Give a “Good” Research Talk
with a bit of bioinformatics flavor

Ying Xu
Biochemistry and Molecular Biology Department, and
Institute of Bioinformatics
University of Georgia
http://csbl.bmb.uga.edu
Give a Good Research Talk

• A research talk should include the following components
  – define the problem you want to solve
  – provide motivation of why to solve it
  – present your solution
  – convince the audience that your solution is good
  – summarize your contribution

• ..... why some people give good talks while others give boring or even bad talks?
Give a Good Research Talk

• Giving a good talk is an art; it takes practice but there are some rules we can follow
  – to accomplish what we intend to achieve
  – to keep our audience interested
Goal of This Talk

• Help young scientists to better prepare and present research talks by
  – explaining some of the “rules” through examples
Outline of the Talk

• Set goals you want to accomplish through your talk
• Know who your audience is
• Design your talk to accomplish your goals
• Present your talk
• Things you should or should not do
• Answer questions
Set Goals for Your Talk

• Before you start preparing, ask yourself the question

“What do I hope to accomplish through this talk?”

- Just want to present a clear talk about what I have done
- Show that I have solved a challenging open problem ….. so I am technically strong
- Show that I have methodically solved a messy and complex problem ….. so I am good at handling large projects
- Show that I have drilled deep into a problem and published ten papers ….. so I am a deep thinker and productive
Set Goals for Your Talk

- There are different types of talks so prepare accordingly
  - interview talk
  - conference talk
  - project report talk
  - journal club talk
  - .....  
  - introductory bioinformatics talk to laypeople
The goal is to convince the employer to hire you by showing your good features, including technical and personal ones.

If interviewing for a faculty position, you want to show:

- You do good science, hopefully in an area that is fundable
- You have both breadth and depth technically
- You are productive
- You know the big picture of the field with a vision
- You present things well: clear, convincing and easy to follow
- You have experience in writing papers, grants, reviews
The goal is to show

- you have made a great contribution to science by having solved an interesting and challenging problem
- your solution is correct, and can benefit others’ research
- interested in collaborating with others
- ......
- plus a hidden agenda: to impress the editor-in-chief of Journal X in the audience so my next paper ........
When giving an introductory bioinformatics talk to, say, college freshmen, you want to:

- To explain to students an emerging field by:
  - giving an example to show how computation can help to solve biology problem (gene finding is my favorite), using simple language
  - extrapolating the idea to other examples to illustrate some general principles, e.g., computation can help speed up biology research
  - showing real examples of what computation has done to biology, e.g., identifying a gene responsible for a disease

- The hidden goal: attract them to study bioinformatics in your lab
Set Goals for Your Talk

• Define clearly what you want to accomplish
  - keep the audience awake and get your technical points across, as the minimum goal
  - additional goals can be achieved through careful design

• Design your talk to best accomplish your goals
Know Who Your Audience Is

• You will lose the audience quickly if did not prepare the talk according to their knowledge level
  - avoid using terminology the audience does not understand
  - avoid repeating things your audience already knew
  - avoid going too deep too quickly for them to follow

• Example I: Poincaré conjecture
  - In mathematical term: every simply connected closed three-manifold is homeomorphic to the three-sphere

  - Using layman’s language: for a three-dimensional object, if every loop on its surface can be shrunken to a point, then it is a (deformed) three-D sphere
Know Who Your Audience Is

• Example II: protein threading

- To a structural biologist: find a sequence-structure alignment between a target sequence and its native-like fold in PDB to minimize energy:
  \[ E_p + E_s + E_g \]

- An advanced version: threading with side-chains – find a sequence-structure alignment and placement of side-chains to minimize energy:
  \[ E_p + E_s + E_g + E_{sd} \]

MTYKLILN .... NGVDGEWTYTE
Know Who Your Audience Is

- To a layperson: put a row of people on different stairs of a stairway, keeping the sequential order and allowing gaps; some people like to be close to each other while others dislike that
  
  • measure the degree of (dis)liking between each pair of people using a distance-dependent function
  
  • put people on the stairs so the total degree of disliking is minimized
Know Who Your Audience Is

- two versions of the problem
  - a person’s arms cannot move
  - a person’s arms can be in any position
Know Who Your Audience Is

- Consider adjusting the focus of your talk, depending who your audience is

- Example: giving a bioinformatics talk to
  - A. computational scientists, you want to focus on
    - biology background so the audience knows why your problem is important
    - how you have formulated a biology problem as a computational one
    - how your methods have solved an important biology problem, better than previous ones
    - how you have avoided high-computational complexity, by taking advantage of special biological insights you have
Know Who Your Audience Is

Avoid a situation: a computer scientist shouts in audience “I can solve the same problem” … only if he/she knew the biology – your talk should let him/her understand that clearly.
Know Who Your Audience Is

- B. biologists, you want to focus on
  - the biology problem you try to solve and the background – make sure that your audience is convinced that you know biology
  - how previous methods are inadequate for solving the problem
  - the technique you used, at a conceptual level
  - why your advanced technique can solve the problem better than using simple methods
  - your method can be used to solve other problems, particularly the ones relevant to the audience

You want to maximize the positive contrast between your strength and that of the audience, without losing them.
Know Who Your Audience Is

• Should make up for the deficiency of audience by providing basics so they can follow the idea of your talk

• To computational scientists
  - cell
  - genome
  - genes
  - proteins
  - pathways
  - ...

• To biologists
  - use examples to illustrate key ideas of your algorithm
    • branch-and-bound
    • linear programming
    • support vector machine
    • ........
Prepare Your Talk

Now I know what to talk about and at what technical level. Tell me how to put the talk together, or even better do the talk for me.
Prepare Your Talk

- Giving a talk is like telling a story; should design the structure of the story that is most interesting to the audience.

- Example: telling a story about mountain climbing in two ways.
  - One way
    - goal is to climb to top of mountain X
    - here is the planned route
    - at point A, used strategy $a$ and tool kit \{Aa\}
    - at point B, used strategy $b$ and tool kit \{Bb\}
    - ...
    - made it to top five minutes faster than the best time before
Prepare Your Talk

- Another way
  - the goal is to see the view on top of mountain X
  - have selected a particular route, because of a, b, c
  - along the way, need to overcome five major obstacles
  - e.g. have to use technique Y to overcome A
  - the view at A is great: the scenery, the monkey, the airplane
  - at top, the view is spectacular; and we got there faster than other folks
Design Your Talk

- Don’t let your goals and brilliant ideas get buried in technical details so the audience could not see
Design Your Talk

• For any research talk, we need to
  – explain what we have done
  – explain why we do it
  – convince our audience that we did a good job
  – keep our audience interested (or entertained)

• So need to design the structure of our talk accordingly!
Design Your Talk

- First let your audience know briefly what you are going to tell them
- Set the background so your audience know the big picture in which your specific accomplishment is made (why)
- Define your specific goals clearly
- Lay out technical challenges you need to overcome
- Present your overall idea for solving the problem
- Highlight some techniques used in your solution
Design Your Talk

- **Use examples** to explain complex ideas/techniques so your audience can follow at conceptual level.

- Only give technical description after you show basic ideas at conceptual level and when you have to.

- Present validation of your solution to convince your audience.

- Demonstrate the usefulness of your work.

- Conclude with thoughts that can provoke your audience to think.

- Never forget to acknowledge where acknowledgment is due.
Prepare Your Talk

• A design template

<table>
<thead>
<tr>
<th>problem definition and background</th>
<th>your contribution and methods</th>
<th>conclusion and future research</th>
</tr>
</thead>
<tbody>
<tr>
<td>conceptual level</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Things You Want to Pay Attention

• Conceptual clarity
  - try to decompose complex concepts/issues
    • e.g., presenting a complex algorithm using a two level presentation, one at high level and one at detailed level
  - avoid mixing things that do not belong together
    • a common mistake: mixing “how” and “why”
    • e.g., here is a procedure for solving problem X; in the middle of the procedure, discus why you do Y
Things You Want to Pay Attention

• Big picture *versus* technical details
  - avoid putting too much emphasis on technical details
    - talks are for providing ideas while papers give details
  - a common mistake: don’t show (see) the forest for the trees
Things You Want to Pay Attention

- Minimize text presentation and use visuals when you can (a picture is worth 1,000 words; and examples are your best weapon!)

- Minimize things that the audience could not see, mathematical notations, tables

- Give your presentation a smooth flow
  - use good transition slides

- State things that can provoke your audience to think

- Give audience a break, by having humorous slides, once in a while
Polish Your Design

• Ask yourself if your audience can follow and stay interested in your talk, after initial design; revise if needed

• Trim your slides to make the presentation as succinct as possible
  - ruthlessly prune material that is not essential to your goals

• Avoid having busy slides 😊

• Refine your presentation so the overall idea is crystal clear
  - even at the expense of cutting some interesting but messy details
Consider two genes $g_i$ and $g_j$, we use the following to measure the functional relatedness between $g_i$ and $g_j$:

\[
P(\bar{g}_i, \bar{g}_j, G_k) = (1 - p_{ik})(1 - p_{jk})
\]

\[
P(g_i, g_j, G_k) = (1 - p_{ik})p_{jk}
\]

\[
P(g_i, \bar{g}_j, G_k) = p_{ik}(1 - p_{jk})
\]

\[
P(g_i, g_j, |g_i - g_j| \leq d, G_k) = p_{ik}p_{jk} \sum_{l=1}^{L} \left( \frac{N_{kl}}{N_k} \right)^2 \min \left\{ \frac{N_{kl} + (2N_{kl} - 1)d - d^2}{N_{kl}^2}, 1 \right\}
\]

\[
P(g_i, g_j, NA, G_k) = 1 - \sum_{l=1}^{L} \left( \frac{N_{kl}}{N_k} \right)^2
\]

where $P$ is $\ldots$; $G$ is $\ldots$; $N$ is $\ldots$; $||$ is $\ldots$; $N$ is $\ldots$; $d$ is $\ldots$, $NA$ is $\ldots$;

If $P$ is within $(a, b]$, we call the two genes very related; if $P$ is in $[c, d]$, we call them kind of related; otherwise not related.
• Two genes are *functionally related* if they are in the same genomic neighborhoods across multiple genomes.

- The "degree of relatedness" can be defined quantitatively.

- Intuitively, the tighter the neighborhood is and the more genomes are involved, the more related the two genes are.
Fun Time Starts .......

- Now you have prepared your talk and are ready for the show time ..... 

- Go through the slides the night before so the whole material is fresh in your head
Present Your Talk

- Always thank your host or meeting chair
- Audience in general wants to see you succeed; so don’t be nervous!
- Always read your audience and react to it
  - skip, repeat or provide additional material
- Engage and provoke your audience
Present Your Talk

• Don’t read your slides as they are for the audience

• Be enthusiastic — if you are not, how can your audience be?

• Tell a joke to wake up the audience or give them a break

• Never go overtime!
Things You Should/Should Not Do

• Should do
  – do homework to learn about your audience
  – include examples that connect with the locals
  – attend many talks and study what goes well and what does not
Things You Should/Should Not Do

• Should avoid
  
  – only tell your audience what you have done but not why
  
  – cover too much material – **less is in general better!!**
  
  – rush through slides to get more material covered
  
  – use same level of voice throughout the talk – it puts people into sleep quickly
  
  – show off – it turns people off quickly
  
  – look at the screen rather than the audience
  
  – end your talk abruptly
Answer Questions

• There are different types of questions, and handle them accordingly
  – need clarification
  – suggest something helpful
  – want to engage in an intellectual dialog
  – show that he/she is better than you are
  – …..

• Repeat the question
  – so the whole audience hears the question
  – give you some additional time to think
Answer Questions

- Should anticipate some questions and prepare additional material in advance

- Avoid long answers, and suggest further discussion after the talk

- Be thankful for each question
Take-Home Message

- Set your goals clearly and design accordingly
- Know your audience and present at the right level
- Make your presentation succinct and simple
- Present things clearly at conceptual level and use visuals
- Do not rush nor go overtime
- Be enthusiastic, confident and gracious
- Your job is: explain, convince and entertain
Have Fun Giving Your Next Talk!

THANK YOU!