Communicating Your Story

A Tell Us Checklist

The National Science Foundation regards timely communication of your research advances to the public as an important shared responsibility. At NSF media relations, we develop and distribute products that inform the media about your research results and that help explain those results directly to the public. We coordinate closely with institution and organization news offices, and PIs have full approval over everything we do. The entire process requires minimal effort from PIs and their teams.

As science communicators, we're ready to put our time and resources to work for you. Together, we can share news of your research accomplishments with the people who funded them.

To gain the widest media coverage, please tell us:

When you are about to submit a paper for publication

Notify:

- NSF program officer
- Institution/organization news office
- NSF media relations

When your manuscript has been accepted for publication or you will be posting new data online

Notify:

- NSF program officer
- Institution/organization news office
- NSF media relations

Send the media relations office your manuscript or galley proofs, or, if you're posting data online, please give us a summary of your findings. We'll work in conjunction with your institution or organization news office to develop one or more of the following, as appropriate:

- web content
- explanatory graphics
- news release
- audio news release (for radio stations and web)
- video news release or B-roll (for TV stations and web)
- news conference

(Samples of each of these are found in the multimedia section of the "Getting Your Story Out" CD.)

You and your NSF program officer will be able to review every product for scientific accuracy and correct context. Nothing is released without your approval.

Please be sure to send us any supporting graphics you have: photographs, animations, diagrams, charts, illustrations, video. Good graphics command attention. They increase the likelihood of media pickup and assist the public in understanding difficult concepts. Note, however, that graphics appropriate for publication in the scientific literature are often too complex for use in the general media. We'll work with you and your colleagues to create effective, appealing graphics for lay audiences.

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NSF media relations will time the release of the materials we create to coincide with your paper's publication date or the day your data are made public. Reporters require information in advance of this date to prepare their stories, so we might coordinate an embargo with the journal or web publisher. The embargo prohibits publishing or broadcasting the story before a specified date and time. Embargoing is a time-honored practice reporters understand and respect—one that has proven highly effective in the case of papers published in *Nature* and *Science*, for example.

Please don't wait to tell us until after your paper is published or your data are made public. By then, the story is "yesterday's news"; there's just not much we can do with it. The time to tell us is when your manuscript is accepted for publication or before you post your data. Please give us plenty of advance notice—a few weeks or more, if possible.

When you are going to make a major presentation at a meeting

Notify:

- NSF program officer
- NSF media relations

Indicate the date, location and meeting sponsor. If appropriate, we will:

- Arrange interviews for you or your team with the media attending the meeting
- Work with the sponsor's media relations staff to prepare and distribute news releases in their media room
- Distribute news releases to media outlets across the country

NSF Media Relations Contact Information

E-mail: TellUs@nsf.gov

Web: http://www.nsf.gov/od/lpa/tellus/start.cfm

Telephone: (703) 292-8070

Media Relations Staff Directory: www.nsf.gov/od/lpa/news/media/contacts.htm

For detailed information and samples of the various products and services the NSF media relations office provides, please explore the interactive, multimedia portion of the "Getting Your Story Out" CD.

How to Transform a Scholarly Presentation into a Public Talk

Table of Contents

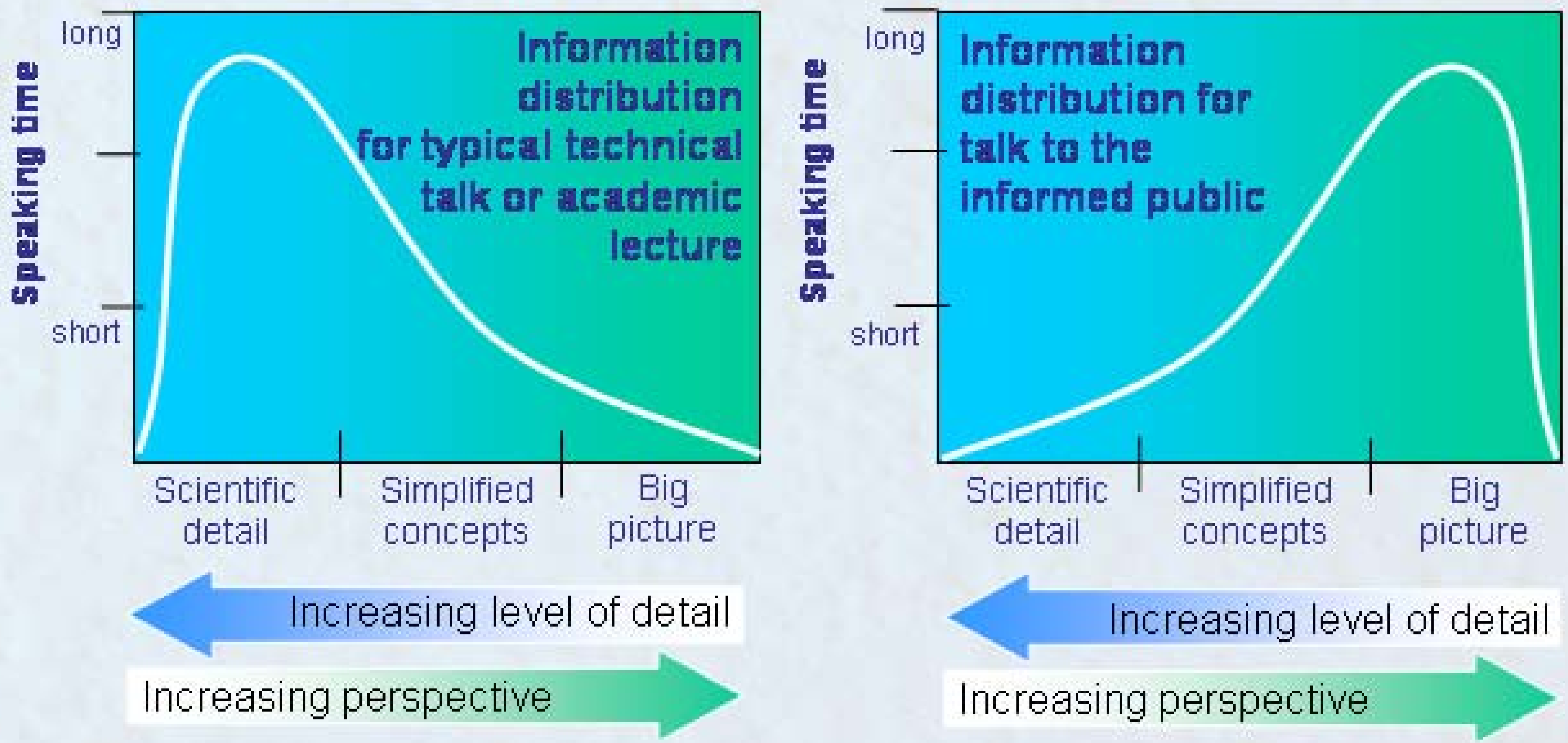
Design of this guide...

- **Allows researchers** to focus on sections most useful to them.
- **Using examples** of published technical data, the guide suggests ways to modify complex graphics, text or ideas to a level that the informed public can understand.
- **You may want to** look at press releases on a technical topic from a university or the NSF website to view good examples of explaining complex technical material to the public.

The following pages summarize the type and amount of information that could be presented to an audience of your peers vs. the informed public.

Effective communication

technical audience vs. the informed public



Discipline-specific examples
Simplifying complex Ideas

Terms and Definitions

- Title of Talk - **Use "attention grabbing" title with non-technical words.**
- Scientific Details - **These are the equations, symbols, jargon, and relationships known by those working in the profession, but not understood by most people outside of it.**
- Simplified Concepts - **This realm is the bridge between the details and big picture. It includes the essential concepts and principles necessary to understand the research. Nearly everyone in your audience should understand this material when you present and explain it.**
- Big Picture - **This is the larger context–the history and justification for the research, plus the intellectual challenge and the possible outcomes and their practical use. Everyone in your audience should be able to understand and identify with your communication of the "Big Picture." It should draw your audience into the rest of your presentation.**

Social sciences

Title	Scientific Details	Simplified Concepts	Big Picture
Colonialism and International Conflict	Hegemonic spheres of influence in the trans-national landscape have been increasingly contested as a result of post-colonial processes.	International struggles for power increased following the decline of colonial empires.	The observance of more wars in the 20th century than in the 19th century may be related to rise and fall of global empires.
Culture and Cancer: Role of Hormones and Nutrition	Ovarian steroid levels, under positive and negative feedback control of HPO axis (hypothalamic-pituitary -ovarian axis), may interact with energetic factors in the etiology of reproductive cancers; life history theory explains these dynamics.	Reproductive patterns (ages at menarche and menopause) and lifestyle factors (diet and activity) may influence body levels of reproductive hormones and thereby play a role in the development of reproductive cancers.	Elevated levels of breast cancer in American women may be related to diet and lifestyle.

Life sciences

Title	Scientific Details	Simplified Concepts	Big Picture
Genes and Disease	Polymorphisms are genetic variations that occur in plants, animals, and at least 1% of the human population. Alleles whose sequences reveal only a single changed nucleotide are called single nucleotide polymorphisms or SNPs. When SNPs occur in noncoding parts of a gene, they are not seen in the protein product. A SNP in the coding part of a gene can have big consequences on protein structure. For humans, who have 30,000 - 40,000 protein-coding genes, a SNP is responsible for Sickle Cell Anemia.	DNA is a really big molecule made up of smaller units called nucleotide bases, abbreviated as A, G, C, T. The four bases are arranged to create the genetic code. The wrong base in the right place is an error or "mutation," just like the wrong letter in the right place is an error or a "misspelled word." A certain group of DNA-bases define a gene; genes in turn code for proteins. Not all the bases in DNA code for genes; some of the bases are just filler. Genetic diseases result when the DNA code is altered in a way that affects protein production.	Many diseases in plants, animals, and humans are being traced to errors in an individual's genetic code. Identifying specific genetic errors offers the hope that treatments can be designed to fix them.

Interdisciplinary life sciences and engineering

Title	Scientific Details	Simplified Concepts	Big Picture
Stinky Drinking Water: Blue-Green Algae Escape Water Treatment	Cyanobacteria (e.g., *Oscillatoria* and *Anabeana*) produce the odorous chemicals geosmin (earthy) and 2-methylisobomeol (musty) that can be detected by humans at nanogram per liter concentrations. Conventional water treatment practices of alum coagulation and chlorination poorly remove the odors, while advanced treatment with activated carbon or ozonation can successful remove or destroy the odors.	Many blue-green algae produce chemicals with earthy-musty odors that are readily smelled by humans but which have no known adverse human health effects. These chemicals are not removed by conventional engineered water treatment practices, but can be removed by advanced and more expensive treatments like activated carbon or ozone.	Bad smelling drinking water is frequently caused by naturally occurring microorganisms that live in lakes and rivers. The odors are difficult and costly to remove during water treatment.

Engineering

Title	Scientific Details	Simplified Concepts	Big Picture
Engineering Smooth Flight: Math to Minimize Turbulence	The turbulence in a moving fluid is determined by these factors: fluid density (ρ); fluid velocity (V); viscosity (μ); and the length (L) of an object moving through the fluid. These individual properties are combined mathematically to calculate a Reynolds Number (Re) that predicts the amount of turbulence: $Re = \rho VL/\mu$	The amount of mixing, or turbulence, created by an object moving through a fluid depends on the object's size and shape, the fluid's properties, and the speed of the object in comparison to the speed of the fluid. Turbulence can be predicted using equations that contain a factor known as the "Reynolds Number." A high Reynolds Number indicates turbulent flow, as when a jet plane encounters a strong headwind. A low Reynolds Number indicates smooth flow, like a light breeze kissing your face.	Smoother airplane rides can be achieved by designing wings that minimize turbulence.

Physical sciences

Title	Scientific Details	Simplified Concepts	Big Picture
Nanotechnology: Building Small Requires Big Tools	The atomic force microscope (AMF) is a type of scanned-proximity probe microscope that measures surface topography on a sub-nanometer scale by raster scanning a 2-30 nm probe tip across the surface to be imaged. The probe also can physically assemble nanoparticles to build structures with an atom-wide precision. Nanometer-sized etchings or dip-pen lithographs can be created by AFM.	An atomic force microscope takes atomic scale pictures. It works by scanning a fine tip over a surface, and as the tip bumps up and down over the atoms, the movements are recorded. The pictures of atoms that are produced look like hills, valleys, and bumps. The atomic probe microscope can also pick up and move single atoms.	Nanotechnology offers the possibility of building tiny machines—machines that are smaller than the width of a human hair, about 50,000 nanometers wide. Specialized tools that can assemble individual atoms are necessary for nanoscience building and research.

How to communicate to the public

Make them care. Emphasize to your audience that what you have to say is relevant to their interests.

Keep it simple! In the words of Albert Einstein, *"An explanation should be as simple as possible, but no simpler."*

Public speaking hints

- Oral presentations should be written and presented for the audience; use visuals to augment your message.
- Do not try to convey too many main ideas in one presentation; 3 is optimum.
- Do not just read your slides.
- For the audience, the optimum listening time is 15 minutes.
- A presentation longer than 20 minutes risks losing the interest and attention of your audience.

The Speech Pyramid

Relates minutes to number of words. One typed, double-spaced page is about 250 words.

Inform, don't instruct!

- Public speaking is not the same as lecturing. Your audience will not be taking notes or reading and underlining your handouts.
- Think and talk in themes. Your audience should grasp the totality and value of your subject matter.
- Distinguish ideas from facts. Present IDEAS supported by facts. Your task is to deliver the BIG PICTURE and instill a desire in listeners to obtain specific FACTS!
- Use active verbs and vivid nouns.
- Be concise. Do not give long-winded explanations.
- Avoid using scientific nomenclature. The informed public will be unlikely to comprehend it. If you must use nomenclature, be sure to explain it.

Connect with your audience

- Introduce yourself with a connection to the audience; e.g., a brief statement about your previous interaction with or historical fact about group, location, organizers or audience.
- Use "we" or "us" instead of "I." Example: "We all want America to excel in science, engineering and math."
- Find and use metaphors. These are powerful tools for explaining concepts and connecting with your audience. Example: "An ecosystem is like a garden– it is a living entity requiring nutrients, water, plants, animals, and care."
- Try to insert a quote from a person the audience will recognize, as it gives credence to your statements.
- Try to insert a joke.

Examples of adequately versus compellingly written public statements

"The Connection Between Basic and Applied Science"

"Adequately" Written

Competent but dry

Many technological advances that improve the lives of citizens had their origins in basic science. Below are several examples.

Magnetic Resonance Imaging, or MRI, was produced through a combination of physics, math and chemistry research. Many other medical imaging techniques resulted from application of the fundamental sciences, including X-rays, CAT scans, laser surgery, and fetal sonograms.

Materials science develops new medical devices like joints, heart valves and dental implants. New and better drugs have been developed with the aid of modern chemistry and computer modeling.

Basic biology and molecular science are needed to identify, analyze and control disease molecules.

"Compellingly" Written

Note active verbs and vivid nouns

Many technological advances that improve the lives of citizens had their origins in basic science.

A classic example of the intersection of basic scientific research and modern medicine is Magnetic Resonance Imaging, or MRI. MRI evolved from physics, math and chemistry research.

Other medical advances similarly trace their roots to fundamental physics: X-rays, CAT scans, laser surgery, and fetal sonograms. Materials science helped develop new joints, heart valves, and dental implants. Advances in chemistry and computer modeling are speeding up drug development and making new drugs more effective, with fewer adverse side effects.

Basic biology and molecular science has even allowed us to identify and analyze disease molecules. Drugs can then be created to bind to disease molecules, atom to atom.

Hints for simplifying data

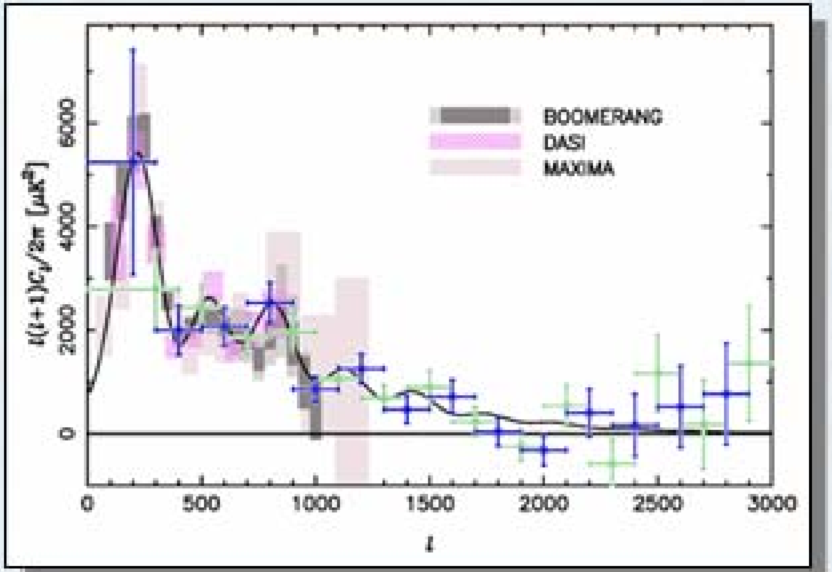
- Assume the audience is intelligent, though perhaps not well informed on your topic.
- Present important big picture data; avoid presenting data that will not be discussed.
- Closely align text and graphics: place names next to graphics, annotate data directly.
- Avoid abbreviations.
- Avoid "chart junk" —decorations that are not data.
- Make comparisons, contrasts, and contexts—do not leave data interpretation to the audience.
- Remember artist Ad Reinhardt's quote: *"If a picture is not worth a thousand words, to hell with it."*

Simplifying graphs

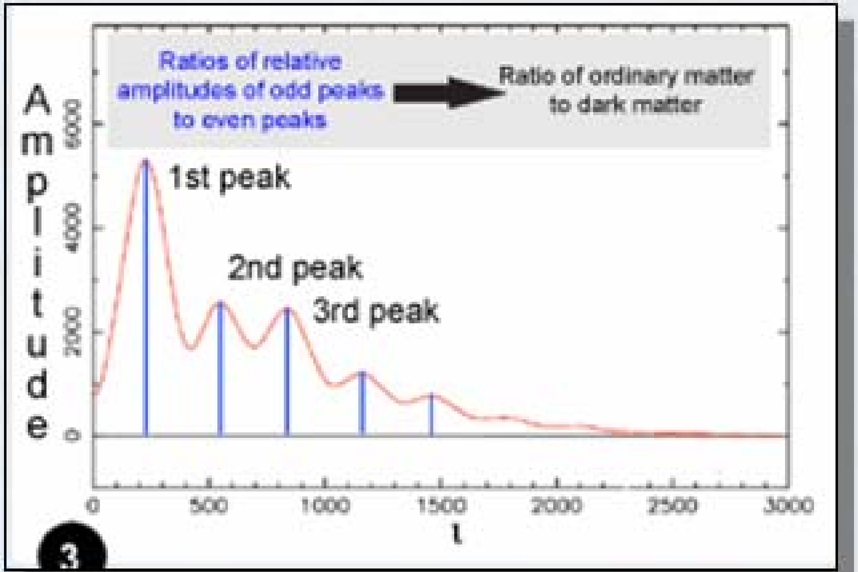
Simplifying graphs

- **The next two pages** contain scientific graphs from refined measurements of radiation emitted when the universe was created.
- **Because the original** astronomical graph was too complex for the public to readily understand and interpret, it was redrawn in a simplified version that still communicated the overall meaning of the process to the public even though some data were omitted.
- **The simplified graph** redefined the axis in more recognizable words, labeled the peaks to draw the audience to important features, provided text for explanation, and eliminated shading and markings of interest to astronomers, but unnecessary to show the big picture.

Simplifying graphs…#1



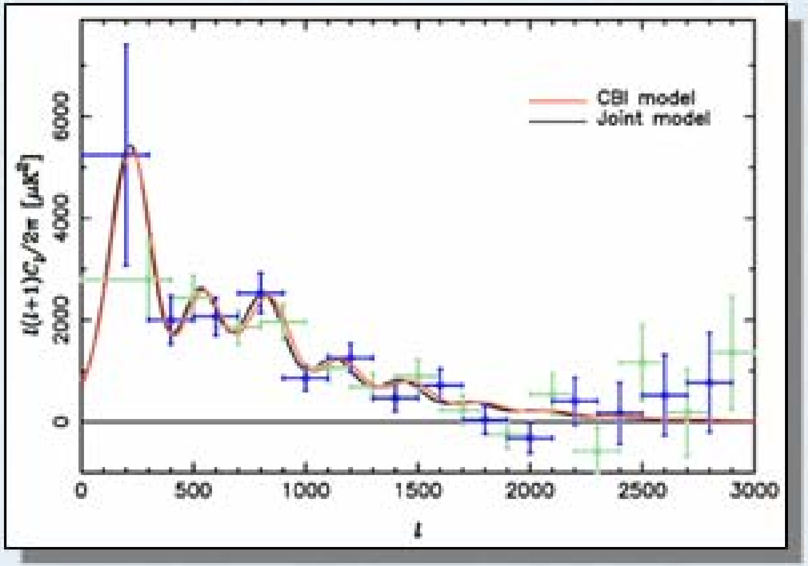
What astronomers want to see



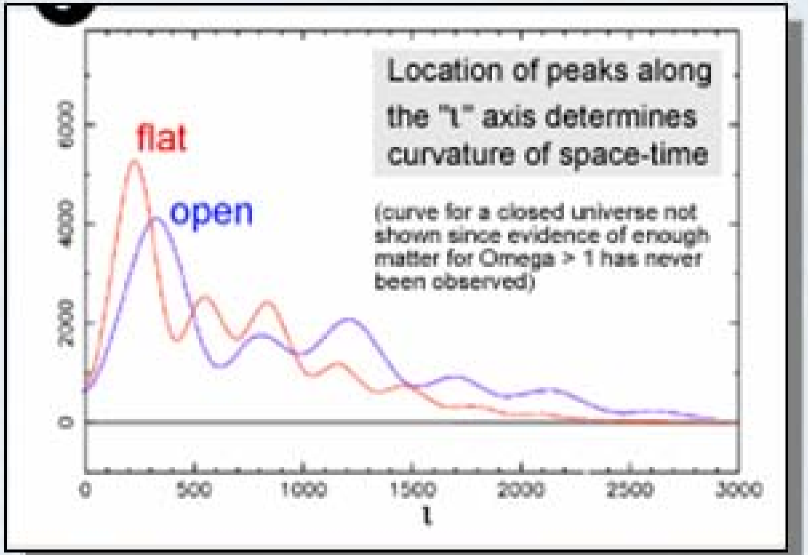
What the public needs to see

Based on NSF-supported research by Anthony Readhead, Steve Padin and Timothy Pearson and others from Canada, Chile and the United States.

Simplifying graphs...#2



What astronomers want to see



What the public needs to see

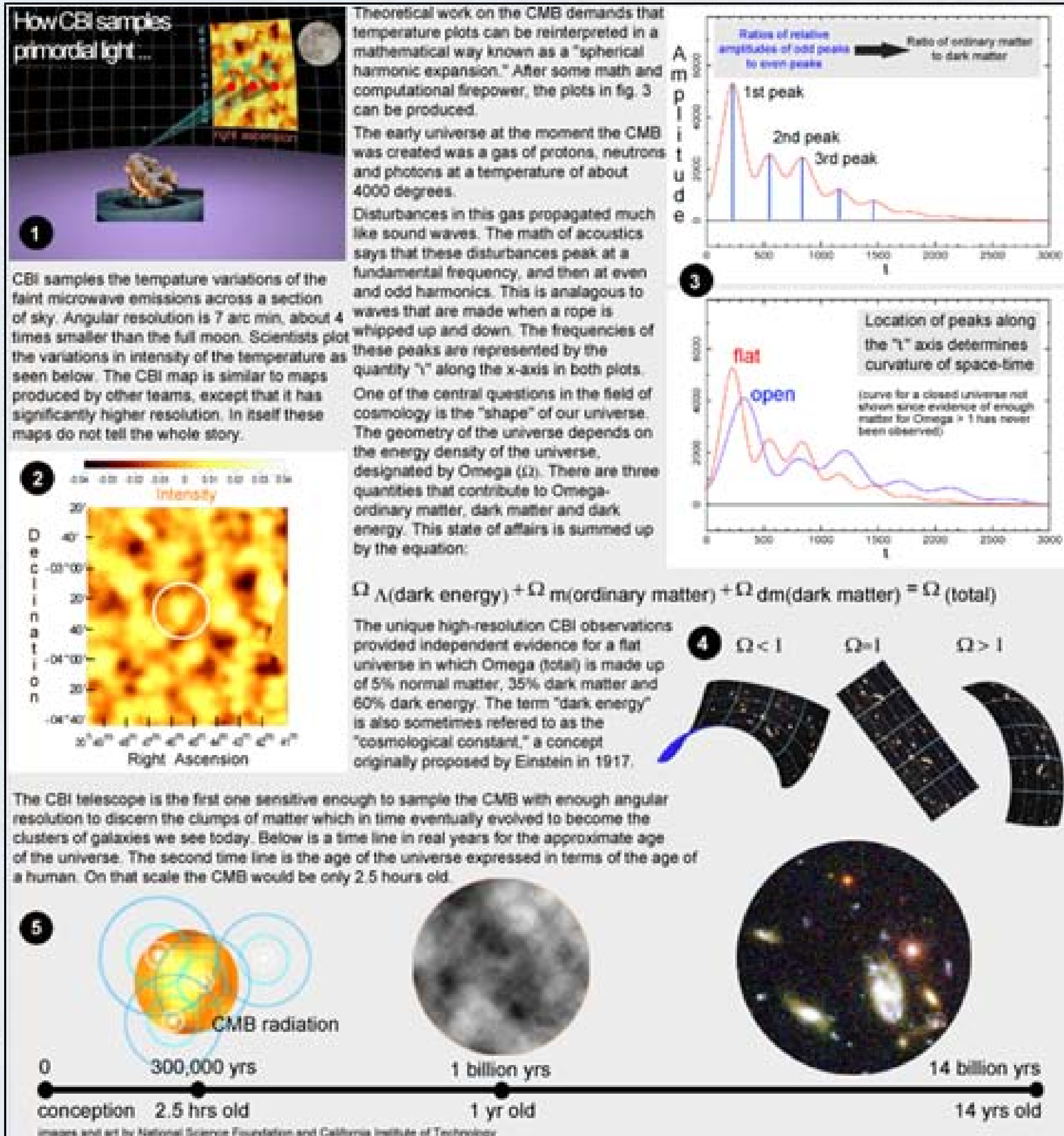
Based on NSF-supported research by Anthony Readhead, Steve Padin and Timothy Pearson and others from Canada, Chile and the United States. See Press Release at http://www.nsf.gov/search97cgi/vtopic

Even the best annotated graphs may not convey the point, and supporting narrative may be needed. In an oral presentation, the narrative is provided by the speaker.

In print materials, the narrative is in the form of text. The figure to the left is known as **"Infoart."** Typically these illustrations are found in the popular science press.

The page shown was prepared by NSF staff to explain data in a news release about the Cosmic Background Imager (CBI) and its astronomical implications.

Note: Inserting this entire page into a PowerPoint slide for a presentation would be inappropriate.



Using schematic diagrams for devices and processes

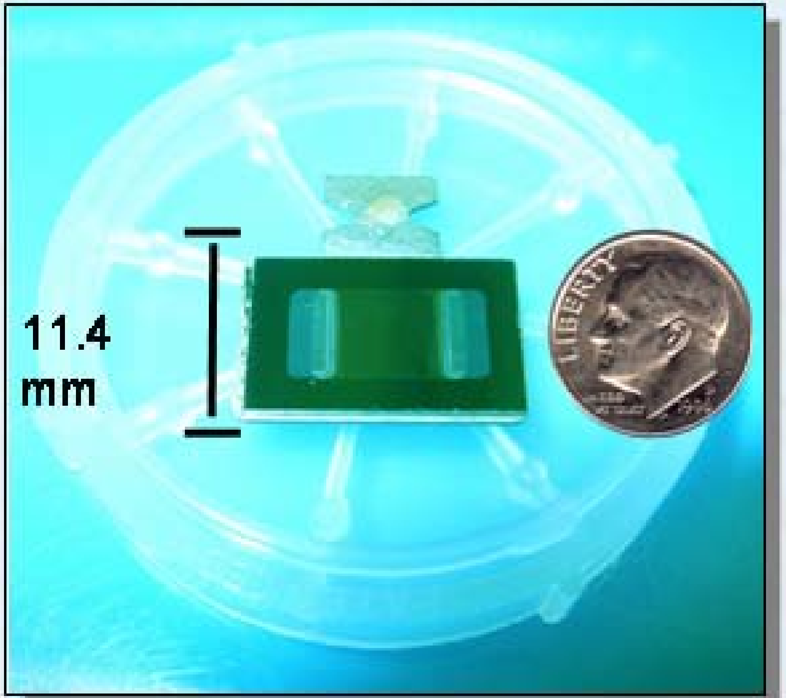
See Press Release at

http://www.nsf.gov/od/lpa/news/press/01/pr01105.htm

Using schematic diagrams

- The next four pages describe a newly discovered effect in physics called "chemicurrent"; i.e., electrical current caused by gas molecules chemically interacting with a metallic surface. The effect is measured by a device called a Schottky diode. (A diode is a type of electronic switch.)
- To communicate to the public the phenomena cited in the *Science* article, the following graphics were developed: a photo of the diode, a schematic of the diode and conceptual illustrations showing how the diode fit in a larger circuit and detected the chemicurrent.

Photographs don't tell all…



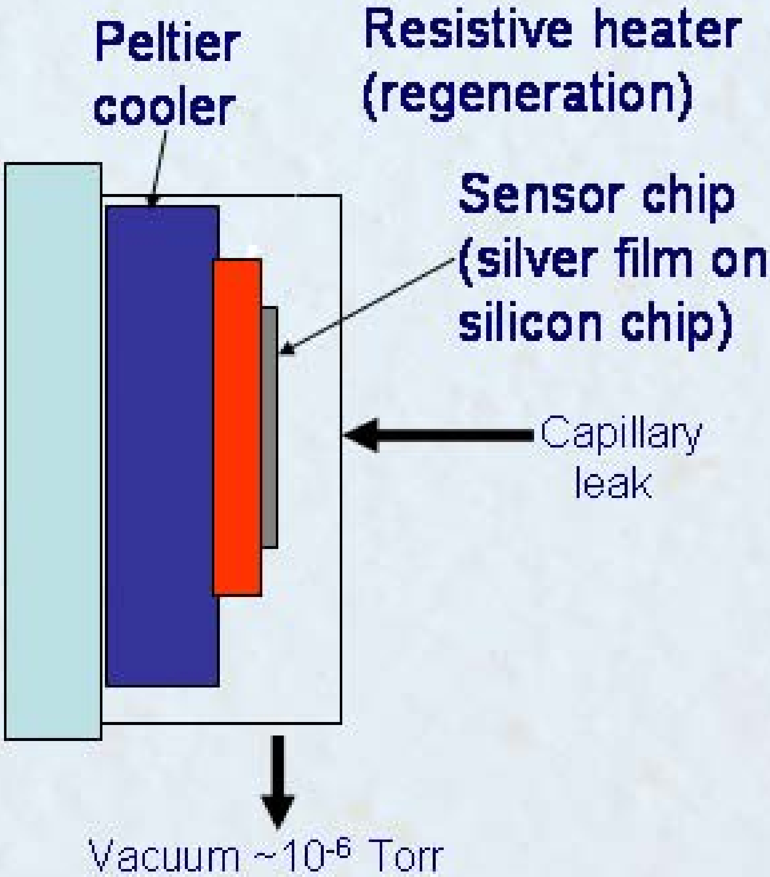
This photo shows the Schottky diode, used to detect the chemical currents, or "chemicurrent," as a result of gas molecules impacting the diode. **This photo, by itself, does not tell the whole story.** That is why the schematics on the next page were developed for a public-oriented press release.

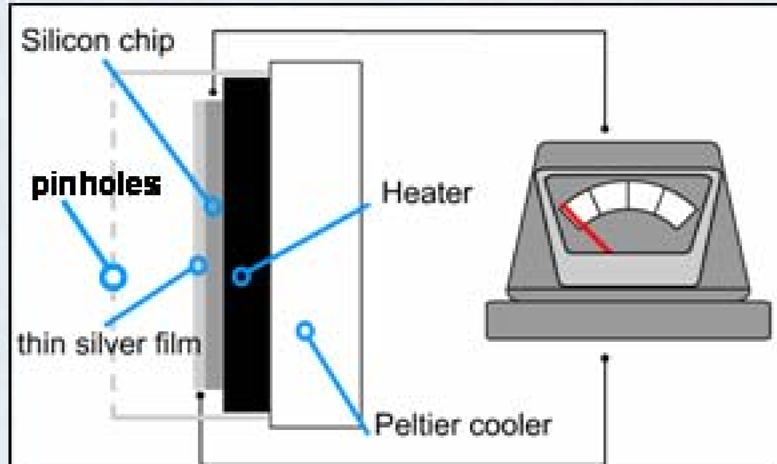
HINT: Remember that all **photos should contain a scale** or comparison with a common object (e.g. a coin) to get a sense of scale.

Based on NSF–supported research from the following publication: "Chemically Induced Electronic Excitations at Metal Surfaces," by Brian Gergen, Hermann Nienhaus, W. Henry Weinberg and Eric W. McFarland, *Science*, 2001 Dec. 21; 294: 2521-2523.

Schematic diagrams

The schematic on the left was provided by the researchers and depicts the components of the Schottky diode. The graphic on the right expands on the original, revealing how the chemically induced current is detected in a familiar setting--an electrical circuit.

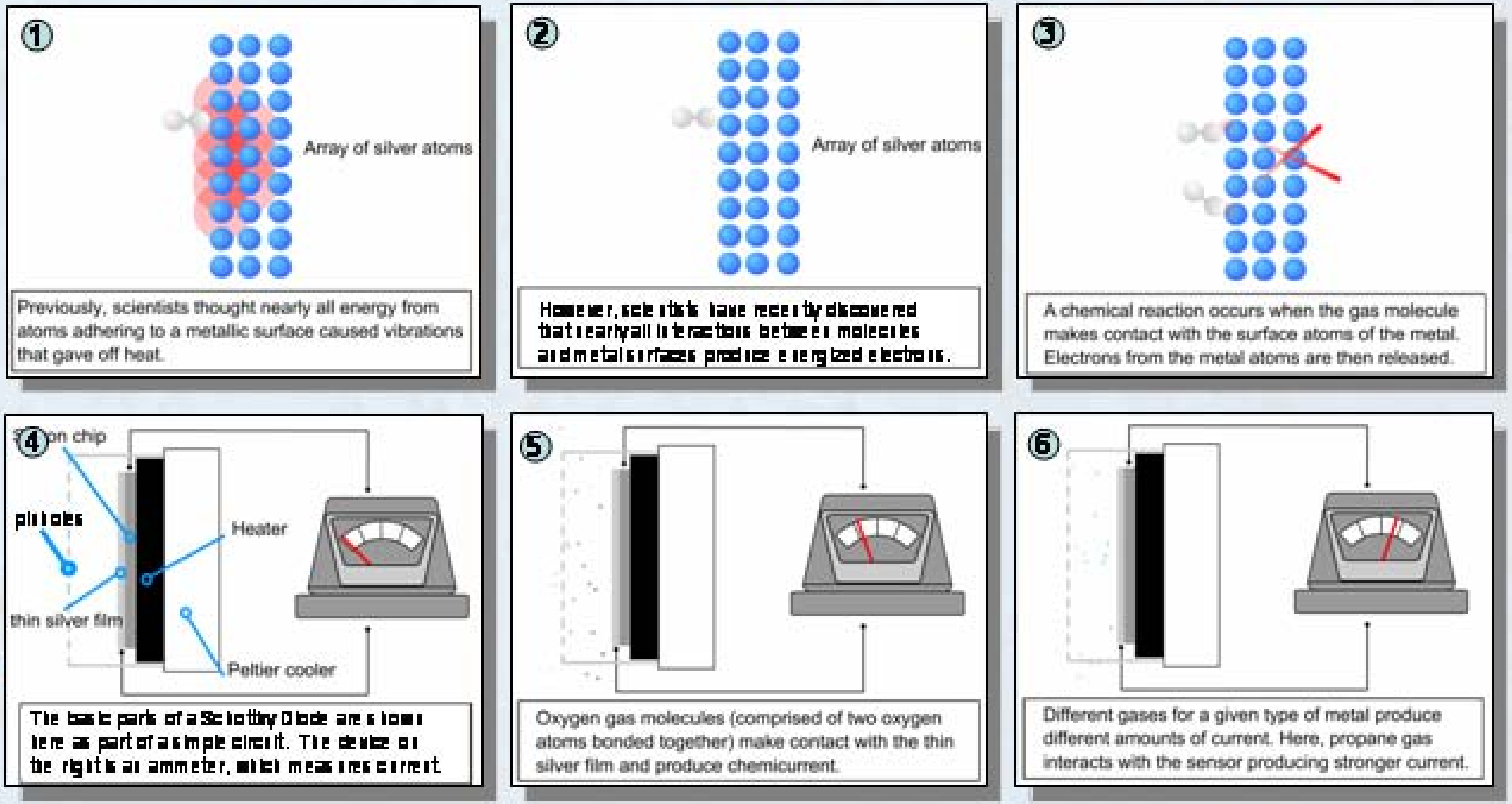




The basic parts of a Schottky Diode are shown here as part of a simple circuit. The device on the right is an ammeter, which measures current.

Schematics explaining chemicurrent

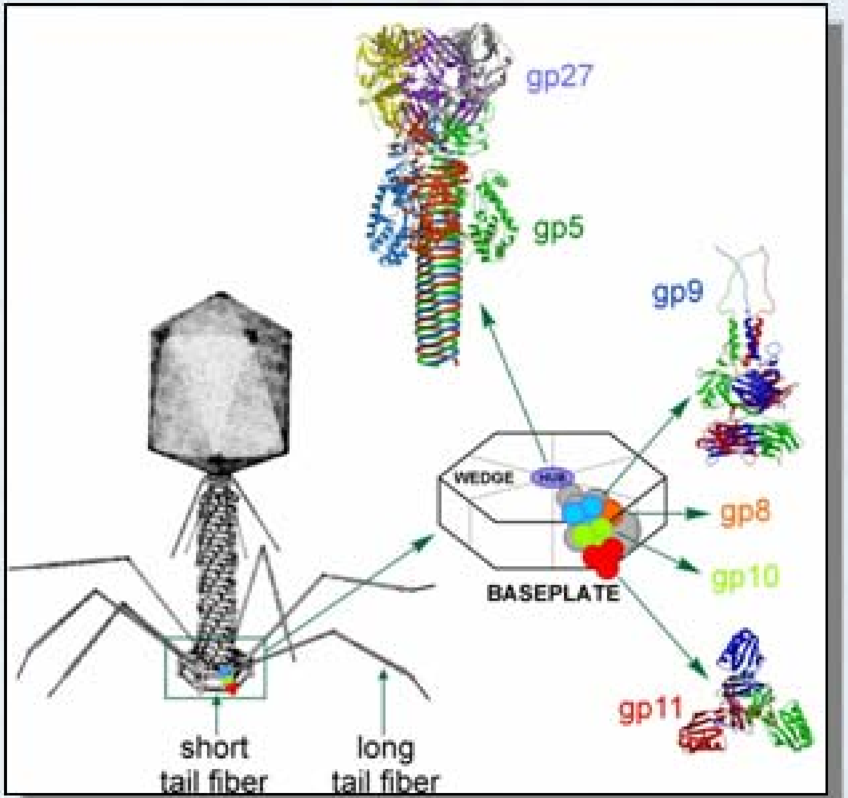
The figures below describe how chemicurrent is generated. Further, the interaction of the Schottky diode with an electrical circuit provides context. Note that the graphics and annotations are straightforward, avoiding terminology and concepts the public may not readily understand.



Simplified drawings of biological organisms

See Press Release at
http://www.nsf.gov/od/lpa/news/02/pr0207.htm

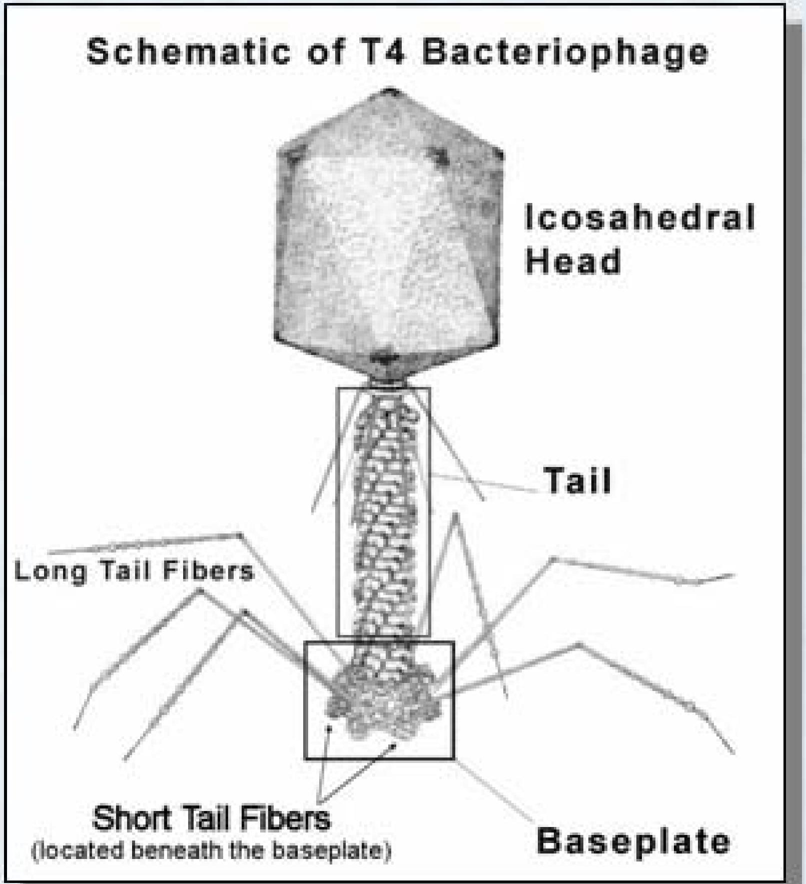
These images, reported in *Nature*, describe the protein structure and operation of the baseplate of the T-4 bacteriophage. Although the colorful graphics were crucial to communicating this discovery to the scientific community, the images were annotated using nomenclature that molecular biologists, but few lay persons, would understand.



CREDIT: Kanamaru S, Leiman PG, Kostyuchenko VA, Chipman PR, Mesyanzhinov VV, Arisaka F, Rossmann MG. (2002) Structure of the cell-puncturing device of bacteriophage T4. Nature. 6871, 553-7. Reprinted with the permission of *Nature*.

This example is based on NSF-supported research from the following publication: Kanamaru, S., P. G. Leiman, V. A. Kostyuchenko, P. R. Chipman, V. V. Mesyanzhinov, F. Arisaka, M. G. Rossmann. 2002. Structure of the cell-puncturing device of bacteriophage T4. *Nature* (London). 415:553-557.

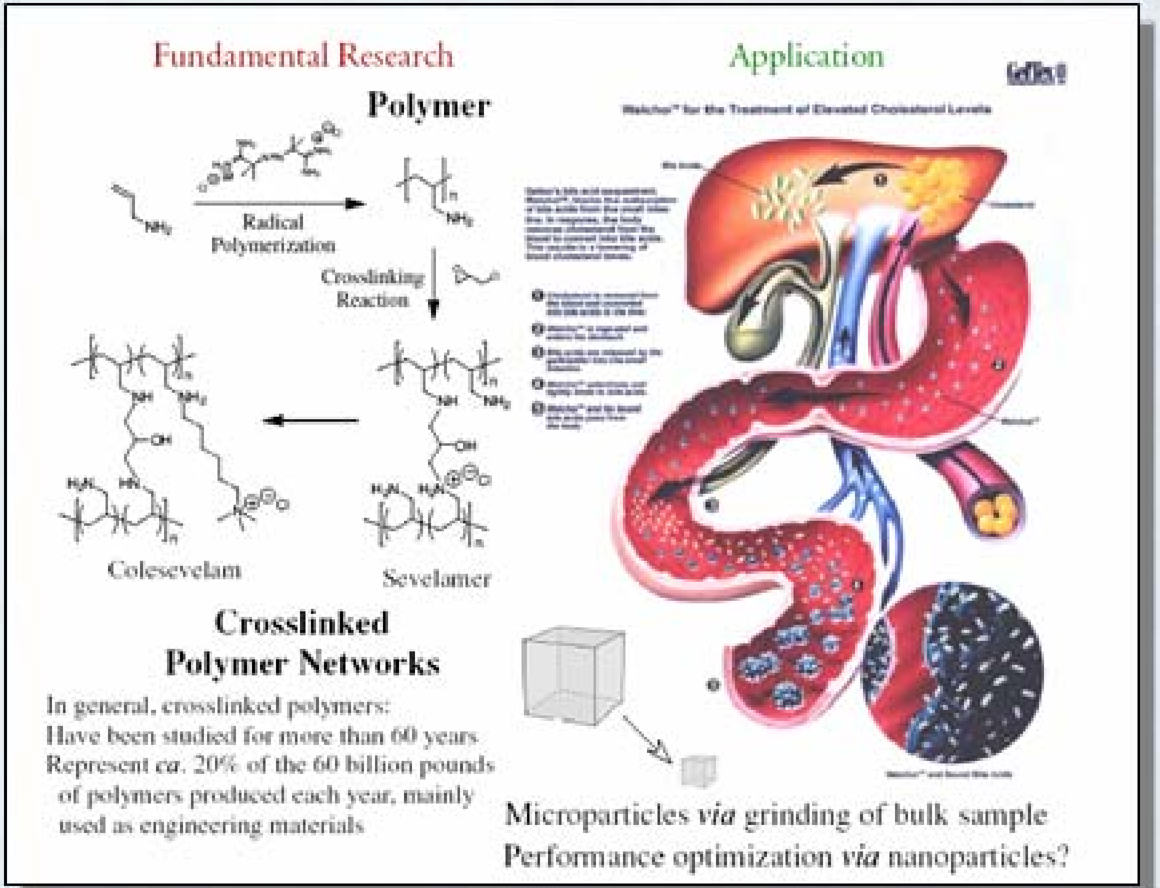
This image was used for a press release. It shows the structure of the T4 bacteriophage, a virus that infects the bacterium *E. coli*. The focus of the diagram is on the overall organization of the phage and away from the detailed protein structure of the base plate. Annotations were added or changed to clearly indicate the major components of the phage.



Caption: "T4 bacteriophage is a virus that consists of an icosahedral (20-sided) head, contacting tail, six short and six long fibers for attaching to its *E. coli* victim, and a base plate that is the nerve center for communicating between the fibers and the tail."

Simplifying illustrations

Although informative for a technical audience, this graphic is too complex for a public audience. The intent is to convey how nano-derived particles can assist the body with eliminating cholesterol. Although it is colorful and well organized, the information density is too high and terminology too sophisticated for the informed public.



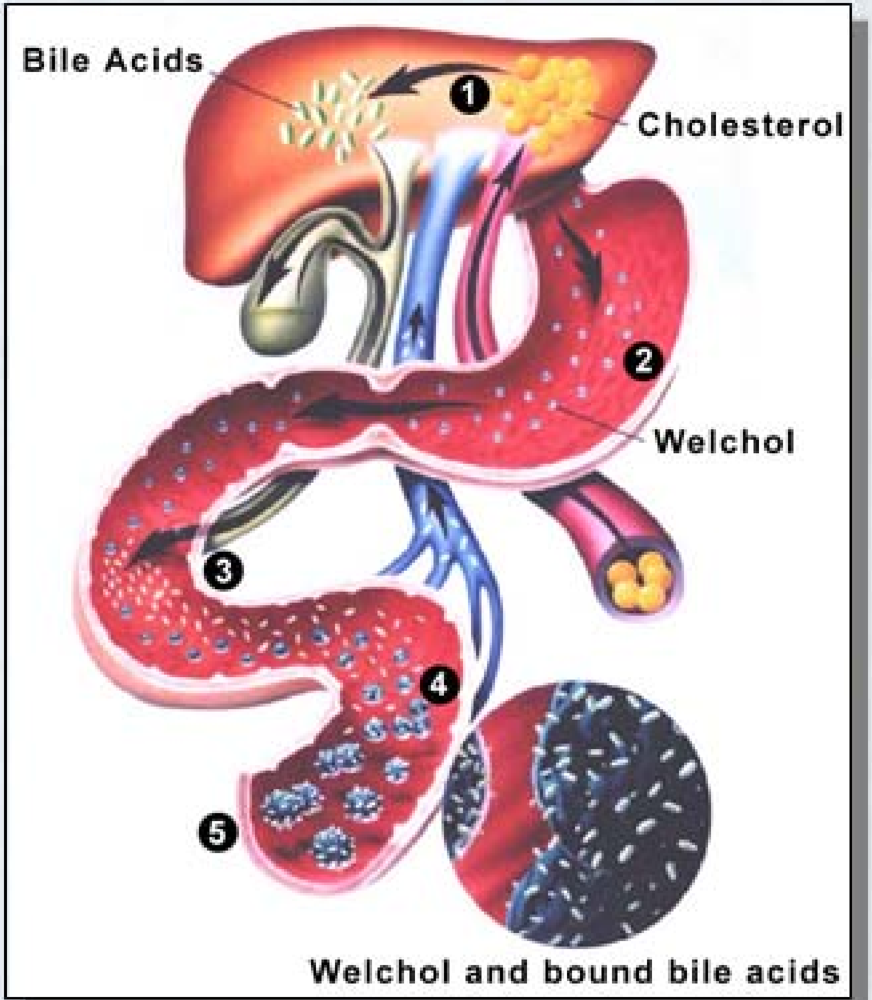
From a presentation by Karen L. Wooley of Washington University, Department of Chemistry, St. Louis, Missouri at the NSF-sponsored symposium, "Small Wonders: Exploring the Vast Potential of Nanoscience," Washington, D.C., March 19, 2002.

This was the graphic that was actually used in a symposium for the public. The focus was narrowed to human health, deemphasizing the chemical dynamics and emphasizing the health aspects of nanotechnology.

Nanotech Applications for Human Health

Welchol™

1) Microparticles that aid the body to rid it of excess cholesterol
2) Example of a cross-linked polymer network (matrix)
3) Molecules are attached to the matrix to make it positively charged
4) Bile acids (result of the liver processing cholesterol) are negatively charged
5) Positively-charged matrix binds to bile acids and are discharged by the body



Welchol and bound bile acids

Karen L. Wooley, Washington University, Department of Chemistry, St. Louis,Missouri [klwooley@artsci.wustl.edu]

Suggested Reading

- *The Lost Art of the Great Speech*, Richard Dowis
- *Visual Explanations, Edward Tufte*
- *Envisioning Information*, Edward Tufte
- *The Visual Display of Quantitative Information*, Edward Tufte
- *Data Analysis for Politics and Policy*, Edward Tufte
- *Elements of Style*, Strunk and White