

COMMUNICATION

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WHAT I HOPE YOU WILL LEARN IN THIS COURSE:

- Why is it important to communicate well?
- What is communication?
- What are the key principles of good communication?
- What makes for a good oral presentation?

INTRODUCTION

to Communication

Why is it important to communicate well?

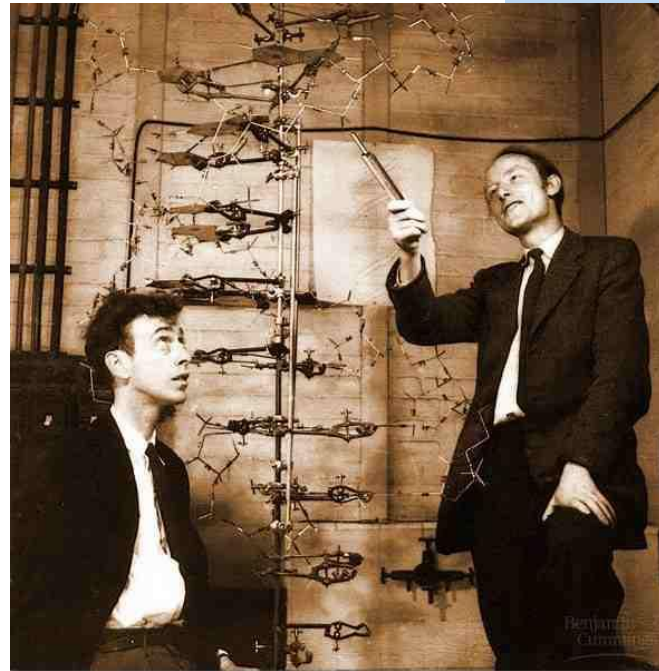
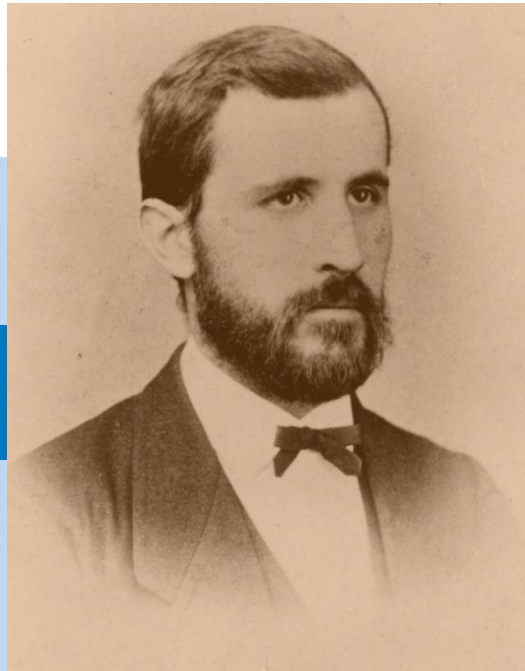
What is communication?

BIG DISCOVERIES DO NOT ALWAYS LEAD TO FAME

- Who knows these gentlemen?

Friedrich Miescher

Discovered DNA



James Watson & Francis Crick

Discovered the structure of DNA

MIESCHER'S DISCOVERIES



DNA is...

- A novel substance (macromolecule, acid...)
- Equal in importance to proteins
- Present in the nucleus → Chemically defines the nucleus
- Present in all cell-types
- Amount of DNA increases when cells proliferate, e.g. in tumors
- Sperm head composed of DNA & protamine [histone equivalent] that occur in constant ratios
- Speculated on role of nucleus/DNA in fertilization & heredity



Given the importance of DNA & Miescher's discoveries,
why does hardly anyone remember him?



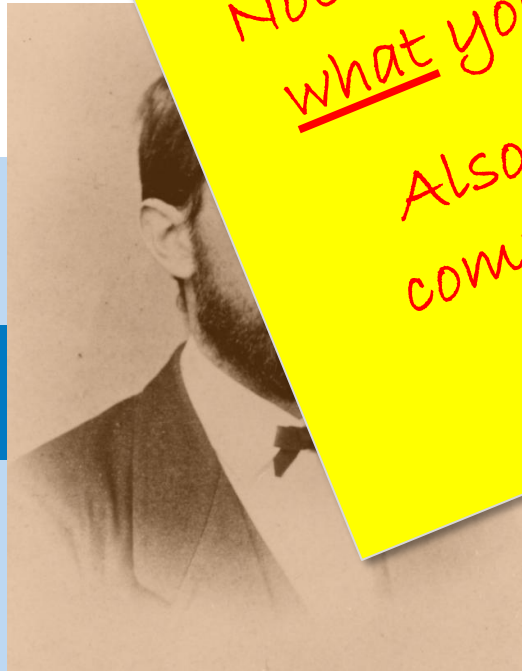
BIG DISCOVERIES DO NOT ALWAYS LEAD TO FAME

- Who knows these names?

Not only important
what you discover
Also, how you
communicate it

Friedrich Miescher

Discovered DNA



**James Watson &
Francis Crick**

Discovered the
structure of DNA

BEYOND PUBLISHING & BEING CITED...

You also need strong communication skills to

- **Get jobs** (application & interview)
- **Raise funding** (proposals & presentations)
- **Coordinate projects & lead people**
- **Win collaborators & convince skeptics**
- ...

WHAT IS COMMUNICATION?

Different forms:

- written
- verbal
- non-verbal
 - Posture, gestures, facial expression, eye contact, touch, clothes...
 - How you speak: speed, emphasis, intonation...
= Paralanguage



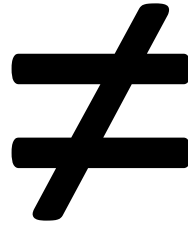
Exact figures depend on

- Individual
- Situation
- Content of communication

→ **Most communication is non-verbal**

THE GOOD NEWS

Effective
Communication



- Few basic rules
- Same for different kinds of presentations, publications...
- Can be learned

IN A NUTSHELL...

- Being able to communicate well is important
- My aim:
Convey the key principles of how you can communicate effectively
- Your benefit:
Being more successful



GENERAL PRINCIPLES

of Good Communication

- 1) Think of your audience
- 2) Focus on the big picture
- 3) Have clear take-home messages
- 4) Keep it short & simple
- 5) Use concrete examples
- 6) Tell a story
- 7) Prepare & practise

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WHY DO WE COMMUNICATE?

(as scientists)



- Get published
- Win over collaborators
- Make a name for yourself
- Obtain funding
- Get jobs
- Educate
- Convince others (colleagues, stakeholders, public) ...

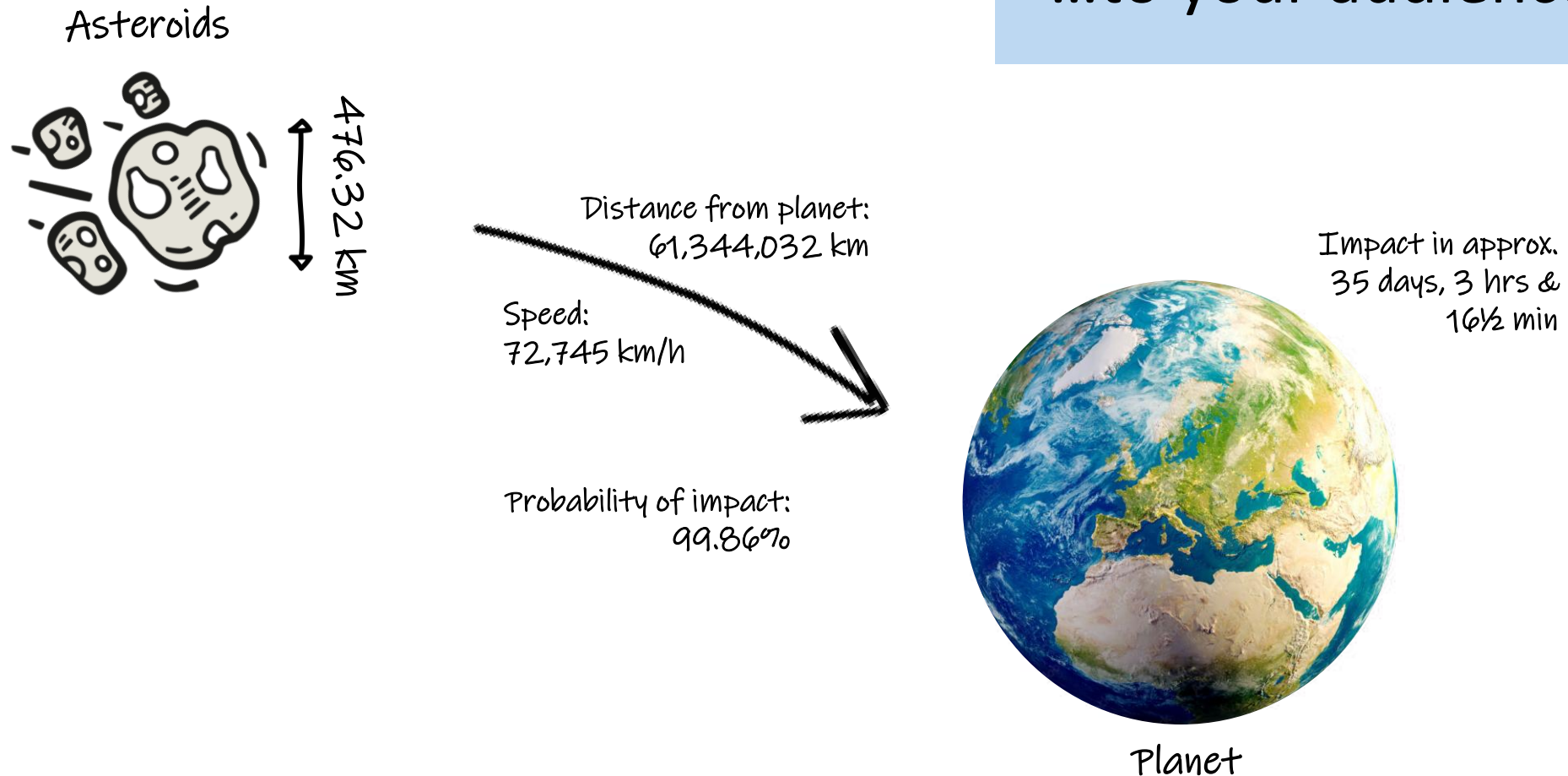
WHO DO WE COMMUNICATE FOR?



- If your audience does not pay attention, you may as well not communicate at all

MAKE WHAT YOU COMMUNICATE RELEVANT

...to your audience



WHENEVER & WHATEVER YOU COMMUNICATE: THINK OF YOUR AUDIENCE



- Who are they?
 - **What do they care about?**
 - What do they know? What don't they know?
 - Why are they there & what do they expect?
- Allows you to maximize your impact

ONCE YOU KNOW WHO YOUR AUDIENCE IS, TAILOR YOUR COMMUNICATION TO THEM



- Capture their attention with a gripping start
- Explain why your topic matters (to them)
- Explain the “problem” & how it relates to them
- Explain how you address the problem, what the outcome is & what this means (to them)

MAKE IT RELEVANT – HOW TO IN A SCIENTIFIC CONTEXT?

- Deliver information in a context that matters to your audience

“Cataract surgery is the most common surgical procedure in industrialized nations”

- 7 / 10 of you will undergo cataract surgery
- ...% of the health care budget is spent on this



PRESENT INFORMATION IN A CONTEXT THAT MATTERS TO YOUR AUDIENCE

We investigate postprandial metabolic regulation & insulin signaling dynamics

- We study why after some meals you feel energized, but after others you are sleepy, unfocused & hungry again quickly

We examine neuroendocrine modulation of cognitive performance under acute stress

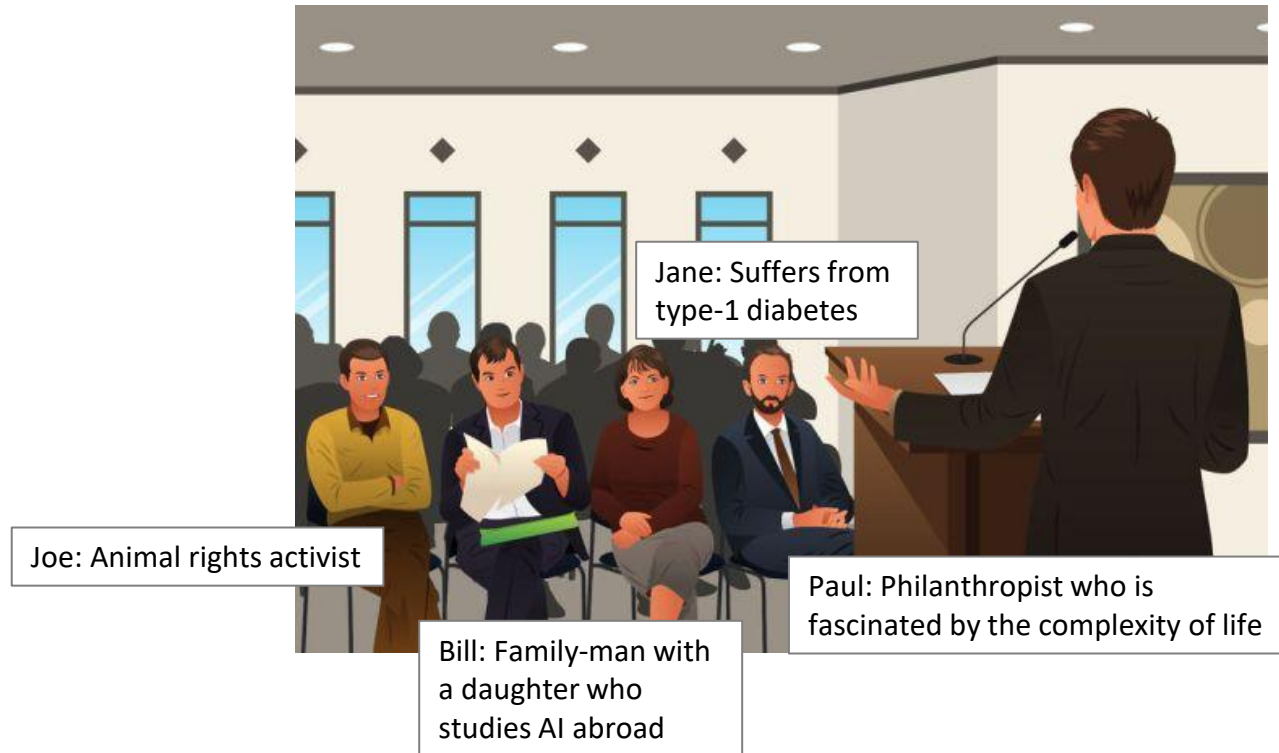
- We study why stress can make it harder to think clearly, remember things, or take decisions
— even when you know the material

Our research focuses on host–microbiome interactions following perturbation of commensal bacterial communities

- We study why a course of antibiotics can cure your infection but also give you diarrhea, stomach problems, or leave you vulnerable to other infections

SCENARIO:

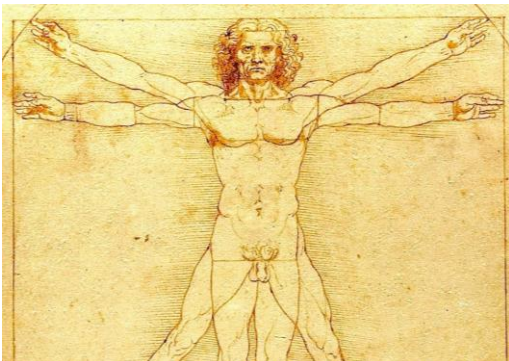
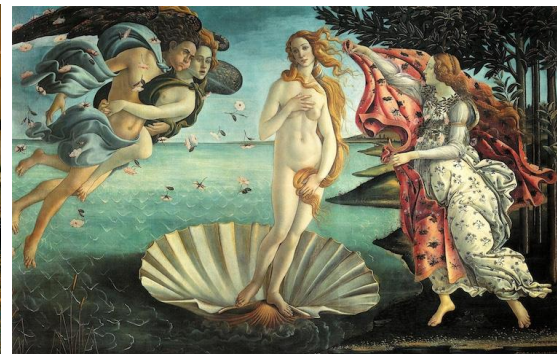
YOU SEEK FUNDS FOR A RESEARCH CENTRE FOCUSED ON COMPUTATIONAL MEDICINE



→ How do you get them interested in your talk?

WHEN YOU DON'T KNOW YOUR AUDIENCE, CAST A WIDE NET

Why visit Italy?



WHY VISIT ITALY? – FOR MY 10-YR OLD DAUGHTER



MAKE IT RELEVANT – HOW TO IN A SCIENTIFIC CONTEXT?

- Deliver information in a context that matters to your audience
- Use analogies to make abstract data more tangible

ANALOGIES CAN MAKE INFO MORE ACCESSIBLE

- 4.5 bn yrs ago: Earth forms
- 3.6 bn yrs ago: Life emerges
- 66 m yrs ago: Dinosaurs extinct
- 250,000 yrs ago: Anatomically modern humans appear
- 11,000 yrs ago: Agricultural revolution



4.5 billion years = 1 year

- 1 January: Earth forms
- 14 March: Life emerges
- 26 Dec, 15:36 hrs: Dinosaurs extinct
- 31 Dec, 23:31 hrs: Anatomically modern humans appear
- 31 Dec, 23:59 hrs: Agricultural revolution



HOW RICH IS ELON MUSK?

- Net worth Elon Musk: ~ **\$1.1tn** (June 2026) = \$1,100,000,000,000
- Net worth typical Italian citizen: \$114,000

1 cappuccino (\$2)



=

For Musk: \$19,298,246



MAKE IT RELEVANT – HOW TO IN A SCIENTIFIC CONTEXT?

- Deliver numbers/data within a context that matters to your audience
- Use analogies to make abstract facts more tangible
- Focus on implications/benefits of your work:
saving lives, saving time, saving money, saving the environment...

THE IMPORTANCE OF DNA REPAIR



- Every day: $\sim 230,000$ lesions / cell
- $> 10^{13}$ cells in the human body
- Total damage: $> 10^{18}$ lesions / day,
every one of which can be the one that causes cancer
- $10^{18} \approx$ Grains of sand on all beaches on Earth

MAKE IT RELEVANT – HOW TO IN A SCIENTIFIC CONTEXT?

- Deliver numbers/data within a context that matters to your audience
- Use analogies to make abstract facts more tangible
- Focus on implications/benefits of your work:
saving lives, saving time, saving money, saving the environment...
- Use emotion → Highly motivational & easier to remember than facts

Child suffering from
Xeroderma pigmentosum



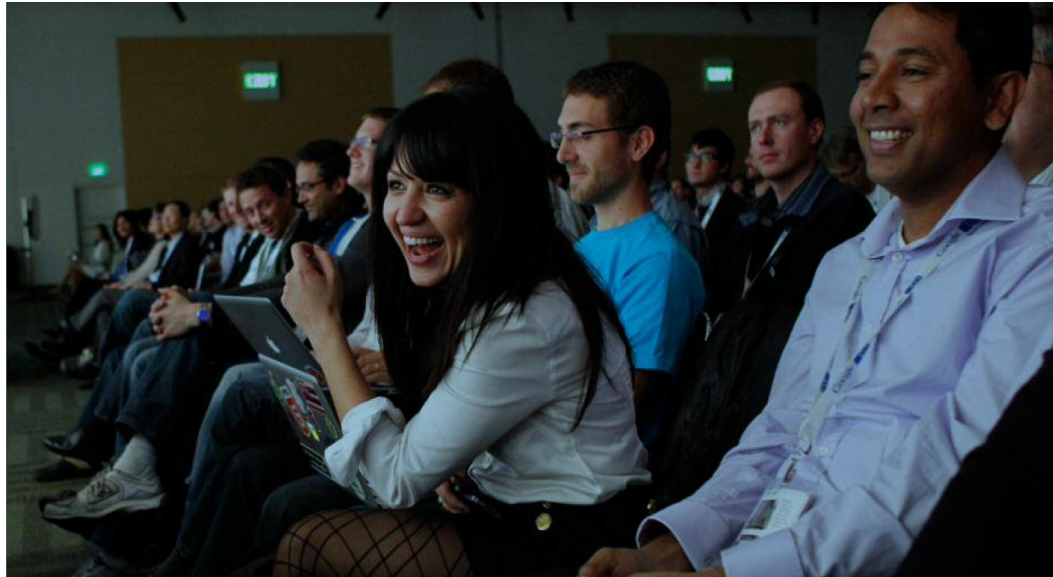
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By making it relevant, you make it memorable & convincing

YOU GIVE YOUR TALK FOR YOUR AUDIENCE, NOT YOURSELF

Think of your audience when preparing your talk



→ Exercise:

How can you make your project relevant to a general biologist

IN A NUTSHELL...

- Find out what your audience knows, desires & expects
- Tailor your communication to them
- Make it accessible & relevant



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FOCUS ON THE BIG PICTURE



DETAILS ONLY MAKE SENSE WHEN INTEGRATED INTO A BIGGER CONTEXT

If you start out with details too soon, your audience will not connect to your topic

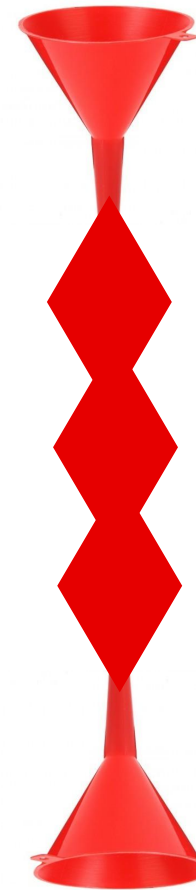
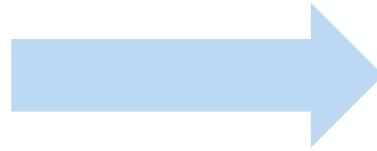
- Instead start your presentation with an overview that...
 - places your specific topic into a general context everyone in the audience is familiar with
 - makes the importance of this area & your work clear
- Regularly “zoom out” & embed details you just related into a wider context again
- At the end, summarise your key findings & again integrate them into a general context

THE DOUBLE FUNNEL:

START WITH BIG PICTURE \square DETAILS \square BIG PICTURE



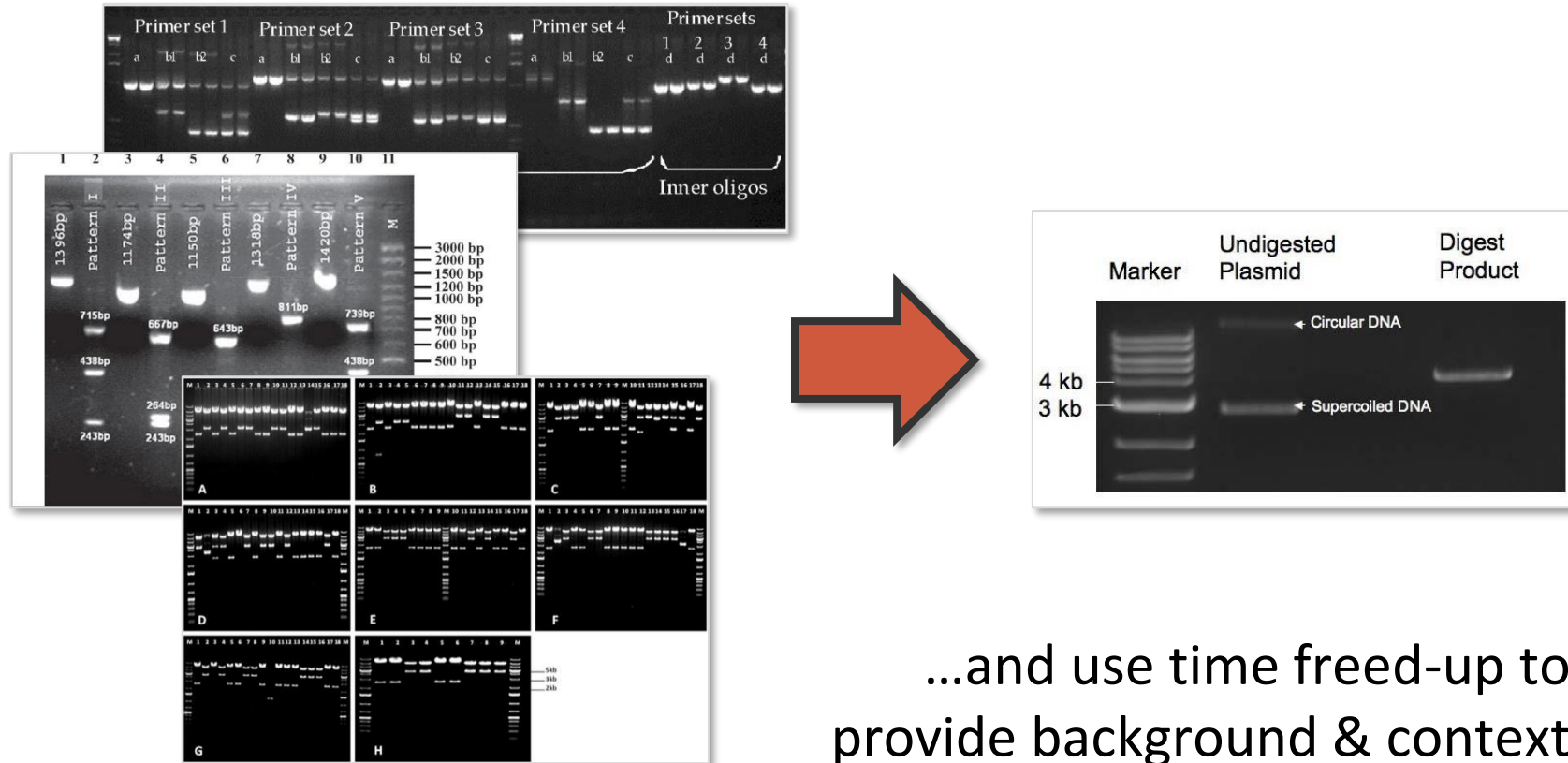
In a longer talk



MAKE CLEAR THAT THERE IS A PROBLEM BEFORE YOU EXPLAIN HOW YOU WILL SOLVE IT



SHOW KEY DATA ONLY



...and use time freed-up to provide background & context

IN A NUTSHELL...

- Without sufficient context, people will not connect with what you have to say
- Explain the importance of your field & what you did
- Regularly zoom out to the big picture



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DEFINE WHAT YOU WANT TO COMMUNICATE

Be very clear about what you want to impress your audience with
= Your take-home message(s)

→ Build your talk / text around it:

- What story best conveys your take-home message?
- What details do you need to support your message?

YOUR TAKE-HOME MESSAGE(S)



A designer knows he has achieved perfection not when there is nothing left to add, but when there is nothing left to take away.

Antoine de Saint-Exupéry

= **Most important part of your talk**

- Convey the significance of your work
- Keep them brief & simple
- Define & state them very clearly
- Not more than 1 key message for every 10-15 min. you talk

STATE YOUR TAKE-HOME MESSAGE EARLY ON

- State them at the start & **before** you add details that support / qualify it
 - Details dilute your key message
 - Anchor the concept first, then qualify it
- Repeat your key message throughout talk / text

DELIVER YOUR TAKE-HOME MESSAGE WITH IMPACT

When stating it

- Face your audience
 - Choose simple, precise & concise language
 - Speak slowly & articulate well
 - Pause
- Repeat it throughout talk / text

THE TITLE OF A SLIDE SHOULD SUMMARISE THAT SLIDE

Main advantages:

- Ensures your main point comes across
- Allows people to get back into your talk if they got distracted

YOUR RESULT MATTERS, NOT HOW YOU GOT IT



TELL YOUR AUDIENCE WHAT YOU FOUND...

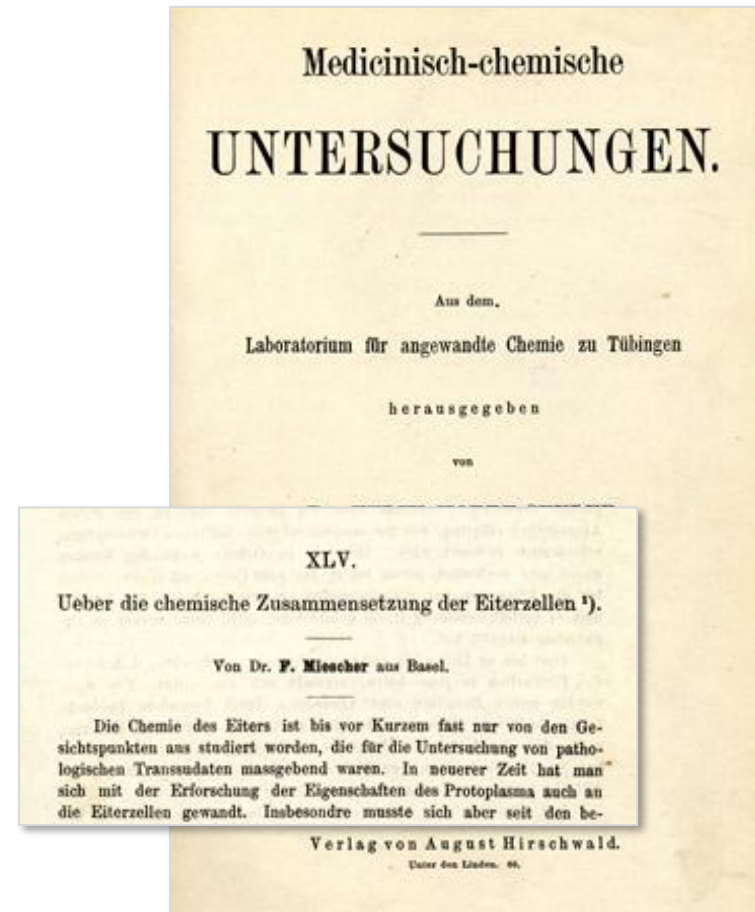
...not what you **did**

Example:

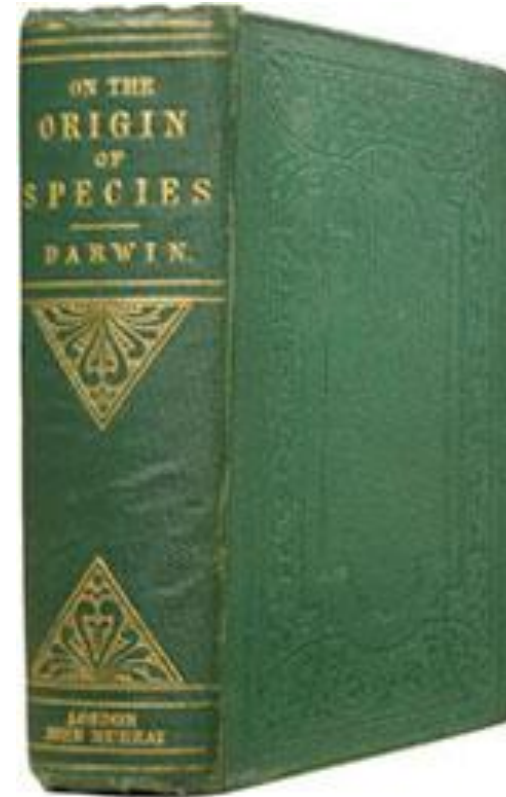
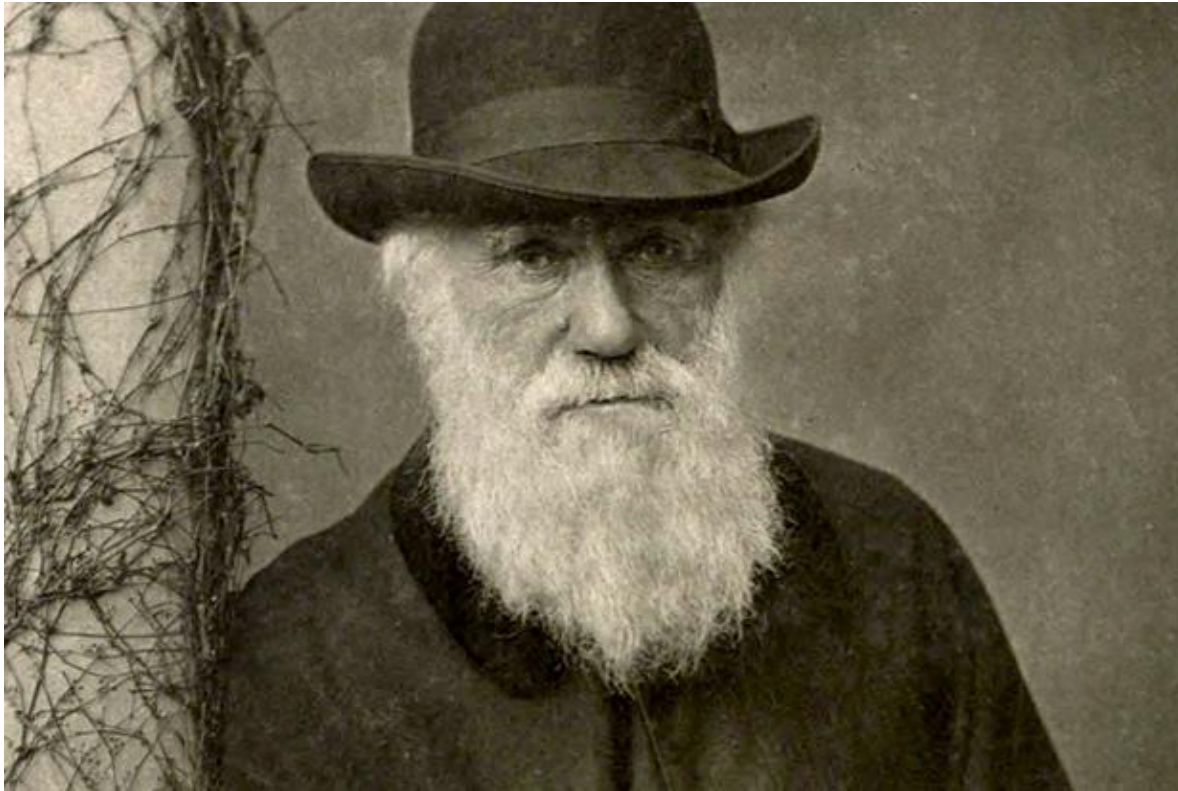
Title of a paper that missed the point:

“On the Chemical Composition of Pus Cells”

[?](#) *Discovery of a New Class of Molecule*



EXAMPLE OF A PUBLICATION THAT GOT IT RIGHT



WHAT IS THE LAST SLIDE OF YOUR TALK?

Acknowledgements

Why should you NOT have this as your last slide?

- Slide that often stays up the longest, but **NOT** the most important take-home from your talk
- Does not inspire questions / discussion

END YOUR TALK WITH A STRONG STATEMENT

- Your take-home message(s)
 - Your key conclusion(s) / result
 - A model you propose
 - ...
- Mention who helped / funded you throughout your talk

IN A NUTSHELL...

- Your take-home message is the most important part of your talk
- Define it well & build your talk / text around it
- State in such that it makes an impact on your audience
- Repeat it



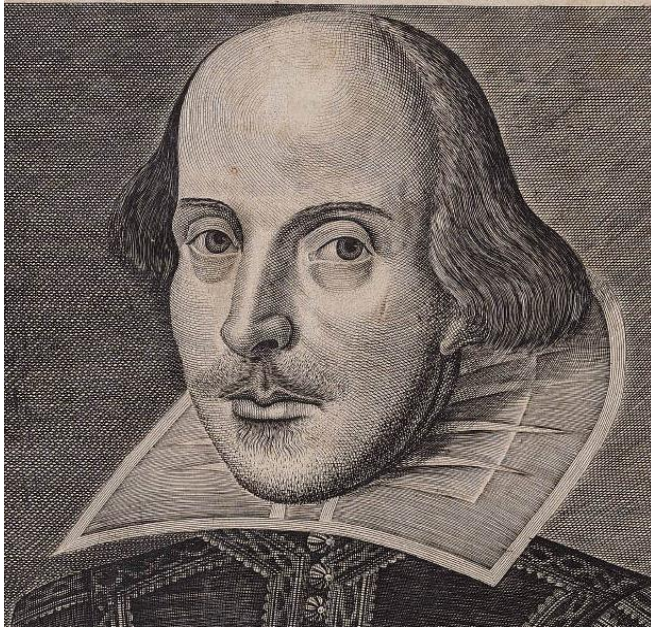
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KEEP IT SHORT & SIMPLE

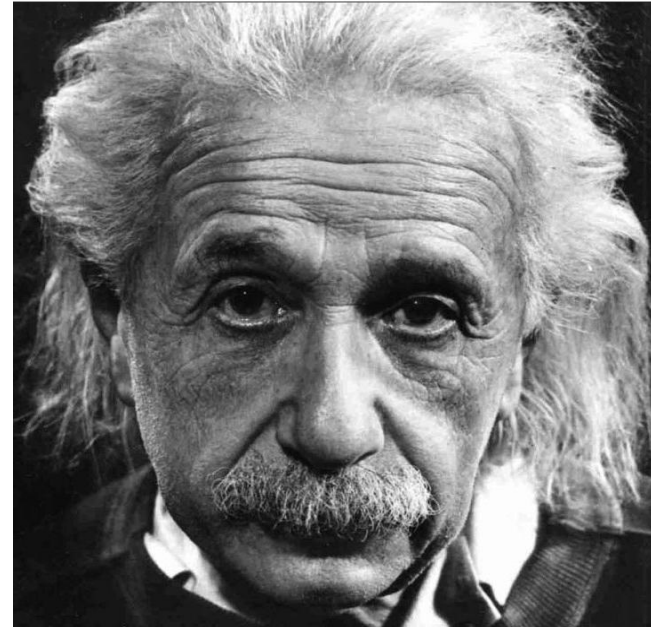
Difference between poetry & science communication



Poetry

Content can be simple

❓ Language can be complex



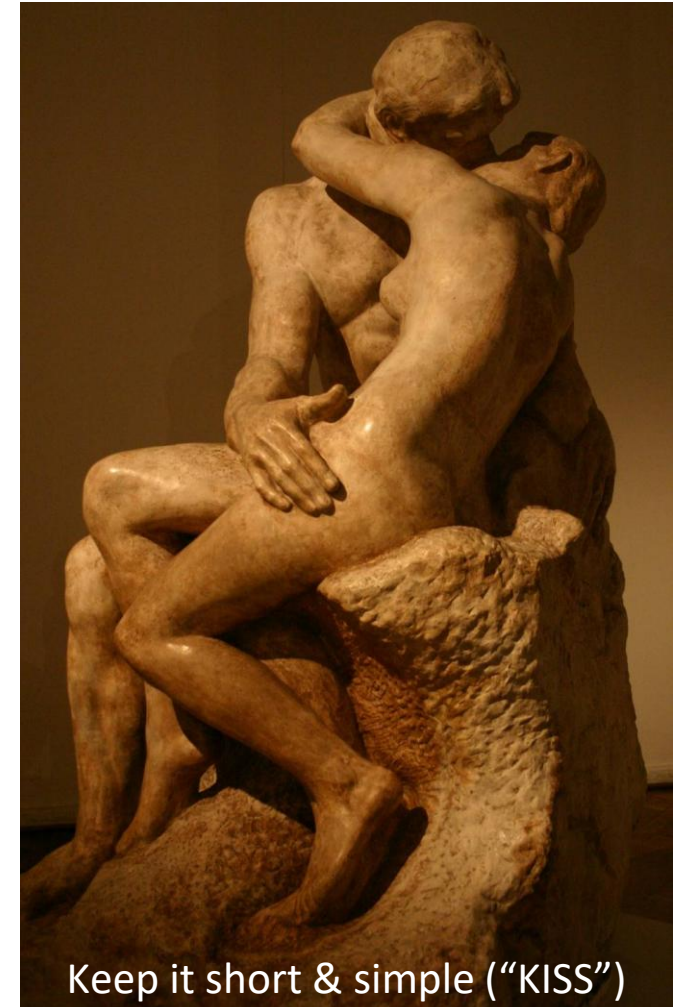
Science

Content is complex

❓ Language should be simple

HOW TO BE EASY TO UNDERSTAND

- Simple, concrete & engaging language
- Minimise technical details & jargon
- Short sentences
- Active voice
- Provide all the info needed & explain it well
 - 🔗 Don't overestimate the audience's knowledge of your area
- Good structure, logical flow of ideas
- Differentiate between important info & details
- Regularly zoom out to the big picture



Keep it short & simple (“KISS”)

KEEP IT SHORT & SIMPLE

Many scientists (people!) have a tendency to express themselves in too complicated a way when writing/speaking publicly

🔗 Use simple words, phrases or explanations

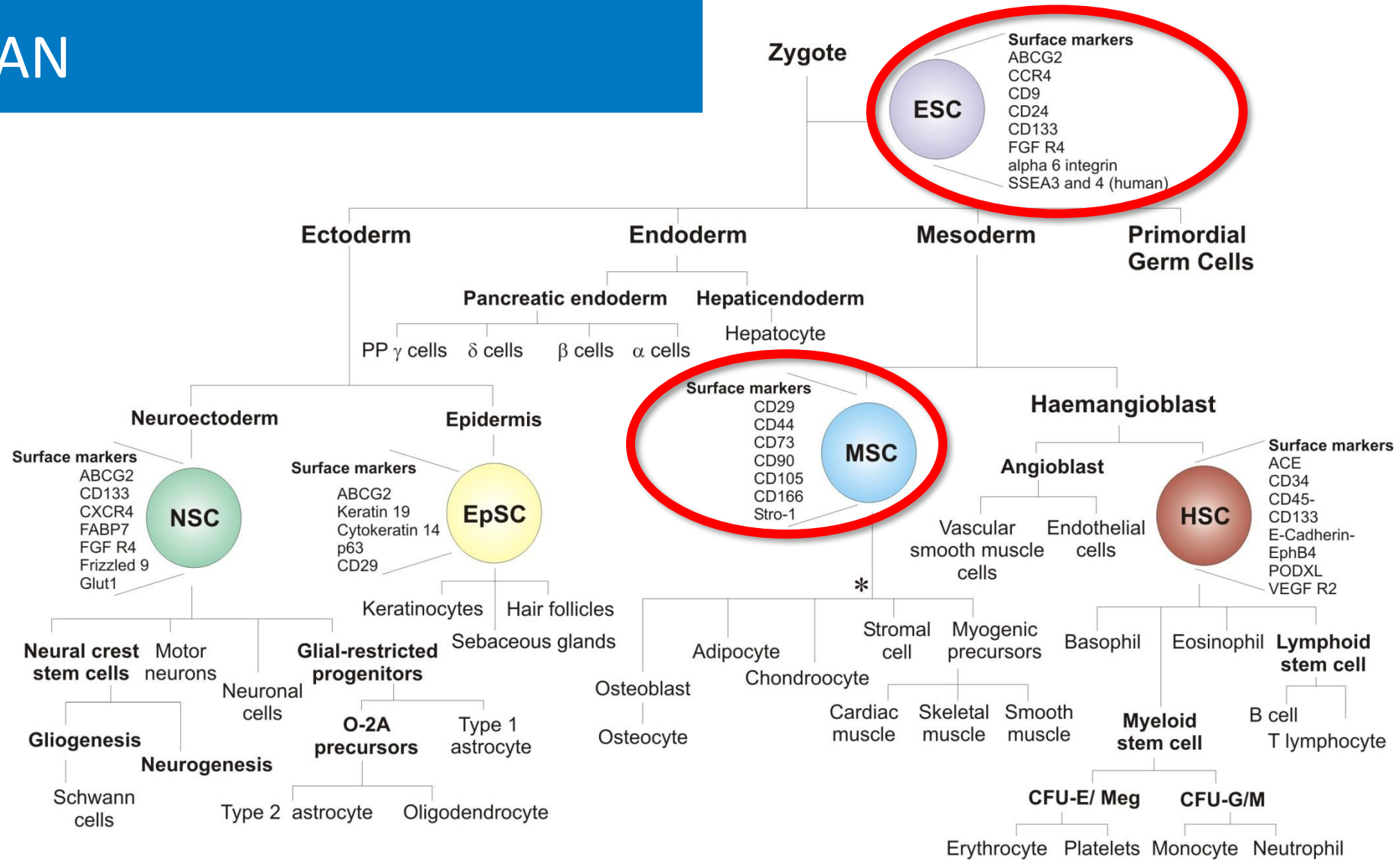
Example:

“Molecular defects abrogating protein X function were, under certain conditions, shown to be causally associated with inappropriate increases in cell proliferation leading to tumourigenesis.”

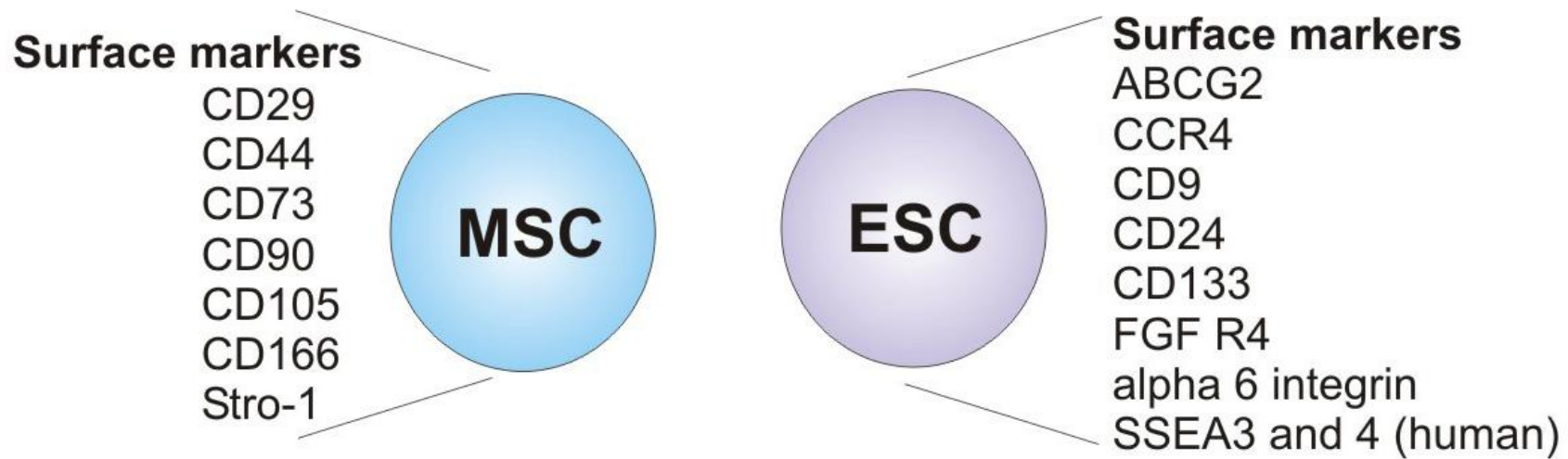
Why not just say:

“A loss of protein X can lead to cancer.”

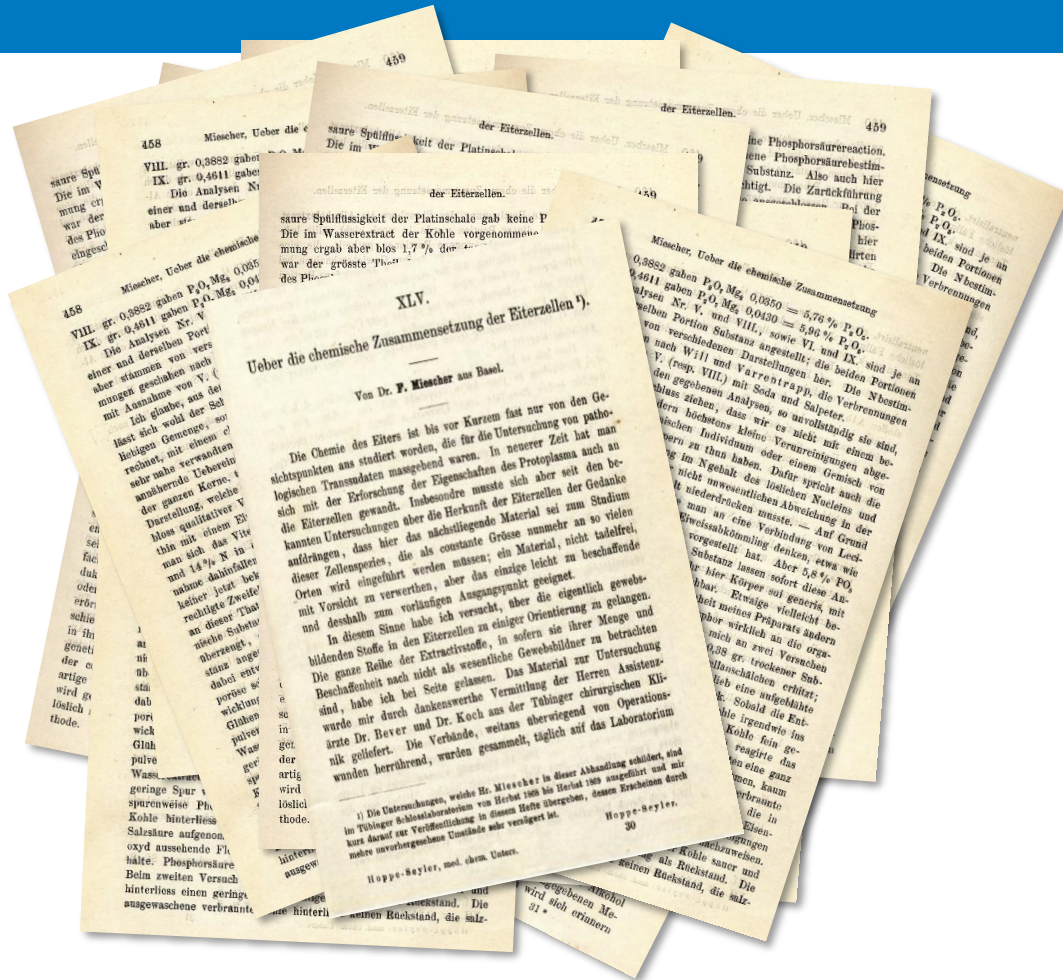
KEEP FIGURES AS SIMPLE AS YOU CAN



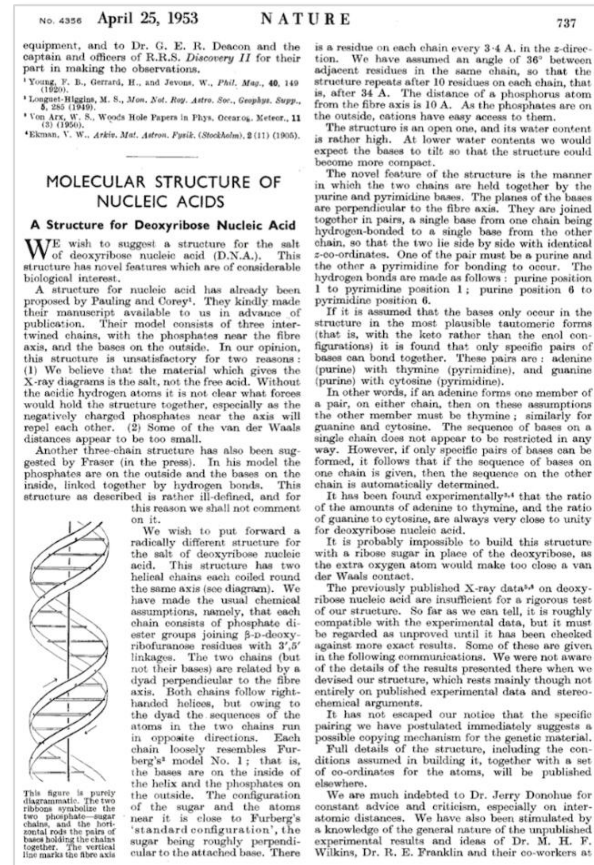
KEEP FIGURES AS SIMPLE AS YOU CAN



MIESCHER'S VS WATSON & CRICK'S PAPER



20 densely written pages

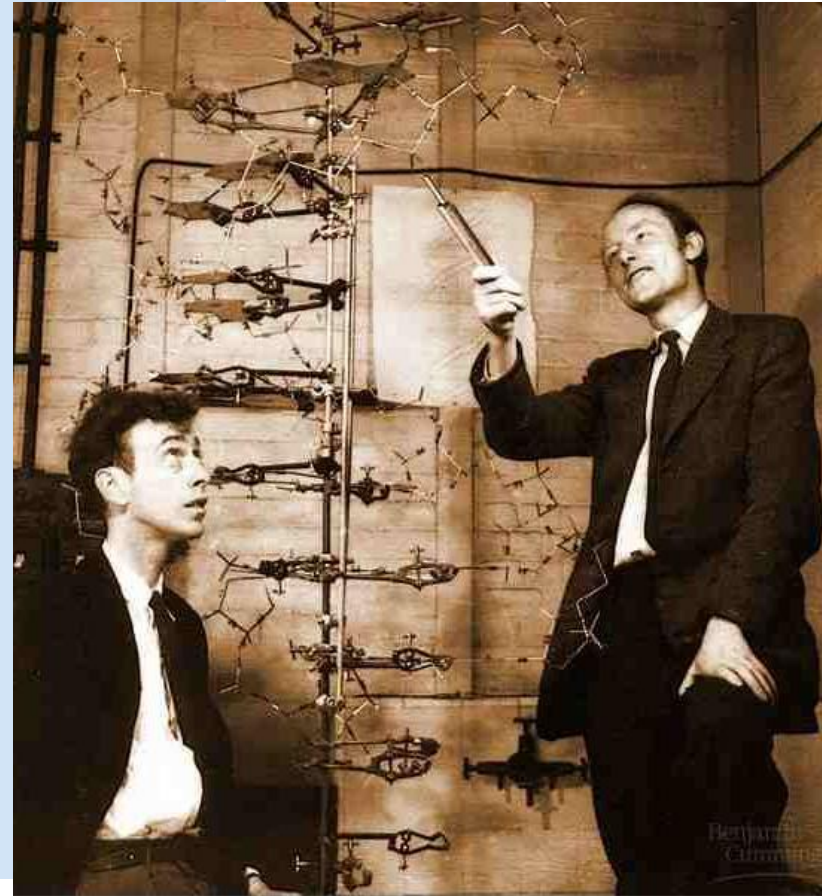


1 page

'GOOD SCIENCE SPEAKS FOR ITSELF'

"I suppose if we had done the usual scientific paper – overly long, poorly written, unnecessarily polysyllabic – it would not have had as great an impact."

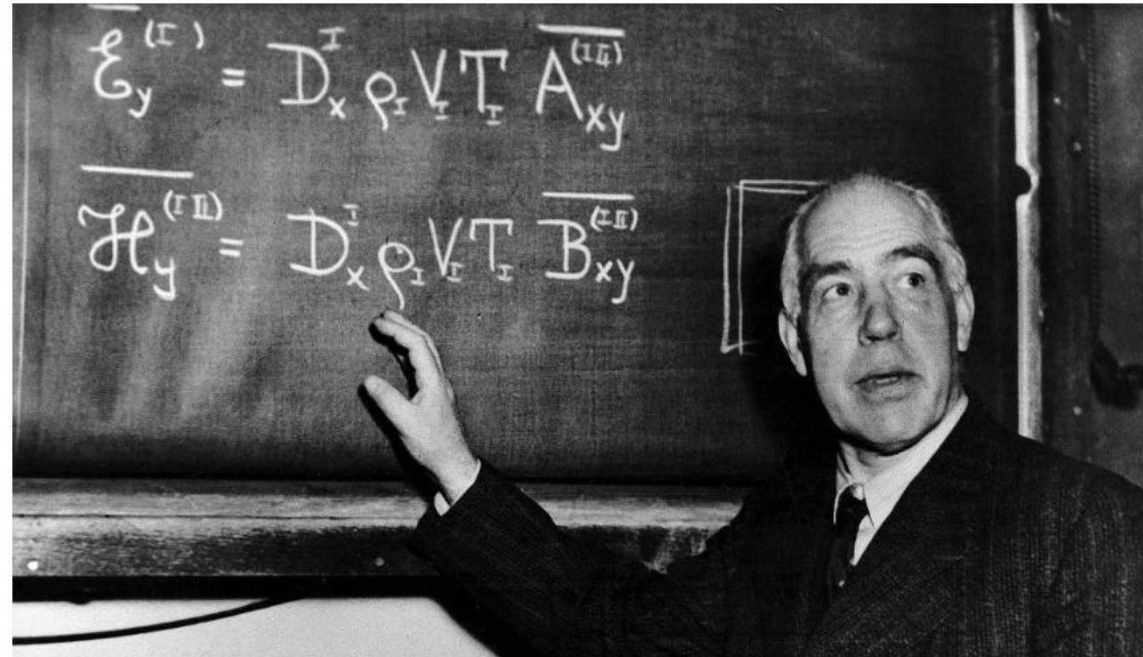
Francis Crick on their 1953 *Nature* paper describing DNA's structure



FIND A BALANCE BETWEEN SIMPLICITY & ACCURACY...

Truth and clarity are complementary.

Niels Bohr



When communicating to an audience from outside your immediate field,
lean heavily towards clarity

SEE YOUR TALK AS A CONVERSATION WITH THE AUDIENCE...

...rather than a performance

☑ Speak as if you were talking to friends over a coffee



IN A NUTSHELL...

- Structure your text / talk well
- Keep your language & visuals concise & simple
- Talk to rather than lecture people



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USE CONCRETE EXAMPLES TO ILLUSTRATE YOUR POINT

The *pax6* gene

- Member of the homeobox gene family of transcription factors
- Master control gene with essential functions in the development of eyes (and other sensory organs)
- Highly conserved across bilaterian species, e.g. ectopic expression of mouse *pax6* in *Drosophila melanogaster* can induce ectopic eyes

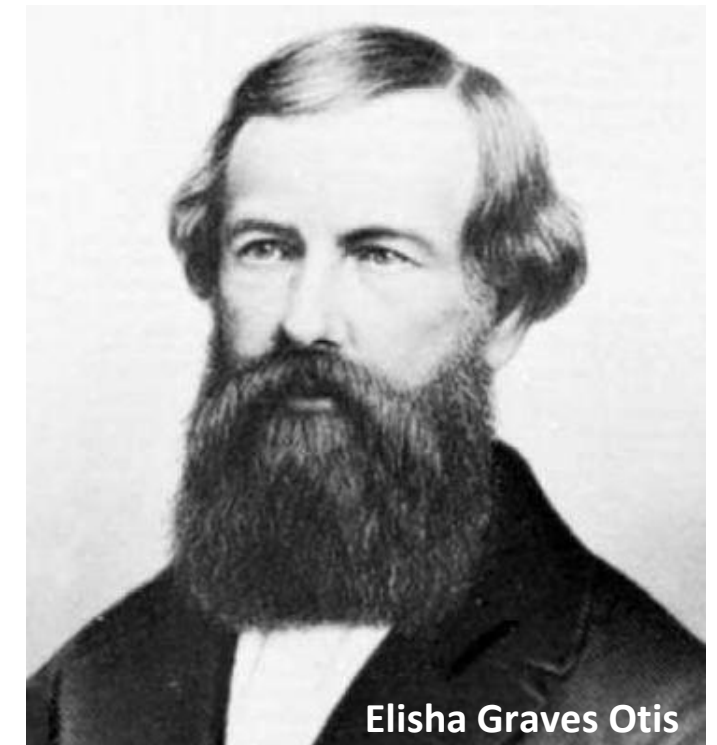
PAX6 CONTROLS EYE DEVELOPMENT



USE PICTURES TO ILLUSTRATE ABSTRACT CONCEPTS



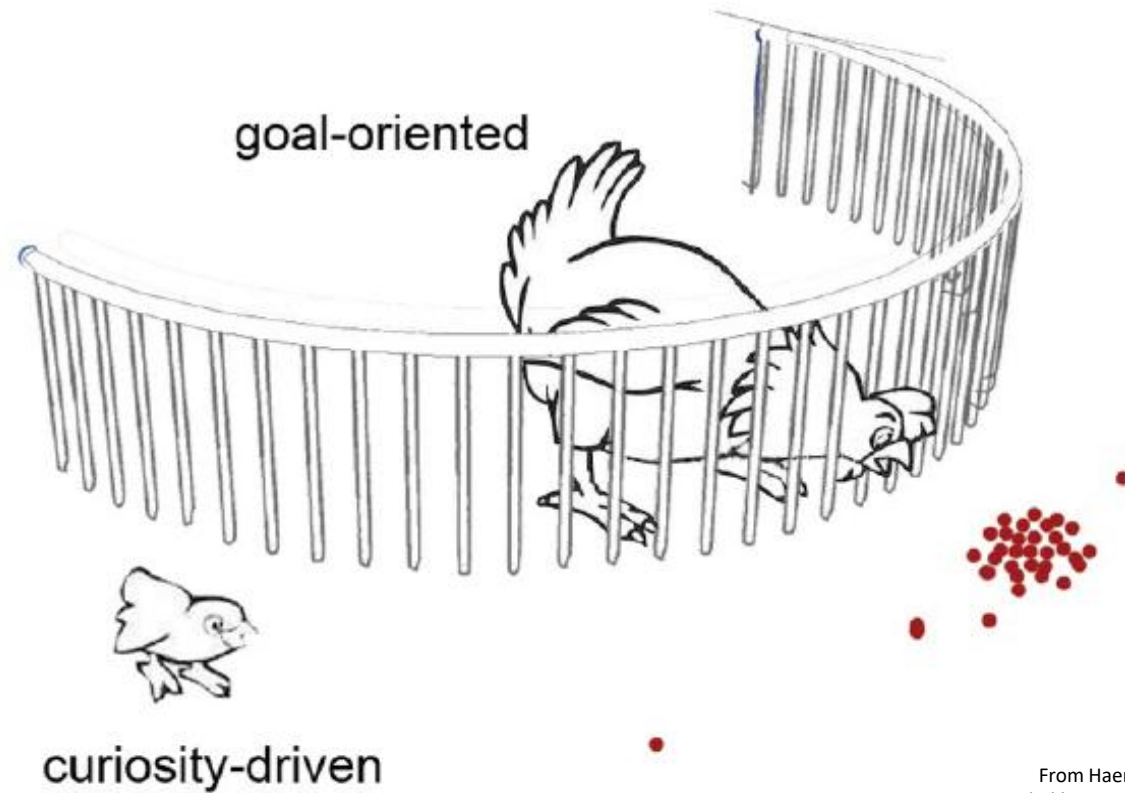
SHOW, DON'T TELL



Elisha Graves Otis

USE PICTURES TO ILLUSTRATE ABSTRACT CONCEPTS

'Goal-oriented' vs 'curiosity-driven' research



From Haentsch
Nobel lecture 2005

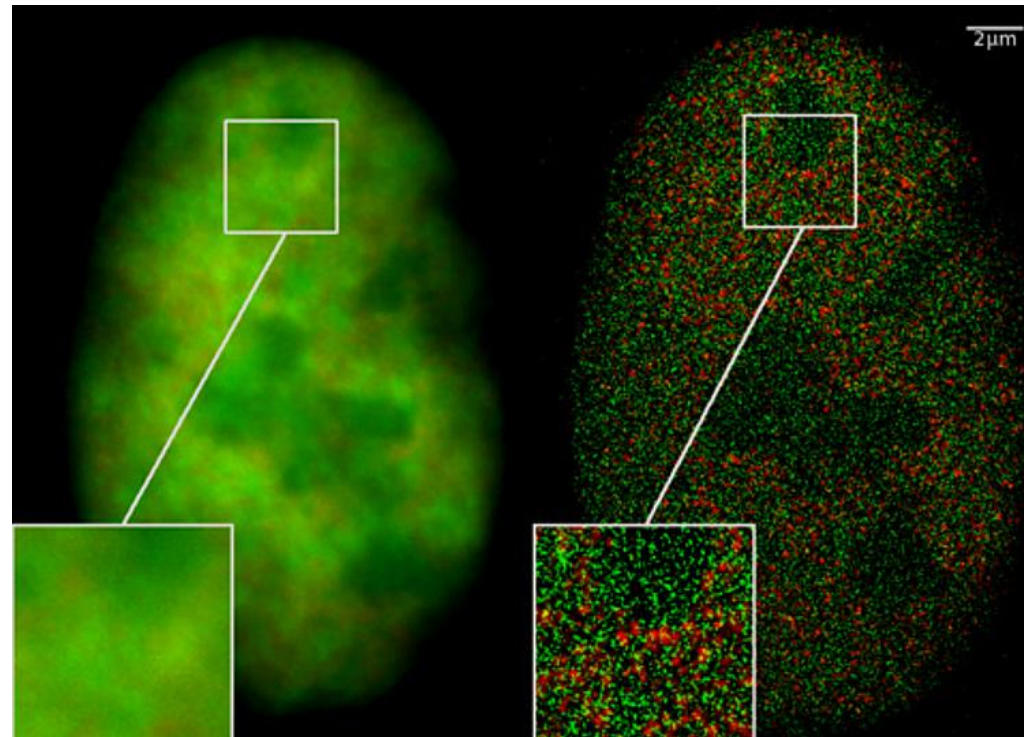
SHOW WHAT YOU WANT TO SAY RATHER THAN SAYING IT

Example: Power of super-resolution microscopy

Abstract approach

- Confocal microscope:
Max resolution:
250-350 nm
- Super-resolution microscopy:
Max resolution:
50-100 nm

Tangible approach



Gunkel et al. 2009

EXPLAIN COMPLEX CONCEPTS IN SIMPLE TERMS

PSYCHOLOGY

Don't Get Even, Stay Mad

Declarations of unintentionality often suffice to defuse tense situations and to reduce or eliminate vengeful responses to a harmful act. But does the reining

Science, 14 Nov 2008

Implicit bias

We all have it. Implicit bias was the shorthand that allowed our distant ancestors to make split-second decisions based on incomplete information. It provided a razor-thin reaction-time advantage that could mean life or death. But today, we no longer

Science, 27 May 2016

IN A NUTSHELL...

- Be as concrete as possible in what you say
- Illustrate what you say with images, experiments, props...



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TELLING A STORY CREATES MORE IMPACT

- We did not evolve to read tables & long lists of facts & figures
- Stories capture our attention & are more memorable because...
 - People will be more interested in what you say & be able to better recount what they heard when you tell a story
 - Manuscripts written in a more narrative style often accepted by better journals & cited more (*PLOS ONE* 11(12): e0167983)



EACH TALK SHOULD HAVE A COMMON THEME



Make sure that

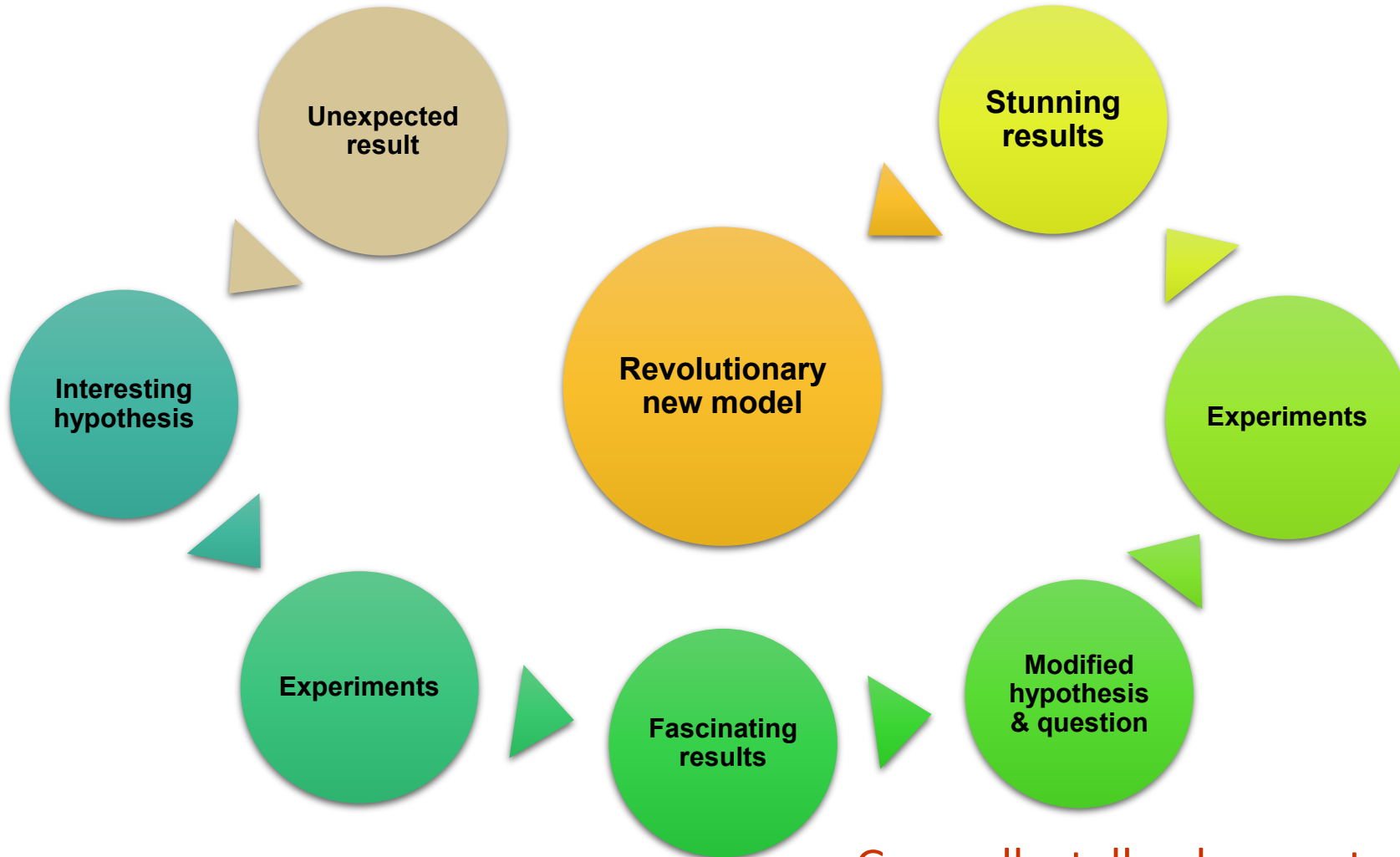
- everything you present relates to **one** theme
- there is a **logical sequence** to how you present it
- you **structure** your talk well

MOVE FROM THE GENERAL TO THE SPECIFICS

- Begin with big picture & info everyone in the audience is familiar with
- Gradually funnel your audience from the general to the more specific
- Regularly provide context & zoom out to the big picture



HOW CAN YOU TELL A STORY WITH SCIENTIFIC DATA?



Generally, tell only **one** story

PRESENT INFO IN BITE-SIZED PIECES



→ Easier to understand & memorise

PRESENT INFO IN BITE-SIZED PIECES

Sub-heading

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SHOW INFO IN TABLES & GRAPHS RATHER THAN AS TEXT

Sub-heading

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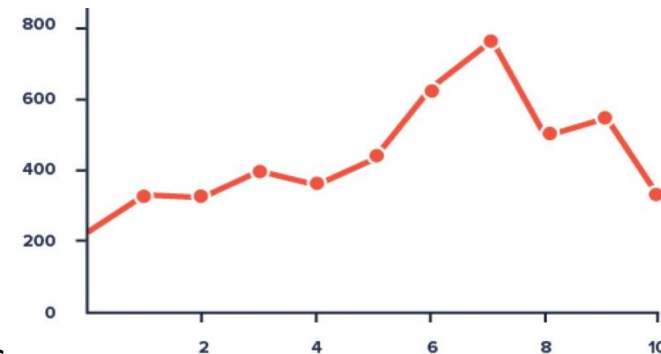
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Sub-heading

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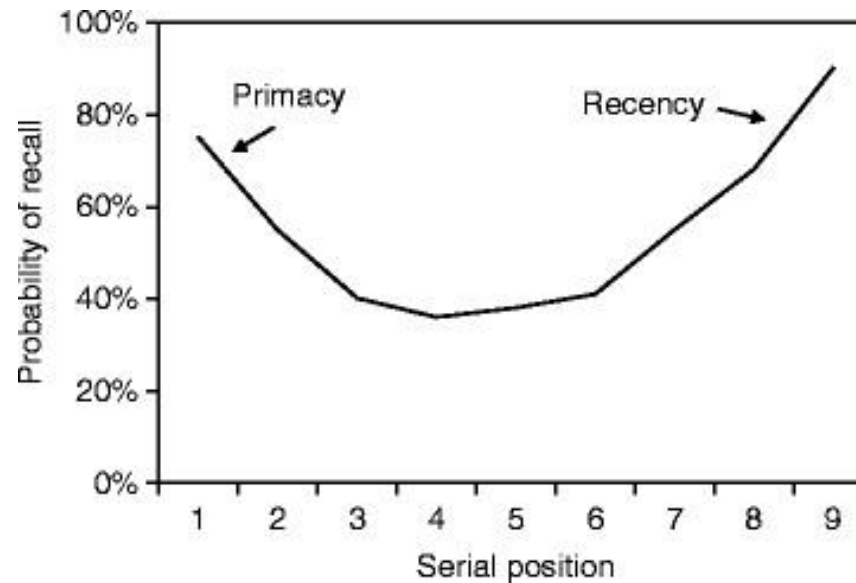


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PRESENT IMPORTANT INFO AT START & (AGAIN) AT END

Serial position effect



- Don't start / end with something obvious / boring
- Start with sth. new & important: bold statement, key question...
 - Give background
 - End with sth. important

YOU ONLY GET ONE CHANCE AT A FIRST IMPRESSION

→ Make sure it is a good impression



STARTING YOUR TALK WELL MATTERS

Many speakers start like this:

“Hello & good afternoon... Er, is my mike working? ... OK, thanks! ... So, yes, thank you very much for the kind introduction and to all of you for coming and listening to my talk today.

I am very pleased to be here. My name is ..., I'm a PhD student in the group of ... at the university of ... and today I'm going to talk about ... [reads title of talk from slide]”

START OUT WITH SOMETHING THAT CAPTURES THE ATTENTION OF THE AUDIENCE

A controversy

“In [field], roughly half of the people believe that...; the other half, however, thinks that... Today, I want to show you...”

“For years now, we have believed that... Now, today I will show you that this is not true”

START OUT WITH SOMETHING THAT CAPTURES THE ATTENTION OF THE AUDIENCE

4. A controversy

3. An interesting question

→ Phrase a problem the audience has as a question

→ *“What if...?”*

START OUT WITH SOMETHING THAT CAPTURES THE ATTENTION OF THE AUDIENCE

4. A controversy
3. An interesting question
2. A statement that surprises / challenges the way your audience sees the world

“There are more people alive today than have ever died”

START OUT WITH SOMETHING THAT CAPTURES THE ATTENTION OF THE AUDIENCE

4. A controversy
3. An interesting question
2. A statement that surprises / challenges the way your audience sees the world
1. Tell a story

IDEAS FOR HOW TO START YOUR TALK WITH A STORY – 2



STRUCTURE YOUR TALK TO MAKE IT EASY TO FOLLOW

- **Have slides introducing what comes next / summarising what was said**
 - Prepare for what is coming (like subheadings in a text)
 - Provide 'big picture' & focus audience's attention on key points
 - Allow people to reconnect with your talk when got distracted
- **Tell your audience what you are going to tell them**
 - "I am now going to present 3 lines of evidence for..."
- **Tell them what you told them**
 - "So, as I just told you, 3 independent approaches lead us to the same result..."
- **Possibly have a slide at start outlining your talk / one summarising it**

REPEAT YOUR TAKE-HOME MESSAGE

*“First, tell them what you are going to tell them;
then tell them;
then tell them what you have told them.”*

anonymous Irish politician

LESSONS FROM THE MOVIES...

- **At the beginning: Make people care**
 - Background: Why is it an interesting / important topic?
 - Think big & connect to something your audience is familiar with!
- **Present a problem**
 - What are the big open questions / challenges / unmet needs?
Why do they matter?
- **Give them a solution**
 - Your approach, results & conclusions: How will / have you contributed to addressing them?
- **Give them a happy ending**
 - Make the impact of your work clear by putting it into a larger context

IN A NUTSHELL...

- We evolved to listen to stories, not facts, numbers...
- Stories are more memorable than incoherently listed facts
- Tell a story when you give a talk or write a text
- Logical flow
- Start out with something that captures attention
- Build tension & release it



GENERAL PRINCIPLES

of Good Communication

- 1) Think of your audience
- 2) Focus on the big picture
- 3) Have clear take-home messages
- 4) Keep it short & simple
- 5) Use concrete examples
- 6) Tell a story
- 7) Prepare & practise**

PREPARE & PRACTISE

Many of the worst talks are given by people who think they are good at what they do
& therefore don't need to prepare or practise for a given occasion



PREPARING FOR AN IMPORTANT PRESENTATION

- Find out who your audience is
 - What do they know?
 - What are they interested in / do they care about?
 - What are their expectations?
 - How can you make your work relevant to them?
- What do you want to get across & what **goal** does your presentation have?
- Practise your talk & get feedback (from people familiar & not familiar with your topic)

SEEK FEEDBACK FROM DIFFERENT TYPES OF PEOPLE

- People familiar with your topic
 - Is what you say correct?
- People NOT familiar with your topic
 - Is what you say understandable & interesting?

Think of your audience

- Make it relevant
- Make it easy to follow you

EVEN IF YOU KNOW HOW TO DO IT...

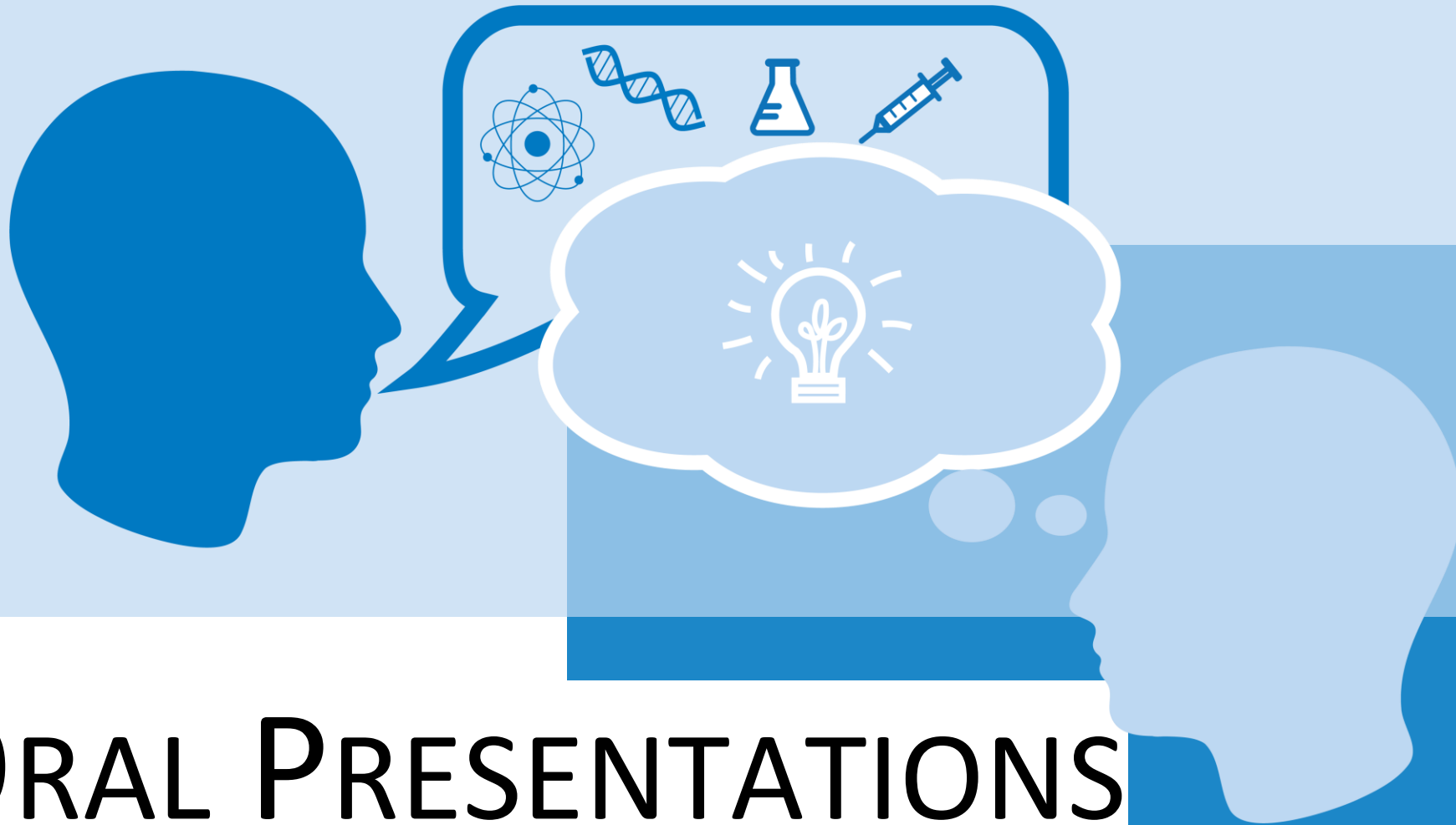
...success comes with actually doing it



IN A NUTSHELL...

- Prepare important talks well
- Practice them (maybe even often)





ORAL PRESENTATIONS

Ralf Dahm

Director of Scientific Management, Institute of Molecular Biology gGmbH (IMB)

ORAL PRESENTATIONS

- How to deliver a convincing oral presentation
- How to overcome stage fright

ORAL PRESENTATIONS

- How to deliver a convincing oral presentation
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WHAT IS COMMUNICATION?

Different forms:

- written
- verbal
- non-verbal
 - Posture, gestures, facial expression, eye contact, touch, clothes...
 - How you speak: speed, emphasis, intonation...
= Paralanguage

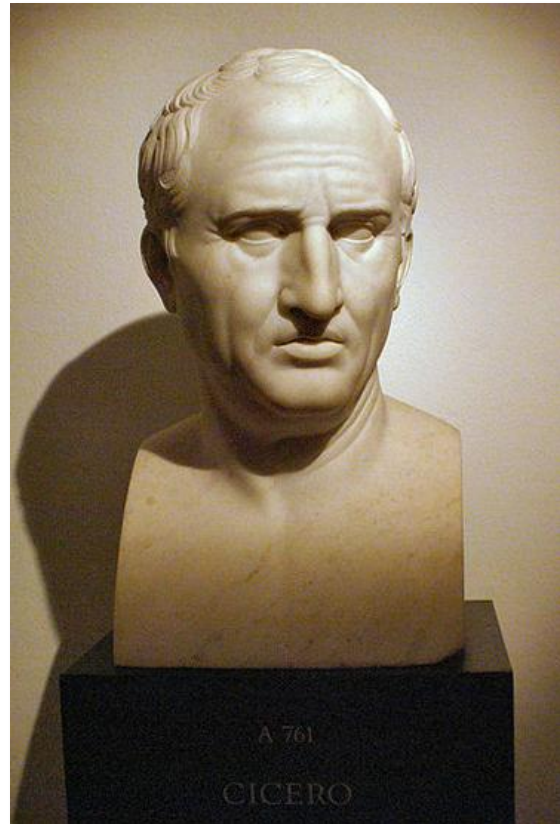


Exact figures depend on

- Individual
- Situation
- Content of communication

→ **Most communication is non-verbal**

HOW TO DELIVER A CONVINCING PRESENTATION



- Speak with conviction & enthusiasm
- Face your audience (eye contact) & focus the attention on you
- Pause after key statements
- Behave naturally / be yourself
- Be spontaneous

SPEAK CONFIDENTLY & WITH PURPOSE



- Speak with a strong voice
- Don't fizzle out at the end
- No hesitation
- Don't end statements with a question mark
- Don't end with words that qualify / weaken what you just said
(“I think”, “basically”, “sort of”, “like” ...)

MODULATE YOUR VOICE TO EMPHASISE & KEEP YOUR AUDIENCE ENGAGED



- Pace:
Speak fast when conveying something less important
→ Slow down for key information
- Volume
- Tone / pitch
- **Pause** after an important statement
→ Gives audience time to absorb what you said

USE BODY LANGUAGE TO CONVINC



- Where to stand (position):
 - Centrally, unobstructed & facing your audience
- How to stand (posture):
 - Relaxed & confident,
but not overly casual or dominant
- What to do with your body (gestures):
 - Use to emphasise your statements
 - Keep consistent with what you say

USE VISUALS OR PROPS TO CAPTURE THE AUDIENCE'S ATTENTION

Showing sth. has more impact than just talking about it



Slides with striking images / videos

Most effective if

- sth. happens
- real object that can be touched

🔍 The more senses are engaged, the stronger the memory

USE THE LASER POINTER TO EMPHASISE



- Use sparingly to highlight key parts
- Point long enough for the audience to see
- Keep it steady
- Often better to gradually develop a slide
- Familiarise yourself with the laser pointer

TAKING YOUR PRESENTATION SKILLS TO THE NEXT LEVEL

- Focus the attention on yourself, not your slides
- Look at & speak to those who seem NOT convinced
- Give your talk a personal touch
 - Draw your own figures; include handwritten text
 - Tell anecdotes
 - Show stuff you did, yourself, your team... (within reason)
- Keep it light, interactive & authentic

SEE YOUR TALK AS A CONVERSATION WITH THE AUDIENCE...

...rather than a performance

☑ Speak as if you were talking to friends over a coffee



IN A NUTSHELL...

- Use your body & voice to support what you say
- Show conviction & enthusiasm for your topic
- Be yourself
- Slides support what you say, but the attention should be on you



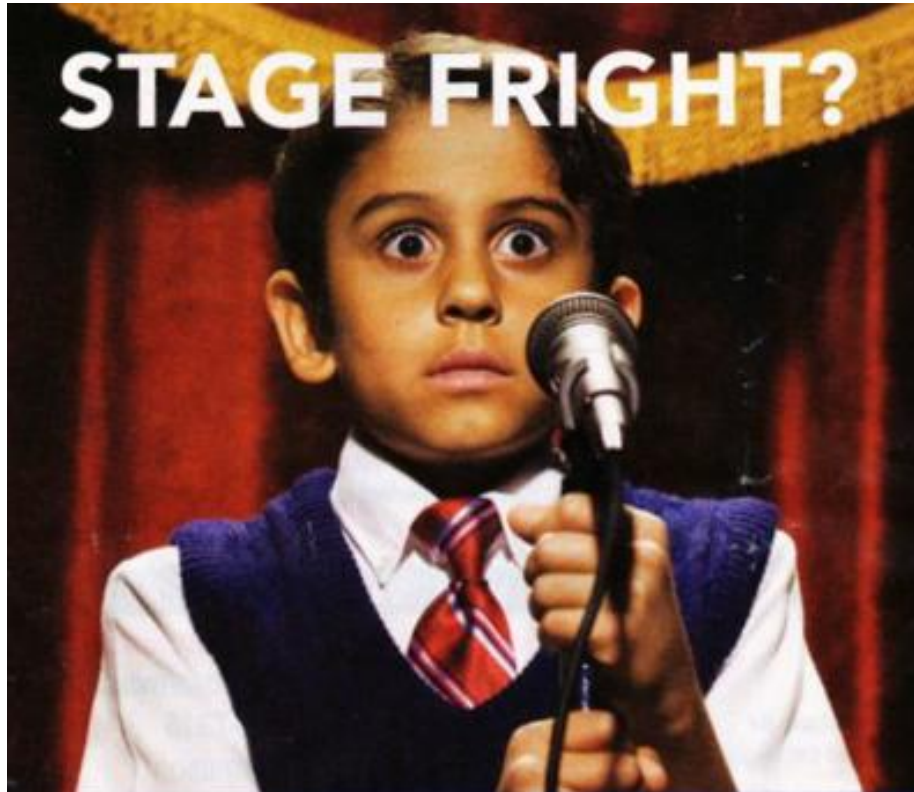
ORAL PRESENTATIONS

- How to deliver a convincing oral presentation
- How to overcome stage fright

WHAT TO DO ABOUT STAGE FRIGHT

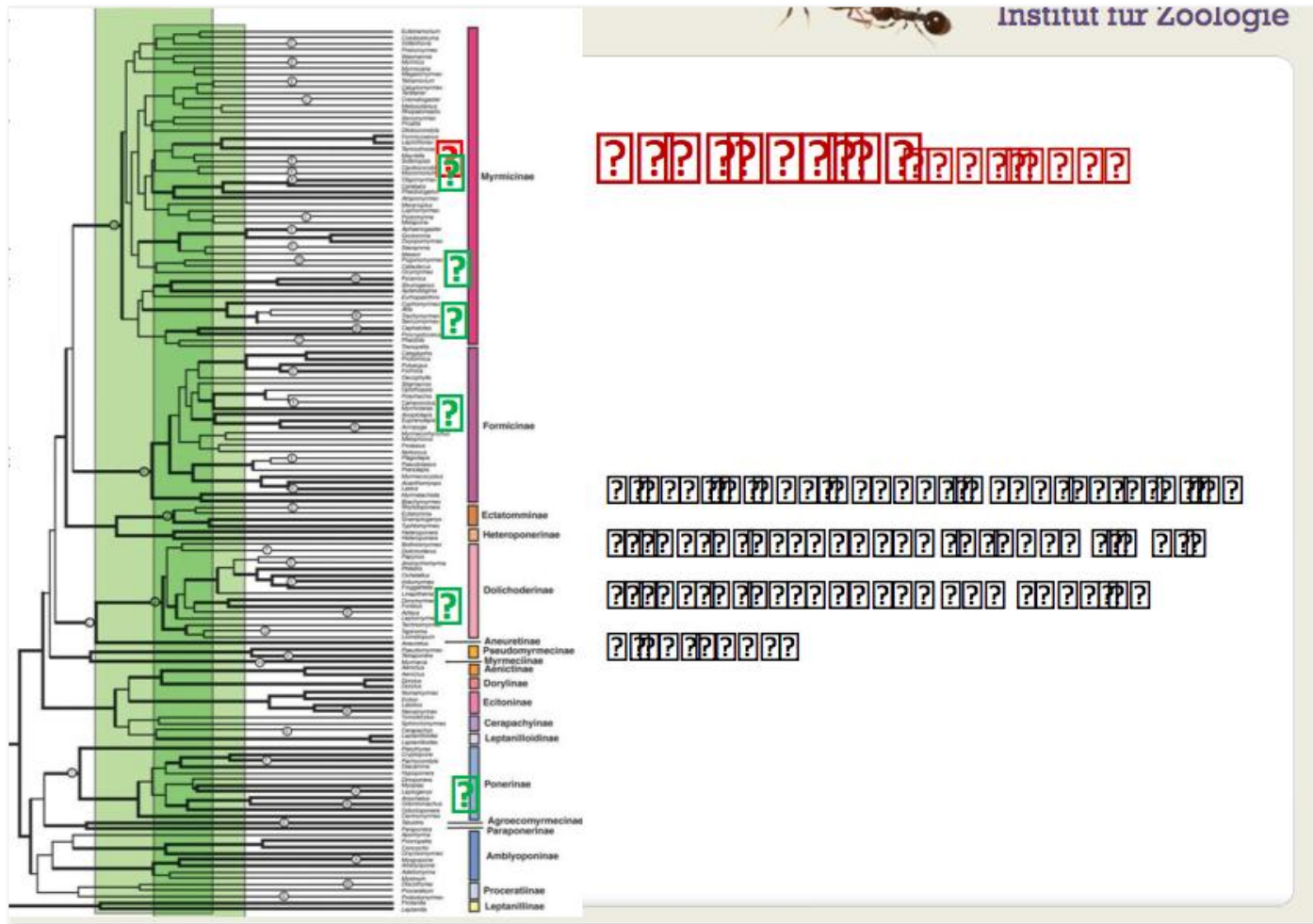


MAKE SURE YOU ARE IN CONTROL OF YOUR PRESENTATION



- Prepare it well
- Memorise key sentences
- Practise it (often)
- Ensure you're within the time limit
- Check the room
- Check your presentation with the computer / projector that will be used

THINGS THAT CAN HAPPEN...



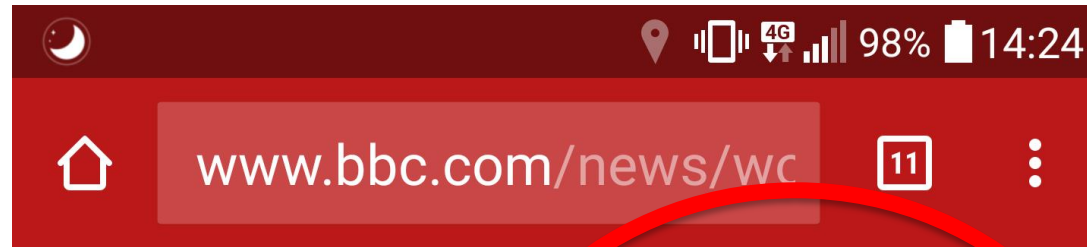
WHAT ELSE TO DO ABOUT STAGE FRIGHT

- Accept that being nervous is part of speaking to an audience
- See being nervous as an impetus to stay focused & talk with energy
- ‘Warm up’ before talk (e.g. physical activity, talking to someone...)
- See your talk as a conversation (rather than a performance)
 - Language you use & way you see your audience

BE YOURSELF

- People react better to you when you're authentic
- Wear something you like
 - You will feel better & the audience realises that

IT CAN BE A DISADVANTAGE TO BE A NATIVE SPEAKER



BBC Autos >



**Six ideas that will
change city driving**

BBC Capital >



**English speakers are
bad communicators**

IT CAN BE A DISADVANTAGE TO BE A NATIVE SPEAKER

Native speakers often...

- Speak too fast
 - Use words / idioms others don't know
- ⇒ More difficult to understand for non-native speakers
- ⇒ Language distracts from your content

Non-native speakers are the majority!



IN A NUTSHELL...

To reduce fear of public speaking

- Prepare & practice
- Make the situation as relaxing as possible for you
- Accept that being nervous is OK

