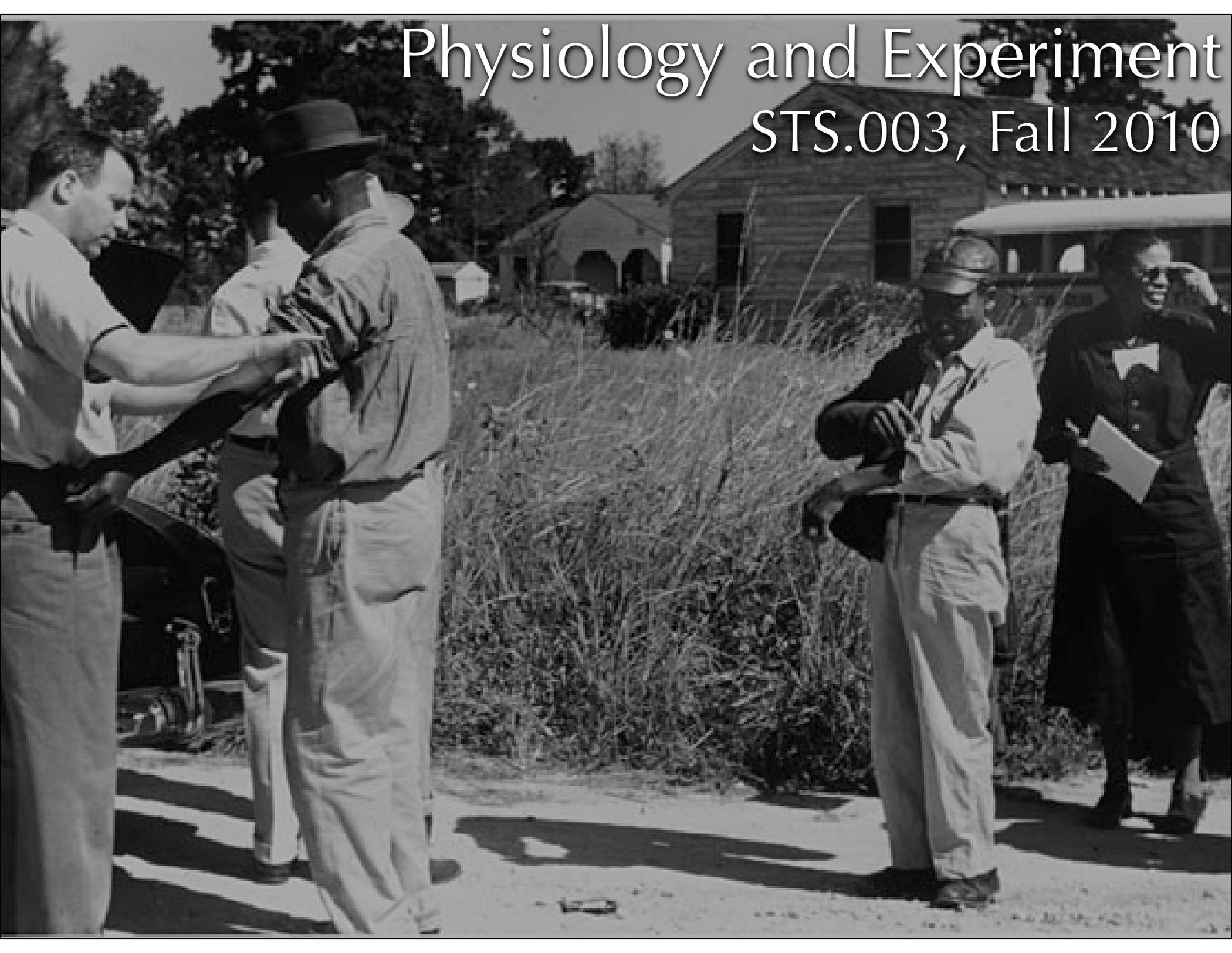


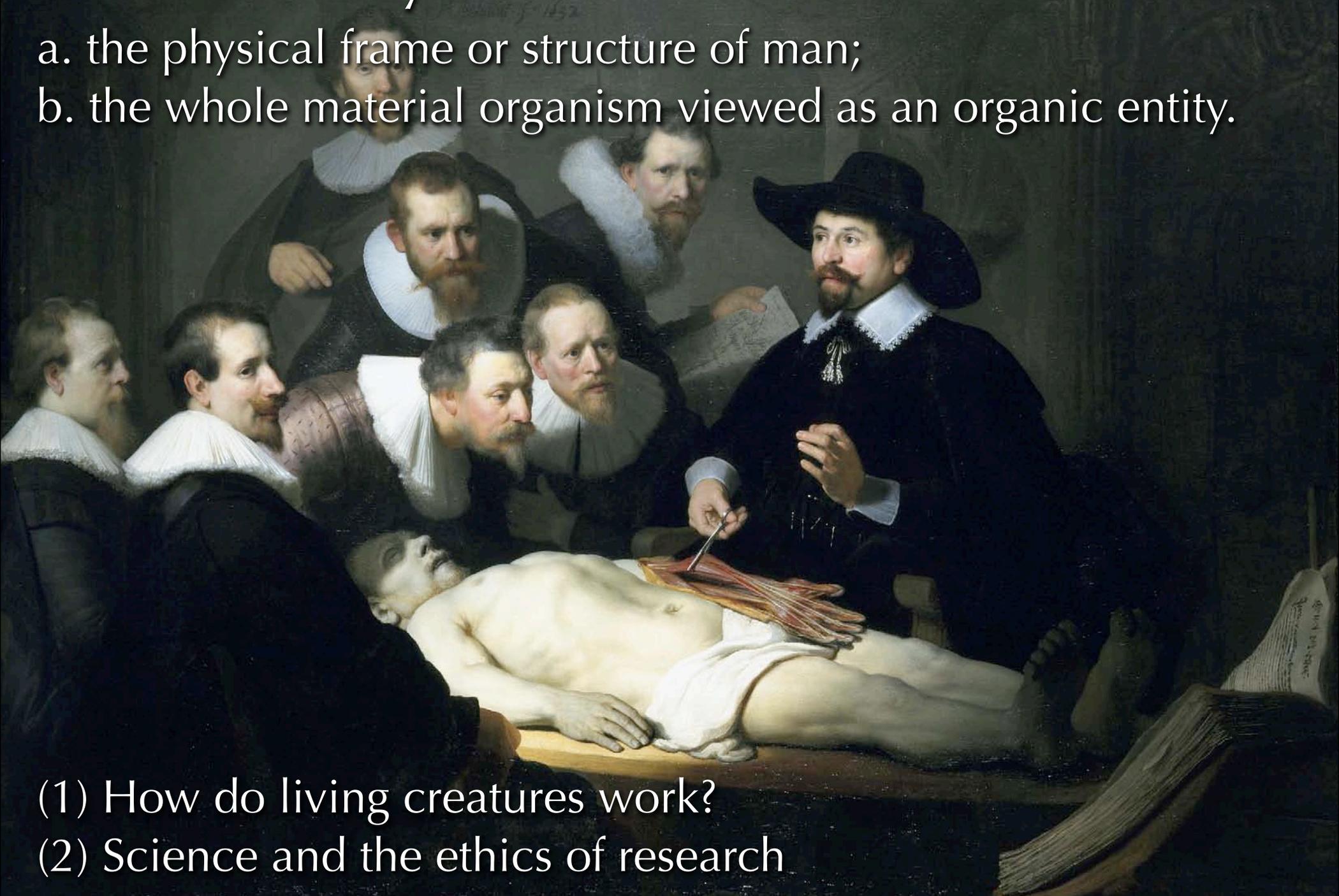
# Physiology and Experiment

STS.003, Fall 2010



# Unit 4: Body

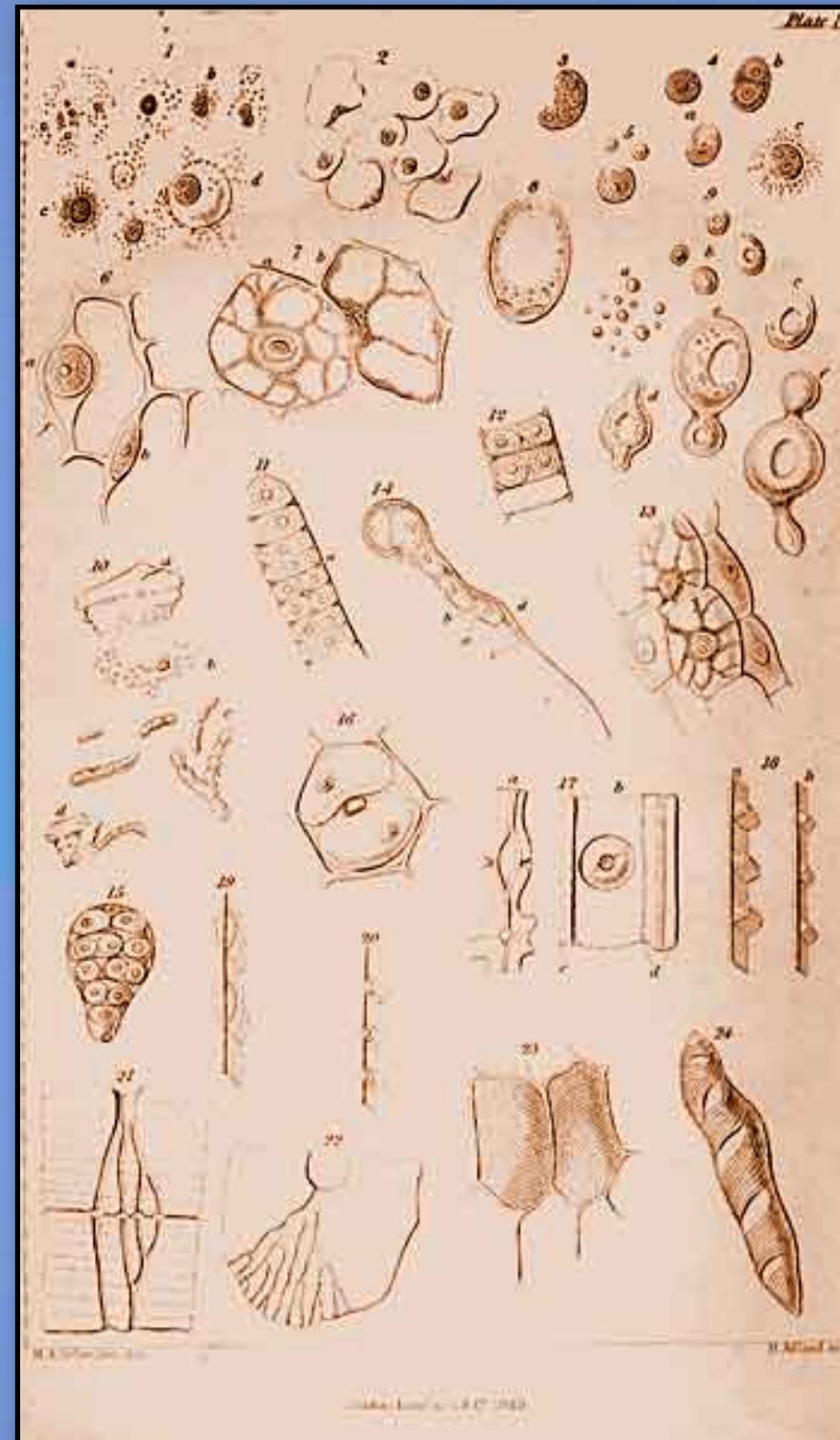
- a. the physical frame or structure of man;
- b. the whole material organism viewed as an organic entity.



- (1) How do living creatures work?
- (2) Science and the ethics of research

# REVIEW

- Anatomy: when is human dissection possible?
- Cell theory: what sorts of bodies can be used for research, e.g., if you want to find out if a bacteria really causes a disease



# OVERVIEW

- Research on living creatures
- Are there certain kinds of experiments that should not be done?



# Alexandria:

Herophilus (330-260 BCE)

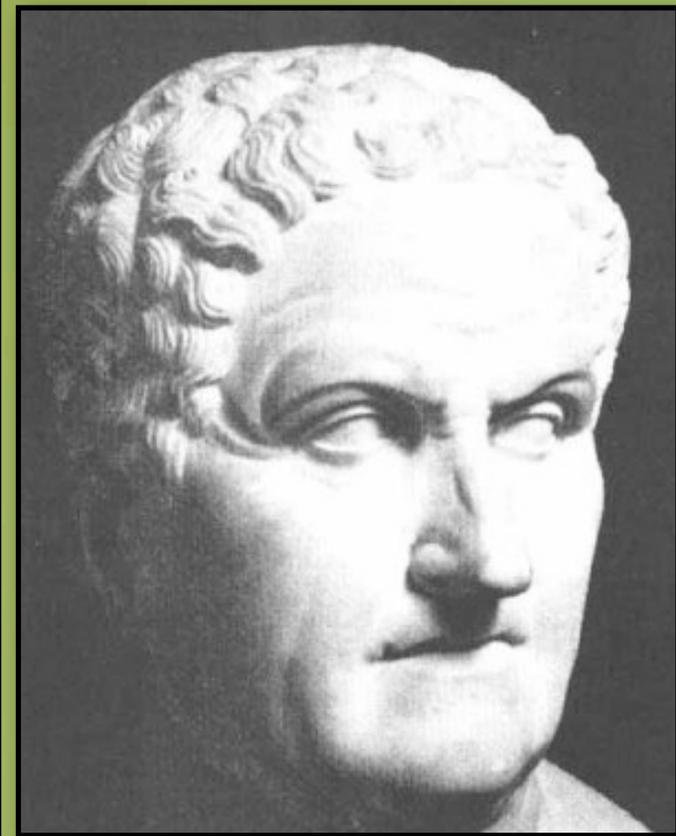
Erasistratus (330-255 BCE)



“Herophilus and Erasistratus, they say, did this in the best way by far when they cut open people who were alive, criminals out of prison, received from kings. And while breath still remained in these criminals, they inspected those parts which nature previously had concealed ... Nor is it cruel, as most people maintain, that remedies for innocent people of all times should be sought in the sacrifice of people guilty of crimes, and of only a few such people at that.” -- Celsus, AD 40

# Galen of Pergamon (c. 129-217)

Gladiator anatomy,  
Animal dissection,  
Public demonstrations



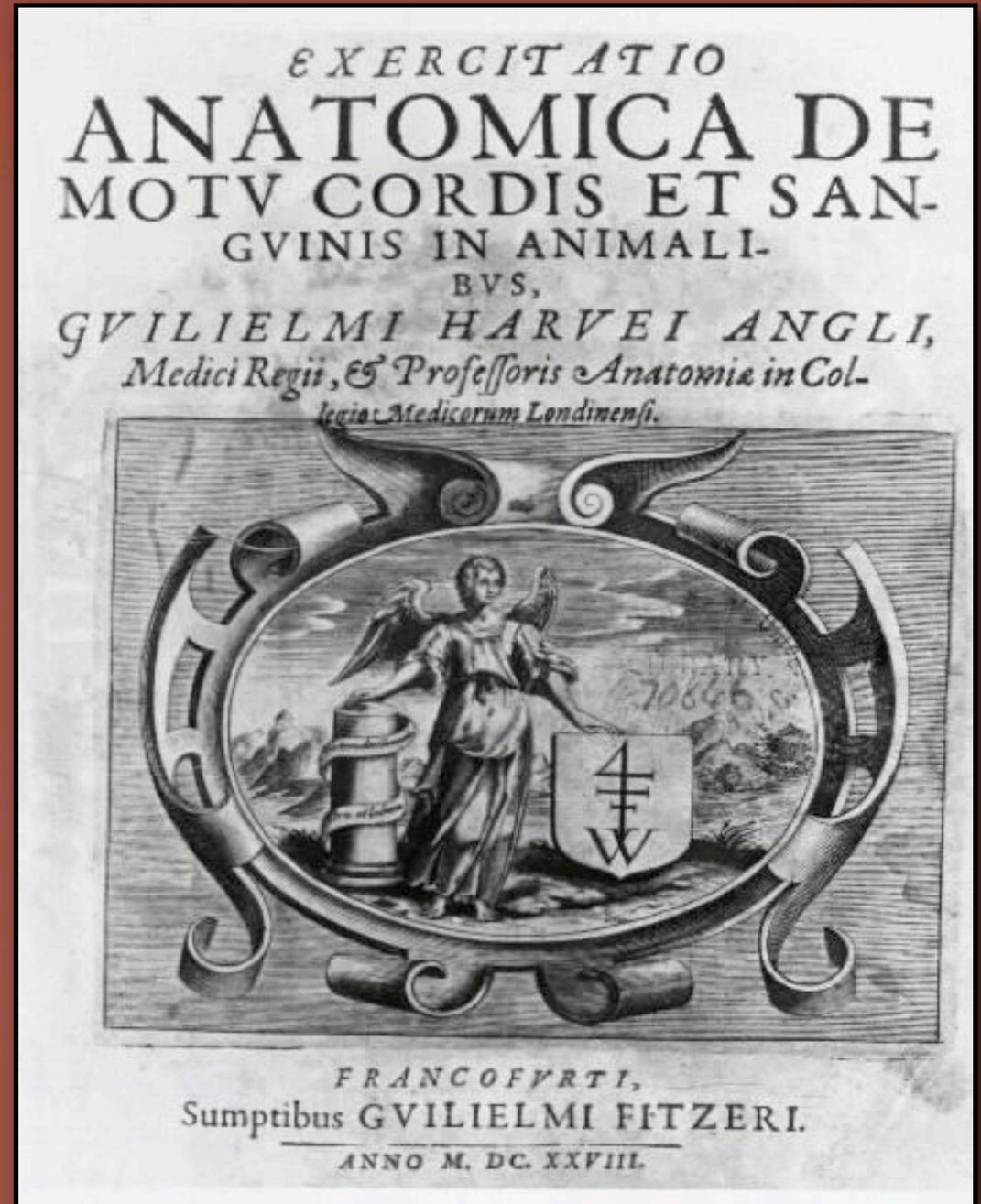


ASTIVVS



RODAN





William Harvey (1578-1657), *De Motu Cordis*, 1628

EXERCITATIO  
ANATOMICA DE  
MOTV CORDIS ET SAN-  
GVINIS IN ANIMALI-

BVS,

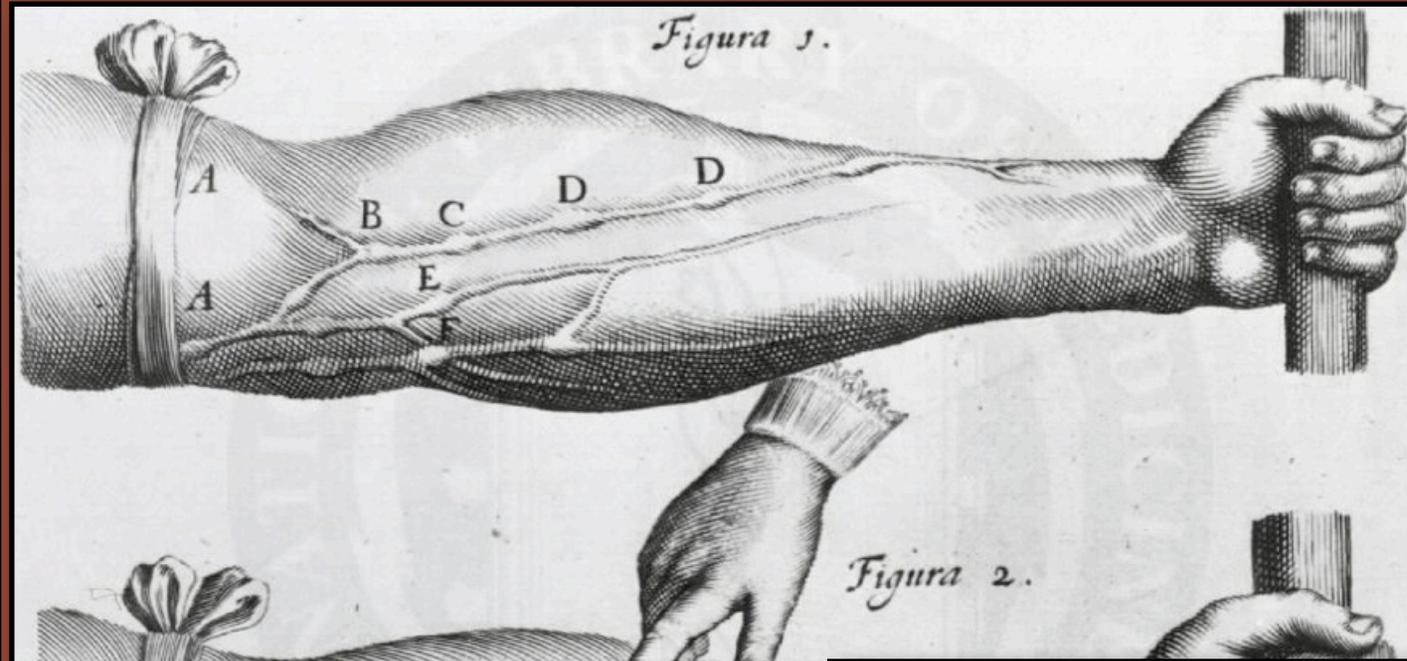
GVILIELMI HARVEI ANGLI,  
*Medici Regii, & Professoris Anatomia in Col-  
legio Medicorum Londinensi.*



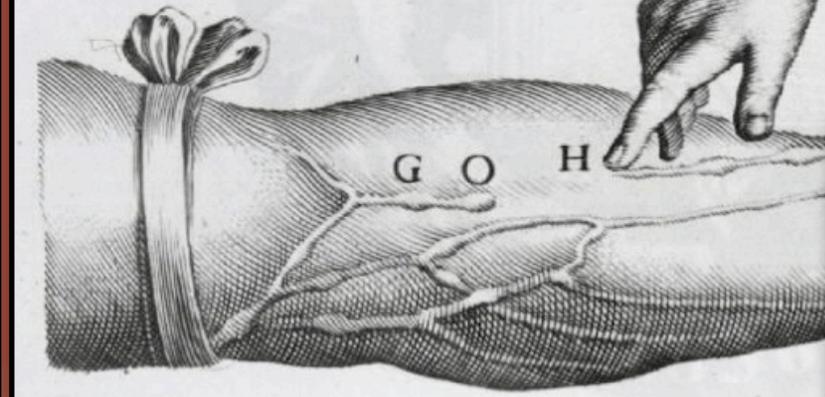
FRANCOFVRTI,  
Sumptibus GVILIELMI FITZERI.  
ANNO M. DC. XXVIII.

*De Motu Cordis -- The Movie!*

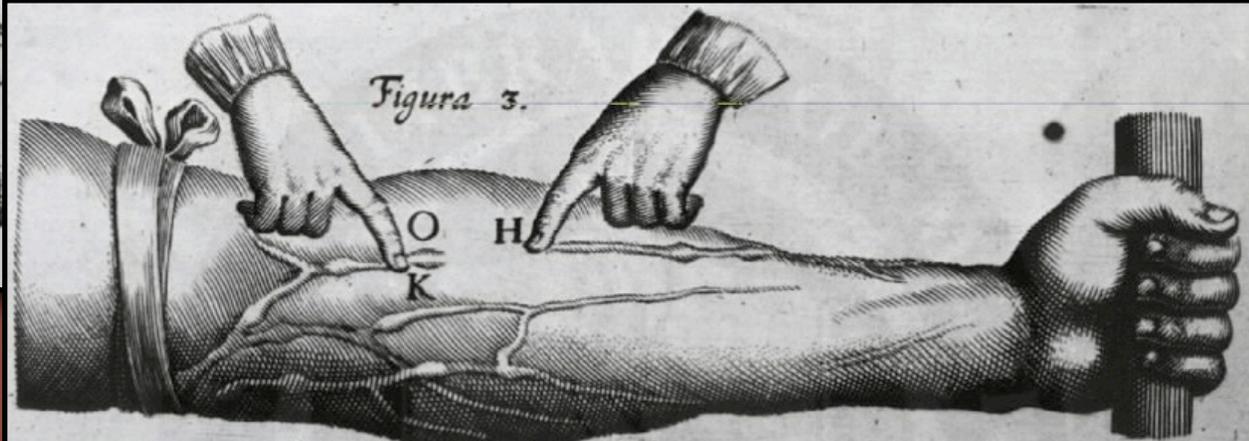
*Figura 1.*



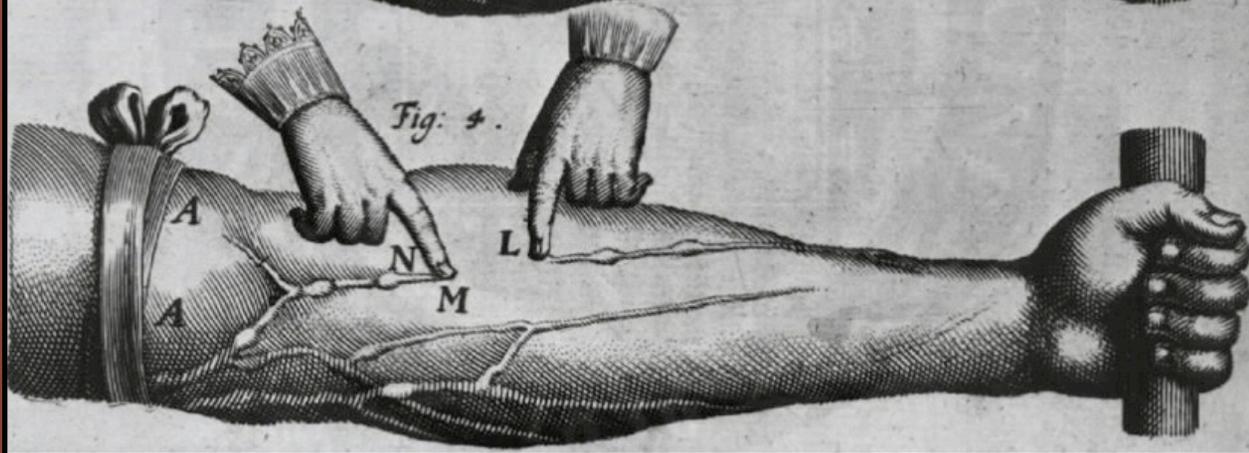
*Figura 2.*



*Figura 3.*



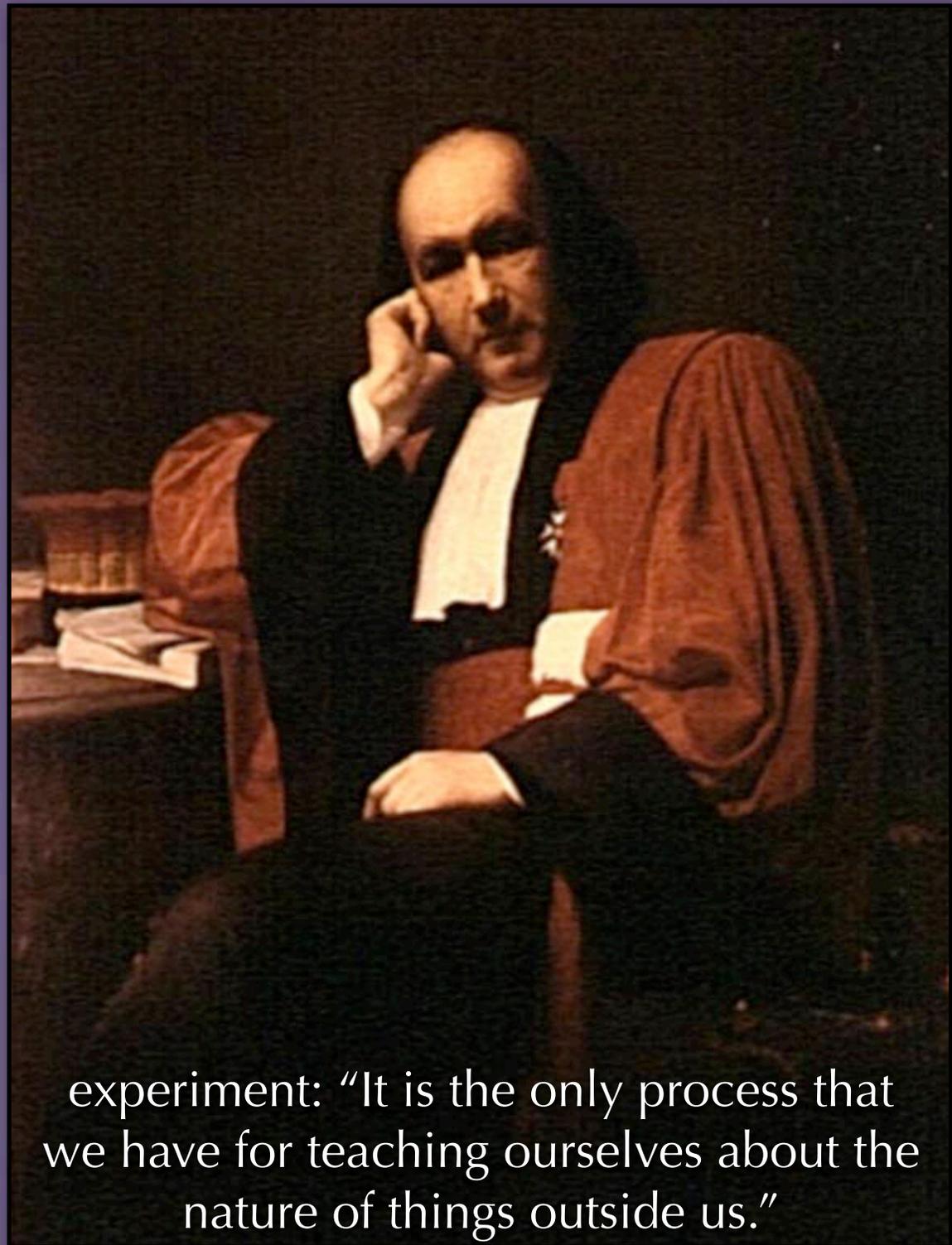
*Fig: 4.*



Animal  
Experiment,  
Human  
Demonstration

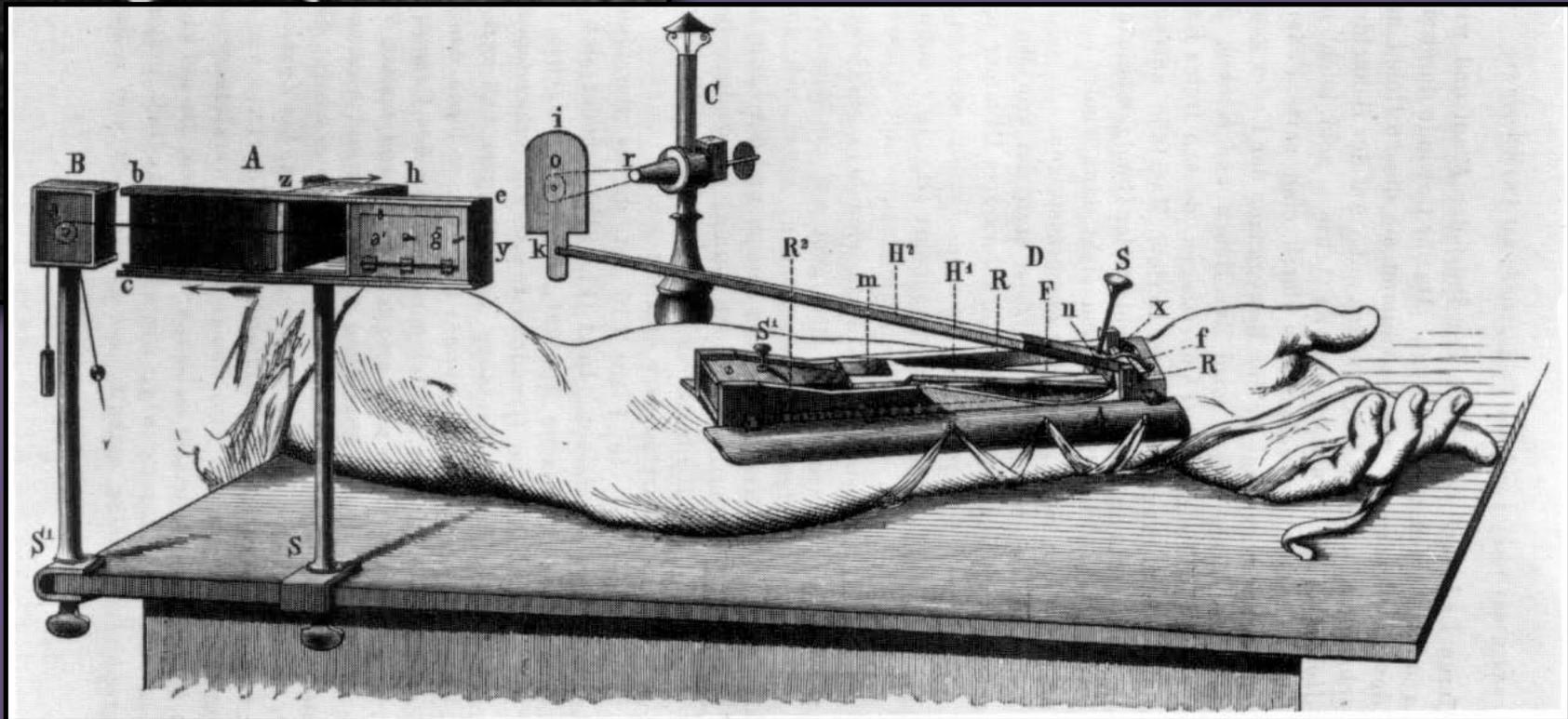
Cover of "An Introduction to the Study of Experimental Medicine," Claude Bernard, removed due to copyright restrictions.

(1813-1878)



Etienne-Jules Marey  
(1830-1904)

“graphic method”

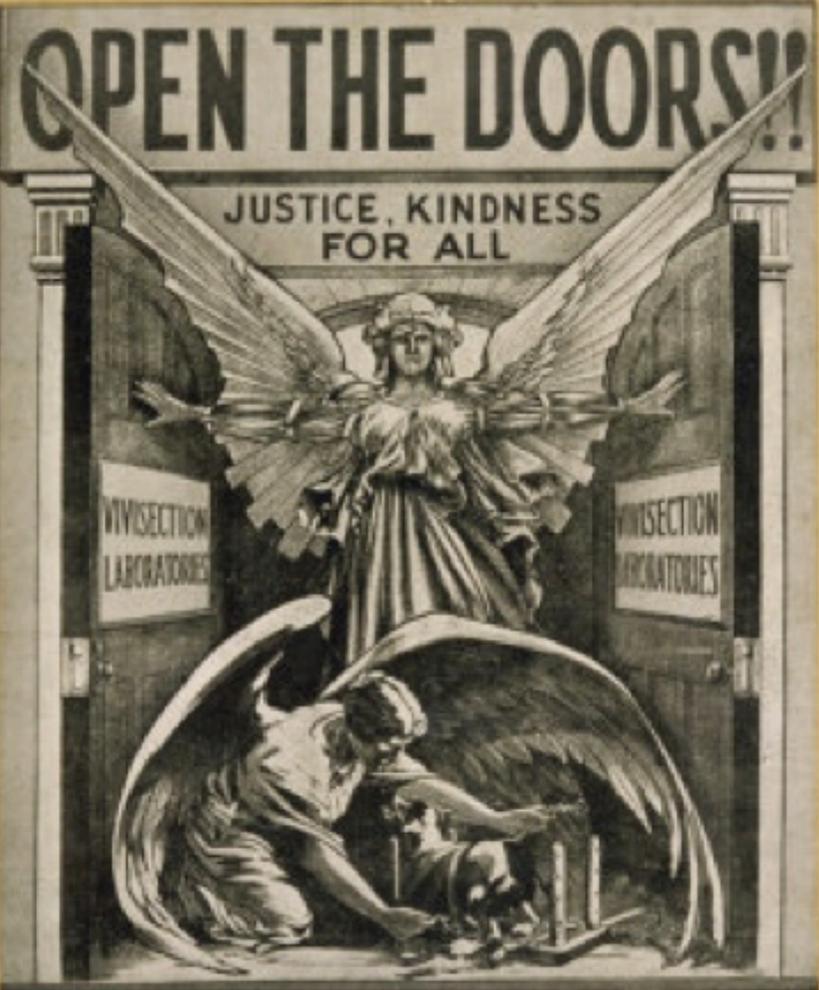


# Routinization of Animal Research



Illustration of a physiological experiment on an animal removed due to copyright restrictions.

# Debates For and Against Animal Research



**OPEN THE DOORS!!**

JUSTICE, KINDNESS  
FOR ALL

VIVISECTION  
LABORATORIES

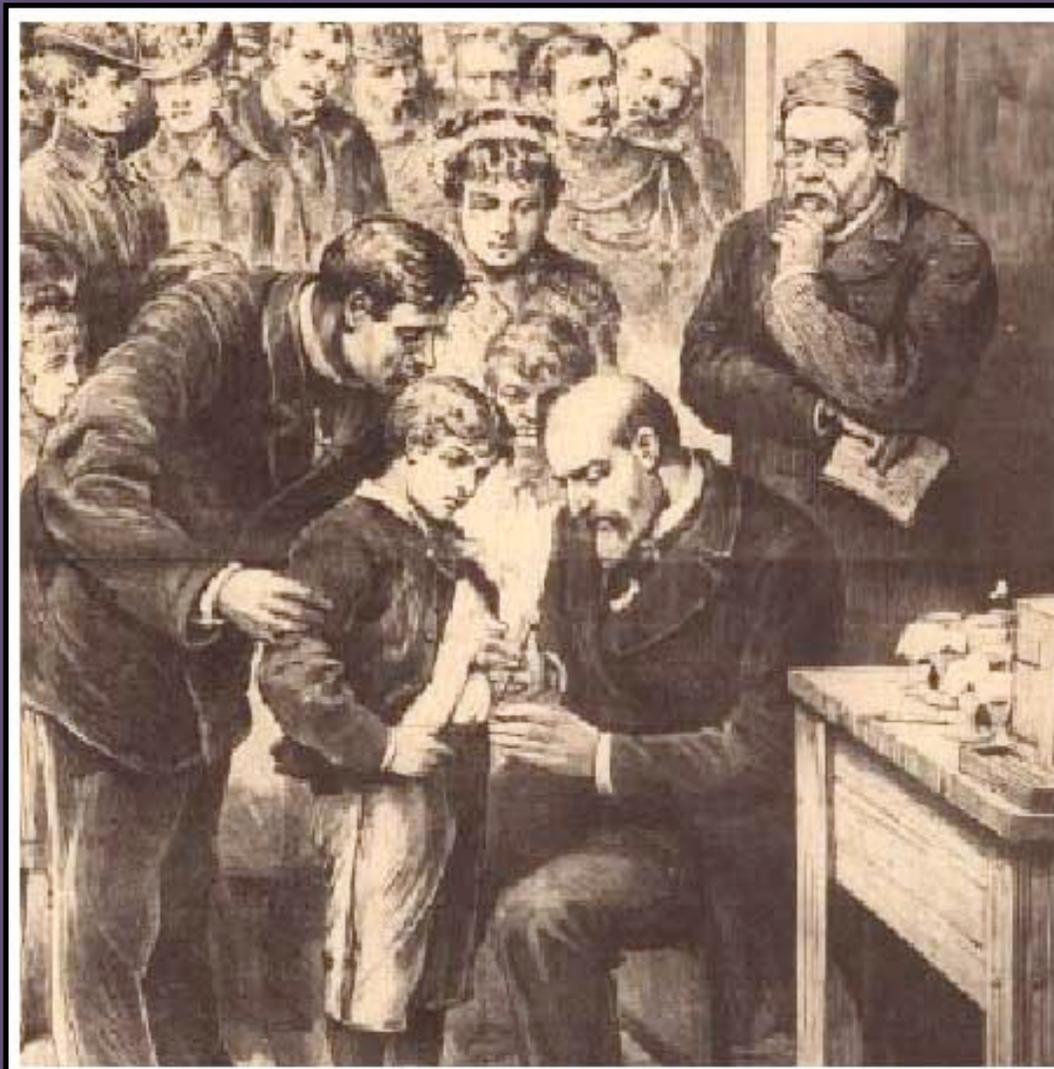
VIVISECTION  
LABORATORIES

We Ask Constant Right Of Entry Into All Vivisection Laboratories For Especially Appointed Humanitarians. If There Is Nothing To Conceal—Why Not Open The Doors?

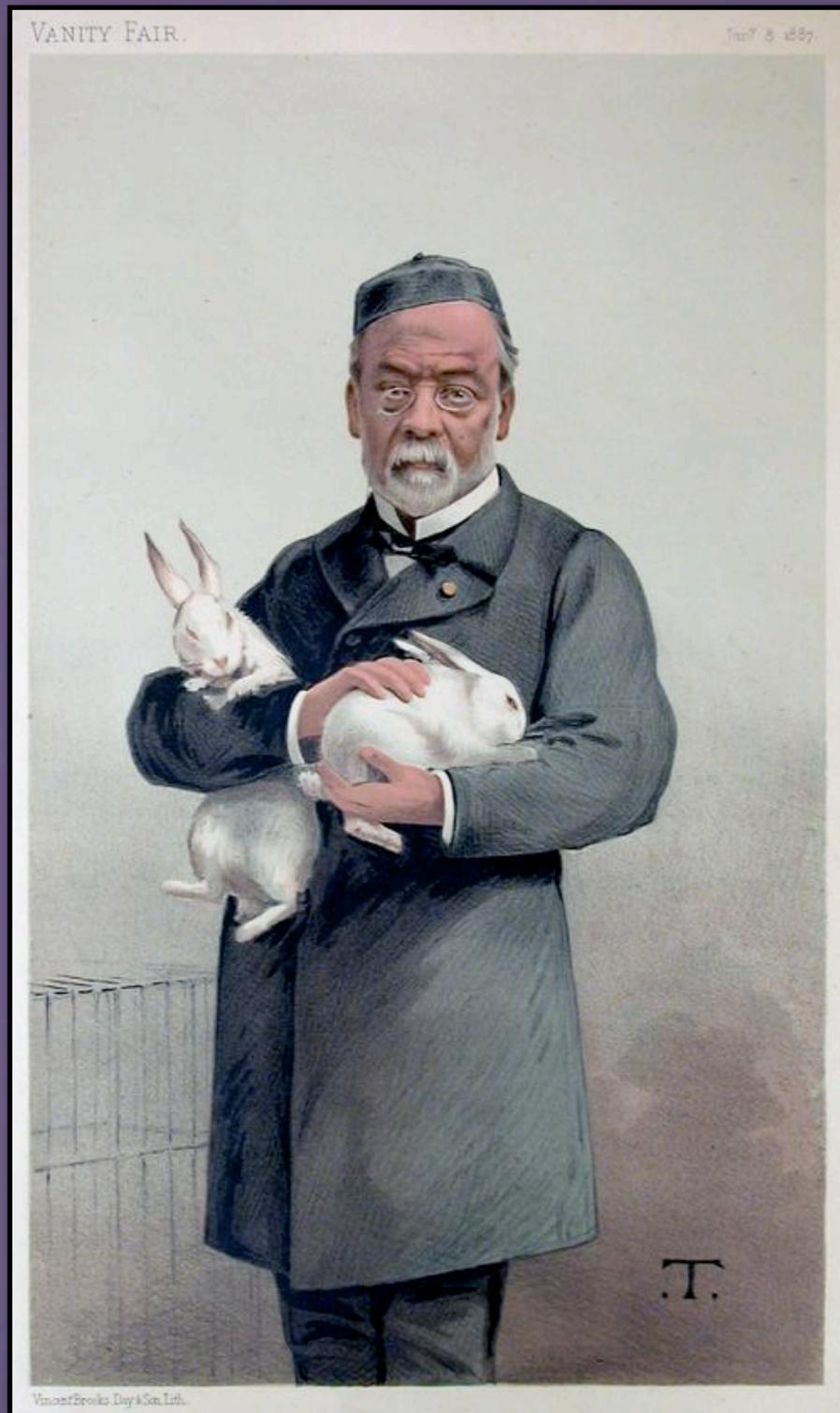
**New York Anti-Vivisection Society**  
**The Open Door Magazine**

1860 BROADWAY                      NEW YORK CITY

USSC advertisement for animal research removed due to copyright restrictions.



Louis Pasteur  
From Animal to  
Human Research



# Walter Reed and the Yellow Fever Commission in Cuba, 1900

“we volunteer solely for the cause of humanity and in the interest of science”





Tuskegee Syphilis Study (1932-1972)

## Macon County Health Department

ALABAMA STATE BOARD OF HEALTH AND U. S. PUBLIC HEALTH  
SERVICE COOPERATING WITH TUSKEGEE INSTITUTE

Dear Sir:

Some time ago you were given a thorough examination and since that time we hope you have gotten a great deal of treatment for bad blood. You will now be given your last chance to get a second examination. This examination is a very special one and after it is finished you will be given a special treatment if it is believed you are in a condition to stand it.

If you want this special examination and treatment you must meet the nurse at \_\_\_\_\_ on \_\_\_\_\_ at \_\_\_\_\_ M. She will bring you to the Tuskegee Institute Hospital for this free treatment. We will be very busy when these examinations and treatments are being given, and will have lots of people to wait on. You will remember that you had to wait for some time when you had your last good examination, and we wish to let you know that because we expect to be so busy it may be necessary for you to remain in the hospital over one night. If this is necessary you will be furnished your meals and a bed, as well the examination and treatment without cost.

REMEMBER THIS IS YOUR LAST CHANCE FOR SPECIAL FREE TREATMENT. BE SURE TO MEET THE NURSE.

Macon County Health Department

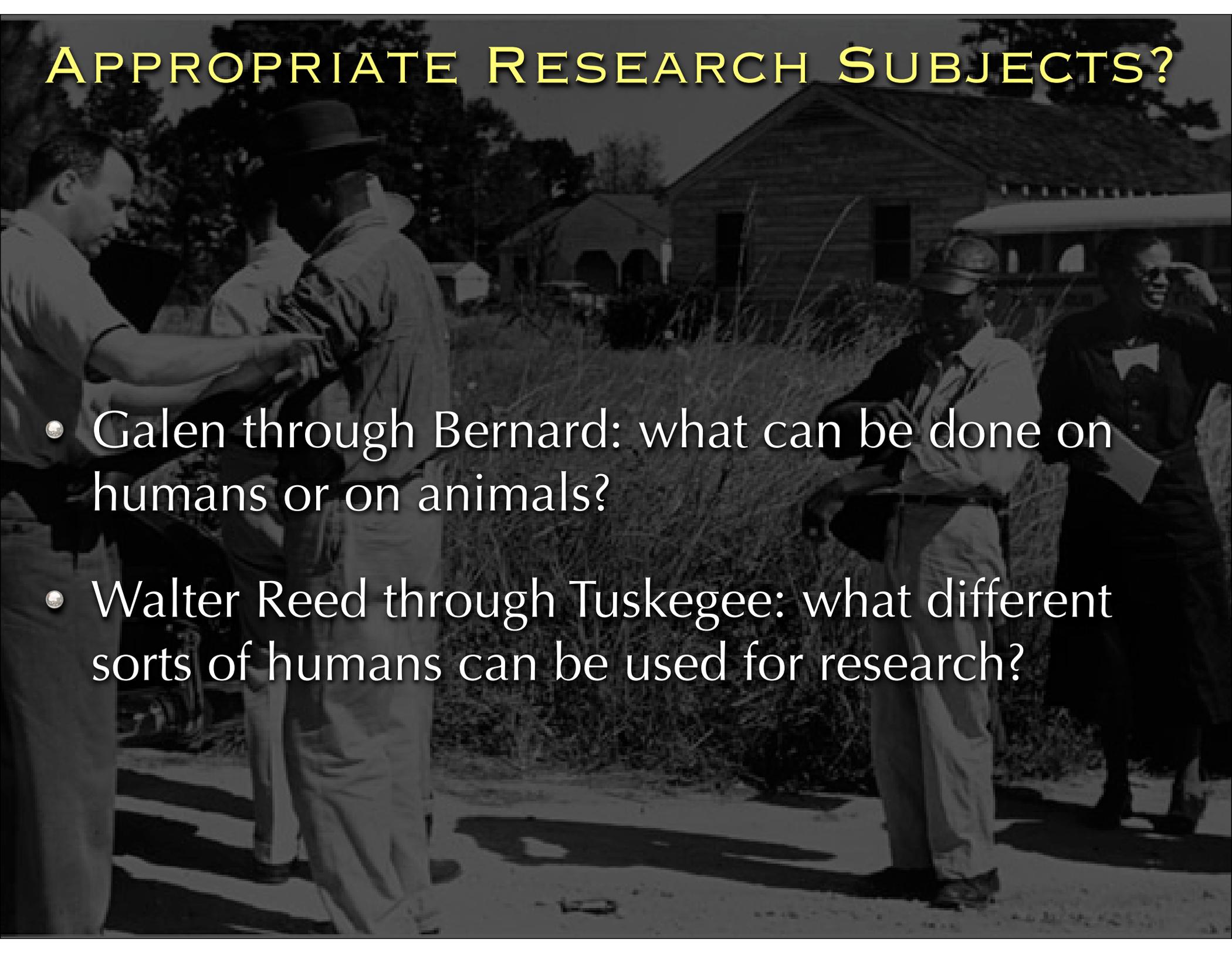
- Not just lack of consent, but active deception
- Worked to prevent men from receiving treatment

Screenshot of a New York Times Article, "U.S. Apologizes for Syphilis Tests in Guatemala," removed due to copyright restrictions.

See: <http://www.nytimes.com/2010/10/02/health/research/02infect.html>

# APPROPRIATE RESEARCH SUBJECTS?

- Galen through Bernard: what can be done on humans or on animals?
- Walter Reed through Tuskegee: what different sorts of humans can be used for research?



Articles removed due to copyright restrictions.

Havens, W. Paul, Jr., and Thomas L. Williams. "The Changes in the Serum Proteins in Patient With Experimentally Induced Infectious Hepatitis." *The Journal of Clinical Investigation* 27, no. 3 (1948): 340-345.

Bell, Joseph, A., et all. "Artificially Induced Asian Influenza in Vaccinated and Unvaccinated Volunteers." *Journal of the American Medical Association* 165, no. 11 (1957): 1366-1373.

Rendtorff, RC. "The Experimental Transmission of Human Intestinal Protozoan Parasites." *American Journal of Hygiene* 59, no. 2 (1954): 209-20.

Collings, William E., et all. "Monkey to Man Transmission of Plasmodium Falciparum by Anopheles Freeborni Mosquitoes." *The Journal of Parasitology* 54, no. 6 (1968).

Salk, Jonas E., Harold E. Pearson, Philip N. Brown, and Thomas Francis, Jr. "Protective Effect of Vaccination Against Induced Influenza B." *Journal of Clinical Investigation* 24, no. 4 (1945): 547-554.

Articles removed due to copyright restrictions.

Dolin, Raphael, et al. "Transmission of Acute Infectious Nonbacterial Gastroenteritis to Volunteers By Oral Administration of Stool Filtrates." *The Journal of Infectious Diseases* 123, no. 3 (1971).

Brown, Leonard, Bobby C. Brown, Martin J. Walsh, and Carl I. Pirkle. "Urethritis in Males Produced by Neisseria Gonorrhoeae From Asymptomatic Females." *Journal of the American Medical Association* 186, no. 2 (1963): 153-155.

Levin, Arthur G., D. B. Custodio, Emanuel E. Mandel, and Chester M. Southam. "Rejection of Cancer Homotransplants By Patients With Debilitating Non-Neoplastic Diseases." *Annals of the New York Academy of Sciences* 120, Sixth International Transplantation Conference: Part I (1964): 410-423.



Can prison inmates give consent?

Article "Men Starve in Minnesota," a 1945 LIFE Magazine Article, removed due to copyright restrictions.

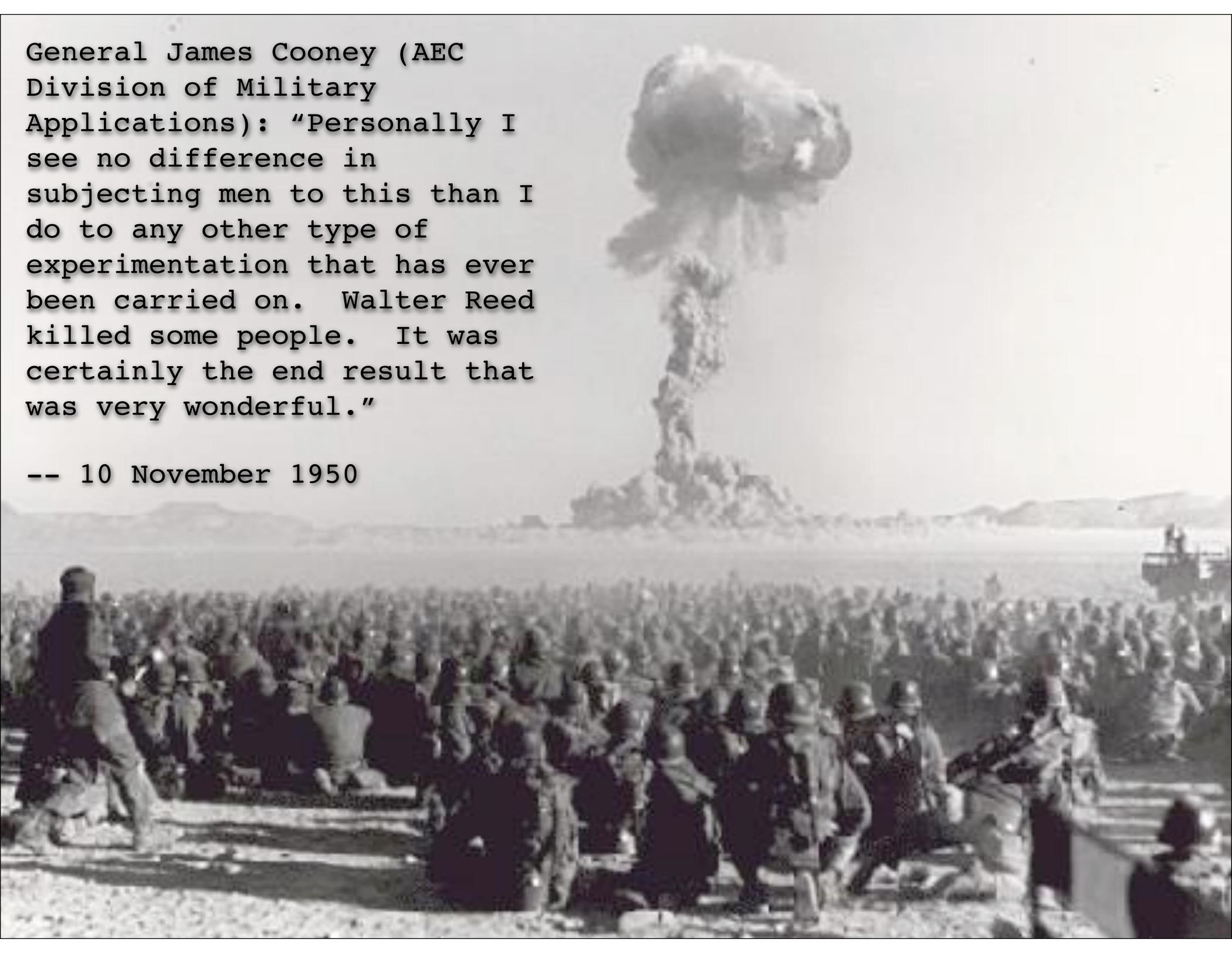
See: <http://amzn.to/mqvXTr>

# Conscientious Objectors And Medical Research

Article "The Effects of Induced Malaria, Acute Starvation and Semi-Starvation on the Electrophoretic Diagram of the Serum Proteins of Normal Young Men," Henry Longstreet Taylor, Olaf Mickelsen, and Ancel Keys, removed due to copyright restrictions.

General James Cooney (AEC  
Division of Military  
Applications): "Personally I  
see no difference in  
subjecting men to this than I  
do to any other type of  
experimentation that has ever  
been carried on. Walter Reed  
killed some people. It was  
certainly the end result that  
was very wonderful."

-- 10 November 1950



Article "Infectious Hepatitis  
Complicated by Secondary Invasion  
with Salmonella," W.P. Havens, Jr., and  
Herbert A. Wenner, removed due to  
copyright restrictions.

# Is Informed Consent Possible? Unknown Risks

Article "Non-A, Non-B Hepatitis after  
Experimental Transmission of Malaria by  
Inoculation of Blood," J.L. Kienstag, et  
all, removed due to copyright  
restrictions.

Image of the MIT Division of  
Comparative Medicine homepage  
removed due to copyright restrictions.

See: <http://web.mit.edu/comp-med>

Image of the Association of Clinical  
Research Organizations home page  
removed due to copyright restrictions.

See: <http://www.acrohealth.com>

# Unscientific Results

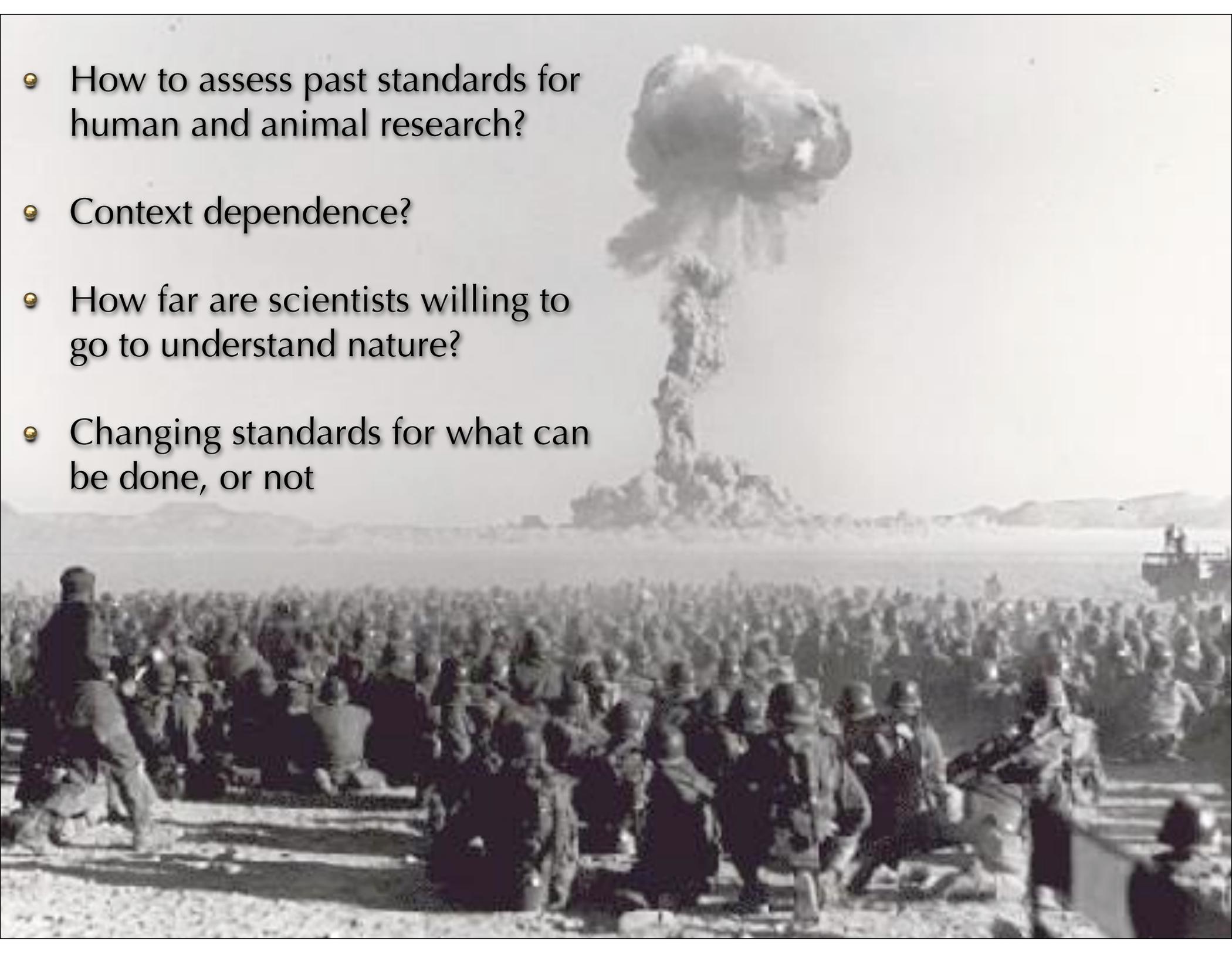
-- in many there was strongly divided opinion --

NAMES: \_\_\_\_\_

You develop a promising new surgical instrument: a laser knife that you hope will cut tissue without bleeding or scarring. You want to find out how well it works and whether or not it is safe. In which of the following scenarios would you be willing to test it?

Research Population	Justifications?	Concerns?	Do it?
Bodies of executed criminals			N
Unclaimed bodies from city hospital			N
Criminals about to be executed, as long as they do not suffer			N
Paid volunteers with informed consent			N
Unpaid but informed volunteers			Y
Animals bred for research			Y
Animals purchased from shelters (otherwise would be euthanized)			N
Self-experimentation by researchers			Y
Student volunteers			Y
Terminally ill dementia patients in nursing home			N
Volunteer prison inmates, unpaid			Y
Volunteer prison inmates, paid			N

- How to assess past standards for human and animal research?
- Context dependence?
- How far are scientists willing to go to understand nature?
- Changing standards for what can be done, or not



# How far are scientists willing to go to understand nature?

Photo of the construction of a superconducting super collider removed due to copyright restrictions.

Graph of the U.S. HEP budget removed due to copyright restrictions.

Graph shows funding steadily rising between 1985 and 1985. After 1985, the budget increased significantly with the start of the superconducting super collider project. Around 1995 the project was canceled, and the budget cut in half.

# Paper 2 Revise/Rewrite

STS.003

*The Rise of Modern Science*

Fall 2010

## Revise-Rewrite Assignment

**Due date:** Wednesday, 10 November 2010, in class. *No late papers will be accepted.*

**Length:** 1800 - 2100 words (6-7 double spaced pages) – same as for the original submission

**Grade:** The rewrite does not replace the existing Paper 2 grade: it is an independent grade. The initial submission and the rewrite are each worth 15% of your final grade. The standards are much higher for the rewrite than for the original paper. If you make only superficial revisions (e.g. fixing typos, adding occasional sentences in response to TA's comments), your grade will drop. If you dutifully respond to most comments, but show no initiative, your grade will likely stay the same. To get a better grade, you must use the feedback and time to produce something fundamentally better.

Revising -- even rewriting -- a paper, as part of the CI requirement, can be an enormously valuable exercise, but only if you invest the time needed to make it worthwhile. Revision means to see again, to take a fresh look at the overall product and to improve the work in a substantial way. You take the opportunity provided by this assignment -- you have as much time for the revision as you did for the original paper -- to re-think your paper from top to bottom. Any paper, no matter how good initially, can be improved dramatically with enough thought and effort. These guidelines should help.

How to proceed? Look again at the original assignment and how you answered it. Look at the comments from your TA and then speak with your TA about them. Brainstorm more about the topic in light of new material that has been presented in the course. Revisit the readings. Once you have done this, think about the best possible answer to this assignment. You might be able to work with your existing material, working it over into something much better. But you might also choose to do something entirely new: reconceived, restructured, making new and better arguments, with more complete and relevant data.

At the very least, follow this process:

1. What is the thesis? Clarify it. Avoid overgeneralization or a thesis that merely states the obvious. What can you say about this material that gives the reader new insight?
2. Is there a clear introduction? Does it state the thesis and give a sense of the structure of the paper? Delete any waffly, redundant, or unnecessary parts.
3. Can you, in a single line, identify how *each paragraph* contributes to the overall thesis? If any paragraph has two or more significant contributions, split it into multiple paragraphs. If a single point is pursued in several paragraphs, combine them. If any paragraph is merely additional, unnecessary material, delete it.
4. Organization: what is the argument of the paper? How is that argument structured? Is there a way to make the argument stronger? Consider rearranging

sections, paragraphs, or sentences to make the essay's argument more effective. *Identify additional points that need to be addressed, and points that can be deleted.*

5. Transitions: once the organization is settled, ensure that the flow of the paper is clear, and that each paragraph fits smoothly into the paper.

6. Evidence: are the points backed up with evidence? Is every key piece of evidence addressed, and every point at least illustrated? Are obvious counter-examples considered and managed appropriately? Is everything cited accurately? Note where additional evidence would strengthen the essay, or where the evidence given is not a good match for the point being made.

7. Logic and analysis: does the essay make the most of its evidence? Is it fully interpreted? Do the interpretations convince you, or is there illogic, an absence of analysis, or other problems?

8. Tone: is the tone appropriate? Is it too stiff? Too casual? What phrases or words would you change?

9. Sentence level check: are any sentences unclear? Mark them, and try to clarify. Remove weak phrases, chop out any extra words, reduce long sentences into more brief ones, and make sure there are no sentence fragments.

10. Conclusion: is it strong? Does it restate the thesis and make a stronger claim than the introduction does? Does it leave the reader thinking "wow, what an interesting way of thinking about the problem?" It should.

One of the best ways to ensure success with the rewrite is to force yourself to be ruthless in your revisions. How to do this? Do not simply revise your existing document. Instead, start from scratch with a blank document and do not cut or paste *anything*. This will force you to reconsider every idea, sentence, and phrase. Even if you want to use a similar sentence or paragraph, having to retype the material always leads to better prose. Since you have as much time to work on the rewrite as you did on the original, and since you will hopefully improve not just the writing but also the thinking behind the paper, similar sentences and paragraphs should be rare. This will produce a rewrite that is fundamentally different and improved.

As the paper approaches its final form, be sure to take the time needed to improve its production values: edit carefully, use citations correctly, etc. Anything else is unacceptable. For instance:

1. Check spelling and grammar (commas, semi-colons, ellipses, quotations, the works). Make sure each sentence has a subject, and that subjects and verbs agree with each other. Check the verb tenses of each sentence, and make sure they don't change randomly.
2. Read essay again to make sure everything makes sense and that no words are missing. One of the best ways to do this is to read the essay out loud. This will (1) slow you down, so that you detect errors, and (2) allow you to hear your prose and recognize awkward or confusing phrasings and constructions.
3. Check footnotes and bibliography – are they in the correct format?

We encourage everyone to meet one-on-one with their TA (and/or the professors) to make sure that expectations are clear and that you have a viable plan. Make good use of Stephen Brophy and the MIT Writing Center to produce the best possible paper.

MIT OpenCourseWare  
<http://ocw.mit.edu>

STS.003 The Rise of Modern Science  
Fall 2010

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