How to Explain Your Summer Project to Your Grandmother: Hints for Better Science Communication to a Lay Audience

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Who am I?

• Department of Cell Biology
• Genomics of microbial eukaryotes (animals, fungi, parasites, and algae)
• Evolutionary aspects of the membrane-trafficking system

• Division of Community Engagement
Lay Audience=basically everybody else!

• Lay audience generally means non-scientists
• Understandably a heterogenous bunch
• The skills to talk to a lay audience are the same needed to talk to anyone
• Because the boundaries of “outside your field” are relative
• Lay Audience=Anyone outside your field, however you define it
Why is it important to connect with a lay audience

• It isn’t enough to discovery, if no one else understands what you did=lost discoveries
• People making decisions find it much easier to assess the technical details of your work, if they understand the basic narrative first-funding, cover letters
• Promote science literacy=connecting with future scientists
• Promote science literacy=People making decisions! Government, voters
Why talk to a lay audience?

- The obvious reasons of being able to connect with everyone else who is not a scientist (i.e. your friends, family, random person you met last week).
When would you talk to a lay audience

- First/brief encounters
- Coffee shop debates
- Family dinners

- Information dissemination (doctors/patients, teachers, administrators)
- Classroom visits
- Science Cafes

- Funding applications-lay summary
- Submission Cover letters
- Interviews
3 basic considerations

• Determine your time window

• Identify your audience

• Find common ground
Know your key points

• What are the essential elements that you think need to be conveyed?
  – What is the problem?
  – Why does it matter?
  – What aspect did you address and why does that matter?
  – What did you find?
  – How does that help?
A Eukaryote without a Mitochondrial Organelle

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Highlights

- *Monocercomonoides* sp. is a eukaryotic microorganism with no mitochondria
- The complete absence of mitochondria is a secondary loss, not an ancestral feature
- The essential mitochondrial ISC pathway was replaced by a bacterial SUF system

Summary

The presence of mitochondria and related organelles in every studied eukaryote supports the view that mitochondria are essential cellular components. Here, we report the genome sequence of a microbial eukaryote, the oxymonad *Monocercomonoides* sp., which revealed that this organism lacks all hallmark mitochondrial proteins. Crucially, the mitochondrial iron-sulfur cluster assembly pathway, thought to be conserved in virtually all eukaryotic cells, has been replaced by a cytosolic sulfur mobilization system (SUF) acquired by lateral gene transfer from bacteria. In the context of eukaryotic phylogeny, our data suggest that *Monocercomonoides* is not primitively amitochondrial but has lost the mitochondrion secondarily. This is the first example of a eukaryote lacking any form of a mitochondrion, demonstrating that this organelle is not absolutely essential for the viability of a eukaryotic cell.
Determine your time window

• How long you have to tell your story?
• 30s (about as long as a polite stranger/family member will listen when they ask, “so what are you doing this Summer”)
• 5 minutes (about as long as an already interested person will listen when they ask, “so what are you doing this Summer” - classmate?)
• 20-45 minutes (a talk to a class or an audience)
Time window=scope

- How long do you have to get to the point?
- How far can you go into the background?
- How complex a story can you tell?
The eukaryote with no mitochondrial organelle

• 30s version
  • It is a rule in cell biology that all cells contain mitochondria. That regardless of the form the organelle takes, it CAN NOT be lost.
  • We have found an organism that broke that rule.
  • Because we were able to also figure out how it survives without the organelle and the likely mechanism by which it lost it, this tells us the likely reason that the organelle is essential in all other organisms and it opens the possibilities for finding biology we did not know existed.
If you have the time...

5 minute version=expand on several aspects

• what is a mitochondria and why people think it is essential,

• the fact that organisms have been found with unusual mitochondrial, but ALWAYS found to possess the organelle,

• implications for cell biology, evolutionary biology.

• What techniques were used to search for mitochondria

• more details of how it survives without, how it was lost,

• expand on the implications.
Understand your audience

• Talking to a lay audience is just a special case of the general ‘know your audience’ rule

• Educational background
  – (Scientists outside your field-poster judges, guest lectures at departments)
  – University, high school
  – How much biology do they know?

• Age
  – Completely different talk for nieces and nephews, your same aged cousins and your parents?
Understand your audience

• Interest (why do they care?)
  – Medical, ecological, economic, social

• Background (What do they know?)
  – Popular cultural perspective (references, vocabulary)
Find common ground

• Based on the time frame and your audience, tailor your story to be as easily understood as possible

• How can you use what you know about the audience to help them follow your train of thought?
  – Use the skillset that the audience has to connect to your work
    • eg. if they have biology training you can talk about organisms, cells, proteins, genes. If not then use more vague terms “bugs/microbes, structures, compartments, pieces”
  – How is your work relevant to the motivation of the audience?
    • Different emphasis for an organism without mitochondria depending on whether the audience is interested in evolution or cell biology
Tip 1: Use analogies

• Use the common ground to set up analogies
  
  – “Imagine meeting another human who lacks a heart, lungs or some other crucial organ, and yet seems to be functioning completely normally. An international team of scientists has discovered the single-celled version of this conundrum: a eukaryotic microbe that has lost its mitochondrion, which scientists long thought was essential for these complex cellular organisms.”

  Amina Khan LA Times May13, 2016
Tip 1-Use good analogies!

- Only useful if the people relate to the reference
- Eg: The dangers of extrapolation
  - Like understanding team sports by comparing baseball and cricket=Not helpful if the person you are talking to hates Sports!
  - Could also use motor vehicles,
Tip 2: Simplify but remain accurate

Simplify as much as needed but remain accurate!

This headline came out with the paper, but is actually mis-leading

There have been many microbial eukaryotes that have mitochondria that don’t produce energy

Led to a frustrating and distracting online ‘comment’ thread
Tip 2: Simplify but remain accurate

**Surprise! This eukaryote completely lacks mitochondria**

May 12, 2016

Light micrograph of Monocercomonoides sp. (PA203). Credit: Dr Naoji Yubuki.
Tip 3: If you can make them understand, it is clear you are smart

• Tempting to make yourself sound smart by using jargon = back away from the iTLA!
• Detailed, accurate and totally unhelpful = 454 Pyrosequencing of the genome of the excavate flagellate Monocercomomonoides yields no indication of proteins with an alpha-proteobacterial ancestry or possessing N-terminal signal peptides
Tip 4: Assume an intelligent but naïve audience

• The entire point is to connect and relay information
• Respect and don’t condescend
• They know things, you don’t: the roles could be reversed and may well be next.
What are the essential elements of your project?

- What is the problem?
- Why does it matter?
- What aspect did you address and why does that matter?
- What did you find?
- How does that help?
Practical exercise

• Find someone you don’t know, explain your project in 30 seconds
• What do you need to know about them in order to make for a useful exchange?
Science communication

• You are already doing an important job of a scientist!
• Act as a representative of the scientific community
• People will not remember the details, they will remember the attitude and the way that you approached the question
• Help promote science literacy and encourage non-scientists to base decisions on evidence and logic