BIOMIMICRY GLOBAL DESIGN CHALLENGE

Teaching with the Challenge

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BIOMIMICRY
GLOBAL DESIGN
CHALLENGE

Challenge.Biomimicry.org

BIOMIMICRY INSTITUTE

the RAY C. ANDERSON foundation™

Look to the abundance of lessons nature has to offer and develop a biomimetic design that solves an important food system challenge while protecting the health of the planet.

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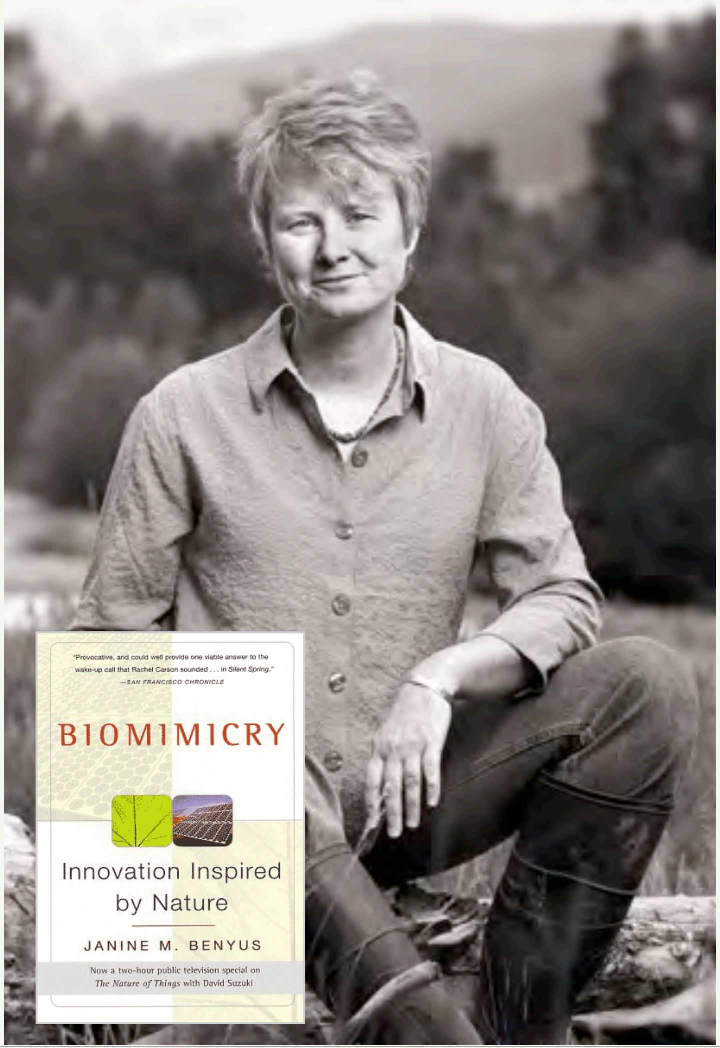
Biomimicry is the practice of adapting nature’s best lessons to the invention of healthier, more sustainable technologies for people.



"The core idea is that nature, imaginative by necessity, has already solved many of the problems we are grappling with. Animals, plants, and microbes are the consummate engineers. They have found what works, what is appropriate, and most important, what *lasts* here on Earth…

The conscious emulation of life's genius is a survival strategy for the human race, a path to a sustainable future. **The more our world functions like the natural world, the more likely we are to endure on this home that is ours, but not ours alone**."

- Janine Benyus

CHALLENGE DETAILS

- The Challenge is open to high school students, university students, and professionals.
- Two categories: Student-only, and Open
  Students may compete in either category
- Teams are required; individuals may not submit.
- Registration is free, but teams are required to pay an entry fee in order to submit their work for judging. ($40 / $100)
- Entries due Spring 2016

BIOMIMICRY GLOBAL DESIGN CHALLENGE
FOOD SYSTEMS

PRIZES

Student category

- 1st prize: $ 3,000
- 2nd prize: $ 1,500
- 3rd prize: $ 750

Open Category

The Open category awards a combination of cash prizes (1st, 2nd, 3rd place) and mentorship and incubation support through the Challenge Accelerator program.

One team will be awarded the Ray C. Anderson Foundation's $100,000 "Ray of Hope" Prize at the conclusion of the Accelerator.

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SUBMITTING

All materials are submitted online

- Project Summary (<300 words)
- Project Image/rendering
- Project Document, describing the solution, sources of biological inspiration, and design process
- Video Pitch (< 3 min)
- Team Photo

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FOOD SYSTEMS

JUDGING

Criteria are similar for the Student and Open categories but weighted differently.

Student competition emphasizes learning and demonstrating a biomimicry process.

Open competition emphasizes solution impact, feasibility, and team readiness to pursue further development in the Accelerator program.

BIOMIMICRY GLOBAL DESIGN CHALLENGE
FOOD SYSTEMS

FREE RESOURCES

Online Introduction to the Core Concepts and Methods of Biomimicry

Live Presentations with Q&A

Topical References

BIOMIMICRY
GLOBAL DESIGN
CHALLENGE

Challenge.Biomimicry.org

KEARNY HIGH SCHOOL - ENGINEERING, INNOVATION & DESIGN

SAN DIEGO, CALIFORNIA

SCHOOL OF
ENGINEERING
INNOVATION
AND DESIGN

PROJECT BASED LEARNING SCHOOL

SCHOOL OF
ENGINEERING
INNOVATION
AND DESIGN

10th Grade Interdisciplinary Project:

- English 3/4
- Introduction to Green Technology
- Biology

Began by analyzing all three of our standards.

PLANNING AN INTERDISCIPLINARY PROJECT

- In addition to the standards, what **inspires** us?
- Bingham: Biomimicry TED talk
  - Innovative, Green, Cutting Edge
  - Biology basis
  - English – Passionate about nature

Biomimcry:
Using nature's design as inspiration to solve current problems.

Example: Biomimic shark skin, on which bacteria cannot grow, on hospital surfaces to prevent the spread of disease.

PLANNING AN INTERDISCIPLINARY PROJECT CONT.

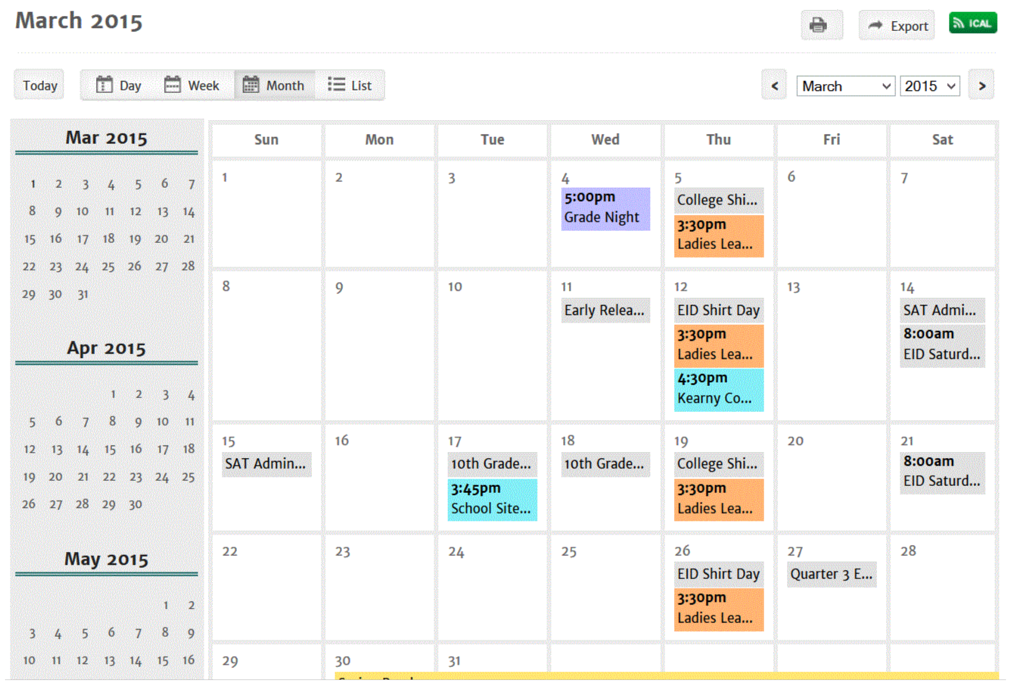
- **Plan the assessment**
  - What will you assess--early in the project, during the project, and at the end of the project? State the criteria for exemplary performance of each product.
- **Map the project**
  - List key dates and important benchmarks for this project.
  - What do students need to know and be able to do to complete the tasks successfully? How and when will they learn the necessary knowledge and skills?
  - Biomimicry:
    - ELA: Read/Research various food system issues.
    - Biology: Learn about ecology, adaptations, etc.
    - IGT: Apply research + biology to inspire design.
    - ELA: Take design and write about it.

PLANNING AN INTERDISCIPLINARY PROJECT

- **Create client and industry connections.**
  - Reach out to real clients or industry to participate in a variety of ways throughout the scope of the project and serve as both mentors and evaluators of student work.
  - Biomimicry: Global Design Challenge
  - Professor from New School of Architecture
  - Biomimicry 3.8 (San Diego Chapter)
  - GMO educator – Kathryn Rodgers
  - Used all of our connections!

CREATION OF PROJECT TIMELINE

- Length of instructional time per course topics
- Master calendar – District calendar, testing windows, staff pregnancy, etc.
- Built in flexibility



PLANNING CONTINUED

- Broke down the “Food Challenge”
- Chose food crisis ideas that would be manageable for students to grasp
- Selected key texts
  - Used a few key anchor texts as resources
  - Could closely examine the content AND form to master content standards.
  - Ex: “Next Green Revolution” by Tim Folger

WRITING PROCESS

- Broke the writing requirement into three big chunks. Then broke those chunks down.
  - *What **content** are the judges looking for?*
- Broke down each chunk of the prompt in to a scoring guide:
  - Ex: Defining the Problem
- Then they put all chunks together and were graded for quality.

Correct MLA Format	______/5
Introduction gives a brief overview of all food system issues	______/5
Introduction states the problem you found most compelling and why you found it most compelling	______/5
Clearly define the problem - explain it to someone who has never seen it before.	______/10
Define the various causes of this problem Include textual evidence & cite correctly	______/5 ______/5
Define the various effects of this problem Include textual evidence & cite correctly	______/5 ______/5
Conclude with a brief statement about your plan for fixing this problem.	______/5
Total:	__________/50

SHOW OFF TIME ☺

- https://vimeo.com/130467310

A CORNY REPLACEMENT

By: Alan Daniels, Kaleo Oliberos, Jervin Monta

PROBLEM:

U.S. produces corn for numerous amounts of uses; from Biofuel to animal feed and human consumption. The problem is that we use corn for other uses instead of human consumption. According to *scientificamerican.com*, roughly 40 percent of U.S corn is used for ethanol and as animal feed. 60% of corn produced is the U.S. is being consumed by livestock.

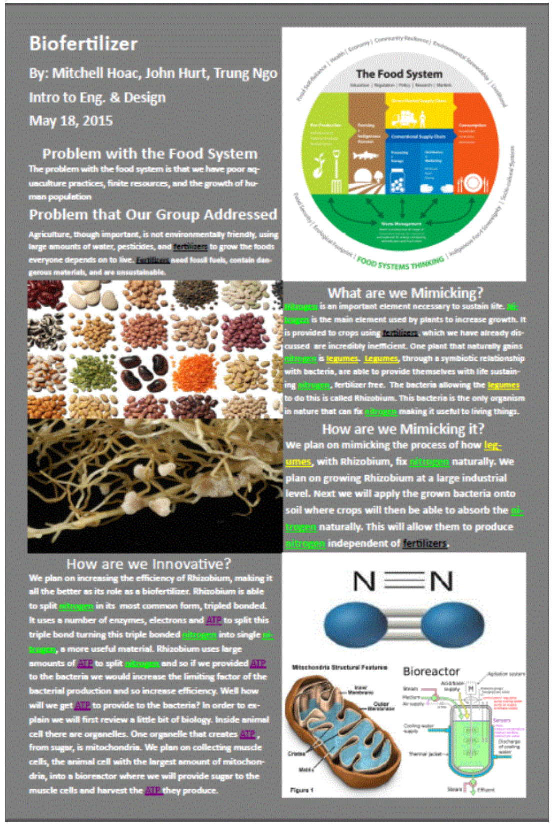
Growing corn requires a large amount of water and space. According to *http://www.epa.gov/agriculture/ag101/cropmajor.html*, in 2011, 84 million acres of corn were grown in the U.S. To produce an acre of corn, it takes 350,000 gallons of water over a 100-day growing season. (John Pohly 1)

SOLUTION: We are genetically modifying duckweed by putting the Mangrove's desalination process into duckweed, so duckweed is able to grow in salt water.

HOW DOES IT WORK?

Duckweed can be a replacement of corn for animal feed and biofuel.

Duckweed grows five to six times faster than corn. Growing this in salt water would not only save a large amount of land, but also a large amount of water.



Biofertilizer

By: Mitchell Hoac, John Hurt, Trung Ngo

Intro to Eng. & Design

May 18, 2015

Problem with the Food System

The problem with the food system is that we have poor aquaculture practices, finite resources, and the growth of human population

Problem that Our Group Addressed

Agriculture, though important, is not environmentally friendly, using large amounts of water, pesticides, and fertilizers to grow the foods everyone depends on to live. Fertilizers need fossil fuels, contain dangerous materials, and are unsustainable.

What are we Mimicking?

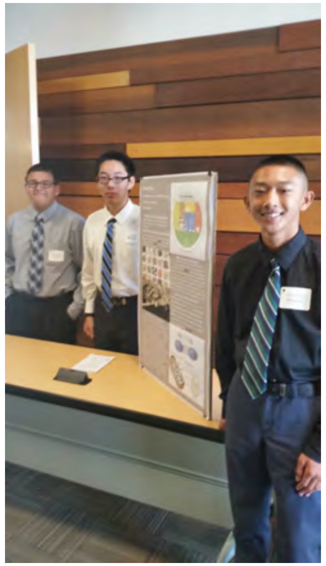
Nitrogen is an important element necessary to sustain life. Nitrogen is the main element used by plants to increase growth. It is provided to crops using fertilizers, which we have already discussed are incredibly inefficient. One plant that naturally gains nitrogen is legumes. Legumes, through a symbiotic relationship with bacteria, are able to provide themselves with life sustaining nitrogen, fertilizer free. The bacteria allowing the legumes to do this is called Rhizobium. This bacteria is the only organism in nature that can fix nitrogen making it useful to living things.

How are we Mimicking it?

We plan on mimicking the process of how legumes, with Rhizobium, fix nitrogen naturally. We plan on growing Rhizobium at a large industrial level. Next we will apply the grown bacteria onto soil where crops will then be able to absorb the nitrogen naturally. This will allow them to produce nitrogen independent of fertilizers.

How are we Innovative?

We plan on increasing the efficiency of Rhizobium, making it all the better as its role as a biofertilizer. Rhizobium is able to split nitrogen in its most common form, tripled bonded. It uses a number of enzymes, electrons and ATP to split this triple bond turning this triple bonded nitrogen into single nitrogen, a more useful material. Rhizobium uses large amounts of ATP to split nitrogen and so if we provided ATP to the bacteria we would increase the limiting factor of the bacterial production and so increase efficiency. Well how will we get ATP to provide to the bacteria? In order to explain we will first review a little bit of biology. Inside animal cell there are organelles. One organelle that creates ATP, from sugar, is mitochondria. We plan on collecting muscle cells, the animal cell with the largest amount of mitochondria, into a bioreactor where we will provide sugar to the muscle cells and harvest the ATP they produce.



SHOW OFF TIME ☺

MESSY!

- Be Flexible.
- It's MESSY.
- It will change.
- It's a work in progress.
- Communicate EVERYTHING all the time.
- But, can be SUCCESSFUL!

CONTACT INFORMATION

- Emily Liebenberg – Eliebenberg@sandi.net

THE CHALLENGE @ UNIVERSITY

MARJAN EGGERMONT [SENIOR INSTRUCTOR, UNIVERSITY OF CALGARY, DESIGNER/EDITOR ZQ]

THE EARLY DAYS

Affiliate Student Challenges
2008-2009

Our first two student design challenges were open to students at our Affiliate universities and were sponsored by a single company, which worked closely with the students over the course of a semester. For each challenge we created an interdisciplinary design team of university students and faculty and facilitated the design process from idea to prototype. Both challenges resulted in new products for our corporate partner and provided an experiential learning opportunity for students.

Pacific Outdoor Equipment (now **Hyalite Equipment**), a well known outdoor gear manufacturer in Bozeman, MT, sponsored our first Affiliate Student Challenge. Participants used biomimicry tools and principles in the design of a specialized backpacking tent. The result is shown here, in the company's 2009 catalog.

2008–2009

A small number of schools worked collaboratively via skype and basecamp

A summary of approaches was presented at ASEE

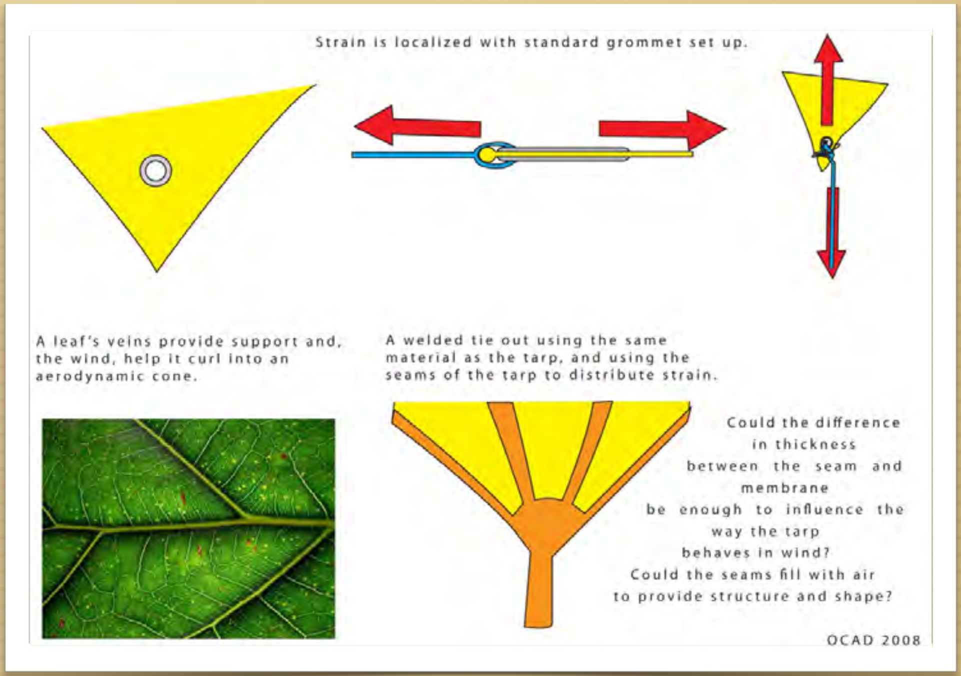
Participation was an independent study for one of my students

The design brief

Design a specialized tarp that can be used as a bottomless ultra-light backpacking tent

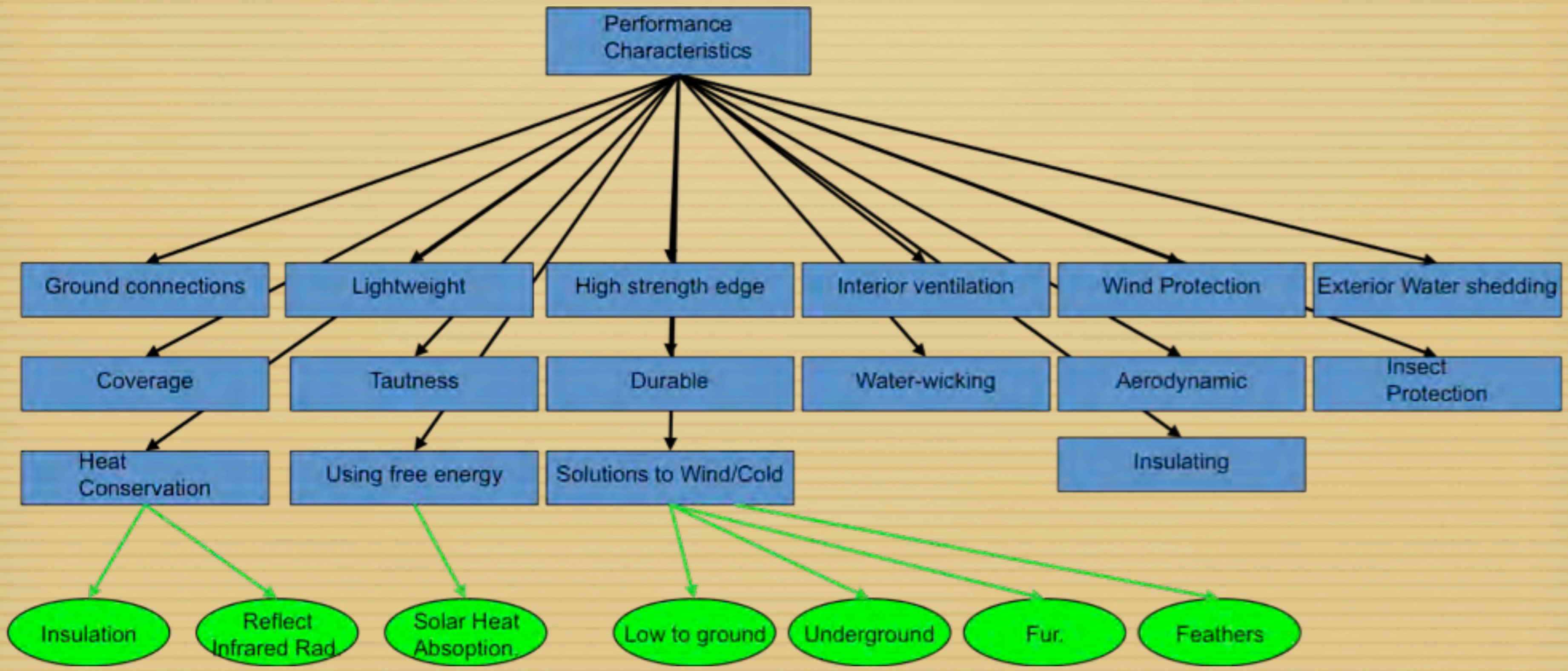
Approach + Institution: OCAD

Apply:
sketching and diagramming to study the relationship between materials, environment and performance



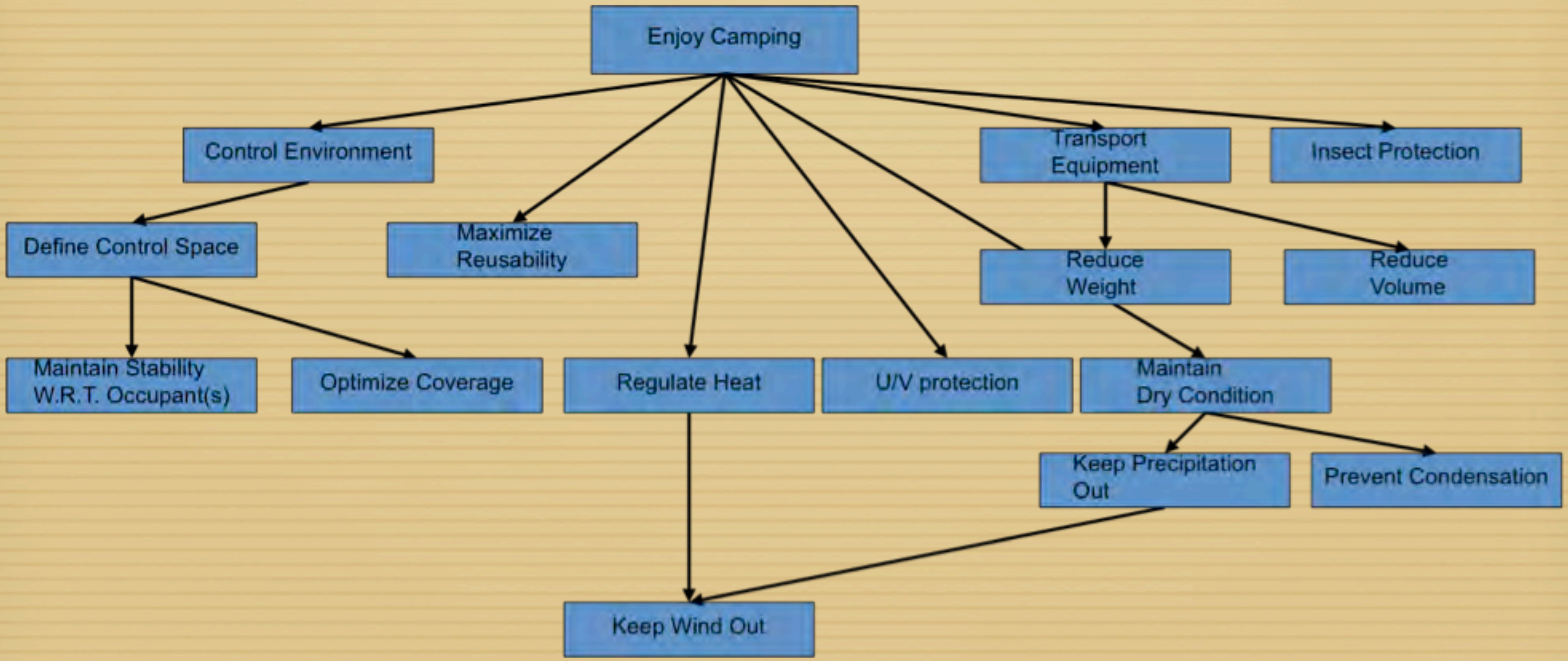
Approach + Institution: CBID

Problem Understanding: A graphical representation of the combined results from individual brainstorming documents



Approach + Institution: CBID

Problem Understanding: A graphical representation of the functional decomposition exercise

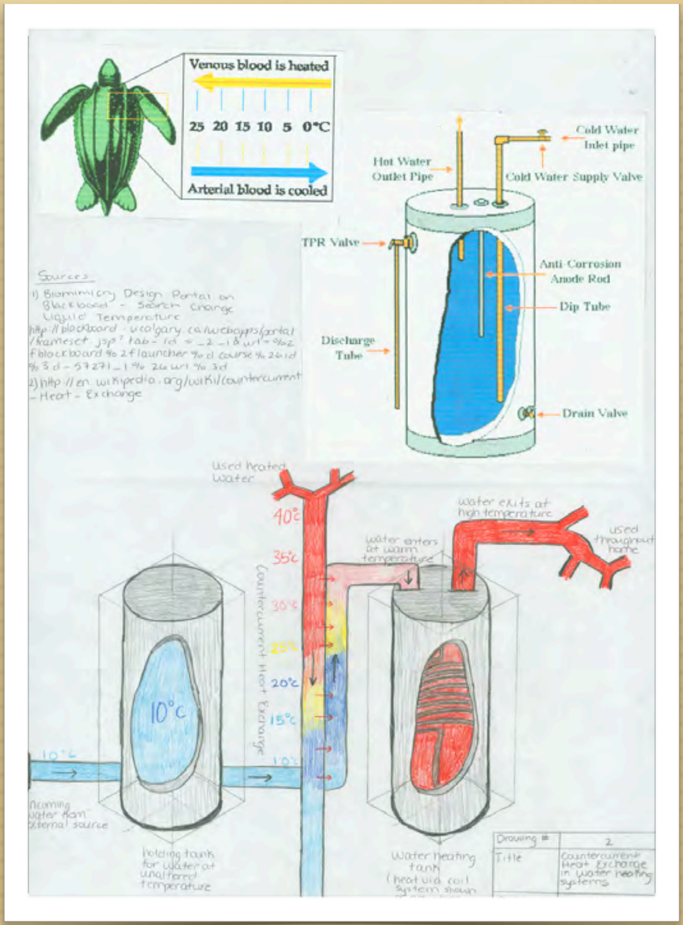


Approach + Institution: University of Calgary

Familiarization:

+seek many different points of view about the design problems from the people impacted by the design.

+get out of the classroom and go talk to a wide variety of people who have interest in and knowledge about the design problem

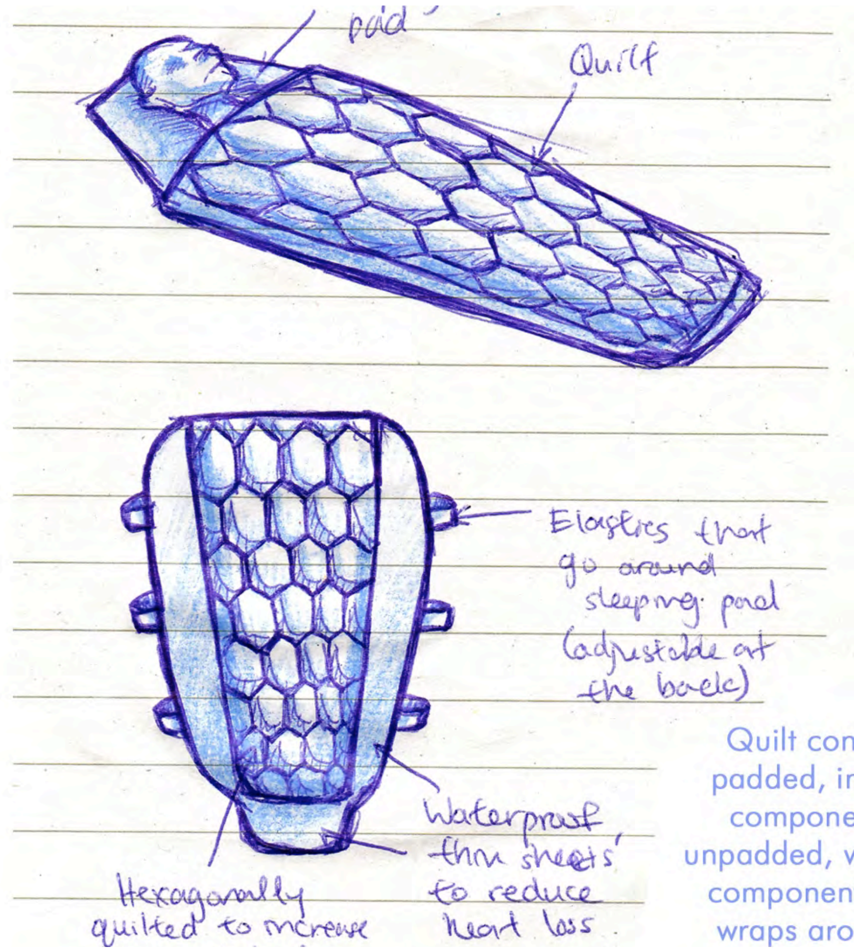


2009–2010

Small group participation

Students who took an interest

Outside of their course work



Quilt consists of padded, insulative component and unpadded, waterproof component that all wraps around the

2009–2010


Marjan Eggermont | Karen Wong | Kathryn Boon | Jack Siu | Mahsan Omid
STUDENT DESIGN CHALLENGE
2010
Our design encompasses several hexagonal sections containing a synthetic insulation material. The sections are very densely spaced (slightly larger size) in regions where the body loses the most heat, and more loosely spaced (slightly smaller size) in other regions, which will vary based on the male and female designs. The area connecting the hexagonal sections will be an uninsulated, flat region of the fabric that 'sandwiches' the insulation, providing areas for ventilation and cooling. The sides of the quilt have larger, uninsulated, waterproof flaps that wrap around the sleeping pad and connect with three adjustable elastics, as well as a larger pocket at the bottom end of the quilt in which the sleeping pad slides into. These features help to reduce the amount of heat lost while sleeping.
DESIGN PROPOSAL
KEY CHALLENGE CONCEPTS
MIMICKED NATURAL MODELS
LIFE'S PRINCIPLES
DESIGN SPECIFICATIONS
PROCESS
REFERENCES

2009–2010

Marjan Eggermont | Karen Wong | Kathryn Boon | Jack Siu | Mohsen Omid

STUDENT DESIGN CHALLENGE 2010

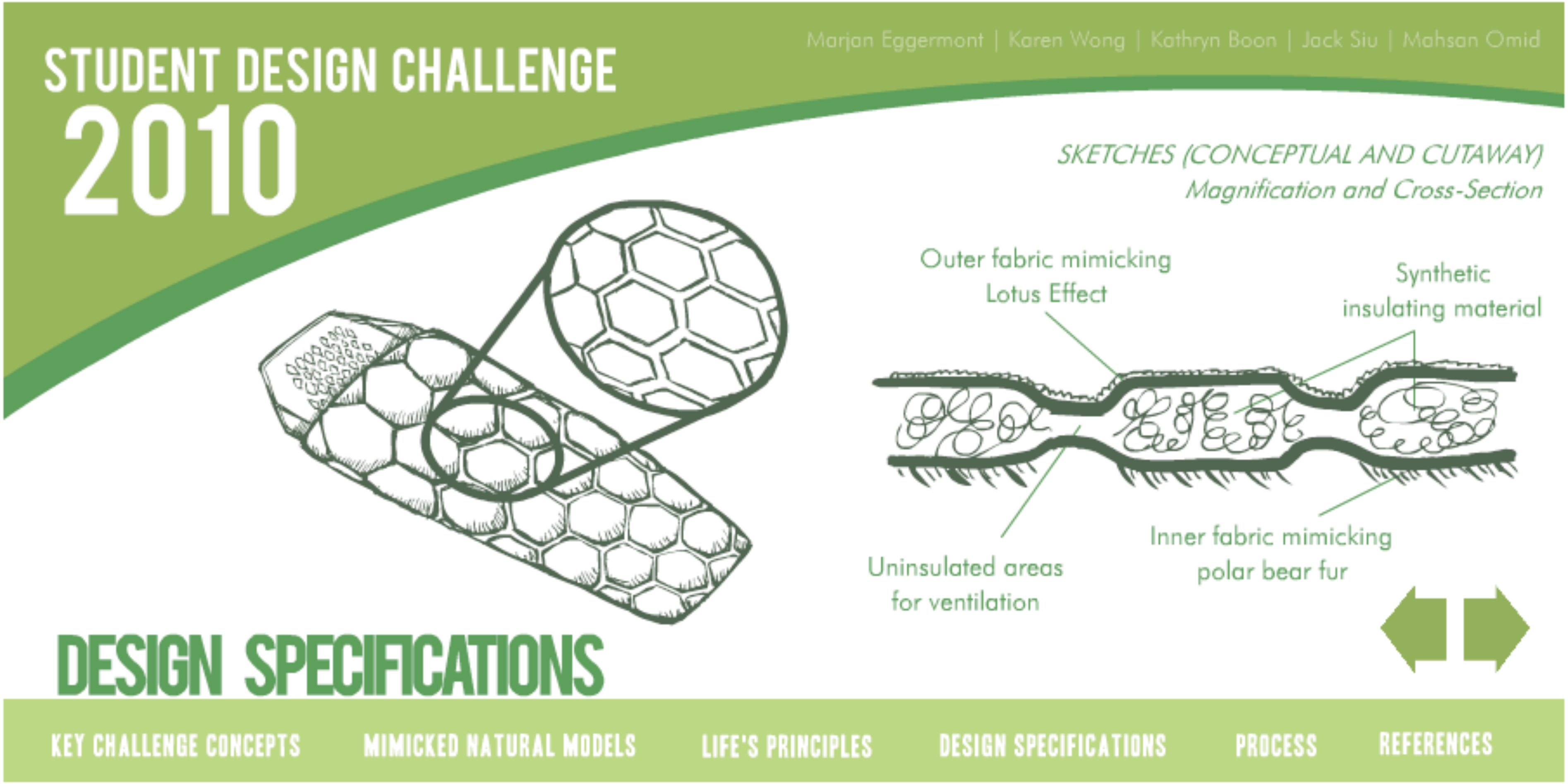
"Nature can be as a model, a standard of measure and a mentor". Its core idea is that nature, by necessity, has already solved many of the problems we are dealing with. It has already found what works, what is appropriate and, most importantly, what lasts here on earth.

Hives of bees and wasps:
According to an Ask Nature article, the body heat of bees creates these hexagonal shapes. These hexagonal shapes are known as a tough yet very light weight material. They are also known to have an extraordinarily strong space frame and minimal conductivity .

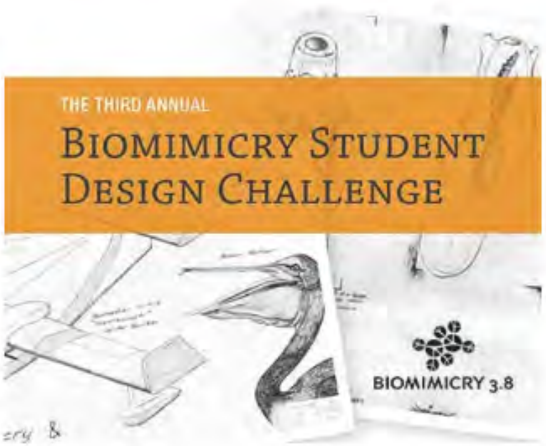
MIMICKED NATURAL MODELS

KEY CHALLENGE CONCEPTS | MIMICKED NATURAL MODELS | LIFE'S PRINCIPLES | DESIGN SPECIFICATIONS | PROCESS | REFERENCES

2009–2010

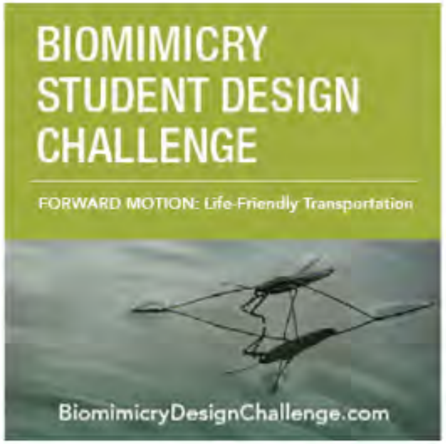

Marjan Eggermont | Karen Wong | Kathryn Boon | Jack Siu | Mahsan Omid
STUDENT DESIGN CHALLENGE
2010
SKETCHES (CONCEPTUAL AND CUTAWAY)
Magnification and Cross-Section
Outer fabric mimicking Lotus Effect
Synthetic insulating material
Uninsulated areas for ventilation
Inner fabric mimicking polar bear fur
DESIGN SPECIFICATIONS
KEY CHALLENGE CONCEPTS
MIMICKED NATURAL MODELS
LIFE'S PRINCIPLES
DESIGN SPECIFICATIONS
PROCESS
REFERENCES

2011–2013



BSDC 2011 - Energy Efficiency

BSDC 2012 - Water Wise: Water access and management



BSDC 2013 - Forward Motion: Life-friendly transportation solutions

Archive link coming soon!

Biomimicry Student Design Challenge 2011

http://biomimicrydesignchallenge.com/

AI-class AnimationsInv greece PhD_book BiomStDesChall2011 SAVEVIDEO.ME: Dezeen RBC BioInspired TechCommLab Mendeley Import to Mendeley

The Biomimicry Institute
Student Design Challenge

A project of the BIOMIMICRY Institute

- **HOME**
  - FAQ
  - Timeline
  - Rules & Eligibility
  - Judging Criteria
  - Past Challenges
  - Prizes
- STUDENTS
- FACULTY
- RESOURCES
- LOG IN
- REGISTER

2011 BIOMIMICRY STUDENT DESIGN CHALLENGE

The 2011 Biomimicry Student Design Challenge is open to any student worldwide enrolled in a university degree program. The challenge is to use biomimicry to design a solution that results in more efficient energy utilization and ultimately reduces greenhouse gas emissions, ideally in your local environment. Teams must include at least two individuals and interdisciplinary teams are strongly encouraged.

This challenge also has a training component. Because most students are not trained in biomimicry, we'll provide videos, lectures, access to Biologists at the Design Table, and other resources to help you apply biomimicry to your design process. Because of this training component and our desire to receive truly biomimetic submissions, each team will be required to pay a $25 registration fee. We'll provide the training and tools; you'll get an introduction to biomimicry, provide the solutions, and have the chance to win $5,000.

REGISTER NOW

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Protecting the Natural Environment.
Strengthening the Urban Community.

Final Model Rendering

The following model renderings illustrate the final design of the transpirational pull based commercial humidification system.

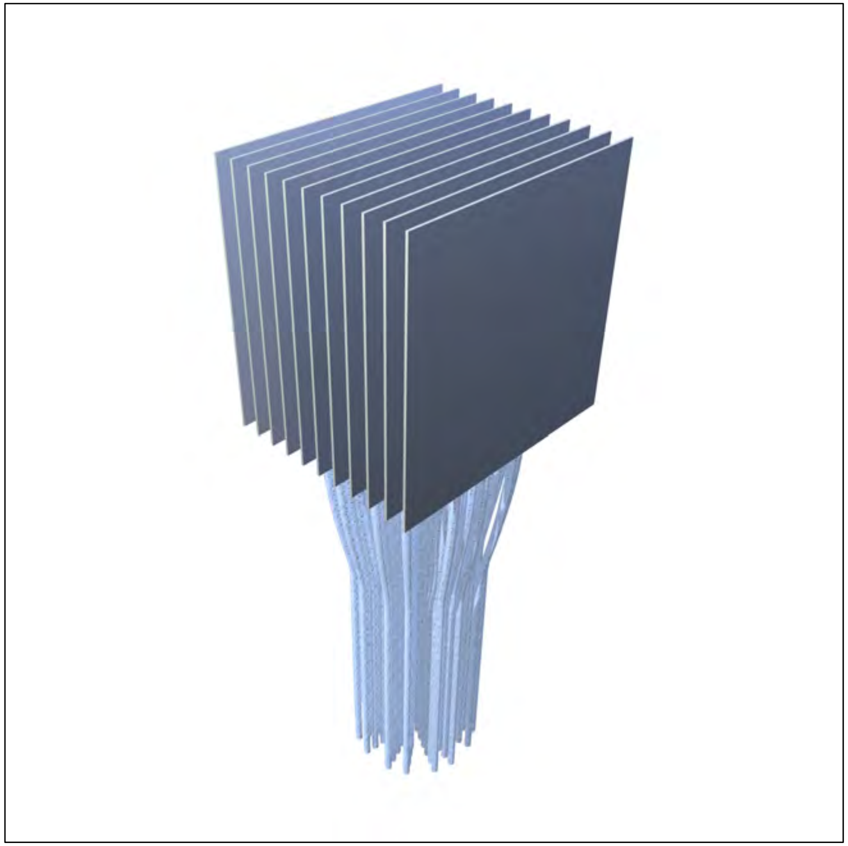
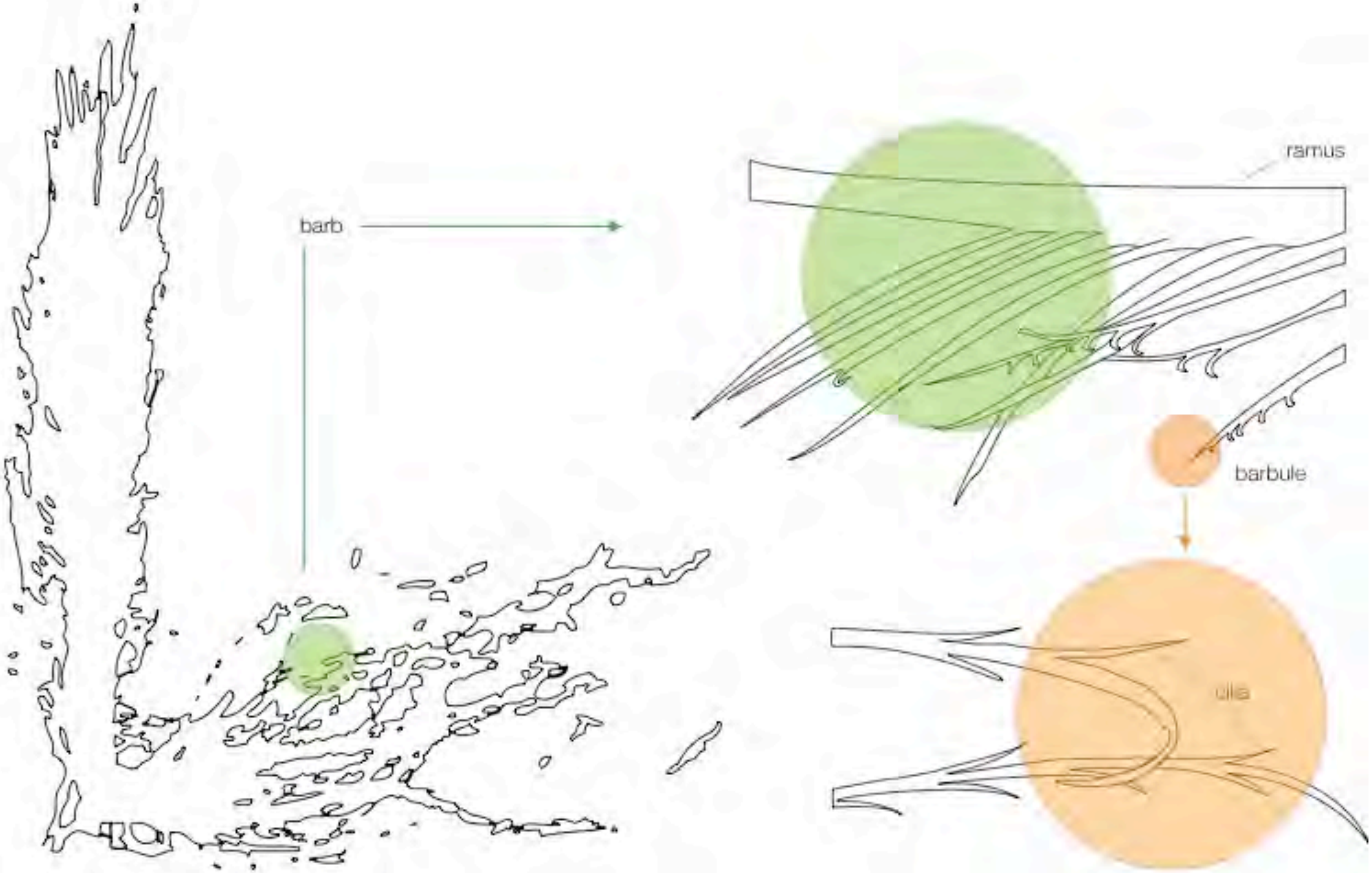
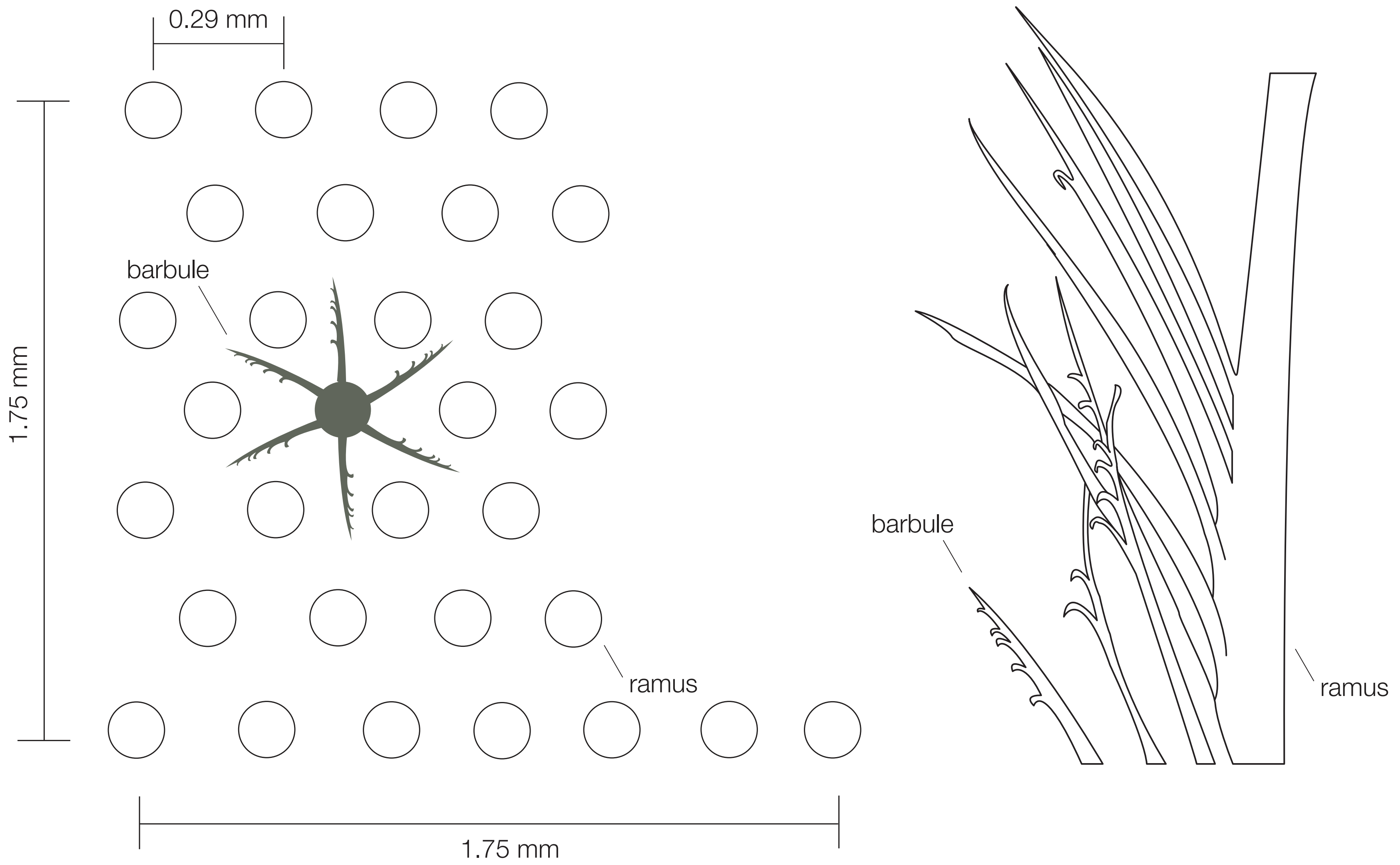


Figure 1: Water transport system and active humidification component

Figure 1 illustrates the hydrogel capillaries, which function to mimic the xylem of a plant by allowing for the transport of water via cohesive and adhesive forces (capillary flow). Also shown are the hydrogel plates, which effectively function to mimic the leaves of a plant, driving transpiration and achieving humidification simultaneously.



penguin feather outline



0.29 mm
1.75 mm
barbule
ramus
1.75 mm
barbule
ramus

Bio-inspiration from a warm, westerly wind

S. L. Sanders, J. D. McMullen, and M. Eggermont

***Abstract*—**In September of 2011, a group of Capstone Design students entered the 2011 Biomimicry Student Design Challenge. Encouraged to look for solutions to energy problems and to look for inspiration locally, they came up with an idea for a new heating system based on a weather phenomenon specific to the Eastern slopes of the Rocky Mountains. Every winter a warm westerly wind, the Chinook, descends into Calgary and southern Alberta. This paper describes initial investigation into the phenomenon and the design concept and process to date. The students will be prototyping their ideas in the new year.

***Keywords*—**Biomimicry, student design challenge, engineering, Chinook, heating, cooling.

I. Introduction

What is Biomimicry? Janine Benyus coined the term "biomimicry" in 1997 when she published her book Biomimcry: Innovation Inspired by Nature. She created this term by combining bios, which refers to life or living things, and mimicry, which means to copy or emulate. So in it's most simple terms biomimicry means copying life.

Benyus, an ever-curious biologist and captivating storyteller, defines biomimicry as "the conscience emulation of nature's genius." She uses the word 'conscience' to imply intent. When you use biomimicry as a design tool, you begin your design process with intent of emulating nature. She uses the word 'emulation' to suggest that biomimicry isn't about just mimicking nature; it is about extracting the best ideas and the strategies from nature and using them as the basis for our designs. She uses the phrase 'nature's genius' because the forms, processes, and systems found in nature are fabulously ingenious compared to our own technologies. As Thomas Edison once said, "Until man duplicates a blade of grass, nature can laugh at his so-called scientific knowledge."

A less eloquent but perhaps more pragmatic definition is that biomimicry is a sustainable design tool based on emulating strategies used by living things to perform functions that we want our technologies to perform – everything from creating color to generating energy. The goal of biomimicry is to design products and processes, companies and policies -- new ways of living -- that are well adapted to life on earth over the long haul.[1]

S. Sanders, and J. McMullen are fourth year Capstone Design students in the Department of Mechanical and Manufacturing Engineering at the Schulich School of Engineering in Calgary.
M. Eggermont is a Senior Instructor in the Department of Mechanical and Manufacturing Engineering at the Schulich School of Engineering in Calgary.

In 2008/09 The Biomimicry Institute held their first Student Design Challenge. Students from Mexico, The United States and Canada participated in a real world design project with a real world client improving a design for outdoor pursuits (in this case a 'camping tarp').

Fig 1: Challenge 1 – Image from familiarization stage - 'Distill,' 'Translate', and 'Observe' phases

The first iteration of the challenge (Figure 1) was a very collaborative process with students from all three countries working as a team. A student from our school summarized the experience as follows: "From the initial day and with just an idea of a tent-like structure inspired by nature, our project has gone through different stages. The design development can be followed from the design spirals and mind maps posted by all groups of the team. After a series of great ideas and creative thoughts, lot of reading and research we came up with something concrete. We now have a potential material used for this purpose, and alongside the color and texture of it.
Being involved in this project I have developed a new way of thinking and a new interest for this field of engineering that I knew very little about. Biomimicry is a term maybe not so recognizable in our society but it is definitely the future of engineering."

In 2009/10, the challenge (Figure 2) had developed into an organized structure that gave student teams access to a 'biologist at the design table'. Students could ask questions related to biology on a weekly basis in order to translate from biology to engineering. Instead of a group of about modern technology with ideas drawn from nature.

Biomimicry has already played an important role in multiple energy-related engineering innovations, such wind turbine blades inspired by the shape of whale fins or solar cells inspired by leaves, and it is important to keep investigating the field's potential. The merit of using the Chinook heating system is that combustion of natural gas is not required for it to operate, thus eliminating emissions. Therefore this heating system falls under multiple topics of interest for the VIII International Conference of Sustainable Design and Construction Engineering.

In addition to biomimicry and design with nature, it also aligns perfectly with the following topics: design and technologies for energy efficiency and conservation and developing energy efficient buildings at design stage to secure long-term savings.

A process that can be summarized into a few stages, which are shown in Figure 3, creates the Chinook winds that are characteristic to Alberta, Canada. Firstly, wet air from the Pacific Ocean is carried by coastal winds over the Rocky Mountains. While passing over the mountains, the moisture is forced out of the air by increasing elevation (decreasing pressure). Note that wet air loses heat at 5°C/1000m as it gains elevation [4]. The dry air then comes down off the mountains and into the Canadian Prairies. Conversely to wet air, dry air gains heat at 10°C/1000m [4]. The resulting air has higher final temperatures, which cause warm winds.

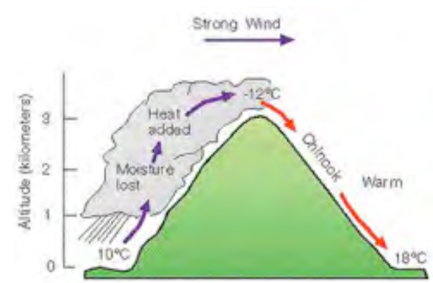


Fig 3 Chinook wind effect (http://rst.gsfc.nasa.gov/Sect14/g_chinook.jpg)

The Chinook heating system would operate in a fashion to reproduce the orographic effect of the actual natural phenomenon and yield the same results:

1. Air from the room is drawn into the device.
2. The air is mixed with water to saturation point (at relative room temperature).
3. The air mixture then experiences a decrease in pressure to simulate an orographic effect.
4. The majority of the moisture is removed from the air.
5. The air is returned to atmospheric pressure.
6. The air is expelled back into the room.

A basic functional decomposition of the proposed Chinook heating system is given in Figure 4. The overall decomposition in Figure 4A depicts the energy, material (air and water), and signal (current and desired room temperatures) inputs into the system and the desired output (warm air). Furthermore, the more specific internal sub-functions within the system are investigated in Figure 4B.

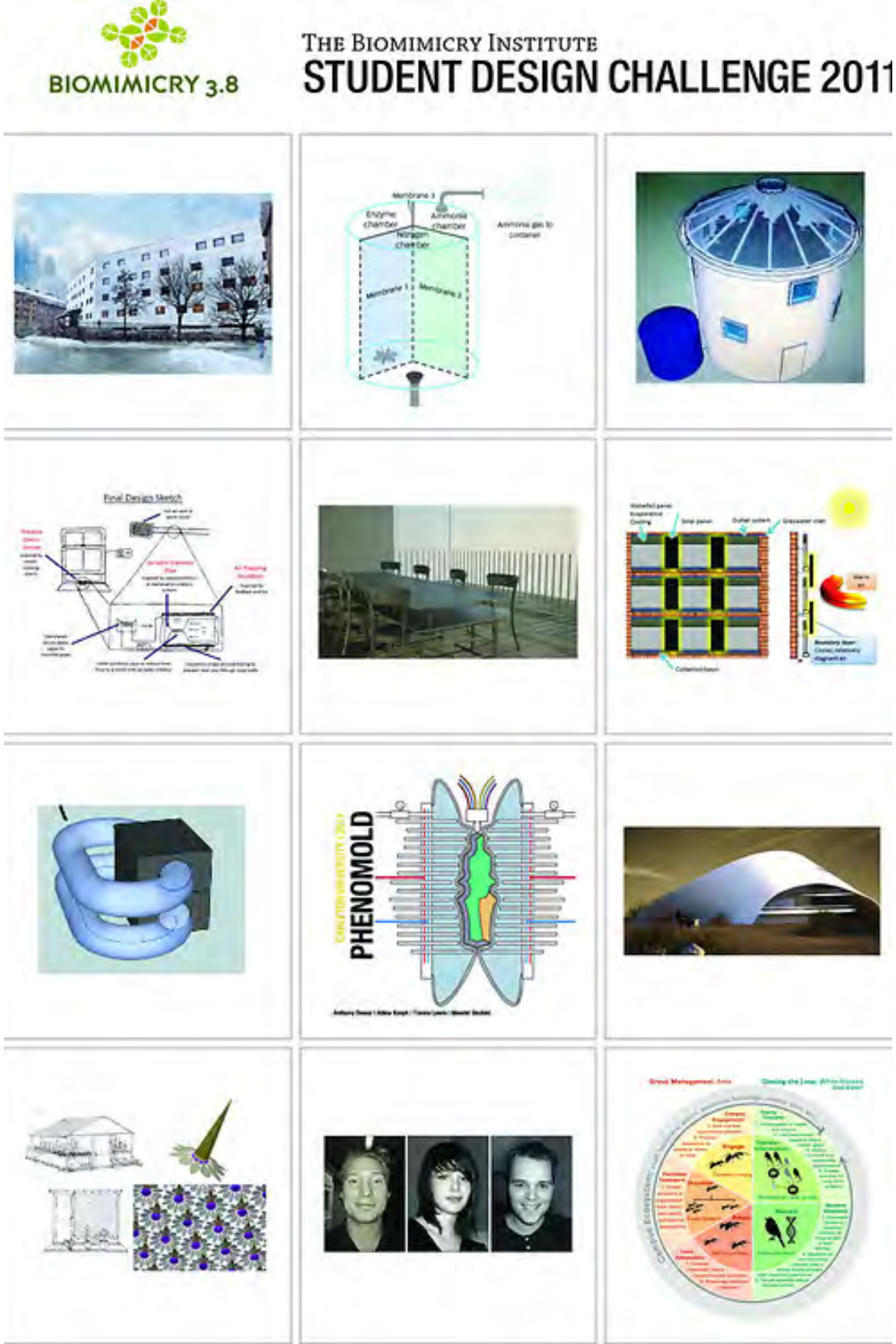
The proposed Chinook heating system requires a design for each sub-function in Figure 4B to achieve the required air conditions, which would be the next stage of investigation for this project. Designs for each sub-function still have to be considered to determine the most effective mechanism for achieving each condition. The system would most likely employ pumps to draw air into the system and to create the pressure drop. Pressure valves and nozzles may also be used in junction with pumps to create the pressure drop. A mechanism for mixing the water vapour and air as well as the collection of the condensed water still needs to be brainstormed.

The energy consumption of this design is not yet known and therefore it is not certain that there will energy or cost savings. The proposed future steps of this project are to establish designs for each sub-function from existing technology and subsequently determine the resulting efficiency of the system. The energy consumption of the Chinook heating system would then be compared with a conventional central heating system to determine which system has superior energy efficiency. Assuming the system is viable, other parameters would be determined such as ideal system positioning within a house, cost to operate and maintain the system, and the manufacturing process and expense.

2011–2012

Student challenges were run in the science and engineering capstone courses for interested teams as their capstone project

I acted as sponsor and mentor

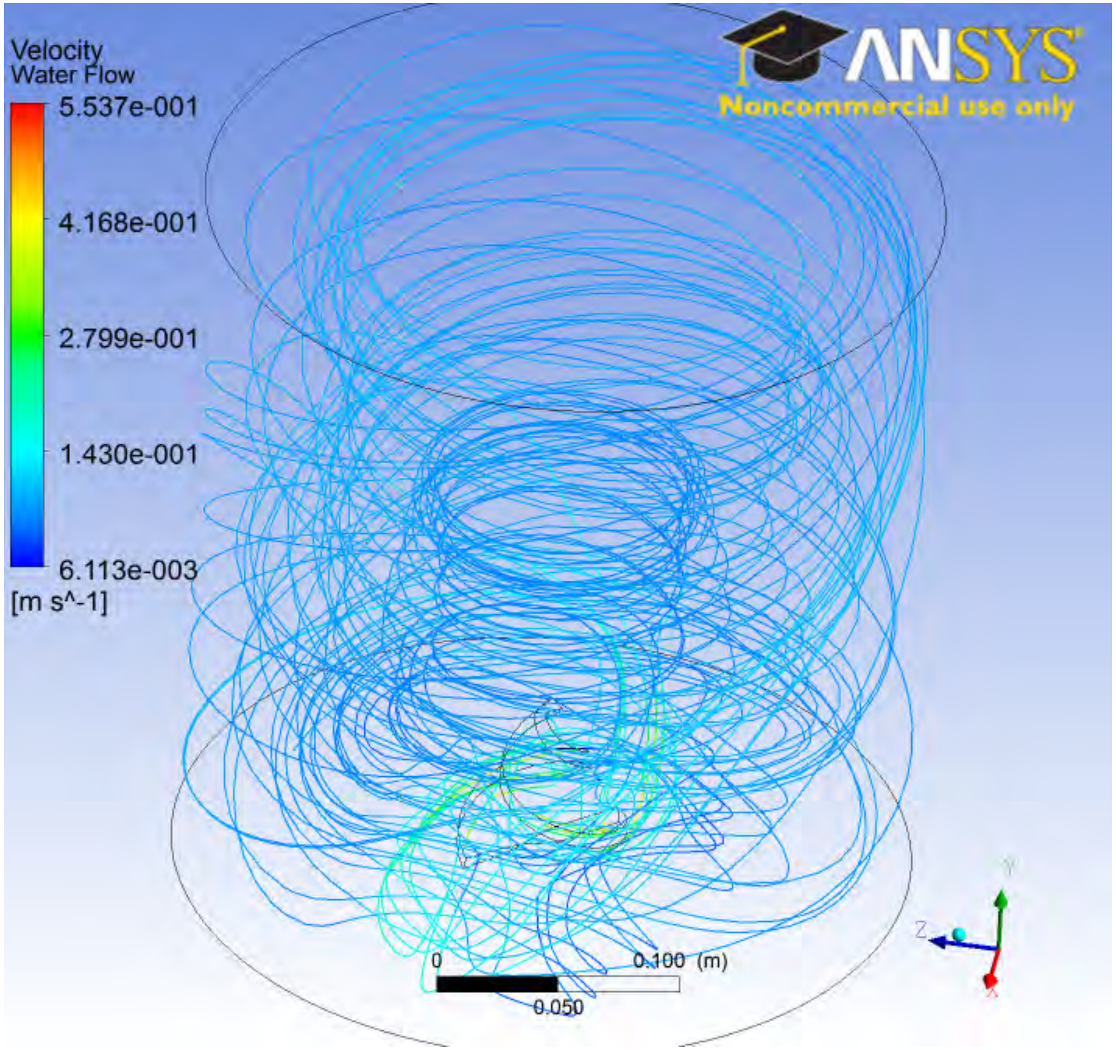


2012–2013

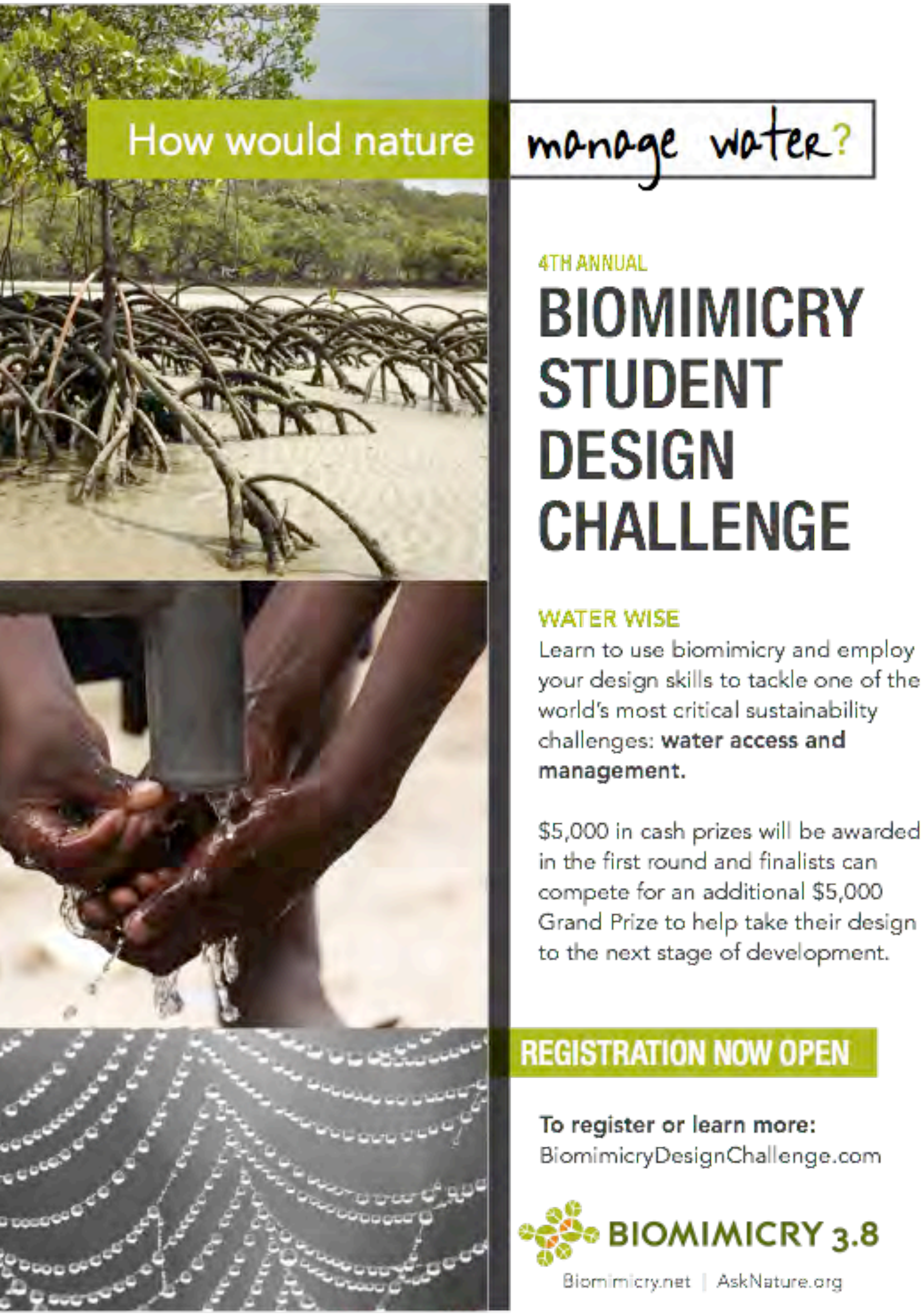
Challenge was a project in the first year engineering design course for all 700 first years

Challenge was modified to fit the course but gave students the opportunity to submit their designs in time for the challenge

The project was again available to capstone groups



Senior students



Engg 200 Fall 2012: Paper project plan

Week	Comms Lecture	Workshop/Lab	Due	Learning Outcomes
1 -- Sept. 10		3 hours: "Icebreaker" 1. An introduction to the communications component of the course 2. An introduction to logbooks 3. An introduction to technical communication. This introduction is similar to reverse engineering. Students are asked to analyze a document 4. An introduction to graphics in this course	Logbook check by TAs at end of lab [Participation mark - in lab]	• Individual and team work • Produce introductory engineering drawings and sketches • Impact of engineering on society • Construct logical and persuasive arguments
2 -- Sept. 17	Communications #1 • Introduction to paper project & components • Introduction to Biomimicry Design Process • [LP #1]* • Sketching practice • Sust. workshop			• Produce introductory engineering drawings and sketches • The impact of engineering on the environment • Interpret ethical, social and environmental influences • Elicit and interpret customer needs

[...]* enrichment material

Week	Comms Lecture	Workshop/Lab	Due	Learning Outcomes
3 -- Sept. 24		1 hour comms portion: Introduction to sketching 2 Introduction to Inventor	Logbook check by TAs @ end of lab [- in lab]	• Produce introductory engineering drawings and sketches • Produce introductory CAD drawings of designs
4 -- Oct. 1	Communications #2 • Sketching practice • Writing in Engineering • In-class writing exercise • Sust. workshop • [LP #2]			• Produce introductory engineering drawings and sketches • Produce introductory technical reports • Interpret ethical, social and environmental influences • Impact of engineering on society • Practice writing with correct spelling, punctuation and grammar • Practice conciseness, crispness, precision and clarity of language

Engg 200 Fall 2012: Paper project plan

Week	Comms Lecture	Workshop/Lab	Due	Learning Outcomes
5 -- Oct. 8	Communications #3 • Sketching practice • Biomimicry case studies • Sust. workshop • Oral presentations • Slide Design • [LP #3]			• Produce introductory engineering drawings and sketches • Produce introductory technical reports • Interpret ethical, social and environmental influences • Impact of engineering on society
6 -- Oct. 15	Communications #4 • Sketching practice • Sust. workshop • [LP #4]			• Produce introductory engineering drawings and sketches • Produce introductory technical reports • Interpret ethical, social and environmental influences • Impact of engineering on society
7 -- Oct. 22		Paper project work • Executive Summary work • Autodesk Inventor time • Oral presentations	• Executive Summary draft - one per team member - collate • Logbook check by TAs @ end of lab	• Give group presentation • Produce introductory CAD drawings of designs • Produce introductory technical reports • Work effectively in a small team • Describe and apply techniques for creative problem-solving

[...]* enrichment material

Week	Comms Lecture	Workshop/Lab	Due	Learning Outcomes
8 – Oct 29		Paper project work	• Draft report: Abstract, Exec. Summary, Concept sketches, Design Process, Model, LP evaluation, Autodesk Sust. Part • Logbook check by TAs @ end of lab	• Produce introductory engineering drawings and sketches • Produce introductory technical reports • Interpret ethical, social and environmental influences • Impact of engineering on society • Work effectively in a small team • Describe and apply techniques for creative problem-solving

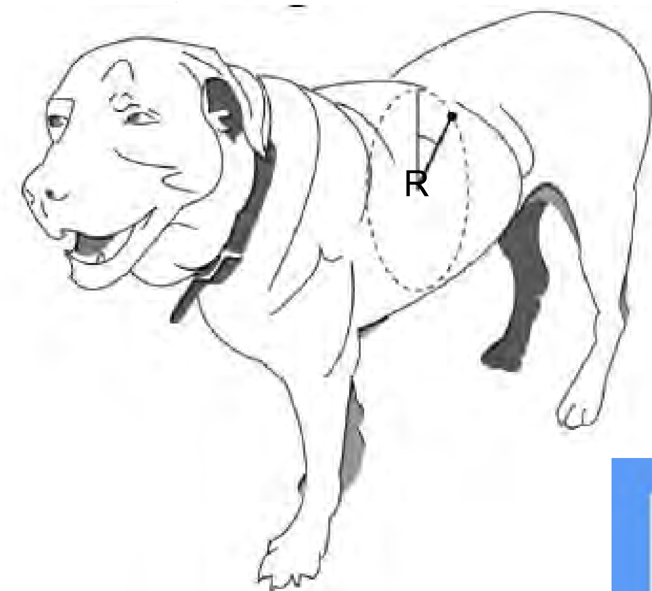
Engg 200 Fall 2012: Paper project plan

Week	Comms Lecture	Workshop/Lab	Due	Learning Outcomes
9 -- Nov. 5	Communication #5 • Sketching practice • Report writing 1		Paper project due in lab [on CD]: • Abstract • Executive Summary • Concept Sketches (may include story boards, flow charts, etc.) • Final Sketch Rendering or Model • Presentation — A maximum of 12 slides • Evaluation According to Nature's Principles • Optional Autodesk Sustainability Workshop Award presentation • Project video incorporating drawing, animation, narration (~3 minutes)	• Produce introductory engineering drawings and sketches • Produce introductory technical reports • Interpret ethical, social and environmental influences • Impact of engineering on society • Work effectively in a small team • Describe and apply techniques for creative problem-solving • Ability to complete basic analysis with respect to the impact of engineering on the environment, and on social, knowledge and economic systems in modern culture
10 -- Nov. 12				
11 -- Nov. 19	Communication #6 • Sketching practice • Report writing 2			• Produce introductory engineering drawings and sketches

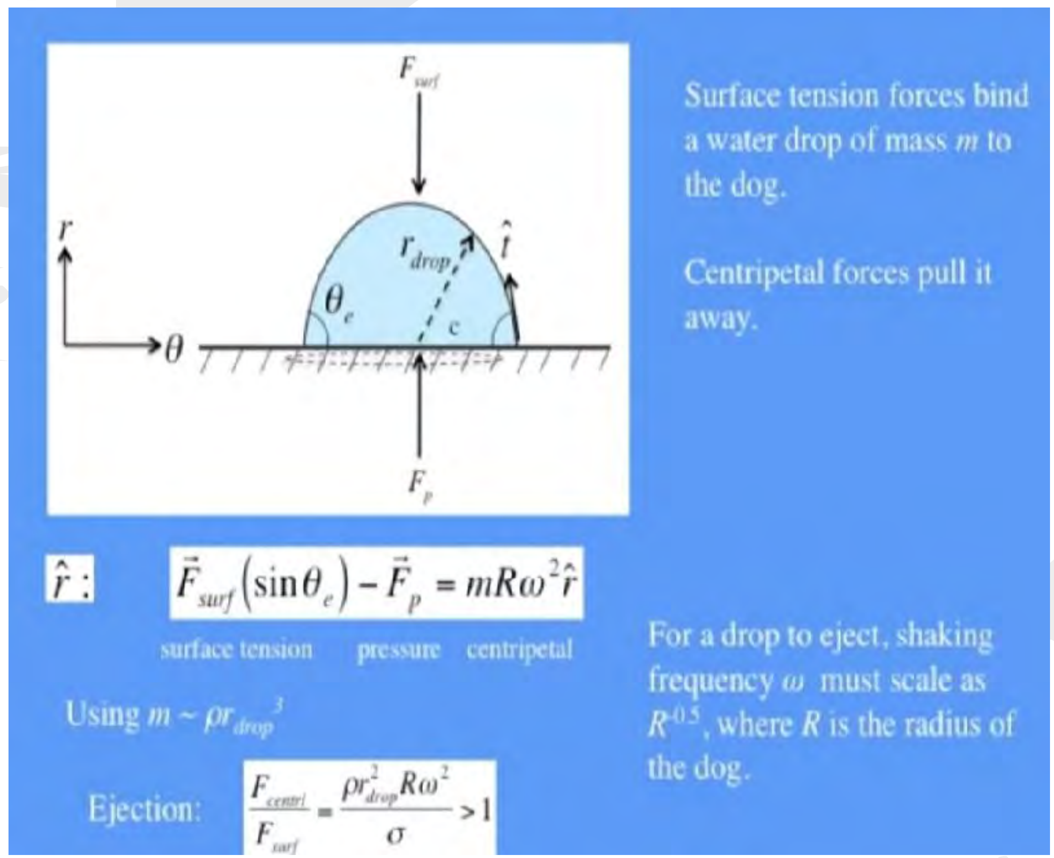
[...]* enrichment material

First year students

Illustrations of body oscillation:



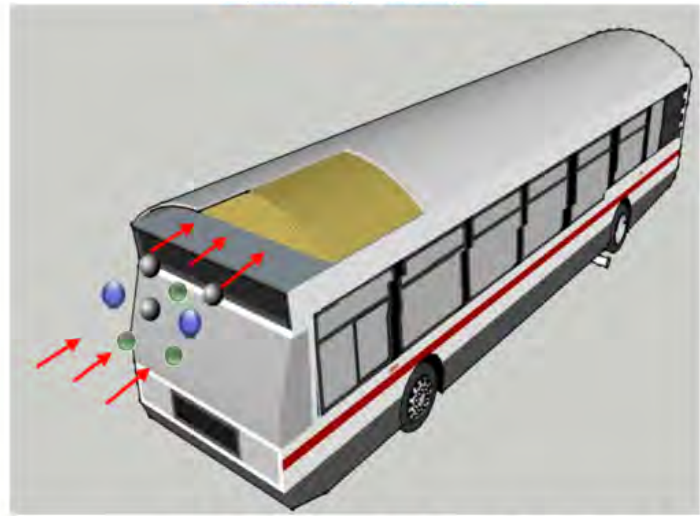
The radius (R) of the mammal's body on which the angular frequency ω depends upon.



Equation that shows the relation between the ratios of centripetal force and surface tension.

2013–2014

Capstone design course participation



Team: University of Calgary Team #2

Members: Jason Hawkins, bram.thibault@gmail.com, and tetamartins@gmail.com

Advised by Marjan Eggermont

University of Calgary, Calgary, Alberta, CA

Removal of Particulate Matter from Ambient Air by Bio-Inspired Processes

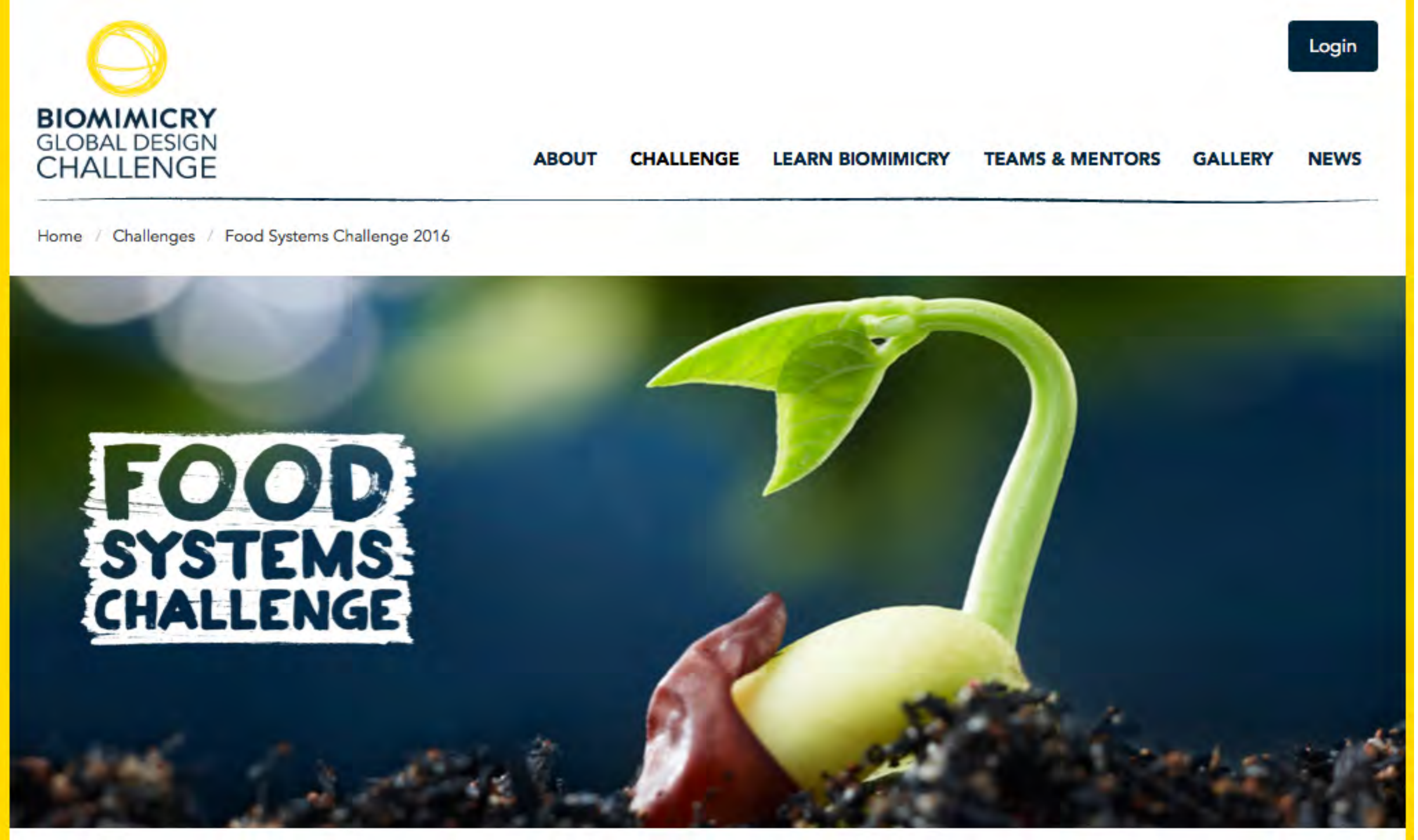
Particulate matter emissions from transportation, and other sources, has a signficant negative effect on both the human and natural environment. There are many methods of filtering particulate matter at the source, but many are ineffective or not economical. It would therefore be a great societal benefit to develop a system of capturing particulate matter from a variety of sources in a simple and economical manner. Our team has devised such a device using the sea sponge as inspiration for design. This device could be a ground-breaking means of capturing particulate matter and reducing smog in many cities. To accomplish this goal, aerodynamic and material testing would need to be completed to develop the final filter design for optimal performance.

2014-2015

A new student society has formed in Calgary: Enova

A biomimicry student group

I mentor the group if and when asked



ENOVA WINS STUDENT CHALLENGE

WindChill - A Food Preservation Unit

1st Place winner

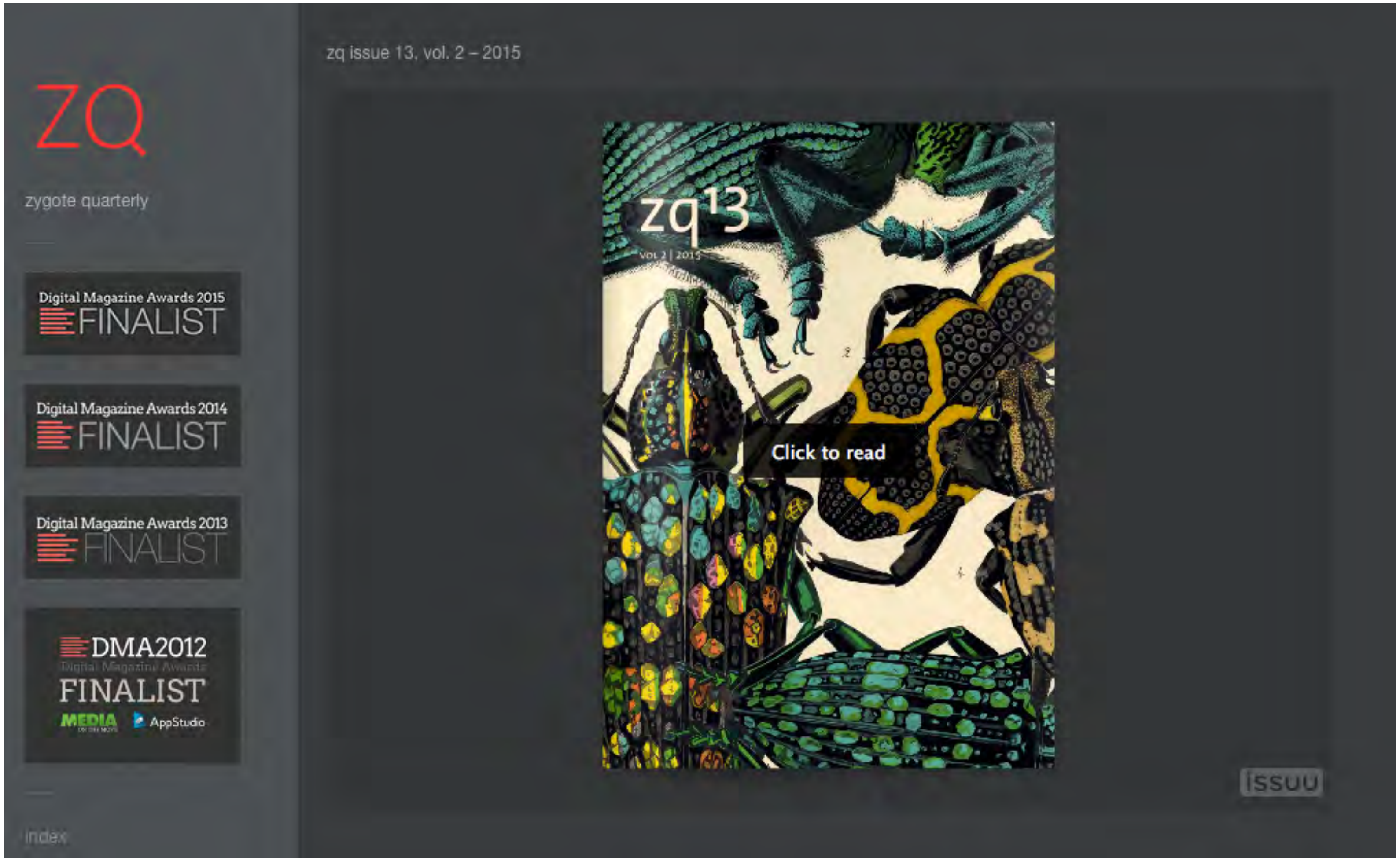
Canada, Calgary

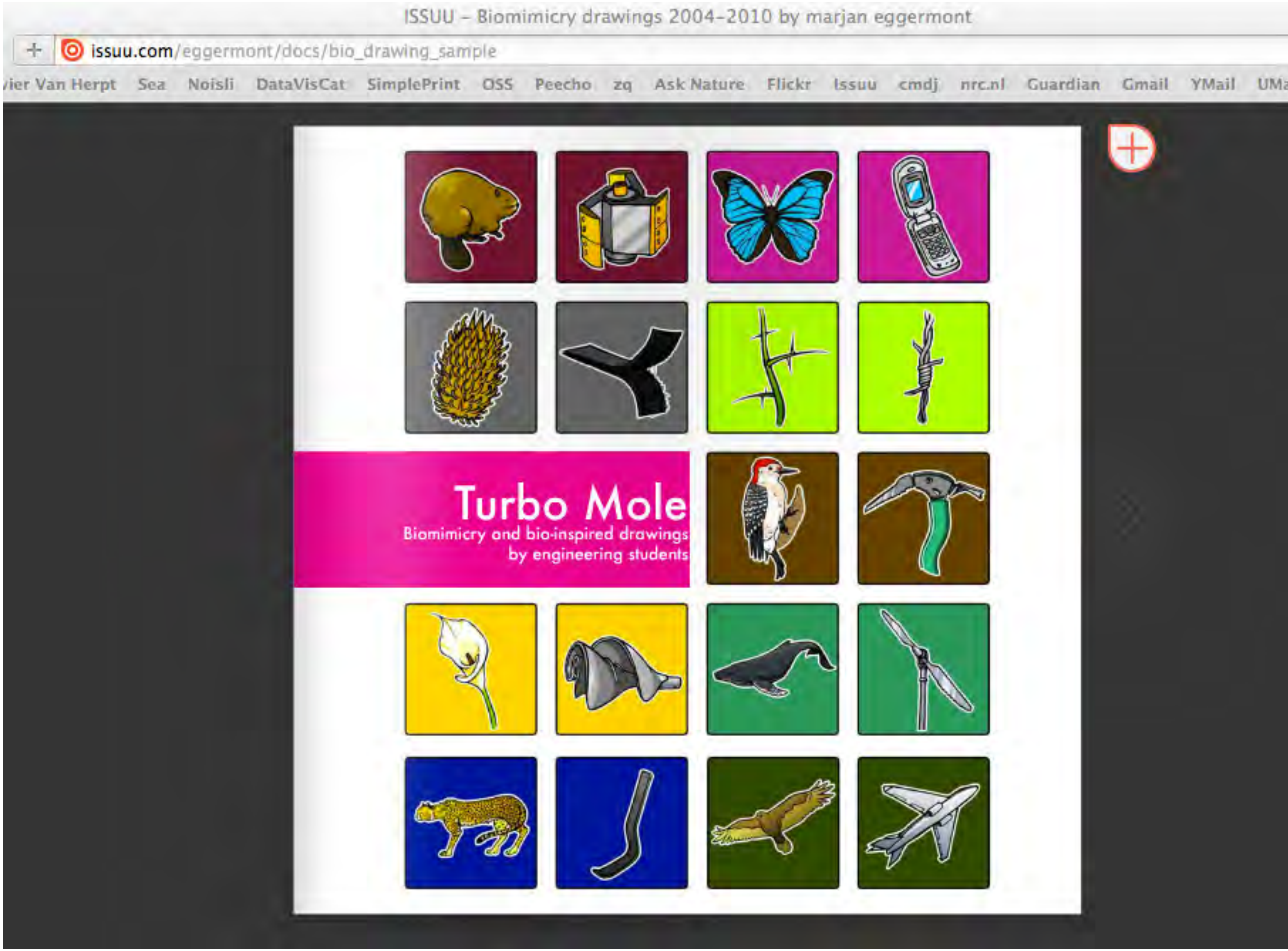
Food Systems 2015

Student Challenge

< Prev Project | Next Project >

POSSIBLE RESOURCES




ISSUU – Biomimicry drawings 2004-2010 by marjan eggermont
issuu.com/eggermont/docs/bio_drawing_sample
ier Van Herpt Sea Noisli DataVisCat SimplePrint OSS Peecho zq Ask Nature Flickr Issuu cmdj nrc.nl Guardian Gmail YMail UMai
Turbo Mole
Biomimicry and bio-inspired drawings
by engineering students

THANK YOU
QUESTIONS?