

UGS 303- Research Methods

Dr. Stuart Reichler



CO₂ levels in Hawaii and average global temp.

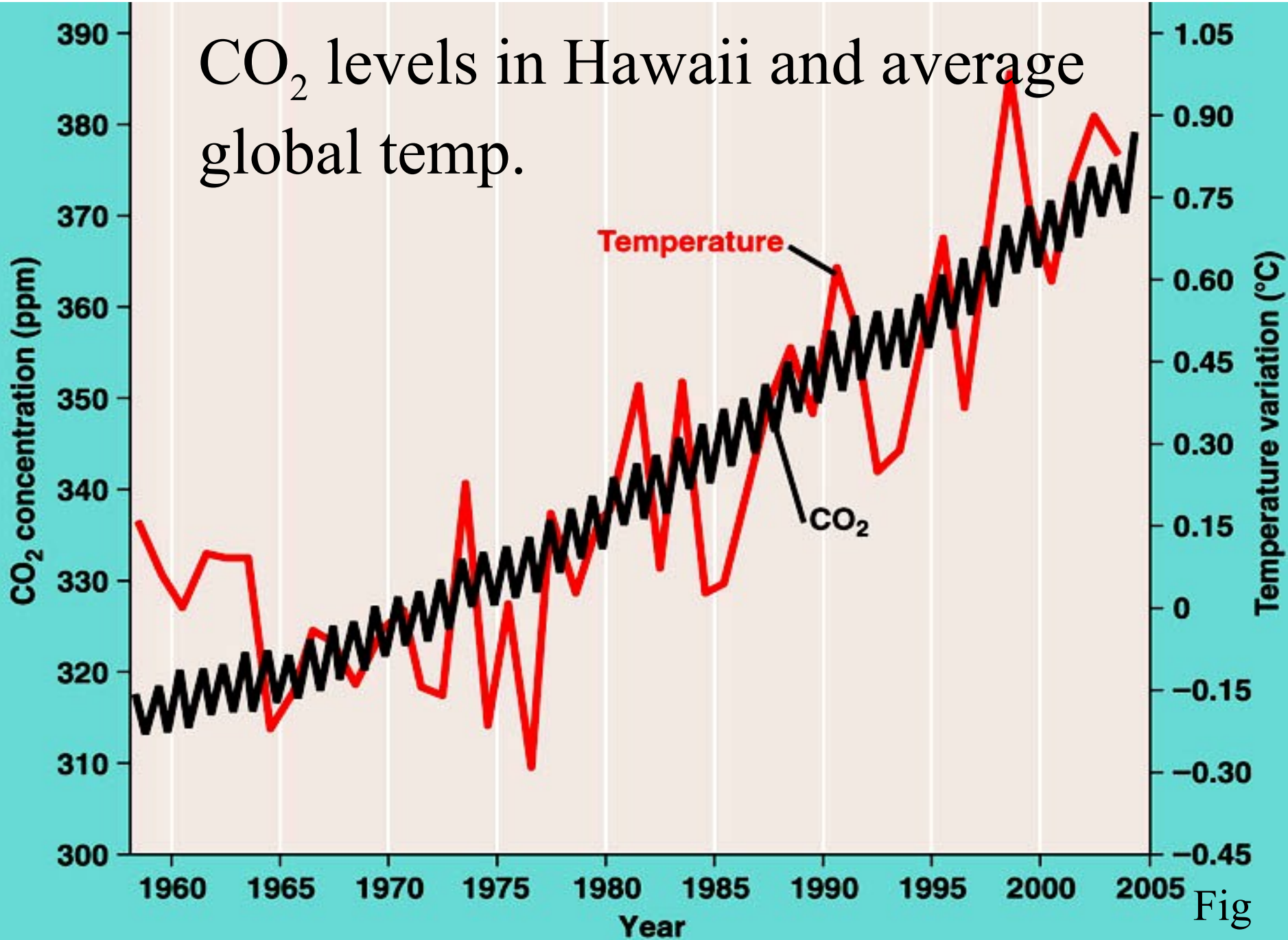
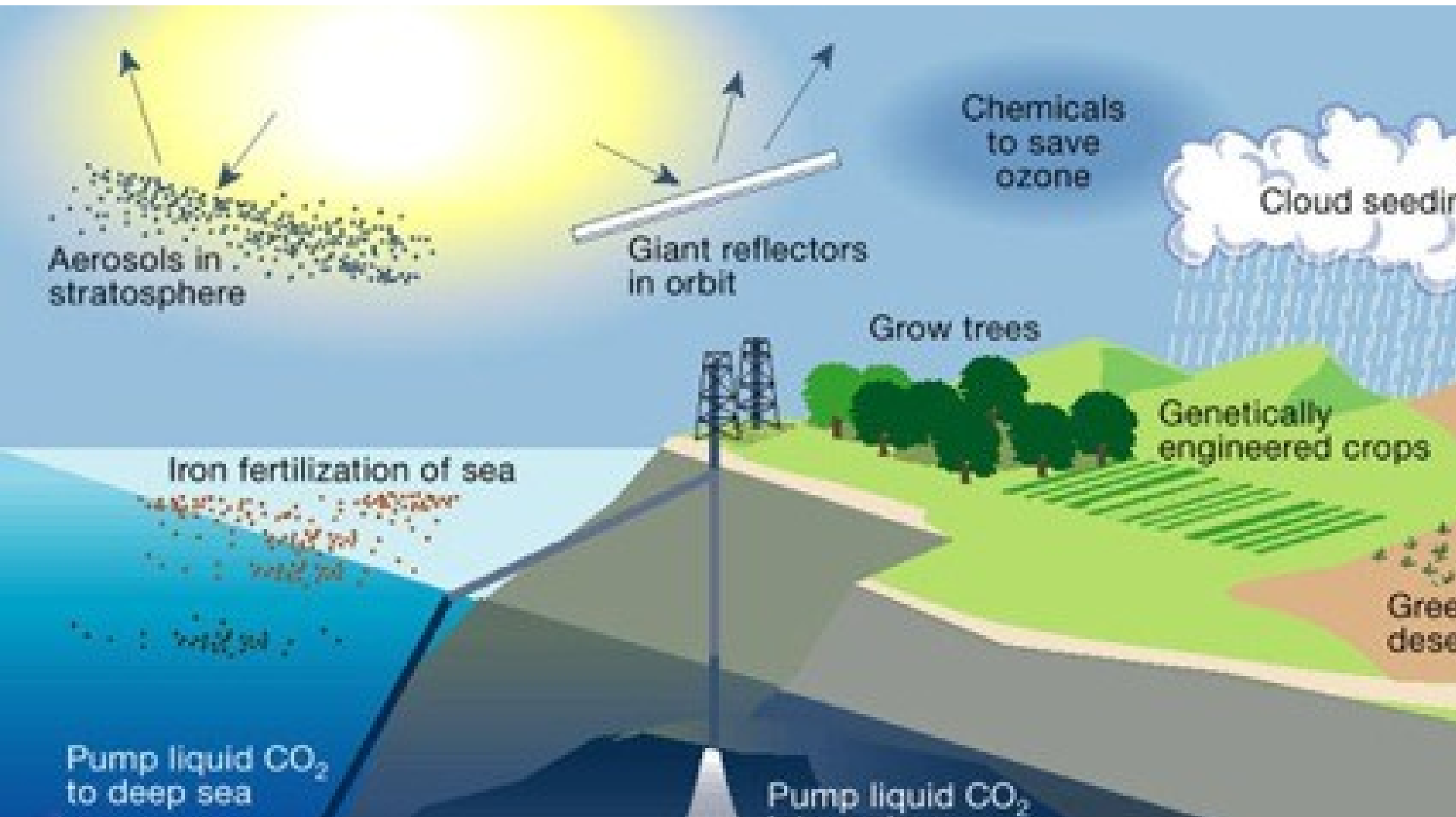
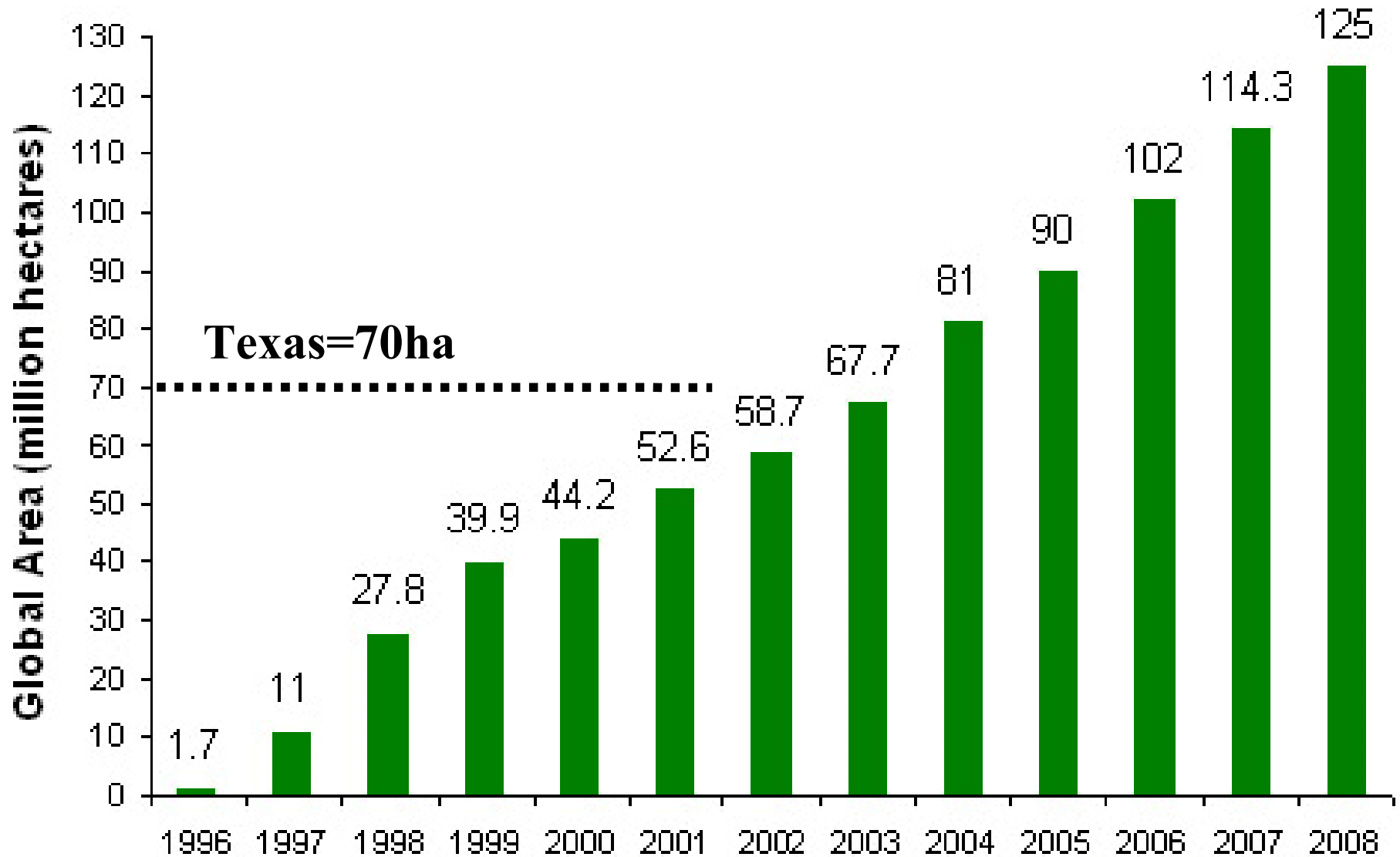


Fig
55.21

Ideas for using Geoengineering to lessen the impacts of Global Climate Change



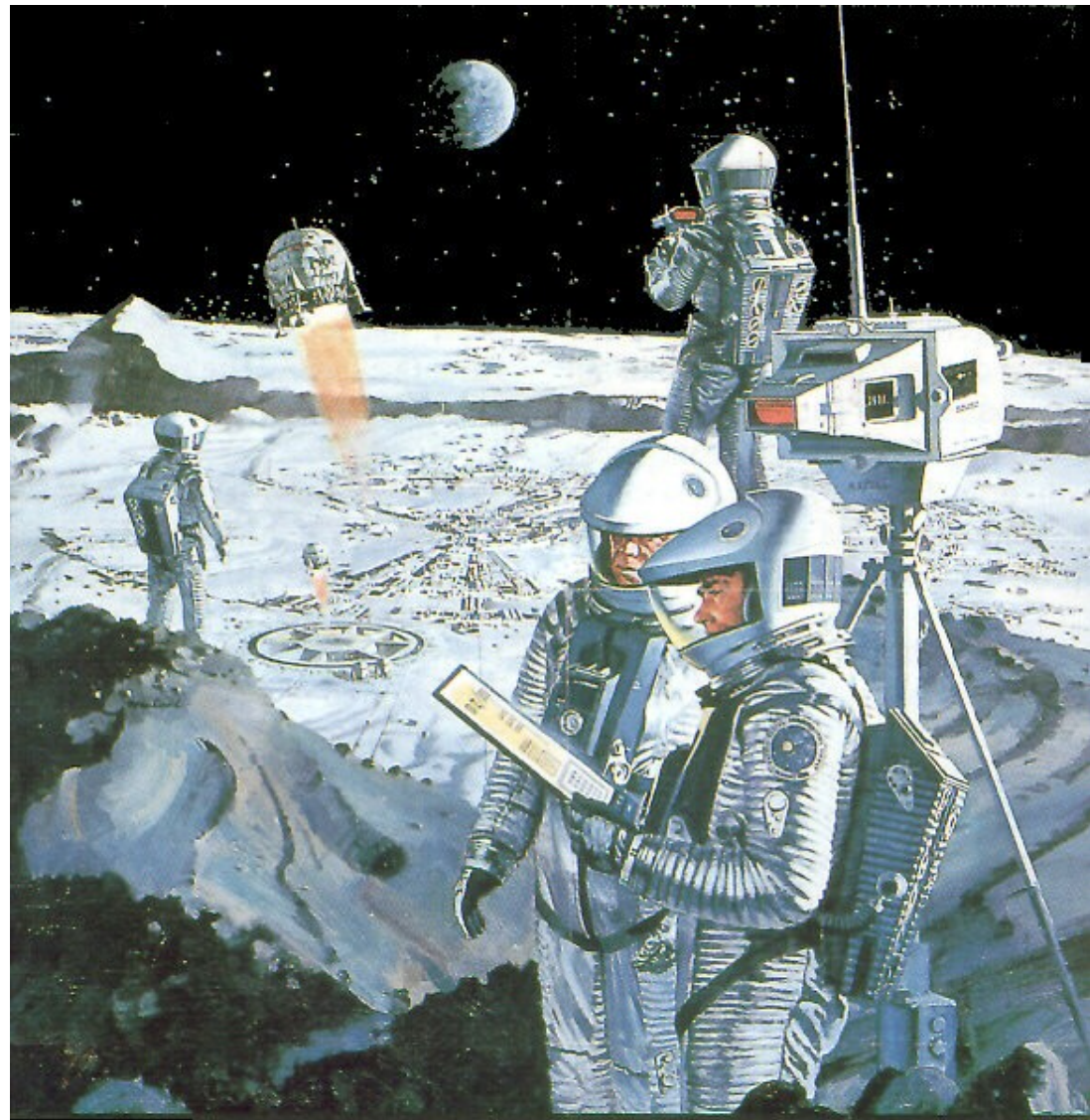
Global area planted with GM crops



http://www.gmo-compass.org/eng/agri_biotechnology/gmo_planting/257/global_gm_planting_2006.html

And http://www.monsanto.com.au/_images/global_area_chart.gif

Should we
explore/colonize
space?



MGM PRESENTS A STANLEY KUBRICK PRODUCTION
2001: a space odyssey
CINERAMA[®] Super Panavision[®]
and Metrocolor

What is the best search engine?

bing™

vs.

Google™

vs.

YAHOO!®

Robots?



WILL SMITH

i,ROBOT

ONE MAN SAW IT COMING

TWENTIETH CENTURY FOX PRESENTS A DAVIS ENTERTAINMENT COMPANY / LAURENCE MARK / OVERSTOCK FILMS PRODUCTION BY ALEX PROYAS WITH WILL SMITH "i,ROBOT" GORET MIYAHARA BRUCE GREENWOOD JAMES CROMWELL FOR MESSOR AND ALVIN TONY
MARCH BELTRAMI MUSIC BY JOHN NELSON COSTUME DESIGNER DOMINIC LEE STEVEN R. MCELREATH EDITOR RICHARD LEIGHTON EXECUTIVE PRODUCERS JAMES MINGOSHA WILLIAM HOLZLICH PRODUCED BY PATRICK TITOPoulos EXECUTIVE PRODUCERS SHAWN DUGAN PRODUCED BY WILL SMITH JAMES LASISTER
MICHEL SPANG ANTHONY ROIANO EXECUTIVE PRODUCERS ISAAC KRASNY'S EXECUTIVE PRODUCERS JEFF VINTAR PRODUCED BY ALEX PROYAS AND AVIVA GOLDSMAN EXECUTIVE PRODUCERS LAURENCE MARK JOHN DAVIS TOPHER BOW WYCK GORFET BY ALEX PROYAS
www.i-robotmovie.dk

How much
autonomy should
our computer
networks have?

SCHWARZENEGGER

**In the Year of Darkness, 2029,
the rulers of this planet
devised the ultimate plan.
They would reshape the
Future by changing the Past.
The plan required something
that felt no pity. No pain.
No fear.
Something unstoppable. They created**

**THE
TERMINATOR**

Hemdale Presents a Pacific Western Production of a James Cameron Film
Arnold Schwarzenegger "The Terminator" Michael Biehn, Linda Hamilton and Paul Winfield
Make-Up Effects By Stan Winston · Executive Producers John Daly and Derek Gibson
Written by James Cameron with Gale Anne Hurd · Produced by Gale Anne Hurd

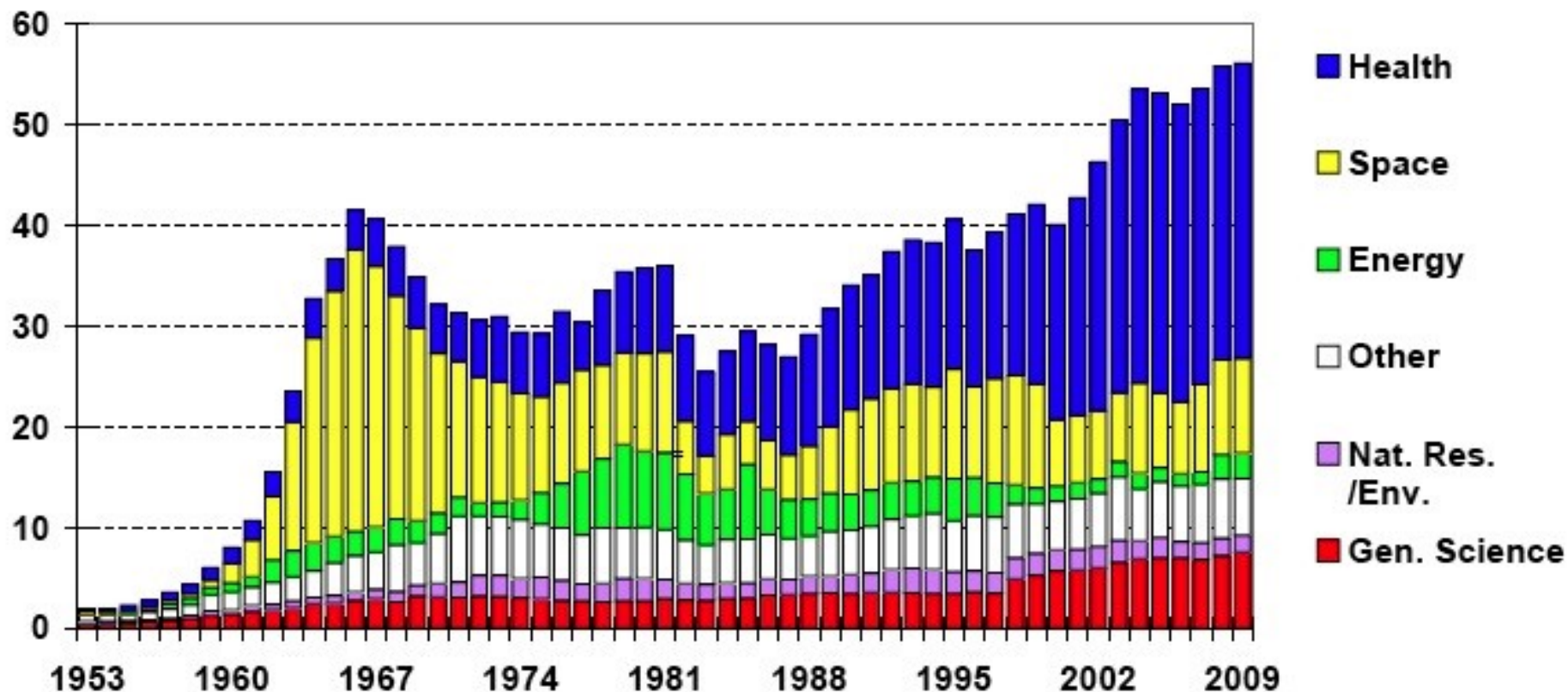
An **ORION** PICTURES Release Directed by James Cameron · Prints by DeLuxe®

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R RESTRICTED
PARENT STRONGLY CAUTIONS
REQUIRES ACCOMPANYING
PARENT OR ADULT GUARDIAN

Trends in Nondefense R&D by Function, FY 1953-2009

outlays for the conduct of R&D, billions of constant FY 2008 dollars



Source: AAAS, based on OMB Historical Tables in *Budget of the United States Government FY 2009*. Constant dollar conversions based on GDP deflators. FY 2009 is the President's request.

Note: Some Energy programs shifted to General Science beginning in FY 1998.

FEB. '08 © 2008 AAAS



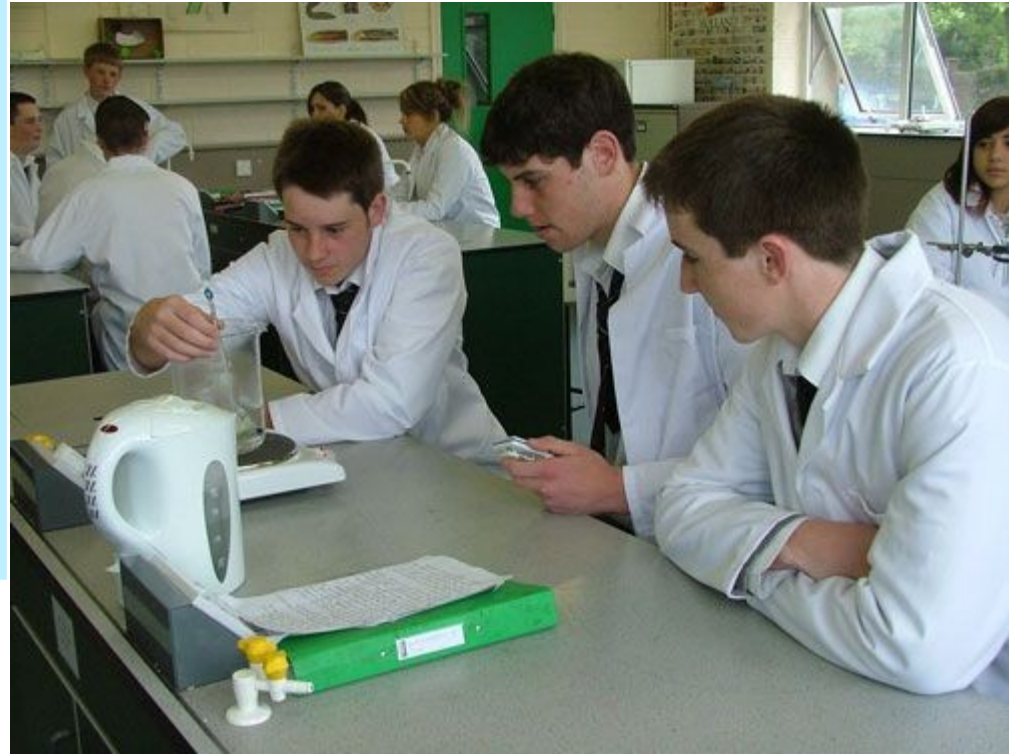
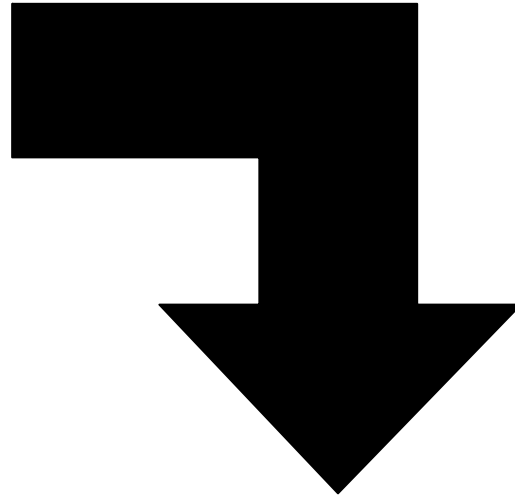
<u>Date</u>	<u>Class</u>	<u>Lab</u>
July 12	Introduction and Strong Inference	<i>no lab</i>
14	What is an inquiry?	Database Searches, Strong Inference, Termites
19	Statistics	Inquiry 1 Proposals due
21	Statistics, Lab Safety and Inquiry 2	Statistics Practice
26	Peer Review and Authorship	Inquiry 1 Reports and Presentations
28	Ethics: Using Animals and People in Research	Inquiry 2 Proposals due
Aug. 2	The Art of Presenting and Writing	Ethics Discussion
4	Funding Research and Patents	Peer Review
9	What happens after graduation?	What is success?
Aug. 11	University Research (Who are all these people?), and Why do we not solve more problems?	Inquiry 2 Reports and Presentations

Most classes...



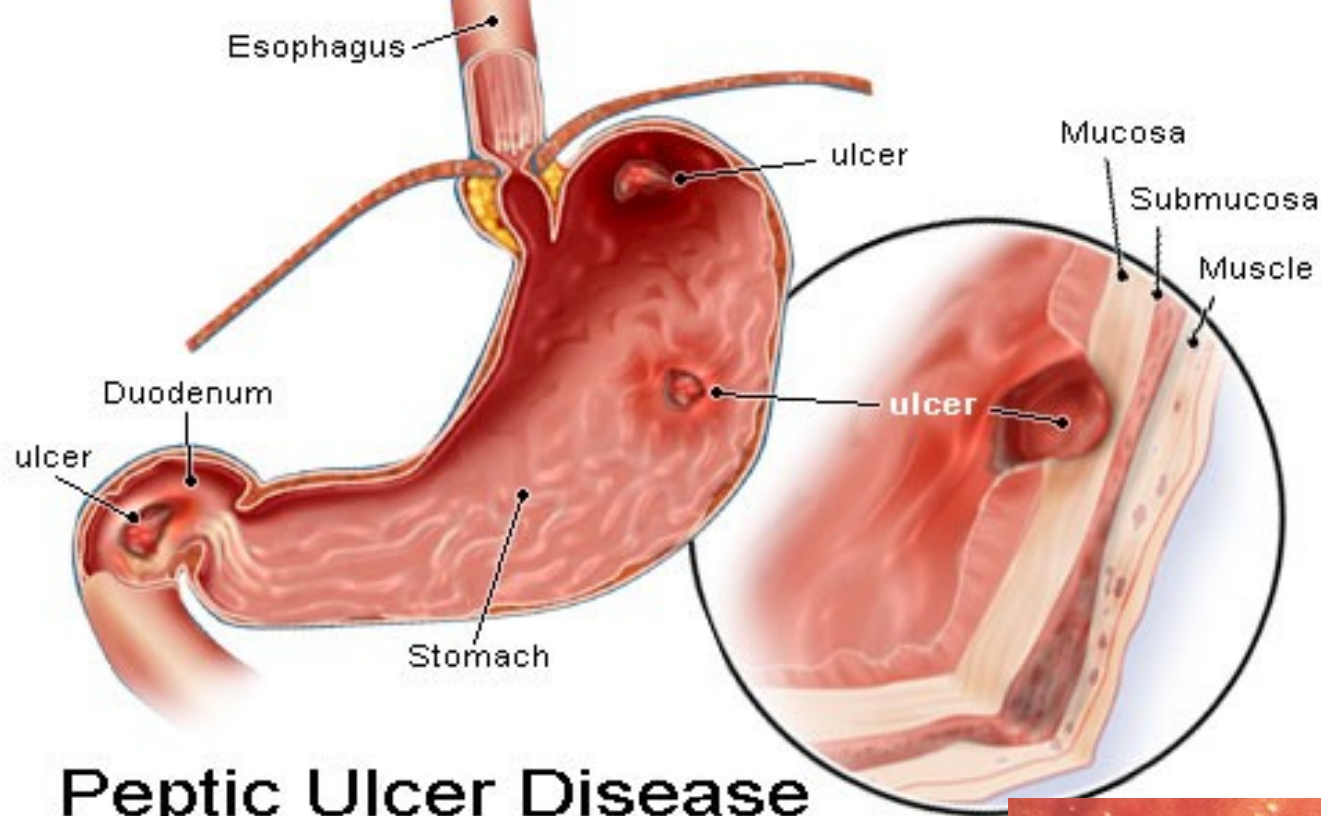


This class...

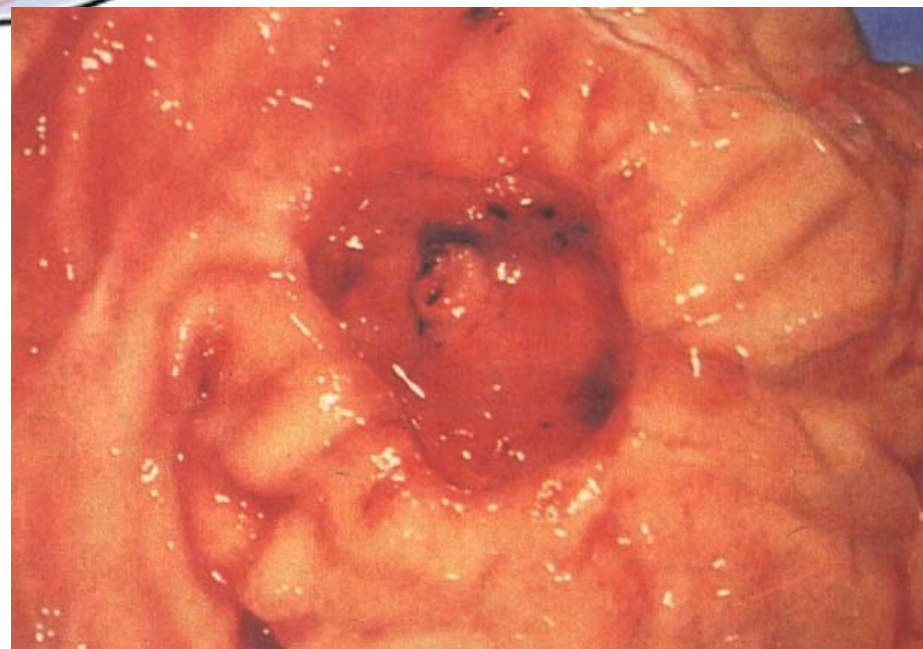


Getting Answers:

- Start with a question.
 - For example:
How? Why? When? Where? Etc?
- How do we get answers?
 - Strong Inference presents one method
(article on webpage)



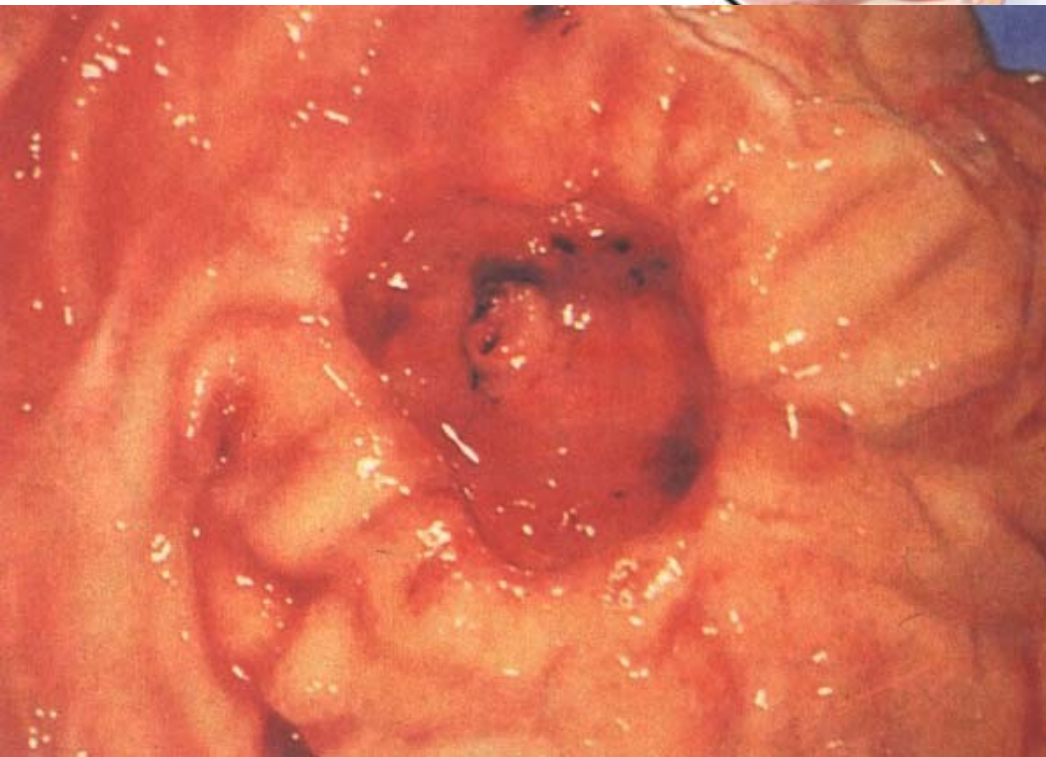
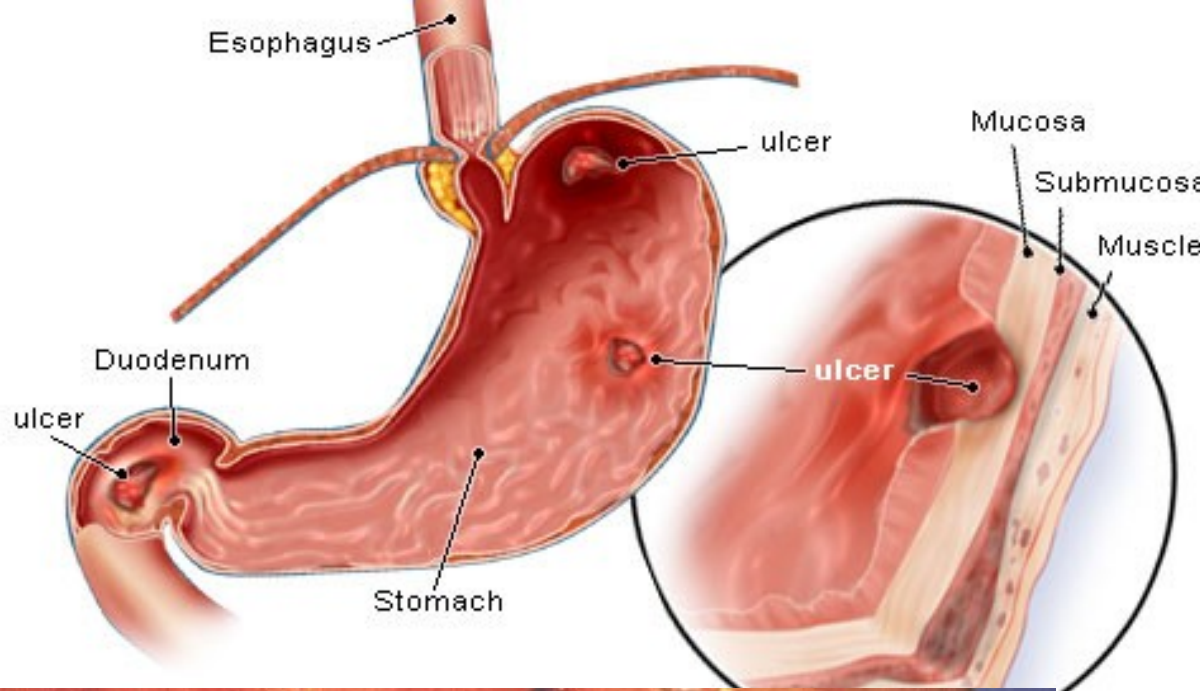
Peptic Ulcer Disease



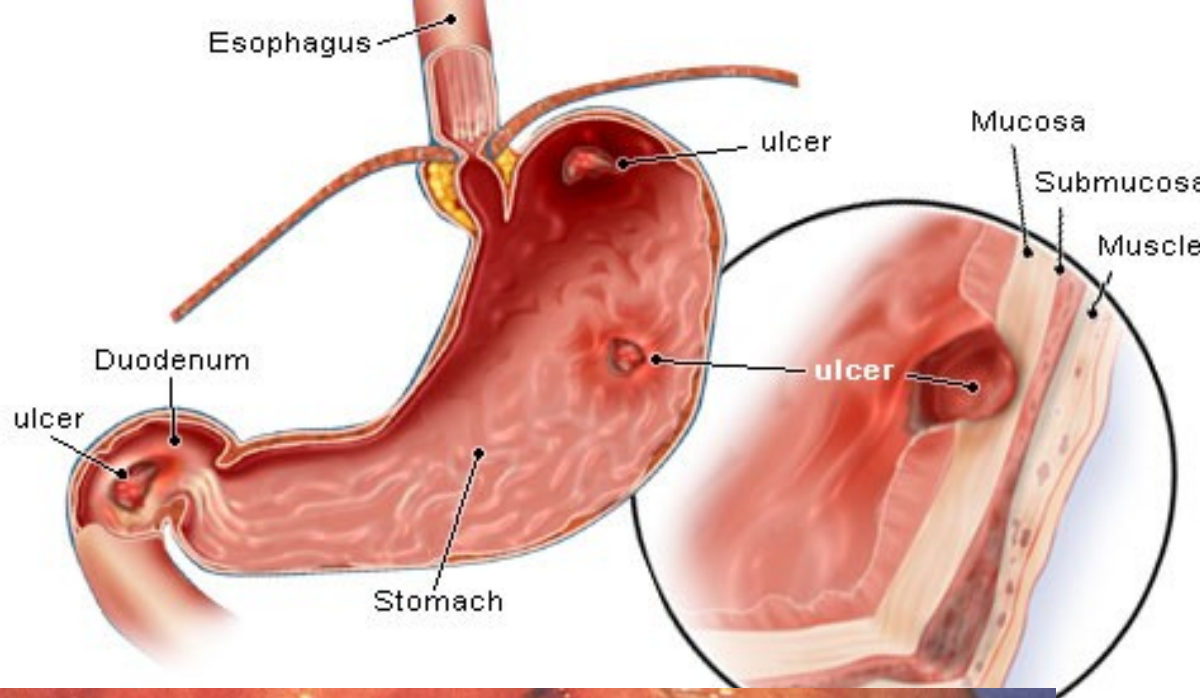
Cause of Peptic Ulcers:

Overabundance of stomach acid due to

- Stress
- Diet
- Anxiety



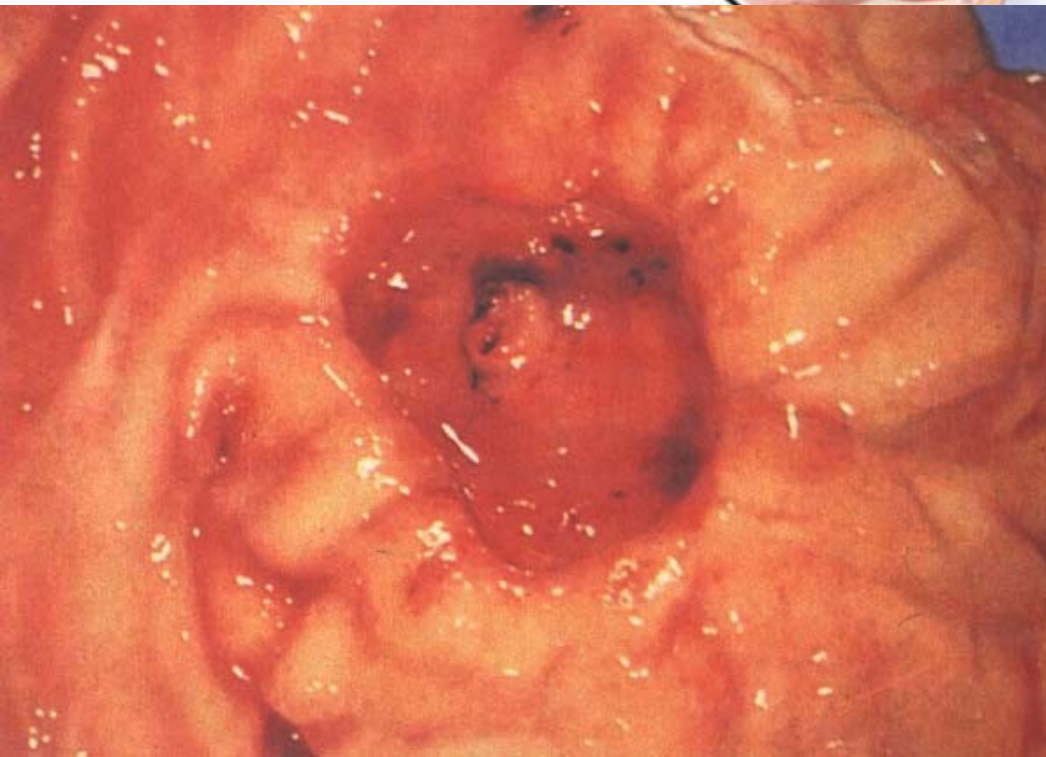
icineNet, Inc.



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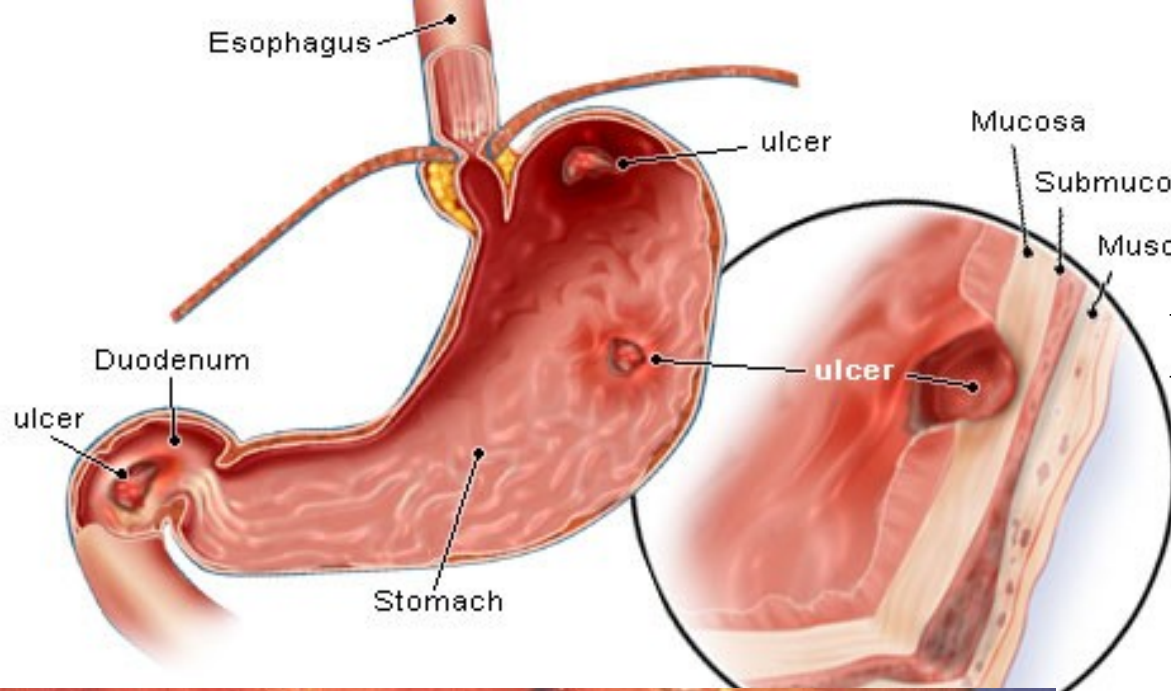


Treatment:

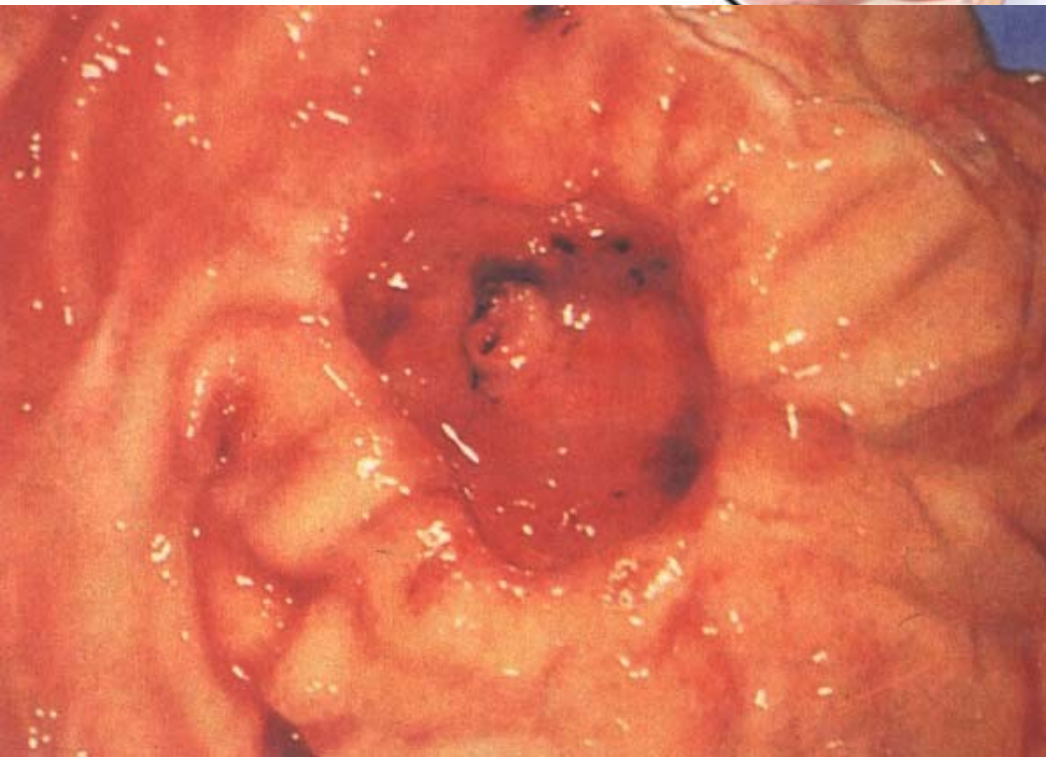
- Antacids

U.S. bought
\$4.4 billion in 1992

- Tranquilizers

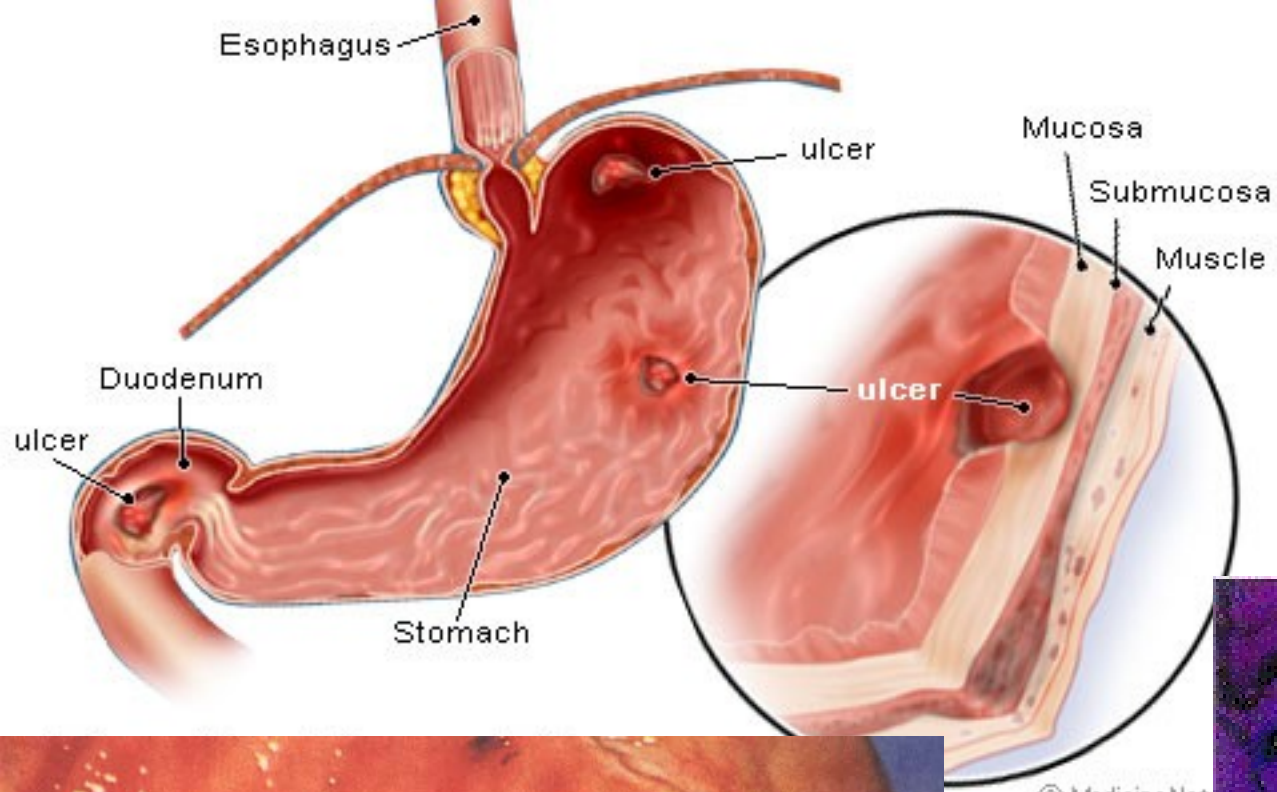


Dr. Barry Marshall

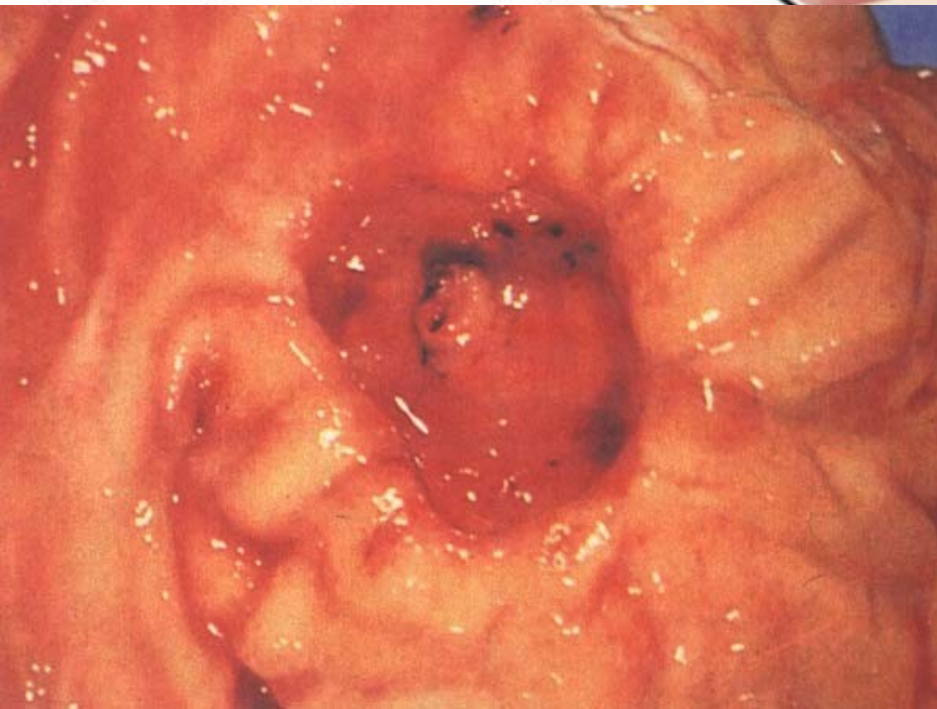


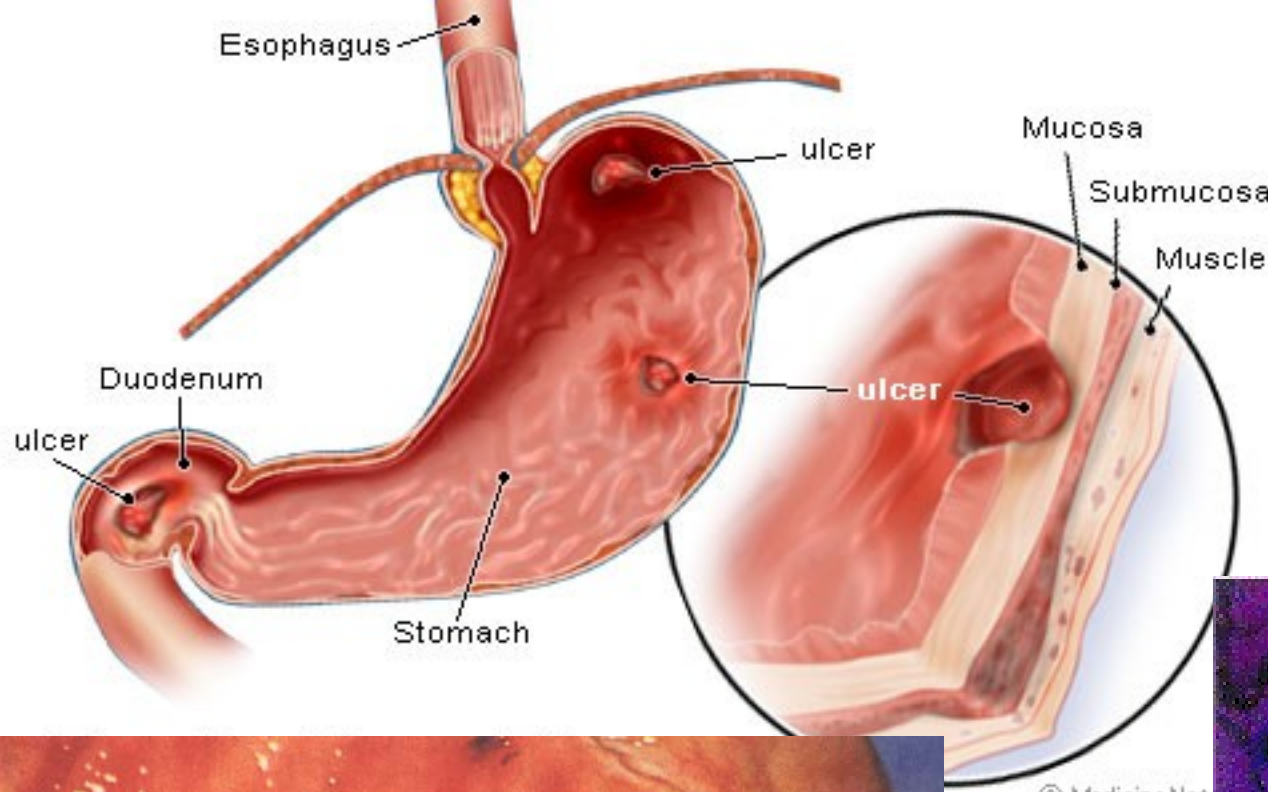
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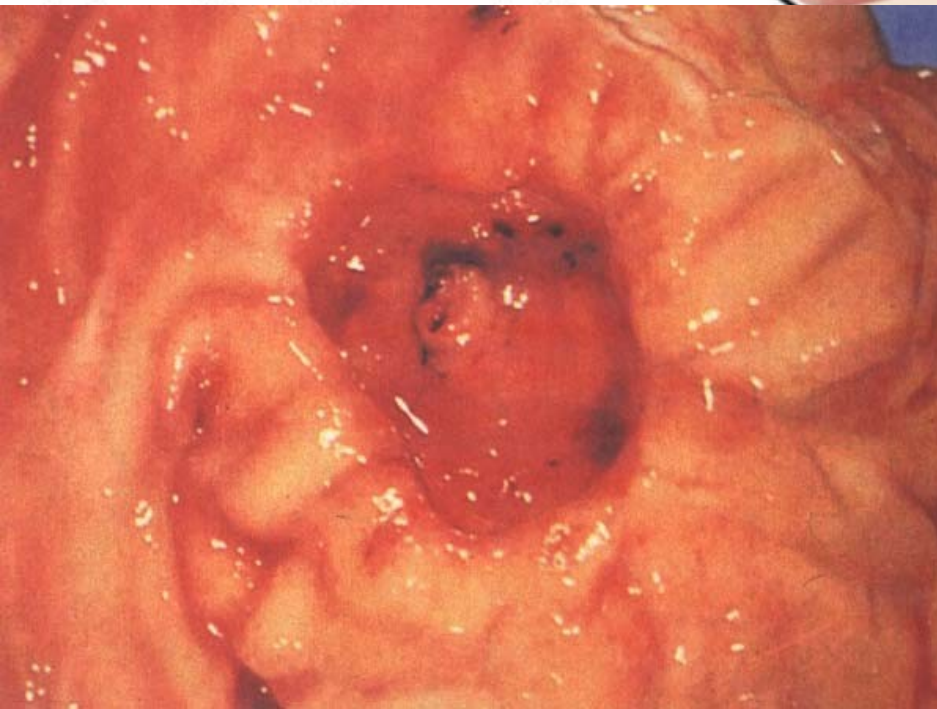


the bacteria
H. pylori





H. pylori is the cause of 80% of peptic ulcers



The obvious or accepted answer was not the correct answer...

Without alternative ideas, the answer would not have been found.

Strong Inference

Knowledge is gained by eliminating incorrect ideas.

Disproof is more reliable than proof.

Where does the matter come from for plants to grow?

Matter can not normally be created or destroyed, only moved from one place to another.

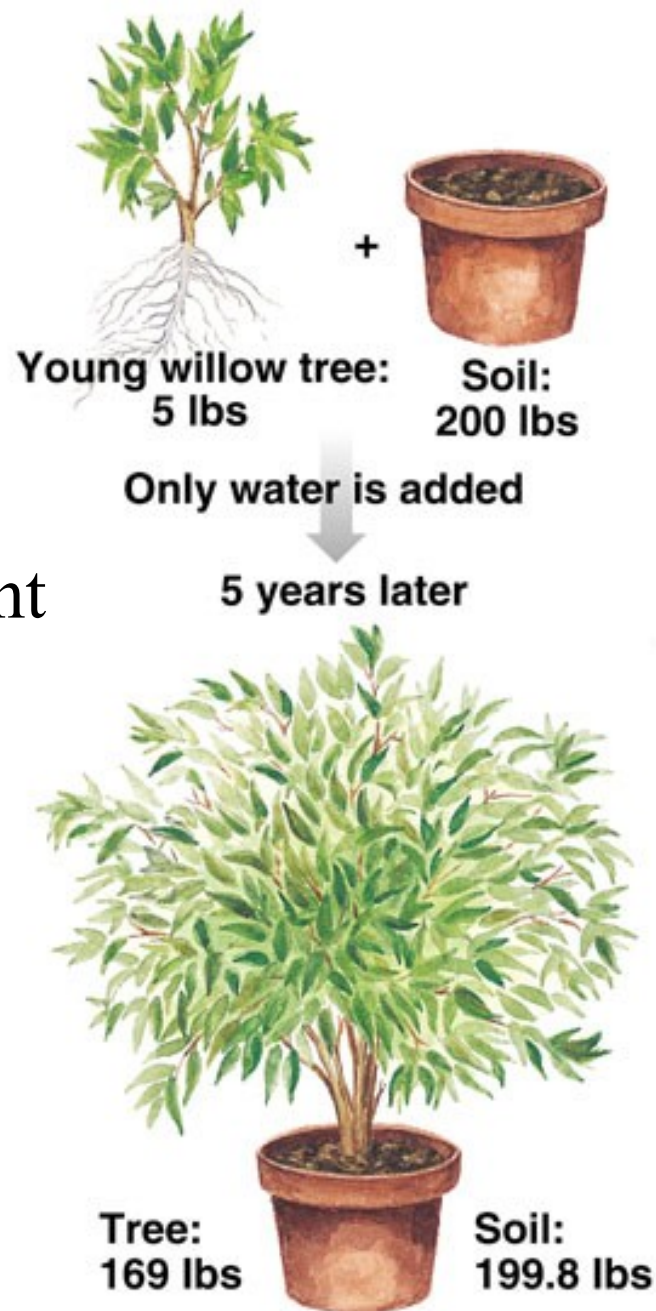


Aristotle (~2,300 y.a.):

Plants gain mass by taking it from the soil.

Supporting Evidence:

- Plants need soil to grow.
- If roots are removed, plants die.
- After several years of cultivation, soil loses its ability to support plant growth.



Johann Baptista van Helmont did a simple experiment in the early 1600's

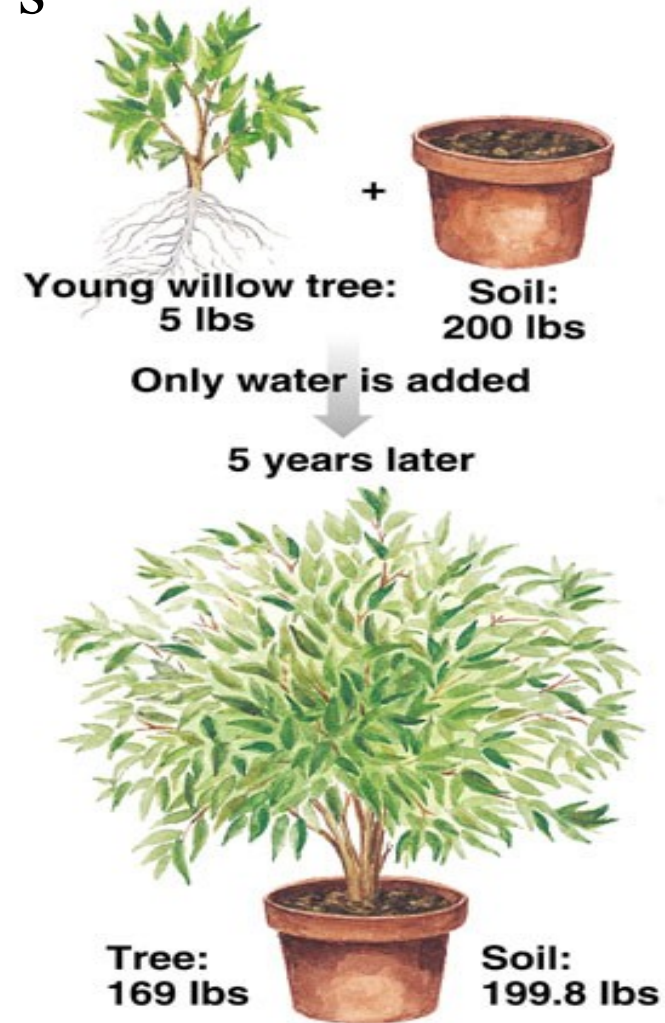
What is the major difference between these two approaches to science?

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The Rules of Strong Inference:

Strong Inference is a method for looking at scientific problems by trying to disprove hypotheses and accepting the hypotheses that can not be disproved. Using Strong Inference entails following these rules (from an article by John Platt, 1964):

1. Devise multiple hypotheses.

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3. Carry out the experiments to get reliable results.

What experimental errors might have been made?



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3. Carry out the experiments to get reliable results.
4. Repeat. Refine hypotheses.

- Webpage and Blackboard fully functional this afternoon
 - Strong Inference article on webpage
 - Get notebook, bound
-
- Next: Details about Inquiries, Practicing Strong Inference, Academic Literature