Get the most out of your Research

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Workshop

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Motivation for this Presentation

• Increase your familiarity
• Improve your understanding
• Add to your longevity
What does getting the most out of your research mean to YOU
Grade Yourself:

Future research aim is to become highly proficient on the

RUBRIC
Getting ideas from the best

“To steal ideas from one person is plagiarism, to steal ideas from many is research.”

- Humorous quote w/real connotations
Exercise: Who should you know

Write down your major

What are 3 active areas of research

Name 10 highly reputable researchers in your field.

First try this w/o using resources, then use resource like the internet for assistance
Priorities of a Researcher

Creating new Knowledge
Grant Money
Publications
Reputation
Good researchers in the lab
Teaching

Science
Presenting
Travel
Invited Talks
Tenure
Getting the most out of your research

1. Understanding research from a perspective of:
   - Accomplishments
   - Abilities
   - Culture
   - Character
   - Skill Set

1. Then applying the knowledge obtained to gain a competitive advantage that enhances collaborations and easily allows you to navigate paths of anticipated complexity.
Abilities

Getting the most out of your research
ABILITIES

Speaking
Reading
Writing
Designing
Funding
Good scientists talk talk talk talk

The ability to talk well is the single most important ability of a researcher

Research talk includes

- Selling your research
- Effective Presentations
- Elevator speech
- Story telling
- Chalk Talk
Selling your research

Name your topic

• I am studying ……..

Imply your question

• Because I want to find out who/how/why…………..

Set the rational for the question and the project:

• In order to understand how/why what ……………
For an effective talk

• Be optimistic about whatever you are talking about
• Take your time
• Keep your audience in mind
• Connect to real life issue
• Attend Talks
• Look up You Tube Videos
• Look up press releases
MULTIMEDIA


Show room
Swish
RESEARCH RELATED FLASH

PEG (2000) lipid

Depiction of micelle encapsulation
YOUTUBE VIDEO - CSTEP
Getting the most out of your research

MAXIMUM
Give memorable talks at National meetings

MINIMUM
Listen to good talks

To do: Talk with family, friends and acquaintances about your work in a way that gets them excited.

Google good and bad presentations
READING is key to intelligence

- Past
  - Papers
  - Patents
- Present
  - Conference Proceedings
- Future
  - Grants
READING

For Scientific papers:

• Select relevant article (Author, journal)
• Read abstract
• View Figures and read caption
• Read conclusion
• Read paper / check references
• Critique paper/get ideas
Biocompatible Luminescent Silicon Quantum Dots for Imaging of Cancer Cells

Read patents for more details
READING – Conference Proceedings

Ex. ABRCMS, CSTEP, MCNair

-Will be more specified the longer you stay in research
Grants

- NIH
  - http://projectreporter.nih.gov/reporter.cfm
- NSF
Getting the most out of your research

MAXIMUM
Read multiple papers, critique and review relevant literature

MINIMUM
Read a paper

To do: Read literature that is pertinent to your work, critique it
Writing abstract

An abstract is a short summary of your completed research. If done well, it makes the reader want to learn more about your research.

For an abstract – write:

- Motivation/problem statement
- Methods/procedure/approach
- Results/findings/product
- Conclusion/implications
One or two sentences providing a basic introduction to the field, comprehensible to a scientist in any discipline.

Two to three sentences of more detailed background, comprehensible to scientists in related disciplines.

One sentence clearly stating the general problem being addressed by this particular study.

One sentence summarising the main result (with the words "here we show" or their equivalent).

Two or three sentences explaining what the main result reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

One or two sentences to put the results into a more general context.

Two or three sentences to provide a broader perspective, readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (The above example is 190 words without the final section, and 250 words with it).

During cell division, mitotic spindles are assembled by microtubule-based motor proteins\textsuperscript{1-3}. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family\textsuperscript{4}. Hypotheses for bipolar spindle formation include the 'push-pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules\textsuperscript{5,6}. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled in vitro assays that Eg5 has the remarkable capability of simultaneously moving at \( \sim 20 \text{ nm s}^{-1} \) towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at \( \sim 40 \text{ nm s}^{-1} \), comparable to spindle pole separation rates in vivo\textsuperscript{7}. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart inter-polar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated in vitro models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.
Getting the most out of your research

MAXIMUM
Write abstract for a top quality research journal conveys the work and it’s broader impact

MINIMUM
Write what you did

To do: Read abstract templates e.g. nature abstract, rewrite someone else's abstract
WRITING : Picking templates

Templates are used for just about everything one produces
NEVER WORK WITHOUT A TEMPLATE

Finding Templates
Get Paper Templates – Journal websites

Templates
  • Download
  • Recreate
Modify old templates
Recycle
Journal websites

Look for Authors Link
Go to submission and review
You may have to create account
Look for manuscript information
WRITING: getting a grant

Grants are the largest source of science funding. They come from the government, Industry and Academia.

To get grants:
Use a single solid idea
Follow guidelines to the T

Get inside knowledge:
- Write conservatively for Government
- Write risky for private
- Write about fundamentals for large co-operations
NIH Undergraduate Scholarship Program for Individuals from Disadvantaged Backgrounds

INFORMATION AT A GLANCE

The National Institutes of Health (NIH) Undergraduate Scholarship Program offers scholarship awards to students from disadvantaged backgrounds who are committed to careers in biomedical, behavioral and social science health-related research. The program is sponsored by the NIH, one of the world’s foremost centers for biomedical research and research training.

The scholarships pay for tuition and reasonable educational and living expenses up to $20,000 per academic year. In return, recipients are obligated to serve as paid employees in NIH research laboratories during the summer and after graduation. In addition to financial assistance, the scholarship program offers invaluable training and mentoring, as well as practical experience in a state-of-the-art research setting.
Getting the most out of your research

MAXIMUM
Life (Career) time funding from a single source such as the National Institute of Health (NIH)

MINIMUM
(Don’t) Apply

To do: look up grants.gov, NIH grants, NSF grants that are suited to you.
Abilities: design experiments

Planned experiments let you and everyone know where you’re going

Allows you to know the feasibility

- To Design experiments
- Start from paper idea that is publishable
- Sketch required figures
- Understand available equipment
- Watch out for unexpected results
Design Process

• Follow a design process to develop an idea in steps from coarse to fine:

**First Step:** Evaluate the resources that are available

**Second Step:** Carefully study the problem and make sure you have a clear understanding of what needs to be done and what are the constraints (rules, limits)

• Steps 1 & 2 are often interchangeable

**Third Step:** Start by creating possible strategies using words, analysis, and simple diagrams

Imagine possible motions, data flows, and energy flows from start to finish or from finish back to start!


Simple exploratory analysis and experiments can be most enlightening!

Whatever you think of, others will too, so think about how to defeat that about which you think!

**Fourth Step:** Create concepts to implement the best strategies, using words, analysis, and sketches

Use same methods as for strategies, but now start to sketch ideas

Often simple experiments or analysis are done to investigate effectiveness or feasibility

Select and detail the best concept...

**Fifth Step:** Develop modules, using words, analysis, sketches, and solid models

**Sixth Step:** Develop components, using words, detailed analysis, sketches, and solid models

**Seventh Step:** Detailed engineering & manufacturing review

**Eighth Step:** Detailed drawings

**Ninth Step:** Build, test, modify...

**Tenth Step:** Fully document process and create service manuals...

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GET TO KNOW DEBRA

Design

Analyze

Build

Run
Abilities: analyze

- Because you follow a procedure - do not blindly expect it to work
- Use error margin
- Compare to literature and reference values
- View patents of the same publications
Getting the most out of your research

MAXIMUM
Design high quality experiments that others can execute and think is reasonable

MINIMUM
Look up figures in papers to understand experimental design

To do: put your experiments in the context of a design, design a new project, motivate someone
Ability : Scientist draw

A schematic indicating what you think a process is key.

To draw schematics :

View previous images on the concept you want to convey
Notice details you can improve

Tailor image to your preference based on understanding of your project
Draw large and reduce later
Use software like
  • Adobe Products (Photoshop, Fireworks)
  • Chem Draw
SCHEMATIC - development

- Silicon quantum dot
- ethyl undecylenate
- DSEP - PEG phospholipid

hydrophilic head
hydrophobic tail
SCHEMATIC –blurry
SCHEMATIC - DEVELOPMENT

- Silicon quantum dot
- Ethyl undecylenate
- DSPE-PEG phospholipid
- Hydrophilic head
- Hydrophobic tail
Getting the most out of your research

MAXIMUM
Use simulation software / graphic designer to create your graphic and flash animation

MINIMUM
Copy graphic from another

To do : learn how to illustrate concepts
Poster

• Follow the Judges Rubric
• Start by sketching it out
• Use graphics, arrows, and supporting text
• Include white space
• Significance of work, problems addressed and conclusions should be obvious
• Use active voice when writing the text.
• Delete all redundant references and filler phrases
• Self-explanatory graphics should dominate the poster.
• Use san-serif fonts
In Vivo Targeted Cancer Imaging and Lymph Node Mapping with Silicon Nanocrystals

Multidisciplinary Motivation

Silicon Nanocrystals

Cancer

Tumor Targeting

Lymph Node Mapping

Abstract

Quantum dots (QDs) can have size-dependent optical properties that make them uniquely suitable for in vivo targeted fluorescence imaging, biosensor development, and therapy. However, group II-VI QDs contain toxic metals that pose a threat to organisms. To address this, we developed a new technology that uses silicon nanocrystals (Si NCs) as a potential replacement for QDs. Si NCs are highly fluorescent, biocompatible, and easy to produce. In addition, they can be used for targeted imaging and therapy. This technology has potential applications in cancer detection and treatment.

Problem

- How do you make them?
- How do you detect them?
- How do you target them?
- How do you track them?

Data and Conclusions

- Video Presentation
  - Video:硅 can safely be used for cancer imaging applications.

In Vivo Imaging

- Targeted to Pancreatic cancer cells:
  - Figure 7: Targeted delivery of silicon to cancer cells. The transmission image shows the signal from the tumor, and an overlay of the two images is also shown.

- Magnetically guided Silicon QDs:
  - Figure 8: Magnetic control of Silicon QDs with controlled particle uptake and targeting to cancer site.

- Cellular and Live Mouse toxicity
  - Figure 9: Cellular toxicity studies of 600 µg/ml and 500 µg/ml. 600 µg/ml is similar to that of 605 µg/ml, but less toxic than 500 µg/ml.

Conclusions

- Si NCs are as effective as QDs in targeting cancer cells.
- Si NCs are biocompatible and non-toxic.
- Si NCs can be used for in vivo imaging and therapy.
- Future work will focus on optimizing the production and targeting of Si NCs.
San-serif fonts

AaBbCc

Sans-serif font

AaBbCc

Serif font

AaBbCc

Serif font (serifs in red)
Getting the most out of your research

MAXIMUM
Create a great poster by taking advantages of your presenting good work and what you think is appealing
Insert your creativity

MINIMUM
Create a poster with all the basic components

To do: Look up posters on your department walls, create a good poster.
Getting the most out of your research

MAXIMUM
Write your paper in the best template, design high quality poster template

MINIMUM
Google and download templates

To do: Find templates relevant to your work for papers, poster
ABILITIES CONCLUDED

• Talking can lead to reputation suicide – do it well well
• Multimedia is like adding spices to bland food
• Reading contains golden nuggets of info
• Drawing is not only for art majors
• Designing research is key to credit
• Abstracts are your salesman
• Get creative and effective with posters
• Templates reduce work load
QUESTIONS