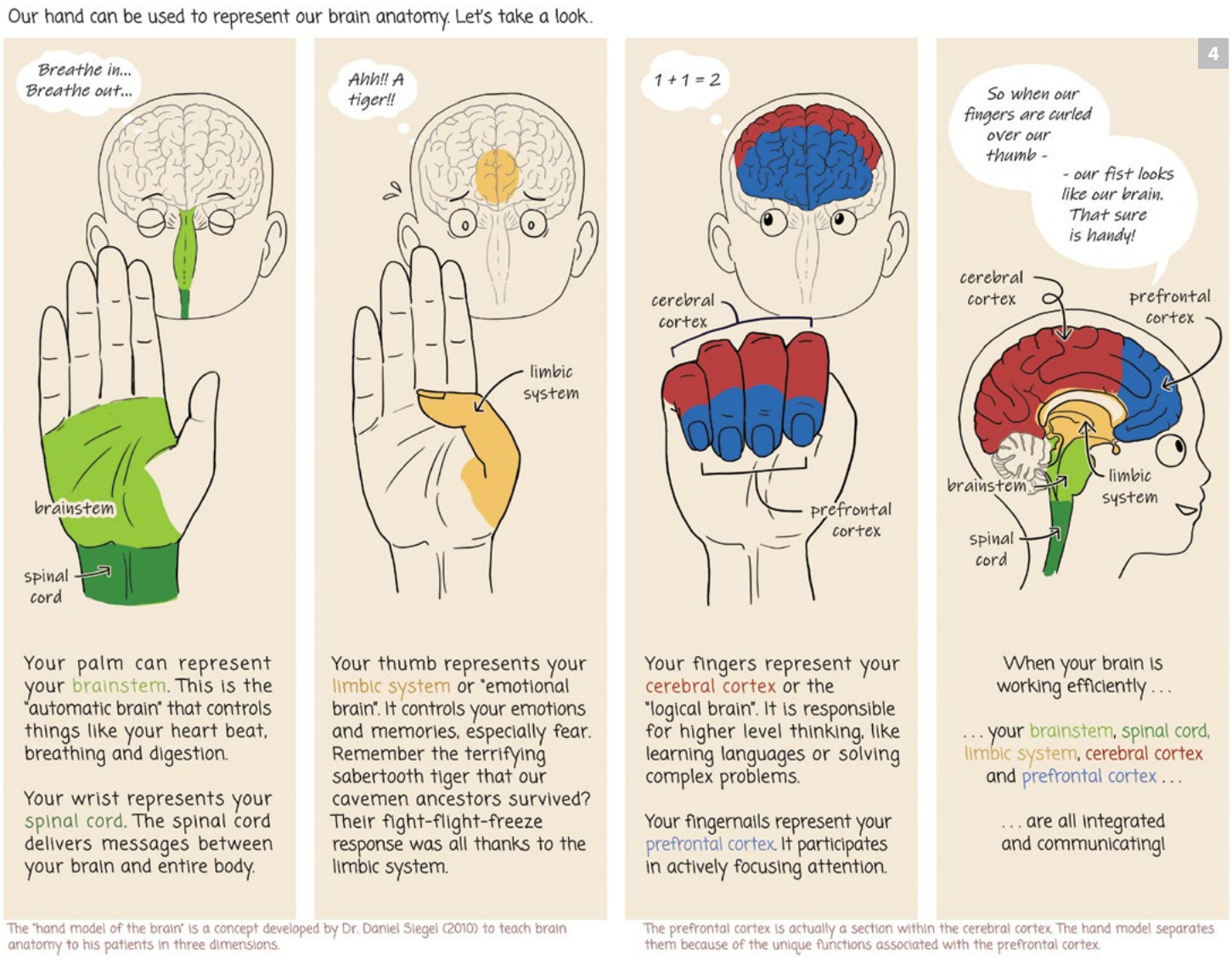




1. Study. I chose three words to describe the feelings that I thought my comic should elicit. From there, I experimented with palettes based off of colour systems described in "Colour Concepts" by Timo Rieke (2014).

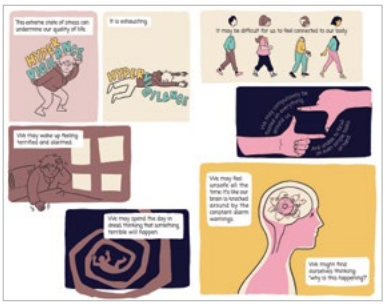
2. Sketch. Preliminary character sketches that I explored prior to rendering.

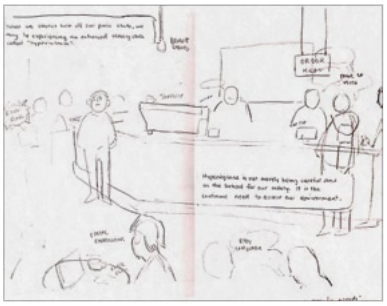
3. Sketch. The central neuroanatomy concept required several iterations to determine prioritization of information and most effective organization of content.

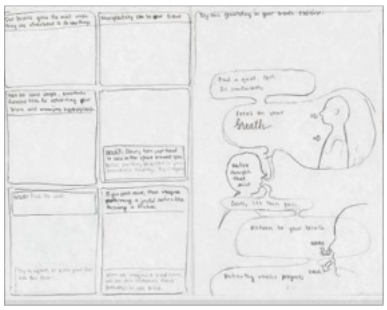


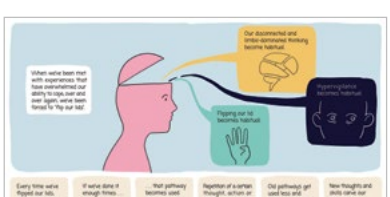
The "hand model of the brain" is a concept developed by Dr. Daniel Siegel (2010) to teach brain anatomy to his patients in three dimensions.

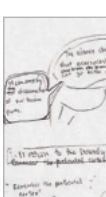
The prefrontal cortex is actually a section within the cerebral cortex. The hand model separates them because of the unique functions associated with the prefrontal cortex.











4. Final illustration. The primary goal of this spread was to communicate basic neuroanatomical principles using the hand as a model for the brain. I designed the colour scheme to emphasize the relationship between anatomical structures in the brain and how we may be able to easily map it onto the hand.

5. Production process. I drafted the comic entirely on paper to quickly test composition and spacing, and more importantly, the feeling of the narrative. Rendering and text were later compiled in *Photoshop*.

Previous spread. Final illustration. A spread from my graphic medicine piece about hypervigilance.

UX/UI Design

I designed and created a prototype iOS application geared towards researchers and professionals who use PubMed in their day-to-day.

1. UX design. I created high-fidelity mockups of select screens and main interactions of the design. I aimed for a minimalistic and functional look.

2. Prototype. Mock-up of the applications sign-in screen.

3. UX design. I produced low fidelity wireframes that were used to flesh out the functionality involved with the main task flow of the target user. These include basic search functions, applying filters, saving into libraries, and downloading texts for convenient reading.

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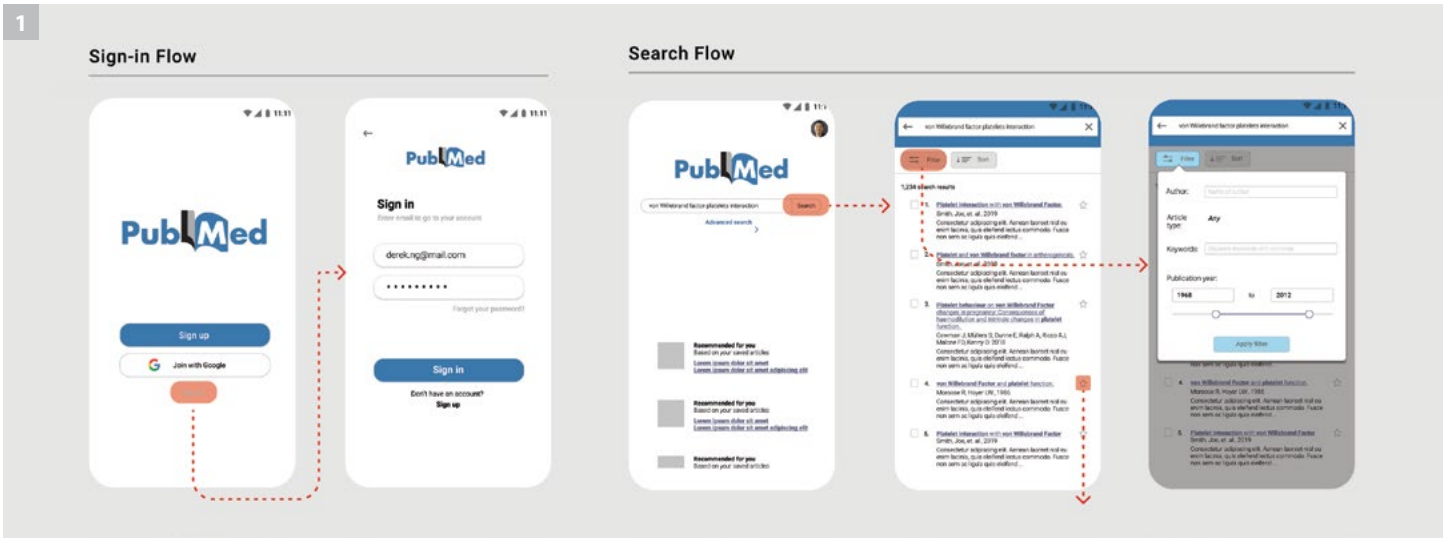

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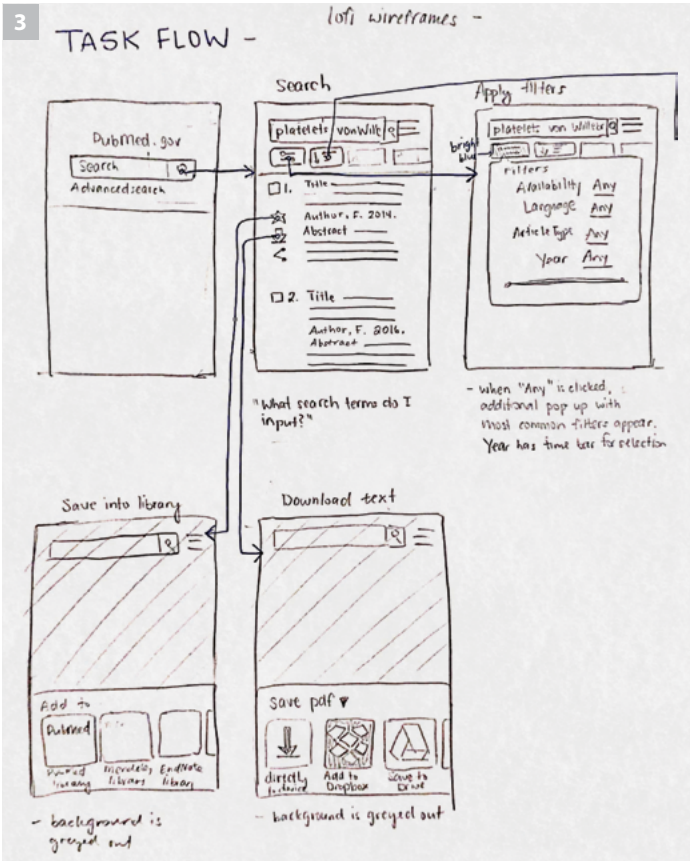

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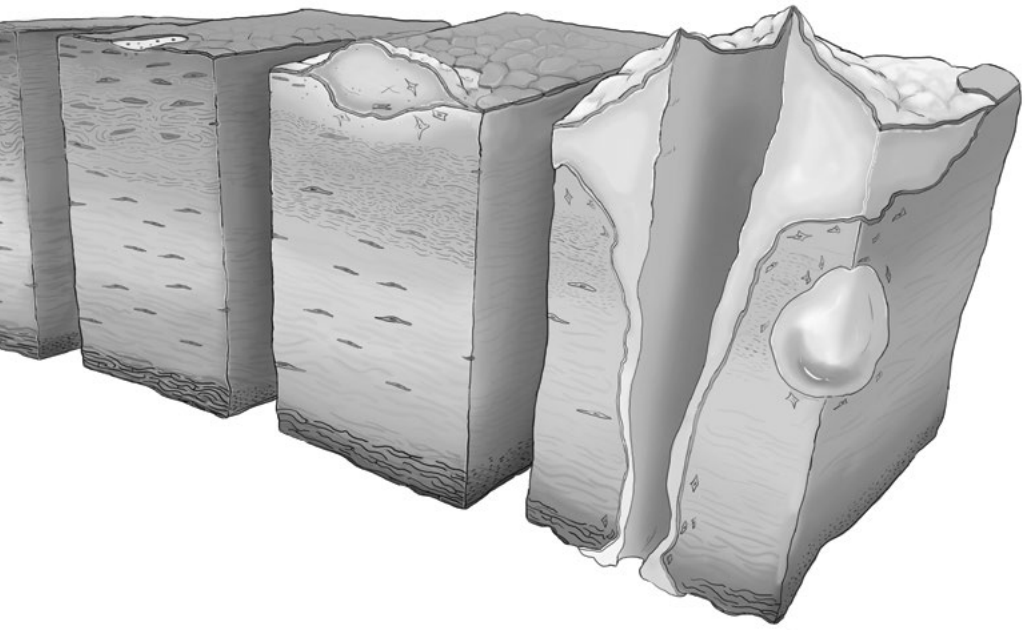

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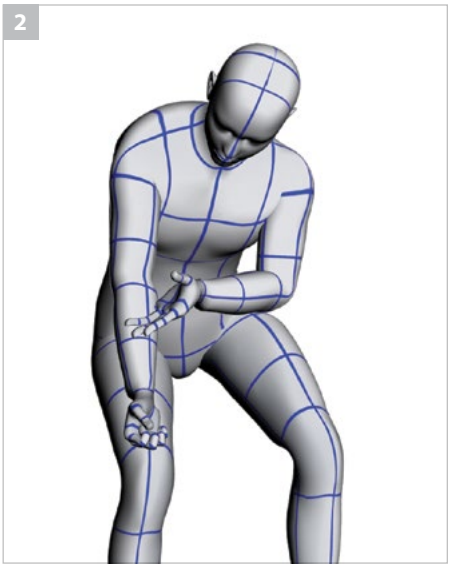

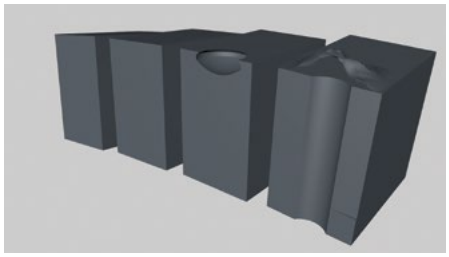

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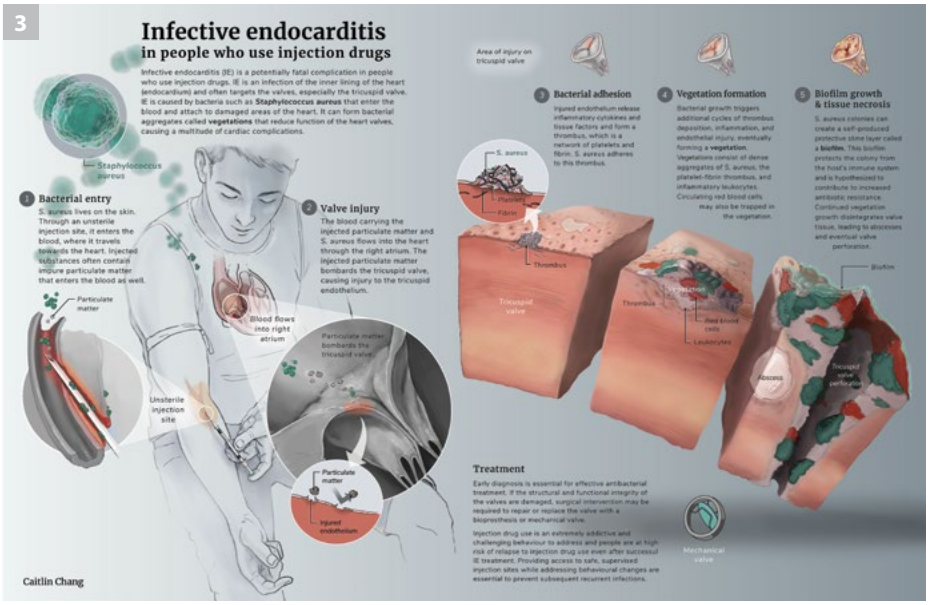

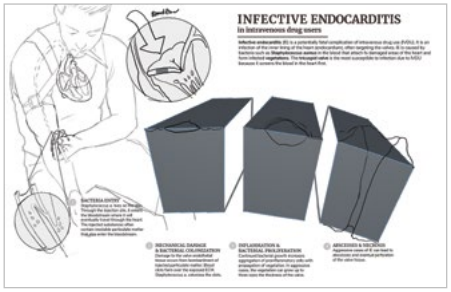

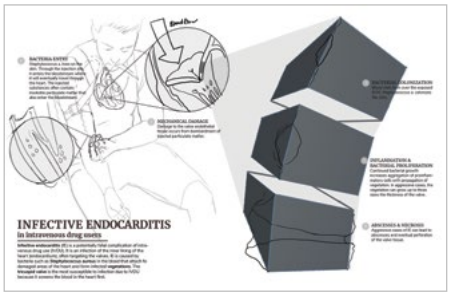

Pathological Illustration

I designed this spread to explain the pathogenesis of infective endocarditis in an IV drug-use population. The mechanism of disease is unique and often goes underdiagnosed within this stigmatized population.

1. Study. I created a preliminary tissue cube illustration to understand the intricate layers of the tricuspid valve, cross-referenced from histology samples and texts.

2. Production process. I created maquettes to base the perspective of the tissue cubes on the spread as well as model the human subject. I experimented with various layouts to determine intuitive reading order and organization of content.

3. Final illustration. The final illustration emphasizes the unique mechanism of disease. Injected particulate matter bombards and injures the tricuspid valve, allowing for bacteria naturally residing on the skin to infect the injured valve.

EXIST: Exploring Visual Instructional Scaffolding in Trauma Therapy

My Master's Research Project (MRP), **EXIST**, is a series of didactic comics designed to scaffold patient learning of trauma therapy education. Comics may uniquely address the challenges of educating a traumatized audience, as it can convey the nuances of experiences that are not always intelligible through text or oral instruction alone.

1. Production process. Some early and intermediate character explorations of the main character, Ava (short for "Avatar"). It was crucial to the project that Ava remain gender-neutral and very, very cute!

2. Final draft. An overview of the completed MRP.

3. Production process. This is the clinical advisory team that I met with weekly over video conference. The team consisted of practicing psychotherapists that teach the trauma module we were designing. MM and CC were my primary points of contact throughout the project.

4. Production process. I explored different ways that the responses of trauma could manifest through Ava.

5. Prototype. Because I met with my clinical advisory team on a weekly basis, it was crucial that I prompted them with specific questions for our engagements. The cat-and-mouse scene was entirely conceived and created together with my clinical team. We walked through each frame carefully as I prompted them with specific questions and images that I wanted their feedback on.

6. Final draft. An example of a completed module.

7. Final illustration. I wanted the therapy module to end on a optimistic and healing note. This was the last panel in the entire module and the only panel to receive colour treatment.

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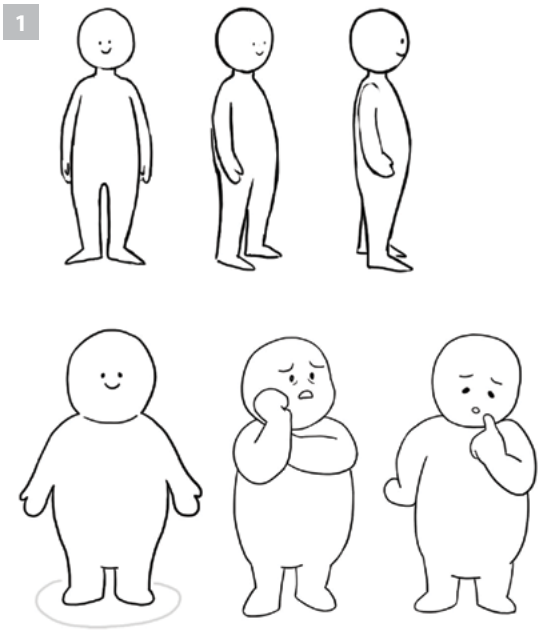

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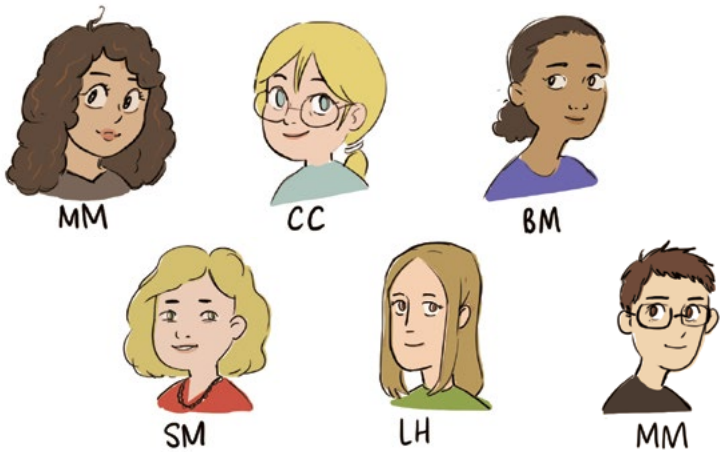

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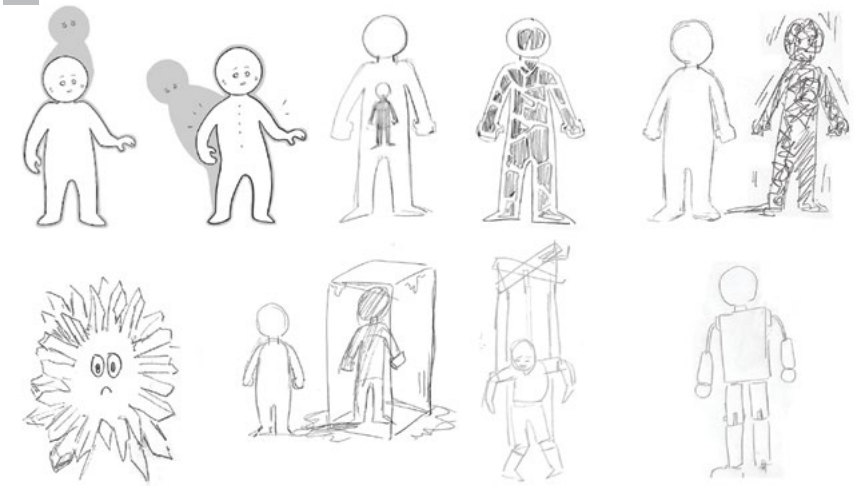

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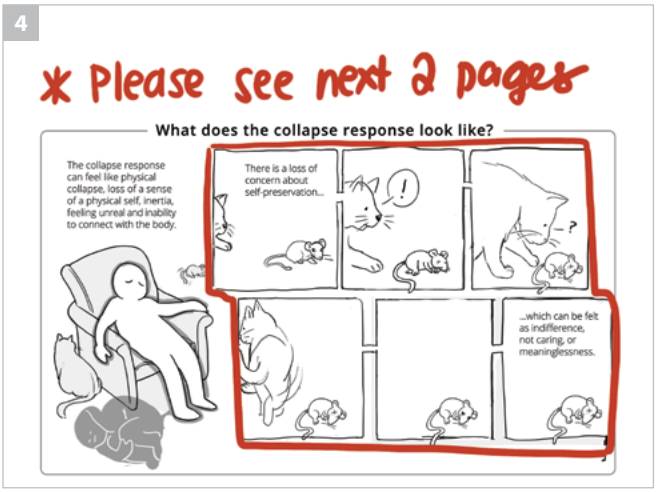
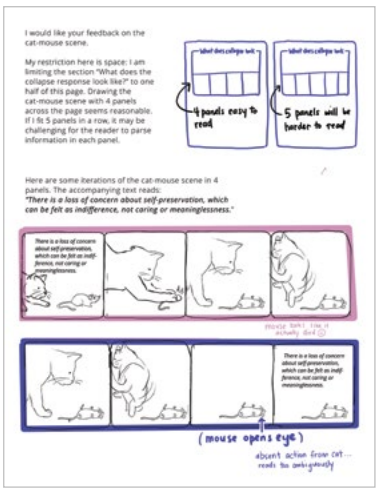
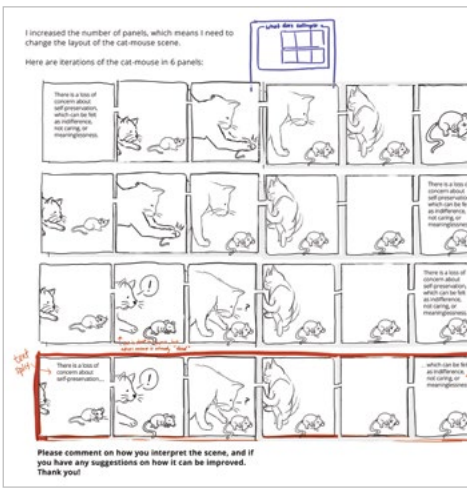
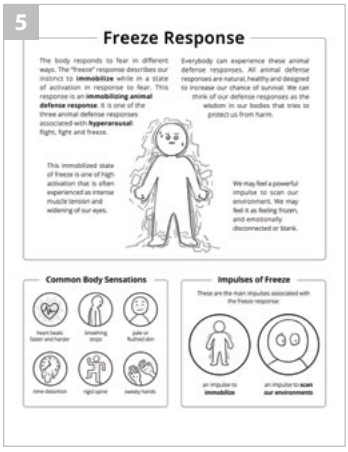

* Please see next 2 pages
What does the collapse response look like?
The collapse response can feel like physical collapse, loss of a sense of a physical self, inertia, feeling unreal and inability to connect with the body.
There is a loss of concern about self-preservation...
...which can be felt as indifference, not caring, or meaninglessness.

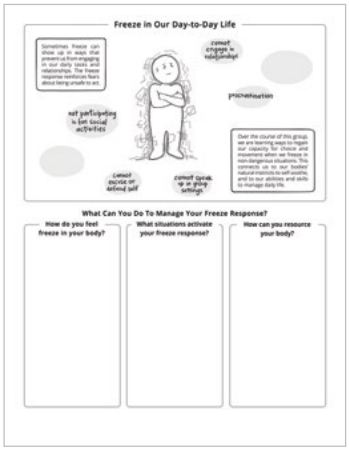

I would like your feedback on the cat-mouse scene.
My restriction here is space: I am limiting the section "What does the collapse response look like?" to one half of this page. Drawing the cat-mouse scene with 4 panels across the page seems reasonable. If I fit 5 panels in a row, it may be challenging for the reader to parse information in each panel.
4 panels easy to read
5 panels will be harder to read
Here are some iterations of the cat-mouse scene in 4 panels. The accompanying text reads:
"There is a loss of concern about self-preservation, which can be felt as indifference, not caring or meaninglessness."
(mouse opens eye)
absent action from cat... reads too ambiguously

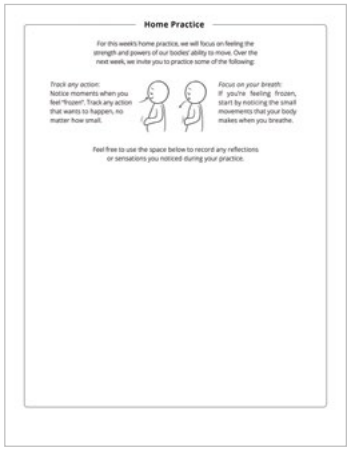

I increased the number of panels, which means I need to change the layout of the cat-mouse scene.
Here are iterations of the cat-mouse in 6 panels:
Please comment on how you interpret the scene, and if you have any suggestions on how it can be improved.
Thank you!

5


Freeze Response
Common Body Sensations
Impulses of Freeze


What Does the Freeze Response Look Like?
When We Have Experienced Chronic Traumatization, the Freeze Response Can Become Our Go-To Survival Strategy


Freeze in Our Day-to-Day Life
What Can You Do To Manage Your Freeze Response?
How do you feel freeze in your body?
What situations activate your freeze response?
How can you resource your body?


Home Practice

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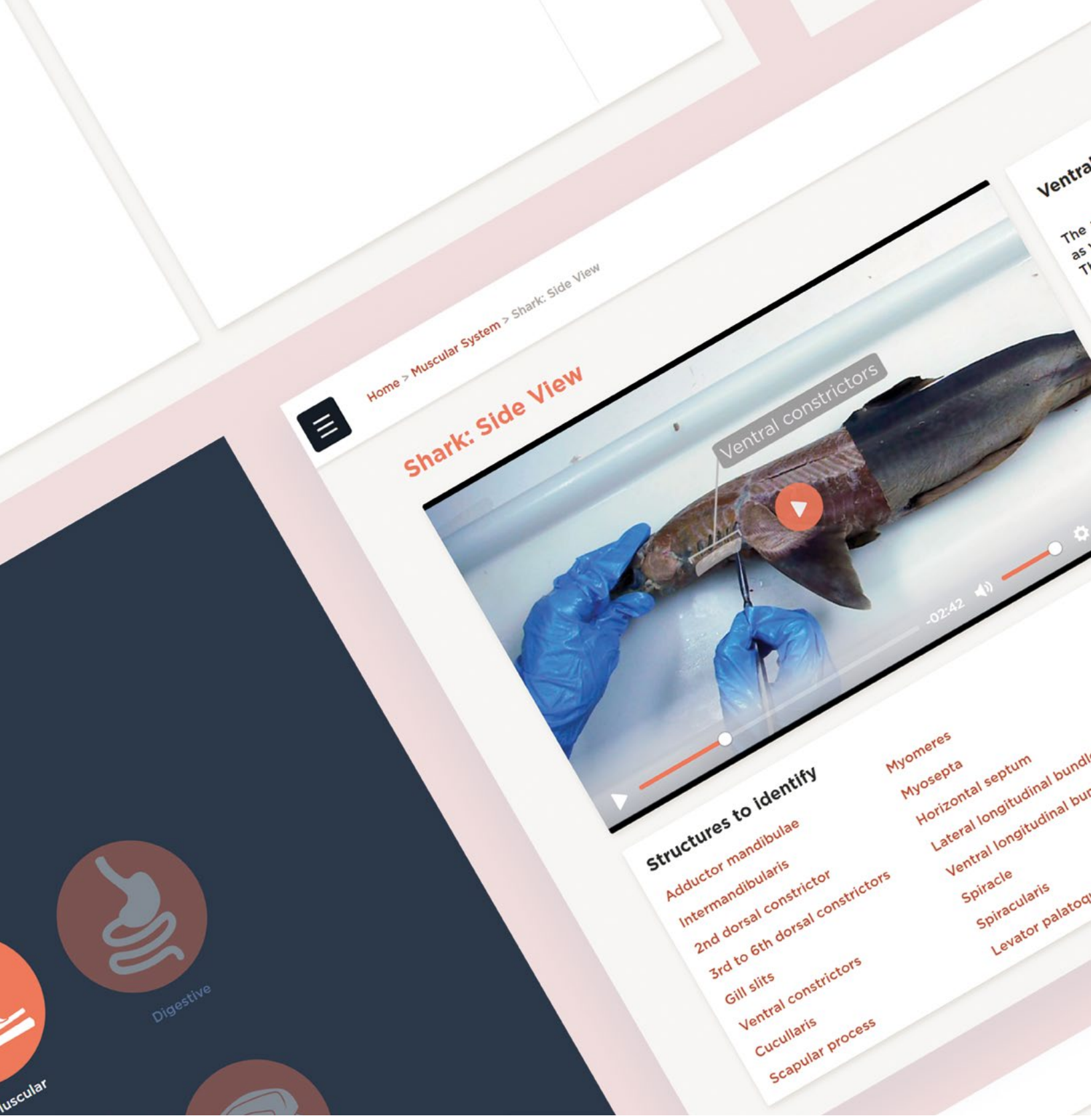
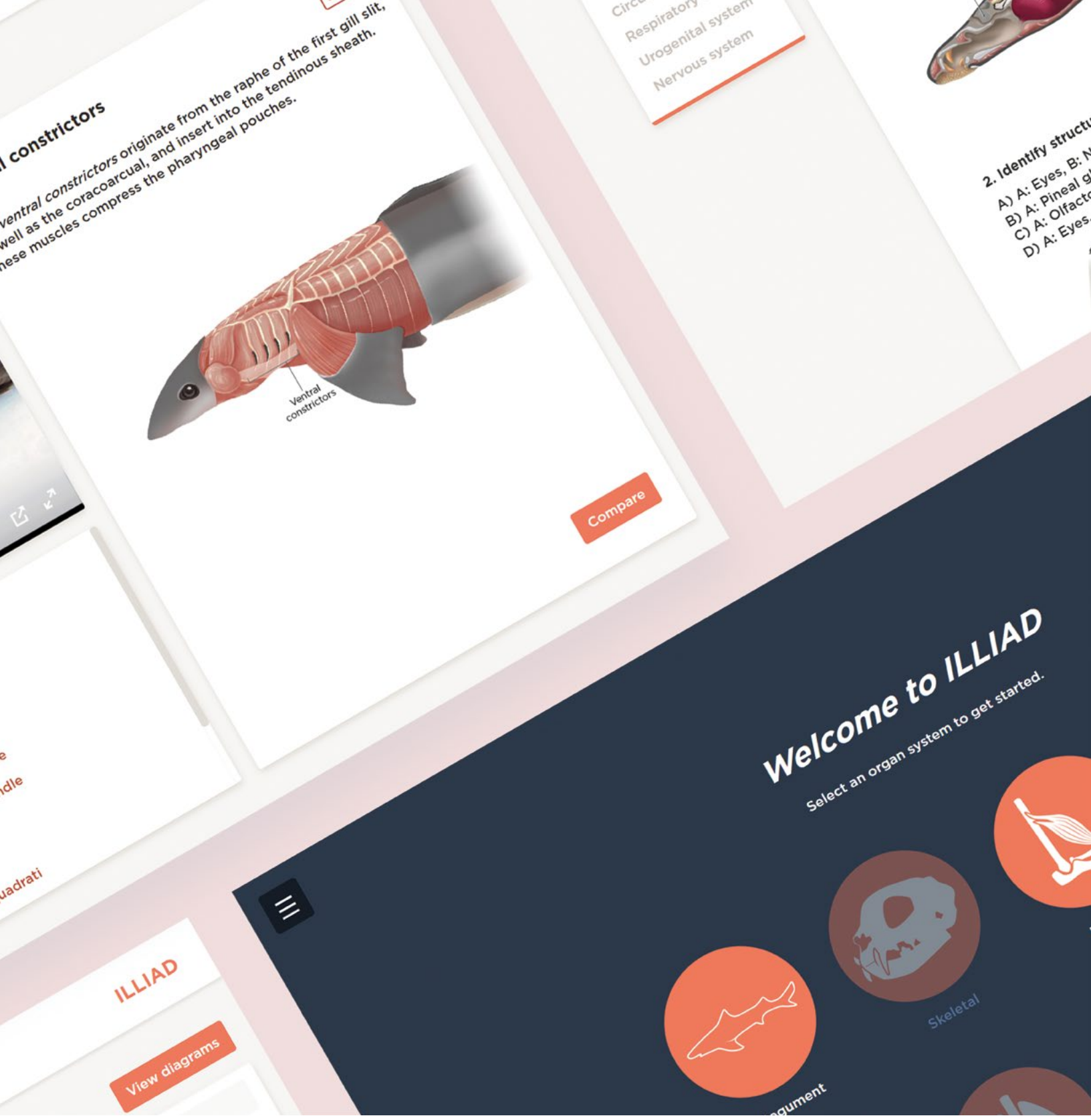

Home > Muscular System > Shark: Side View
Shark: Side View
Ventral constrictors
-02:42
Structures to identify
Adductor mandibulae
Intermandibularis
2nd dorsal constrictor
3rd to 6th dorsal constrictors
Gill slits
Ventral constrictors
Cucullaris
Scapular process
Myomeres
Myosepta
Horizontal septum
Lateral longitudinal bundl
Ventral longitudinal bun
Spiracle
Spiracularis
Levator palatoq
Digestive



Chloe Ng

I have a passion for combining my graduate research experience in physiology with my biomedical visualization skills in order to take complex scientific concepts and translate them into aesthetically-pleasing visuals. My interests lie in teaching, interactive application design, and data visualization.

Surgical Illustration

These surgical illustrations were done based upon observation of an InterStim II implant surgery. After initial sketches, I went through multiple iterations of the sketches to produce a final product aimed to teach residents how to do this surgery.

1. Sketch. Initial surgical observation sketches from the operation room.

2. Production process. I used maquettes of the pelvis to ensure that the illustrations in the final renders were accurate. These maquettes also helped with drawing the foramen needle at an angle.

3. Final illustration. Some select pages from the completed set of surgical illustrations. I laid out the final illustrations into the style of an instructional book.

Previous spread. Final interactive. Various screenshots of my Master's Research Project: ILLIAD (Illustrated Interactive Guide to Anatomy Dissection).

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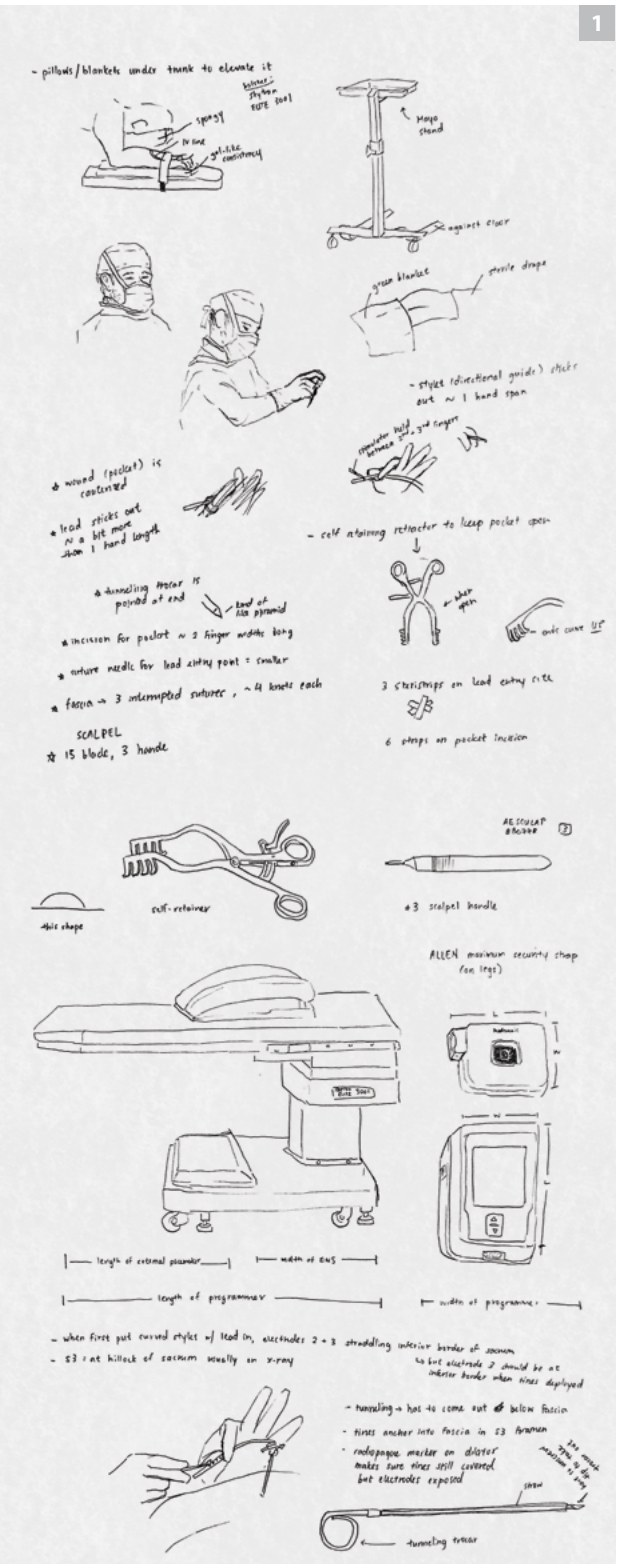

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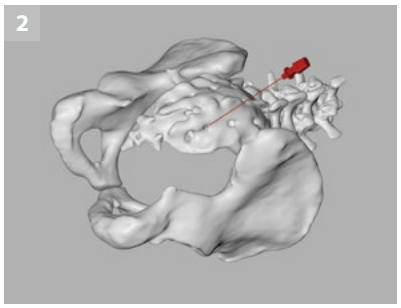

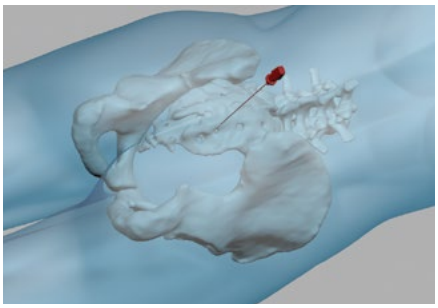

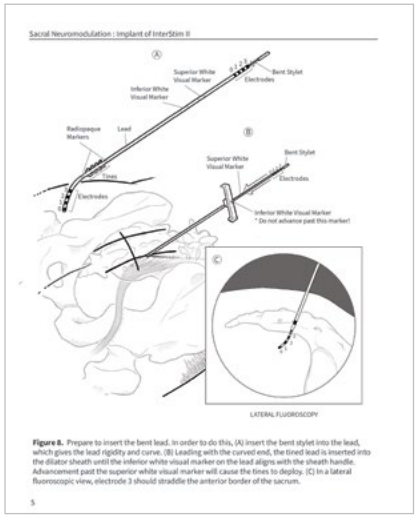

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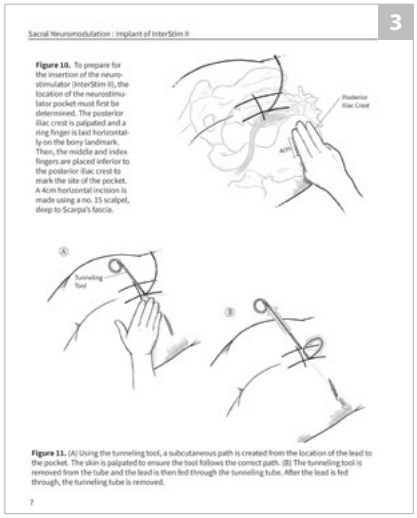

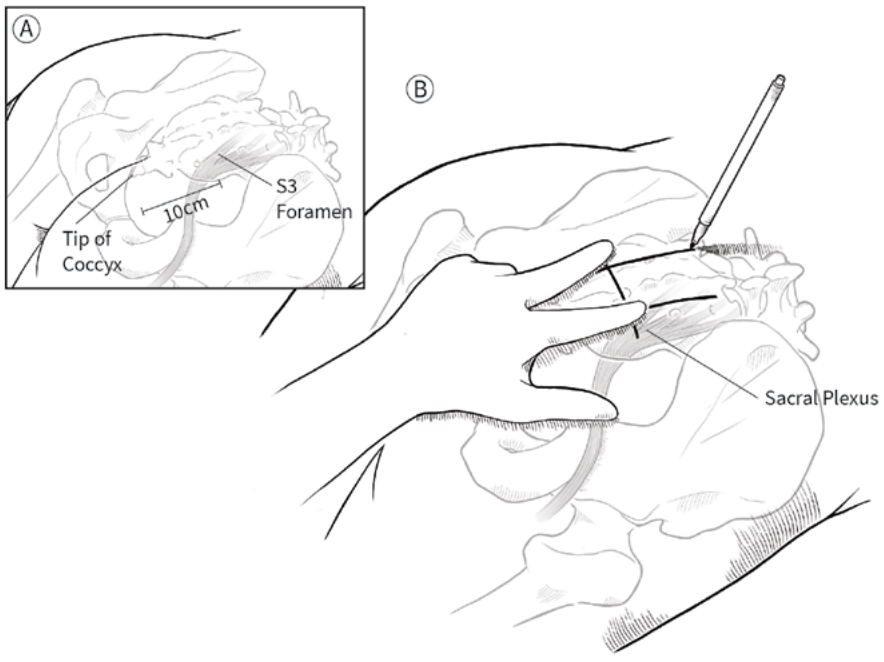

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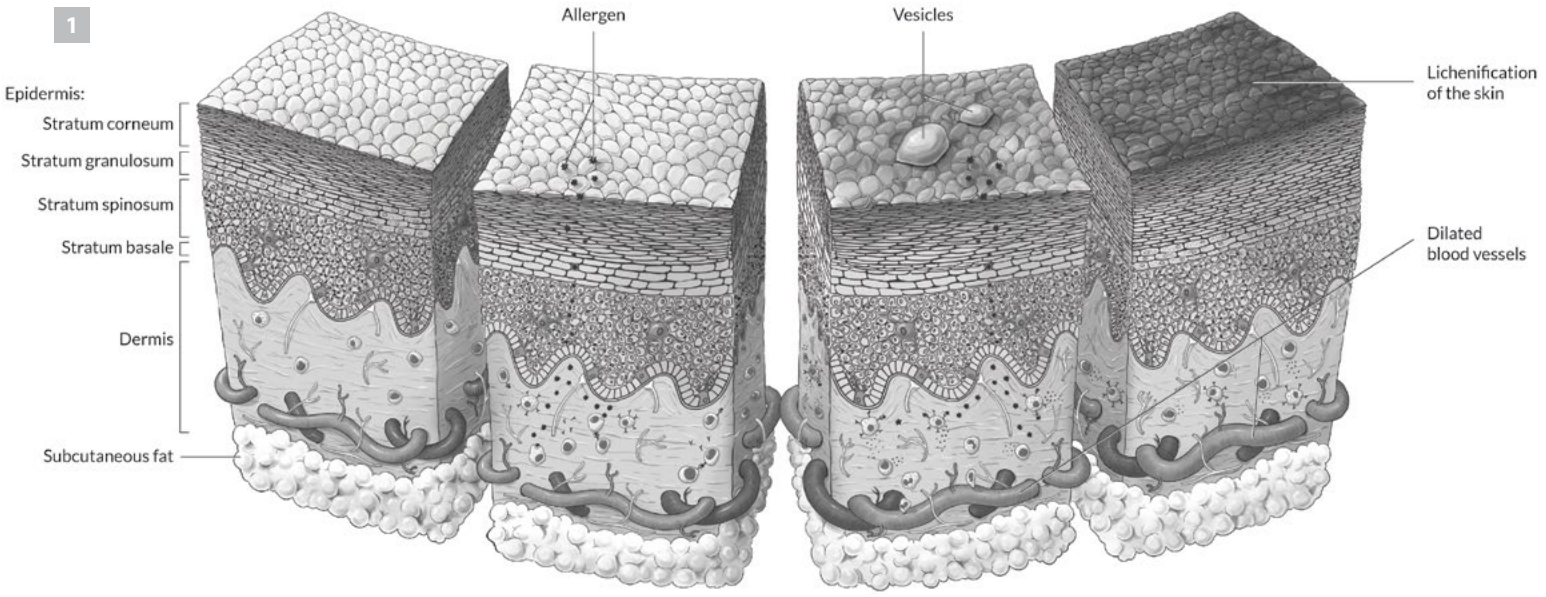

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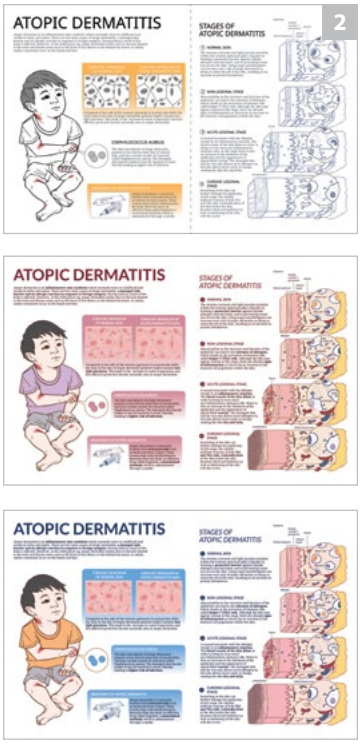

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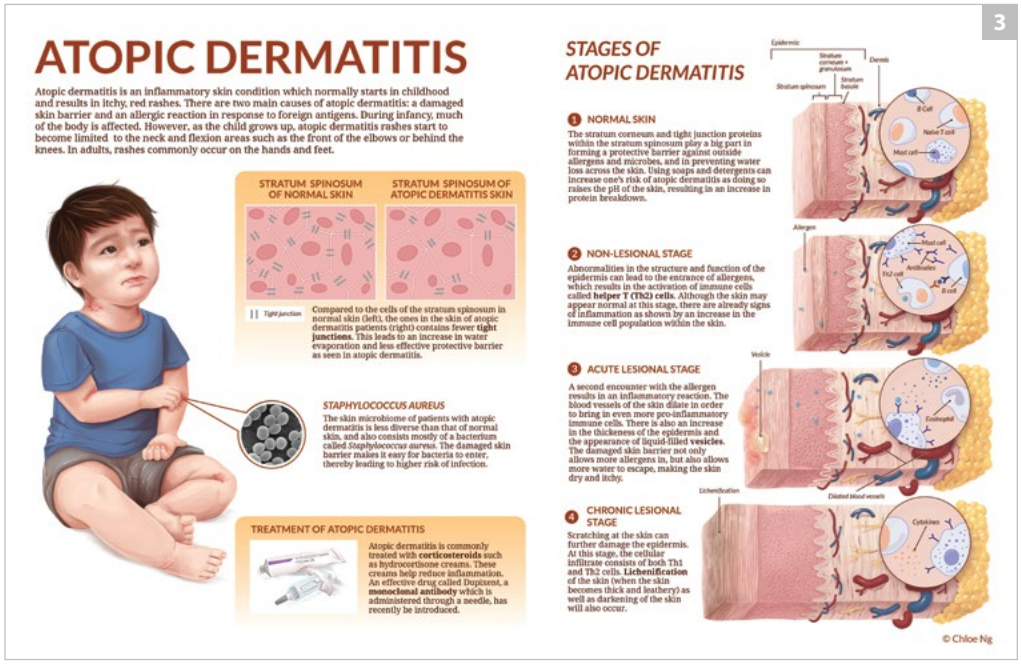

Pathological Illustration

A didactic illustration visualizing the pathogenesis of atopic dermatitis. The tissue cubes visualize the changes seen within the layers of the epidermis and dermis as the disease progresses.

1. Study. I illustrated some skin tissue cubes as a study prior to rendering the final piece, in order to get a better grasp on the specific changes that happen to the skin throughout the progression of the disease.

2. Study. I completed various sketches and colour thumbnails to decide on a suitable colour palette for the final spread.

3. Final illustration. Final rendered illustration, designed to be a 2-page magazine spread.

Data Visualization

The first data visualization is a visual analysis of the top 140 fielding players of the 2016 MLB season. The second is an original data and information visualization on how Canada spends its money on healthcare-related expenses.

1. Sketch. Ideation sketches for the baseball data visualization. I had a lot of information that I could have used, and therefore went through a few ideas before deciding on the final one.

2. Final illustration. The final baseball data visualization. It breaks down the top 140 players into which teams they are from as well as how well they did offensively at home plate.

3. Final interactive. Screenshots from the final prototype of the Canada health expenses data visualization.

4. UX design. High-fidelity prototype for the Canada health expenses data visualization. I designed this to be an interactive scrollytelling-type webpage application.

5. Storyboard. I created storyboards for the Canada health expenses data visualization during the design process so that I could ensure the story flowed well and made sense.

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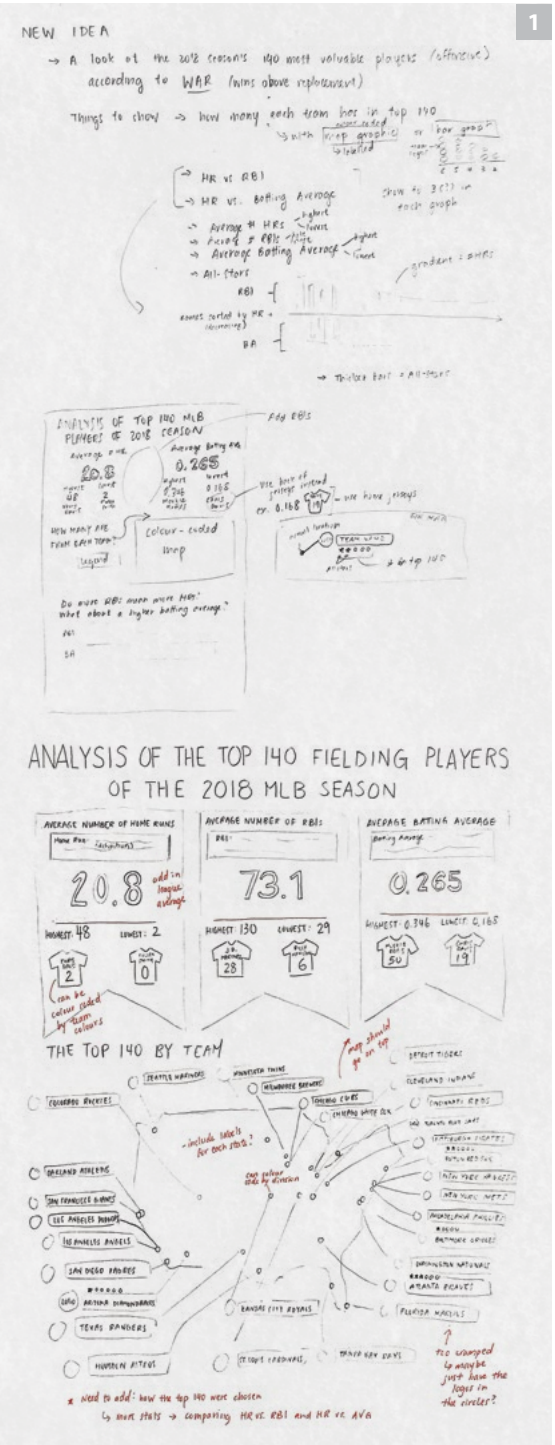

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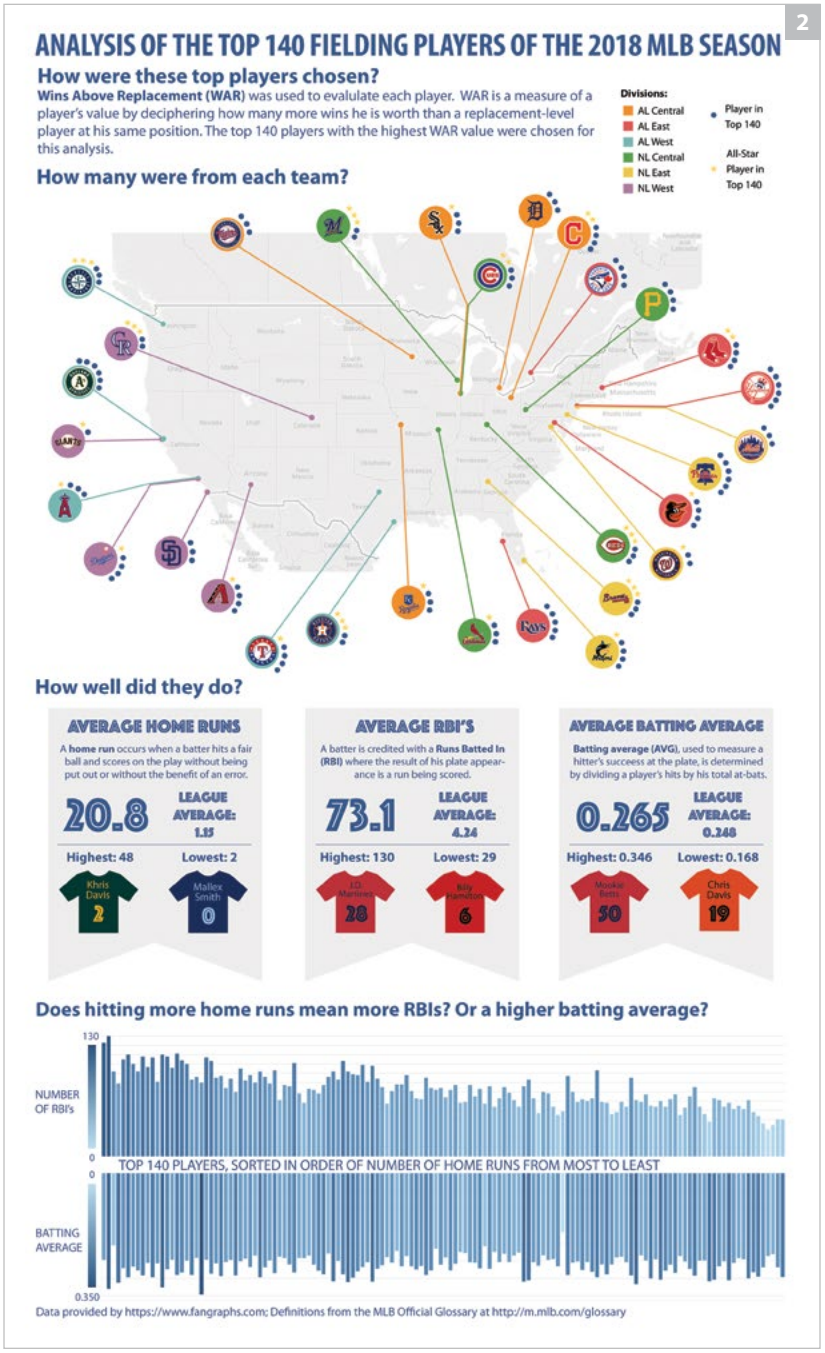

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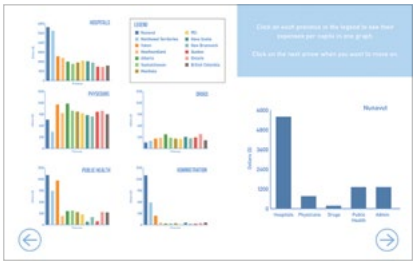

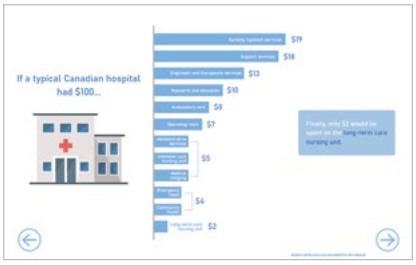

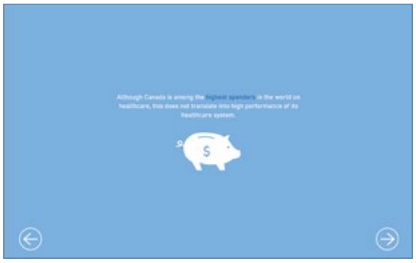

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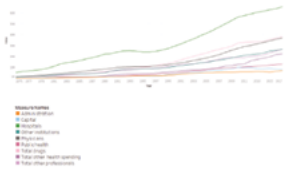
The percentage of Canada's gross domestic product taken up by healthcare spending has been steadily increasing, from 7% in 1975 to 11.5% in 2017. It is predicted to only keep increasing in the future.

70% of the money that is spent on healthcare comes from public funding, such as from governments, and 30% comes from private funding such as private insurance or out of pocket spending.

Health Expenditure Across Canada
1975 - 2017



In contrast, the total amount spent on health-related expenses in 2017 was $____.

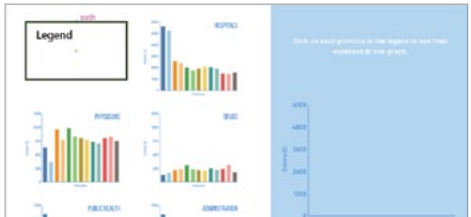
Is health spending equal across Canada?

Let's take a look at how much each province spent per person on health-related expenes in 2017...

The province the spent the least per person on healthcare was British Columbia.

The province the spent the most per person was Nunavut.

Despite the wide range in per capita health expenses across provinces, do they spend their money the same way?



Let's take a look at the national expenses once again.

If I hospital had $100...

Nursing services	$19
Support services	$18

$18 would be spent on support services.

This includes...

ILLIAD (Illustrated Interactive Guide to Anatomy Dissection)

ILLIAD was a collaborative project with my partner, Miranda MacAskill. The project was created for undergraduate students taking a comparative anatomy course. Features include dissection videos, supplementary illustrations, an interactive structure comparison page, as well as virtual bell-ringer quizzes.

1. Production process. Design process for the shark side view. I first created a rough sketch, and then discussed colour and style options with my project partner and advisors. The last is the final illustration.

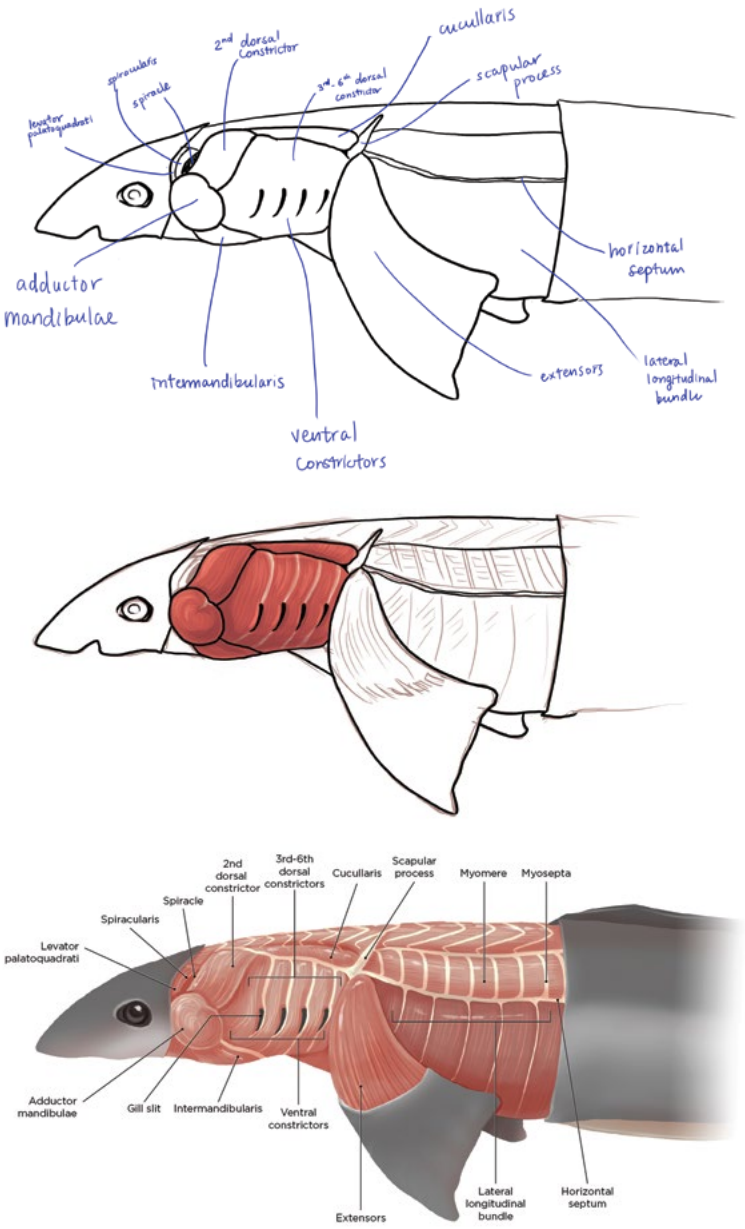
2. Final interactive. Screenshots from the final ILLIAD website: (1) landing page; (2) video page; (3) quiz page.

3. Production process. We filmed all the dissection videos of the animals ourselves, with the help of teaching assistants from the Department of Biology.

4. Production process. An example of JavaScript code that I wrote for the creation of the website. This particular code is for the quiz page.

5. UX design. My project partner and I iterated on many wireframes for ILLIAD when designing for the user experience.

1



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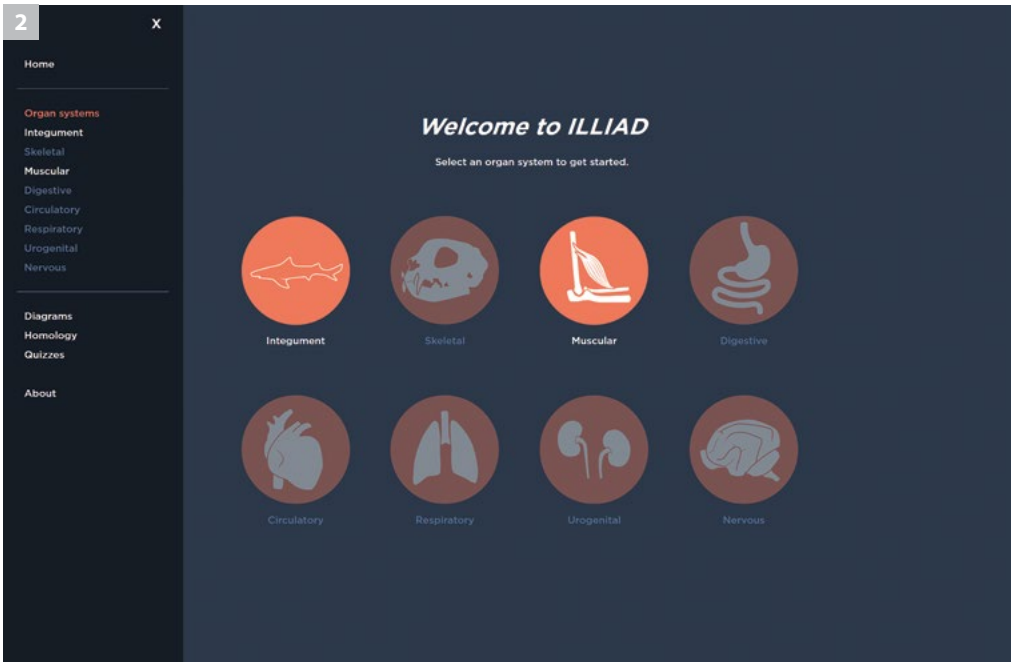
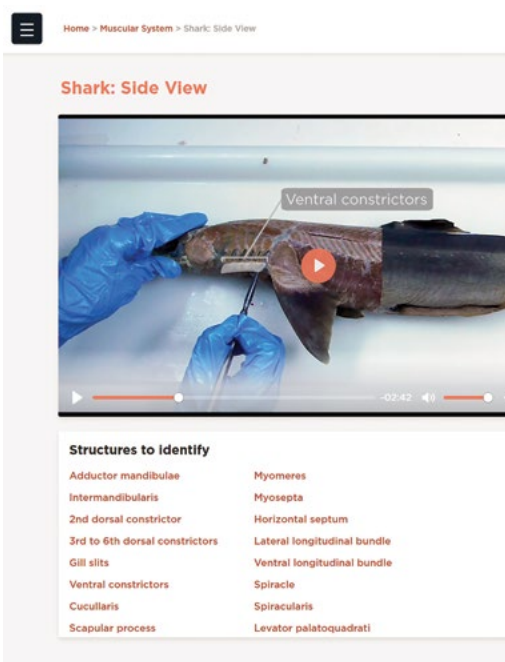




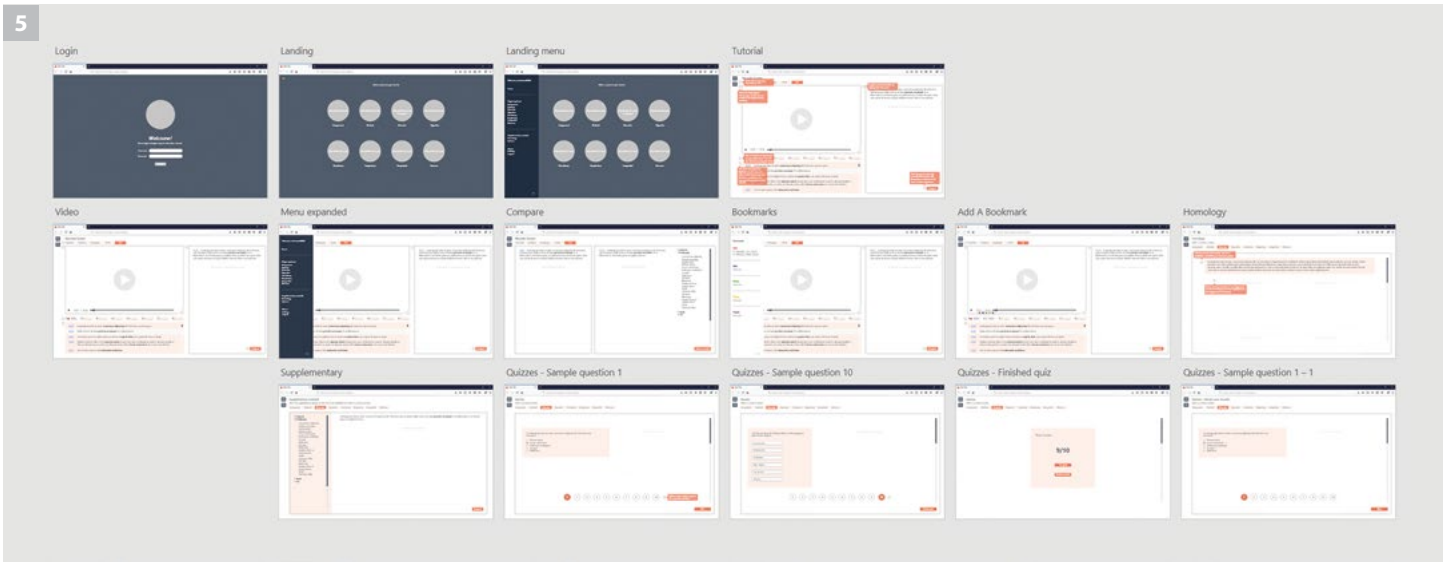
3

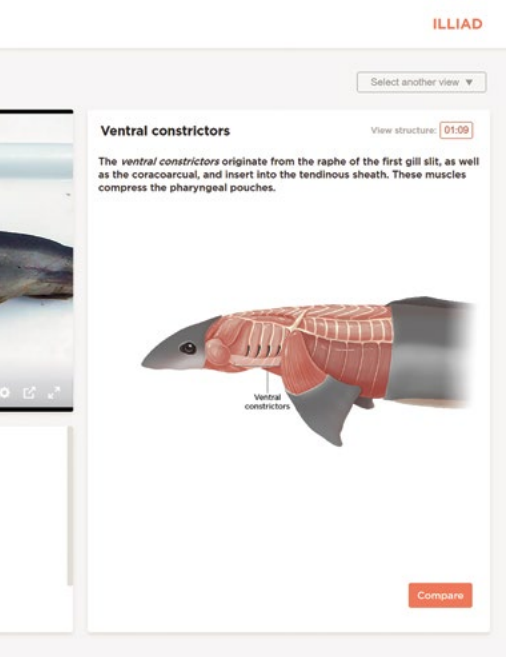
4

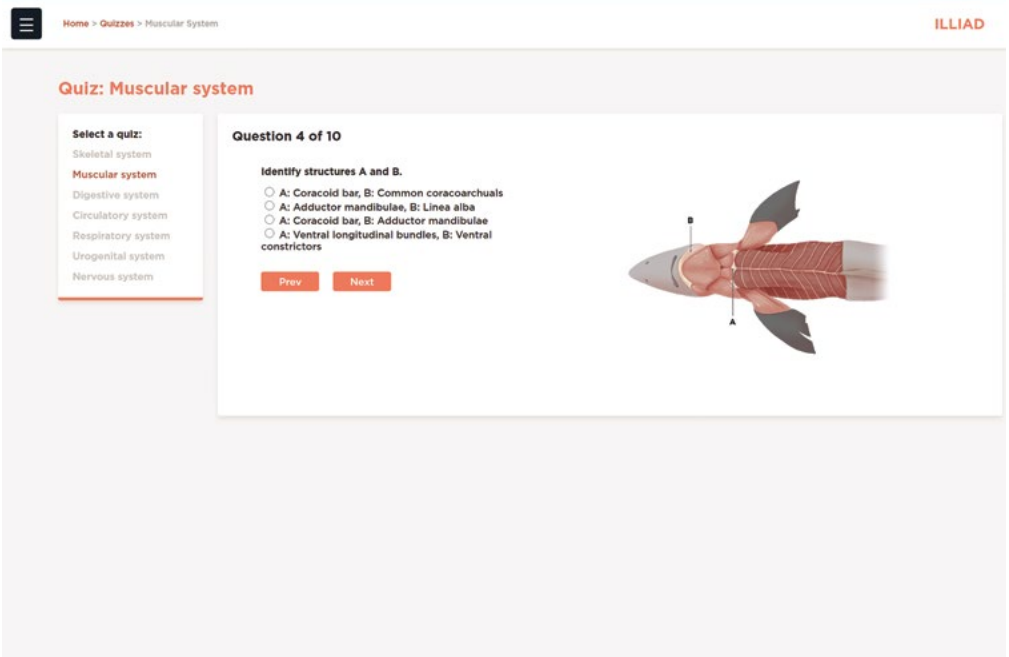
quiz_muscular.js

```
// Nav menu

function openNav(){
  document.getElementById("navSidebar").style.width = "250px";
}

function closeNav(){
  document.getElementById("navSidebar").style.width = "0";
}

// Quiz Javascript

let pos = 0;
let correct = 0;
let test, test_status, question, choice, choices, chA, chB, chC, chD;
let answers = [];

let questions = [
  ["Identify structures A and B.", "A: Notochord, B: Olfactory bulb", "A: Notochord, B: Pineal gland", "A: Spinal cord, B: Olfactory bulb",
  ["Identify structures A and B.", "A: Eyes, B: Notochord", "A: Pineal gland, B: Notochord", "A: Olfactory bulb, B: Spinal cord", "A: Eyes,
  ["Identify structure A. What is the function of A?", "Cucullaris. Elevates pectoral girdle and last branchial arch.", "Lateral longitudina
  ["Identify structures A and B.", "A: Coracoid bar, B: Common coracoarchuals", "A: Adductor mandibulae, B: Linea alba", "A: Coracoid bar, B
  ["Identify structure A. What is the origin and insertion of A?", "Branchiohyoideus. Origin: First branchial arch. Insertion: Ceratohyal ca
  ["Identify structures A and B.", "A: Depressor mandibulae, B: Doraslis trunci", "A: Intermandibularis, B: Interhyoideus", "A: Depressor ma
  ["Identify structure A. What is the function of A?", "Puboischiofemoralis externus. Adducts hind limb.", "Puboischiofemoralis externus. Ad
  ["Identify structure A. What is the origin and insertion of A?", "Pectoralis major. Origin: Clavicle. Insertion: Pectoral ridge of humerus
  ["Identify structure A. What is the function of A?", "Rhomboideus. Draws scapula forward.", "Rhomboideus. Rotates humerus laterally.", "In
  ["Identify structures A and B.", "A: Gluteus medius, B: Biceps femoris", "A: Gluteus maximus, B: Biceps femoris", "A: Gluteus medius, B: A
];

function get(x) {
  return document.getElementById(x);
}

function renderAnswers(questionNum){
  for (let i = 1; i <= 4; i++) {
    let letterChoice;
    // Turning the choices into letters so that it matches the format of answers[questionNum]
    if (i == 1) {
      letterChoice = "A";
    }
    else if (i == 2) {
      letterChoice = "B";
    }
```

5







Christine Shan

I enjoy learning about science and my goal is to make science more accessible to everyone. During my time at MScBMC, I explored a diverse range of mediums that can effectively communicate to different audiences. What makes me the most excited is to create engaging visuals that are both fun and informative. I like to create cute characters and add a little humor into my storytelling. I want to create work that puts a smile on your face and piques your curiosity about the world.

Editorial Illustration

This mock journal cover is based on the study of how microbes grow in simulated Martian gravity to test the possibility of space biomining. The concept of microbe miners was inspired by the *Little Prince* and the Minions characters.

1. Sketch. I created three sketches with different compositions in order to work out the mining poses and to determine what objects to include around the microbes.

2. Production process. I continued to work out the color scheme and lighting. At this stage, I wanted to recreate the harsh lighting as seen in photos of planets.

3. Final illustration. I changed the background to a painted storybook style and rendered the 3D models with softer lighting and vibrant colors.

4. 3D modelling. In *Maya*, I modelled and then rigged the microbe characters so they can be posed in various positions around the scene.

Previous spread. Final illustration. A close-up of the microbe miner characters from my mock journal cover.

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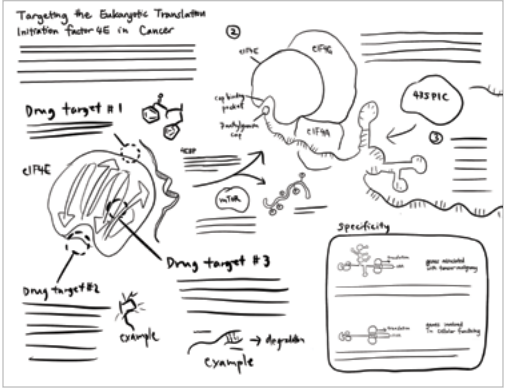
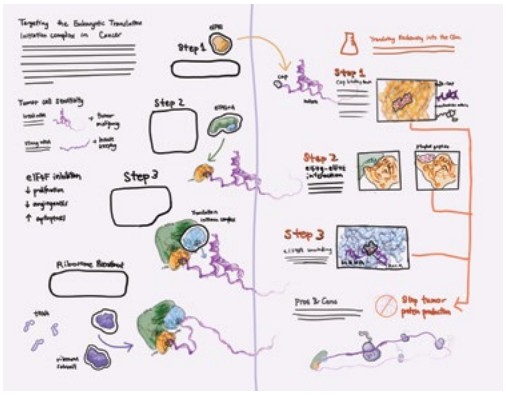
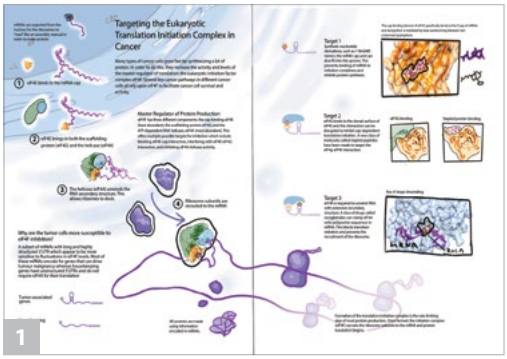
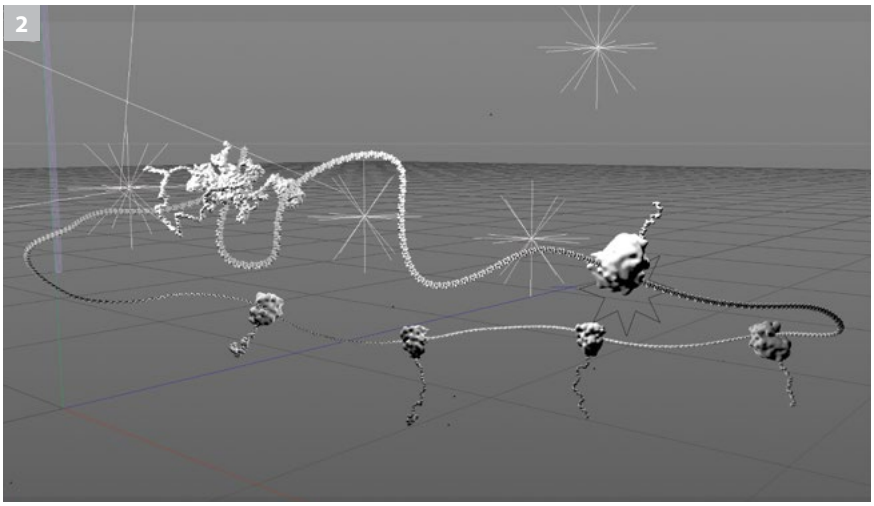
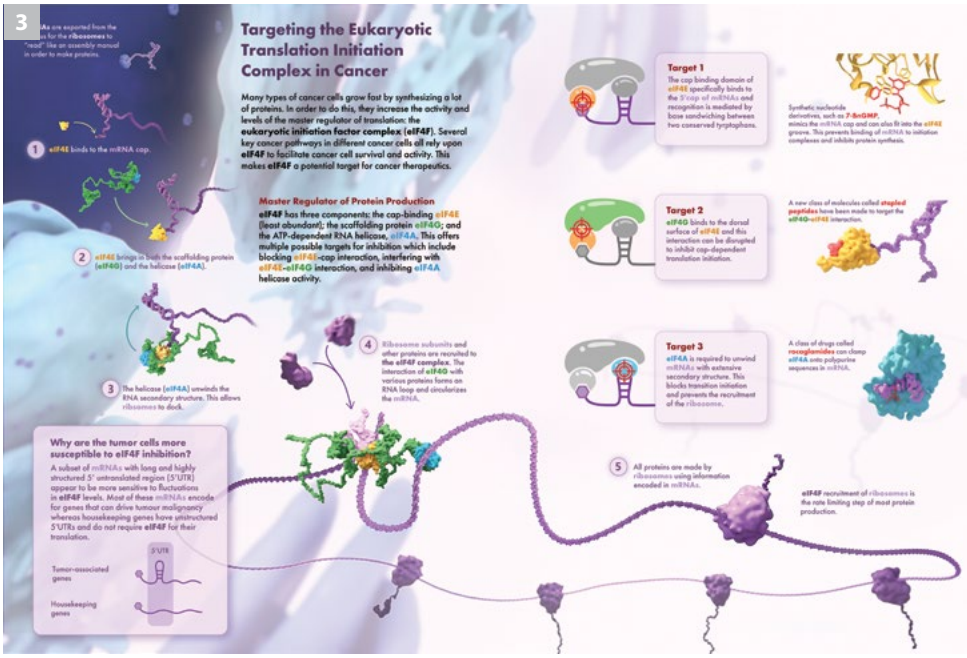










Molecular Visualization

The eukaryotic initiation factor complex, eIF4F, is the master regulator of translation in the cell. This is an important cellular process to understand and also a potential drug target for cancer therapy.

1. Production process. I created many different layouts to figure out the best way to structure all the information and guide the reader through a complex story.

2. 3D modelling. Formation of the translation initiation complex circularized in the mRNA. I assembled the 3D structures in *Cinema 4D* after using *Chimera* and *VMD* to export 3D models from PDB files.

3. Final illustration. The final spread shows the steps in the formation of the translation initiation complex in a 3D cellular environment with 2D elements highlighting the drug targets for cancer therapy.

Graphic Medicine

Genetically modified (GM) foods is a controversial topic, but many people do not understand what GM foods are. I want to explain genetic engineering and how GM foods are created in a fun, easy-to-understand way for the general public. During the creation of the GM piece, COVID-19 hit and we had a special seminar (online, of course) about comics related to the pandemic.

1. Production process. This is the detailed sketch where I worked out the key details before inking. The speech bubble type and content is also determined during this stage.

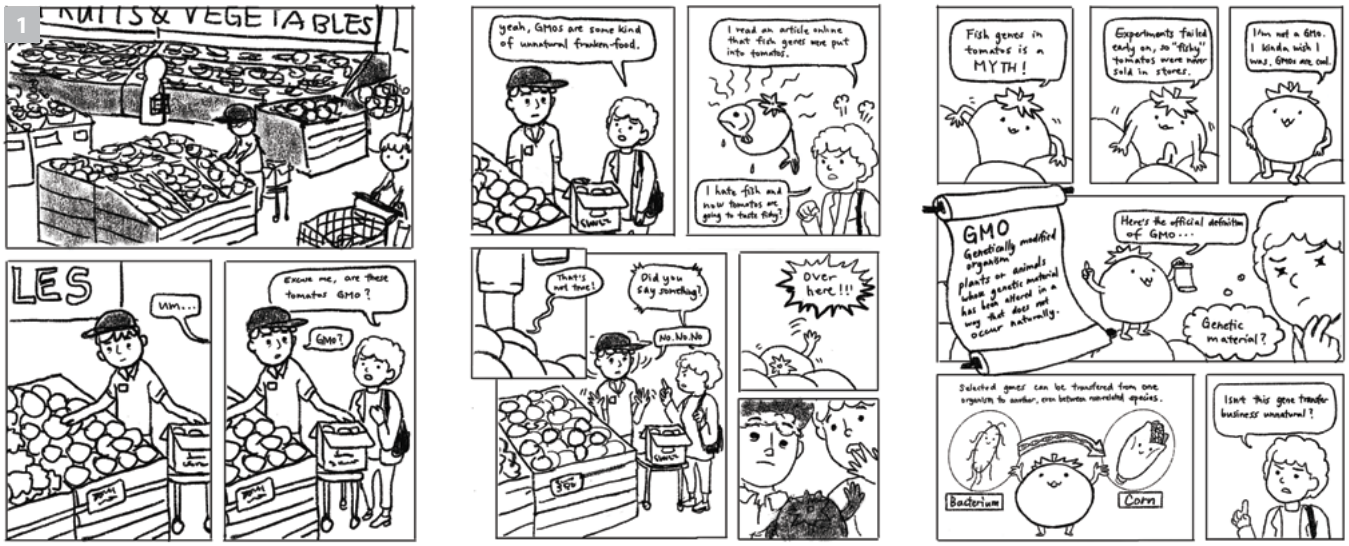
2. Final illustration. I inked the final comic in *Procreate* and colored it using digital water-color brushes. The text was then added in *Illustrator*.

3. Sketch. I made this rough draft after I wrote the script. I loosely sketched out how the panels should be divided and where the speech bubbles should be placed.

4. Study. I created these character sketches to test the digital brushes and comic styles. You can see the earlier designs of the main character, Tomas the Tomato.

5. Final illustration. I created this short comic to explain the new research on how SARS-CoV-2 infects the cell.

1



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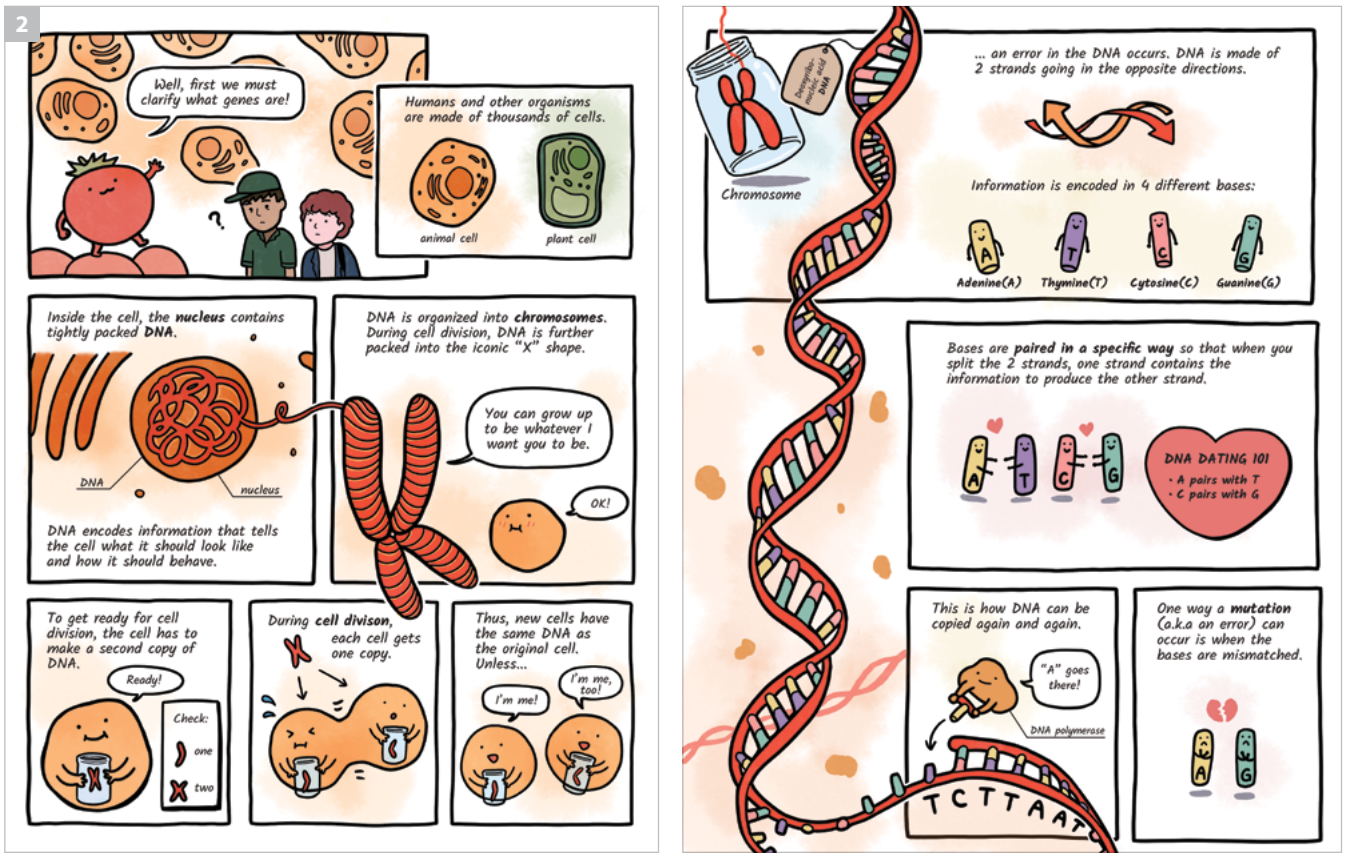

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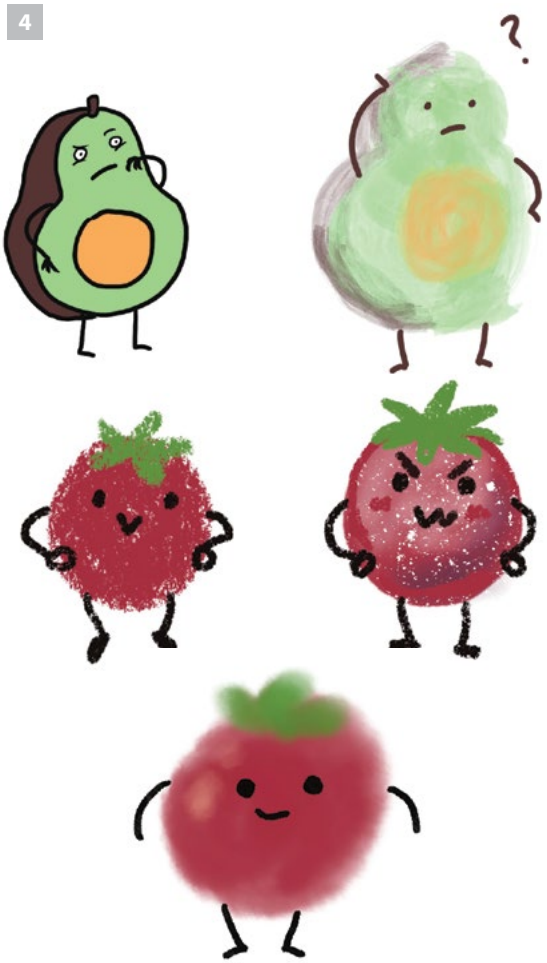

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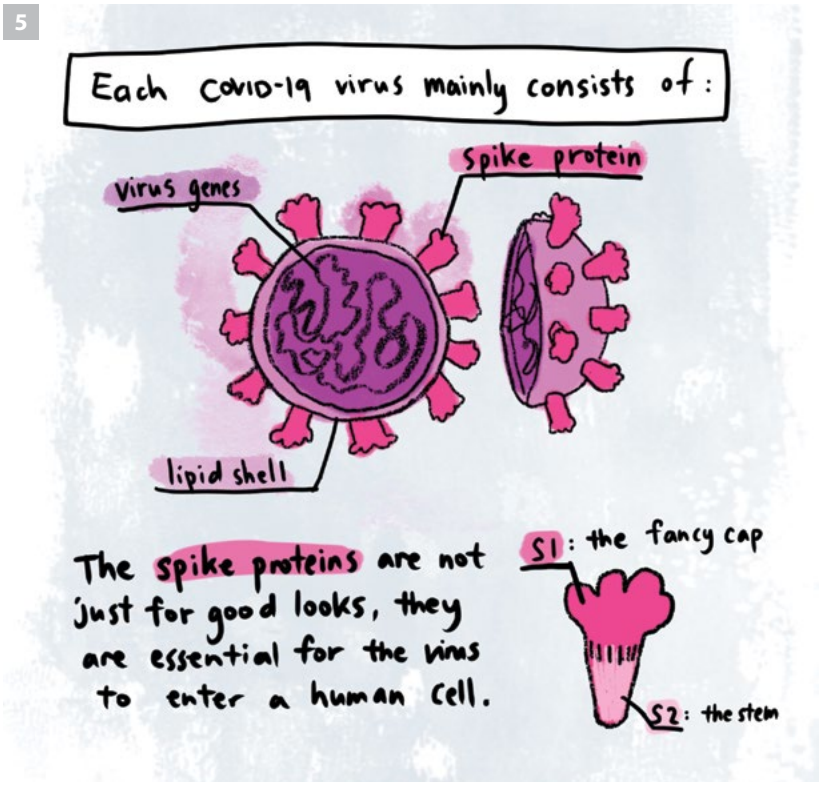
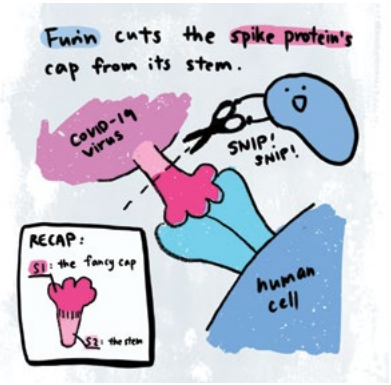
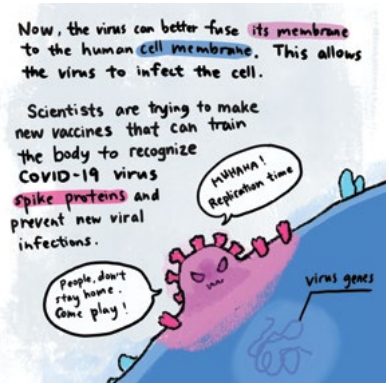
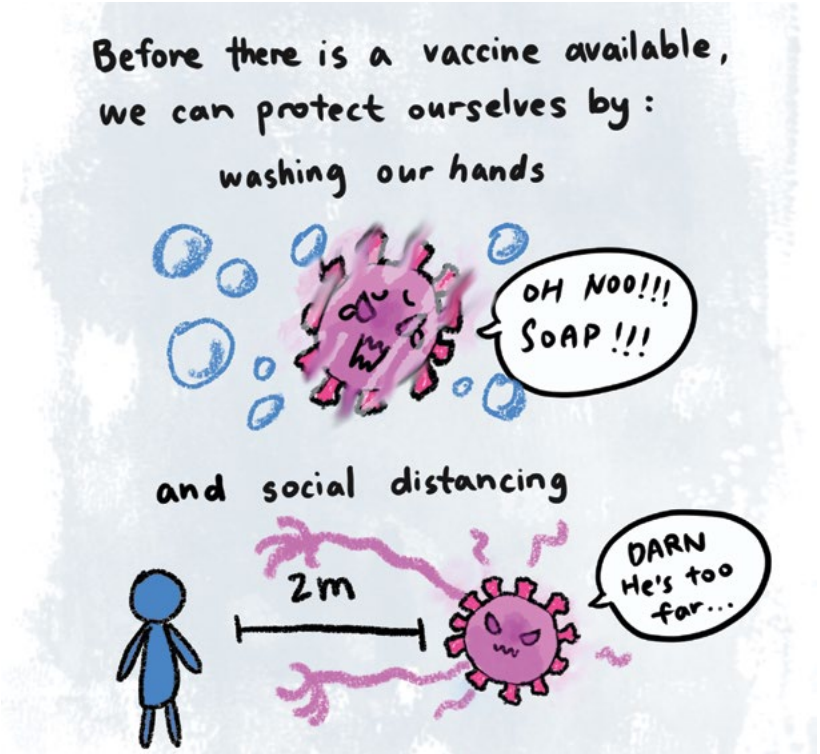

Each COVID-19 virus mainly consists of:
Virus genes
Spike protein
lipid shell
The spike proteins are not just for good looks, they are essential for the virus to enter a human cell.
S1: the fancy cap
S2: the stem


Furin cuts the spike protein's cap from its stem.
COVID-19 virus
SNIP! SNIP!
human cell
RECAP:
S1: the fancy cap
S2: the stem


Now, the virus can better fuse its membrane to the human cell membrane. This allows the virus to infect the cell.
Scientists are trying to make new vaccines that can train the body to recognize COVID-19 virus spike proteins and prevent new viral infections.
MUHAHA! Replication time
People, don't stay home. Come play!
virus genes


Before there is a vaccine available, we can protect ourselves by:
washing our hands
OH NOO!!! SOAP!!!
and social distancing
2m
DARN He's too far...

Cellular and Molecular Dynamics of Axolotl Limb Regeneration

My MRP aims to visualize the cellular dynamics and temporal sequence of axolotl (a type of salamander) limb regeneration. One main design challenge was to depict limb regeneration steps at the organismal, cellular, and molecular levels.

1. Production process. I first did a study of the axolotl limb cross-section and then created the 3D model based on the study.

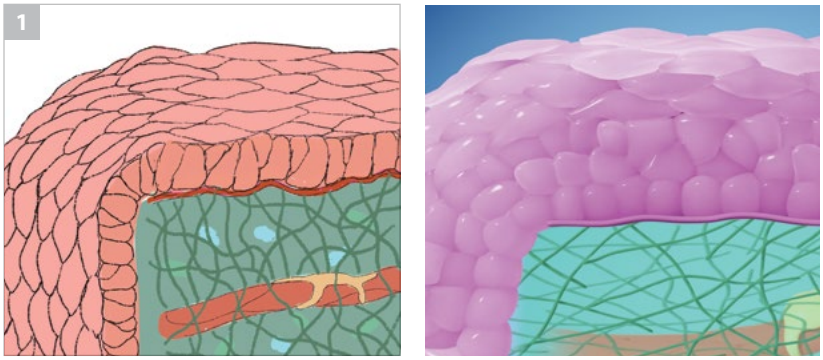
2. Production process. At the top is the storyboard for this scene. I modelled the 3D assets for this scene in *Maya* and textured them with the help of *Substance Painter*.

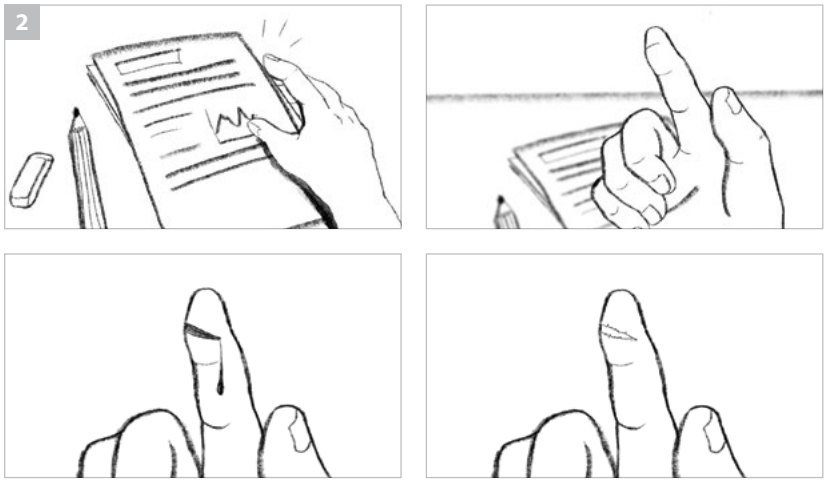
3. 3D modelling. This is the rigged 3D model of the hand in the final animation.

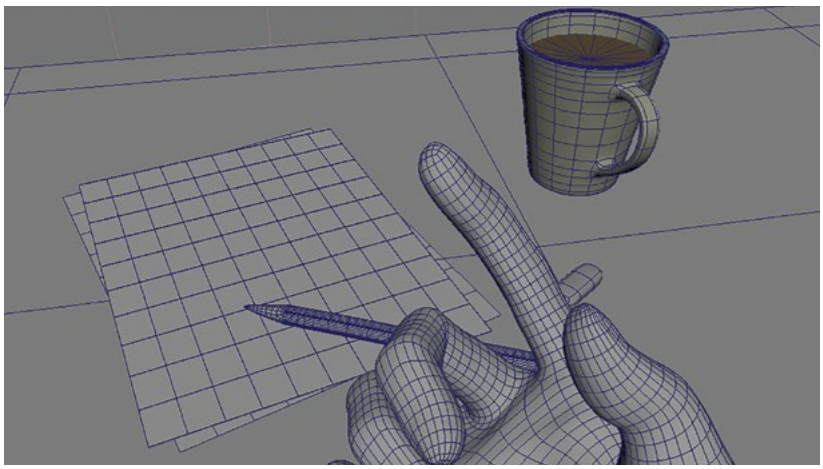
4. Storyboard. These are snippets from the storyboards. In the top three panels, axolotl limbs are shown regeneration, and in the bottom three panels, an axolotl is shown swimming.

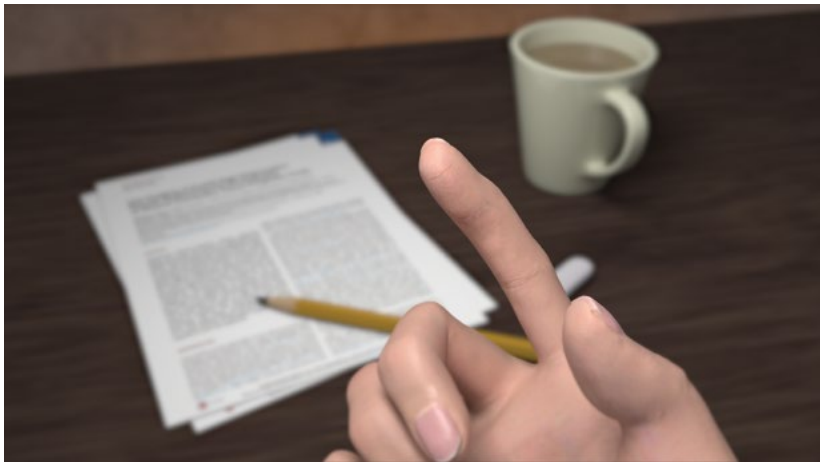
5. 3D modelling. This is the rigged 3D model of the main character, Marshy the Avxolotl. On the left is the UV map of the axolotl model that was used to paint texture.

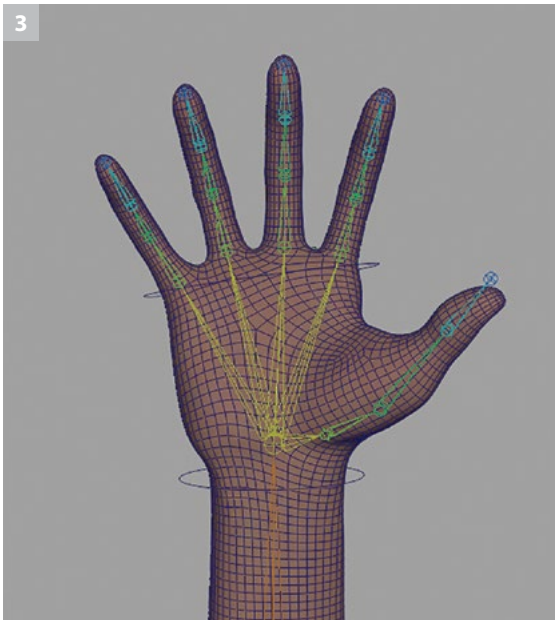
6. Final animation. Final beauty shot of the axolotl in an underwater environment. No axolotls were harmed in the making of this animation.











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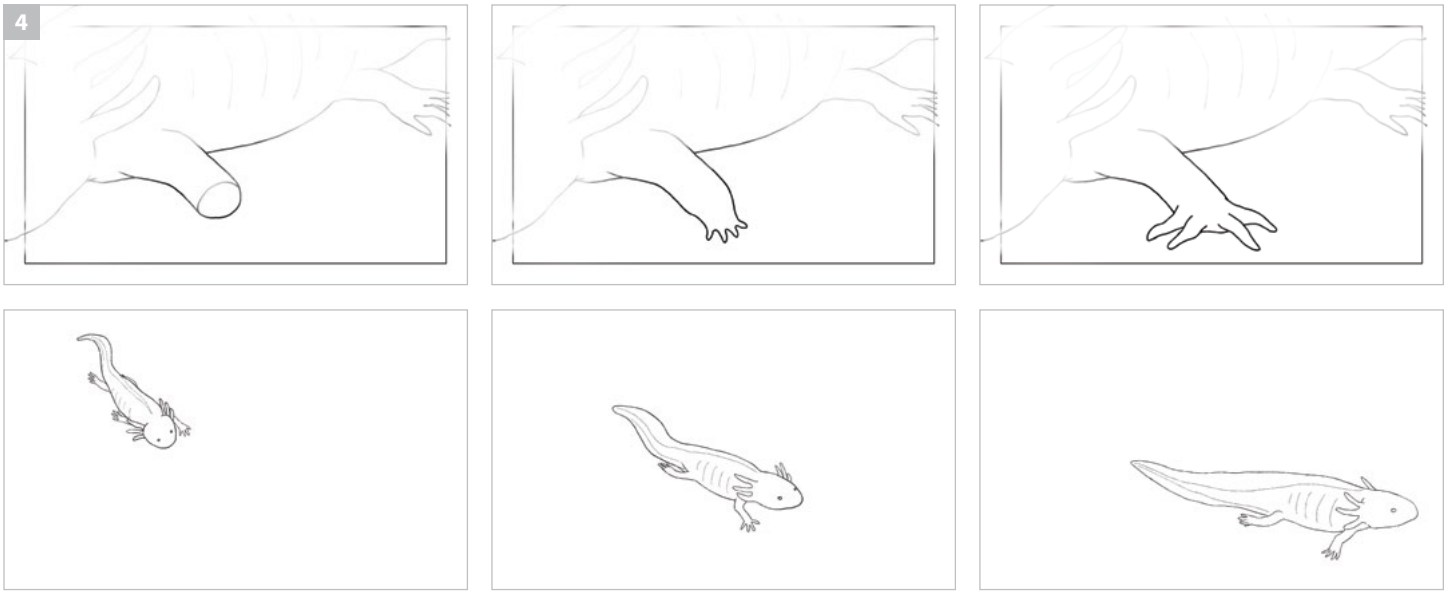

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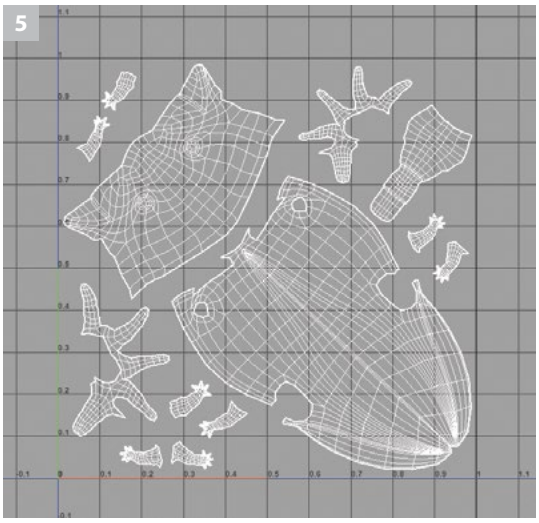
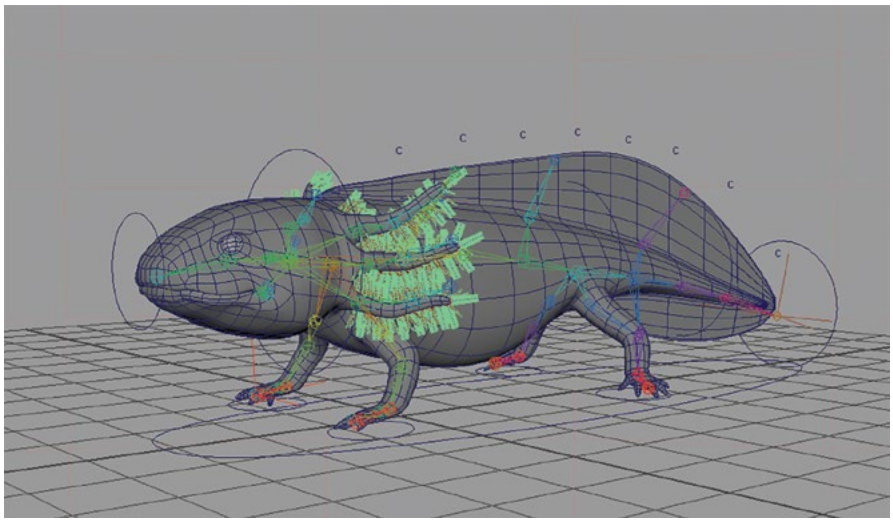




6

Deniz Kaya

I am a biomedical illustrator and animator. Prior to completing my MScBMC, I completed a BSc with Distinction in Psychology from the University of Calgary as well as classical art training with the Academy of Realist Art. My areas of interest include vertebrate anatomy, storyboarding, character animation, image segmentation, and mental health. I hope to eventually become a Certified Medical Illustrator and lead my own medical illustration studio.

Data Visualization

This was a data visualization about the causes of airplane accidents and fatalities from the past 50 years. I narrowed down my focus to three main factors: human error, weather, and mechanical failure. Weather influences human error and mechanical failure, but not vice-versa.

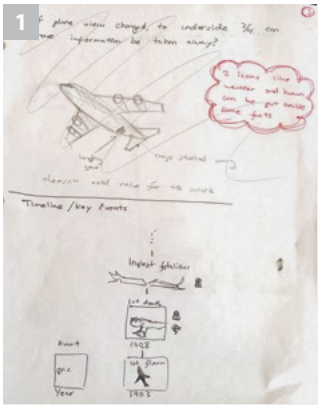
1. Sketch. These are some concept drawings I did as I researched the topic. I kept a notebook to record my thoughts and ideas.

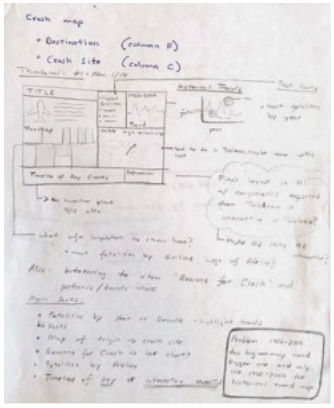
2. Production process. As you can see, my initial idea evolved into organizing graphical elements around the plane's dashboard.

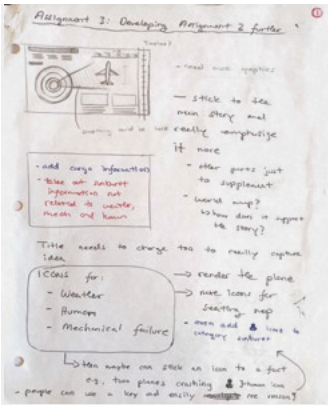
3. Final illustration. The final render features graphical elements within the cockpit of the plane. The smaller images featured show the last stages as the design was fine-tuned.

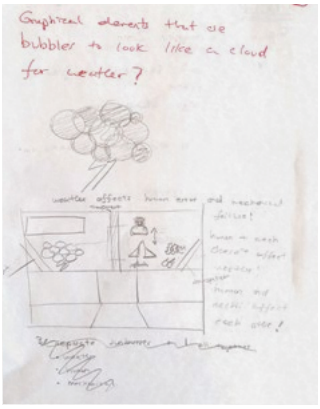
Previous spread. Final illustration. This shot from my MRP features one competitor hummingbird driving another male hummingbird away from the flowers.

1









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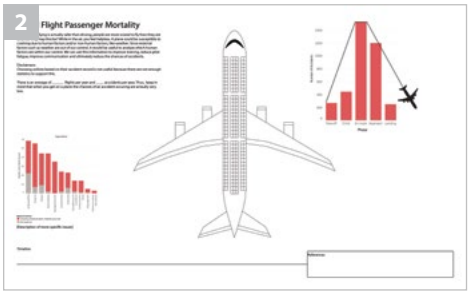

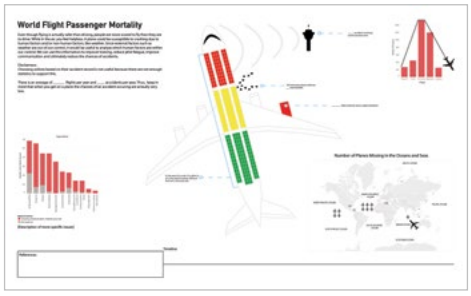

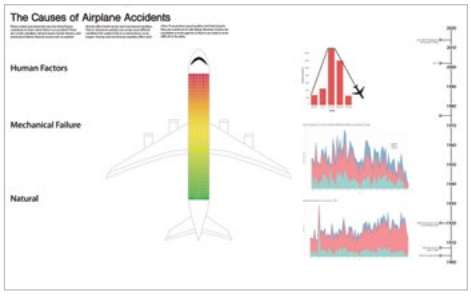

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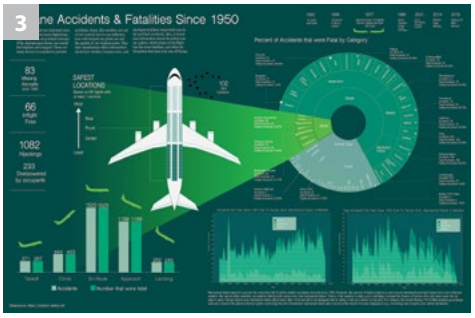

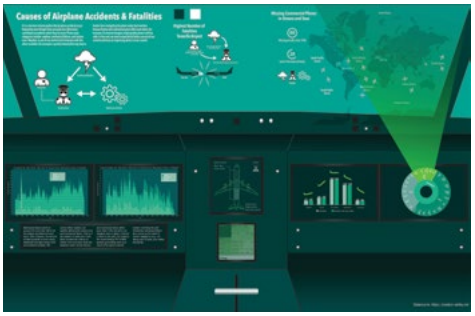

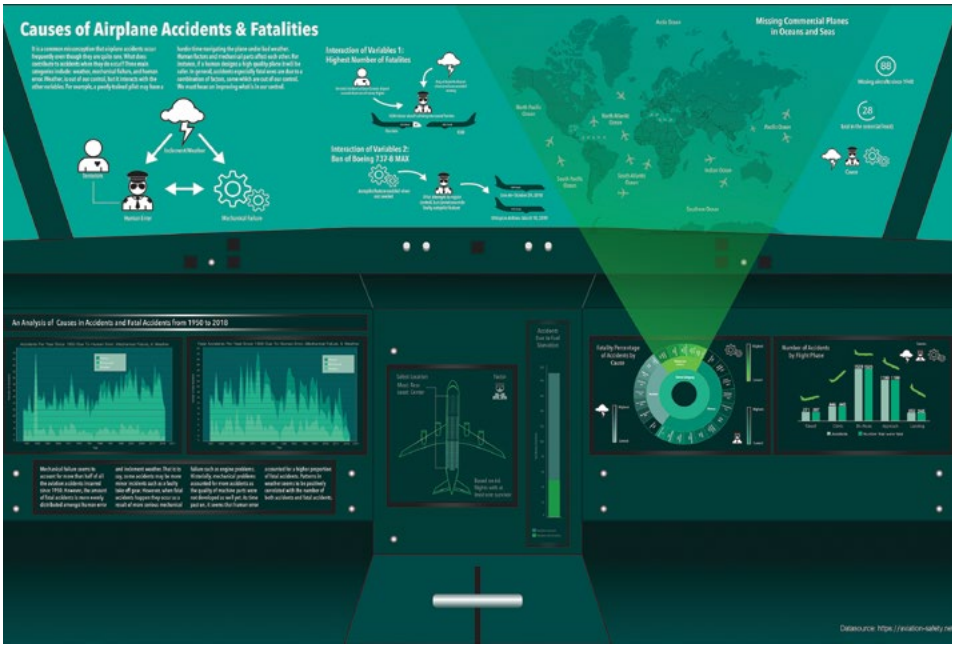

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Editorial Illustration

This editorial cover features research that uses CRISPR to cure deafness in the Beethoven gene. I replaced nucleotide base pairs with piano keys since the composer Beethoven was famous for playing the piano.

1. Sketch. These were various mock-ups of my idea before I began modelled assets in *Maya*.

2. Final illustration. This was the final output of the assignment. All elements were modelled in *Maya* and then composited in *Illustrator*.

Pathology Illustration

Ménétrier's Disease (MD) is a rare disorder of the stomach, where an overproduction of transforming growth factor-alpha causes stem cells to proliferate. This illustration guides the audience through each key step in MD's pathogenesis.

1. Notes. Since this disease begins at the cellular level, I created initial studies and notes of the gland and its cells.

2. Study. The tonal study was created in graphite to familiarize myself with the inside of the stomach. This fresh tissue study was done from a specimen in the surgical pathology lab. This is an example of an earlier draft of the piece.

3. Study. This tissue cube exercise helped me to understand how the disease progresses from cellular level to the tissue level.

4. Production process. I was able to experiment and clarify visuals through exploring numerous layouts.

5. Final illustration. After numerous iterations, this was the final output.

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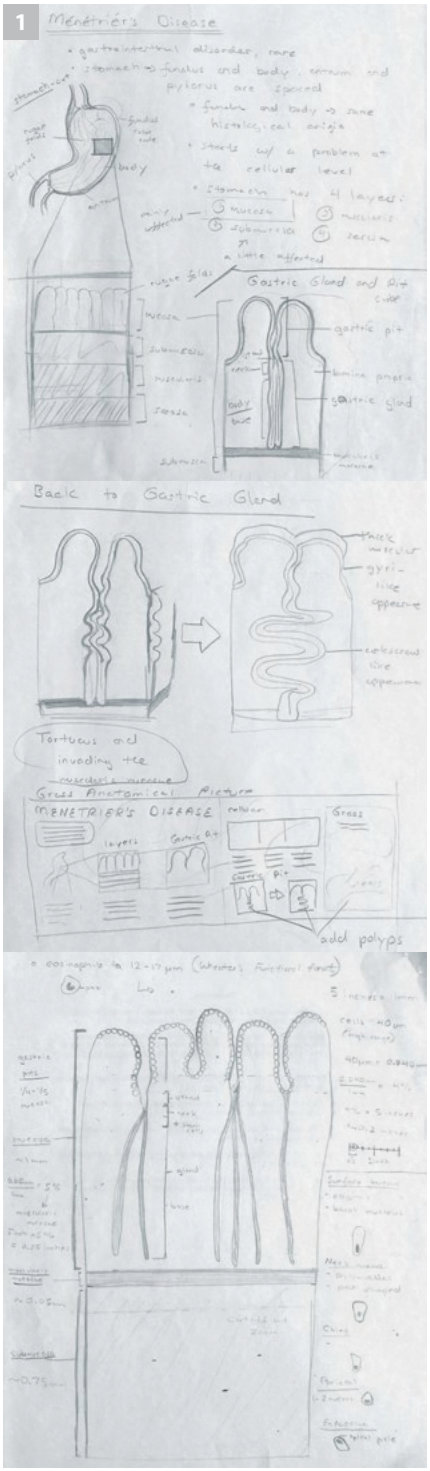

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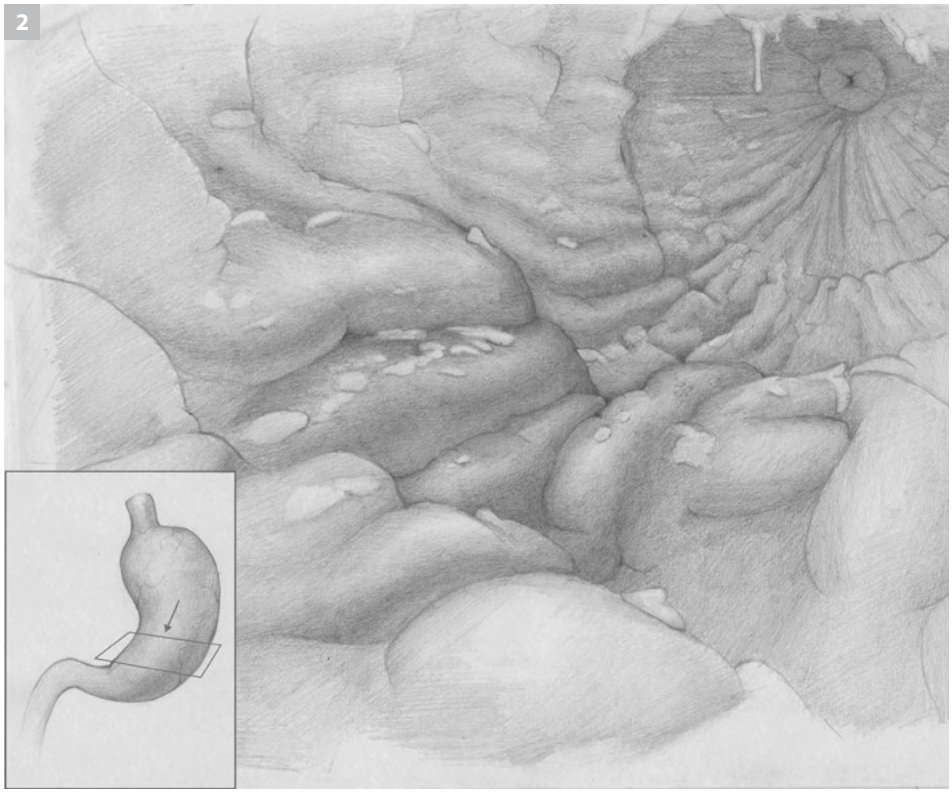
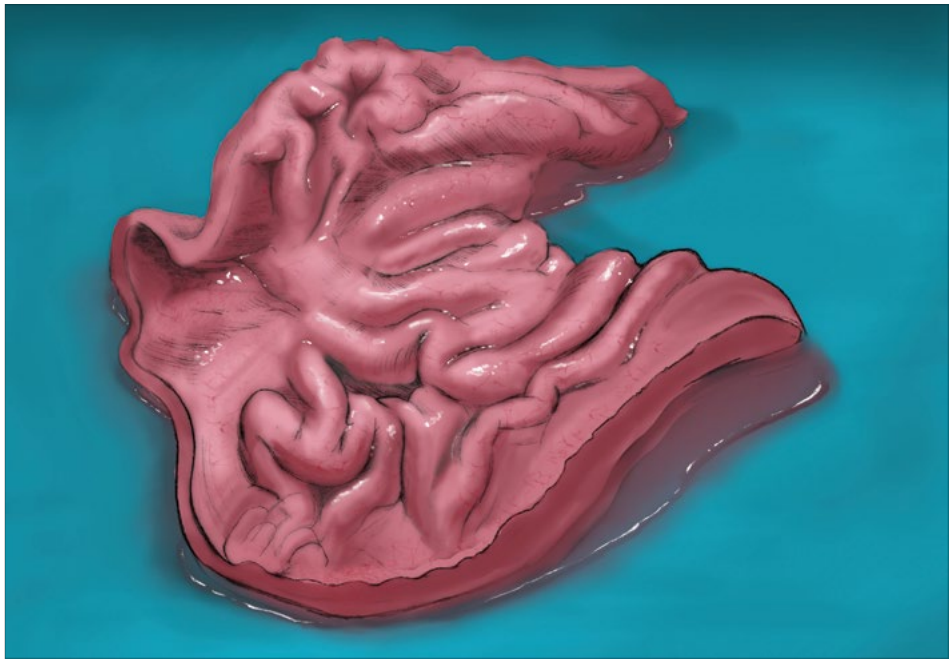
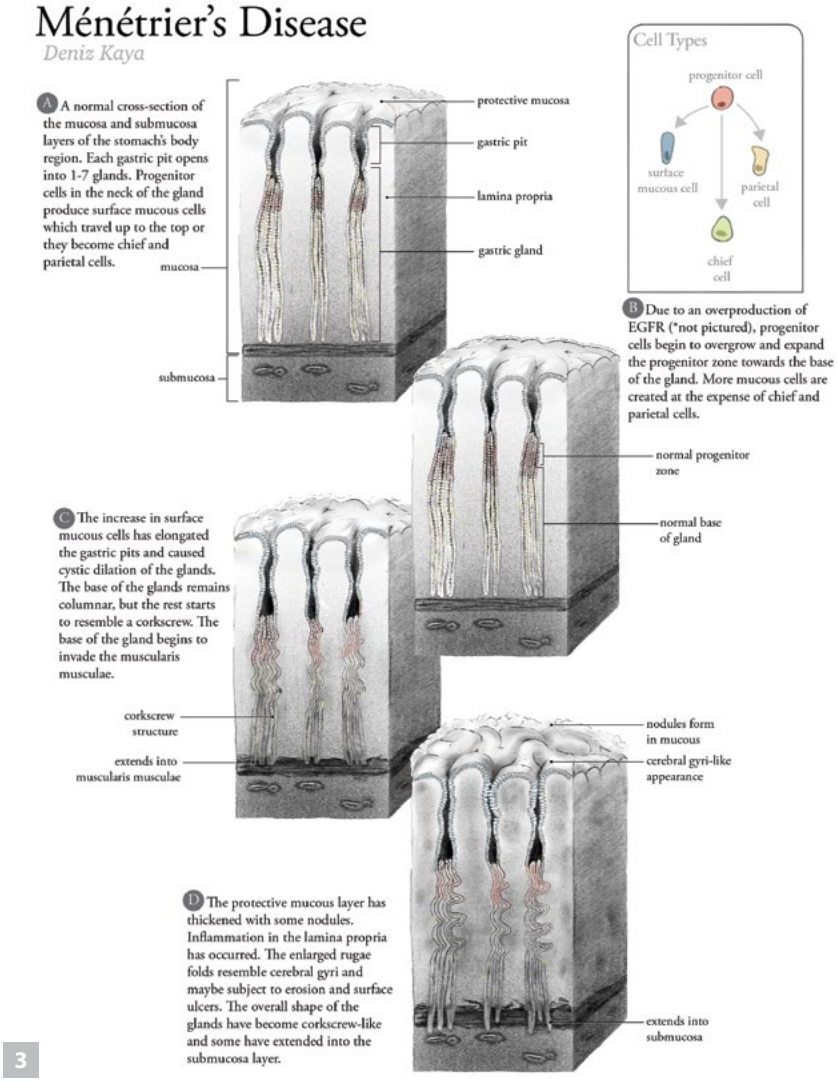
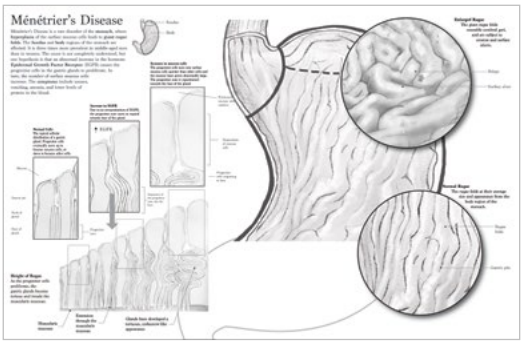
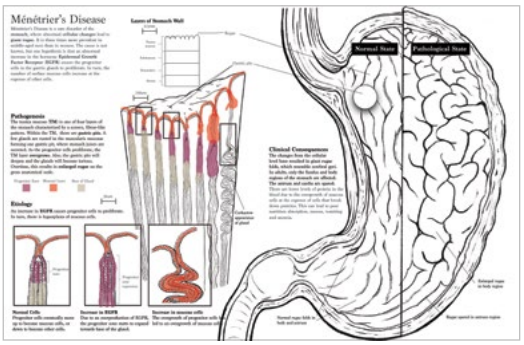


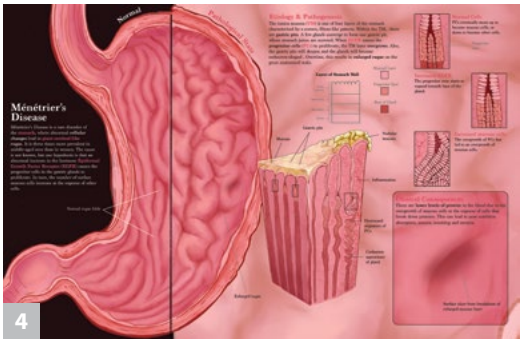



Ménétrier's Disease
Deniz Kaya
A A normal cross-section of the mucosa and submucosa layers of the stomach's body region. Each gastric pit opens into 1-7 glands. Progenitor cells in the neck of the gland produce surface mucous cells which travel up to the top or they become chief and parietal cells.
protective mucosa
gastric pit
lamina propria
gastric gland
mucosa
submucosa
Cell Types
progenitor cell
surface mucous cell
parietal cell
chief cell
B Due to an overproduction of EGFR (*not pictured), progenitor cells begin to overgrow and expand the progenitor zone towards the base of the gland. More mucous cells are created at the expense of chief and parietal cells.
normal progenitor zone
normal base of gland
C The increase in surface mucous cells has elongated the gastric pits and caused cystic dilation of the glands. The base of the glands remains columnar, but the rest starts to resemble a corkscrew. The base of the gland begins to invade the muscularis musculae.
corkscrew structure
extends into muscularis musculae
nodules form in mucous
cerebral gyri-like appearance
D The protective mucous layer has thickened with some nodules. Inflammation in the lamina propria has occurred. The enlarged rugae folds resemble cerebral gyri and maybe subject to erosion and surface ulcers. The overall shape of the glands have become corkscrew-like and some have extended into the submucosa layer.
extends into submucosa

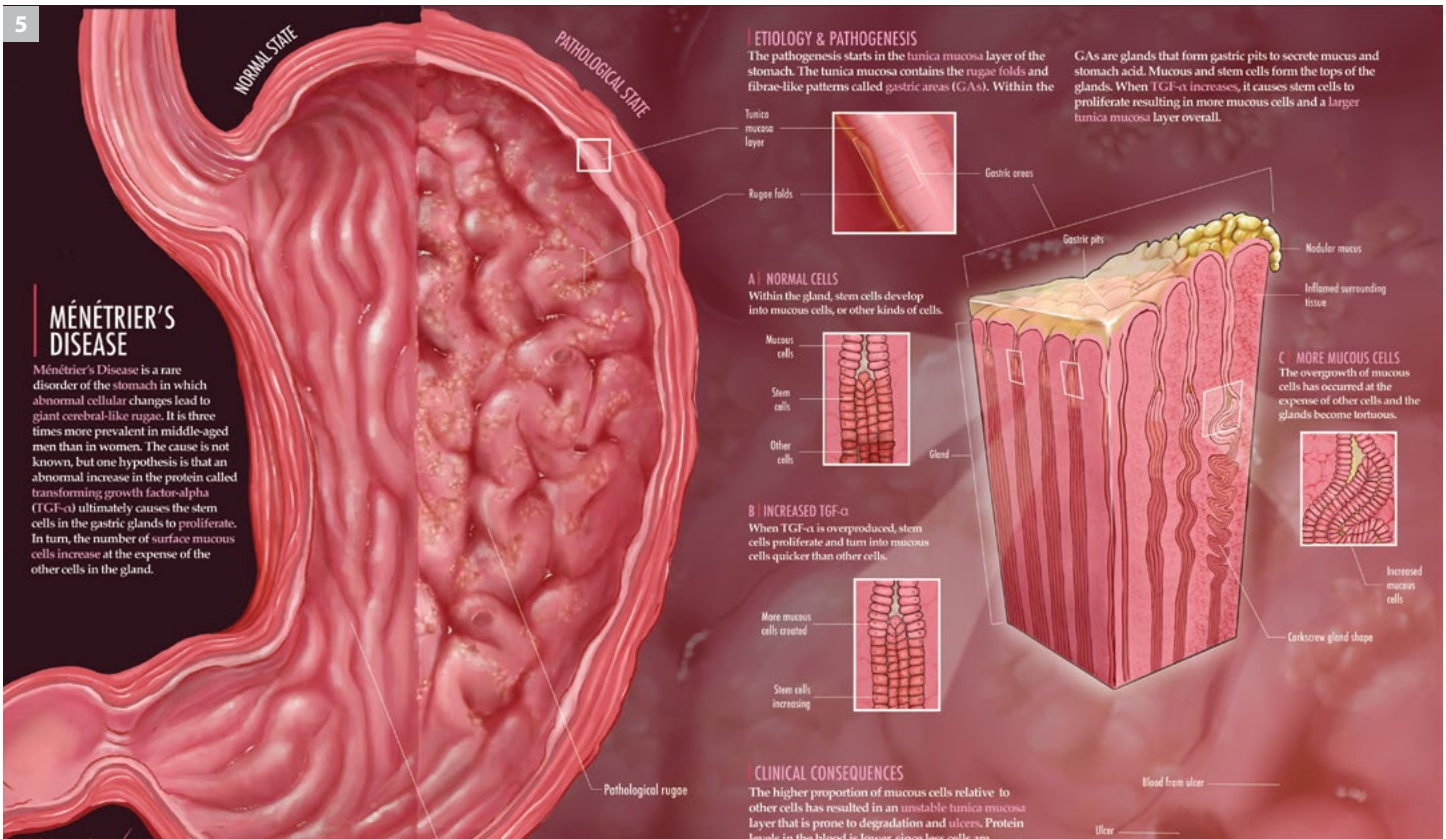
3


Ménétrier's Disease


Ménétrier's Disease
Normal State
Pathological State


Ménétrier's Disease

4


NORMAL STATE
PATHOLOGICAL STATE
MÉNÉTRIER'S DISEASE
Ménétrier's Disease is a rare disorder of the stomach in which abnormal cellular changes lead to giant cerebral-like rugae. It is three times more prevalent in middle-aged men than in women. The cause is not known, but one hypothesis is that an abnormal increase in the protein called transforming growth factor-alpha (TGF-α) ultimately causes the stem cells in the gastric glands to proliferate. In turn, the number of surface mucous cells increase at the expense of the other cells in the gland.
ETIOLOGY & PATHOGENESIS
The pathogenesis starts in the tunica mucosa layer of the stomach. The tunica mucosa contains the rugae folds and fibrae-like patterns called gastric areas (GAs). Within the GAs are glands that form gastric pits to secrete mucus and stomach acid. Mucous and stem cells form the tops of the glands. When TGF-α increases, it causes stem cells to proliferate resulting in more mucous cells and a larger tunica mucosa layer overall.
Tunica mucosa layer
Rugae folds
Gastric areas
Gastric pits
Nodular mucus
Inflamed surrounding tissue
A NORMAL CELLS
Within the gland, stem cells develop into mucous cells, or other kinds of cells.
Mucous cells
Stem cells
Other cells
Gland
B INCREASED TGF-α
When TGF-α is overproduced, stem cells proliferate and turn into mucous cells quicker than other cells.
More mucous cells created
Stem cells increasing
C MORE MUCOUS CELLS
The overgrowth of mucous cells has occurred at the expense of other cells and the glands become tortuous.
Increased mucous cells
Corkscrew gland shape
Pathological rugae
CLINICAL CONSEQUENCES
The higher proportion of mucous cells relative to other cells has resulted in an unstable tunica mucosa layer that is prone to degradation and ulcers. Protein
Blood from ulcer
Ulcer

5

The Versatility of Torpor-Use in Ruby-throated Hummingbirds

My MRP was a hybrid animation on the role of torpor-use in Ruby-throated hummingbirds. The 2D portion visualized scientific concepts while the 3D portion acted as a palette cleanser before new topics were introduced. I used a visual motif of "energy circles" to show fat reserves as well as representing torpor.

1. Sketch. I sketched designs for the main states of the 2D bird to be used as a reference in both *Illustrator* and *After Effects*.

2. Sketch. I designed this trumpet vine set in *Savage Procreate* to explore colour and mood for the model in *Maya*.

3. Storyboard. Here are some examples of storyboards I created. This traditional, hand-drawn method allowed me to see all the storyboards laid out at once, as I could fill in gaps and smooth out transitions.

4. 3D modelling. This was the most challenging process of the animation pipeline. I set up a rig for each feather and tied it to the main body. FK controls, MEL scripts, connection editors, trax editors, constraint blenders, and utility nodes were used.

5. Final animation. These are final animation stills.

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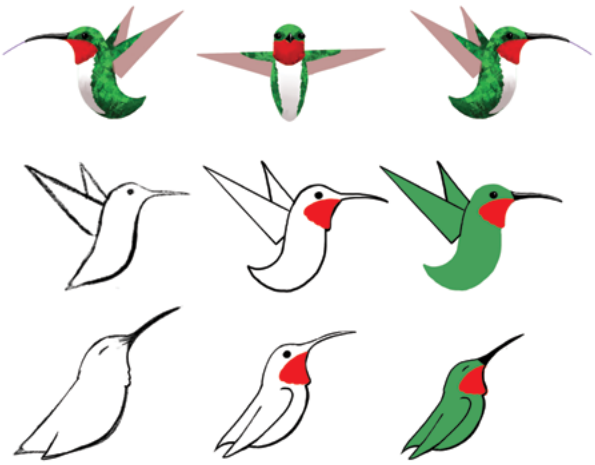

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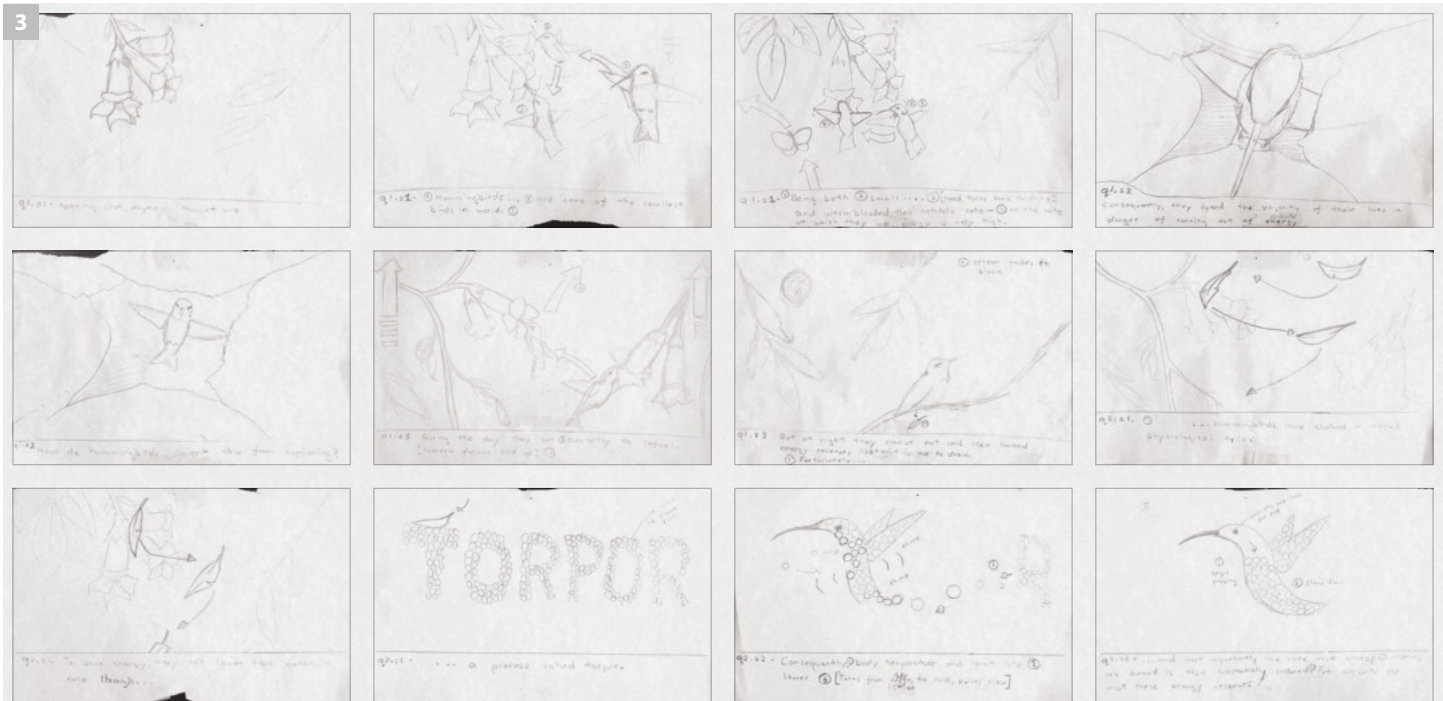

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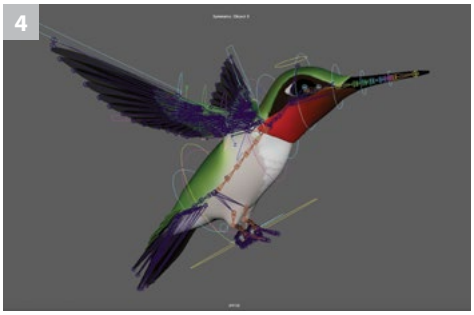

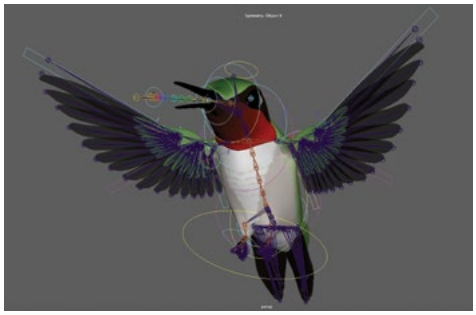

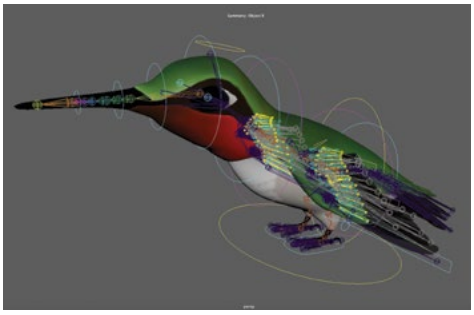

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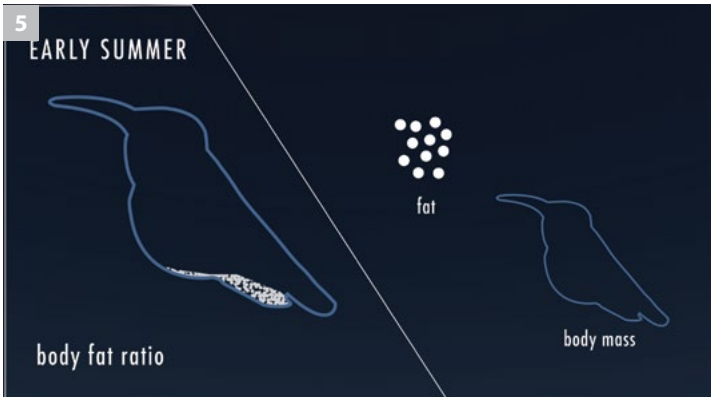
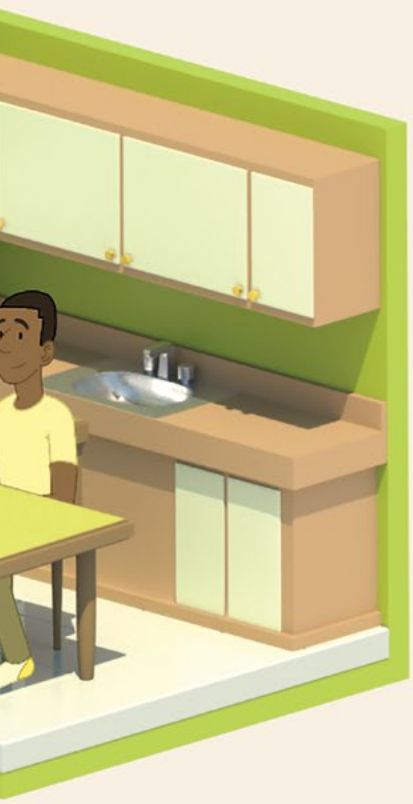




Emily Taylor

My time at MScBMC allowed me to explore many different styles and mediums that are all encompassed within the field of biomedical communications. Included in these next few pages are some of my favourite pieces that I created. I am most compelled by projects where I can use 2D and 3D storytelling to introduce the audience to new topics. Stylistically, I am happiest when I can convey information using toon-style or clean, simple graphics.

Pathological Illustration

This mock 2-page spread introduces the condition endometriosis. The target audience would be an engaged general public. A personal goal of this piece was to avoid using gendered language when talking about the condition.

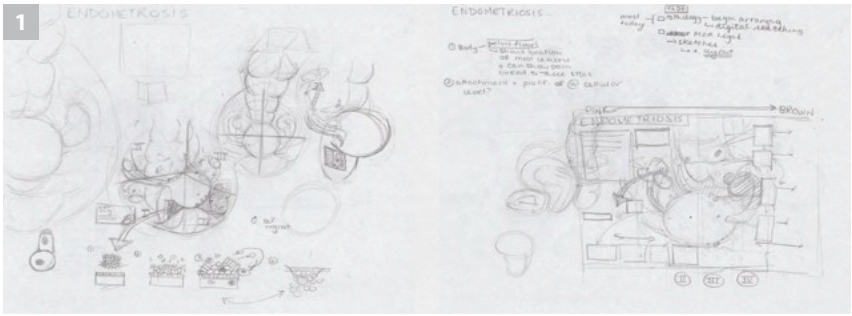
1. Notes. These are rough visual notes and ideas about how I wanted to represent the anatomical scale of the pathology. I also created a 3D maquette which I used to better understand the form of the structure.

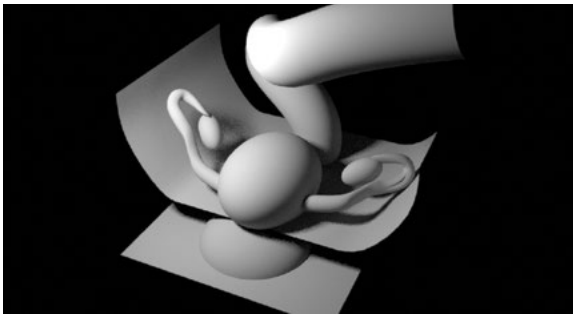
2. Study. This tissue landscape shows the endometrium of the uterus shedding.

3. Final illustration. Here is a first draft of the layout and final piece. Many of the elements were included in the final piece but arranged or represented differently.

Previous spread. Final animation. A still from my Master's Research Project which explores sex and gender's impact on traumatic brain injury.

1





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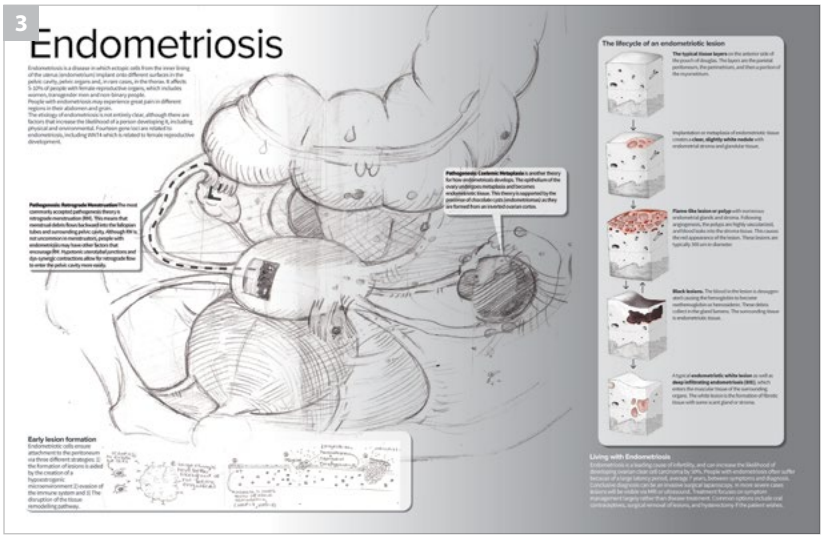

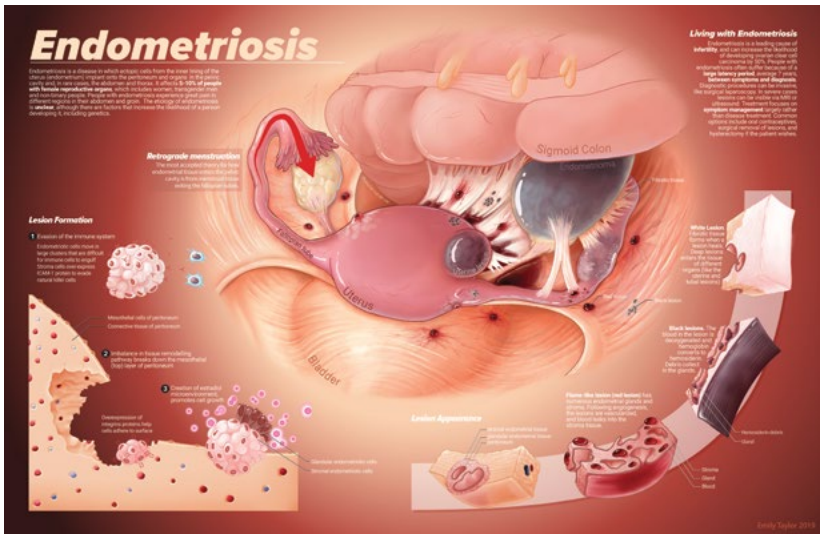

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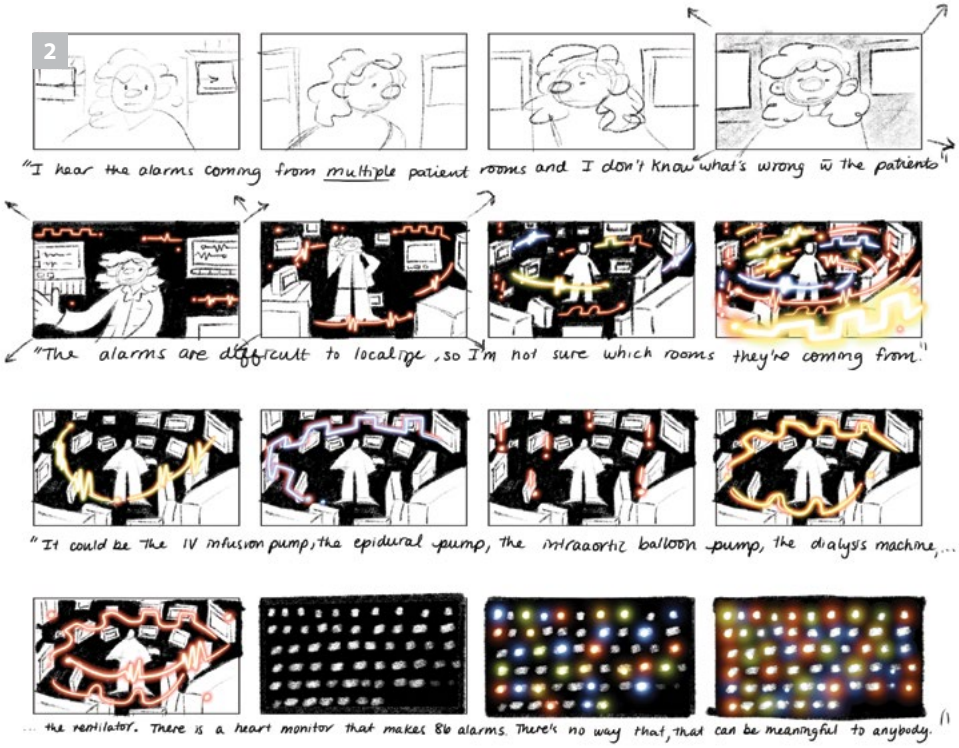

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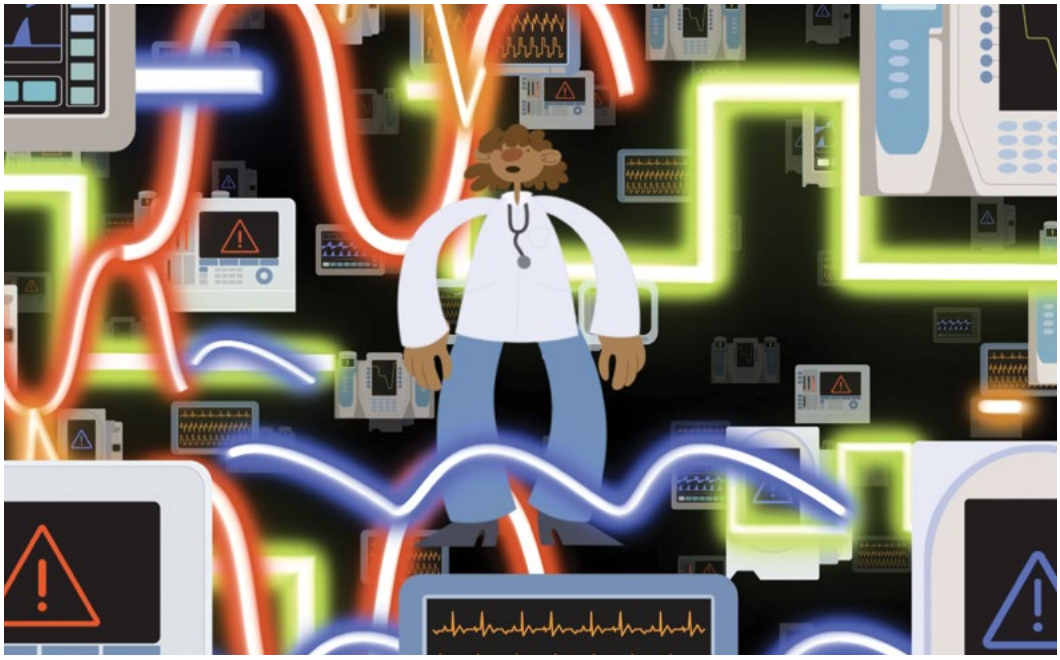


Scientific Animation

This short animation visualizes dialogue from a clip of the 99% Invisible Podcast. It explores hospital noise and its effects on patients and their providers. This project was done with Taeah Kim, Farah Hamade, and Sabrina Cappelli.

1. Study. Character design was done in a group session where we all explored different styles. Here is the character that was included during my section of the animation.

2. Storyboard. Here is a rough storyboard of the final sequence. Certain elements didn't make the final animation, mainly how the monitors curved around the character.

3. Animatic. These stills are from the more refined animatic. The animatic was used to assess the timing of the visuals with the narration. The larger image is how these ideas materialized in the final piece.

Emily Taylor

Graphic Medicine

My comic, Vulgaris, is a pathography of my own experience with acne. Pathographies can be used to teach an audience about a topic in medicine, while also humanizing and adding context to the experience. The goal of this piece was to educate and entertain a lay audience, while resonating with people who have shared the experience.

1. Study. These images are taken from an early ideation phase. I was experimenting with both the character and style that the piece would have. I also picked the outfit I would wear if I was a cartoon. What fun.

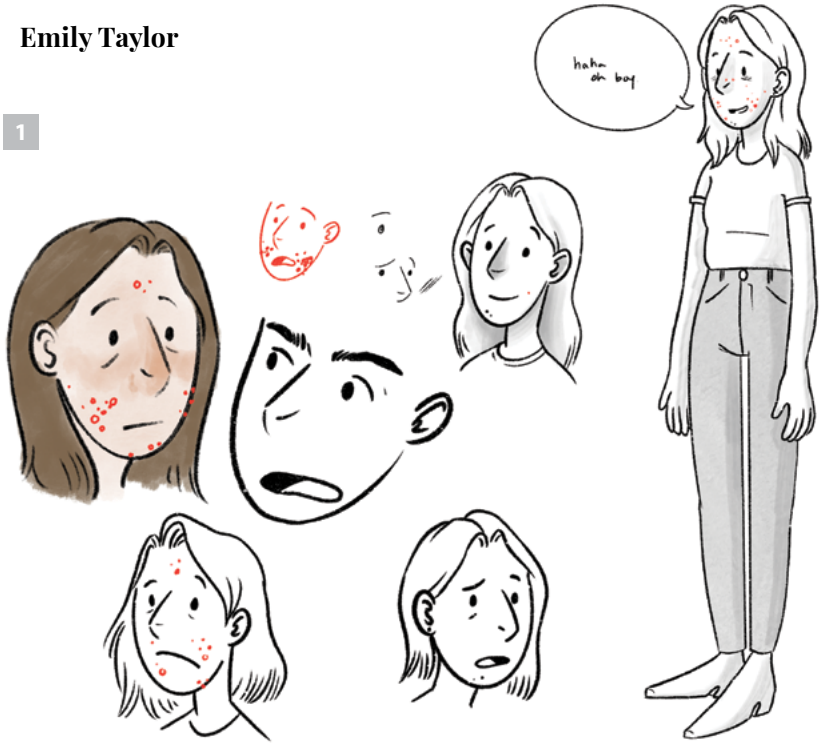
2. Storyboard. This was the approach I used to figure out the structure of the story. Pages were moved and rearranged as needed to improve the overall flow.

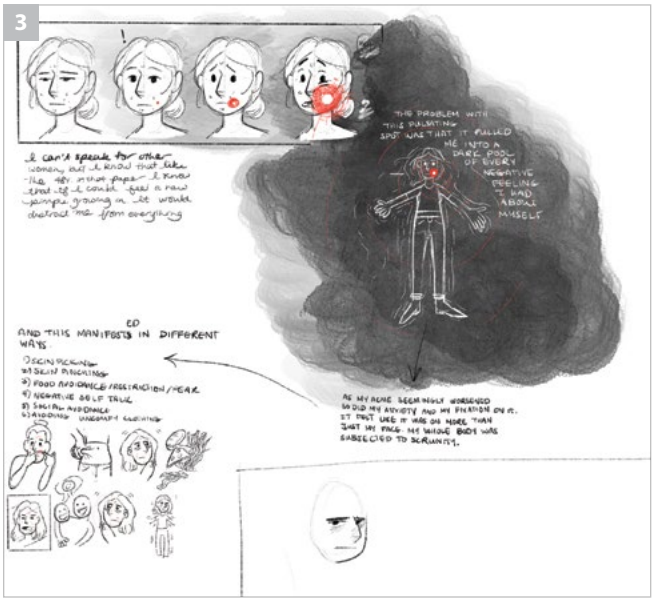
3. Storyboard. Here you can see two different phases of thumbnailing. The first was more stream of conscious as I established the story. The second is a more refined thumbnail that was a guide for the final page.

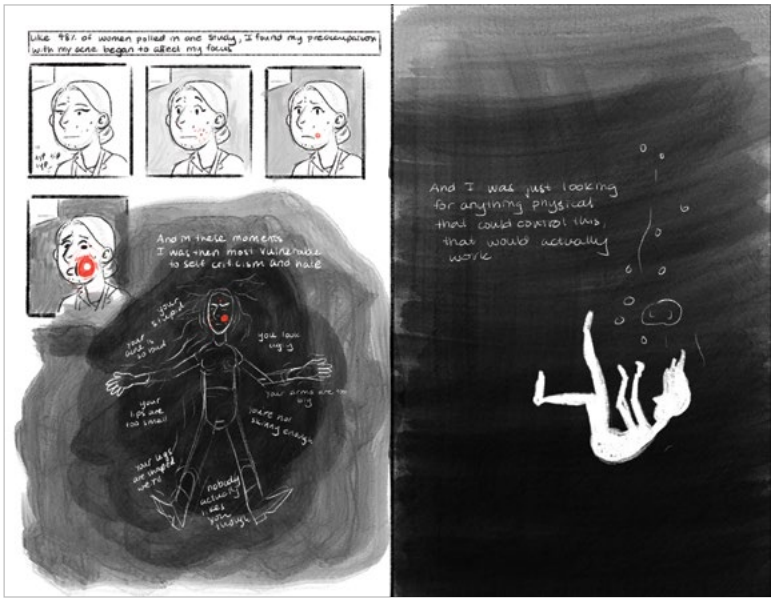
4. Final illustration. A final two-page spread from the completed comic.

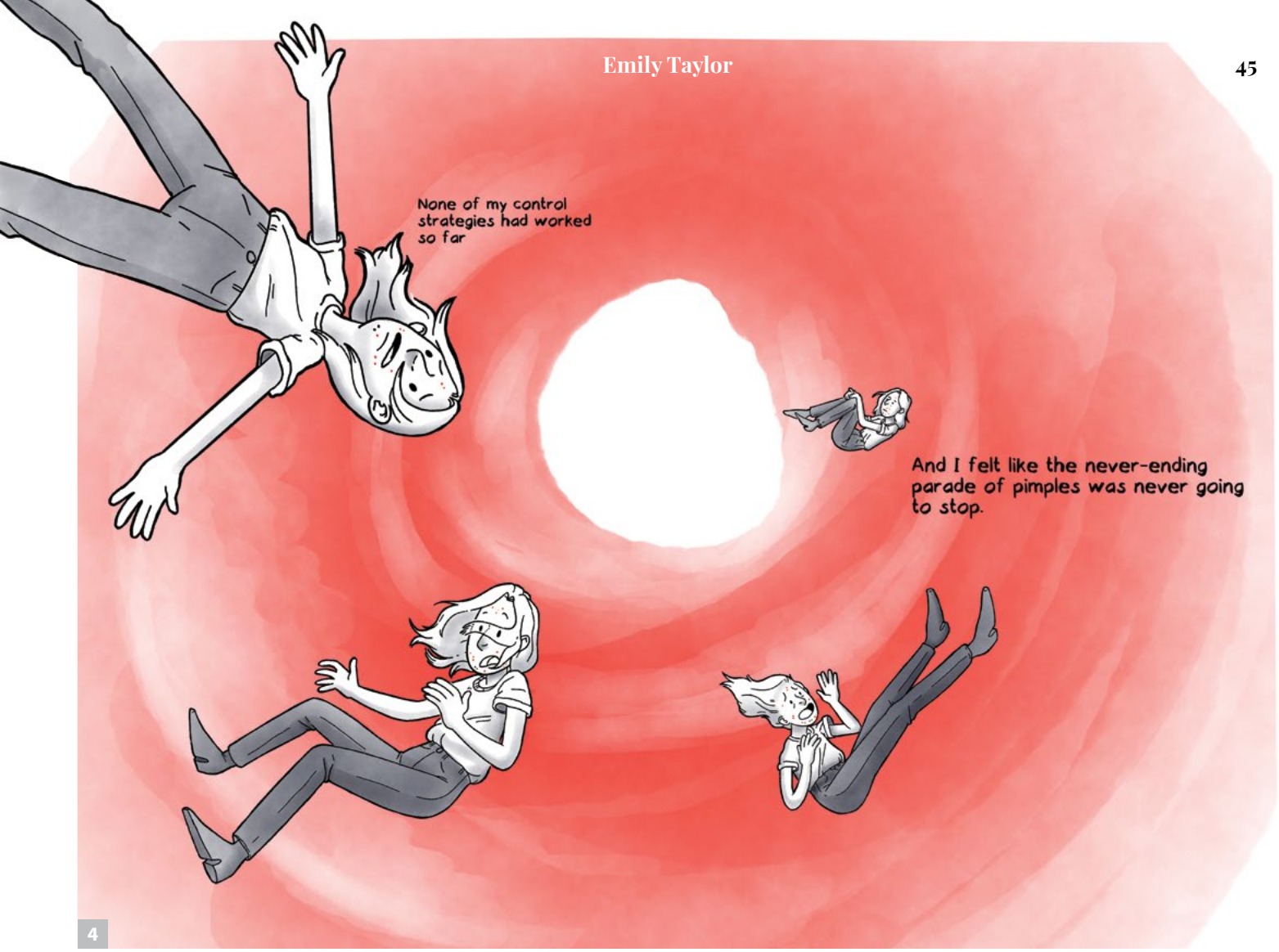
5. Storyboard. These three stills show some of the thumbnailing that resulted in the final spread shown in Figure 4.

6. Sketch. Extras from the ideation phase that didn't make it into the final work.







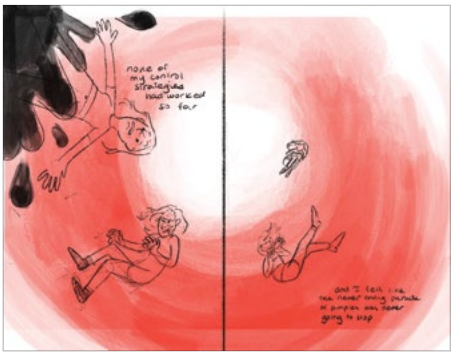

None of my control strategies had worked so far
And I felt like the never-ending parade of pimples was never going to stop.

4


So you can imagine my surprise at age 25 when suddenly...

5


none of my control strategies had worked so far


none of my control strategies had worked so far

6


Stories to tell about acne
What having conversations with acne feels like
yeah I'll have a medium black pls
sounds good
They think I am disgusting I mean right
I know you think my skin is bad. I'm sure you winced when you saw me
hey!! we're out today
Anyway! Nice to meet you
hope to talk soon
I think that went well!!!

The Role of Sex and Gender in TBI

Traumatic Brain Injury (TBI) is a common and complex disease process. A person's sex and gender can affect their experience with TBI. Sex and gender are complex, fluid, and changing, so I wanted to be careful to capture that. I used characters to engage the audience. The final medium was a combination of 2D and 3D animation.

1. Storyboard. Stills from various stages of storyboarding. These include visuals from earlier versions of the script which were later cut.

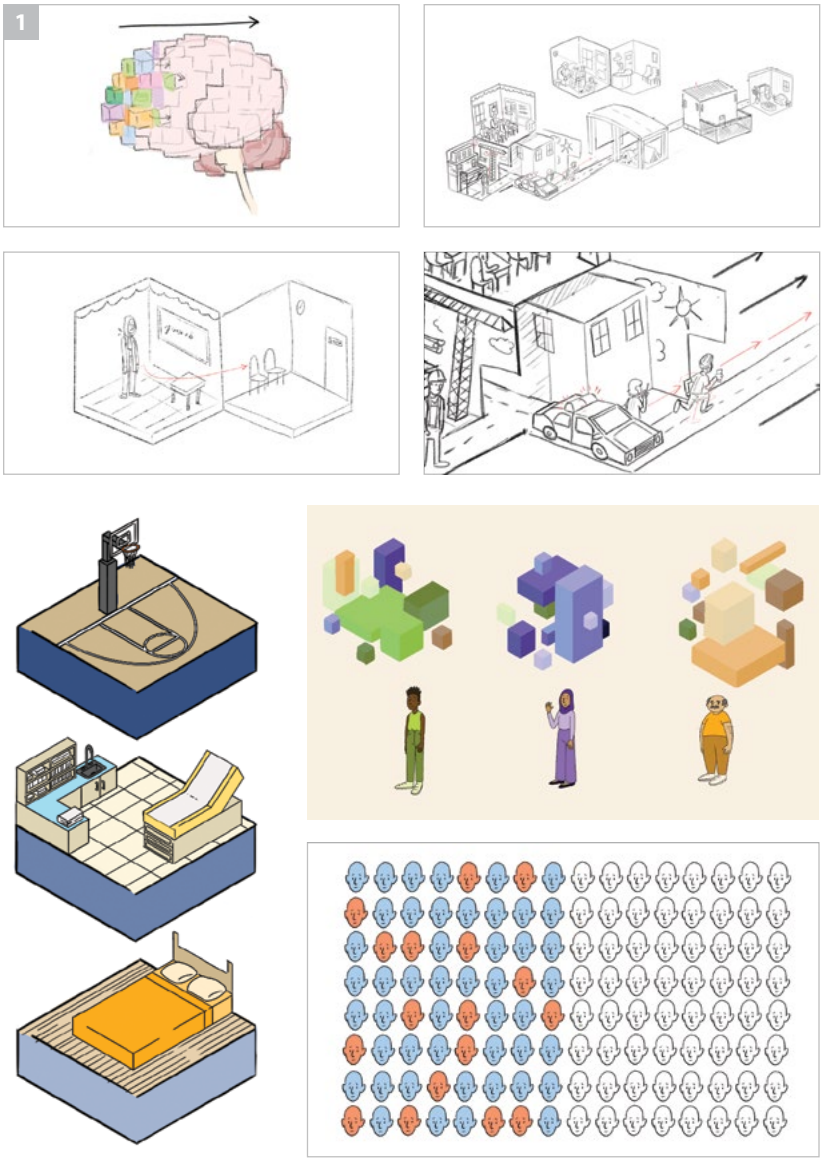
2. Notes. This is how most of my rough work looks. It is a combination of visual ideation as well as jot notes.

3. Production process. A comparison of how a rough storyboard might look compared to the final frames of the animation.

4. Final animation. Animation stills show the brain being engulfed by cubes. These were used throughout the animation to represent factors contributing to TBI and recovery.

5. Final animation. Some selected stills from the final animation. I feel these best capture the style of the piece as well as how I integrated 2D and 3D elements.

1



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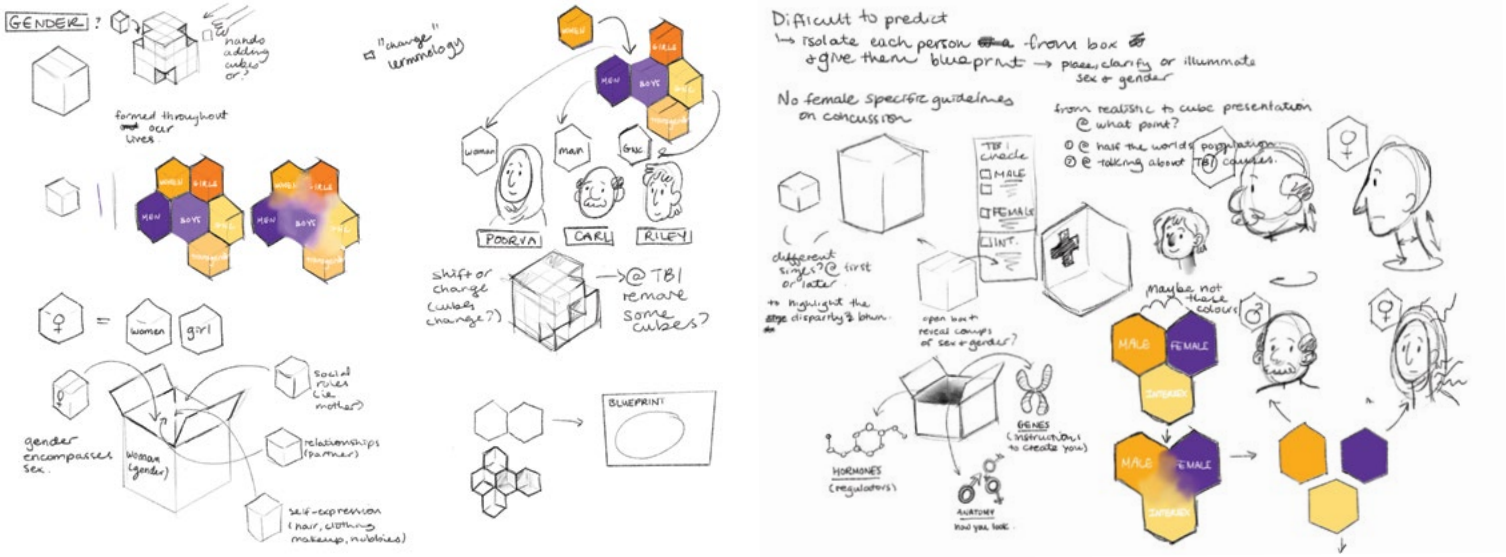

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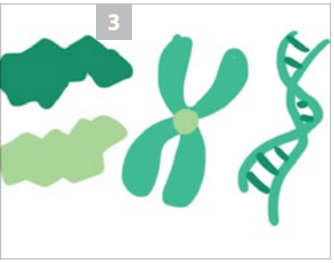



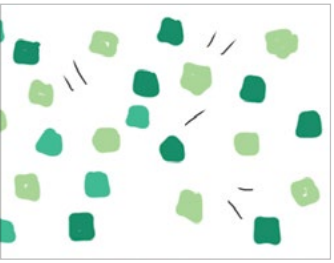


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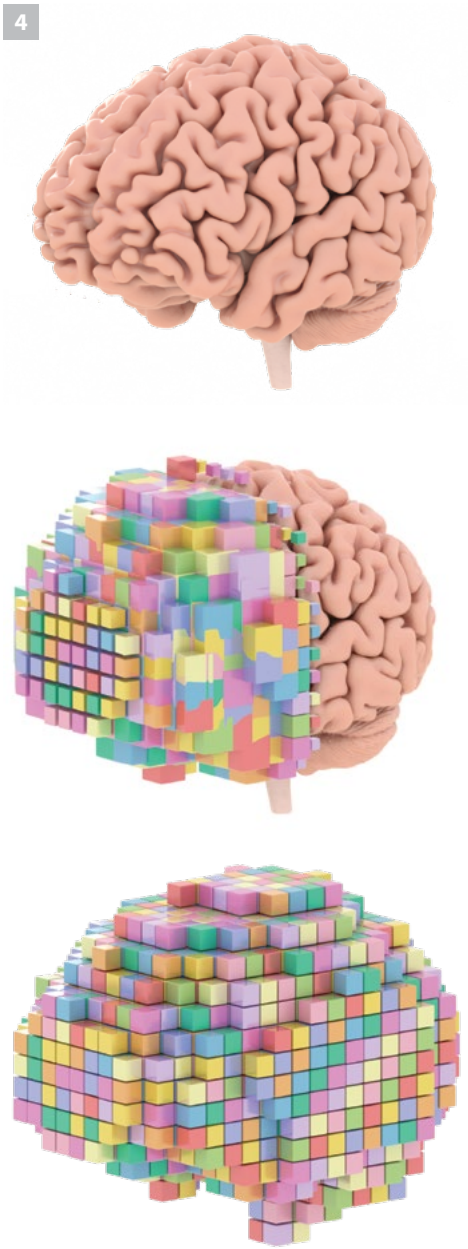
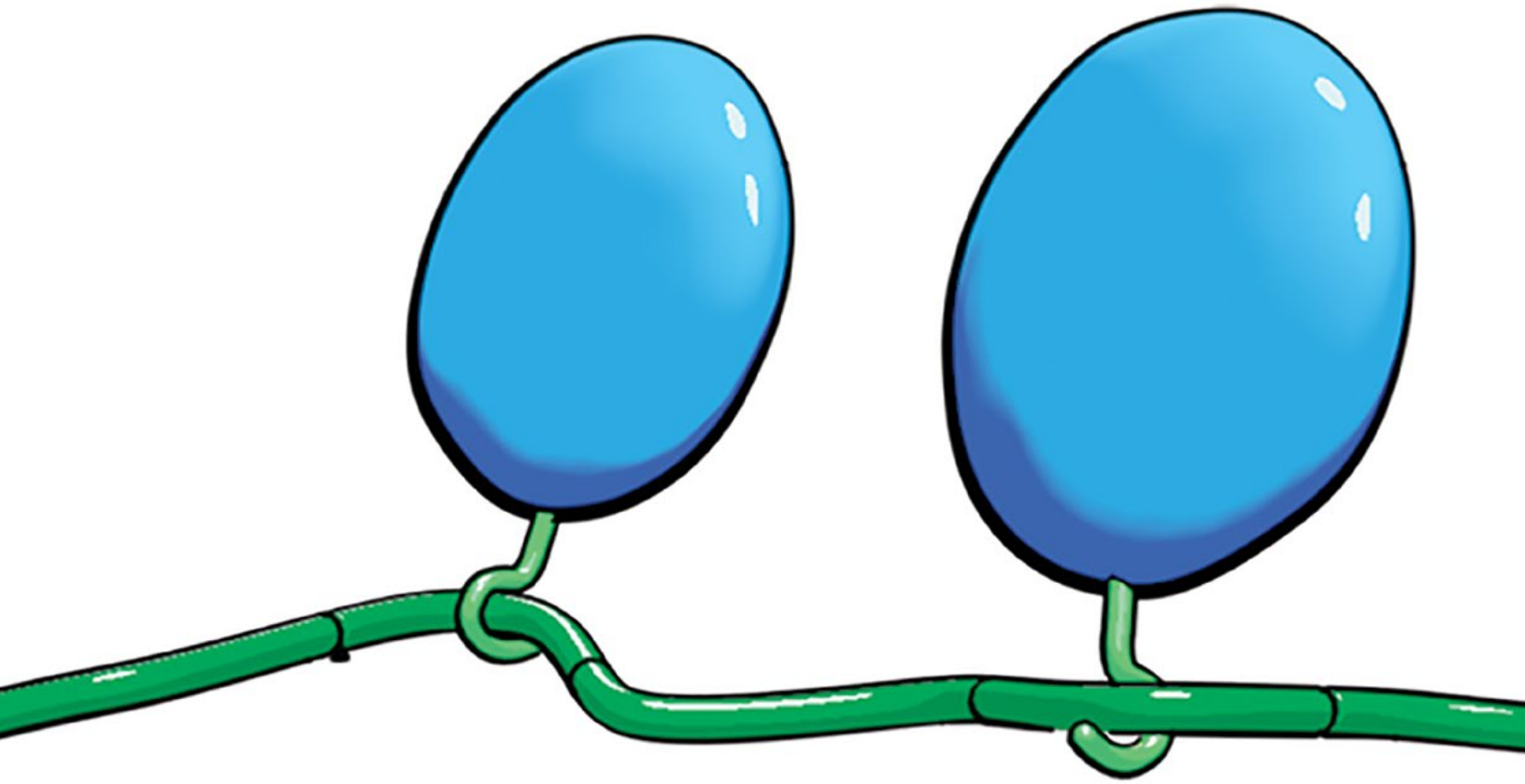
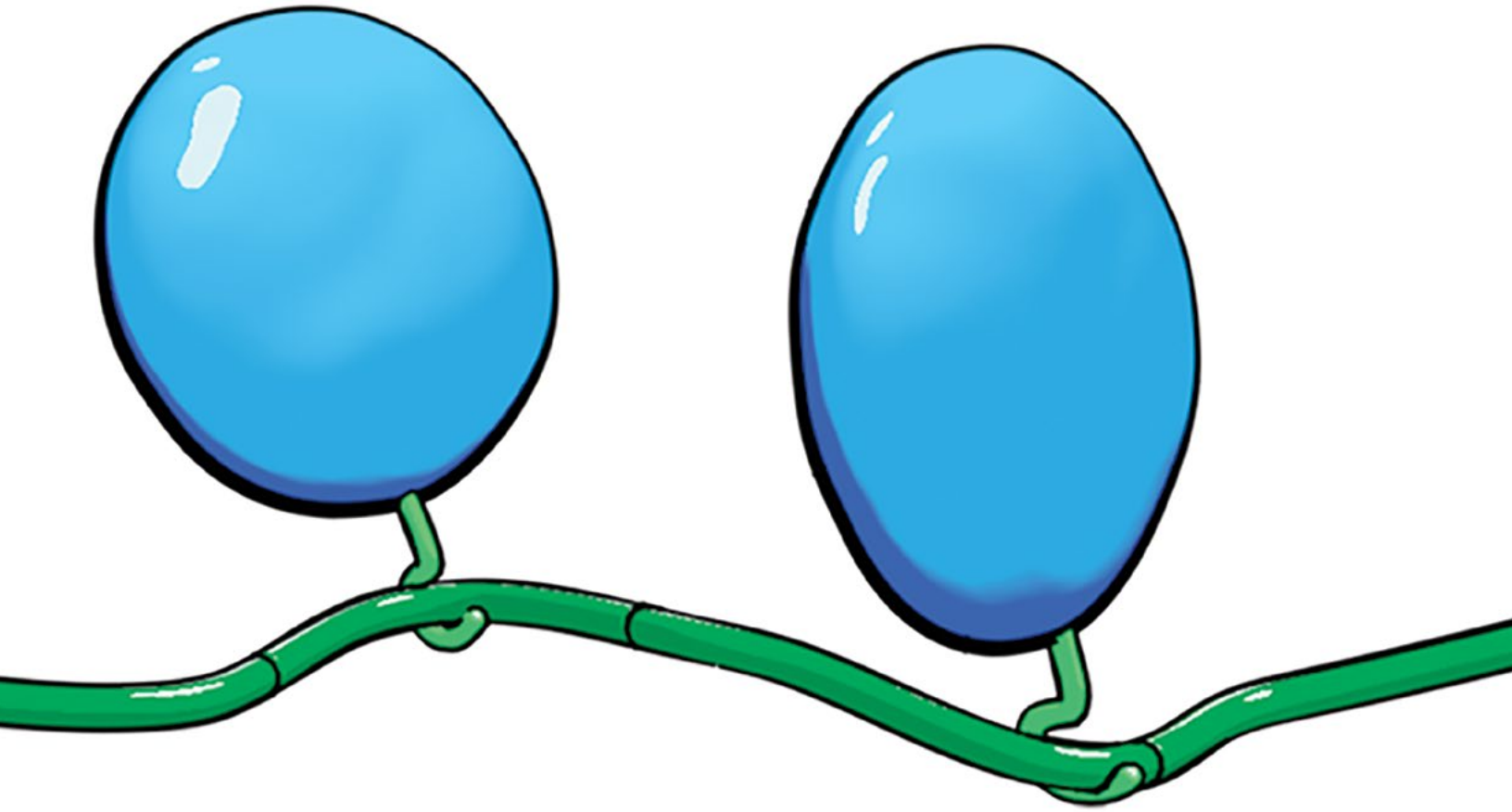


5


Cause of Injury
Falls
Struck by object
Motor Vehicle Accidents


How they get a TBI
If and how they get help after
How they will recover





Evelyn Lockhart

I am a pathologist and transfusion medicine physician at the University of New Mexico. My focus on clear communication with patients and learners inspired me to pursue a MScBMC degree. During my time at BMC, I grew fascinated with the cognitive psychology behind didactic animation and the educational potential in sequential storytelling. Following my time in Toronto, I aim to research evidence-based animation design in medical education.

Anatomical Illustration

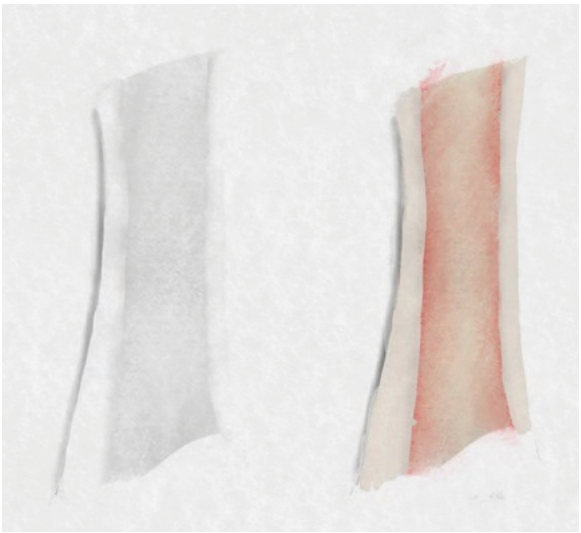
The goal of this illustration was to create a full colour rendering of an anatomical structure in a non-canonical view. I elected to do an oblique view of a knee sagittal cross-section, extending into the thigh and leg.

1. Final illustration. Anatomy for the final illustration was derived from multiple CT and MRI scans, as well as anatomic atlases. Sketches were done in *Procreate*, with final digital painting done in *Procreate* and *Photoshop*.

2. Production process. I built a maquette in *ZBrush* and *Cinema 4D* to study lighting for the final illustration, sculpting the main anatomic structures.

3. Study. As the illustration was to reflect living tissue, I studied beef bone cross sections and beef muscle for tissue texture reference. Studies were done in *Procreate*.

Previous spread. Final animation. A still from my master's research project: Animating primary hemostasis for medical student education.



Surgical Illustration

I developed illustrations depicting key steps in cesarean hysterectomy, a procedure performed in the setting of placenta percreta complicating pregnancy. These illustrations were created in collaboration with Drs. John Kingdom and Ally Murji.

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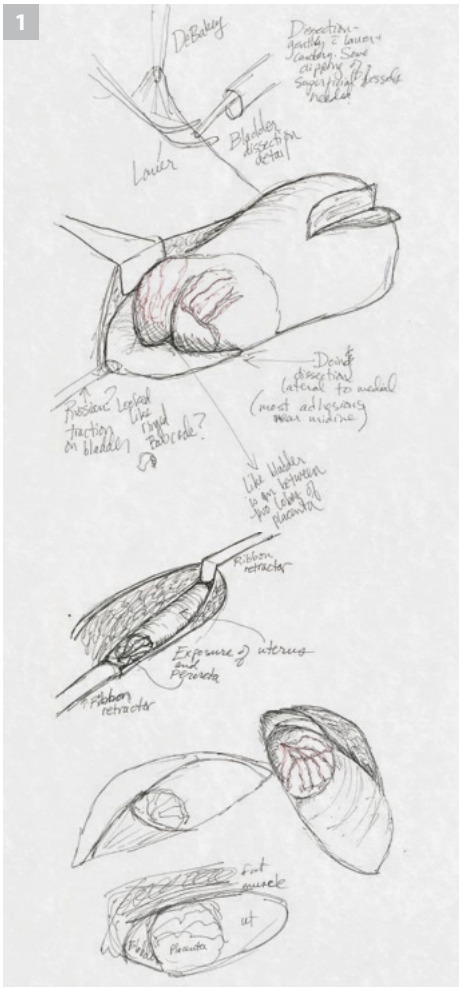

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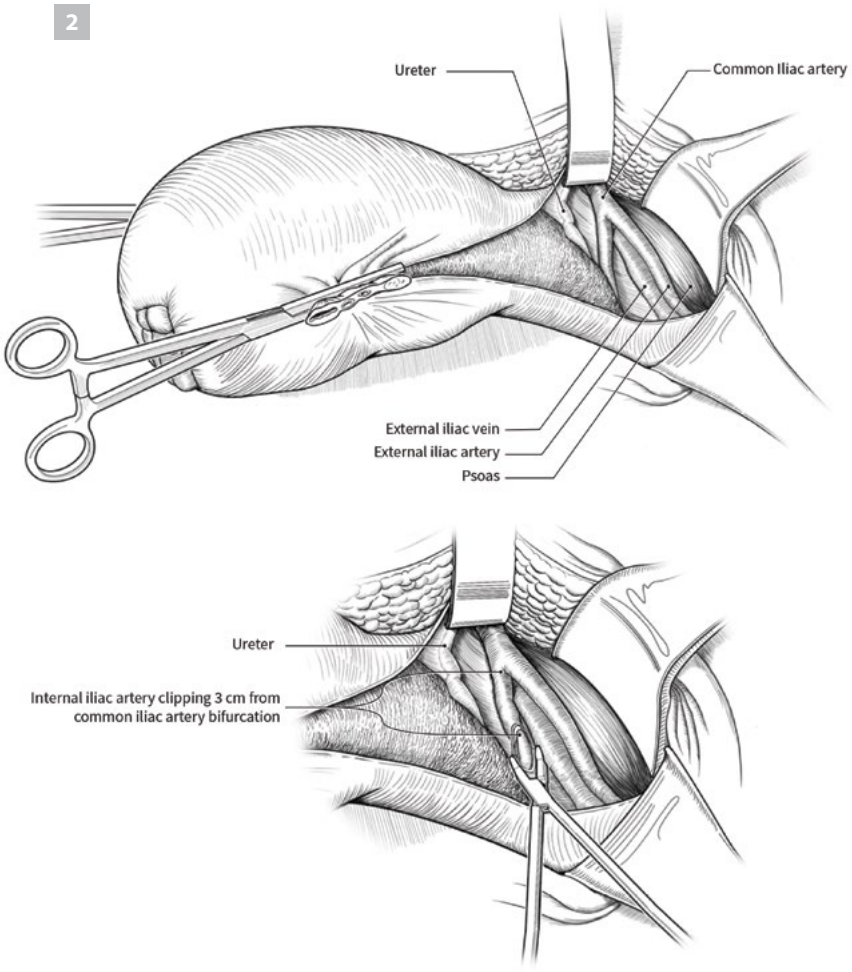

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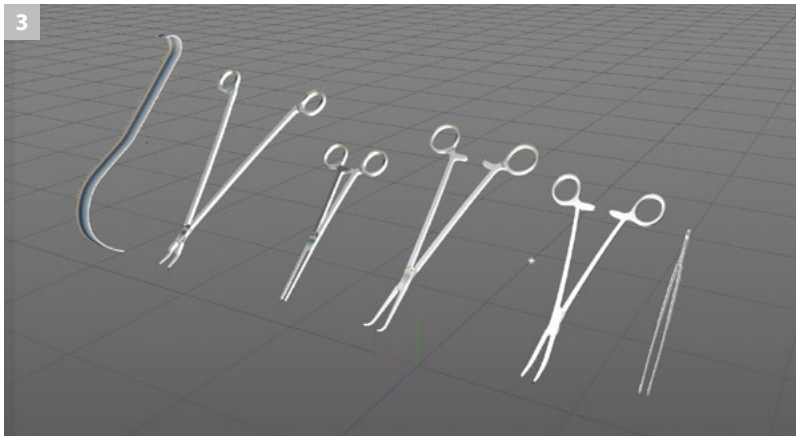

1. Sketch. During my surgical observations, I sketched the relevant surgical anatomy as well as instruments used, taking notes on the instruments' use.

2. Final illustration. For the final illustration, I chose to digitally ink the surgical ligature of the internal iliac artery, a critical step for achieving surgical hemostasis. Digital sketches and inking were done in *Procreate*, with final composition done in *Illustrator*.

3. Production process. I modeled all the surgical instruments in *Cinema 4D*. These models were used to ensure correct instrument perspective and size in the illustrations. Pelvic anatomic maquettes were made with a 3D printed pelvis (created from female pelvic CT scans) and Sculpey.

Pathological Illustration

This illustration shows the gross and histologic pathology of lepromatous leprosy (LL), a disease which causes disability and, for many of those afflicted, social stigma.

1. Study. A skin tissue cube study allowed me to explore the histopathology of LL, analyzing the affected microanatomy.

2. Production process. I built maquettes of the skin tissue cubes in *Maya* to explore lighting dynamics and composition.

3. Sketch and final illustration. The composition went through multiple iterations, with each iteration refining and simplifying the visual storytelling.

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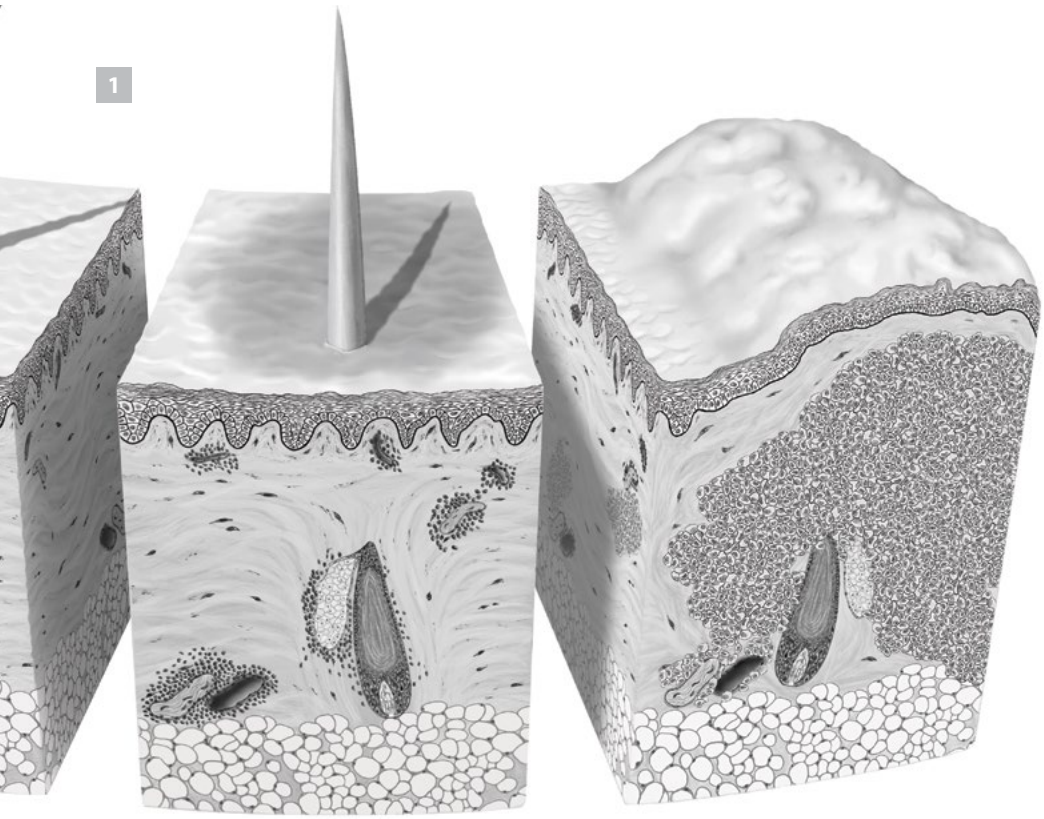

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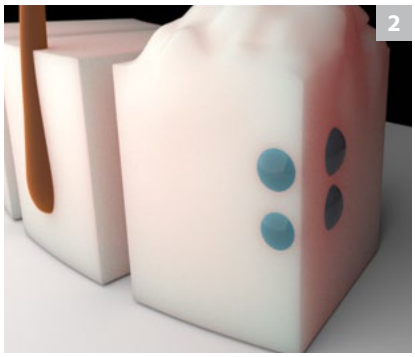

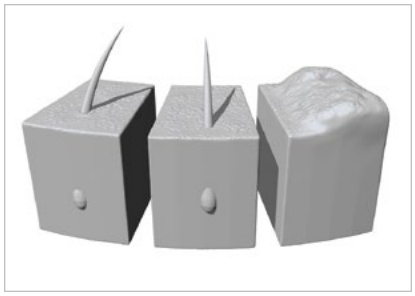

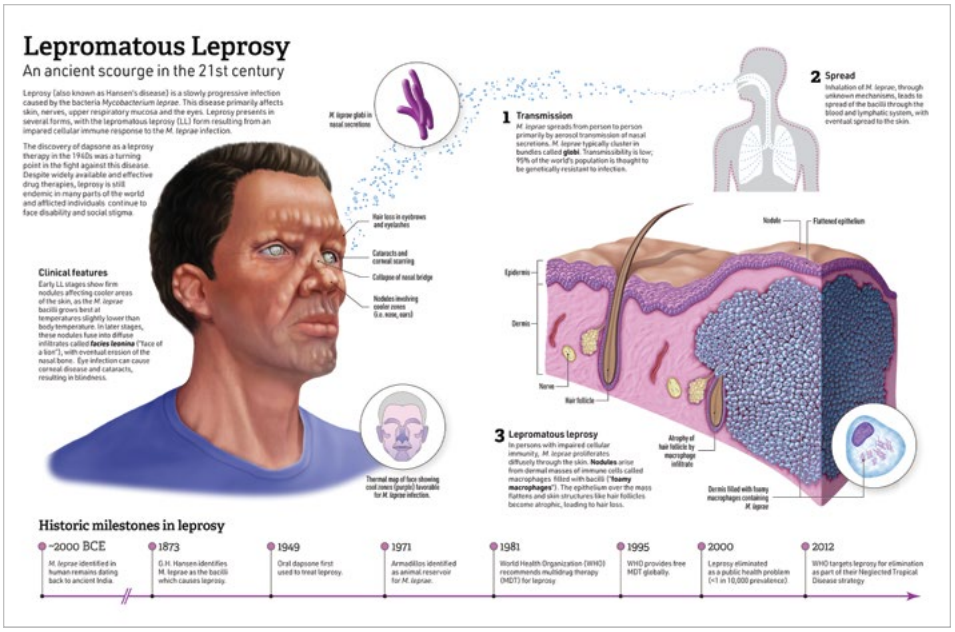

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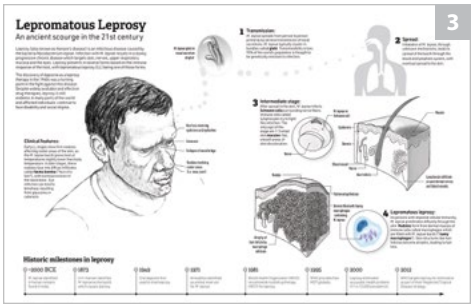

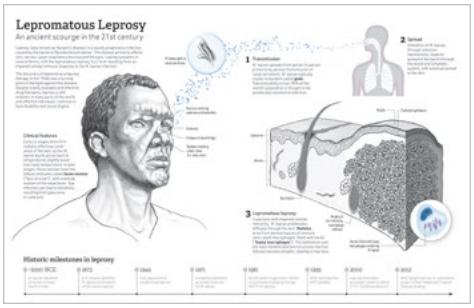

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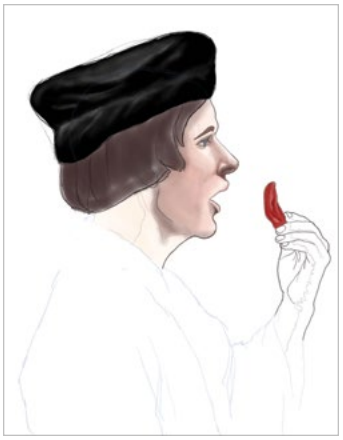

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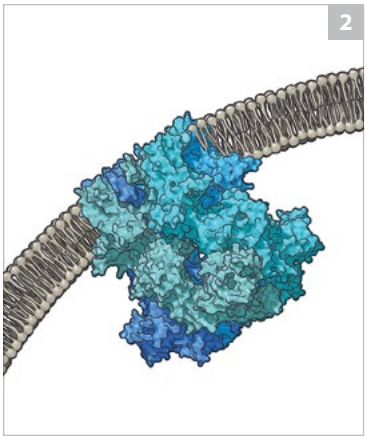

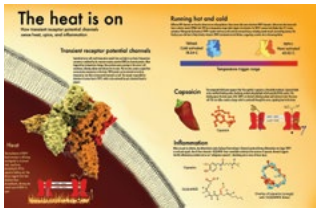

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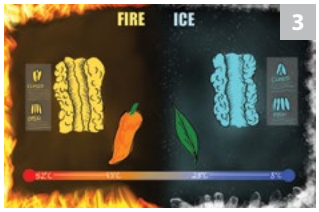

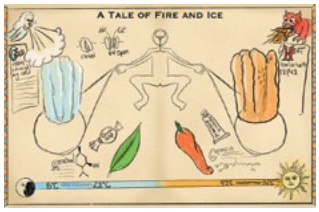

Molecular Visualization

An Illusion of Fire and Ice is a mock two-page scientific magazine spread showing the molecular mechanisms of TRP channels, the receptors responsible for sensing temperature. Curiously, TRP channels are also activated by foods such as chili and mint.

1. Final illustration. The illustration's design was inspired by medieval illuminated manuscripts. The mirrored composition aimed at a "heads up" comparison of the mechanisms, with decorative elements emphasizing the molecular mechanisms.

2. Production process. Digital painting was performed in *Procreate* and *Photoshop*. Molecular models were created in *Chimera* and *Cinema 4D*, with non-photorealistic rendering in *ZBrush*.

3. Sketch. Multiple design styles and compositions were explored in this series of iterative full colour sketches.

Animating Primary Hemostasis for Medical Student Education

My MRP was a didactic animation of primary hemostasis made for medical students. I surveyed hemostasis educators on the animation's learning objectives, with the design informed by the Animation Processing Model (developed by Ric Lowe and Jean-Michel Boucheix).

1. Production process. I performed an event unit analysis of the learning objectives (according to the Animation Processing Model) to develop the script and storyboard.

2. Sketch. As part of preproduction, I explored different representational styles for the animation (here showing different styles for platelets).

3. Production process. The animation opened with the injury of a character ("Hap"). Character turnarounds and expression sheets were developed in *Procreate*. Frame-by-frame animation was done in *Rough Animator* and *Photoshop*.

4. Final animation. Look development for foreground elements and backgrounds was performed in *Procreate* (left). The final 2D-plus animation (right) was done in *Cinema 4D* using the Sketch and Toon module for cel shading and variable line weights. Compositing was performed in *After Effects* and *Premiere Pro*.

5. Storyboard. Early storyboard iterations were done without use of the Animation Processing Model (left). Following event unit analysis, storyboards underwent complete revision (right).

6. Animatic. An animatic was created using *Procreate*, *Photoshop* and *After Effects*.

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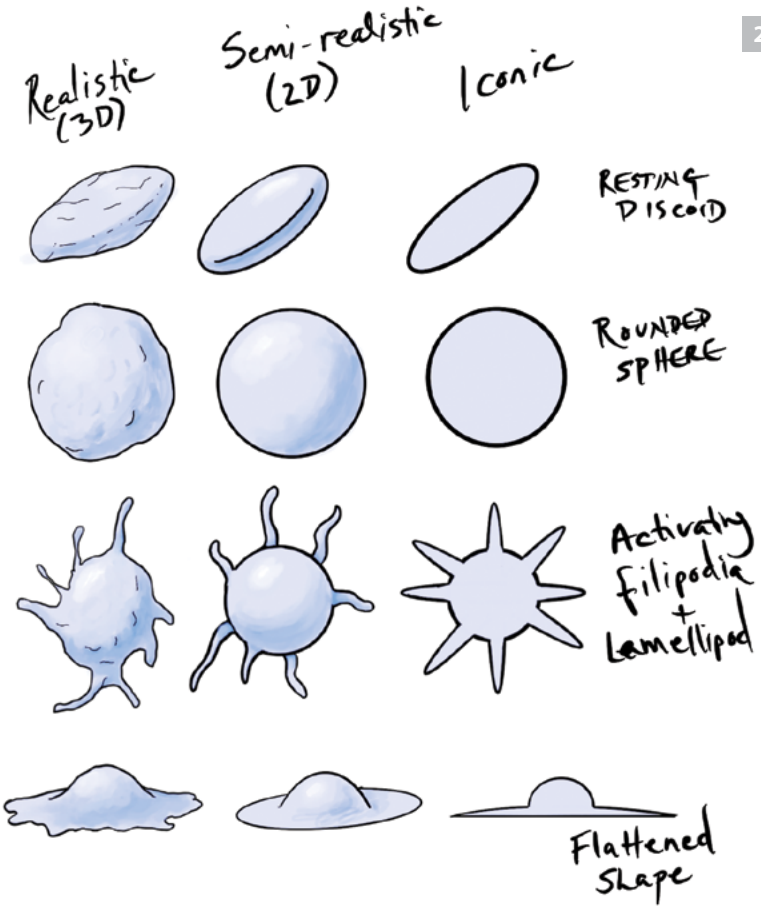

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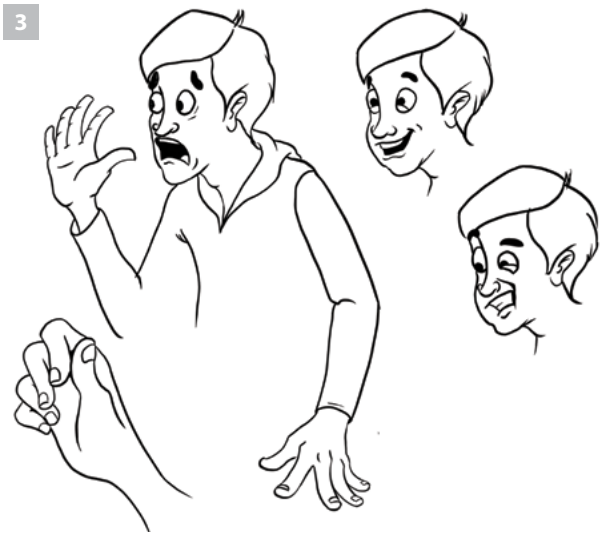

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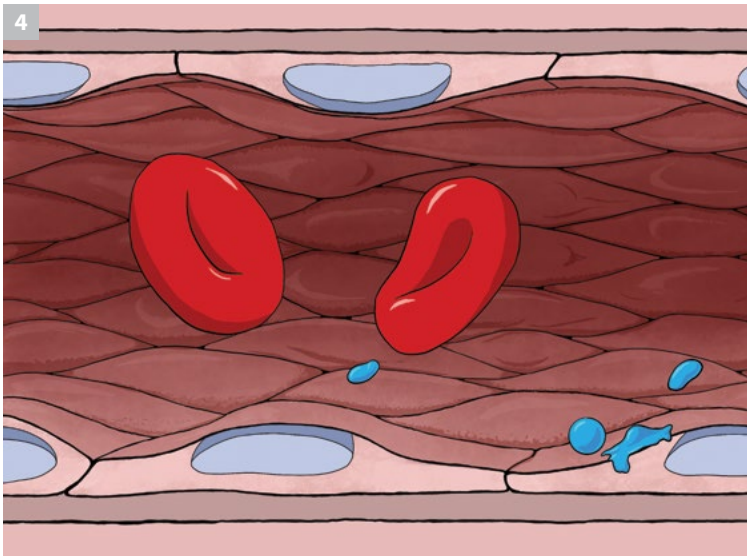

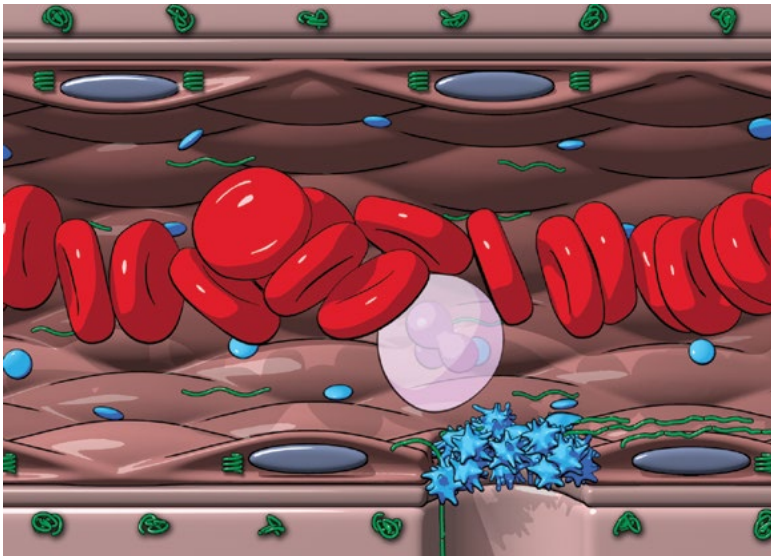

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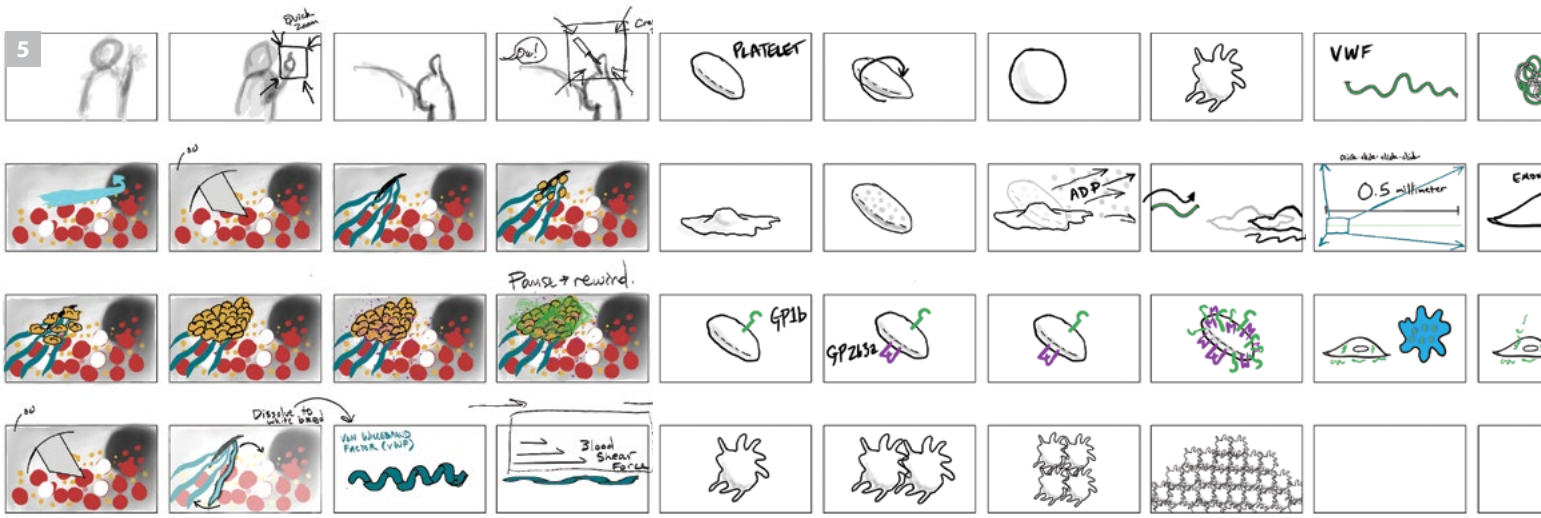
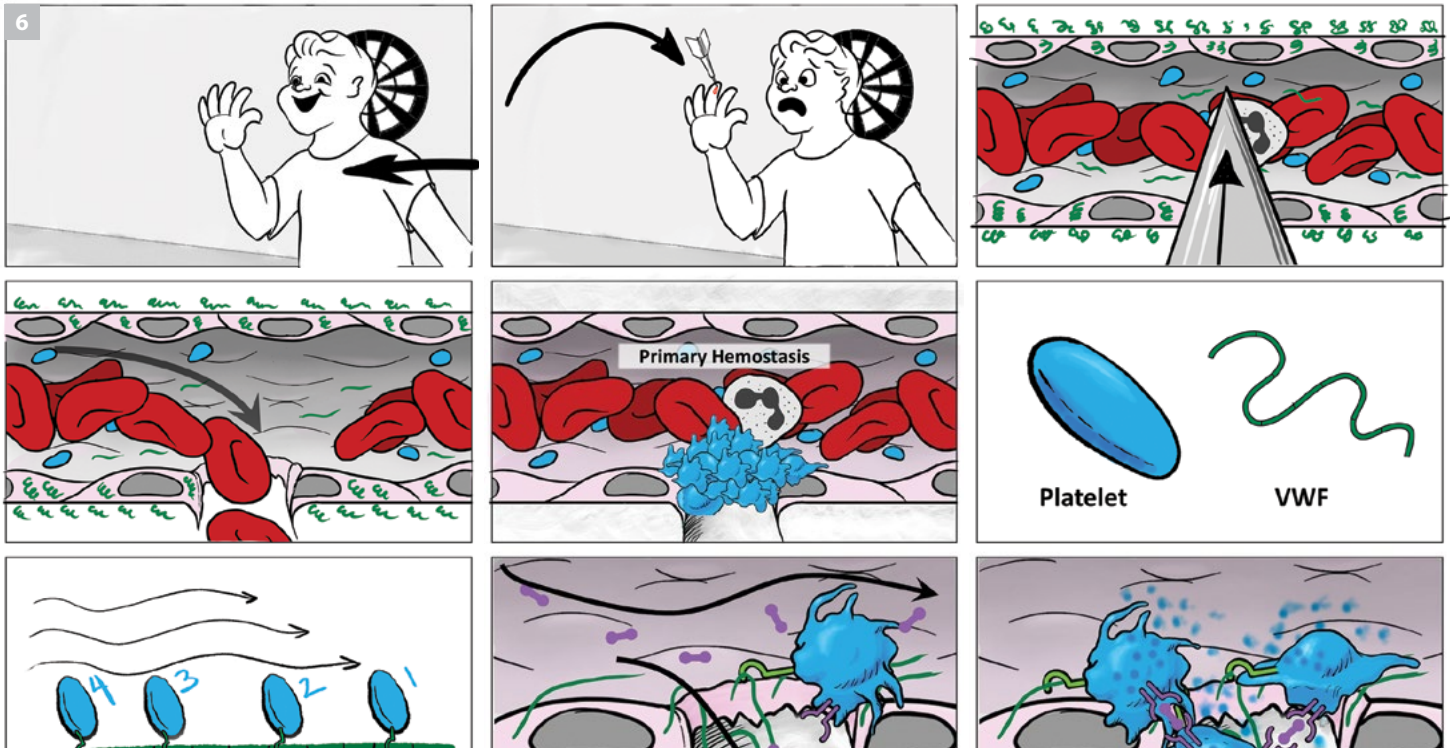
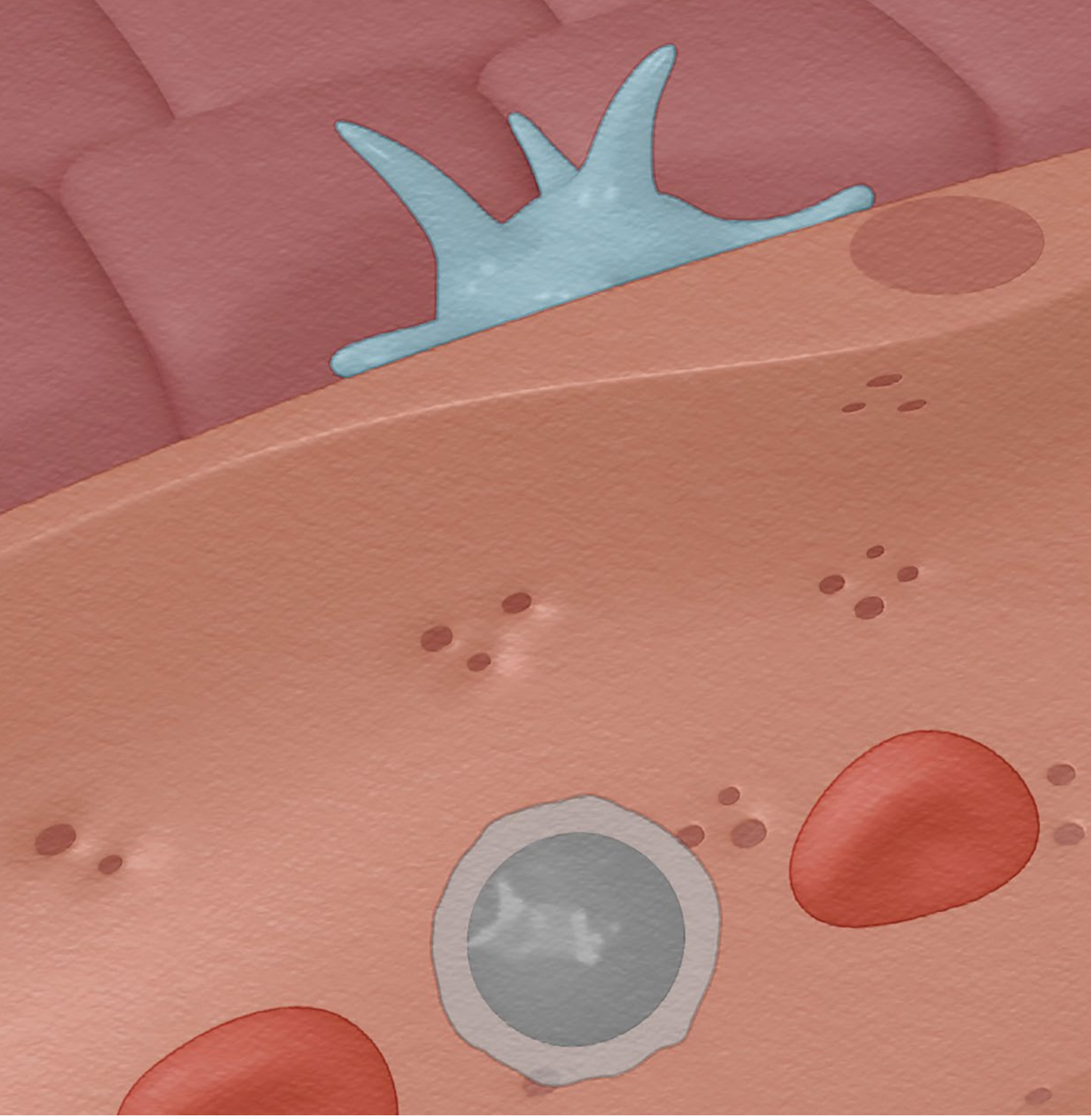
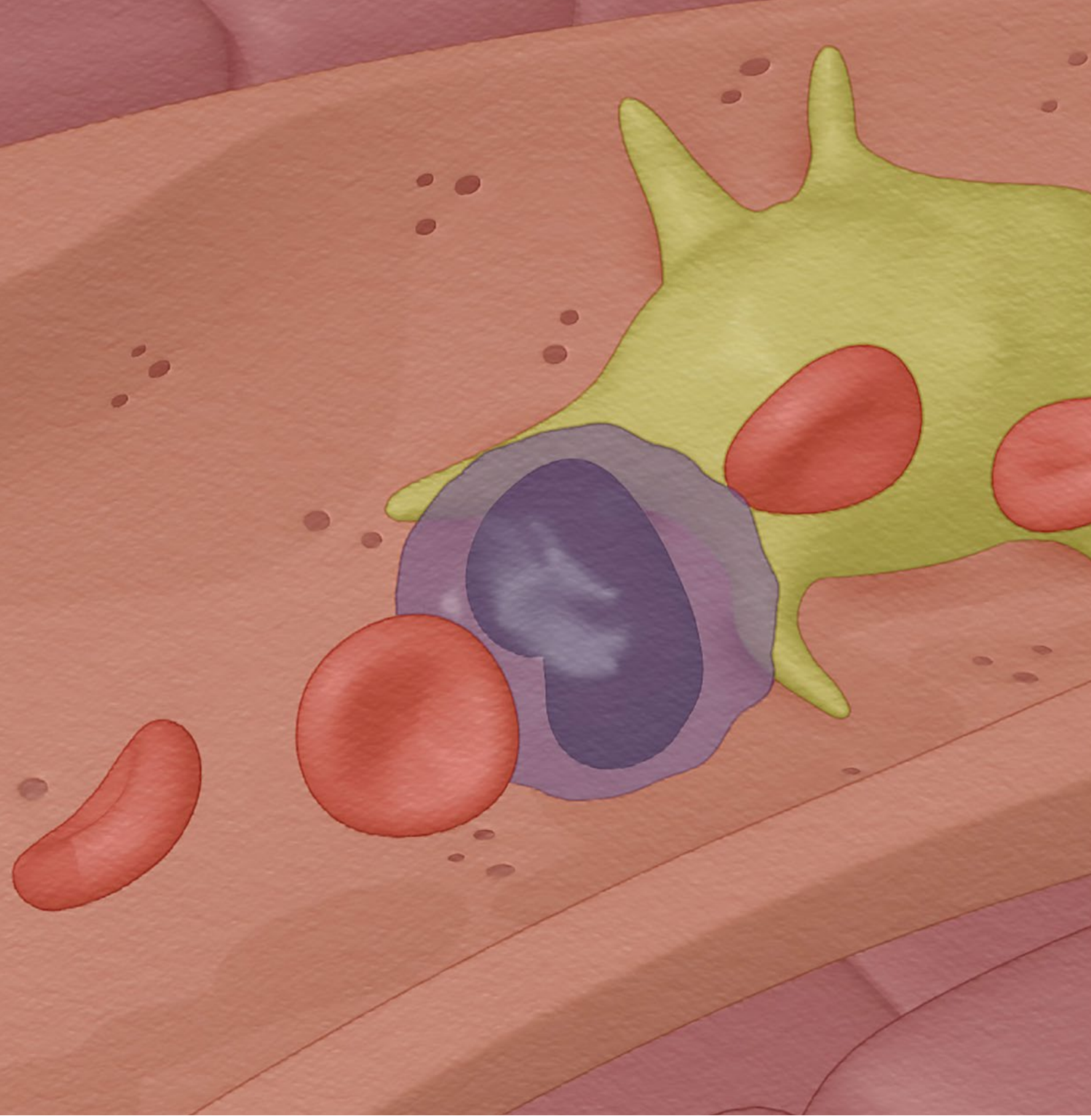

PLATELET
VWF
ADP
0.5 millimeter
Pause + rewind.
GP1b
GPIIb/IIIa
Blood Shear Force

6


Primary Hemostasis
Platelet
VWF
4
3
2
1





Farah Hamade

I am a biomedical illustrator and animator who strives to create visuals that help educate and engage diverse audiences on difficult topics. I love the ideation process and using storytelling to bridge communication gaps in the health sciences. My experience working with patients inspire me to create inclusive and accessible visuals.

Graphic Medicine

Jedo's (Grandpa's) Unknown is a comic illustrating my experience surrounding my grandfather's cancer diagnosis, discussing the cultural and generational shifts related to cancer diagnosis disclosure (CDD).

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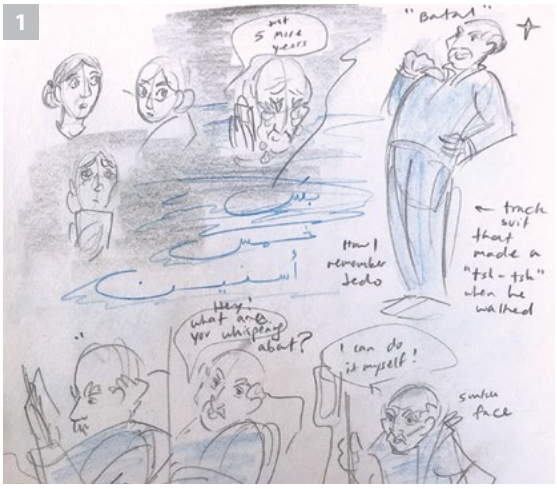

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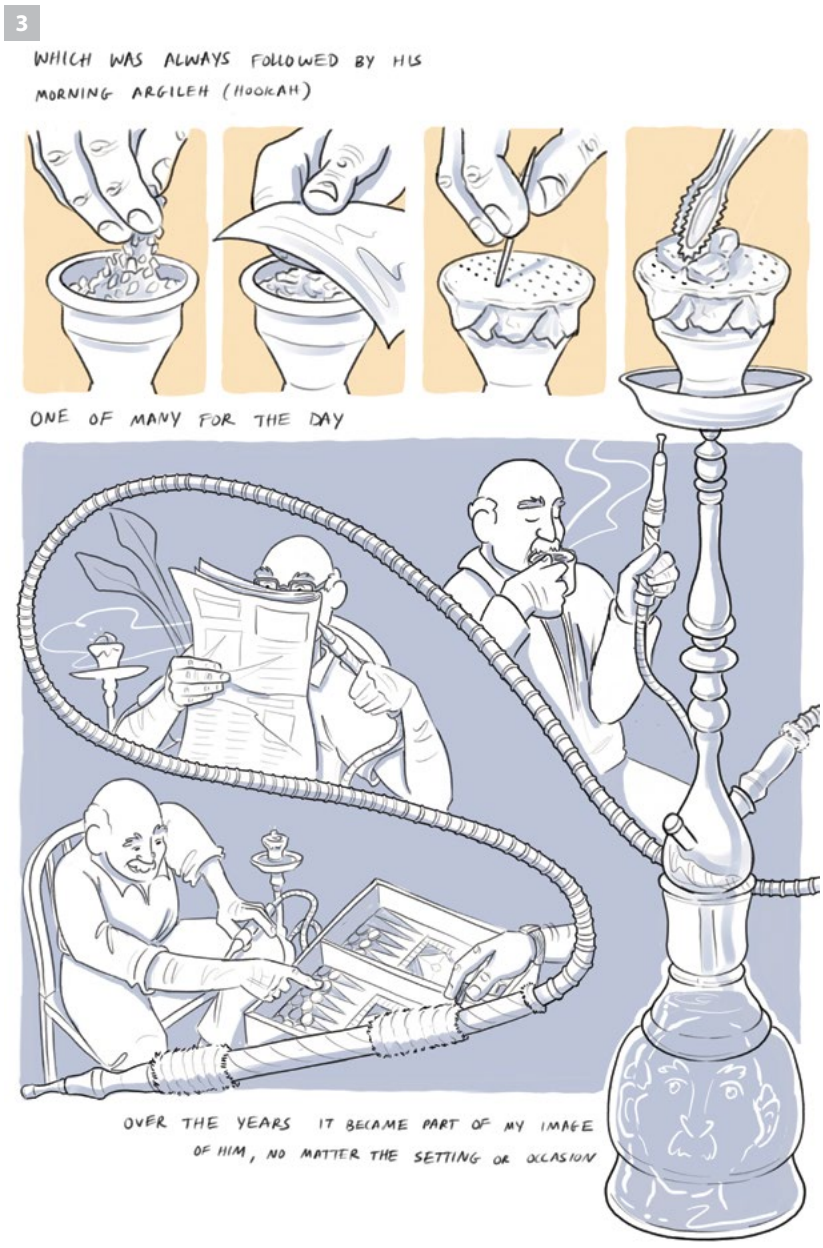

1. Sketch. Rough sketches exploring dialogue helped inform my page thumbnails (shown here are pages one and two), which lay out the main actions and text.

2. Study. Initial exploratory style studies experimenting with traditional techniques (ink, watercolour) and digital sketching and testing different colour palettes.

3. Final illustration. Page two of my final comic depicting my grandfather's daily hookah routine through sequential storytelling. I wanted to take care in illustrating the details that were part of his everyday life. I decided on a final digital render style using a muted complimentary colour palette.

Previous spread. Final animation. A still from my master's research project: Harnessing the liver's immune system.

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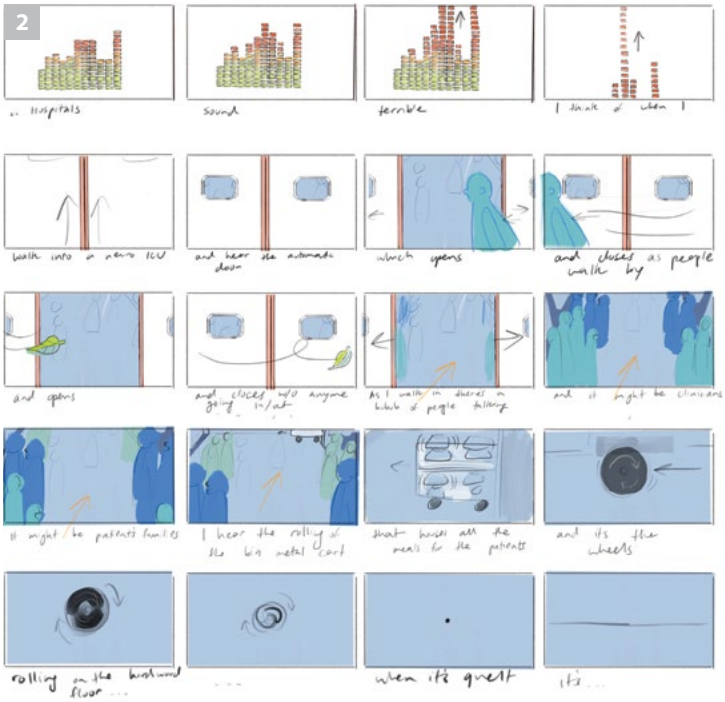

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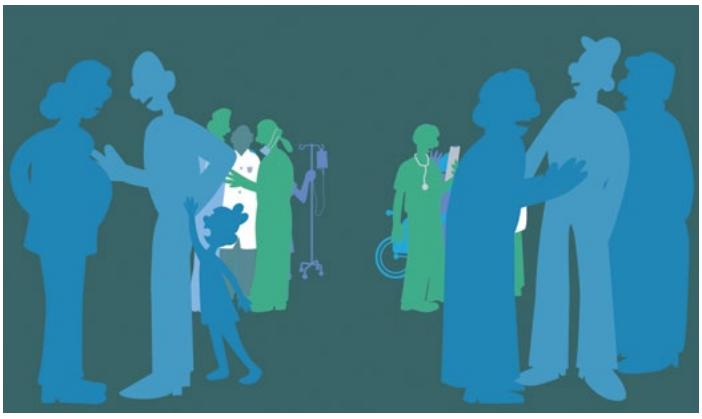

Scientific Animation

A 2D animation visualizing the audio from the 99% invisible podcast "Hospital Noise" episode. The clip discusses the different sources of hospital noise that disrupt patient care, and is part of a longer collaborative animation.

1. Study. Character style and colour palette exploratory sketches. Our group decided on a simplified style and colour palette, using analogous blues commonly found in hospital settings.

2. Storyboard. Storyboards for the 2D animation based on the script from the podcast clip. I wanted to lay out the main actions and colours, and create smooth start/end transitions that would work well with the clips created by my collaborators.

3. Final animation. Final animation stills depicting an action sequence with the final character design, and the ICU hospital environment that lies beyond the doors. The ICU layout was constructed so the camera can push in, creating a parallax effect.

Surgical Illustration

An illustrated surgical sequence depicting the anastomosis of a donor lung created through live surgical observation and anatomical references.

1. Sketch. It was important to understand the procedure through observation and live study. This was done by observing two 10-hour double-lung transplant surgeries, and capturing the main steps, tissue texture/colour, and setting.

2. Final illustration. Figure 10 from the final surgical sequence depicting the anastomosis of the pulmonary veins via an everting mattress suture. The final sequence was digitally inked, focusing on accurate line work.

3. Notes. Notes were taken during the live surgical observation to later inform me on the tools used and the anatomical terms. Notes were also taken during draft revision sessions to make sure the information and sketches are accurate.

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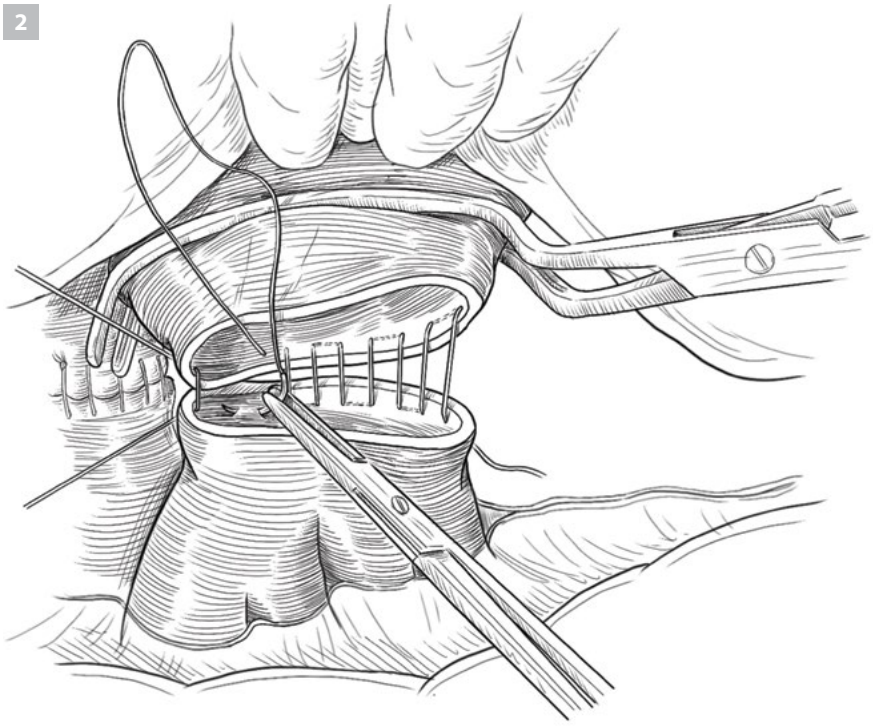

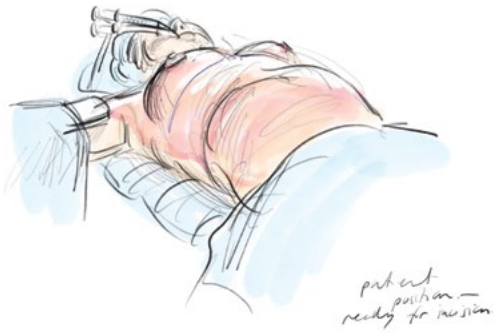

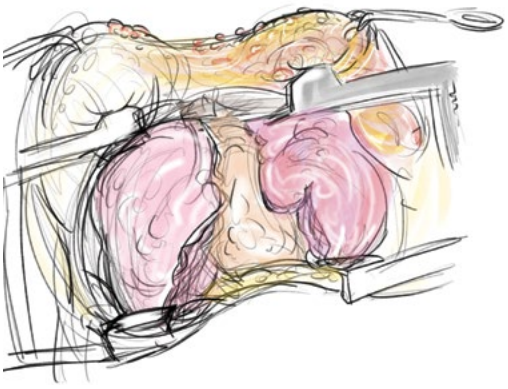

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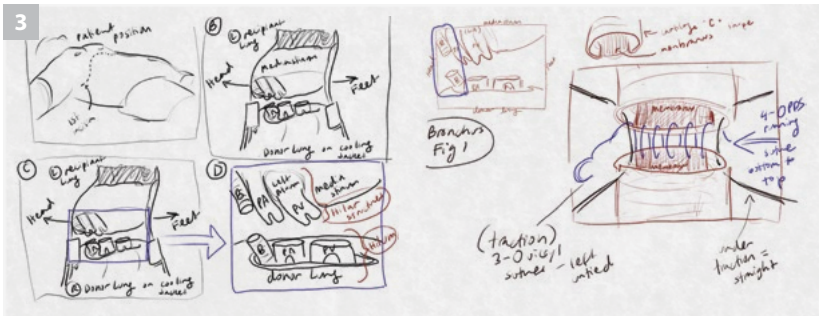

Pathological Illustration

An editorial spread illustrating the progression of atherosclerosis and how it leads to ischemic stroke. The goal was to illustrate the pathology at different levels of magnification and how it results in the typical stroke symptoms.

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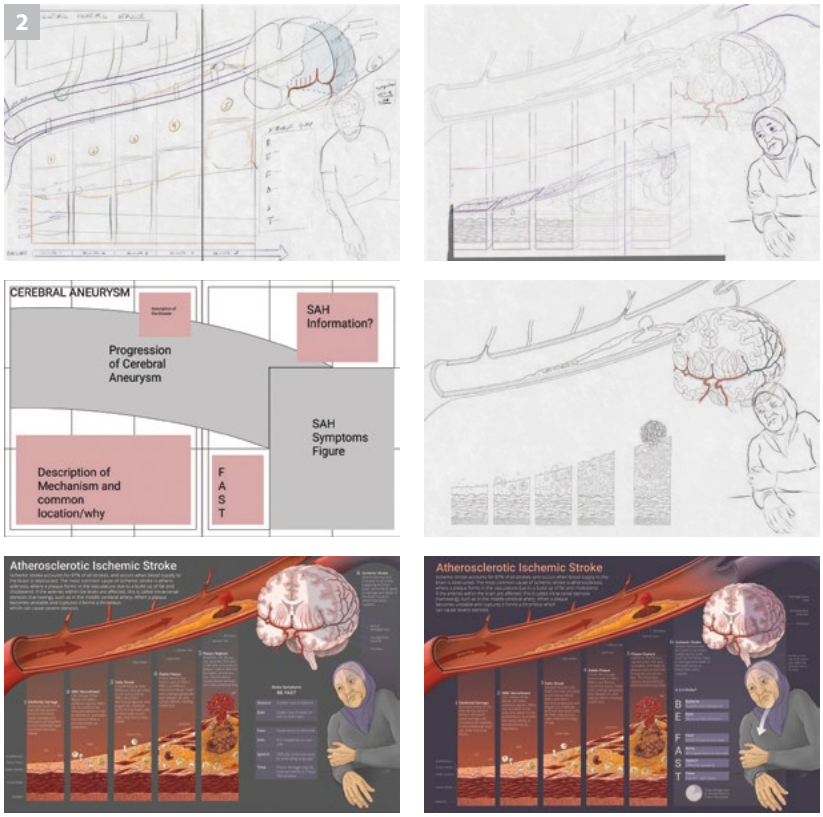

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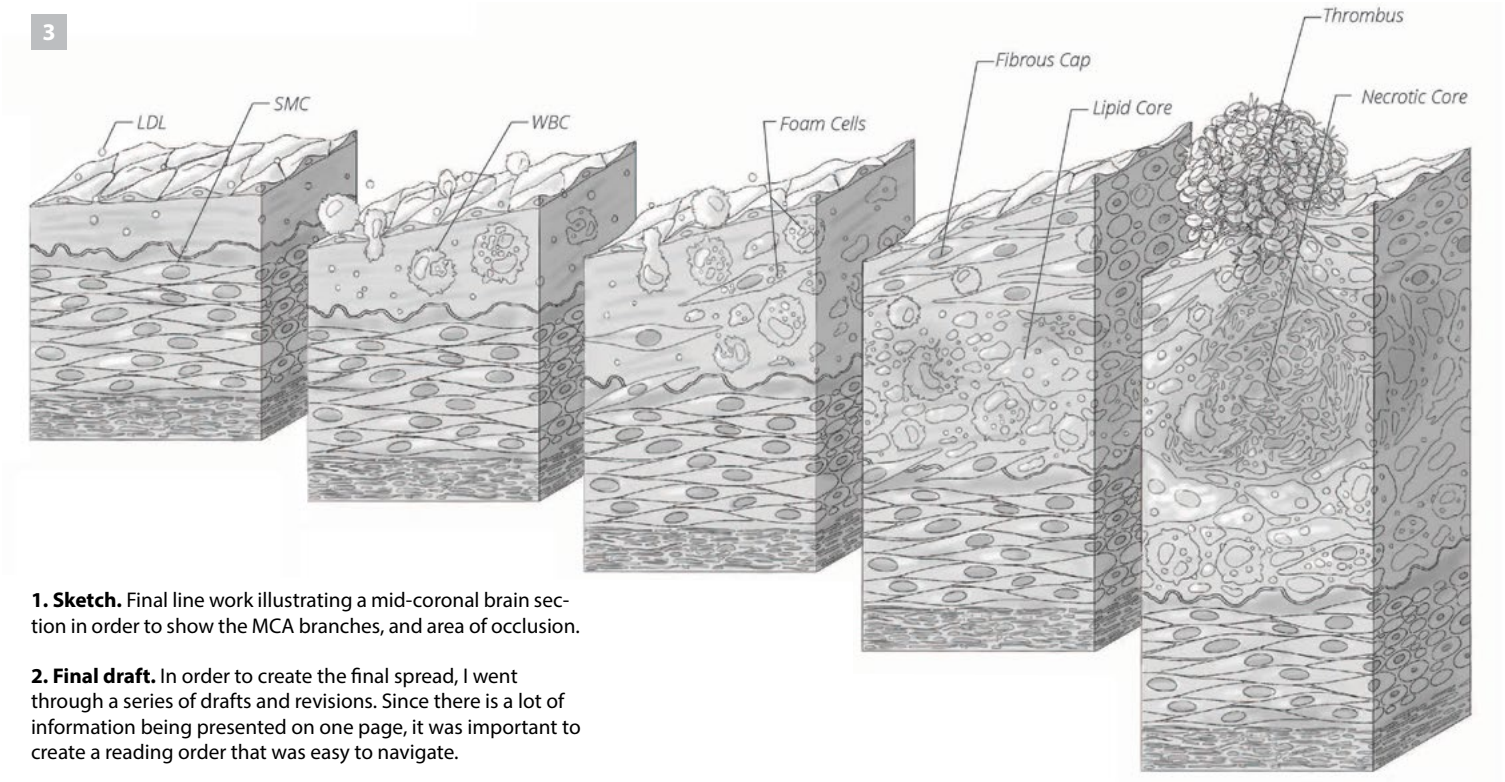

1. Sketch. Final line work illustrating a mid-coronal brain section in order to show the MCA branches, and area of occlusion.

2. Final draft. In order to create the final spread, I went through a series of drafts and revisions. Since there is a lot of information being presented on one page, it was important to create a reading order that was easy to navigate.

3. Study. A tissue cube study of the progression of atherosclerosis was illustrated to better inform me on the different stages of pathogenesis, and the various cells involved. The study was created in grayscale to focus on the main elements and terminology.

Harnessing the Liver's Immune System: A 3D animation visualizing liver immunology as it relates to disease and homeostasis

A dynamic visualization describing general liver functions and the new developments in hepatic immunological research to be used as an educational tool in understanding how the liver's immune system can be harnessed to treat liver disease and metastases.

1. Notes. Notes comparing different hepatic cell populations when healthy (normal) and damaged.

2. Notes. It was important for me to understand how the various hepatic cell populations compare in size, and their relationships in space in order to accurately model them.

3. Storyboard. Storyboards depicting shots five through ten of the final animation. I focused on visualizing the key actions in the script, and blocking in the colours for each component.

4. Sketch. Sketches illustrating the main focus of the animation, the liver sinusoidal landscape. Liver lobules are hexagonal in shape, so I wanted to sketch out the model plan for a "1/6th slice." These exploratory sketches also helped me understand the direction of blood flow, the colour palette, and cell populations in space.

5. 3D modelling. 3D models in *Maya* as compared to the final scenes rendered using the MNPRX renderer.

6. Final animation. A still from the final animation depicting the liver's general functions. The final animation style was composited to combine 3D animation (using the watercolour MNPRX render), and 2D animation (hand drawn frame-by-frame) to achieve a cohesive illustrative look.

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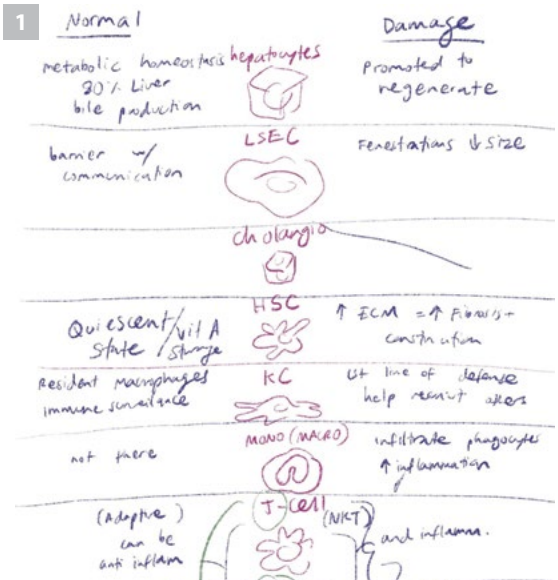

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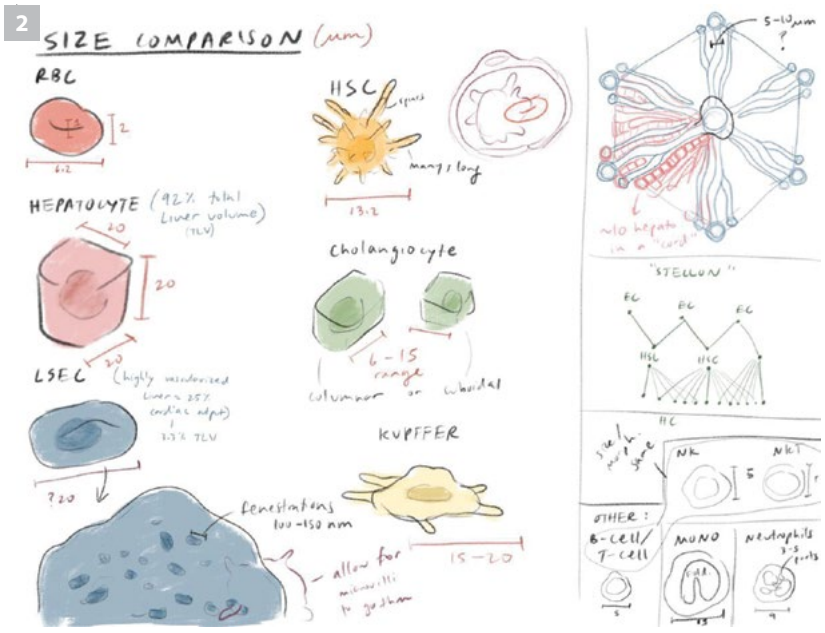

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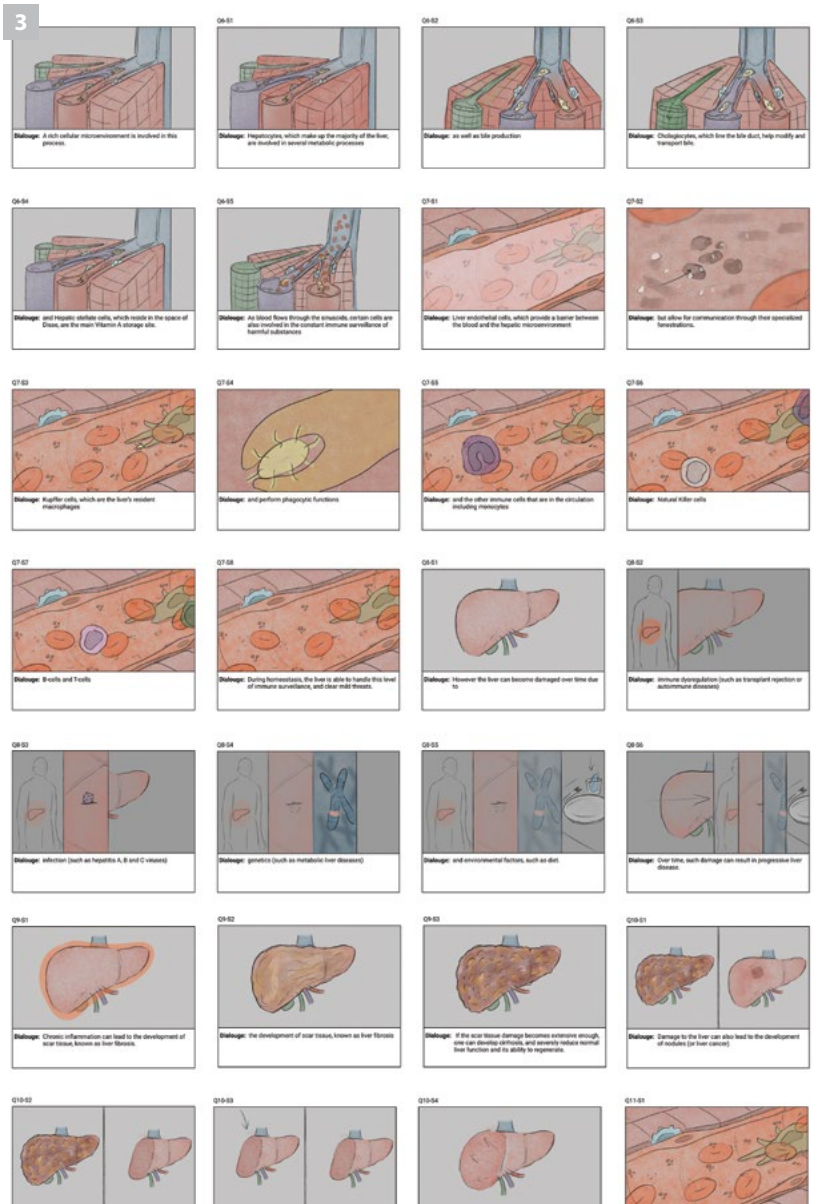

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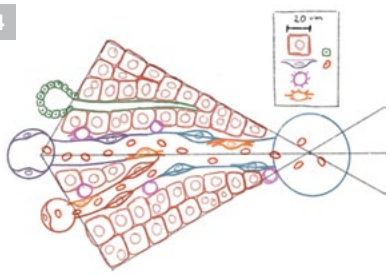
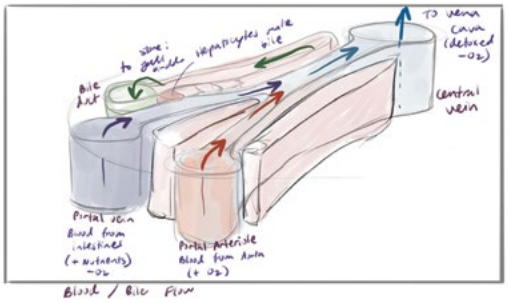
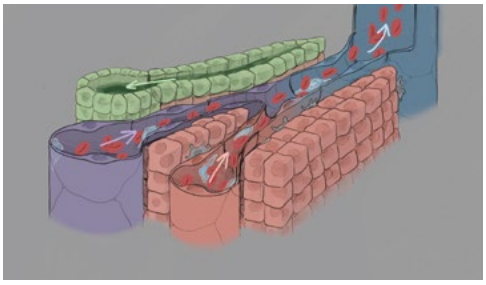



Bile duct
Hepatocytes make bile
To vena cava (deoxy -O2)
Central vein
Portal vein Blood from intestines (+ nutrients) -O2
Portal Arteriole Blood from Aorta (+ O2)
Blood / Bile Flow



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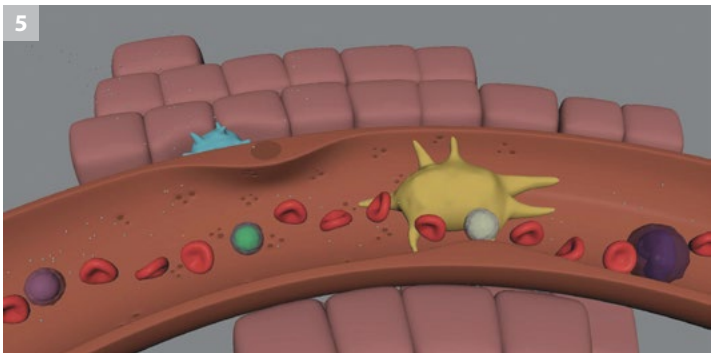

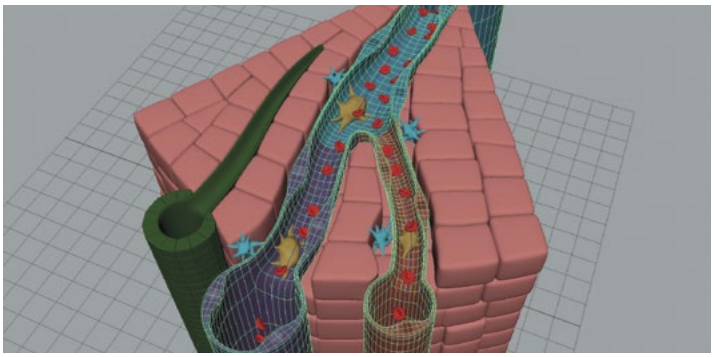

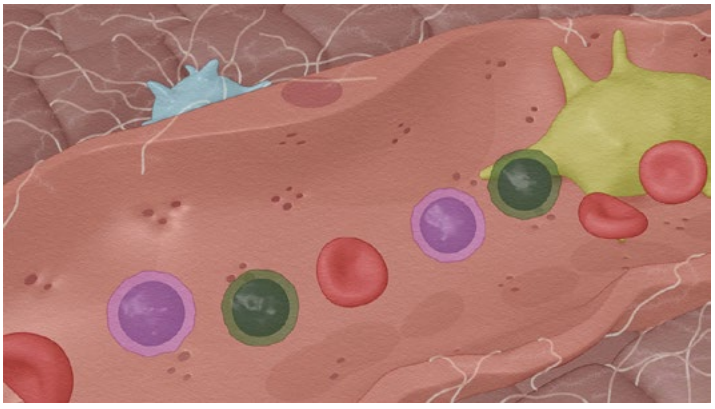

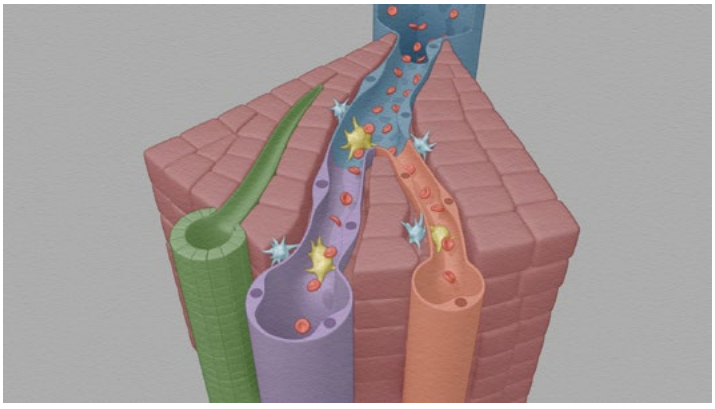

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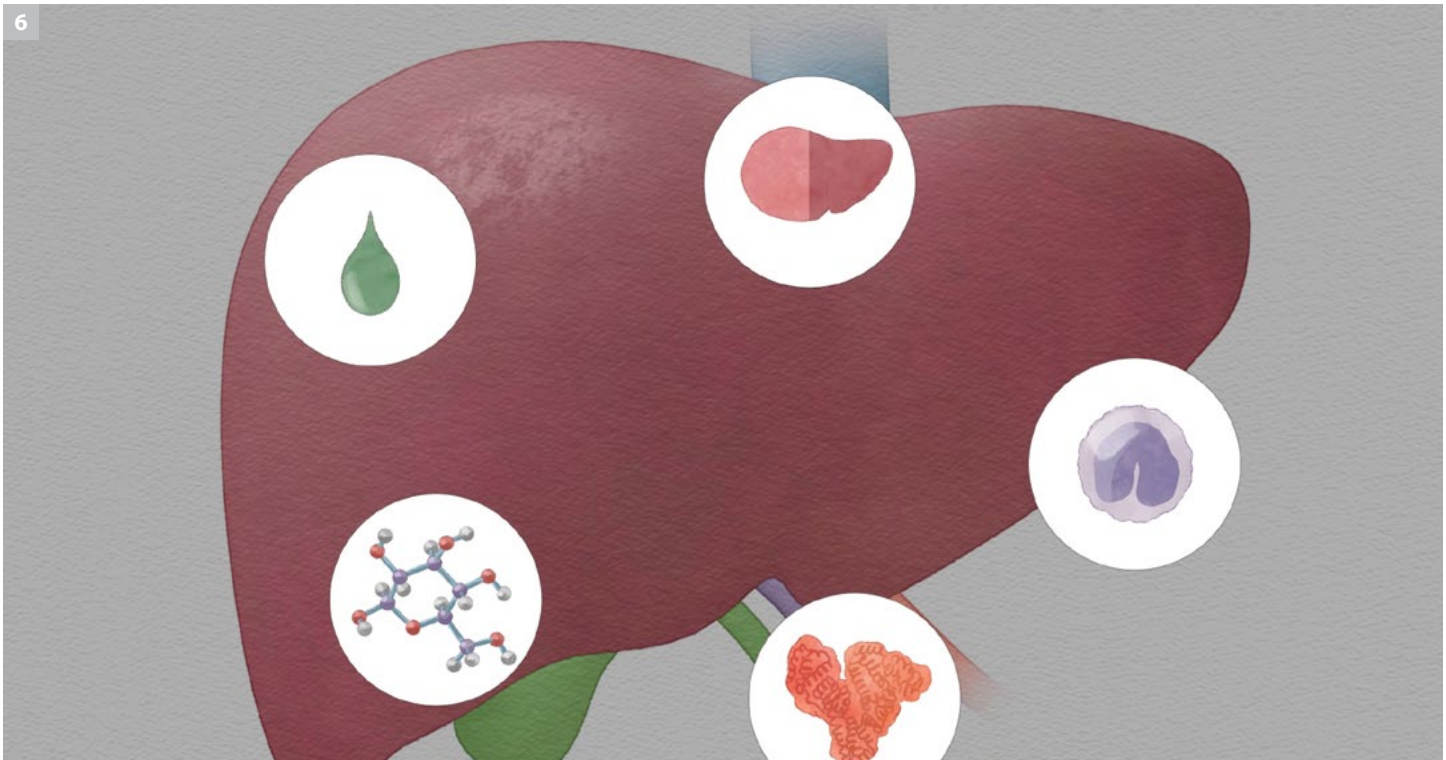


Felix Wieler

My passion for science and art lead me to MScBMC. I am privileged to have immersed myself in the subjects of anatomy, surgery, biology, illustration, and animation while studying under creative, inspiring professors. I focus on 3D media and find the most rewarding part of a project is finding ways to push the software. Collaboration and ideation drive me creatively; I am always excited to immerse myself in a new subject area, learn with experts, and contribute to our ever-expanding understanding of the world.

3D Modelling

This project served as my introduction to a *ZBrush* workflow using zSpheres. The challenge was to model a natural science subject and I chose to depict the dogbane beetle, *Chrysochus auratus*. The final product was a turntable animation to display the iridescent surface.

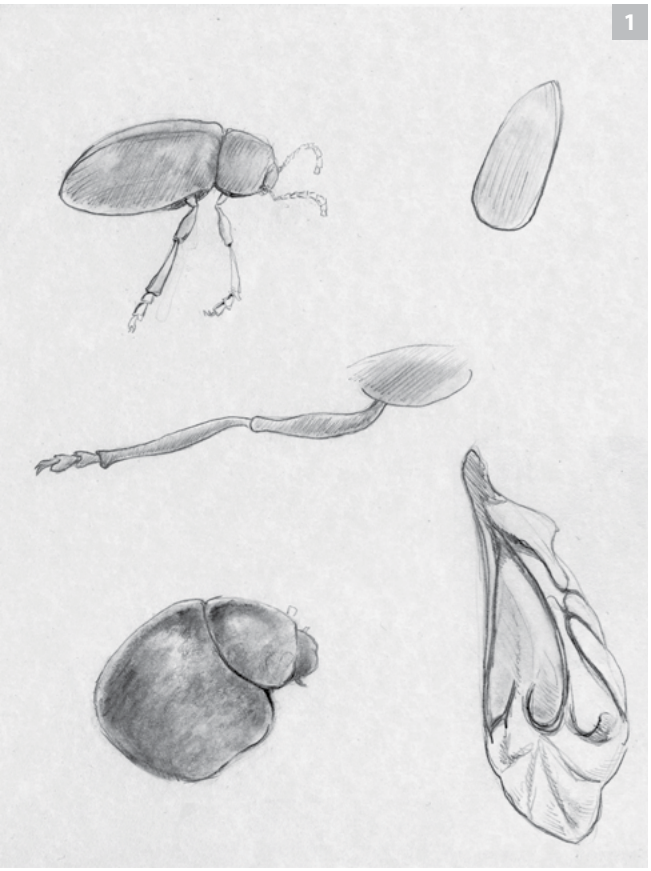
1. Sketch. Reference sketches from a preserved specimen I caught in Edmonton.

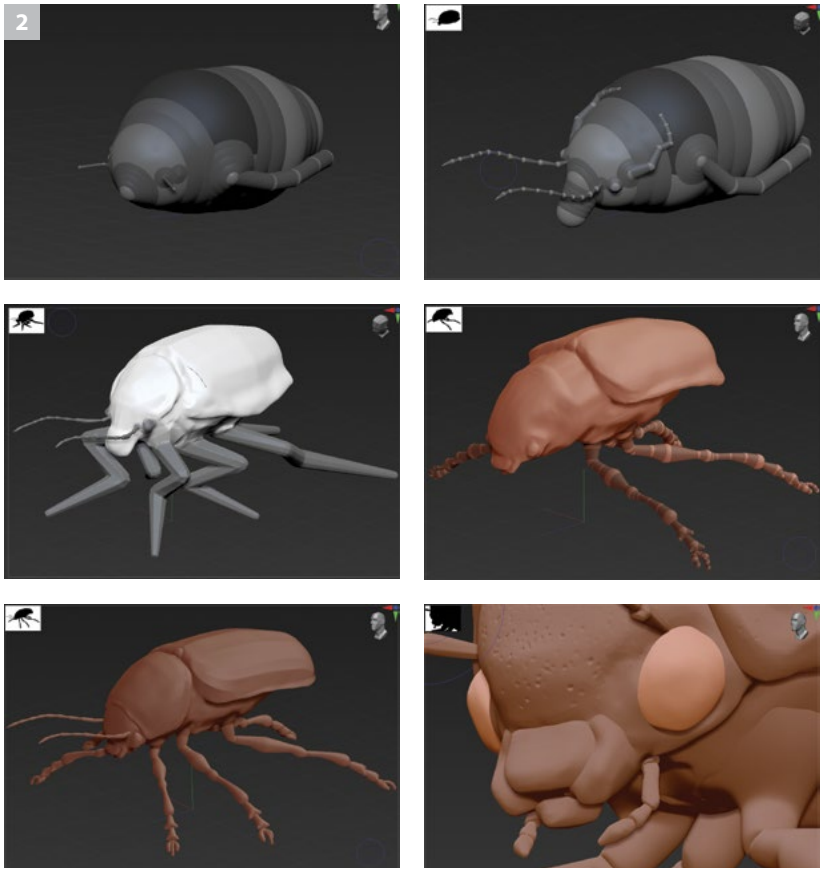
2. 3D modelling. I built the model from a zSphere sketch into a detailed mesh. The body, limbs, eyes, antennae and maxillary palps are separate meshes.

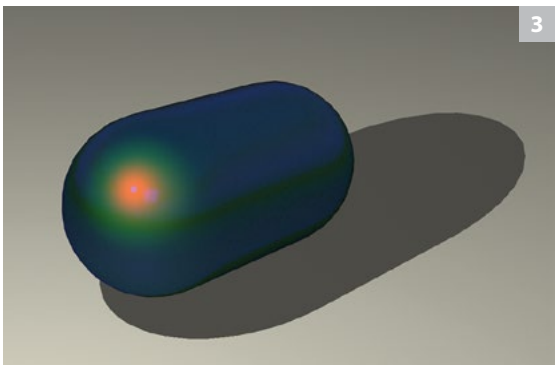
3. Study. Iridescent material study, that I rendered using the physical render engine in *Cinema 4D*.

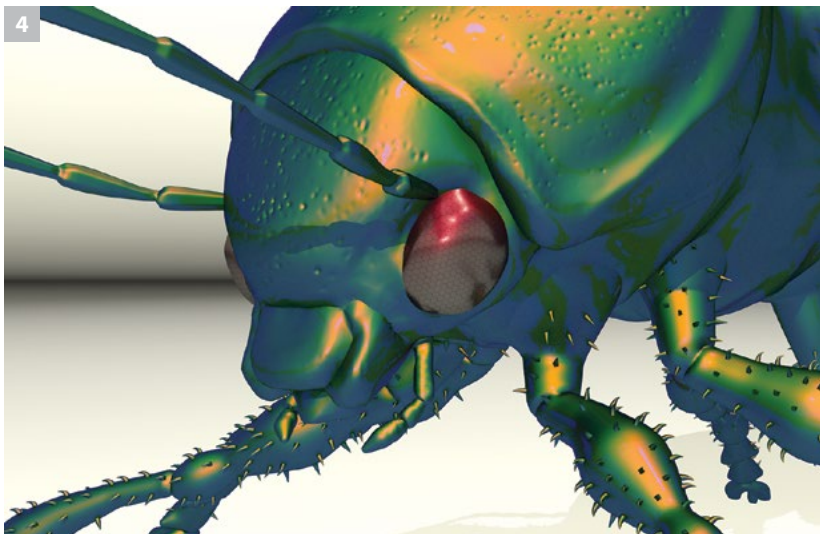
4. Final draft. Close-up of the final model emphasizing the compound eye texture. Note the setae on the legs that I created with the *Cinema 4D* hair tools.

Previous spread. Final illustration. Final render of the dogbane beetle.









Editorial Illustration

This cover was inspired by the visceral reaction of some to GMO crops. I wanted to satirize the idea GMOs as "unnatural" by placing outlandish crops in a traditional cornucopia. The crops show elements of viruses and bacteria: a parody of the tools of genetic modification.

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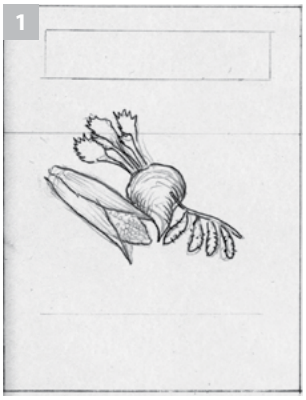

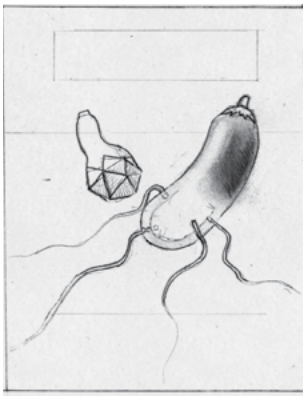

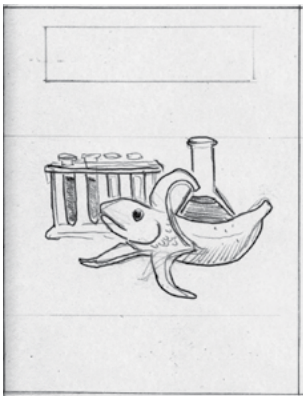

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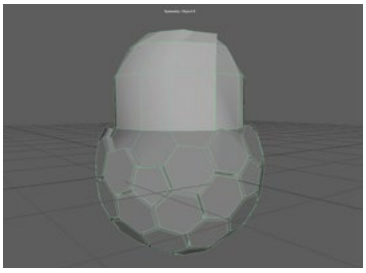

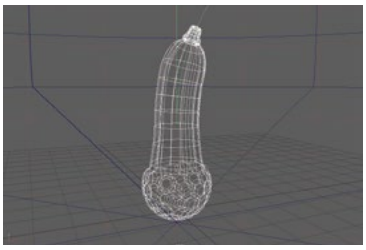

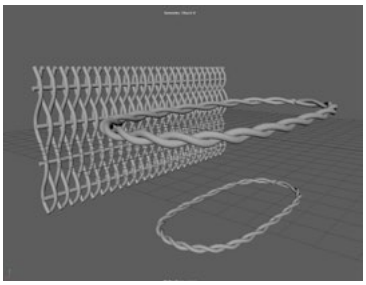

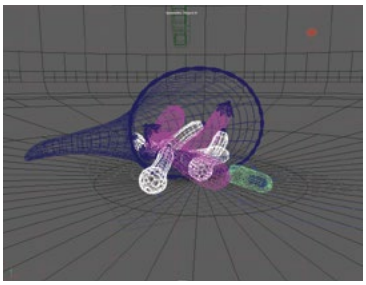

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1. Sketch. Preliminary sketches where I explored misconceptions of GMOs. In the rough draft of the cover, I added the cornucopia as a backdrop.

2. 3D modelling. I based the squash "capsid" off of polyhedra from the polyHédronisme GitHub project. Other modelling challenges included the braided rim of the cornucopia, the flagella and the double membrane of the eggplant. The latter I created using an separate internal mesh and a ramped transmission layer on the outer mesh.

3. Final illustration. The final assembled cover I closely modeled based on Nature's layout. I adjusted the render in *Photoshop*, added the background gradient, and completed the layout in *Illustrator*.

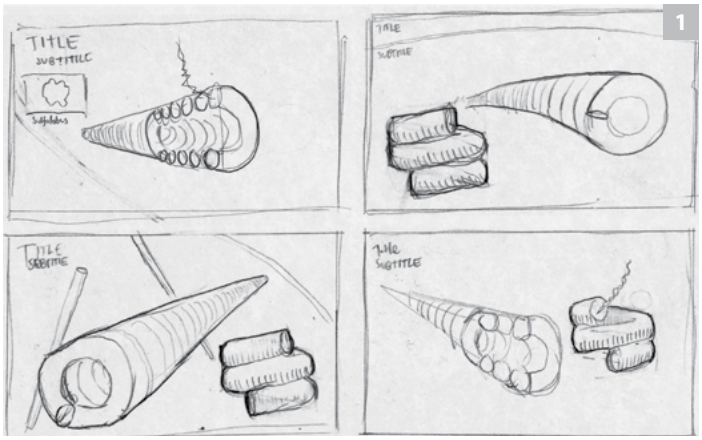
Molecular Visualization

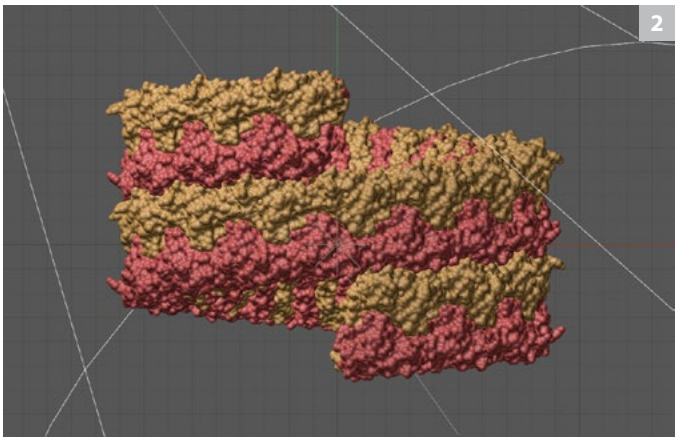
A Google search based on extremophiles lead me to research about the viruses that infect them. Curiously, the egress mechanism of one such rudivirus, SIRV2, involves the production of a self-assembling protein that forms seven-sided pyramids. These pyramids "bloom" and allow the escape of newly replicated viruses from their host.

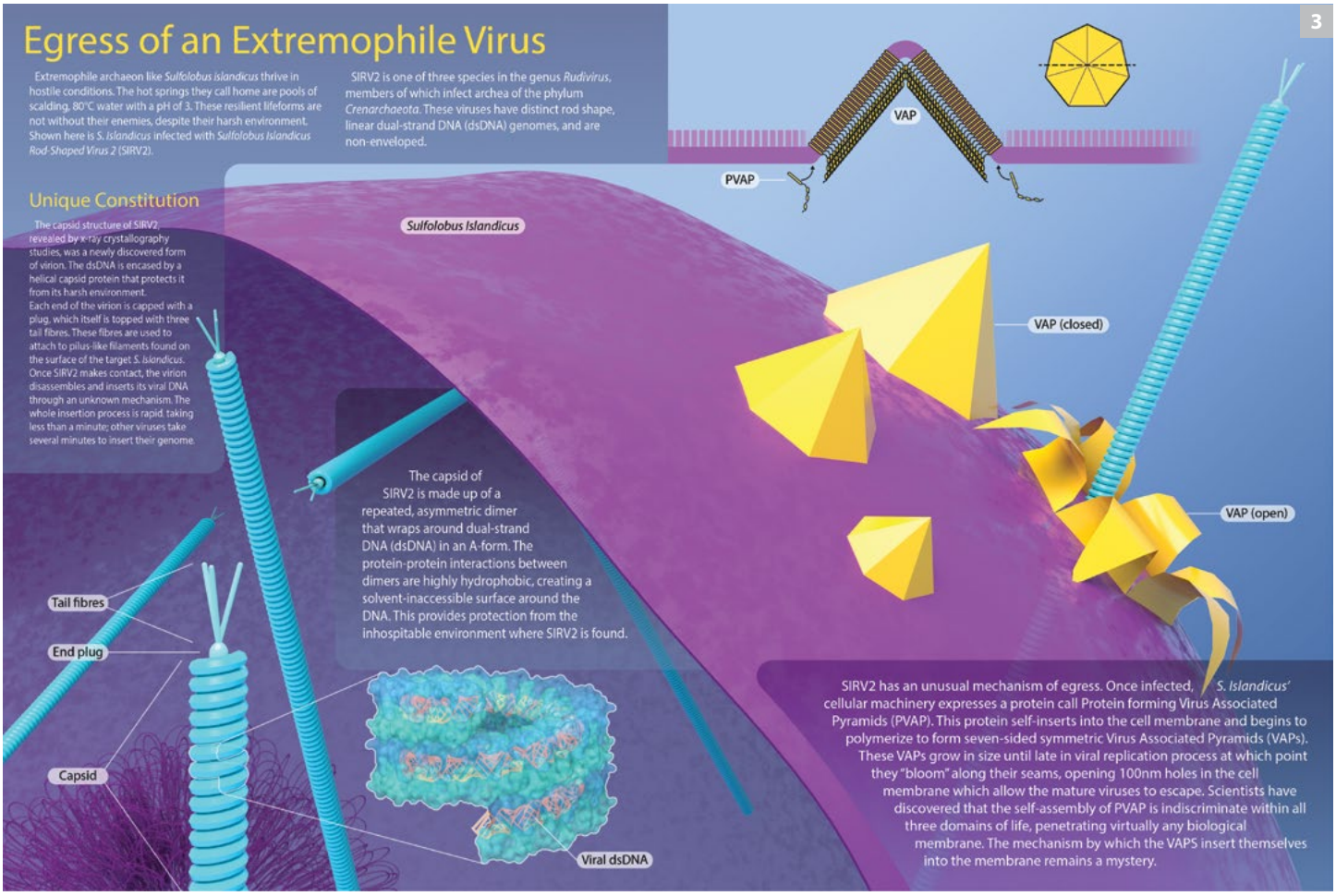
1. Sketch. The capsid of the virus survives in hot springs at a temperature of 80°C and ~pH 3. This incredible coiled structure was the focus of my initial sketches.

2. Study. I wanted to depict the dimer subunit of the capsid and initially, I used a surface model exported from *Chimera*. This model proved to be too detailed and I switched to the molecular *Maya* plugin to import a simplified surface.

3. Final illustration. My final draft involved a scene, shown to scale, with the host organism dividing the internal and external environs. I designed a spread with the left side depicting the assembled virus inside *Sulfolbus islandicus* and the right showing the viral egress strategy. Call-outs on both sides help to orient the reader to the capsid structure and pyramid structure, respectively.







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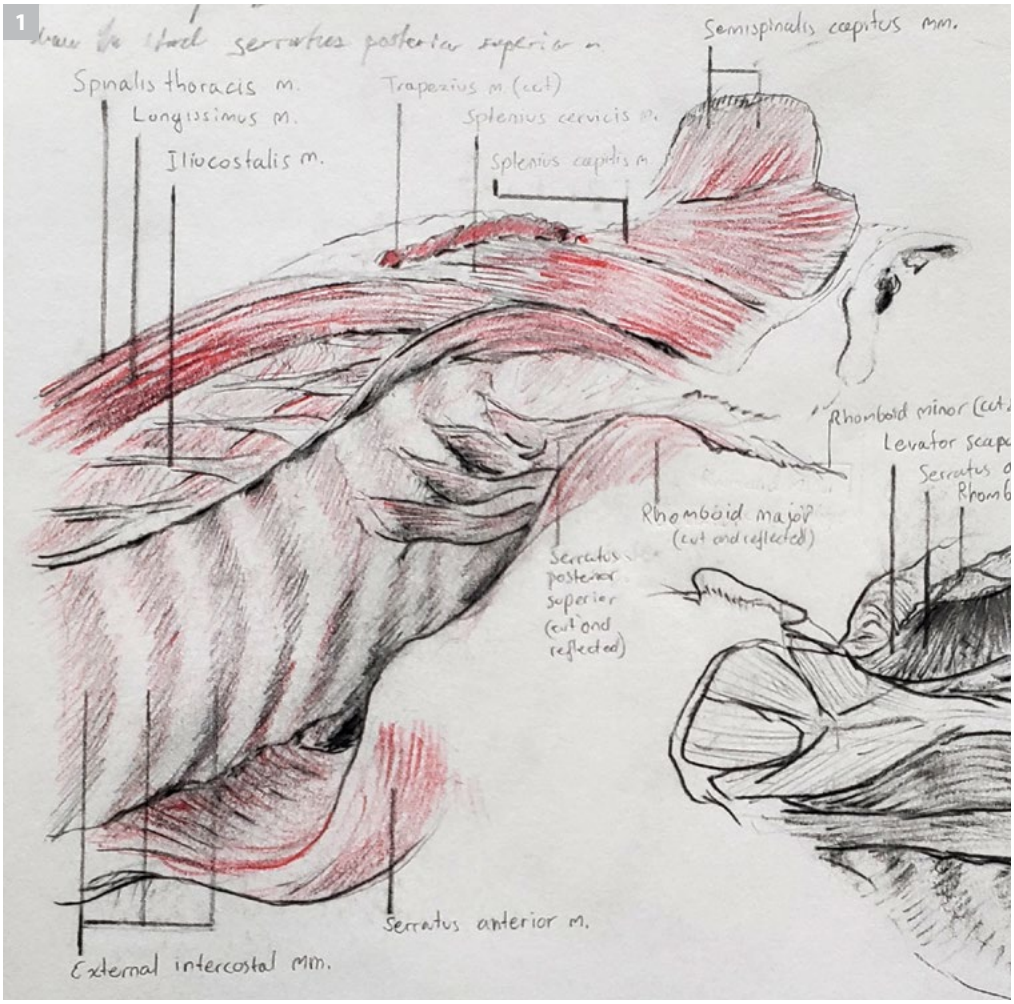

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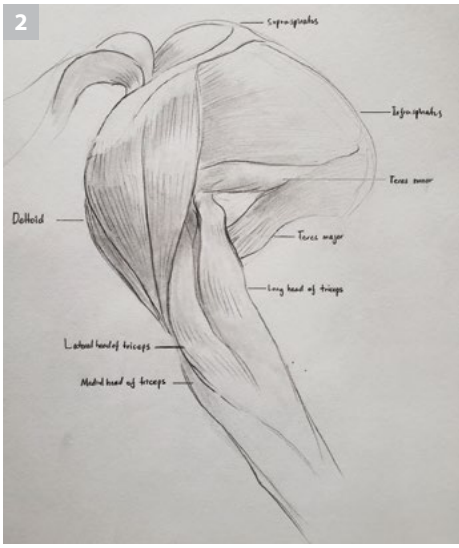

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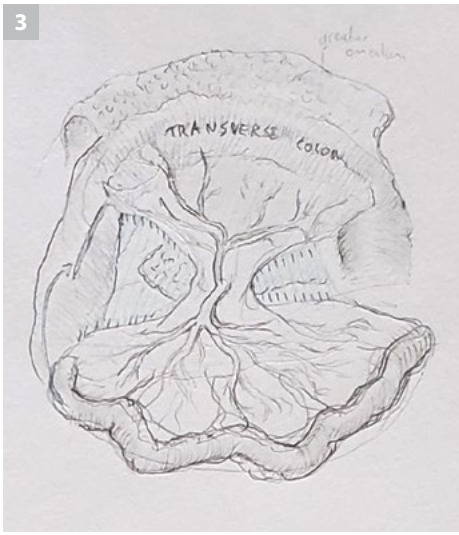

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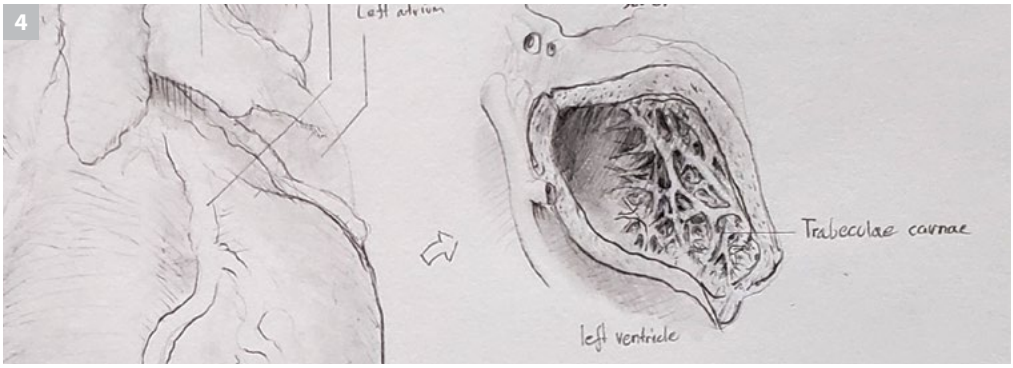

Anatomical Illustration

This series of images are from life-drawing sessions during anatomical dissection labs. This was a unique opportunity and one of the highlights of the MScBMC program, in my opinion. These sessions were an inspiring experience for me.

1. Sketch. Muscles of the back and neck. The musculature deep to the trapezius and rhomboids was enlightening to see for the first time: musculature hidden without dissection.

2. Sketch. Observing the origins and insertions of the musculature of the shoulder complex, was fundamental to my understanding of upper limb function and range of motion.

3. Sketch. I found the ease with which the mesentery and small intestine would default to their initial position after being manipulated for study, intriguing.

4. Sketch. After extracting the heart, I had a chance to dissect it further. The formations of trabeculae in the ventricle were a unique feature to observe.

Recovery Following Partial Spinal Cord Injury

My MRP is an animation of a mechanism of recovery after partial spinal cord injury. Sprouting of injured axons, above the level of injury, can lead to new connections to interneurons. This may form a bypass circuit to target muscles. Strengthening these connections relies on targeted physical training.

1. 3D modelling. To depict moving action potentials (AP), I modeled a dendrite with an internal network of curve paths, running from each branch to the end of the axon. Organizing these paths within *Maya* outliner folders ensured the paths could be easily utilized with MASH. The dendrite was created by extruding the surfaces of a polyhedron.

2. Study. A lighting test I built for the sprouting axons (growth cones). The goal was to create contrast with the background axons.

3. Study. I constructed this materials study to test the necessary transmission and exposure settings to allow the AP mesh lights to glow.

4. Production process. By rendering each AP as a separate clip, I could use *After Effects* to compile multiple AP into one scene. This required careful timing, organizing, and labeling of individual clips.

5. Production process. I rigged this model to have both inverse-kinematic and forward-kinematic systems for arm movement. Learning to build a skeleton and to troubleshoot controls was a difficult but rewarding experience.

6. Final animation. I produced these stills from the final scenes. I created the texture of the neurons by connecting a generated cloud texture into the specular roughness attribute of the *Arnold* shader.

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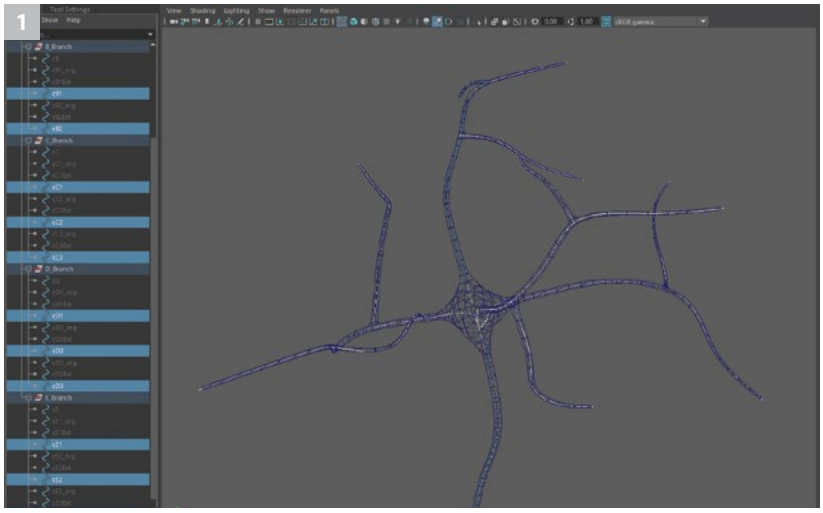

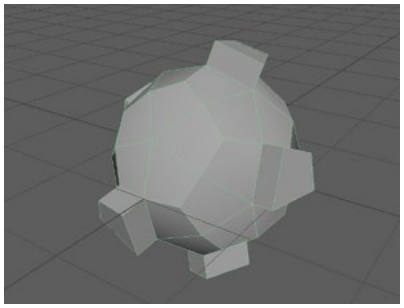

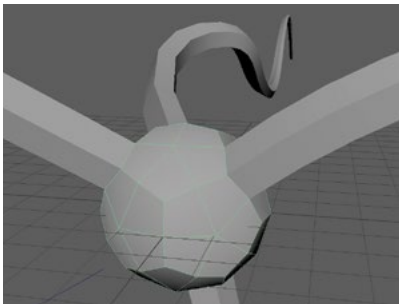

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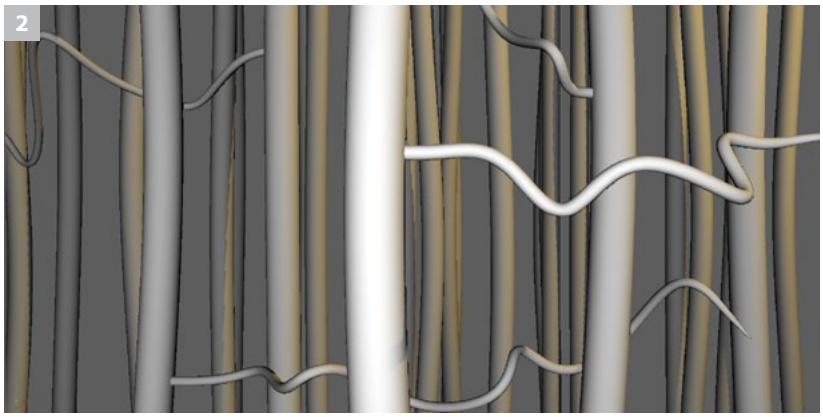

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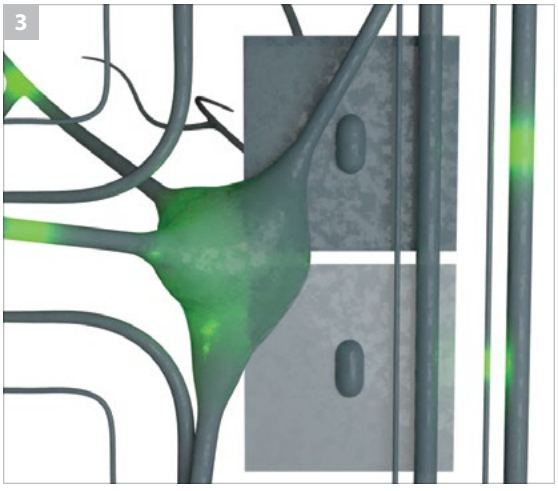

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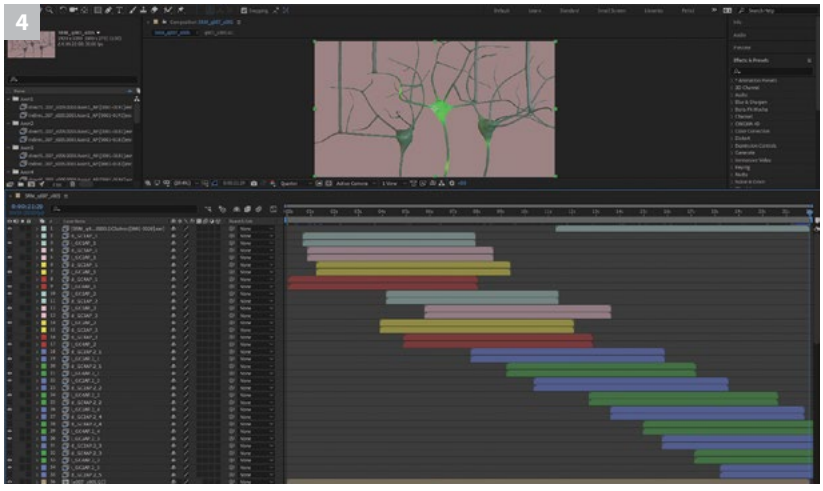

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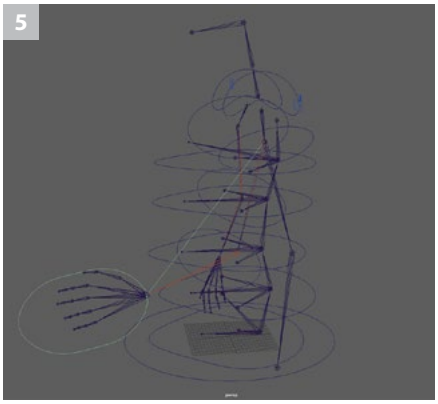

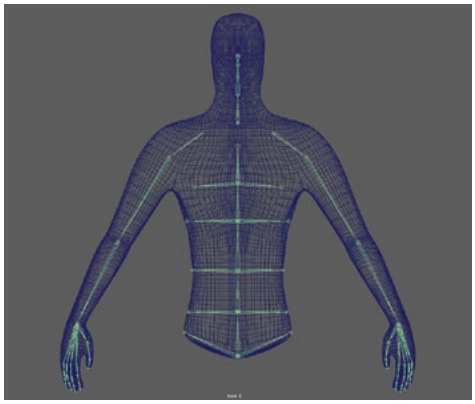

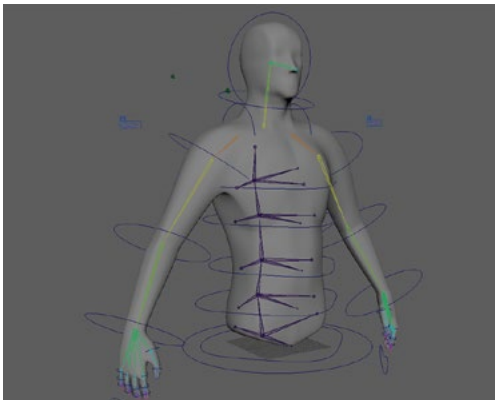

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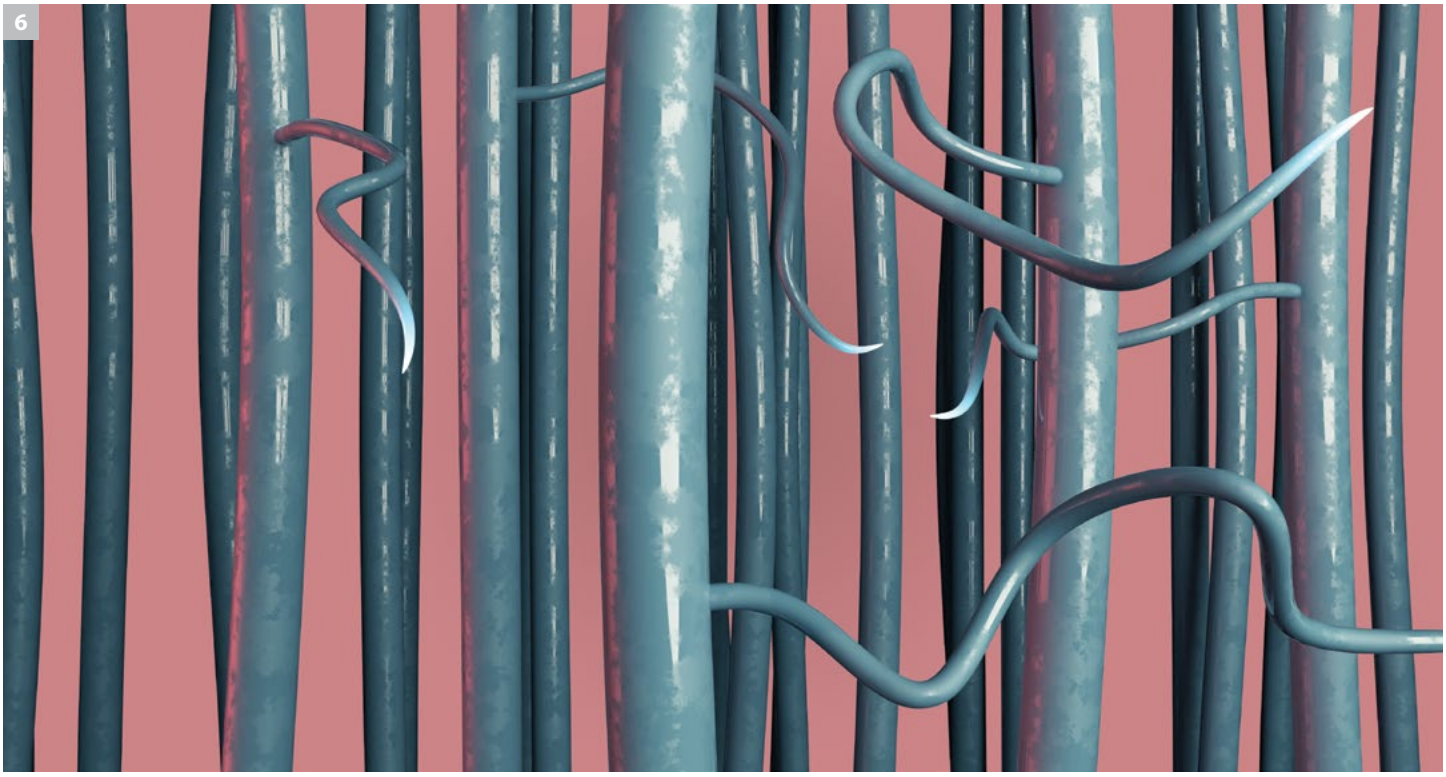
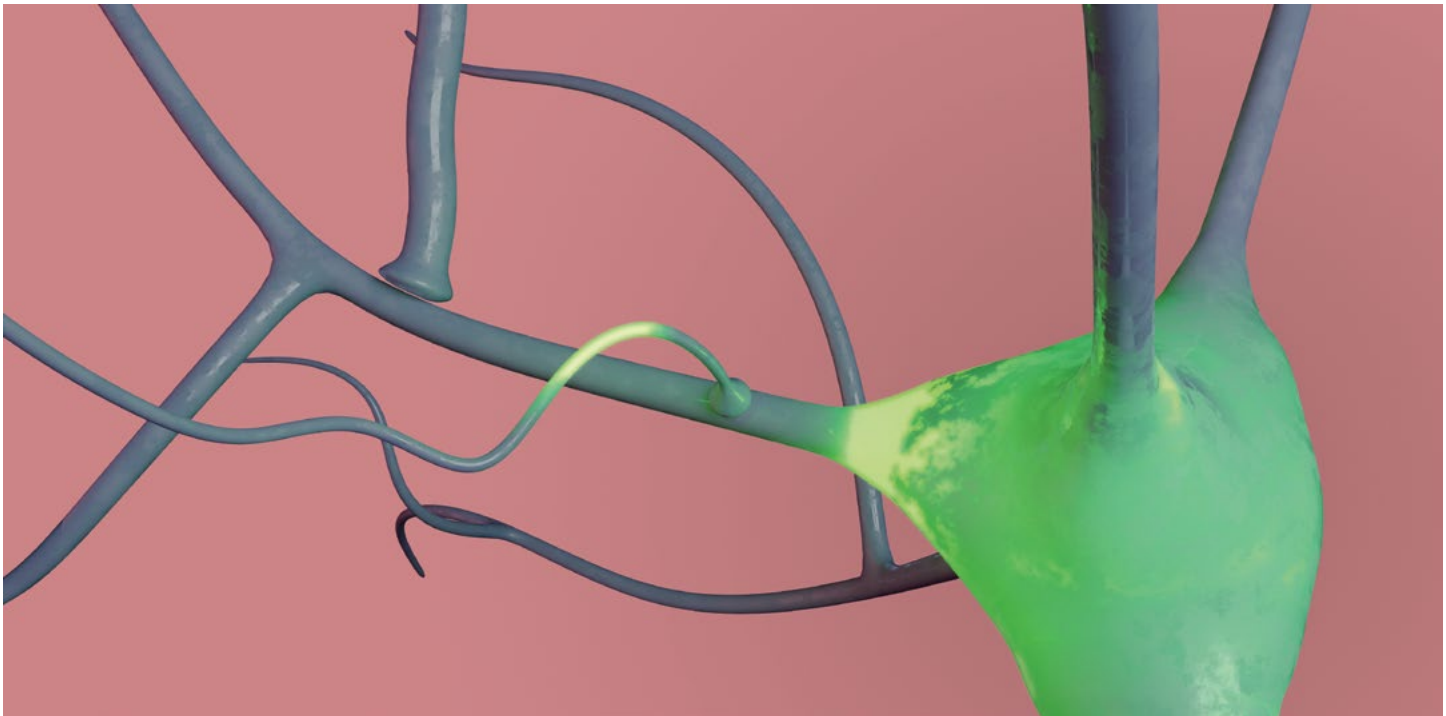
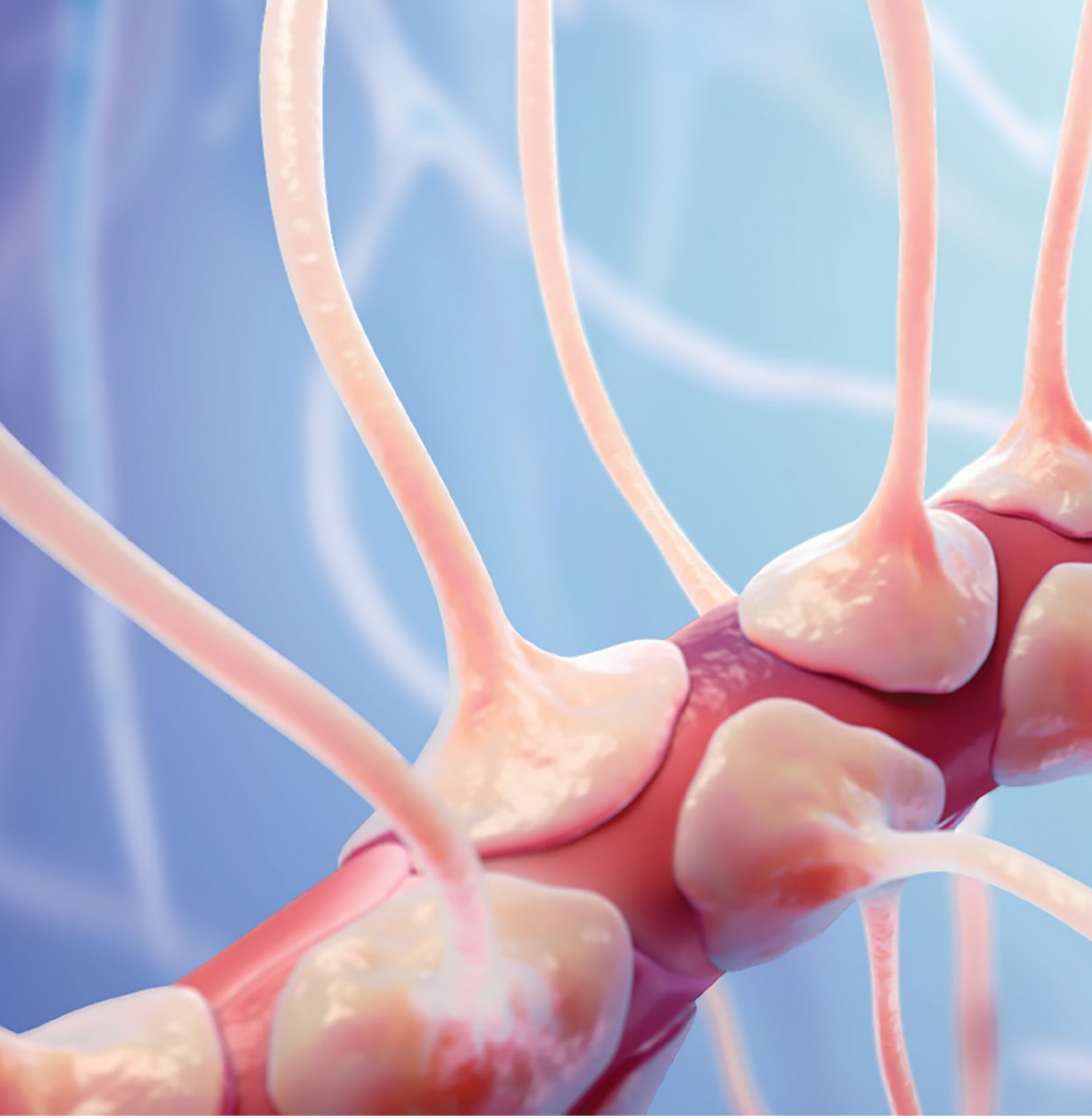




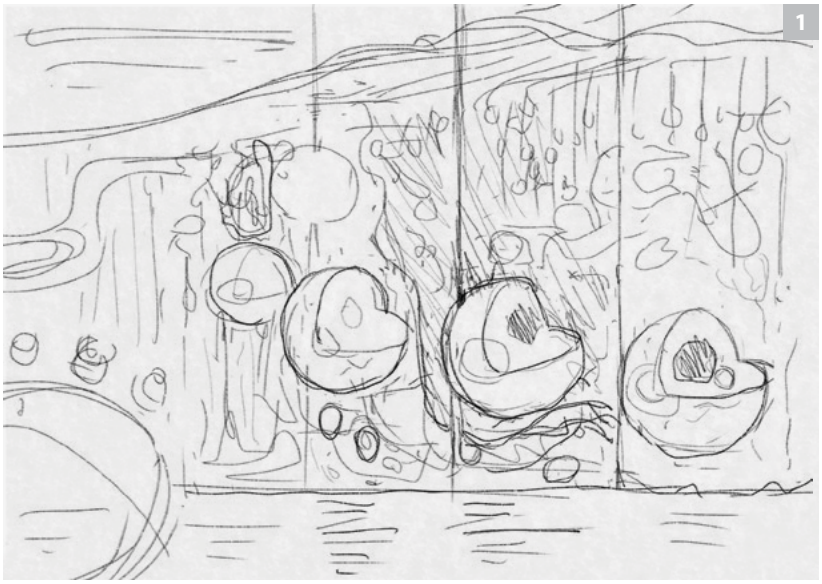


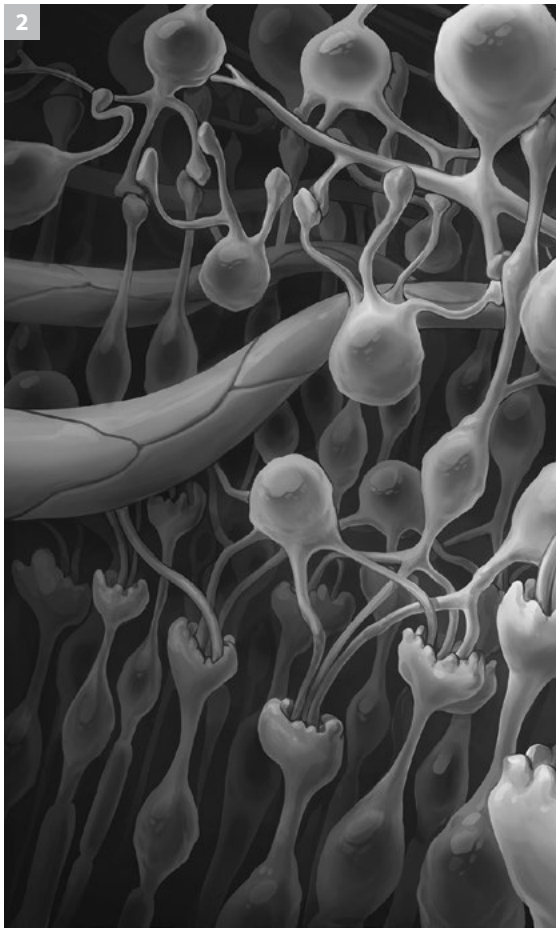
Hang Yu Lin

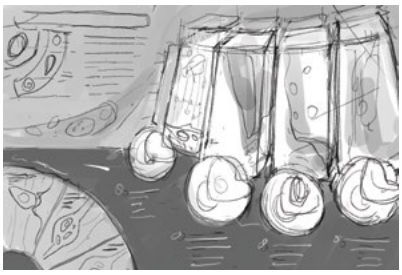
I am a 2D/3D medical artist specializing in animation and digital painting. I love to experiment with various compositions and colour palettes to communicate scientific subjects beautifully. I also strive to be inspired often by many types of art – immersing myself within art trends and finding ways to apply them to science and health communication. Visuals make a great impact on audience interest and learning, and so it is a goal of mine to always be creating works that inform and engage.

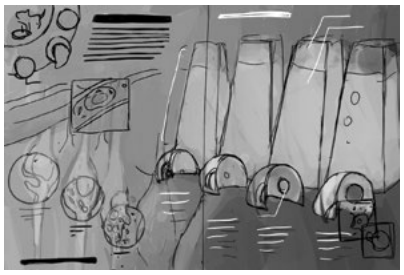
Pathological Illustration

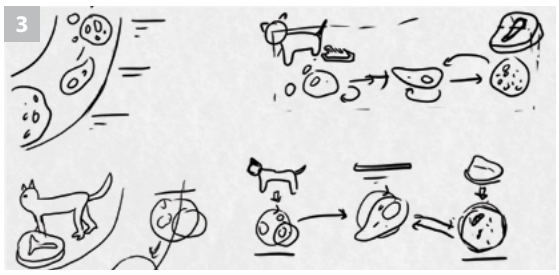
Acquired ocular toxoplasmosis is retinal infection caused by the protozoan parasite *Toxoplasma gondii*. The goal of this project was to use a magazine spread format to communicate its disease process on multiple scales.

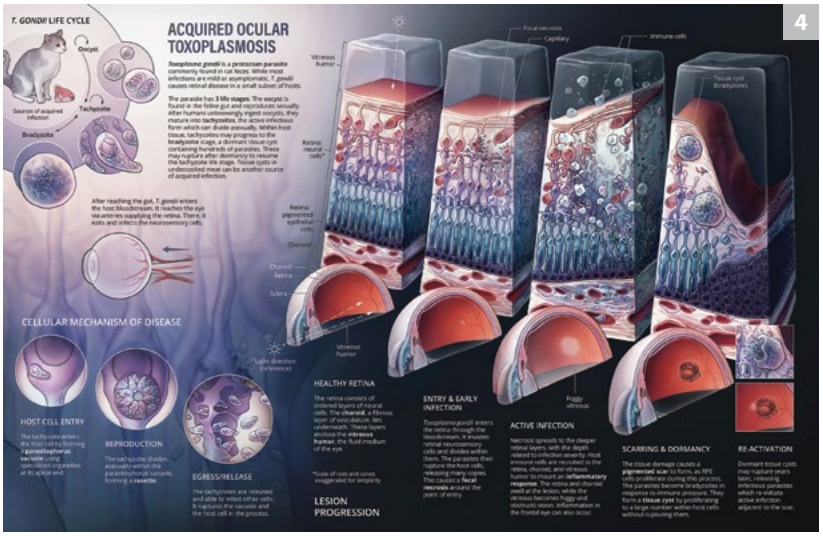












1. Sketch. Sketches created to explore different layout approaches that can show all of the planned components: the protozoan's life cycle, the method of infiltration, and the disease's effects on a cellular, tissue, and organ scale. The visual flow of information was also considered.

2. Study. A tissue landscape study created to familiarize myself with the complex and ordered cellular environment of the retina. This idea of an immersive cellscape inspired the background of the final illustration.

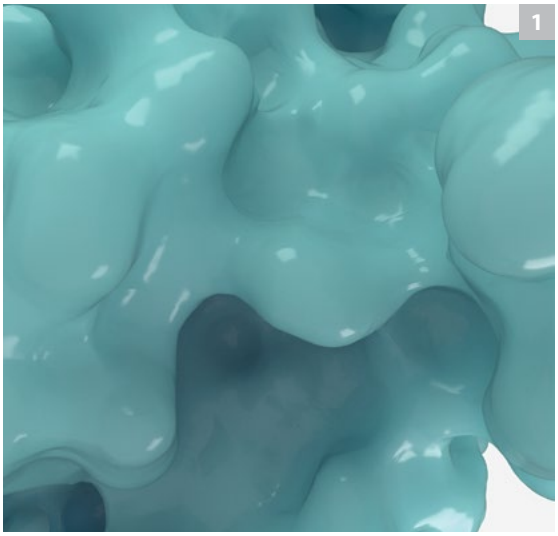
3. Sketch. Rough sketches to experiment with how to depict the protozoan life cycle and common sources of infection.

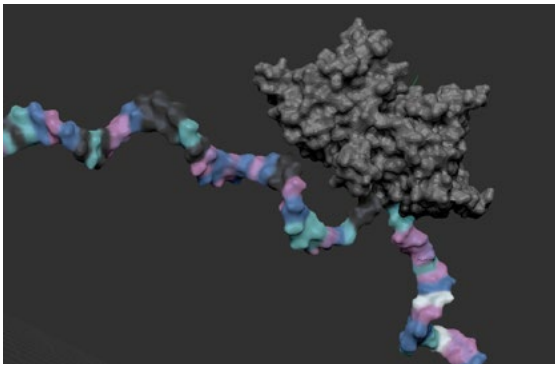
4. Final illustration. The final mock magazine spread painted in *Photoshop*.

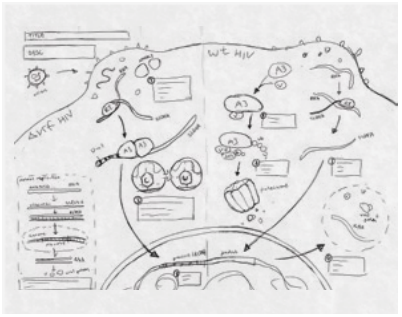
Previous spread. Final animation. A still from my master's research project: Focused ultrasound and microbubbles to overcome the blood-brain barrier for drug delivery.

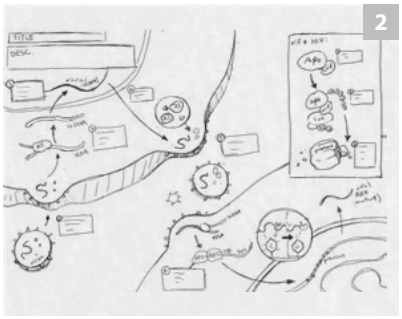
Molecular Visualization

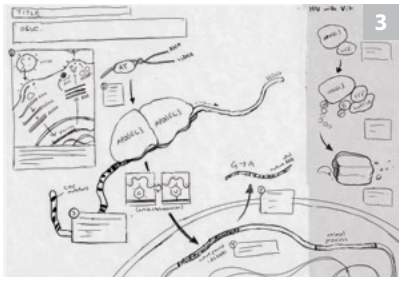
APOBEC3 can mutate the DNA of retroviruses such as HIV, but HIV had evolved to produce Vif, which tags APOBEC3 for degradation before it can act. The goal of this project was to use 3D molecular visualization tools to depict these molecular processes.

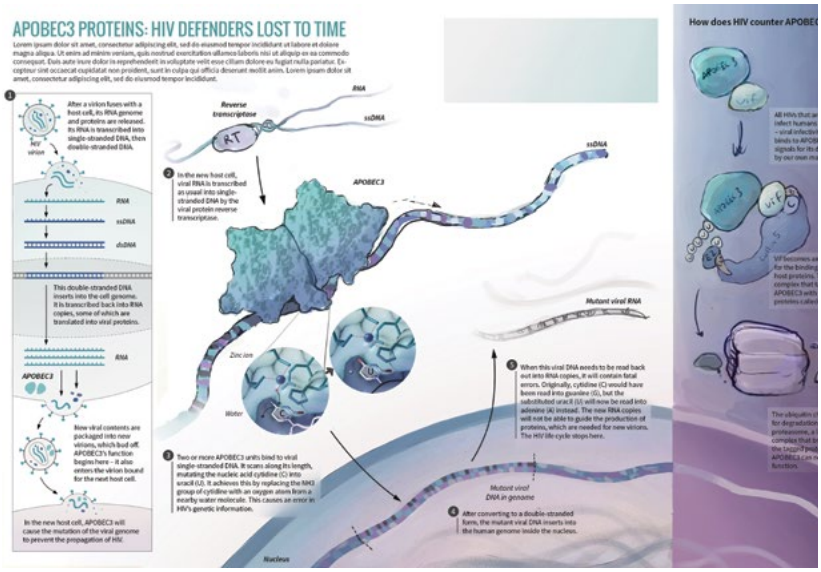


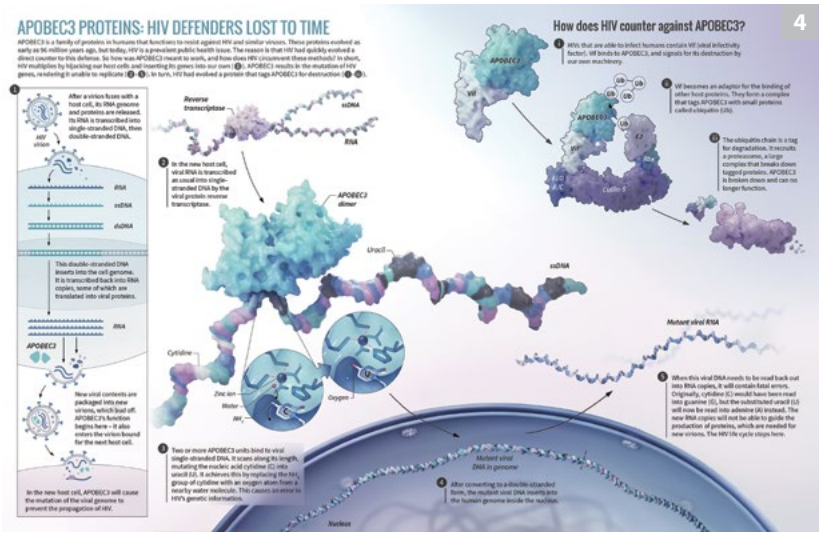












1. Production process. Above is a render of the active site surface. Below that is a *ZBrush* screenshot of APOBEC3 bound to a strand of DNA. I used *Zbrush* to pose and paint the DNA strand before importing it into *Maya* to light and render.

2. Sketch. Two alternate layout sketches when exploring composition. These weren't favoured because they were not as engaging, resembling traditional cellular pathway figures.

3. Sketch. A series of sketches and mock-ups done to arrive at the final composition. This idea was pursued because the presence of a 'main character' in focus was more visually interesting, and the information was more organized into distinct compartments.

4. Final illustration. The final magazine spread featuring 3D rendered molecules, and schematics drawn in *Illustrator*.

Editorial Illustration

Cyborg Botany was the name of an MIT design project in which researchers explored ways to augment plants with technology to become functional sensors, actuators, and more. This mock journal cover represents this research through visual metaphor.

1. Sketch. A character design sketch to figure out the silhouette and mechanical details of the robot.

2. 3D modeling. Screenshots from *Maya* showing the robot's rig, topology, and final pose with some textures used in the render.

3. Sketch. Four early cover concepts that could convey the topic of plant-machine interfaces. These were inspired by what was achieved by the researchers, e.g. chemical sensors for plant fluid uptake, working circuitry grown inside stems, and mechanical motion based on the light-sensing ability of the plant. The more humanoid design was chosen for its additional visual metaphors and emotional intrigue.

4. Final illustration. The final composited render without journal cover elements.

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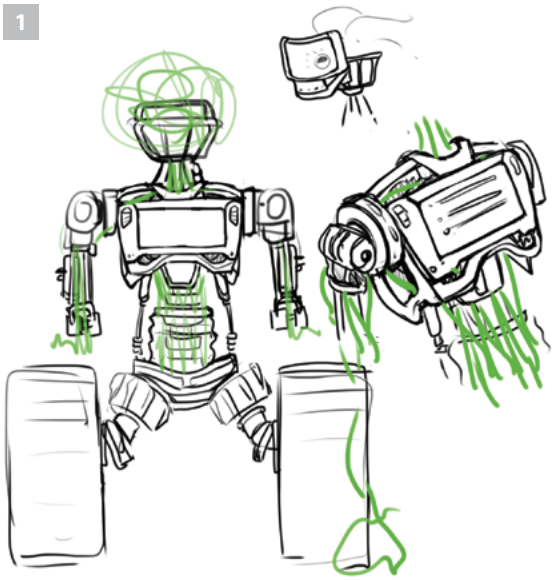

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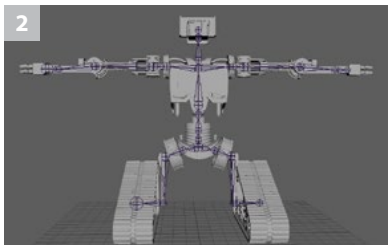

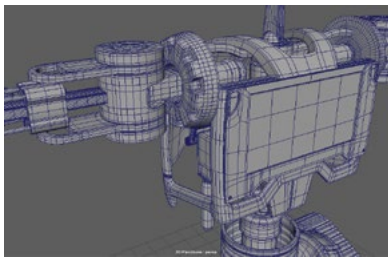

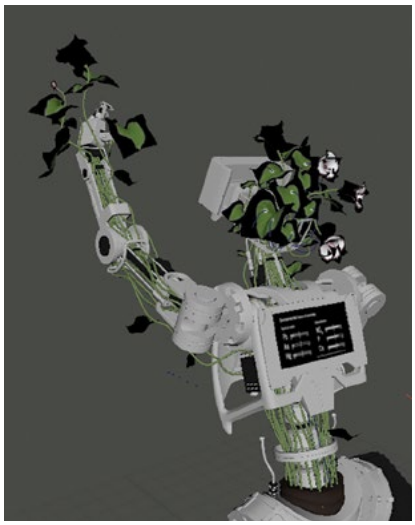

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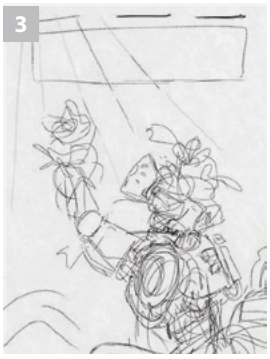

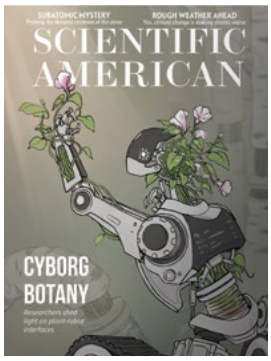

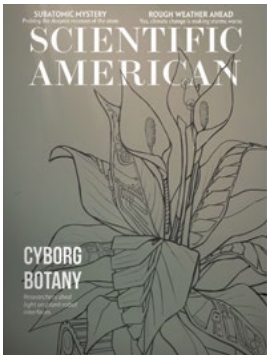

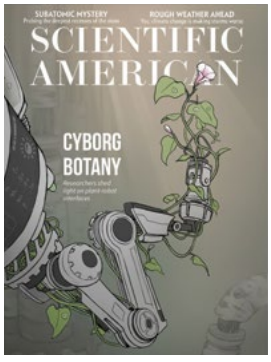

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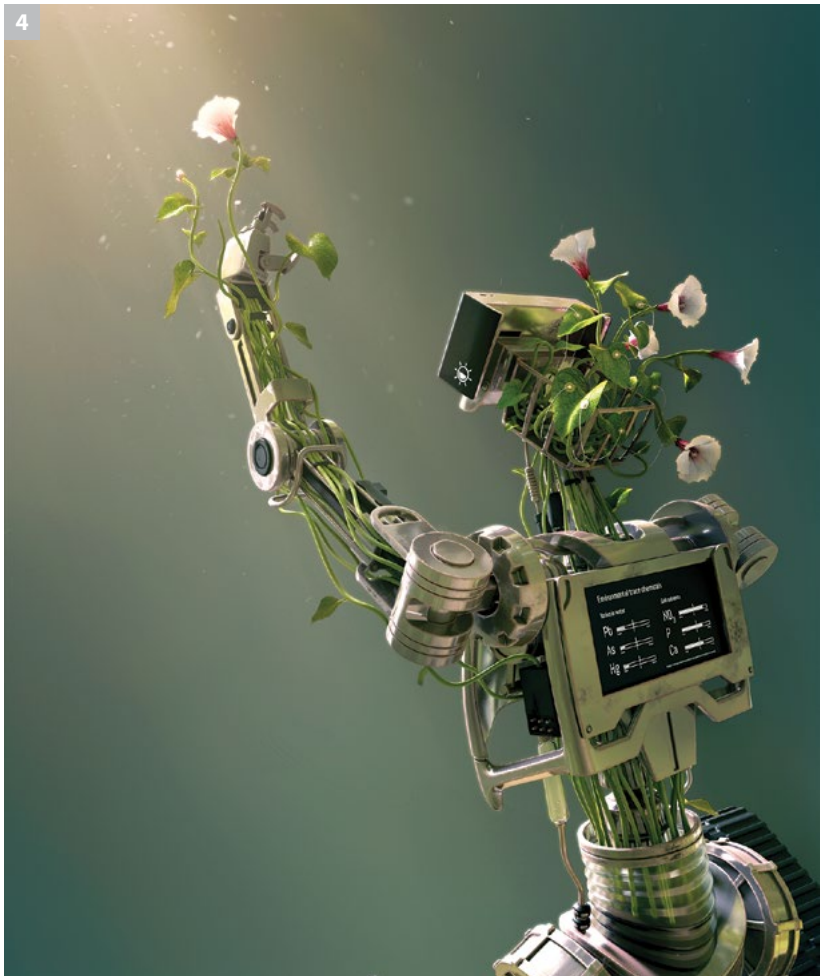

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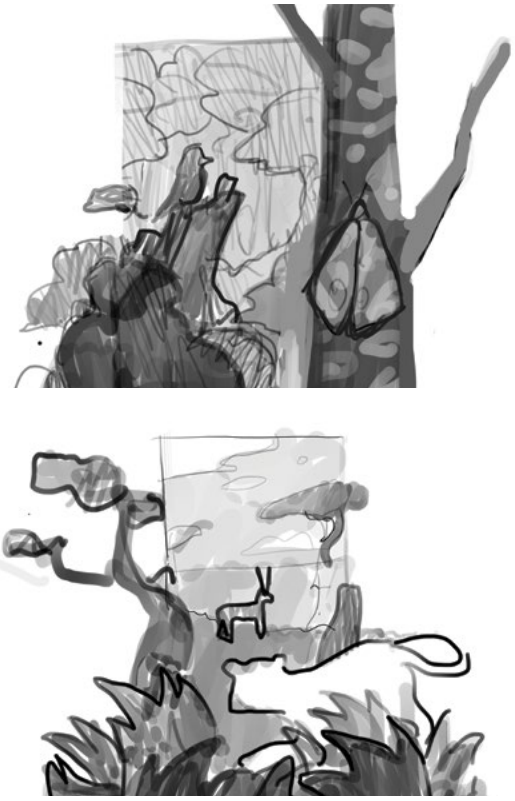

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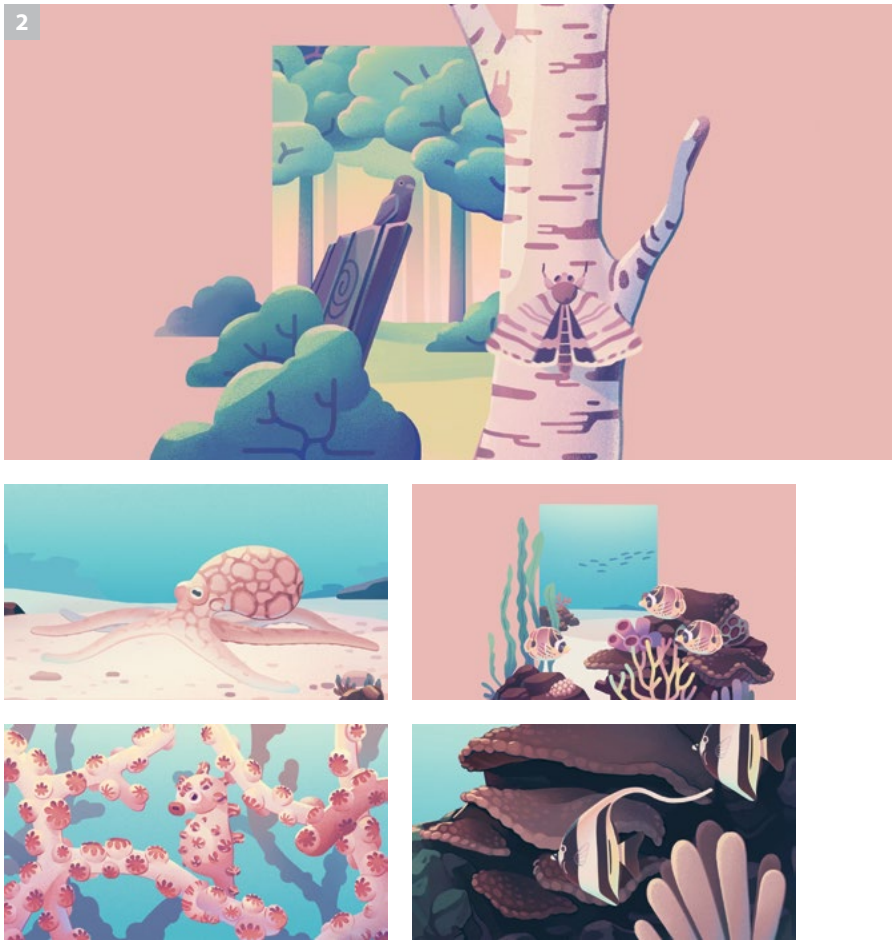

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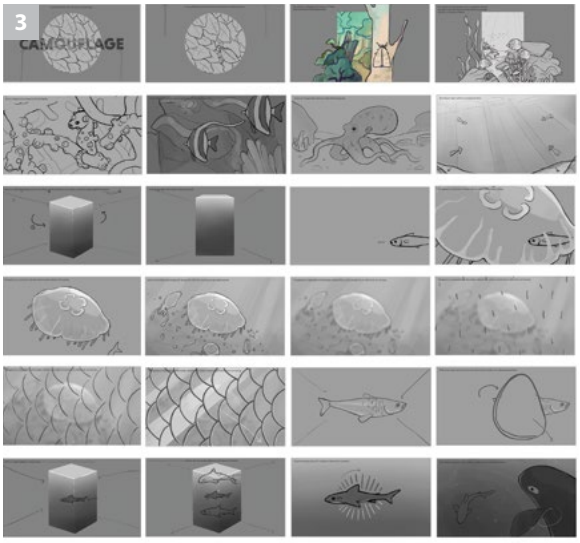


4

Scientific Animation

A 2D animation introducing the camouflage strategies of aquatic animals. Underwater camouflage has unique features, and explains why aquatic creatures look the way they do. This is meant to have a fun and approachable style for a general audience.

1. Sketch. Concept sketches for the introduction mentioning terrestrial camouflage. A rectangle motif was explored as a way to separate animals in the foreground from ones in the background.

2. Final animation. Stills from the completed portion of the animation (the introduction section).

3. Storyboard. This grayscale storyboard describes my plan for the visuals throughout the story. A coloured storyboard was made later, based on this sequence.

4. Animation assets. Although the full animation was not finished during the semester, I had created all the planned assets - these are a few examples.

Focused Ultrasound and Microbubbles to Overcome the Blood-Brain Barrier for Drug Delivery

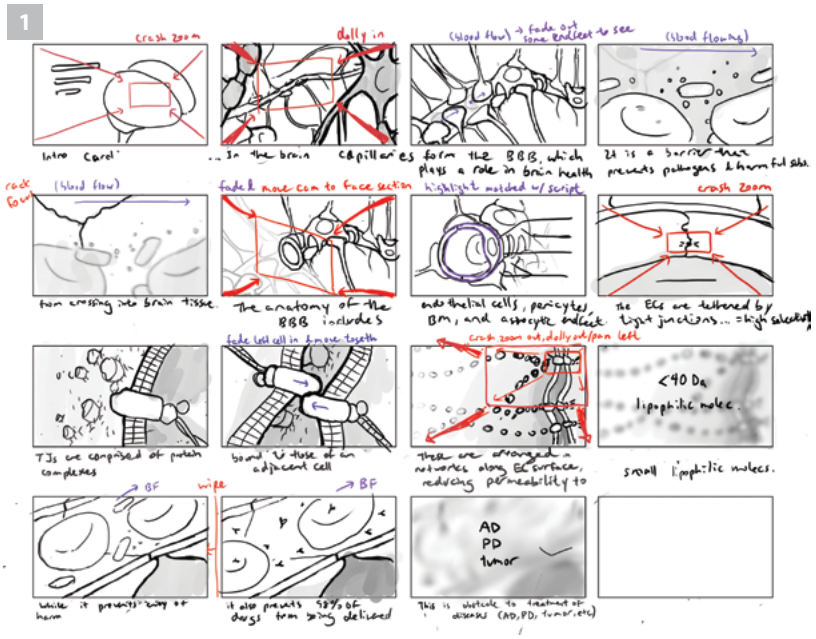
The blood-brain barrier (BBB) has a protective function but restricts drug delivery into the brain. Sunnybrook scientists have created a non-invasive procedure to reversibly 'open' the BBB in targeted treatment areas. This is a 3D animation to explain the course of the procedure and the mechanism of opening.

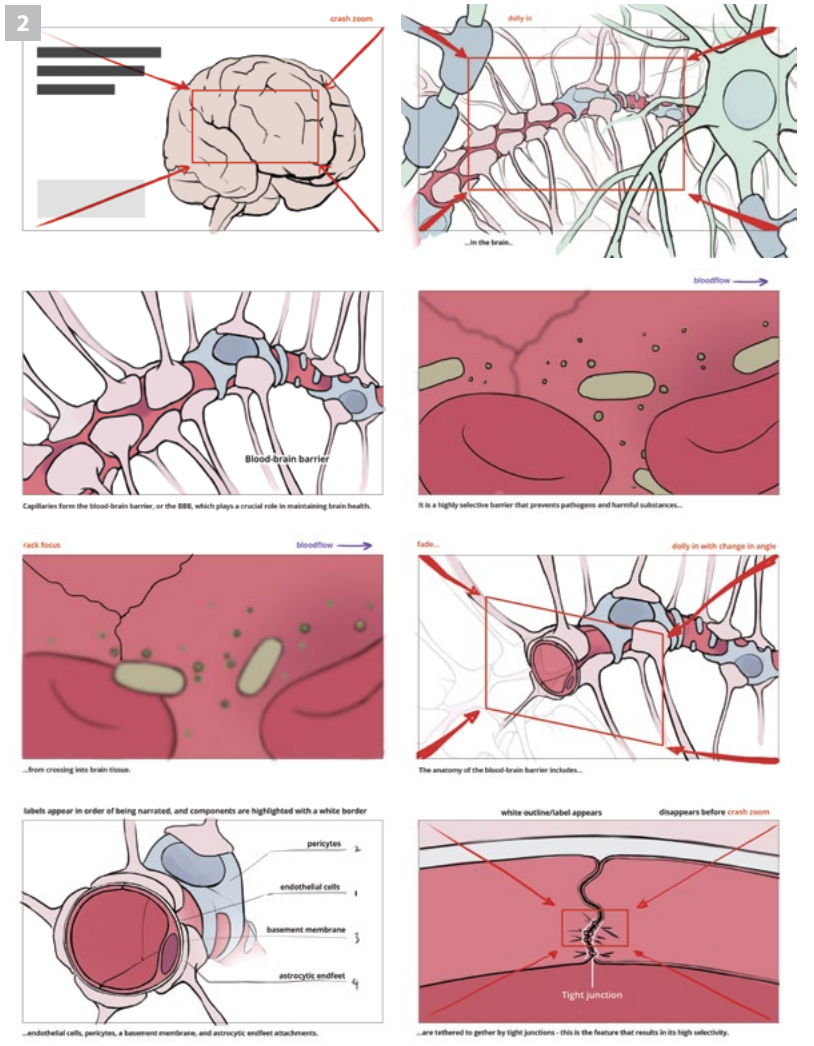
1. Storyboard. A rough draft of storyboard thumbnails, which was done as a broad overview of how the story will be told visually. One of the storytelling challenges was that the audience needs to understand the BBB on multiple scales in order to eventually understand the mechanism of opening. These storyboard frames show the introduction of the BBB, in which we move through each scale, from organ down to molecular, explaining the relevant components which will later be interacting within the procedure.

2. Storyboard. A refined draft of the storyboard which tells the story with more visual detail and initial colour palette ideas.

3. Production process. Images showing the production process from playblast to textured previews to the final composited frame.

4. Final animation. A frame from the final animation, showing tight junction proteins from neighbouring endothelial cells tethered together - this is the molecular basis of how the brain's blood vessels remain impermeable, and this binding is reversibly interrupted during the non-invasive procedure.





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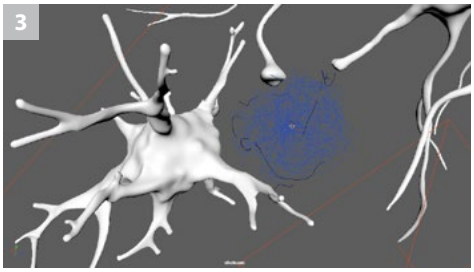

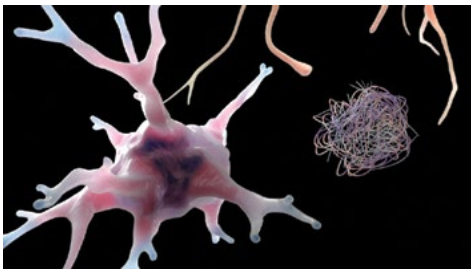

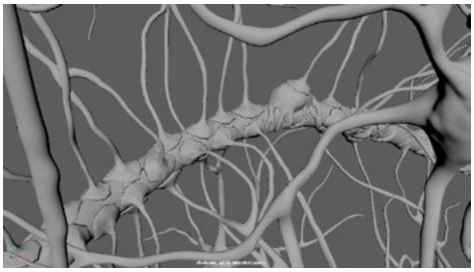

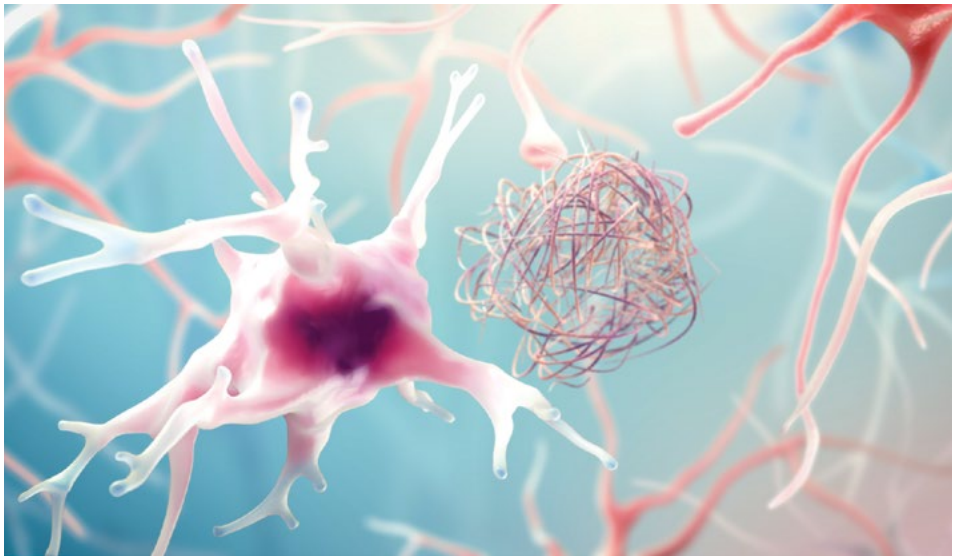

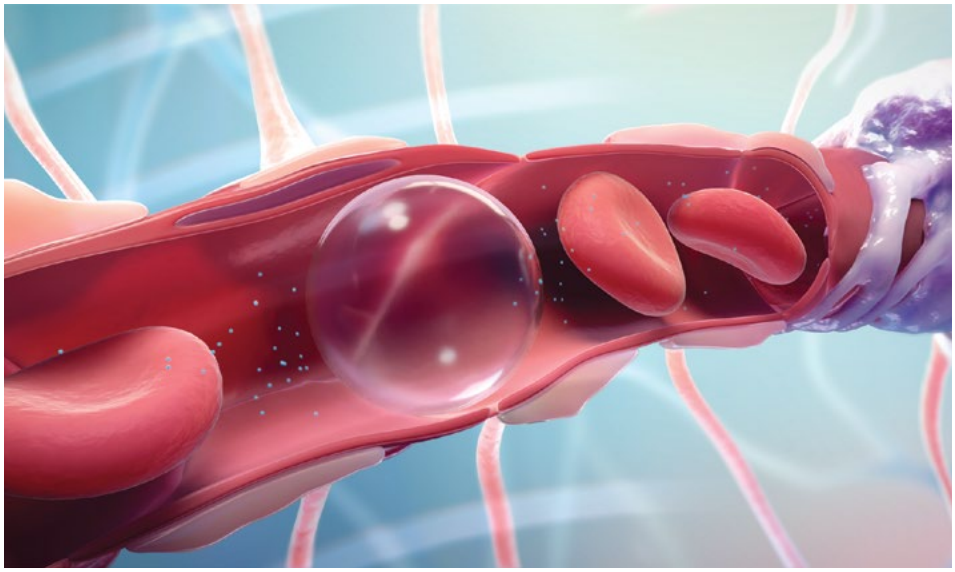

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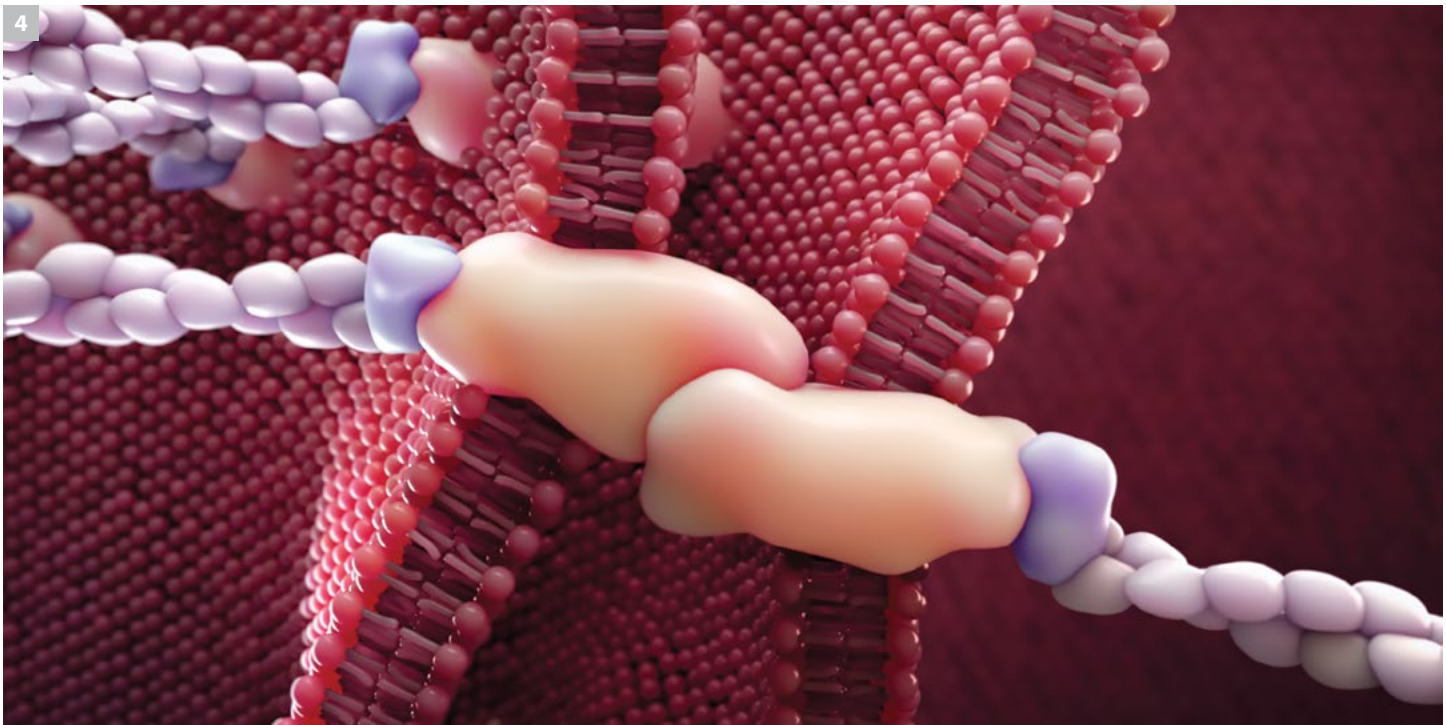



Ligaments
Stretched
Neutral
Compressed
Neutral
MUSCLES
LIGAMENTS
Hyperkyphotic
BACK TO EXERCISE
ReKinnect
Arm Lift
Let's observe arm swing is more limited in the hyperkyphotic spine compared to the aligned spine.
1. Click the trapezius and pectoralis major and supraspinatus buttons to observe the muscular excursion during arm raising.
2. Drag the slider to toggle to observe how muscles, the scapula,
Neutral Spine
Neutral Arm
Gary
been wo
landscapi
for more tha

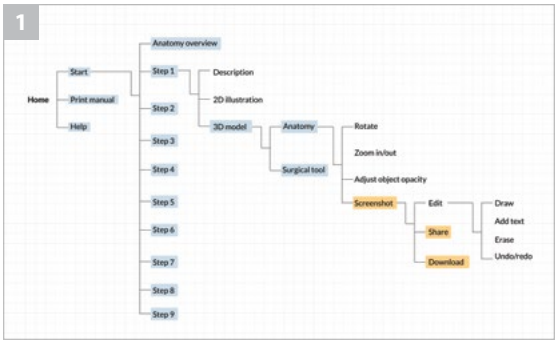
Janell Lin

I'm a designer who strives to craft compelling and authentic experiences. With training in biomedical communications, I make complex information a little easier and more interesting to understand. I value clarity, thoughtfulness, and aesthetics in my visual solutions. I received a Master in Biomedical Communications at the University of Toronto and Bachelor in Studio Art at Smith College, Massachusetts.

UX/UI Design

An eLearning tool for surgeons learning an anterior cruciate ligament reconstruction technique. I designed the UI/UX of the tool while the illustrations and 3D models are created in collaboration with Christine Shan.

1



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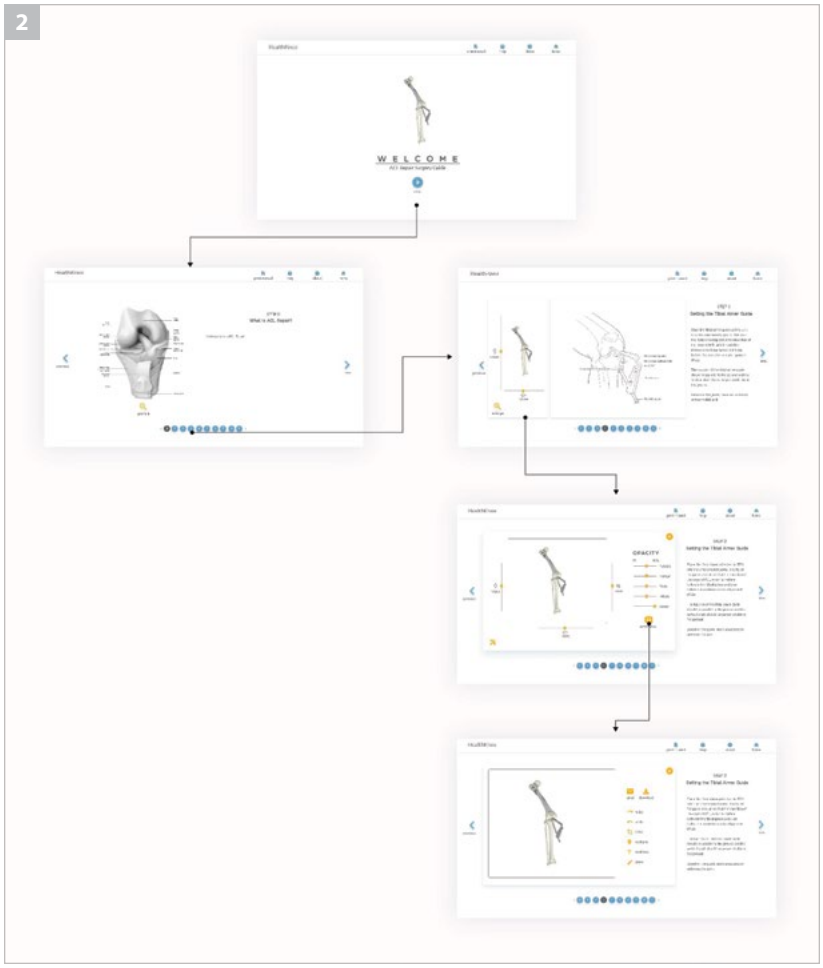

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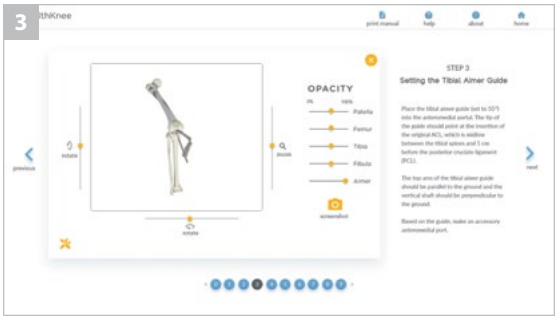

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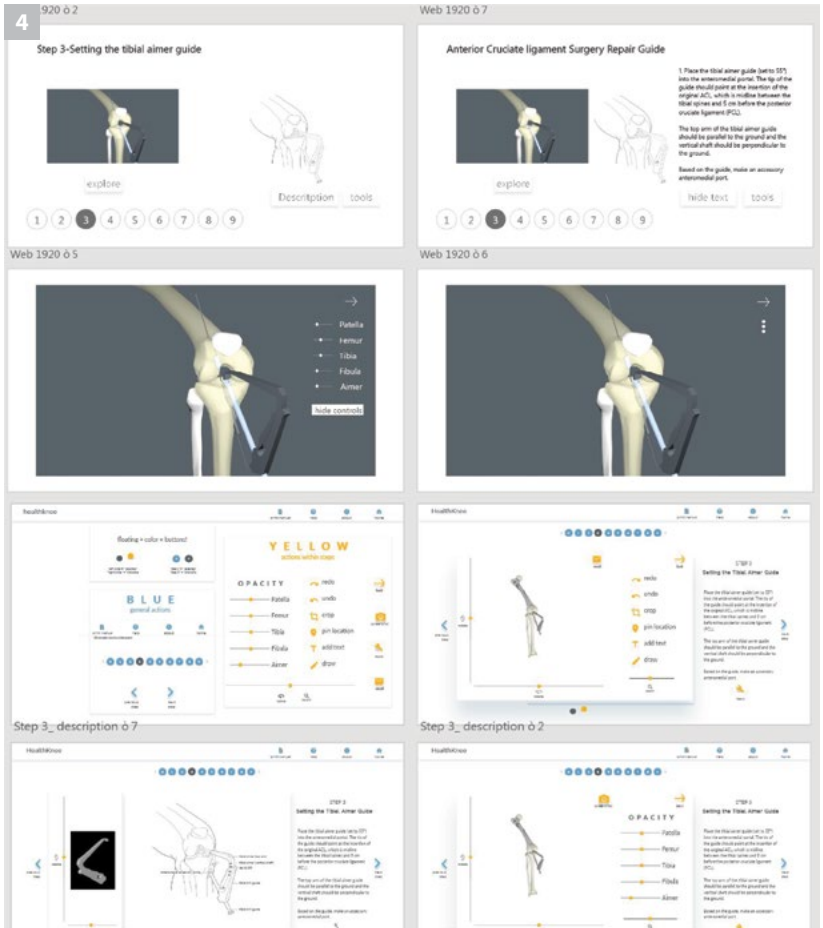


1. UX design. Information architecture that organizes the structure of the application.

2. UI design. One screen of the application showing the interface for rotating the 3D model to understand the anatomy. Users can use sliders on the right to adjust the opacity for each anatomical structure.

3. UX design. User flow showing key screens in the application. Users can learn about the procedure from illustrations and 3D models. When viewing the 3D model, they can take screenshots of the desired angle and export the screenshot with annotations.

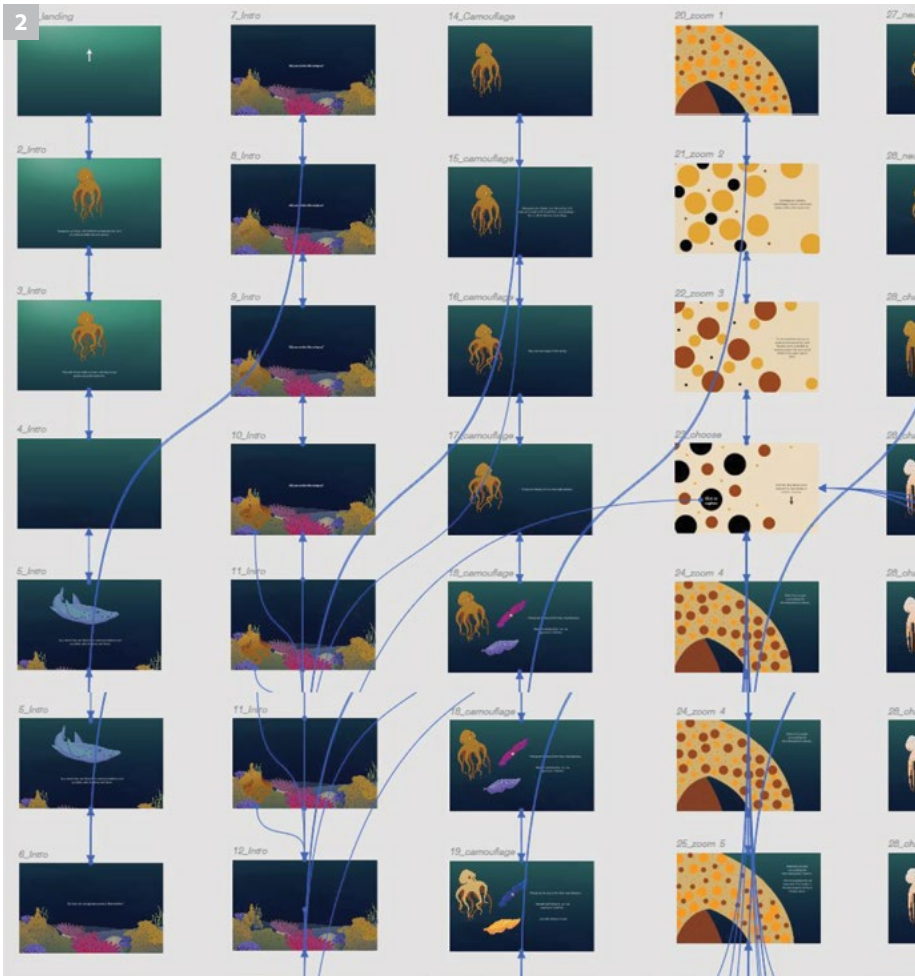
4. UI design. Early experimentations with different UI.

Interactive Animation

An animated scrolling website explaining adaptive camouflage in octopuses. The target audience is educated lay people who would read pop-sci magazines or go on a museum website. It is created in collaboration with Roxy Ziman and Miranda MacAskill.

1

2



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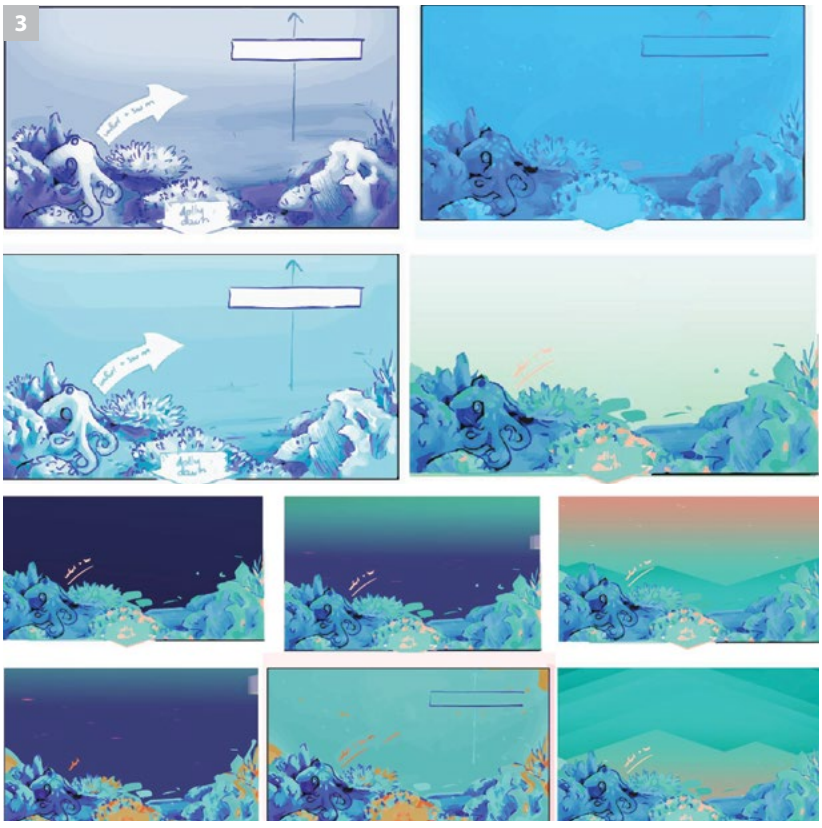


1. Final illustration. Illustrated characters created in *Procreate*.

2. Prototype. We created an animated prototype using Invision Studio. This prototype allowed us to imitate the animated scrolling effect of the website and test the website with different users.

3. Production process. Colour studies showing different palette ideas.

Previous spread. Final animation. Screens of my master research project, Kinundrum: Spine, a kinesiology eLearning module.

Molecular Visualization

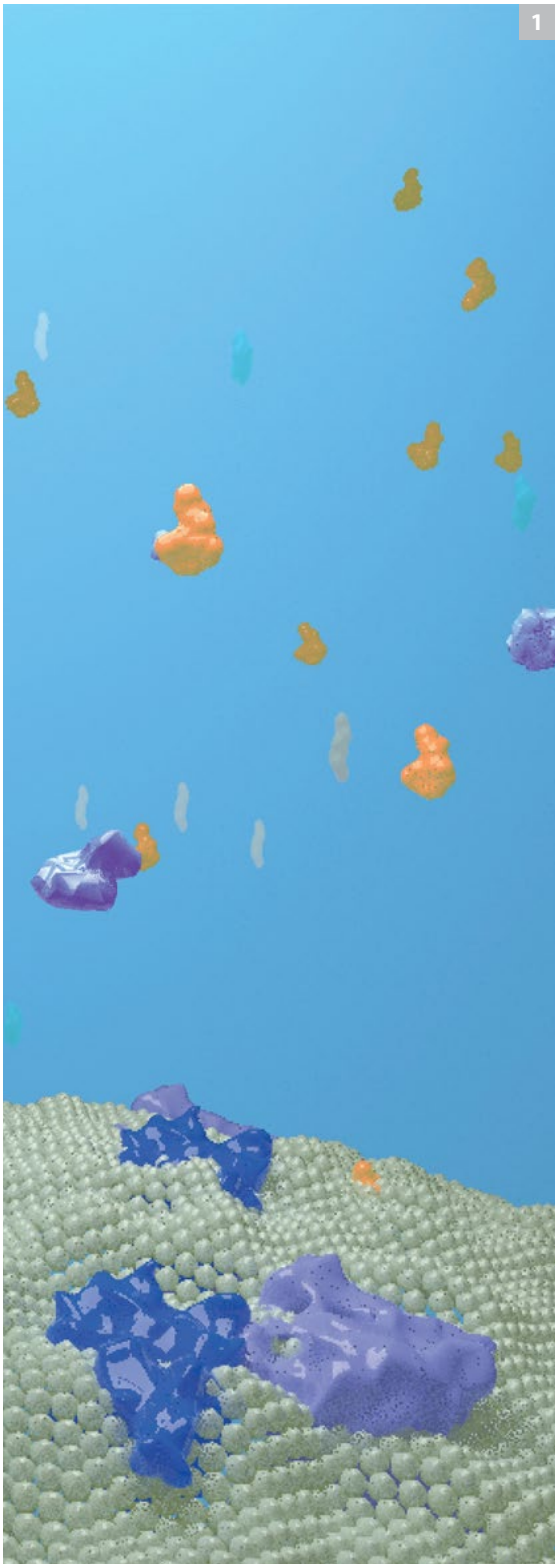
Magazine spread explaining how drugs that selectively target melatonin receptors can have more specificity in treating sleep disorders. The molecular mechanisms are explained by visualizing the binding sites of melatonin receptors.

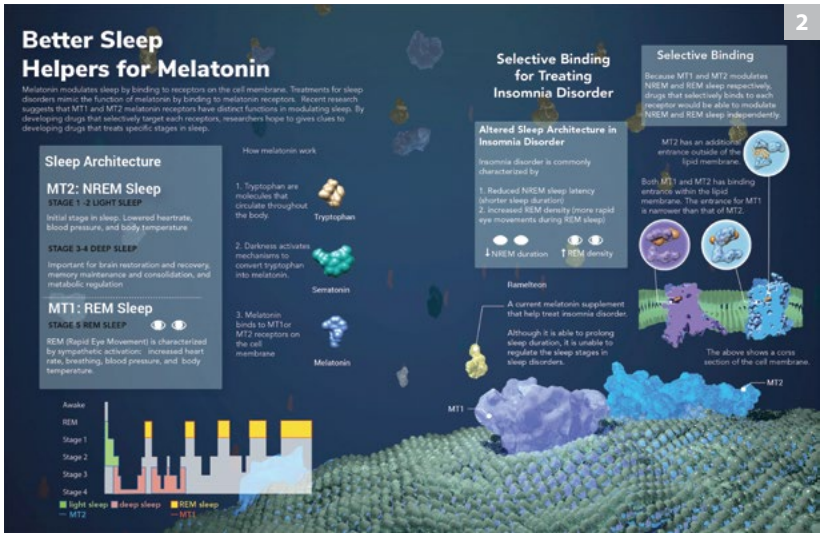
1. Production process. A render of the lipid layer using *Maya*. I experimented with different materials and lighting to show the melatonin receptors.

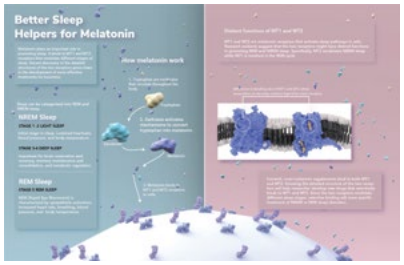
2. Final illustration. Final magazine spread.

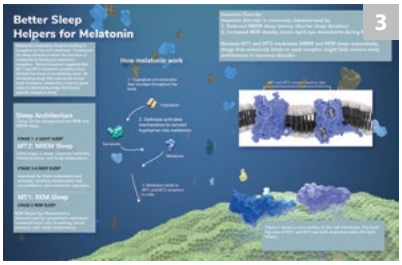
3. Production process. On the left is an earlier draft where I can use simple shapes to quickly render and experiment with different layouts. On the right is a later draft where I did more modelling and lighting refinement.

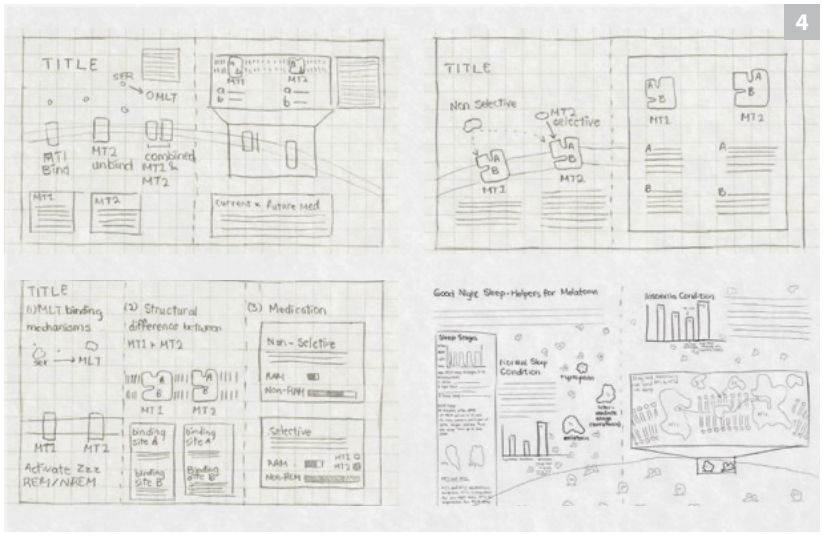
4. Sketch. Initial sketches for layout ideas.

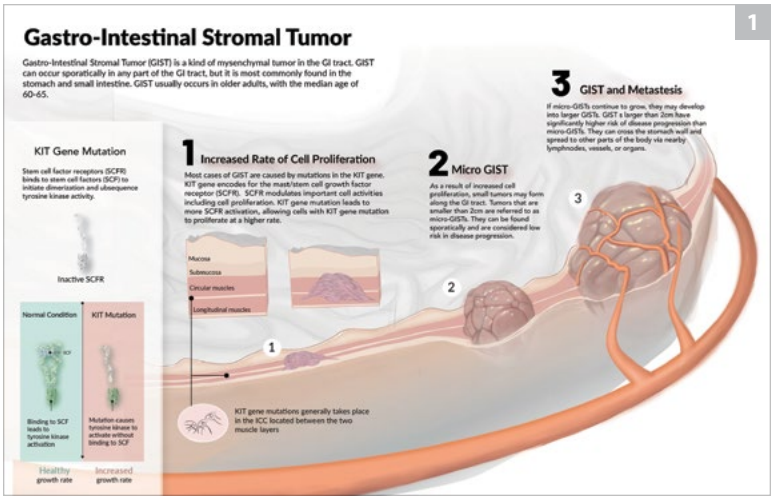


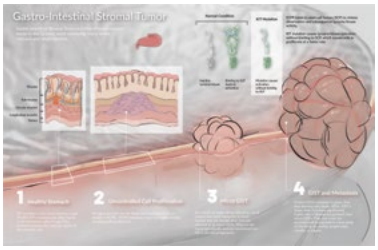


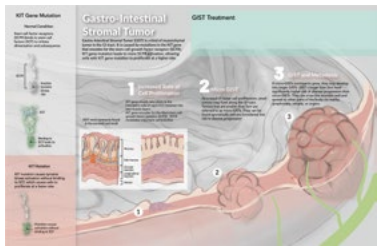


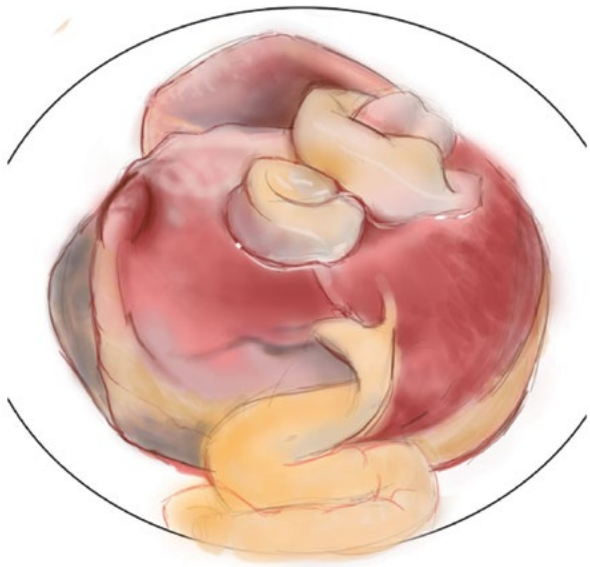


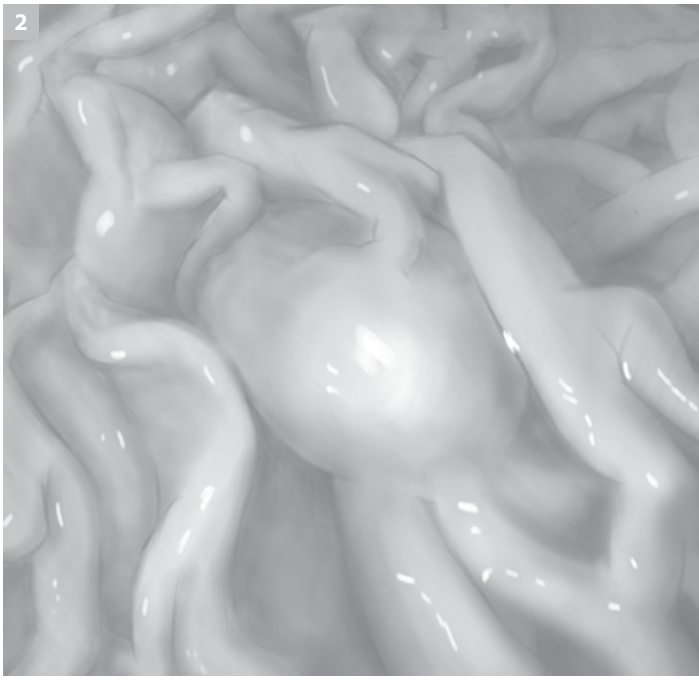


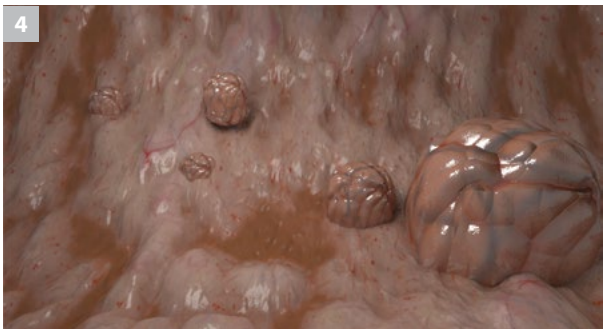


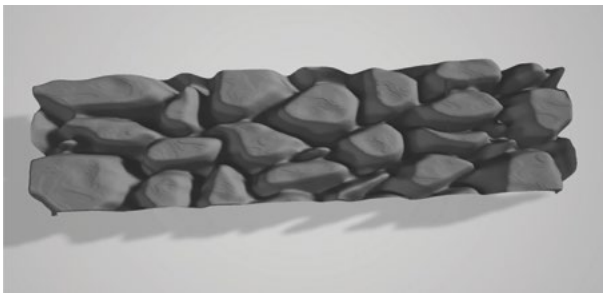












Pathological Illustration

Gastrointestinal Stromal Tumors (GIST) is a unique type of cancer that develop within the muscle layers of the stomach wall. This editorial spread illustrates the gross pathology and the molecular mechanism involved in the development of GIST.

1. Final illustration. The challenge of this magazine spread is to visualize the pathology at a molecular, cellular, and gross anatomy level. I experimented with different layouts to help categorize information and guide the viewer's reading order. Images below are process drafts that I created before finalizing the layout and colour palette.

2. Study. Drawing of gastric folds to learn about how to illustrate the stomach environment.

3. Study. Tissue study of a placenta through observership at Trillium Health Partners - Mississauga Hospital.

4. 3D modelling. Experimentations in modelling and lighting the stomach environment and tissue cubes.

Kinundrum: Spine

A desktop eLearning module that helps guide students through solving kinesiology case studies. Students will learn about the injury scenario through illustrated slides and answer guiding questions with accompanying interactive 3D modules.

1. Storyboard. Each case will be first presented with a set of illustrations that explains the injury scenario. These are the storyboards I created before working on the final illustrations.

2. Production process. The top-left image is the ideation character sketch and the other images are the vector character portraits and poses.

3. Production process. These images show the illustration process of starting from a grayscale sketch to the final coloured landscape.

4. Production process. These images show the process of designing 3D interactive modules from sketch to final 3D render.

5. Final illustration. These are the final illustration slides that explains a spinal injury case.

1

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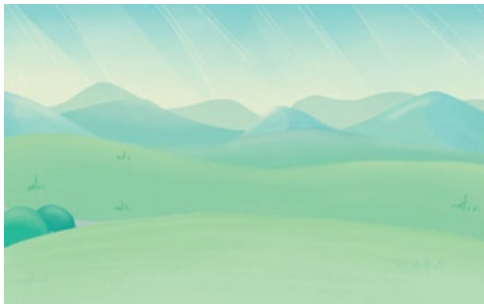

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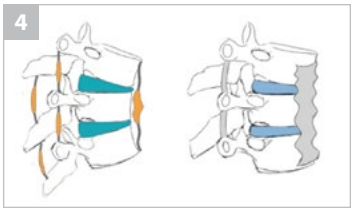
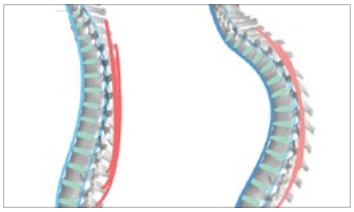
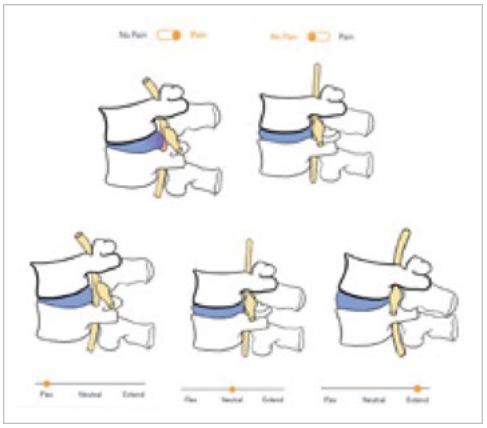
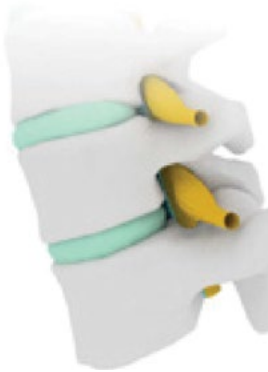
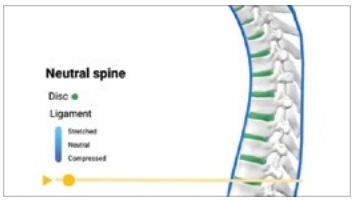





Neutral spine
Disc
Ligament
Stretched
Neutral
Compressed

Ligaments
Stretched
Neutral
Compressed

5


Case of the Gardener

Gary Gardener has been working on landscaping as a job, for more than 5 years.

There is a lot of twisting, lifting, and bending in his job.

This is usually not a problem for him at all!

Over the weekend, he was doing laundry at home.


Thinking that he pulled a muscle...

he spent most of the weekend lying down.

By Monday his back was better.

However, as the week went on, he noticed a burning pain

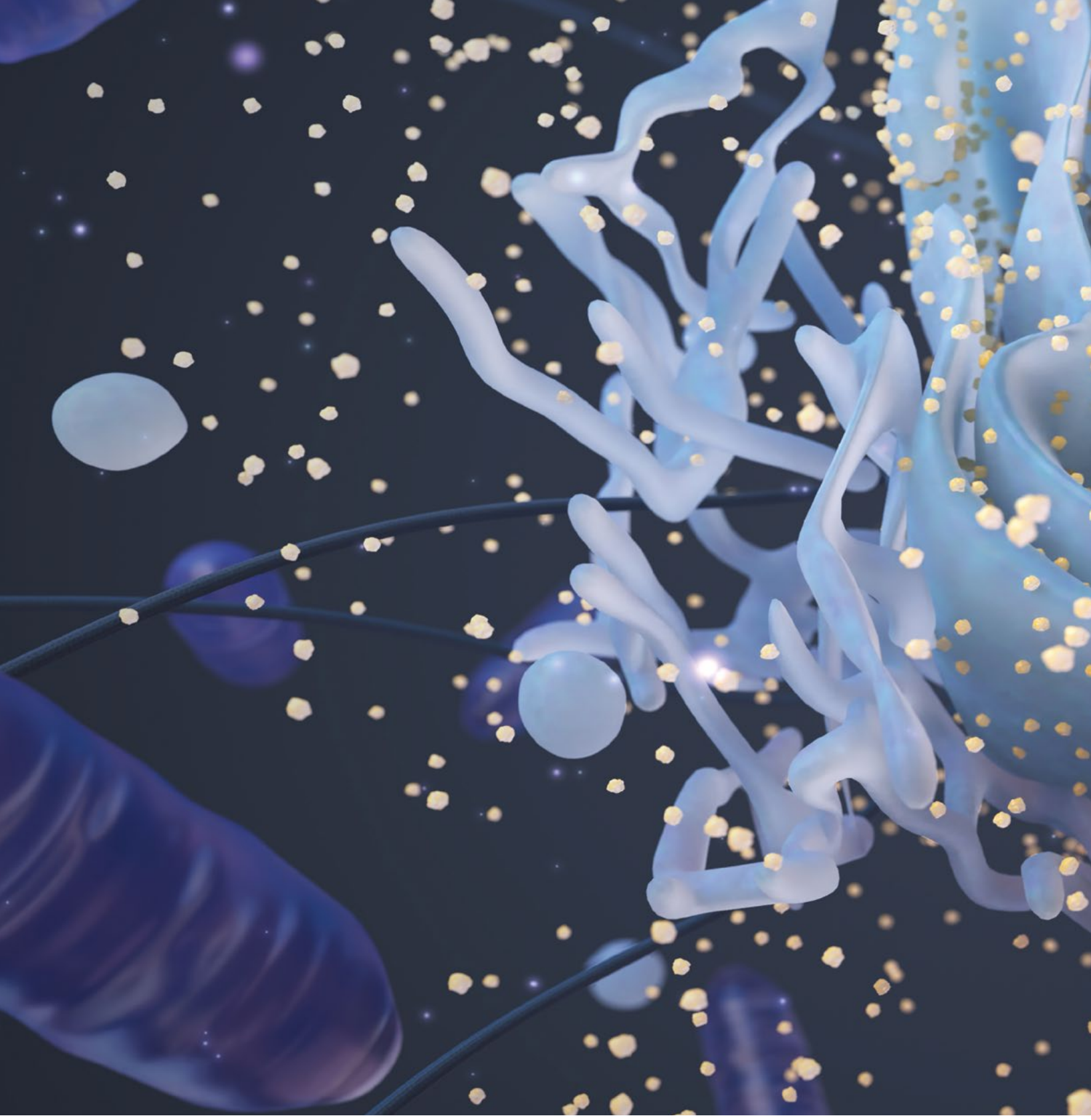
down the back of his left leg.

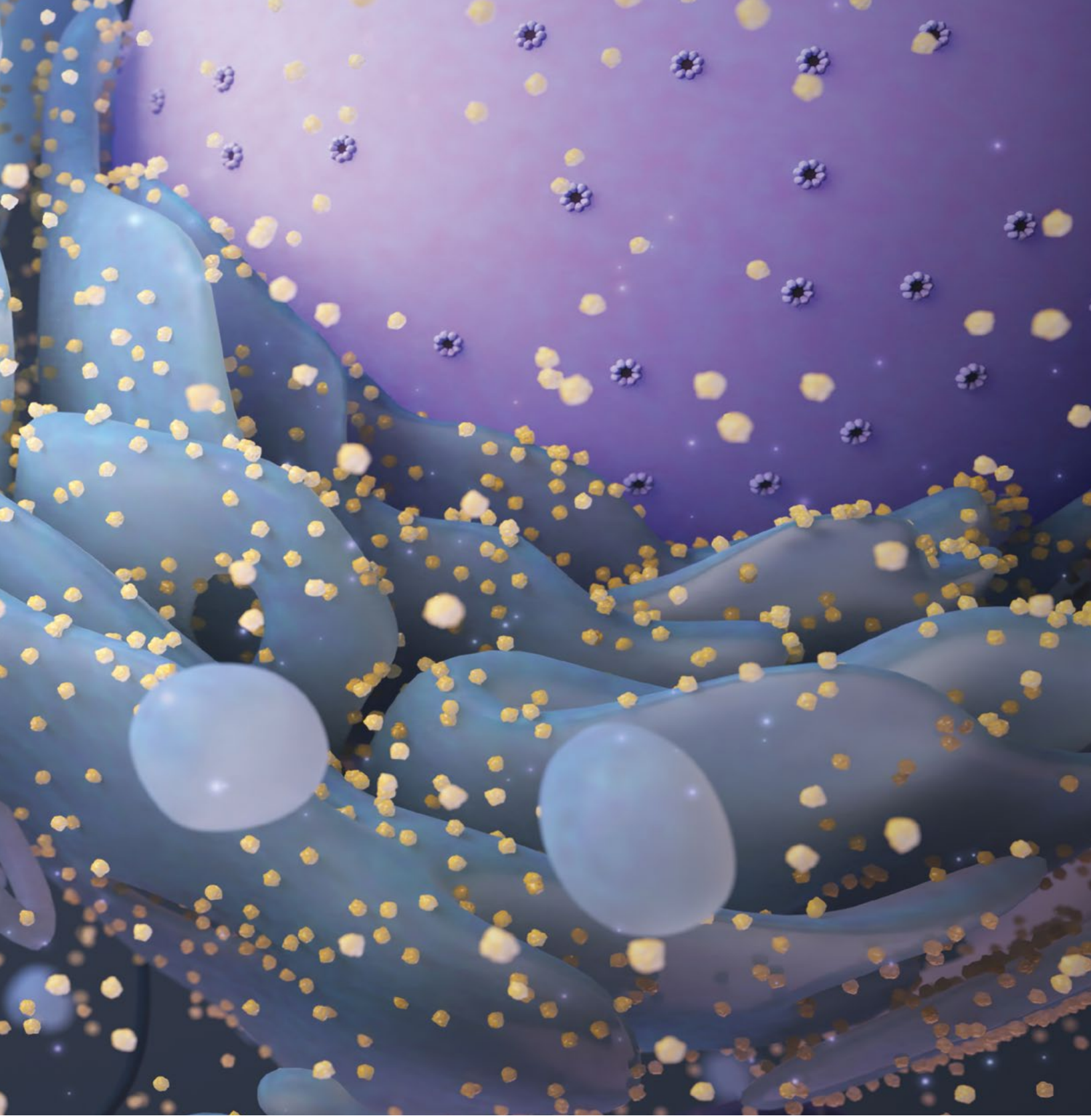
PAIN
PAIN
The pain got worse when he worked and better when he rested.

He first thought he pulled a back muscle.

but now the pain is down his leg...strange!

Let's solve this
Kinundrum!





Jenny Zhen Bai

I've been endlessly curious since I was a child. Even after earning a BSc in Pharmacology and Physiology, and now an MSc in Biomedical Communications, I still have so much of that curiosity. I want to explore how we can use principles of design to improve systems of healthcare and education. I want to continue exploring the realm of molecular visualization. I believe that, despite how niche it may seem, biomedical communications holds endless possibilities.

Editorial Illustration

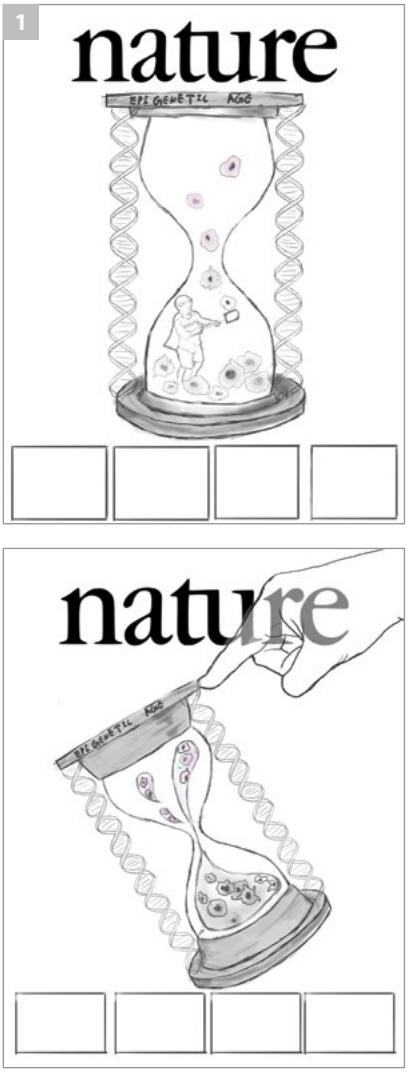
This was a mock journal cover modeled and rendered in *Maya*. I wanted to visualize the reversal of time. I was inspired by an article about a study where scientists showed that epigenetic age can be reversed by medications.

1. Sketch. In this journal cover illustration, I wanted to visualize the reversal of time. I was inspired by a study that showed that epigenetic age can be reversed by medications.

2. Final illustration. In the final version of the mock journal cover, I built an hourglass that sits in the palm of a lab-glove-wearing hand. Lymphocytes flow backwards and are rejuvenated, signifying the reversal of epigenetic age.

Previous spread. Final illustration. MRP still image—Eukaryotic cellscape.

1



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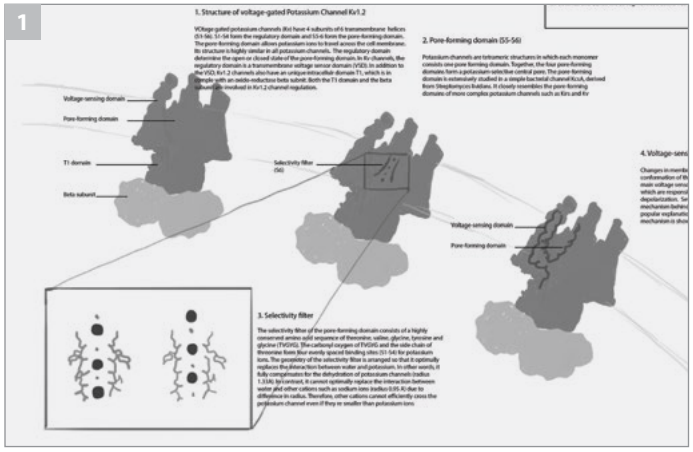

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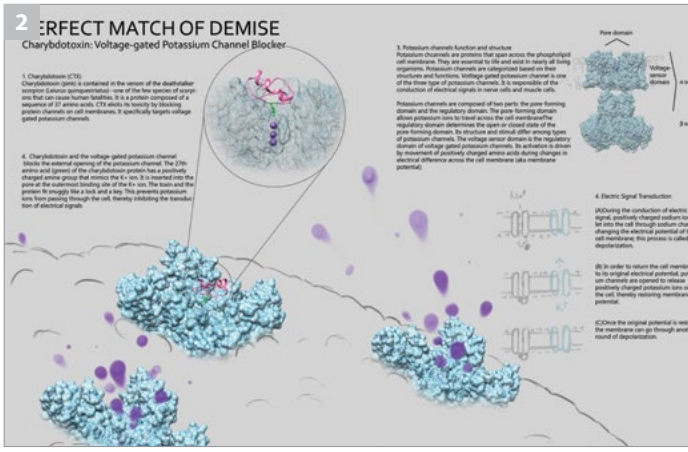

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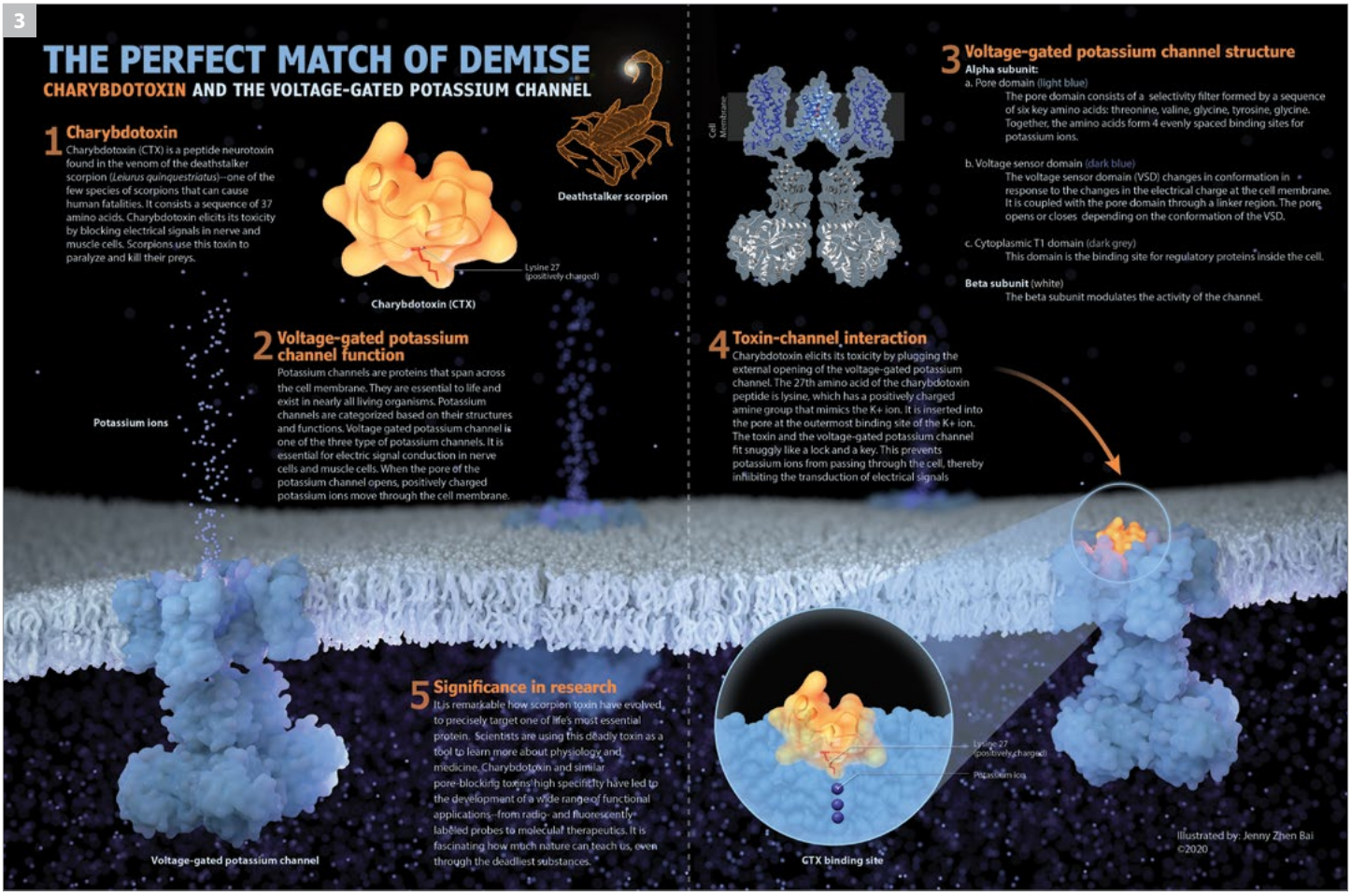

Molecular Visualization

This illustration depicted the mechanism of action of charybdotoxin, which is a scorpion toxin. The main goal of this project was to experiment with visualization tools for protein molecules.

1. Sketch. In my initial drafts, I played around with the placement of voltage-gated channels and text blocks.

2. Sketch. I also considered changing the placement of the channel to reveal only the binding site instead of the entire structure of the channel.

3. Final illustration. In my final version, I depicted the structure of the toxin and channel as well as the toxin-channel interaction. I used colour to create an information hierarchy—making the toxin the most salient subject of the visualization.

Pathological Illustration

This is a two-page editorial depicting the pathology of intracranial saccular aneurysm at both macro and micro scale. The main goal was to depict pathological change over time.

1. Sketch. The biggest challenge was to fit the dense amount of verbal and visual information within the two-page limit.

2. Final illustration. In the final illustration, the pathological changes were illustrated at three different scales. At the macro-scale, I illustrated the brain and close-ups of the blood vessels, and at the micro-scale, I illustrated the cells within the vessel wall.

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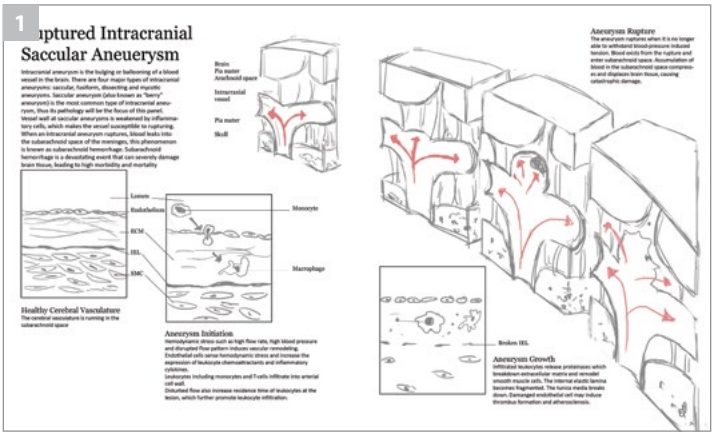

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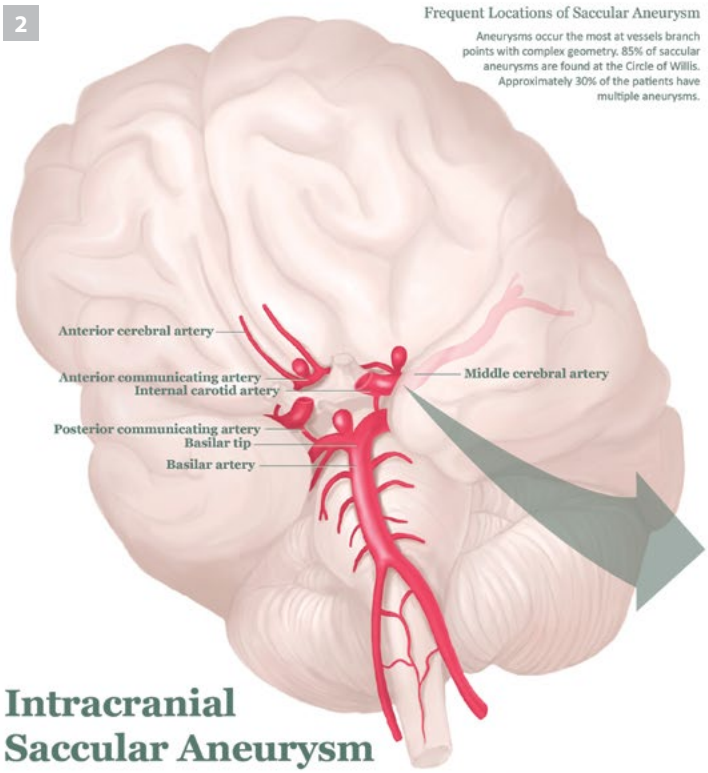
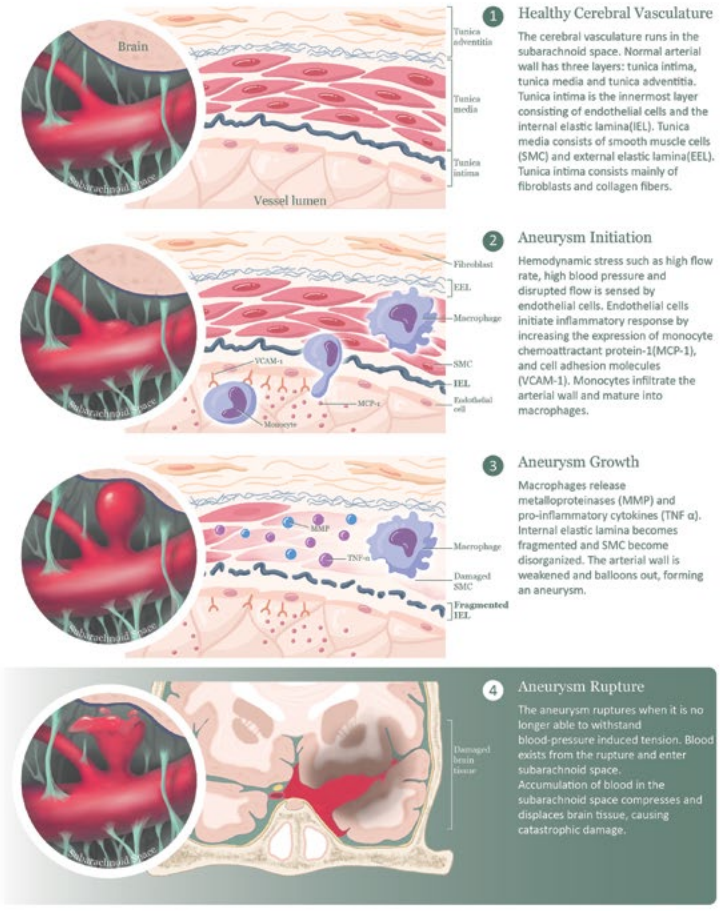


Intracranial Saccular Aneurysm

Intracranial aneurysm is the bulging or ballooning of a blood vessel in the brain. There are four major types of intracranial aneurysms: saccular, fusiform, dissecting and mycotic aneurysms. Saccular aneurysm (also known as "berry" aneurysm) is the most common type of intracranial aneurysm. Vessel wall at saccular aneurysms is weakened by inflammatory cells, which makes the vessel susceptible to rupturing. When an intracranial aneurysm ruptures, blood leaks into the subarachnoid space of the meninges, this phenomenon is known as subarachnoid hemorrhage. Subarachnoid hemorrhage is a devastating event that can severely damage brain tissue, leading to high morbidity and mortality.



Scientific Animation

This animation was an experiment to explore motion graphic production using *After Effects*. An exerpt from the TED video, "How the compass unlocked the world," was the inspiration and narration of this video.

1. Study. This was a study where I practiced building a HUD element in *After Effects*. Through this study, I became more familiar with the program.

2. Final illustrations. In this animation, I experimented with some basic techniques such as looping textures and shape-morph transitions.

3. Final illustration. In the final scene of the animation, I used the 3D camera inside *After Effects* to create the parallax effect.

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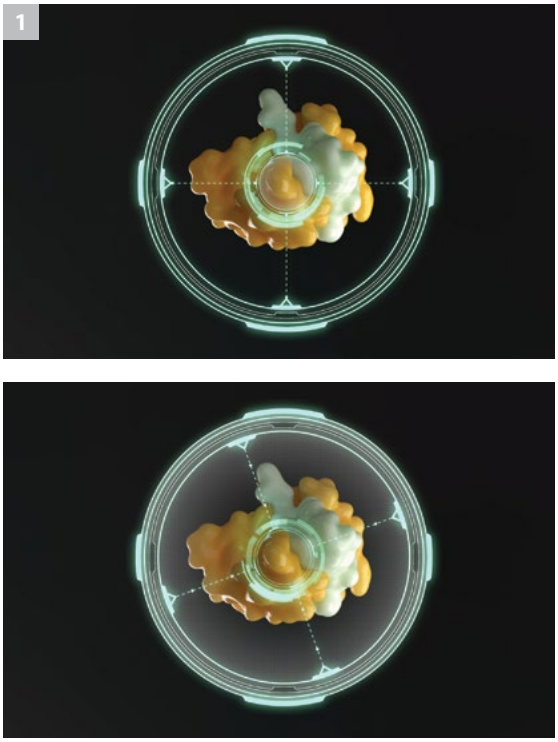

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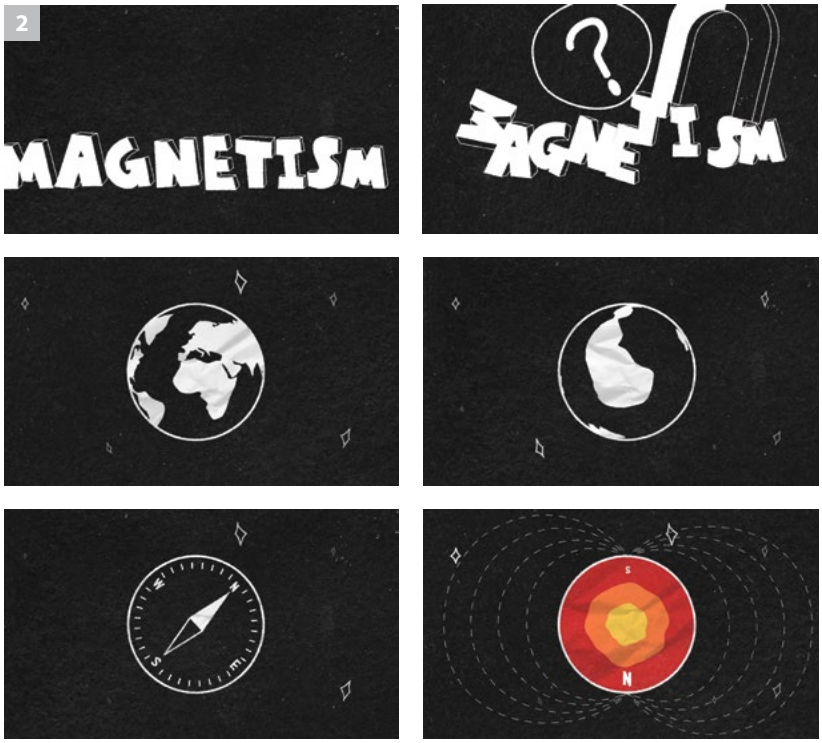

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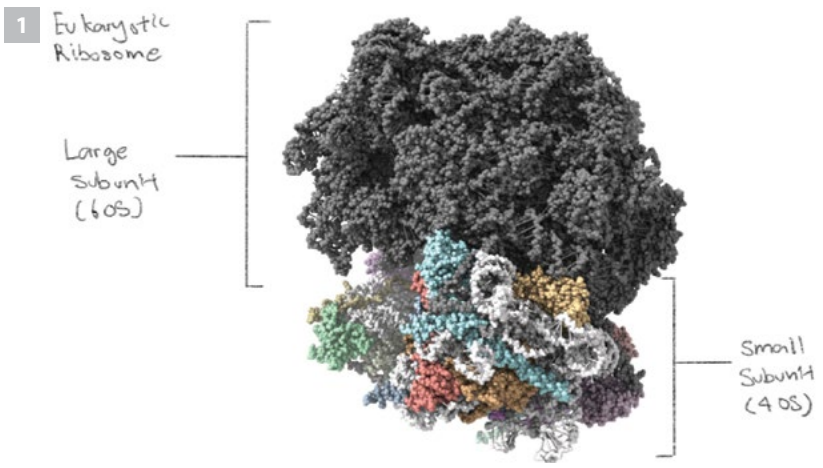
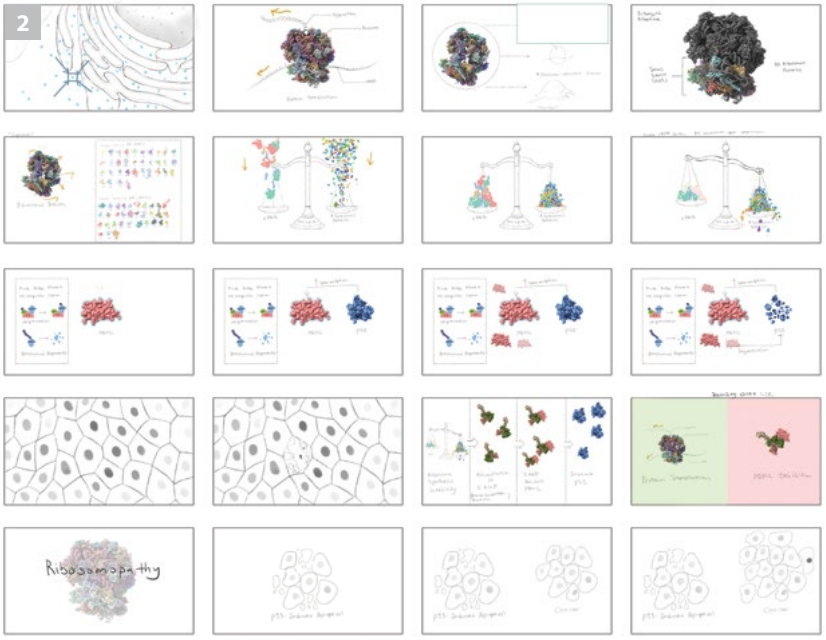
Extra-ribosomal function of ribosomal proteins

When we learn about ribosomes, rRNAs are often the stars of the show, and ribosomal proteins (RPs) are introduced as mere structural supports. However, scientists have discovered that RPs play key roles in monitoring ribosome integrity. In my MRP, I visualized RPs' newly discovered role.



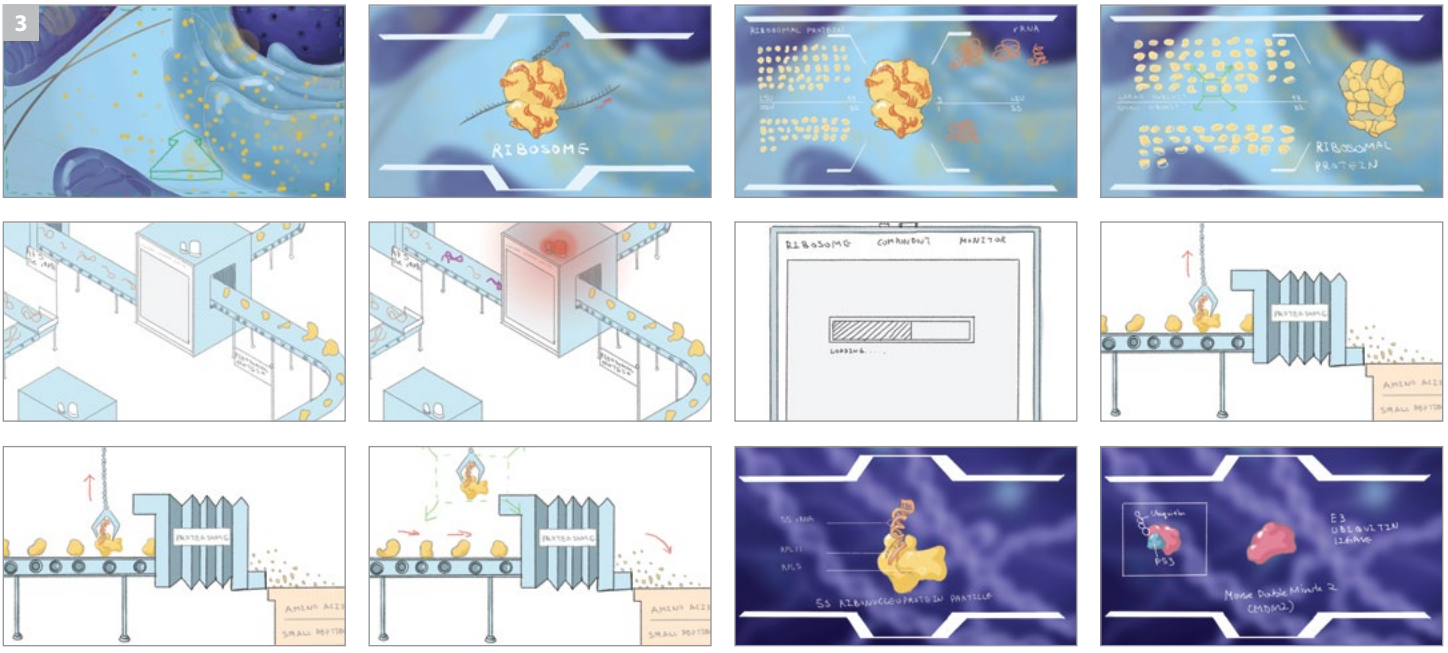
1. Study. This is an 80S eukaryotic ribosome model based on the PDB model, 4V88. It is visualized and colour coded in *ChimeraX*.

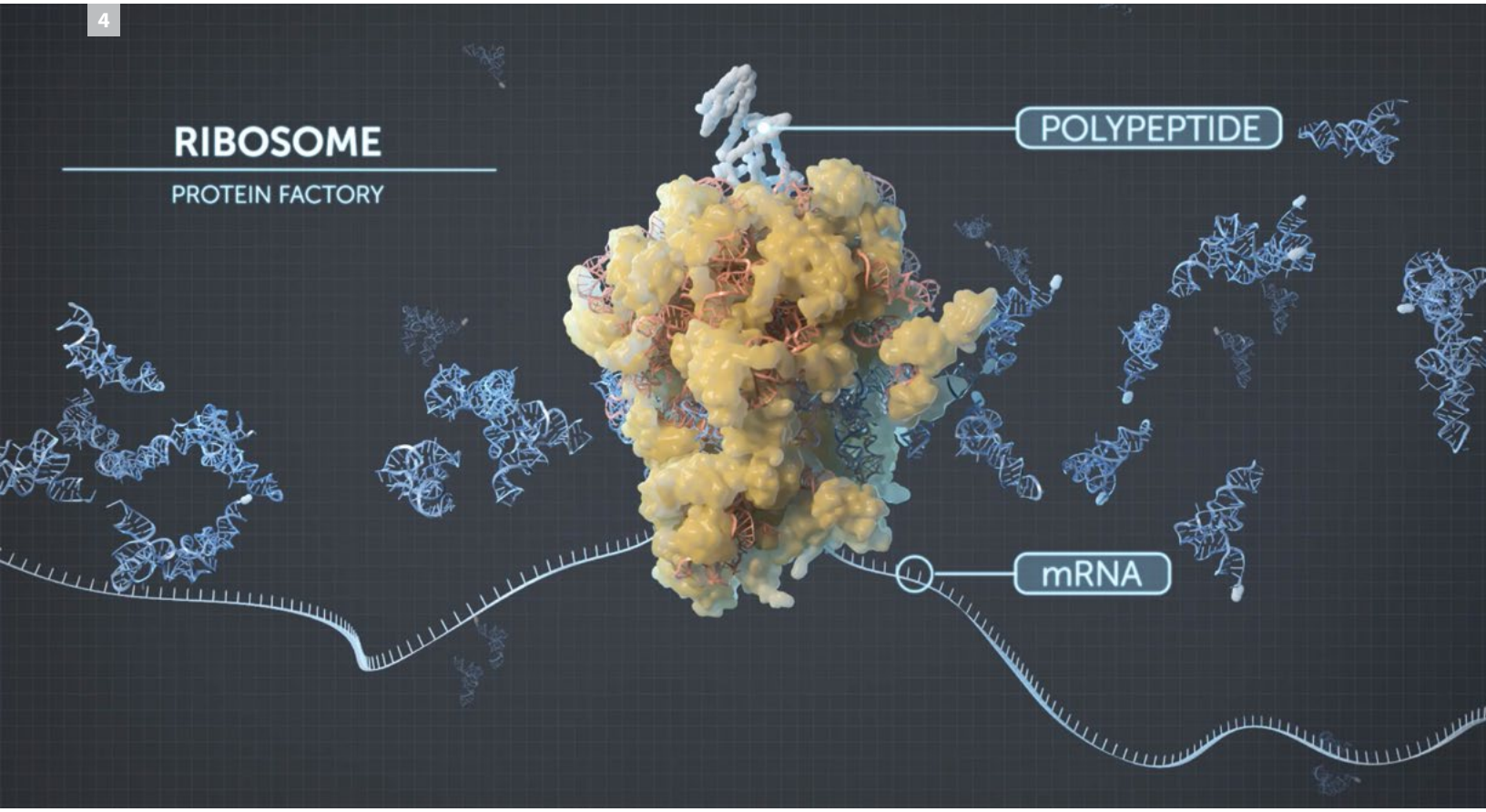
2.Storyboard. When illustrating the initial versions of my storyboard, I had difficulty visualizing and conveying the story in these simple sketches. My MRP Supervisor said (nicely) that they looked like *PowerPoint* slides. This was the most challenging phase of my MRP.

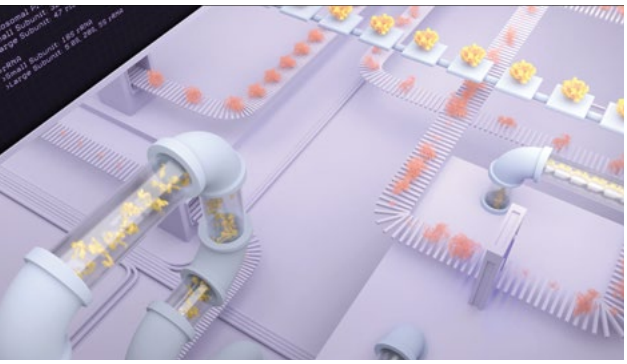


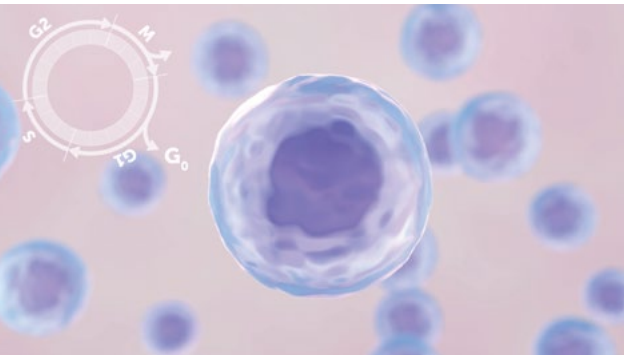
3. Storyboard. The 'aha' moment came when I realized that, although storyboards are commonly in greyscale, this convention can be challenging for visualizing a molecular scene. Molecules often don't have distinctive forms; however, deliberate use of colours can set them apart from each other and the environment. With the use of colours, my later versions of storyboards had much more clarity and richer information.

4. Final animation. My final animation was modelled and animated in *Maya*. I had the chance to build a variety of different types of scenes: extracellular space, factory, cytoplasm, nucleoplasm, and more!




4
RIBOSOME
PROTEIN FACTORY
POLYPEPTIDE
mRNA

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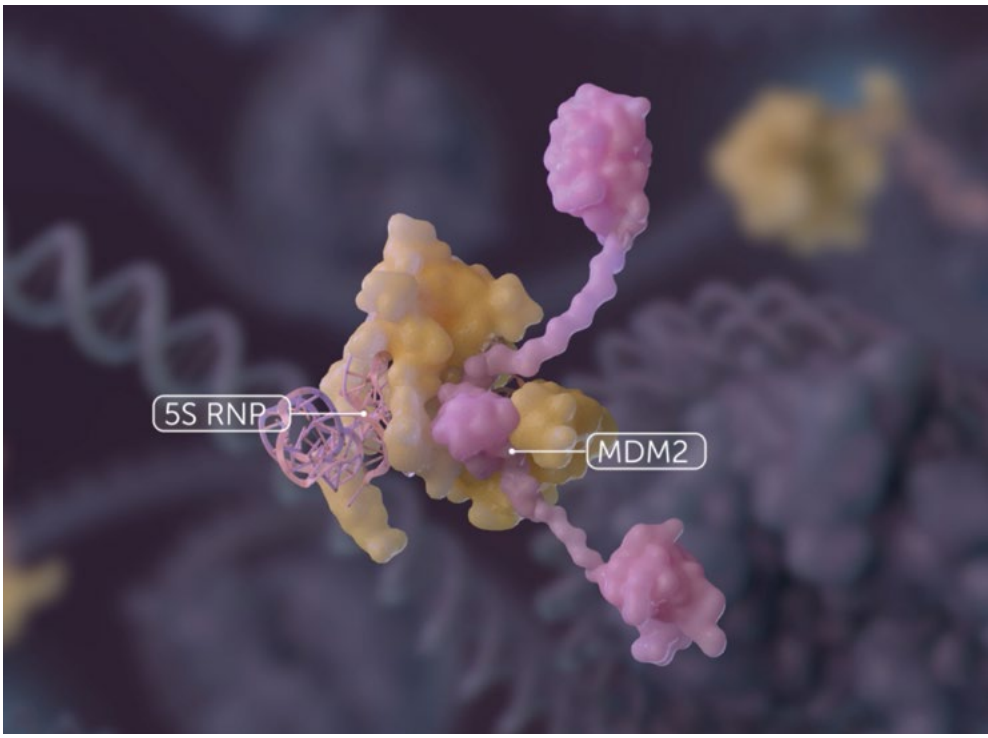
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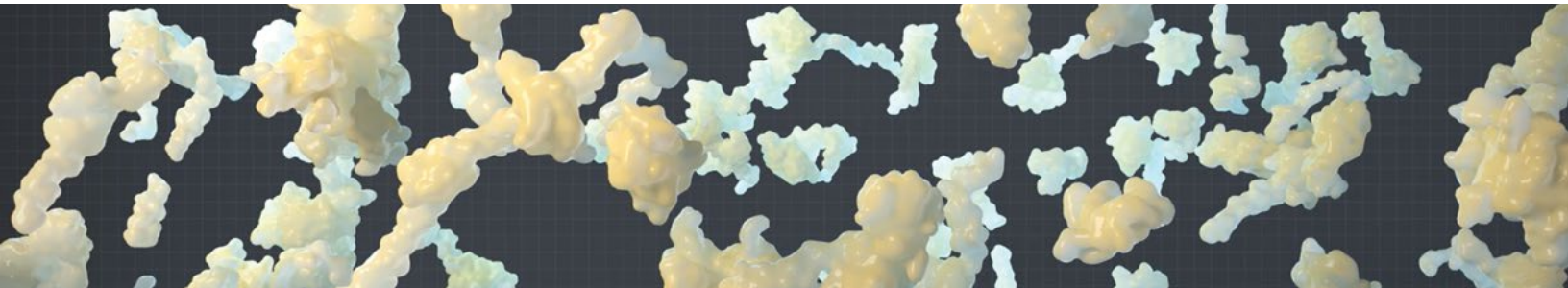
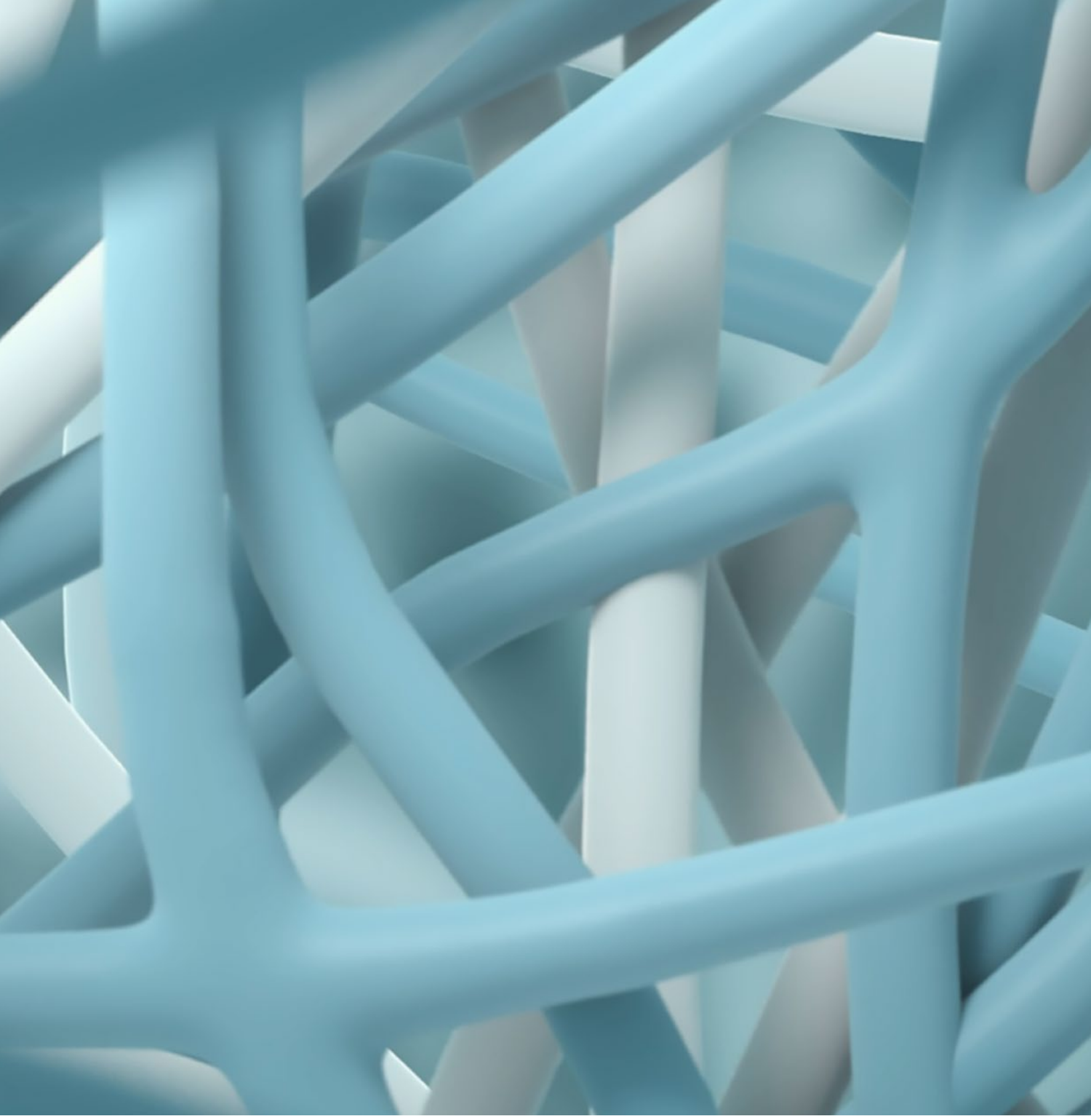
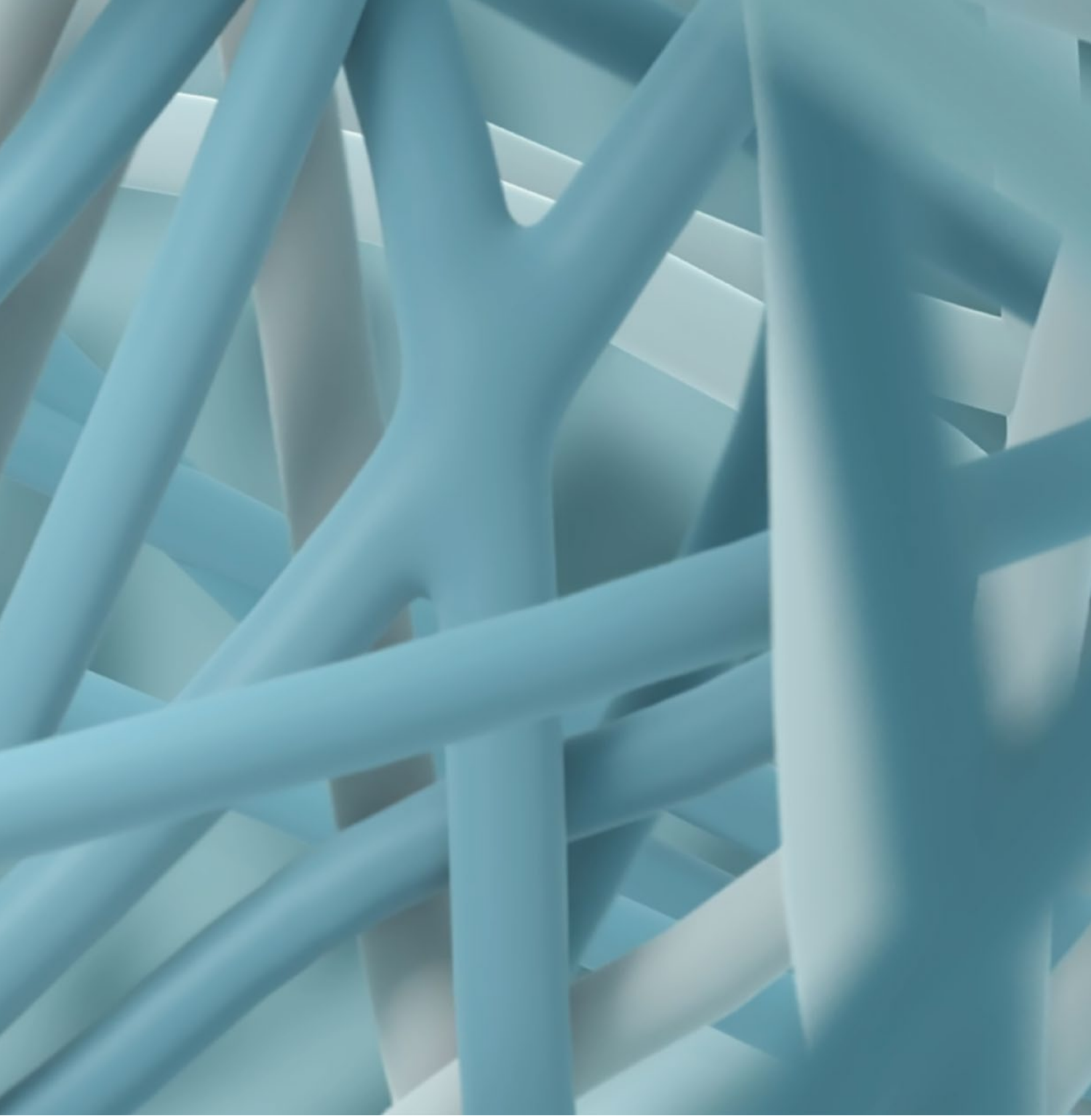






Lesia Szyca

My name is Lesia Szyca and I am a biomedical illustrator and animator. I am passionate about solving complex communication problems in science and medicine. I specialize in 3D modelling, illustration, data visualization, and design.

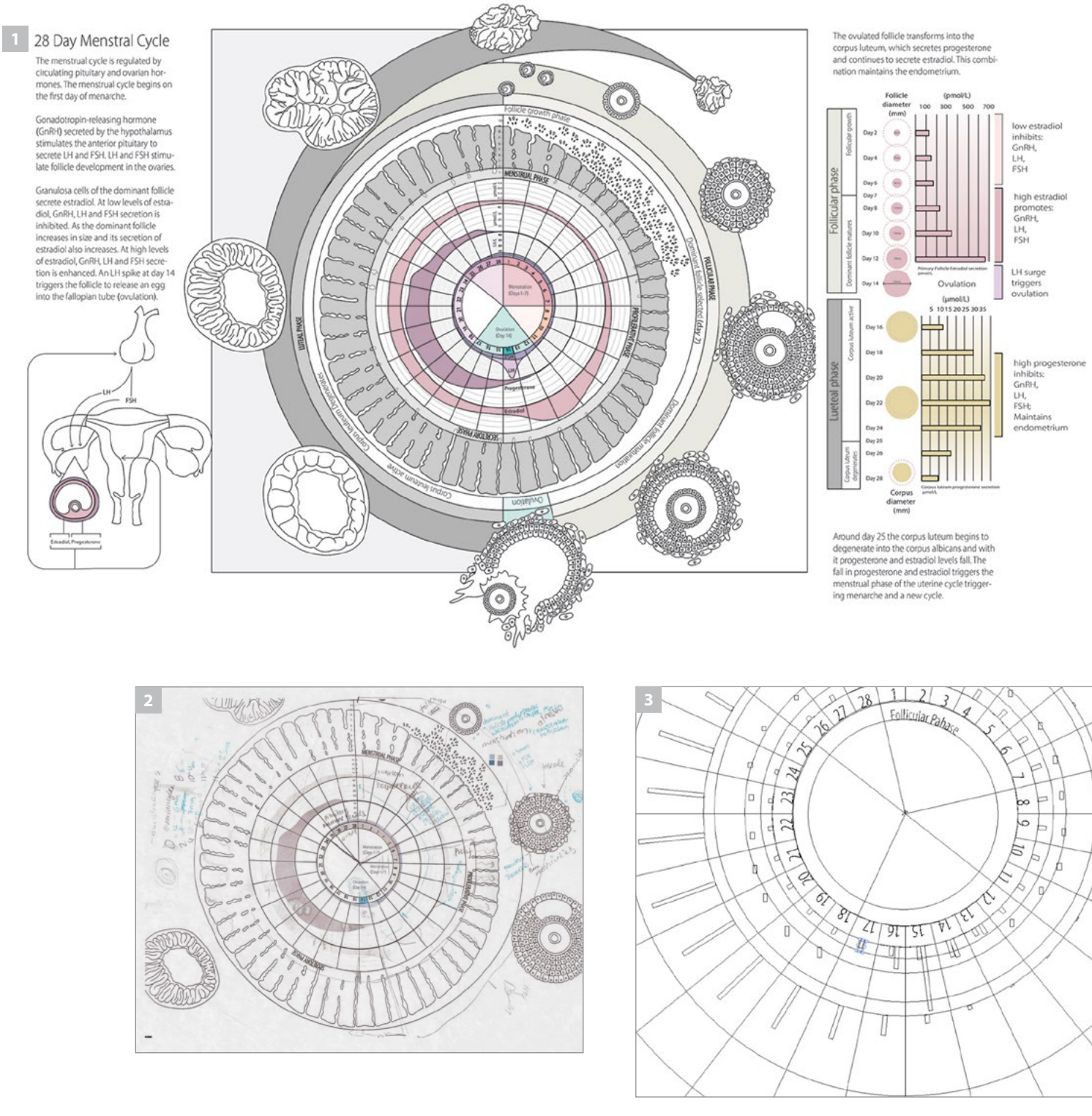
Data Visualization

Designing for insight: redesign of a multivariate dataset that encourages comparison and exploration. My goal was to redesign menstrual cycle data in a way that ties together the relationships between pituitary hormones, female sex hormones, menstruation, and ovulation in an intuitive manner.

1. Final draft. The menstrual cycle is regulated by circulating pituitary and ovarian hormones. GnRH secreted by the hypothalamus stimulates the anterior pituitary to secrete LH and FSH hormones, which stimulate follicle development in the ovaries. The dominant follicle secretes estradiol, and as it increases in size, so does its secretion of estradiol. At high levels of estradiol, LH and FSH secretion are enhanced. A spike in LH triggers the dominant follicle to release an egg (ovulation).

2. Sketch. Inspired by the rippling and cyclical nature of the dataset, I chose to incorporate the use of circles in my data visualization.

3. Production process. I visualized menstrual cycle data in *Illustrator* by using the column graph tool to create the data set skeleton.



Editorial Illustration

Editorial Cover Challenge: to distill a complex scientific concept, or research finding into a clever editorial image that communicates the paper's key message.

1. Sketch. Thumbnails created in *Photoshop* used to prototype the most effective composition.

2. Final illustration. Excessive alcohol use, even in social drinkers, can cause structural and functional abnormalities in the brain. The dark-coloured liquid encased in the skull-shaped bottle represents brain capacity. As the liquor is consumed, the sybolic brain becomes depleted. The final composition was sculpted in *Maya* then refined in *ZBrush*. The scene was lit and textured in *Maya* then assembled and colour corrected in *Photoshop*.

Previous spread. Final animation. A hyaluronan-methylcellulose hydrogel developed at the Shoichet lab for cell delivery in spinal cord injury (MRP stillframe).

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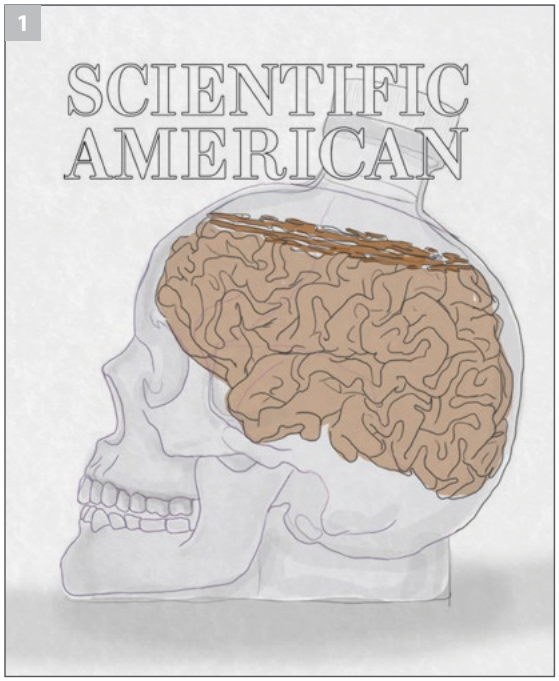

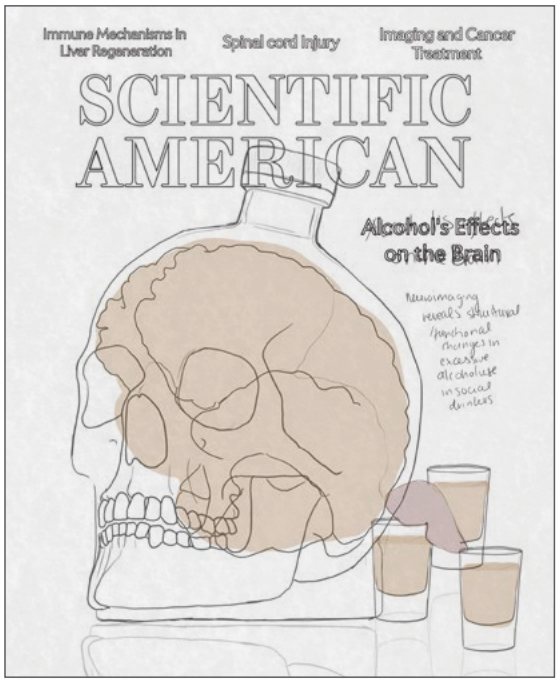

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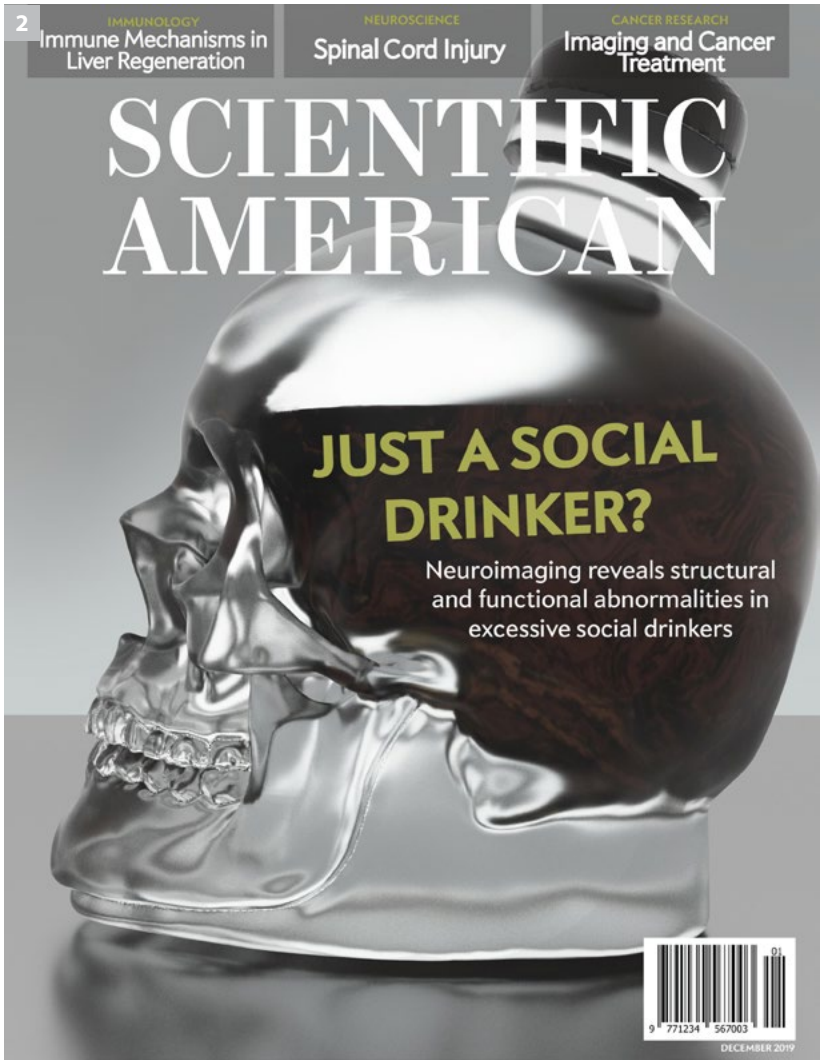


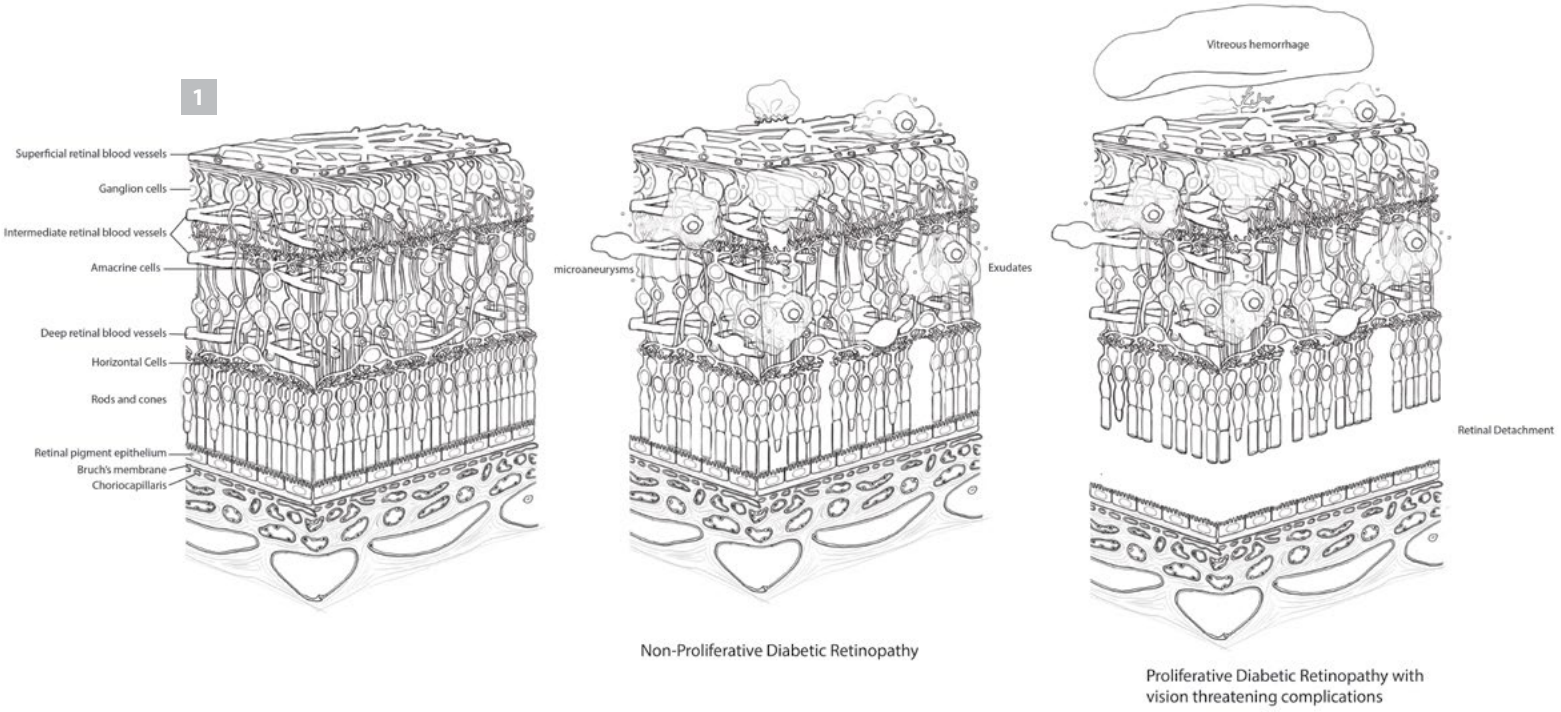
Pathological Illustration

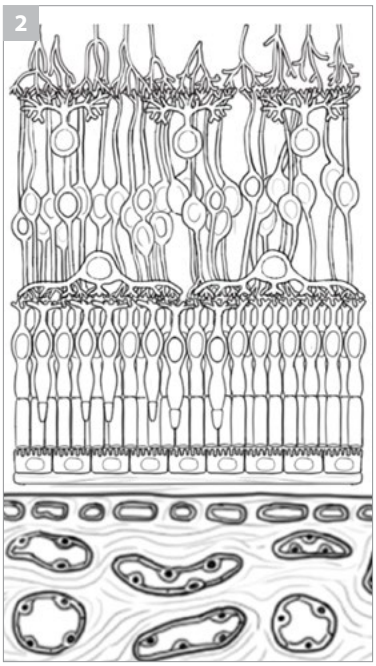
Pathophysiology of diabetic retinopathy.

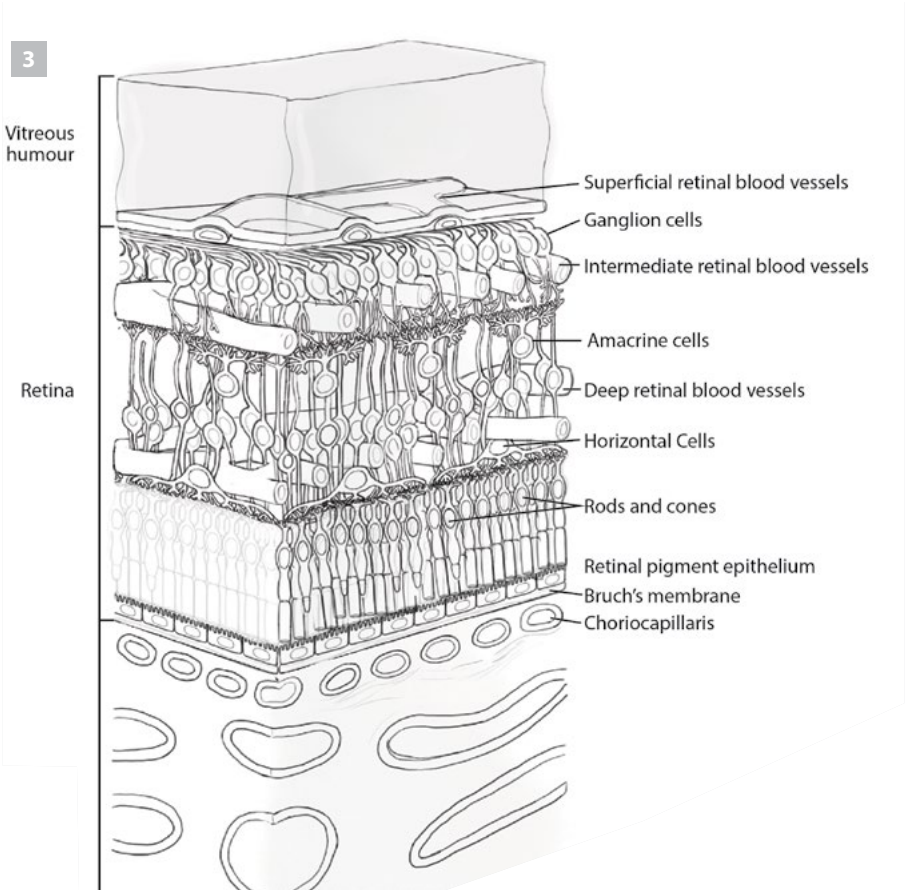
1. Study. Tissue cubes describing the cellular changes that occur in non-proliferative and proliferative diabetic retinopathy.

2. Sketch. Cross-sectional illustrations describing the cellular layers of the retina and choroid. These components were used in the construction of the final tissue cube illustration.

3. Final illustration. Final tissue cube (normal) with corrected cellular proportions.







Biological Illustration

Freefrom sculpt of an oranda goldfish.

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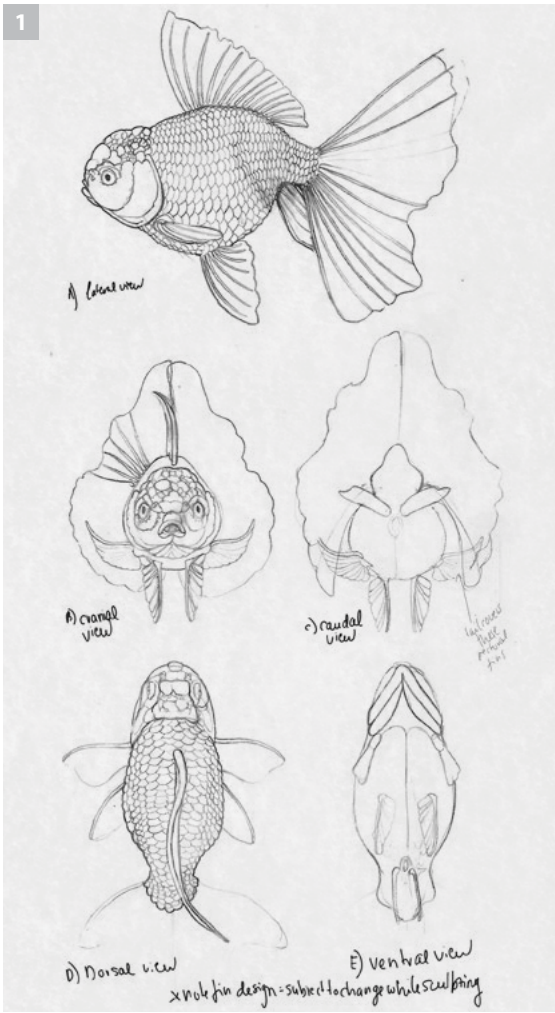

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1. Sketch. Freefrom sculpt planning.

2. 3D modelling. Model was sculptedand painted in *ZBrush*.

3. Final illustration. Model was rendered and animated in *Cinema 4D*.

A novel approach in spinal cord injury repair

Spinal cord injury is devastating. Apart from standard rehabilitation, little can be done to restore the loss of sensory and motor functions. Researchers in Dr. Shoichet's lab, have been developing a potential therapeutic approach that overcomes barriers in spinal cord injury recovery.

1. 3D modelling. Several approaches in realism were explored to tackle the representation of animal models in medical testing.

2. 3D modelling. To create the rat brain, simplified MRI data from the Waxholm Rat atlas was used.

3. Storyboard. The project began with a rat-model-centered narrative, but it was later scraped for a human-centered narrative in order to better highlight the potential end-benefits of this experimental therapeutic approach.

4. Final illustration. The final representation of the rat model, optimized for fast rendering.

5. Final animation. Assets were modeled in *ZBrush* and rendered in *Maya* using *Arnold*.

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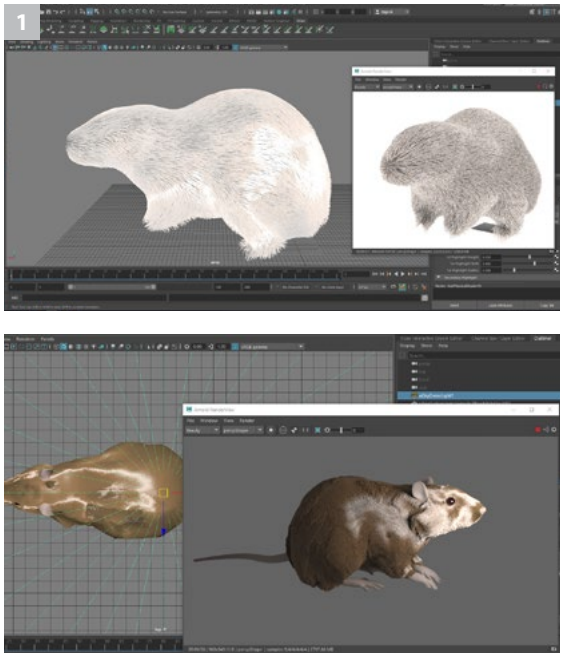

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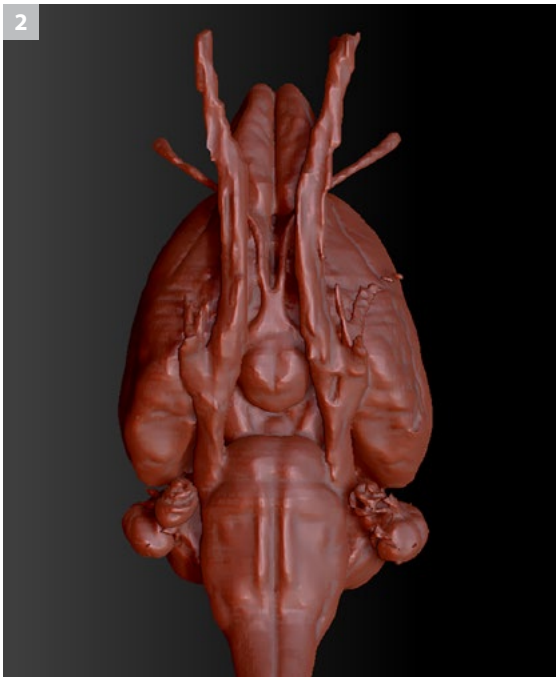

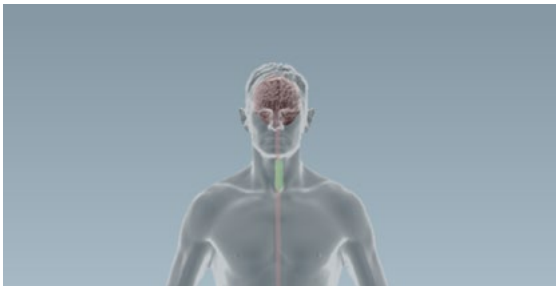

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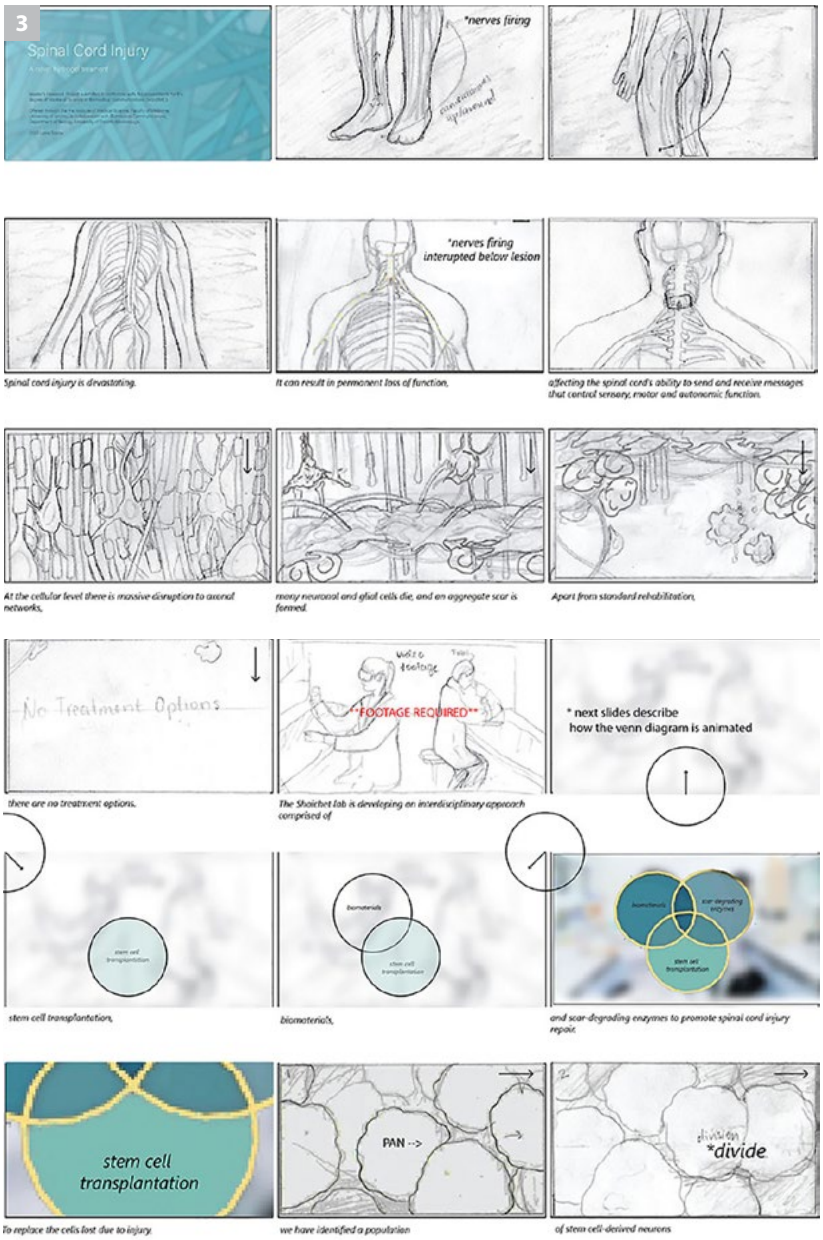

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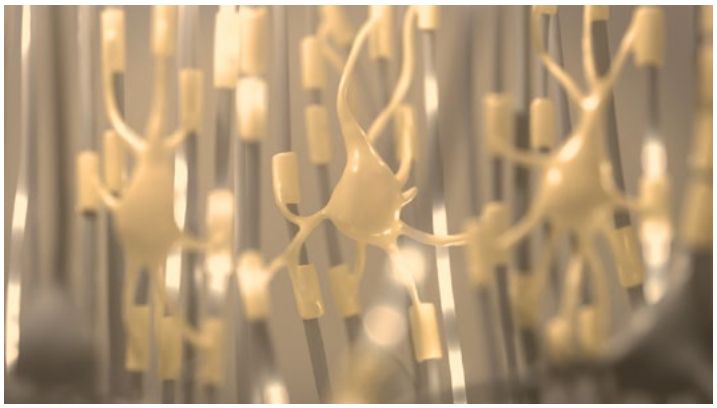

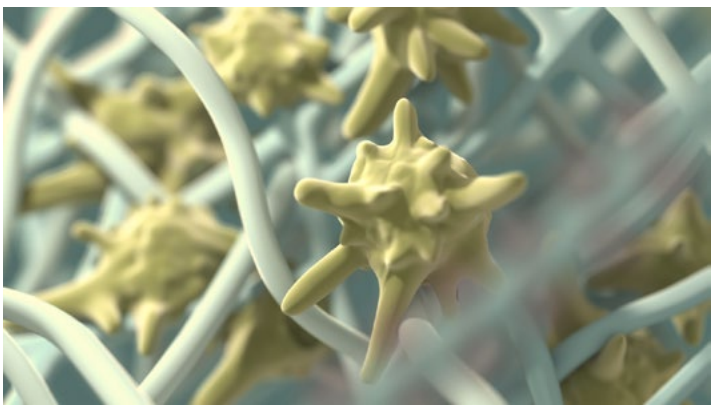

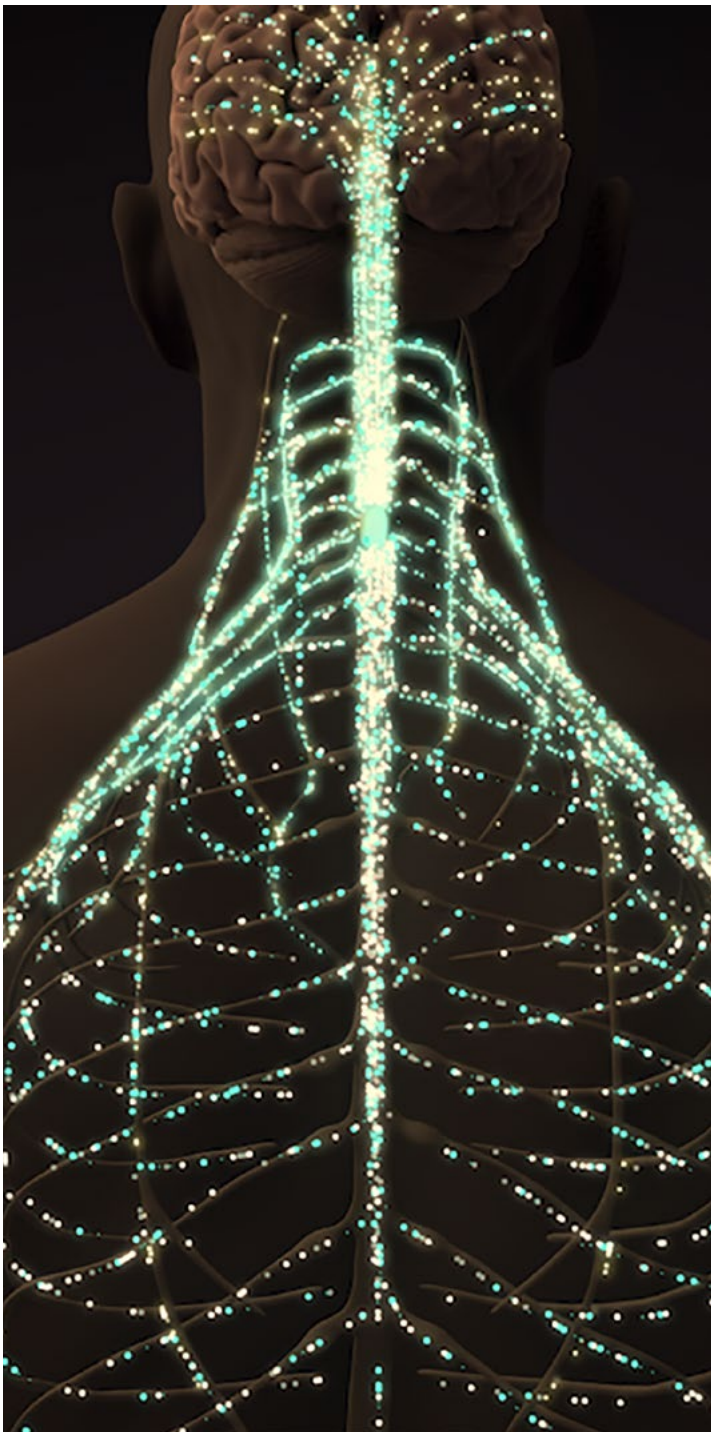

Miranda MacAskill

I am a biomedical communicator specializing in illustration and interactive design. Prior to completing my MSc in Biomedical Communications, I earned my BSc in Biomedical Science from the University of Guelph and have worked in corporate communications, graphic design, and marketing. I am thrilled to be pursuing a career where I can apply my design experience to communicate complex scientific concepts in an accessible and enaging way.

Anatomical Illustration

The purpose of this assignment was to illustrate an anatomical structure from a view that's not typically seen in a textbook. It depicts the tertiary bronchi branch of the superior lobe of the right lung.

1.Study. These bronchi studies were based on preserved specimens from Grant's Museum. I did this study to figure out the 3D relationship between the bronchi and how to depict them from an oblique angle.

2. Final illustration. The final illustration was completed in *Photoshop*. I used 3D maquettes and photographic references of tissue samples to support the accuracy of the lighting and angle in the final piece.

Previous spread. Study. This is a timber wolf skull study I did as form and lighting practice. It was also my first time using the *Procreate* painting app, and I wanted to see what the software was capable of.

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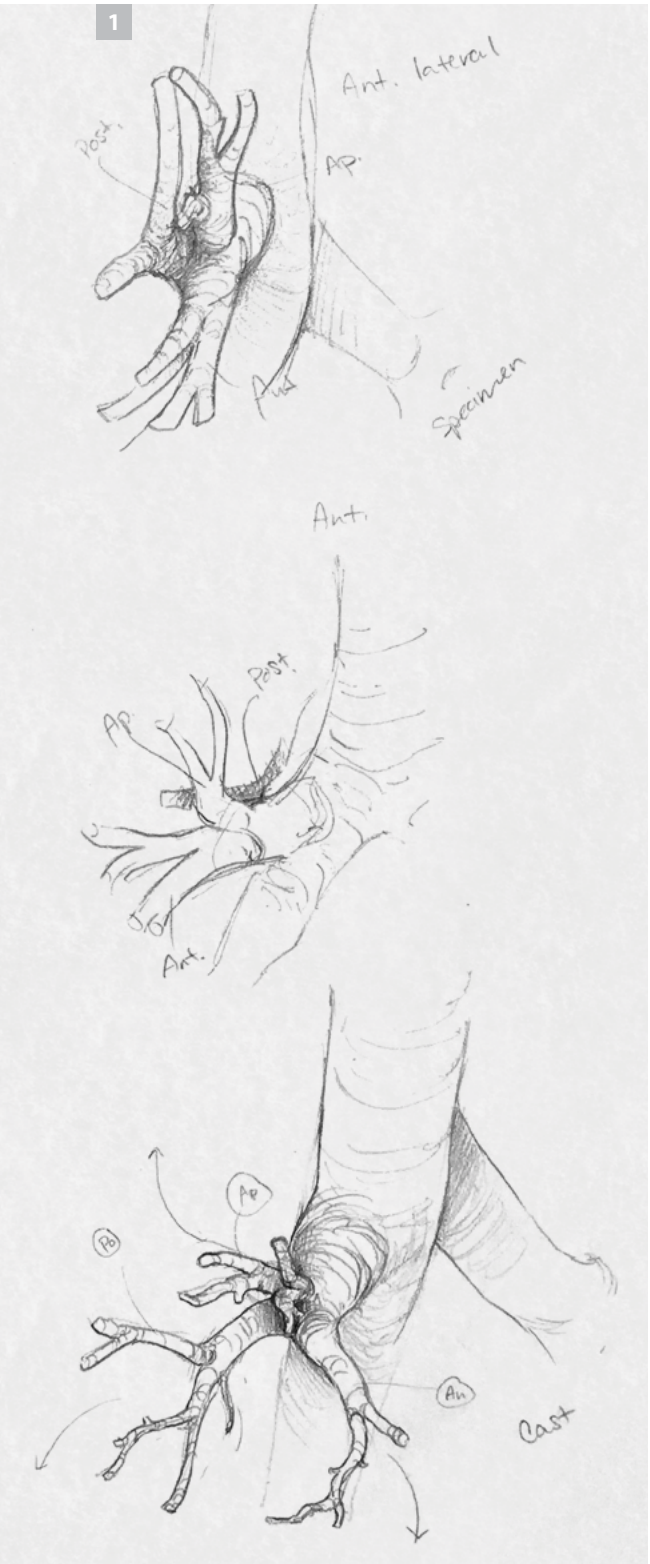

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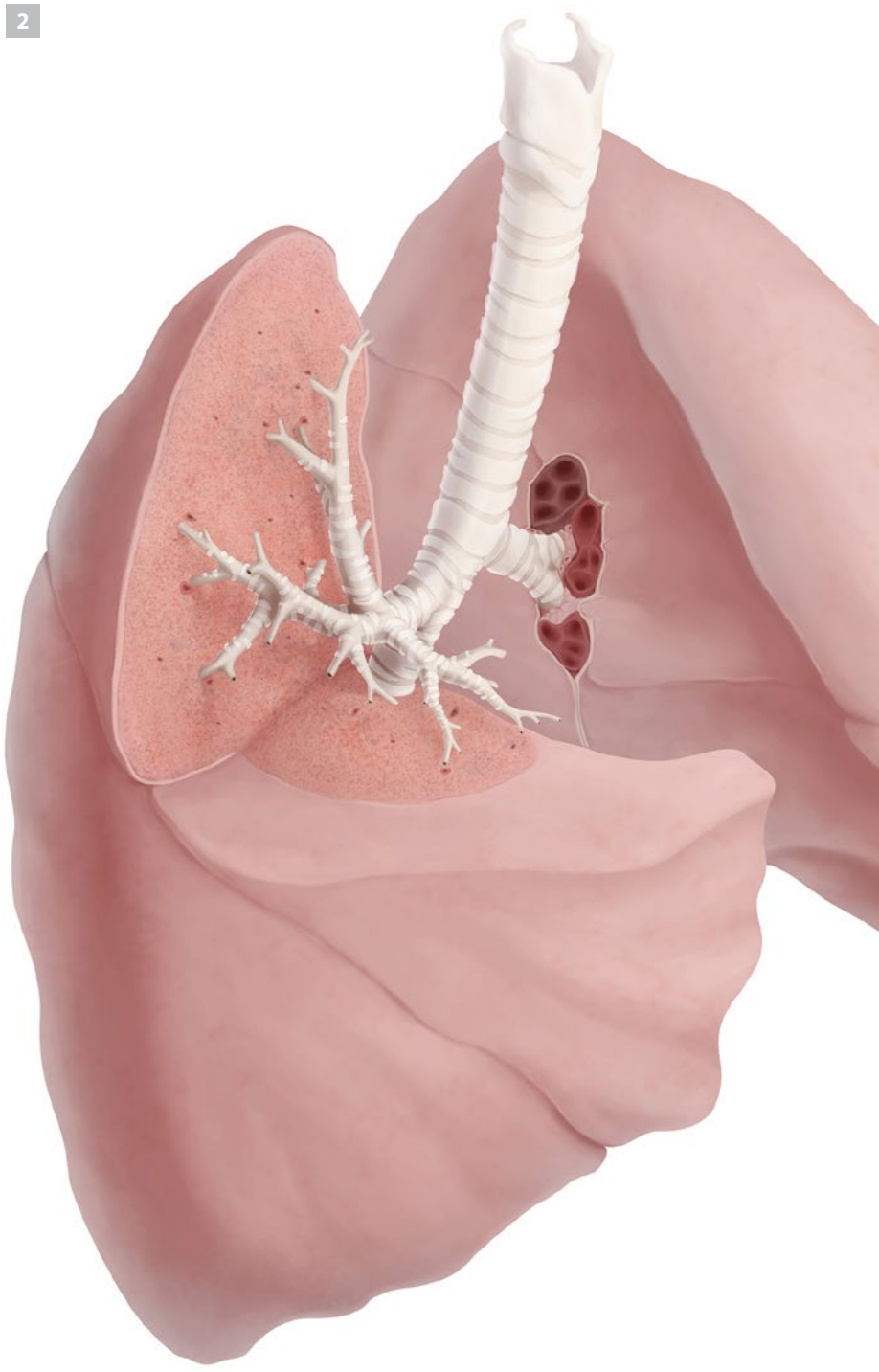

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Editorial Illustration

The assignment was to create an editorial cover in *Maya*, and at the same time, to depict a metaphorical representation rather than a literal interpretation of a recent scientific study.

1. Sketch. The study I settled on found that humans have changed the brain anatomy of dogs through breeding for specific jobs. I explored a few different concepts for the image but finally settled on the use of Legos.

2. Final illustration. In the final render, Legos building blocks form the brain that is being placed into the head of a dog. I felt that the idea of this simple toy, from which someone can build whatever they wish, lent itself well to the core findings of the study.

Medical Legal Illustration

This skull illustration was part of a three-panel visualization to be used as demonstrative evidence in a pediatric homicide case. The intent was to replace photographs with highly accurate diagrams. The final panels were created in collaboration with Evelyn Lockhart and Roxanne Ziman.

1. Sketch. This is the comprehensive sketch for the second panel in the series. It summarizes the head injuries sustained by the deceased.

2. Final illustration. The final illustration shows the position and extent of the diastatic skull fracture. A drawing would be used in this situation to replace autopsy photographs which are difficult to interpret and potentially disturbing to the jury.

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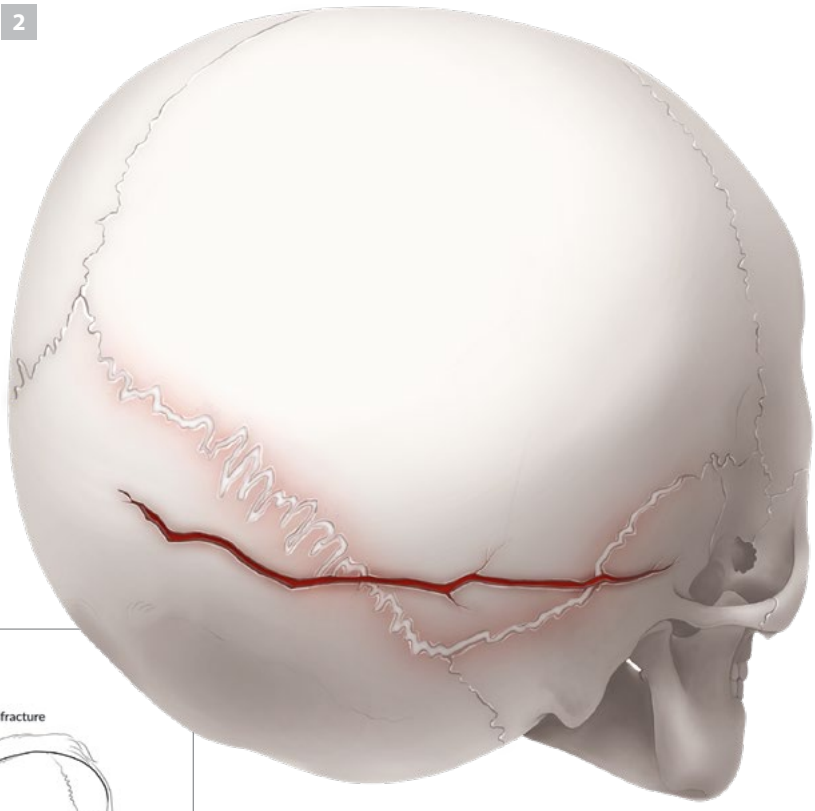

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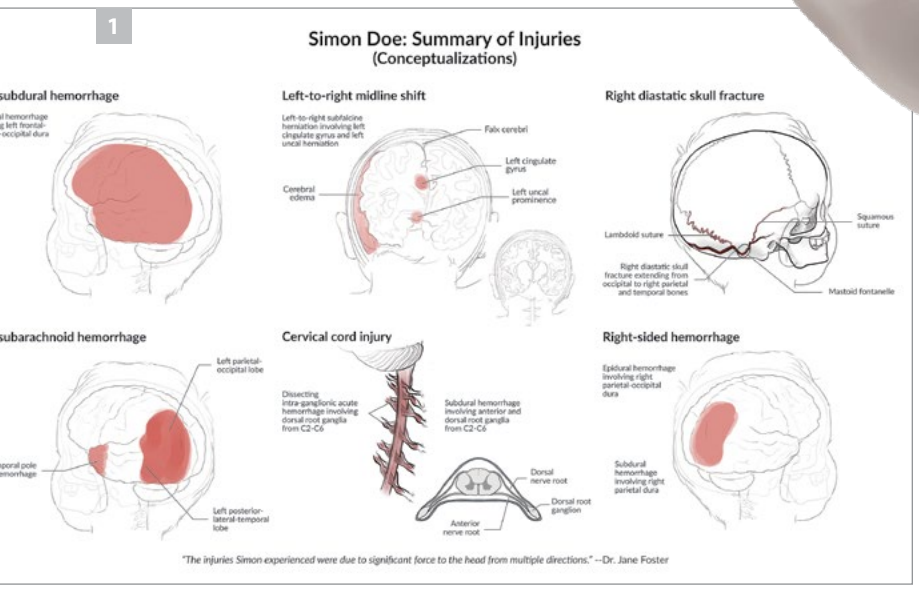

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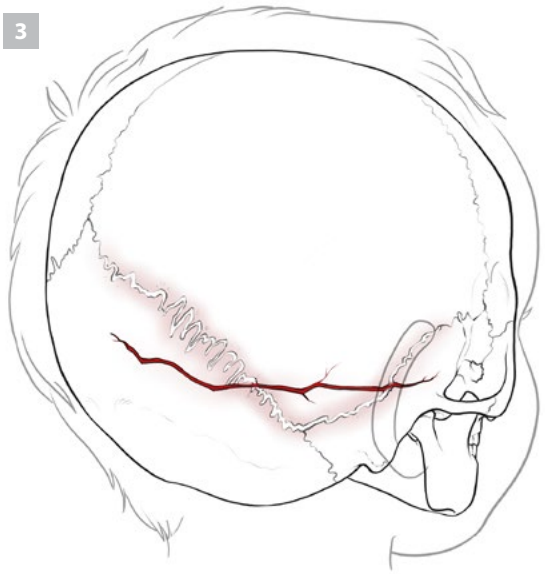

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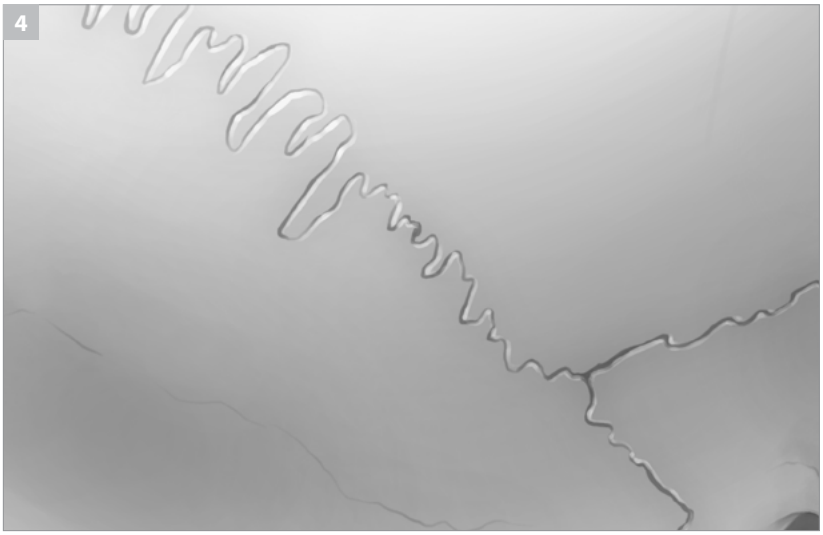

3. Final draft. This line drawing shows the final injury within the context of the head position, and it served as the basis for the final rendering.

4. Final illustration. A detail shot of the sutures of the skull, prior to colourization and the injury rendering.

Pathological Illustration

The purpose of this assignment was to design a two-page spread showing the pathological progression of high-altitude pulmonary edema. My choice of this topic was inspired by prominent news stories in spring 2019 about the high volume of climbers on Mount Everest.

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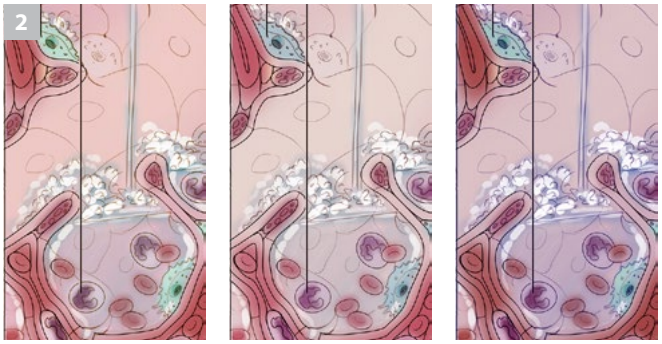

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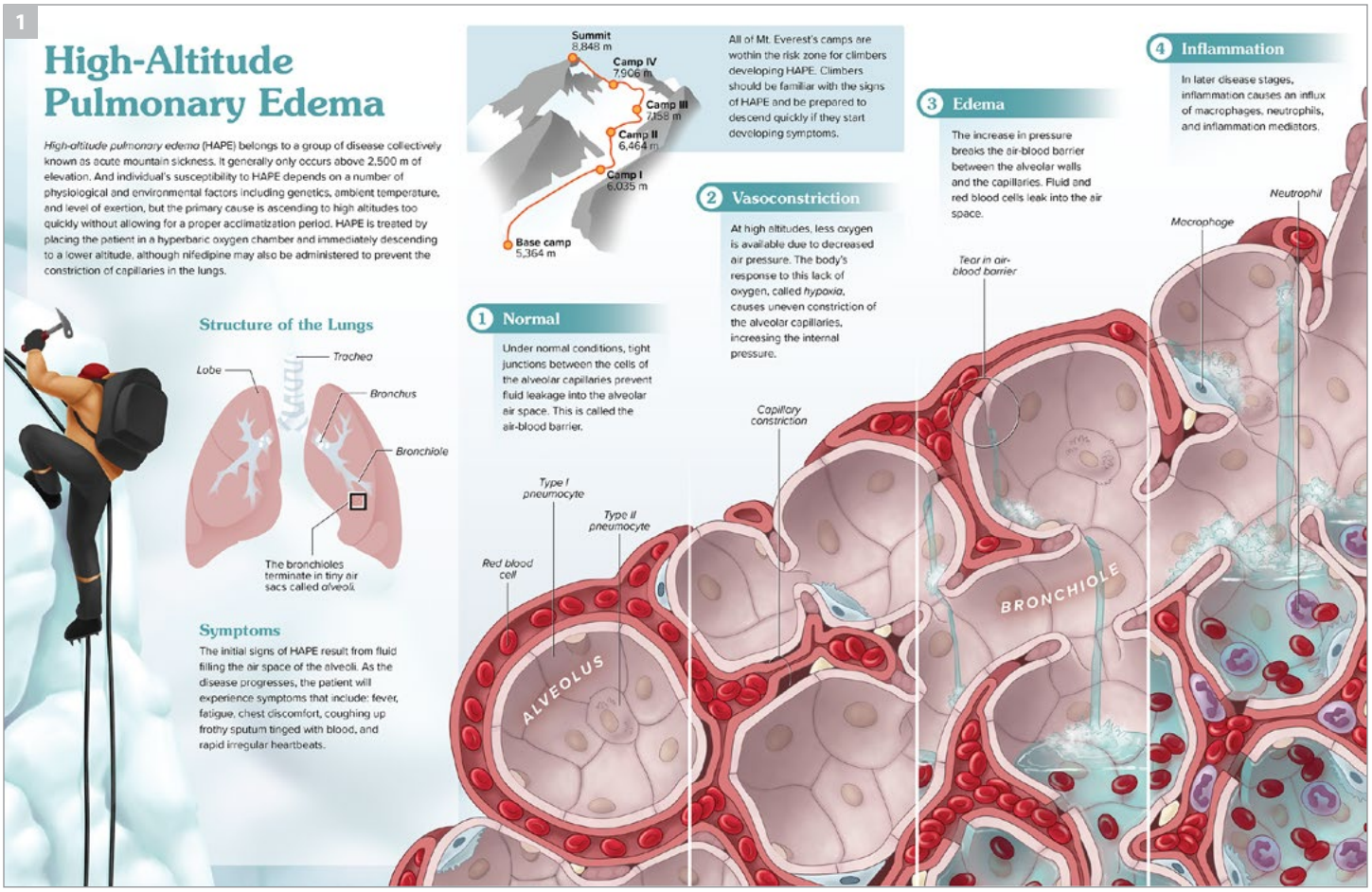

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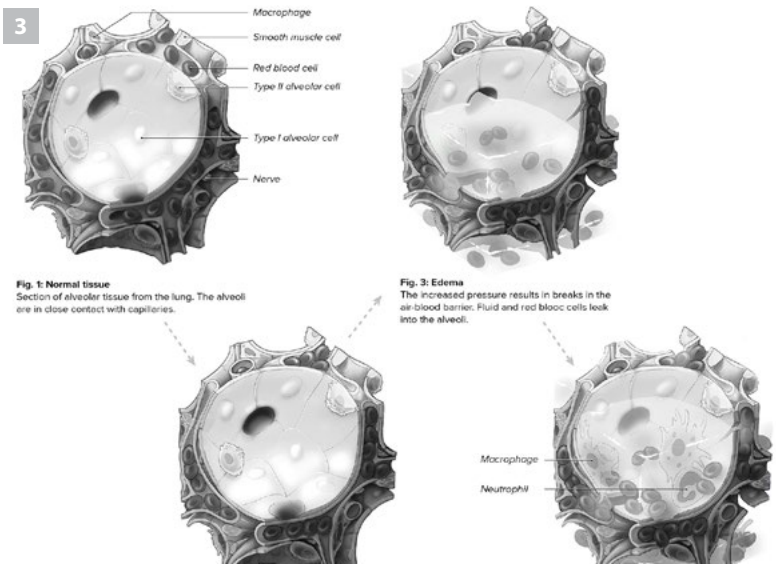


1. Final illustration. Since the disease takes place under highly specific conditions, I wanted to illustrate the context by including a climber and the most common climbing path. The ascending composition reflects the worsening of conditions as climbers reach higher altitudes.

2. Study. These colour studies let me test out a few different palettes prior to rendering the final piece.

3. Study. These studies helped me to work through the affected cell structures, fluid dynamics, and disease progression for the final drawing.

ILLIAD (Illustrated Interactive Guide to Anatomy Dissection)

ILLIAD is a web-based dissection tool for undergraduate comparative anatomy students. The goal was to digitize the existing dissection manual while also taking advatange of interactive media to improve student engagement and learning outcomes. It was built in collaboration with Chloe Ng.

1. Sketch. These are my initial sketches for the cat and lamprey anatomical diagrams. The sketches were based directly on the dissections we filmed in order to ensure visual consistency between the videos and diagrams.

2. Production process. I created this style guide as a reference for all the colours, fonts, and other design elements for the project in order to help keep everything consistent across all 40 webpages that comprised the final project.

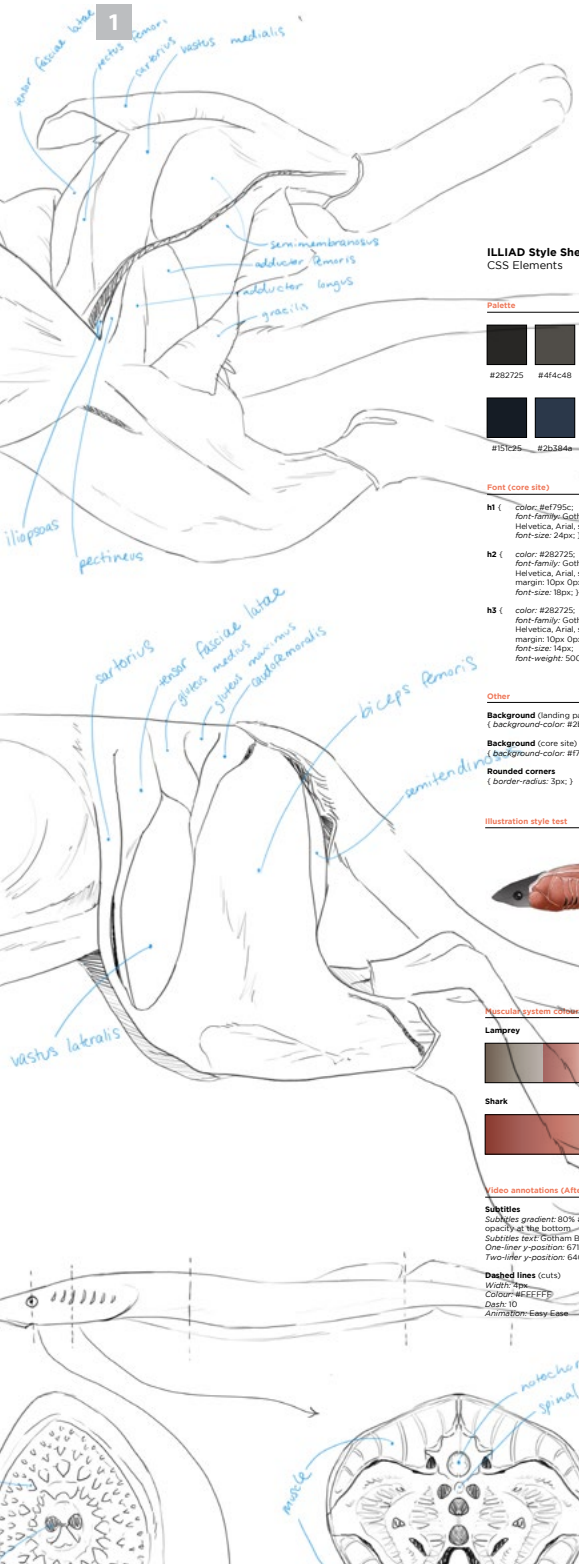
3. Final draft. These are a few of the wireframes I created to help refine the visual style of the website prior to coding. They were created fairly late in the pre-production process after many rounds of brainstorming and prototyping, and they are very similar to the final product.

4. Final interactive. ILLIAD's home page features icons representing all the units of the course. Units that are not currently available are greyed out.

5. Final interactive. These screens from the finished project show the side-by-side comparison feature as well as the dissections video pages that make up the majority of the site.

6. Final illustration. In addition to dissection videos and side-by-side comparisions, ILLIAD also includes fully labelled diagrams for students to study from.

1



2

ILLIAD Style Sheet
CSS Elements

Palette

#282725 #4f4c48 #7d786f #abb69e #c6c0b8 #e1ddd6 #eeece9 #f7f5f4 #ffffff

#151c25 #2b384a #3d5678 #4c71a3 #6b97d1 #b7d6ff #80240e #b9472b #ef795c

Font (core site)

h1 { *color:* #ef795c; *font-family:* Gotham, "Helvetica Neue", Helvetica, Arial, sans-serif; *font-size:* 24px; }

h2 { *color:* #282725; *font-family:* Gotham, "Helvetica Neue", Helvetica, Arial, sans-serif; margin: 10px 0px; *font-size:* 18px; }

h3 { *color:* #282725; *font-family:* Gotham, "Helvetica Neue", Helvetica, Arial, sans-serif; margin: 10px 0px; *font-size:* 14px; *font-weight:* 500; }

p { *color:* #282725; *font-family:* Gotham, "Helvetica Neue", Helvetica, Arial, sans-serif; *font-size:* 14px; line-height: 18px; }

a { *color:* #b9472b; *text-decoration:* none; }

a:hover { *color:* #ef795c; *transition:* 0.3s; *text-decoration:* underline; }

.pPale { *color:* #C6C0B8; } (p class, inactive text)

Other

Background (landing page) { *background-color:* #2b384a; }

Background (core site) { *background-color:* #f7f5f4; }

Rounded corners { *border-radius:* 3px; }

Drop shadows { *box-shadow:* 0px 3px 6px #e1dd6; }

Accent border { *border-bottom-style:* solid; *border-bottom-color:* #EF795C; *border-bottom-width:* 4px; }

Illustration style test

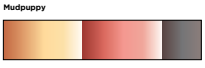
This is a rough initial style draft, but it depicts the following aspects that should be included in the final illustrations:

- realistic depiction of the specimens, based on frames from the dissection videos
- realistic but slightly more saturated colour palette
- fully rendered with shading and muscle fiber texture
- greyscale used for the specimen's skin/fur

Muscular system colour schemes

Lamprey

Mudpuppy



Shark

Cat

Video annotations (After Effects)

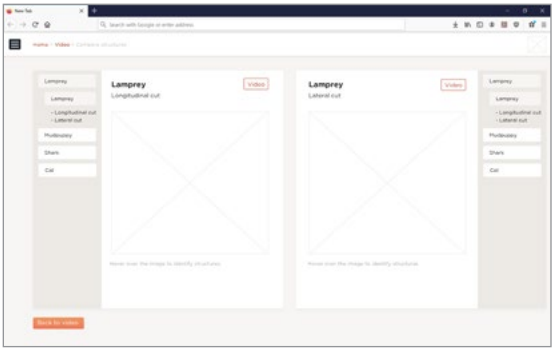
Subtitles
Subtitles gradient: 80% #FFFFFF, fade to 0% opacity at the bottom
Subtitles text: Gotham Book, 28px, Black
One-liner y-position: 671px
Two-liner y-position: 640 px

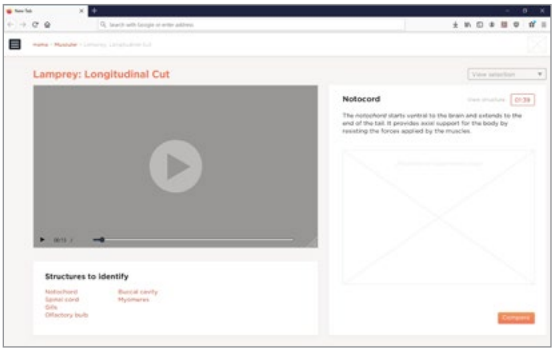
Dashed lines (cuts)
Width: 2px
Colour: #EFEFEF
Dash: 10
Animation: Easy Ease

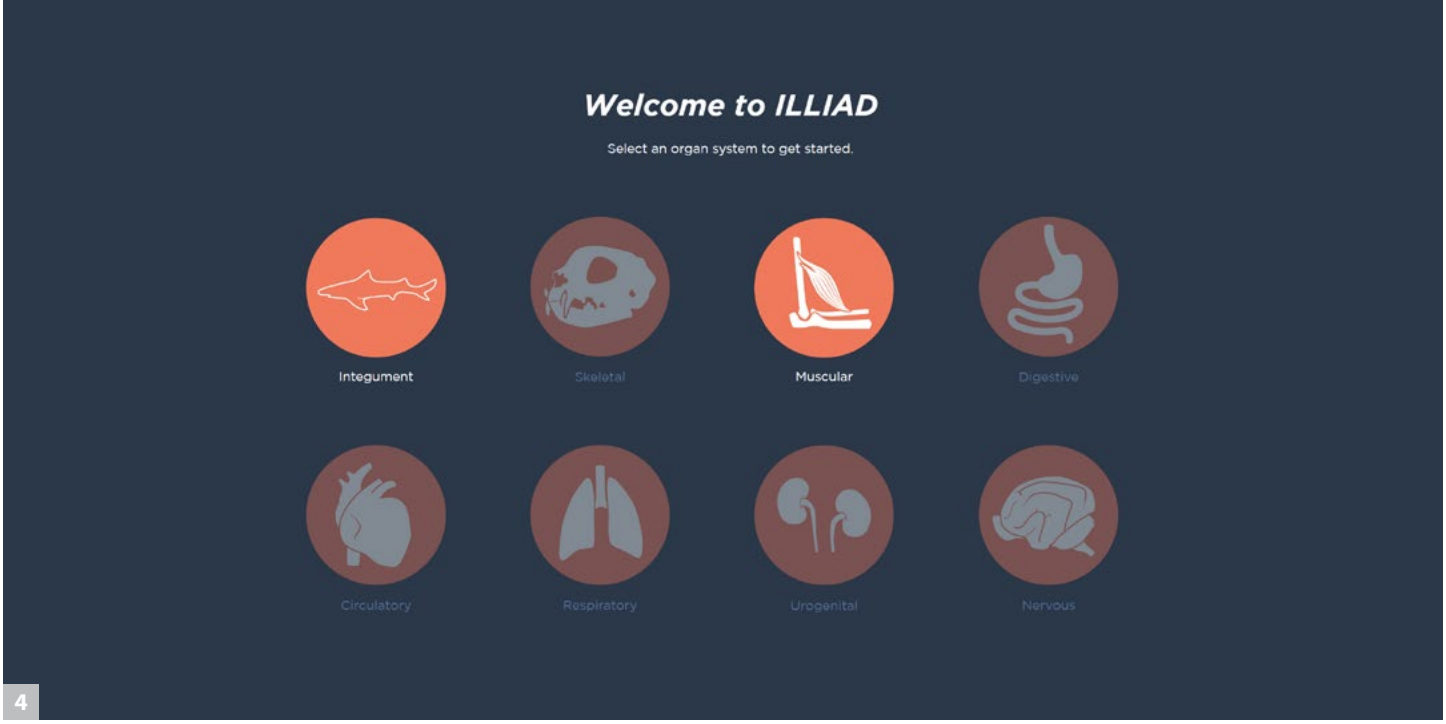
Labels
Height: 79.0 px
Roundness: 10.0
Fill colour: #9D9D9D
Label text: Gotham Book, 36px, White

Leader line
Width: 4px
Colour: #9D9D9D or #BABABA if need lighter depending on background
Round cap

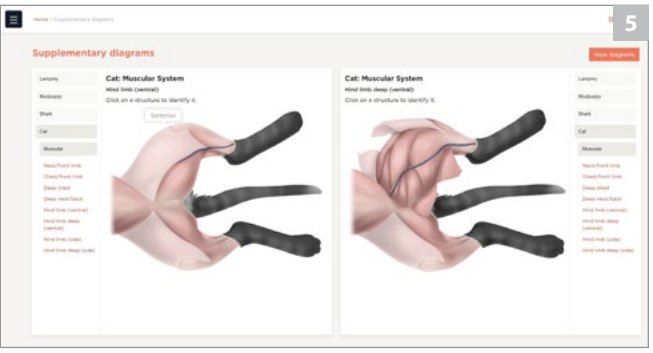
3



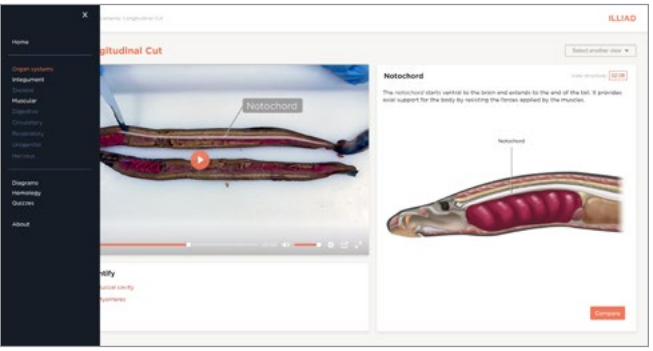


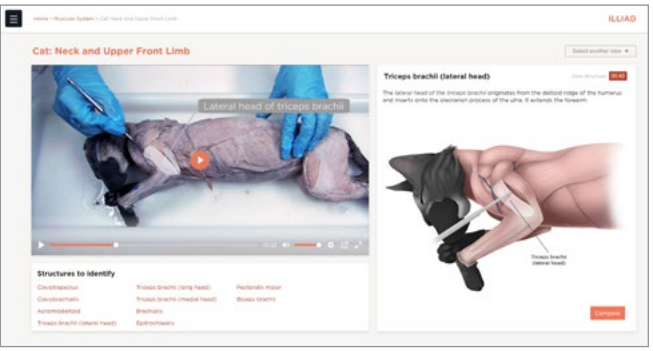

Welcome to ILLIAD
Select an organ system to get started.
Integument
Skeletal
Muscular
Digestive
Circulatory
Respiratory
Urogenital
Nervous

4

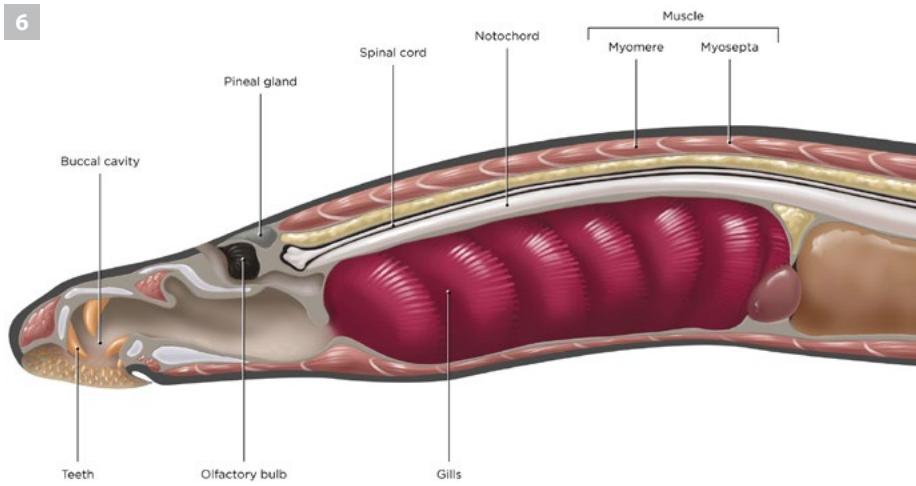

Supplementary diagrams
Cat: Muscular System
Cat: Muscular System

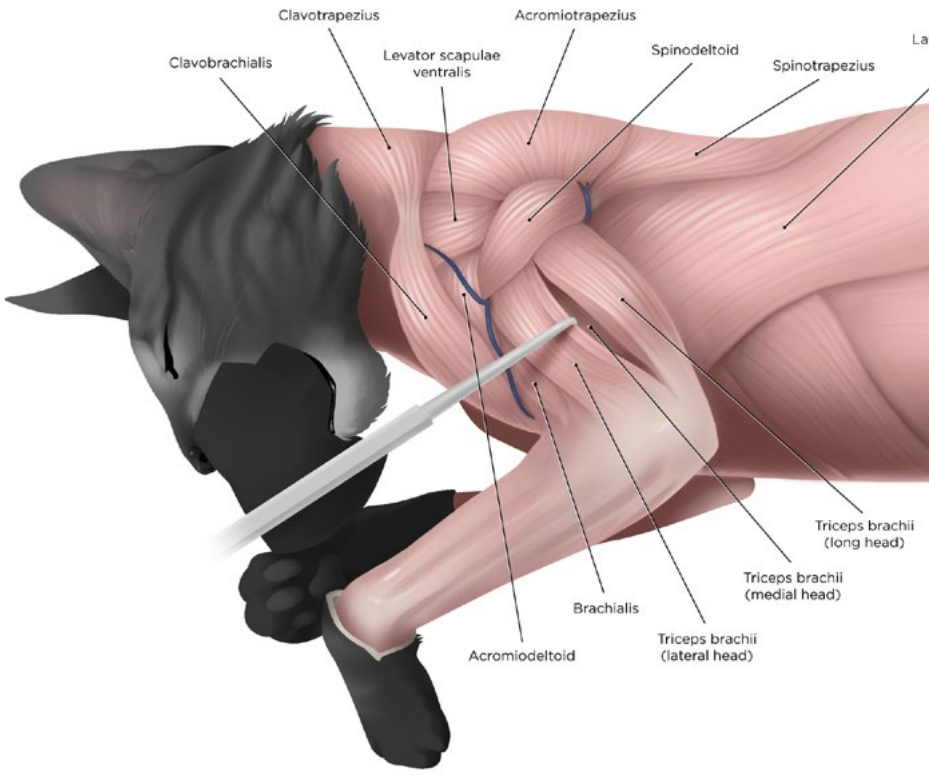
5

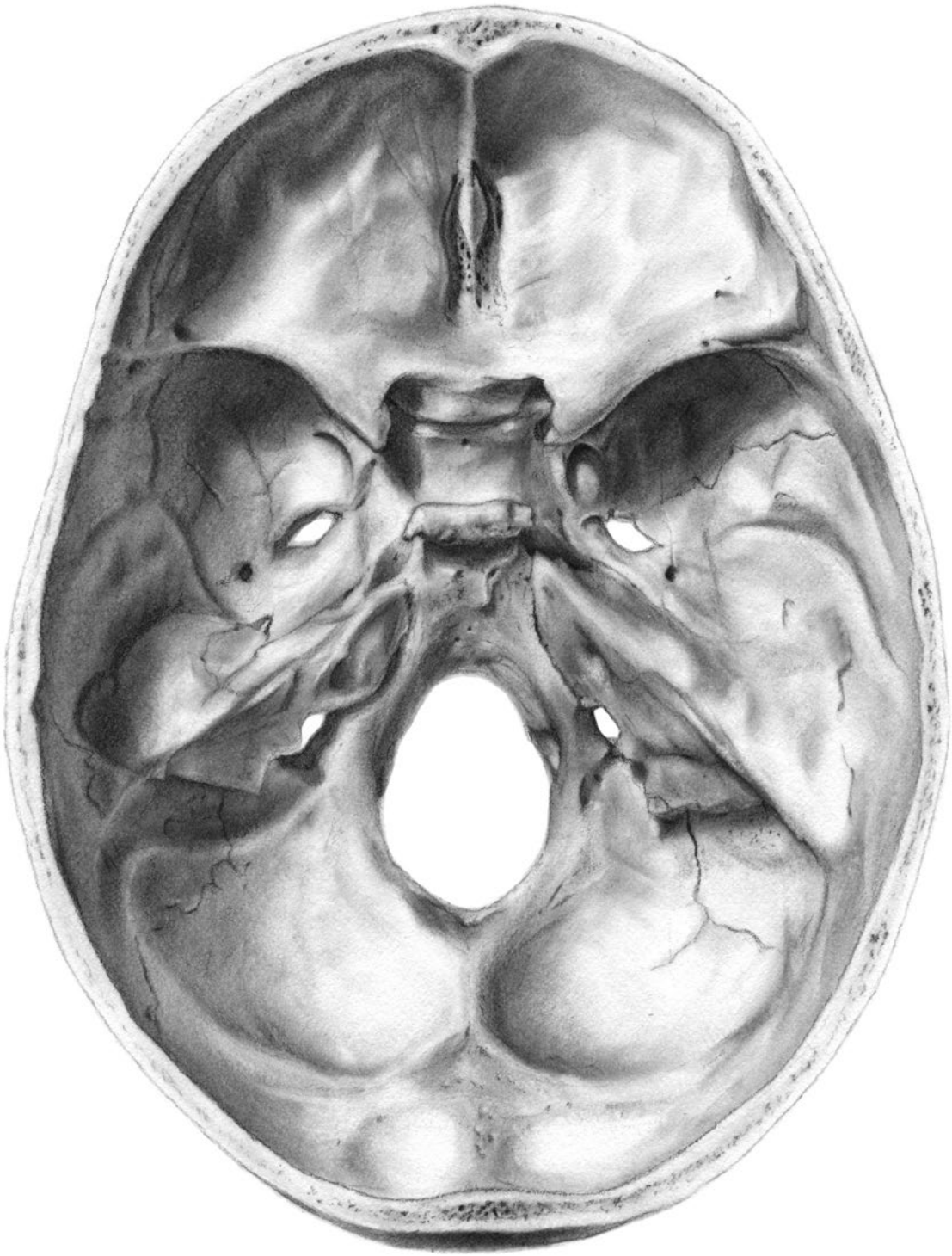

ILLIAD
Notochord


ILLIAD
Cat: Neck and Upper Front Limb
Lateral head of triceps brachii
Triceps brachii (lateral head)
Structures to identify

6


Muscle
Notochord
Spinal cord
Myomere
Myosepta
Pineal gland
Buccal cavity
Teeth
Olfactory bulb
Gills


Clavotrapezius
Acromiotrapezius
Clavobrachialis
Levator scapulae ventralis
Spinodeltoid
Spinotrapezius
Triceps brachii (long head)
Triceps brachii (medial head)
Brachialis
Triceps brachii (lateral head)
Acromiodeltoid



Roxanne Ziman

The MScBMC program was, for me, the perfect culmination of my previous degrees in visual art (Claude Watson Arts Program), business (iBBA at York University), and biomedical sciences (BSc at Ryerson University). While my primary interest lies in patient education, I enjoy both exploring a broad range of topics in science and medicine and working in a variety of traditional and digital media.

Anatomical Illustration

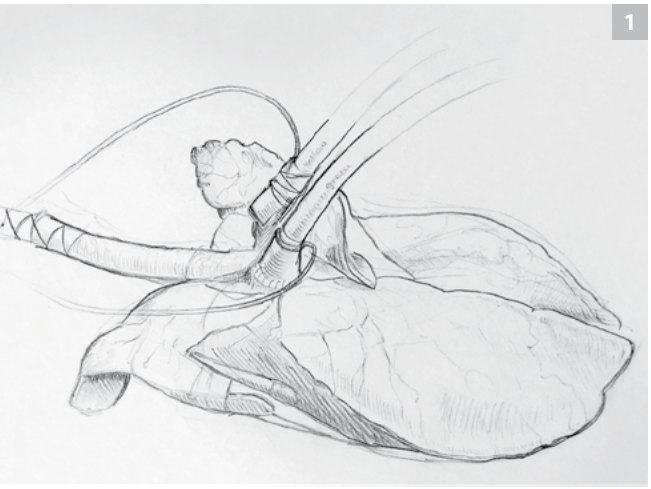
The challenge of the "Unseeable" project was to depict a hidden structure, the tertiary bronchi, from an atypical perspective. Research included the use of 3D maquettes, cadaver and fresh tissue observations, and studying casts of the bronchi to inform the final illustration.

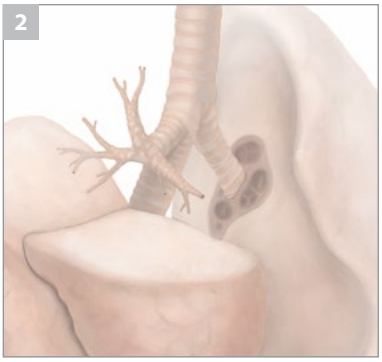
1. Study. Live tissue study of *ex vivo* lung perfusion experiment using pig lungs. Observation of live tissue informed the texture and feel of the lungs.

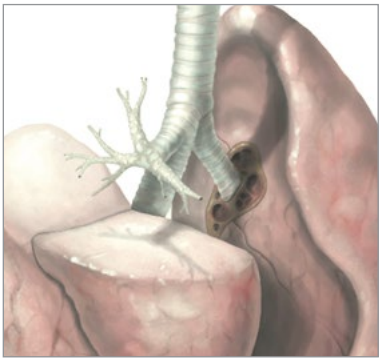
2.Study. Lungs in *ex vivo* perfusion don't pump blood, and so they appear much more pale and airy than live lungs *in vivo*. These colour studies show the evolution of my understanding after observing a lung transplant procedure.

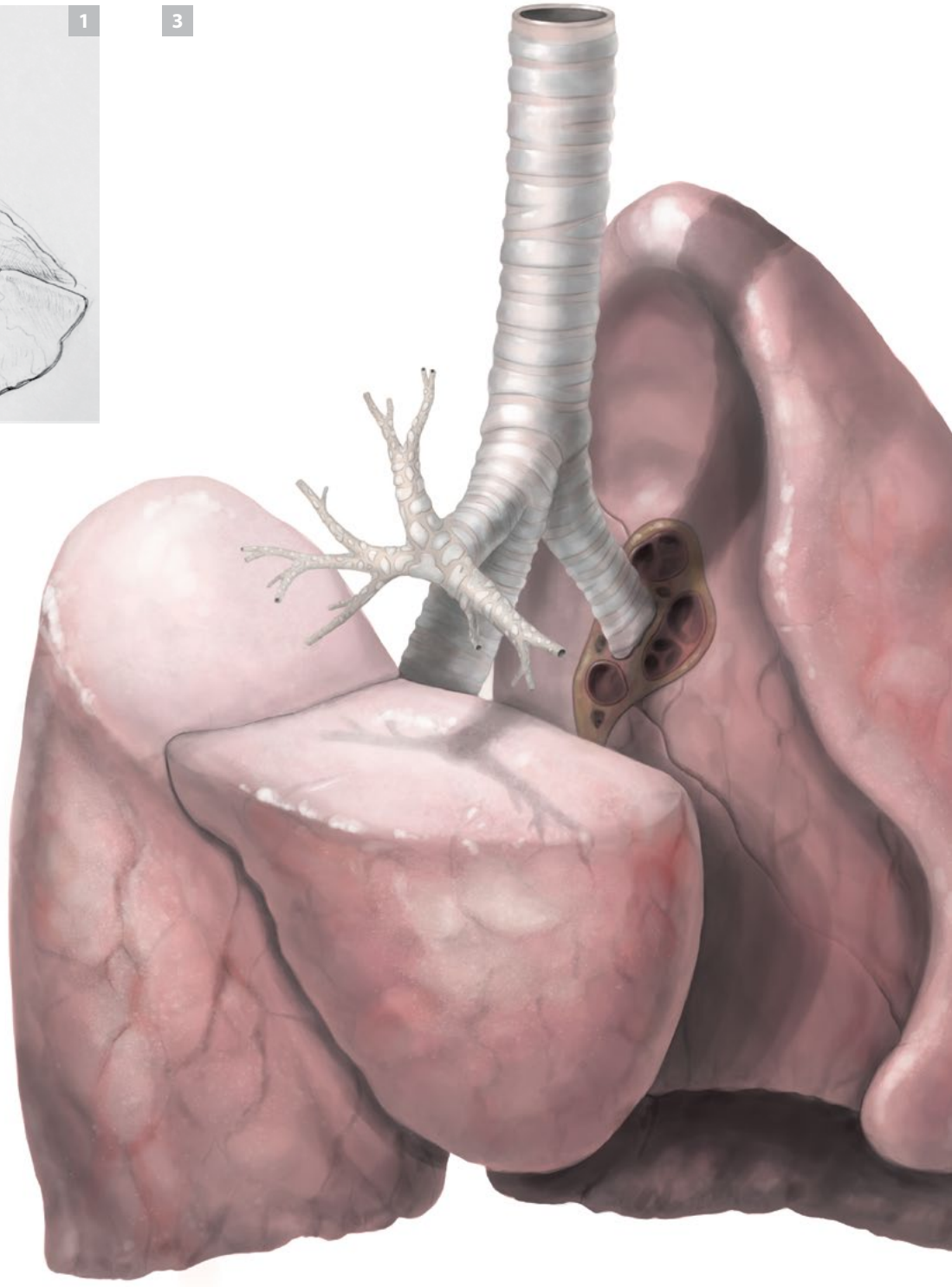
3. Final illustration. Final piece rendered in *Photoshop*.

Previous spread. Final illustration. Interior base of the skull done in carbon dust.









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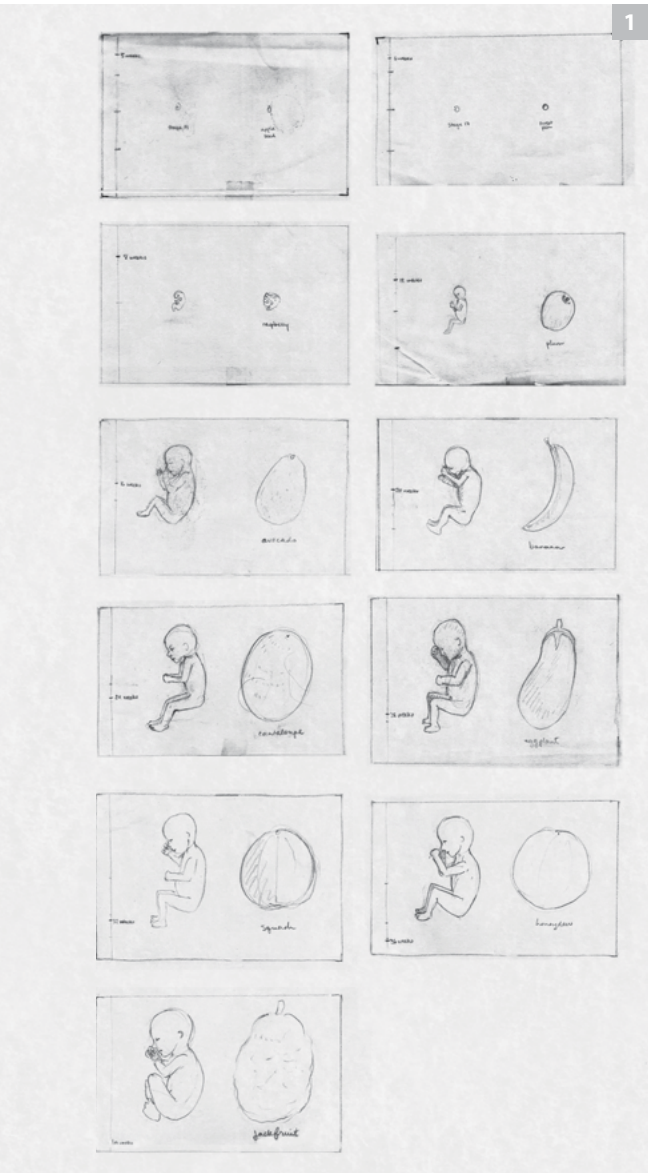
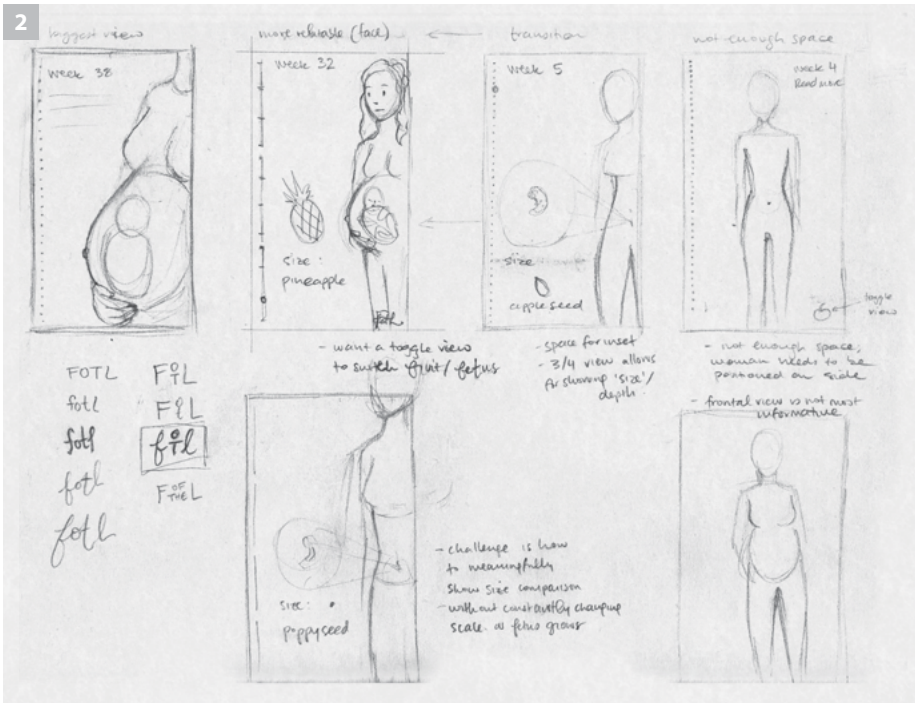


2



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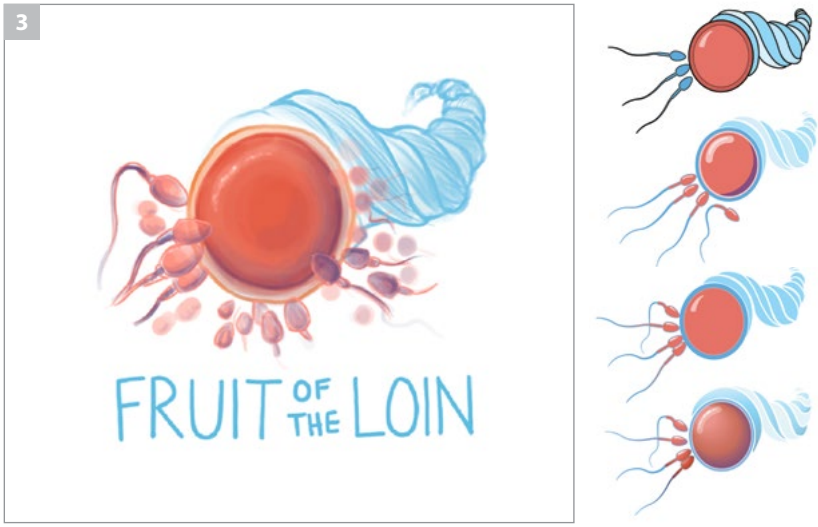


UX/UI Design

This was a rough storyboard created for a scrollytelling-style website showing weekly development of the fetus, using fruit as a relatable comparison for relative size. This is a mock-up that I'd like to fully develop and bring to fruition one day.

1. Storyboard. Sketches of key phases of development positioned alongside different fruits to show relative size.

2. UI design. Sketches to mock-up the UI of the app, designed for phone or tablet. I played around with different layouts to find the best way to organize the elements on the screen.

3.Sketch. Initial sketch of the logo, "Fruit of the Loin," a play on "Fruit of the Loom," and style experiments for the logo, trying different rendering styles in *Illustrator*.

Scientific Illustration and Animation

Whales and octopuses are both fascinating, mysterious creatures of the ocean. I wanted the opportunity to learn more about them by studying their form and behaviour through these two projects, while also getting to explore new forms of digital media.

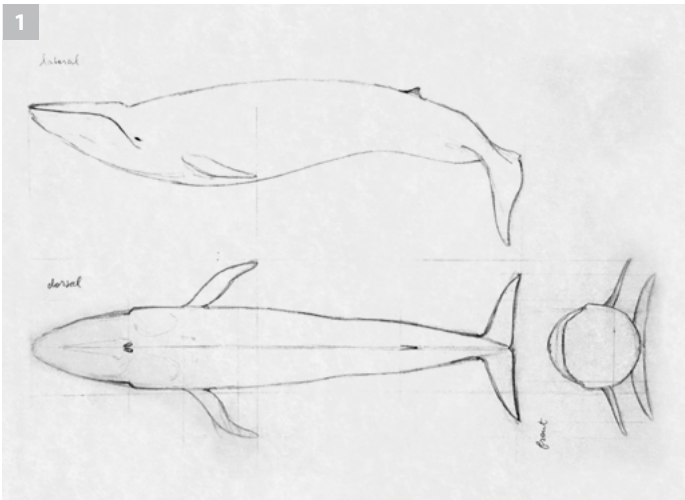
1. Sketch. Orthographic sketches of the front, lateral, and dorsal views of the whale. These sketches were brought into *ZBrush* to serve as references for sculpting.

2. Final draft. A still frame of the whale in its environment (built in *Cinema 4D*). A special thanks to Nick Woolridge for helping me figure out the caustics effect.

3. Production process. In-progress whale model during the painting/texturing stage

4. Production process. Still frames of the animated octopus for a scrollytelling project explaining how octopuses camouflage. The first and last key frames served as the endpoints for this movement; the keyframes in the middle were steps created by using the blend tool in *Illustrator*.

1



2

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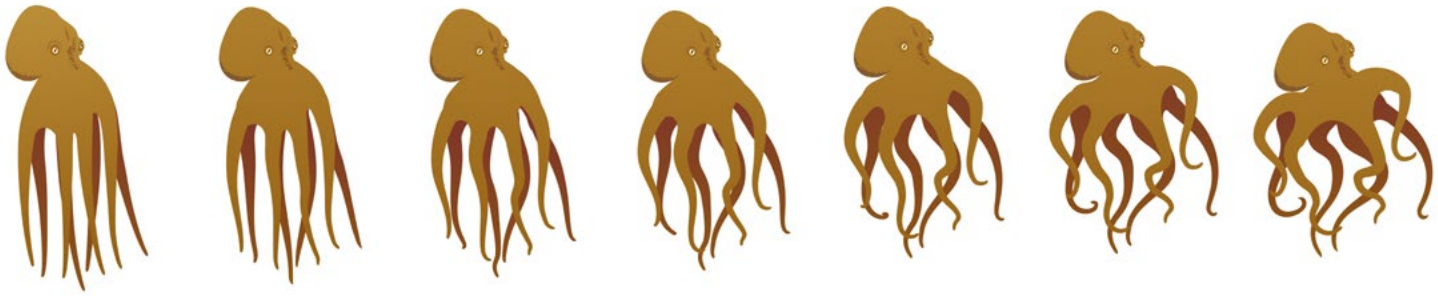
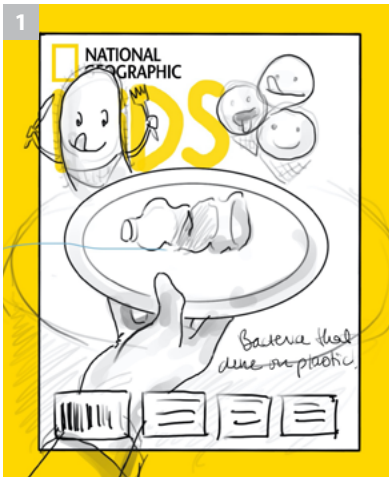


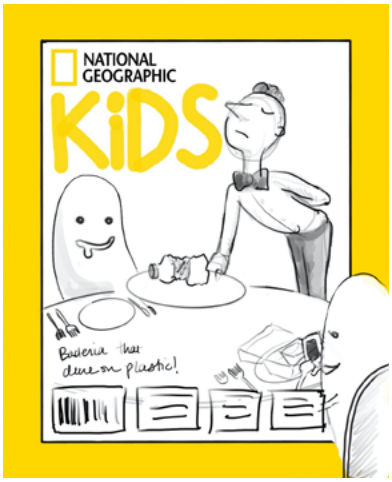
Editorial Illustration

The discovery of so-called "**plastic-eating bacteria**" in 2018 was the topic for this National Geographic Kids mock cover. This playful concept was designed for a younger audience to inspire their imagination, curiosity, and interest in science at an early age.

1. Sketch. Thumbnail sketches of two different compositions (top two) using visual metaphors and characters to exaggerate the concept. While the viewer's perspective was interesting, it had less opportunity for playfulness and caricature as did the second. The bottom sketch shows some colour experimentation.

2. Final illustration. The final rendered piece, done in *Maya* with touch-ups in *Photoshop* and *Illustrator*.



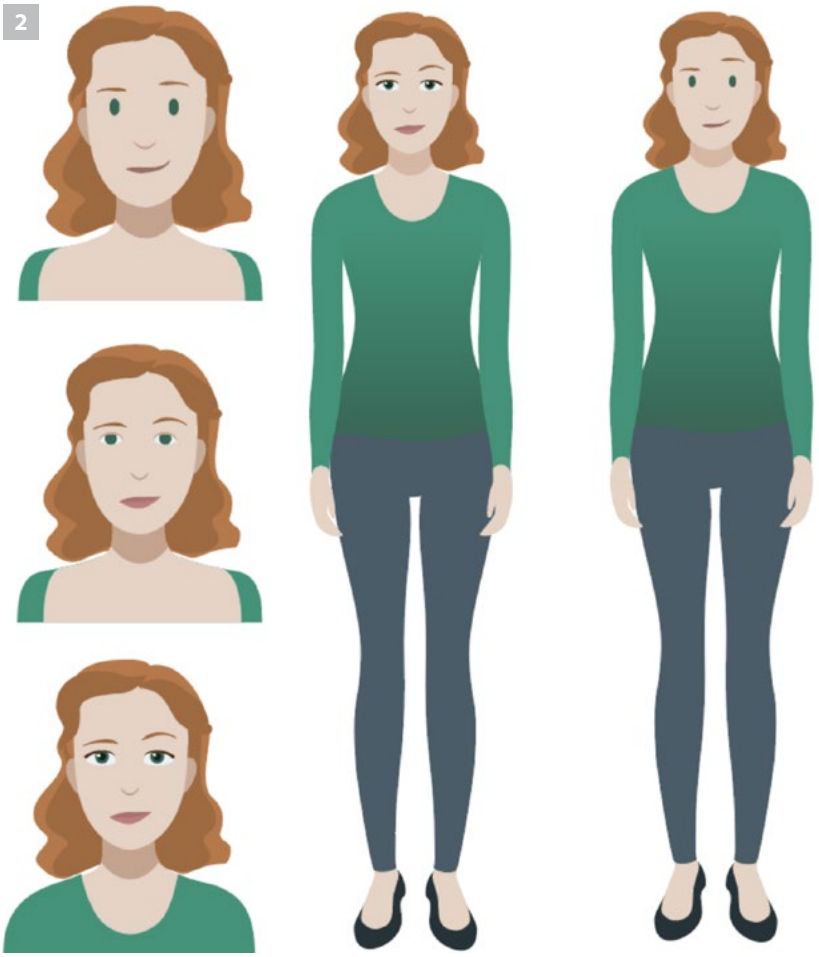


Hepatitis C Virus and Your Transplant

My MRP is a 2D animated video that aims to educate transplant candidates and their caregivers about being matched with donor organs from hepatitis C virus (HCV) positive donors. It explains what HCV is, how it is and is not transmitted, its treatment protocol, and its risks and benefits.

1

2



1. Study. Portrait studies of Alex Pangman, Canadian jazz singer and two-time double lung transplant recipient on whom my main character is based. An initial version of this MRP was aimed at lung transplant recipients, until it was expanded to include all solid organ tranplants. I kept Alex as the inspiration for this main character, nevertheless.

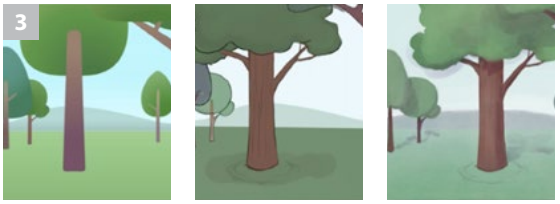
2. Study. Character studies. I explored different styles for her features and aimed to give her a warm, personable countenance (like her real-life counterpart).

3. Study. Environment style exploration. I tried different render styles including vector (left), cel shading (middle), and painterly (right). I settled on a painterly style for the backgrounds.

4. Final animation. The park scene. Low-risk behaviours for HCV transmission are demonstrated by a range of background characters. Hap from Evelyn Lockhart's MRP makes a cameo appearance, as does Geri from Geri's Game (a Pixar short).

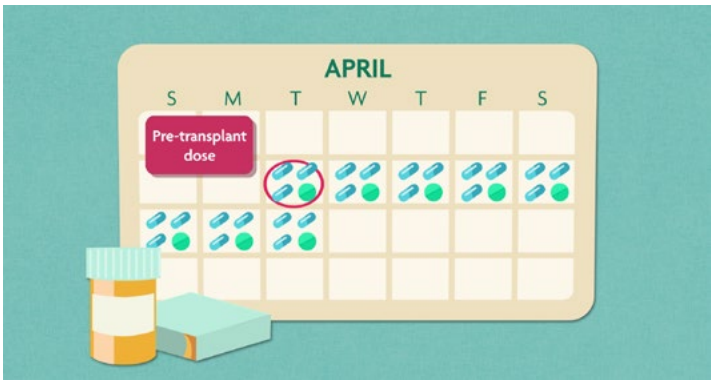
5. Final animation. Alex and her husband-caregiver, Tom, are pictured in the surgeon's office for consultation (top). The 'explanatory' scenes feature simplified, expressive characters that represent the HCV positive donor (in yellow) and recipient (in pink); the treatment protocol and schedule are illustrated (bottom).

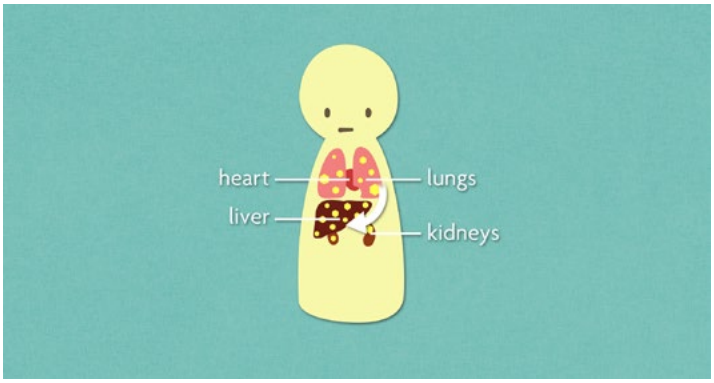
3

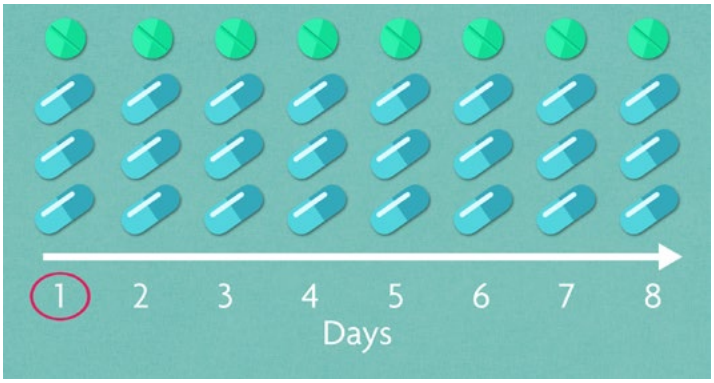


4


5


APRIL
S M T W T F S
Pre-transplant dose


heart
lungs
liver
kidneys


1 2 3 4 5 6 7 8
Days


WC
WC

Sabrina Cappelli

I am a biomedical communicator with a passion for visualizing scientific and medical topics for the general public. I specialized in 3D modeling and animation in the MScBMC program after completing a Bachelor of Science degree in Life Sciences at the Univeristy of Toronto. For my research project, I developed a 3D animation in collaboration with the Royal Ontario Museum which focused on reconstructing a newly discovered species from the Cambrian period using fossil remains.

Editorial and Anatomical Illustrations

An Odyssian Strategem and **The Human Mandible** are two projects that highlight the many applications 3D modeling has to offer - from realistic reconstructions of human anatomy to the creation of abstract visual metaphors.

1. Final illustration. This mock journal cover illustrates how modified antibodies can act as molecular Trojan horses for cancer-drug delivery across the blood brain barrier. The final piece was modeled in *Maya* using MASH and deforming effects and was then rendered using *Arnold*.

2. Sketches. Rough sketches for the mock journal cover were created to explore different ways of depicting the Trojan horse metaphor as well as the blood brain barrier environment.

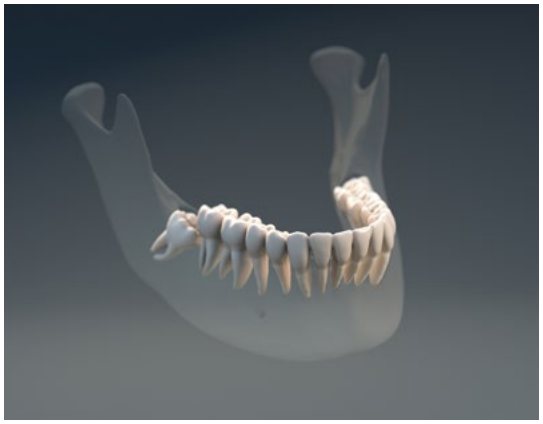
3. 3D modelling. This 3D model of a human mandible was created by extracting data from CT scans using *Horos*. Elements like the roots of the teeth and and alveolar sockets of the mandible were reconstructed in *ZBrush* along with textural detail before being rendered in *Cinema 4D*.

Previous spread. The final render of a digitally-sculpted 3D model of *Phyllium giganteum*.

1

2

3



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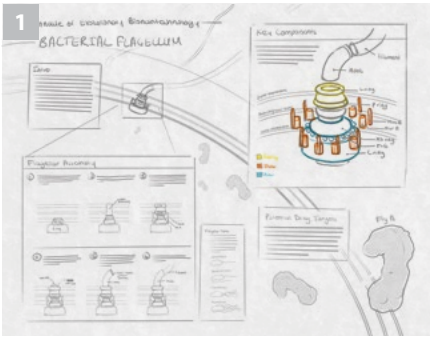

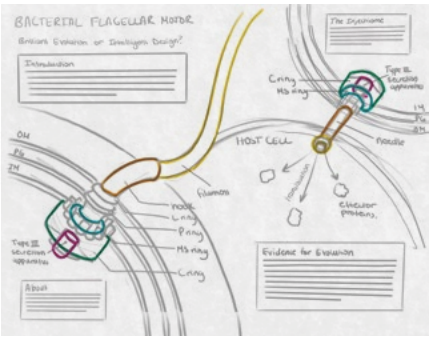

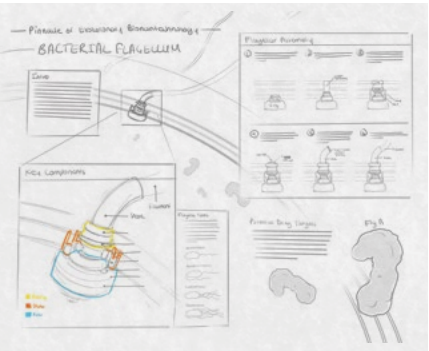

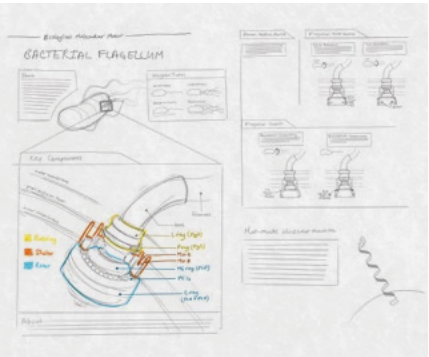

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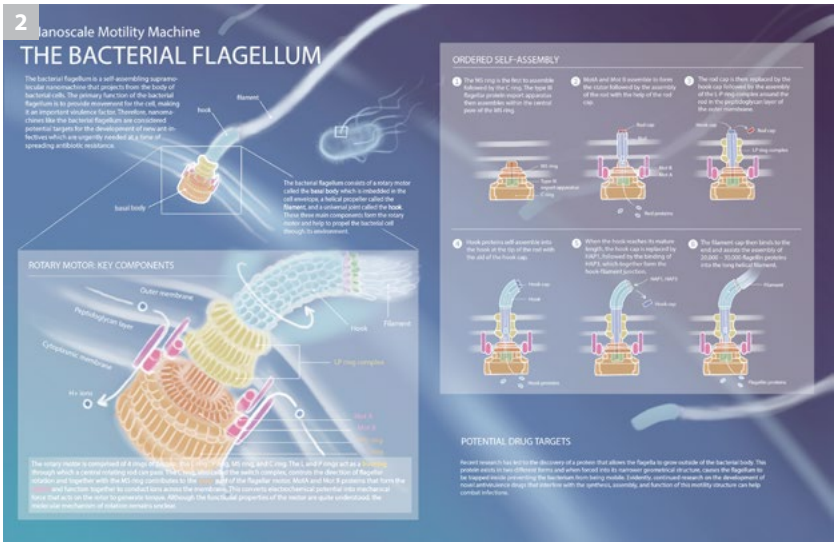

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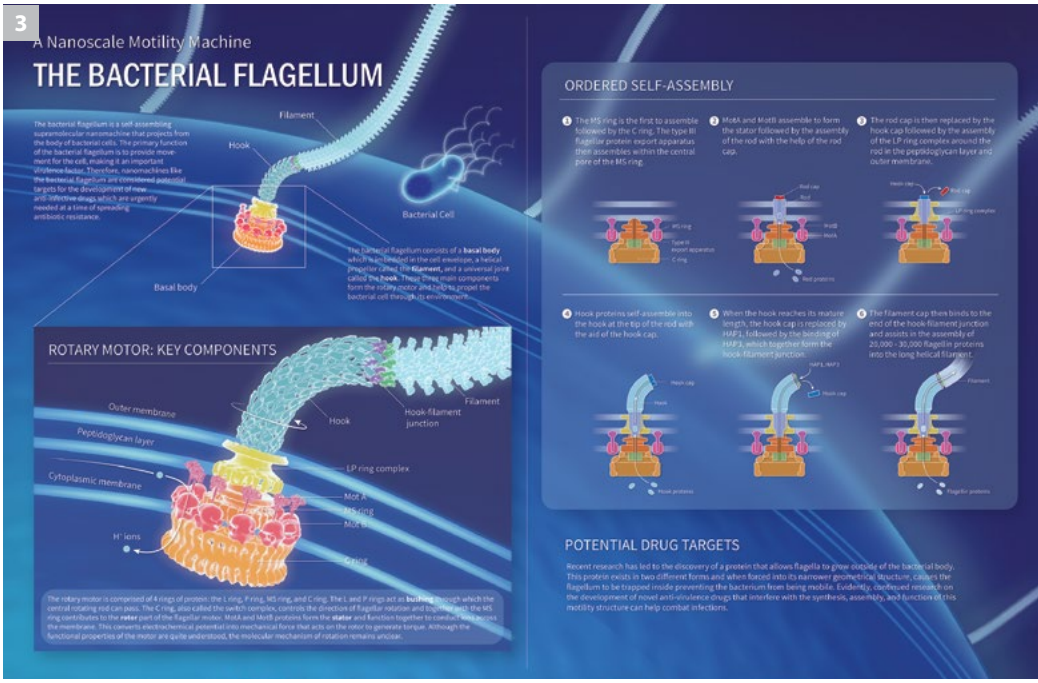


Molecular Visualization

The Bacterial Flagellum: A Nanoscale Motility Machine is a magazine spread illustrating how the bacterial flagellum self-assembles and generates a propulsive rotary movement.

1. Sketches. Multiple thumbnail sketches were created to explore different visual stories and to determine the layout of visual elements.

2. Final draft. A refined sketch was created to establish the final textual content, layout of visual elements, and colour palette before working in 3D.

3. Final illustration. Protein models were obtained from the RCSB Protein Data Bank (PDB) and then cleaned and isolated in *Chimera* for export. Individual protein components of the flagellum were then assembled and rendered in *Cinema 4D*.

Pathological Illustration

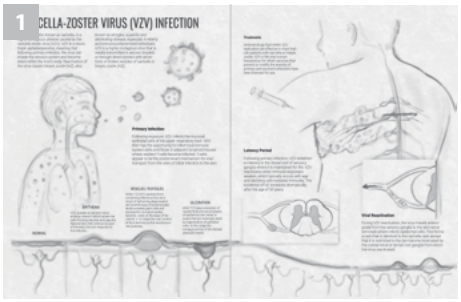
Varicella-Zoster Virus (VZV) Infection is a magazine spread created to educate the public on the infection cycle of the varicella-zoster virus, which causes both chickenpox and shingles in individuals.

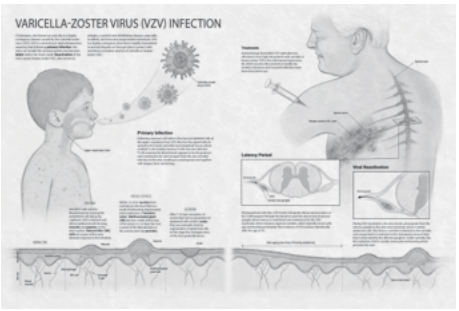
1. Sketches. Draft sketches were created to explore different layouts for visual elements as well as how to integrate the pathological progression of the infection at the gross, cellular, and molecular scales.

2. Study. A series of tissue cubes were created to gain a better understanding of the pathological changes that occur to produce the rash seen in both chickenpox and shingles.

3. Final illustration. The final spread highlights the three main phases of this viral infection (primary infection, latency, and reactivation) while addressing the pathological changes that occur at the tissue level over time.

1





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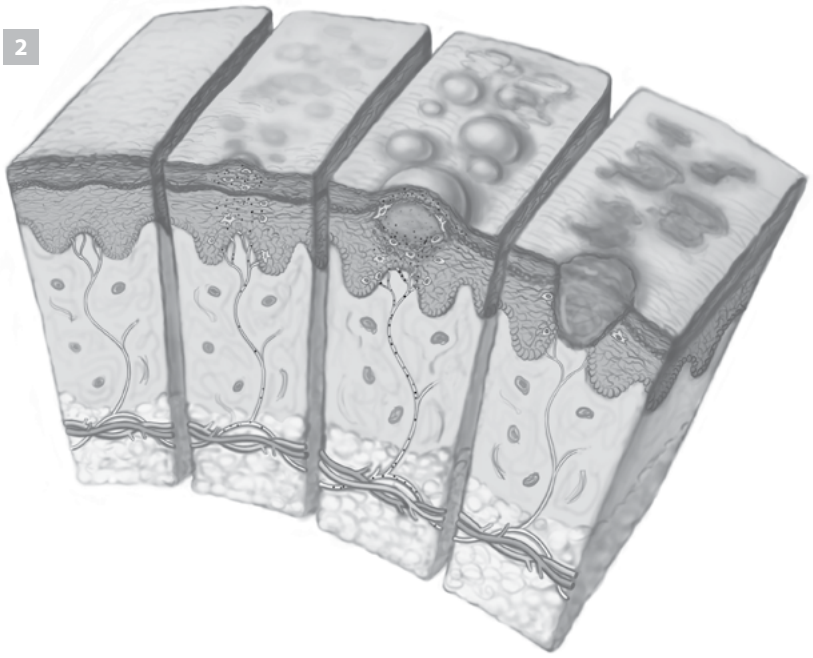

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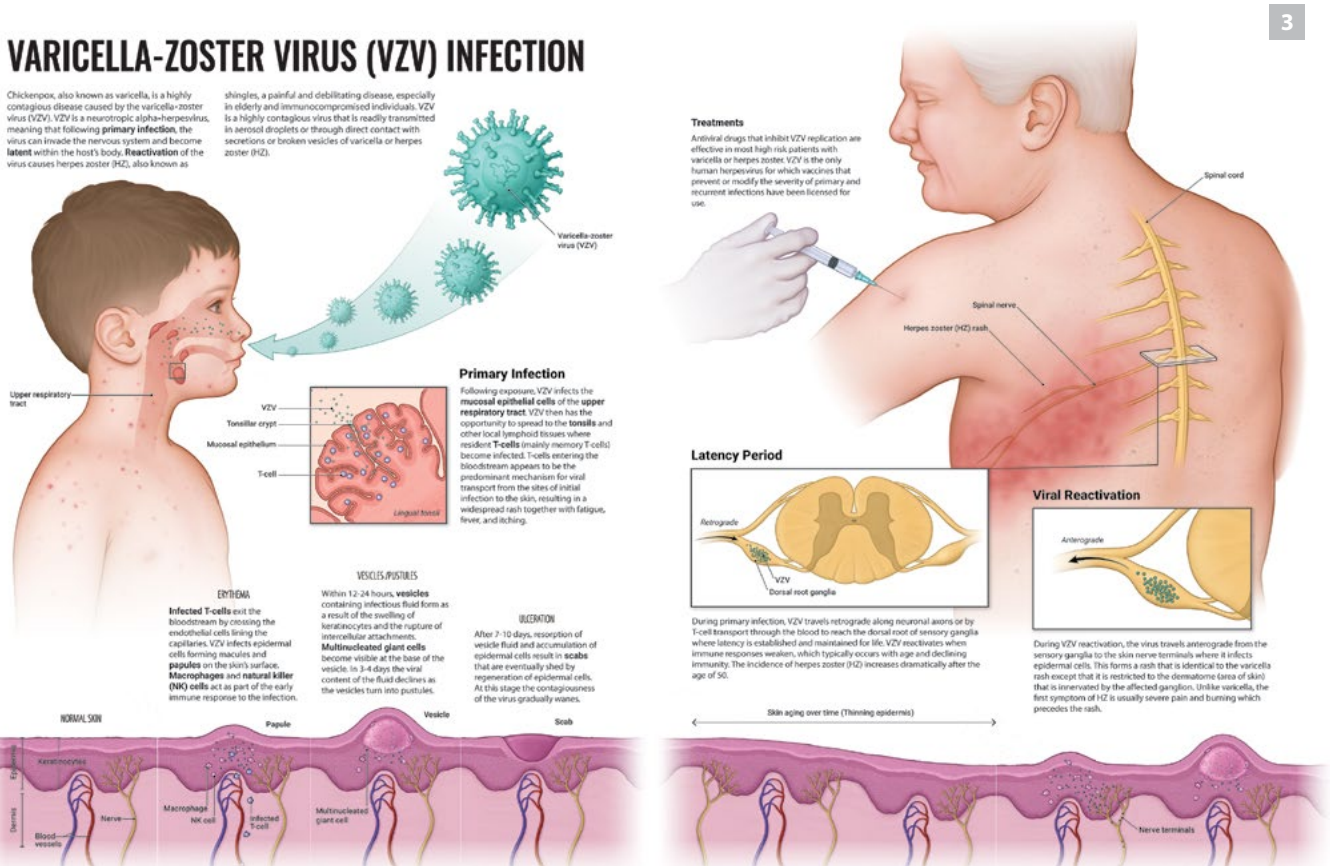

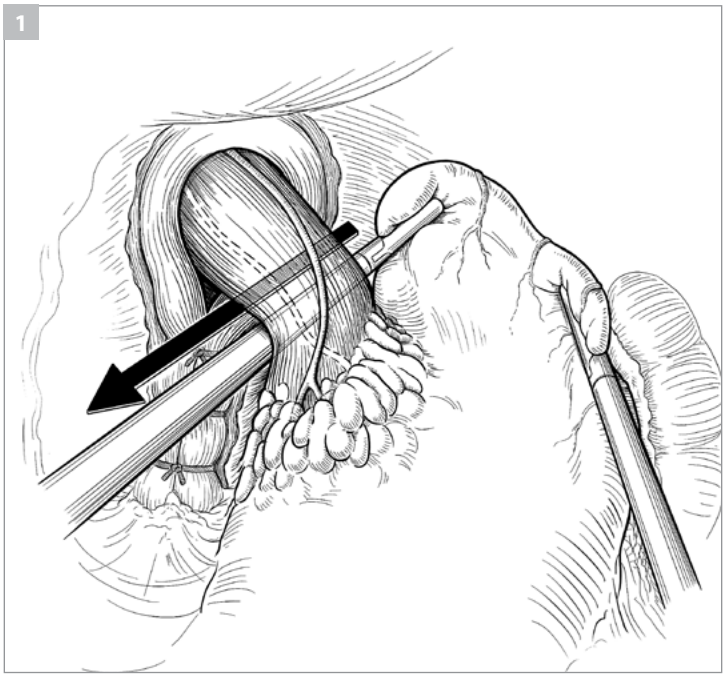

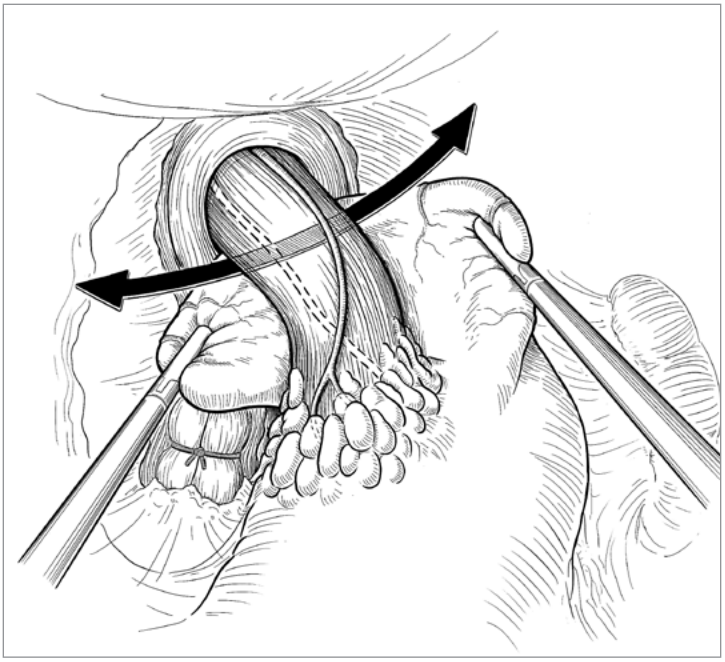

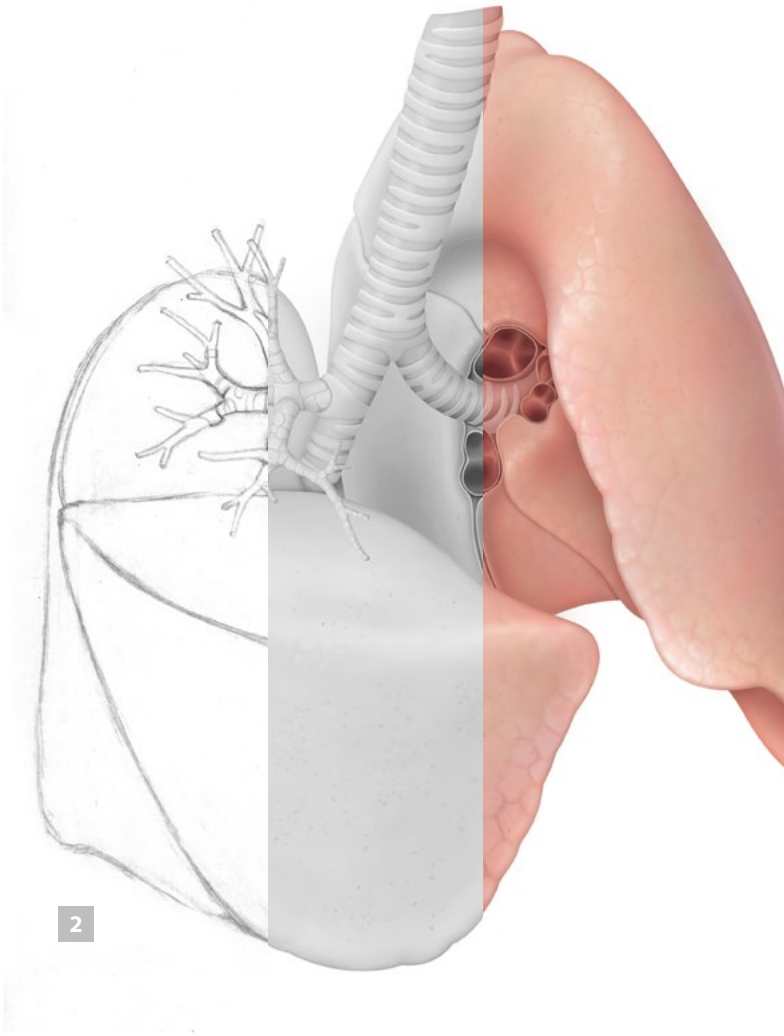

Surgical and Anatomical Illustrations

Nissen Fundoplication and **Show me the Unseeable** are two projects that highlight the variety of media that can be used to illustrate anatomical subject matter—from traditional pen and ink to digital painting.

1. Final illustration. These illustrations are part of a surgical sequence demonstrating how to perform a Nissen fundoplication during a para-esophageal hernia repair surgery. The goal was to illustrate the techniques used in this procedure as accurately as possible. Sketches and notes were produced while observing the procedure live and supplemented with input from the surgeon.

2. Production process. The goal of this project was to illustrate an "unseeable" anatomical structure. The structure illustrated is the bronchial tree of the superior lobe of the right lung which is shown split into the main stages of rendering. Anatomical atlases, CT scans, and preserved specimens from Grant's Museum were used as reference.

Reconstructing A New Species From The Burgess Shale, British Columbia

This project aims to improve the accessibility of current Cambrian research to the general public. This was achieved by reconstructing a new species of radiodont named *Stanleycaris* and by creating a multimedia animation about the importance of identifying and classifying these extinct organisms.

1. Sketches. Detailed sketches were produced of the external and internal anatomy of *Stanleycaris* based on fossil remains provided by the Royal Ontario Museum. An iterative design process was implemented which involved ongoing feedback from content experts in order to ensure that the body plans were as accurate as possible.

2. 3D modelling. Final orthographic sketches of *Stanleycaris* were imported into *Maya* as templates to ensure that the scale and proportions of the organism were modeled accurately.

3. Final animation. Texture maps for *Stanleycaris* were created in *ZBrush*. The final model was rigged in *Maya* and rendered using *Arnold*.

4. Production process. A joint system was created for each organism included in the Cambrian scene to animate their unique locomotive movements. Expressions were used to outline and control parameters including offset, range, and speed for joint elements within fins and legs. Render previews were created to get an idea of the speed and locomotive motion of each organism and to ensure the movement appeared smooth and realistic.

5. Final animation. The final animation attempts to immerse viewers in an underwater environment that is accurate to the Cambrian time period.

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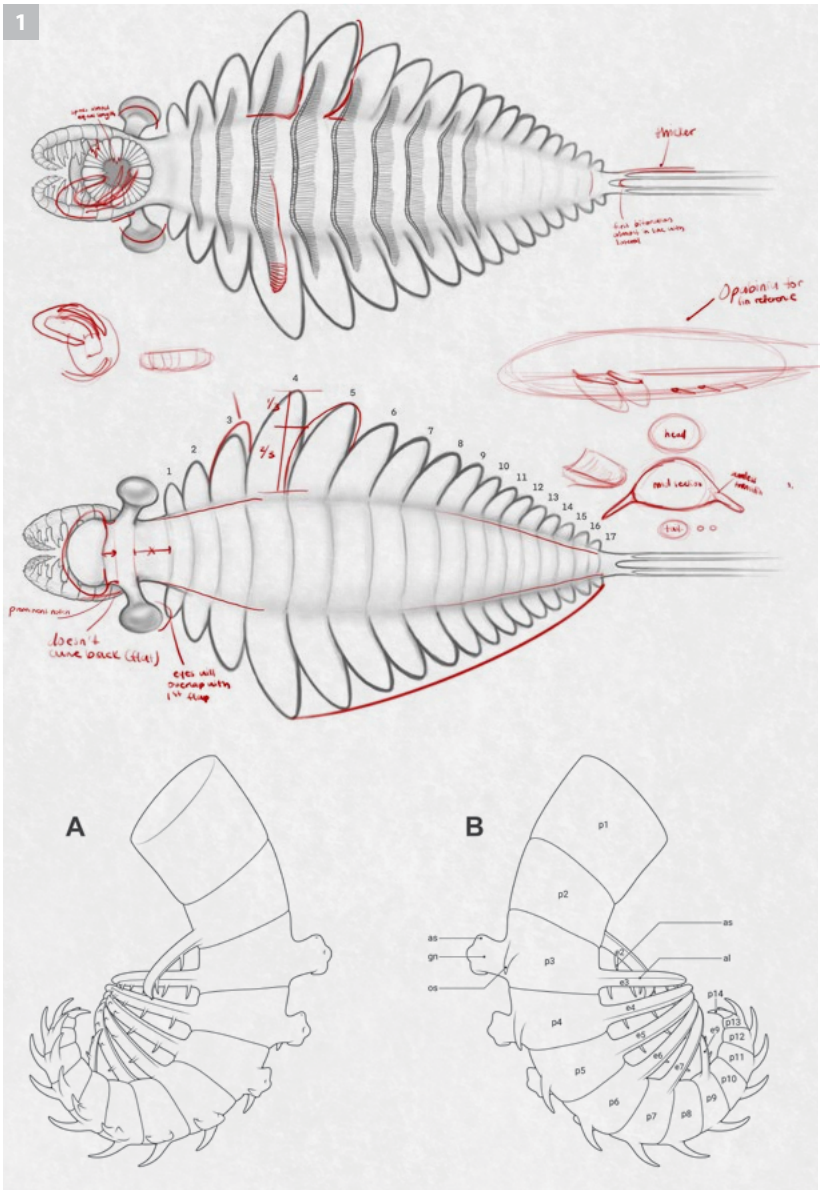

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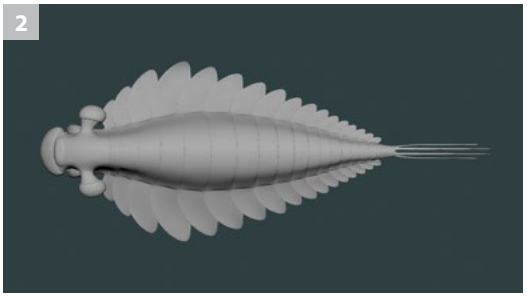

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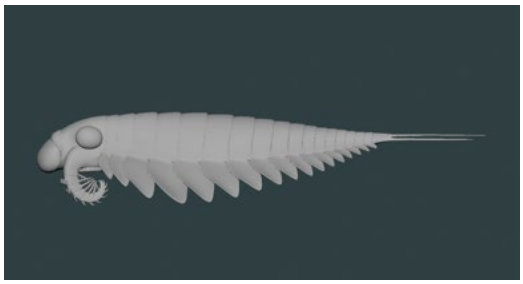

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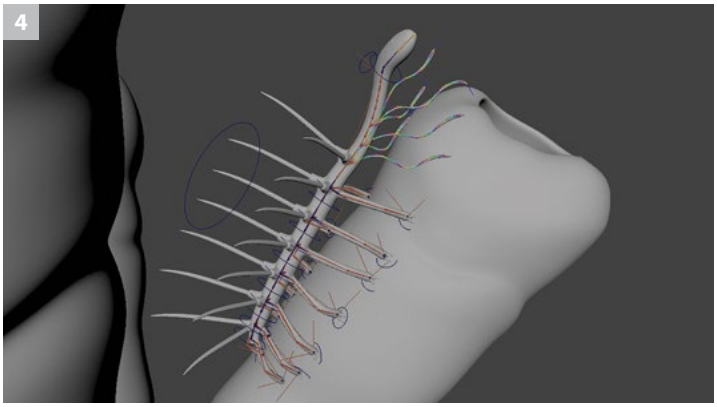

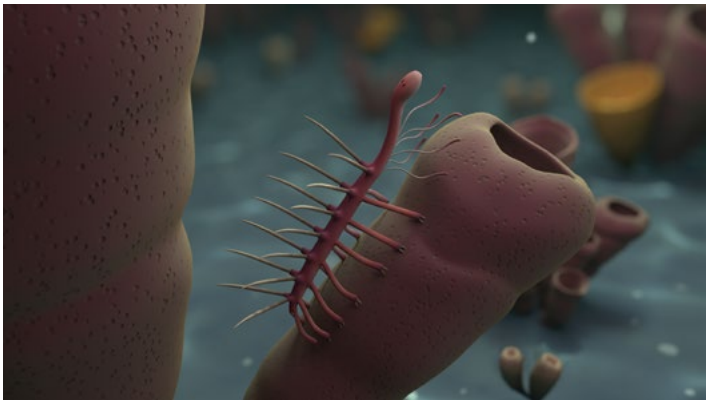

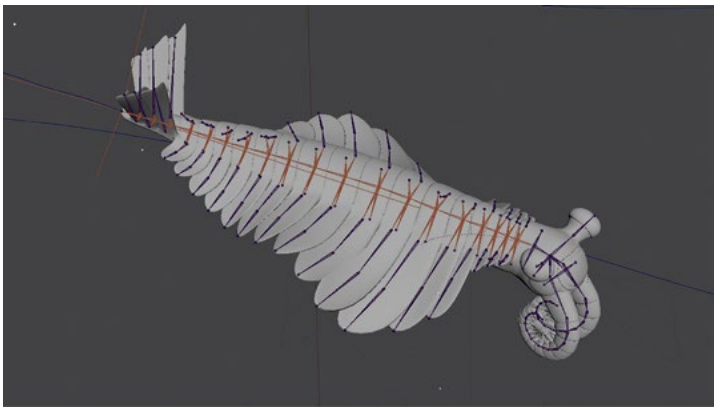

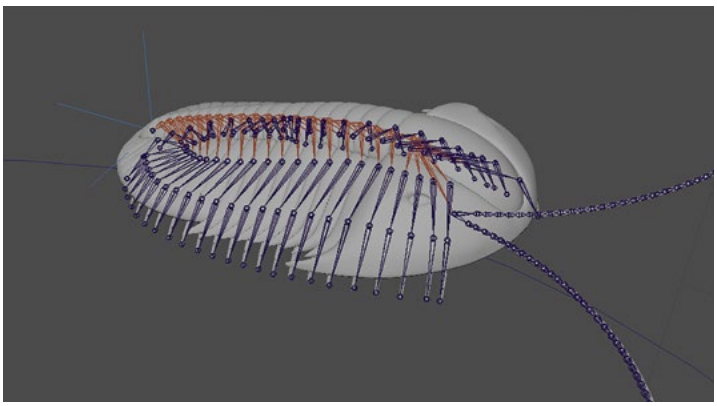

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Su Min Suh

What does it mean to be a great medical communicator? I believe it's a balance of clear and compelling storytelling, scientific accuracy, and artistic beauty. These are the goals I've set to achieve in all my projects while studying at MScBMC. During my graduate training, I specialized in 2D/3D animation and illustration. I have refined my skills in problem-solving and always aim to generate unique approaches to my visual storytelling.

Pathological Illustration

Uterine Leiomyoma: A Threat to Pregnancy is a two-page spread aimed to communicate the etiology, pathogenesis, and threats of uterine leiomyoma to an educated lay audience. I aimed to accurately visualize the various stages of the pathology while maintaining a clear composition.

1. Production process. The series of sketches showcase the process I undertook to create the composition. Various layouts were developed to balance the textual information with the illustrations to generate a smooth reading order.

2. Study. A tissue landscape study of the endometrium was created from both EM images as well as *Human Microscopic Anatomy* by R.V. Krstic.

3. Final illustration. The final illustration is a combination of 3D rendering using *Maya*, illustration in *Photoshop*, and compositing using *Illustrator*. I used the repetition of colour to tie in the various graphical elements together.

Previous spread. A still from my master's research project: Window Chamber Method: A Novel Intravital Approach of Cellular Imaging.

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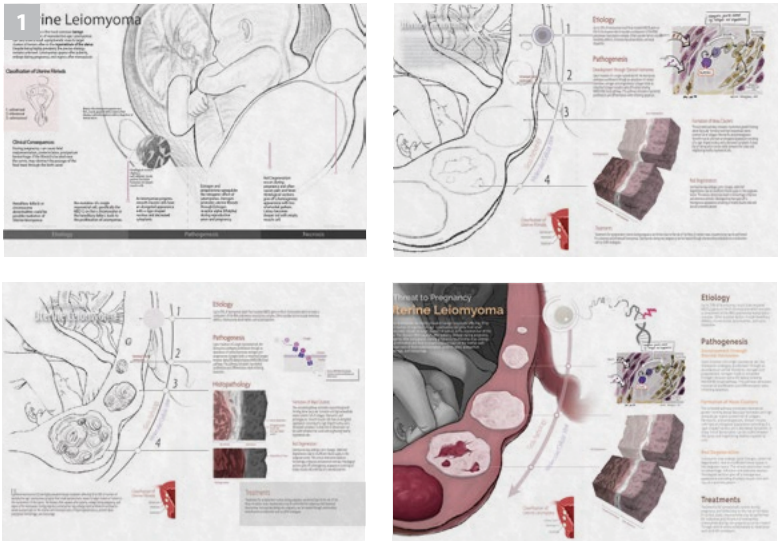

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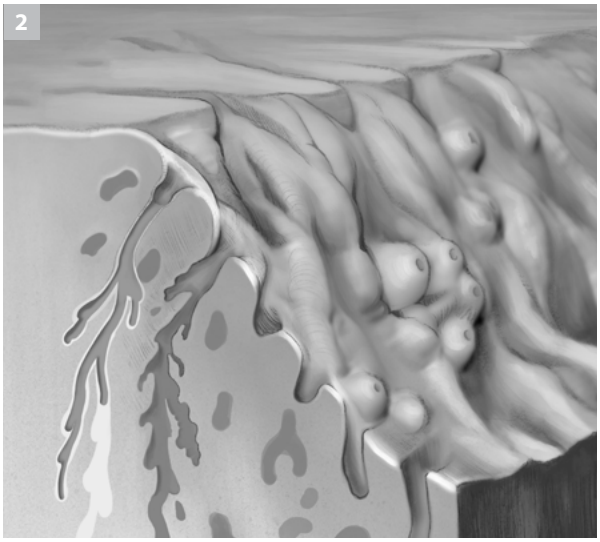

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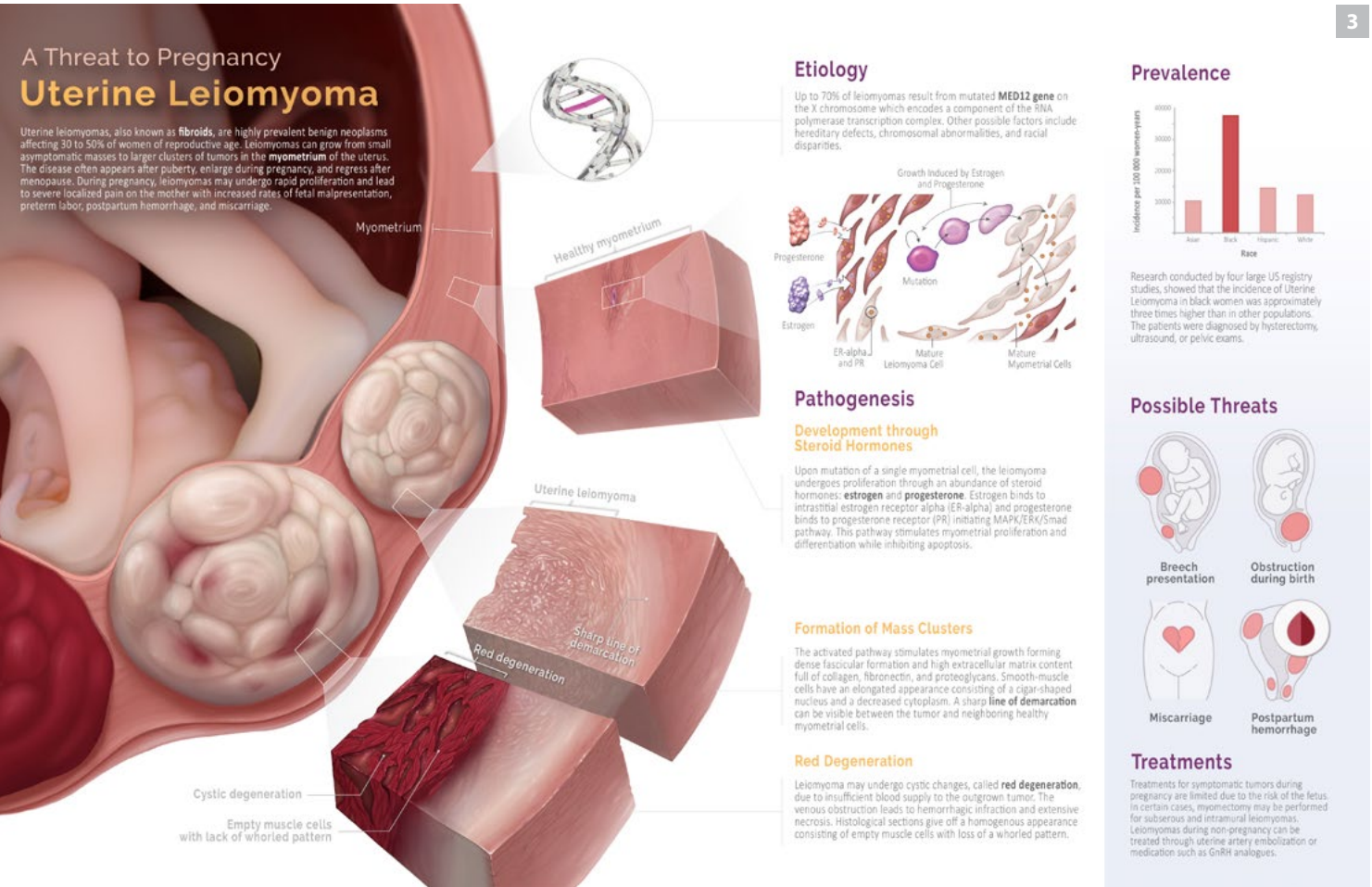

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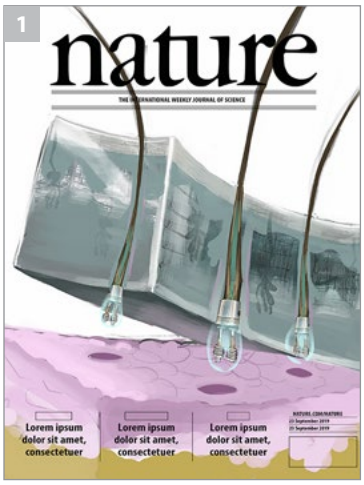

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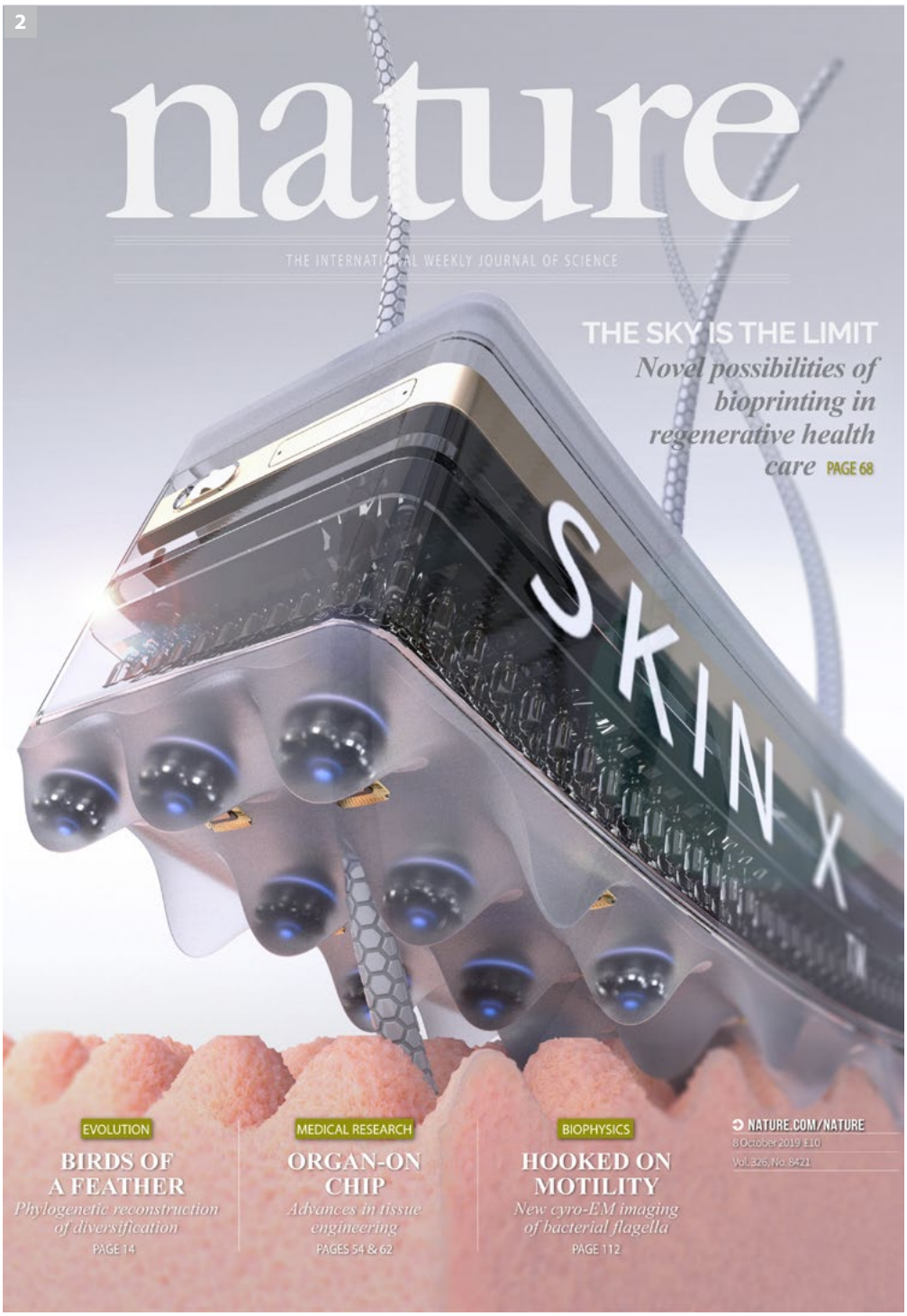

Editorial Illustration

Bioprinting is the process of selectively depositing "bio-ink" (an aqueous mixture of biomaterials, living cells, and growth factors) to create customized skin tissue. For my magazine cover, I wanted to show the future possibilities of advanced skin grafts.

1. Production process. The series of images showcases the process from the thumbnail sketches to the development of a finalized comprehensive sketch. The goal was to juxtapose the two components, the organic dermis underneath the artificial bio-printed skin above, in an interesting way. At this stage, it was crucial to establish all the assets I wanted to build in *Maya*.

2. Final illustration. The final mock magazine cover was completed in *Maya* using *Arnold* and composited in *Illustrator*. Various industrial materials such as glass, metal, silicone, and plastic were developed to match the ideas from the comprehensive sketch.

Medical Legal Illustration

This illustration was created as a visual panel for the Canadian courtroom, in a physician's malpractice lawsuit, to teach the judge and jury the advanced medical information that may be unfamiliar to them. It was co-designed by Christine Shan, Hang Lin, and Sabrina Cappelli.

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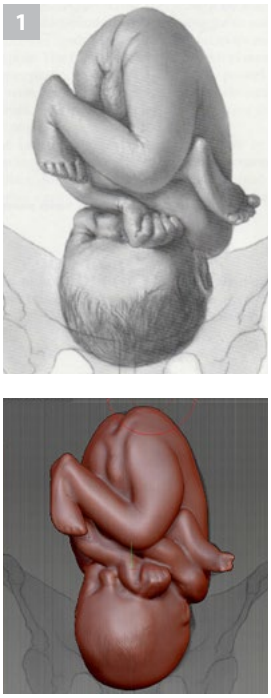

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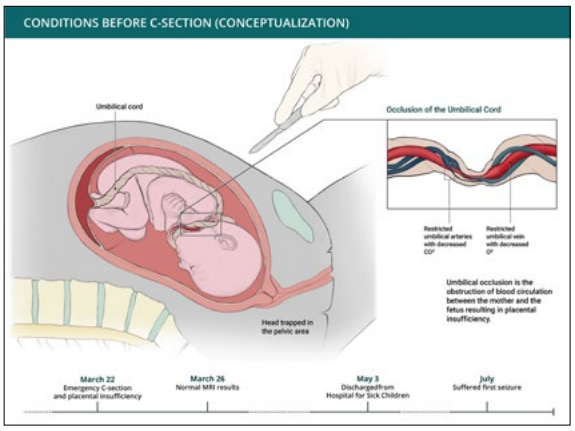

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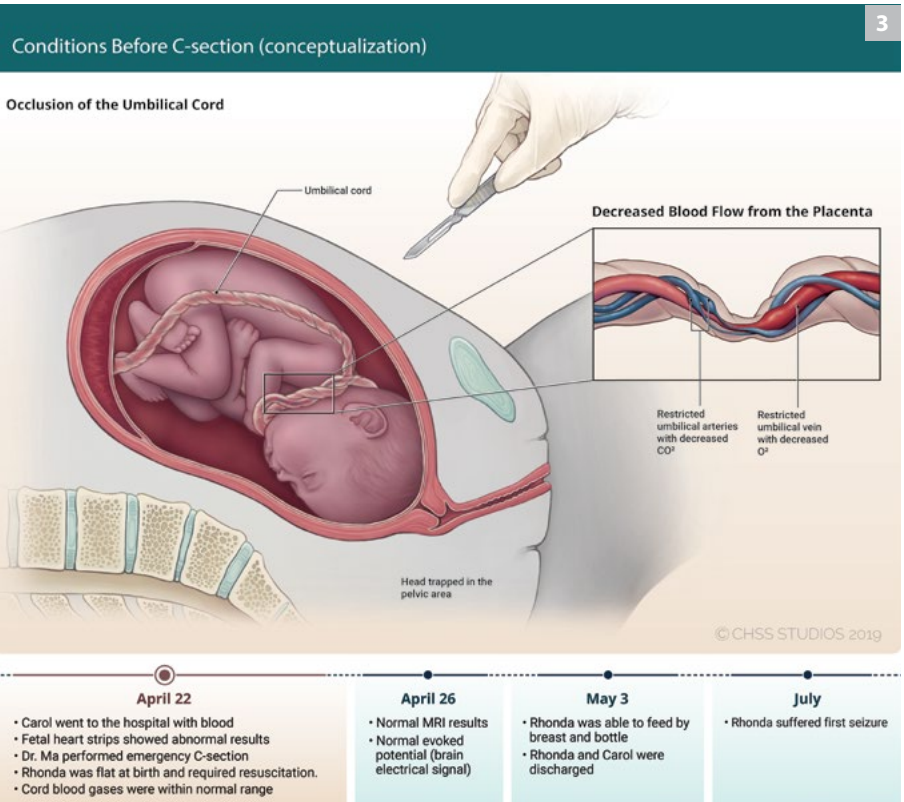

1. Study. This visual transposition exercise was a stepping stone in understanding the anatomy and position of the fetus in utero. The original illustration on the top left is derived from Williams Obstetrics. I created a *ZBrush* maquette using the original sketch as a reference to accurately depict a fetus rotated in 90-degrees.

2. Production process. Many iterative steps were taken to accurately and clearly depict the occlusion of the umbilical cord that resulted in placental insufficiency in this medical-legal visualization project.

3. Final draft. The render stage was divided evenly among the four teammates and the final illustration was finished in *Photoshop* and composited in *Illustrator*.

Anatomical Illustration

This illustration was a part of a collaborative neuroanatomy textbook project, where I was given the task to research, illustrate, and design the layout. I aimed to generate a unique approach that differs from conventional textbook illustrations.

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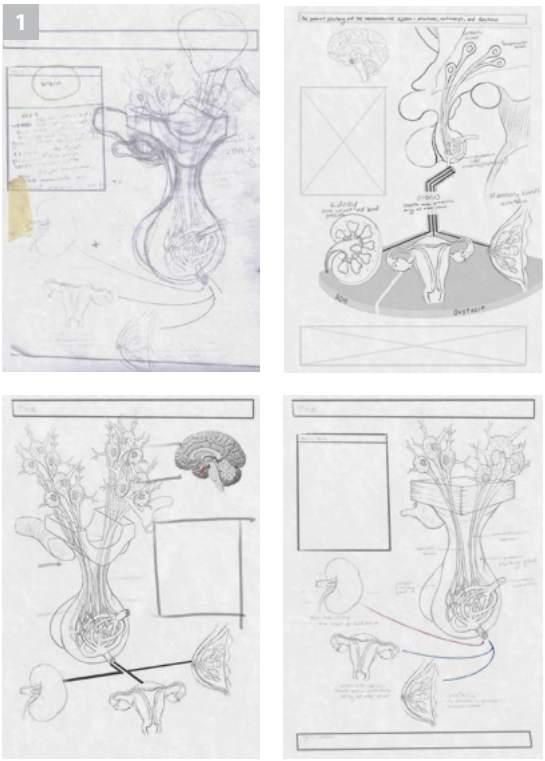

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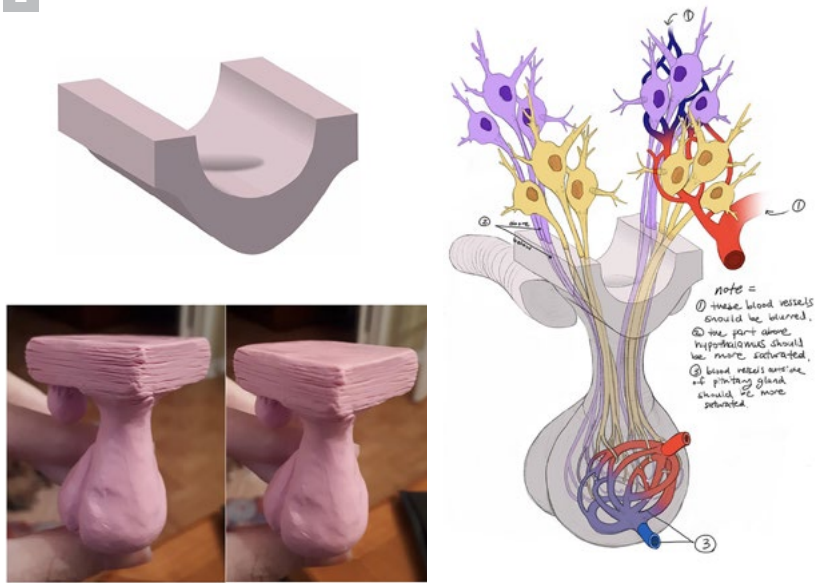

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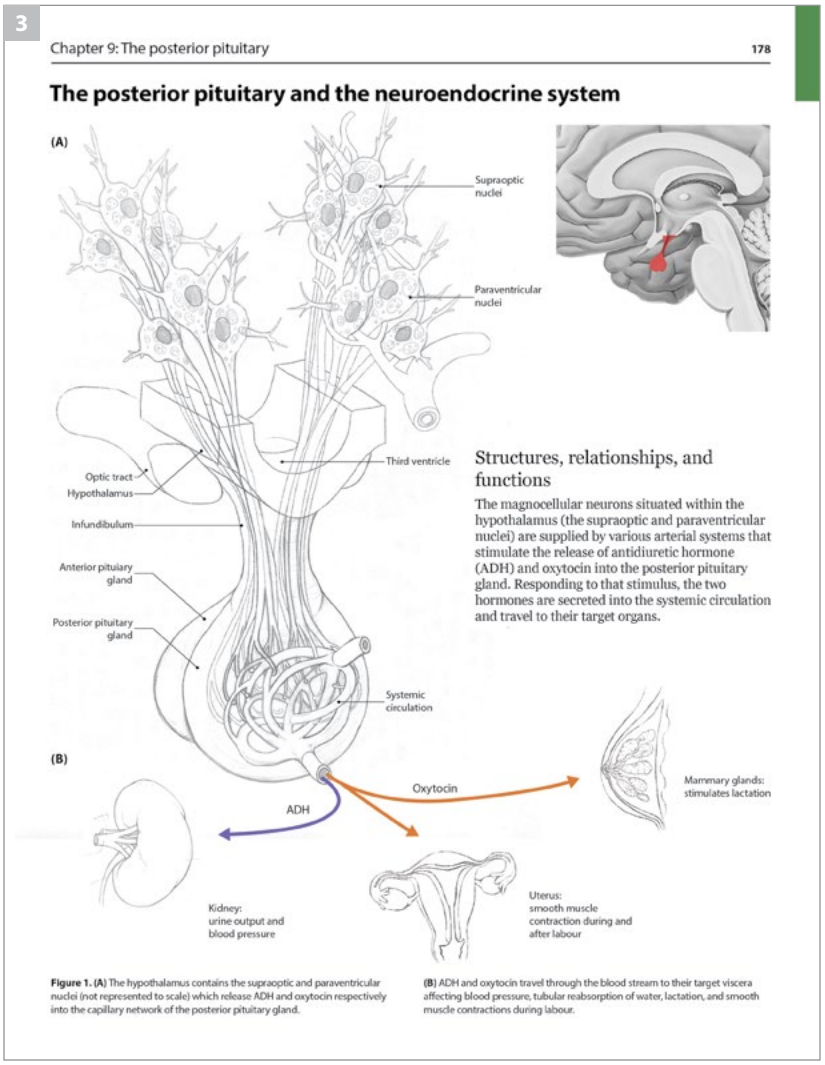


1. Sketch. These thumbnail sketches show various approaches I took to visualize a unique view of the pituitary gland. At this stage, I aimed to resolve any layout issues I might have with the illustrations.

2. Production process. The conceptualization of the pituitary gland was an iterative process. First, I started with a clay maquette to understand the form and angles of the pituitary gland. Then I revised the upper portion to depict the cavity of the third ventricle. Lastly, the placement of the magnocellular neurons, paraventricular nuclei, and supraoptic nuclei, were revised.

3. Final draft. This illustration showcases the final concept sketch that was sent to be vectorized and rendered. The top right image of the brain call out was a shared render produced by Hang Lin.

Window Chamber Method: A Novel Intravital Approach of Cellular Imaging

Acute Myeloid Leukemia (AML) is a widespread disease with much ongoing research. AML cells migrate to hypoxic areas, making detection difficult. My MRP showcases the Window Chamber (WC) mechanism which is a promising tool to track Leukemia cells by imaging the bone marrow microenvironment *in vivo*.

1. Production process. The steps in creating a scene involved an initial storyboard sketch, the building of assets in *ZBrush* or *Maya* (below), and the final render in *Maya* (above).

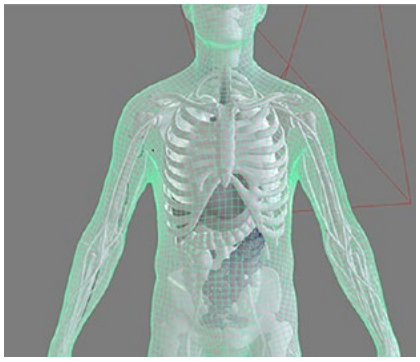
2. Study. When developing the look and feel of the AML cell, I wanted the model to embody two elements: 1) for the audience to grasp that the AML cell is dangerous, and 2) for the cell to look alive. I developed texture studies exploring various software like *Substance Painter, ZBrush,* and *Maya* node-based texturing.

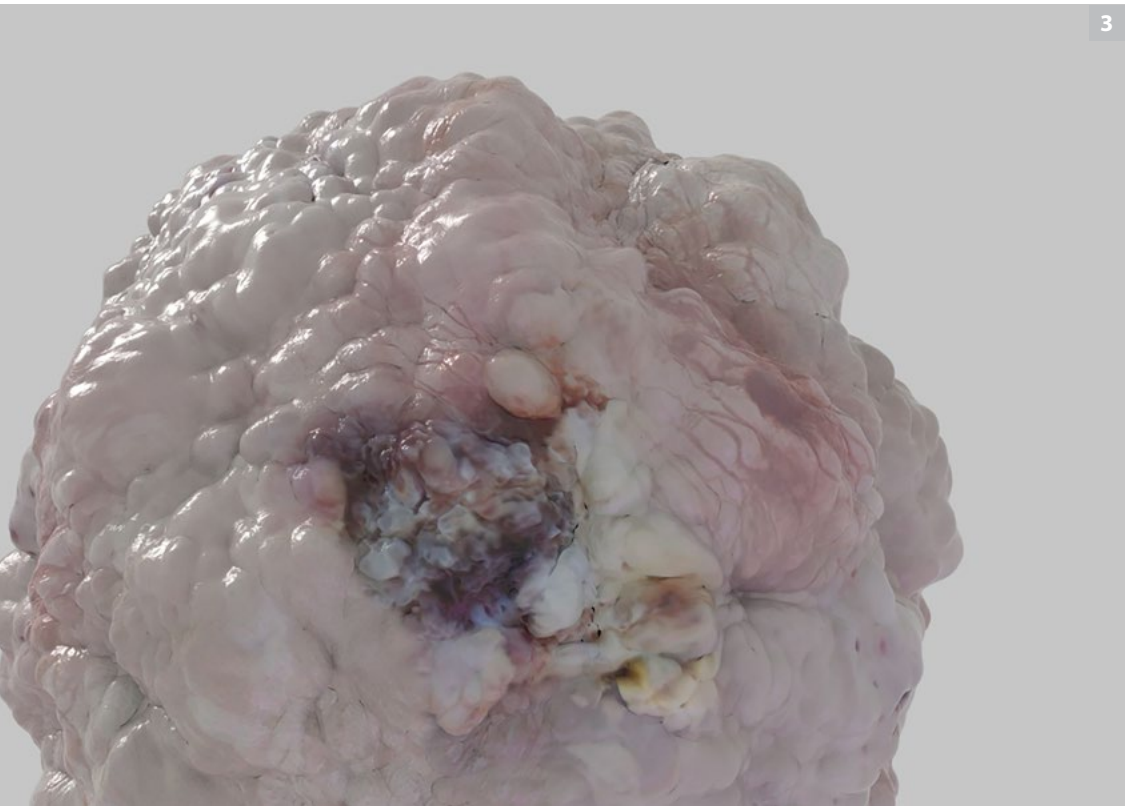
3. Final draft. The final model was sculpted in *ZBrush* from EM images and textured to meet the two criteria.

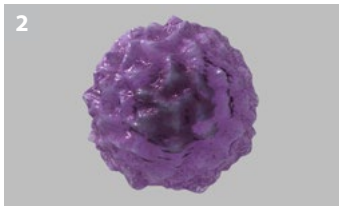
4. Storyboard. A series of quick thumbnail sketches were developed to establish the narrative and look of the animation.

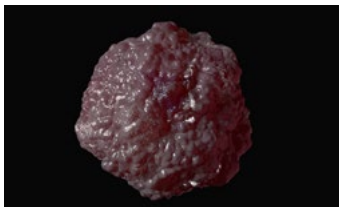
5. Animatic. The timing of events and transitions were considered through an animatic. A 'colour bar code' was generated (top) to look over the hues, values, and saturation in each scene. This information helped me direct the choice of music for the scenes.

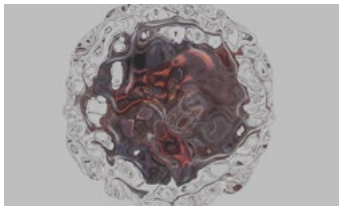
6. Final animation. A series of still frame renders of my completed MRP.











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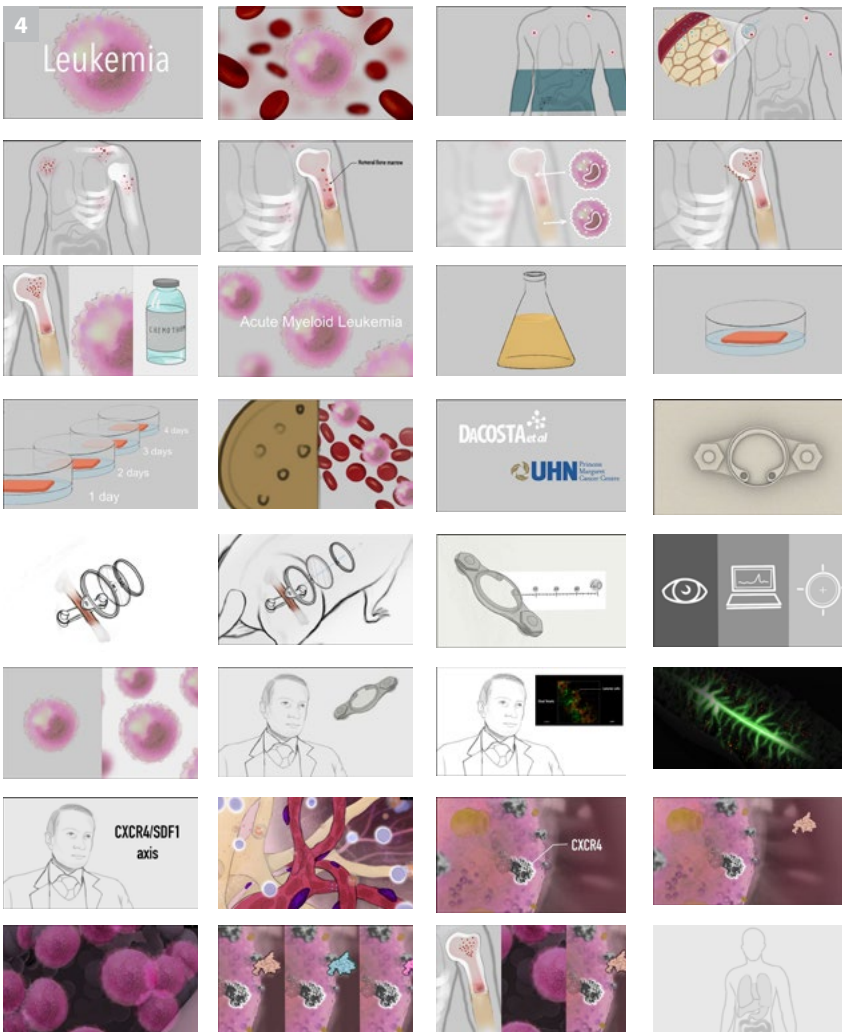
Leukemia
Acute Myeloid Leukemia
DaCOSTA et al
UHN
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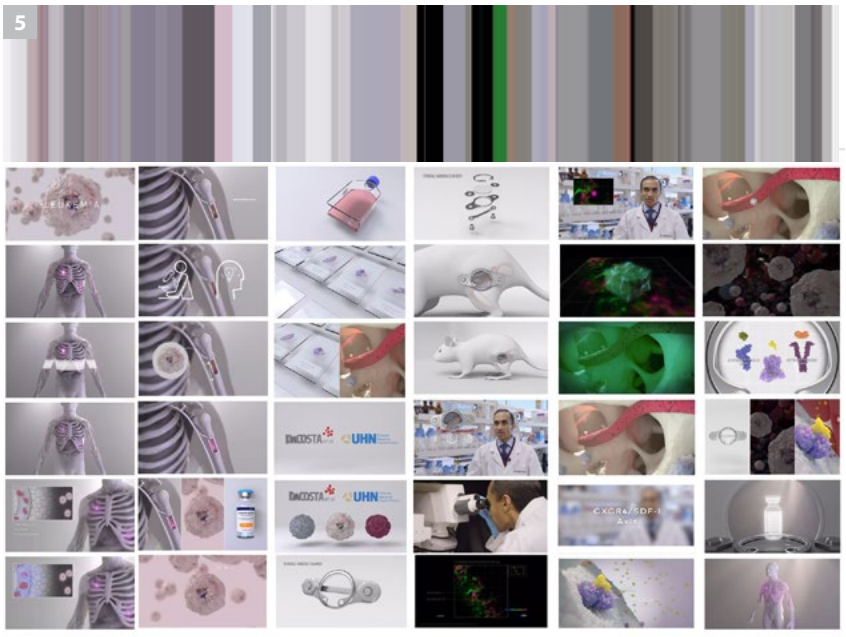

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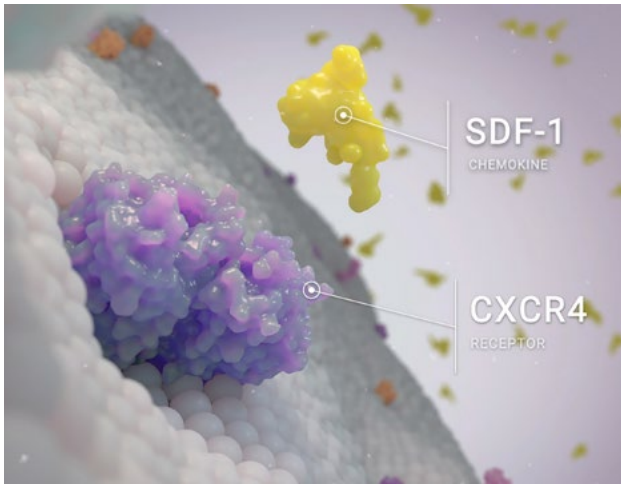
SPECIMEN No.9
SPECIMEN No.10
SPECIMEN No.11


3D Bone Marrow Environment


SDF-1
CHEMOKINE
CXCR4
RECEPTOR

Taeah Kim

I am a medical artist who is passionate about making life science more accessible to everyone. My goal in life is to create stunning, timeless and useful pieces of art to educate and inform. I strive to make scientific and medical concepts accessible, easy to understand, and fun to watch, observe, and experience.

Editorial and Biological Illustrations

3D modelling was used in *Maya* to provide an eye-catching mock journal cover titled **Microbes in Space**, exploring convergence of human microbiome compositions across astronauts. In another 3D project, the **ground pangolin** was sculpted and rendered to bring to light its vulnerable conservation status due to habitat loss and illegal trafficking.

1. Sketches & 3D modelling. Initial concept sketches of astronauts and floating food particles, followed by 3D modelling of the astronaut suits.

2. Final illustration. Final mock journal cover titled Microbes in Space.

3. Final illustration. Final render of the ground pangolin in *Cinema 4D*.

4. 3D modelling. The *ZBrush* model of the ground pangolin sculpt in *Cinema 4D*.

5. Sketch. General sketches of the pangolin to use as reference in *ZBrush* sculpting.

Previous spread. A render close-up from my mock journal cover titled Microbes in Space.

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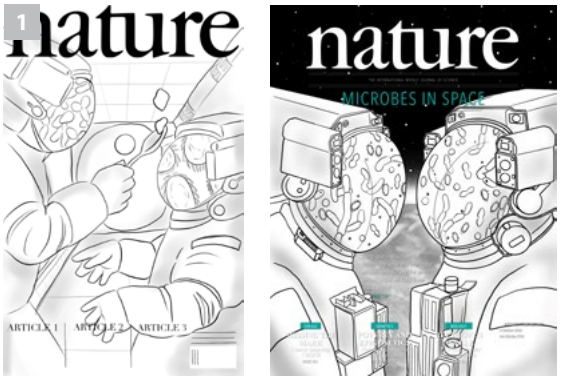

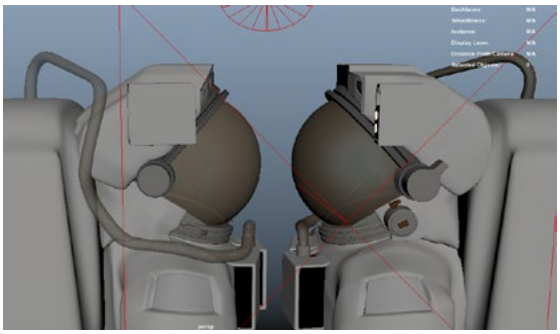

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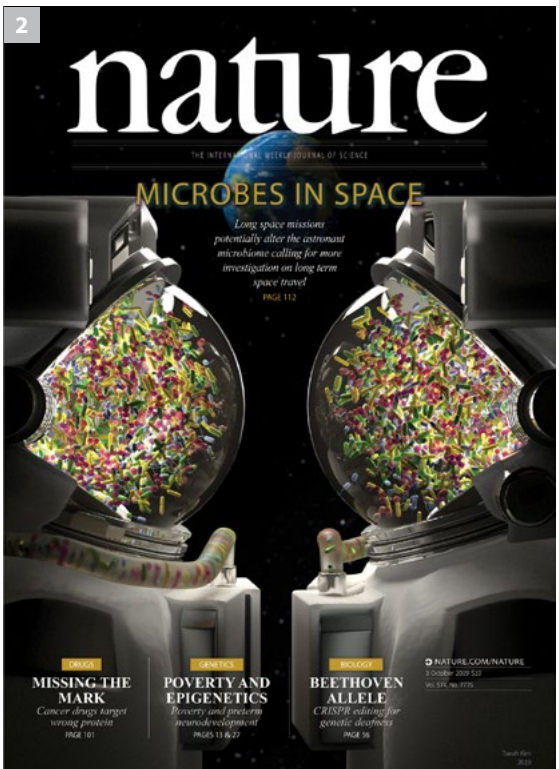

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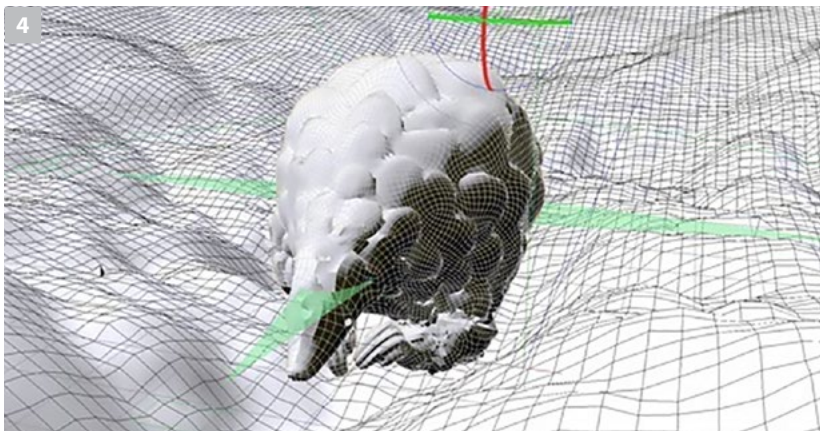

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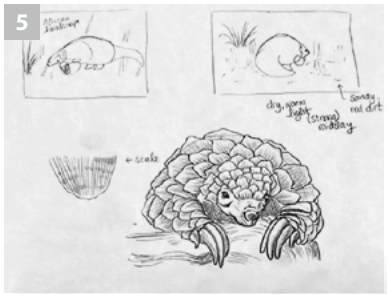

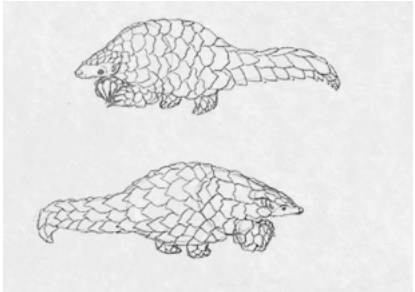

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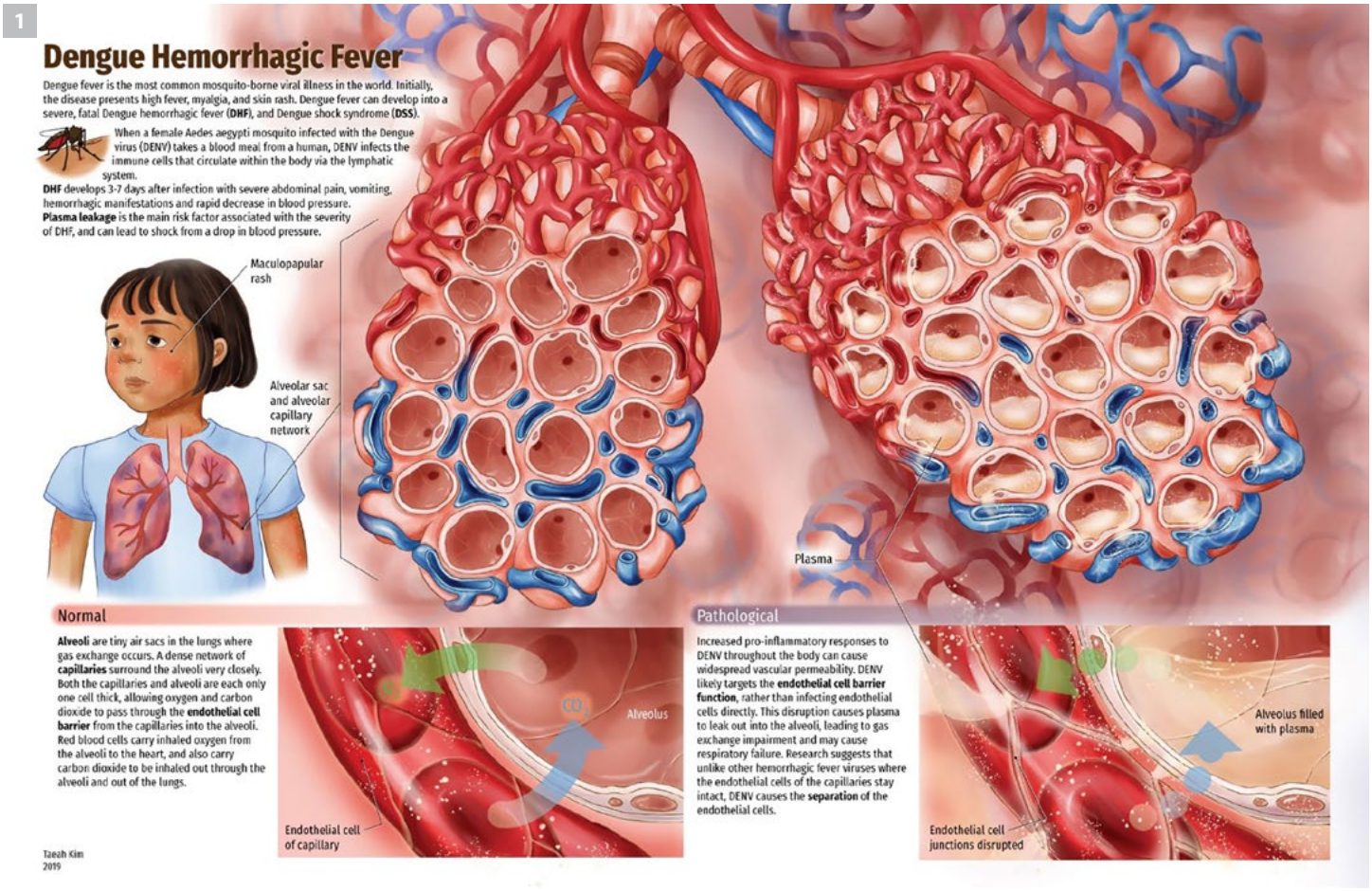

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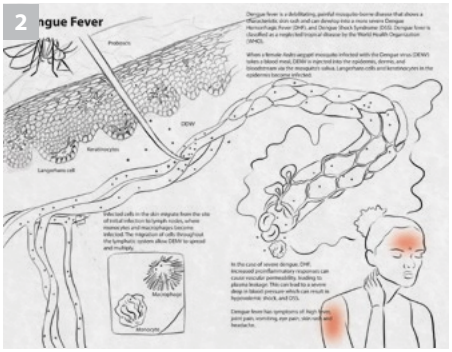

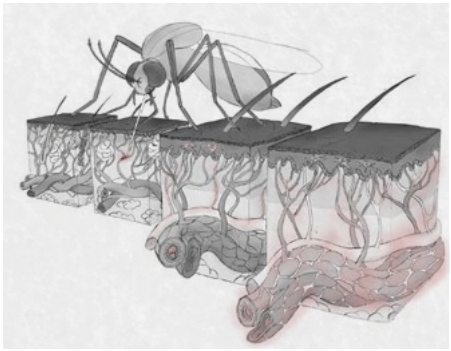

Pathological Illustration

The Pathology of Dengue Hemorrhagic Fever is a two-page spread visualizing the alveoli of the lungs when Dengue fever escalates to Dengue hemorrhagic fever. Many different drafts were created due to lack of specific and conflicting evidence at the time.

1. Final illustration. Final two-page spread illustration of the pathological spread.

2. Sketches & final line draft. Rough sketches exploring concepts of plasma leakage in the skin, and of a mosquito and skin cubes showing the progression of plasma leakage, followed by the final refined line draft of the pathology in preparation for the final illustration.

Graphic Medicine

The Story of Barbara McClintock presents the following story: Barbara McClintock was the first woman to receive an unshared Nobel Prize in Physiology or Medicine for her discovery of mobile genetic elements. This comic provides a brief overview on the geneticist's journey, and her Nobel-Prize winning discovery.

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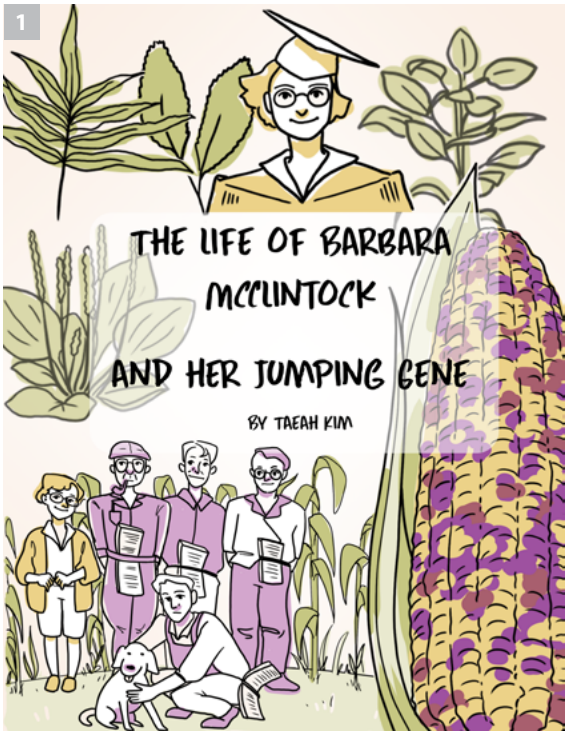

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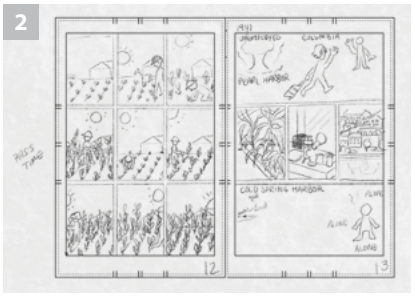

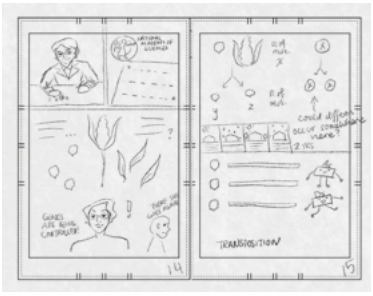

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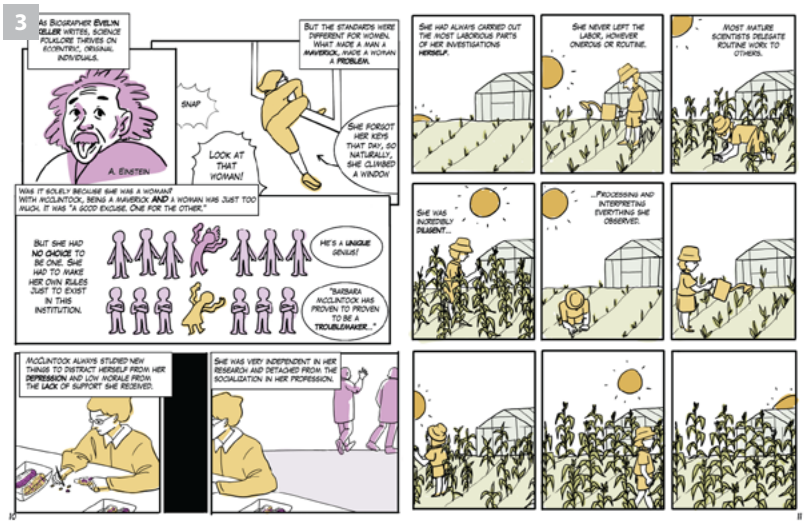
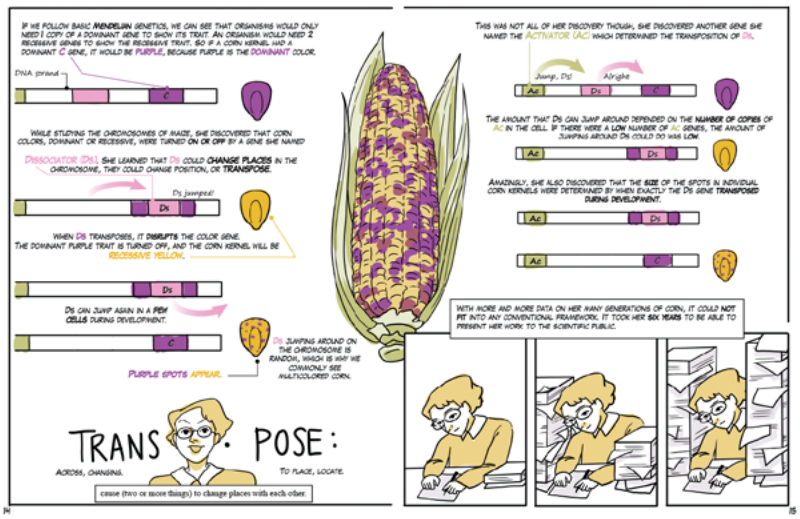
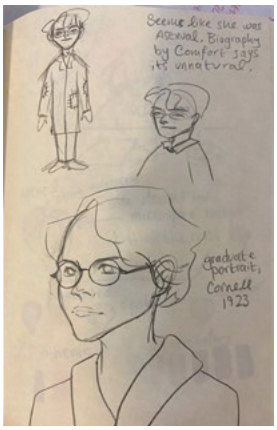
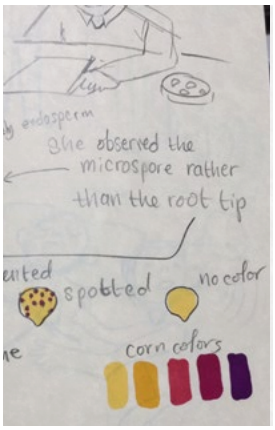




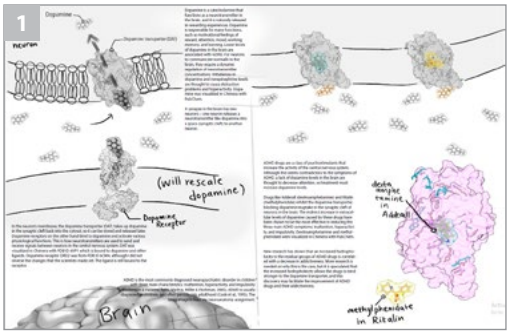


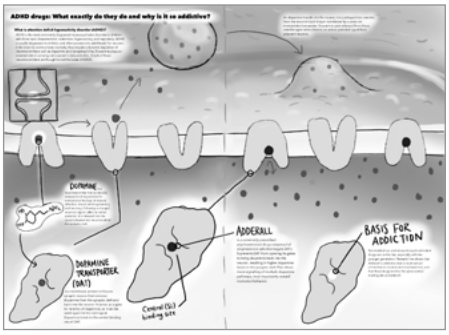


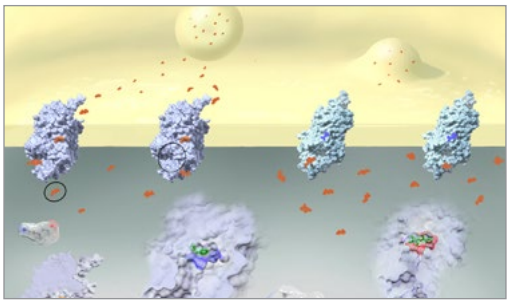
1. Final illustration & style guide. Final cover illustration. Sketches of character styles and color palette.

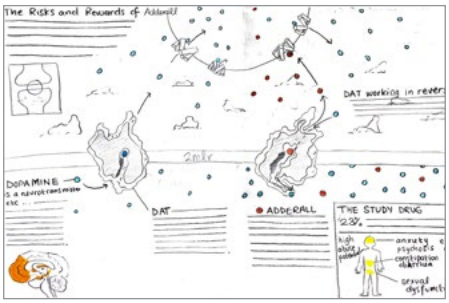
2. Storyboards. Drafts/storyboards of the comicbook storytelling structure.

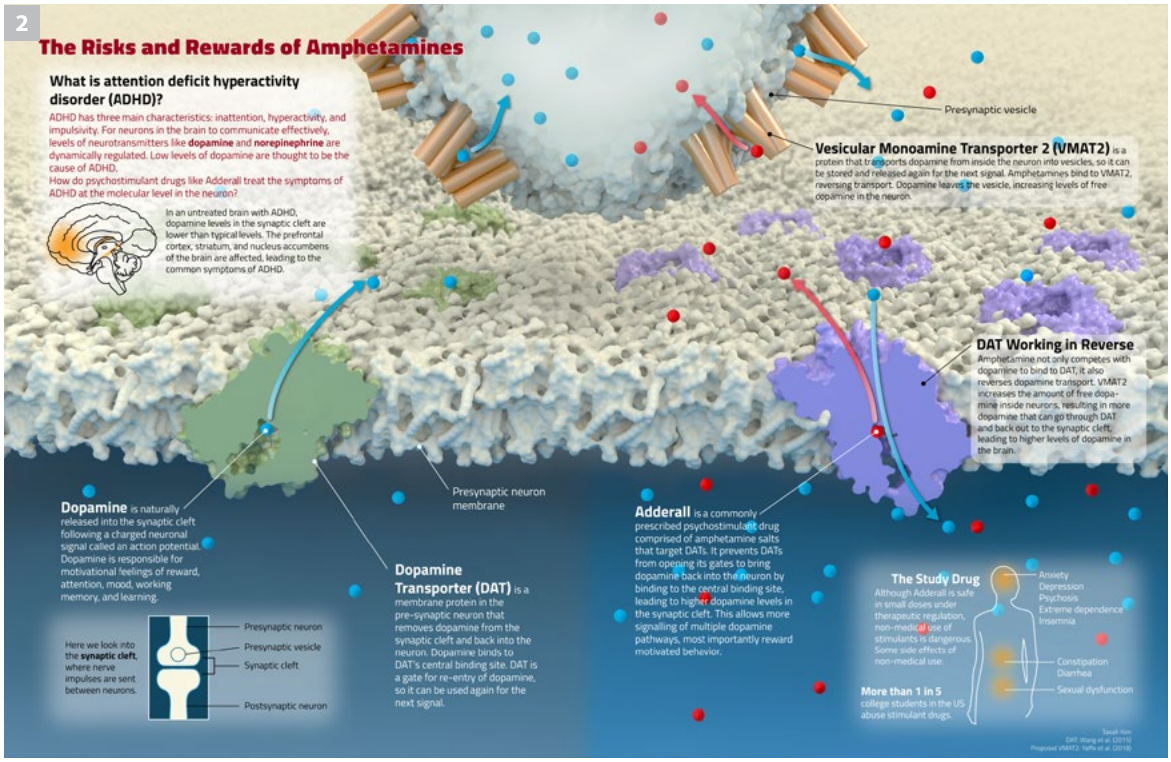
3. Final illustrations. Pages from the final illustrated comic.











Molecular Visualization

The Risks and Rewards of Amphetamines is a two-page spread created to visualize the molecular mechanisms of amphetamines in the synaptic cleft. PDB data was used to extract the molecular structures, and *Cinema 4D* was used to composite and light the environment.

1. Sketches & Final draft. Many iterations of sketches and drafts of the layout.

2. Final illustration. Final 2-page spread of the synaptic cleft and amphetamines.

Socioeconomic Status and Preterm Brain Development

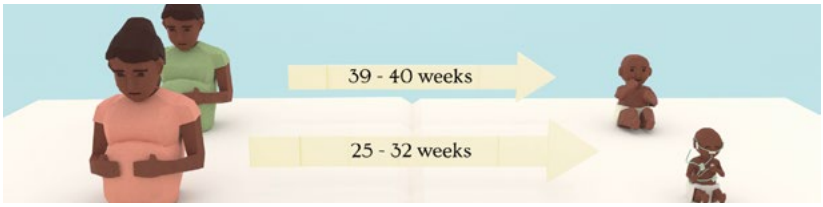
This MRP explains the intersections between preterm brain development, socioeconomic status, and epigenetics. Abstract scientific concepts were visualized, taking care to eliminate harmful stereotypes. The general public and potential policy makers were the intended audience.

1. Animatic. Shots from the final animatic in the production process, detailing the scenes.

2. Production process. The creative process behind the 3D page-turning effect, from sketch to 3D modelling, rigging, and composition.

3. 3D modelling. The process of creating the infant visual in the animation, from sketch to 3D modelling, and the final composition.

4. Final animation. Snapshots from the final animation.



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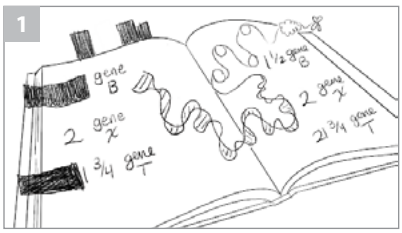

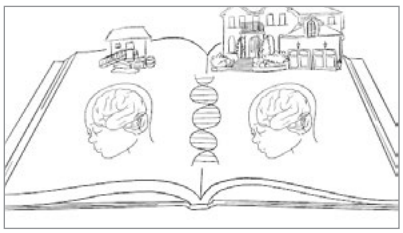

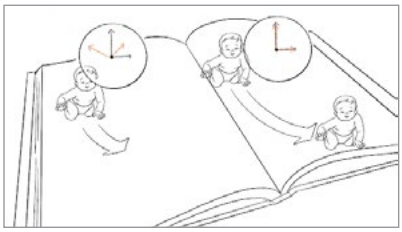

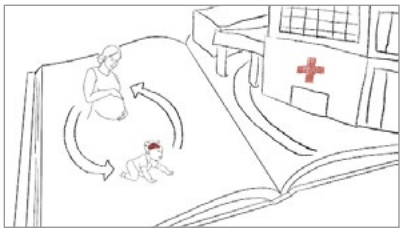

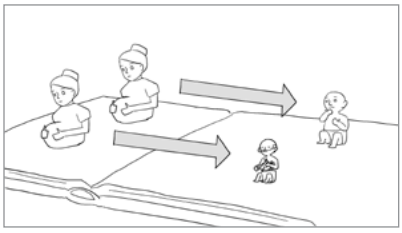

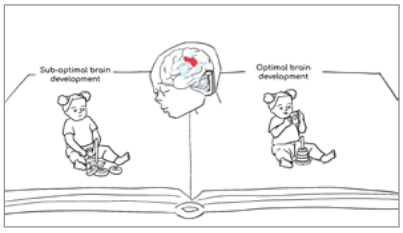

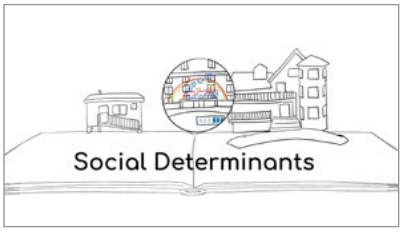

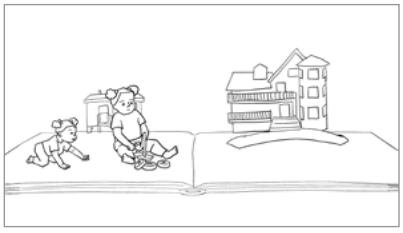

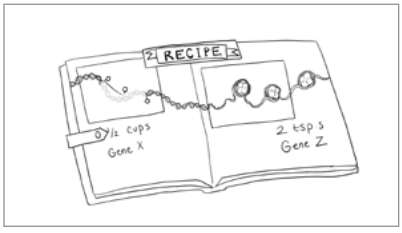

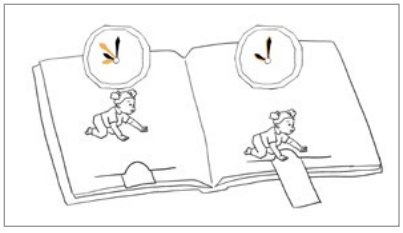

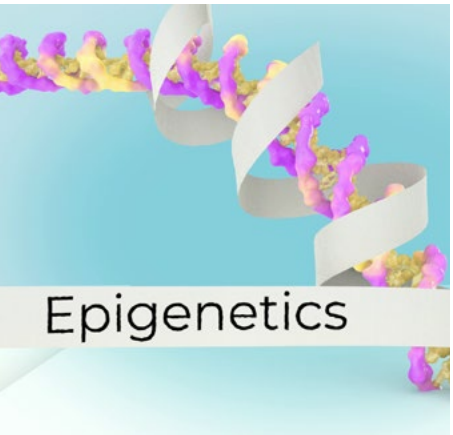

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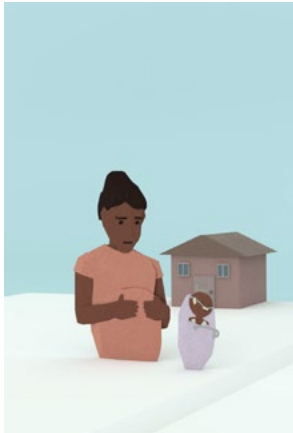

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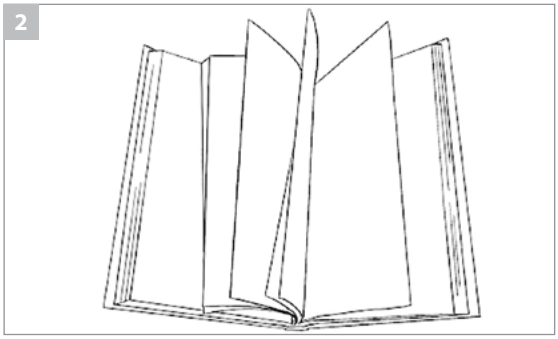
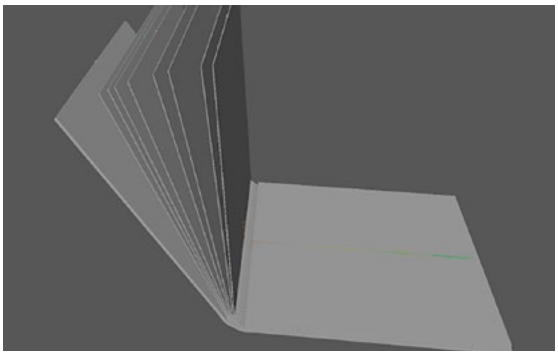
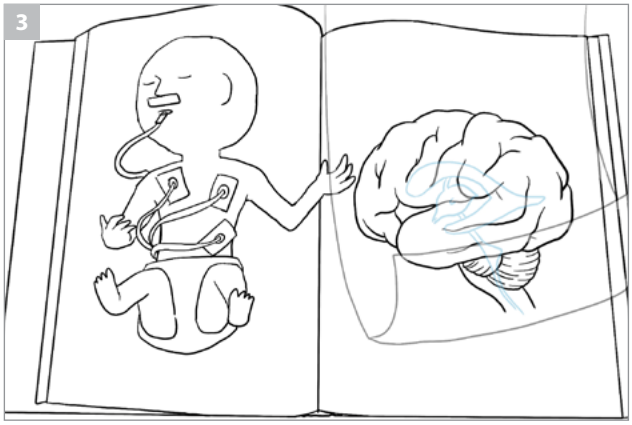
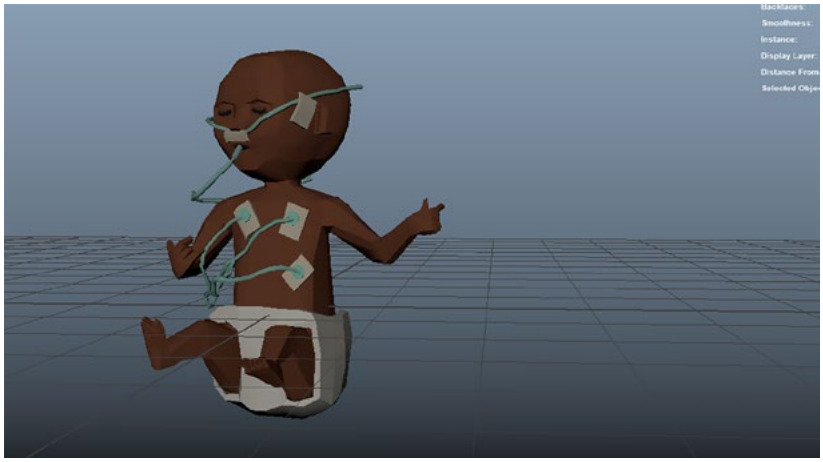


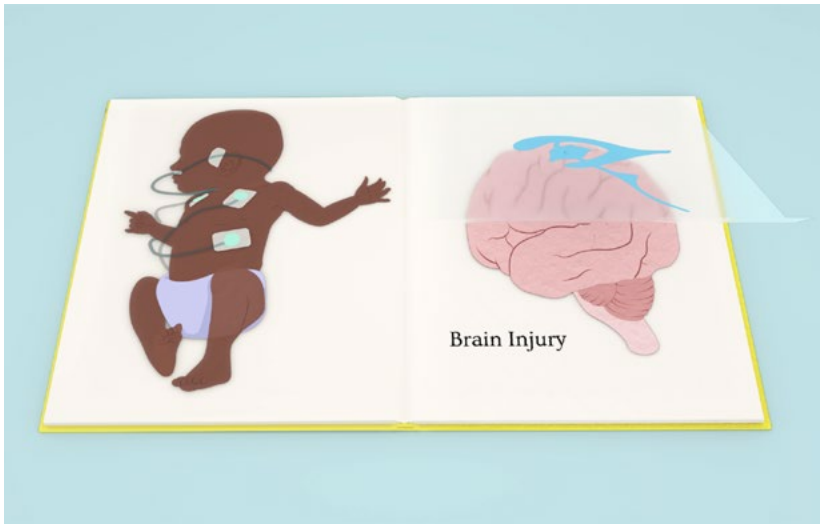


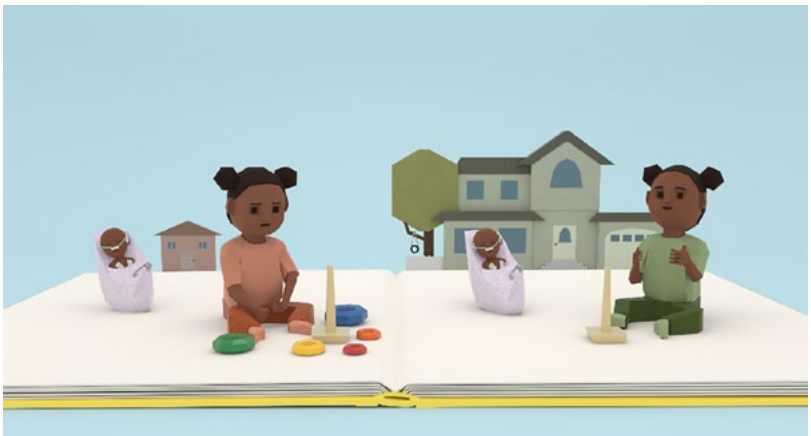

Recipe for cells
1 cup Gene X
2 tbsp CCAGGCGCGTAAC
5 tsp TTACGTACCGCTCG TAACC
Gene Inhibition
Gene Activation
4 tbsp Gene Z
1/2 cups ATTCGAAGCTTCG
5 tsp GCAACGTTCGATA AGCGTTA

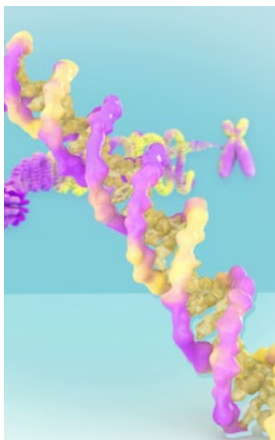
3

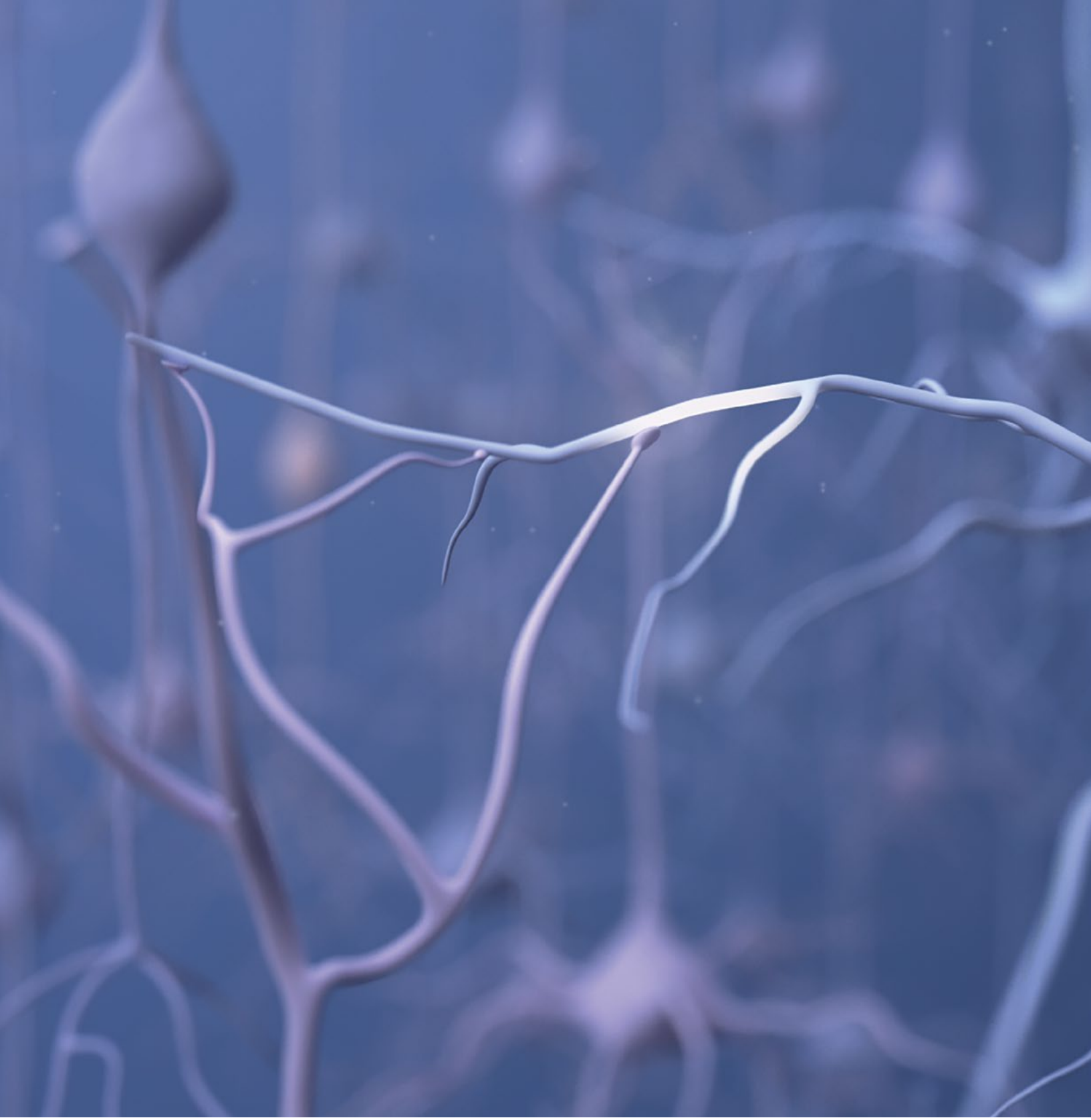


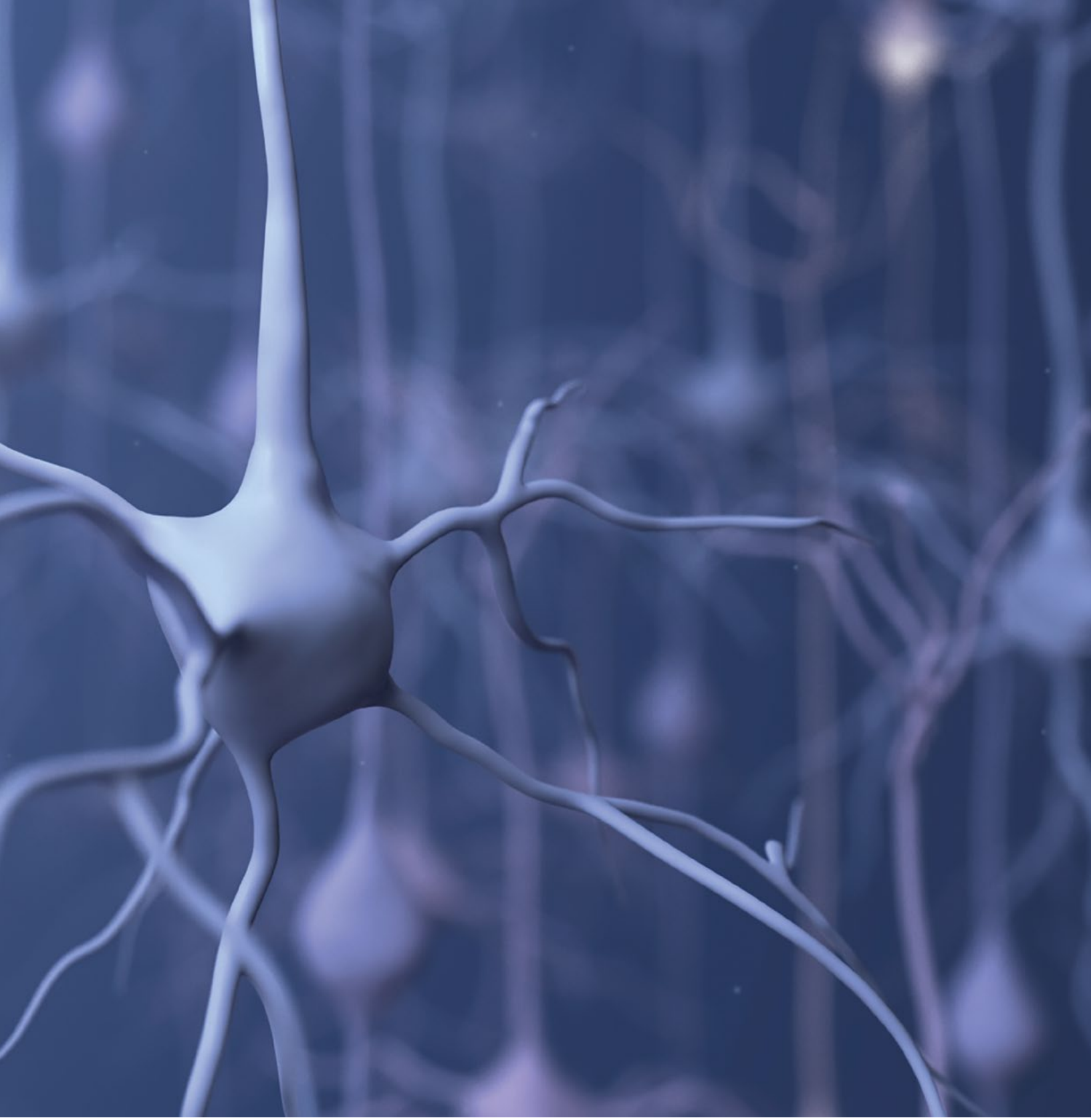



Brain Injury









Vivian Yeung

I am a biomedical illustrator and animator passionate about making complex scientific topics easily understood using appealing and informative visuals. Prior to MScBMC, I obtained a BSc degree at McGill University, majoring in physiology. I realized the importance of visuals, especially when it comes to molecular biology. My Master's Research Project was a 3D animation on targeting protein complexes in the brain with interfering peptides, intended to generate funding for a lab.

Scientific Animation

What is Spiciness? is a 2D animation explaining how molecules in spicy food interact with receptors on the tongue, thereby making us perceive certain foods as "spicy". This project is completed using *Procreate*, *Photoshop*, and *After Effects*.

1. Final animation. Shown here is an asset board, followed below by rendered stills from the final animation.

2. Production process. In the storyboard, the character must have the ability to dodge and run away from a dropping chili pepper. Therefore, he was rigged using the puppet tool in *After Effects* and the plug-in *Bassel DUIK*.

3. Storyboard. The storyboard was created to determine the storytelling, establish the general style, and explore transitions between shots. I drafted the storyboard grayscale to allow for flexibility to explore different colour schemes in later stages of production.

Previous spread. A still from my master's research project: Targeting Protein Complexes in the Brain with Interfering Peptides.

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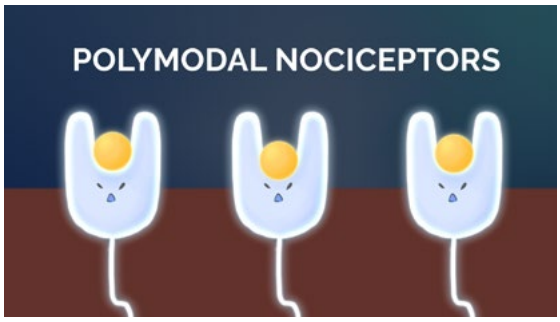

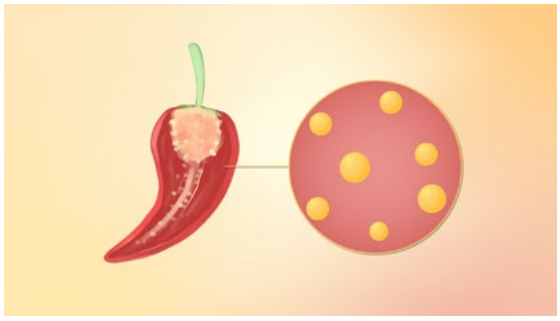

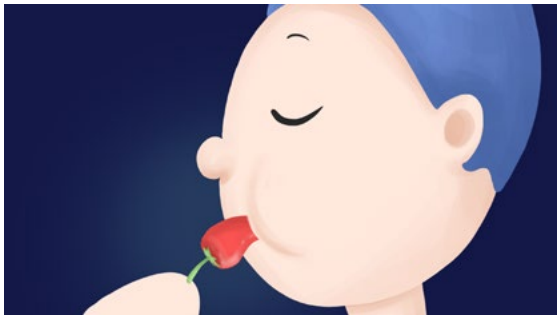

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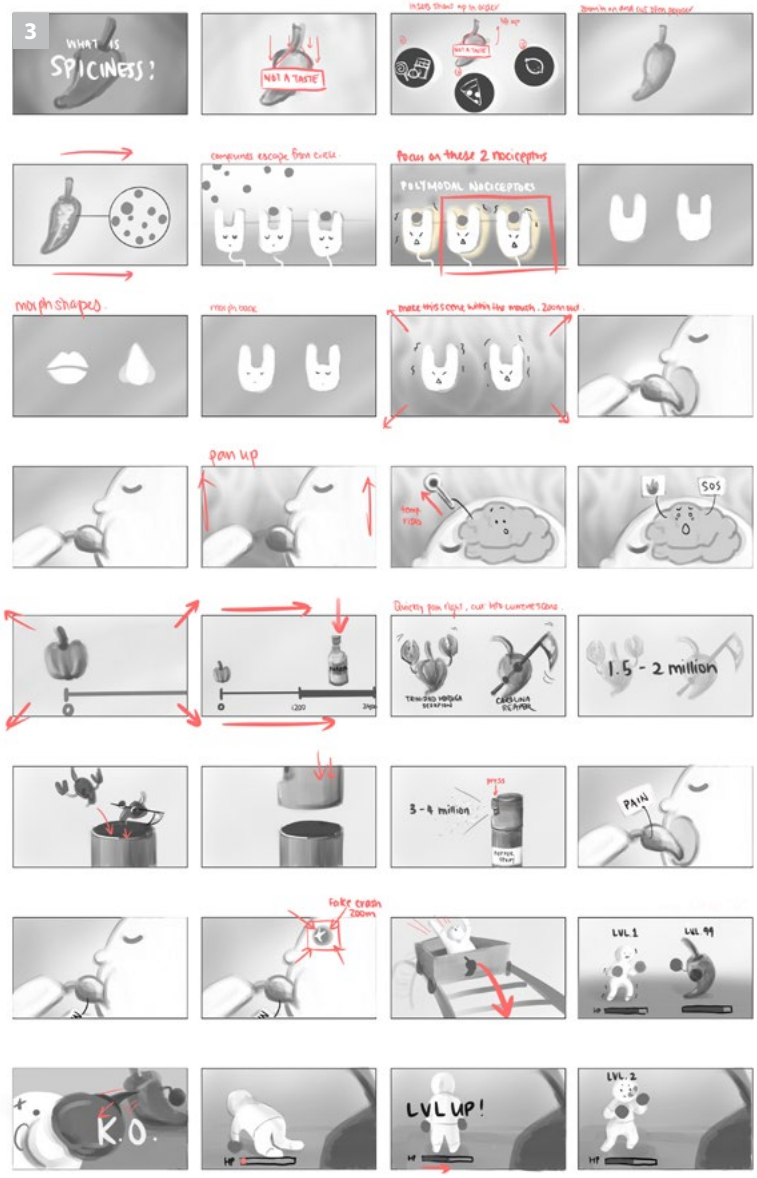

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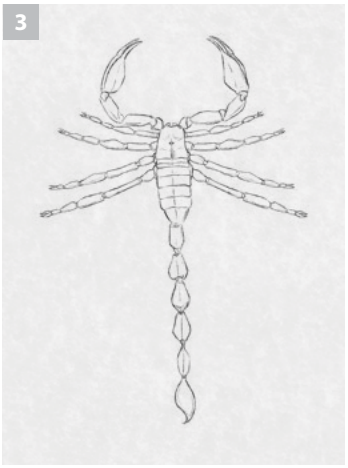

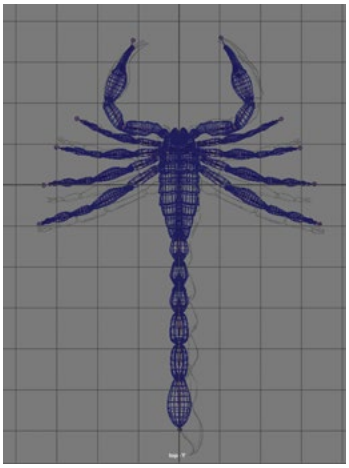

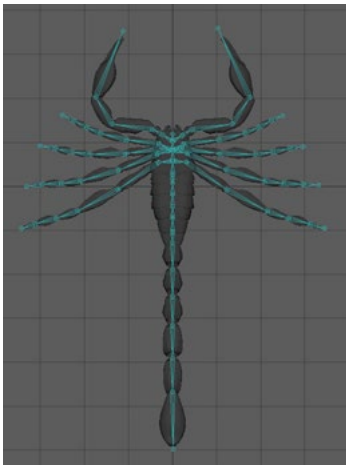

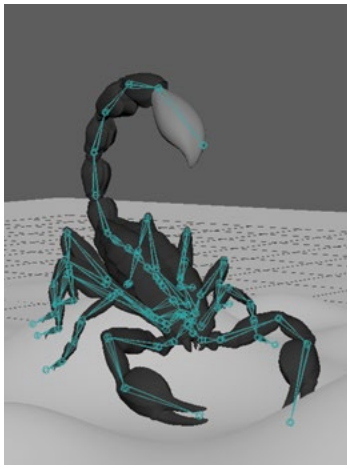

Editorial Illustration

Tumor paint is a mock editorial cover for a popular science magazine. The topic originated from an article in Science on how a molecule, chlorotoxin, found in scorpion venom can interact specifically with tumor cells. After modifications in laboratories, chlorotoxin glows under infrared light, aiding neurosurgeons in tumor resection.

1. Final illustration. The final illustration depicts the scorpion resting on top of a tumor cell after identifying it, marking it with fluorescent green paint.

2. Sketches. Concept sketches that explores different colour schemes and the positioning of the scorpion.

3. 3D modelling. The process of creating the scorpion include the initial sketch, modelling, rigging, and posing.

Pathological Illustration

Intended for a two-page magazine spread, **Bacterial Meningitis** informs the public about the symptoms that manifest, its etiology and pathophysiology, and the consequences if medical attention was not seeked out immediately.

1. Study. A conceptual sketch of the environment in the subarachnoid space. The elements further away are blurred and lightened to give the sketch a sense of atmosphere.

2. Sketch. An early iteration that explores the placement of the illustrations, graphic elements, and text.

3. Study. This tissue cube study visualizes the structural changes within the subarachnoid space at each step of the disease progression.

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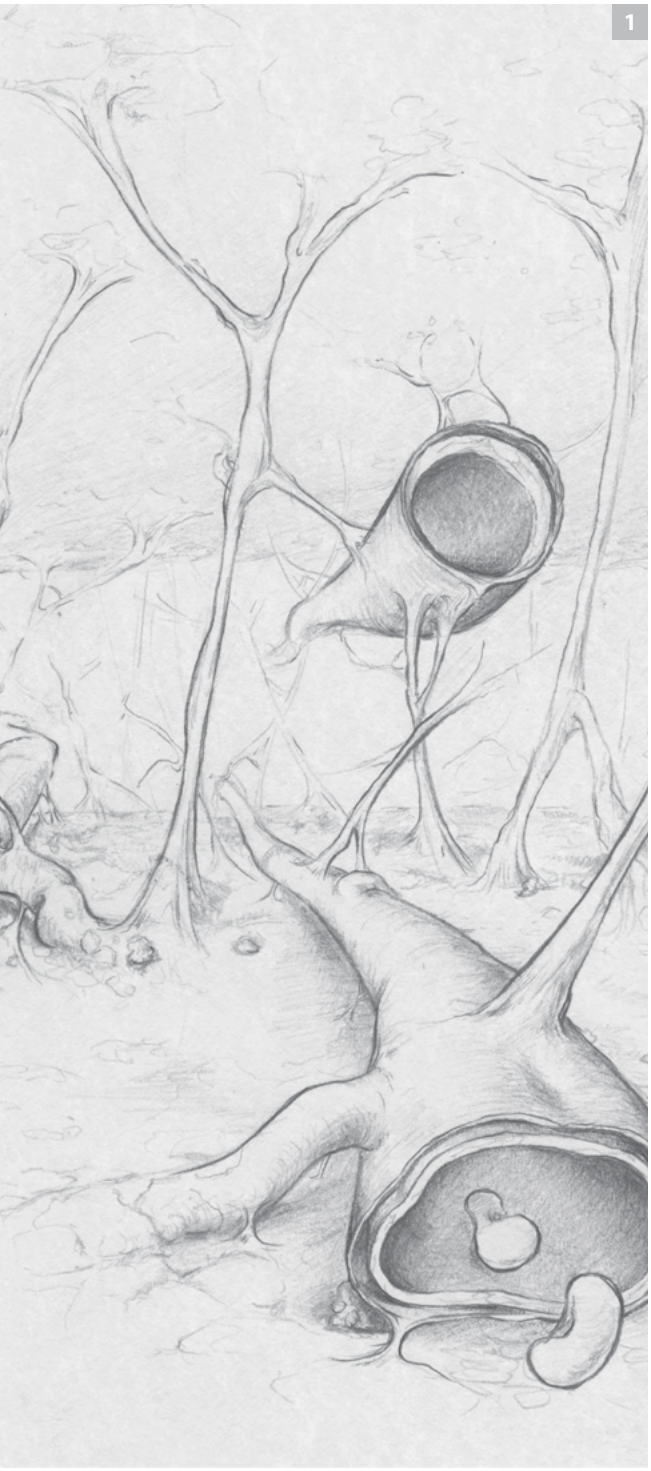

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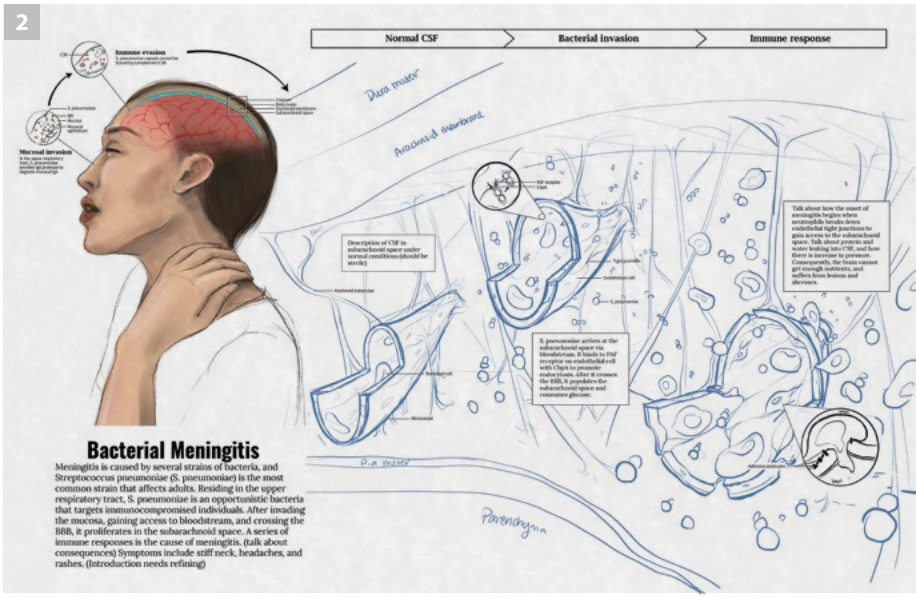

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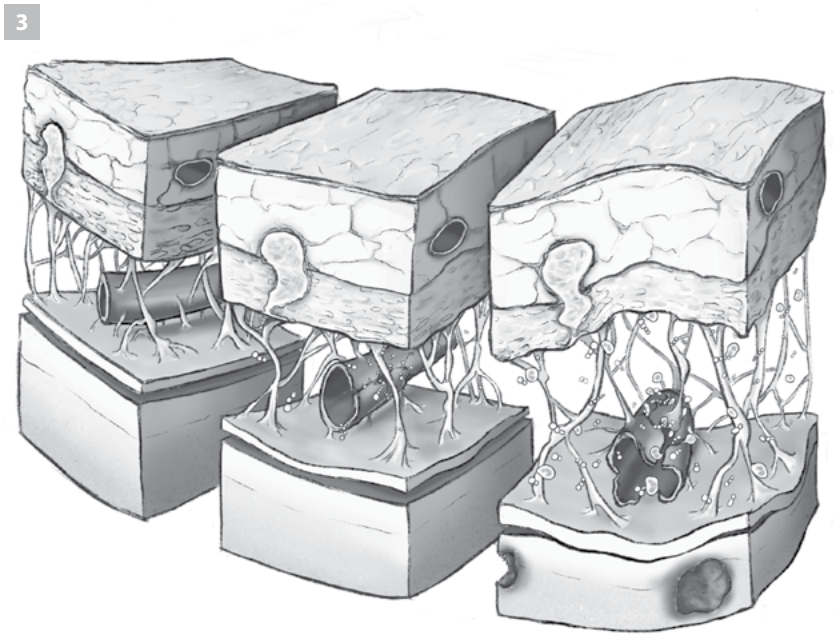

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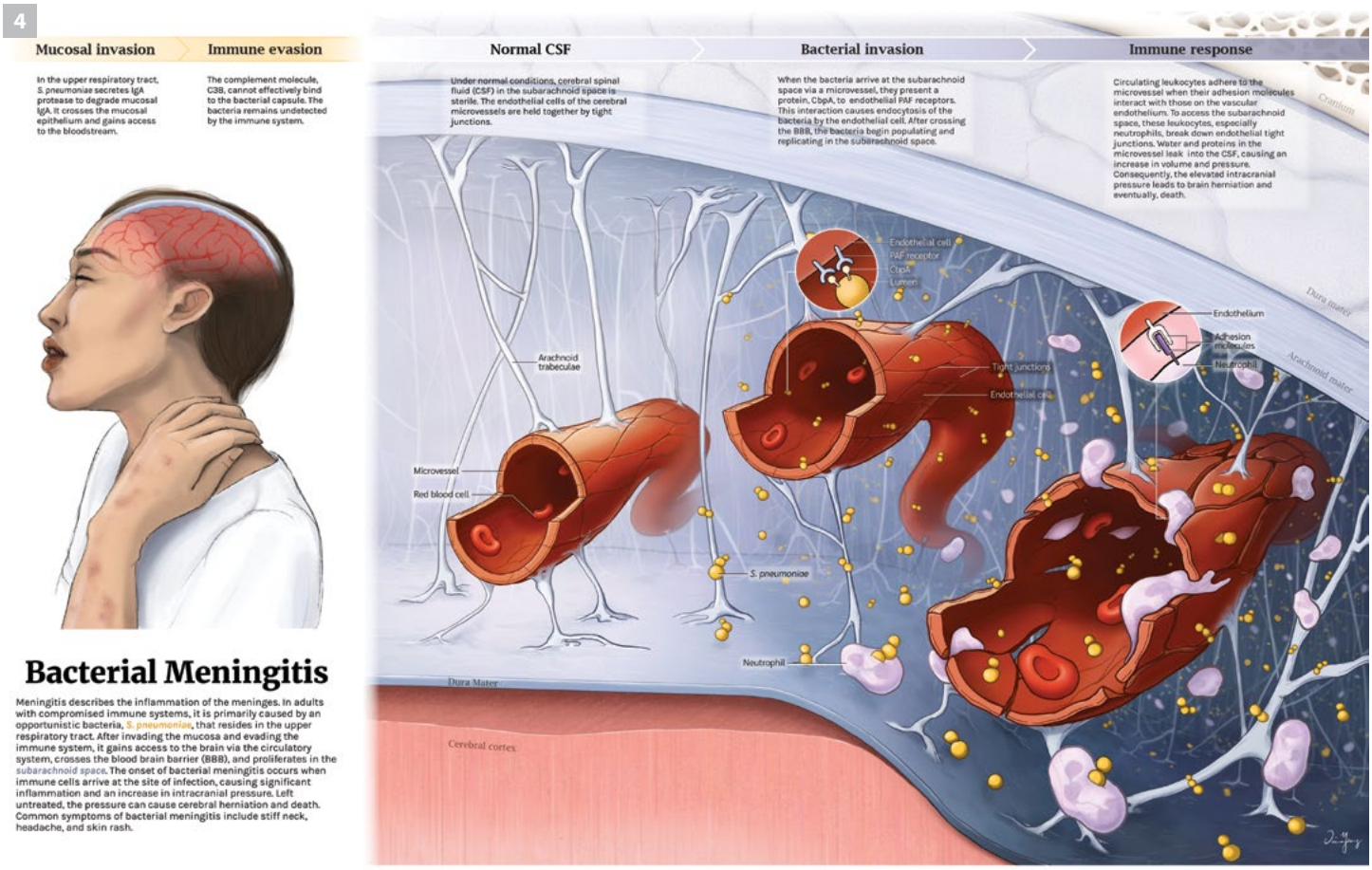

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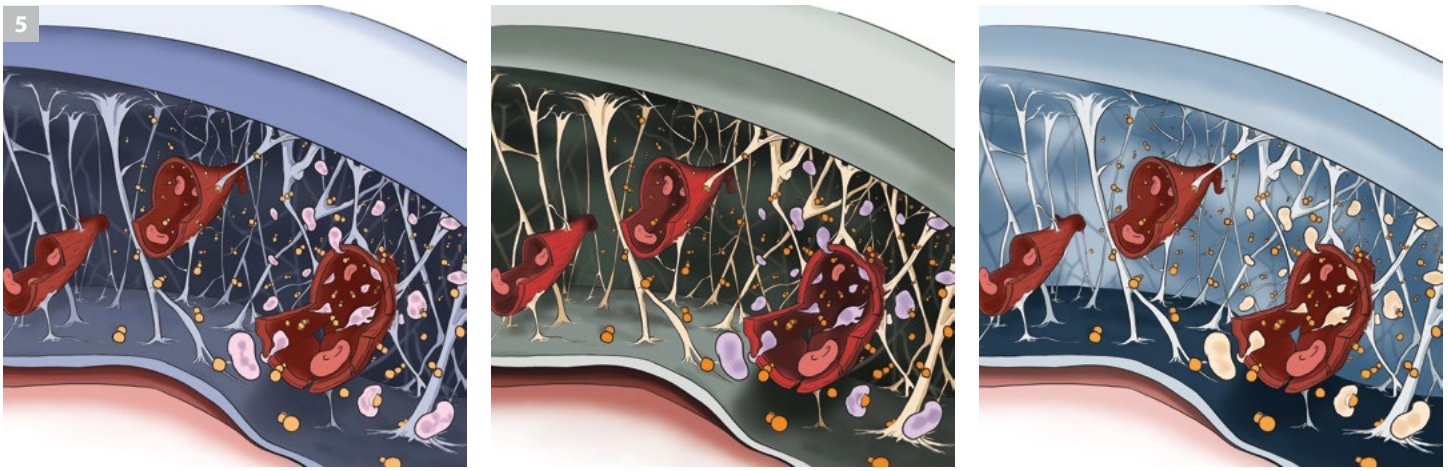


4. Final illustration. This project was rendered using iPad *Procreate*, *Photoshop*, and *Illustrator*.

5. Study. Colour comps were created to explore different colour schemes and the mood of the project. The final illustration is a combination of both the leftmost and the rightmost blocks.

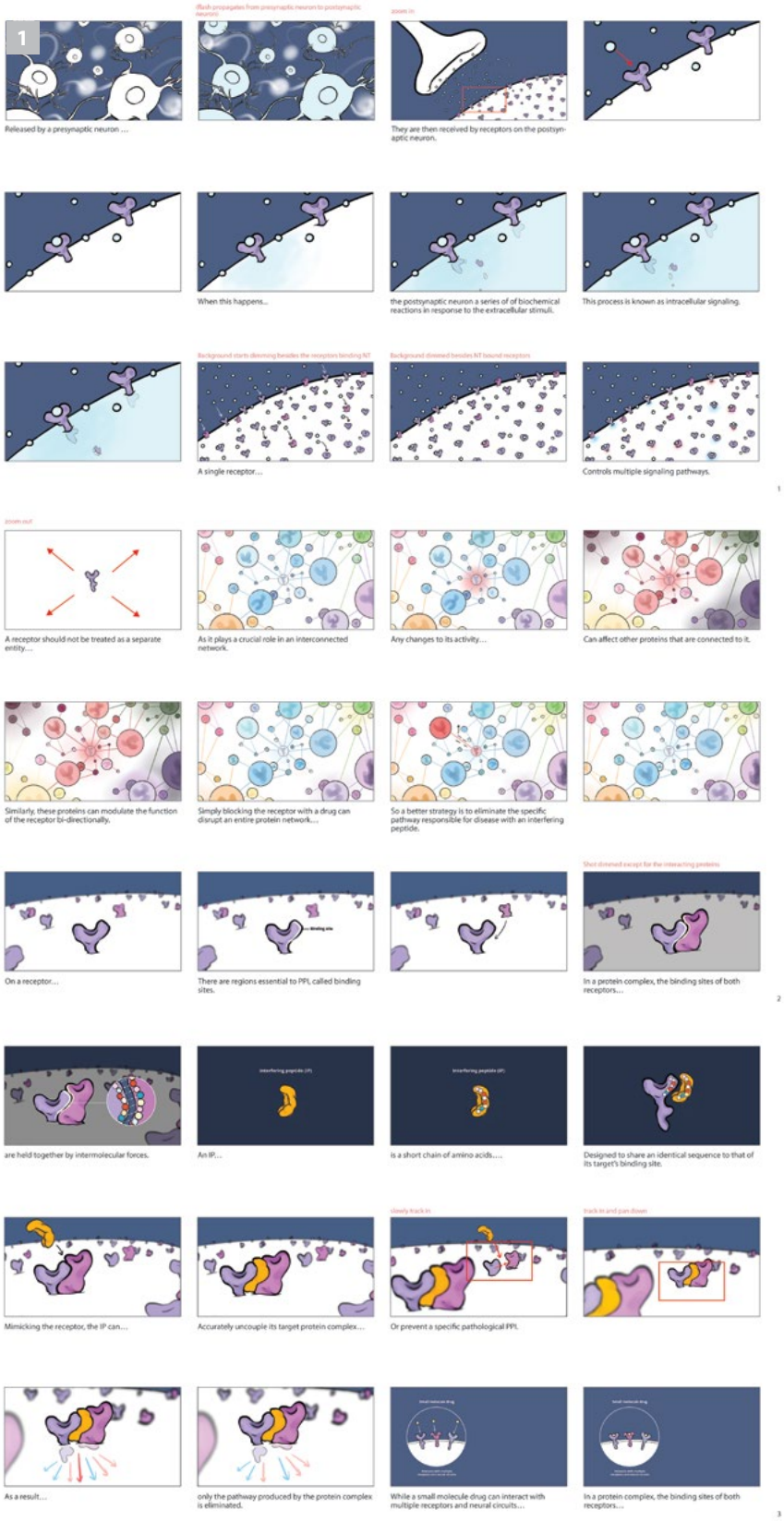
Targeting Protein Complexes in the Brain with Interfering Peptides

Brain diseases are treated with small molecule drugs that can cause debilitating side effects. However, research has shown that preventing certain PPIs with specific IPs can treat these diseases with minimal side effects. Intended for conferences, this animation promotes targeting protein complexes as a superior therapeutic strategy to conventional medication.

1. Storyboard. These sequences of sketches were created to determine the general style of the animation. Since a specific set of colours were needed to represent physiological and pathological conditions, the entire storyboard was drawn in colour to ensure that other elements were lower in salience. Camera movements were also roughly determined.

2. Production process. These three columns of stills show the same frame in different stages of production (Left to right: *Maya* models, *Maya* render, *After Effects* post-production). Most hue and brightness adjustments were done in post-production to minimize rendering time.

3. Final animation. Final rendered frames of the 3D animation.



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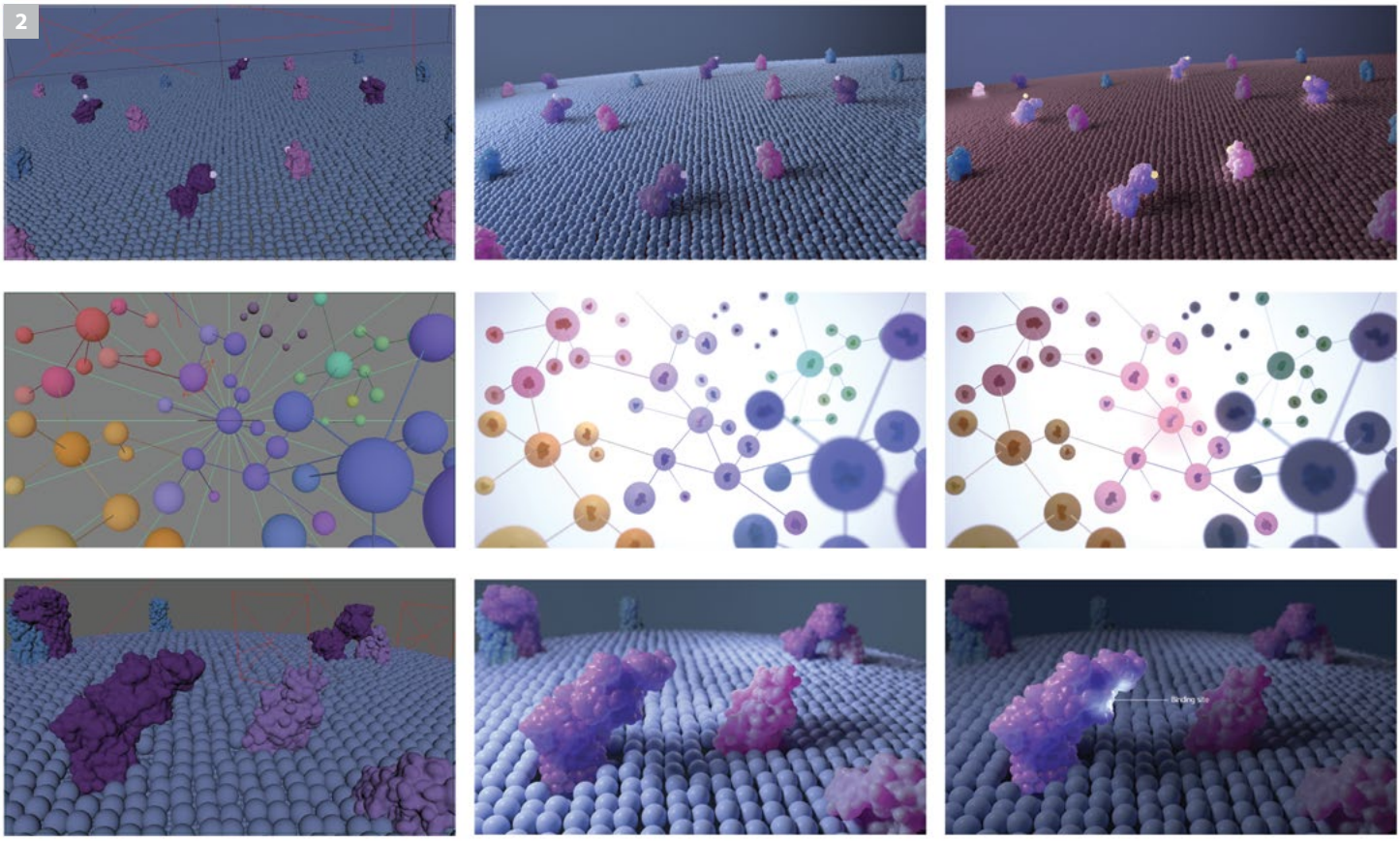

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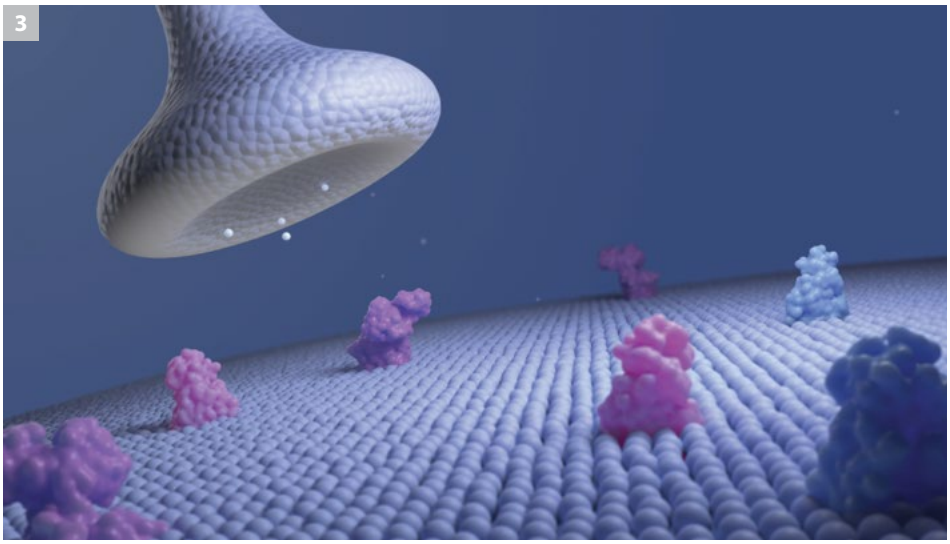

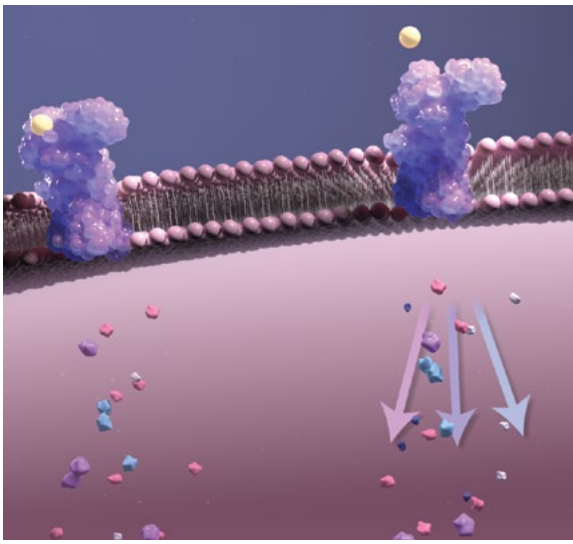

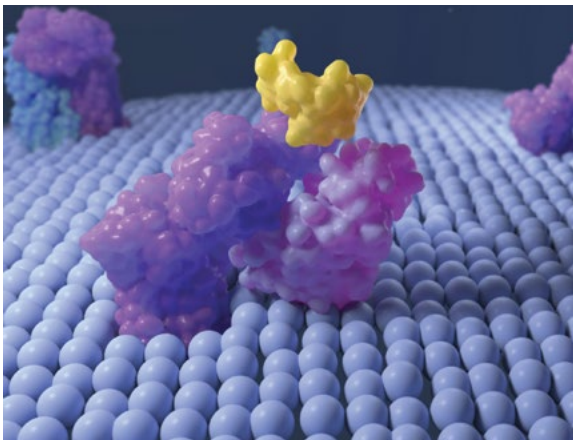

Acknowledgements

When the BMCAA team and I first came up with the idea of the Viewbook four years ago, we knew we wanted to create something for our community that was meaningful, a rallying point, a legacy. Three years in, it's still an endeavour in its infancy, but I've seen and felt its impact, and I believe it's truly something for all of us to cherish and celebrate.

Thank you to all the students who have bared their hearts and minds to this third volume of the MScBMC Viewbook. Thank you to my fellow BMCAA execs who have given so selflessly through thick and thin. Thank you Jodie, Michael, Maeve, and the MScBMC faculty for your support and encouragement, not only towards the Viewbook, but for giving all of us alumni our wings. To my fellow editors, Chelsea, Jerry, and Alex who so masterfully constructed these pages before you, thank you for joining me on this crazy, wonderful, intense, and inspiring journey.

— Geoffrey Cheung

"... but what you make others see."

— Edgar Degas

Biomedical Communications
Alumni Association

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Ontario, Canada