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[January 27, 2015 at 18:33]

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ACRONYMS

NON-SCIENCE STUFF

There'll also be an index of terms, I think, but it's not written yet.

FLOSS free/libre open source software

GPL GNU General Public License

GNU GNUs Not Unix

PLOS Public Library of Science

OS open science

SCIENCE STUFF

GPCRS G-protein coupled receptors

RA retinoic acid

5-HT 5-hydroxytryptamine

CNS central nervous system

BHLH basic helix-loop-helix protein structural motif

VMNS visceral motor neurons

SHH sonic hedgehog

ASCL1 Achaete-scute homolog 1

1

"SCIENCE STUDIES, FEMINIST THEORY, CULTURAL STUDIES"

Science is an empowering technology. It satisfies some deep drive to understand and explain the world around us. "Science" is part of a long heritage of bold exploration, innovation, and human ingenuity. define "science" here and also WITH GREAT POWER COMES GREAT RESPONSIBILITY

1.0.1 *"I am become death": Biopolitics and scientific responsibility*

Science is both handmaid to progress and the worst ever.

"Science" – "modern" science – evolved in an era of Western expansionism and wholehearted imperialism. The Scientific and Industrial Revolutions enabled and fed on the expansion of European powers into new territory. Discovery of the 'cure' for malaria (by indigenous tribes in the Amazon, transferred to the Jesuit, and eventually the expanding European empires) allowed European nations to make inroads into tropical areas, as their soldiers were no longer dying at the prodigious rates.[40]

western expansionism has not stopped, merely transmuted.

Scientific ethics and responsibility is often looked at only within the frame of experimental design and execution. This is, indisputably, desperately important. The Tuskegee Syphilis Experiments represent a clear failure on the part of the scientists involved, their funding body, and whatever oversight the university claimed to consider basic human rights ; undoubtedly, the study leaders were deeply and irrevocably shaped by the anti-black racism in the post- Civil War. The following experiments on prisoners in the U.S. and around the world remains in the same vein.

Obviously, in the U.S. racial frame black bodies are unhuman, and the experimenters were more or less within their rights, so...

More insidious and more difficult to make sweeping moral judgements on is the way science has not just been done "poorly", but used to justify and *create* new systems of exclusion, as well as enabling [[war!]], all while staying within the ethical bounds of the time. Racism – the peculiar brand of American racism, derived from slave-owners desperate to justify their brutality of human bondage – was created through the collusion of science and society, specifically a science that carefully cataloged and characterized the way Africans and African-Americans differed, and were therefore lesser, than White slaveholders. Lest we dismiss scientific racism as a legacy of the United States past, the eugenics ("well-born", in Greek) movement came to us from Charles' Darwin, via Francis Galton. Eugenics, of course, gained notoriety in Nazi Germany, but its legacy in the United States is deeply rooted.

That was the 40's and 50's – today, we have genetic surveillance.[65]

We have the science of homosexuality – every time we discover a new gay, someone uses that 'fact' to cure queers.

Trans bodies have entered the neuroscientific sphere – brain images used to confirm that the brains of transmen are more like cis men than they are cis women.

The scientific heritage, the accumulated knowledge upon which we build our futures, is not exempt. At the same time, the undeniable power of science and technology to do "good" – hormones for trans people, Internet communities for otherwise isolated activists, the reclamation of environmental sciences by Native communities, technologies that enable disabled bodies, pharmaceuticals that prolong lifespans and raise quality of life, technologies that allow people to take control of their bodie's reproduction in every dimension* – means we need it. Not to mention the insatiable curiousty to understand and the delightful appeal of "basic" research, of discovering something new.

Science is not going away, and nor should it; but to ignore our scientific inheritance, the complicity between science and power, and the role of individual scientists in perpetuating and creating power dynamics is to be neutral in the face of injustice.

> "If you are neutral in situations of injustice, you have chosen the side of the oppressor."
>
> Desmond Tutu

1.1 SCIENCE STUDIES

Summarizing Fleck is going to take some serious work. I'm not sure how specific I should be here, w/r/t page numbers and quotes in Genesis *JC - I really like the idea of expanding this section. Having some prospective about people that did analysis/critiques on how science was performed on the past would help you generate a foundation about how you feel science should be critiqued now (which seems to be one of the overarching goals of your div).*

May include that Fleck was Jewish, working in Ukraine in 1935, and consequently subject to Nazi occupation, as a potential reason his work went hidden for so long. Also because it was radical.

Like with Fleck, not sure how much time Kuhn deserves.

Both my historical time line and ideological foundation for science studies starts with Ludwik Fleck's *Genesis and Development of a Scientific Fact*, originally published in 1935 pre-WWII Germany.[29] A practicing syphilis researcher and pathologist, Fleck proposes that scientists are the creators of facts, rather than mere passive observers. He proffers an explanation that certain *styles* of thinking permeate and circumscribe scientific collectives and the people within them. Scientific knowledge is only accepted as true once the evidence been thoroughly vetted, trimmed, mediated, and judged acceptable by experts in the field. "Facts" are then not so much realities of the world but interpretations of it, made by collaboration between individual, collective, and evidence; they only take shape in a matrix of other beliefs and discoveries about the world.

His ideas re-appear in one of the most well-known historians or sociologists of science, Thomas Kuhn, famed writer of *Structures of Scientific Revolution*.[47] The publication of Kuhn's *Structure* in 1962 is considered a landmark event in philosophy and history of science. He coined the usage of "paradigm" in the incredibly-common, borderline meaningless sense it's used today.† A previous Div III expressed my feelings, with regards to at least *Structures:*

> "Thomas Kuhn's work occupies an awkward and somewhat inexplicable position in the contemporary intellectual environment. Kuhn's thinking, and here I refer specifically and exclusively to the thoughts put forth in The Structure of Scientific Revolutions (SSR), while conceptually worthwhile, erodes quickly under scrutiny. "
>
> -Campbell, *Essays on Biological Epistemology*, Div III in 2007

Don't actually know enough about science studies to make these kinds of judgement, probably, but it's my general impression

Fleck and Kuhn and many of their concurrent and subsequent philosophers, historians, and sociologists of science offer compelling arguments that science is, yes, evolution, but not evolution *towards* anything. Science is just another way to try to make sense of the world,.

[[Linking paragraph about how dissatisfying it is to deconstruct science without talking about the *implications* of a value-laden science]]

*Given access and governments that don't insist on fucking bullshit lookin' @ you, everybody.

†Masterman (reference not currently included) cites 21 diff uses of paradigm

1.2 FEMINIST THEORY

"... Questioning representation with a vengeance."

should read up on feminist/critical science studies chronology

At some point in the past 30-40 years (mid-1980s?), feminist science happened; not, of course, always under one name or one set of goals. New ways of knowing overlaps with technology and science studies overlaps with philosophy of science overlaps with a plethora of other modes of analysis. What I now call feminist science studies emerges out of activists against white supremacy, patriarchy, heteronormativity, and ecological destruction working on ways to critique science as a social institution, and find new ways of answering scientific questions.

feminist science studies more specifically tied to 1970s women's & environmental social movements: also in a specifically Western/US context

What I call feminist science studies is then at confluence of many ideas, summed up in Donna Haraway's 1994 *Cat's Cradle: Science Studies, Feminist Theory, Cultural Studies.*[37]. Per Haraway, feminist science studies is at some meeting point of:

> "**Cultural studies** ... Not culture only as symbols and meanings, not comparative culture studies, but culture as an account of the agencies, hegemonies, counter-hegemonies, and unexpected possibilities of bodily construction... Relentless attention to the ties of power and embodiment... location and knowledge. Unconvinced by claims about insuperable natural divides between high and low culture, science and everything else, words and things, theory and practice.
>
> **Feminist, Multicultural, and Antiracist Theory/Projects** ... situated knowledges, where the description of the situation is never self-evident, never simply "concrete," always critical; the kind of standpoint with stakes in showing how "gender," "race," or any structured inequality in each interlocking specific instance gets built into the world–i.e., not "gender" or "race" as attributes or as properties, but "racialized gender" as a practice that builds worlds and objects in some ways rather than others, that gets built into objects and practices and exists in no other way... gender and race are built into practice, which is the social, and have no other reality, no origin, no status as properties ... questioning representation with a vengeance."
>
> **Science Studies** ... reflexivity, constructionism... science in the making (not science made), actors and networks... science as practice and culture... the culture of no culture, the nature of no nature... All the disciplines of science studies: history, philosophy, sociology, semiology, and anthropology; but also the formation of science studies out of the histories of radical science movements, community organizing, and policy-directed work. These histories are regularly erased in the hegemonic accounts of disciplinary and interdisciplinary development in the academy and the professions."
>
> -Donna Haraway, *Cat's Cradle*, p. 66-68

So now that we know what we're dealing with (sort of, although it's a slippery web of concepts), that brings us to: so what? Sociological and historical questions are all very good, but what of the modern day?

1.3 What does this do in a practical sense?

1.3.1 *"Asking Different Questions"*

Feminist science studies allows, and demands, a number of things of practicing scientists. It lets us ask questions of representation in our labs, our most important journals, and our students: "Where are the women? *Who* is practicing science, and who is deciding what science is important?" This extends to questioning not just gender, but about the representation of race, physical ability, nationalities, and other sociological classifications.

Or it should *extend...*

Feminist science studies also lets – and again, demands – that we ask questions on a deeper level, about the nature of the knowledge produced. This includes (among many other things),

This section is fairly weak representationally. Mostly women (9/11), but only 3 of the 9 are women of color (African-American, Asian-American, and Indian).

- an examination the scientific *construction* of race and gender perpetuated by the perceived objectivity of the sciences,[30,28,22]
- the deep paradoxes involved in the ab/use of women's bodies in pursuit of reproductive technologies,[64,6]
- the shaping of science by gendered and racialized metaphors and languages,[?] [54] and the historical complicity between scientific exploration and colonialism, misogyny, and racism[38,61,67]
- challenging the artificial boundaries between "basic research" and nature/culture to explain a rapidly-growing scientific-industrial complex, and then linking basic research to community activism for women's rights and environmental movements.[71]

It asks us to look at science as a practice inseparable from culture, and what that might mean for knowledge and for scientists as the future producers of that knowledge.

1.4 Indigenous knowledges and local biologies

1.4.1 *Local biologies*

Local biologies are implied by feminist science theory, and indeed general science studies. That biological realities differ between geographical and cultural locations should not, realistically, surprise anybody who's made the commitment to trek through this div.

May not be the right place, but have to establish that talking about gendered health issues is not some specialized "women's issue" but is something that the medical community as a whole should be implicated. what about gynecologists and medical communities that specialize *in women? Women do give birth.*

Local biologies were most famously used by Margaret Lock, in comparing the uniquely North American symptoms of "menopause", a recognized disorder often treated with pharmaceutical interventions, to the experience of Japanese women after cessation of menstruation.[‡]

Moreover, while local is often geographical, location is only one of many axes. "Local" biologies more accurately speaks to our specific socioeconomic, racialized, gendered, sexual, *and* geographic identities and locations.

In practice, that means young boys in the United States who act out are diagnosed with autism, while young girls are ignored. Dialysis patients in Egypt might refuse a kidney donation from their Egyptian

[‡] There's a whole fucking book dedicated to explaining this, I'll see what I can do in a paragraph.

relatives, recognizing that the unique stresses placed on Egyptian bodies might require two functioning kidneys, differing from the global biomedical truth that one kidney is sufficient.

1.4.2 *Indigenous knowledges and sciences*

Specific knowledges! Eradicated by colonialism!

1.5 WHY SHOULD SCIENTISTS CARE?

Because feminist science asks questions that are fundamentally geared towards addressing socialized inequalities in science, it can help scientists take those inequalities into account.Scientists (in theory) care about helping people , and choose science because it seems like the best way to do so. It can't help people if it's racist, misogynistic, and not considerate of how work will be ab/used downstream.

I want to find a frame that really efficiently explains why this matters for a given audience.

JC while I agree, I think you need some kind of a reference here to support this assertion. Thinking about just hampshire, how many people do you think got into science just to show other people how smart they are?

1.5.1 *The point of the thesis*

Scientists should care about where their work is coming from and where it's going, and we *need* good – read: concerned and activist – people everywhere if we want social progress. This div is (hopefully) a road map and detailed exploration into doing (good) value-laden scienceFigure out *how* to apply all of that stuff to everything else I care about: namely, open science, open neuroscience, molecular neuroscience and then write about what did and did not work.

JC I think this might be another area to expand on. Examples from the 40s-50s of civil rights abuse by scientists. Even to modern day with potential exploitation by the 1000 genomes project.

1.6 WHAT YOU HAVE TO LOOK FORWARD TO!

Chapter 1 (aka what you just read) describes (in brief) the theoretical logic behind my Div III, explaining why I believe that science is just as much a cultural construct as any other knowledge project, and as a result, why scientists have a serious responsibility to consider their work in the greater context of social issues.

Sketch of regular book introductions with what chapter is going to be about and why. Definitely *needs a lot of work*

Chapter 2 explores the growing and heterogeneous community of open science (OS) advocates, who propose to make science more inclusive, collaborative, and useful, largely via the power of the Internet for sharing. OS is an alluring idea, especially backed with the rhetorical power of "open"; but "open" is not by itself a panacea for the hegemony of scientific establishments. Chapter 3 continues on this same theme, considering the representation of the global scientific community in open science vs. science at large.

Not sure where the actual content wrt "representation" should go. continuing reorganization

Chapter 6 is the follow up to this – it's a description of my attempts to implement open science proposals into a biological project, and the myriad complications and barriers I've surmounted – or not – in doing so. It offers a description of what I think the open science movement is missing on a practical implementation level, and examines the open science movement with a mind to discover and analyze the values underlying those efforts. Ultimately, I'd propose how a movement hoping to democratize and equalize science desperately needs to consider and account for their values from a (feminist) different standpoint. I also review some *awesome* projects already happening.

Chapter 8 is the background to my work – a "purely" scientific description. It describes why I think serotonin systems are important to model and explore, why I care about them, and my attempts to create a way to explore serotonin signaling by manipulation of a stem cell line.

Chapter 9.1.1 is the capstone chapter of sorts. It is critical questions about the links between my own areas of interest – molecular signaling and psychotropic drugs – and gender, environmental concerns, indigenous rights and colonialism, and race relations. While I don't have answers to any of those questions, asking those questions has (already) helped find d a myriad of ways in which social factors are fundamental parts of my scientific process and questions.Then there will be a conclusion when I finish my div.

2 NON PEOPLE ORIENTED PUBLISHING FAILURES

ACRONYMS

FLOSS free/libre open source software

GPL GNU General Public License, the founding document of the Free Software Movement

PLOS Public Library of Science, a leader in open access publishing

OS open science

TREND Teaching and Research in (Neuro)science for Development in Africa

OKF Open Knowledge Foundation

GMH growing misconduct hypothesis (per Fanelli 2013[25])

SSH 'stronger system' hypothesis (per Fanelli 2013[25])

PPV positive predictive value (per Ioannidis 2005[42])

IF Journal Impact Factor

CNS *Cell*, *Nature*, and *Science*

The broad initiatives huddling under the OS umbrella begin from the point of view in which the scientific ecosystem – that network of funding and publishing that undergirds the production of konwledge – is suffering from serious flaws. This includes concern about They propose transparency, greater access, and technological innovation can 'fix' or alleviate those flaws. The "fundamental goals" of open science include, per Gezelter, 2009:

1. Transparency in experimental methodology, observation, and collection of data.
2. Public availability and reusability of scientific data.
3. Public accessibility and transparency of scientific communication.
4. Using web-based tools to facilitate scientific collaboration.

Naturally, different groups see and emphazise different problems, proposing specific solutions accordingly. Generally, t's accomplished by opening up the scientific ecosystem in three to areas, and implementing structures that allow for and incentivize:

1. open access publishing - namely, cost- and licensing-free to full-text published papers and research results
2. open data - publishing raw data pre- or concurrently with paper publication
3. open research - everything else, including, but not limited to:

a) code distribution - code for analyses, model generation, etc. should be hosted somewhere accessible

b) lab notebooks - tracing the entire research process with all dead ends and kinks included in an accessible (read: digital) form

There's also a hundred other subcategories on the fringes of those overarching categories new systems of distributed, ongoing, or otherwise "open" peer review; community discussion of publications, billed as an "online journal club"; altmetrics to re-allocate scientific credit away from impact factors towards diverse forms of knowledge transmission.

Despite the complexities and contradictions of any movement, OS included, There are sufficient commonalities in both intent and execution to examine the value systems composing both problem and solution.

2.1 PROBLEMS WE'RE TRYNA SOLVE

Before we start talking about solutions, it makes sense to identify the problems. To some extent, the OS movement takes these as a given, and move straight to proposing the solution.

2.1.1 *THE PUBLISHING PIPELINE*

2.1.2 *Access & Pay Walls*

Well then.

> "Scholarly journals have been at the heart of academic life since the publication of the Journal des sçavans and the *Philosophical Transactions of the Royal Society* in the middle of the 17 th Century." -Parker 2013 [58]
>
> Under the prevailing subscription-based system, commercial publishers own a monopoly over the distribution of scientific research. They charge authors for the publication of their works, then charge the readers subscription, advertising, and online access fees; in addition they retain the copyright of the articles they publish. Shelton [68]

"Primary literature" is the holy grail of contemporary knowledge. 6 pages of double-column size 10 text in *Nature*, *Science*, or *Cell* represent the cutting edge of scientific research; the foundation for future work, and great accomplishments.

I've been working from primary literature since my very first semester at school, but it was only a few minutes after my first Google Scholar searches that I immediately slammed up against pay walls to the papers I wanted. So did everyone else I knew. I've spent the past four years of my education begging for paper access from UMass friends, various professors, my mother (who works in pharma), and MIT friends. While Hampshire's paucity of journal access is perhaps extreme, even the wealthiest of school librarians call journal prices prohibitive. In April of 2012, Harvard University issued a memo in which it stated it could not continue to afford the 3.5M in journal subscriptions. From the mere practical standpoint of a consumer, economically unsustainable.

presumes internet access; presumes journals are highest repository of info; presumes major barrier is dollars, not quality of research

There's also a justifiable sense of outrage at these monetary barriers to research that is (a) publically funded and (b) all of the writing/production is done by uncompensated scientists.

Publicly Funded Research

> Consequently, though the vast majority of the scientific research is publicly financed by taxpayers' dollars, access to research is not freely and publicly available: it is restricted to customers who can afford to pay for subscriptions. Shelton [68]

Most studies in the U.S. and U.K (the strongholds of scientific research generally) are publically funded research, in part or in whole. "Taxpayer dollars" fund, via the NIH, much of the high-profile, high-impact research that subsequently appears in journals. For taxpayers – your average layperson, or average scientists – to pay *again* for accessto th eproduced knowledge, when they paid to fund it, seems (justifiably) a little ridiculous.

Unpaid labor & 'community' service

Scientific journal publishers play the role of publishers. They don't *produce* the content, make the figures, or draw the conclusions in scientific papers. Publishers act, although the boundaries are shifting in the digital age, as a clearinghouse and managerial stage. Labs submit a manuscript (gratis); publishers coordinate the peer review of said manuscript by shipping it out to 2-3 other academics. Those academics review the paper, give feedback, and send it back – also gratis. The original writer makes revisions; sometimes the process is repeated. Eventually, the submitting lab pays a per-figure per-page fee, signs away their copyright, and the journal takes the final work as its own. Then, those submitting and reviewing scientists pay to access the product of their intellectual labors, having given up the legal right to share that knowledge on their own accord.

In return, journals provide, to varying degrees: a measure of typesetting and formatting, a measure of editorial work, and a distribution system. Pre-Internet, the cost of the journal was tied to the costs of printing and physical distribution. With that barrier out of the way, it's hard to see exactly how worthwhile whatever-it-is that publishers provide is.

2.1.3 *Knowledge Gaps: Developed/ing Worlds*

> The science base in the developing world cannot be strengthened without access to the global library of research information. Currently, this is nearly impossible due to the high costs of journal subscriptions, with the result that even the most prestigious institutes in poorer countries cannot afford to buy the journals they need. Many initiatives have been started to resolve the access problem, but progress has been slow and, since they are generally dependent on grants or subsidies, are unlikely to be long-term solutions. With the advent of the Open Access (OA) initiative, the outlook for building science capacity in developing countries has

> improved significantly. In particular, the establishment of interoperable open access archives that is now underway by a rapidly growing number of institutes opens opportunities for true global knowledge exchange.Chan et al. [13], 2005

2.1.4 *Reproducibility and Retraction: Crisis!*

Assessing the unreliability of the medical literature: a response to "why most published research findings are false"

The principle of the elusive scientific method is replication and reproducibility. Researchers document their methods and results to such an extent that any other researcher is able to reproduce their data independently, or, more often, build more experiments atop their conclusions.

Unfortunately, that optimistic theory of reproducibility is in question. The so-called reproducibility crisis had many harbingers, but the flashiest remains a 2005 article titled *Why Most Published Research Findings Are False*.[42] John P. A. Ioannidis' calculations led him to estimate that more than 50% of published biomedical research findings with a p value of < 0.05" are likely to be false positives.[1]

aka research deemed 'significant' aka the research that's get published

While the *extremely* inflammatory title ruffled the feathers of statistications round the world, leading to a fierce statistical "battle of the titans", Ioannidis' statement hallowed scientific halls.[34,43]

Evidence for the practical ramifications of replicability (or lack thereof) comes on a larger scale from a set of biotech companies translating academic preclinical research into clinical drug trials. Amgen had an 11% success rate with respect to 50 very high-profile cancer studies[7]; drug targets identified by academics rarely pan out in the clinic.[3,60]

It's not really fucking reproducible than, is it?

There's explanations for that – principically, that biological research is at such a level of complexity that even minor changes from lab to lab in the microenvironment can "break" an experiment.

We can explain away the lack or replication. Where the literature really gets into trouble is retraction –that is, journals and authors withdrawing published articles that have theoretically already undergone peer review. This represents an enormous cost to both journal and author; retraction often leads to firing (or mandatory stepping down) of the editor, and more insidiously, a distinct downward trend in the citation rate of the author's former papers. Retraction is *serious* business, which makes the relatively increasing incidence all the more concerning.

In 2008, Cokol, Ozbay, and Rodriguez-Esteban had concluded that*

> "...even limiting our analysis to the period between 1990 and 2006, we found a significant increase (r = 0.55, p = 0.02)...From these observations, we conclude that retraction rates are still on the rise.[16]

This, of course, begs the question: why? Some propose the pressure to publish, increasingly important to funding and hiring decisions, hits researchers in a vulnerable spots. To some extent this is borne out, as "papers were more likely to support a tested hypothesis if their corresponding authors were working in states that, according to NSF data, produced more academic papers per capita. . . competitive

*Publishing in *EMBO*, a European journal, plausibly explaining why U.S. metric fiends hadn't caught on to it.

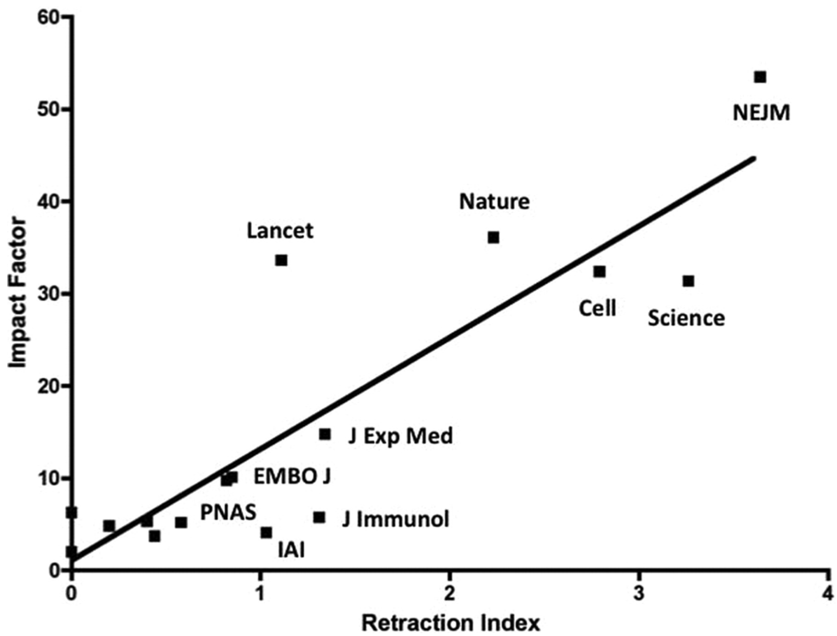

Figure 1: "Correlation between impact factor and retraction index. The 2010 journal impact factor...is plotted against the retraction index as a measure of the frequency of retracted articles from 2001 to 2010."[26]

academic environments increase not only scientists' productivity but also their bias."[24]

> "[Two viable interpretations] The first interpretation implies that increasing competition in science and the pressure to publish is pushing scientists to produce flawed manuscripts at a higher rate, which means that scientific integrity is indeed in decline. The second interpretation is more positive: it suggests that flawed manuscripts are identified more successfully, which means that the self-correction of science is improving."[16]

Intriguingly, and tellingly, not only are the rate of retractions increasing, but they're increasing in the journals we respect the most. In a 2011 PloS publication, Fang and Casadevall found a "strikingly robust" correlation between a journal's "retraction index" and its impact factor (Figure 1). [26]

But if we look past the doom and gloom, Daniele Fanelli is here to save us again. Fanelli proposes four lines of evidence to support that the relative increase in retraction rates is due to an increased awareness and responsiveness to misconduct (the 'stronger system' hypothesis (SSH)), rather than increased misconduct itself (the growing misconduct hypothesis (GMH)).[25] The summary points are:

1. Corrections to scientific papers have been published for much longer than retractions, and show little sign of a recent increase.
2. The number of journals issuing retractions has grown dramatically in recent years, but the number of retractions per retracting journal has not increased.
3. The number of queries and allegations made to the US Office of Research Integrity has grown, but the frequency of its findings of misconduct has not increased.

4. Therefore, the rising number of retractions is most likely to be caused by a growing propensity to retract flawed and fraudulent papers, and there is little evidence of an increase in the prevalence of misconduct.

5. Statistics on retractions and findings of misconduct are best used to make inferences about weaknesses in the system of scientific self-correction.

This is nice talk, but it's not supported – particularly, by data.

There *is* reassuring data from Grieneisen and Zhang, who did not just count numbers of retractions, but examined *why* articles were being retracted. Of the 4,449 retracted articles found in 42 of the largest bibliographic databases from 1928-2011, retractions were due to

47% alleged publishing misconduct[†]

20% alleged research misconduct

42% the usage of questionable data or interpretations

% stack to >100% because more than one reason is often cited

*And retracted research doesn't go away, perDavis [18], but stays on the *internet* 4ever.*

goshhh

Of the alleged research misconduct, fifteen individuals accounted for >50% of the retractions. WhileGrieneisen and Zhang admit the growth in retractions by a factor of 11.36 (excluding repeat offenders, adjusting for literature growth), they assert that neither data nor research misconduct underlie most retractions.[36]

*Statistical Failures: Underpowered and Badly Analyzed Data Sets*****

> *Power failure: why small sample size undermines the reliability of neuroscience* -Button et al. [11]
>
> *Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition* (originally *Voodoo Correlations in Social Neuroscience*)[77][‡]
>
> *Willingness to Share Research Data Is Related to the Strength of the Evidence and the Quality of Reporting of Statistical Results*[81]

File Drawer Problems, Negative Results, Publication bias

> Publication bias occurs when results of published studies are systematically different from results of unpublished studies.
>
> Empirical research consistently suggests that published work is more likely to be positive or statistically significant (P,0.05) than unpublished research [3].[20]

Let me tell you – scientific "failure" sucks. An experiment that is *not* working that *should* work (with regards to the current literature) lays its blame on reagants, on the technical skill of those involved, on the time of year, as seen in 2.1.4[§] – everywhere but the "science" It's much harder to see a negative result than a positive. That is, it's hard for scientists to say "*this* is the reason we're *not* succeeding" because there's

the thing where we can really only see difference *so if we can't literally notice a difference it's not meaningful*

[†]Peer review and citation RINGS. People making up email addresses. What a fuckin' world.

[‡]

[§]Interesting, the time of year *is* a meaningful factor, as seen in the experiments that established chemical neurotransmission in frog hearts. I think. Otto Loewi.

always more variables. Somehow this problem doesn't come up with positive results.

A specific problem area created by this bias against negative results shows up in the literature, in the positive publications bias. The most notable description appears in *The Lancet* in 1991, when Easterbrook, Gopalan, Berlin, and Matthews reviewed a set of clinical research trials from start t finish, concluding:

> "Studies with statistically significant results were more likely to be published than those finding no difference between the study groups (adjusted odds ratio [OR] 2·32; 95% confidence interval [Cl] 1·25-4·28). Studies with significant results were also more likely to lead to a greater number of publications and presentations and to be published in journals with a high citation impact factor. An increased likelihood of publication was also associated with a high rating by the investigator of the importance of the study results, and with increasing sample size."

This is not limited to clinical trials: ecology and "harder" fields show a similar bias.

> A substantial body of research demonstrates trends against publishing research where the results are not statistically significant. For example, one study has shown that clinical trials showing statistically significant results often had a higher probability of being included in meta-analyses published in medical journals than studies showing other results. Another study, examining 293 NIH clinical trials funded in 1979, showed that trials with statistically significant outcomes were over 12 times more likely to be published than trials without statistically significant results."

One effect of this is the file drawer effect (per Robert Rosenthal): many studies in a given research area may be conducted but never reported, leading to a set of journal articles wholly unrepresentative of the actual research state of affairs. The abandoned data stays in a theoretical file drawer, useless to everyone but the carpenter ants.

> The file drawer effect, or file drawer problem, is that many studies in a given area of research may be conducted but never reported, and those that are not reported may on average report different results from those that are reported. An extreme scenario is that a given null hypothesis of interest is in fact true, i.e. the association being studied does not exist, but the 5% of studies that by chance show a statistically significant result are published, while the remaining 95% where the null hypothesis was not rejected languish in researchers' file drawers. Even a small number of studies lost "in the file drawer" can result in a significant bias.
>
> Wikipedia page on publication bias, re: file drawer effect

Why there is a preponderance of significant results is unclear, but it's likely due a combination of effects. Scientists, first and foremost, are extremely loath to submit a paper with negative results. Journal editors, especially those in high-impact journals, are less likely to accept them. Readers are less likely to be interested. Funding bodies aren't interested in therapies that *don't* work. In Ioannidis's words, "claimed research findings may often be simply accurate measures of the prevailing bias".[42]

"According to John Ioannidis, negative papers are most likely to be suppressed when:[19]

> the studies conducted in a field are smaller
>
> effect sizes are smaller
>
> there is a greater number and lesser preselection of tested relationships
>
> there is greater flexibility in designs, definitions, outcomes, and analytical modes
>
> there is greater financial and other interest and prejudice
>
> more teams are involved in a scientific field in chase of statistical significance."
>
> as quoted from the wiki on publication bias, reffing his 2005bombshell

> "In the basic biological sciences, statistical considerations are secondary or nonexistent, results entirely unpredicted by hypotheses are celebrated, and there are few formal rules for reproducibility [20,21]. A signalling benefit from the market—good scientists being identified by their positive results—may be more powerful in the basic biological sciences than in clinical research, where the consequences of incorrect assessment of positive results are more dire. As with clinical research, prominent claims sometimes disappear over time [21]. If a posteriori considerations are met sceptically in clinical research, in basic biology they dominate.
>
> [] Negative data are not necessarily different than positive results as related to considerations of experimental design, execution, or importance. Much data are never formally refuted in print, but most promising preclinical work eventually fails to translate to clinical benefit [22]. Worse, in the course of ongoing experimentation, apparently negative studies are abandoned prematurely as wasteful."
>
> **?**

> Studies with positive results are more likely to be published than studies with negative results (publication bias). One reason this occurs is that authors are less likely to submit manuscripts reporting negative results to journals. There is no evidence that publication bias occurs once manuscripts have been submitted to a medical journal. We assessed whether submitted manuscripts that report results of controlled trials are more likely to be published if they report positive results.

> olson et al, 2002, "Publication Bias in Editorial Decision Making

Whatever the reason, the current journal system, the de facto dissemination system for scholarly production, is leaving out an enormous amount of information and doing damage in the process. Researchers may spend years trying to duplicate results that would have been quickly proved wrong, had failures to replicate been published. Meta-analyses, papers that use the entirety of collected data in a field to compare results, report positive results that are flawed to an extraordinary degree because of lack of access to the entirety of conducted research.

Problems for metanalyses

2.1.5 *Impact Factors: Gatekeeping Dissemination*

> "Does the pressure to publish in prestigious, high-ranking journals contribute to the unreliability of science?"
> -Brembs, Button, and Munafò

Citation is the metaphorical currency of science because it leads to real currency!

Nominally, choosing papers to read and base future work off of is based on relevance and applicability, but a serious factor in where scientists invest their researching and publishing time and energy is which journals are the highest ranked.

> Most researchers acknowledge an intrinsic hierarchy in the scholarly journals ("journal rank") that they submit their work to, adjusting not only their submission but their reading strategies accordingly.[9]
>
> The citation game [33,34] has created distinct hierarchical relationships among journals in different fields.[?]

Presumably physics and plants as well, but it seems like nature mostly does bio? I have literally no idea

Qualitatively, the top of the biology journal hierarchy is the central nervous system (CNS) triumvirate; journals that are instantaneously recognizable and eminently reputable. To get a *"Cell* paper" is to be immediately given respect.[¶]

Quantitatively, the journal hierarchy is represented by the Journal Impact Factor (IF), assigned to journals by publishing hous? Thomson-Reuters,. The IF was originally proposed as one metric of many to track scientific productivity: a simple mathematical formula reflecting the number of citations of a journal's material divided by the number of citable materials published by that same journal.[||] [48]

$$\text{Impact Factor} = \frac{\text{number of citations}}{\text{total number published in journal}} \tag{2.1}$$

> "The original intention for the use of the impact factor was to allow comparison between the citation rates of journals... This has proven invaluable for researchers and librarians in the selection and management of journals."[48]

¶Sources are: my life, everybody's life, a lot of blog posts? IDK man, it's just what everybody says

|| insert time (2 years) and other data

That's all well and good, but like with many metrics**, it's been applied with a widening and indiscriminatory brush. IFs have evolved from metric for journal quality overall, on the premise that a higher citation rate indicates higher journal quality.[48]From there, IFs also serve as a marker of quality on individual papers and researchers. Undeniably, this is an abuse of a simple equation, but just as undeniably, it has serious consequences for the scientific ecosystem of research, hiring, grantsmanship, and publishing.

See: all the ways you can game the system. Probably not gonna list them

2.1.6 *How Journals choose their acceptances*

> ... Editors make estimates of likely citations for submitted articles to gauge their interest in publication. **?**
>
> see[50] for experiential account of how editors modulate for interest

Journal editors and publishing administrators shape what we see and pay attention to; peer reviewers have to maintain impartiality when reviewing the make-or-break publication of their competitors.

who thought this would go well?

and this is important; implciations for "paradigm shifts" or reproducibility etc

duplicate results can't be published even if they're temporally simultaneous/very slightly behind the other

Choosing the right journal

> Impact factors are widely adopted as criteria for "success", despite whatever qualms have been expressed. [quotes mine] **?**

Scientists choose, extremely carefully, which journals they'll submit to. It's a game of saying is this research trendy *and* of high enough quality *and* an original idea *enough* to make it in this high-impact journal or another? A manuscript submission takes months, even in high-profile journals, and in the intervening time, the manuscript can't be sent out anywhere else. This means choosing a too high impact journal is a loss of months of publication time; but publishing in a less-cited journal can have serious consequences on tenure decisions, grant applications, and other administrative gambols.††

> They powerfully discriminate against submission to most journals, restricting acceptable outlets for publication.

Choosing the "best" journal wastes time and leads to not picking the best journal for functional *dissemination*

Moreover, impact factor trumps audience: while a field-specific journal might make your research more visible to people wh could use it, it won't have the same on-paper look as a CNS publication.

while you're getting submitted, you might get scooped

scientists spend time on this

Gaming the System?: Fraud in High Impact journals

> "What is obvious from this equation is that the impact factor depends crucially on which article types Thomson Scientific

**Comparison to NCLB? or SAT

††There's a number of sources denying that IFs are specifically counted in any of these. But they're certainly powerful tokens in the scientific imaginary, from which reviewers of any kind are hardly exempt. Except maybe in our school, where there's only one scientist.

deems as "citable"—the fewer, the better (i.e., the lower the denominator, the higher the impact factor)." -[‡‡]

wrt gaming the sysstem

. . . Because a journal's impact factor is derived from citations to all articles in a journal, this number cannot tell us anything about the quality of any specific research article unin that journal, nor of the quality of the work of any specific author. These points become particularly evident by understanding that a journal's impact factor can be substantially affected by the publication of review articles (which usually acquire more citations than research articles) or the publication of just a few very highly cited research papers.The PLoS Medicine Editors 2006[74]

Fixin' Data to Meet CNS

We've already seen that high-impact journals tend to have higher retraction rates. Why, and how?

> On the other hand, much has been written about the negative effects of institutionalizing journal rank as an impact measure. So far, contributions to the debate concerning the limitations of journal rank as a scientific impact assessment tool have either lacked data, or relied on only a few studies. The most recent and pertinent data on the consequences of our current scholarly communication system with respect to various measures of scientific quality (such as utility/citations, methodological soundness, expert ratings or retractions) corroborate previous hypotheses: using journal rank as an assessment tool is bad scientific practice. [9]
>
> So what can we do to return to how things once were? The rewards of science rise out of publications, but simply publishing does not guarantee success. We are increasingly judged according to where we publish rather than what we publish. Remarkably, we are ranked in proportion to the number of citations garnered by the other papers in the journals that contain our papers (the impact factor). **Some organizations decide promotions and grant applications on the basis of the impact factors of the journals that publish a scientist's papers.** So, **rewards come from being published in the journals with the highest impact factors.** As a result, the perception of the need for this kind of reward runs strong and deep. [53]

from Lisberger 2013*: I realize it would be a big change of culture, but data fraud would be reduced - and the quality of the entire scientific literature improved - if we established requirements for publishing not just your paper, but also your data.*

2.1.7 *Getting More For Less: Metanalyses and Code/Data Reuse*

Duplication of efforts.

peer review of code is fake///won't catch *serious* errors in data processing like someone else using the code will

[‡‡] And because they only take shit in english.

2.2 OPEN IS THE SOLUTION?: CRACKING THE SYSTEM AND CHANGING INCENTIVES

> "Open means **anyone** can **freely access, use, modify, and share** [content] for **any purpose**."

2.2.1 *Open Access*

"The objective of open access is *not* to quarrel with or replace journals (at all). *Not* to resolve the budgetary problems of libraries, not to provide access to teachers - students- the general public, *not* to provide access the the Developing World. The objective of open access is: to maximise research *impact* by maximizing research *access.*" - Stevan Harnad

LOL WHO THE FUCK ARE YOU

2.2.2 *open code*

3 REPRESENTATION & SCIENCE

ACRONYMS

OEAC Other Euro-American Countries, including Australia, NZ, and Canada

ROW "Rest of World", for what that's worth

OECD Organisation for Economic Co-operation and Development

BRICS Brazil, Russia, India, China, considered the rising economic and scientific powerhouse countries

From a "purely" numbers standpoint, scientific production is unequally distributed around the world and on a variety of axes. This is the basic question of representation: where are the women? Where are the colonized countries? Where are the black and brown researchers, and where are the queer and trans researchers?

To be clear: this is not a point blank question of "Is *Nature* sexist?" Lack of representation does not *necessarily* place blame on paper and grant reviewers, editors, faculty members, or other individuals, although undoubtedly this plays a part. The prominence of white men from Europe and North America in our literature stems from, re: feminist theory, a structural system that discredits, discourages, and actively shunts women and minority groups away from positions of power, of which science is one.

Who gets to make science, and who gets credit?

3.0.3 *Some more notes*

> "science" is gonna be pretty generalized; clinical research is generally more studied and more prioritized in the literature, plausibly as a result of a pervading belief in the relative hardness of sciences. Clinical research is more easy to critique and more visible.
>
> Also, there *is* some representation. It seems plausible that the "harder" fields simply don't have the capacity to create and be a part of data production at the LHC.
>
> IF you don't have internet access, you can't even do bioinformatics. Entire scientific fields are built purely on the internet.

3.1 DEVELOPING COUNTRIES:

CITATIONS FOR HERE:[23,32,33,39,45,49,66,72,73,76,78]

3.1.1 *Who gets counted?: global citation indices*

In *Unseen Science: Scholarly Publication in the BRICs but not in the Web of Science*, Wagner examined representation in citation indices and found only 4% of developing countries journals were counted. Luckily, this isn't country-specific – only 4% of journals in *any* country are indexed. Which is not so much an indictment of what countries get indexed, but of impact factors in general.

More starkly – the disproportionate – truly disproportionate data in Figure 2

> "Of the material in SCIE, more than 50 percent of journals are attributed to just three countries: the United States (34 percent); England (19 percent) and the Netherlands (8 percent) reflecting an English-language bias that has been documented"[78]

3.1.2 *Who contributes to knowledge?*

> Authors from countries with poor publication records who submit a paper to the Journal will be positively discriminated towards, in that the editors will comment on the quality of papers and return these comments to the authors prior to refereeing. The authors will also request the name of a local referee. When the editors return the paper, it will go through the usual process of refereeing, together with comments from the local referee. The standard of final acceptance of papers will not be varied, but it is hoped that the extra input will allow some papers that were marginal to be pub- lished.
>
> Vetter[76]
> Editor, *Journal of Public Health Medicine*

Numbers are boring, but wow, are they depressing.

In a retrospective of 5 major medical journals, Sumathipala, Siribaddana, and Patel examined contributions by 4 geographic areas: the UK, USA, Other Euro-American Countries (OEAC), and "Rest of World" (RoW). RoW, on average, contributed 6.5% of the research literature. The highest seen was in the Lancet (12%), and of the 151 RoW articles involved, 68.9% involved authorship from a developed county in Europe or North America. 15 original papers in the journals had data from RoW w/ no RoW coauthors.

This study selected the highest impact general purpose medical journals, of all issues in one calendar year (either 2000 or 1999), and examined authorship (by institutional affiliation) and the methods, to ascertain the geographic origin of data. Some notable variations in the regional data: 2 countries (Japan and Israel) contribute a 5th of the RoW-published literature, while China and India combined (the two most populous countries in the world) contribute a total of 13%. Only 31% of the total articles were entirely independent RoW.

Interesting to remember that Japan was the aggressor in WWII; Japanese nationalism. Israel is...well, Israel and Palestine. Their research is not an accident. *Tryna' not homogenize people of color into one group.*

re: independence – should look into the developing culture of collaboration and thus the changing nature of discrimination or not

3.1.3 *notes on production from the SCAP report*

UB FOH University of Botswana, Faculties of Humanities

UOM FOS University of Mauritius, Faculties of Science

UCT COMM University of Cape Town, Commerce

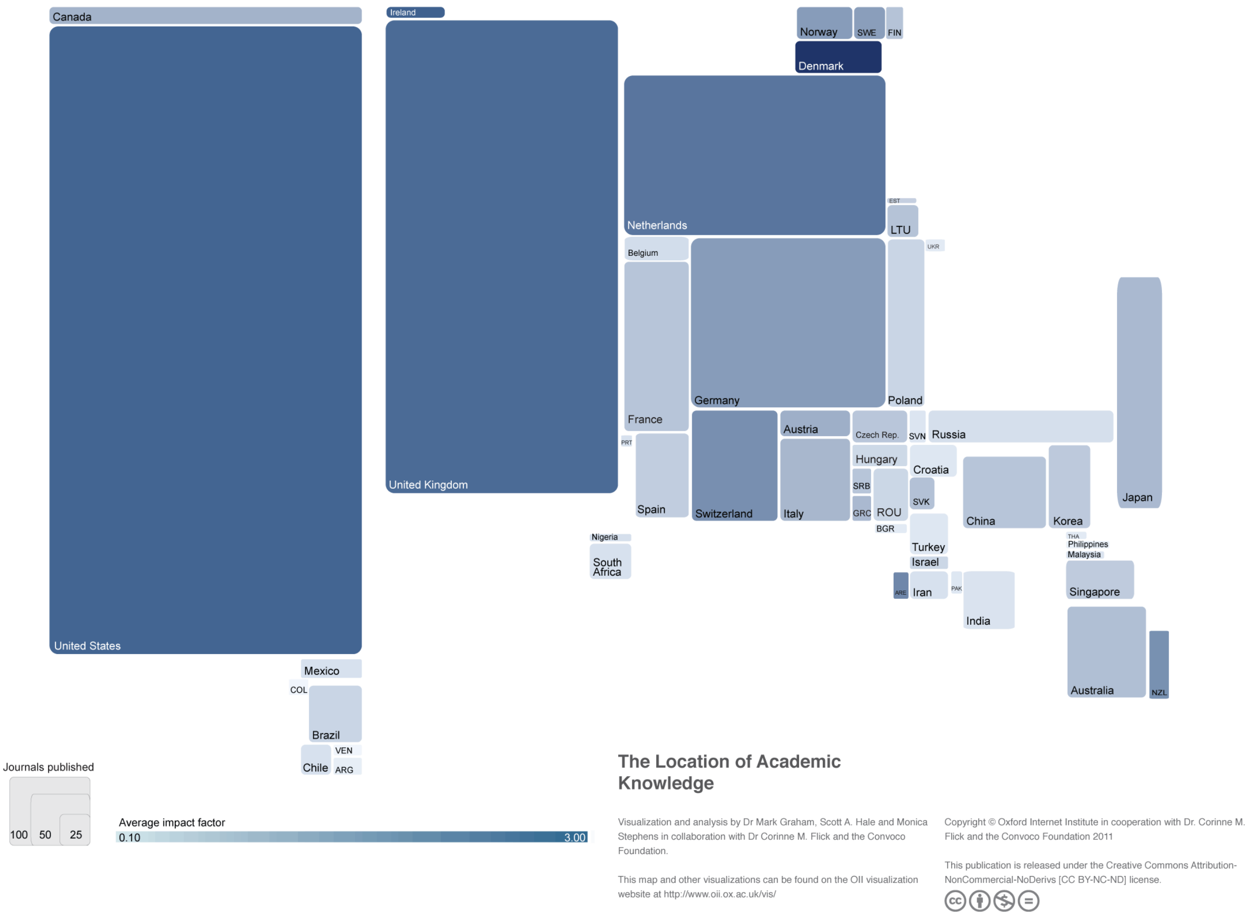

Figure 2: location of academic knowledge

This map reveals a staggering amount of inequality in the geography of the production of academic knowledge. The United States and the United Kingdom publish more indexed journals than the rest of the world combined. Western Europe, in particular Germany and the Netherlands, also scores relatively well. Most of the rest of the world then scarcely shows up in these rankings. One of the starkest contrasts is that Switzerland is represented at more than three times the size of the entire continent of Africa. The non-Western world is not only under-represented in these rankings, but also ranks poorly on average citation score measures. Despite the large number and diversity of journals in the United States and United Kingdom, those countries manage to maintain higher average impact scores than almost all other countries. It is important to note that the 9,500 journals included in this map do not represent the entirety of all published journals. However, given the influence of the JCR, and its claims to provide a "systematic, objective means to critically evaluate the world's leading journals," 1 it remains crucial to understand the geography of academic knowledge.

UNAM FHSS University of Namibia, Humanities and Social Sciences

from the last summary chapter of[41],

> Before we begin, however, it is worth foregrounding a foundational assumption concern- ing regional scholarly visbility that we have confirmed through our research.

FINDING 1. Southern African research is comparatively marginal and invisible in the global context of academic research production.

> This general condition of marginality and invisibility is due to both external and internal factors. Externally, the wealth and productivity of Northern institutions (and increasingly other Southern ones in China) simply dwarf the research potential of the smaller Southern African countries, a fact that will not change soon. However, it is also influenced by internal factors which, if altered, could increase its reach, prestige and relevance.

FINDING 2. Southern African scholars are motivated to produce and disseminate research for both intrinsic and extrinsic reasons, including: the institutional mandate (University of Botswana, Faculties of Humanities (UB FoH)), peer expectation (University of Cape Town, Commerce (UCT Comm)), personal desire (University of Mauritius, Faculties of Science (UoM FoS)) and to generate new knowledge and enhance teaching (University of Namibia, Humanities and Social Sciences (UNAM FHSS))

FINDING 3. Not all Southern African scholars want their research to be visible.

- anxieties about quality, peer judgment and community exposure (especially if they doubt the value of their research contributions)
- a culturally informed sense of modesty (where it is considered improper to engage in self-promotion, such as calling attention to one's own work)
- a minimalist communications strategy (where dissemination is achieved through reading a paper at a conference, or perhaps allowing a journal to publish it, but nothing further)
- fear that others may steal their ideas/data (especially if still in gestational form)
- a teaching- rather than research-oriented approach to scholarship (which speaks to one's sense of academic identity, as a teacher rather than a researcher)

FINDING 4. Heavy teaching and administrative loads hinder research production in Southern African universities.

FINDING 5 The majority of Southern African research projects are either unfunded or funded by their universities.

> Considering that the four universities that we profiled were some of the more prolific in the region (each was the top

producing university in their respective countries) and belonged to countries that had moderate financial resources (especially as compared to their neighbours), the challenges of research funding are likely much greater across the rest of Southern Africa.

finding 6. Many Southern African research projects are small, local projects, confined to an immediate geographical area.

3.1.4 *Which Bodies/Diseases?*

> **Background** More than two-thirds of the world's population live in low-income countries, where health priorities are different from those of people living in more affluent parts of the world. We evaluated the relation between the global burden of dis- ease and conditions or diseases studied in randomized controlled trials (RCTs).
>
> **Results:** Among the 286 RCTs in our sample, 124 (43.4%) ad- dressed 1 of the 35 leading causes of the global burden of disease. Of these, ischemic heart disease, HIV/AIDS and cere- brovascular disease were the most commonly studied condi- tions. Ninety articles (31.5%) studied 1 of the top 10 causes of the global burden of disease. The mean rating (and standard deviation) for international health relevance assigned by experts was 2.6 (1.5) out of 5. Only 14 (16%) of the 90 trials re- ceived a rating of 4 or greater, indicating high relevance to in- ternational health. Almost half of the 40 leading causes of the global burden of disease were not studied by any trial.
>
> **Interpretation:** Many conditions or diseases common internationally are underrepresented in RCTs published in leading gen- eral medical journals. Trials published in these journals that studied one of these high-priority conditions were generally rated as being of little relevance to international health.
>
> 66

The 10/90 problem is simple: only 10% of the world's resources are used for 90% of health problems. Only 6% of psychiatiric jurnals arose from regions accounting for >90% of the population.[73]

3.2 gender disparities

> "Although there are more female than male undergraduate [especially in "softer" scientific fields" and graduate students in many countries, there are relatively few female full professors, and gender inequalities in hiring, earning, funding, satisfaction and patenting persist."

Quantitition of gender disparities in measures of scholarly output and has been few and far between – "highly localized, mono-disciplinary, and dated"; they take little account of the rise in collaborative research etc. Larivière et al.[49] analyzed the relationship between gender and research output (authorship), collaboration extent (co-authorships) and scientific impact of publications (citation count, according to the Web of Science); The authors analyzed >5 million research papers and reviews with more than 27 million involved authors, assigning gender using data from the Social Security database.

Web of science, of course, is an extremely flawed way to do this because it barely includes anything that isn't the US or UK. See the sections on citation factors and global publishing

Some results:

1. in the most productive entries, all articles with women in dominant author positions receive fewer citations than those with men in the same position
   a) accentuated by domesticity [nationality-wise] - women benefit less from the extra citations accrued by international collaborations
2. globally, women account for <30% of fractionalized authorship, men are >70%
   a) 1:1.93 women:men first authorships
3. South America & Eastern Europe had best gender parity –
   a) female authorship generally more prevalent in countries and/or states with lower output
4. **impact:** when a woman is in prominent position (sole authorship, first-author, last-author), paper attracts fewer citations; holds for national and international collaborations

There are, of course, major limitations, the biggest one being obvious – age has an enormous role to play. Many trends are likely not actually markers of overt discrimination, but rather that women aren't making it to the top ranks of science and thus are not in a position to be publishing or collaborating on the most important papers.

Basically, this is quantitative numbers to back up what women have been saying for years – there are tall, tall hurdles to jump. In 17% of countries, active scientists are equally represented: but fewer than 6% Web of Science countries come even close to gender parity in # papers published.

West et al. [80] published an extremely similar paper in PLoS one the same year, without the global analysis component but with even more papers as part of the analysis. Their source was the JSTOR corpus, "a body of academic papers...spanning five centuries". They look at similar variables – authorship order and overall percentages. This includes the humanities research as well, which is interested.

with the mention that publication counts obviously are relevant in tenure *discussions, e.g. hiring e.g. perpetuating cycle*

Also, HUGE points for their methods and reproducibility, e.g. creating the gender browser and communicating with me about making that something to apply to individual libraries in reference managers. Secret part of my div that may or may not manifest depending on the cooperation of these authors

3.3 DIGITAL DIVIDES

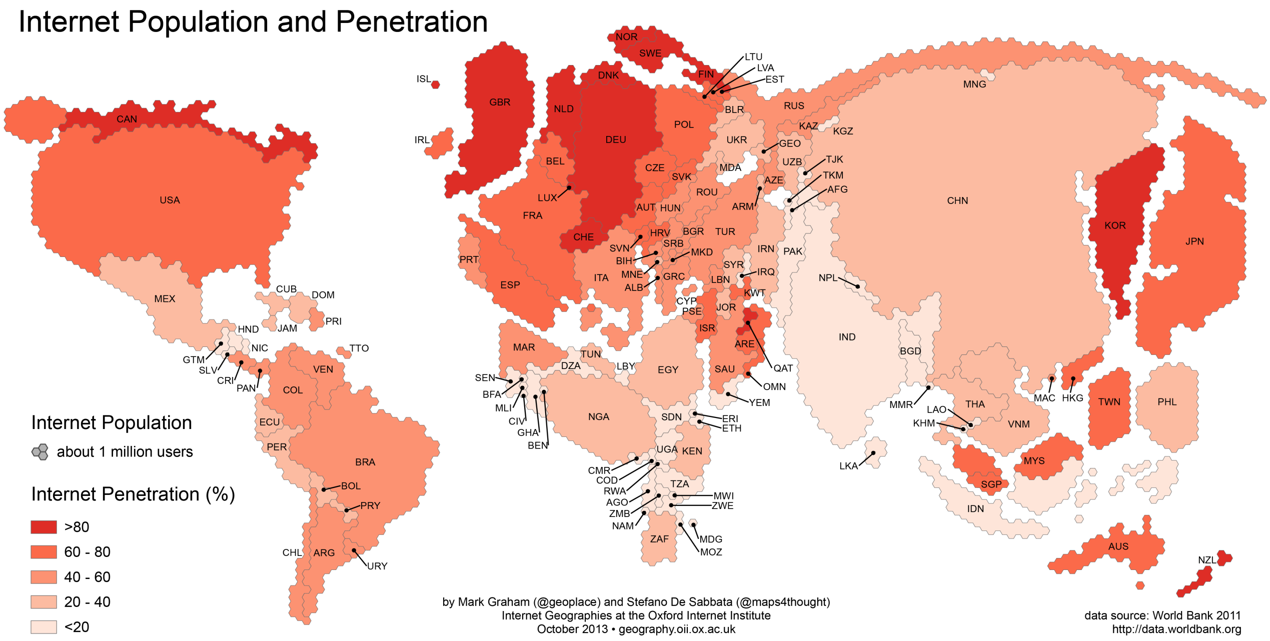

Figure 3: Description - This map illustrates the total number of Internet users in a country as well as the percentage of the population that has Internet access.

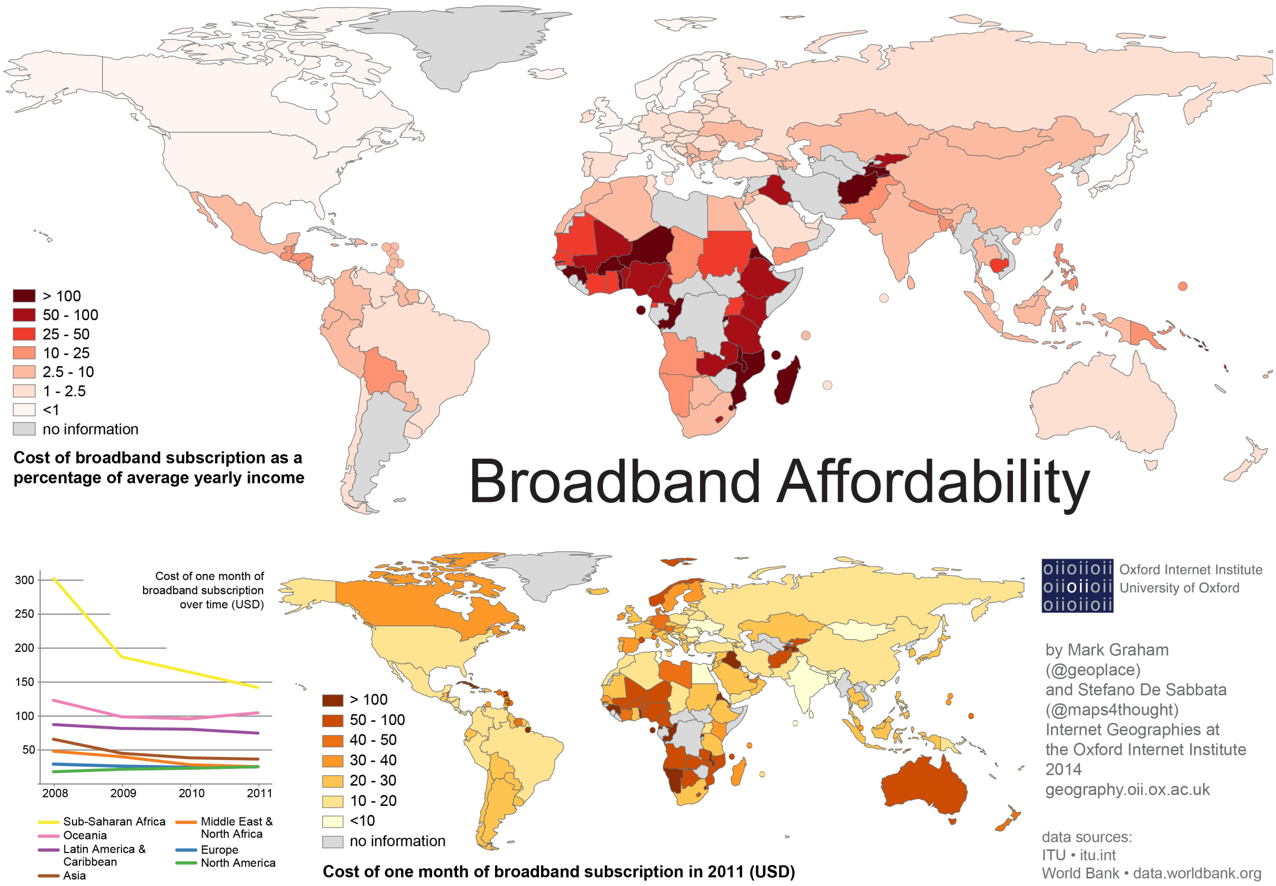

Figure 4: **Description** -This map presents an overview of broadband affordability, as the relationship between average yearly income per capita and the cost of a broadband subscription.

BIBLIOGRAPHY

[1] Hilda Bastian |. Biomedical research: Believe it or not? | Absolutely Maybe, Scientific American Blog Network. (Cited on page 10.)

[2] Joelle M. Abi-Rached and Nikolas Rose. The birth of the neuromolecular gaze. *History of the human sciences*, 23(1):11–36, 2010. (Cited on page 54.)

[3] John Arrowsmith. Trial watch: Phase II failures: 2008–2010. *Nature Reviews Drug Discovery*, 10(5):328–329, May 2011. ISSN 1474-1776. doi: 10.1038/nrd3439. (Cited on page 10.)

[4] V. Babuška, V. Kulda, Z. Houdek, M. Pešta, J. Cendelin, N. Zech, J. Pacherník, F. Vožeh, P. Uher, and M. Králíčková. Characterization of P19 cells during retinoic acid induced differentiation. *Prague medical report*, 111(4):289–299, 2010. (Cited on page 51.)

[5] Marie Battiste. Indigenous knowledge: foundations for First Nations. *World Indigenous Nations Higher Education Consortium-WINHEC Journal*, 2005. (Cited on page 40.)

[6] K. Beckett. Choosing Cesarean: Feminism and the politics of childbirth in the United States. *Feminist Theory*, 6(3):251–275, December 2005. ISSN 1464-7001. doi: 10.1177/1464700105057363. (Cited on page 4.)

[7] C. Glenn Begley and Lee M. Ellis. Drug development: Raise standards for preclinical cancer research. *Nature*, 483(7391):531–533, March 2012. ISSN 0028-0836. doi: 10.1038/483531a. (Cited on page 10.)

[8] Bo-Christer Björk and David Solomon. Open access versus subscription journals: a comparison of scientific impact. *BMC Medicine*, 10(1):73, July 2012. ISSN 1741-7015. doi: 10.1186/1741-7015-10-73. PMID: 22805105. (Cited on page 41.)

[9] Björn Brembs, Katherine Button, and Marcus Munafò. Deep impact: unintended consequences of journal rank. *Frontiers in Human Neuroscience*, 7, 2013. ISSN 1662-5161. doi: 10.3389/fnhum.2013.00291. (Cited on pages 15 and 17.)

[10] Beverly H. Brummett, Stephen H. Boyle, Ilene C. Siegler, Cynthia M. Kuhn, Allison Ashley-Koch, Charles R. Jonassaint, Stephan Züchner, Ann Collins, and Redford B. Williams. Effects of Environmental Stress and Gender on Associations among Symptoms of Depression and the Serotonin Transporter Gene Linked Polymorphic Region (5-HTTLPR). *Behavior Genetics*, 38(1):34–43, January 2008. ISSN 0001-8244, 1573-3297. doi: 10.1007/s10519-007-9172-1. (Cited on page 53.)

[11] Katherine S. Button, John P. A. Ioannidis, Claire Mokrysz, Brian A. Nosek, Jonathan Flint, Emma S. J. Robinson, and Marcus R. Munafò. Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, 14(5):365–376,

April 2013. ISSN 1471-003X, 1471-0048. doi: 10.1038/nrn3475. (Cited on page 12.)

[12] Maria Carlsson and Arvid Carlsson. A regional study of sex differences in rat brain serotonin. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 12(1):53–61, 1988. ISSN 0278-5846. doi: 10.1016/0278-5846(88)90061-9. (Cited on page 53.)

[13] Leslie Chan, Barbara Kirsop, and Subbiah Arunachalam. Open access archiving: the fast track to building research capacity in developing countries. November 2005. ISSN 90-429-1645-1. (Cited on page 10.)

[14] Suparna Choudhury and Jan Slaby. *Critical Neuroscience: A Handbook of the Social and Cultural Contexts of Neuroscience*. Wiley-Blackwell, Chichester, West Sussex, 1st edition, November 2011. ISBN 9781444333282. (Cited on page 54.)

[15] Gideon Emcee Christian. Open Access Initiative and the Developing World. SSRN Scholarly Paper ID 1304665, Social Science Research Network, Rochester, NY, 2008. (Cited on page 39.)

[16] Murat Cokol, Fatih Ozbay, and Raul Rodriguez-Esteban. Retraction rates are on the rise. *EMBO Reports*, 9(1):2, January 2008. ISSN 1469-221X. doi: 10.1038/sj.embor.7401143. PMID: 18174889 PMCID: PMC2246630. (Cited on pages 10 and 11.)

[17] Farid Dahdouh-Guebas, Jennifer Ahimbisibwe, Rita Van Moll, and Nico Koedam. Neo-colonial science by the most industrialised upon the least developed countries in peer-reviewed publishing. *Scientometrics*, 56(3):329–343, 2003. (Cited on page 39.)

[18] Philip M. Davis. The persistence of error: a study of retracted articles on the Internet and in personal libraries. *Journal of the Medical Library Association : JMLA*, 100(3):184–189, July 2012. ISSN 1536-5050. doi: 10.3163/1536-5050.100.3.008. PMID: 22879807 PMCID: PMC3411255. (Cited on page 12.)

[19] Alessandro Delfanti. *Biohackers: The Politics of Open Science*. Pluto Press, London, May 2013. ISBN 9780745332802. (Cited on page 38.)

[20] Kerry Dwan, Douglas G. Altman, Juan A. Arnaiz, Jill Bloom, An-Wen Chan, Eugenia Cronin, Evelyne Decullier, Philippa J. Easterbrook, Erik Von Elm, Carrol Gamble, Davina Ghersi, John P. A. Ioannidis, John Simes, and Paula R. Williamson. Systematic Review of the Empirical Evidence of Study Publication Bias and Outcome Reporting Bias. *PLoS ONE*, 3(8):e3081, August 2008. doi: 10.1371/journal.pone.0003081. (Cited on page 12.)

[21] P. J Easterbrook, R Gopalan, J. A Berlin, and D. R Matthews. Publication bias in clinical research. *The Lancet*, 337(8746):867–872, April 1991. ISSN 0140-6736. doi: 10.1016/0140-6736(91)90201-Y. (Cited on page 13.)

[22] George T. H Ellison, Andrew Smart, Richard Tutton, Simon M Outram, Richard Ashcroft, and Paul Martin. Racial Categories in Medicine: A Failure of Evidence-Based Practice? *PLoS Med*, 4(9): e287, September 2007. doi: 10.1371/journal.pmed.0040287. (Cited on page 4.)

[23] J. A. Evans and J. Reimer. Open Access and Global Participation in Science. *Science*, 323(5917):1025–1025, February 2009. ISSN 0036-8075, 1095-9203. doi: 10.1126/science.1154562. (Cited on pages 19 and 41.)

[24] Daniele Fanelli. Do pressures to publish increase scientists' bias? An empirical support from US States Data. *PloS one*, 5(4):e10271, 2010. (Cited on page 11.)

[25] Daniele Fanelli. Why growing retractions are (mostly) a good sign. *PLoS medicine*, 10(12):e1001563, 2013. (Cited on pages 7, 11, 35, and 37.)

[26] Ferric C. Fang and Arturo Casadevall. Retracted Science and the Retraction Index. *Infection and Immunity*, 79(10):3855–3859, October 2011. ISSN 0019-9567, 1098-5522. doi: 10.1128/IAI.05661-11. PMID: 21825063. (Cited on pages ii and 11.)

[27] Mohamed H. Farah, James M. Olson, Holly B. Sucic, Richard I. Hume, Stephen J. Tapscott, and David L. Turner. Generation of neurons by transient expression of neural bHLH proteins in mammalian cells. *Development*, 127(4):693–702, 2000. (Cited on page 51.)

[28] A. Fausto-Sterling. The Bare Bones of Race. *Social Studies of Science*, 38(5):657–694, October 2008. ISSN 0306-3127. doi: 10.1177/0306312708091925. (Cited on page 4.)

[29] Ludwik Fleck. *Genesis and Development of a Scientific Fact*. University of Chicago Press, Chicago, August 1981. ISBN 9780226253251. (Cited on page 2.)

[30] J. H. Fujimura and R. Rajagopalan. Different differences: The use of 'genetic ancestry' versus race in biomedical human genetic research. *Social Studies of Science*, 41(1):5–30, December 2010. ISSN 0306-3127. doi: 10.1177/0306312710379170. (Cited on page 4.)

[31] Virginia Gewin. Turning point: Carl Boettiger. *Nature*, 493(7434):711–711, January 2013. ISSN 0028-0836, 1476-4687. doi: 10.1038/nj7434-711a. (Cited on page 43.)

[32] Global Forum for Health Research (Organization). *The 10/90 report on health research, 2000*. Global Forum for Health Research, Geneva, Switzerland, 2000. ISBN 2940286019 9782940286010. (Cited on page 19.)

[33] Fiona Godlee, Richard Horton, and Richard Smith. Global information flow. *The Lancet*, 356(9236):1129–1130, September 2000. ISSN 01406736. doi: 10.1016/S0140-6736(00)02752-5. (Cited on page 19.)

[34] Steven Goodman and Sander Greenland. Assessing the unreliability of the medical literature: a response to "why most published research findings are false. *Johns Hopkins University, Dept. of Biostatistics Working Papers*, February 2007. (Cited on page 10.)

[35] Root Gorelick. Indigenous sciences are not pseudoscience. *Ideas in Ecology and Evolution*, 7(1), May 2014. ISSN 1918-3178. doi: 10.4033/iee.v7i1.5150. (Cited on page 39.)

[36] Michael L. Grieneisen and Minghua Zhang. A comprehensive survey of retracted articles from the scholarly literature. *PLoS One*, 7(10):e44118, 2012. (Cited on page 12.)

[37] Donna Jeanne Haraway. A Game of Cat's Cradle: Science Studies, Feminist Theory, Cultural Studies. *Configurations*, 2(1):59–71, 1994. ISSN 1080-6520. doi: 10.1353/con.1994.0009. (Cited on page 3.)

[38] Sandra Harding. Postcolonial and feminist philosophies of science and technology: convergences and dissonances. *Postcolonial Studies*, 12(4):401–421, December 2009. ISSN 1368-8790. doi: 10.1080/13688790903350658. (Cited on page 4.)

[39] Jonathan Harle, Sioux Cumming, Citations, and Research funding | 5 Comments. Geographies of knowledge: practical ways to boost the visibility of research undertaken and published in the South. (Cited on page 19.)

[40] Daniel R. Headrick. *The tools of empire: technology and European imperialism in the nineteenth century*. Oxford University Press, New York, 1981. ISBN 0195028317. (Cited on page 1.)

[41] Trotter Henry and Kell Catherine. *Seeking Impact and Visibility: Scholarly Communication in Southern Africa*. African Minds, June 2014. ISBN 9781920677510. (Cited on page 22.)

[42] John P. A. Ioannidis. Why Most Published Research Findings Are False. *PLoS Med*, 2(8):e124, August 2005. doi: 10.1371/journal.pmed.0020124. (Cited on pages 7, 10, 14, 35, and 37.)

[43] Leah R. Jager and Jeffrey T. Leek. An estimate of the science-wise false discovery rate and application to the top medical literature. *Biostatistics*, 15(1):1–12, January 2014. ISSN 1465-4644, 1468-4357. doi: 10.1093/biostatistics/kxt007. PMID: 24068246. (Cited on page 10.)

[44] Bob Jolliffe. Aligning the ideals of free software and free knowledge with the South African Freedom Charter. *First Monday*, 11(7), 2006. (Cited on page 39.)

[45] David A. King. The scientific impact of nations. *Nature*, 430(6997): 311–316, July 2004. ISSN 0028-0836. doi: 10.1038/430311a. (Cited on page 19.)

[46] Laurence J. Kirmayer. Beyond the 'New Cross-cultural Psychiatry': Cultural Biology, Discursive Psychology and the Ironies of Globalization. *Transcultural Psychiatry*, 43(1):126–144, March 2006. ISSN 1363-4615, 1461-7471. doi: 10.1177/1363461506061761. PMID: 16671396. (Cited on page 55.)

[47] Thomas S. Kuhn. *The Structure of Scientific Revolutions, 3rd Edition*. The University of Chicago Press, Chicago, IL, 3rd edition, December 1996. ISBN 9780226458083. (Cited on page 2.)

[48] Andrew P. Kurmis. Understanding the Limitations of the Journal Impact Factor. *The Journal of Bone & Joint Surgery*, 85(12):2449–2454, December 2003. ISSN 0021-9355, 1535-1386. The impact factor, a simple mathematical formula reflecting the number of citations

of a journal's material divided by the number of citable materials published by that same journal, has evolved to become one of the most influential tools in modern research and academia. The impact factor can be influenced and biased (intentionally or otherwise) by many factors. Extension of the impact factor to the assessment of journal quality or individual authors is inappropriate. Extension of the impact factor to cross-discipline journal comparison is also inappropriate. Those who choose to use the impact factor as a comparative tool should be aware of the nature and premise of its derivation and also of its inherent flaws and practical limitations. PMID: 14668520. (Cited on pages 15 and 16.)

[49] Vincent Larivière, Chaoqun Ni, Yves Gingras, Blaise Cronin, and Cassidy R. Sugimoto. Bibliometrics: Global gender disparities in science. *Nature*, 504(7479):211–213, December 2013. ISSN 0028-0836, 1476-4687. doi: 10.1038/504211a. (Cited on pages 19 and 23.)

[50] Peter A. Lawrence. The politics of publication. *Nature*, 422(6929): 259–261, March 2003. ISSN 0028-0836. doi: 10.1038/422259a. (Cited on page 16.)

[51] Qian Li, Christine Wichems, Armin Heils, Klaus-Peter Lesch, and Dennis L. Murphy. Reduction in the Density and Expression, But Not G-Protein Coupling, of Serotonin Receptors (5-HT1A) in 5-HT Transporter Knock-Out Mice: Gender and Brain Region Differences. *The Journal of Neuroscience*, 20(21):7888–7895, November 2000. ISSN 0270-6474, 1529-2401. PMID: 11050108. (Cited on page 53.)

[52] Matthias E. Liechti, Alex Gamma, and Franz X. Vollenweider. Gender differences in the subjective effects of MDMA. *Psychopharmacology*, 154(2):161–168, March 2001. ISSN 0033-3158, 1432-2072. doi: 10.1007/s002130000648. (Cited on page 53.)

[53] Stephen G. Lisberger. Sound the Alarm: Fraud in Neuroscience. *Cerebrum: the Dana Forum on Brain Science*, 2013, May 2013. ISSN 1524-6205. PMID: 23847713 PMCID: PMC3704310. (Cited on pages 17 and 37.)

[54] Emily Martin. The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles. *Signs*, 16(3):485–501, April 1991. ISSN 0097-9740. (Cited on page 4.)

[55] Amanda Mascarelli. Research tools: Jump off the page. *Nature*, 507(7493):523–525, March 2014. ISSN 0028-0836, 1476-4687. doi: 10.1038/nj7493-523a. (Cited on page 43.)

[56] Eleanor Murphy and Francis J. McMahon. Pharmacogenetics of Antidepressants, Mood Stabilizers, and Antipsychotics in Diverse Human Populations. *Discovery Medicine*, 16(87):113–122, August 2013. (Cited on page 53.)

[57] D. Nafus. 'Patches don't have gender': What is not open in open source software. *New Media & Society*, 14(4):669–683, June 2012. ISSN 1461-4448, 1461-7315. doi: 10.1177/1461444811422887. (Cited on page 39.)

[58] Michael Parker. The ethics of open access publishing. *BMC Medical Ethics*, 14(1):1, April 2013. ISSN 14726939. (Cited on page 8.)

[59] Martyn Pickersgill. Between Soma and Society: Neuroscience and the Ontology of Psychopathy. *BioSocieties*, 4(1):45–60, 2009. ISSN 1745-8552. doi: 10.1017/S1745855209006425. (Cited on page 55.)

[60] Florian Prinz, Thomas Schlange, and Khusru Asadullah. Believe it or not: how much can we rely on published data on potential drug targets? *Nature Reviews Drug Discovery*, 10(9):712–712, September 2011. ISSN 1474-1776. doi: 10.1038/nrd3439-c1. (Cited on page 10.)

[61] Marcus G. Raskin and Herbert J. Bernstein. *New Ways of Knowing: The Sciences, Society, and Reconstructive Knowledge*. Rl Innactive Titles, Totowa, N.J, June 1987. ISBN 9780847674633. (Cited on page 4.)

[62] Rinki Ray, Nathan M Novotny, Paul R Crisostomo, Tim Lahm, Aaron Abarbanell, and Daniel R Meldrum. Sex Steroids and Stem Cell Function. *Molecular Medicine*, 14(7-8):493–501, 2008. ISSN 1076-1551. doi: 10.2119/2008-00004.Ray. PMID: 18475312 PMCID: PMC2376641. (Cited on page 53.)

[63] Joseph Reagle. "Free as in sexist?" Free culture and the gender gap. *First Monday*, 18(1), December 2012. ISSN 13960466. (Cited on page 38.)

[64] Dorothy E. Roberts. Race, Gender, and Genetic Technologies: A New Reproductive Dystopia? *Signs: Journal of Women in Culture and Society*, 34(4):783–804, June 2009. ISSN 0097-9740. doi: 10.1086/597132. (Cited on page 4.)

[65] Dorothy E. Roberts. Collateral Consequences, Genetic Surveillance, and the New Biopolitics of Race. 2011. (Cited on page 1.)

[66] Paula A. Rochon, Azad Mashari, Ariel Cohen, Anjali Misra, Dara Laxer, David L. Streiner, Julie M. Dergal, Jocalyn P. Clark, Jennifer Gold, and Malcolm A. Binns. Relation between randomized controlled trials published in leading general medical journals and the global burden of disease. *CMAJ : Canadian Medical Association Journal*, 170(11):1673–1677, May 2004. ISSN 0820-3946. doi: 10.1503/cmaj.1031006. PMID: 15159365 PMCID: PMC408507. (Cited on pages 19 and 23.)

[67] Londa Schiebinger. Feminist history of colonial science. *Hypatia*, 19(1):233–254, 2004. (Cited on page 4.)

[68] Victoria Shelton. Scientific Reseach: The Publication Dilemma. (Cited on pages 8 and 9.)

[69] Tom Slee. FutureEverything: Notes Against Openness, March 2013. (Cited on page 45.)

[70] Ronald Snijder. Do developing countries profit from free books? Discovery and online usage in developed and developing countries compared. *Journal of Electronic Publishing*, 16(1), 2013. ISSN 1080-2711. doi: http://dx.doi.org/10.3998/3336451.0016.103. (Cited on page 41.)

[71] Banu Subramaniam. Moored Metamorphoses : A Retrospective Essay on Feminist Science Studies. 34(4), 2009. (Cited on page 4.)

[72] Cassidy R. Sugimoto. Global gender disparities in science. 2013. (Cited on page 19.)

[73] Athula Sumathipala, Sisira Siribaddana, and Vikram Patel. Underrepresentation of developing countries in the research literature: ethical issues arising from a survey of five leading medical journals. *BMC Medical Ethics*, 5(1):5, October 2004. ISSN 1472-6939. doi: 10.1186/1472-6939-5-5. PMID: 15461820. (Cited on pages 19, 20, and 23.)

[74] The PLoS Medicine Editors. The Impact Factor Game. *PLoS Med*, 3(6):e291, June 2006. doi: 10.1371/journal.pmed.0030291. (Cited on page 17.)

[75] Richard Van Noorden. Data-sharing: Everything on display. *Nature*, 500(7461):243–245, August 2013. ISSN 0028-0836, 1476-4687. doi: 10.1038/nj7461-243a. (Cited on page 43.)

[76] N. Vetter. Research publication in developing countries. *Journal of Public Health*, 25(3):189–189, September 2003. ISSN 1741-3842, 1741-3850. doi: 10.1093/pubmed/fdg063. (Cited on pages 19 and 20.)

[77] Edward Vul, Christine Harris, Piotr Winkielman, and Harold Pashler. Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition. *Perspectives on Psychological Science*, 4(3):274–290, May 2009. ISSN 1745-6916, 1745-6924. doi: 10.1111/j.1745-6924.2009.01125.x. (Cited on page 12.)

[78] Caroline Wagner. Unseen Science: Scholarly Publication in the BRICs but not in the Web of Science. 2011. (Cited on pages 19 and 20.)

[79] Yi Wei, Thomas Harris, and Geoffrey Childs. Global gene expression patterns during neural differentiation of P19 embryonic carcinoma cells. *Differentiation; Research In Biological Diversity*, 70 (4-5):204–219, June 2002. ISSN 0301-4681. (Cited on page 51.)

[80] Jevin D. West, Jennifer Jacquet, Molly M. King, Shelley J. Correll, and Carl T. Bergstrom. The Role of Gender in Scholarly Authorship. *PLoS ONE*, 8(7):e66212, July 2013. doi: 10.1371/journal.pone.0066212. (Cited on page 24.)

[81] Jelte M. Wicherts, Marjan Bakker, and Dylan Molenaar. Willingness to Share Research Data Is Related to the Strength of the Evidence and the Quality of Reporting of Statistical Results. *PLoS ONE*, 6 (11):e26828, November 2011. doi: 10.1371/journal.pone.0026828. (Cited on page 12.)

[82] L Zhang, W Ma, J. L Barker, and D. R Rubinow. Sex differences in expression of serotonin receptors (subtypes 1A and 2A) in rat brain: a possible role of testosterone. *Neuroscience*, 94(1):251–259, September 1999. ISSN 0306-4522. doi: 10.1016/S0306-4522(99)00234-1. (Cited on page 53.)

4 SOLUTIONS: CRACK IT OPEN?

ACRONYMS

FLOSS free/libre open source software

GPL GNU General Public License, the founding document of the Free Software Movement

PLOS Public Library of Science, a leader in open access publishing

OS open science

TREND Teaching and Research in (Neuro)science for Development in Africa

OKF Open Knowledge Foundation

GMH growing misconduct hypothesis (per Fanelli 2013[25])

SSH 'stronger system' hypothesis (per Fanelli 2013[25])

PPV positive predictive value (per Ioannidis 2005[42])

IF Journal Impact Factor

CNS *Cell*, *Nature*, and *Science*

> "Open means **anyone** can **freely access, use, modify, and share** [content] for **any purpose**."

4.1 OPEN ACCESS

"The objective of open access is *not* to quarrel with or replace journals (at all). *Not* to resolve the budgetary problems of libraries, not to provide access to teachers - students- the general public, *not* to provide access the the Developing World. The objective of open access is: to maximise research *impact* by maximizing research *access.*" - Stevan Harnad

LOL WHO THE FUCK ARE YOU

4.2 OPEN CODE

5 What happens when we "fix" publishing?

Acronyms

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5.1 Where do we start?

Open science proposes a "fix" of sorts, a return to a scientific world marked by honesty and loyalty.

> I think that fraud has increased since I came into scientific research 40 years ago, as the challenges of running a successful research laboratory, obtaining funding, and publishing papers likewise have increased. In the not-so-recent past, we did not have cutthroat competition to publish in the most prestigious journals as we do today, and grant funding flowed freely. There was enough reward to go around. The life of a scientist was relatively simple, so there were fewer incentives to cheat.
>
> "So what can we do to return to how things once were?"[53]

Lisberger proposes, among other things, what we've already seen: increased data sharing,

Lineages of open (science)

> "The most common narrative about open science tells us that, once upon a time, science was an ethical enterprise: sharing, equality, disinterest and the common good drove the everyday work of scientists. Then evil corporations entered science and changed the rules of the game, patenting

> life, enclosing the commons, and eventually destroying the willingness to share data, information, and knowledge. But today, so the story goes, we have new tools that together with the old open science spirit an be used to rebel against evil, defeat it and allow scientific knowledge to flow freely again. These tools are open source and open access science, and they can be used to tear down the barriers to the access of scientific knowledge." (Delfanti, p. 5)

Open science rhetoric draws on a mystical past where information flowed free ("In the 17th century, journal publication *was* open science!"), and in so doing, constructs a seamless narrative where open science is part of every major discovery since Newton. Or whoever, pick your scientist. The construction of an illustrious history lends legitimacy to the moral appeal of the movement.

5.1.1 *Open, not free*

The open science movement is closely affiliated with the free/libre open source software (FLOSS) movement, and so it's taken as almost a default that the "free" is free as in freedom, not as in beer. For clarification:

> "The terminology of and factions within this movement are complex, but, in short, "free software" tends to be associated with the ideology of freedom, "open source" with the openness of the development process, and "libre" with those concerned about confusion from the previous two. FLOSS are used as monikers to refer to all of these meanings." (Reagle [63])

Part of what draws many to OS are its ties to the free and open source software movement, specifically in the realm of community-driven creation. The similarities are many and significant; since the OS movement grows out FLOSS community, it makes sense to start there.

For the FLOSS movement, there's a sharp ideological divide between the free/libre and the open licenses. Advocates of the libre licensing model use many rhetorical tools, but their focus is on libre software as social imperative. User freedom, as laid out in the founding document of the Free Software movement (the GNU General Public License (GPL)) is paramount. "Open source", as a term and associated licensing models, comes from an explicit attempt to side-step the social values and ideological connotations of the term "free software". It instead has a narrow focus on access and production of source code - i.e. the 'practical' benefits of distributed production.

Bearing that distinction in mind, as trivial as it may seem, I think the usage of *open* in OS is a valuable point of entry into the ambivalent moral aspects of open science. Lots of proponents of OS either come from and/or explicitly draw from the F/LOSS movement, but the chosen movement nomenclature is "open". The same disavowal (or maybe just lack of acknowledgment) of social values seen in open source is apparent in a lot of the open science movement. It's not about science helping (or empowering) people, it's about doing "better" science – more reproducible, more reliable, more powerful (disruptive, even!). Open science is defined almost entirely by the *mechanisms*, in the same way open source is *just* focused on production. Even projects that

A lot of the following ideas draw heavily on analyses of the FLOSS movement, because that's where work has been done to some extent. "Open science" isn't nearly as widely talked about or analyzed.

pitch themselves as a place for citizen scientists can be construed as just a way to shift labor from cheap graduate students to even cheaper laypeople.

5.2 corporate uses of open science

Open science, by intent, can be used by anybody for anything. That also means corporate entities can take advantage of the methods, tools, and data released into the public sphere.

Interestingly, there's been attempts to implement a copyright license similar to the GPL, but with a clause of "only ethical consideration"

In the free software world, corporate uses aren't bad – and here, as well, I don't think they're necessarily *bad.* But they do undercut the "open is good" in the sense that corporations are notorious for only considering the bottom line. That means any usage of open resources is for the bottom line, and not necessarily for whatever heroic potential purpose open data/science advocates had in mind.

5.3 creation and representation

5.3.1 *Who gets to create?*

Generally, white men. In free software communities, men outnumber women to a much greater degree than in more traditional development structures[57]; presumably, racial and ethnic minorities fare even more poorly, although there's even less data to support that.

The dismal representation in FLOSS derives in part from a flawed perception that social stratifications and classifications "don't matter" on the internet. Code is race- and gender-agnostic (except that, for somewhat obvious reasons, it's *not*). Thus, collaborative, decentralized community structures like those in FLOSS usually fail to include any direct safeguards or rules about what kinds of behavior are acceptable. As a result, misogyny and racism run rampant and unchecked.

Whether representation is *worse* in open science than science at large is something I don't know yet, but it's probably fair to say that open science carries professional risks, and women and minorities in the sciences tend to disproportionately suffer for taking risks.

5.3.2 *Who is it designed for?*

I don't know yet! But probably I won't like it.

5.4 global definitions of "open" and "free"

Free software and open science are built on European/U.S. legal, moral, and social codes. Probably and definitely an issue, especially when "open science" is supposed to level the playing field but other communities, sciences, etc. aren't actually consulted in how they would like that leveling to be done in the legal sense.

Relevant citations: Christian[15], Dahdouh-Guebas et al.[17], Gorelick[35], Jolliffe[44]

5.5 indigenous sciences and local biologies

We often conflate oppressions. Sexism was created by second wave feminists to draw a parallel to the preexisting racism. This is, at its best, a solidarity tool – using our intimate understandings of our oppressions to help form coalitions with others against the interlocking systems of imperialist white supremacist capitalist patriarchy.

"... because I wanted to have some language that would actually remind us continually of the interlocking systems of domination that define our reality" -bell hooks

At worst, this conflation and confusion leads to movements that claim "gay is the new black", dismissing one oppression in lieu of another.

So although they pair nicely, indigenous sciences are not the same as local biologies.

To try and parse out an indigenous science is to frame it against a Eurocentric background, placing it in square opposition. This is the only framework within which I am capable of understanding an indigenous science or a local biology.

Local biologies are implied by feminist science theory, and indeed general science studies. That biological realities differ between geographical and cultural locations should not, realistically, surprise anybody who's made it this far in my div.

5.5.1 *defining indigenous sciences*

Indigenous sciences are hard to define without explicit reference to our dominating framework of Eurocentric experiment-based knowledge production, which holds objectivity as king. Maintaining a myth of Indigenous inferiority in scientific development allows European-based systems to devalue and demean indigenous knowledge, erasing and destroying locally created systems of knowledge. The long history of "re schooling" of Aboriginal children in all areas colonized by European expansionism (notably Canada and the U.S., as well as Australia). More formally, the systematic cutting down of non-European knowledges has tentacles in all eras:

1. the blind reliance on and citation of Greco- Roman references despite the fact that the Greek alphabet is largely of Syrian/Lebanese origin

2. the manipulation of dates and demotion in importance of non-European knowledge such as Mayan, Hindu, and Arabic numerals, the concept of zero and algebraic notations, the use of decimals, and the solution of complex equations

3. the Europeanization of the names of outstanding scientists and their devices, scientific documents, and processes to undermine equal and fair assessment of the global history of knowledges (for instance, a comet identified by the Chinese as early as 2,500 years ago is attributed to Haley)

4. and the classification and trivialization of non-European science and technological innovations and invention as "art"

[5]

5.5.2 *Local biologies*

Local biologies: menopause.

Local environments: weather systems

l

if indigenous sciences are local sciences, specific to the time and place and users involved, then they may not be generalizable to a mythic global community of "scientists".* And *if* we create a system where one of those many sciences is designated as the right one to be spreading, and making access to it the ultimate and only bridge to success, local knowledges are crowded out and erased. Indigenous sciences lose by virtue of what they are – non globalized, local knowledges, with no (monetary, legal) excuse to *not* use globalized standardized bits of (scientific) knowledge.

5.6 effect of open access publishing *on* access

What is the influence of publishing OA on relativ3

e research impact? It's at least equal – impact factors and citation count remain the same.[8]

There's also the proposal, backed by limited data, that OA makes it's greatest impact in increasing access and scientific participation globally, and specifically in the developing world.

> Across sub-fields, the impact of commercial online availability was positive, statistically significant, and on average 40% larger than the OA effect, suggesting that most researchers rely on institutional subscriptions.
>
> The influence of OA was more than twice as strong in the developing world but was less apparent in the very poorest countries where electronic access is limited[23]

5.7 digital divides and open access

"Does open access actually increase access?"

[70]

Internets

If OA is internet enabled (largely it is!), then...broadband matters, and broadband is not equally distributed.

5.8 issues i'm running up against

I can't actually do an anthology of open science in the developing world. I can't catalog all of the grassroots citizen science projects. I can only speak about my concerns and highlight specific projects that are doing well or poorly. It is not, by ANY means, definitive, which I resent and feel is a flaw in myself.

*Again, *if* science is local, there is no homogeneous global community of science/tists. There isn't one anyway tho.

6 OPEN SCIENCE & SEROTONIN: CASE STUDY

Open notebook science has been described as the "epitome of open" and a "revolution" in scientific opportunities.

It's also (I think) the easiest for an undergraduate biologist to implement. I don't publish, yet, so I can't publish any papers open access. I don't generate a lot of data or have data sets, so publishing a data note for others to analyze is out of the question, and of course, since I'm not publishing I can't publish supplemental data.

So, starting from scratch, making all of my lab work openly accessible is the first and easiest way to implement open science. My efforts were inspired and guided by other proponents and practitioners of an Open Notebook methods.

6.1 OPEN NOTEBOOKS IN THE WILD

The first open notebook, and the originator of the term, was Jean Claude-Bradley, a chemist, in a blog post in 2006:

> "...By this [Open Notebook Science] I mean that there is a URL to a laboratory notebook (like this) that is freely available and indexed on common search engines. It does not necessarily have to look like a paper notebook but it is essential that all of the information available to the researchers to make their conclusions is equally available to the rest of the world.
>
> -Jean Claude-Bradley

He maintained, and the group has continued the effort, a project exploring synthesis and testing of anti-malarial compounds in the effort to hasten the search for an effective cure. The group has also added a similar project on HIV.

A second and more technically minded scientist is Carl Boettinger, a mathematical ecologist who's maintained an open lab notebook hosted on Github since 2010. His work and has been mentioned at least three times in Nature (once in 2013, twice in 2014).[31,55,75] His technical model for sharing his scientific progress is one that I emulated – the technicalities are detailed elsewhere, but it relies on minimal HTML, CSS, and coding knowledge to produce a reasonably clean and logical website, with lab notebook entries and any other relevant pages.

With that, I've been keeping my online notebook more or less in sync with my physical lab work since the first entry on July 15, 2014. All the entries are time stamped and track revisions, and are written in human-readable HTML Markdown.

The bulk of this project is currently located at a Github repository (https://github.com/kathleenleeper/workhorse) and detailed there.

Although the current systems may be undergoing some fairly large revisions in the next month

6.2 TECHNICAL DISCOVERIES

A large part of my goal with documenting my scientific process was to access its feasibility on a large scale, and for those who weren't already deeply invested in open science. What would be required for open notebooks to become common place? What would happen if they were? What do we lose when we go digital, and what do we gain?

6.2.1 *Frustrations*

1. The pure technical set up takes too much time. To mimic Carl Boettinger's Github-hosted and tracked site, it took a not-insignificant technical investment of time into exploring options and figuring out how to use the tools. There's no good guide to getting your standard wet lab "pure" biologist set up with Jekyll and Github to build a site from scratch like I did.
2. It's clear from my efforts to keep the digital version up with the paper version that any digital notebooks *need* automatic integration; they're otherwise unsustainable and always a little behind the times.
   a) Because paper notes don't translate perfectly to typed text (see 3a), it's frustrating and tiring to have to re-type and revisit a protocol run just earlier, and translate from paper to digital.
   b) Writing up negative results is *annoying* and feels *useless.* Trouble shooting procedures is incredibly tedious; having to write up and explain your attempt and subsequent failure time and again is far from encouraging, and I would venture to say increases the feeling of failure upon revisiting the entry.
3. While there are tablet and smart phone options, a basic laptop is simply not as versatile for note taking as a paper notebook. Computers can't get wet; you can't prop them against a beaker on a crowded lab bench.
   a) This also relates to the sketching and informal drawing that happens in lab notebooks – quick calculations, arrows between protocols, annotations of protocols on the fly as you mis-time, forget, or mix up steps.

Can cite this if people feel strongly

4. Studies have shown time again that physically writing notes helps students retain knowledge better than typing them. Similarly, I do more careful checking of protocols and the steps I have to follow when I'm writing them, rather than just reading and following a protocol from a typed page.
5. Some advocates claim that knowing your work flow could be examined at any time – an ever-present Potential Big Brother
   a) good to consider other people reading it, but i find it doesn't really change my choices in lab work – not my top focus
   b) dissemination is not a high priority

6.2.2 *Celebrations*

There are, of course, many benefits, although I'm not sure I'm taking full advantage of them yet. Some that have already proved immensely useful, and in fact often saved serious time for me.

1. Full text searching of entries, by date, content, and tag. This reduces the time spent flipping back and forth between physical pages, trying to figure out when exactly a sample was taken and the conditions it was processed with (Did you elute that DNA sample in TE, H_2o, or elution buffer?)

2. It's very easy to share and talk about my project – because the repository and site are accessible from my smart phone, I can pull out data and explain the state of my lab work almost anywhere, quickly, efficiently, and with a minimum of fuss.*

3. Because I've already documented everything (mostly), I never have to *remember* small details that take up mental space. I'm never at a loss of which bands in a gel correspond to which samples – because I annotate my gels as soon as I get them, so that I can update the protocol with the results immediately.

4. Version control of files. It's easy to ask a computer to compare many different runs of the same protocol and show you differences in the protocols (assuming you've entered all the relevant information), which helps in comparing why an experiment may not have replicated properly.

   a) Version control of *protocols*, where if you modify a protocol, it's easy to add a note saying why. This would be very helpful for a collaborator of mine, who might wonder why a given protocol deviated from the lab standard in seemingly idiosyncratic ways.

I'm not saying they're not *idiosyncratic, but at least now there's some accountability for why changes were made and when.*

5. Metrics on my lab entries. It's very easy to generate maps and time lines of processes; to see how many times and when my work has been done. I can run self-improvement metrics on myself

Or at least prove to my committee how much work I am or am not doing

6.3 suggestions for surmounting notebook challenges

These might belong in the earlier section? Or the earlier sections analyzing OS belongs here

Some thoughts: Since being open is *not* the same as being accessible, transparent, or even useful (re: Slee, *Notes against openness*); anything that wants to accomplish those goals needs a lot more thought and planning. I think open notebooks are only a small component of what sharing procedures is; said differently, "notebooks" need redefinining. The open, accessible, etc. notebook online is identical in terms of words, graphics, etc. to my paper notebook – in many instances, it's even better. It is not, however, *complete*. No one would ever look at my paper notebook and be able to coherently trace protocols as they evolved; at least, not without my help. A direct transfer of notebook pages to web pages doesn't help the situation.

I think a more ideal situation is *not* a transfer of paper to electronic.

*This is mostly useful when John is upstairs on the 3rd floor and I forget to bring my notebook up when I ask him questions, but it's also been used when I'm traveling and unexpectedly meet someone who's interested. And then I have something to show *right then*.

Rather, multiple layers of publication - namely, including methods. Real protocols, but protocols as you might write them out for someone in your lab running an experiment for you, instead of bite-sized uber-simplified "Procedures were performed as described previously." Following an open lab notebook with nothing else is hard; using it as a reference to supplement a larger work sounds like an incredible resource.

7 SHIT I LIKE

Acronyms

FLOSS free/libre open source software

GPL GNU General Public License, the founding document of the Free Software Movement

PLOS Public Library of Science, a leader in open access publishing

TREND Teaching and Research in (Neuro)science for Development in Africa

OKF Open Knowledge Foundation

7.1 TREND IN AFRICA: 3D PRINTED LABS, NAIROBI, KENYA

The Teaching and Research in (Neuro)science for Development in Africa (TReND) organization "run[s] a wide range of educational activities, and support the establishment of top-level scientific facilities at several countries across the continent by leveraging large scale, low cost approaches to innovation and research. For this, [they] make use of latest technologies and developments, ranging from open source software and hardware approaches such as 3D printing, online teaching tools, and the use of the cost-effetive yet powerful model organism, the fruit fly Drosophila."

They believe "scientific education is pivotal to the ability of societies to innovate, move forward and integrate within the global society. To date, most developing nations need to import their solutions, innovations and patents from abroad, while losing their most capable minds to Western universities. Therefore we believe that providing top-level education to local elites in their home country is key to enabling developing societies to take their futures into their own hands."

SO FUCKING COOL PRINT ME A FUCKING PIPETTE

On December 8th of 2014, two of TReND's founders ran a two day "workshop module as part of the currently ongoing IBRO school on Behavioural Neuroscience run at icipe, Nairobi (organised by N Patel and R Brown). For the first time we are proud to report that the entire module was successfully run using exclusively free and open source materials – from 3D printed pipettes* and behavioural assays using simple off-the-shelf tools to custom built behavioural arenas based on Raspberry Pis and simple electronic control circuits that allow targeted activation of light- and temperature-sensitive proteins expressed in different lines of transgenic fruit flies. Even our microscope ("RPi-scope") was home-built. "

7.2 ASIA-PACIFIC CONFERENCE CALLS

The Open Knowledge Foundation (OKF) foundation supports, among other things, an extremely active mailing list and monthy public confer-

*Availability of 3d printers; also accuracy, and tips?

ence calls on open science. The calls are traditionally held at around 4:30 GMT – an easy and accessible time for those in the Western hemisphere.

> "I'm very keen to participate, but (as with every single conference call...) its not the most Asia Pacific time zone friendly time. Being only a bit after midnight isn't the worst so I'll see if I can make it that day, but if I can't I'll try to send some notes of what we've done so far surveying Hong Kong, and I'd appreciate if someone takes good (etherpad?) notes for us APAC people. (Scott @ Gigascience, OKF Mailing List)

On December 21st, 2014, Ranjith Raj Vasam, bioinformatics scholar and OS enthusiast from Hyderabad, India organized the *first* Asia-Pacific Conference Call. While not particularly well attended, the notepad for the call demonstrates a covering of APAC countries in specifics.

The phrase "lakhs of engineers" is used

7.3 communities using open access

PUBLIC LAB!!

Also this cool project mapping radiation – http://www.cesarharada.com/sampling-sea-and-riverbeds-around-fukushima-nuclear-power-plant/

7.4 "developing" countries fuckin' led open access

> Ten years ago, in 2004, only 1,5% of all North American journals indexed by ISI were open access, for Western Europe this percentage was even smaller – 1,1%. For Eastern Europe it was 6,7%, for Middle East and Africa 8,8%, for Asia and Pacific 14,9% and for Central and South America 42,3% (McVeigh, 2004: 4). And we are only talking here about the journals that underwent the rigorous inclusion procedure by Thomson Reuters, so we can be pretty sure that they were reputable...
>
> Moreover, Evans and Reimar using Web of Science data, report that open access content has 8% more citations, but with a clearly higher level of around 20% for countries originated from developing countries (ibidem: 3).

Interesting and I wonder if it correlates with the gender (approximate) parity?

7.5 pubchase/altmetrics/retraction watch/pubpeer

wooah networked systems for coping with literature!

this isn't really my div? but retraction watch is....:D

7.6 green neuroscience lab, san diego

The Green Neuroscience lab really deserves its own section. It's a lab studying various aspects of neuroscience; it refuses military funding and is a zero emissions lab. They believe in neurodiversity and making neuroscience that empowers. They work with community members and they take their research with a grain of salt.

8 SCIENCE?

"every biological organism is inherently individual"

8.1 WOW WHY?

* Culturally significant and an identity at my (soon to be) alma mater, hallucinogens – psychotropics – are small molecules with a big impact. They entered the modern scientific frame with full force with Heffter's isolation of LSD from ergot, and have since been implicated (within the US) ins CIA coverups and in counter-culture radical movements, used as unorthodox dorm-room herapy and as a field of battle for Native American rights. The plants and complexes they come from – ayahuasca in the the past and present Amazon river basin, ergot-containing drinks for ancient Greek philosophers. etc.

I hate *myself*

these drugs have been around a hella long time, and it's only just now that Western science/culture is beginning to treat them as a potentially meaningful therapeutic substance.

In my own experience and those around, they're either positively life-changing; or not. Some functionally similar signalling mechanism interacts with environment and person to crate this completely unique experience. Part of what's incredible about really any drug experiences is the alterning of how you think – it's a paradigm shift in the most literal sense of the word

8.1.1 *Consciousness-raising molecules*

Presumably, one piece of the psychedelic puzzle is understanding what happens on a molecular level to induce both short term and long term perceptual changes. The most interesting aspect of (really all drugs) but specificaly hallucinogens, is their binding mechanisms Classical psychedelics are selective, to varying degrees, for a specific receptor subtype of the serotonin system, the 5-HT_{2a} receptor. They bind to the same physical receptor as serotonin, but downstream effects within the cell (second messenger signalling molecules, transcription factor activation, and receptor sensitization/internalization) differ radically between drug and substrate, as does psychological effects. Intriguingly, there appear to be certain molecular "fingerprints" characterizing known hallucinogenic drugs (based on both formally obtained and...less formal knowledge) in opposition to their non-consciousness altering counterparts.

little sticky to draw lines between hallucinogenic and non— how specific is that?

* Acronyms

GPCRS G-protein coupled receptors

RA retinoic acid

5-HT 5-hydroxytryptamine

CNS central nervous system

The areas of interest for me here are the elucidation of the signalling pathways created by the stereoelectronic perturbation and conformational movement of specific amino acid residues at the binding site of drugs.

8.2 model serotonin systems

Those signalling pathways have been investigated in a variety of systems. This is by no means a comprehensive overview, but studies on hallucinogens have occurred in a number of different systems since the 1950s (mostly in the 50s and 60s, with a resurgence since the mid-2000s). They include:

1. Humans, with psilocybin, LSD, and MDMA
   a) fMRI, EEGs, interviews of subjective experience
2. Rats, LSD + many other drugs
   a) global RNA extraction to look @ gene transcription
   b) staining to see receptor expression
3. primary neurons? (pretty sure)
4. Oocytes with mGlu & 2a receptors
   a) to study signalling & colocalization
5. CHO (others?) cells expressing a fluorescent 5-HT2a receptor (my thing!)

Obviously, 1 is the most full bodied (pun *totally* intended) "system", but we can't look at short term neuronal changes, and imaging studies have, you know, all the flaws of imaging studies.

2 has problems. Largely cost, and scale, and I can't use them at Hampshire, and it's harder to study specific receptors in specific cells on a tiny temporal basis.

3 are expensive and hard to maintain and dumb.

4 and 5 both suffer from what seems to me fatal flaws – cells express different internal proteins and matrices. Undifferentiated cell lines won't have the same signalling pathways set up to receive signals from a receptor; what's the point in studying signalling pathways, receptor dynamics, or gene transcription in a set of cells that likely is incapable of accurately reproducing the full breadth of signalling pathways

Because I wanted to write a div about more than "just" science, I opted to work at Hampshire. Our money and our model systems are limited; I also won't be getting DEA approval (not that I tried, but I have other things I'd rather wrestle with the government about).

8.3 background

The available cell line P19 stem cells, which are known to differentiate into relatively poorly-characterized neuron-like cells when cultured with a micro-molar concentrations of retinoic acid (RA) in the media. The trick for us, however, is not just the production of neuronal cells, but neurons expressing the 5-HT_{2a}receptors, with GPCR machineary full intact and functional.

as far as cancerous, genetically manipulated, and traumatized rat cells can be "normal"

8.4 P19S

P19s are derived from rat embryonal teratocarcinoma cells, from behind the testes of XY rats. They are immortal and easy to maintain, retaining pluripotency under normal cell culture conditions. Upon application of RA and a slight modification of culture conditions, P19 differentiate into CNS cells, including glia, neurons, and fibroblast-like cells.[4] Studies of this differentiation pathway have elucidated a number of genes important for neural development,[79] and they're an established model system for exploring embryonic differentiation of neuronal cells.[27]

8.5 THE 5-HT SYSTEM

The 5-HT system is one of the most complex projection networks in the CNS. This large network means serotonin signaling not only transmits information, but plays a large role in *modulating* the rest of brain function. Hallucinogens affect the excitability of neurons in areas like the locus coerelus, which are responsible for "filtering" stimuli – that is, more stimuli than normal makes it to the "processing" centers of the brain. The attempt to make all of that extra stimuli into a cohesive image is presumably what creates visual patterns for the drug user.Brain anatomy.

5-HT *actual* distributionStem cells = embryonic cells; hence, knowing and examining the embryonic precursors to 5-HT neurons and then mimicking them => 5-HT neurons in culture

9 CRITICAL NEUROSCIENCE

9.1 FEMINIST SEROTONIN STUDIES

9.1.1 *Stem Cells and Gender*

Problems – points of analysis – come in the form of either not enough attention to gender (seatbelts, heart attacks, stem cells) or too much attention to gender.

Stem cells: They have a "sex", in the sense that there is a chromosomal makeup, and it matters. See Ray et al. [62] and Gendered Innovations.P19s are karotypically 'male' – i.e. XY. This has consequences for how they differentiate and how their signaling pathways work downstream of differentiation.

9.1.2 *Serotonin & Gender/Race*

Questioning the use of race as a categorization without defining what is meant *by race, re feminist/womanist analyses of the use of racial categories in medicine*

- serotonin receptors are differentially distributed and have different activation levels in male vs. female rats[51,12,82]
  - especially the 5-HT2$_a$ receptor, implicated in hallucinogen signaling
- pharmacogenetics are differential along racial and gender lines[56]
  - depression (associated with the 5-HT system, among others) shows different responses along racial and gender lines[10]
- if hallucinogens and signaling differentially affect men and women and different races/ethnicities,[52] then that has to be studied in model systems as to how it might affect plasticity and molecular effects

  > "However, the binding of serotonin-2A receptor measured with [$_3$H]ketanserin was significantly higher in females in all regions of the hippocampus."[82]

  - modulated by testosterone

9.1.3 *Serotonin Model Systems*

If serotonin systems are affected by testosterone (re: Zhang et al. [82]), how would incorporating androgens and estrogens into the cell culture dish affect the effectiveness of P19s as a model system?

9.2 CULTURAL NEUROSCIENCE

9.2.1 *Hallucinogens*

I'm a little conflicted about the relevance of this section, but I also am really *excited about it, and the possibilities for re-envisioning how I could do cultural molecular neuroscience.*

Psychotropic drugs have a rich and important history of spiritual and mental use in nearly every human culture. It seems that any and every culture has sought new insights and views with the help of native pharmacological agents. Although largely reduced now to their chemical structure* in the labs funded by the NIH, most of the compounds derive

*site of reductionism?

from different cultural traditions. Peyote (active ingredient: mescaline)† has historically been used by the Native American church, a right they successfully fought for in court. Ayahuasca (active ingredient: DMT combined with monooxygenase amine inhibitor) is a traditional South American drug. LSD is derived from ergot, a fungus – it's often thought that outbreaks of "witch craft" in medieval Europe are actually attributable to ergot contaminations.

Source for ergot and historical significance

On a related note – how presumptuous to take drugs from indigenous cultures and push them into the laboratory. Is plasticity and all of the signaling mechanisms relevant if the experience isn't included? Hallucinogens are notoriously sensitive to situation – or rather, individual interpretations of a situation. The quality (and thus long term effects) of a psychotropic experience is created through the *interplay* between environment and individual; like facts, it doesn't wholly reside in either, or even at the mere intersection. Trying to pull that out in a lab environment, is, as Fleck describes, not just a translation of information from one knowledge realm to another, but a full fledged transformation such that the ayahuasca in the lab is only nominally related to ayahuasca in practice.‡

9.3 TURTLES ALL THE WAY DOWN

"Neuroscience" as a discipline constructs a history tied to Galen and Aristotle and ancient Sumerian hieroglyphs,[2]. More realistically, "neuroscience" isn't a discipline, but rather a heterogeneous mush of an extremely broad range of nearly unrelated subfields. That said, neuroscience, the field, was deliberately named, funded, and institutionalized to lie at the intersection of complementary disciplines – interdiscplinary from the start.[2]

Disciplines aren't real, basically.

9.3.1 *Interdisciplinary studies*

- In *Critical Neuroscience,*Choudhury and Slaby[14] propose "interdisciplinary" as a code word for scientism (which I recall as being a bad thing)
- Situating the brain/cognition within a culture is an expanding trend (which I should be happy about). The large problem is that when "culture" and its importance are talked about in scientific settings, culture is a fixed quantity with Right responses. Hispanic medical patients require an interpreter; cases of Vietnamese

Need to define scientism/find description from Crit Neuro. Also page numbers.

†A comparison of the plant/spiritual context to the chemical structure should go here to demonstrate how we separate them out. With an analysis of the rights of traditional groups to use those drugs [re: NA church lawsuits], and also the danger of deforestation and environmental destruction to *traditional* methods of harvesting plants – making them only available with clinical approval – and chemical synthesis methods, which probably contribute to pollution and destruction.

‡Anne Fausto-Sterling, and many others, talk about knowledge outside the academy – communal, social, and indigenous knowledges. Hallucinogens have amazingly well-documented and supportive communities. Taking psychotropics is, for many, a spiritual and deeply-prepared for experience. Users are often hyperaware of the chemical effects, interactions with medical conditions or other drugs, how to set scenes, how to guide their mental state in meaningful ways – in short, expert and specific knowledge more typically associated with discerning scientists than hippies in the woods. But hippies in the woods may know a lot more about how to *use* those drugs than scientists who have never experienced them and treat them solely as tools in a molecular toolkit.

epilepsy require a cultural translation between spiritual/traditional Vietnamese and doctors with curative drugs.

- Epigenetics – the metaphorical and physical incorporation of social effects into the genome, is a way of explaining what culture does for human development, creating a narrative of "soma to society". But incorporating social factors as a genomic part of humans also creates new "at risk" populations, making the epigenetic traces of historical marginalization into fundamental parts of those groups that need fixing.[46,59]

9.3.2 *Molecular and genetic reductionism*

"Reductionism" is a bit of a catch all. To a large extent, the Western scientific traditions is entirely focused on reducing systems to their smallest working unit,, with the intention of finding out one "answer" and threading it into many other answers to form a kind of tapestry of knowledge. The reduction and simplification of systems roughly correlates with the notion of "pure" sciences, pure being perceived as better, "harder", and (incidentally, of course) more masculine. In the biological sciences, and in the neurosciences, reductionism is generally

- generally a trend in the biological sciences – maybe due to perception of increased objectivity/hardness (a la physics and chemistry).
- Somewhat inherent to "neuroscience", since the ultimate goal is to reduce function/cognition to a set of circuits/cells/meaningful small and completely circumscribed/understood units.
- Where does it come from?
  - What goals are there and how does reductionism accomplish them for us? What is good and not good about applications to neuro? Can and should cell studies be used to "answer" or explore questions about cognition? What do we lose when we "solve" disease in vitro? [§]
- Personalized medicine; or personalized neuroscience is still a way of reducing the individual to the cellular and genomic information, without accounting for personhood. "Personalized medicine" is not actually personalized; it's genomic. Relying on genetic information to give meaningful information about health care and responses is hardly specific to an individual's needs and abilities, as we'd like a feminist science t be.

[§] A sensible research strategy (isolationism/reducitonism) becomes a metaphysical commitment to a system, where the system is reality. For us, cell lines are indicative of some reality. It's plausible that scientists themselves know their work to be missing enormous sweeps of holistic knowledge, but any written work rarely acknowledges it. Grants and papers imply and argue, point-blank that molecular work is the answer to XYZ – and not just the answer, but the problem to be studied as well.

REFERENCES

[1] Hilda Bastian |. Biomedical research: Believe it or not? | Absolutely Maybe, Scientific American Blog Network. (Cited on page 10.)

[2] Joelle M. Abi-Rached and Nikolas Rose. The birth of the neuromolecular gaze. *History of the human sciences*, 23(1):11–36, 2010. (Cited on page 54.)

[3] John Arrowsmith. Trial watch: Phase II failures: 2008–2010. *Nature Reviews Drug Discovery*, 10(5):328–329, May 2011. ISSN 1474-1776. doi: 10.1038/nrd3439. (Cited on page 10.)

[4] V. Babuška, V. Kulda, Z. Houdek, M. Pešta, J. Cendelin, N. Zech, J. Pacherník, F. Vožeh, P. Uher, and M. Králíčková. Characterization of P19 cells during retinoic acid induced differentiation. *Prague medical report*, 111(4):289–299, 2010. (Cited on page 51.)

[5] Marie Battiste. Indigenous knowledge: foundations for First Nations. *World Indigenous Nations Higher Education Consortium-WINHEC Journal*, 2005. (Cited on page 40.)

[6] K. Beckett. Choosing Cesarean: Feminism and the politics of childbirth in the United States. *Feminist Theory*, 6(3):251–275, December 2005. ISSN 1464-7001. doi: 10.1177/1464700105057363. (Cited on page 4.)

[7] C. Glenn Begley and Lee M. Ellis. Drug development: Raise standards for preclinical cancer research. *Nature*, 483(7391):531–533, March 2012. ISSN 0028-0836. doi: 10.1038/483531a. (Cited on page 10.)

[8] Bo-Christer Björk and David Solomon. Open access versus subscription journals: a comparison of scientific impact. *BMC Medicine*, 10(1):73, July 2012. ISSN 1741-7015. doi: 10.1186/1741-7015-10-73. PMID: 22805105. (Cited on page 41.)

[9] Björn Brembs, Katherine Button, and Marcus Munafò. Deep impact: unintended consequences of journal rank. *Frontiers in Human Neuroscience*, 7, 2013. ISSN 1662-5161. doi: 10.3389/fnhum.2013.00291. (Cited on pages 15 and 17.)

[10] Beverly H. Brummett, Stephen H. Boyle, Ilene C. Siegler, Cynthia M. Kuhn, Allison Ashley-Koch, Charles R. Jonassaint, Stephan Züchner, Ann Collins, and Redford B. Williams. Effects of Environmental Stress and Gender on Associations among Symptoms of Depression and the Serotonin Transporter Gene Linked Polymorphic Region (5-HTTLPR). *Behavior Genetics*, 38(1):34–43, January 2008. ISSN 0001-8244, 1573-3297. doi: 10.1007/s10519-007-9172-1. (Cited on page 53.)

[11] Katherine S. Button, John P. A. Ioannidis, Claire Mokrysz, Brian A. Nosek, Jonathan Flint, Emma S. J. Robinson, and Marcus R. Munafò. Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, 14(5):365–376,

April 2013. ISSN 1471-003X, 1471-0048. doi: 10.1038/nrn3475. (Cited on page 12.)

[12] Maria Carlsson and Arvid Carlsson. A regional study of sex differences in rat brain serotonin. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 12(1):53–61, 1988. ISSN 0278-5846. doi: 10.1016/0278-5846(88)90061-9. (Cited on page 53.)

[13] Leslie Chan, Barbara Kirsop, and Subbiah Arunachalam. Open access archiving: the fast track to building research capacity in developing countries. November 2005. ISSN 90-429-1645-1. (Cited on page 10.)

[14] Suparna Choudhury and Jan Slaby. *Critical Neuroscience: A Handbook of the Social and Cultural Contexts of Neuroscience*. Wiley-Blackwell, Chichester, West Sussex, 1st edition, November 2011. ISBN 9781444333282. (Cited on page 54.)

[15] Gideon Emcee Christian. Open Access Initiative and the Developing World. SSRN Scholarly Paper ID 1304665, Social Science Research Network, Rochester, NY, 2008. (Cited on page 39.)

[16] Murat Cokol, Fatih Ozbay, and Raul Rodriguez-Esteban. Retraction rates are on the rise. *EMBO Reports*, 9(1):2, January 2008. ISSN 1469-221X. doi: 10.1038/sj.embor.7401143. PMID: 18174889 PMCID: PMC2246630. (Cited on pages 10 and 11.)

[17] Farid Dahdouh-Guebas, Jennifer Ahimbisibwe, Rita Van Moll, and Nico Koedam. Neo-colonial science by the most industrialised upon the least developed countries in peer-reviewed publishing. *Scientometrics*, 56(3):329–343, 2003. (Cited on page 39.)

[18] Philip M. Davis. The persistence of error: a study of retracted articles on the Internet and in personal libraries. *Journal of the Medical Library Association : JMLA*, 100(3):184–189, July 2012. ISSN 1536-5050. doi: 10.3163/1536-5050.100.3.008. PMID: 22879807 PMCID: PMC3411255. (Cited on page 12.)

[19] Alessandro Delfanti. *Biohackers: The Politics of Open Science*. Pluto Press, London, May 2013. ISBN 9780745332802. (Cited on page 38.)

[20] Kerry Dwan, Douglas G. Altman, Juan A. Arnaiz, Jill Bloom, An-Wen Chan, Eugenia Cronin, Evelyne Decullier, Philippa J. Easterbrook, Erik Von Elm, Carrol Gamble, Davina Ghersi, John P. A. Ioannidis, John Simes, and Paula R. Williamson. Systematic Review of the Empirical Evidence of Study Publication Bias and Outcome Reporting Bias. *PLoS ONE*, 3(8):e3081, August 2008. doi: 10.1371/journal.pone.0003081. (Cited on page 12.)

[21] P. J Easterbrook, R Gopalan, J. A Berlin, and D. R Matthews. Publication bias in clinical research. *The Lancet*, 337(8746):867–872, April 1991. ISSN 0140-6736. doi: 10.1016/0140-6736(91)90201-Y. (Cited on page 13.)

[22] George T. H Ellison, Andrew Smart, Richard Tutton, Simon M Outram, Richard Ashcroft, and Paul Martin. Racial Categories in Medicine: A Failure of Evidence-Based Practice? *PLoS Med*, 4(9): e287, September 2007. doi: 10.1371/journal.pmed.0040287. (Cited on page 4.)

[23] J. A. Evans and J. Reimer. Open Access and Global Participation in Science. *Science*, 323(5917):1025–1025, February 2009. ISSN 0036-8075, 1095-9203. doi: 10.1126/science.1154562. (Cited on pages 19 and 41.)

[24] Daniele Fanelli. Do pressures to publish increase scientists' bias? An empirical support from US States Data. *PloS one*, 5(4):e10271, 2010. (Cited on page 11.)

[25] Daniele Fanelli. Why growing retractions are (mostly) a good sign. *PLoS medicine*, 10(12):e1001563, 2013. (Cited on pages 7, 11, 35, and 37.)

[26] Ferric C. Fang and Arturo Casadevall. Retracted Science and the Retraction Index. *Infection and Immunity*, 79(10):3855–3859, October 2011. ISSN 0019-9567, 1098-5522. doi: 10.1128/IAI.05661-11. PMID: 21825063. (Cited on pages ii and 11.)

[27] Mohamed H. Farah, James M. Olson, Holly B. Sucic, Richard I. Hume, Stephen J. Tapscott, and David L. Turner. Generation of neurons by transient expression of neural bHLH proteins in mammalian cells. *Development*, 127(4):693–702, 2000. (Cited on page 51.)

[28] A. Fausto-Sterling. The Bare Bones of Race. *Social Studies of Science*, 38(5):657–694, October 2008. ISSN 0306-3127. doi: 10.1177/0306312708091925. (Cited on page 4.)

[29] Ludwik Fleck. *Genesis and Development of a Scientific Fact*. University of Chicago Press, Chicago, August 1981. ISBN 9780226253251. (Cited on page 2.)

[30] J. H. Fujimura and R. Rajagopalan. Different differences: The use of 'genetic ancestry' versus race in biomedical human genetic research. *Social Studies of Science*, 41(1):5–30, December 2010. ISSN 0306-3127. doi: 10.1177/0306312710379170. (Cited on page 4.)

[31] Virginia Gewin. Turning point: Carl Boettiger. *Nature*, 493(7434): 711–711, January 2013. ISSN 0028-0836, 1476-4687. doi: 10.1038/nj7434-711a. (Cited on page 43.)

[32] Global Forum for Health Research (Organization). *The 10/90 report on health research, 2000.* Global Forum for Health Research, Geneva, Switzerland, 2000. ISBN 2940286019 9782940286010. (Cited on page 19.)

[33] Fiona Godlee, Richard Horton, and Richard Smith. Global information flow. *The Lancet*, 356(9236):1129–1130, September 2000. ISSN 01406736. doi: 10.1016/S0140-6736(00)02752-5. (Cited on page 19.)

[34] Steven Goodman and Sander Greenland. Assessing the unreliability of the medical literature: a response to "why most published research findings are false. *Johns Hopkins University, Dept. of Biostatistics Working Papers*, February 2007. (Cited on page 10.)

[35] Root Gorelick. Indigenous sciences are not pseudoscience. *Ideas in Ecology and Evolution*, 7(1), May 2014. ISSN 1918-3178. doi: 10.4033/iee.v7i1.5150. (Cited on page 39.)

[36] Michael L. Grieneisen and Minghua Zhang. A comprehensive survey of retracted articles from the scholarly literature. *PLoS One*, 7(10):e44118, 2012. (Cited on page 12.)

[37] Donna Jeanne Haraway. A Game of Cat's Cradle: Science Studies, Feminist Theory, Cultural Studies. *Configurations*, 2(1):59–71, 1994. ISSN 1080-6520. doi: 10.1353/con.1994.0009. (Cited on page 3.)

[38] Sandra Harding. Postcolonial and feminist philosophies of science and technology: convergences and dissonances. *Postcolonial Studies*, 12(4):401–421, December 2009. ISSN 1368-8790. doi: 10.1080/13688790903350658. (Cited on page 4.)

[39] Jonathan Harle, Sioux Cumming, Citations, and Research funding | 5 Comments. Geographies of knowledge: practical ways to boost the visibility of research undertaken and published in the South. (Cited on page 19.)

[40] Daniel R. Headrick. *The tools of empire: technology and European imperialism in the nineteenth century*. Oxford University Press, New York, 1981. ISBN 0195028317. (Cited on page 1.)

[41] Trotter Henry and Kell Catherine. *Seeking Impact and Visibility: Scholarly Communication in Southern Africa*. African Minds, June 2014. ISBN 9781920677510. (Cited on page 22.)

[42] John P. A. Ioannidis. Why Most Published Research Findings Are False. *PLoS Med*, 2(8):e124, August 2005. doi: 10.1371/journal.pmed.0020124. (Cited on pages 7, 10, 14, 35, and 37.)

[43] Leah R. Jager and Jeffrey T. Leek. An estimate of the science-wise false discovery rate and application to the top medical literature. *Biostatistics*, 15(1):1–12, January 2014. ISSN 1465-4644, 1468-4357. doi: 10.1093/biostatistics/kxt007. PMID: 24068246. (Cited on page 10.)

[44] Bob Jolliffe. Aligning the ideals of free software and free knowledge with the South African Freedom Charter. *First Monday*, 11(7), 2006. (Cited on page 39.)

[45] David A. King. The scientific impact of nations. *Nature*, 430(6997):311–316, July 2004. ISSN 0028-0836. doi: 10.1038/430311a. (Cited on page 19.)

[46] Laurence J. Kirmayer. Beyond the 'New Cross-cultural Psychiatry': Cultural Biology, Discursive Psychology and the Ironies of Globalization. *Transcultural Psychiatry*, 43(1):126–144, March 2006. ISSN 1363-4615, 1461-7471. doi: 10.1177/1363461506061761. PMID: 16671396. (Cited on page 55.)

[47] Thomas S. Kuhn. *The Structure of Scientific Revolutions, 3rd Edition*. The University of Chicago Press, Chicago, IL, 3rd edition, December 1996. ISBN 9780226458083. (Cited on page 2.)

[48] Andrew P. Kurmis. Understanding the Limitations of the Journal Impact Factor. *The Journal of Bone & Joint Surgery*, 85(12):2449–2454, December 2003. ISSN 0021-9355, 1535-1386. The impact factor, a simple mathematical formula reflecting the number of citations

of a journal's material divided by the number of citable materials published by that same journal, has evolved to become one of the most influential tools in modern research and academia. The impact factor can be influenced and biased (intentionally or otherwise) by many factors. Extension of the impact factor to the assessment of journal quality or individual authors is inappropriate. Extension of the impact factor to cross-discipline journal comparison is also inappropriate. Those who choose to use the impact factor as a comparative tool should be aware of the nature and premise of its derivation and also of its inherent flaws and practical limitations. PMID: 14668520. (Cited on pages 15 and 16.)

[49] Vincent Larivière, Chaoqun Ni, Yves Gingras, Blaise Cronin, and Cassidy R. Sugimoto. Bibliometrics: Global gender disparities in science. *Nature*, 504(7479):211–213, December 2013. ISSN 0028-0836, 1476-4687. doi: 10.1038/504211a. (Cited on pages 19 and 23.)

[50] Peter A. Lawrence. The politics of publication. *Nature*, 422(6929): 259–261, March 2003. ISSN 0028-0836. doi: 10.1038/422259a. (Cited on page 16.)

[51] Qian Li, Christine Wichems, Armin Heils, Klaus-Peter Lesch, and Dennis L. Murphy. Reduction in the Density and Expression, But Not G-Protein Coupling, of Serotonin Receptors (5-HT1A) in 5-HT Transporter Knock-Out Mice: Gender and Brain Region Differences. *The Journal of Neuroscience*, 20(21):7888–7895, November 2000. ISSN 0270-6474, 1529-2401. PMID: 11050108. (Cited on page 53.)

[52] Matthias E. Liechti, Alex Gamma, and Franz X. Vollenweider. Gender differences in the subjective effects of MDMA. *Psychopharmacology*, 154(2):161–168, March 2001. ISSN 0033-3158, 1432-2072. doi: 10.1007/s002130000648. (Cited on page 53.)

[53] Stephen G. Lisberger. Sound the Alarm: Fraud in Neuroscience. *Cerebrum: the Dana Forum on Brain Science*, 2013, May 2013. ISSN 1524-6205. PMID: 23847713 PMCID: PMC3704310. (Cited on pages 17 and 37.)

[54] Emily Martin. The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles. *Signs*, 16(3):485–501, April 1991. ISSN 0097-9740. (Cited on page 4.)

[55] Amanda Mascarelli. Research tools: Jump off the page. *Nature*, 507(7493):523–525, March 2014. ISSN 0028-0836, 1476-4687. doi: 10.1038/nj7493-523a. (Cited on page 43.)

[56] Eleanor Murphy and Francis J. McMahon. Pharmacogenetics of Antidepressants, Mood Stabilizers, and Antipsychotics in Diverse Human Populations. *Discovery Medicine*, 16(87):113–122, August 2013. (Cited on page 53.)

[57] D. Nafus. 'Patches don't have gender': What is not open in open source software. *New Media & Society*, 14(4):669–683, June 2012. ISSN 1461-4448, 1461-7315. doi: 10.1177/1461444811422887. (Cited on page 39.)

[58] Michael Parker. The ethics of open access publishing. *BMC Medical Ethics*, 14(1):1, April 2013. ISSN 14726939. (Cited on page 8.)

[59] Martyn Pickersgill. Between Soma and Society: Neuroscience and the Ontology of Psychopathy. *BioSocieties*, 4(1):45–60, 2009. ISSN 1745-8552. doi: 10.1017/S1745855209006425. (Cited on page 55.)

[60] Florian Prinz, Thomas Schlange, and Khusru Asadullah. Believe it or not: how much can we rely on published data on potential drug targets? *Nature Reviews Drug Discovery*, 10(9):712–712, September 2011. ISSN 1474-1776. doi: 10.1038/nrd3439-c1. (Cited on page 10.)

[61] Marcus G. Raskin and Herbert J. Bernstein. *New Ways of Knowing: The Sciences, Society, and Reconstructive Knowledge*. Rl Innactive Titles, Totowa, N.J, June 1987. ISBN 9780847674633. (Cited on page 4.)

[62] Rinki Ray, Nathan M Novotny, Paul R Crisostomo, Tim Lahm, Aaron Abarbanell, and Daniel R Meldrum. Sex Steroids and Stem Cell Function. *Molecular Medicine*, 14(7-8):493–501, 2008. ISSN 1076-1551. doi: 10.2119/2008-00004.Ray. PMID: 18475312 PMCID: PMC2376641. (Cited on page 53.)

[63] Joseph Reagle. "Free as in sexist?" Free culture and the gender gap. *First Monday*, 18(1), December 2012. ISSN 13960466. (Cited on page 38.)

[64] Dorothy E. Roberts. Race, Gender, and Genetic Technologies: A New Reproductive Dystopia? *Signs: Journal of Women in Culture and Society*, 34(4):783–804, June 2009. ISSN 0097-9740. doi: 10.1086/597132. (Cited on page 4.)

[65] Dorothy E. Roberts. Collateral Consequences, Genetic Surveillance, and the New Biopolitics of Race. 2011. (Cited on page 1.)

[66] Paula A. Rochon, Azad Mashari, Ariel Cohen, Anjali Misra, Dara Laxer, David L. Streiner, Julie M. Dergal, Jocalyn P. Clark, Jennifer Gold, and Malcolm A. Binns. Relation between randomized controlled trials published in leading general medical journals and the global burden of disease. *CMAJ : Canadian Medical Association Journal*, 170(11):1673–1677, May 2004. ISSN 0820-3946. doi: 10.1503/cmaj.1031006. PMID: 15159365 PMCID: PMC408507. (Cited on pages 19 and 23.)

[67] Londa Schiebinger. Feminist history of colonial science. *Hypatia*, 19(1):233–254, 2004. (Cited on page 4.)

[68] Victoria Shelton. Scientific Reseach: The Publication Dilemma. (Cited on pages 8 and 9.)

[69] Tom Slee. FutureEverything: Notes Against Openness, March 2013. (Cited on page 45.)

[70] Ronald Snijder. Do developing countries profit from free books? Discovery and online usage in developed and developing countries compared. *Journal of Electronic Publishing*, 16(1), 2013. ISSN 1080-2711. doi: http://dx.doi.org/10.3998/3336451.0016.103. (Cited on page 41.)

[71] Banu Subramaniam. Moored Metamorphoses : A Retrospective Essay on Feminist Science Studies. 34(4), 2009. (Cited on page 4.)

[72] Cassidy R. Sugimoto. Global gender disparities in science. 2013. (Cited on page 19.)

[73] Athula Sumathipala, Sisira Siribaddana, and Vikram Patel. Under-representation of developing countries in the research literature: ethical issues arising from a survey of five leading medical journals. *BMC Medical Ethics*, 5(1):5, October 2004. ISSN 1472-6939. doi: 10.1186/1472-6939-5-5. PMID: 15461820. (Cited on pages 19, 20, and 23.)

[74] The PLoS Medicine Editors. The Impact Factor Game. *PLoS Med*, 3(6):e291, June 2006. doi: 10.1371/journal.pmed.0030291. (Cited on page 17.)

[75] Richard Van Noorden. Data-sharing: Everything on display. *Nature*, 500(7461):243–245, August 2013. ISSN 0028-0836, 1476-4687. doi: 10.1038/nj7461-243a. (Cited on page 43.)

[76] N. Vetter. Research publication in developing countries. *Journal of Public Health*, 25(3):189–189, September 2003. ISSN 1741-3842, 1741-3850. doi: 10.1093/pubmed/fdg063. (Cited on pages 19 and 20.)

[77] Edward Vul, Christine Harris, Piotr Winkielman, and Harold Pashler. Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition. *Perspectives on Psychological Science*, 4(3):274–290, May 2009. ISSN 1745-6916, 1745-6924. doi: 10.1111/j.1745-6924.2009.01125.x. (Cited on page 12.)

[78] Caroline Wagner. Unseen Science: Scholarly Publication in the BRICs but not in the Web of Science. 2011. (Cited on pages 19 and 20.)

[79] Yi Wei, Thomas Harris, and Geoffrey Childs. Global gene expression patterns during neural differentiation of P19 embryonic carcinoma cells. *Differentiation; Research In Biological Diversity*, 70 (4-5):204–219, June 2002. ISSN 0301-4681. (Cited on page 51.)

[80] Jevin D. West, Jennifer Jacquet, Molly M. King, Shelley J. Correll, and Carl T. Bergstrom. The Role of Gender in Scholarly Authorship. *PLoS ONE*, 8(7):e66212, July 2013. doi: 10.1371/journal.pone.0066212. (Cited on page 24.)

[81] Jelte M. Wicherts, Marjan Bakker, and Dylan Molenaar. Willingness to Share Research Data Is Related to the Strength of the Evidence and the Quality of Reporting of Statistical Results. *PLoS ONE*, 6 (11):e26828, November 2011. doi: 10.1371/journal.pone.0026828. (Cited on page 12.)

[82] L Zhang, W Ma, J. L Barker, and D. R Rubinow. Sex differences in expression of serotonin receptors (subtypes 1A and 2A) in rat brain: a possible role of testosterone. *Neuroscience*, 94(1):251–259, September 1999. ISSN 0306-4522. doi: 10.1016/S0306-4522(99)00234-1. (Cited on page 53.)