Learning Objectives

• 1. Understand general principles for giving clear presentations, including strategies for organizing presentation slides

• 2. General guidelines for writing up research results for publication, and understanding the manuscript review process

• 3. Understand the general categories of research funding sources and the grant review process
I. Giving Effective Presentations

- General presentation principles
- Organizing your thoughts for presentation
- Strategies for presentation slides

“I’ll pause for a moment so you can let this information sink in”
Goals Of A Scientific Presentation

• Present your results in a clear and memorable fashion that engages your audience

• Helps you re-frame or organize your work in a new perspective
Focus The Message

- First, actually have a message
  - The “five sentence elevator pitch”: Can you tell your story in five sentences in an elevator ride?
  - Ideally, remember to state the hypothesis being tested and your conclusion
- Second, know your audience
  - Your grandparents
  - A TV reporter
  - Bright but uninformed undergraduate
  - Researcher in a related field
- Finally, answer the question: “Why should I care?”
Types of Presentations

- There are different scientific presentations and settings, each with slightly different aims
  - Poster
    - Personal engagement, networking
  - Research talk to specialized group
    - Communication and collaboration
  - Workshop or short talk
    - A new piece in the puzzle
  - Plenary session talk
    - Overview of a big story
  - Community outreach explainer
    - Science education
Poster Presentations

- **Goals**
  - Having a story that is clear and easy to explain in a few short sentences
  - Having a poster with a clear logical progression and items that can be seen from a distance
  - Attracting a crowd to drive discussion
The main elements should be readable from a distance.

Ideally, that includes a title that helps describe the study and conclusion, a brief abstract, explanatory diagrams, and bullet point conclusions.
PRESENTING a Poster

- That means **not** just standing there like a wallflower waiting to be asked to dance. Engage passers-by and tell them about your poster!! Show that you are excited to tell them!
- As with any presentation – PRACTICE your talk with a brief overview with hypothesis and conclusions (five sentence elevator pitch!)
  - Anticipate questions
  - Know the context and experimental details
- Have business cards at hand (no matter what your level) – this is networking building time!
Platform Presentations

• Workshop or short talk (10-15 min)
  • Audience should already be familiar with the topic, so give VERY brief introduction to significance
  • Keep it direct and go directly to hypothesis and conclusions, with minimal detail on methods

• Research talk to specialized group (30-45 min)
  • The audience may be familiar with the work but more detail on background and use of your experimental models, etc. is helpful
  • Focus should still be on latest result(s) and significance

• Plenary session talk (45-60 min)
  • Though very rarely for late breaking big discoveries, is it usually for an Overview of Your Big Research Story
  • However, ideally there should still be a single simple take home story – something to go back and tell their colleagues
Community Outreach Explainer

• The truest test of your understanding of your own work!!
• Your audience may be lay persons with minimal medical or science background or scientists in a different field
  • Most people just want basic education and information, not confusing scientific debates, so hypothesis testing is sometimes less prominent here
    • (e.g., “do vaccines cause autism?”)
• In many cases, you may also have to overcome serious misinformation and prejudices
• Consider your role as educator (as all doctors should be)

• SIMPLIFY – but do not mislead
Most people have some familiarity with a few basic terms, but not a sophisticated understanding of the details.

Small digestible nuggets of information!!

Practical information that relates to real life experience
Slide Shows and Sound Bites

- Powerpoint slide shows help enforce the
  
  **“one slide, one concept” rule**
  
  - Each slide should focus on one point
  - The title of the slide emphasizes the point
  - Figures should have labels to explain
  - Try to avoid cluttering the slide with excessive text that you simply read out loud;
    
    **Your audience can read faster than you can talk**
  - Aim for one minute per slide;
    A ten minute talk should have no more than ten slides
Toll-like Receptors

- TLR1-10 in humans
- Heterodimers for precise recognition
- Recognition domains built from leucine-rich repeats (LRR)
- Recognize PAMPs both inside (nucleic acids) and outside the cells (e.g., PGN)
- TLR expression on many different cell types
- TLR distribution can be apical, basolateral, cytoplasmic
- Complex transduction pathways
- Recognize a wide range of pathogens
- Elicit antibacterial, antifungal and antiviral responses

TLR1 (with TLR2)
- Triacyl lipopeptides (Bacteria, mycobacteria)
- Soluble factors (Neisseria meningitidis)

TLR2
- Peptidoglycan (Gram+ bacteria)
- Lipoteichoic acid (Gram+ bacteria)
- Lipoarabinomannan (Mycobacteria)
- Glycolipids (Treponema maltophilum)
- Porins (Neisseria)
- Zymosan (Fungi)

TLR3
- Double-stranded RNA (Viruses)

TLR4
- LPS (Gram- bacteria)
- Fusion protein (RSV)
- Envelope protein (MMTV)

TLR5
- Flagellin (Bacteria)
- Lipoteichoic acid (Gram+ bacteria)
- Zymosan (Fungi)

TLR6 (with Flagellin)
- Lipoteichoic acid (Mycoplasma)

TLR7
- Imidazoquinoline (Synthetic)
- Single-stranded RNA (Viruses)

TLR8
- Imidazoquinoline (Synthetic)
- Single-stranded RNA (Viruses)

TLR9
- CpG-containing DNA (Bacteria and viruses)
Skin gamma-delta T cells regulate tissue homeostasis through production of growth factors Insulin-like Growth Factor (IGF)-1, Keratinocyte Growth Factor (KGF).

Tissue damage induces growth factor production, which in turn promotes healing.
Presenting Statistical Data

• Showing the absence of statistically significant effects can be just as important as showing significant P values.
• Especially important here to avoid clutter.
  • What comparisons are most relevant?
Presenting Statistical Data

- When there are multiple data points and sets, make it clear what comparisons are most relevant.

(Puntambekar et al.)

(Neuronal number microglia/macroglia of Trem2 KO)

(Otani et al.)
Self-Explanatory Data Figures

- Simple repetition of elements is less confusing to the eye
- Color helps highlight distinct features
- Simple labels provide explanation

Ideally, a data image explains itself, leaving you time to discuss the actual results and implications. You can do this with brief text, and arrows and lines help point to critical data.
Toward More Effective Scientific Presentations: SIMPLICITY

• Even the most sophisticated audience doesn’t know the topic as well as you do; avoid jargon and easy acronyms
  • e.g., MHC could be
    • Major Histocompatibility Complex
    • Myosin Heavy Chain
    • Managed Health Care, etc.
• Do NOT show extra data or additional topics just to show off -- It confuses the audience and distracts
• Aim high to your lowest audience – The most effective presentation is clear to even the most novice in the room
  • Judge your success by the number of questions from the audience!
Presentation Pointers

- Practice, practice, practice
  - Use a stopwatch to track your timing
  - If possible use “Presenter Tools”

- When you get to the end, STOP!!

- Ideally,
  - Your talk should begin by telling what you are going to tell them
  - You should then tell them CLEARLY what you promised to tell them
  - You should end by repeating or summarizing what you just told them
Another Useful Point

- The best presentations convey a sense of your own excitement and interest in the subject!
II. Preparing the Paper by Preparing Your Research

“A I h a v e h a d m y r e s u l t s f o r a l o n g t i m e : b u t I d o n o t y e t k n o w h o w I a m t o a r r i v e a t t h e m . ”  -- Carl Friedrich Gauss

- A good scientific paper is not simply a report on random data accumulated over a sufficient period of time; it should have a plan.
- So even if you do not yet know the answer to the ‘experimental test of your overall hypothesis’, you should still have a framework:
  - what kind of question you are asking
  - what kind of answer you will have
When To Write Up Your Results

• The Big Story versus Salami Slicing
• First To Report versus Confirm And Extend

• The Publish Or Perish Imperative
  • Grant application
  • Tenure decision
  • PhD defense
  • Making your mark in the field
General Guidelines

- The work should be more than just an initial novel observation
  - It should seek to explain a phenomenon or elucidate a specific mechanism as completely as possible
- It should use several different experimental approaches to confirm or explain the finding
- The conclusions reached by the study should comprise a significant advance in the field rather than simply confirming what is known

- It is NOT simply a collection of bits of data with no clear organization or story
Assembling The Manuscript: One Suggested Strategy

• Start with a great title that gives the punch line

• Write a complete abstract that tells a complete, self-contained story (format often dictated by the journal)

• Put together all data figures and figure legends in sequence to match your telling of the story

• Methods: be sure all the details are there

• Write the text; the Introduction should focus only on the question at hand and not the whole field

• Write the Discussion

• Review and revise many times for CLARITY
Immunize Yourself Against A Few Unfortunate Ethics Issues

• Authorship
  • Journals often require a statement describing the contributions of authors
    • Gratuitous authorships are discouraged
  • Earning authorship includes significant intellectual contribution, and ability to vouch for the integrity of the data
    • Does that include
      • a lab technician
      • undergrad helper
      • paid contract service provider
      • Chair of the department
  • Authorships should be agreed upon early
    • Does it matter where you are on the author list?
      • (Is the number of papers more important?)
Immunize Yourself Against A Few Unfortunate Ethics Issues

- **Conflict of Interest**
  - All journals require a statement to disclose authors’ financial interests that may affect the scientists’ objectivity in the research
  - Conflict of interest arises when an author or family member has a significant financial interest in the topic being studied (e.g., ownership of a potential drug therapy, equity stake in a company doing the work, consulting arrangements, etc.)
  - [Note that disclosure does not address the financial or career interest of the scientist applying for research funds from the NIH etc.]
  - Disclosure does NOT prevent bias, and only shines a light on sources of potential bias
Manuscript Review Process

1. Journals have an Editorial Board or Associate Editors that are responsible for review
   • Incoming articles are assigned to two or more referees, often suggested by the authors
2. Reviews are returned with a critique for the authors and confidential comments to the editors
   • Secondary checklists address impact, appropriateness for the journal, urgency
   • Usually, comments request revisions (text, or data) for possible resubmission
3. Resubmitted manuscript must provide a letter with a point-by-point response to the critique and the revised manuscript
4. Final decision is made by an editor
Getting Your Paper Accepted (or Not)

• If you get rejected, maybe you targeted the wrong journal. Reset and try again.

• **Common reasons for rejection**
  • Topic lacks broad significance or high impact
    • (Trends; Generally from high impact journals)
  • Topic or conclusions not sufficiently novel
    • (What is truly novel? Scholarship issue)
  • Data/methods not up to contemporary standards
    • (Keeping up with scientific trends)
  • Not convincing
    • (Salami slicing/minimal preliminary correlation)
  • Poor presentation
    • (Confusing text and figures)
Getting Your Paper Accepted

- If you targeted the right journal and actually got a review, you’re on the right track
  - Do your best to answer all concerns
  - Do all reasonable experiments requested
  - A chance to review the clarity of the writing
- Write a very cordial response letter with a point by point answer to every criticism
  - The objective is to get the paper accepted, so “the reviewer is always right”
Some Thoughts On Publication

• What we do is science; if we fail to communicate our results by publication, it is as if we never did the work
  • “In Science the credit goes to the man who convinces the world, not to the man to whom the idea first occurred.”
    Sir Francis Darwin
• Publications are the “coin of the realm” so nearly all your work should be organized with careful thought toward the next paper
• Continued productivity is far more valuable than the “flash-in-the-pan” single Nature or NEJM paper
  • Corollary: Each paper should be viewed as a chapter in a larger story. The next goal is the big picture overview – Review Article!!
III. FUNDING!!!

- Funding sources
- Choosing a topic and writing the proposal
- The grant review process

"Well, we got the grant"
Diverse Funding Sources

- **National Institutes of Health**: By far the largest source of federal funding - $30B per year
- **Department of Defense**: Research to benefit the military or national defense
- **National Science Foundation**: Basic science, not biomedical
- **State and local sources**: Can be to stimulate industry development or disease research (e.g., CIRM)
- **Disease foundations**: Funding to benefit specific diseases or goals (e.g., T1D, MS, IBD)
  - Some very large foundations (Wellcome Trust, Gates Foundation, HHMI)
- **Biotech and Pharma**: Collaborative projects to aid drug development including clinical trials
Funding Comes With A Constituency!

- Congress mandates each of the NIH institutes based on constituents (people with the disease):
  - National Cancer Institute
  - National Institute on Aging
  - Eunice Kennedy Shriver National Institute of Child Health and Human Development
  - National Institute on Deafness and Other Communication Disorders

- Even more obvious with disease foundations!
  - Juvenile Diabetes Foundation, Multiple Sclerosis Society, etc. were founded and are run by families of patients
When To Submit A Proposal

• Proposals can be “Investigator Initiated”
  • Starting from an idea you had been working on
• Proposals can be in response to a published solicitation
  • Program Officers write these in response to new science or trending topics in the field
• “Program Announcement” – general topics or themes of interest to an NIH institute or disease foundation
• “Request for Applications” – the agency publishes a topic that needs research attention, and asks for applications to research this topic
• The RFA generally has a specific application deadline, and is reviewed by a panel of medical and research specialists (and sometimes patient advocates)
Who Qualifies For Funding?

- Research grants generally go to individuals with “independent positions”
  - Tenure-track faculty
  - Research Faculty, “Senior Research Assoc”
  - Large projects (center, program project) often expect additional experience
- Career development awards: set aside for new “independent” faculty (e.g., “K” series for clinicians)
- Postdoctoral fellowships
  - NIH, Disease foundations
- Predoctoral fellowships: support PhD students
Picking The Topic Of Your Grant

• Go with what you know!
  • ORIGINALITY/INNOVATION: Original ideas are always possible
  • FEASIBILITY/INVESTIGATOR: The expertise you have acquired to this point in knowledge and methods is preparation
  • SIGNIFICANCE/IMPACT: What are the important unanswered questions in your field
  • What are your scientific and career goals

“You don’t seem to understand, Prescott. We’re not trying to cure diseases occurring only in guinea pigs”
Organizing And Writing The Proposal

• The central working hypothesis is always first
  • The proposed work should be designed to test the working hypothesis
  • The work should remain tightly focused on this and not be distracted or diffused by all the things you can do on related topics
• Nearly all proposals have this structure:
  • Specific aims
  • Background and Significance
  • Preliminary Studies
  • Experimental Design
Specific Aims

- The Specific Aims page defines the proposal
  1. It briefly states the background problem
  2. It describes the working hypothesis
  3. It lists the goals of the proposed work
  4. It mentions the methods to be used
  5. It should establish predicted outcomes
- Remember the five sentence elevator talk?
Background and Significance

• Background and Significance
  • Establishes the importance of the unsolved problem – why should we care?
  • Does the leg work of finding all the previous relevant work to date and summarizing
  • Establishes your understanding of the field

• Preliminary Studies
  • Does NOT show off all the things you can do
  • Provides a brief, clear overview of relevant data from your lab that points to
    • Feasibility of proposed work
    • Likely outcome and conclusions of proposed studies
Experimental Design

• This section provides a clear, cohesive plan to test the **WORKING HYPOTHESIS** using well defined experiments with established methods
  • Note emphasis on Hypothesis Testing
  • Well designed Specific Aims are critical for a successful detailed plan: It should be logical, often organized in fine detail as follows:
    • Sub-aim description of specific question
    • Experiments with significant detail
    • Expected results and conclusions
    • Alternative approaches if primary plan fails
  • The proposal ends with a timeline to show a clear understanding of the scale of the work involved
Outline of A Simple Proposal

• Aim 1. Calculate whether Entropy can be reversed
  • Using Computational Systems Analysis of biological models in which organizational principles violate the second law of thermodynamics, we will identify pathways toward induction of anti-entropic fields
    • Implications of these studies will predict the feasibility of a cyclic universe. More immediate practical applications include the construction of telekinetic devices for repositioning of human and planetary bodies.

• Aim 2. Apply findings to models of universe formation
  • Using higher order neurological network systems, generate small scale anti-entropic field
  • Building on small scale anti-entropic field, generate a new universe
    • Implications of these studies will be a practical means of producing novel deities; e.g., “Let there be light!”
Grant Review (NIH): Behind The Curtain

- Five criteria used in reviewing NIH grants (not all equal weight)
  - **Significance**
    - For the NIH, usually means potential **clinical impact**
  - **Approach** (the main event!)
    - Preliminary results – do they justify the proposed studies, and indicate feasibility
    - Detailed experimental design – are the experiments testing the hypothesis, and are they feasible
  - **Innovation**
    - Are novel methods used; is hypothesis innovative (trendy?)
  - **Investigator**
    - Is the investigator’s experience and training adequate to perform the proposed experiments
  - **Environment**
    - Are institutional and lab resources appropriate
Grant Review (NIH): Behind The Curtain

- The Study Section meeting – in person
  - Critiques and preliminary scores are filed in advance. Grants are reviewed in order from best preliminary score (low # - 1) to worst (high # - 9)
  - The primary reviewer presents an overview of the proposal, strengths and weaknesses
  - Secondary and tertiary reviewers add their comments, the merits are debated by all
  - Each member records final score based on the general discussion; scores are averaged

- Grants do best when a referee decides to be an active advocate of the proposal
- Grants do worse when discussion gets into too many details
The challenge

- You might not get funded the first time; presently, only the top 10% (or less!) get funded
- You now get multiple chances to revise and resubmit
  - Revisions should be handled the same way we discussed for journal articles
    - don’t fight, try to understand the criticism and respond to the wisdom of the referees
- Top grants often benefit from big name reputations and latest fashion trends
  - But timely topics and high impact count for a lot
- Attending scientific meetings helps you keep up on latest trends, and also to build your reputation
Keep Hope Alive

- New investigators get a small boost in scores, funding paylines
- Some foundations give small grants to help people get preliminary results for NIH grants
  - New faculty start-up funds also help with that
- K awards (mentored development) can help get new clinicians started in research careers