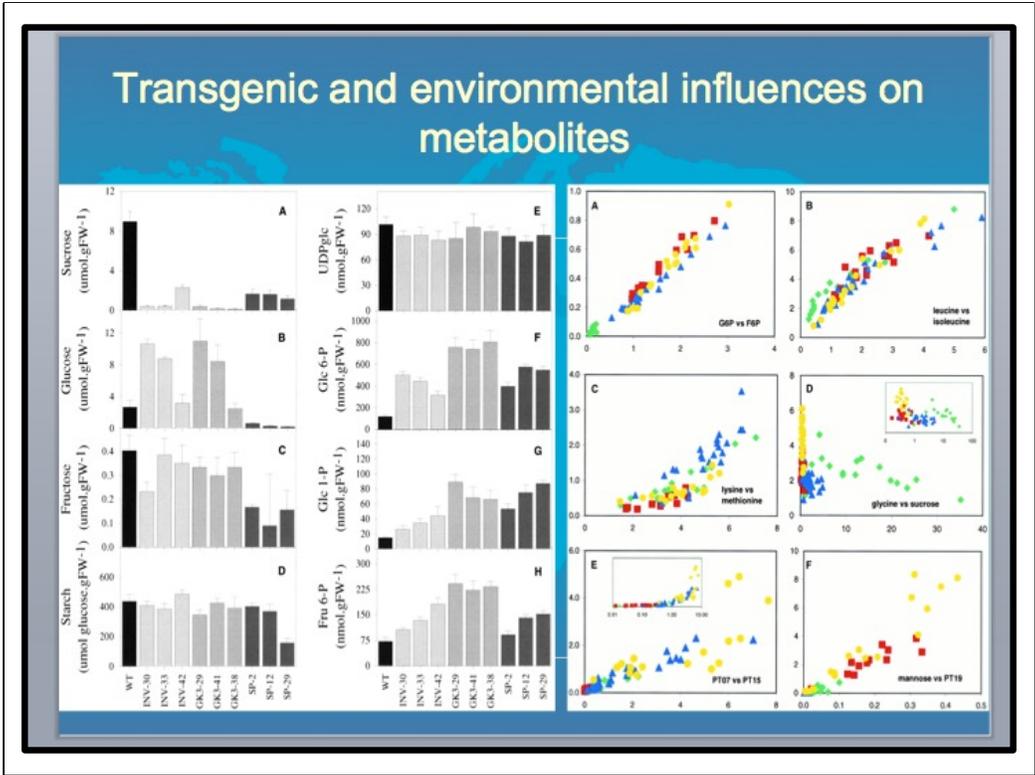


Scientific presentations that meet audience needs (10 “tips”)

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The title reflects the tendency that presenters inadvertently do things that please themselves rather than the audience. The “tips” are aimed at avoiding such pitfalls.



This kind of slide is way too common in biomedical research. Too much going on; fonts too small; etc. There are 16 graphs on this slide (2 of them are embedded in a graph!). It may be comprehensible to the presenter, but the audience can't possibly grasp such a slide.

Why would anyone show such a slide? The presenter is probably proud of his/her work and enjoys going over the material, but the audience will be bored and confused.

Slide Presentations

- **Frequently “overstuffed”**
 - “tell it all” desire
 - insufficient focus on audience
- **Biomedical complexities**
 - culture of comprehensiveness
 - specialization (tools, data, audience members)
- **Awareness not enough**
- **“Tips” to overcome?**

Tip #1: Set up an overarching question early

Many slide presentations, in almost every field, are “overstuffed” with too much detail. We seem to be “hard-wired” for wanting to tell everything. It is also difficult to maintain a focus on audience needs while preparing a presentation.

Biomedical research is particularly problematic. There is (appropriately) a culture of comprehensiveness due to the complexity of the problems and the difficulty in developing reliable results. The trouble is that a slide presentation is a poor format for being comprehensive; it is a summary. Specialization adds to the difficulty in focusing on audience needs.

Awareness is not enough. We slip back too easily. The overarching question for this presentation is therefore what specific “tips” can we employ to jolt us out of the traps.

Tip #1 is to set up an overarching question early. By “set up,” I mean provide the “bare bones” rationale for a question that encapsulates the talk’s content. You can redefine the question and rationale in more detail later in the talk, but the audience needs to know right away why they are sitting there. Your talk need not answer the question completely. You can provide a partial answer and suggest next steps. Your question can even involve how to plan to solve a problem.

Chordoma is a rare tumor presenting at the brain stem and end of the spine



- **Significant variation in clinical outcome**
- **“Obvious” biomarkers unhelpful**
- **There are new methods in “Multi-omics” informatics**
- **Can they predict clinical variation?**

Here’s an example of Tip #1.

Chordoma is a rare tumor with significant variations in clinical outcome. Obvious biomarkers, such as expression of single genes, cannot predict this variation. So the overarching question for the talk involves whether multi-omics informatics techniques can predict clinical outcome.

A few things to notice here. First the yellow circles help the audience identify the tumor on the images and help connect the title to the images. Always direct the audience to what they are supposed to look at.

I spend a lot of time working on the logic and language of this kind of “set up” slide. A well crafted “set-up” slide frequently illuminates a narrative (outline) for the overall talk. In this case the talk might follow the four bullets: an introduction to Chordoma and its variable outcomes, results from the literature regarding “obvious” biomarkers, a discussion of new informatics methods, and results from employing those methods.

Outline



- **Strategy:**
 - who?
 - what?
 - how?
- **Slides**
- **Final thoughts**

The first half of the talk will focus on a general strategy for developing a presentation. How do we think about: who will attend?, what kind of information can they comprehend?, and how to convert that information into a slide presentation.

The second part of the talk will focus on how to deliver and design individual slides.

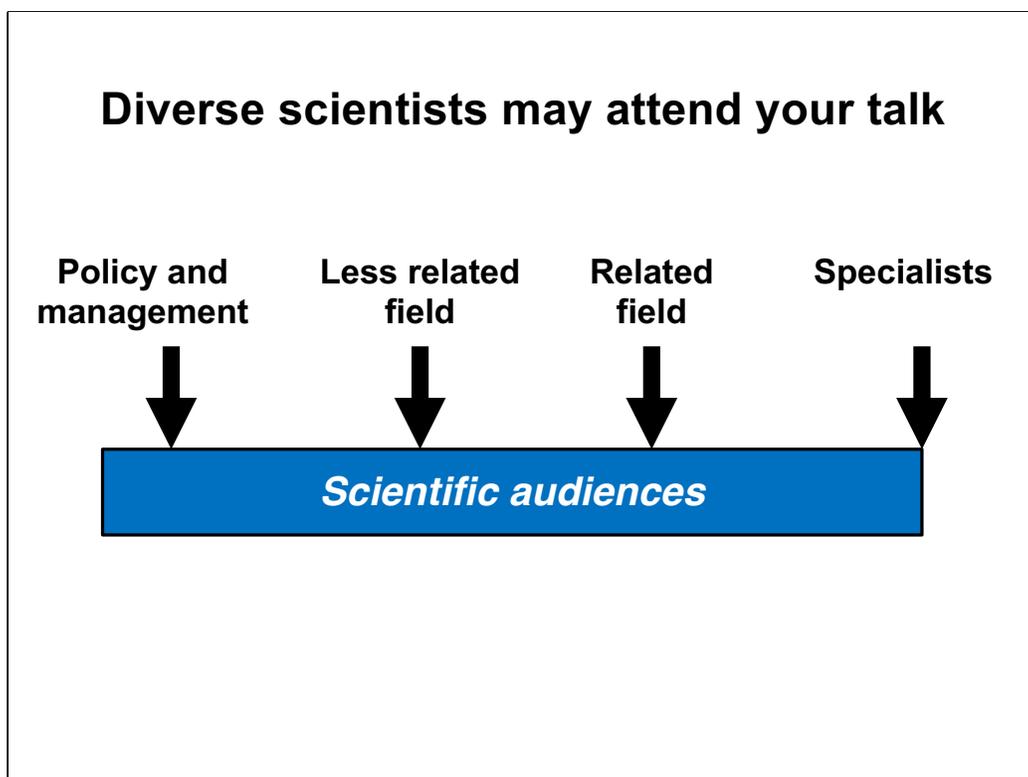
I like showing an outline as I move through the talk. Some presenters find it cumbersome; breaking the flow. My suggestion is to include outline slides as you are creating your presentation, and once completed, decide if it helps or hurts your oral presentation.

Are there only two kinds of audiences? (a common misconception)



When I hold a class on presentation techniques for scientists, I often get the question, “are you teaching us to address a scientific or lay audience?” This question usually arises when I challenge the presenter about using terms highly specific to his/her subspecialty. The question usually involves a desire to fall back on methods and vocabulary highly specific to the questioner’s subdiscipline. It fails to recognize, that even if audience members are trained in a similar field, there are differences in their tools, sub-disciplines, and vocabulary.

Many of my classes involve small groups of molecular biologists. Still they have a great deal of understanding each other when they use vocabulary and concepts that are unique to their specific areas of interest.

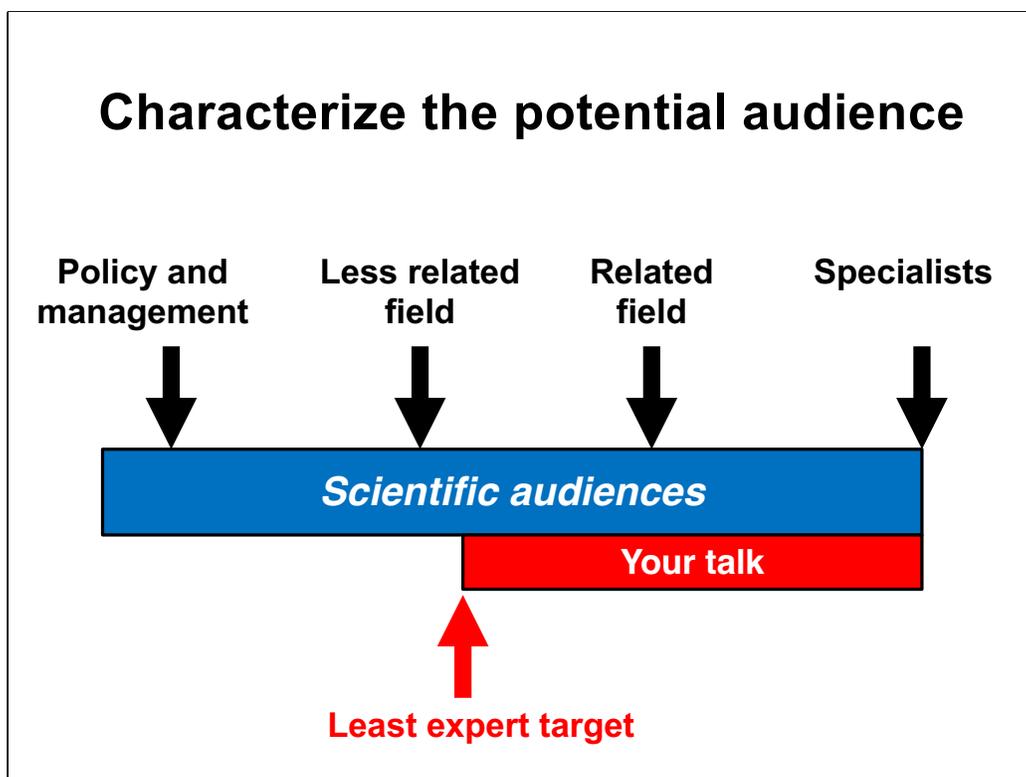


The question on the previous slide is a misconception because there are many kinds of scientists, ranging from colleagues in your subdiscipline to department heads and provosts (policy and management). This is particularly true in industry, where scientific managers use presentations to make business decisions.

The above metric is of course hypothetical. There is no quantitative way of measuring the distances pictured above. The key point is that almost all talks have some degree of multi-disciplinarity in the audience. Many audience members may not be specialists in the speaker's sub-discipline, but they are anxious to learn.

This is critical because there is a widely held view that the solution to complex biomedical problems will involve collaborations among varied disciplines and techniques. Many collaborations may be unexpected, emerging only when scientists learn a bit about other research. Scientific talks are arguably the most potentially effective way to stimulate such conversations.

On a side note, maintaining the color from the previous slide allows the audience to immediately understand the slide's subject. Don't change names or colors (if a color represents something specific) among slides. In a presentation "a car is not an automobile." Use one term!



You need to characterize the potential audience as best you can. Obviously there is great uncertainty, but you know two things: how the talk advertised and your own communication goals. Is your talk intended for all scientists or just some with some who those in a related field (as illustrated in the above example)?

Also think about the type of person with the least knowledge of your work, but whom you still want to communicate with. For example, you may be studying cancer proteomics, but you might hope that a bioengineer working on mass spec might be able to apply his/her knowledge to your problem. Maybe you don't care if a pure clinician can understand your talk.

I call this identifying the "least expert target listener." Obviously there is no measurable scale for doing this and there may be several types of listeners, from different fields, that might satisfy this definition.

A successful talk will be generally understood by the "least expert" even if a few slides are only comprehensible to the "specialist." The question is how do you do this?

Tip #2: Write a short narrative for the “least expert”



- **Qualitative (~ ½ page, 1-3 minutes)**
- **Include overarching question**
- **Main points: approach, findings, uncertainties, etc.**
- **Practice the narrative!**

Slides are a trap. Each represents a fragmented piece of thinking. You need to think holistically. What is the overall message? What is the flow (the narrative)?

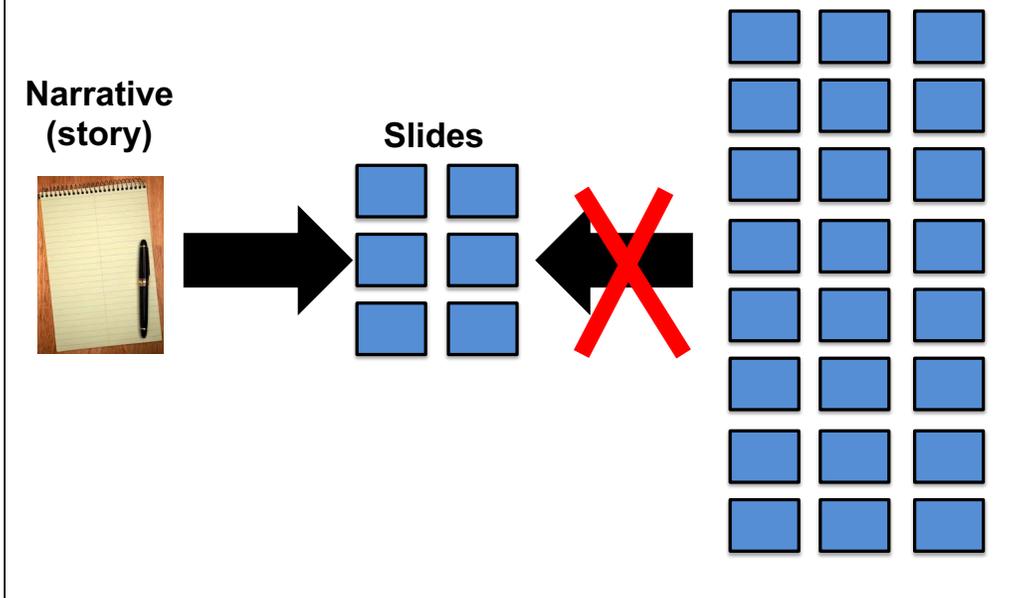
Tip #2 is writing a short summary of what you want to communicate in the talk. Include the rationale and summary points, not the data. Make the narrative understandable to that “least expert.”

It is equally important to practice your narrative as it is to practice the presentation of the slides. Try giving a short version (1-3 minutes) to someone who knows your work well and someone more representative of that “least expert.” Both will help you clarify confusing things.

Have trouble writing? Here’s a place where you can get a few ideas to get you started:

<https://www.nobadslides.com/tip-of-the-week/categories/formulating-the-story>

Tip #3: Build up, don't cut down!!



If you are going to remember any slide 24 hours after the talk, this might be it.

When starting to make slides, don't go to the folder on your computer with 500 slides and ask, "what should I cut?" You'll never succeed. You love your work, it all seems critical.

Instead start with that narrative and ask, "what slides would I include if I only had five minutes? What more if I had 10? Always use the points in the narrative to guide what you include. Limit yourself to supporting points in the narrative.

The process can be iterative. You may find that the process of making slides alters your narrative. That's fine, modify the narrative. But make sure you are maintaining it. Don't add slides that are outside the narrative.

"Build-up" is Tip #3.

(again note how carrying over the symbol for the narrative helps build connectivity between slides)

The “build-up” strategy...

- Prevents “including everything”
- Reaches a range of listeners
 - “Least expert” can follow the talk, even if...
 - some slides are for experts
- Implies time management

**Tip #4: Have a time management strategy
(~~rapid slide flipping and talking~~)**

The build-up strategy has some key advantages. Most importantly, it prevents you from including “everything.” The essential message of the talk should be clear, even if a few slides may be difficult for some to understand. And since you’ve “built up,” you have a pretty good idea what you can quickly summarize if you run out of time.

Frequently, you don’t have as much time as planned. The talk starts late, the projector breaks, or there are good questions you don’t want to short circuit. Tip #4 is have a time management strategy. Going faster is not it. Rushing through may give the speaker a good feeling about getting through all their slides, but it only confuses the audience. Once again the presenter is pleasing him/herself, not the audience.

Figure out parts you can verbally summarize quickly, rather than flipping slides faster and rapid fire talking. Those parts may differ depending on whether the talk starts late or you run out of time at the end.

Outline

- **Strategy**
- **Slides**
 - multi-tasking
 - information overload
- **Final thoughts**

Let's turn to individual slides. We'll do this by looking at two problems from the audience perspective; the multi-tasking challenge and information overload.

Note, when I showed you the previous outline slide I did not include the words "multi-tasking" and "information overload." I did not want you trying to figure out what those were because they require some explanation I wasn't ready to give.

Do not have things on the slide that you don't want the audience to start thinking about. The audience will always focus on the wrong thing unless you guide them carefully.

Audience's multi-tasking challenge



You are asking the audience to do a lot: read the slide, listen to you, look at you, watch the pointer. I call this the “multi-tasking” challenge.

The entire purpose of a slide presentation is to create a synergy between the audio and visual that is more powerful than either. If you can't do that, just let the audience read the slide, or conversely, talk to them without a visual.

The pointer is the key to connecting the audio and visual. When you are talking about a particular part of a slide, point to it. Don't wave the pointer randomly.

Help the audience multi-task

- **Slides are not freestanding (Why are you talking?)**
- **Speaker's job is to explain the slide**
- **Erase items not discussed**
- **Oral "extras" after**

Tip #5: Talk about what you show, show what you talk about (use pointer purposefully)

This slide makes additional points about multi-tasking.

Slides don't stand on their own. If they do, why are you talking? Why make the audience read and listen, if only one of those modes is needed?

The speaker's job is to explain the slide. As soon as a visual appears the audience will try to understand it. They won't listen to you unless you are helping explain the visual.

If there are things on the slide you don't discuss, ask yourself why they are on the slide. 99% of the time you can remove them.

Conversely, if you have anything to say that is not depicted visually (oral "extras"), say it after you've explained the slide.

While "oral extras" are a small exception, Tip #5 is useful rule to follow. Connect the audio and the visual with purposeful use of the pointer.

Text slides

- **Display and discuss structure (these are your notes)**
 - Key points
 - Sub sections
- **Amplify each point**
- **Condense bullet lists (4 or less)**
- **Text slides have a visual message!**

Let's look at what you might think would be the easiest kind of slide to blend oral and visual; the simple text slide.

Many speakers screw it up. They don't know whether to read the slide, let the audience read the slide, or read their notes. None of this is correct.

The main idea behind a text slide is to give some insight into how you are thinking. Ideally the text slide will reveal the structure of your thinking.

Don't put every word on the slide. Put enough so that when you point to that part of the slide your voice amplifies the text.

The audience will not absorb lists of 7 or 8 items. Such lists mean you haven't done your homework in organizing the information. Identify broader categories.

Hopefully a text slide has a (admittedly weak) visual message!

Text slides

- **Display and discuss structure (these are your notes)**
 - Key points
 - Sub sections
- **Amplify each point**
- **Condense bullet lists (4 or less)**
- **Text slides have a visual message!**

Tip #6: All slides should have less than 40 words

One last point, which really leads us to the “information overload” issue. Text slides should have less than 40 words. Any longer and you’ll put people to sleep.

This slide now has 39 words (yes, counting the title and the numbers as words). In my class on presentation techniques, we take a 100+ text slide and convert it to less than 40 words without losing content. The key is to use the voice to supplement condensed text on the slide.

40 arbitrary? Of course, but it is a useful discipline. Follow it, or, if you don’t like it, try 35 words.

Tip #7: Write Big

Bold 36+: Titles

Bold 32: Acceptable for titles

 **Bold 24: Acceptable for text**

Bold 18: Marginal for text

Bold 14: unreadable

Normal 14: invisible

Tip #7, write big.

24 bold (Helvetica size equivalent) or larger is your go-to font. 18 bold is marginal, anything smaller is unreadable. No fancy fonts!

I can hear you now, “I can’t possibly get what I need on a slide with 24 font.” You are probably trying to say too much. Also you don’t need every word on the slide, remember voice supplements visual.

If for some reason (and there aren’t many) you need to include something with less than 18 font (e.g. to illustrate an easily recognized book cover, etc.) point to the item and tell the audience they shouldn’t try to read it. Otherwise they will try to read it and won’t be listening to you. The audience has never seen the slides so they are primed to do the wrong thing. You need to guide them every step of the way.

<https://merkelcell.org/prognosis/recur/>

Year of original MCC diagnosis
2021

Month of original MCC diagnosis
4

Age at diagnosis
65

Sex
 Male Female

AJCC 8th Edition Stage Type (overview of MCC stages)
 Pathological Clinical

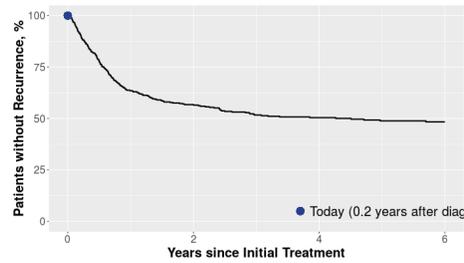
AJCC 8th Edition Stage (pathological)
 P-I P-II P-IIIa P-IIIb P-IV

Site of Primary Tumor
 Extremity Chest/abdomen/pelvis Head/neck
 Unknown primary

Immune suppressed at diagnosis?
 Yes No

Chance of Recurrence

- Starting right after initial treatment: 52%
- Starting today (0.2 years after diagnosis): 52%



The model has been validated for predictions up to 5 years after initial treatment and for ages 11-98. The predictions are only applicable to those who have not recurred since their primary MCC diagnosis. Initial treatment is assumed to be completed 90 days after diagnosis. Model last updated: 2019-07-31 21:10:05; n = 618

Let's look at a couple of slides that have too much information. This slide has no obvious visual message. Let's go into more detail and examine its problems.

4. No help from title

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2021

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4

Age at diagnosis
65

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 Male Female

AJCC 8th Edition Stage Type (overview of MCC stages)
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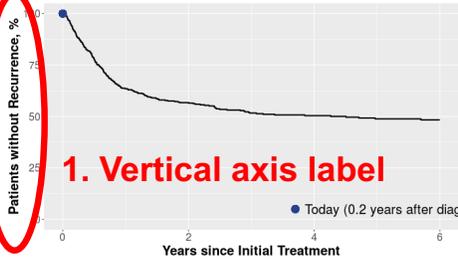
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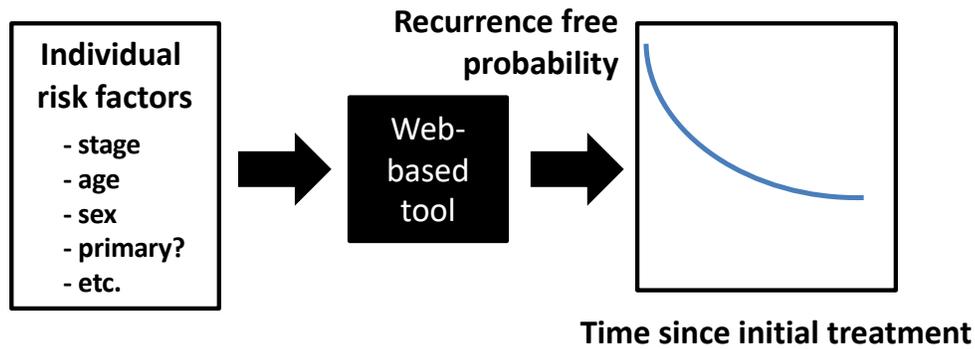
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2. Unreadable font, no obvious data category

3. Too much information

1. The graph axis is vertical. It's hard to read. Probably it is an Excel default that is time consuming to change (again keeping the speaker not the audience happy).
2. The table on the left is obviously some sort of input form, but it isn't obvious what is being input. In trying to give exact information about the inputs, we've lost any information. And of course the fonts are too small
3. After speaking with the slide creator, item 3 are details that are not of primary importance
4. We're not getting any help from the title as to what the slide is about

Tool converts Merkel Cell Carcinoma individual risk factors into a recurrence curve



A much simpler version. By eliminating detailed information we have created more information. Now that the audience understands the main point, any interested party can ask questions or contact the speaker after the talk.

Antitumor activity and safety of Pembrolizumab in Patients with advanced recurrent Ovarian Cancer (KEYNOTE-100 study)

	Cohort B N = 91			Cohorts A + B N = 376		
	CPS <1 n = 34	CPS ≥1 n = 50	CPS ≥10 n = 22	CPS <1 n = 141	CPS ≥1 n = 197	CPS ≥10 n = 82
ORR % (95% CI)	8.8 (1.9 - 23.7)	10.0 (3.3 - 21.8)	18.2 (5.2 - 40.3)	5.0 (2.0 - 10.0)	10.2 (6.3 - 15.2)	17.1 (9.7 - 27.0)
DCR % (95% CI)	38.2 (22.2 - 56.4)	38.0 (24.7 - 52.8)	45.5 (24.4 - 67.8)	32.6 (25.0 - 41.0)	38.1 (31.3 - 45.2)	41.5 (30.7 - 52.9)
Best overall response						
Complete response n (%)	0 (0.0)	2 (4.0)	2 (9.1)	0 (0.0)	7 (3.6)	7 (8.5)
Partial response n (%)	3 (8.8)	3 (6.0)	2 (9.1)	7 (5.0)	13 (6.6)	7 (8.5)
Stable disease n (%)	10 (29.4)	14 (28.0)	6 (27.3)	39 (27.7)	55 (27.9)	20 (24.4)
Progressive disease n (%)	18 (52.9)	29 (58.0)	12 (54.5)	87 (61.7)	113 (57.4)	44 (53.7)

Combined Positive Score (CPS): $\frac{\# \text{ PD-L1 staining cells (tumor cells, lymphocytes, macrophages)}}{\text{Total \# of viable cancer cells}}$

This slide summarizes the key data from a clinical trial and has too much data for the audience to comprehend. The only visual message is “we’ve got a lot of data.” It that’s your message, point to the slide and tell the audience your message and not to try to read the slide.

In general, data tables are fine for journal articles but don’t work in presentations.

Antitumor activity and safety of Pembrolizumab in Patients with advanced recurrent Ovarian Cancer (KEYNOTE-100 study)

5

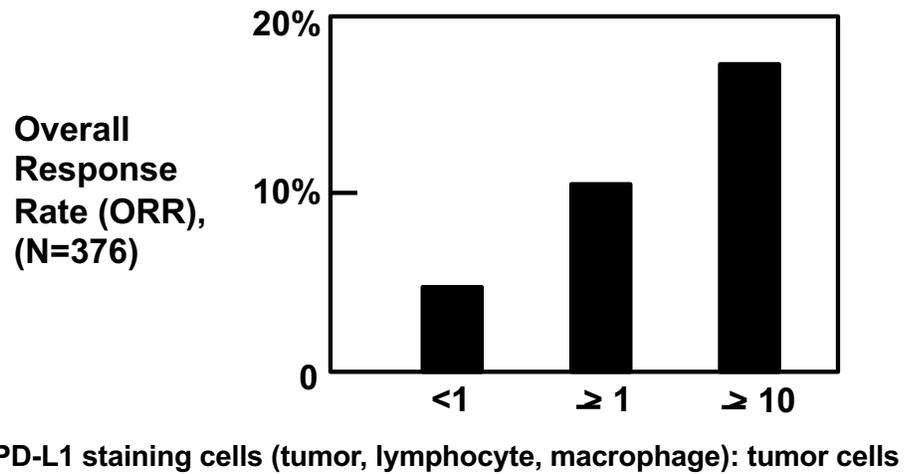
	Cohort B N = 91			Cohorts A + B N = 376		
	CPS <1 n = 34	CPS ≥1 n = 50	CPS ≥10 n = 22	CPS <1 n = 141	CPS ≥1 n = 197	CPS ≥10 n = 82
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Combined Positive Score (CPS): $\frac{\text{\# PD-L1 staining cells (tumor cells, lymphocytes, macrophages)}}{\text{Total \# of viable cancer cells}}$

Problems:

1. There are abbreviations all over the place
2. There are 6 figures of merit
3. The most important variable is poorly highlighted and not easy to comprehend
4. We can only show one result at a time. What is the most important result? This slide has enough results for an entire presentation.
5. Once we focus on the one result we want to show, we can use the title in a more effective way to transmit the message.

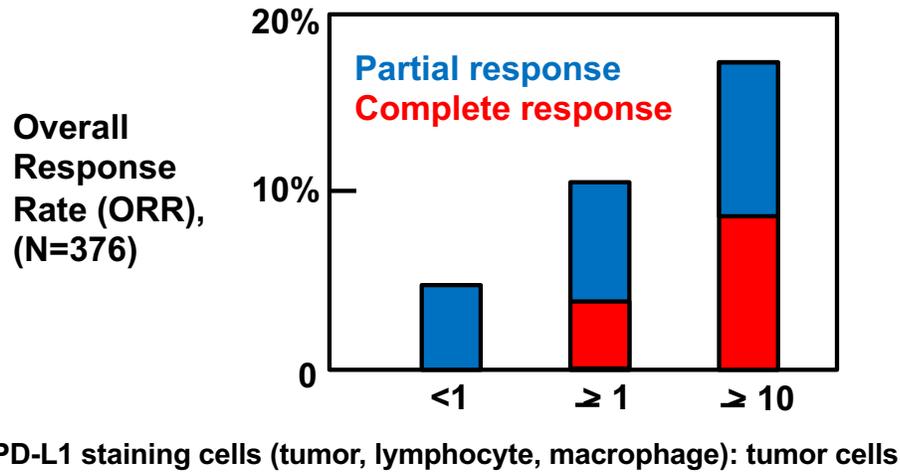
Ratio predicts Pembrolizumab response in recurrent ovarian cancer



You can only show one message at a time on a slide. This slide addresses the 5 problems shown on the previous slide. The title is used to begin to explain the X axis label, which remains a complicated concept.

Always spend a few second explaining every axis on a graph.

Ratio predicts Pembrolizumab response in recurrent ovarian cancer



Now you can start to add additional results. Notice how color allows me to avoid using a legend. A small issue, but anything you can do to simplify the slides helps the audience. Use color strategically to highlight different types of information. Don't use it as a decoration.

Two tips

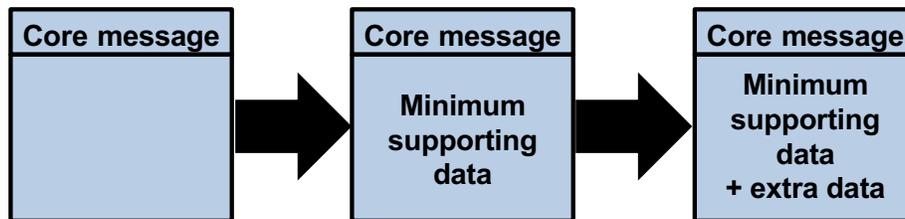
- **#8: No journal article graphics**
 - axes
 - fonts
 - complexity
- **#9: One slide; one overarching message**
 - title helps convey it
 - no unrelated content (don't decorate!)
 - be able to state it!

Two tips emerge from the previous two examples.

#8: Don't use journal article graphics. The fonts are too small, the concepts are often too complex, and the axes might be vertical. These graphics are fine when the reader can study the graphic at his/her own pace and read a long explanatory caption, but they don't work in a slide presentation.

#9: Each slide has a single overarching message. The title should be that message or be words that help you verbally convey it. Remove content that doesn't support the message. Also be able to state the message, at least to your self.

Tip #10: build up individual slides, don't cut down



The process of making individual slides is quite similar of the strategy for creating the entire presentation (Tip #3); build up, don't cut down.

First you need to know what your slide is about. What is the core message? Practice saying it without any supporting data.

Then add the minimal data needed to support and reinforce the core message. If the slide is still simple enough to be easily understood you can add additional supporting data.

Outline

- **Strategy:**
- **Slides**
 - multi-tasking
 - information overload



- **Final thoughts**

Scientific slide presentations

- **Poor format for comprehensive data**
- **Good for stimulating:**
 - interest
 - discussion
 - multi-disciplinary collaborations
- **Frequently too "overstuffed" for these goals**
- **"Tips" overcome presenter recidivism**

Just a recap. A slide presentation is not a good format for comprehensive data that "proves" results. That is best left for journal articles with supplementary appendices.

Slide presentations are far better than journal articles for creating interest and provocative discussion. It may be the best way to stimulate those unexpected multi-disciplinary collaborations needed to solve complex problems in biomedicine.

Unfortunately many presentations are too detailed to achieve these goals. The desire to "overstuff" presentations seems to be "hard-wired" into the human psyche and we slide into it, even if we are aware of it. The 10 tips discussed here are a way to jolt yourself out of it.

The Worst Words in Science?

“I’ll write the presentation on the plane”



All of this takes time. Work on your presentation early and practice both the narrative and the slides.

Don't have time for that? Remember, the time needed to prepare a presentation can add to the quality of your research. It is an opportunity to think through what is important and what makes a difference. It allows you to see the relative importance of different data. It provides a pause from the detailed lab work and emails. It may create important insights in the audience.

We have some funny incentives in biomedical research! Many scientists are too busy giving presentations to dedicate the time to prepare a good presentation. Are 20 incomprehensible presentations better than 2 or 3 great ones? Many scientists do not want to spend an extra 3 or 5 hours improving their presentation, even though it may result in 75 scientists (the audience) wasting an hour.

You'll find a more complete discussion about why you should spend time preparing your talk at, <https://www.nature.com/articles/d41586-021-01281-8>