

Communication Handbook



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Using this handbook

Each section is split into the following parts:

Best Practices

Explains our top three actionable tips that provide the best value.

Process

Provides a structure and the steps to address the best practices.

In Practice

Provides concrete methods and examples that address how to implement the best practices.

Checklist

Provides an easy, concise list of items to help achieve the best product.

More Resources

This handbook is only the beginning. Here we list our hand-picked resources. CommKit is a collection of guides by BE Comm Lab at mitcommlab.mit.edu/be/.

To explore additional resources and make 1:1 communication appointments, head to the MIT BE Comm Lab website mitcommlab.mit.edu/be/

Guiding Principles

The goal of effective communication is to get a message across. Your audience needs to be paying attention and to understand the information you are trying to convey. This handbook provides a framework to shape your communication task.

Who?

Define your audience. How much time does your audience have to read or listen to your work? How much do they know about your work?

What?

Identify the main message of your work.

Why?

Identify the purpose of your message (e.g., convincing stakeholders, empowering people with new knowledge, getting new funding).

How?

Translate raw information into messages that are interpretable by your audience.
Identify opportunities to communicate the main message (e.g., titles/subtitles).

Visual Communication

Visual Figures

Best practices

Highlight **one message** with each plot

Focus on a central relationship in the data to ensure each visual is easy to read and understand.

Design figures to maximize **signal-to-noise**

To highlight your message, remove plot features that are not relevant or distract from your intended message.

Adapt each plot to the **medium**

Presentations, posters, papers or other media require different levels of detail since the story and context may change.

Process

1. Identify the messages your data support.
2. Choose an appropriate plot type for these data (e.g., scatter plot, heatmap, violin plot).
3. Generate and iterate on a plot that maximizes focus on a single message.
4. Save the data and code that directly generate the plot for reproducibility.
5. Revisit the plot as necessary to adapt to different communication tasks.

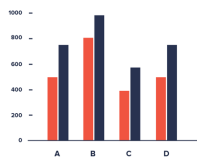
Visual Figures

Highlight your message with the appropriate plot type

Example plot types

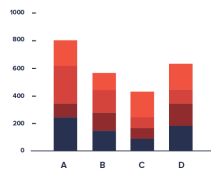
Amounts

Grouped bar



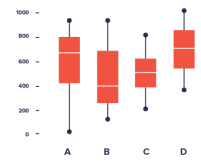
Proportions

Stacked bar



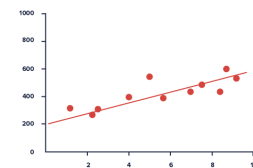
Distributions

Boxplot (1-D)

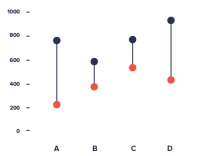


Relationships

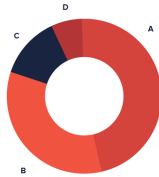
Scatter (2-D)



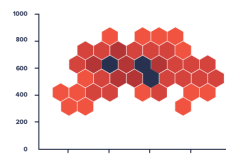
Dumbbell



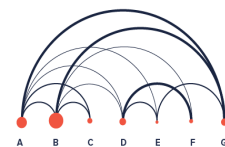
Donut



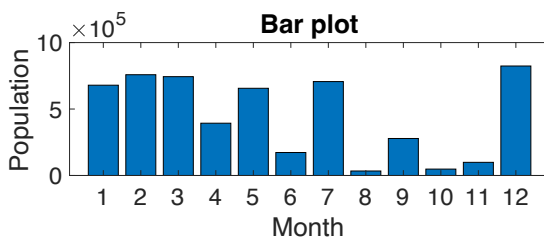
Hexbin (2-D)



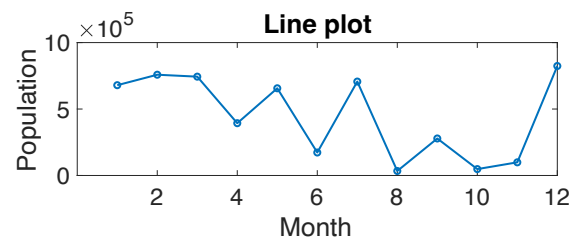
Arc (multi-D)



Highlight your message with the appropriate plot styling



Emphasis on each month's value



Emphasis on overall trend

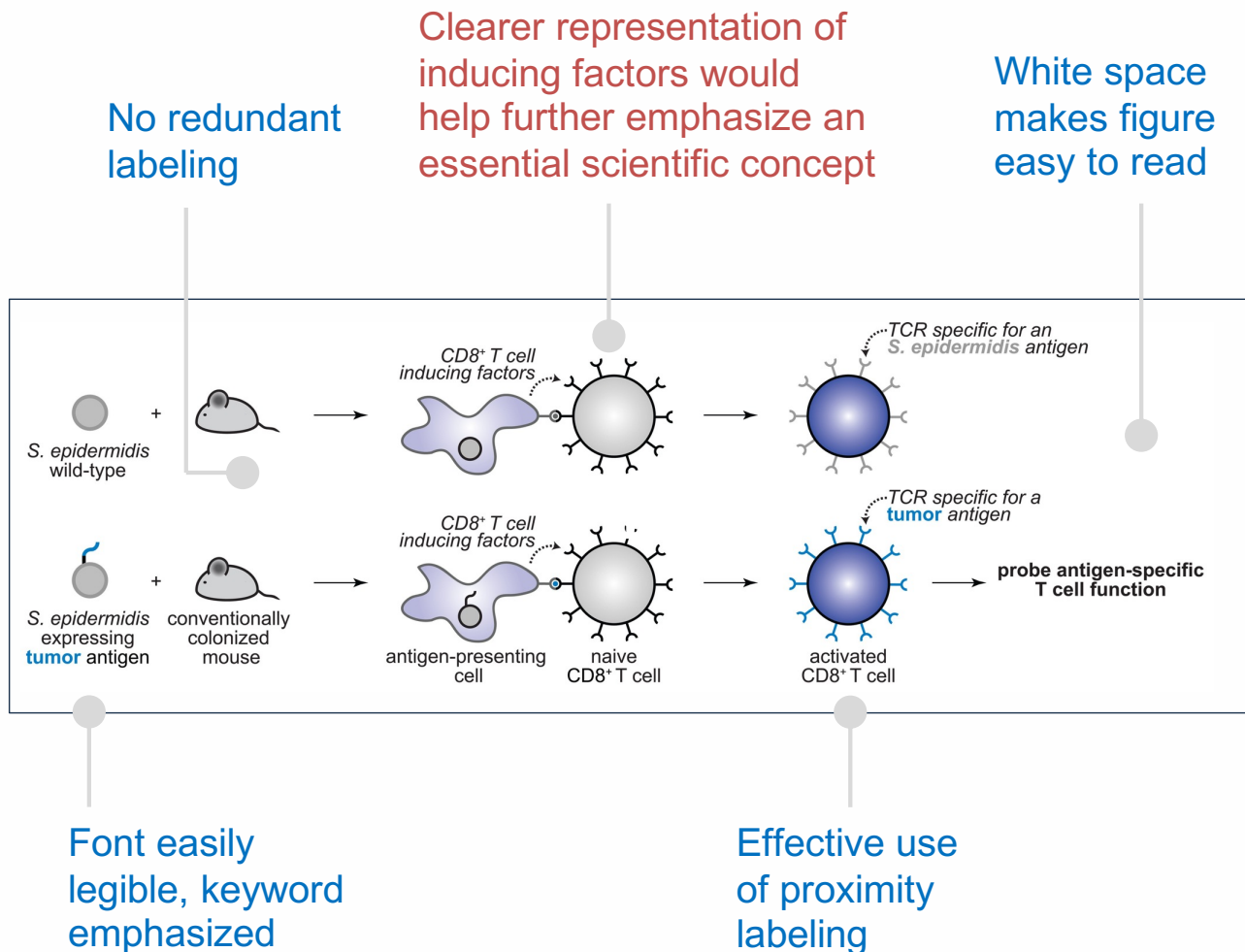
Figures

Design figures to maximize signal-to-noise

Do	Don't
Focus on one central message per figure	Include unnecessary or supplementary data
Split complex data into multiple panels to ease understanding	Condense data into a few multi-dimensional plots or use unnecessary double axes
Choose distance (e.g., bar plot) over area (e.g., pie chart) or color (e.g., heatmap) to display simple quantities	Substitute, without a defined purpose, familiar plot types with unfamiliar ones
Use appropriate plot types and axes limits to avoid distorting your data	Truncate axes in a way that conveys magnitudes inaccurately
Use a left-to-right / top-to-bottom flow of information	Use unstructured or circular layouts
Add clear labels with appropriate font size	Replace labels with information in the caption
Use colors intentionally for grouping or showing relationships	Use many colors or color data without a purpose
Remove unnecessary information to make essential elements stand out	Overcrowd figures or illustrations

Visual Figures

Annotated example 1

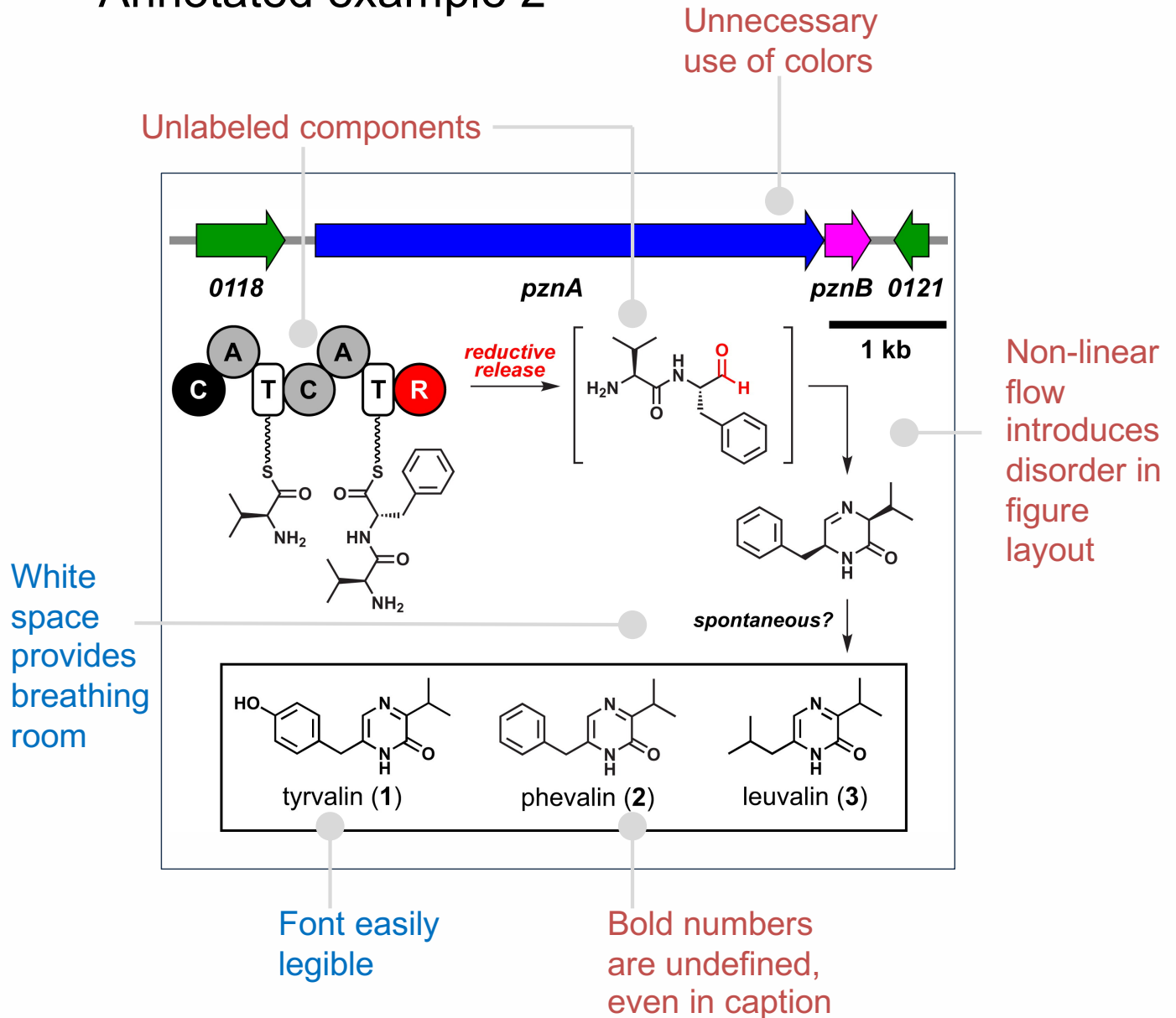


Overall, the figure uses an effective linear flow of information (left-to-right), and the main message is easily understandable. Colors are used sparingly and consistently.

From: Chen YE, Bousbaine D, Veinbachs A, Atabakhsh K, Dimas A, Yu VK, Zhao A, Enright NJ, Nagashima K, Belkaid Y, Fischbach MA. Engineered skin bacteria induce antitumor T cell responses against melanoma. Science. 2023 Apr 14;380(6641):203-210. doi: 10.1126/science.abp9563. Epub 2023 Apr 13. PMID: 37053311.

Visual Figures

Annotated example 2



Overall, the figure can be revised to support better flow of information and the main message. Better labeling and color use would also improve understandability.

From: Zimmermann M, Fischbach MA. A family of pyrazinone natural products from a conserved nonribosomal peptide synthetase in *Staphylococcus aureus*. *Chem Biol*. 2010 Sep 24;17(9):925-30. doi: 10.1016/j.chembiol.2010.08.006. PMID: 20851341.

Visual Figures

Checklist

- ☐ Is the figure self-contained? Are all elements labeled?
- ☐ Does the plot contain enough whitespace?
- ☐ Do figure and plot layouts enable comparison between conditions?
- ☐ Are scales appropriate and truthful? Are error bars or confidence intervals shown where applicable?
- ☐ Are all figure elements consistent (e.g., fonts, font sizes, colors, alignments, figure sizes, nomenclature)?
- ☐ Is color utilized aptly? Is the color scheme colorblind-friendly? Would the figure work in grayscale?
- ☐ Are the data and figures saved in vector and bitmap formats at high resolution for future reference?

More Resources

- **Ten Simple Rules for Better Figures**, by Rougier NP, Droettboom M and Bourne PE
- **Scientific Figure Design** presented by Babraham Bioinformatics Core
- **Fundamentals of Data Visualization** by Claus O. Wilke
- **Effective Graphical Displays** by Jean-luc Doumont

Visual Slides

Best practices

Structure slides around the audience and message

Slides should be structured to convey clear messages that were designed with content, audience, and logistical constraints in mind.

Maximize the **signal-to-noise** ratio

Prioritize easily digestible slides, requiring visually clear and concise design.

Emphasize **visuals over text**

Utilize slides to display visuals that strengthen the verbal delivery of your message.

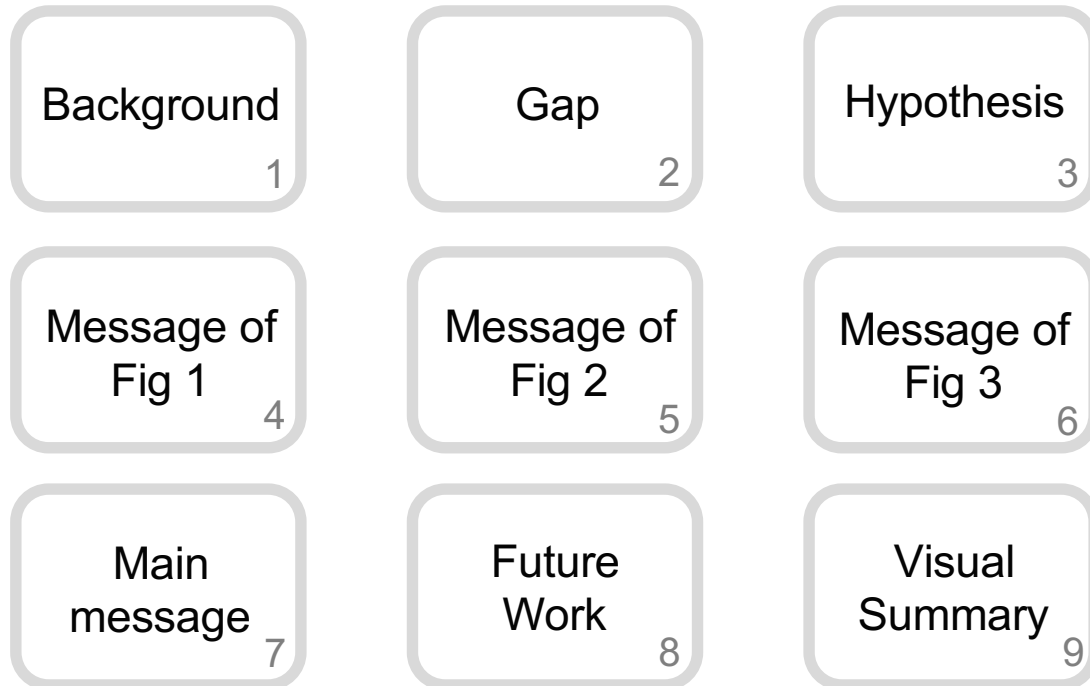
Process

1. Map the message and structure of the slide deck.
2. Incorporate initial content and visuals to ensure the message and structure are aligned.
3. Iteratively refine visuals to maximize signal and minimize noise.
4. Walk through slides with verbal accompaniment to ensure the visual messages match the verbal messages.

Visual Slides

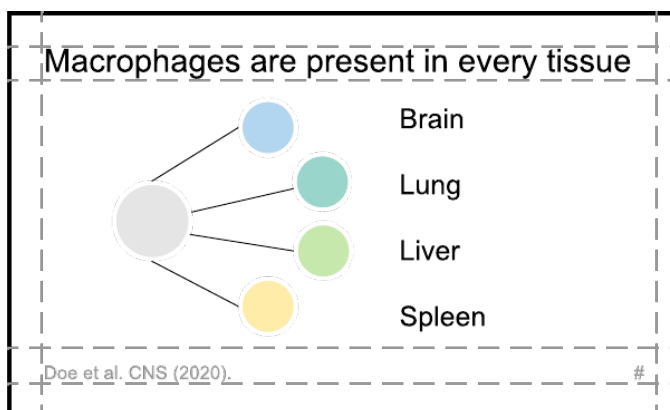
Structure the slide deck

Think about the most logical transitions to help organize the slide deck.



Lay out each slide

Prioritize visuals that strengthen the message without distracting from the speaker.



Large, declarative title

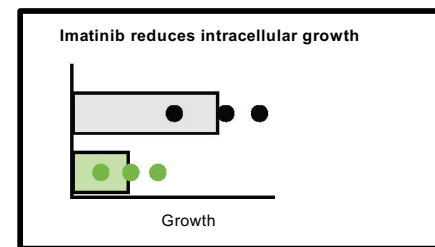
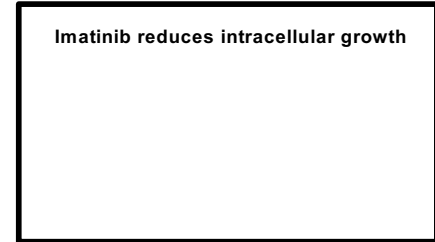
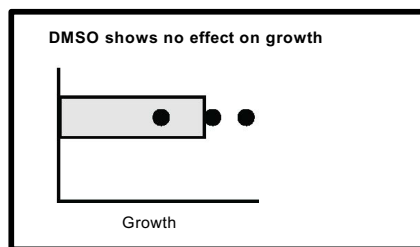
Grid to keep slides consistent

References and slide number

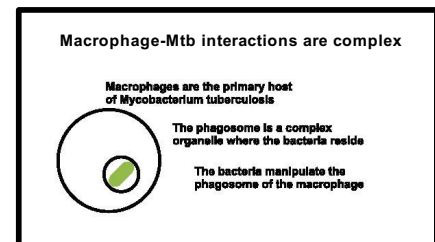
Visual Slides

Present one message per slide:
a declarative title and
one visual
(diagram, plot, or image)

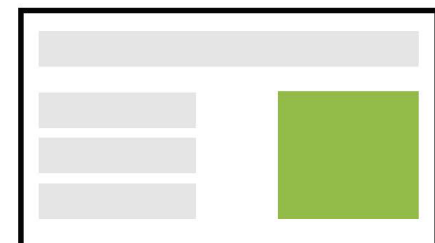
Build content
iteratively



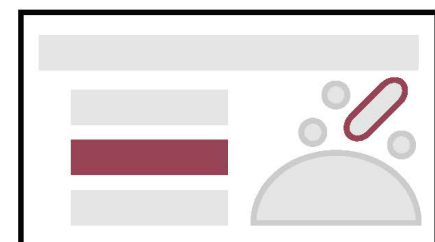
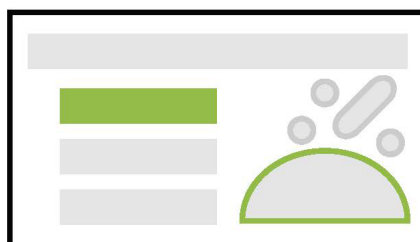
Convert **text into visuals** to
emphasize information structure



Keep it
consistent



Utilize visual
signposts



Visual Slides

Checklist

- ☐ Are all slide titles declarative and connected to your main message?
- ☐ Is the content generally visual?
- ☐ Are all slide elements (e.g. fonts, font sizes, colors, alignments, figure sizes, nomenclature) consistent throughout the slide deck?
- ☐ Is sufficient whitespace present on each slide?
- ☐ Does each slide have necessary supplementary information (e.g., references, slide number)?
- ☐ Can the slide be understood on its own?
- ☐ Do the slides enable you to adhere to the logistical constraints (time, space, projector) of the presentation?

More Resources

- **Slideshow CommKit** by MIT BE Comm Lab
- **Trees, Maps, and Theorems** by Jean-luc Doumont
- **Academic Slide Design** by Ann E. Fandrey

Best practices

Structure the poster into **frames**

Design your poster to follow a logical pattern, instead of fitting different sections together according to space.

Compose a **strong title**

Utilize key nouns and verbs that convey the main message of your poster.

Minimize text and **emphasize visuals**

Summarize the content of your sections into bullet points that complement the figures in your poster. Avoid big chunks of text that could deter the audience.

Process

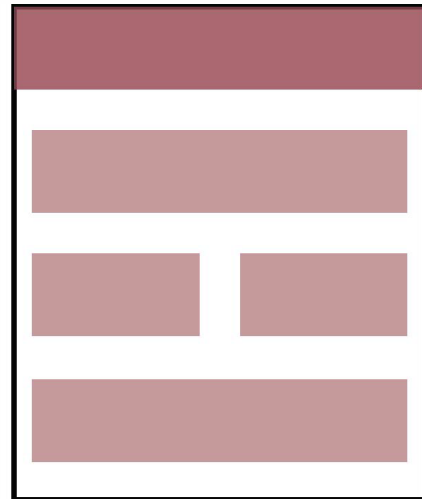
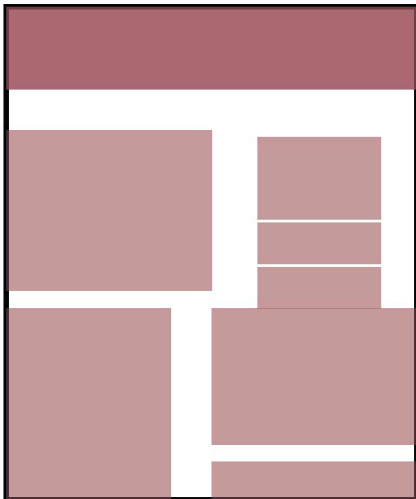
1. Determine the main message and identify your audience.
2. Outline sections that support the main message (e.g., background, methodology, results).
3. Arrange content so that it flows easily for the reader (i.e., left-to-right and/or top-to-bottom).
4. Practice a 20-second pitch that summarizes the what, why, and how of the poster.

Visual

Posters

Structure your poster

Follow a logical pattern that the audience can understand without you explaining it to them. Use rows and columns to guide the reader. Keep white space in the design to avoid over-crowding.



Visual

Posters

Compose a strong title

The title of your poster should specifically convey the main message by emphasizing key verbs and nouns.

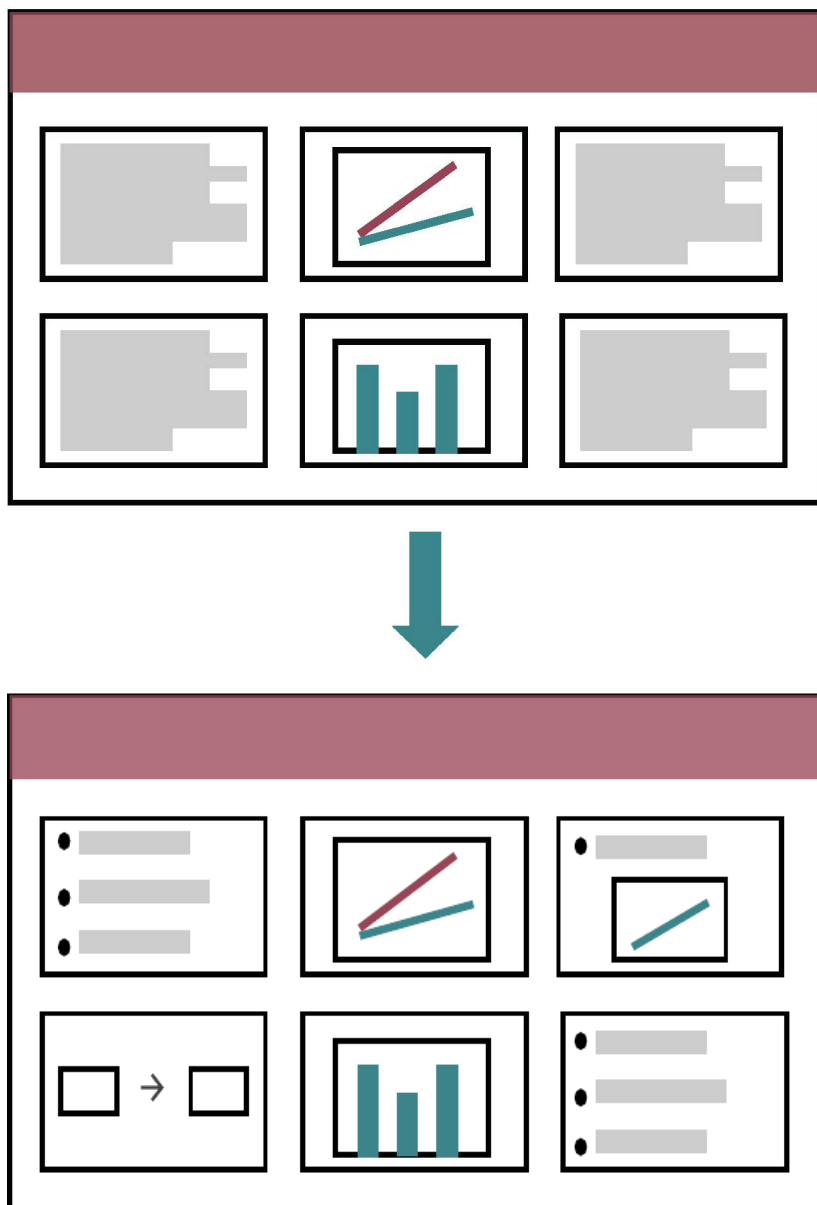
Example title	Comment
"Impact of the microbiome on drug function"	Weak title: too general, no message is captured
"Elucidating the Complex Interplay Between Pharmacological Agents and Microbial Interactions Within the Human Microbiome to Predict and Mitigate Drug Interference Effects"	Weak title: too complex and difficult to follow
"Predicting and alleviating drug interference by the human microbiome"	Strong title: concise and clear, captures the main message and includes key terms

Visual

Posters

Emphasize visuals

For each section, outline the most important content that supports your main message. Highlight that information using figures, diagrams, and concise bullet points.



Checklist

- ☐ Does the content of the poster flow logically?
- ☐ Are visuals prioritized over text? Are paragraphs broken up into concise bullets?
- ☐ Are visuals labeled clearly and directly?
- ☐ Is there adequate whitespace between and within sections?
- ☐ Is the color scheme consistent and corrected for color-blindness?
- ☐ Can the poster be understood on its own? Is your eye immediately drawn to the main message?
- ☐ Does the size of the poster comply with the event requirements?

More Resources

- **Posters CommKit** by MIT BE Comm Lab
- **How to Design an Award-Winning Conference Poster** by Tullio Rossi
- Resource for Visual Design in general: **The Visual Display of Quantitative Information** by Edward Tufte

Written Communication

Written

Personal Statements

Best practices

Highlight your **interests and qualifications**

Link your experiences and accomplishments to your skillset, growth and goals.

Demonstrate your **fit**

Connect your background and goals to the requirements and offerings of the intended program or fellowship.

Tell your **story**

Use personal, straightforward language, and organize content in a theme-driven narrative.

Process

1. Organize important experiences from your CV into a narrative structure that highlights your learning journey. Move beyond a simple chronology-driven structure and focus on highlighting your growth.
2. Make your language personal, bringing each paragraph back to your own growth and goals.
3. Use concise, direct language. Remove redundant explanations, vague ideas, or insignificant experiences to keep your statement clear and brief (<2 pages).

Written

Personal Statements

Make your statement a story

Weave your experiences and goals into a clear story of who you are, where you are going, and why. Avoid simply listing information. Strong statements have a clear structure and theme beyond just "I am qualified". Each paragraph should build on a central idea.

One way to structure your narrative

Provide a picture/theme of your background and interests.

What are your unique personal and professional attributes?

Use your experiences to share your story and qualifications.

What did you learn and gain from each experience? How did these influence you and your goals?

Connect your interests and experiences to your broader goals.

How has your training prepared you for short- and long-term career goals? What would you gain from this program/school/award?

Examples

"I want to combine engineering and clinical practice, because ... "

"My research experiences cemented my interest in tissue engineering, because ... "

"The next steps in my training will require a PhD, because ... "

Written

Personal Statements

Highlight your qualifications

Your statement should not be a list of accomplishments, but your experiences and training should still take center stage. Your professional and personal qualifications should serve as the backbone of each paragraph.

CV

2020
Research assistant
Lee Lab, MIT
2018
Summer Intern
Small Biotech Company

Personal statement

My interest in improving stem cell technologies led me to the Lee Lab at MIT, where I worked to develop [...] This project taught me [...] and left me interested in translational research.
To gain more experience with translational science and iPSC maintenance, I took a summer internship at Small Biotech Company [...] This experience showed me [...]

Demonstrate fit

The audience for your personal statement must evaluate whether you'd fit well in a given program or institution. Show what you bring to the table, and your understanding of the environment you hope to join.

Your Fit for Them

What relevant training and/or skills do you have?

What makes you unique or sets you apart from other candidates?

Their Fit for You

How will what they offer support your goals?

What makes their program, award, or community uniquely appealing to you?

Written

Personal Statements

Checklist

- ☐ Is the statement in the form of a personal narrative, instead of a chronological list?
- ☐ Does the statement clarify both why you are applying and why you would be a strong selection?
- ☐ Does each sentence and paragraph directly link to your qualifications or future goals? If not, make the connection explicit (or exclude the sentence).
- ☐ Does the statement address all concepts requested by the prompt (such as experiences, challenges, background, research interests, etc.)?
- ☐ Does the statement strictly adhere to all rules regarding word/character count and formatting?

More Resources

- **Graduate school personal statement CommKit** by MIT BE Comm Lab
- **NSF personal statement CommKit** by MIT BE Comm Lab

Written

Resumes

Best practices

Tailor content to the desired position

Research the company and position to understand their mission. Highlight your most relevant experiences and skills. Resumes don't have to be all-inclusive.

Show, don't tell

Set yourself apart by providing specifics and avoiding "fluffy" statements. Be deliberate about verb choice and quantify achievements when possible.

Use a clean and professional layout

Keep your document organized with key information prominent. Avoid overcrowded layouts.

Process

1. Research the company and job position.
2. Compile your most relevant experiences.
3. Decide on sections and resume structure.
4. Provide concise descriptions with quantitative details and strong word choice.
5. Polish formatting and check for errors and inconsistencies.

Written

Resumes

Tailor to the job

Use phrases from the job listing to decide which of your experiences will best demonstrate your qualifications.

Pay attention to both technical and transferable skills.

Examples

Phrases from job listing	Relevant experiences
"work with other groups"	multi-agency research project
"dynamic and motivated"	pilot mentorship program
"use automation to work efficiently"	custom data analysis pipeline

Use strong verbs

Select descriptive verbs to emphasize your skillset.

Leadership

Administered
Coordinated
Directed
Executed
Organized
Oversaw

Technical

Adapted
Designed
Calculated
Introduced
Identified
Reviewed

Collaborative

Communicated
Coordinated
Trained
Facilitated
Guided
Mediated

Written

Resumes

Use specific language

Provide concise descriptions and concrete details for your experiences to distinguish yourself. Where possible, quantify your achievements.

Examples

Too vague	Specific, memorable
"assisted in various lab tasks during my internship"	"optimized fermentation processes in a biotech lab, increasing yield of target metabolites by 30% over three months"
"led a student organization and coordinated events"	"chaired the MIT XYZ club, boosting monthly event attendance by 40% and securing \$5,000 in funding for research initiatives"

Polish your final document

Use headers, whitespace, and text emphasis to help direct your reader to key information. Check for errors and inconsistencies in format.

Written

Resumes

Checklist

- ☐ Are key technical and transferable skills conveyed clearly?
- ☐ Do bullets use strong action verbs and quantitative details?
- ☐ Is the formatting clean and easy to skim?
- ☐ Where possible, does content explicitly match desired qualifications in the job listing?
- ☐ Are generic descriptors minimized? Space is limited, so make every word count.
- ☐ Is the final document free from errors?

More Resources

- **CV / Resume CommKit** by MIT BE Comm Lab
- **List of strong action verbs** by MIT CAPD

Written

Manuscripts

Best practices

Define your **narrative**

Clearly situate your work by starting and ending with the broader context. Lead into your work with a focused line of reasoning. Consider both your audience and your objective.

Use **parallel structures**

Be consistent with your narrative in every section. The reader should get the same story from the abstract, headings, and figures.

Focus on a clear **message**

Your manuscript should convey one central message/finding. Think critically about what data is necessary to illustrate your point and present it as directly as possible.

Process

1. Research the audience and the journal where you aim to publish your work.
2. Compile your figures and results into a cohesive narrative.
3. Frame your work with the introduction and discussion sections.
4. Get feedback and iterate to refine your narrative.

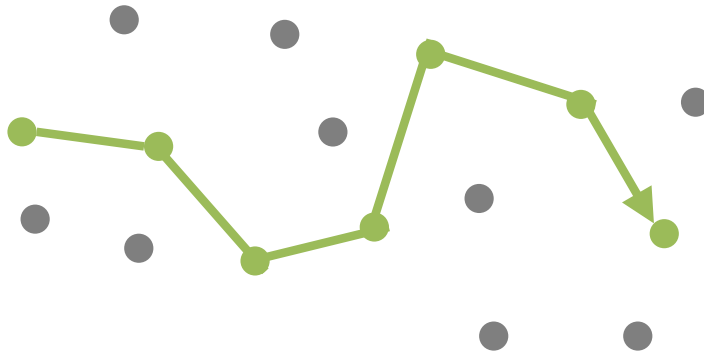
Written

Manuscripts

Define a clear narrative

Focus on a central finding. Research can be messy; it is important that you parse out a clean and logical path to follow.

Your process:



Your story:



Consider your audience

Both the journal you submit to and your target audience will shape the narrative structure and writing style.

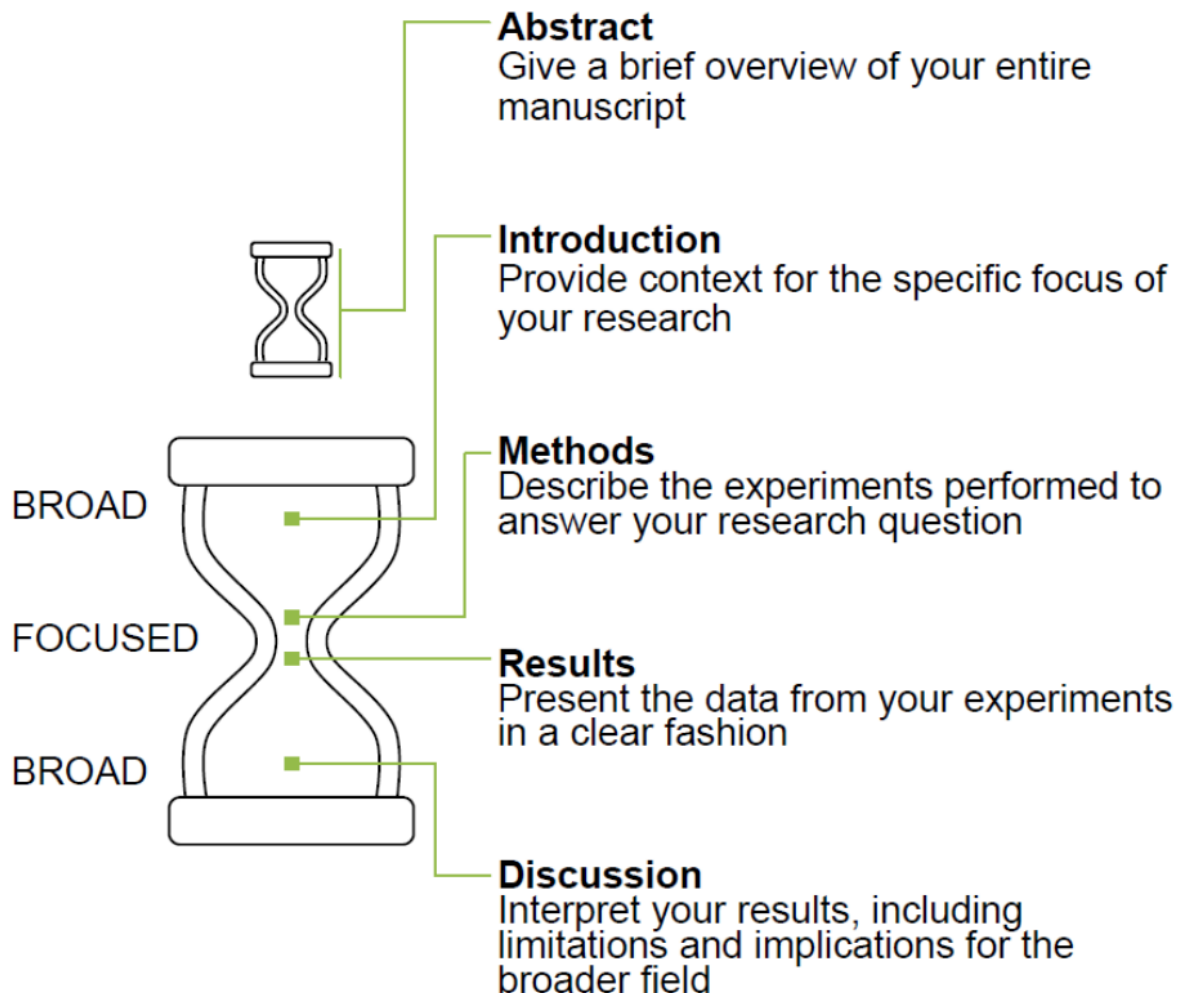
- Is the journal narrow or broad in scope? Theoretical or applied?
- What are the journal's specific guidelines?
- What are the style and tone of recent articles?
- How familiar is your audience with this topic?
- What do you want the reader to take away? (e.g., a novel method, a new biological finding)

Written

Manuscripts

Structure your manuscript

Each section communicates a specific aspect of the study, from context and methods to findings and their implications. Follow an hourglass structure that is broad in the beginning and end, but focused in the middle.



Written

Manuscripts: Abstracts

The abstract provides a highly condensed version of the manuscript for the reader to quickly assess relevance.

A typical abstract structure is shown below:

Example

Problem-specific background



Cellular processes are carried out by many genes, and their study and optimization requires multiple levers by which they can be independently controlled. The most common method is via a genetically encoded sensor that responds to a small molecule.

Knowledge gap



However, these sensors are often suboptimal, exhibiting high background expression and low dynamic range. Further, using multiple sensors in one cell is limited by cross-talk and the taxing of cellular resources.

Approach to address gap



Here, we have developed a directed evolution strategy to simultaneously select for lower background, high dynamic range, increased sensitivity, and low cross-talk.

Quantitative Results



This is applied to generate a set of 12 high-performance sensors that exhibit >100-fold induction with low background and cross-reactivity [...]

Implications



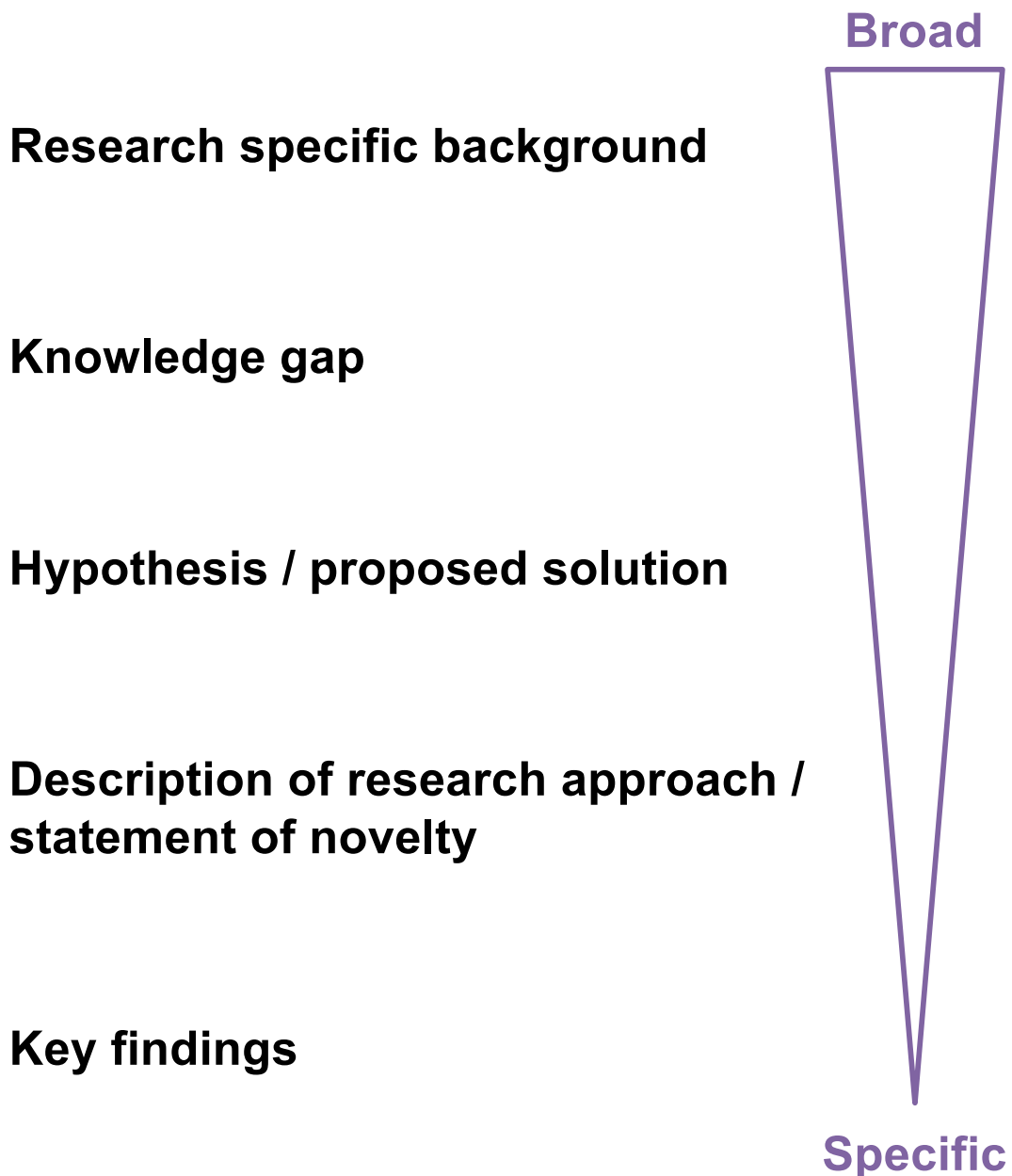
These “Marionette” strains allow for the independent control of gene expression using 12 small-molecule inducers.

Meyer, A.J. *et al. Nat Chem Biol* **15**, 196–204 (2019)

Written

Manuscripts: Introduction

The introduction should lead into the specific knowledge gap or problem that your research addresses. Provide your reader with the context needed to understand what you did and why it matters.



Written

Manuscripts: Methods

The methods section is generally for people familiar with your field to assess the validity of your research or to replicate your experiments. Order subsections in your methods logically, and where possible, align your methods to the results section. For each subsection, be sure to cover the following points:

Justify your experimental design

Example: "Site-saturation mutagenesis ... enables systematic coverage of substitutions at sites of interest."

Succinctly describe how the experiment was done

Example: "Seeds of the wild type or transgenic lines were surface sterilized, stratified for 4 days at 4°C, and then grown ... After 10 days, the culture solutions were adjusted to contain 50 µM ABA, 2 µM mandipropamid, or a mock ... After RNA was isolated using RNAEasy Plant RNA isolation kit (Qiagen) ... the libraries were sequenced using a HiSeq instrument."

Explain how data was analyzed

Example: "The raw HiSeq data was mapped to the Arabidopsis genome using TOPHat ... The Cufflinks package was used to compare samples."

Park et al., *Nature* **520**, 545-548 (2015)

Written

Manuscripts: Results

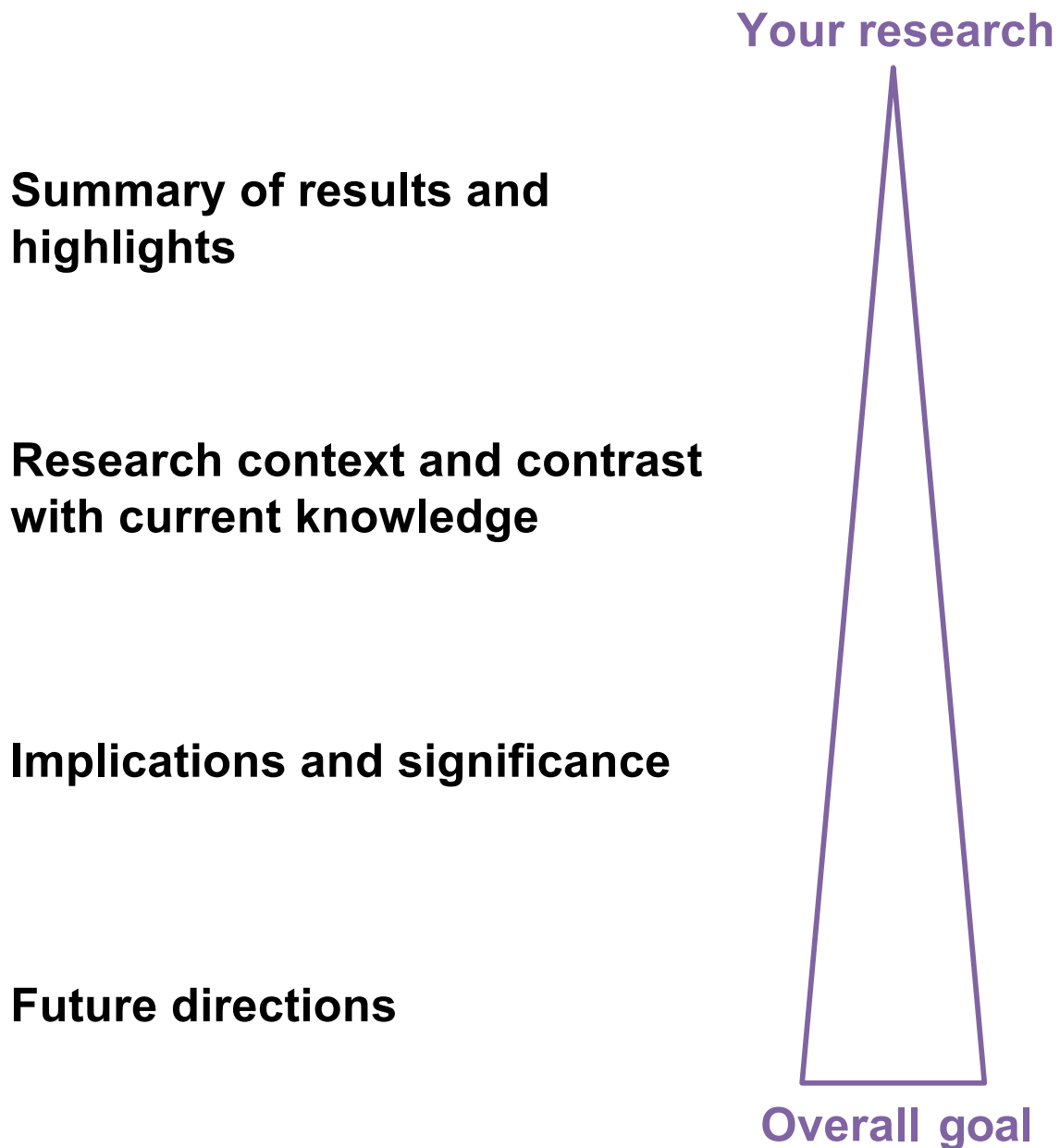
In the results section, clearly present the data from your experiments and explain what it means. Organize the results into sections, each describing one main takeaway. Save more extensive interpretations for the discussion section.

Structure	Example
Compose a meaningful title: Choose a title that summarizes the main point of the section	Enhanced Metabolic Pathway Increases Biofuel Production in <i>E. coli</i>
Orient your reader: Explain the rationale behind the work	To improve yield of the biofuel ethanol, we engineered <i>E. coli</i> to enhance the fatty acid biosynthetic pathway.
Present your data: Reference figures	The modified strains produced 1.5 g/L of fatty acids, compared to 0.8 g/L in the wild type (Fig. 1).
Interpret your results: Summarize the most important and direct interpretation	These results indicate a 87.5% increase in ethanol production, confirming the effectiveness of the metabolic modifications.
Transition to the next section	These findings underscore the potential for engineered microbes in sustainable biofuel production, warranting further exploration of pathway optimization.

Written

Manuscripts: Discussion

The discussion section is the place for you to explain and interpret your results in greater depth. Finish with a forward-looking position that leaves the reader with an understanding of the significance of your research.



Manuscripts

Checklist

- ☐ Is the manuscript written with the intended journal in mind? Does it follow all of the journal's guidelines?
- ☐ Is the narrative clear and consistent? Do headers and figure captions reinforce one central story?
- ☐ Is there sufficient explanation of the motivation behind research and the key concepts needed to understand the work? (**Introduction**)
- ☐ Are descriptions of how the research question was investigated concise and specific? (**Methods**)
- ☐ Are data from experiments presented clearly? Are key takeaways highlighted explicitly? (**Results**)
- ☐ Are experiments linked to each other with a logical progression? (**Results**)
- ☐ Are the significance of findings and the implications for the field explained? (**Discussion**)

More Resources

- **Manuscript CommKit articles** by MIT BE Comm Lab
- **How to write a first-class paper** by Virginia Gewin
- **Scientific Writing Made Easy** by Sheela Turbek et al.

Written

Proposals

Proposal writing is a key part of the scientific process. Whether you are writing a proposal for your graduate qualifying exam, a fellowship application, or as part of a grant submission, you need to address the following:

Know the field

Your proposal should address a **critical gap or need** in your field.

Understand what approaches have been tried before to identify a **novel solution**. Talk to professors and labmates, read the literature, and adjust your ideas as you **receive feedback**.

Demonstrate the match

Identify concrete points that highlight the match between your proposal and the **aims of the funding agency**. If possible, **reach out** to the funding organization to learn more about the fit.

Tailor to the audience

Write with the reviewers in mind. Use technical terms according to the reviewers' expertise.

Follow the format

A good proposal can be dismissed due to improper formatting. Be sure to **include the proper sections** and follow font, figure, and page number requirements.

Written

Proposals: Aims

Best practices

Compose aims that tackle a **specific problem**

Identify a key knowledge or technical gap in your field. Justify the need for a solution and articulate its impact. Make sure that your proposed problem and solution are within the same scope.

Defend the feasibility of each aim

Use any preliminary data or results from literature as a rationale for your approach. Provide an overview of planned experiments and expected outcomes. Include metrics for success. Describe potential challenges and alternative approaches to address them.

Connect aims to the **big picture**

Each aim should address your main problem or question. Aims can be connected to each other linearly or can stand alone.

Process

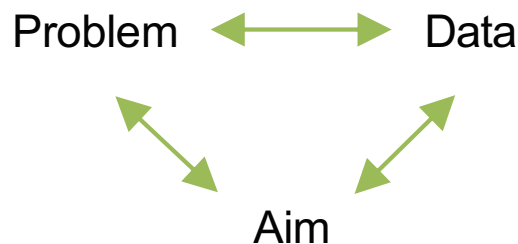
1. Conduct a literature search in your field and understand what the long-term goals are.
2. Brainstorm questions or problems that currently limit advancement of the field toward these goals.
3. Evaluate the feasibility, impact, and limitations of your ideas.
4. Get feedback from colleagues.

Written

Proposals: Aims

Draft aims that tackle a specific problem

A common pitfall seen in specific aims sections is that the proposed solution ends up answering a different problem than the one identified. To avoid this, think about the data you will collect and how they will help address the problem of interest.



Defend the feasibility of each aim

For each aim, describe, in detail, the appropriate **experiments**, expected **results**, and suitable **data analysis**.

Example:

Aim: Determine if Molecule1 recruits Molecule2 in a pathogen-containing vesicle

We will generate endogenous expression of fluorescent Molecule1 and Molecule2 and will conduct live imaging. We expect to see Molecule2 localize to vesicles after presence of Molecule1. Imaging data will be analyzed by marking vesicles as regions of interest and measuring fluorescent expression of molecules in a set time frame.

Written

Proposals: Aims

Connect aims to the big picture

Proposal aims work together to back up a central claim. They can add on each other or function independently to accomplish that main objective. If aims are connected linearly, try to ensure the first aim's success. Below are examples of aims that work together.

Aim 1	Aim 2	Aim 3	Claim
Build a model	Test the model	Apply the model	Model can be used to solve X
Build part 1	Build part 2	Build part 3	Develop technology
Example of a phenomenon	Example of a phenomenon	Example of a phenomenon	Phenomenon is true and important

Written

Proposals: Aims

Checklist

- ☐ Does each proposed solution address the problem being tackled?
- ☐ Is the feasibility of each aim justified? Are adequate background and technical details included?
- ☐ Does each aim have a defined metric for success?
- ☐ Does each aim include possible pitfalls and alternative solutions?
- ☐ Do the aims connect to each other to answer an overarching problem?

More Resources

- **Resource on NIH grant writing** by NIAID
- **NIH Grant Applications - The Anatomy of a Specific Aims Page** by Bioscience Writers

Written

Editing Checklist

Edit at the section level

- ☐ Does each section follow the hourglass structure? Are all critical sections included and easily identifiable?
- ☐ Are the structures of different sections comparable? Do they have parallel formatting?

Edit at the paragraph level

- ☐ Does each paragraph contain a claim, appropriate evidence, and a transition sentence?
- ☐ Does the subject of one sentence logically transition to the subject of the next sentence?
- ☐ Is the verb tense the same in all sentences? If not, be sure that the change in tense is intentional.

Edit at the sentence level

- ☐ Are the subject and the verb as close to each other as possible?
- ☐ Do all instances of "this", "that", and "they" have a clear subject that each refers to?
- ☐ Are any sentences too long and hard to follow? If yes, consider dividing into two or more sentences.

A full checklist can be found at:

<https://mitcommlab.mit.edu/be/2020/08/11/editing-checklist>

Verbal Communication

Public Speaking

Best practices

Engage the audience vocally and visually

Play with the volume, speed, and complexity of your speech to maximize clarity. Practice effective body language to connect with the audience.

Maximize **signal** and minimize cognitive load

Each slide should convey one central message/finding. Think critically about what data is necessary to illustrate your point and present it as directly as possible.

Orient your audience before stating your point

Be consistent with your narrative in every section. Start by orienting the audience to the content. Specifically, explain each plot and describe how to interpret the data.

Process

1. Design content to match your audience's expertise.
2. Present one idea at a time.
3. For each slide/idea, organize your speech by summarizing all necessary information to understand the data, then stating the main point.
4. Plan transitions from one slide/idea to the next.
5. Practice, get feedback, and repeat.

Verbal

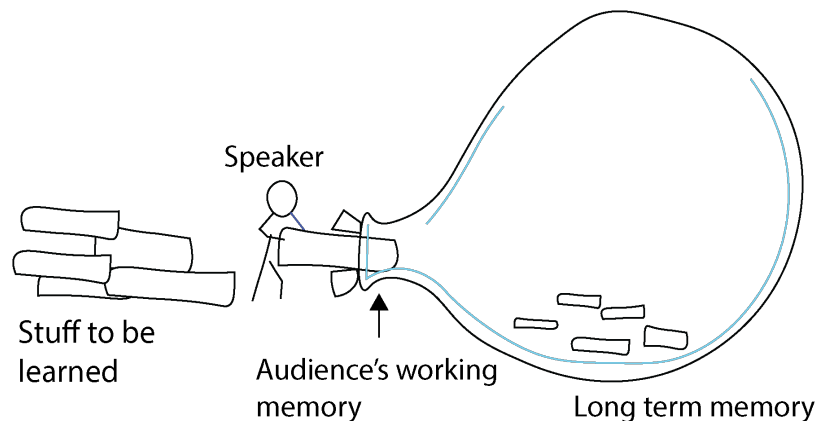
Public Speaking

Engage the audience vocally and visually

Do	Don't
Modulate your tone, pace, and volume to emphasize key points	Speak in a monotone, which can cause listeners to lose interest
Use pauses effectively to give the audience time to absorb information and to signal important transitions	Speak quickly or read text directly from your slides or notes
Use power poses and eye contact to project confidence during your talk	Project unnecessary motions that are distracting

Minimize the audience's cognitive load

Focus on concepts and conclusions connected to the visible slide. Use simple, clear sentences and exclude minor or confusing details as well as unnecessary jargon.



Verbal

Public Speaking

Orient your audience before stating your point

Ensure that each section flows logically and maintains a consistent narrative. Clear transitions help bridge ideas and make your talk easier to follow.

Introduce data visuals (graphs/tables) by explaining what they show and why they're relevant. Walk the audience through how to interpret each element (e.g., axes, colors). Giving an example of how to interpret a specific data point can be especially helpful in complex presentations.

Example skeleton for audience orientation:

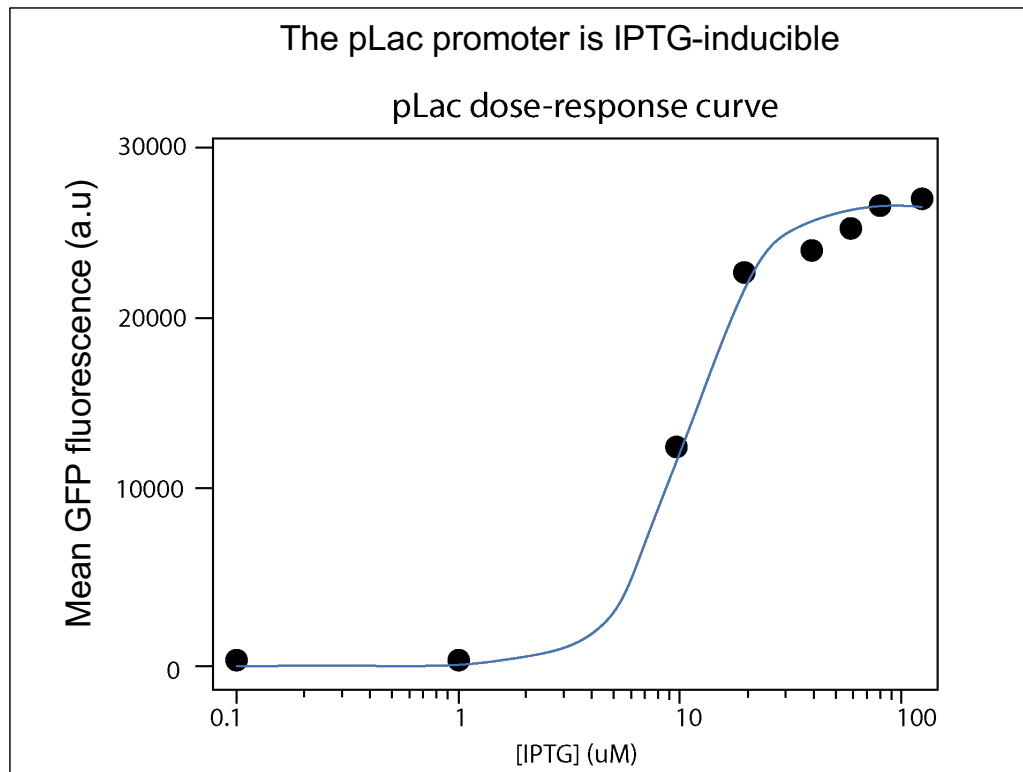
"To accomplish/ To test ABC, we performed experiment X , On the x-axis we plotted On the y-axis..... Data points are shown in X color/shape.... The dotted lines refers to This plot shows XYZ..."

Verbal

Public Speaking

Orient your audience before stating your point

Example:



"To check that the pLac promoter is inducible by IPTG, we engineered cells to express a reporter green fluorescent protein using the pLac promoter. This is a plot showing GFP fluorescence at varying IPTG concentrations. On the x-axis are the IPTG concentrations in uM. On the y-axis is the mean GFP fluorescence from three replicates. The black dots are experimental samples. The blue curve represents the Hill curve that has been fitted to the experimental data. As shown in this dose response curve, IPTG induces pLac promoter activity by up to 30000 fold."

Public Speaking

Checklist

- ☐ Did you practice the full talk at least once and receive feedback?
- ☐ Have you identified and addressed issues with volume, speed filler words or distracting gestures?
- ☐ Can you present information without reading directly from the slides?
- ☐ Does your verbal speech match slide content without logical or conceptual discrepancies?
- ☐ Is your speech flow is not interrupted by excessive use of animations/ incremental appearance of relevant information on the slide?
- ☐ Do you have smooth transitions from one point to the next?

More Resources

- **Intro to Public Speaking CommKit** by the MIT BE Comm Lab
- **Slideshow CommKit** by the MIT BE Comm Lab
- **MIT's Oral Communication Studio** by the Writing and Communication Center

Verbal Interviews

Best practices

Do your research and **prepare**

Research the role and the company. Learn about their values and mission. Familiarize yourself with interviewers' backgrounds.

Reflect and carve out your **story**

Reflect on your experiences and identify how they match the mission and values of the company and its current employees. Prepare story-based responses, rather than fact-based ones.

Practice, practice, practice

Practice your responses with a friend or a career advisor. Improve your delivery and answers based on feedback.

Process

1. Research the company and the interview participants.
2. Prepare a list of potential questions and identify the experiences that are relevant to each question.
3. Reflect on the stories that shape your work and achievements. Prepare a script of how you plan to tell those stories to demonstrate your fit.
4. Practice to refine your answers based on feedback. Eliminate gestures that might undermine your delivery.

Verbal

Interviews

Do your research and prepare

Before the interview, take time to thoroughly research the company and the role you're applying for.

Information	Where to find it
Company values, mission and achievements	Company "About" page Press releases
Work culture	Recruiter or hiring manager Ask different people the same question for a more complete picture Example questions: <ul style="list-style-type: none">• <i>Why do you like working here?</i>• <i>What makes the company culture unique?</i>
Priorities for the role	Start with the company's values and mission on their website Ask the future manager; it can be more effective to ask indirectly Example questions: <ul style="list-style-type: none">• <i>What support structures exist for project A?</i>• <i>In the first six months, should I be focused on project A or B?</i>
Key people you'll meet, their roles and background	Job listing may name the hiring manager Company website, LinkedIn

Interviews

Reflect and carve out your story

Reflect on your experiences and identify examples that align with the company's values/mission. Rather than covering all of your resume, prepare story-based responses that illustrate your skills, qualities and growth journey relevant to the position you are applying to.

Example

Question: "Tell me about yourself."

Fact-based answer: "My name is Jenna; I am a 4th year undergraduate at MIT, studying biological engineering. I currently work in the lab of Dr. XX, studying endometriosis."

Story-based answer: "My name is Jenna; I am a 4th year undergraduate student in biological engineering at MIT.

I currently work in the lab of Dr. XX, where we study the impact of hormonal imbalance on endometriosis. I am particularly interested in this topic because many women in my family suffer this condition, and I know how it directly impacts their quality of life.

Recognizing the lack of understanding that still hinders progress in developing effective cures, I reached out to Dr. XX and expressed my interest. Dr. XX then paired me with Dr. Y, a postdoc who mentored me and helped me learn XYZ skills. And I am hoping to use the skills I learned to contribute to your company in this role.

Verbal

Interviews

Use the **STAR** method to show you're qualified

The **S**ituation, **T**ask, **A**ction, **R**esult (STAR) method is highly effective in answering behavioral questions and in demonstrating technical competence

Example

Question: "Describe a situation where you had to communicate complex ideas to someone with a different background from yours."

STAR answer:

Situation: As a PhD student in Biological Engineering, I was mentoring a group of high school students during a summer synthetic biology research program. Many of them had little to no background in biology or coding, yet their project required them to understand and implement a genetic circuit design and simulate its behavior using Python.

Task: My goal was to help them grasp the basic biological concepts underlying the genetic circuit—such as transcriptional regulation and feedback loops—and translate those into a working computational model, all while keeping them engaged and confident.

..... *Continued on the next page (p.55)*

Verbal Interviews

..... *STAR answer continued*

Action: I began by breaking down the biology into simple analogies—comparing promoters to “light switches” and repressors to “traffic stops.” I used diagrams and interactive visual tools rather than jargon-heavy slides. For the coding portion, I scaffolded the programming tasks step-by-step, pairing each line of code with a biological meaning. I also encouraged them to ask questions freely and gave them real-time feedback on their logic and code.

Result: By the end of the program, not only had the students successfully built and simulated a genetic toggle switch, but they were also able to present their work clearly to a panel of scientists. Several of them said they were now considering biology or bioengineering as potential career paths. One student even reached out later for help starting a synthetic biology club at her school.

Verbal

Interviews

Engage resources to practice

Practicing your responses is essential to building confidence and improving your delivery. Conduct mock interviews with a friend, mentor, or career advisor, and ask for constructive feedback on your answers, body language, and tone.

Evaluate how well you employ the following strategies:

Content

- Let the interviewer(s) finish the question before answering
- Be comfortable admitting to not knowing the answer, but still demonstrate critical thinking
- Avoid flat “yes” or “no” answers to technical questions
- Ask meaningful questions about the company/position

Delivery

- Answer questions with confidence
- Avoid rambling at the end of answers
- Speak clearly and avoid mumbling
- Maintain good posture, with an open and attentive position (arms not crossed, etc.)
- Provide good eye contact with interviewer

Through your answers and delivery, demonstrate **interest and enthusiasm** for the job.

Verbal Interviews

Checklist

- ☐ Are you prepared to arrive with proper materials and attire?
- ☐ Did you conduct background research on participants?
- ☐ Did you prepare a list of potential questions and answers?
- ☐ Did you practice with another person and receive feedback?
- ☐ After the interview, did you follow-up with interview participants to thank them?

More Resources

- **Interview resources** by MIT CAPD
- **Strategies of Effective Interviewing** by Samuel G. Trull, Harvard Business Review
- **A practical guide to graduate school interviewing for historically excluded individuals** by Elizabeth Ransey et al.

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Want to continue your communication journey beyond this resource?

Visit the BE Comm Lab Website to make a 1:1 communication coaching appointment or see more tips and examples in our CommKit at mitcommlab.mit.edu/be/.

