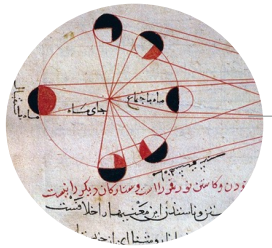
Social dimensions of modern science:

history, scientific values & diversity



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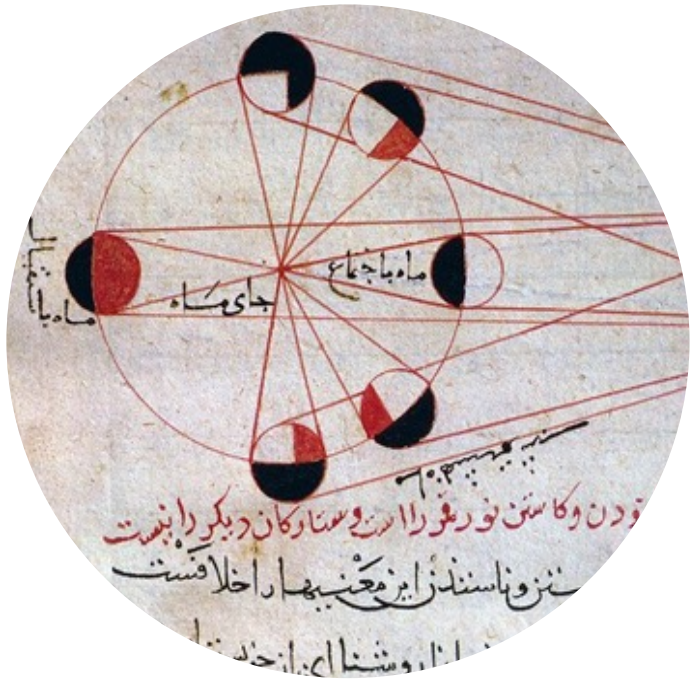
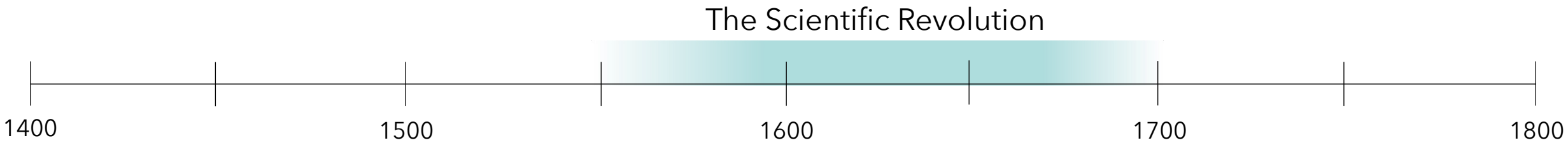


1. *The origins of "modern" scientific* ***values***



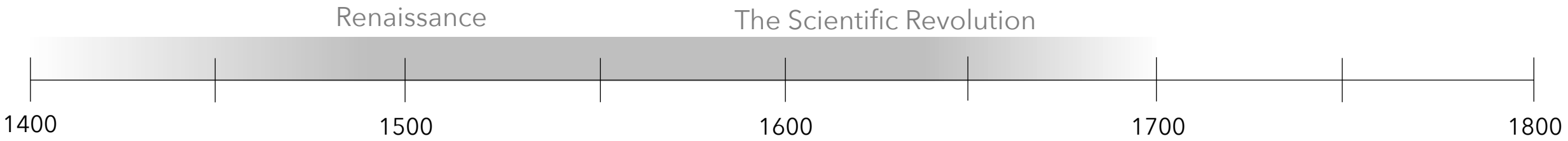
thinking

new scientific thinking:

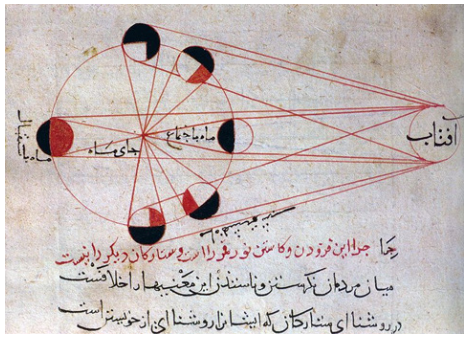
- empiricism
- mechanism
- experimentation
- scientific societies

human values

- come from outside of science
- retain role for God
- *science for sake of science*



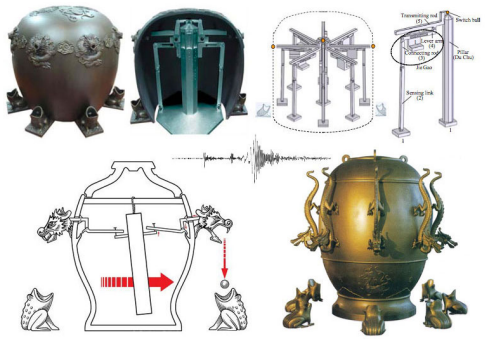
Islamic science *assimilated and built upon Indian, Chinese, Greek, Aramaic & African scientific traditions.*



Middle east

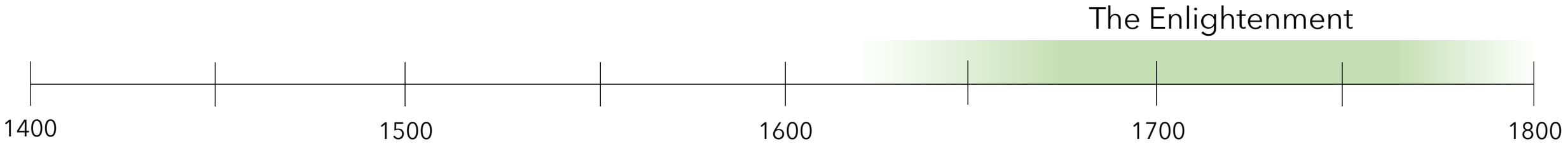
Value	0	1	2	3	4	5	6	7	8	9
Western Arabic	٠	١	٢	٣	٤	٥	٦	٧	٨	٩
Eastern Arabic	٠	١	٢	٣	۴	۵	۶	۷	۸	۹
Devanagari	०	१	२	३	४	५	६	७	८	९
Gujarati	૦	૧	૨	૩	૪	૫	૬	૭	૮	૯
Gurmukhi	੦	੧	੨	੩	੪	੫	੬	੭	੮	੯
Limbu	᥆	᥇	᥈	᥉	᥊	᥋	᥌	᥍	᥎	᥏
Bengali	০	১	২	৩	৪	৫	৬	৭	৮	৯
Oriya	୦	୧	୨	୩	୪	୫	୬	୭	୮	୯
Telugu	౦	౧	౨	౩	౪	౫	౬	౭	౮	౯
Kannada	೦	೧	೨	೩	೪	೫	೬	೭	೮	೯
Malayalam	൦	൧	൨	൩	൪	൫	൬	൭	൮	൯
Tamil (Grantha)	൦	க	உ	ங	ச	ஞ	ஶ	ஸ	அ	ன
Tibetan	๐	๑	๒	๓	๔	๕	๖	๗	๘	๙
Burmese	၀	၁	၂	၃	၄	၅	၆	၇	၈	၉
Thai	๐	๑	๒	๓	๔	๕	๖	๗	๘	๙
Khmer	๐	๑	๒	๓	๔	๕	๖	๗	๘	๙
Lao	๐	๑	๒	๓	๔	๕	๖	๗	๘	๙

India



China

Islamic Science *paved the way for the European renaissance and scientific revolution*



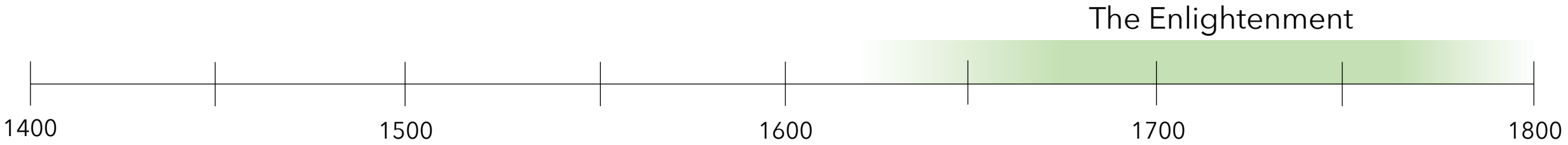
thinking

apply scientific thinking in **new ways**:

- society
- government

human values

- reason is a natural law that governs men and society (Locke)
- human values linked to science
- understand mankind via science (*not religion*)



1. origin story: “modern science” is European

2. hierarchies of *knowledge systems*… some ***are*** superior to others

3. “modern” values

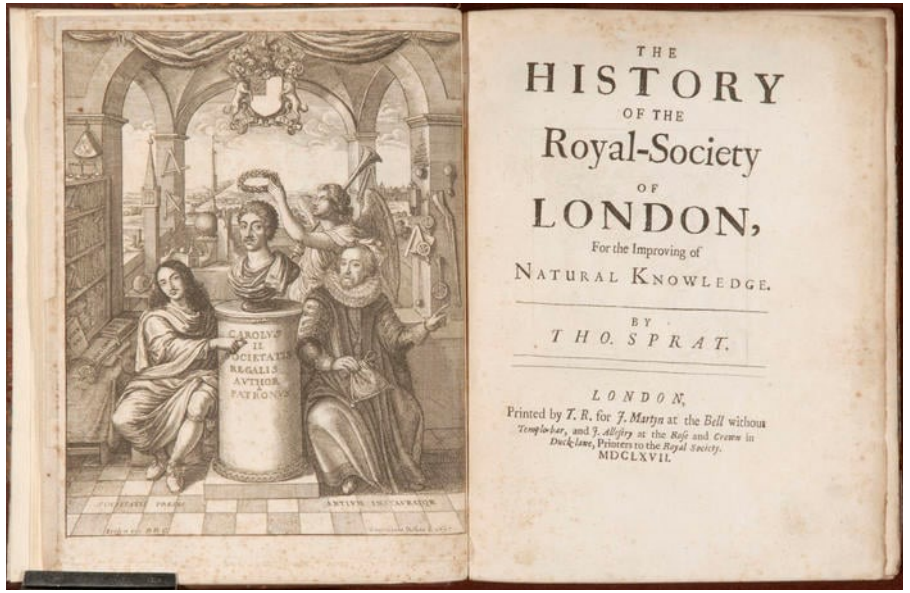
2

2. *The "view from nowhere" is a modern scientific* ***value***

The “God’s eye view” in film

2. *The "view from nowhere" & objectivity in modern science*

The Royal Society …



founded: 1660

history: 1666

2. *The "view from nowhere" & modern science*

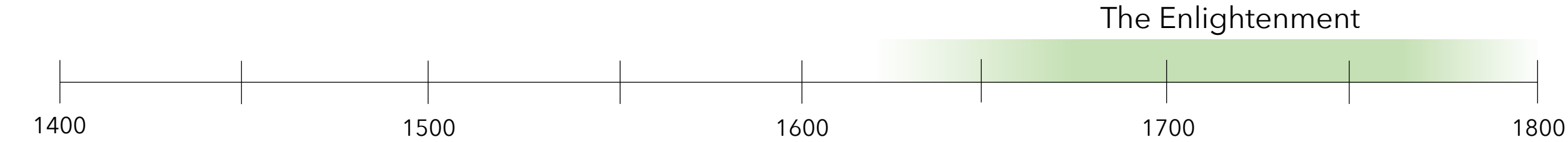
Externalist view of science/scientist:

- science ought to be external to system
- "omniscient being"
  - unbiased
  - infallible
- *objectivity* is a core scientific value

But… *we are not Gods*.

*3. Western science has always been entangled with Western **values**:*

race and colonialism (as an example)



nascent forms of race and racism predate enlightenment

- enlightenment **invents human racial taxonomy** we would recognize today
- Western science is “pointed at race” and it becomes a **mainstream research activity** (birth of race science)
- **permanent (biological) racial hierarchy** justifies simultaneous notions of enlightenment liberalism and slavery

European colonialism and science

"Since its birth around the same time as Europeans began conquering other parts of the world, modern Western science was inextricably entangled with colonialism, especially British imperialism."

— Dr. Rohan Deb Roy

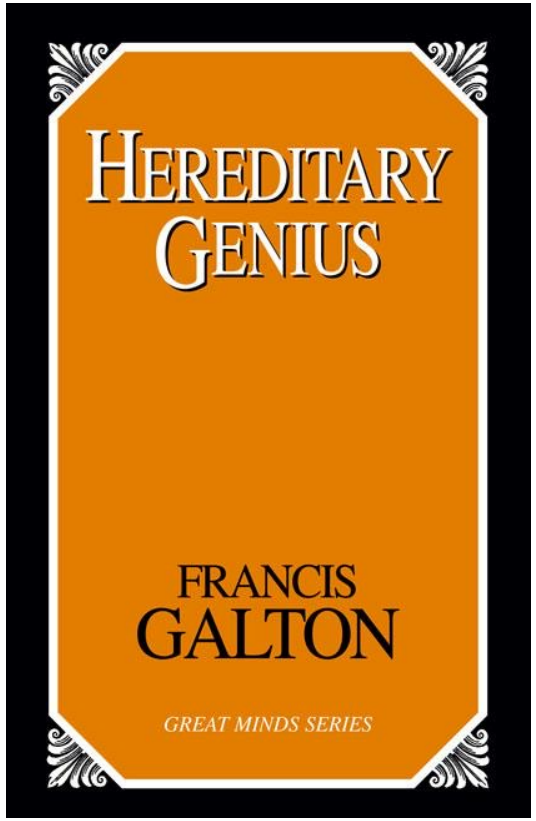
- **knowledge hierarchy**: European science is 'modern' and superior (**progress of knowledge**)
- **civilization hierarchy**: educate and civilize less developed indigenous societies (**progress of societies**)
- **racial hierarchy**: some races are biologically inferior (**progress requires European intervention**)
- "***The gracious gift of science***": scientific insights promote superior health, hygiene and sanitation among colonial subjects ("**colonization of the body"**, David Arnold)

Sir Ronald Ross

"… in the coming century, the success of imperialism will depend largely upon success with the microscope".

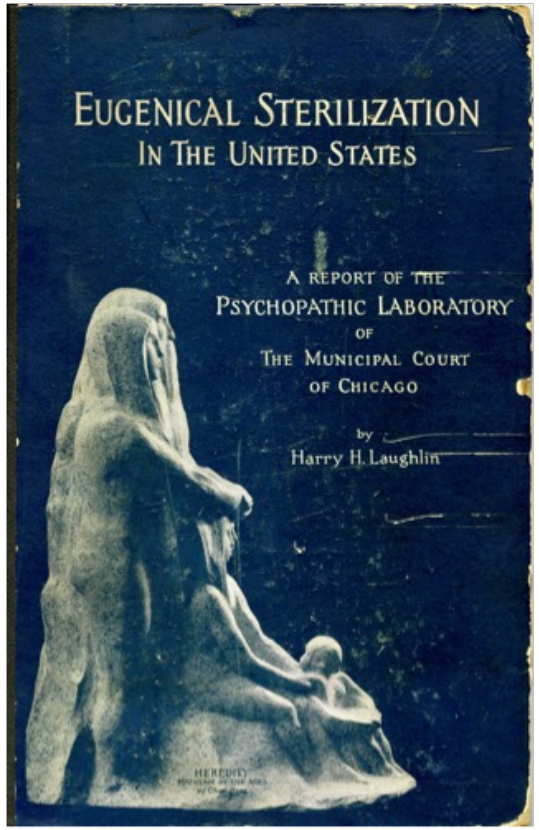
1902: Nobel prize for Medicine

Genetics and heredity transform race science → *Eugenics and racial hygiene*



1869

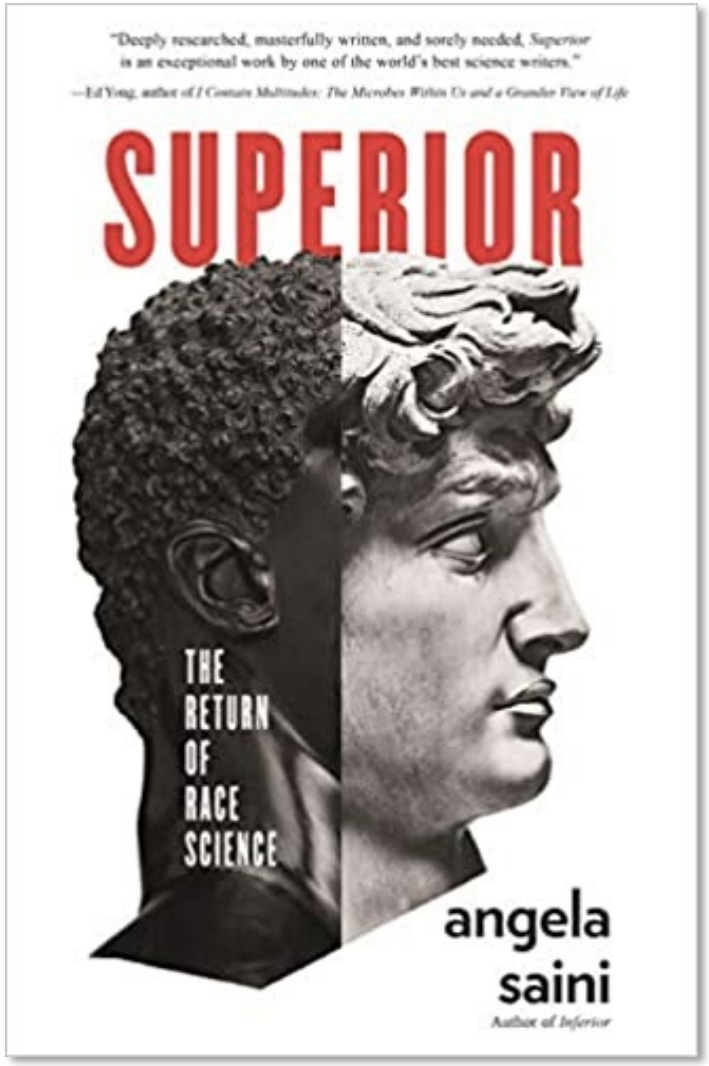
Francis Galton coined the term **Eugenics** in 1883



1922

1930's

Race science during and following World War II

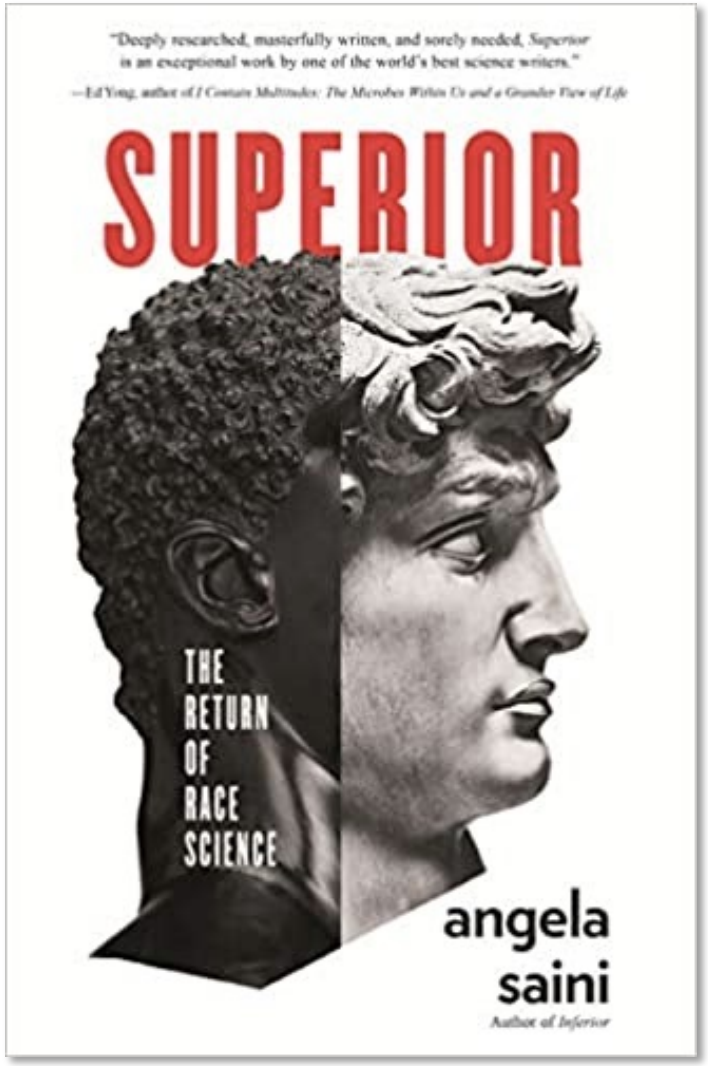


"The truth, that it was perfectly possible for prominent scientists to be racist, to murder, to abuse people and knowledge, doesn't sit easily with the way we like to think about scientific research. We imagine that it's above politics, that it's a noble, rational and objective endeavor, untainted by feelings or prejudice."

"Many of us choose to remember Nazi scientists as some kind of uniquely evil exception, nothing like scientists who found themselves on the winning side of the war."

"This was never a simple story of good verses evil. The well of scientific ideas from which Hitler and others drew their plans for racial hygiene, leading to genocide, didn't originate in Germany alone. They had been steadily supplied by race scientists for more than a century, from all over the world, supported by well-respected intellectuals, aristocrats, political leaders and women and men of wealth."

Race science during and following World War II



*"**We <u>imagine</u> that it is well and truly over now…** We imagine that the end of WWII spelled an abrupt end to race science. Eugenics is a dirty word. We are enlightened now. We are wiser."*

*"**But the story doesn't end quite so quickly**. Although they may have tempered their politics, race scientists didn't simply disappear after the war. Those that had built their work around eugenics … just found new avenues."*

*"In the decades after the war, **scientists in Britain and the United States airbrushed away their pivotal role in race science and eugenics, quietly moved into other fields**, silently renamed their university departments, consigning the past to that dark chapter. History was rewritten by the victors."*

*"The post war narrative of good triumphing over evil **glossed over the messier truth**. That in fact everyone who pointed a finger at others should have pointed a finger at themselves."*

CHAPTER 17

Science in the Belly of the Beast: My Career in the Academy

JOSEPH L. GRAVES, JR.

Associate Dean for Research and
Professor of Biological Sciences,
Joint School of Nanosciences
and Nanoengineering,
North Carolina A&T State University,
University of North Carolina–Greensboro,
Greensboro, North Carolina

The Nature of the Beast

And I stood upon the sand of the sea, and saw a beast rise . . . having seven heads and ten horns, and upon his head ten crowns, and upon his heads the name of blasphemy.

—Revelation 13:1

I had a difficult time deciding to accept the invitation to write this article. It is true that I am probably the first person of African American descent[1] to earn a PhD in evolutionary biology,[2] be hired in a tenure-track position, achieve tenure, and finally be promoted to full professor. However, I have collected as many failures in my career as I have successes. This fact, I realized, probably makes me the right person for this task because I can honestly say I learned much more about academe through my failures.

Definitions are important. To recognize success you must first know what it is you want to accomplish. You must also know the nature of your opposition. Because all humans are self-interested, it follows that there is the potential for the interests of individuals to clash. In addition, societies

Joseph L. Graves Jr.

- 1st African to earn PhD in evolutionary biology
- evolutionary geneticist
- written extensively on genetics and race in American society (and debunking biological concepts of race)

Slaying the Beast: The unwritten rules

"My career has demonstrated that if you adhere to the written rules, you are likely to achieve reasonable success. However, my greatest weakness is that I did not effectively learn and apply the unwritten rules of the academy.

…professional scientists have different grasps of nature, history and philosophy of science. ***These shortcomings often contribute to the prevailing ethos that scientific research and the scientific community are value-neutral entities. My experience is that they are not…*** *It is from here that many of the unwritten rules of the academy emanate."*

4. ***Values*** *and modern scientific gatekeeping.*

scientific gatekeeping

- scientific standards
- training standards
- volunteer peer review
- volunteer service
- communication
- data sharing
- *scientific societies*

- **quality control**
- **reproducibility**
- **self-correction**

- **self-interest**
- **political influence**
- **systematic bias**
- **diversity problems**

A modern gatekeeping example:

How ideas about gender affected a scientific community, and how the gender of scientists affected ideas about behavioral ecology.

Sarah Blaffer Hrdy: *the social behaviour of non-human primates*

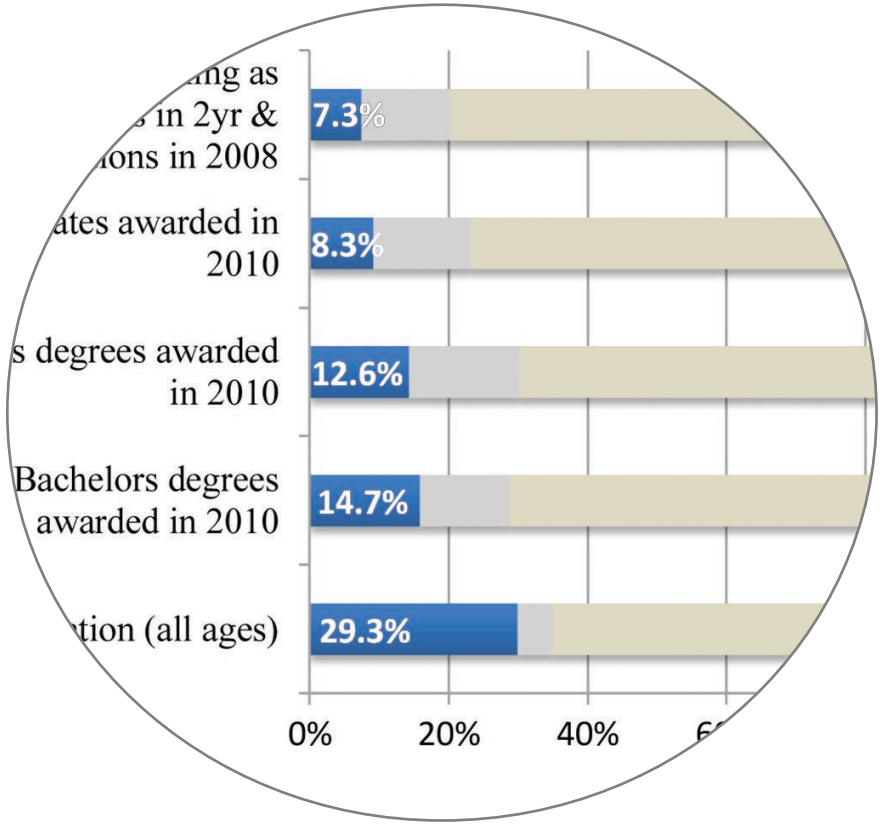
Representation and beliefs in science: 1970's

- **women are <u>under-represented</u> in this field prior to 1970's**
- consensus opinion: social and sexual lives of non-human primates are controlled by males
- more individual variation among males than females in reproductive success
  - male sexual behaviour: "*finely honed by selection*"
  - female behaviour: not evolutionarily significant
    - *"simple" & "unsophisticated"*

Sarah Blaffer Hrdy: *the social behaviour of non-human primates*

“beliefs” shift after 1970’s:

- influx of female scientists starts in 70’s
- views on female primates shift (according to Hrdy & others)
- **female scientists *transform the field***:
  - different assumptions about female primate behaviours
  - watched female primate behaviour more closely
- similar shift on sex role in the science of bird behaviour



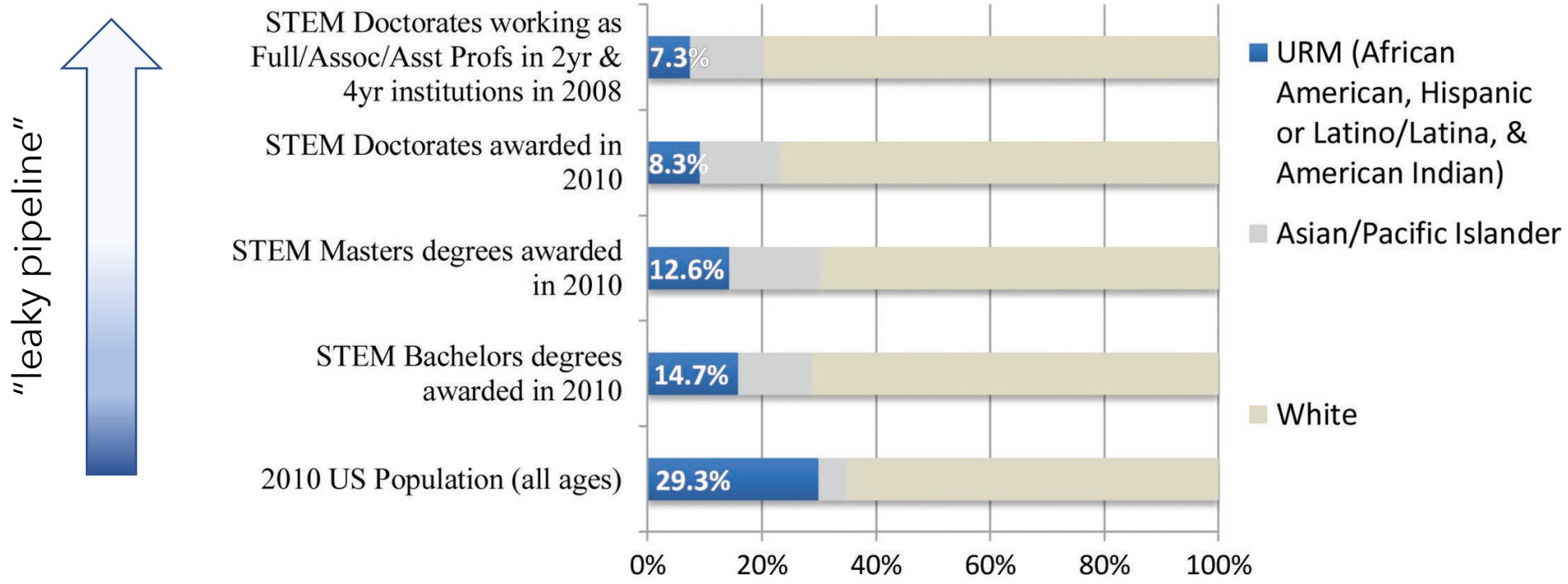
5. *Science has a diversity problem*

VOICES | DIVERSITY AND EQUITY

Science Has a Diversity Problem. For the Sake of Our Students, We Have to Change the Narrative.

By Geoffrey Carlisle Jan 31, 2022

The problem: STEM academic pipelines fail to retain underrepresented minorities (URMs).

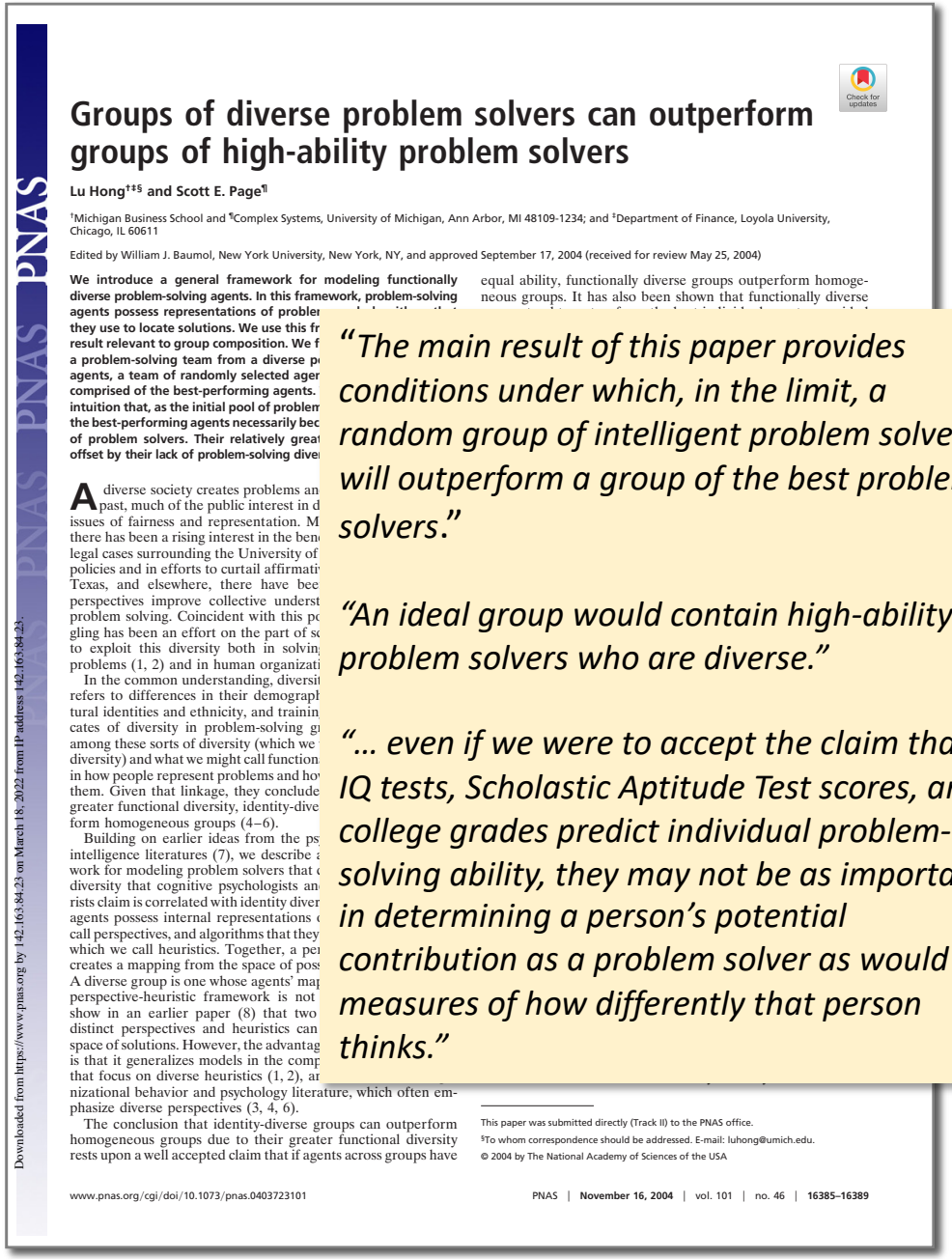


DATA: National Center for Science and Engineering Statistics based on data from the U.S. Department of Education's IPEDS 2010 Completions Survey.

SOURCE: Estrada, Mica, et al. "Improving underrepresented minority student persistence in STEM." CBE—Life Sciences Education 15.3 (2016): es5.

Diversifying science matters.

Cognitive diversity will yield better science.



PNAS

Groups of diverse problem solvers can outperform groups of high-ability problem solvers

Lu Hong[†‡§] and Scott E. Page[¶]

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Edited by William J. Baumol, New York University, New York, NY, and approved September 17, 2004 (received for review May 25, 2004)

We introduce a general framework for modeling functionally diverse problem-solving agents. In this framework, problem-solving agents possess representations of problem they use to locate solutions. We use this fr result relevant to group composition. We f a problem-solving team from a diverse p agents, a team of randomly selected ager comprised of the best-performing agents. intuition that, as the initial pool of problem the best-performing agents necessarily bec of problem solvers. Their relatively great offset by their lack of problem-solving dive

A diverse society creates problems an past, much of the public interest in d issues of fairness and representation. M there has been a rising interest in the ben legal cases surrounding the University of policies and in efforts to curtail affirmati Texas, and elsewhere, there have bee perspectives improve collective underst problem solving. Coincident with this pc gling has been an effort on the part of s to exploit this diversity both in solvin problems (1, 2) and in human organizati

In the common understanding, diversit refers to differences in their demograph tural identities and ethnicity, and trainin cates of diversity in problem-solving g among these sorts of diversity (which we diversity) and what we might call function in how people represent problems and ho them. Given that linkage, they conclude greater functional diversity, identity-dive form homogeneous groups (4–6).

Building on earlier ideas from the ps intelligence literatures (7), we describe work for modeling problem solvers that diversity that cognitive psychologists an rists claim is correlated with identity diver agents possess internal representations call perspectives, and algorithms that they which we call heuristics. Together, a pe creates a mapping from the space of pos A diverse group is one whose agents' ma perspective-heuristic framework is not show in an earlier paper (8) that two distinct perspectives and heuristics can space of solutions. However, the advantag is that it generalizes models in the comp that focus on diverse heuristics (1, 2), a nizational behavior and psychology literature, which often em-phasize diverse perspectives (3, 4, 6).

The conclusion that identity-diverse groups can outperform homogeneous groups due to their greater functional diversity rests upon a well accepted claim that if agents across groups have equal ability, functionally diverse groups outperform homoge-neous groups. It has also been shown that functionally diverse

This paper was submitted directly (Track II) to the PNAS office.

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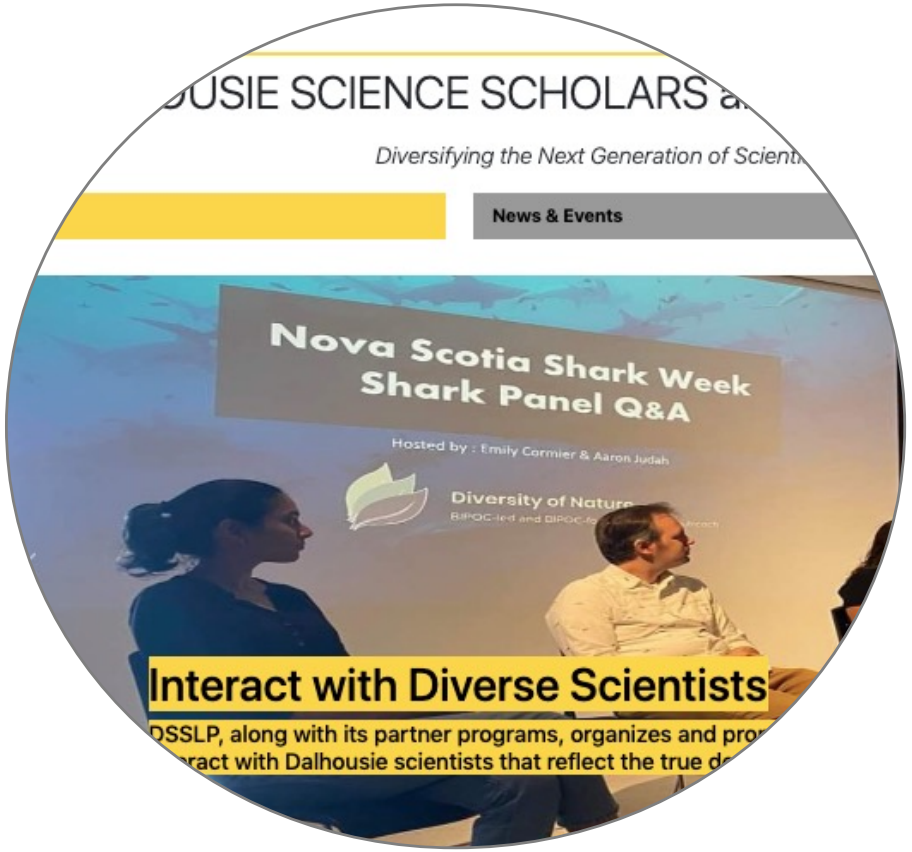
"The main result of this paper provides conditions under which, in the limit, a random group of intelligent problem solvers will outperform a group of the best problem solvers."

"An ideal group would contain high-ability problem solvers who are diverse."

"… even if we were to accept the claim that IQ tests, Scholastic Aptitude Test scores, and college grades predict individual problem-solving ability, they may not be as important in determining a person's potential contribution as a problem solver as would be measures of how differently that person thinks."

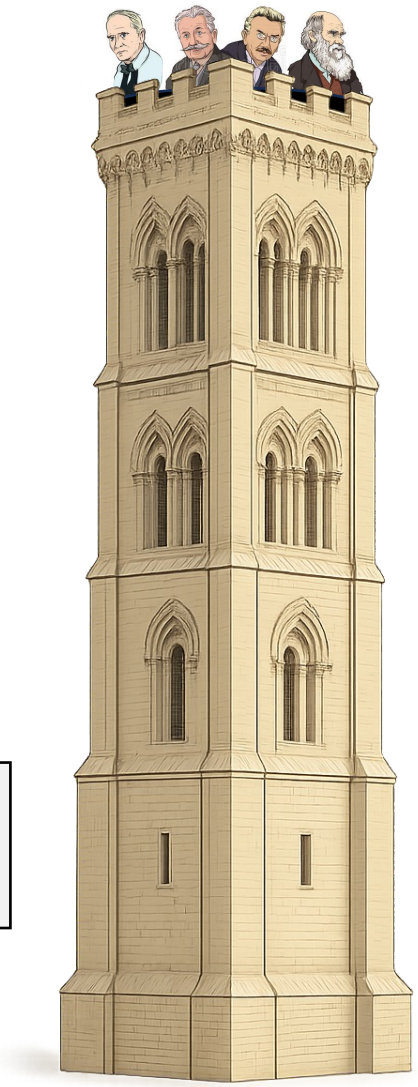


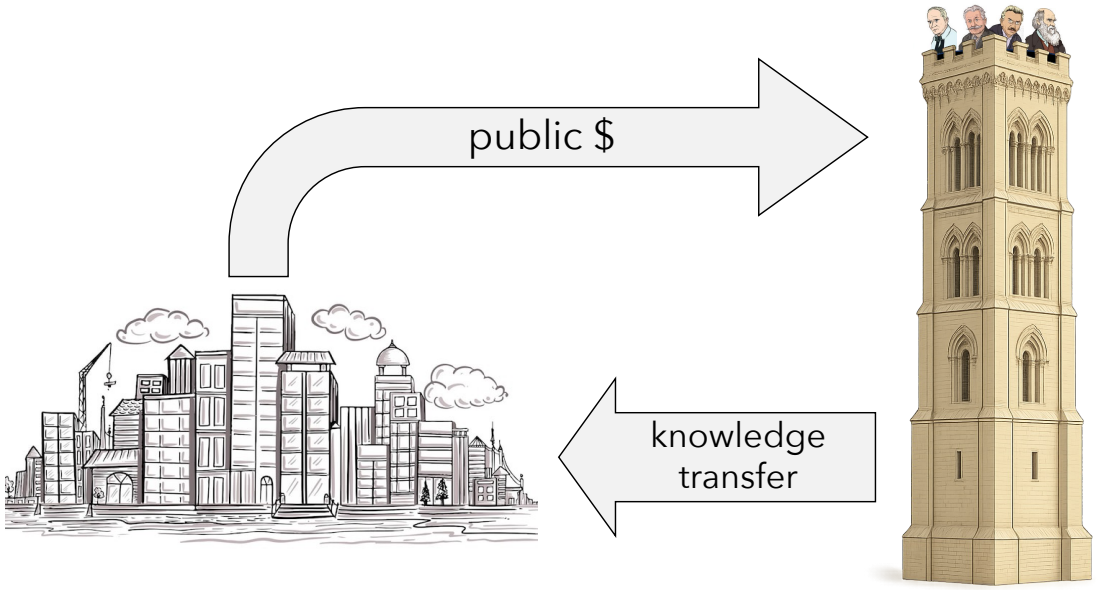
6. *Decline of the social contract between science and society*

Government funds science on behalf of society

public $

knowledge transfer





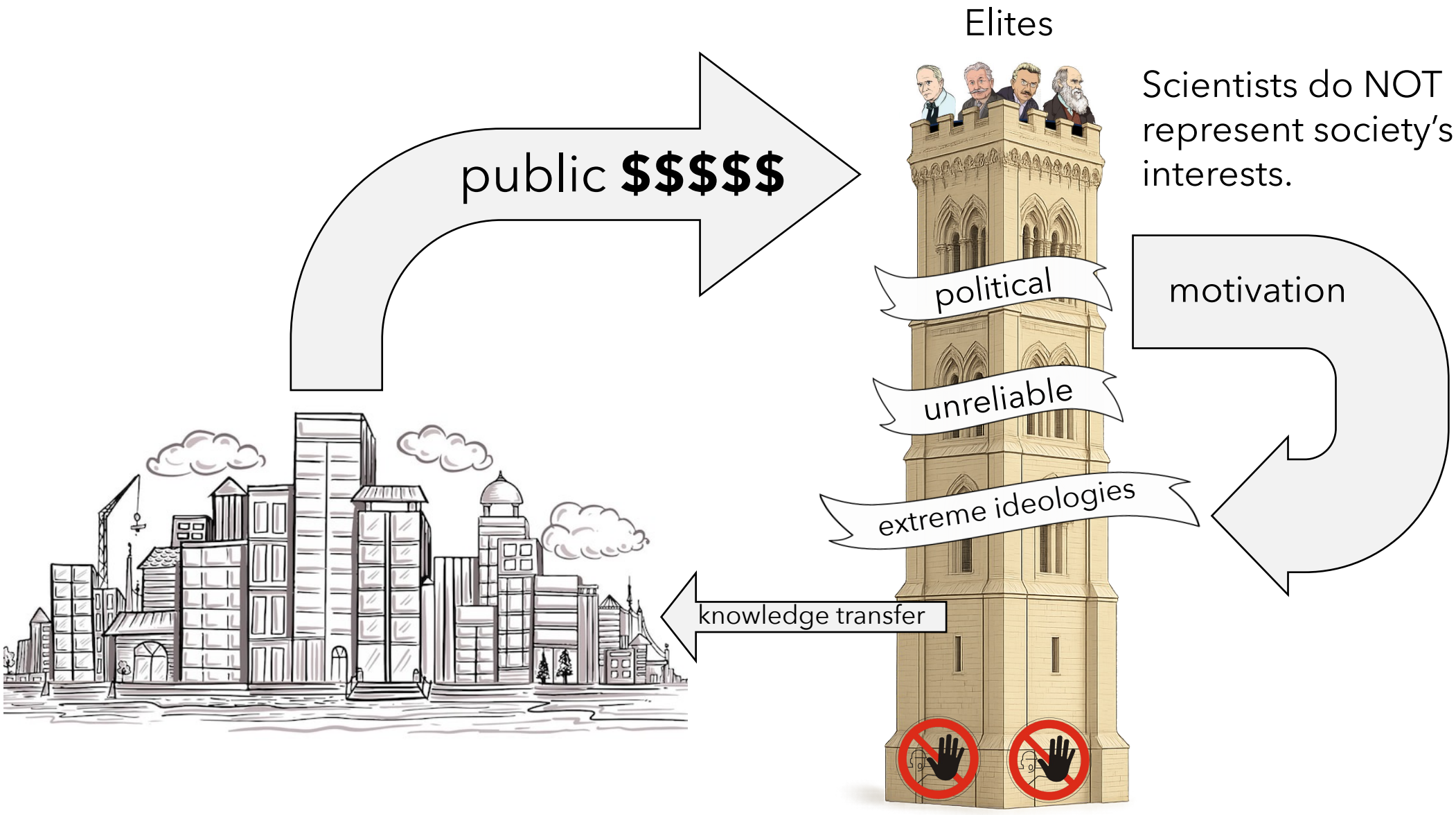
(negotiated when trust in science was highest)

Social contract assumes:

1. linear progress: BASIC → APPLIED
2. "pure science" → special value
3. free from social influence (**VFI**)

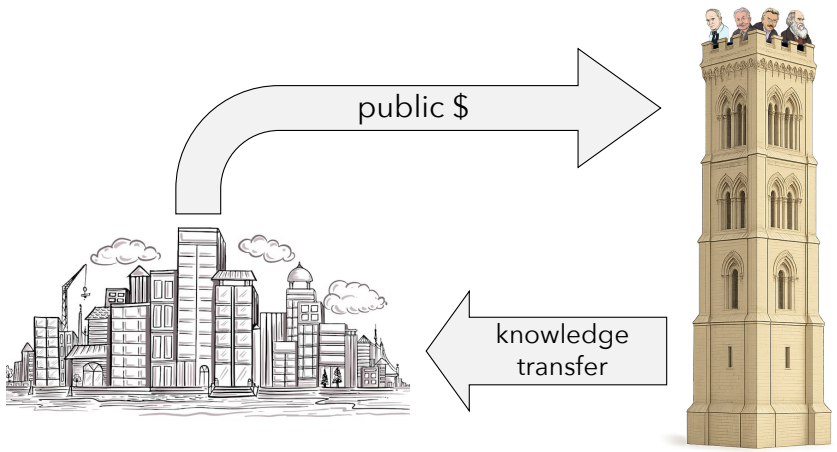
Value Free Ideal (VFI): Discovery of "pure truth" by basic science requires that it is free from social influence, and **to deserve this autonomy scientists must be objective an impartial**.

Public ***perception*** today…



How do we fix the problem?

Reinforce the status quo?



– vs. –

Reform the social contract?

- collective expertise
- co-production (stakeholder) model
- bi-directional sci. comm.
- joint funding of science & humanities
- sci translation as social science
- **values** affirmation in STEM educ.
- **ethics and citizenship** in STEM educ.
- "***truth & responsibility***" in STEM educ.

"I am just a boy who liked frogs."

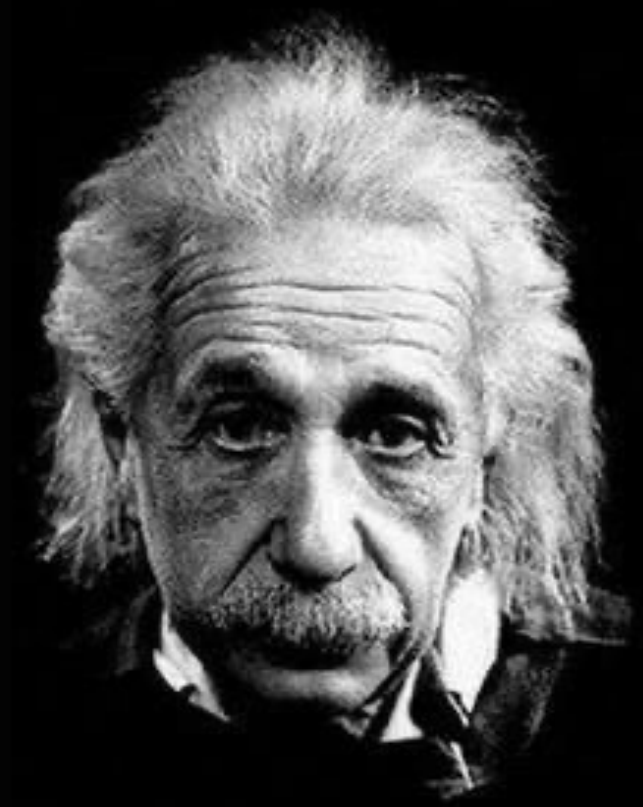
– Tyrone B. Hayes

"We have to change the way we do things in the ivory tower."

"Now, you are here."

"We can change the past, but only if we act now, while there is still a future."

https://www.youtube.com/watch?v=Hu0IXMTFY9Q



Those who have
the privilege to know
have the duty to act.

- Albert Einstein