EbM Netzwerk

Darlegung potentieller Interessenkonflikte

Der Inhalt des folgenden Vortrages ist Ergebnis des Bemühens um größtmögliche Objektivität und Unabhängigkeit.

Der Referent versichert, dass in Bezug auf den Inhalt des folgenden Vortrags keine Interessenkonflikte bestehen, die sich aus einem Beschäftigungsverhältnis, einer Beratertätigkeit oder Zuwendungen für Forschungsvorhaben, Vorträge oder andere Tätigkeiten ergeben.

Wertlose Forschung in der präklinischen Medizin

Hamburg, 10.3.2017
ulrich.dirnagl@charite.de
http://dirnagl.com
http://bit.ly/hamburgdirnagl

Präklinische Medizin:
Mehr Wert, weniger Müll

Hamburg, 10.3.2017
ulrich.dirnagl@charite.de
http://dirnagl.com

http://bit.ly/hamburgdirnagl

Metaanalysis of 20.000 animals in neuroprotection trials – all therapies are highly effective

Intervention	No. of Data Sources	No. of Experiments	No. of Animals	Reported Effect Size (95%CI)
Estrogens [10]	27	99	1,452	26.7% (20.4%–33.0%)
FK506 [12]	27	96	1,596	32.0% (27.8%–36.3%)
Growth factors	70	128	1,750	29.7% (25.9%–33.4%)
Hypothermia [40]	98	222	3,256	43.5% (40.1%–47.0%)
IL1-RA [21]	23	44	784	38.2% (31.2%–45.1%)
Melatonin [13]	12	29	443	42.1% (35.7%–48.5%)
Minocycline	8	25	535	30.9% (24.1%–37.6%)
Nicotinamide [11]	11	57	719	29.2% (23.0%–35.5%)
NOS donors [19]	17	40	483	21.4% (13.7%–29.1%)
NOS inhibitors [41]	52	148	1,998	22.2% (17.1%–27.3%)
NXY-059 [14]	9	29	408	43.8% (34.7%–52.8%)
Piracetam and related compounds [18]	5	14	197	29.6% (16.1%–44.4%)
Stem cells	46	112	1,352	29.6% (23.7%–35.4%)
Tirilazad [16]	18	34	544	31.9% (23.1%–40.7%)
tPA [15]	105	256	4,029	22.5% (19.2%–25.9%)
Other thrombolytics	12	26	410	46.6% (35.7%–57.5%)
Pooled analysis	**525***	**1,359**	**19,956**	**31.3% (29.7%–32.8%)**

PLoS Biol. 2010;8(3):e1000344.

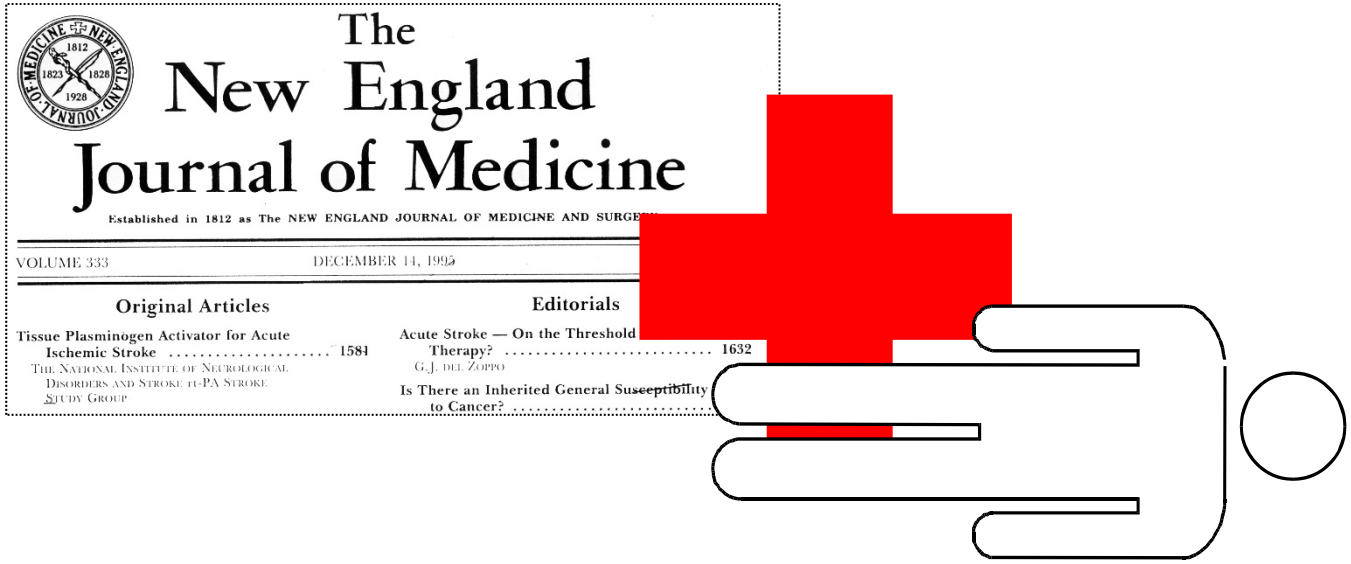
NULL or neutral acute stroke trials (selection…)

Minnerup et al. Exp.Transl. Stroke Med. 2014;6:2

Table 1 Identified phase III studies

Study acronym/study title	Year of publication	Intervention	No. of subjects	Result
PAIS	2009	Acetaminophen	1400	Neutral
AHAIS	2001	Aptiganel	628	Neutral
BEST	1988	Atenolol, Propanolol	302	Neutral
POST-010 and POST-011	*	BMS-204352	1978	Neutral
SCAST	2011	Candesartan	2004	Neutral
Cervene phase 3	2000	Cervene (Nalmefene)	368	Neutral
Citicoline ECCO 2000	2001	Citicoline	899	Neutral
Citicoline 007	1999	Citicoline	394	Neutral
ICTUS	2012	Citicoline	2298	Neutral
CLASS	1999	Clomethiazole	1360	Neutral
CLASS-I	2002	Clomethiazole	1198	Neutral
EGASIS	2006	Diazepam	880	Neutral
MACSI	2013	DP-b99	446	Neutral
EAIS	1998	Ebselen	302	Neutral
EAST	2009	Edaravone	814	Neutral
Eliprodil phase III	*	Eliprodil	483	Neutral
EAST	2001	Enlimomab	625	negative
ESS	2009	Epoetin Alfa	522	Neutral
Fiblast phase III	2002	Fibroblast growth factor	286	Neutral
FIST	1996	Flunarizine	331	Neutral
Fosphenytoin phase III	*	Fosphenytoin	462	Neutral
GAIN International	2000	Gavestinel (GV150526)	1804	Neutral
GAIN Americas	2001	Gavestinel (GV150526)	1367	Neutral
EST	1994	GM1 ganglioside	792	Neutral
SASS	1994	GM1 ganglioside	287	Neutral
IASSH	1989	GM1 ganglioside	502	Neutral
ASCLEPIOS	1994	Israpidine	357	Neutral
LUB-INT-13	2000	Lubeluzole	1786	Neutral
Lub	1997	Lubeluzole	721	Neutral
IMAGES	2004	Magnesium	2589	Neutral
PRISTINE	1996	Naftidrofuryl	620	Neutral
ANS	1992	Nimodipine	1064	Neutral
INWEST	1994	Nimodipine	295	negative
TRUST	1990	Nimodipine	1215	Neutral
VENUS	2001	Nimodipine	454	Neutral
SAINT II	2007	NXY-059	3306	Neutral
SAINT I	2006	NXY-059	1722	positive
RREACT	2007	ONO-2506, Arundic acid	841	Neutral
PASS	1997	Piracetam	927	Neutral
mRECT	2009	Repinotan	681	Neutral
ASSIST	2000	Selfotel (CGS19755)	567	Neutral
RANTTAS	1996	Tirilazad mesylate	556	Neutral
RANTTAS II	1998	Tirilazad mesylate	126	Neutral
NEST-2	2009	Transcranial laser therapy	660	Neutral
ASTIN	2003	UK279,276	966	Neutral
ARTIST+	*	YM872	312	Neutral

Only thrombolysis clinically effective!



I.v. thrombolysis is the only clinically proven pharmacological therapy of acute ischemic stroke. Benefit only to a small percentage of stroke victims.(ARR 2%)

There is no therapeutic ,neuroprotection or 'neuroregeneration' in human stroke.

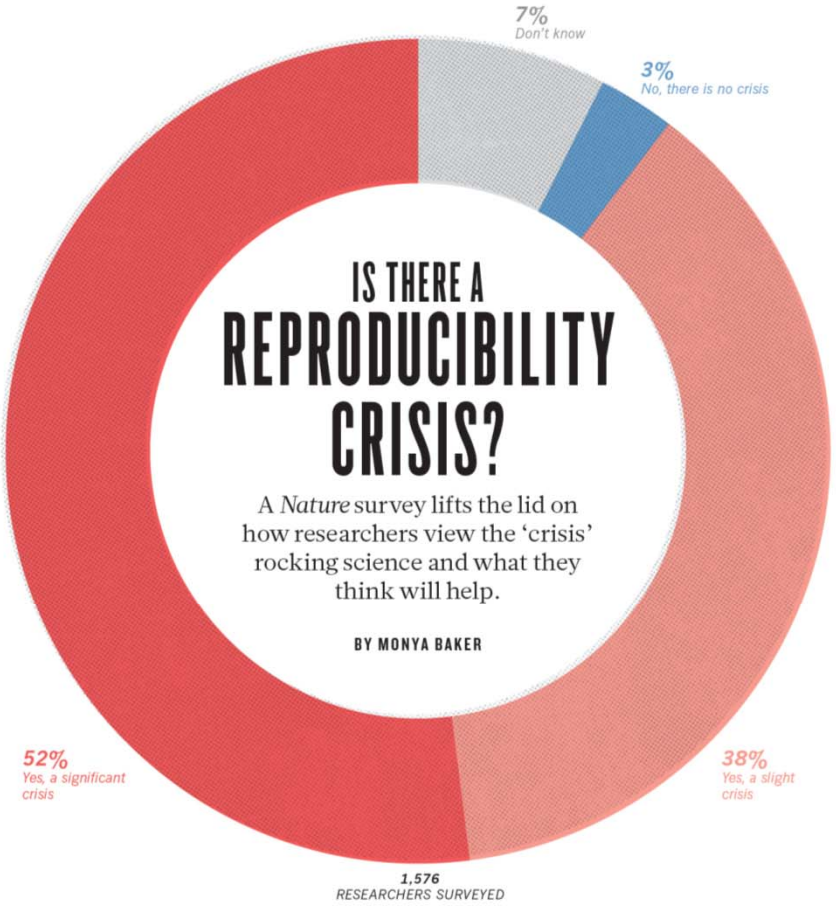
How solid are the preclinical foundations of translational medicine? _____

nature

ILLUSTRATION BY RICHARD WILKINSON

Consider drug efficacy before first-in-human trials

Ethical review boards must focus on clinical promise as well as safety to hold the first tests of drugs in humans to a higher standard, say **Jonathan Kimmelman** and **Carole Federico**.



THE CAUSE

The survey asked scientists what led to problems in reproducibility. More than 60% of respondents said that each of two factors — pressure to publish and selective reporting — always or often contributed. More than half pointed to insufficient replication in the lab, poor oversight or low statistical power.

WHAT CAN BE DONE?

Respondents were asked to rate 11 different approaches to improving reproducibility in science, and all got ringing endorsements. Nearly 90% — more than 1,000 people — ticked "More robust experimental design" "better statistics" and "better mentorship".

John Ioannidis

Open access, freely available online

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

Summary

There is increasing concern that most current published research findings are false. The probability that a research claim is true may depend on study power and bias, the number of other studies on the same question, and, importantly, the ratio of true to no relationships among the relationships probed in each scientific field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance. Simulations show that for most study designs and settings, it is more likely for a research claim to be false than true. Moreover, for many current scientific fields, claimed research findings may often be simply accurate measures of the prevailing bias. In this essay, I discuss the implications of these problems for the conduct and interpretation of research.

Published research findings are sometimes refuted by subsequent evidence, with ensuing confusion and disappointment. Refutation and controversy is seen across the range of research designs, from clinical trials and traditional epidemiological studies [1–3] to the most modern molecular research [4,5]. There is increasing concern that in modern research, false findings may be the majority or even the vast majority of published research claims [6–8]. However, this should not be surprising. It can be proven that most claimed research findings are false. Here I will examine the key factors that influence this problem and some corollaries thereof.

The Essay section contains opinion pieces on topics of broad interest to a general medical audience.

Modeling the Framework for False Positive Findings

Several methodologists have pointed out [9–11] that the high rate of nonreplication (lack of confirmation) of research discoveries is a consequence of the convenient, yet ill-founded strategy of claiming conclusive research findings solely on the basis of a single study assessed by formal statistical significance, typically for a p-value less than 0.05. Research is not most appropriately represented and summarized by p-values, but, unfortunately, there is a widespread notion that medical research articles

It can be proven that most claimed research findings are false.

should be interpreted based only on p-values. Research findings are defined here as any relationship reaching formal statistical significance, e.g., effective interventions, informative predictors, risk factors, or associations. "Negative" research is also very useful. "Negative" is actually a misnomer, and the misinterpretation is widespread. However, here we will target relationships that investigators claim exist, rather than null findings.

As has been shown previously, the probability that a research finding is indeed true depends on the prior probability of it being true (before doing the study), the statistical power of the study, and the level of statistical significance [10,11]. Consider a 2×2 table in which research findings are compared against the gold standard of true relationships in a scientific field. In a research field both true and false hypotheses can be made about the presence of relationships. Let R be the ratio of the number of "true relationships" to "no relationships" among those tested in the field. R is characteristic of the field and can vary a lot depending on whether the field targets highly likely relationships or searches for only one or a few true relationships among thousands and millions of hypotheses that may be postulated. Let us also consider, for computational simplicity, circumscribed fields where either there is only one true relationship (among many that can be hypothesized) or the power is similar to find any of the several existing true relationships. The pre-study probability of a relationship being true is $R/(R + 1)$. The probability of a study finding a true relationship reflects the power $1 - \beta$ (one minus the Type II error rate). The probability of claiming a relationship when none truly exists reflects the Type I error rate, α. Assuming that c relationships are being probed in the field, the expected values of the 2×2 table are given in Table 1. After a research finding has been claimed based on achieving formal statistical significance, the post-study probability that it is true is the positive predictive value, PPV. The PPV is also the complementary probability of what Wacholder et al. have called the false positive report probability [10]. According to the 2×2 table, one gets $PPV = (1 - \beta)R/(R - \beta R + \alpha)$. A research finding is thus

Citation: Ioannidis JPA (2005) Why most published research findings are false. PLoS Med 2(8): e124.

Abbreviation: PPV, positive predictive value

John P. A. Ioannidis is in the Department of Hygiene and Epidemiology, University of Ioannina School of Medicine, Ioannina, Greece, and Institute for Clinical Research and Health Policy Studies, Department of Medicine, Tufts-New England Medical Center, Tufts University School of Medicine, Boston, Massachusetts, United States of America. E-mail: jioannid@cc.uoi.gr

Competing Interests: The author has declared that no competing interests exist.

DOI: 10.1371/journal.pmed.0020124

4000 cit.

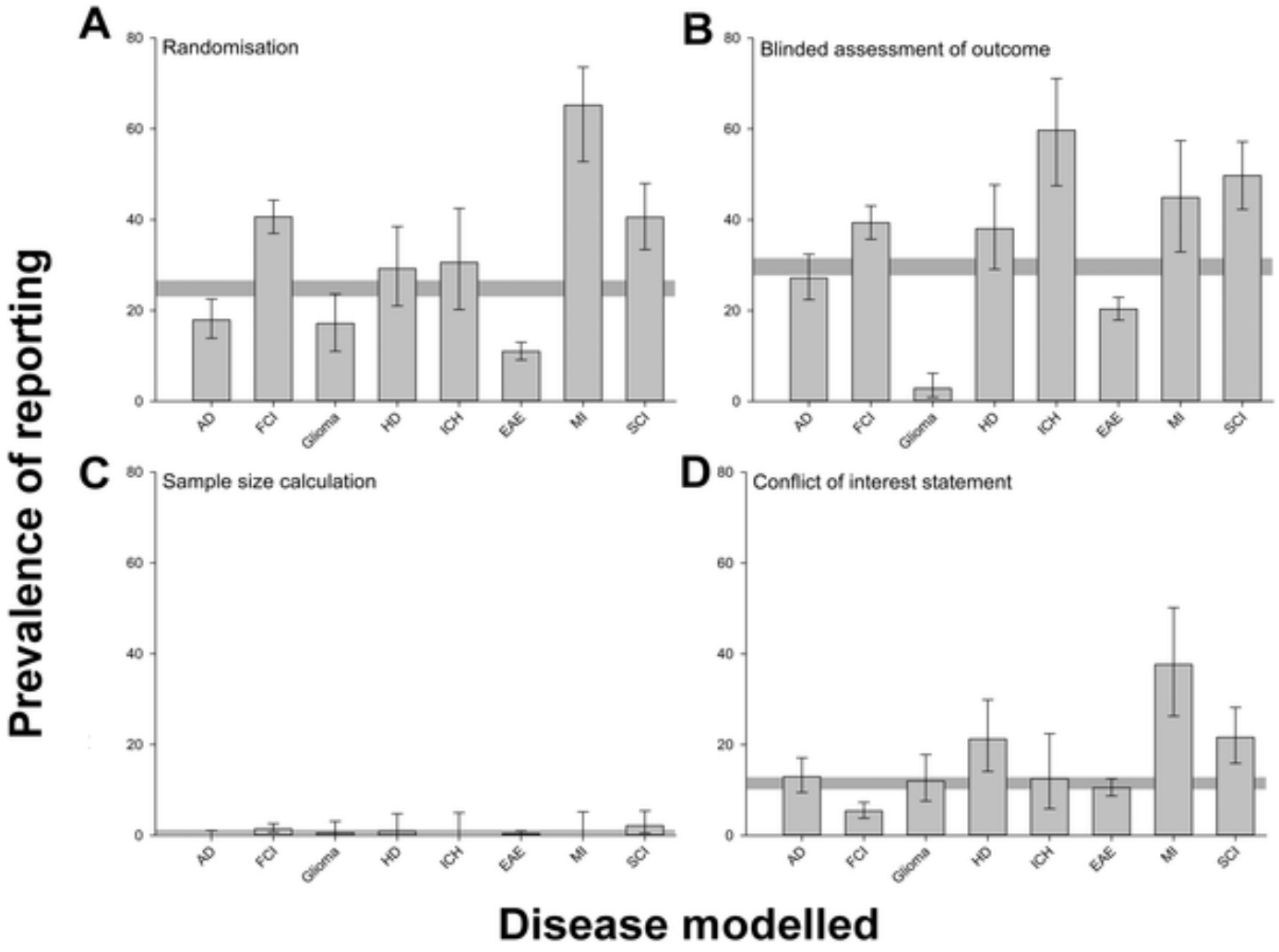
Internal validity

- selection bias (creating groups with different confounders; solved by randomization)

- performance bias and detection bias (investigators respectively treating or assessing more positively those subjects on the treatment arm; controlled by blinding interventions and outcome assessments)

- attrition bias (dropouts of subjects with a negative outcome not included in the final result)

Low prevalence of methods to prevent bias ____



Macleod MR, et al. (2015) Risk of Bias in Reports of In Vivo Research:
A Focus for Improvement. PLoS Biol 13: e1002273.

Effects of attrition in experimental biomedical research

PLOS | BIOLOGY

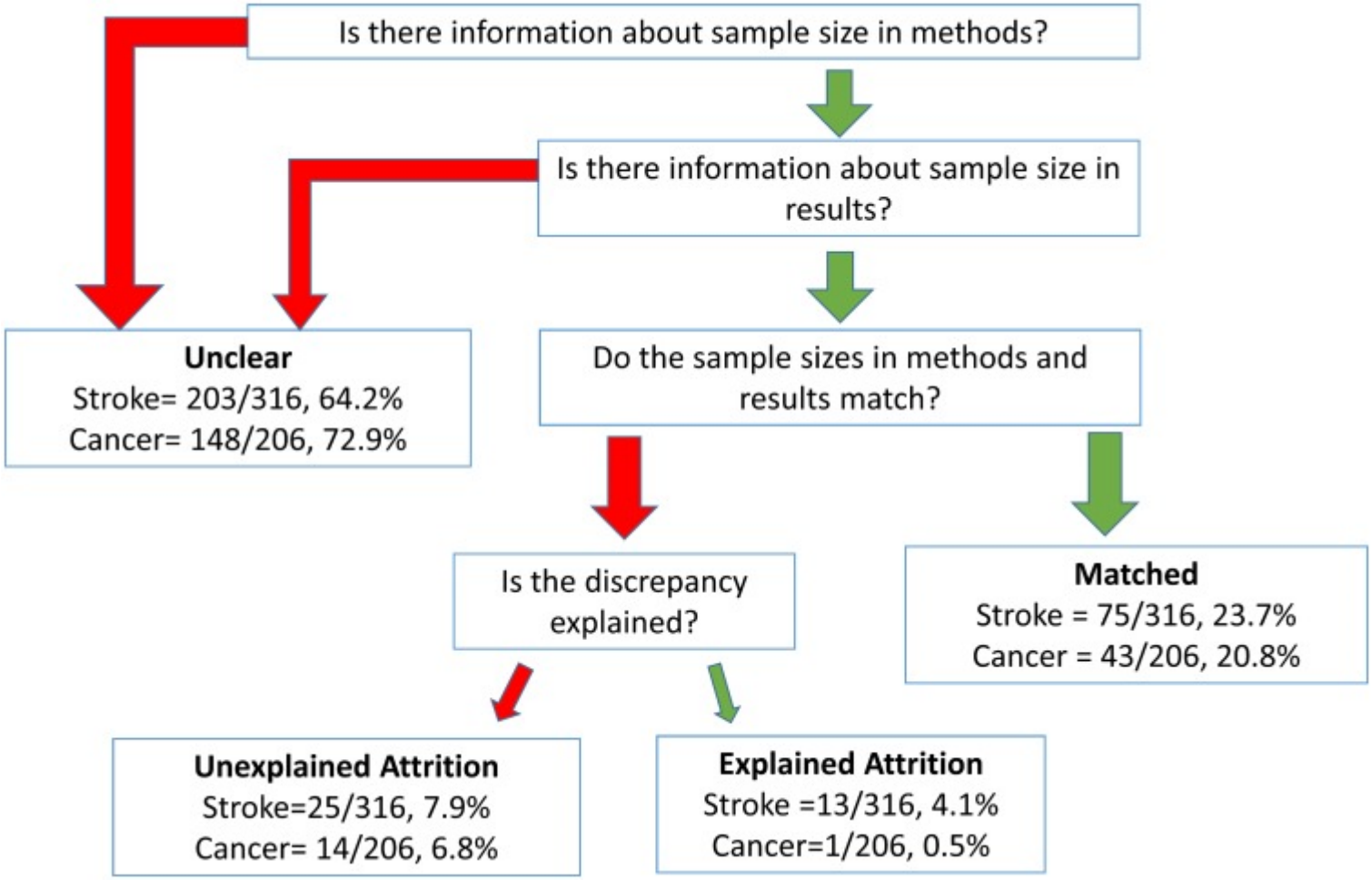
META-RESEARCH ARTICLE

Where Have All the Rodents Gone? The Effects of Attrition in Experimental Research on Cancer and Stroke

Constance Holman[1], Sophie K. Piper[2,3], Ulrike Grittner[3,4], Andreas Antonios Diamantaras[1], Jonathan Kimmelman[5], Bob Siegerink[3], Ulrich Dirnagl[2,3,6,7,8]*

PLoS Biol. 2016;14:e1002331

Effects of attrition in experimental biomedical research



PLoS Biol. 2016;14:e1002331

Low n's = low power, many false positives, inflated effect sizes

Mean group size n ≈ 8

Mean statistical power ≈ 45 %

False positive rate ($p \leq 0.05$): ≈ 50 %

Overestimation of true effects: ≈ 50 %

Collaborative Approach to Meta Analysis and

·C·A·M·A·R·A·D·E·S·

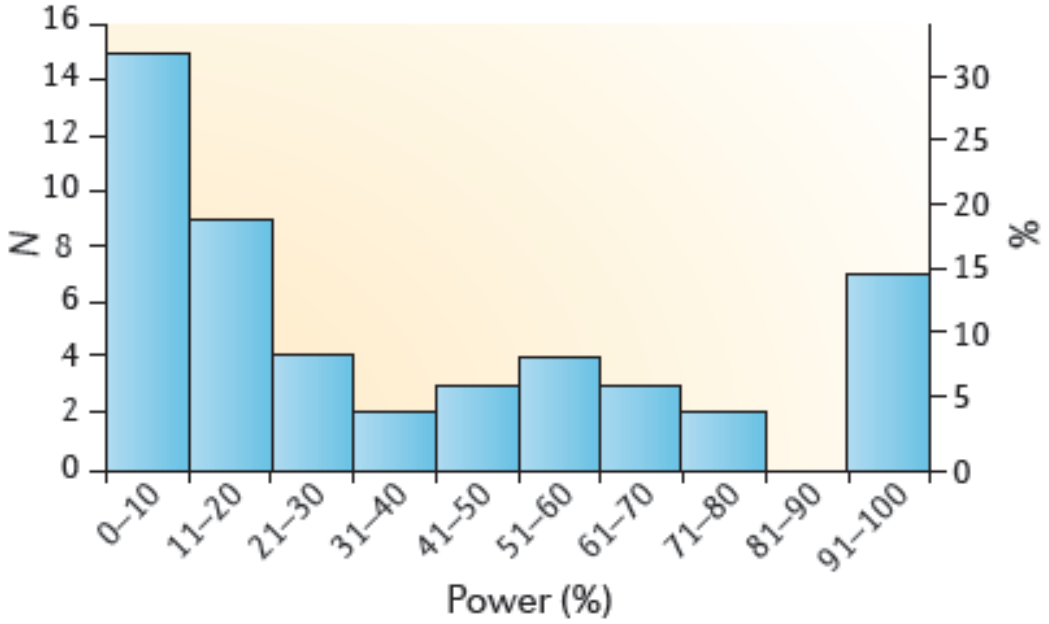
Review of Animal Data from Experimental Studies

False positives and inflation of effect sizes _

Power failure: why small sample size undermines the reliability of neuroscience

Katherine S. Button[1,2], John P. A. Ioannidis[3], Claire Mokrysz[1], Brian A. Nosek[4], Jonathan Flint[5], Emma S. J. Robinson[6] and Marcus R. Munafò[1]

Nature Reviews Neuroscience | AOP, published online 10 April 2013; doi:10.1038/nrn3475



Overall median power of 730 primary neuroscience studies: **21** %

Even without bias and p-hacking, many statistically significant results are false positives, and effect sizes are inflated _____

- **Low base rates (low prior probability)**
- **Low power (small n's, high variance, low effect size)**
- **Winner's curse**
- **Regression to the mean**

Bias against the NULL hypothesis

***p* > 0.05**
Repeat experiment, add animals or repeat statistics with different test (e.g. contrast) (i.e. p-hack), remove outliers (to nudge effect size in proper direction), try different strategy (antibody, assay, claim that the previous one 'did not work'), etc.

Once mission accomplished (p<0.05): don't talk about how you got there.

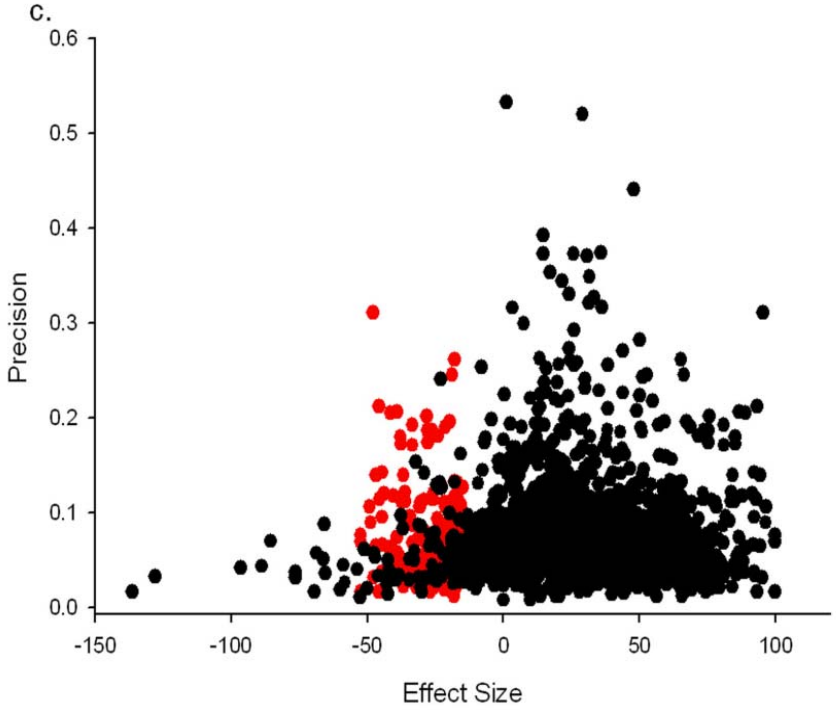
***p* < 0.05**
Move on to next experiment, write paper

Publication bias accounts for 30% of the reported efficacy of candidate neuroprotective interventions

OPEN ACCESS Freely available online PLoS BIOLOGY

Publication Bias in Reports of Animal Stroke Studies Leads to Major Overstatement of Efficacy

Emily S. Sena[1,2,3], H. Bart van der Worp[4], Philip M. W. Bath[5], David W. Howells[2,3], Malcolm R. Macleod[1,6]*



"Only ten publications (2%) [of 525] reported no significant effects on infarct volume and only six (1.2%) did not report at least one significant finding."

PLoS Biol. 2010; 8 e1000344

Non-publication of results: Publication bias

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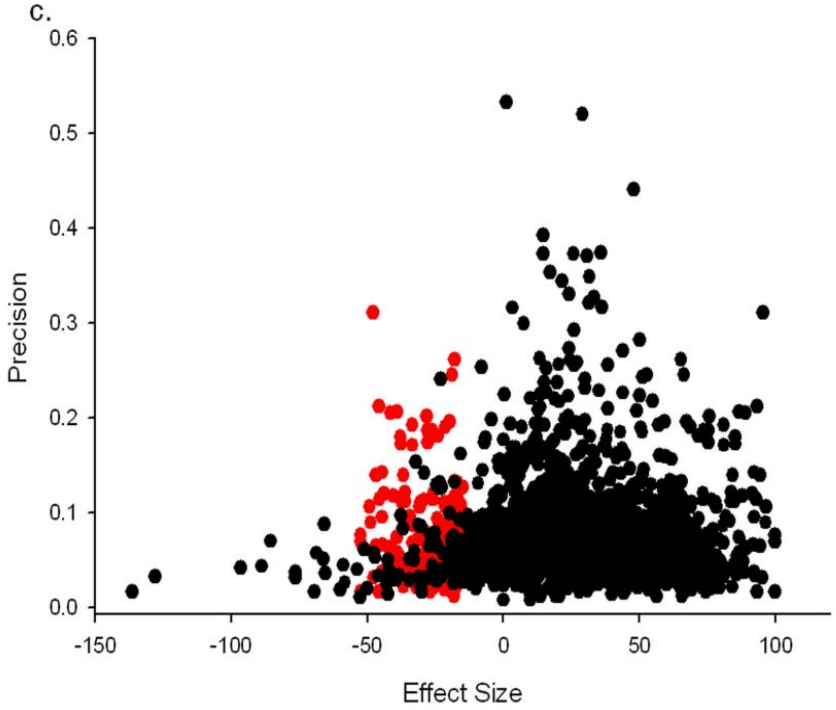
PLoS BIOLOGY

Publication Bias in Reports of Animal Stroke Studies Leads to Major Overstatement of Efficacy

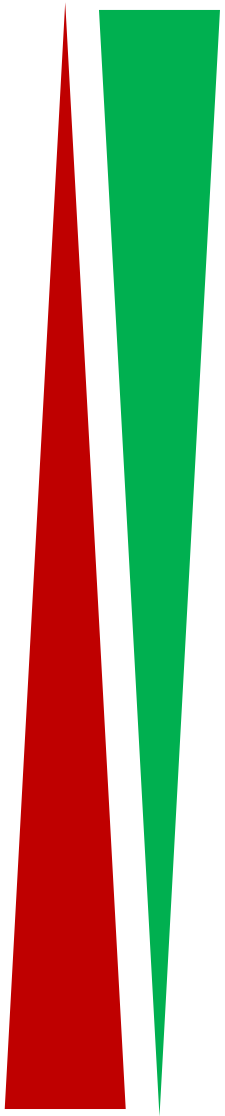
Emily S. Sena[1,2,3], H. Bart van der Worp[4], Philip M. W. Bath[5], David W. Howells[2,3], Malcolm R. Macleod[1,6]*



"Only ten publications (2%) [of 525] reported no significant effects on infarct volume and only six (1.2%) did not report at least one significant finding."

PLoS Biol. 2010; 8 e1000344

What can we do about it ?



Practicability

Open access

Education/Training (Statistics, study design etc.)

Enforce compliance with existing guidelines

Electronic labbooks (preclinical)

Authentication of reagents and biologicals (incl. animals)

Open data / Repositories / Publication of negative results

Replication (culture)

Structured quality management (preclinical)

Better study designs and analysis

Enforced registration (studies, protocols, etc.)

(Peer-) Auditing (preclinical)

Large-scale cooperation / Data sharing

Enforce publication of results (evidence)

Novel indicators and incentives

Impact

How to make more published research findings true?

Reduce Bias!
Blinding, randomization,in/exclusion criteria.
Publication of Null results.
Reporting according to guidelines (e.g. ARRIVE).

Increase Power!
Minimum of 80% power.
Apriori sample size calculation.
Replication.

Question ‚Statistical Significance‘!
P-values do not provide evidence regarding a model or hypothesis.
Think biological significance, think effect size.
Replication.

Preclinical multicenter trials

RESEARCH ARTICLE

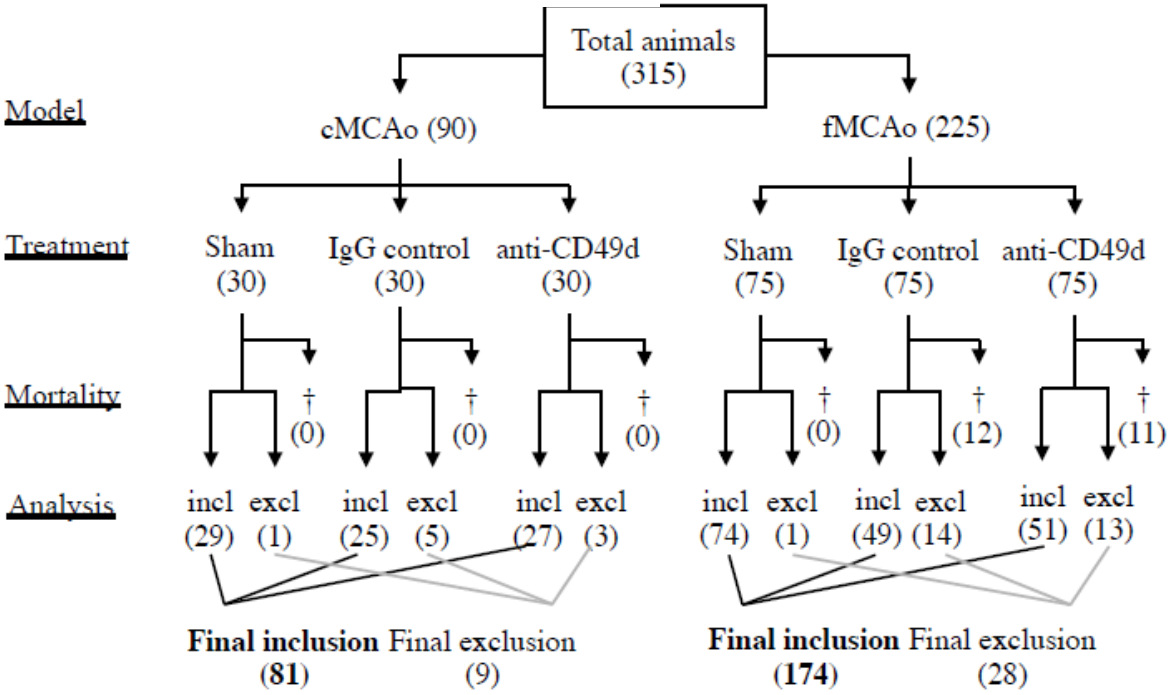
STROKE

Results of a preclinical randomized controlled multicenter trial (pRCT): Anti-CD49d treatment for acute brain ischemia

Gemma Llovera,[1,2] Kerstin Hofmann,[1,2] Stefan Roth,[1,2] Angelica Salas-Pérdomo,[3,4] Maura Ferrer-Ferrer,[3,4] Carlo Perego,[5] Elisa R. Zanier,[5] Uta Mamrak,[1,2] Andre Rex,[6] Hélène Party,[7] Véronique Agin,[7] Claudine Fauchon,[8] Cyrille Orset,[7,8] Benoît Haelewyn,[7,8] Maria-Grazia De Simoni,[5] Ulrich Dirnagl,[6] Ulrike Grittner,[9] Anna M. Planas,[3,4] Nikolaus Plesnila,[1,2] Denis Vivien,[7,8] Arthur Liesz[1,2]*

Science Translational Medicine AAAS

2015;7:299ra121



Robustness of data, collaboration, and much more…

Systematic replication (with higher n's)

RESEARCH ARTICLE

PSYCHOLOGY

Estimating the reproducibility of psychological science

Open Science Collaboration*†

Science AAAS

ON OUR WEB SITE

Read the full article at http://dx.doi.org/10.1126/science.aac4716

NATURE | NEWS

Science EXCHANGE

eLIFE

Cancer reproducibility project releases first results

An open-science effort to replicate dozens of cancer-biology studies is off to a confusing start.

Monya Baker& Elie Dolgin

18 January 2017

Discriminate exploration and confirmation

OPEN ACCESS Freely available online

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Perspective

Distinguishing between Exploratory and Confirmatory Preclinical Research Will Improve Translation

Jonathan Kimmelman[1]*, Jeffrey S. Mogil[2], Ulrich Dirnagl[3,4,5]

PLoS Biol. (2014) 12:e1001863.

Study designs in exploration vs confirmation _

	Exploratory	Confirmatory
Hypothesis	(+)	+++
Establish pathophysiology	+++	(+)
Sequence and details of experiments established at onset	(+)	+++
Primary endpoint	-	++
Sample size calculation	(+)	+++
Blinding	+++	+++
Randomization	+++	+++
External validity (aging, comorbidities, etc.)	-	++
In/Exclusion criteria	++	+++
Test statistics	+	+++
Preregistration	(-)	++
Sensitivity (Type II error) Find what might work	++	+
Specificity (Type I error) Weed out false positives	+	+++

Stroke 2016; 47:2148-2153

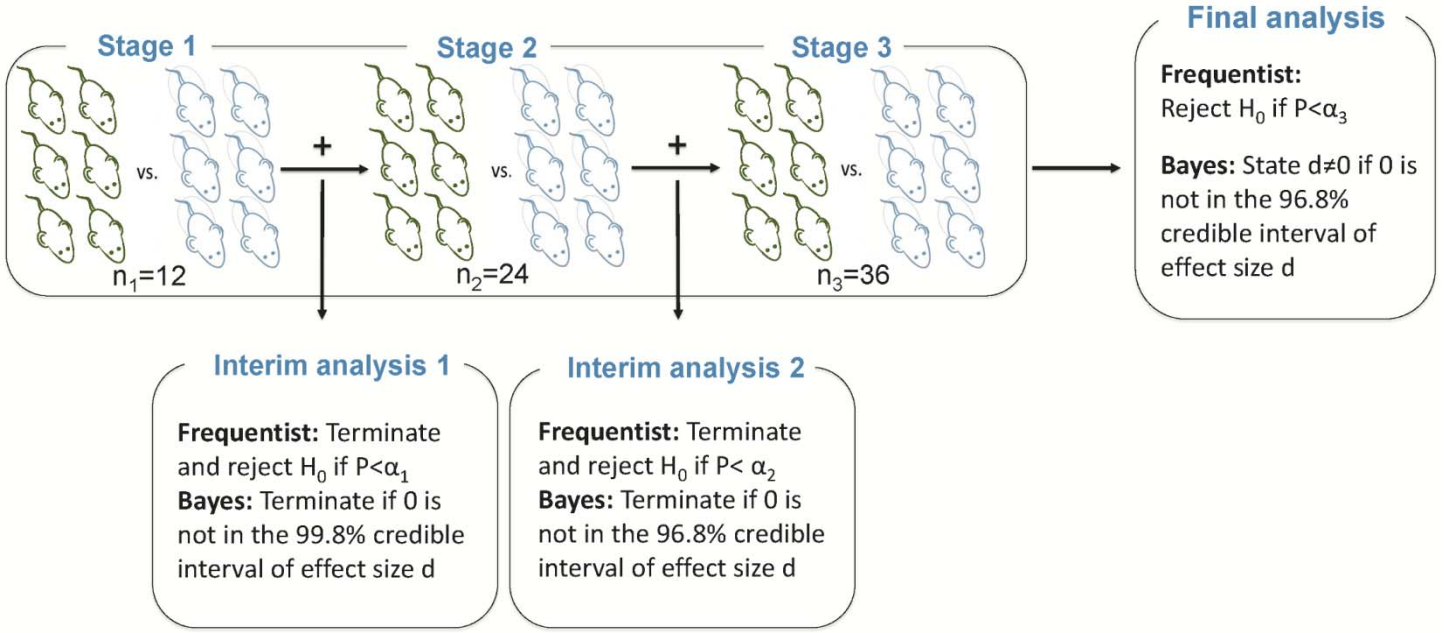
Novel study designs

PLOS | BIOLOGY

PERSPECTIVE

Increasing efficiency of preclinical research by group sequential designs

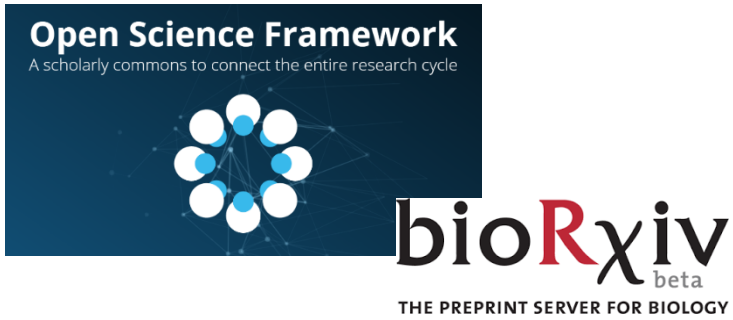
Konrad Neumann[1☯], Ulrike Grittner[1,2☯*], Sophie K. Piper[1,2,3], Andre Rex[2,4], Oscar Florez-Vargas[5], George Karystianis[6], Alice Schneider[1,2], Ian Wellwood[2,7], Bob Siegerink[2,8], John P. A. Ioannidis[9], Jonathan Kimmelman[10], Ulrich Dirnagl[2,3,4,8,11,12]



PLOS Biol (in press)

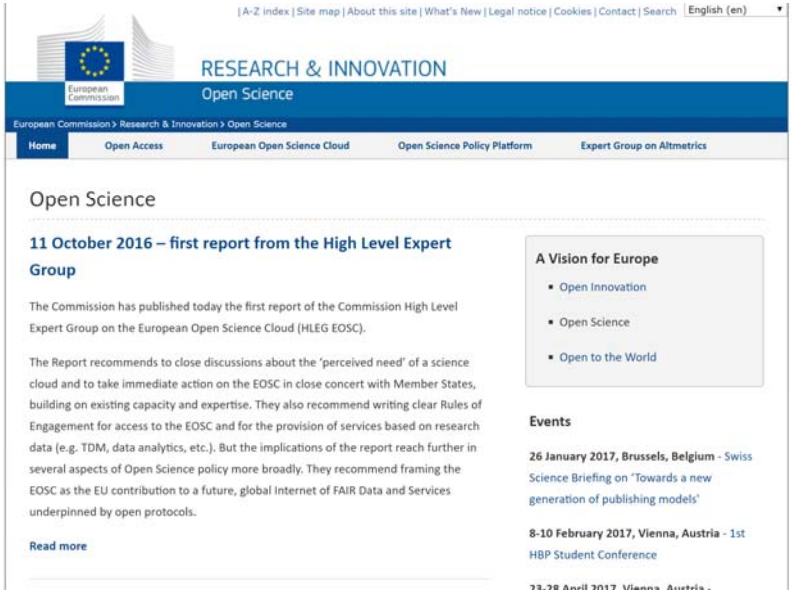
Publication of NULL results - preregistration _

Prevents:
Publication bias



Prevents:
Outcome switching,
Cherry picking of results

OPEN SCIENCE POLICY: Find, Access, Interoperate, Reuse Data (FAIR)



OPEN ACCESS

zenodo

DRYAD

OPEN DATA

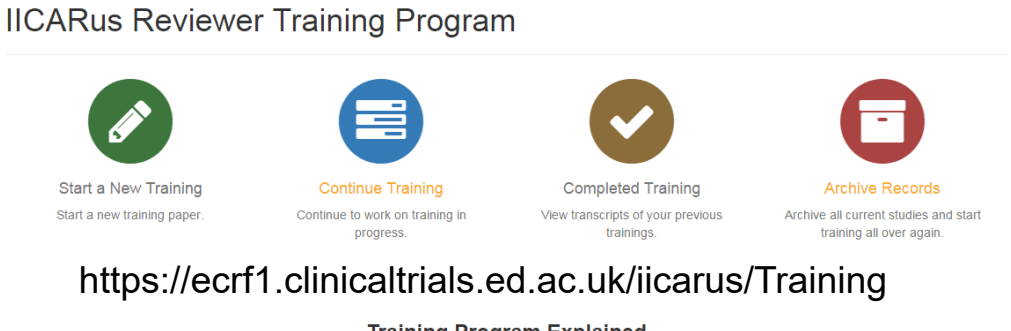
figshare
credit for all your research

Data aggregation, Metaanalysis

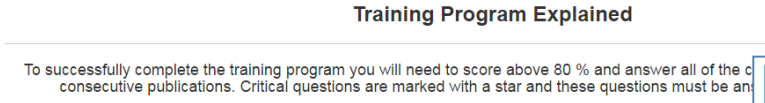
- **CAMARADES**
- **Collaborative Approach to Meta-Analysis and Review of Animal Data from Experimental Studies**
- **Look systematically across the modelling of a range of conditions**
- **Data Repository**
  - **19 Diseases**
  - **7,000 studies**
  - **from over 200,000 animals**

Tools

Training in critical appraisal of publications in biomedicine (IICARUS)



https://ecrf1.clinicaltrials.ed.ac.uk/iicarus/Training



http://syrf.org.uk/

https://www.nc3rs.org.uk/experimental-design-assistant-eda

Guidelines

ARRIVE

http://www.nc3rs.org.uk/

The ARRIVE Guidelines Checklist

Animal Research: Reporting In Vivo Experiments

Carol Kilkenny[1], William J Browne[2], ... [4], ... [5]

[1]The National Centre for the Replacemen
Science, University of Bristol, Bristol, UK,
Institute, Imperial College London, UK, [5]C

Good Laboratory Practice

Preventing Introduction of Bias at the Bench

Malcolm R. Macleod; Marc Fisher; Victoria O'Collins; Emily S. Sena; Ulrich Dirnagl; Philip M.W. Bath; Alistair Buchan; H. Bart van der Worp; Richard Traystman; Kazuo Minematsu; Geoffrey A. Donnan; David W. Howells

Background and Purpose—As a research community, we have failed to demonstrate that drugs which show substantial efficacy in animal models of cerebral ischemia can also improve outcome in human stroke.

Summary of Review—Accumulating evidence suggests this may be due, at least in part, to problems in the design, conduct and reporting of animal experiments which create a systematic bias resulting in the overstatement of neuroprotective efficacy.

Conclusions—Here, we set out a series of measures to reduce bias in the design, conduct and reporting of animal experiments modeling human stroke. (***Stroke*. 2009;40:e50-e52.)**

ELSEVIER CrossMark

Alzheimer's & Dementia 12 (2016) 1177-1185

Alzh
Den

Perspective

Guidelines to improve animal study design and reproducibility Alzheimer's disease and related dementias: For funders and resear

Heather M. Snyder[a,*,1], Diana W. Shineman[b,1], Lauren G. Friedman[b], James A. Hendrix[a], Ara Khachaturian[c], Ian Le Guillou[d], James Pickett[d], Lorenzo Refolo[e], Rosa M. Sancho[f], Simon H. Ridley[f]

[a]Division of Medical & Scientific Relations, Alzheimer's Ass
[b]Scientific Affairs, Alzheimer's Drug Discovery Foundati
[c]Editorial Office, Alzheimer's & Dementia: The Journal of the Alzheime
[d]Research Division, Alzheimer's Society, Lo
[e]Division of Neuroscience, National Institute on Aging at the National In
[f]Research Division, Alzheimer's Research UK, C

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PLoS Biol 2014;12: e1001756

PLOS | BIOLOGY

Perspective

Two Years Later: Journals Are Not Yet Enforcing the ARRIVE Guidelines on Reporting Standards for Pre-Clinical Animal Studies

David Baker[1], Katie Lidster[1]*, Ana Sottomayor[1,2], Sandra Amor[1,3]

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Rewards and incentives

Source: Slate

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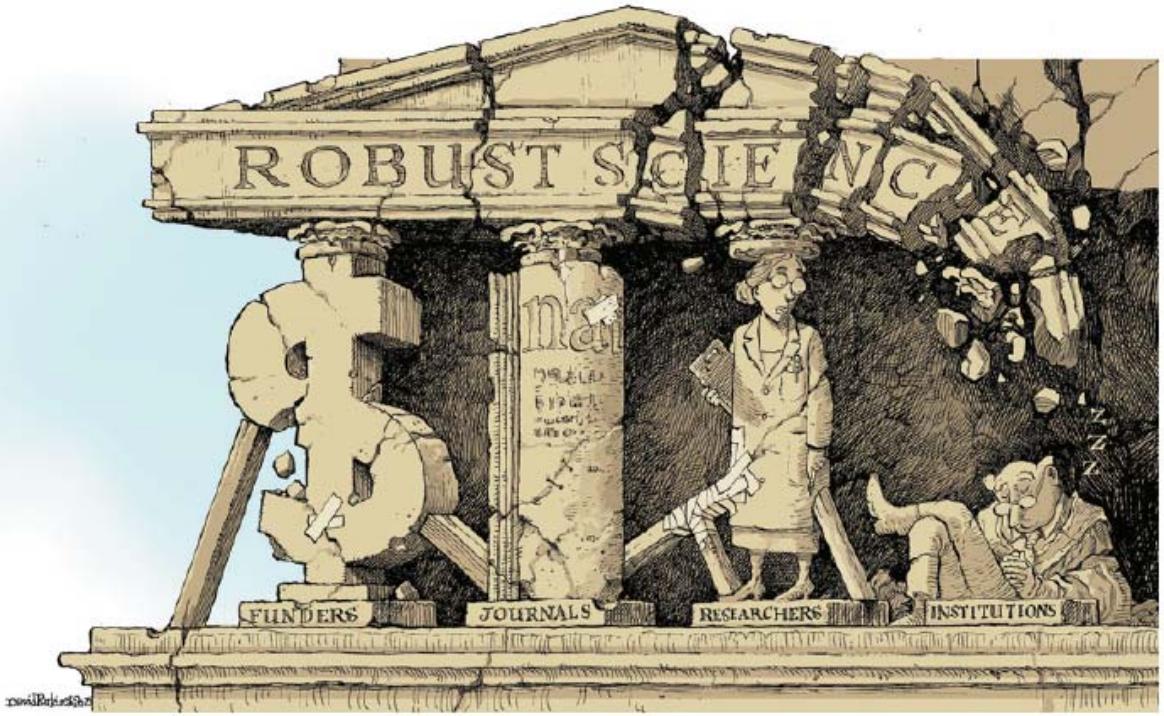

Institutions must do their part for reproducibility

Tie funding to verified good institutional practice, and robust science will shoot up the agenda, say **C. Glenn Begley**, **Alastair M. Buchan** and **Ulrich Dirnagl**.

Bewerber/innen

Bewerbungsportal für Professuren

Forschungsrelevante Informationen

Schwerpunkte

Schwerpunkte Forschung *

z.Bsp. Apoptose - +

Schwerpunkte klinische Versorgung

z.Bsp. Klinische Psychotherapie - +

Kennzahlen Forschung

ORCID	z.Bsp. 0000-0002-2627-833X	ResearchGate-Profile	z.Bsp. Max_Mustermann2
Anzahl Originalarbeiten *	z.Bsp. 50	Anzahl Erst- und Letztautorschaften *	z.Bsp. 15
Anzahl Originalarbeiten in letzten 5 Jahren *	z.Bsp. 30	Anz. Erst-/Letztautorschaften in letzen 5 Jahren *	z.Bsp. 10
Kumulativer Impactfaktor *	z.Bsp. 200	Hirschfaktor *	z.Bsp. 20

Kennzahlen Drittmitteleinwerbung

Drittmittel laufend in € *	z.Bsp. 20.000	Drittmittel der letzten 10 Jahre in € *	z.Bsp. 20.000
Drittmittel laufend als PI in € *	z.Bsp. 10.000	Drittmittel als PI der letzten 10 Jahre in € *	z.Bsp. 10.000
laufende Förderung durch NIH/EU/DFG/BMBF in € *	z.Bsp. 0	gefördert in den letzten 10 Jahren durch NIH/EU/DFG/BMBF in € *	z.Bsp. 0

Beschreiben Sie kurz den Ihrer Meinung nach wesentlichsten wissenschaftlichen Beitrag, den sie in Ihrem Feld geleistet haben:

Textfeld mit max 10 Zeilen

Welches sind die 3 Ihrer Meinung nach wichtigsten Arbeiten, welche Sie veröffentlicht haben? Bitte begründen Sie diese Auswahl stichwortartig und erwähnen dabei Ihren jeweiligen Beitrag. Wie wurden die Arbeiten im Feld aufgenommen, welchen ‚Impact' hatten sie auf den Erkenntnisfortschritt oder die klinische Praxis (Therapien, Guidelines)?

Textfeld mit max 20 Zeilen

Die Charite legt Wert auf transparente replizierbare Forschung und unterstützt die Ziele von Open Science (Open Access, Open Data). Hierzu zählt auch die Registrierung von Studien in Registern (clinicaltrials.gov, DRKS etc.), die Präregistrierung von Studien, und die Publikation von Negativ- und Null – Resultaten **In welcher Weise haben sie diese Ziele bisher verfolgt, und was planen Sie hierzu in Zukunft?**

Textfeld mit max 10 Zeilen

Die Charite ist an Team Science und Kollaborationen interessiert. Schildern Sie stichwortartig ihre wichtigsten kollaborative Projekte der letzten 5 Jahre.

Textfeld mit max 10 Zeilen

Beschreiben Sie stichwortartig, falls vorhanden, Ihre Interaktion mit relevanten Akteuren in der Biomedizin, z.B. der Industrie, Patientenvertretern, Policy panels, etc.)

Textfeld mit max 10 Zeilen

What should (must) be done

Scientists

Reduce Bias, Increase Power, Question ‚Statistical Significance', Replicate ...

Funders

Request: Measures to increase internal validity, publication of NULL results, preregistration, Open Science policy; Audit/Monitor implementation; Institutional funding, Funding of specific programs ...

Institutions

Incentives and rewards, Infrastructure, Education, Monitor and safeguard compliance ...

http://bit.ly/hamburgdirnagl