GROWING CHALLENGES
FOR OUR
GROWING INTEGRITY

Daniele Fanelli

(For infos and all references: danielefanelli.com)

Growing...

- Systems against misconduct
- Concerns for scientific integrity
- Awareness of integrity/misconduct
- Misconduct?
- Biases in the literature
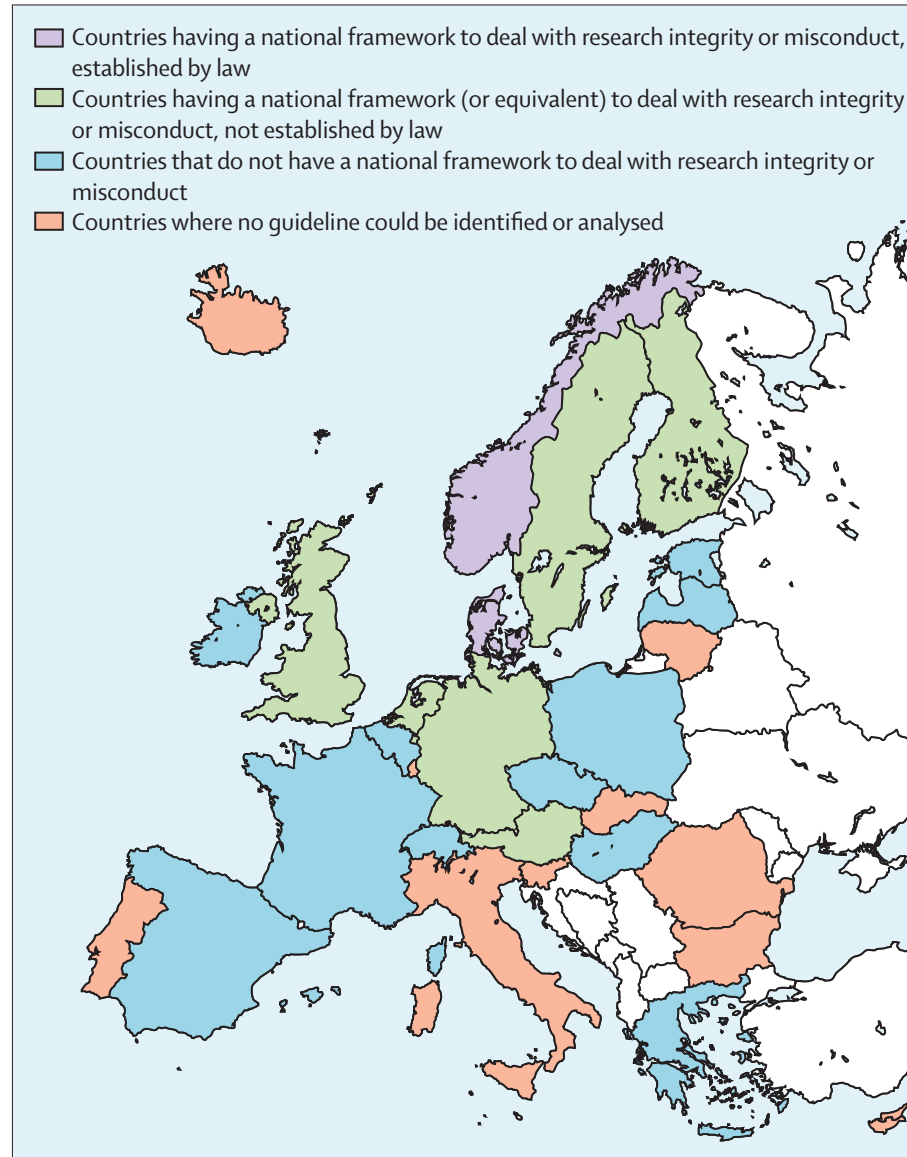- Subtlety of misbehaviours?

Growing systems

(Formal definitions of misconduct, by country and year)

	1981	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
US	x	PHS	NSF	PHS	NSF		x	NAS			x					OSTP		NSF			PHS					
AU						NHMRC								NHMRC						x		x	NHMRC			
DK								DCSD						DCSD					x		DCSD			DCSD		
NO										NCISM							x						NCISM			
DE													MP			DFG										
SW														SRC	x				SMR	SRC						
FI														NREC			TENK									
FR															INSERM											
NL																	KNAW									
CN																		UB				MOT	CAS			
JP																			x	RIKEN		MEXT				
CH																			SAAS							
IN																						ICMR				
CR																							CESHE			
INT																							x		OECD	
UK																									UKRIO	

(RED=Research Institution's Definition; X=unofficial definition)

(Fanelli 2011, in Promoting Research Integrity in a Global Environment)

Growing process

Countries having a national framework to deal with research integrity or misconduct, established by law

Countries having a national framework (or equivalent) to deal with research integrity or misconduct, not established by law

Countries that do not have a national framework to deal with research integrity or misconduct

Countries where no guideline could be identified or analysed

(Godecharle, et al 2013, The Lancet)

Growing literature on scientific misconduct

Web of Science records
title, abstracts or keywords containing:

"research integrity" OR "scientific integrity" OR "research misconduct" OR "scientific misconduct"

"research bias" OR "publication bias" OR "scientific bias" OR "questionable research"
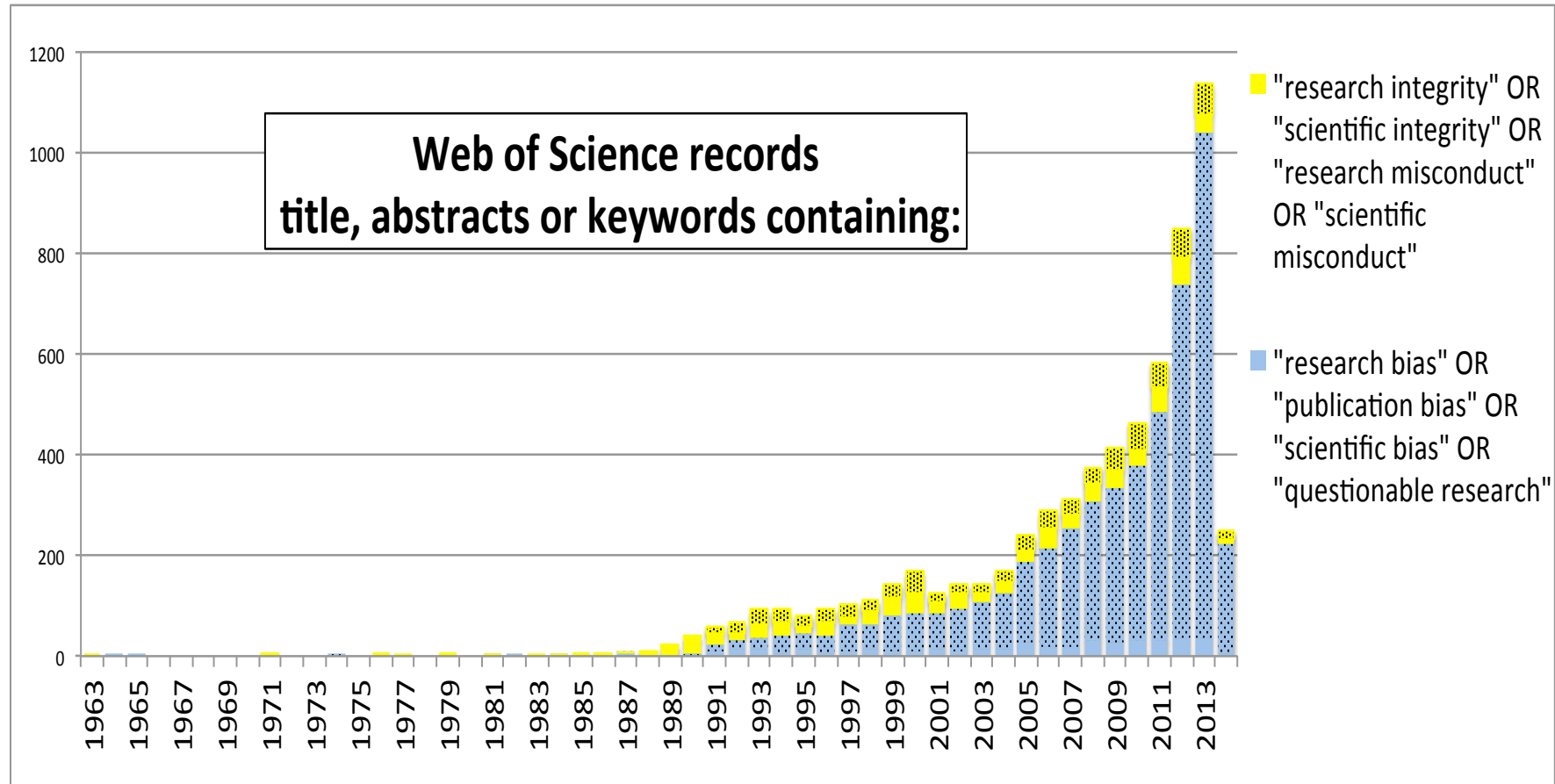
(dotted: articles or reviews)

Growing concerns

[Publish or perish cartoon]

- Growing competition for jobs/funding
- Winners (individuals, institutions, journals) determined by publications/citations/impact
- Everyone striving for constant novelty/ high impact

Growing article productivity & career insecurity

(Study on all INSPEC authors, i.e. physical sciences)
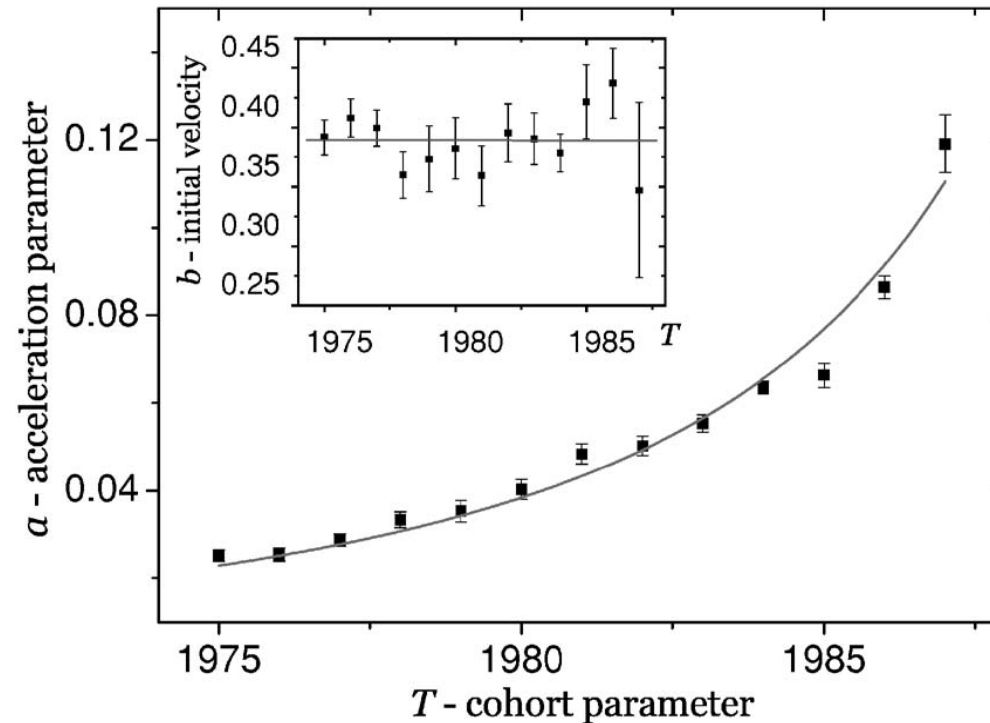
FIG. 6. Acceleration parameter *a* and initial velocity *b* versus cohort parameter *T*. As previously, points represent data retrieved from INSPEC, whereas solid lines express a trend in the data.

(Fronczak et al. 2007, Physical Review E)

Growing submission rates to top-journals
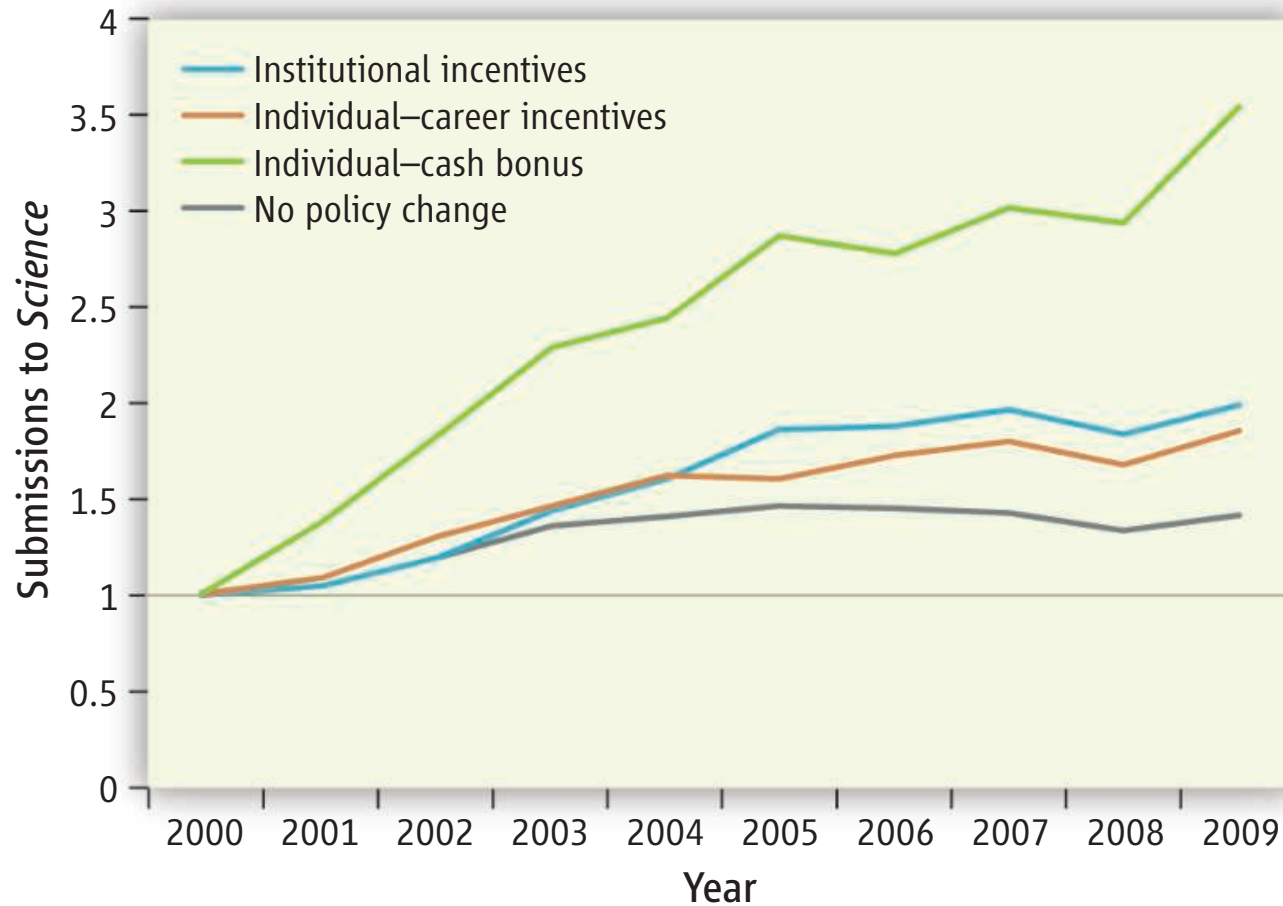
(Franzoni et al. 2011, Science)

Growing misconduct "records"

Is misconduct really growing?
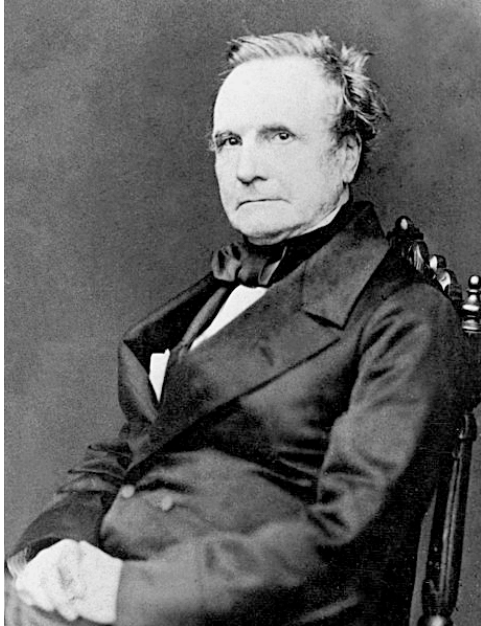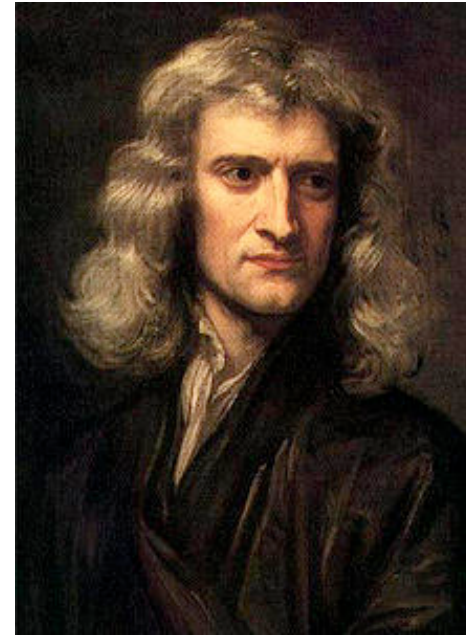
- Charles Babbage (1830). *Reflections on the decline of science in England, and on some of its causes*
  - Hoaxing
  - Forging
  - Trimming
  - Cooking

Growing retractions ⇔ Growing misconduct?

Misconduct accounts for the majority of retracted scientific publications

Ferric C. Fang[a,b,1], R. Grant Steen[c,1], and Arturo Casadevall[d,1,2]

Departments of [a]Laboratory Medicine and [b]Microbiology, University of Washington School of Medicine, Seattle, WA 98195; [c]MediCC! Medical Communications Consultants, Chapel Hill, NC 27517; and [d]Department of Microbiology and Immunology, Albert Einstein College of Medicine, Bronx, NY 10461

Edited by Thomas Shenk, Princeton University, Princeton, NJ, and approved September 6, 2012 (received for review July 18, 2012)

A detailed review of all 2,047 biomedical and life-science research articles indexed by PubMed as retracted on May 3, 2012 revealed | published by the authors of a manuscript in the *Journal of Cell Biology* stated that "In follow-up experiments . . . we have shown

Research ethics

Retractions in the scientific literature: is the incidence of research fraud increasing?

R Grant Steen

The Scientist » News & Opinion

Fraud Breeds Retractions

An analysis of retractions dating back to 1977 shows that most papers are retracted due to misconduct.

By Sabrina Richards | October 1, 2012

EDITORIAL
Retracted Science and the Retraction Index[∇]

The New York Times

SUNDANCE FILM FESTIVAL 2013 OFFICIAL SELECTION

April 16, 2012

A Sharp Rise in Retractions Prompts Calls for Reform

By CARL ZIMMER

## Males Are Overrepresented among Life Science Researchers Committing Scientific Misconduct

Ferric C. Fang,[a] Joan W. Bennett,[b] Arturo Casadevall[c]

Departments of Laboratory Medicine and Microbiology, University of Washington, School of Medicine, Seattle, Washington, USA[a]; Department of Plant Biolo

Or growing ability to respond to misconduct and retract?

Retractions are a recent "invention"
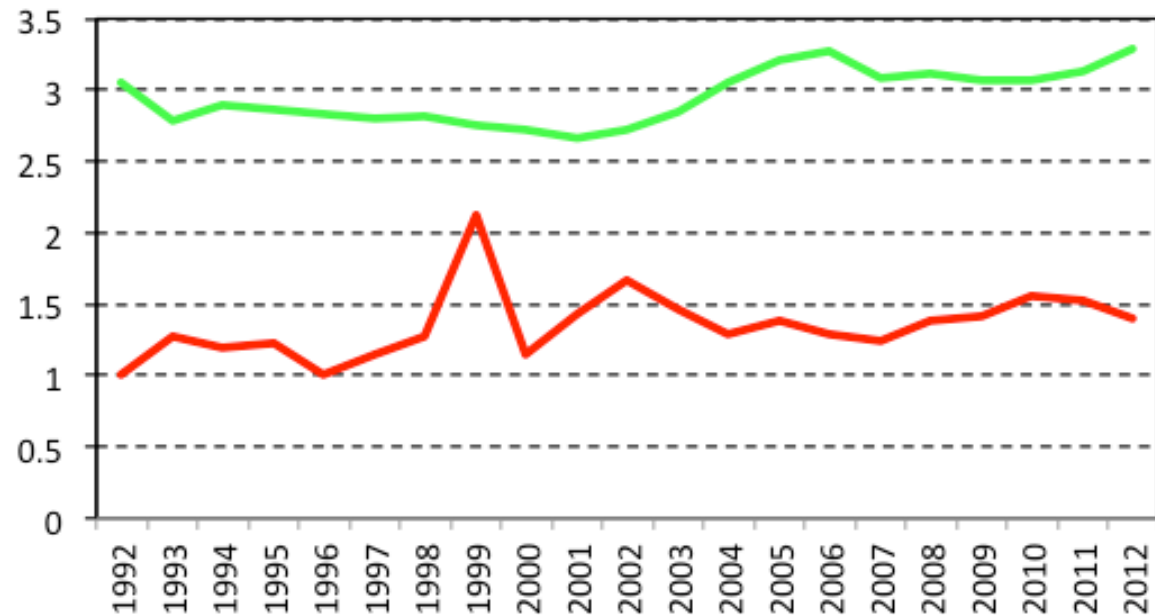
Proportion of corrections and retractions, 1901-2012
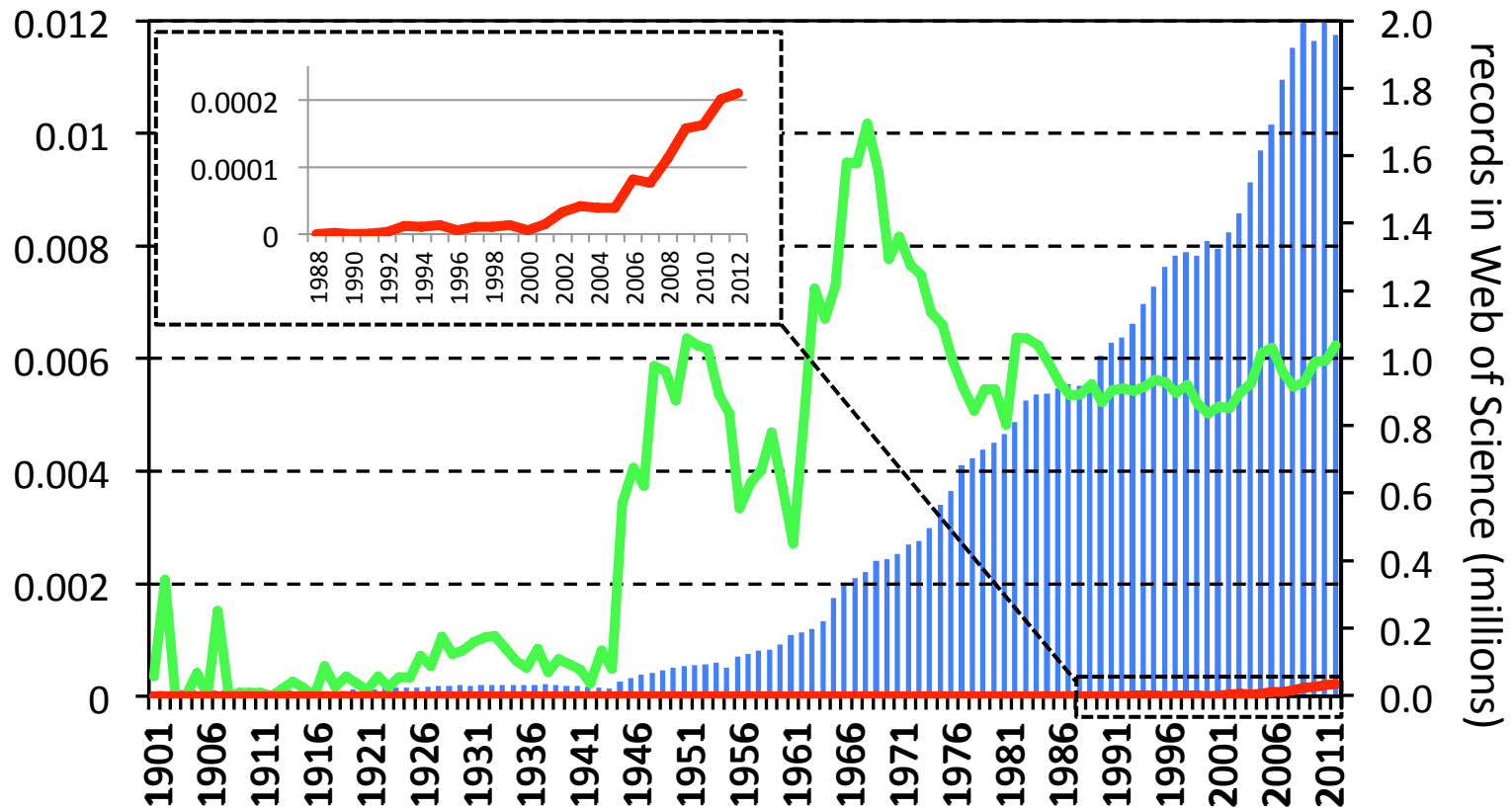
(Fanelli 2013, PLoS Medicine)

Not retractions, but <u>retracting journals</u> are growing
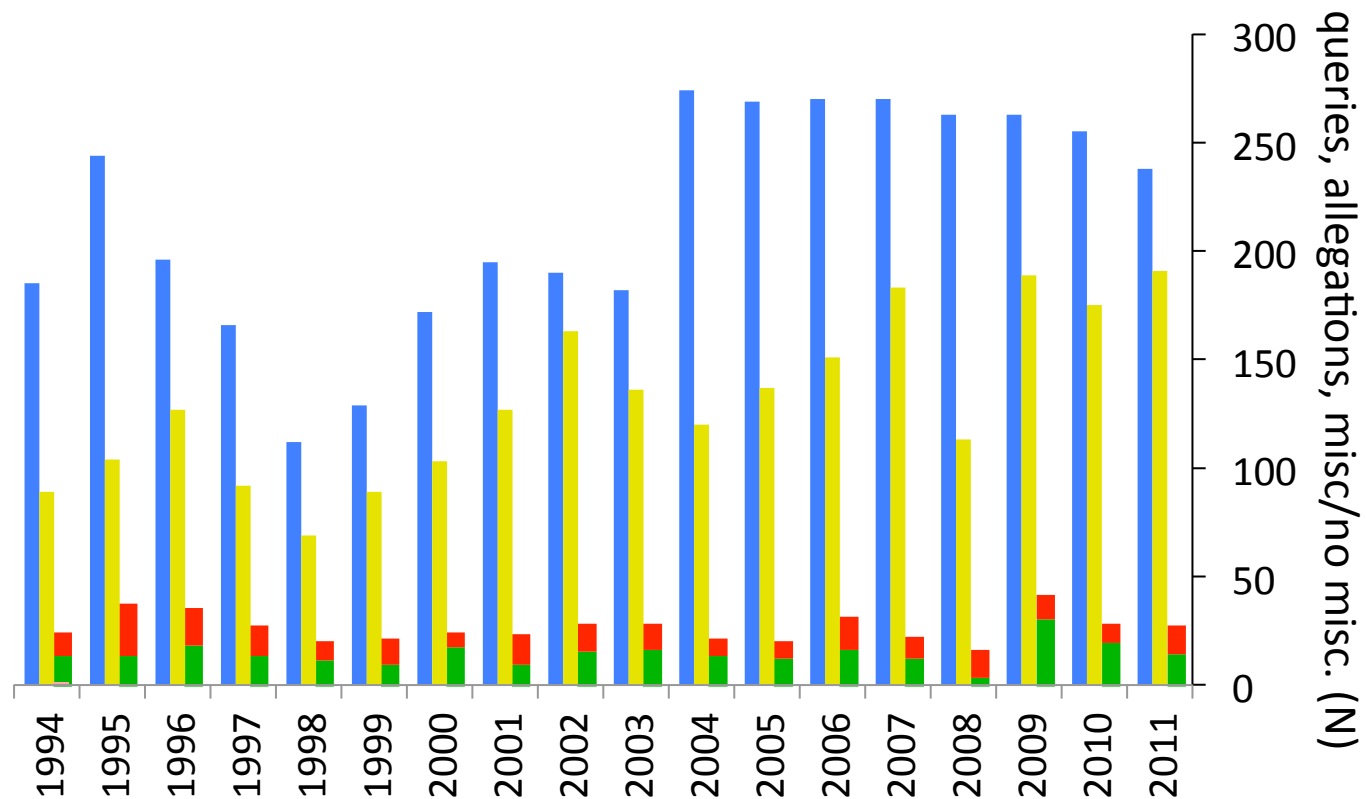
Corrections
_____
correcting journals

Retractions
_____
retracting journal

(Fanelli 2013, PLoS Medicine)

Allegations to US-ORI have grown investigations and findings have not

(Fanelli 2013, PLoS Medicine)

Clear evidence that
awareness is growing

No conclusive evidence that
misconduct is growing

So we have nothing to worry about?

Growing bias in the literature

In abstracts: $\dfrac{\text{"non significant difference"}}{\text{"significant difference"}}$

(a)

n = 18, y = 32 - 0.01x, $R^2 = 0.72$, p < 0.001

proportion of papers in the Science Citation Index (per 1000)

non sign./ sign.

□ "no significant difference*"
♦ "significant difference*"
▲ non sign./sign.

(b)

n = 34, y = -5452 + 5.48 x -0.001x², $R^2 = 0.70$, p < 0.001

proportion of papers in Medline (per 1000)

non sign./sign.

□ "no significant difference*"
♦ "significant difference*"
▲ non sign./sign.

(c)

n = 18, y = 18.4 - 0.01x, $R^2 = 0.23$, p < 0.001

proportion of papers in Social Sciences Citation Index (per 1000)

non sign./sign.

♦ "significant difference*"
□ "no significant difference*"
▲ non sign./sign.

(d)

n = 36, y = 43.5 -0.02x, $R^2 = 0.79$, p < 0.001

proportion of papers in CAB abstracts (per 1000)

non sign./sign.

□ "no significant difference*"
♦ "significant difference*"
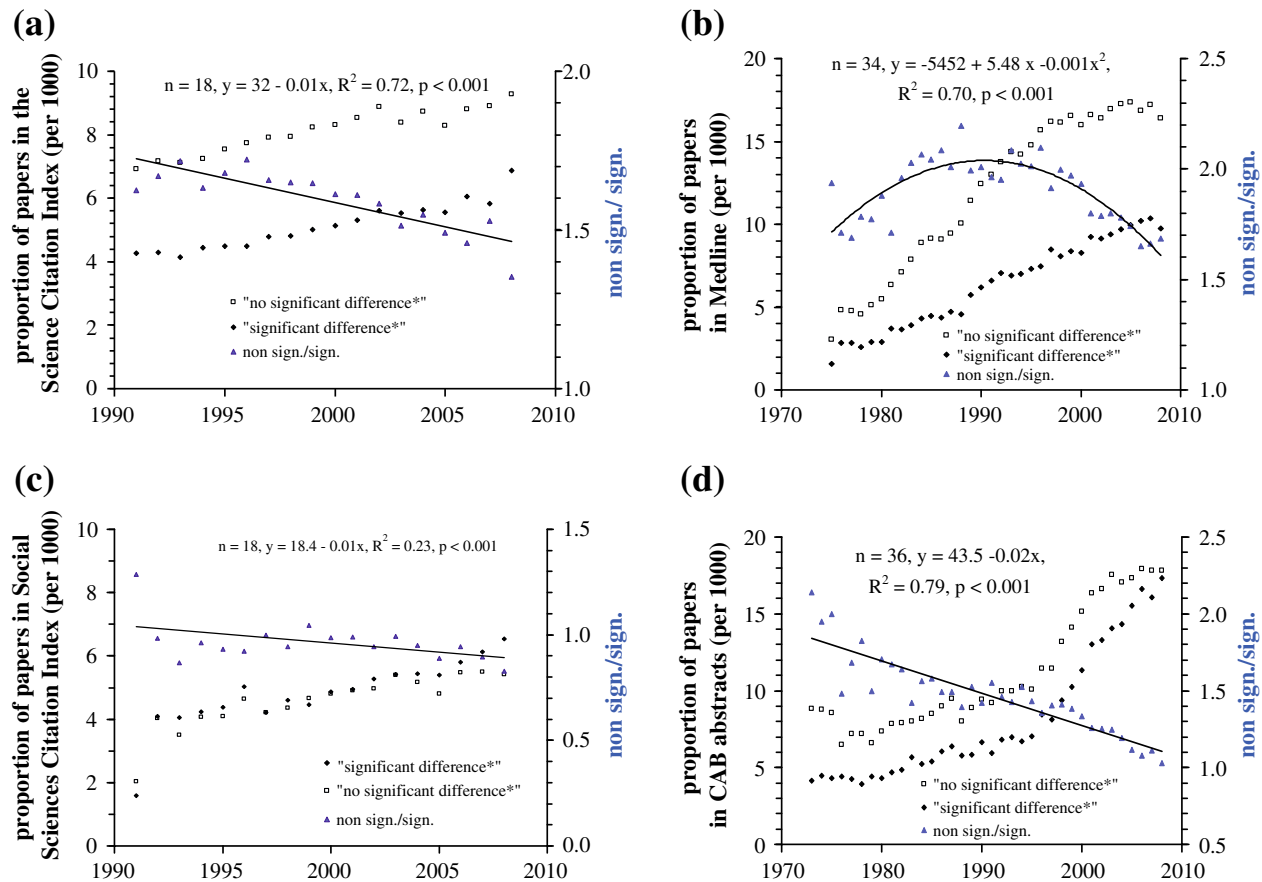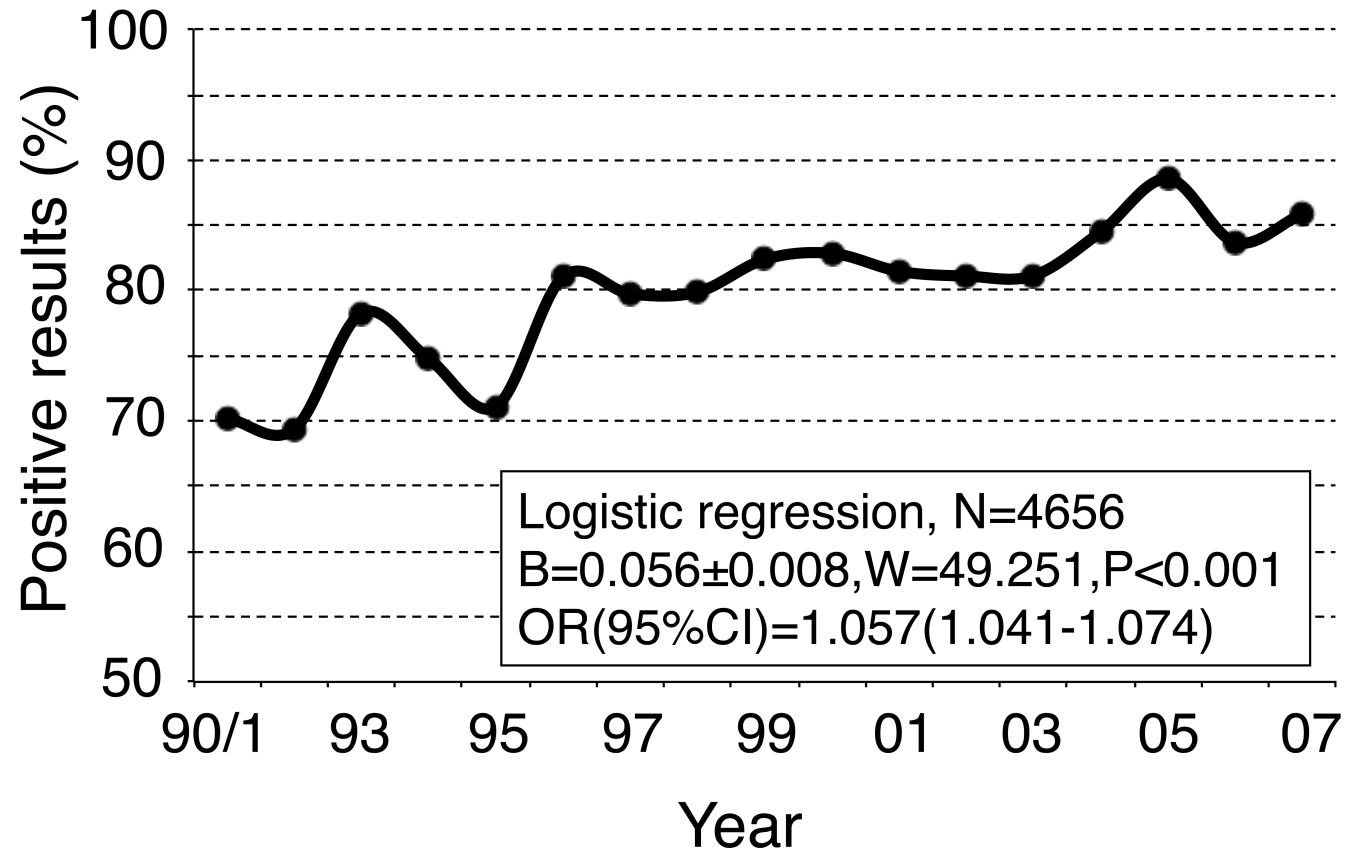▲ non sign./sign.

Fig. 2 Proportion of papers (per 1000) in **a** the Science Citation Index, **b** Medline, **c** the Social Science Citation Index, and **d** CAB Abstracts, reporting the absence or presence of significant differences in the title/abstract, as of March 2009. The ratio between the two variables is provided with a regression line (secondary *y*-axis)

(Pautasso 2010, Scientometrics)

Growing bias in the literature

(Fanelli 2011, Scientometrics)

Growing bias…in <u>some</u> disciplines
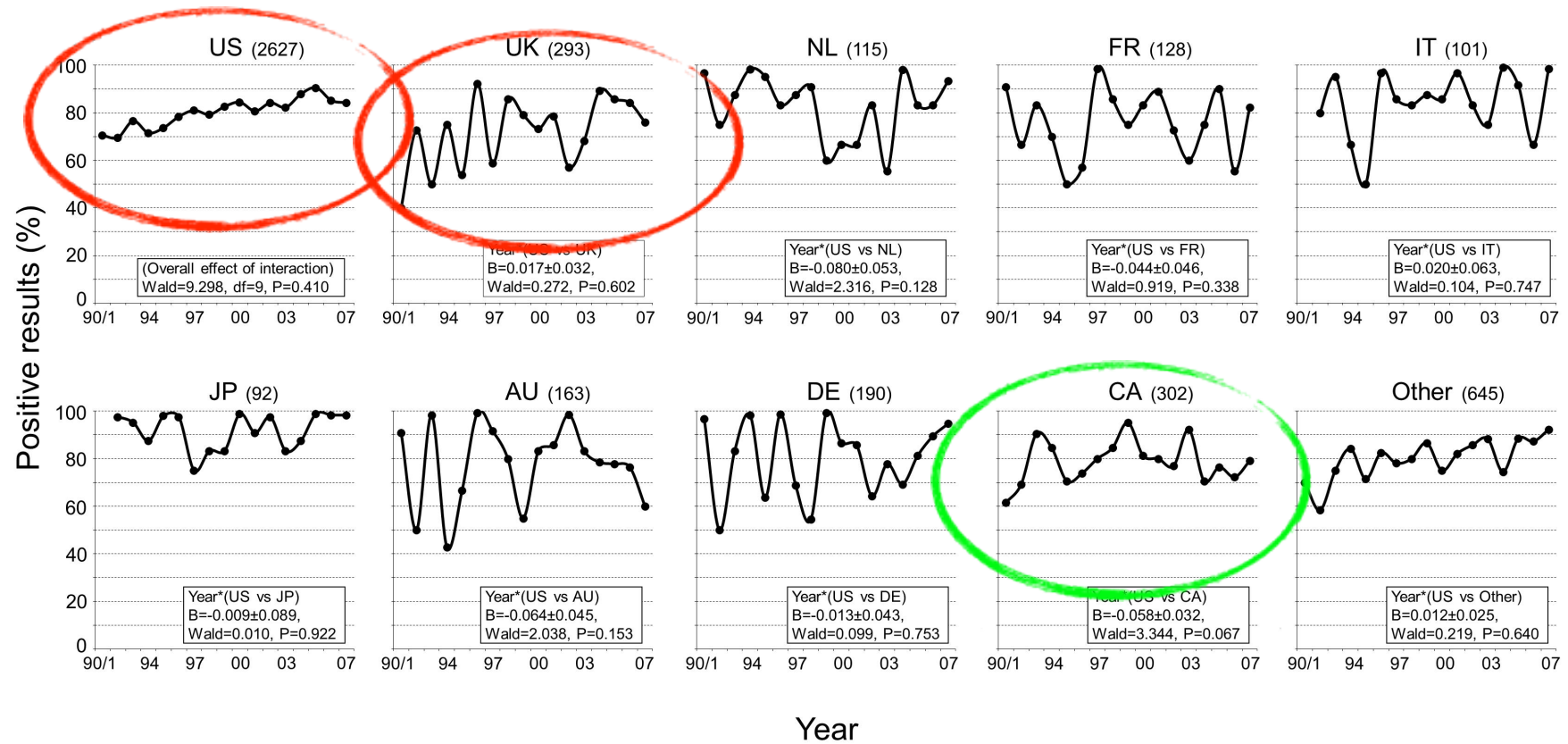
$$\frac{\text{papers that support a tested Hp}}{\text{all papers that "tested" a Hp}}$$
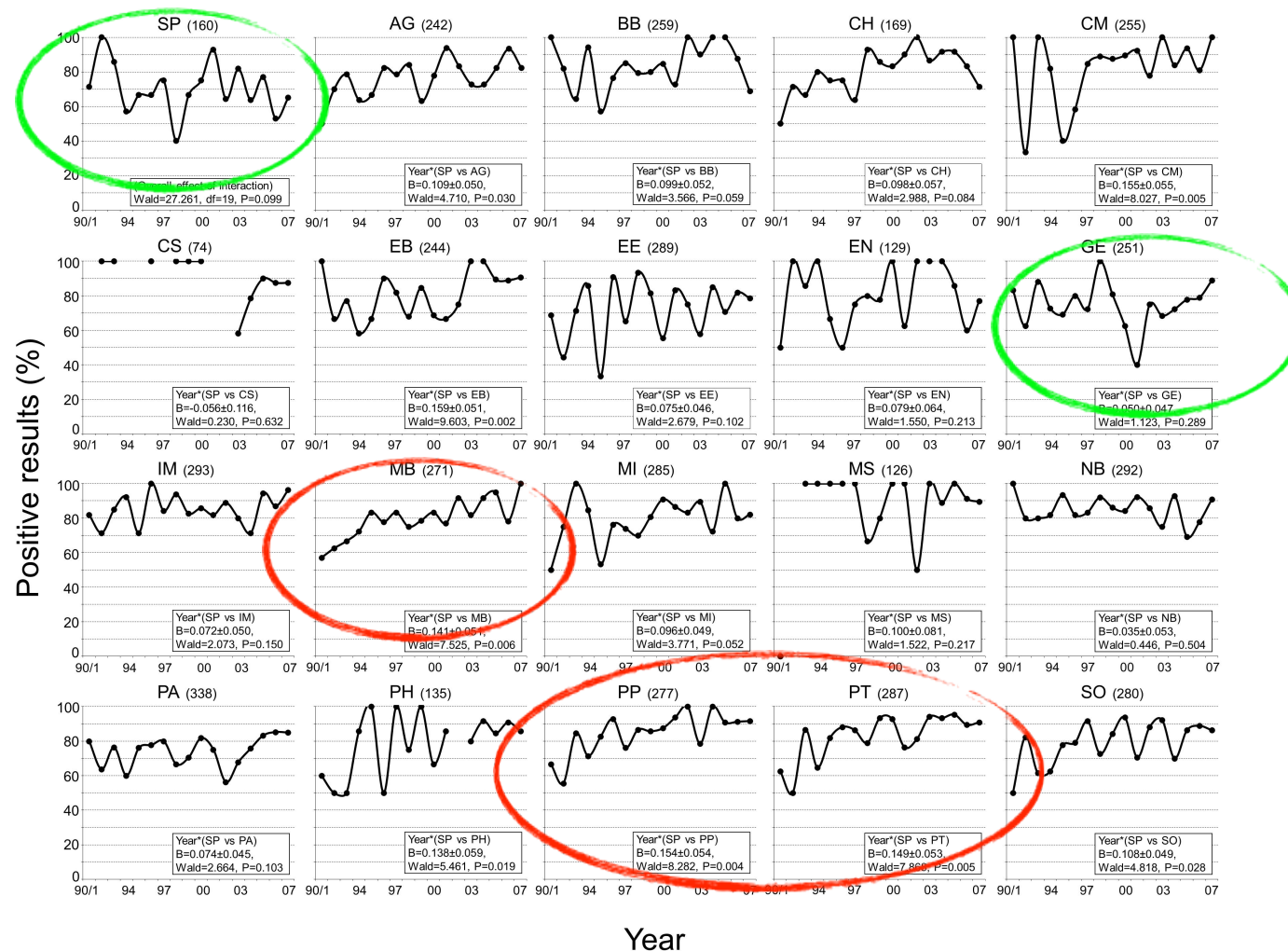
(Fanelli 2011, Scientometrics)
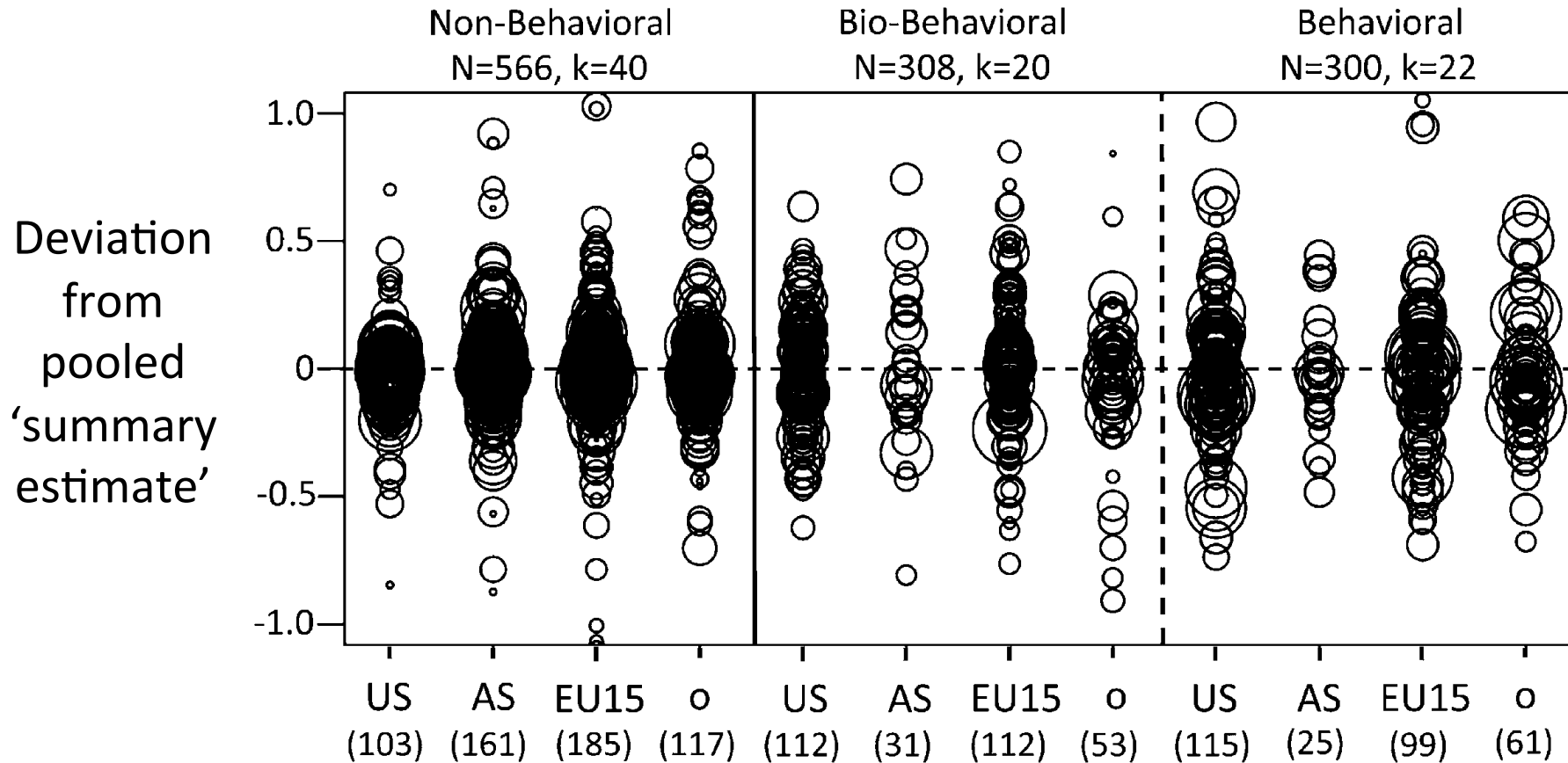
Growing bias...in some countries
(by corresponding author)

The "US effect" ?

Positive results by corresponding author
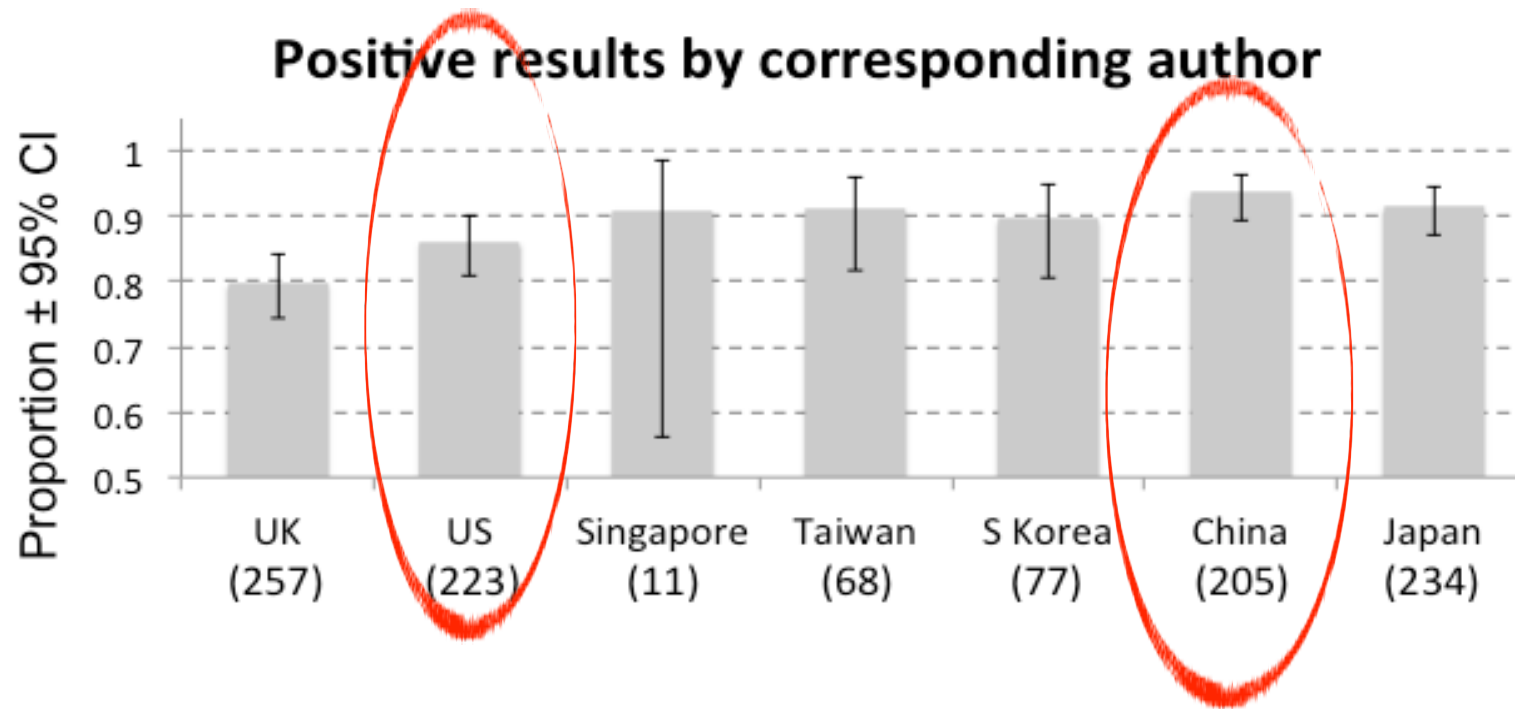
(2008-2009, sampled by country)

(Fanelli 2012, COLLNET Proceedings)

US studies overestimate effect sizes in "softer" studies

(Fanelli and Ioannidis 2013, PNAS)

Growing pressures in the US?

survey to members of an international association for demographers (IUSSP)

| | Agreement to "The pressure to publish is high in my organization" | | Number of publications (last year) | |
| | I | | II | |
	Coefficient	t Value	Coefficient	t Value
Regions: (U.S. = 0)				
Canada, U.K., Australia	−0.34	1.22	−0.25	0.91
Western Europe (excl. U.K.)	−0.89**	3.67	−0.66**	2.70
Asia, Africa, Latin America, Eastern Europe	−1.08**	5.10	−1.16**	5.35
Age	−0.02**	3.11	−0.02*	2.35
Gender (male = 0)	0.30*	2.08	−0.12	0.77
Level of applied/fundamental work (applied = 0)				
Equally applied/fundamental	0.10	0.63	−0.01	0.05
Fundamental	0.33	1.74	0.16	0.84
Level of function (PhD graduate = 0)				
Assistant professor/researcher	−0.01	0.03	1.17**	4.21
Associate professor/researcher	0.35	1.40	1.26**	4.39
Full professor	0.27	0.96	1.85**	5.75
Other (outside academia/retired)	−0.97**	3.55	−0.13	0.41
University (no = 0, yes =1)	0.93**	5.79	0.25	1.49
N		748		699
Pseudo R^2		0.08		0.07

Note. Method of analysis ordered logit of five categories: *Fully disagree, Disagree; Neither agree nor disagree, Agree, Fully agree.*
*$p < 0.05$. **$p < .01$.

(van Dalen and Henkens 2012, JASIST)

Growing bias with productivity, in USA?
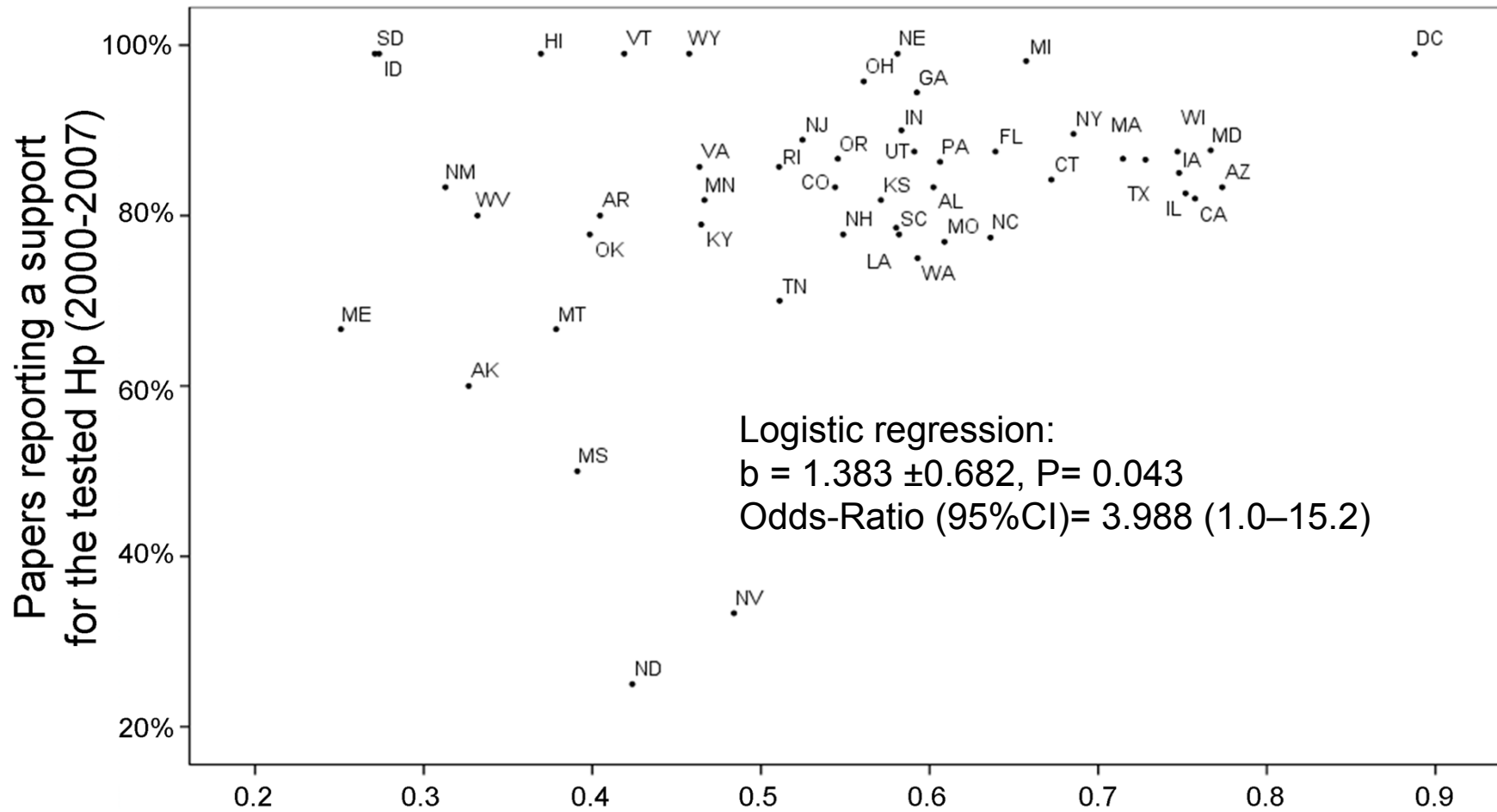
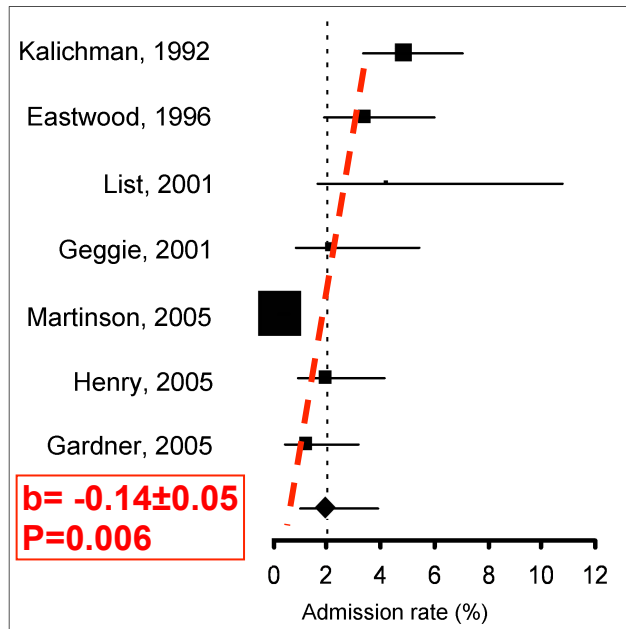(Fanelli 2010, PLoS ONE)

In sum…

- Retractions are not growing
- US ORI findings of misconduct are not growing
- But…
- Pressure to publish are growing
  - Higher in USA
- Biases in the literature are growing
  - Higher in USA
- So…
  - Are researchers committing more misconduct?
  - Are US researchers committing more misconduct?
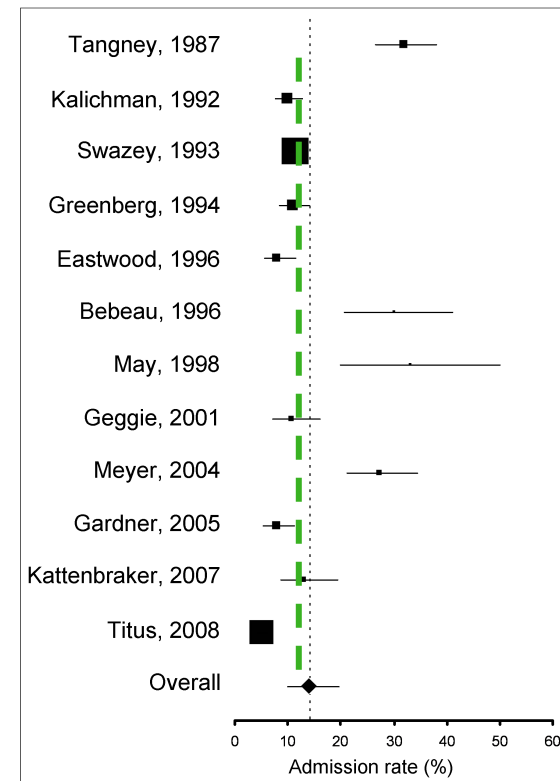
Are scientists becoming more honest?

Scientists who admit fabrication, falsification, or alteration of results

Scientists who know a colleague who fabricated, falsified, or altered results

1.97% (N=7, 95%CI: 0.86-4.45)

(Fanelli 2009, PLoS ONE)

14.12% (N=12, 95% CI: 9.91-19.72)

Or <u>less likely to admit</u> it in surveys?

Are US scientists more honest?

Table 3. Inverse variance-weighted regression on admission rates.

	Variable	B±SE	P	Stand. Coeff.	Model R²
Base Model	Constant	−4.53±0.81	<0.0001	0	0.82
	Self-/Non-self	−3.02±0.38	<0.0001	−1.04	
	Mailed/Handed	−1.17±0.4	0.0032	−0.33	
	"Fabricated, Falsified"/"Modified"	−1.02±0.39	0.0086	−0.34	
Candidate co-variables	Year	−0.03±0.03	0.3	−0.14	0.83
	USA/other	−0.71±0.4	0.08	−0.2	0.8
	Researcher/other	−0.33±0.33	0.32	−0.11	0.83
	Biomedical/other	0.17±0.39	0.66	0.06	0.82
	Medical/other	0.85±0.28	0.0022	0.29	0.89
	Social Sc./other	−0.03±0.37	0.94	−0.01	0.82

The table shows model parameters of an initial model including three methodological factors (top four rows) and the parameter values for each sample characteristic, entered one at a time in the basic model. All variables are binary. Regression slopes measure the change in admission rates when respondents fall in the first category.
doi:10.1371/journal.pone.0005738.t003

(Fanelli 2009, PLoS ONE)

Or <u>less likely to admit</u> it in surveys?

Is our growing awareness of integrity a growing challenge for scientific integrity?

- Growing awareness of « the rules » +

- Growing pressures to perform =

[doping cartoon]

(For infos and all references: danielefanelli.com)