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# Ethics under siege in science

# Historical highlight from the French Revolution:



- *a story from more than 200 years ago ->*
- Marie Jean Antoine de Condorcet

## Marie Jean Antoine de Condorcet 1795: “Sketch for a Historical Picture of the Progress of the Human Mind”

“Will increased welfare and improved health of man lead to largely increased populations? Will not necessarily there be a time when the number of people has outgrown the natural resources that nature can supply? Is it not reasonable to assume that when resources become scarce, then there will be fight for the resources, war between people?”

**[Technology Fix argument:]** Nobody could claim that such a time is imminent, Technological progress may bring the answers.

**[Ethics argument:]** People’s ethics and morality will progress alongside reason. Our moral duty is not to make sure that unborn life is born, but that those that are born are secured a life in reasonable welfare, dignity and happiness.”

# Condorcet believed in the power of rationality / science.

*The following is an obvious truth for him:*

- *The progress of science and technology cannot be conceived without at the same time assuming that human reason and ethics also will have made considerable progress!*
- *Moral progress matches the scientific progress!*



# Moral Progress?

## In line with scientific progress?

- What do you think?



# The case of the vanishing support for ethics

# Impressions from the World Conference on Science (UNESCO & ICSU)

155 countries, 1800 delegates, 60 NGOs, 90 Ministers

**Saturday, 26 June 1999**

**Opening Session:**

Opening statements by High Officials of Unesco, ICSU and Hungary

Keynote addresses on:

Science for the Twenty-first Century

Science in Response to Basic Human Needs

Science as an Investment

Science and Human Values



## WORLD CONFERENCE ON SCIENCE



SCIENCE FOR THE TWENTY-FIRST CENTURY  
A New Commitment

# Ethics on the Agenda!

*Science and Engineering Ethics* (2000) 6, 131-142

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## **Ethics and the Responsibility of Science**

Background paper for the World Science Conference, Budapest June 26-July 1, 1999

**Prepared by the International Council for Science's Standing  
Committee on Responsibility and Ethics in Science\***

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**Keywords:** International Council for Science, ethics, responsibility in science



# Sir Joseph Rotblat !

From Wikipedia:

**Sir Joseph Rotblat** KCMG CBE FRS (November 4, 1908 – August 31, 2005) was a Polish physicist, a self-described "Pole with a British passport".[2] Rotblat worked on Tube Alloys and the Manhattan Project during World War II, but left the Los Alamos Laboratory after the war with Germany ended. His work on nuclear fallout was a major contribution toward the ratification of the 1963 Partial Nuclear Test Ban Treaty. A signatory of the 1955 Russell–Einstein Manifesto, he was secretary-general of the Pugwash Conferences on Science and World Affairs from their founding until 1973, and shared, with the Pugwash Conferences, the 1995 Nobel Peace Prize "for efforts to diminish the part played by nuclear arms in international affairs and, in the longer run, to eliminate such arms."



Nobel Peace Prize Awarded 1995



Hermann Joseph Muller was an American geneticist, educator, and Nobel laureate best known for his work on the physiological and genetic effects of radiation.



Hideki Yukawa was a Japanese theoretical physicist and the first Japanese Nobel laureate.



Max Born Born won the 1954 Nobel Prize in Physics.



Linus Pauling was an American scientist, engineer, peace activist, author and educator.



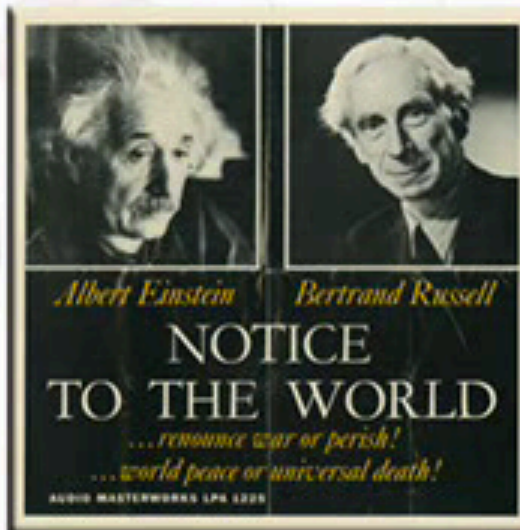
Leopold Infeld was a Polish physicist. He was a Rockefeller fellow at Cambridge University



Cecil Frank Powell was a British physicist, and Nobel Prize in Physics laureate (1950) working at Bristol University.



Frédéric Joliot-Curie was a French physicist and Nobel laureate.



Percy Williams Bridgman won the 1946 Nobel Prize in Physics for his work on the physics of high pressures



Joseph Rotblat was a Polish-born and British-naturalised physicist.

## The Russell - Einstein Manifesto, 9 July 1955

### Signatories to the Manifesto



# The wake-up call!

**The time has come to  
formulate guidelines for  
the ethical conduct of  
scientist, perhaps in the  
form of a voluntary  
Hippocratic Oath.**

**Joseph Rotblat**  
Polish Physicist

# Accepted result:

- Section 3.2 on Ethical Issues:
- "The ethics and responsibility of science should be an integral part of the education and training of all scientists. It is important to instil in students a positive attitude towards reflection, alertness and awareness of the ethical dilemmas they may encounter in their professional life. Young scientists should be appropriately encouraged to respect and adhere to the basic ethical principles and responsibilities of science. UNESCO's World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), in cooperation with ICSU's Standing Committee on Responsibility and Ethics of Sciences (SCRES), have a special responsibility to follow up on this issue."



# The case of the vanishing uncertainties – science for policy

# A special challenge: the fallacy of the disappearing uncertainties:

- A case: building the Oslo airport
- A fact: the use of de-icing fluids (glycole etc) in wintertime
- A challenge: De-icing fluids contain e.g. glycol and other substances, which are easily degradabe under aerobic conditions, but large spills in runoff water may create anaerobic conditions, which again may lead to organic sulphur compounds, contaminating the ground water.



# The study:

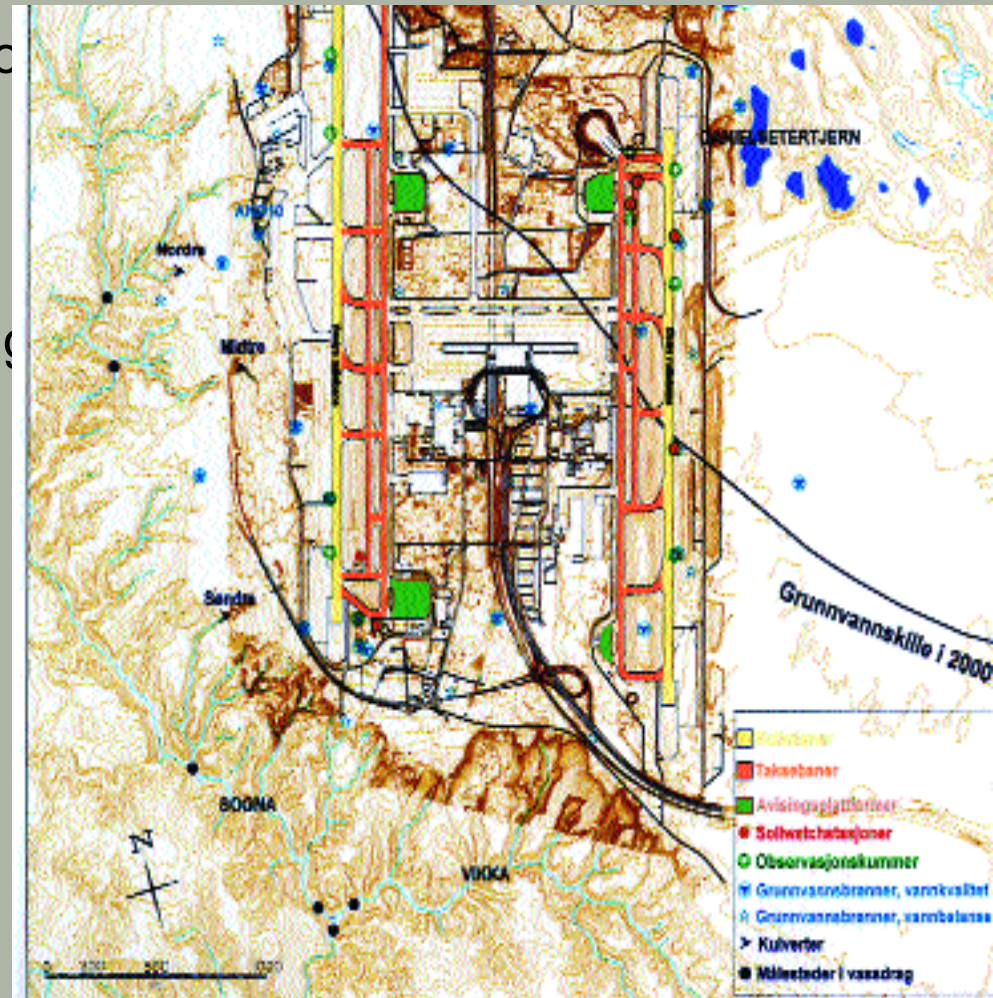


- Based on thesis by my student Ole Espen Rakkestad, 1996:
- Studied the research leading up to the authorities' permission of discharges of the new Oslo airport, prior to its opening in 1998.
- Focus on scientific uncertainties



# Scientists at work:

- The airport was situated on top of Norway's largest aquifer, with a water-shed right between: 100 km<sup>2</sup>; airport 1/10
- Ten different studies were commissioned by builder, relating to possible water pollution, and the soils' remediation capacity.
- Various types of study: from laboratory simulations to field studies, actual measurements, technical solutions, and assessment of environmental impacts.



## Politicised issue from the beginning:

- Various NGOs and other interest groups used environmental pollution of the aquifer as one concern when pollution from the old airport made headlines.
- Parliament demanded, in its initial agreement to go ahead with the planned airport, that the airport be "100% environmentally safe".
- The aquifer had to remain a potential source of drinking water.
- Scientists participating in the study agreed not to be involved in the public disputes about the airport.

# Some basic initial uncertainties:

- Due to lack of knowledge and experience, the scientists had to build up their own expertise while conducting the studies. Few studies available. **Background of ignorance**
- The scientists were given a strict and **short time frame**: only a few months within one winter/spring season.
- The precise composition of the used substances remained unknown to the scientists, due to **industrial secrecy**.
- The system for cleaning up the spills from de-icing fluids had to be developed while construction was under way.
- Some pollution already present from earlier military uses.

# More specific uncertainties:

## ■ Imprecision in measurement:

- While basic science can correct some imprecisions, applied science is dependent on the limited number of measurements actually performed.
- Standard variation for soil studies was ca 60% of the mean.
- Some studies reported a statistical uncertainty of results of + - 5-10%, though a more realistic estimate might have provided even larger uncertainties.

## ■ Lack of transferability of results

- Studies from one site were used for another site, without evidence that results were actually transferable.
- Lack of temperature data from soil makes laboratory study uncertain
- Absence of ground frost during measurement affects data on transport of fluids
- Precipitation during study period was 2% of average for this month, thus affecting data on how deep the fluids reach.
  - Researchers assumed that normal precipitation will not change transport by more than 40 cm, but without obvious basis for this assessment.
- Studies used clean solutions, not actual products, thus joint effect of all substances could not be observed.
- Soil samples for laboratory studies used one sample from one location which was then purified for controlling results, thus strong idealization occurred.

## ■ Framing uncertainties in regard to causal influence from external factors:

- Local versus global
- Short term versus long term
- Micro versus macro descriptions.

# How were the uncertainties managed?

- The builder set own emission limits that were to reassure the authorities.
- Original reservations in reports by researchers due to some uncertainty in measurements, were hidden in summary reports, and disappeared altogether in application to authorities.
  - **4-step invisibility of uncertainty**

Component to be decomposed	Load	Capacity
	Kg/m <sup>2</sup> /year	Kg/m <sup>2</sup> /year
Acetate	2	13-33
Glycol	0,3-1,2	3-40



# Inadequate information for a given purpose = uncertainty

- Systemic uncertainties, the complex nature of the soil's remediation capacity and groundwater flow, could not be handled by safety levels related to uncertain data. Irreducible uncertainty.
- The practical context with existing guidelines for environmental safety would indicate that uncertainties were to be communicated qualitatively to decision makers.
- Scientists did not even object when all their initial reservations disappeared.

# What happened?

- 6 months after the opening of the airport the groundwater data indicated that significant residues of substances from de-icing fluids had reached the groundwater.
- All preset limits were exceeded.
- Public outcry: who is the culprit?
- Scientists blamed the politicians for setting unrealistic standards and fostering too high hopes; politicians blamed the airport, and the airport found "some" faults in the previous assessments.

# The case of the vanishing quality

# Scientific integrity / integrity of science ?



Hypothesis...experiment...conclusion.  
Wow. This is so last century.

# Retraction Watch

## “FDA has repeatedly hidden evidence of scientific fraud,” says author of new study

with 2 comments

For decades, the U.S. FDA has uncovered misconduct in clinical trials but hidden it from the public, according to a new paper in [JAMA Internal Medicine](#).

The study, by New York University journalism professor [Charles Seife](#), looked at 78 publications resulting from trials where the FDA found serious misconduct, including “failure to protect the safety of patients” and data fakery. Only three of those publications mentioned the problems uncovered by the FDA. No retractions or errata were ever issued for any of them.

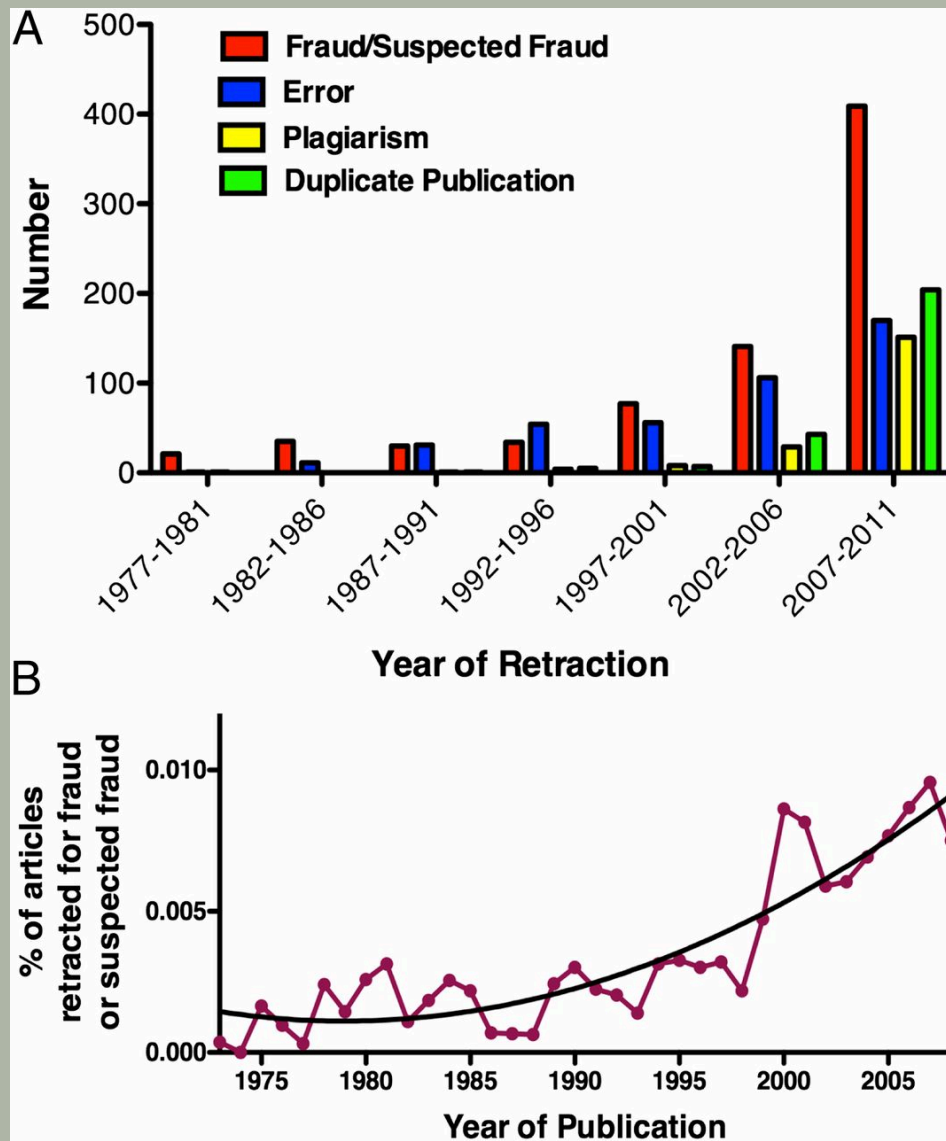
For example, in one of the three cases:

“...data from several patients were excluded from the efficacy analysis because “site monitoring raised questions in regard to certain data at 1 study site.”<sup>65(p431)</sup> The FDA documents<sup>64</sup> allege that none of the individuals enrolled at 1 study site had met the inclusion criteria and that the responsible researcher had fabricated chest radiographs of participants and committed other forms of misconduct.

(Reference 65 reported results of a trial Ivan [wrote about several years ago](#), in coverage that raised some unrelated questions.)



(A) Number of retracted articles for specific causes by year of retraction.



Fang F C et al. PNAS 2012;109:17028-17033

# Fabrication, Falsification, Plagiarism

- “Research misconduct means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.
  - (a) Fabrication is making up data or results and recording or reporting them.
  - (b) Falsification is manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
  - (c) Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit.
  - (d) Research misconduct does not include honest error or differences of opinion. “

(<http://ori.hhs.gov/definition-misconduct>; accessed 8 February 2014)

<p><u>Core “Research Misconduct”</u></p> <p>Fabrication of data</p> <p>Falsification of data</p> <p>Plagiarism</p> <p>FFP normally includes:</p> <ul style="list-style-type: none"> <li>Selectively excluding data from analysis</li> <li>Misinterpreting data to obtain desired results (including inappropriate use of statistical methods)</li> <li>Doctoring images in publications</li> <li>Producing false data or results under pressure from a sponsor</li> </ul>	<p><u>Research practice misconduct</u></p> <p>Using inappropriate (e.g., harmful or dangerous) research methods</p> <p>Poor research design</p> <p>Experimental, analytical, computational errors</p> <p>Violation of human subject protocols</p> <p>Abuse of laboratory animals</p>
<p><u>Data-related misconduct</u></p> <p>Not preserving primary data</p> <p>Bad data management, storage</p> <p>Withholding data from the scientific community</p> <p>NB: The above applies to physical research materials as well</p>	<p><u>Publication-related misconduct</u></p> <p>Claiming undeserved authorship</p> <p>Denying authorship to contributors</p> <p>Artificially proliferating publications (“salami-slicing”)</p> <p>Failure to correct the publication record</p>
<p><u>Personal misconduct</u></p> <p>Inappropriate personal behaviour, harassment</p> <p>Inadequate leadership, mentoring, counselling of students</p> <p>Insensitivity to social or cultural norms</p>	<p><u>Financial, and other misconduct</u></p> <p>Peer review abuse e.g., non-disclosure of conflict of interest, unfairly holding up a rival’s publication</p> <p>Misrepresenting credentials or publication record</p> <p>Misuse of research funds for unauthorised purchases or for personal gain</p> <p>Making an unsubstantiated or malicious misconduct allegation</p>



# Scientific fraud?

- Many discussions and cases
- Recently: The Diederik Stapel case, NL
- "a more general failure of scientific criticism in the peer community and a research culture that was excessively oriented to uncritical confirmation of one's own ideas and to finding appealing but theoretically superficial ad hoc results". And: "not infrequently reviews [of social psychology journal articles] were strongly in favour of telling an interesting, elegant, concise and compelling story, possibly at the expense of the necessary scientific diligence." (The Levenvut commission)
- FFP = fabrication, falsification, plagiarism
- QRP = questionable research practices



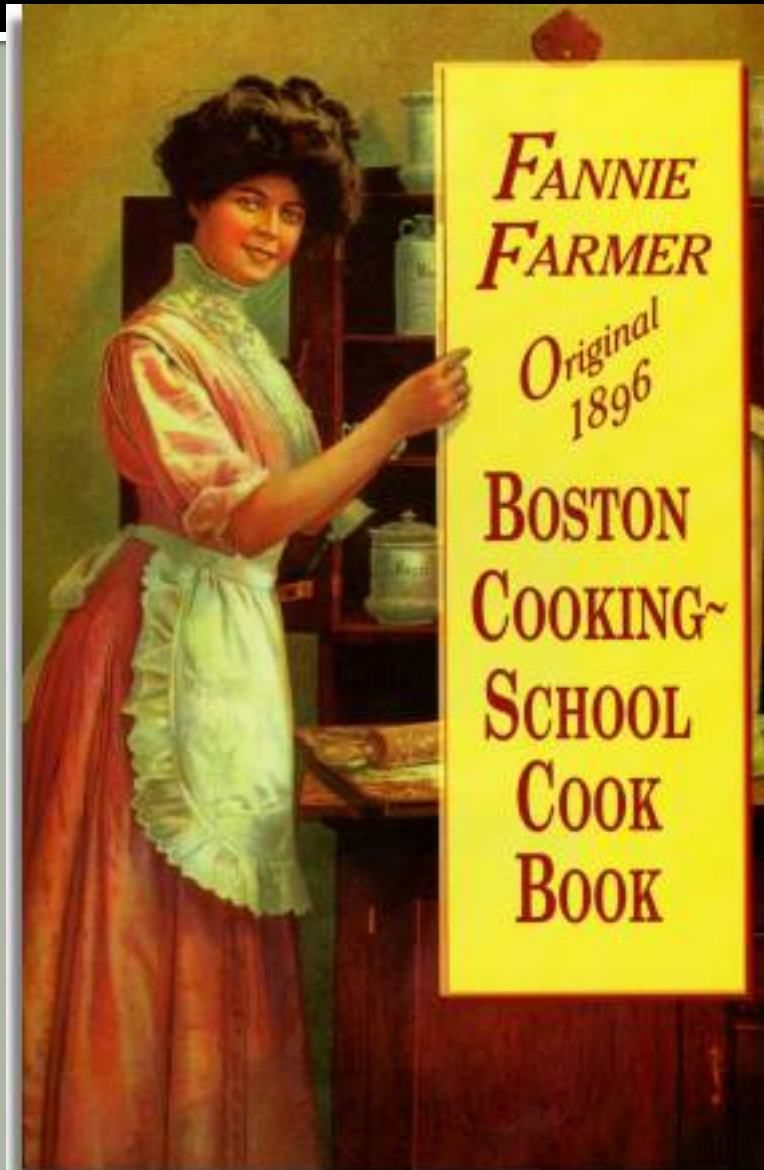
## The causes of scientific misconduct?

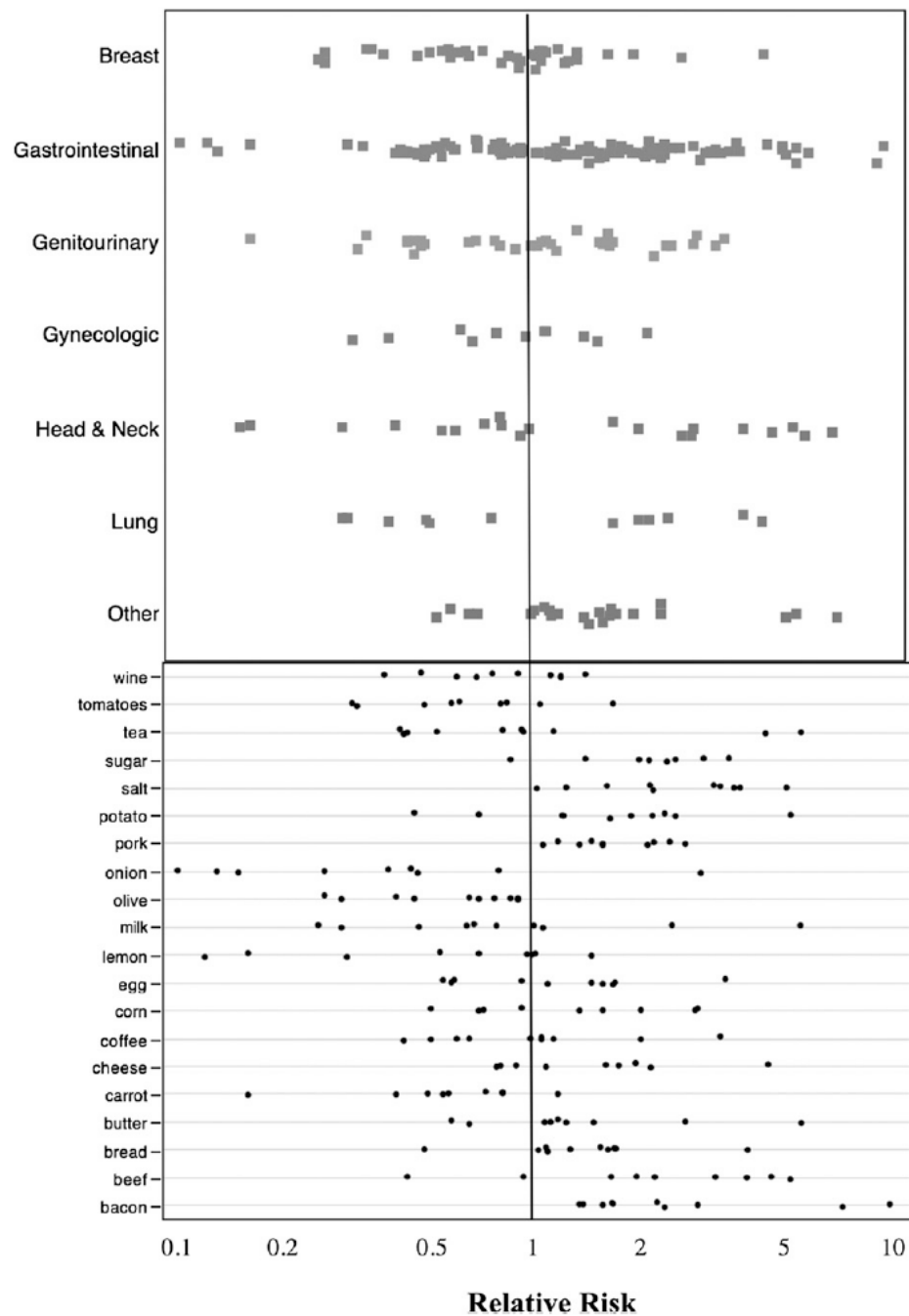
- Rotten apple theory
- Lack of training and knowledge
- Systemic factors in knowledge production



# Most published results are wrong?

- John Ionnidis
- PLoS Med  
2005;2(8): e124
- Example: The Boston Cook Book!





**FIGURE 1.** Effect estimates reported in the literature by malignancy type (top) or ingredient (bottom). Only ingredients with  $\geq 10$  studies are shown. Three outliers are not shown (effect estimates  $> 10$ ).

# The solution?

- Transparent and clear procedures;
- Institutions with visibility
- Ethics teaching- some!
- Talk about it!
- Slow Science!



# Thanks for your kind attention!



Just one more thing... is your  
data faked?

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