Earth 351 - *Forming a Habitable Planet* - Fall Quarter 2017

Discovery Missions - Outer Solar System

Region/Body/**Mission**

Trojan Asteroids: Thurs, 10/19

Ajax - characterize the geology, morphology, geophysical properties, and chemistry of a Trojan asteroid

Calvin Anderson, Bogdan Anghel, Clark Skillman, Negatwa Tewodros

Europa: Thurs, 10/26

Europa Ocean - study Europa with an orbiter, characterize ocean, measure ice structure, determine surface activity

Douglas Henry, Bethany Ketchem, Jay Valdillez

Enceladus: Tues, 10/31

ELF - search for life on a habitable moon, fly through plumes, measure, sample collection

Kevin Eisenstein, Eric Van Camp, Gretchen Vogt

Titan: Tues, 10/31

TiME - Titan Mare Explorer lander to measure organics and explore an extra-terrestrial sea

Michael Campbell, Colton Colwell, Jamie Easton, Anna Scarborough

Kuiper Belt: Thurs, 11/2

Whipple - exploring the solar system beyond Neptune to discover the number and sizes of objects in the outer solar system

Wyatt Cook, Mauli Hemani, Sam Remier

Comets: Thurs, 11/2

CoRe - Radar explorer mapping of nucleus of comet Temple 2 to examine composition, properties, surface geology, activity

Reece Elliing, Dajung Geng, Matthew Lees

Paper Draft Due: A week after presentation

Drafts can be submitted for review, allowing for team revision, addition, corrections in response to comments.

Final Paper Due: Final Class, Tuesday, November 21st

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Team Mission Report - Final Paper

Reports due one week after presentation.
Revised reports all due at 3:30PM, Final Class Tuesday, November 21, 2017.

Each team should hand in a final report containing:

- a cover page listing the Team members, and Mission

- a one page abstract explaining your mission, scientific goals, and conclusions

- 5-10 pages of text (12 point) and figures included in the text.

References - author and year - These sources should be cited in the text,
i.e.
"Kirk and Spock (2178) describe silica creatures on Planet X ...".
or
"The silica creatures on Planet X have been described (Kirk and Spock, 2158)..."

Each section should have a title. List who was involved in writing the section.
The text should be written to be clear to non-scientists,
hence technical terms, acronyms and concepts should be clearly explained and,
as appropriate, illustrated.

- a Reference list with full citation in the form:
i.e. "Kirk, J.T. and Spock, Silicon based life, Federation Journal of Astrobiology, 5, 12-56, 2178."
Use peer-reviewed, scientific papers, ones published. (Google Scholar can locate these.)
Minimize use of websites, though citing a NASA or other authoritative site could supplement references.

Drafts submitted before Tuesday, November 7th will be critiqued and returned later that week. The returned draft with comments should be used in crafting your final version, allowing for revision, additions and corrections in response to comments.

Final Mission Report due Tues., November 21st, the last day class meets.
Include a separate page summarizing revisions or response, also the earlier paper draft.

Please submit **TWO** hard copies of the report (*printed on paper*).

EPS 351 Presentations

Challenge:

NASA is interested in pioneering discovery both in space and on our home planet. NASA's mission is to pioneer the future in space exploration, scientific discovery and aeronautics research. One of NASA's central questions about space is "What can we learn there or learn just by trying to get there that will make life better here on Earth?"

Your project partner on this mission is the New Opportunities Center at the NASA Ames Research Center. NASA's Ames Research Center, one of ten NASA field centers, is located in the heart of California's Silicon Valley. The New Opportunities Center is especially interested in understanding how space discoveries, technologies, and innovations can be commercialized to advance life on Earth.

Overview: Your task is to explain

- the key scientific issue motivating the mission you have chosen

- why this is important

- how the mission will address it.

- how could the results advance sustainability on Earth and otherwise benefit humanity?

Oral: The oral version will be a 5-minute presentation, designed to "sell" the mission as THE ONE that should be chosen from among many excellent possible missions. It's the scientific equivalent of a venture capital "elevator pitch."

For good advice, read the attached article.

Your PowerPoint presentation should be in Ignite format in which presenters get 20 slides, which automatically advance every 15 seconds. For advice on Ignite, see

http://sixminutes.dlugan.com/ignite-presentations/

or similar websites.

There's a sample Ignite talk at

https://www.youtube.com/watch?v=AYiWtkeDtdo

To make such a PowerPoint, set up your 20 slides (some can repeat) and then use the "Transitions" tab: unclick "Advance slide on mouse click" , click "After" at

set the time to 15 seconds for all slides

Getting this to work takes practice, so budget the time!

Please email your presentation to us the day before your presention by noon so we can load them.

Written:

The written version should be 5-10 pages, double spaced, including figures and references, in AGU journal format. For a sample, see

http://www.earth.northwestern.edu/people/seth/Texts/mcrevoln.pdf

CAREERS

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F. MAKSYM/SHUTTERSTOCK

COMMUNICATION

Two minutes to impress

With ruthless revision, researchers can compose a punchy 'elevator speech' to sell their science to a neighbour, potential employer or politician.

BY ROBERTA KWOK

In a buzzing exhibition hall at the Moscone Center in San Francisco, California, cell biologist Cecilia Seixas steps in front of a video camera and prepares to sell her science in two minutes or less.

"Hi, my name is Cecilia," says Seixas, a postdoc at the New University of Lisbon's Chronic Diseases Research Center in Portugal. "I am studying how cells assemble an organelle, the cilium, that is like an antenna sticking out of the surface..."

She explains that the cilium acts as a receptor for signals, often needs its parts replaced and can cause diseases when not functioning properly. "Really nice!" says John Fleischman, a science writer at the American Society for Cell Biology (ASCB) in Bethesda, Maryland, who is operating the camera. "And you were 10 seconds short."

Seixas was competing in the ASCB's inaugural Elevator Speech Contest. Brevity is not many scientists' strong suit, but 20 attendees at the society's 2012 annual meeting gamely tried to pitch their research to a hypothetical layperson in the time it takes to travel several floors in a lift. Although Seixas didn't win, she found the competition a useful exercise. "I usually go a little bit longer in my explanation," she says. "I think the system is complex, so I always give more details."

Giving an effective elevator speech is a crucial skill. Aside from fielding questions about their jobs at cocktail parties, researchers may need to summarize their work briefly while interviewing for a position, asking for money, taking a visiting politician on a lab tour or wooing a potential collaborator at a conference. ▶

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Even casual conversations with friends and neighbours can educate about the importance of taxpayer-funded research. "Everybody goes to Thanksgiving dinner and gets seated next to Aunt Kelly, and she goes, 'And what do you do, dear?'" says Fleischman. "You have to be able to explain it without her tearing up in boredom."

But that is a struggle for many scientists. Researchers are notorious for using jargon, spouting streams of facts or becoming so bogged down in the details of their experiments that they forget to mention why they are doing them at all. They sometimes explain their research to lay audiences in the same way as they would to a lab colleague — resulting in a lot of glazed eyes and wrinkled brows.

With thoughtful preparation, however, researchers can compress their work into a few key points. Emphasizing everyday relevance, tailoring the speech to the audience and using simple terms and analogies can turn a garbled, dissertation-length discussion into a punchy two-minute pitch.

HONING THE MESSAGE

One of the most common pitfalls is cramming an overwhelming number of details into the speech. "The biggest challenge for scientists is they suffer the curse of too much knowledge," says Nancy Baron of Santa Barbara, California, who is director of science outreach at COMPASS, an organization that helps scientists to communicate their research. "They've got a bunch of things they want to talk about. But really, at the core of it, if someone has just one moment, what do you want to say?"

Baron suggests thinking about four key topics: the problem, why it matters, potential solutions and the benefits of fixing it. To address these questions concisely, scientists should list all the points that they might want to make, and then winnow them down to the most important ones. At one of Baron's workshops, a scientist who studies jellyfish population trends started by writing a description of his research problem that mentioned how the life stage called a polyp tolerates harsh conditions; the lack of long-term data on population trends; and the complex interactions between factors such as overfishing, eutrophication and aquaculture. But in the end, he kept only his first point: "Humans have degraded marine ecosystems, making them more favourable for jellyfish."

To articulate the purpose of the work, researchers should step back and consider the bigger picture. For example, particle physicists often say that the goal of their research is to measure some property to high precision. "I have to remind them, 'No, no, no, that's not the goal'," says Kurt Riesselmann, head of the office of public information at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. "That's the measurement you want to do. But the goal is that you want to better understand a particle or you want to verify a theory."

Scientists sometimes forget to explain the broader benefits of the work, too. "They talk about the details of the mechanism, but they don't talk about why it matters to other people or how it could improve our lives," says Nancy Blount, assistant director for society communications at the American Chemical Society in Washington DC. For example, most people won't care about research on one step in the synthesis of a molecule. But they do care if a scientist tells them that he or she is working on a drug for Alzheimer's disease, says Blount. Even if practical applications are a long way off, think about how the research might eventually improve health, food, safety, everyday technology or some other aspect of people's lives.

It is important to tailor the speech to the listener. A good sound bite for a visiting politician might be something like, "This research is going to make this community a focal point in nanotechnology," says Richard Fox, a partner at research-commercialization organization Astralis Group in Orlando, Florida, and a judge of a 2011 elevator-pitch contest for the US National Science Foundation's Engineering Research Centers. The head of a conservation organization will want to know how the research helps to preserve biodiversity, whereas a potential employer is looking for information about a scientist's skill set.

"The biggest challenge for scientists is they suffer the curse of too much knowledge."
Nancy Baron

The same goes for conversations about the commercialization potential of the research. An elevator speech to the vice-president "sounds nothing like what you're going to say to the junior engineer", says Fox. Engineers are curious about how the technology works, but executives are seeking a high-level conceptual picture that tells them how they will save money or get an edge on the competition.

It is often best to omit caveats and exceptions, or to mention them only at the end. Scientists can be afraid that other researchers will criticize them for being inaccurate, says Riesselmann. But most of the time, the exception to the rule is not important unless the study focuses on it, he says. Some scientists even make the mistake of leading with caveats, which undermines their credibility and diminishes the listener's interest, says Baron.

NO MUMBO-JUMBO

Deciding what to say is only the first step; sorting out how to say it is just as important. Avoiding technical jargon such as gene names is key. Navneeta Pathak, a cell biologist at the University of California, San Diego, and one of the winners of the ASCB elevator-speech contest, studies cancer metastasis but chose not to use that word in her speech. Instead, she described how tumour cells break away and travel through the blood to other parts of the body.

Some words or phrases that may not seem too technical, such as 'synthesis' or 'mechanism of the reaction', should be avoided because they sound too vague, says Blount. A better phrase would be something like, "I'm looking for a greener way to make this chemical."

Elevator speeches to other scientists can be more technical, but should avoid specialist vocabulary. Non-chemists may know what anions and cations are, but they are unlikely to remember the finer points of the Fischer–Tropsch process. And even biologists may not be familiar with a specific protein or pathway.

Analogies and strong images are effective ways of capturing attention. In her winning elevator speech, Pathak compared a cell structure to a drill bit that pokes holes through blood vessels. Analogies can be helpful in explaining phenomena such as the hard-to-conceptualize invisible subatomic world. For example, Riesselmann recalls an article in the March 2005 issue of *symmetry*, a magazine co-produced by Fermilab, in which a particle physicist wrote that the theory of supersymmetry "describes a grand dance of particles through the universe, but we can currently see only one partner from each pair". Every analogy will have shortcomings, but speakers have to compromise to give the audience a memorable image, says Riesselmann.

Crafting an elevator speech doesn't mean composing it word for word. It is best to jot down bullet points and remain flexible enough to think on one's feet, says Fox. Researchers who do write out a complete oration should not try to memorize and repeat it verbatim, because that can come across as unnatural. It is helpful to practise with family and friends, or to convene a small group of people from different backgrounds to give feedback. Using Twitter is good training in being concise, says Baron.

Energy and body language are important: make eye contact and use natural gestures to convey enthusiasm and draw the listener in, says Blount. Watch for cues, too; if the listener is glazing over, stop and let them ask a question, or bring in details that might pique their interest. Someone talking about work on an Alzheimer's drug, for example, might mention their grandmother's experience with the condition to convey how devastating the symptoms are.

Finally, resist the nervous urge to ramble. The purpose of an elevator speech is to get someone interested, not to tell them everything there is to know. As ASCB contest judge Lynne Cassimeris, a cell biologist at Lehigh University in Bethlehem, Pennsylvania, notes: "They'll ask if they want to know more." ■

Roberta Kwok *is a freelance science writer in Burlingame, California.*

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