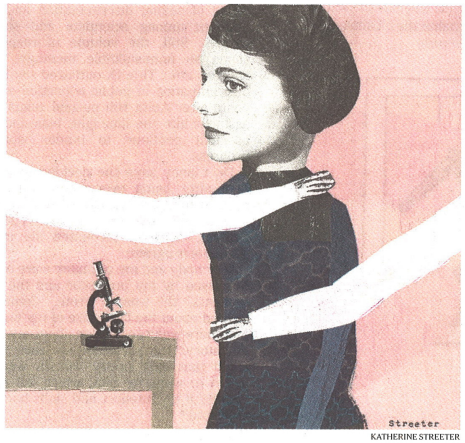

Global/Diversity Learning in Chemistry

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Fall 2014
Chemistry Department

Queensborough Community College

QUEENSBOROUGH COMMUNITY COLLEGE CUNY

Typical general chemistry

Problem 1

Given that

$$2\ SO_{3\ (g)} \rightleftharpoons 2\ SO_{2\ (g)} + O_{2\ (g)} \quad K_{eq} = 2.3 \times 10^{-7} \quad (1)$$

$$2\ NO_{3\ (g)} \rightleftharpoons 2\ NO_{2\ (g)} + O_{2\ (g)} \quad K_{eq} = 1.4 \times 10^{-3} \quad (2)$$

Calculate the equilibrium constant for the following reaction.

$$SO_{2\ (g)} + NO_{3\ (g)} \rightleftharpoons SO_{3\ (g)} + NO_{2\ (g)} \quad (3)$$

Problem 1 solution

$$2\ SO_{3\ (g)} \rightleftharpoons 2\ SO_{2\ (g)} + O_{2\ (g)} \qquad K_{eq} = 2.3 \times 10^{-7}$$

$$2\ SO_{2\ (g)} + O_{2\ (g)} \rightleftharpoons 2\ SO_{3\ (g)} \qquad K_{eq} = (2.3 \times 10^{-7})^{-1}$$

$$= 4.3 \times 10^{6}$$

$$2\ NO_{3\ (g)} \rightleftharpoons 2\ NO_{2\ (g)} + O_{2\ (g)} \qquad K_{eq} = 1.4 \times 10^{-3}$$

$$2\ SO_{2\ (g)} + 2\ NO_{3\ (g)} \rightleftharpoons 2\ SO_{3\ (g)} + 2\ NO_{2\ (g)} \qquad K_{eq} = (4.3 \times 10^{6})$$

$$\times (1.4 \times 10^{-3})$$

$$K_{eq} = 6.1 \times 10^{3}$$

For the overall reaction as written above with all coefficients equal to 1,

$$K'_{eq} = \sqrt{6.1 \times 10^{3}} = \boxed{78}$$

Problem 1 solution

$$2\ SO_{3\ (g)} \rightleftharpoons 2\ SO_{2\ (g)} + O_{2\ (g)} \qquad K_{eq} = 2.3 \times 10^{-7}$$

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$$2\ NO_{3\ (g)} \rightleftharpoons 2\ NO_{2\ (g)} + O_{2\ (g)} \qquad K_{eq} = 1.4 \times 10^{-3}$$

$$2\ SO_{2\ (g)} + 2\ NO_{3\ (g)} \rightleftharpoons 2\ SO_{3\ (g)} + 2\ NO_{2\ (g)} \qquad K_{eq} = (4.3 \times 10^{6}) \times (1.4 \times 10^{-3}) = 6.1 \times 10^{3}$$

For the overall reaction as written above with all coefficients equal to 1,

$$K'_{eq} = \sqrt{6.1 \times 10^{3}} = \boxed{78}$$

$\Rightarrow$ One problem, one solution.

Typical organic chemistry

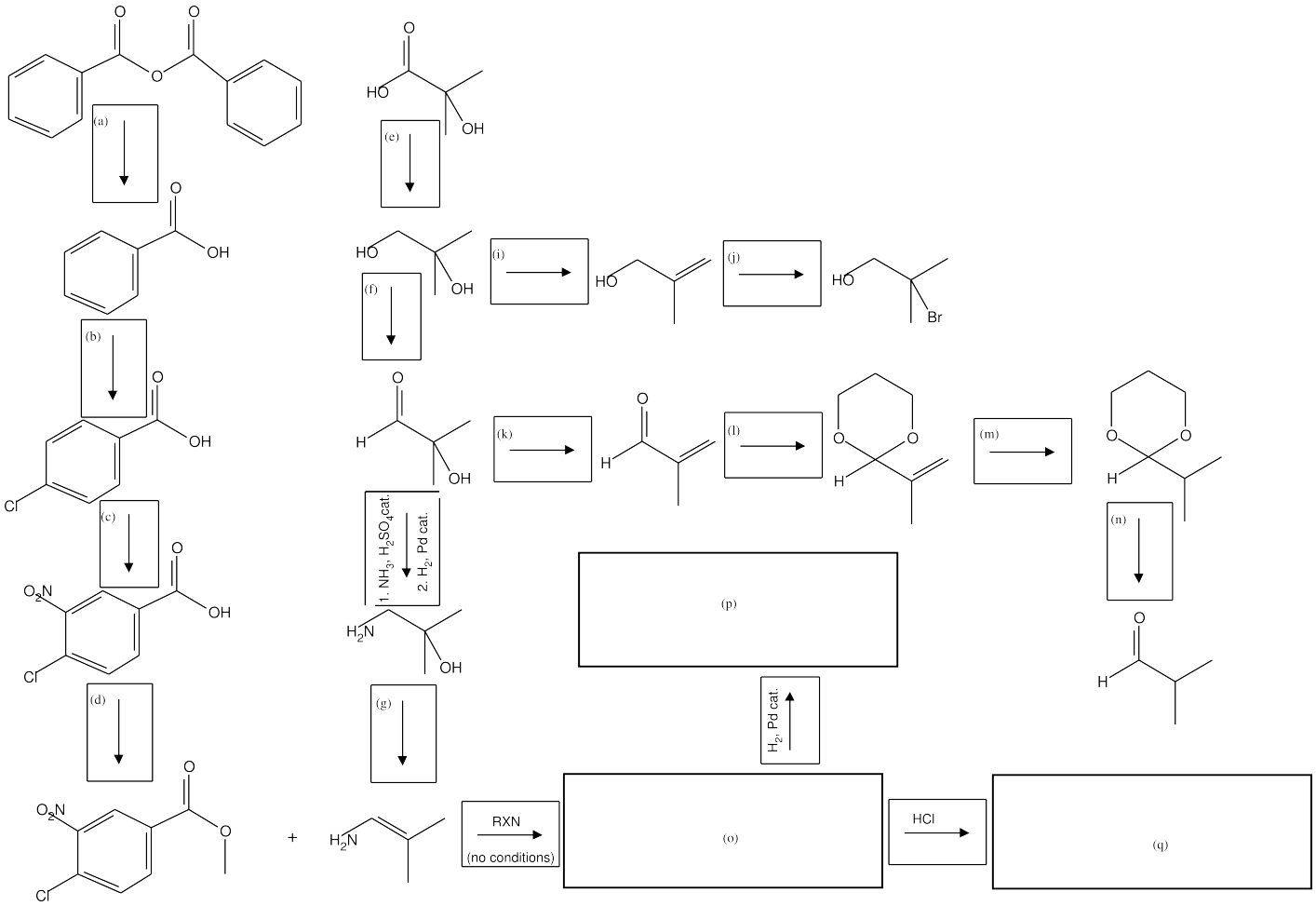


Figure: Fill in the blanks. Hop to it.

In the laboratory

Figure: Lab is fun (*sic*)

We do science there

- Experimental results do require your own interpretation

In the laboratory

Figure: Lab is fun (*sic*)

We do science there

- Experimental results do require your own interpretation
- . . . but the "correct" answer is still always already known

In the laboratory

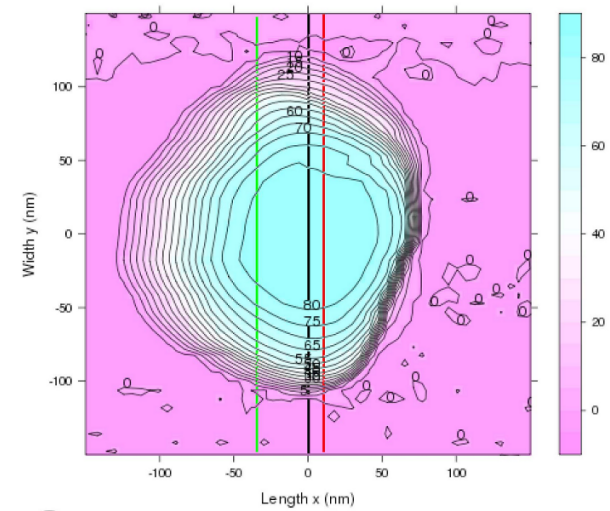
Figure: Lab is fun (*sic*)

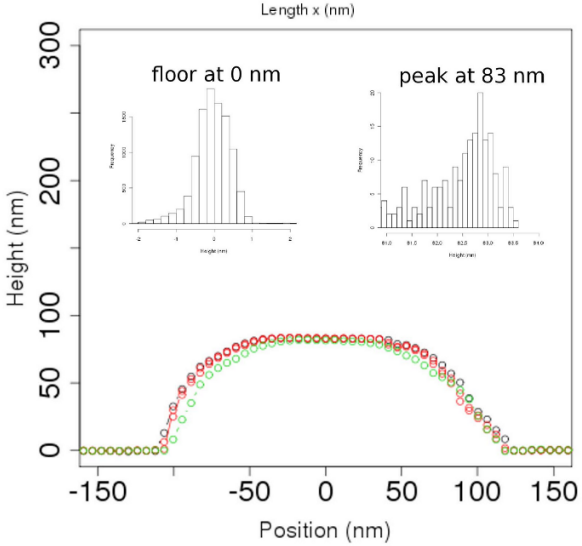
We do science there

- Experimental results do require your own interpretation
- . . . but the "correct" answer is still always already known

  (Really, the objective of the exercise is to learn the techniques)

More than a learning exercise





The laboratory and/against the world

- Experiments yield new knowledge

More than a learning exercise

Figure: Forensic authentication of a painting.

The laboratory and/against the world

- Experiments yield new knowledge
- Other disciplines need input from science

More than a learning exercise

The laboratory and/against the world

- Experiments yield new knowledge
- Other disciplines need input from science
- Scientific evidence is only part of the answer to most questions

Paradigm shift

What we do

A few goals of science and scientists

- Prediction and control
- Technology
- Changing the culture

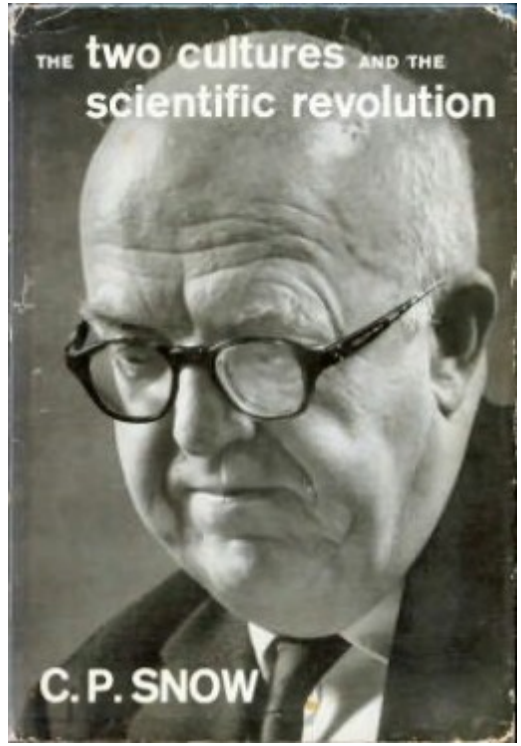


Figure: C. P. Snow wrote (in 1958) that scientists and non-scientists were losing the ability to communicate with each other. Maybe now it's worse.

Paradigm shift

What we do

A few goals of science and scientists

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- Technology
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Figure: The first transistor ever built. Now billions fit on a single computer chip.

Paradigm shift

What we do

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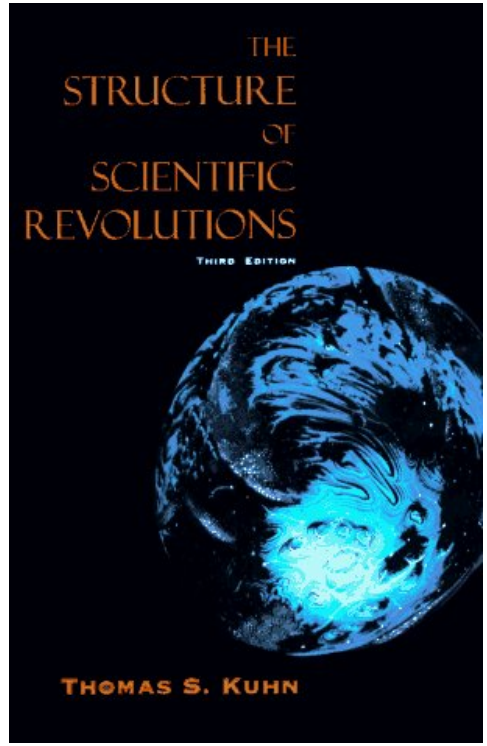

Figure: Thomas Kuhn explained how new ideas shape the interests of young investigators in the scientific community.

Why GDL in chemistry?

We are not alone on this avenue.

- Chemistry and human rights
- Chemistry and global citizenship
- Chemistry and environmental sustainability

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How GDL in chemistry?

- Identify a global issue related to the course

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- Identify a global issue related to the course
- Analyze from multiple perspectives:

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  Different groups are affected differently

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Outline

1. **GDL Avenues**
   - Social and Human Rights
   - Intercultural Learning and Global Citizenship
   - Environmental Sustainability
2. **GDL Project**
   - What to do now
   - What to do next

Social justice

Figure: US soldiers returning home after . . .

Social justice

Figure: US soldiers returning home after . . . World War I.

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- Time for a renaissance—these heroes were not treated as such in the Roaring Twenties.

Social justice

Figure: US soldiers returning home after . . . World War I.

- Time for a renaissance—these heroes were not treated as such in the Roaring Twenties.

  (What about that guy in the upper right?)

Human rights

Japanese Americans waiting to be evacuated to internment camps.

But who worries about Volodya?

Figure: "Interned" Japanese-Americans during World War II.

Human rights

But who worries about Volodya?

- Even bad ideas have a context
- There are always multiple perspectives

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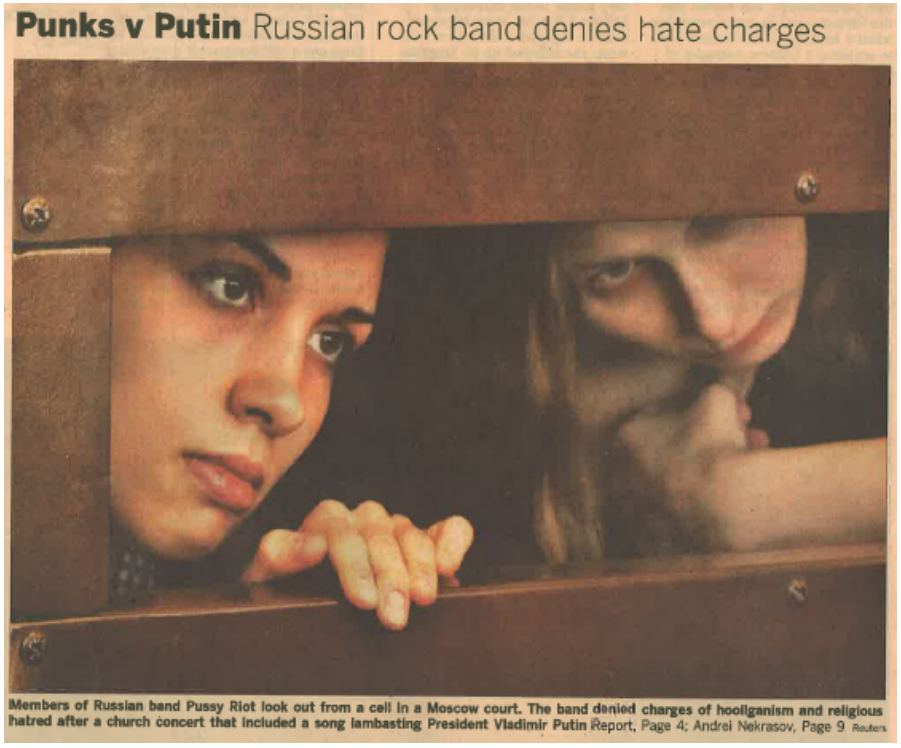
Punks v Putin Russian rock band denies hate charges

Members of Russian band Pussy Riot look out from a cell in a Moscow court. The band denied charges of hooliganism and religious hatred after a church concert that included a song lambasting President Vladimir Putin Report, Page 4; Andrei Nekrasov, Page 9 Reuters

But who worries about Volodya?

- Even bad ideas have a context
- There are always multiple perspectives
- What can chemistry contribute?

Figure: Members of a Russian punk band on trial (since freed).

Human rights

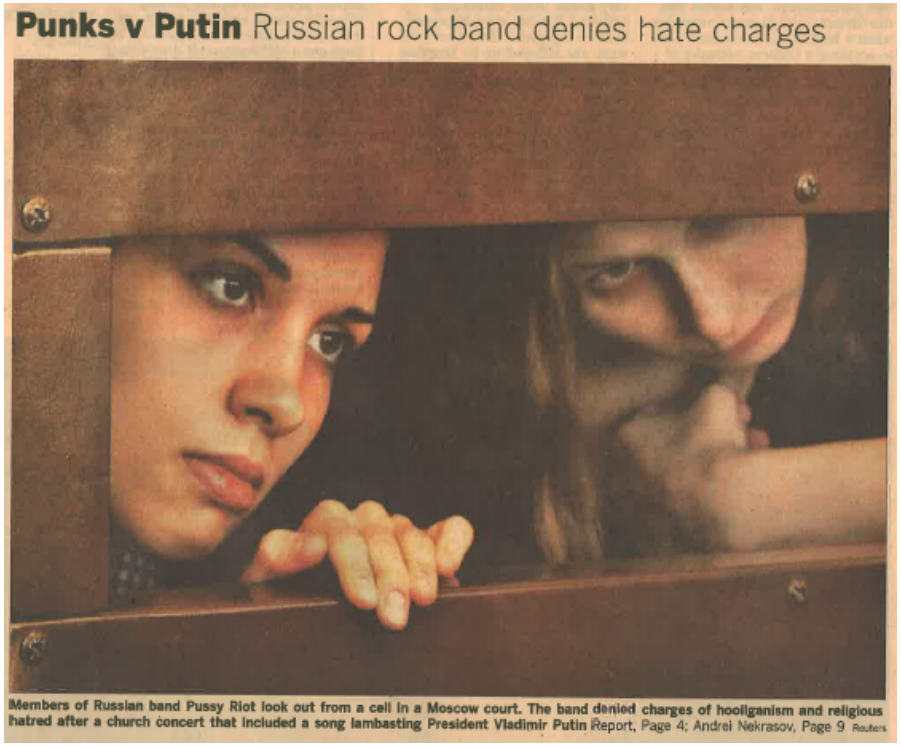

Figure: Members of a Russian punk band on trial (since freed).

But who worries about Volodya?

- Even bad ideas have a context
- There are always multiple perspectives
- What can chemistry contribute? (Maybe nothing here)

But that trash came from somewhere

Figure: . . . and not necessarily from Gauhati, India . . .

But that trash came from somewhere

Figure: . . . and probably not from Pakistan.

Health literacy

Figure: Babies in China getting their shots.

Problem 3

Vaccination is unpleasant and can carry certain risks.

- Why do some areas require vaccination (by law)?
- Why don't others?

Health literacy

Figure: Babies in China getting their shots.

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- "Herd immunity" means that the entire population is safer when a large majority is immunized.

Health literacy

Figure: Babies in China getting their shots.

Problem 3

Vaccination is unpleasant and can carry certain risks.

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- Why don't others?

- "Herd immunity" means that the entire population is safer when a large majority is immunized.

$\Rightarrow$ Private actions can have public consequences.

Another form of literacy

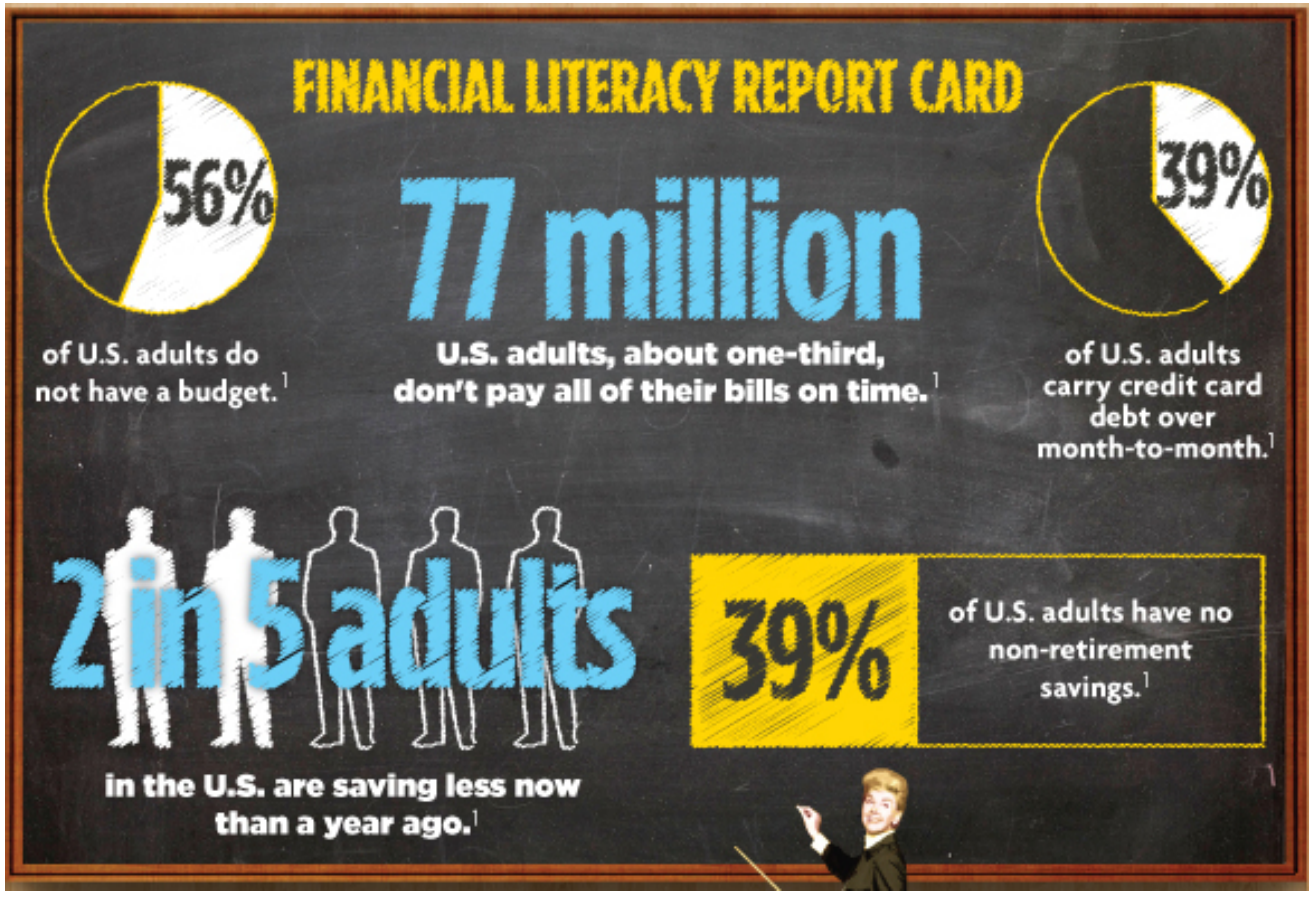

Figure: The numbers for retirement savings are even scarier.

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“Some people say” and ”views differ”

Figure: Examine multiple perspectives or risk missing the larger point.

Interconnected I

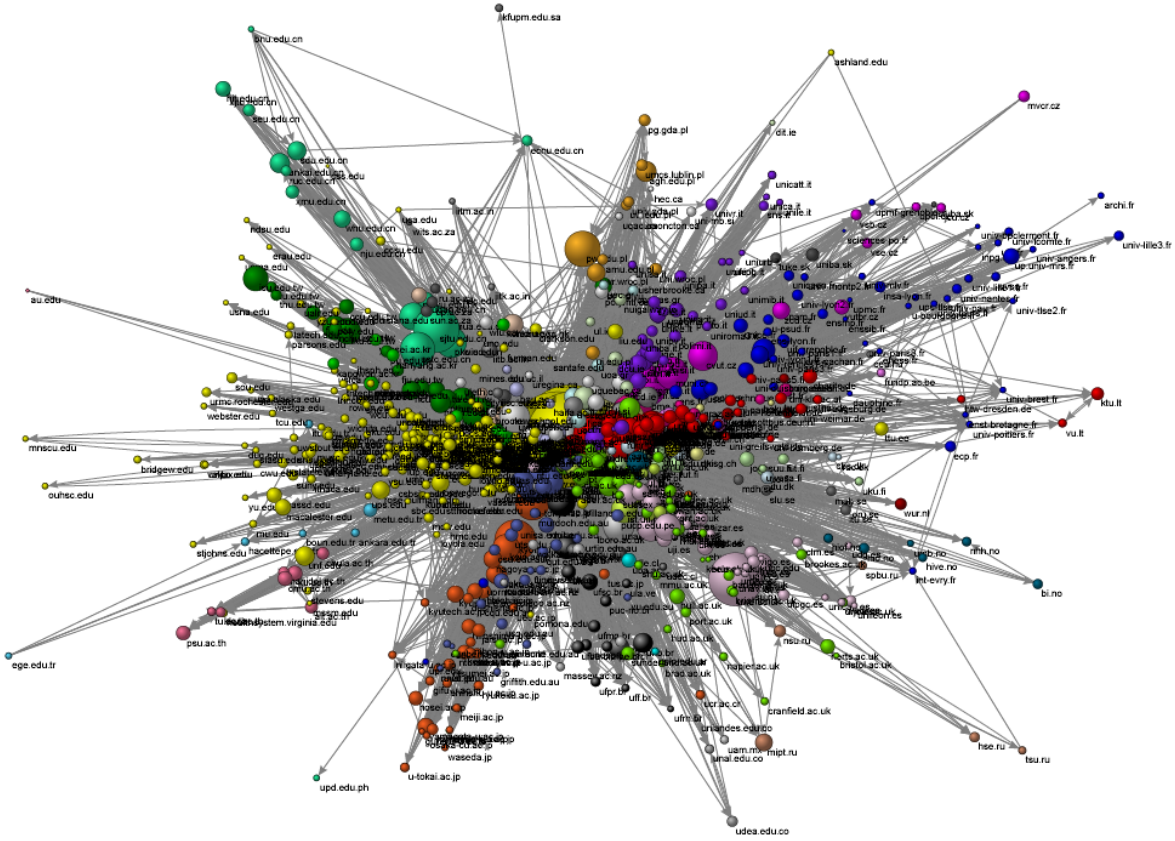

Figure: A directed graph of the scale-free internet. Some nodes are far more central—and therefore, influential—than others.

Interconnected II

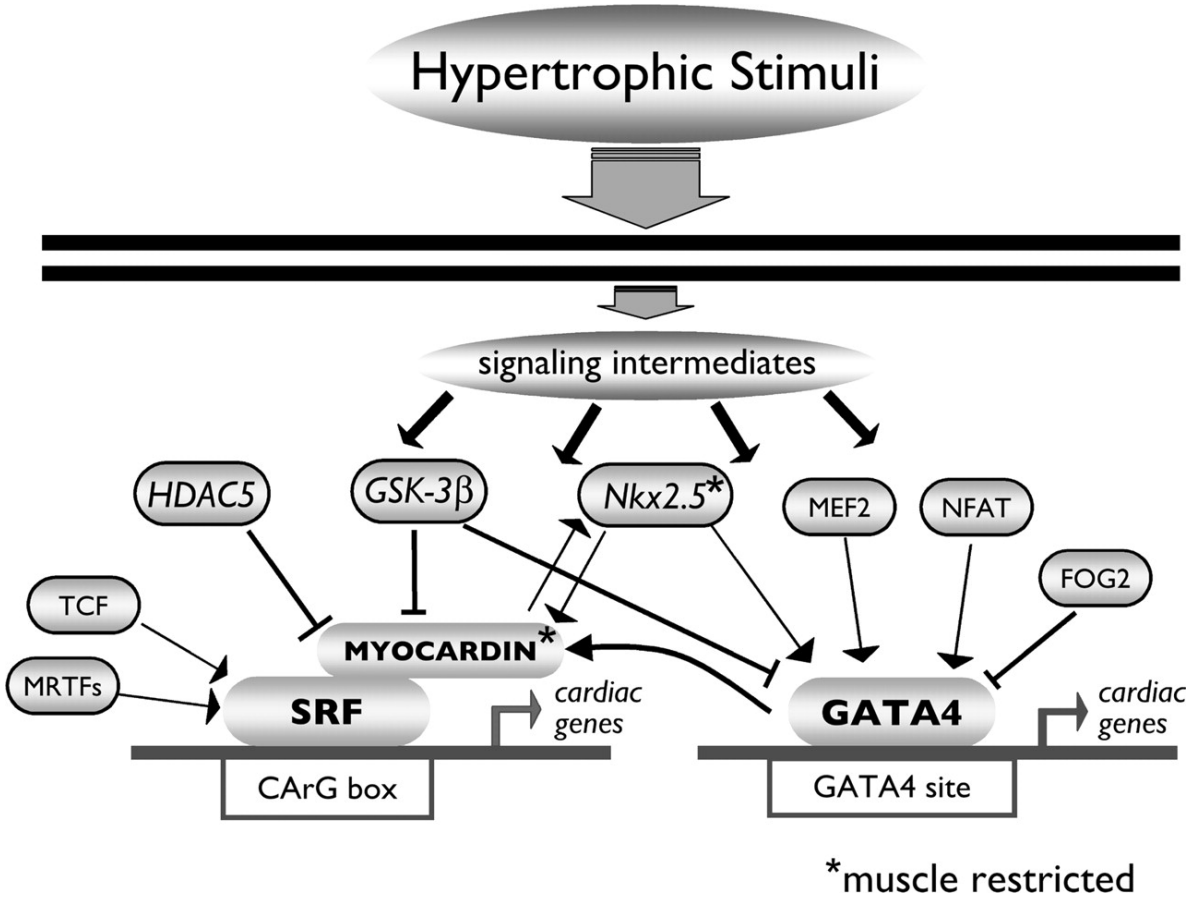

Figure: Enzymes in one biochemical network interact by promoting or blocking action of related proteins.

Interconnected III

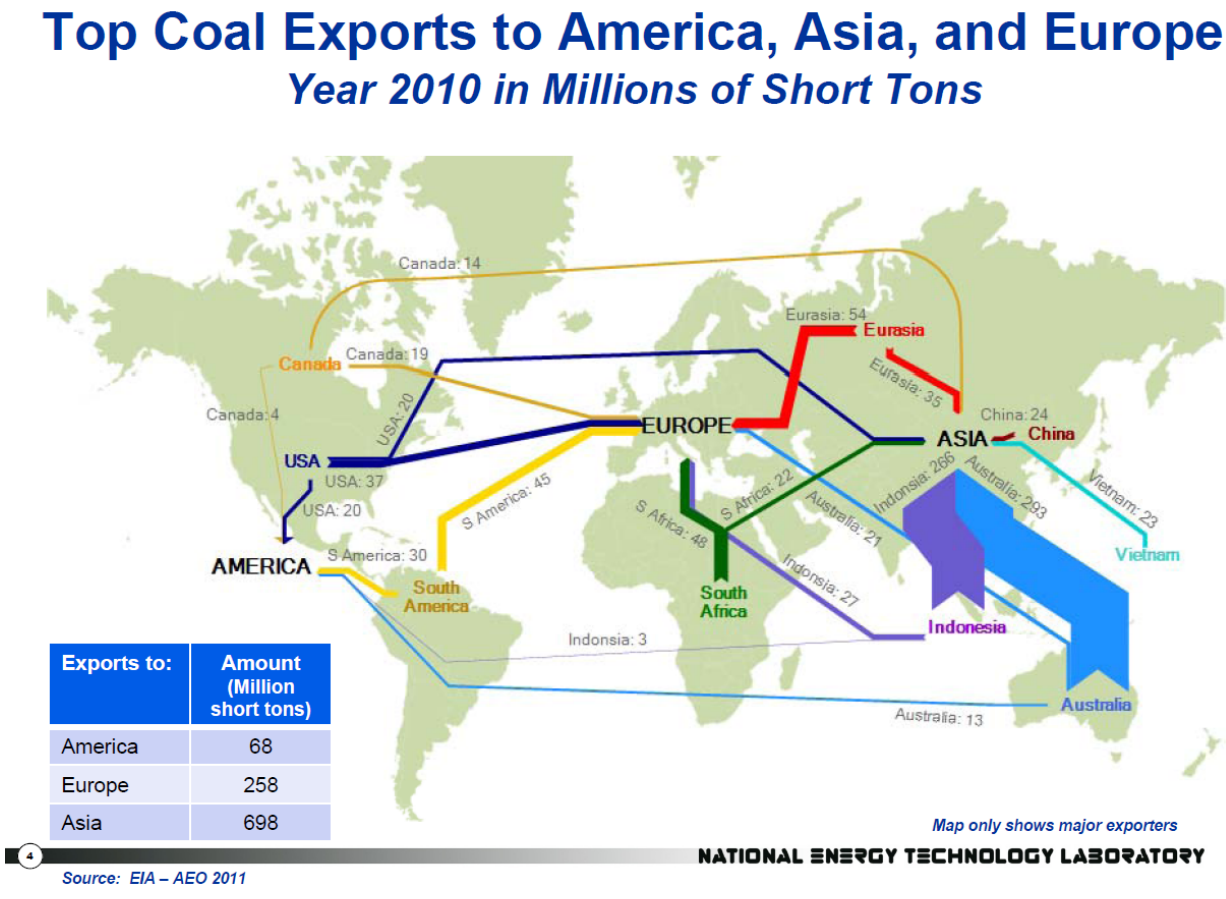

Figure: International flows of coal exports. Scientific and mathematical models sometimes work outside of their original context.

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Burning coal releases carbon dioxide

Problem 4

Climate change is clearly a global issue: everyone is affected.

- What groups of people (or regions of the globe) are most harmed by rising average temperatures?
- Does anyone **benefit**, at least in the short- or medium-term?

Formerly known as global warming

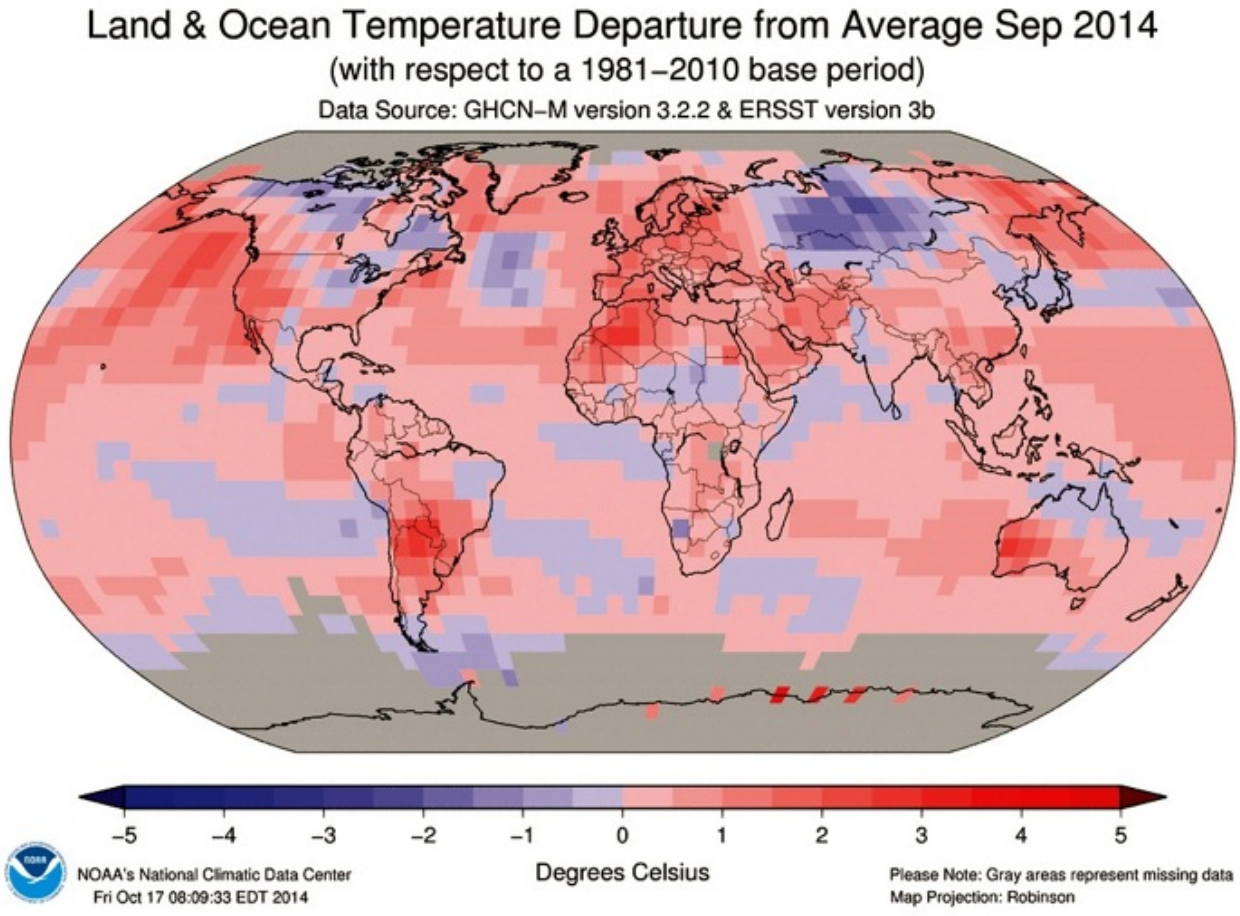

Figure: A literal heat-map.

Formerly known as global warming

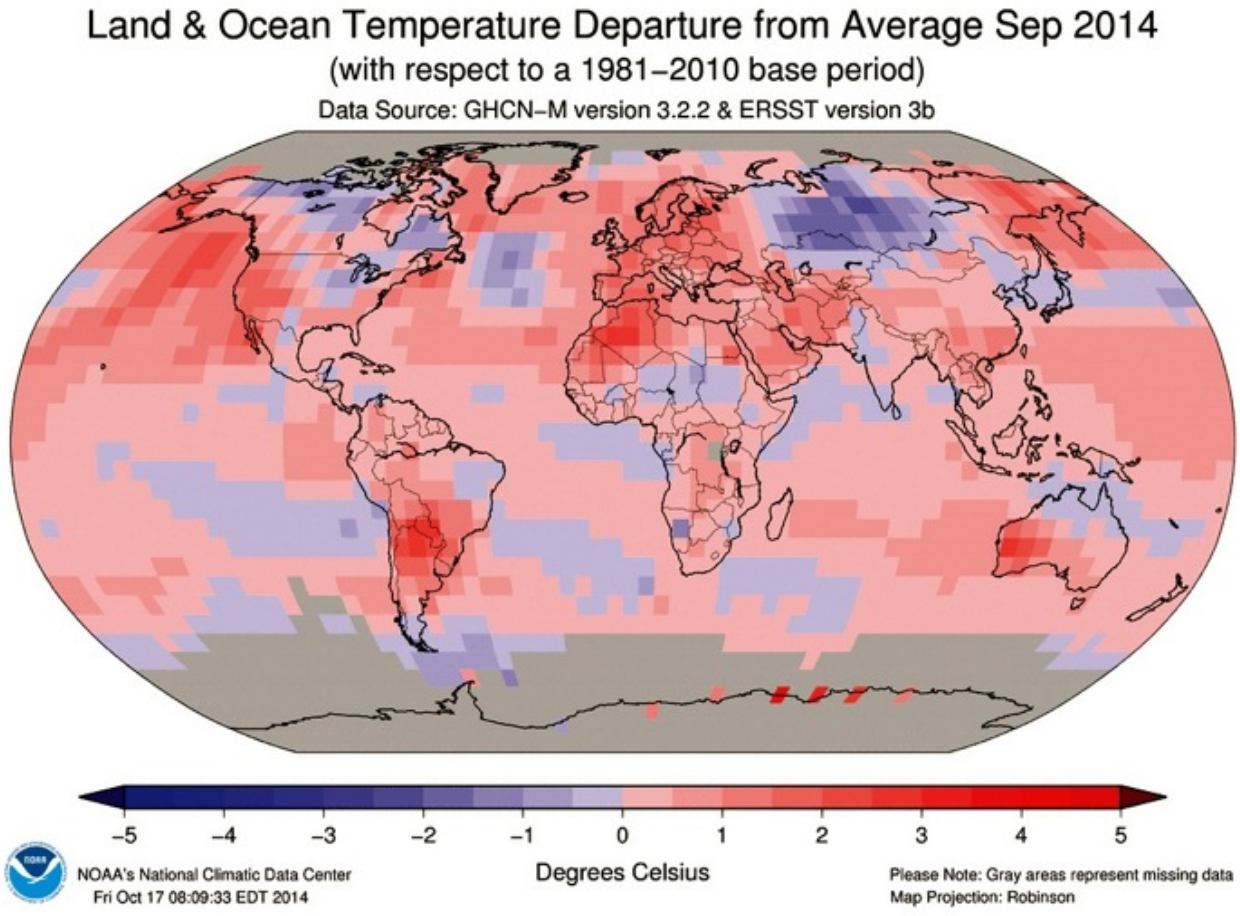

Figure: A literal heat-map.

⇒ Even issues that seem to affect everyone **affect different groups differently**

Water security

Problem 5

Consider both physical **and** economic scarcity of water.

- What communities suffer from water scarcity?
- Does anyone **benefit**?

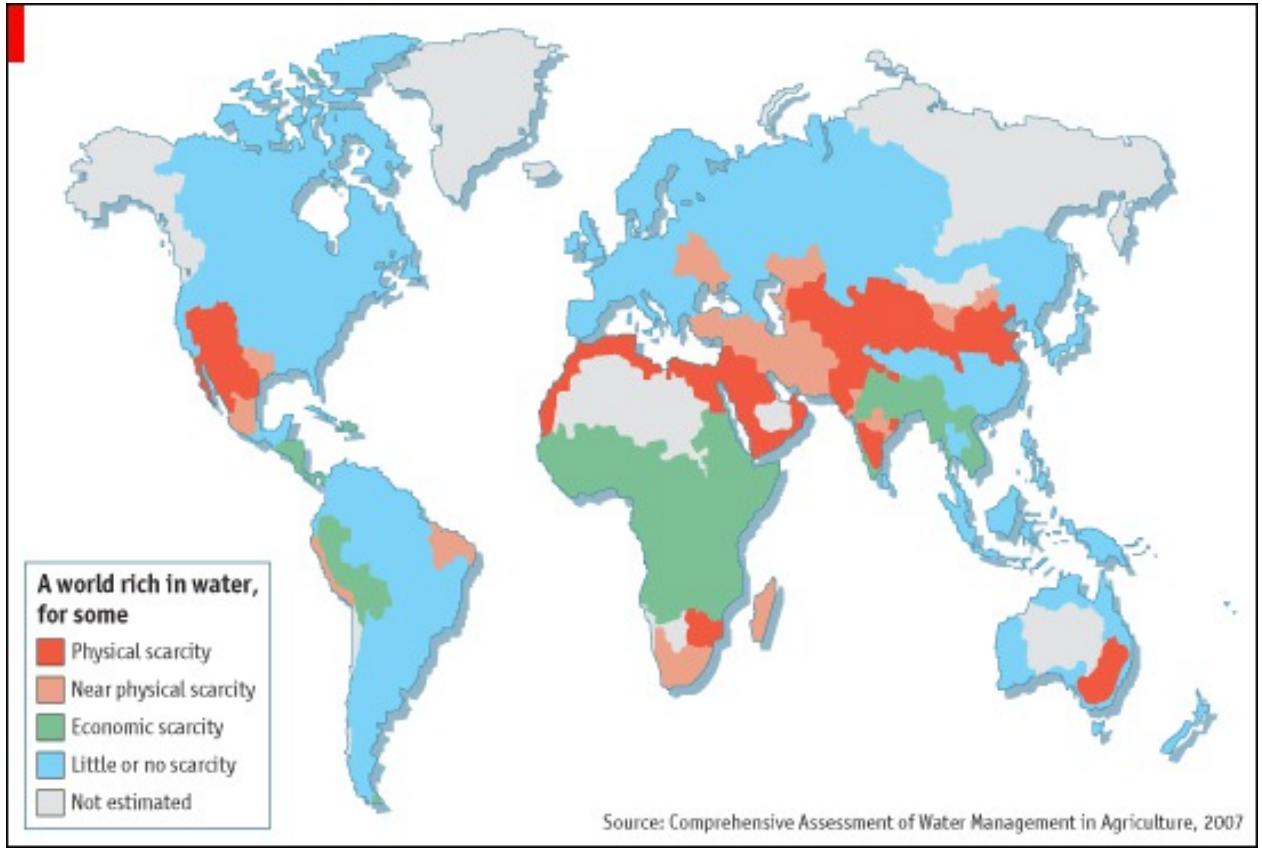

Figure: The rich and the poor (in water).

An opportunity for chemistry

Problem 6

What is meant by the term *opportunity cost*?

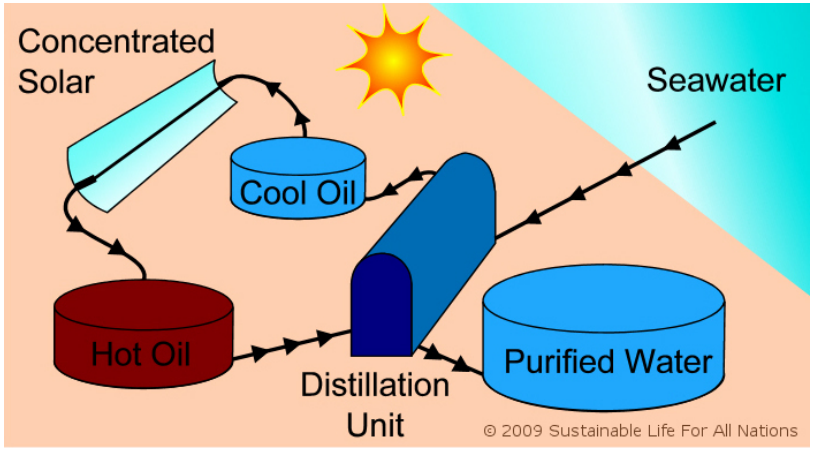

Figure: Purifying salt water requires large amounts of energy.

An opportunity for chemistry

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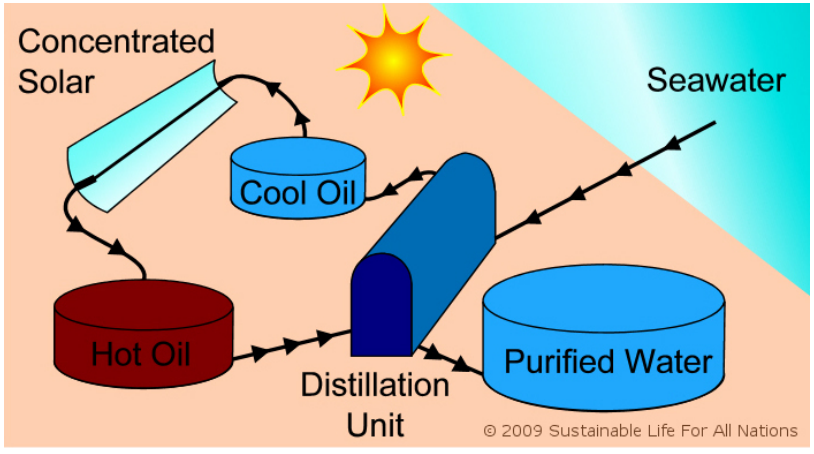

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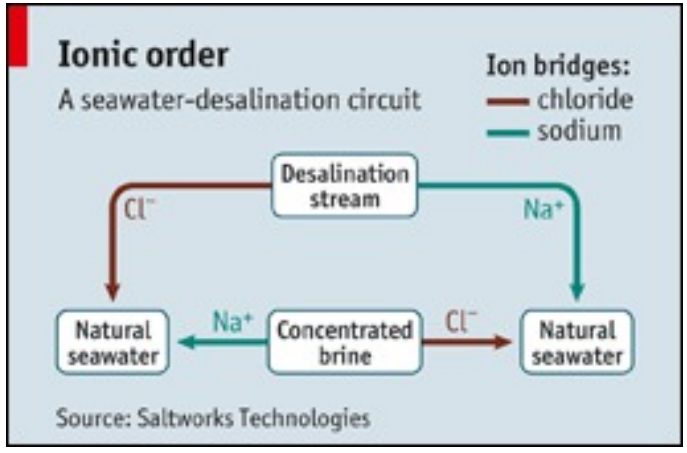

Figure: An alternative method for desalination.

Energy security

- Nuclear power is zero-carbon, but current technology (and most plants) are decades old and often face public protest

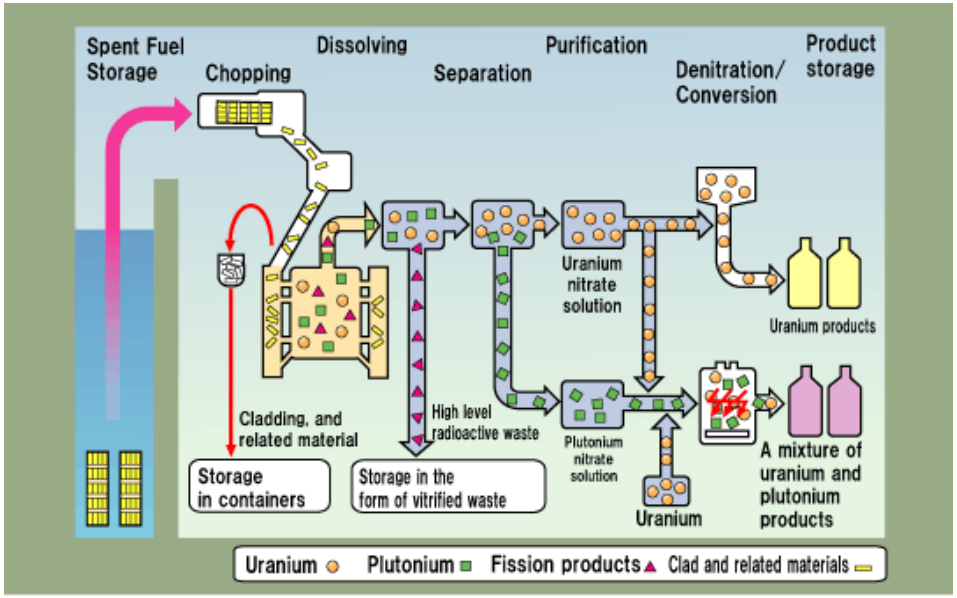

Figure: Recycling nuclear fuel improves safety and avoids risk of proliferation.

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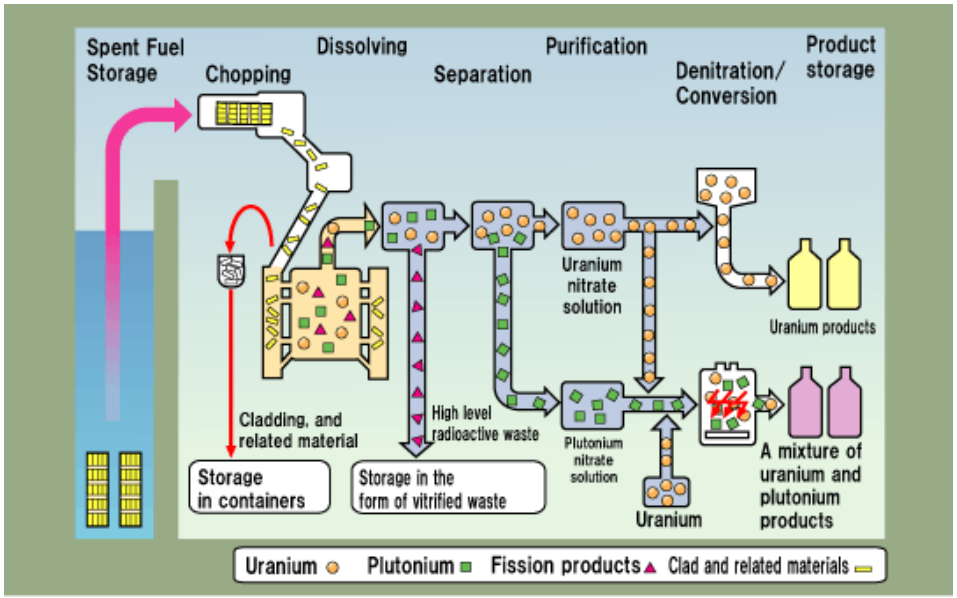

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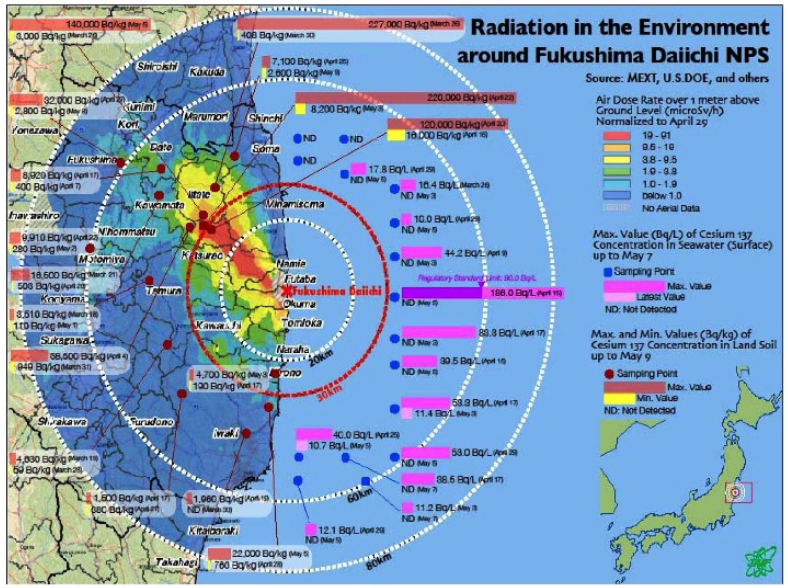

Figure: The spread of radiation after the meltdown at Fukushima.

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Choose a topic

- Climate change
- Diagnostic devices
- Disposal of chemical weapons
- Disposal of plastics
- Food preservation
- Green revolution
- Organic or alternative farming
- Development of pharmeceuticals
- Petroleum industry
- Pollution of a certain type, like soot
- Pollution at a certain area
- Preservation of cultural heritage or artifacts

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(This list is not exhaustive)

At least three diverse sources

General interest, popular science, business

- New York Times, Financial Times, Economist, LA Times, Guardian, Times (UK), Wall Street Journal, Christian Science Monitor
- Scientific American, Seed, New Scientist, Discover, National Geographic, Popular Science, Chemical and Engineering News
- Bloomberg BusinessWeek, Forbes, Fortune, Harvard Business Review

Figure: Protect journalism.

At least three diverse sources

News from scientific journals, governments, NGOs

- Analytical Chemistry, JACS, Science, Nature, NEJM
- `science.gov`, `www.uspto.gov`, `europa.eu`
- WHO, FAO, NBER, OECD, scidev.net, World Bank, IMF, FAS, UCS, Gates Foundation

Figure: Protect journalism.

At least three diverse sources

etc.

- Long-form press
- Politics- or advocacy-oriented press
- Peer-reviewed research
- Annual reports
- Books (excerpted)
- Documentaries or other video
- Interview or communication with an authority

Figure: Protect journalism.

At least three diverse sources

At least three articles from diverse sources

- General interest
- Popular science
- Business press
- News for scientists
- Government publications
- NGO reports

Optional:

- Peer-reviewed science
- Long-form
- Political and other

Figure: Protect journalism.

The product

Outline, draft, and revise 750–1250 words

- **Introduction and chemical background**

  Define the global issue and any terms.
  Connect the issue to the course.

- **Body—Global communities**

  Identify three important communities affected by the issue and explain their viewpoints.

- **Discussion and conclusion**

  Weigh the several interests in light of evidence and propose a way to address the issue.

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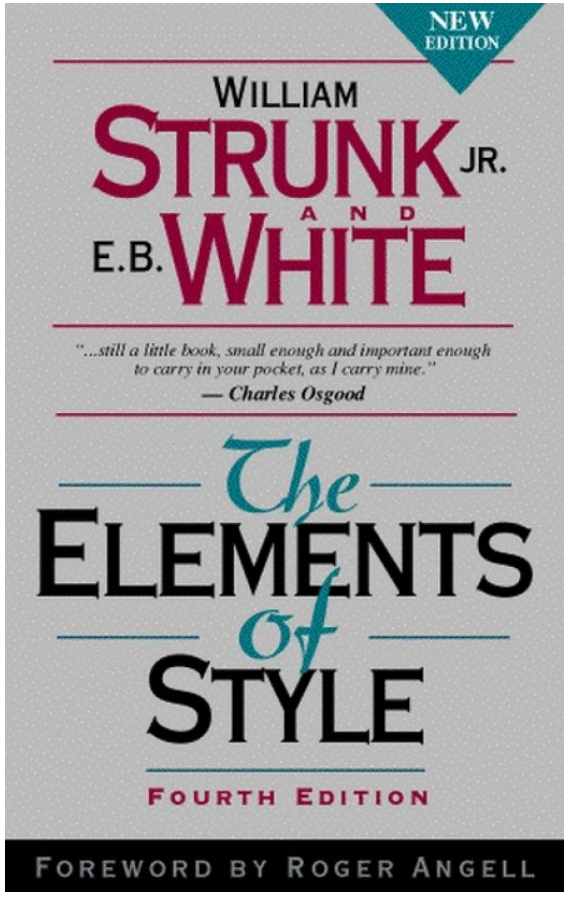
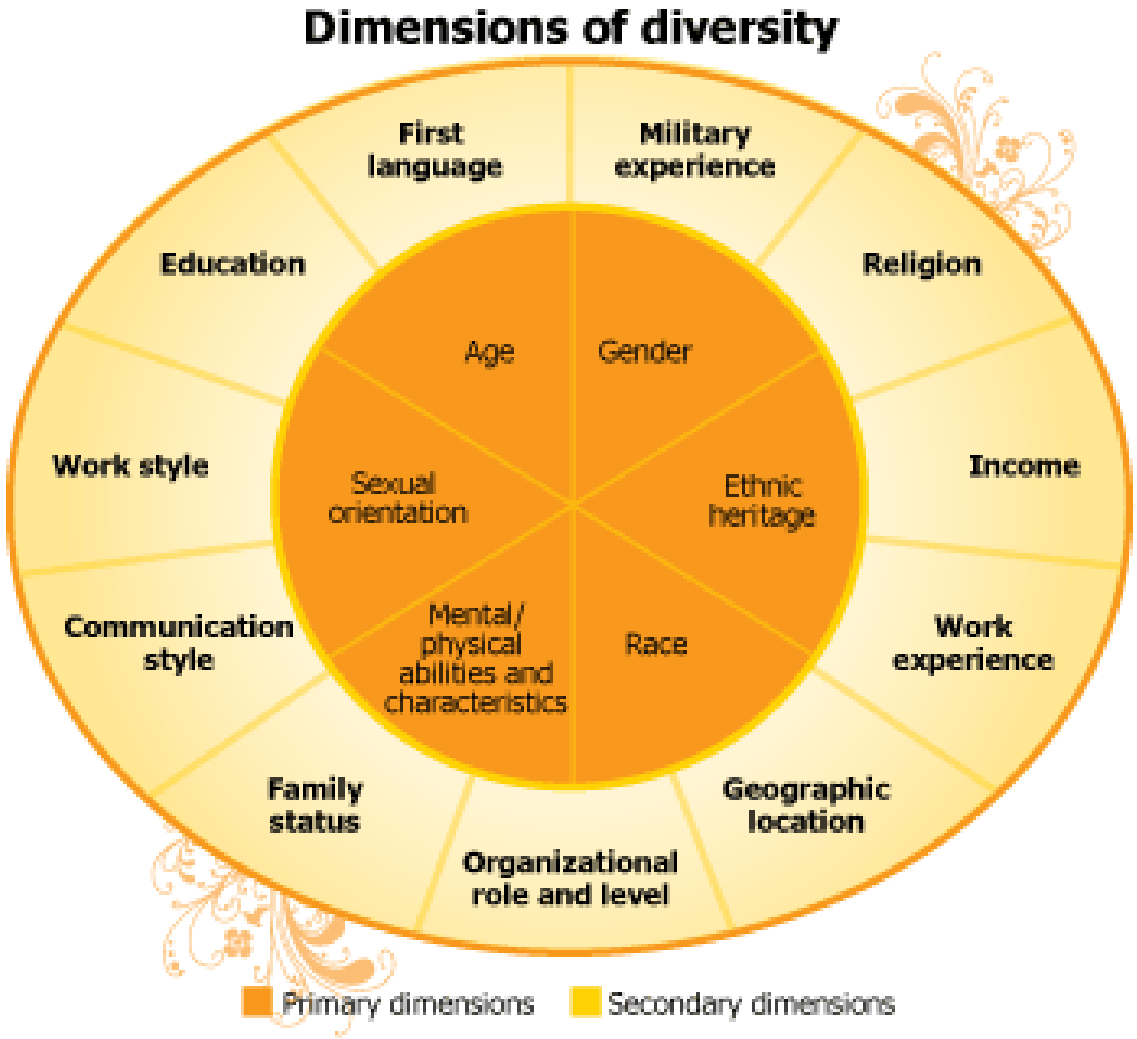


Different groups are affected differently



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This project is

- a wealth, potentially, of extra-credit;
- a chance to showcase your skills in writing and research;
- an invitation to express a sincere interest and opinion.

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- a comprehensive review of your topic—it is brief and narrow in scope;

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$\Rightarrow$ Some global issues really do affect absolutely everyone in the world—but they do not affect everyone the **same way**.

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And then?

Show off your GDL experience

Employers seek candidates who are savvy about finding and evaluating diverse viewpoints.

- Mention this project on your resumé and ePortfolio
- Take other GDL courses
- Pursue other GDL issues by following `@ThisChemistry`

Figure: Resistance or terror?

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- Take other GDL courses
- Pursue other GDL issues by following `@ThisChemistry`
- Present your work at the QCC Honors Conference

Figure: Resistance or terror?