You need a job (and maybe tenure)

• A job talk
• Conferences and tenure tour

Most science is transmitted orally

• 55% of scientific papers receive no citations within 5 years of publication

Why is Public Speaking Important?

Public Speaking for Scientists & Engineers

Melissa A. Hines, Dept. of Chemistry, Cornell University
Planning a Scientific Presentation

Tell a story, don’t present a report

• Why should anyone care about your work?
• Plan your take-home message first

Know your audience

• Never overestimate your audience (or their attention span)
• Aim your presentation at the median person, not the expert
Doing Science

No stone left unturned
No idea left untested
Every possibility considered
In science, the credit goes to the man who convinces the world, not to the man to whom the idea first occurs.

—Sir William Osler
Doing Science
No stone left unturned
No idea left untested
Every possibility considered

Presenting Science
Tom Robinson is innocent.
Here is the evidence...

Captive audience: Watson
Fickle Audience: Jury
The Structure of the Talk

- **Introduction (and title)**

  Most important slide (everyone is paying attention)
  Give the big picture
  Must pass the “grandmother test”
  Should introduce the take-home message
In Search of Perfection:
The quest for atomically flat silicon and the mechanism of silicon oxidation
Melissa A. Hines, Dept. of Chemistry, Cornell University

Technological Question
Can Si(100) be made atomically flat? (Perfect Etching)

Long-Term Vision
Make transistors with chem/bio functionality? (Precise Chemistry)

MOSFET (Field-effect transistor)

Si(100)

Simple chemistry can be extraordinarily (atomically) precise!
The Structure of the Talk

- Introduction (and title)
- Outline of talk
The Odyssey (starring Odysseus)

Homer, Poet in Transit

- Finish Trojan war
- Travel for 10 years
  - Visit Lotus Eaters
  - Blind the Cyclops
  - Shack up with Circe
  - Pass between Scylla and Charibdis
  - Listen to Sirens
- Return to Ithaca
  - Kill wife’s suitors
  - Live happily ever after
The Structure of the Talk

- Introduction (and title)
- Outline of talk
- Experimental/Computational

Keep it simple!

Photos are rarely helpful
The Chemistry of Etching: An Atomic Scale View

Experimental:

- steady state morphology
- Use pictures of etched surface to understand chemistry

UHV STM
The Structure of the Talk

- Introduction (and title)
- Experimental/Computational
- Body

  Tell a story, don’t give a report

  Logical, not chronological, order

  A series of questions and answers is effective

  \textit{No detective stories!}
Typical Structure of the Body

Experiment #1
(e.g. Synthesis)
Results of #1
Conclusion from #1

Question raised by #1

Experiment #2
(e.g. Characterization)
Results of #2
Conclusion from #2

Question raised by #2

Experiment #3
(e.g. Testing)
Results of #3
Conclusion from #3

To Conclusions
Typical Structure of a “Body” Slide
The Structure of the Talk

- Introduction (and title)
- Experimental/Computational
- Body
- Conclusions & Acknowledgments

Keep it simple! Reiterate take-home message
Out of time: Let the audience read
Conclusions

- STM and simulations yield quantitative information on defect site reactivity
  - NH₄F etching consistent with pentavalent transition state
  - O₂ preferentially inserts into steps. No evidence of radical anion mechanism.

- Orientation-resolved kinetic studies offer new insights into etching

Acknowledgments

Yi-Chiau Huang
Jaroslav Flidr
Theresa A. Newton

Rikard A. Wind
Simon P. Garcia
Hailing Bao

National Science Foundation
Cornell Center for Materials Research
Cornell Nanofabrication Facility
Petroleum Research Fund
Handling Questions

• Make sure you understand the question
  If necessary, repeat or rephrase the question

• Keep your answer short and to the point
  Don’t be arrogant or hostile

• Useful answers for awkward situations
  “That’s an interesting point. I’ll have to think about it.”
  “Maybe we should discuss this off-line.”

• Watch out for ringers
**The Intangibles**

**Presentation style is important**
- Speak firmly, slowly, and confidently
- Look at the audience
- Learn to use pointer, clicker, & microphone

**Expect the unexpected**
- Use your own laptop if possible
- Check equipment right before the talk
- Bring back-up media and pointer

**Practice! Practice! Practice!**
Planning your slides

Timing is critical!
- Going overtime is rude
- A seriously undertime talk is embarrassing

Rule of Thumb: 1.5 minutes per slide
- Conclusions & acknowledgments somewhat less
- Going faster will annoy the audience

Only one concept (or experiment) per slide
A good slide speaks for itself

- Informative title and self-contained content
- Short phrases, not complete sentences
- No garish or gratuitous colors
- Conclusion and/or question at bottom
The images show that the dislocation spacing depends sensitively on the angle. Note that the 0.4° sample is not as periodic as the 0.9° sample.
Small angle buried dislocations imaged by TEM

Increasing twist angle leads to decreasing spacing.

Too busy! Improve with animation.

Increasing Dislocation Spacing

Increasing twist angle leads to decreasing spacing.
Small Angle Buried Dislocations imaged by TEM

Increasing twist angle leads to decreasing spacing
Potential Applications for Nanomechanical Resonators

Chemical and Biological Sensors

Minaturized and Ultralow Power Devices

New Science

Problem: Advances limited by poor performance of nanomechanical devices
The Nuts and Bolts

Two choices for slide background

- **Dark solid color (black, dark blue, …)**
  
  High contrast for gray-scale images

  Problems: All graphs must be redesigned or presented on white square

  Difficult to match colors between programs (except black & white)

- **Light solid color (white …)**
  
  Can use images prepared for journal directly

  Can give others your slides easily
The Nuts and Bolts

• **Size matters!**
  • Big type is important (This is Helvetica 24)
  • Everything on slide must be legible
  • Use the 8' test

Legible at 8 feet?
The Nuts and Bolts

• Size is important

• Font is important

  Use a font designed for headlines/labels
Fonts are Serious Business

There are two general classes of fonts:

**Legible Fonts**

Legibility: Ease of character recognition

**Readable Fonts**

Readability: Ease of reading large blocks of text (i.e. paragraphs)

There are two general classes of fonts.

Use a sans serif font!
Font Color is also Important
The Nuts and Bolts

- Large, bold san serif font
- Choose colors to maximize contrast
  
  Best: Black text on white
  Dark color on white OK
  White text on black OK
  Avoid colored text on colored background
- Use contrast and size to prioritize information
What is wrong with this graph?
Improved Presentation of Data

- Frequency (MHz) vs. Etch Time (min)
- Paddle Width:
  - 2.5 \( \mu \)m
  - 4.0 \( \mu \)m
  - 5.5 \( \mu \)m
  - 7.0 \( \mu \)m
Making Annotations Stand Out

A thin line (or "stroke") around text makes it stand out against a busy background.
Presenting Equations

Rule #1: Don’t do it!

Rule #2: There is no rule #2.

Alternatives: Show a graph of the equation

Sketch the physical concept

\[
\frac{dC}{dt} = k_1 \left[ A \right] \left[ B \right] - k_2 \left[ C \right]
\]

Rxn rate
production of \( C \) from \( A \) and \( B \)
spontaneous rxn of \( C \) to form \( D \)

If you must, then clearly label parts of eqn
Some Closing Thoughts

• Practice your talk out loud

• Practice your talk on friends
  Catch typos, missing labels, & inconsistencies
  Recruit outside your group
  Ask to speak at an outside group meeting

Solicit (and give!) honest, constructive criticism

  Tough criticism from a friend is better than not getting the job