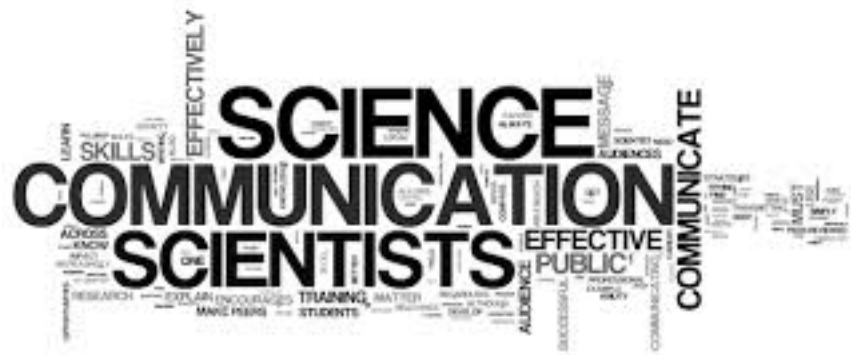# THE FUNDAMENTALS of SCIENTIFIC COMMUNICATION

Prof CECARO MASSIMO

Effective science communicators
educate non-specialist audiences
about scientific topics, issues, and debates
in ways that are informative, accessible, and empowering.

Before embarking on a science communication project,
science communicators should be able to answer the following questions:

- Who is my target/audience?

- What is my message for my target/audience?

- What medium am I going to use to communicate my message to my target/audience?

Know Your Target/Audience

Knowing your target/audience is key to communicating successfully about scientific topics.

Common target audiences include:
the lay public,
the media,
policy makers.

As you prepare your article, presentation, visuals etc.,
keep your intended audience in mind.

The Lay Public

The "lay public" is made up of all the people who are not experts in a specific field.

(T. W. Burns, D. J. O'Connor, and S. M. Stocklmayer, "Science Communication: A Contemporary Definition," Public Understanding of Science April 2003 12: 184, doi:10.1177/0963662503012004)

**It's important to consider that members of the public can differ greatly in
their ages,
interests,
experiences,
and opinions.
To accommodate these differences, use the following techniques:**

(Doumont, J., ed, English Communication for Scientists (Cambridge, MA: NPG Education, 2010).

Use analogies and visuals

- **Respect your audience's prior knowledge** (be mindful of "talking down")

- Address the question **"so what?"** early on to keep your audience interested
- Address the points that less-specialized audience members care about first, followed by the interests of the more knowledgeable audience members

SO WHAT?

Analogies and their close relations,
metaphors (in which one thing is said to be another thing),
appear to be central to the way the human brain
conceptualizes abstractions (Lakoff and Johnson 1980).

One theory is that we construct mental representations
of abstract concepts by basing them
upon concrete and tangible physical experience.

So, for the concept of "in,"
the concrete metaphor of a physical container
is applied to a wide variety of abstractions,
such as being "in" a statistics course,
"in" a bad mood,
or "in" the category of patients with diabetes
(Lakoff and Johnson 1980).

Choose an analog familiar to the audience
(Sowey 2001, Glynn 2008, Braasch and Goldman 2010).

**A baseball analogy is likely to be unfamiliar to many non-U.S. students.
Cards might be unfamiliar in cultures that prohibit gambling (Martin 2003).**

Choose an analog that shares important similarities with the target
(Glynn and Takahashi 1998, Glynn 2008).

**The analog should have relatively deep,
structural similarities with the target,
rather than simply superficial similarities (Martin 2003).**

**The features of the target and analog should resemble each other, and relationships
between the features should also be similar.**

This approach makes sure that
no listener gets lost or loses interest during the lecture.

After the lecture, speakers hold Q&A sessions
that focus on specific interests of more knowledgeable audience members.

Using stories is also an effective was to engage the public.
Stories help the audience understand how science works
(Joshua Schimel, *Writing Science* (USA: Oxford University Press, 2011), 196.

and build the audience's trust in the communicator.
(Randy Olson, "Trust and likeability: The twin pillars of effective science communication,"*Policy Options* December 2012 - January 2013: 11.)

Keep the following points in mind as you develop your story:

- Keep It Short and Simple
- Focus on making the story relevant and meaningful to your audience
- Front-load the story to keep your audience interested
- Avoid jargon - use simple language but don't oversimplify
- Include the people and the process (challenges, successes, collaborations, etc.

The Media
The media is a "mediator" between scientists and the public.
(Lars Lindberg Christensen, The Hands-On Guide for Science Communicators (Springer, 2007), 38.

The media is not a homogenous group:
Members of the media range
from print journalists to television broadcasters
to documentary-filmmakers.

Effectively communicating with the media
ensures that your research reaches interested readers,
policy-makers, and other scientists.

Know Your Message

**Once you know your audience,
you can develop your message.**

Your message should answer the audience's questions like

"So what?" and "Why should I care?"

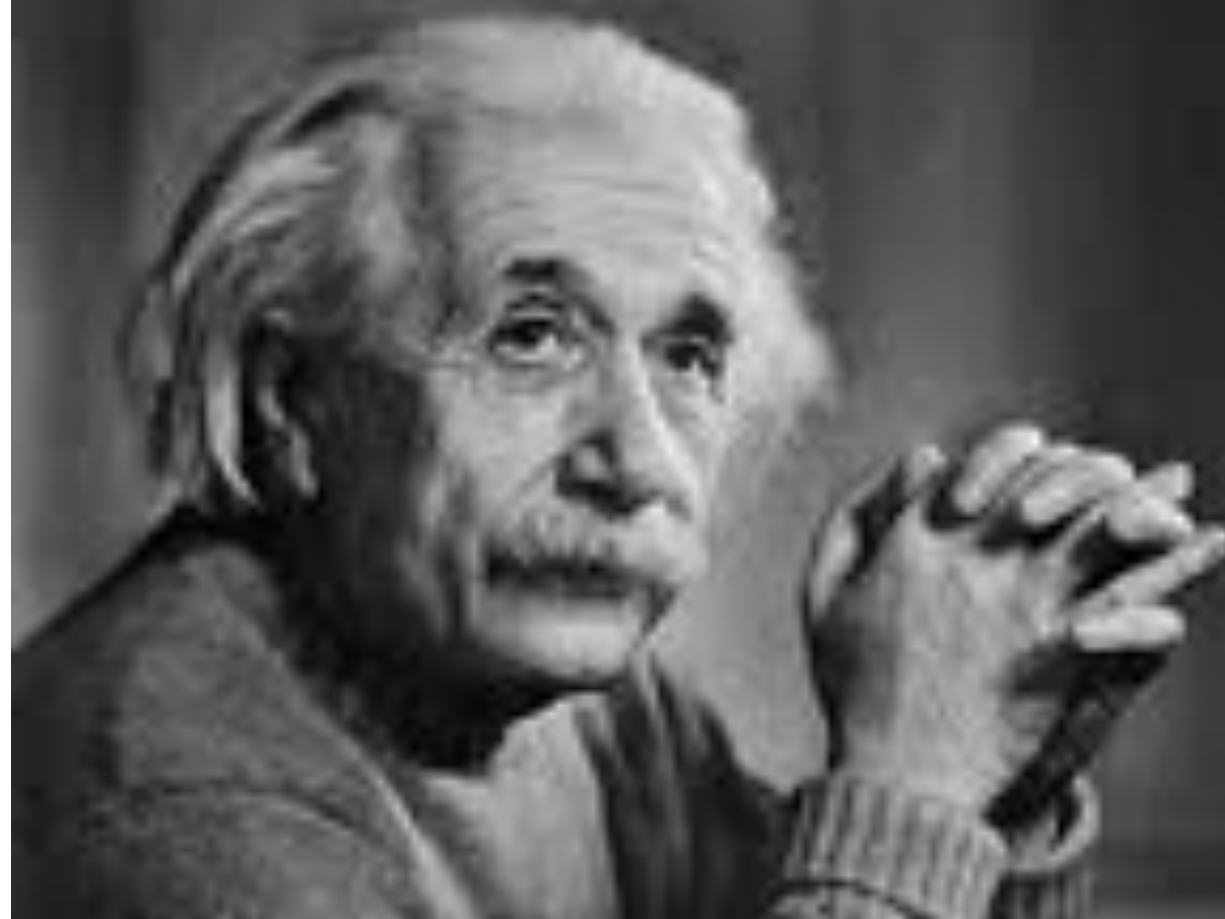Answers to these questions vary depending on your audience.

As a science communicator,
you want to frame your message in terms that are
accessible, relatable, and meaningful for your specific audience,
ethics

M. Kahan, Hank Jenkins-Smith, and Donald Braman, "Cultural cognition of scientific consensus," *Journal of Risk Research* 14, no. 2 (2011): 151, doi:10.1080/13669877.2010.511246

When developing your message,
think about how your audience approaches the issue and topic.
People think about an issue based on the aspects
of the issue that resonate with their values.

Background

Supporting
Details

Results/Conclusions

Researcher

Public

Bottom Line

So What?

Supporting
Details

Adapted from *Escape from the Ivory Tower*   AAAS | Center for Public Engagement with Science & Technology

AAAS
AMERICAN ASSOCIATION FOR
THE ADVANCEMENT OF SCIENCE

Framing Your Message

**As a science communicator,
it is important to frame your message in terms that are:
accessible, relatable, and meaningful for your specific audience.**

**Framing is not a way to "market" your point of view.
It is a way to actively engage your audience with an issue,
build trust and relationships with the public,
and encourage the public to participate in dialogues about scientific issues.**

Nisbet and Scheufele, "What's Next for Science Communication?",

Know Your Medium

**Whether you are writing an article,
giving a public lecture,
or posting tweets,
understanding how to use media effectively
will help you successfully communicate your message.**

Social Networking Explained

I'm #writing...

I like writing!

Watch me write!

I am skilled at writing.

Let's all write together!

Here are my scrapbooks.

**Scientists use blogs and other social media platforms
such as Twitter and Facebook for a variety of purposes.**

SOCIAL MEDIA

Writing About Science

In her book "Am I Making Myself Clear?"
Cornelia Dean offers the following <u>suggestions for writing about science and technology</u>
Cornelia Dean, Am I Making Myself Clear (Harvard University Press, 2009) 129-142.

- Use active verbs
- Avoid jargon, euphemisms, clichés, wordplays, and puns
- Use analogies and examples
- Only include critical details
- Create an outline
- Tell a story but stay true to the facts
- Spend a lot of time revising and rewriting
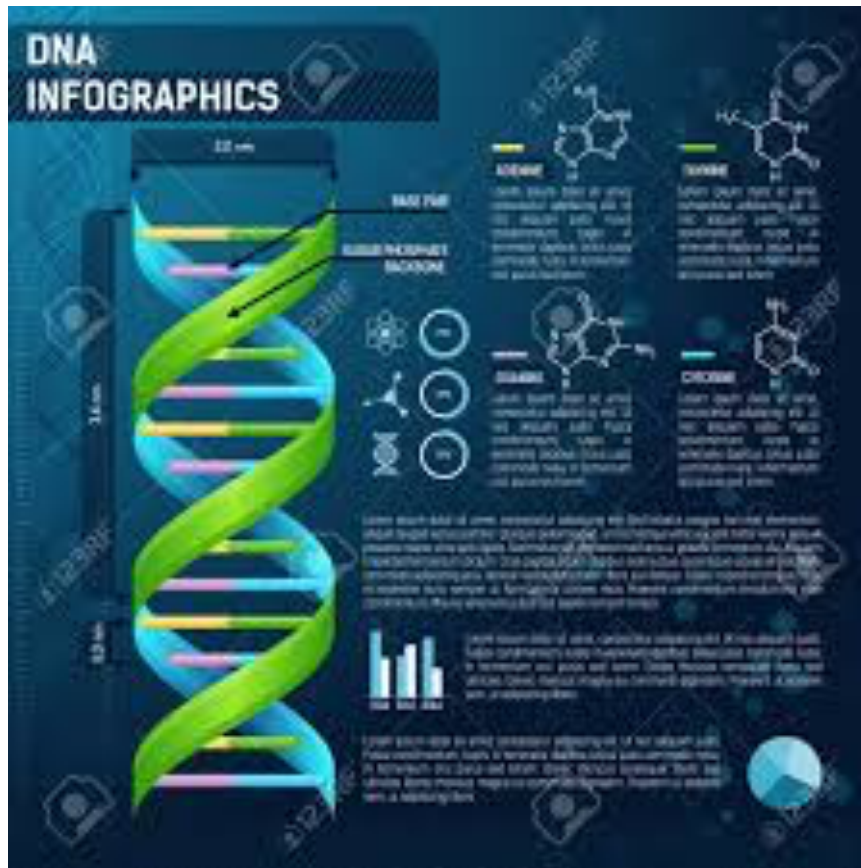- Cite your sources
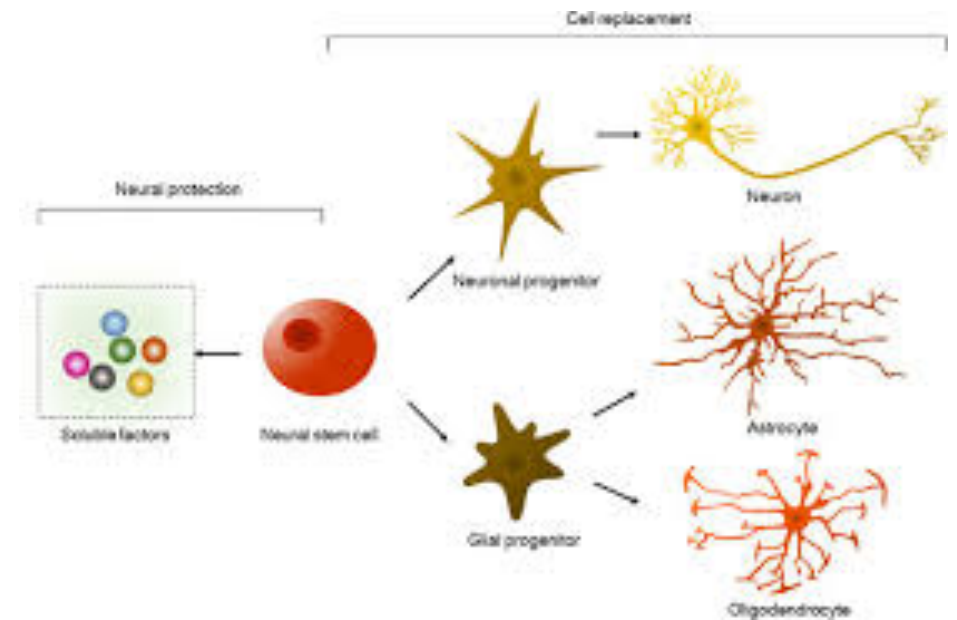- Prepare to be edited
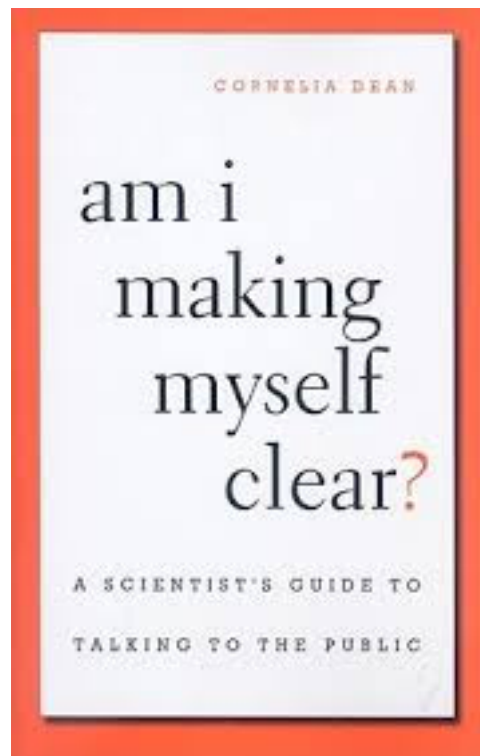
VISUALIZING SCIENCE

Visuals make the data supporting your message clear and accessible to your audience.

Science visualizations include:

Thomas et al., Communicating Science Effectively, 9-13.

- **Photographs**

- **Conceptual diagrams**

- **Information graphics (infographics)**

Speaking About Science

Scientists are often asked to give presentations
about their work or about a topic in their field.

To make an effective presentation, be sure to

- Give yourself plenty of time to prepare and practice
- State your message at the beginning and end of the presentation
- Give your audience background on your topic
- Focus on the aspects that are most interesting and relevant to your audience and introduce them early on
- Engage your audience through questions and dialogue
- Explain your visuals and use them to support your presentation
- Talk about the process, not just the results
- Aim to use less time than you are allotted
- Leave time for questions
- Based on what you know about the audience, try to predict their questions and prepare answers

National Action Plan
to Improve
Health Literacy

U.S. Department of Health and Human Services
Office of Disease Prevention and Health Promotion

Characteristics of Effective Health Communication

Effective health communication is essential because it equips the public with the tools and knowledge to respond appropriately to health crises, or bioethics themes.

Some features of effective health communication include in order for a health communication program to **have an impact, it should disseminate appropriate health content that satisfies the following criteria**, as prescribed by the *Office of Disease Prevention and Health Promotion (*https://health.gov*):*

○ **Accuracy**: The content is valid and without errors of fact, interpretation, or judgment.

○ **Availability**: The content (whether targeted message or other information) is delivered or placed <u>where the audience can access it.</u>

○ **Balance**: Where appropriate, the content presents the *benefits Vs risks* of potential actions or recognizes different and valid perspectives on the issue.

○ **Consistency**: The content remains internally consistent over time and also is consistent with information from other sources

○ **Cultural Competence**: The design, implementation, and evaluation process that accounts for special issues for Target/select population groups (for example, ethnic, racial, and linguistic) and also educational levels and disability.

○ **Evidence-based**: Relevant scientific evidence that has undergone comprehensive review and rigorous analysis to formulate practice guidelines, performance measures, review criteria, a technology assessments for tele-health applications.

○ **Reach:** The content gets to or is available to the largest possible number of people in the target population.

○ **Reliability**: The source of the content is credible, and the content itself is kept up to date.

○ **Repetition**: The delivery of/access to the content is continued or repeated over time, both to reinforce the impact with a given audience and to reach new generations.

Barriers to Effective Health Communication

Effective health communication can be impeded by:

- **Low health literacy:** The illiterate/semi-illiterate often cannot access the information because health information is normally relayed in the form of written communication. Thus, *health literature should be custom-made for each target audience and written in a style appropriate to their level of comprehension.* At the same time, health literacy programs should train low-literacy individuals to avail themselves of these health resources.

- **Limited Internet access:** The Internet has become the channel of choice for information delivery worldwide. However, *in certain communities*, even in the developed world, *internet access is still too costly, or maybe even outright unavailable*. Moreover, though there is abundant health information on the Internet, it is still out of reach of those in resource-poor settings. Given the importance of the Internet in disseminating vital health information, there *should be increased effort to bring access to rural communities and the developing world*. In particular, this effort should involve both the public and private sectors, namely the government agencies and technology corporations.

- **Lack of research activity in developing countries:** Research and evaluation are required in order to design, develop and implement effective health communication interventions. Unfortunately, most research is done with an eye to solving health problems in the developed world, while pressing health problems in the developing world are often neglected. (Edejer, Tessa Tan-Torres . "Disseminating health information in developing countries: the role of the internet ." *BMJ* 30 Sep 2000 Web.23 Jun 2009.) Even if research is done in developing countries, it seldom comes to the attention of health professionals.

- **Proliferation of low quality healthcare information on the Internet:** As the volume of Internet content increases on a daily basis, consumers need help evaluating the reliability of the information that they are bombarded with. According to the *Office of Disease Prevention and Health Promotion,*"*People are using the Internet to look up information, purchase medications, consult remotely with providers, and maintain their personal health records. Approximately 70 million persons in the United States use the Internet for health-related reasons, and the potential for harm from inaccurate information, inferior quality goods, and inappropriate services is significant.*"(Health Communication." *Healthy People 2010*. Office of Disease Prevention and Health Promotion. 15 Jun 2009.)

- In order to protect consumers, Internet health resources and health-related Web sites should be required to adhere to a strict code of conduct. Site owners should disclose their identity   and essential contact information clearly and honestly. They should explicitly state the   purpose of their site and provide proper citation for the content they display. They should   inform their users how personal information is used, and whether the content is periodically updated to prevent misinformation.

- **Inability of health workers to communicate with patients:**(Boyd, Barbara L. and William D.Shaw. "Unlocking Health Worker Potential: Some Creative Strategies from the Field." Mar 1995 Web.23 Jun 2009.) Due to various communication hurdles such as language barriers, socio-cultural differences etc., health workers sometimes have difficulty transmitting vital health information to their patients. Moreover, given the shortage of human resources, which is a common problem in developing countries, health workers often deal with multiple patients at a time, making communication even more difficult.

Identifying the Target Audiences:("A Guide to Adapting, Developing and Producing Effective Radio Spots." Mar 2005 Web.23 Jun 2009)

Health communication strategies must be geared towards a clearly defined target audience in order to achieve optimal effect.

There are **two kinds of target audiences**, namely the primary target whose behavior is to be influenced directly, and the secondary target who can influence the primary target such as a family member who makes decisions about the household or health worker with whom the primary audience comes into contact.

As much information as possible should be collected about the target audiences, especially with regards to their views and understanding of disease/scientific knowledge

STEPP approach to health literacy improvement:

■   Sharing: We must share, among ourselves and across disciplinary and organizational boundaries, information, findings, program successes, and areas for improvement

■   Technology: Being mindful of the digital divide, we must consider technology as an essential tool for improving health literacy.

■   Evaluation: More programs need all types of evaluation, especially evaluation that accounts for what is important to different population groups.

■   Partnership: We must create partnerships with communities and each other.

■   Participation: Health literacy has its roots in community engagement. We must partner with the people whom we are trying to help.

The ways in which health and safety information are communicated to the public have a significant impact on health literacy.
Numerous attributes of our health system contribute to poor health information:

- Technical and medical terminology in public communications

- Confusing or unnecessary statistics

- Nuanced or unclear recommendations and explanations of risk

- Over-reliance on written communication

- A focus on awareness and information rather than action and behavior

- Limited use of cultural preferences and practices when targeting and tailoring information and interventions

Check for Conflict of Interest

Pay attention to:
- Institutions involved: How big are they? Do they have a certain take on this area of science?

- Correct statistical use

- Do they reveal anything?

- Did a company pay for this study? Donate equipment or materials? Do the scientists own stock or work for a company on staff or as a consultant?

- Who was included: If the study is about humans, did it include only white people? Men? Women? College students? If it was about animals, such as mice, what (if anything) can be inferred about humans?

- Remember: Studies don't *prove* anything.

- Single case?

Before you do the interview, you'll want to consider:

- How much of an expert is this person? On exactly what is the specialization?

- who is your scientist? One way to find this out is to check your scientist's website and look at things he or she has written. If your scientist is an academic, what type of courses does he or she teach?

- If you need some of the science basics in your recording, ask for some summary statements and explain why you need them.

Some questions to think about asking:

(suggestion from Sally Lehrman, an award-winning reporter and writer on medical and science policy for some of the top names in national print and broadcast media. Her byline credits include Scientific American, Nature, Health, The Washington Post, Salon.com and *The DNA Files*.)

- What was your most important finding? What surprised you?

- How do you know ___ [whatever claim they are making]? What aspect of your research or other people's work supports it?

- Are your methods generally accepted? Are they unusual or new?

- How do your results compare with others in the area? Do you think they are reproducible or an anomaly? How much consistency is there generally in this area?

- How accurate is your data? What's the level of uncertainty? Were there any areas in which you had to compromise?>/li>

- How sure are you of your conclusions and interpretation? What else could explain your data? Is there anyone who interprets the problem differently?

- Is there controversy in this area? Other schools of thought?

- What got you interested in this area?

- Are there ways you might profit from your ideas, research or results?

- What are the negatives I should know? Who disagrees with your conclusions?

- Do you have pet peeves about the way this area is covered, or about metaphors that are used?

- What's next?

….. Remember …..

- Ask for clarification.

- Restate the concept in your own words.

- Ask "What do you mean?"

- Ask "Can you suggest a good metaphor people will understand?"

- If you think your scientist misspoke, double-check; don't use the recorded statement if it's a mistake. You can say it accurately yourself or go back and re-record.

- Don't try to sound like you understand something when you really don't.