The drain on scientific publishing

or the unsustainability of publishing, and how to fix it

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ESP – University of Milan – 27 november 2025

The team

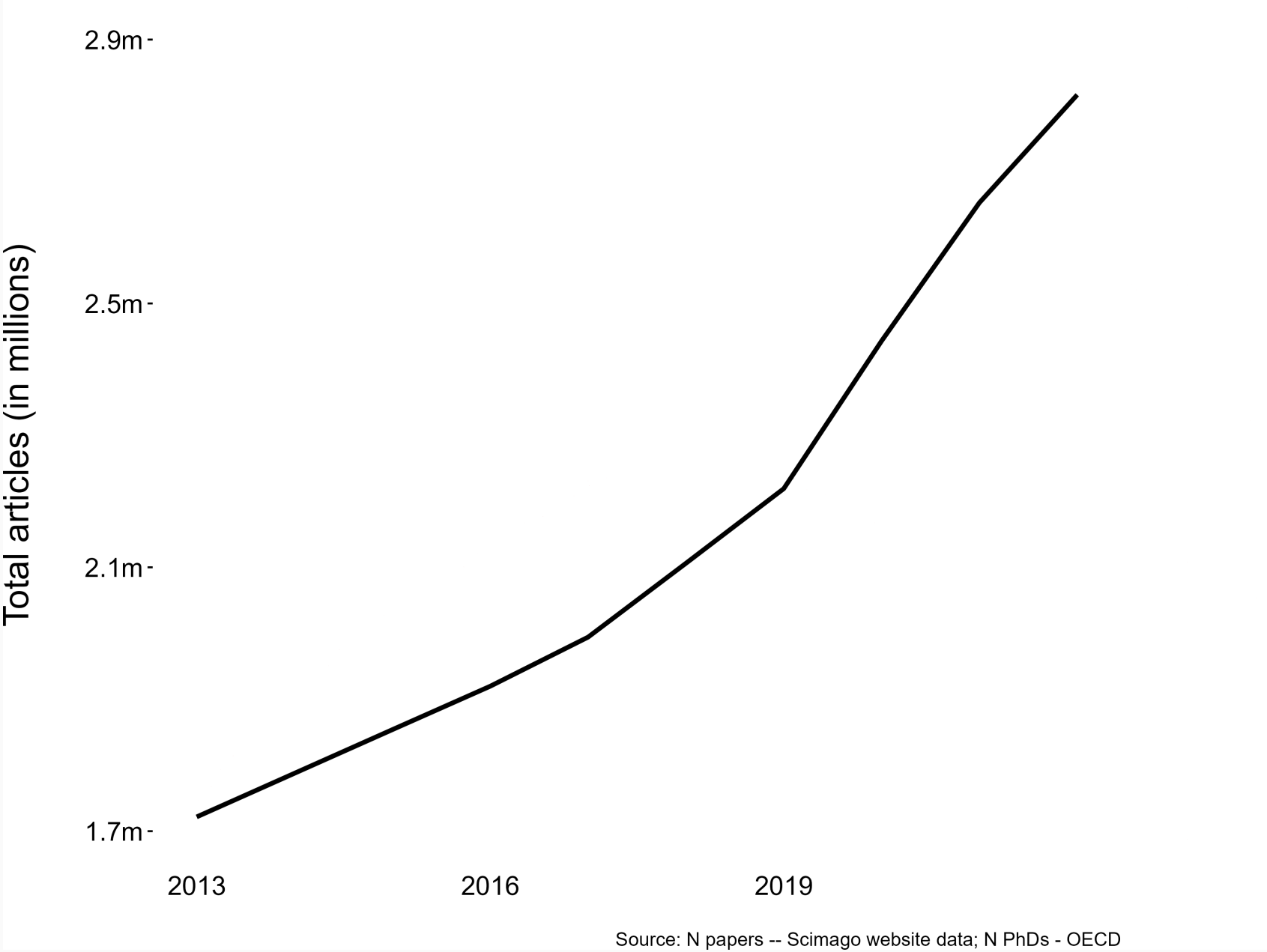
Immunologist

Experimental economist

Seed technician

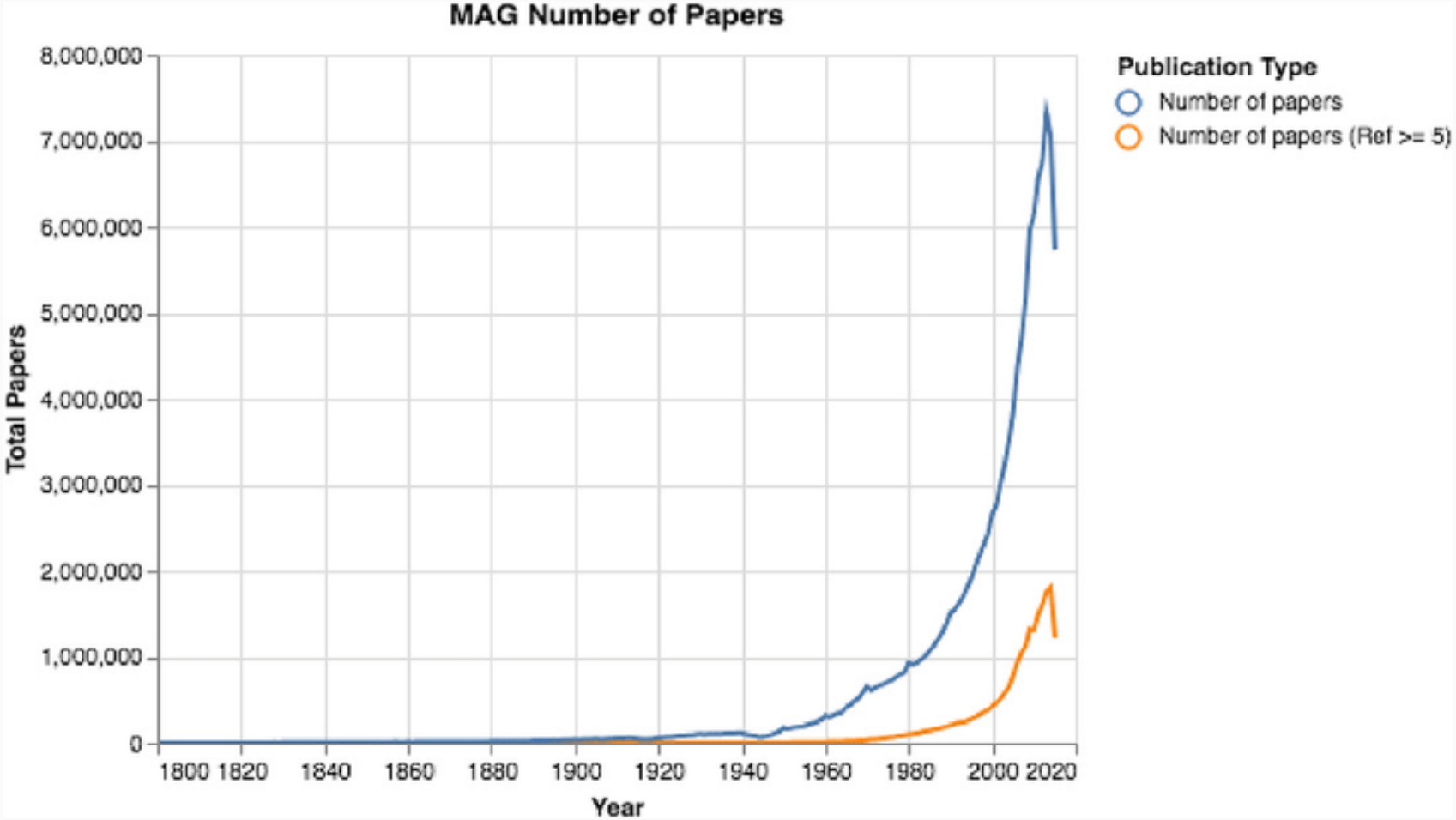
Anthropologist

Academic publishing is undergoing an exponential growth



Source: N papers -- Scimago website data; N PhDs - OECD

This is not news



Source: Fire & Guestrin 2019

...and people have been complaining about it for a long time

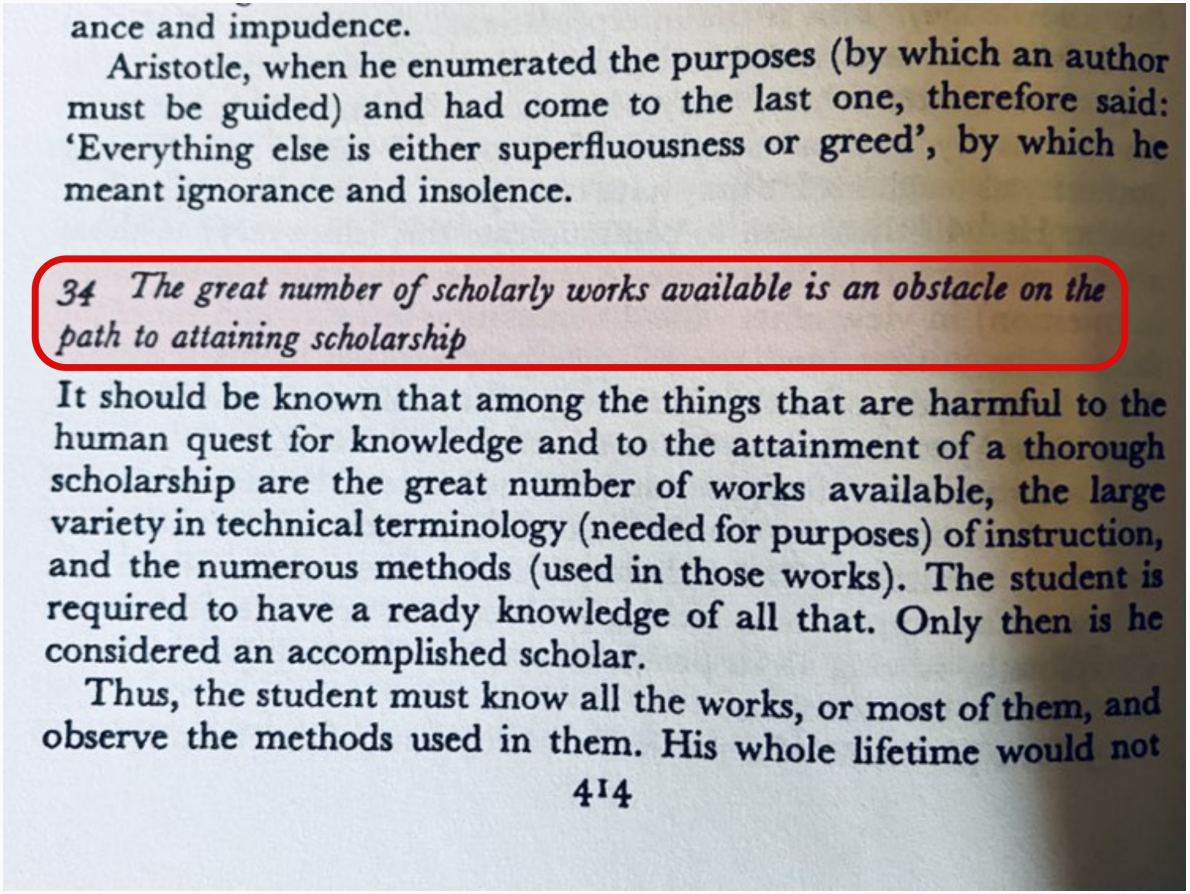
In 1958, when James D. Watson worked his way up to the rank of associate professor at Harvard, the young biochemist had on his curriculum vitae 18 papers. One of them, published 5 years earlier, described the structure of deoxyribonucleic acid.

Today, the bibliography of a candidate facing a similar climb often lists 50 or even 100 papers.

As the comparison suggests, paper inflation has become a fact of academic life during the past two decades. This is

Science, March 1981

a LONG time



ance and impudence.

Aristotle, when he enumerated the purposes (by which an author must be guided) and had come to the last one, therefore said: 'Everything else is either superfluousness or greed', by which he meant ignorance and insolence.

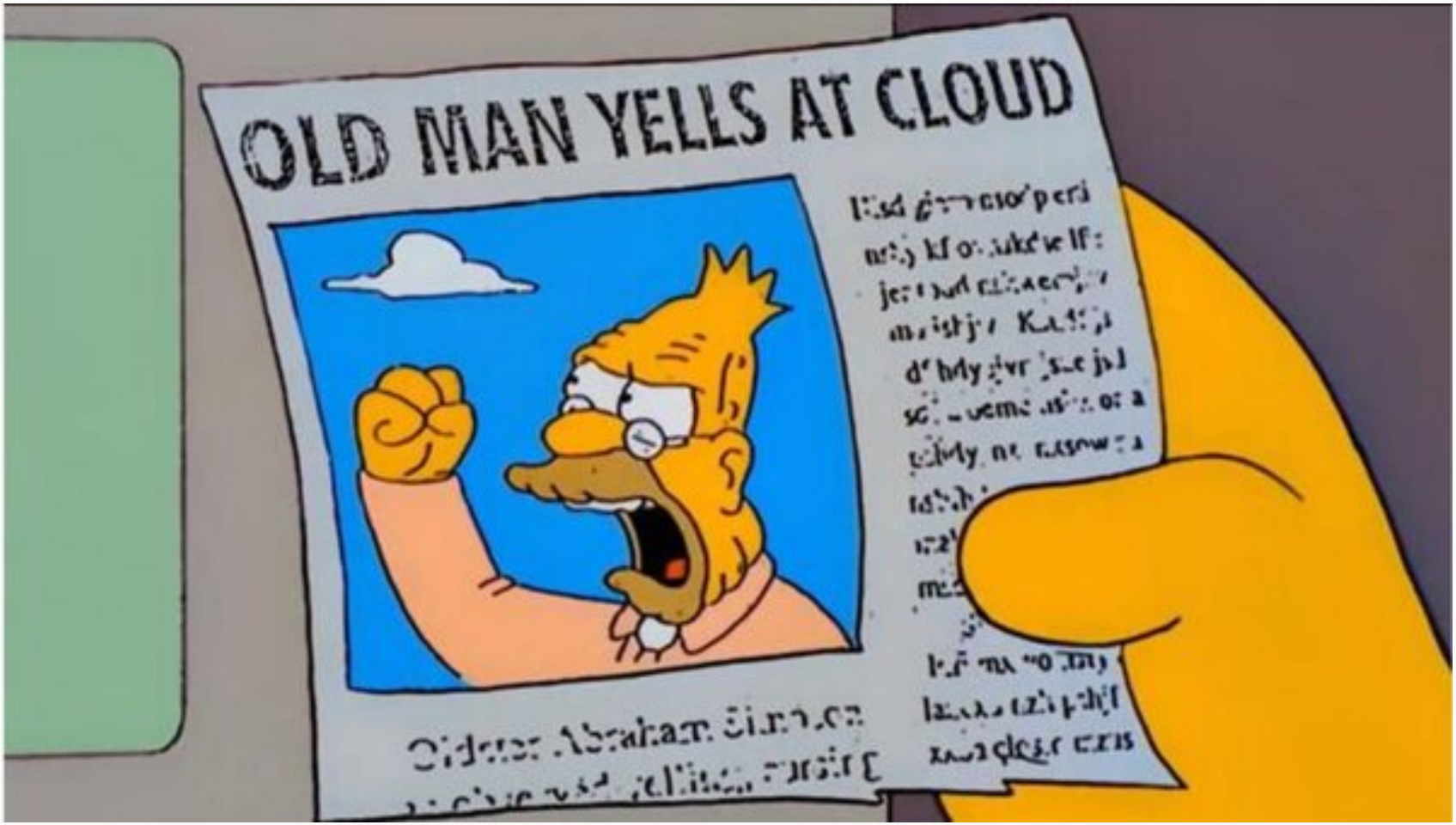
34 The great number of scholarly works available is an obstacle on the path to attaining scholarship

It should be known that among the things that are harmful to the human quest for knowledge and to the attainment of a thorough scholarship are the great number of works available, the large variety in technical terminology (needed for purposes) of instruction, and the numerous methods (used in those works). The student is required to have a ready knowledge of all that. Only then is he considered an accomplished scholar.

Thus, the student must know all the works, or most of them, and observe the methods used in them. His whole lifetime would not

414

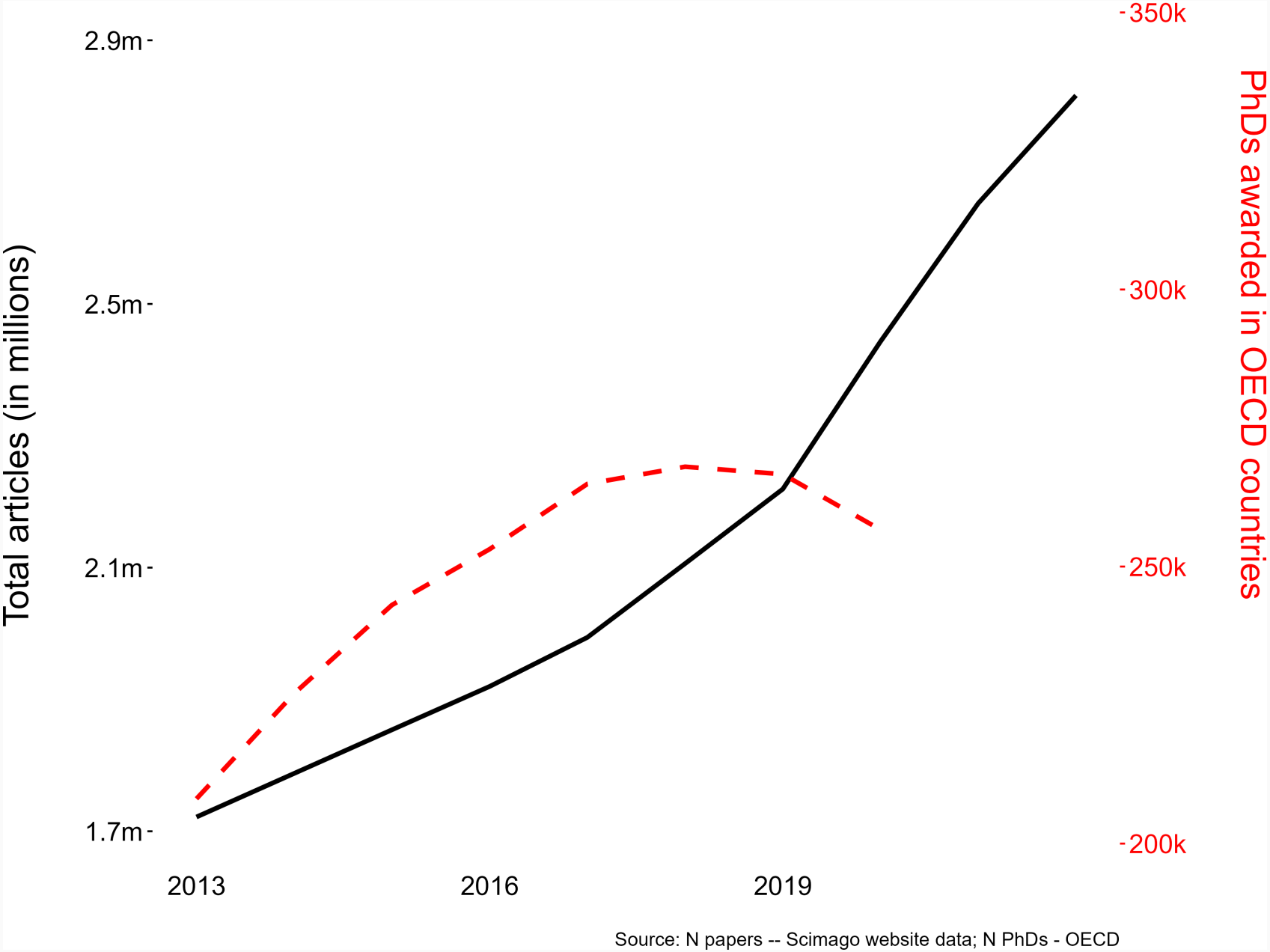
Ibn Khaldun, 1332-1406


OLD MAN YELLS AT CLOUD

The growth of scientific articles is mostly a good thing

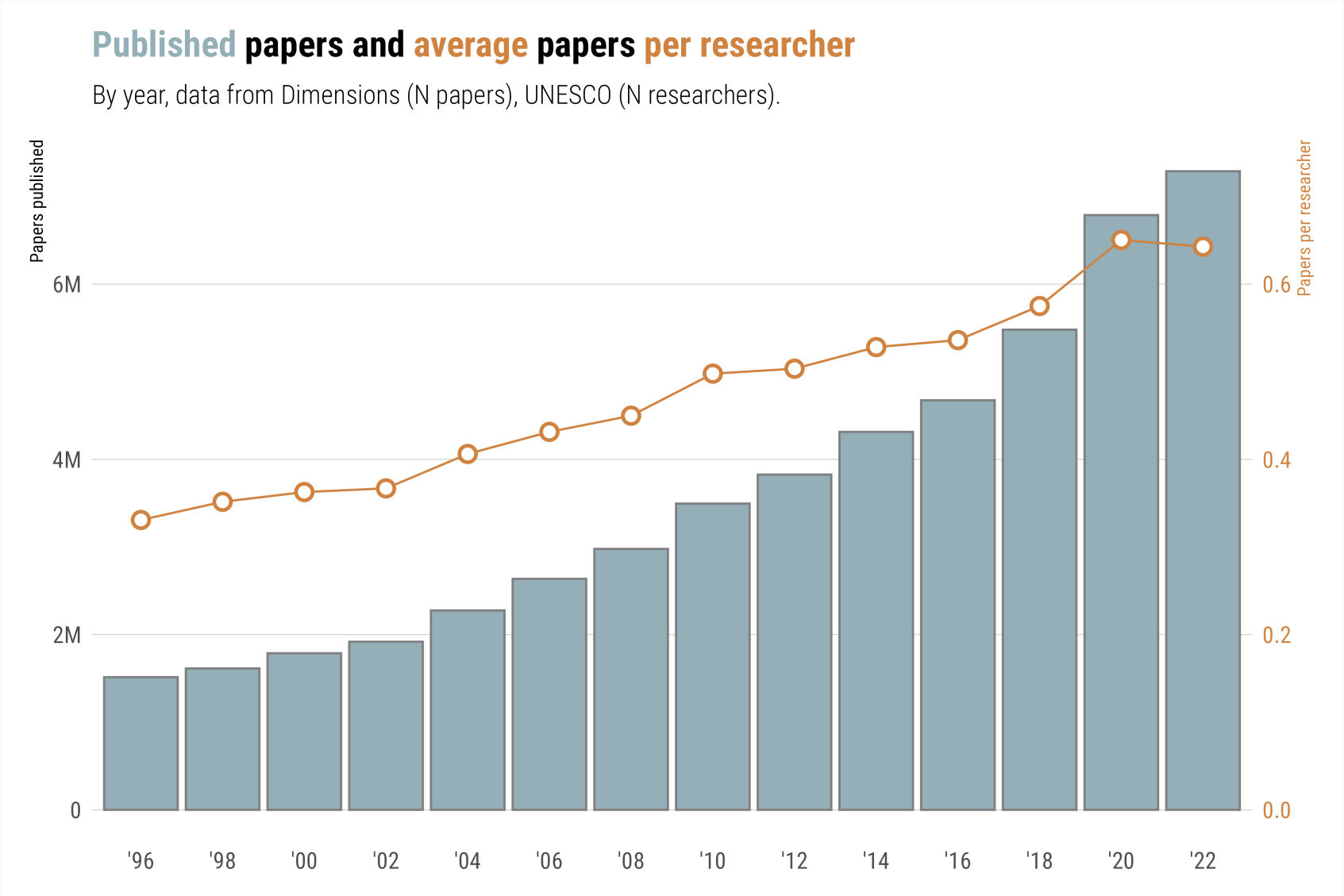
- More scientists around
- More funds for research
- Open Access: more results available to anyone
- Web tools: faster dissemination of ideas
- Lower file drawer effects
- More replications, robustness, reviews, meta-analyses

But the number of researchers has hit a limit



Source: N papers -- Scimago website data; N PhDs - OECD

. . . and the papers didn't: more papers per researcher



...and we've got issues

Editors resigning over high fees

...and we've got issues

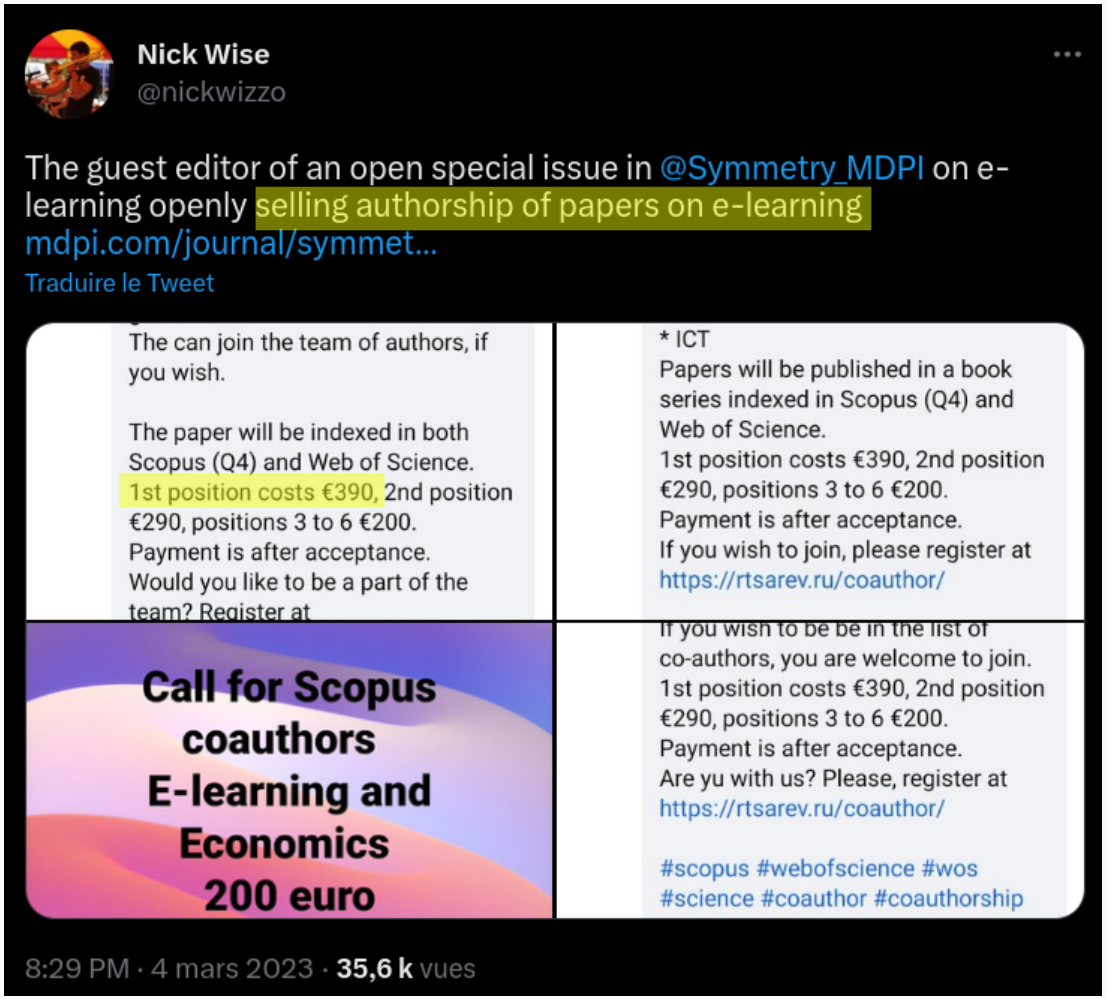
Paper mills
mass producing
fake articles

NEWS FEATURE | 23 March 2021

The fight against fake-paper factories that churn out sham science

Some publishers say they are battling industrialized cheating. A *Nature* analysis examines the 'paper mill' problem – and how editors are trying to cope.

...and we've got issues



Authorship sales rings

...and we've got issues

Stunningly prolific authors

EL PAÍS

ce & Tech

SILICON VALLEY · YOUTUBE ·

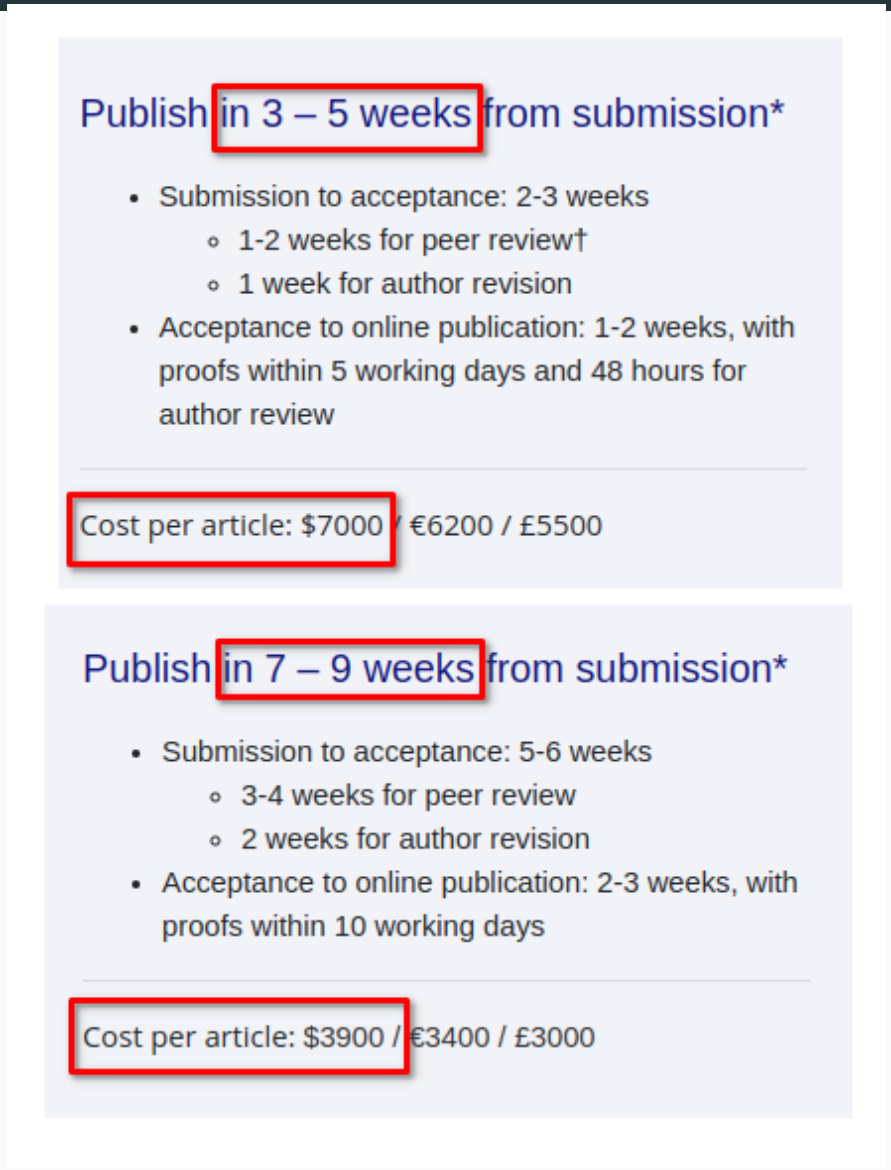
SCIENTIFIC ETHICS >

One of the world's most cited scientists, Rafael Luque, suspended without pay for 13 years

The prolific chemist, who has published a study every 37 hours this year, has been sanctioned by the University of Córdoba over his research work for other institutions in Russia and Saudi Arabia

...and we've got issues

Pay to get faster through peer-review



...and we've got issues

PHR Public Health Reviews

CiteScore 9.6 How to publish Submit

EDITORIAL

Public Health Rev, 17 November 2022
https://doi.org/10.3389/phrs.2022.1605407

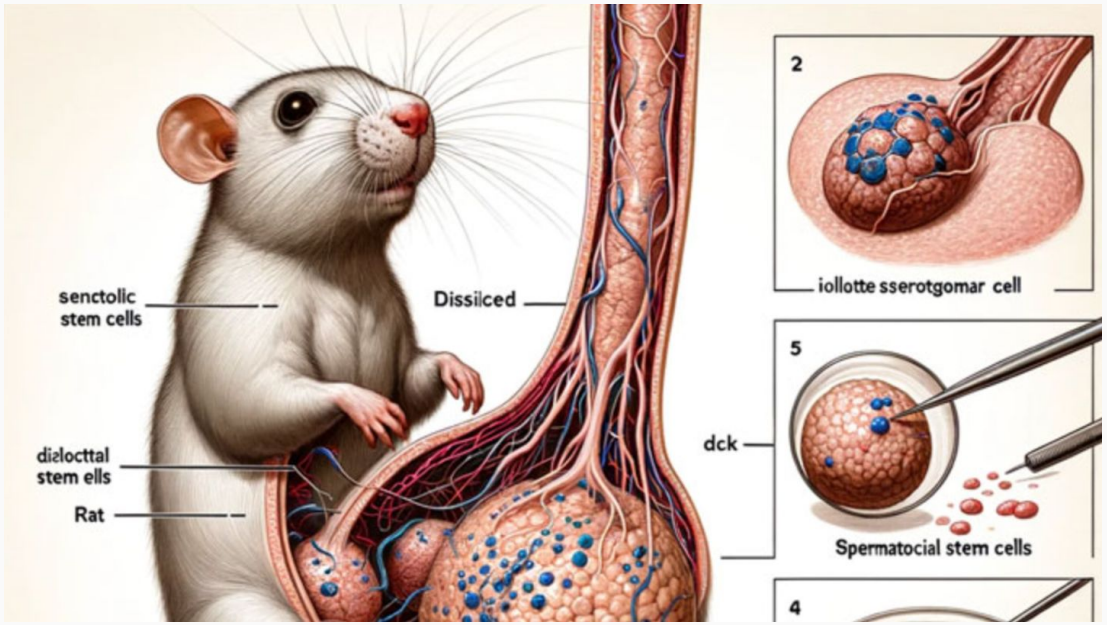
Check for updates

«I Do Not Have Time»—Is This the End of Peer Review in Public Health Sciences?

Nino Künzli[1,2,3*], Anke Berger[1,3], Katarzyna Czabanowska[4], Raquel Lucas[5], Andrea Madarasova Geckova[6], Sarah Mantwill[7] and Olaf von dem Knesebeck[8]

Editors unable to find referees

...and we've got issues



and don't get me started on AI

. . . and yet the system thrives. . .

Swiss Library Consortium (CSAL) Renews Partnership with MDPI

Consortium
Academic Li
Konsortium
Hochschulb
Consortium
universitaire
Consorzio d
universitarie

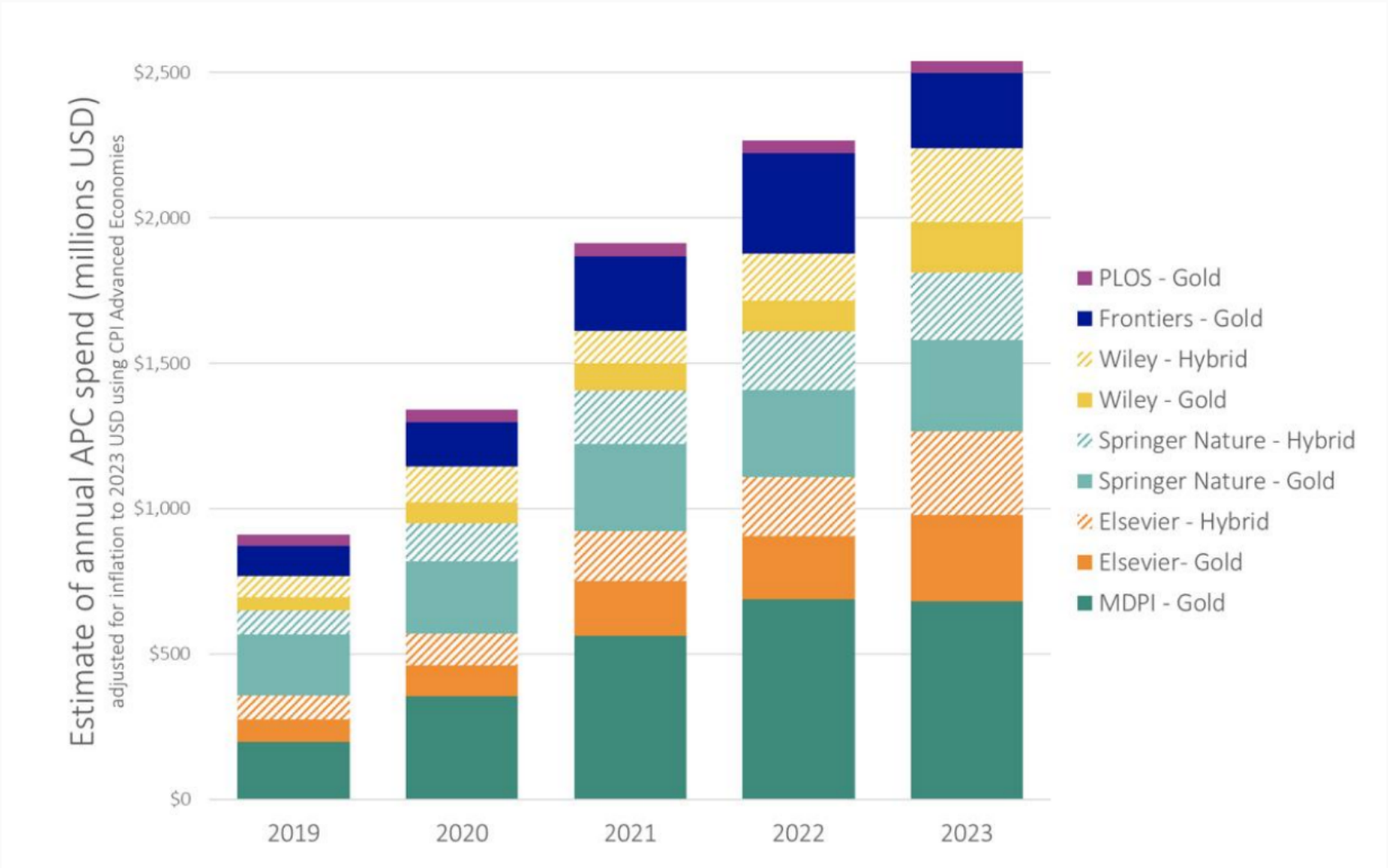
MDPI

Springer Nature's shares leap on Frankfurt debut

By **Lucy Raitano** and **Hakan Ersen**

October 4, 2024 11:00 AM GMT+2 · Updated 6 months ago

. . . and it's not cheap

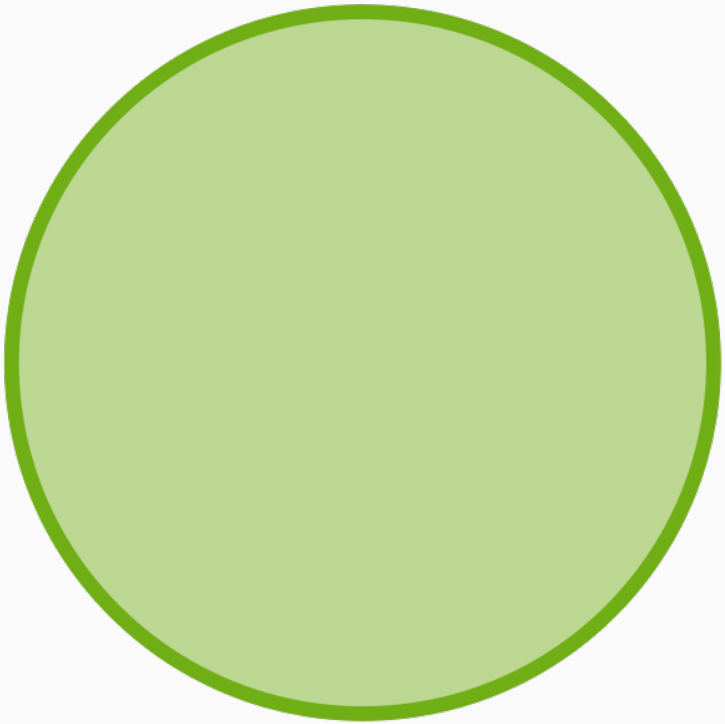


. . . from the strain to the drain

How does publishing work?

Behold the scientific publishing system

Publishers



Researchers

Funders

What does the system do?

What functions does the system fulfill?

for Scientists

- dissemination
- reputation
- sorting

for Publishers

- profits
- dissemination
- sustainability

for Funders

- selection
- prioritization
- public access

What do the different actors want?

What do different actors want from the system?

Scientists

- high reputation
- low effort
- stability

Publishers

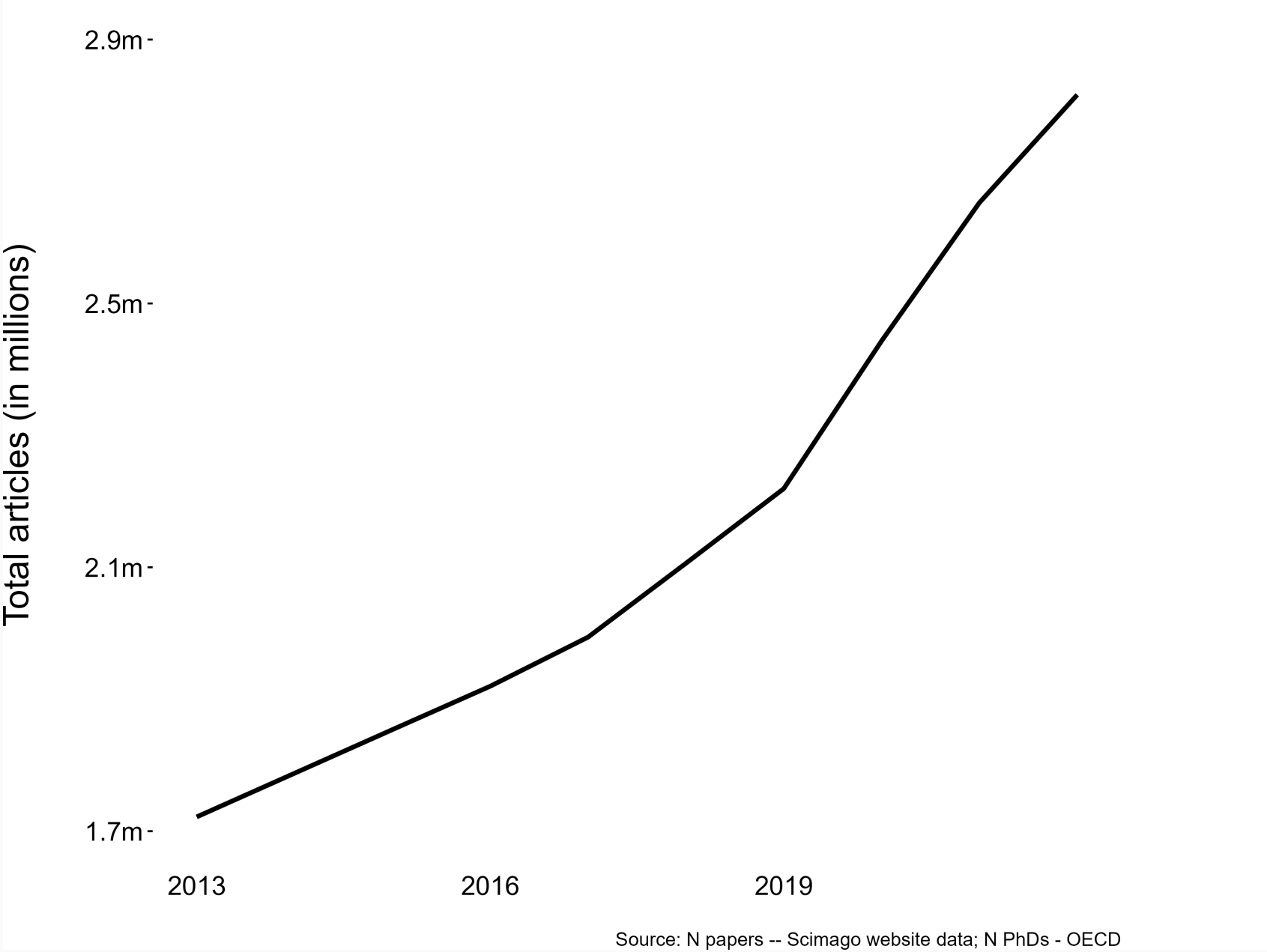
- high reputation
- high quantity
- high revenue

Funders

- stability
- true signal
- low spending

How did we get to this?

What trends are at play behind this growth?

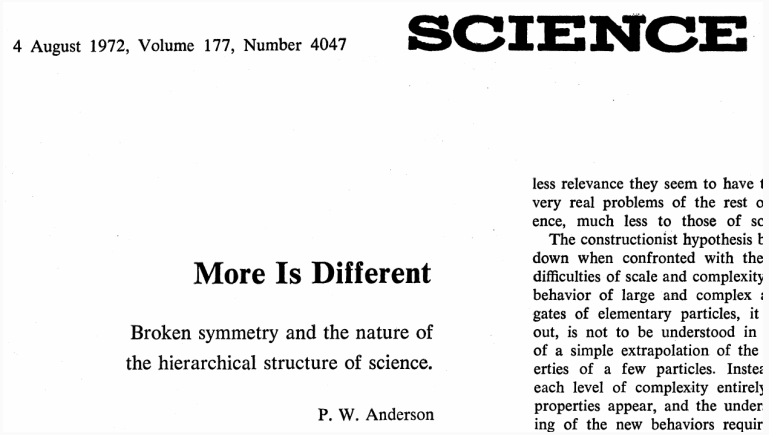


Source: N papers -- Scimago website data; N PhDs - OECD

More is different

Growth is not more of the same:
growth means change.

- new practices
- new business strategies
- new incentives
- new constraints
- new meanings



4 August 1972, Volume 177, Number 4047 **SCIENCE**

More Is Different

Broken symmetry and the nature of the hierarchical structure of science.

P. W. Anderson

less relevance they seem to have t
very real problems of the rest o
ence, much less to those of sc
The constructionist hypothesis b
down when confronted with the
difficulties of scale and complexity
behavior of large and complex
gates of elementary particles, it
out, is not to be understood in
of a simple extrapolation of the
erties of a few particles. Instea
each level of complexity entirely
properties appear, and the under
ing of the new behaviors requir

The Strain on Scientific Publishing (Hanson et al, QSS, 2024)

We single out five indicators of strain on the system:

- Number and size of journals
- Number and role of Special Issues
- Turnaround times
- Rejection rates
- Impact Factor inflation

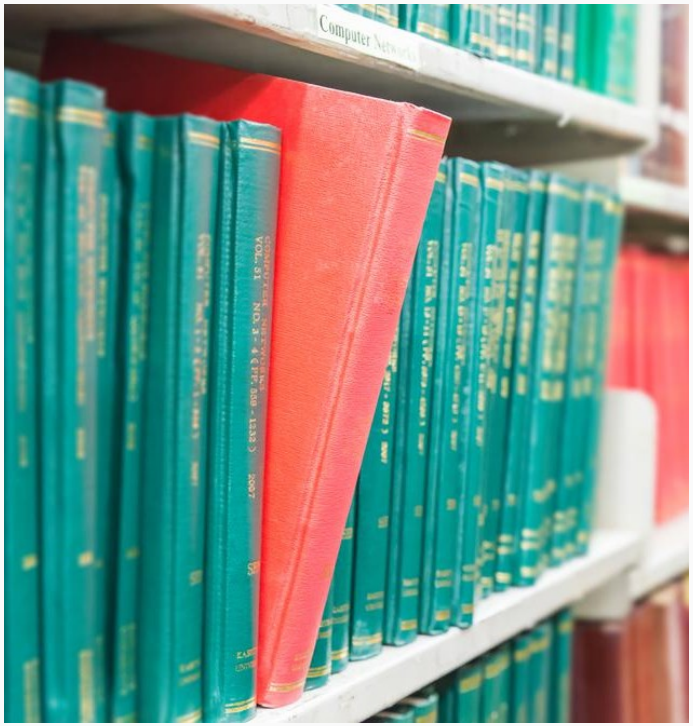
None of them is critical *per se*

together they indicate strain imposed by publishers

Under the hood: a semantic shift

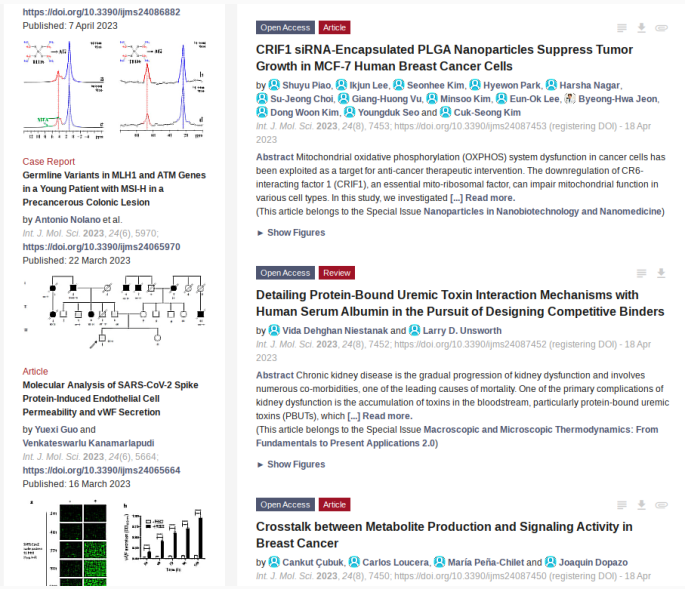
"Journal"

used to mean



A physical object with limited available space

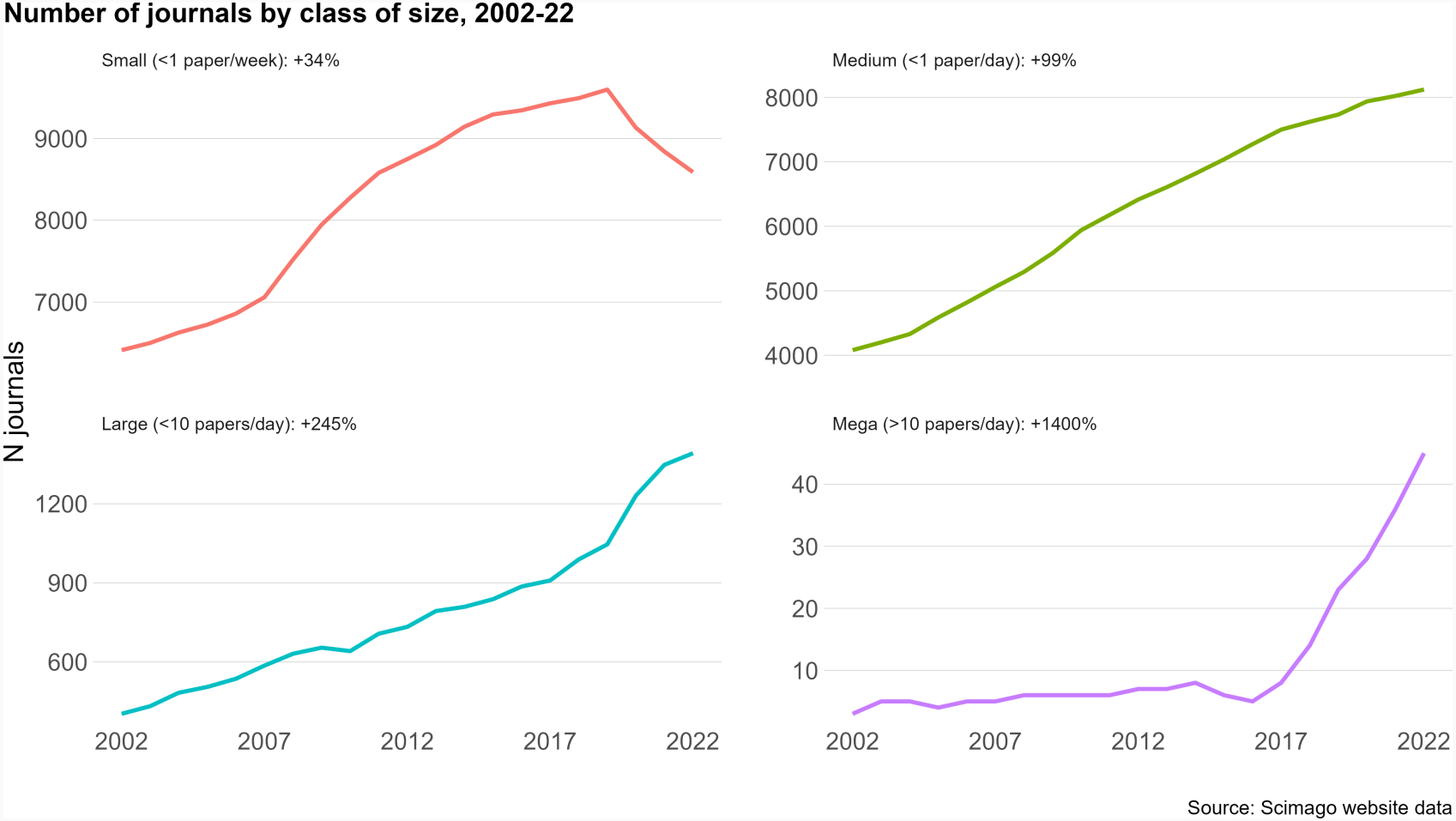
now it also means



A limitless electronic repository with a name

. . . which led to this

The rise of mega-journals



Under the hood: a semantic shift. . .

"**Publication**"

used to mean

- a handful of journals
- long delays
- low acceptance rates
- free for authors
- do it and thrive

⇒ *good science rejected?*

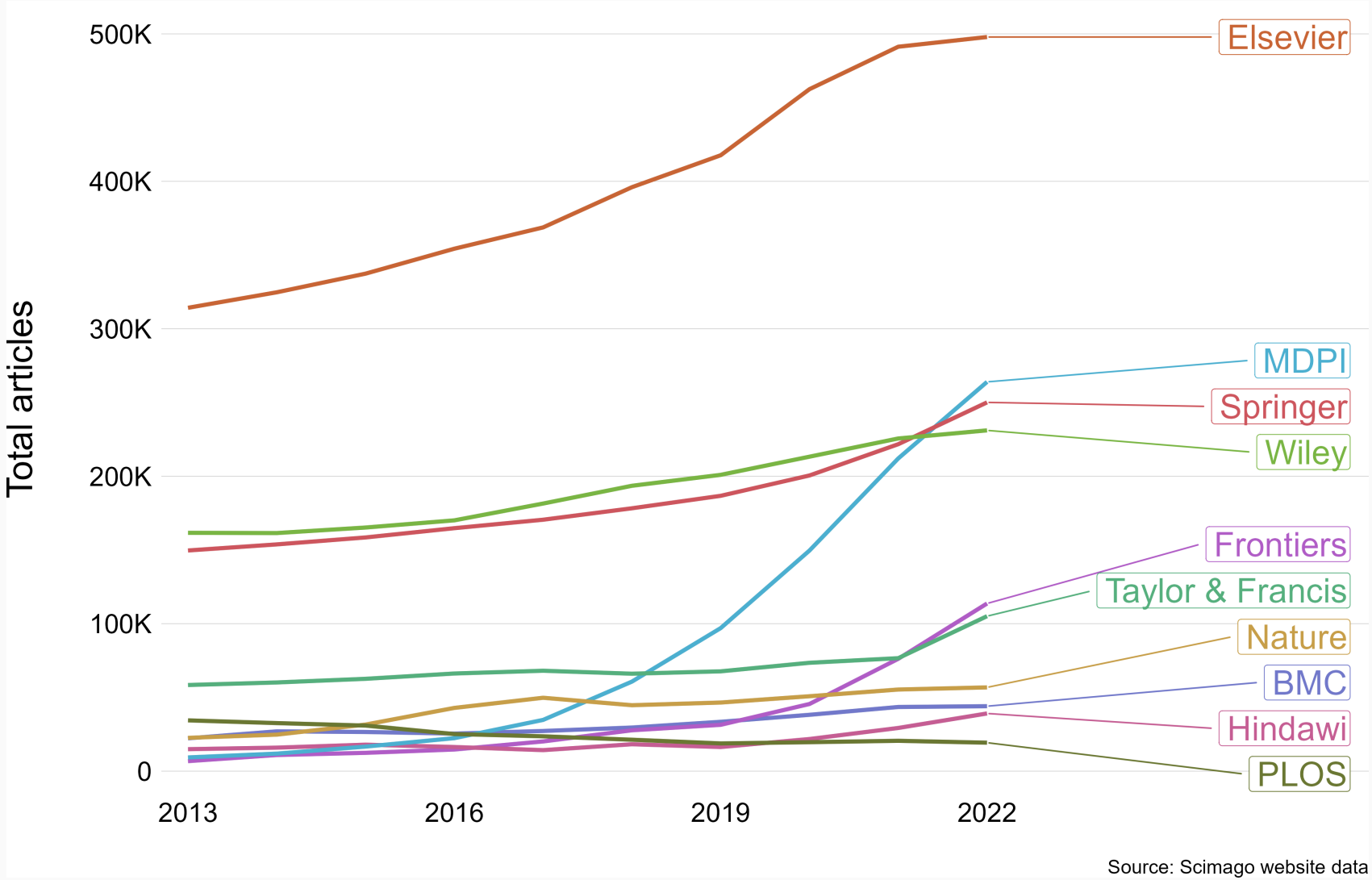
now it also means

- thousands of journals
- short delays
- high acceptance rates
- authors pay
- don’t do it and die

⇒ *bad science accepted?*

. . . that led to this

The rise of the for-profit OA model



Source: Scimago website data

Under the hood: a semantic shift. . .

"**Publisher business model**"

used to mean

- Many small journals
- Readers pay
- $ through subscription
- "*Polish your gems*"

Incentive to ↑↑ quality, quantity? . . .

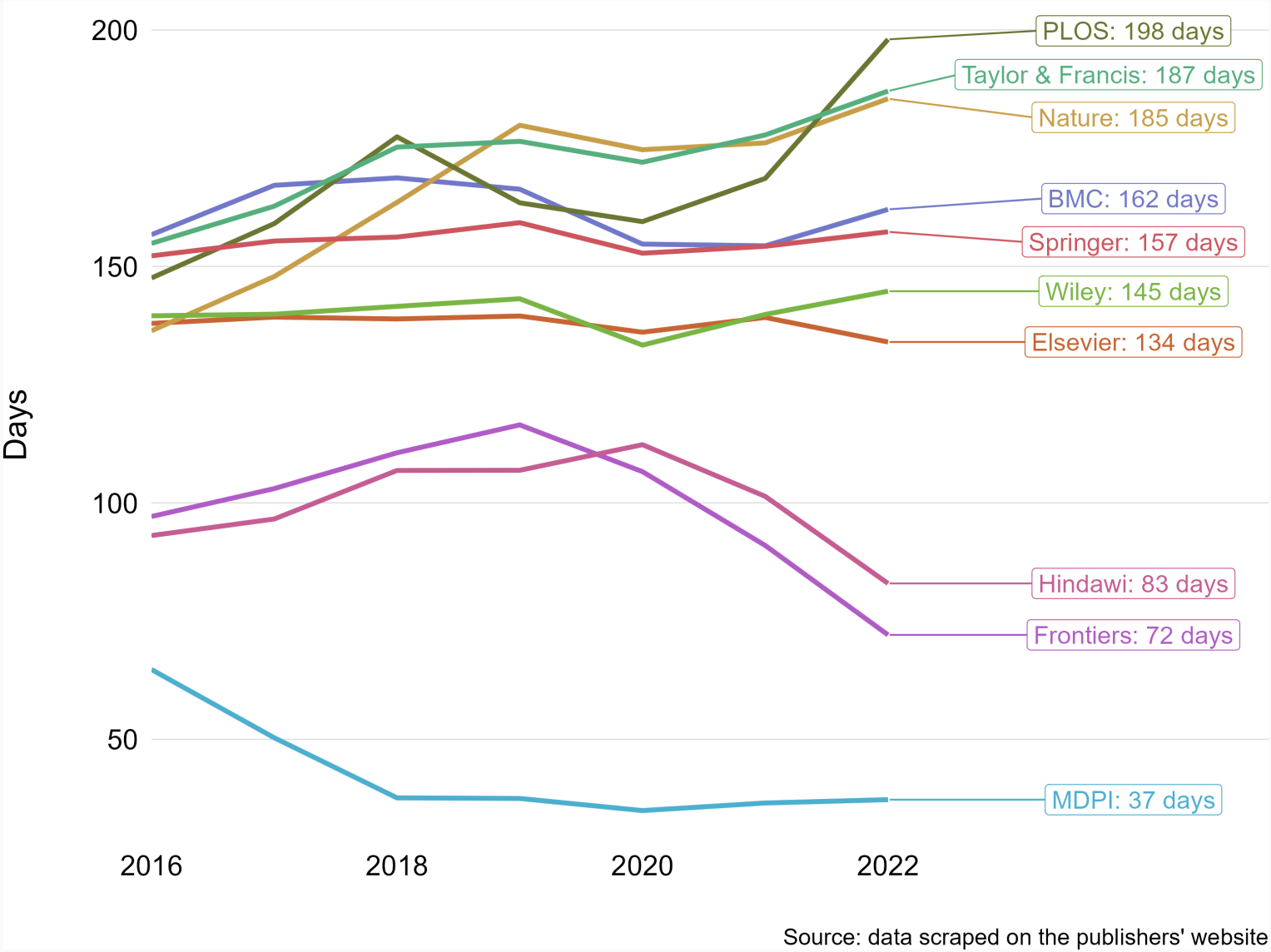
now it also means

- Few mega-journals
- Authors pay
- $ through publication
- "*Get authors on board*"

Incentive to ↑↑ quantity, quality? . . .

. . . that led to this. . .

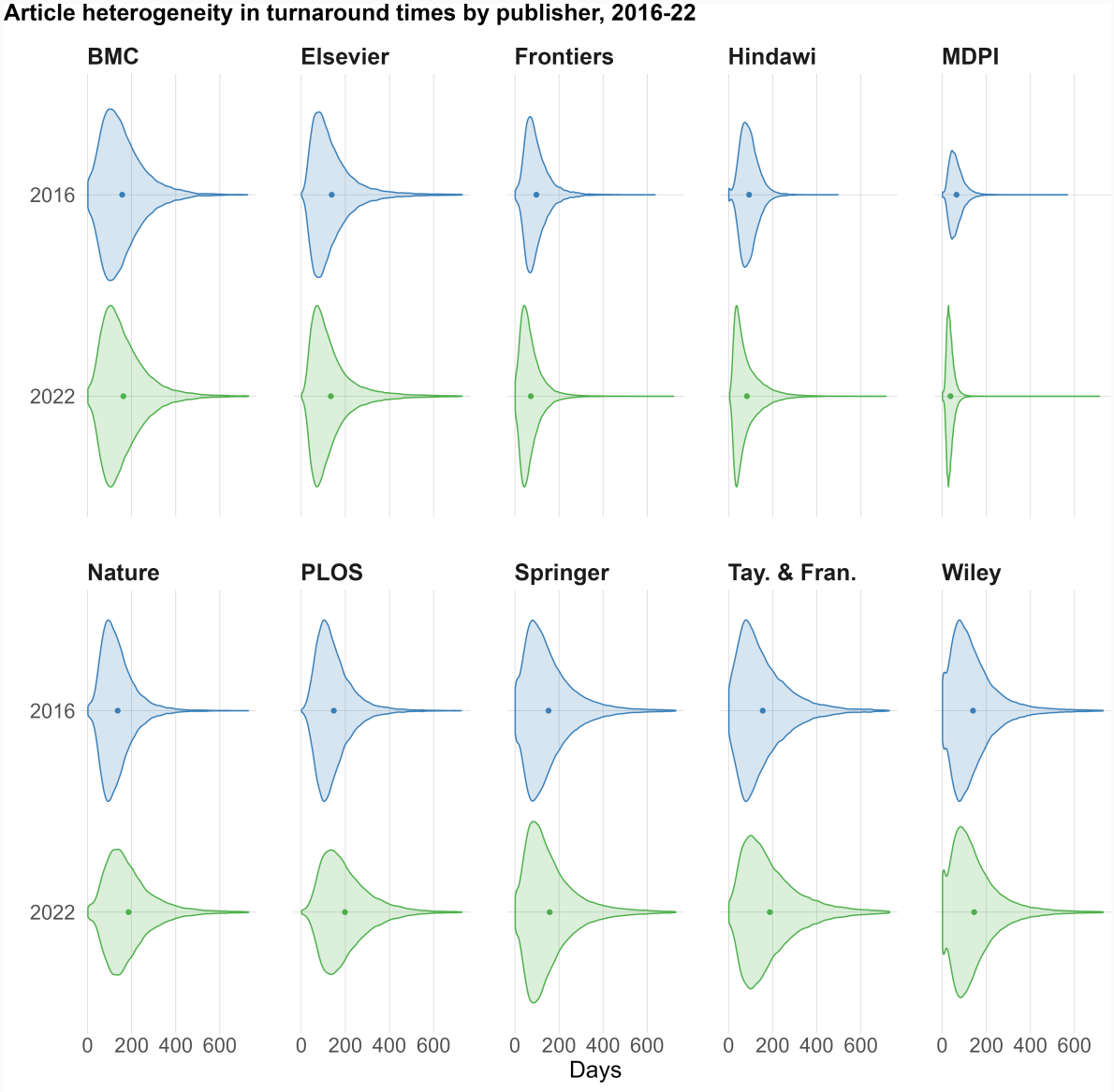
Much lower turnaround times. . .



Source: data scraped on the publishers' website

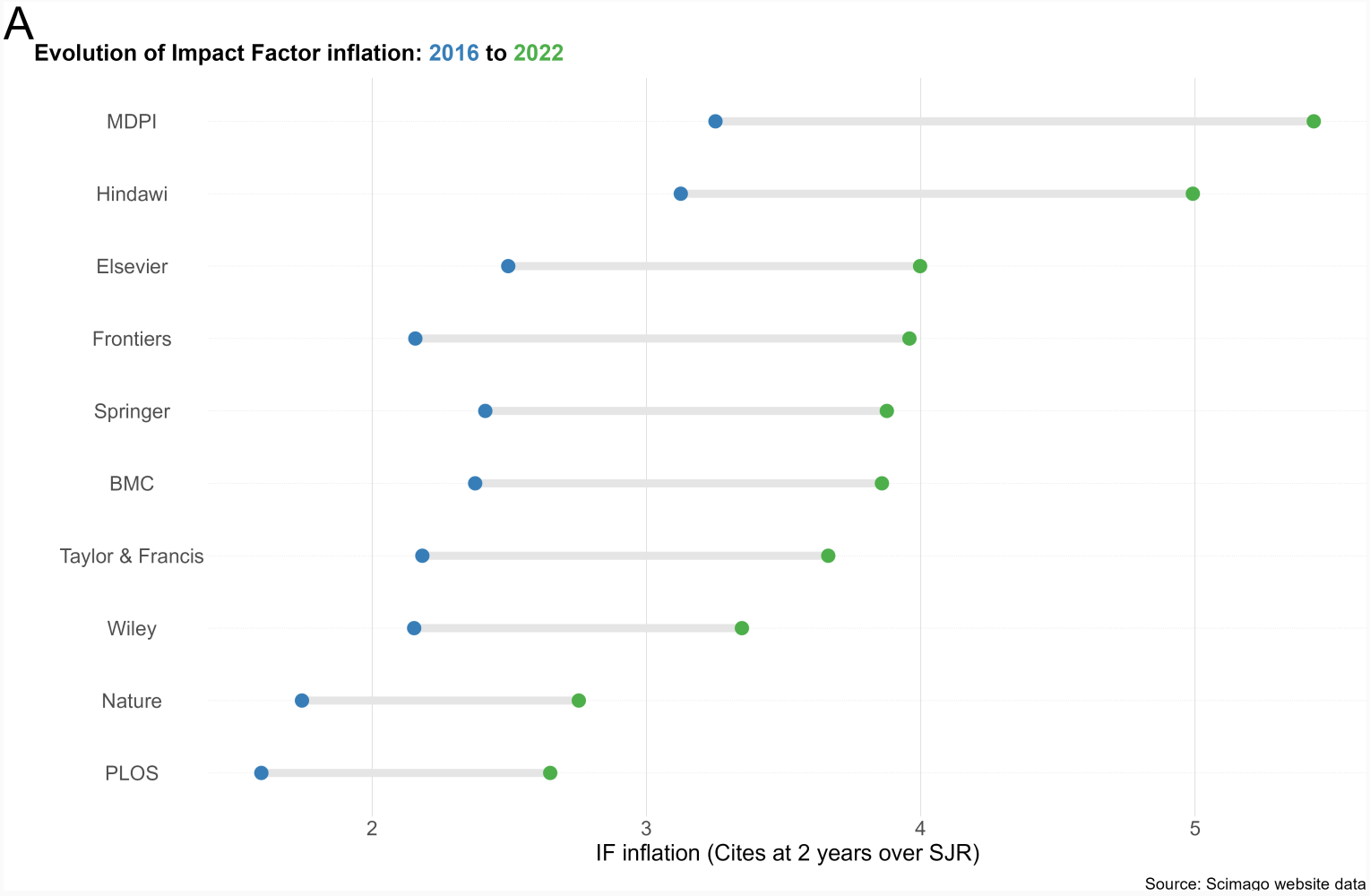
. . . and this. . .

. . . increasingly homogeneous turnaround times



. . . and this

. . . general inflation of the Impact Factor



Indicators of impact: Impact factor, Scimago Journal Rank

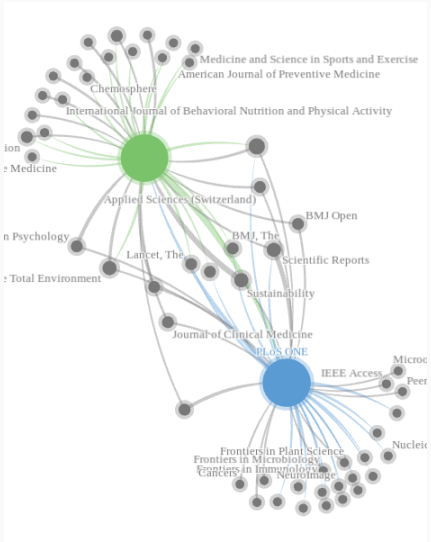
We measure Impact Factor Inflation as the ratio of IF to SJR

Impact Factor:

- cites/document at N years
- easily gamed

SJR: citation network counts

- Limits prestige from single source
- More prestige if cited by relevant journals
- Normalizes for field size
- Less easily gamed



Under the hood: a semantic shift. . .

"**Special issue**"

used to mean

- A once-in-a-while issue
- About a special topic
- Strict editor control
- regular $>$ special

now it also means

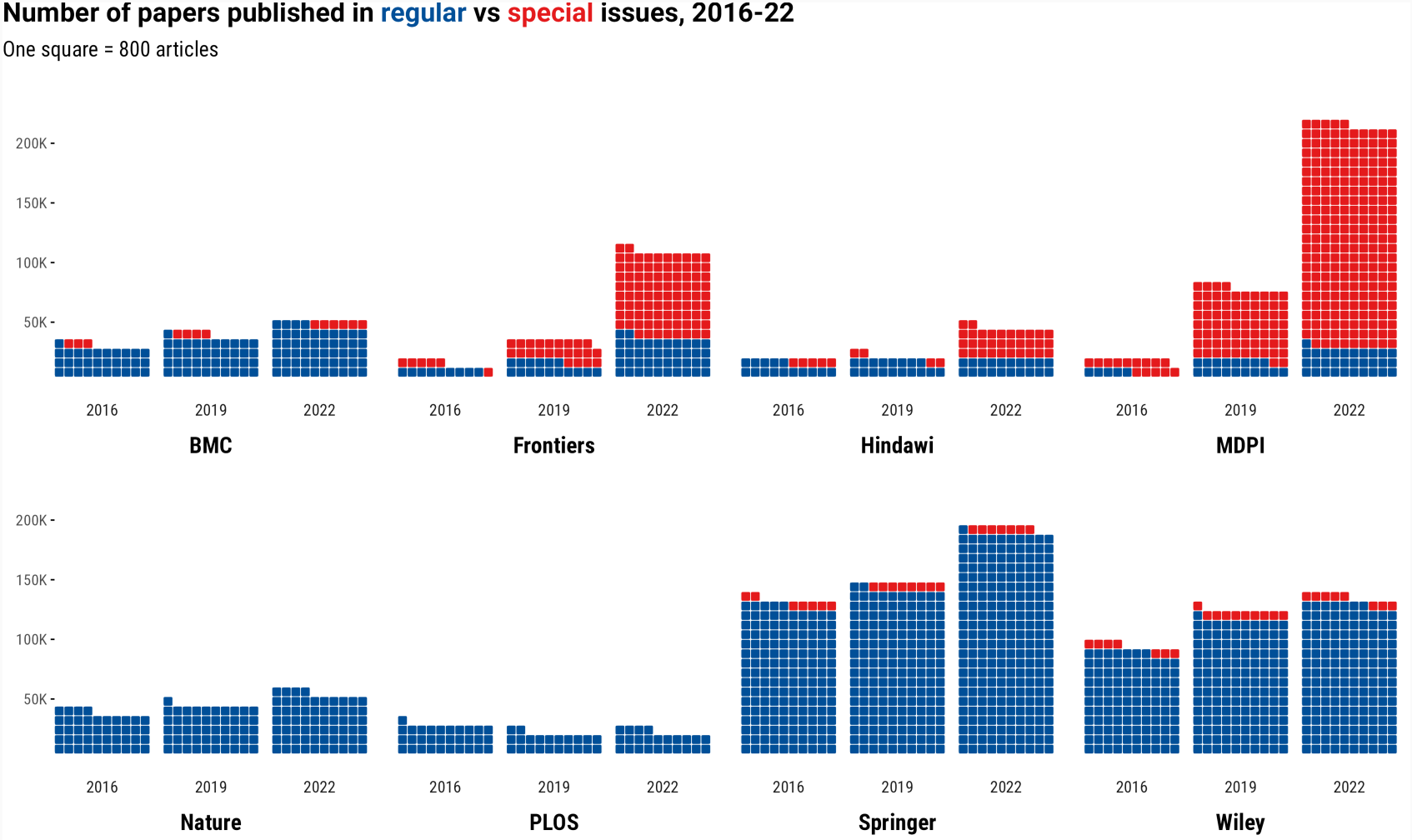
- A many-a-day issue
- About any topic
- Relaxed editor control
- special $>$ regular

. . . that led to this

Not so special after all

Number of papers published in regular vs special issues, 2016-22

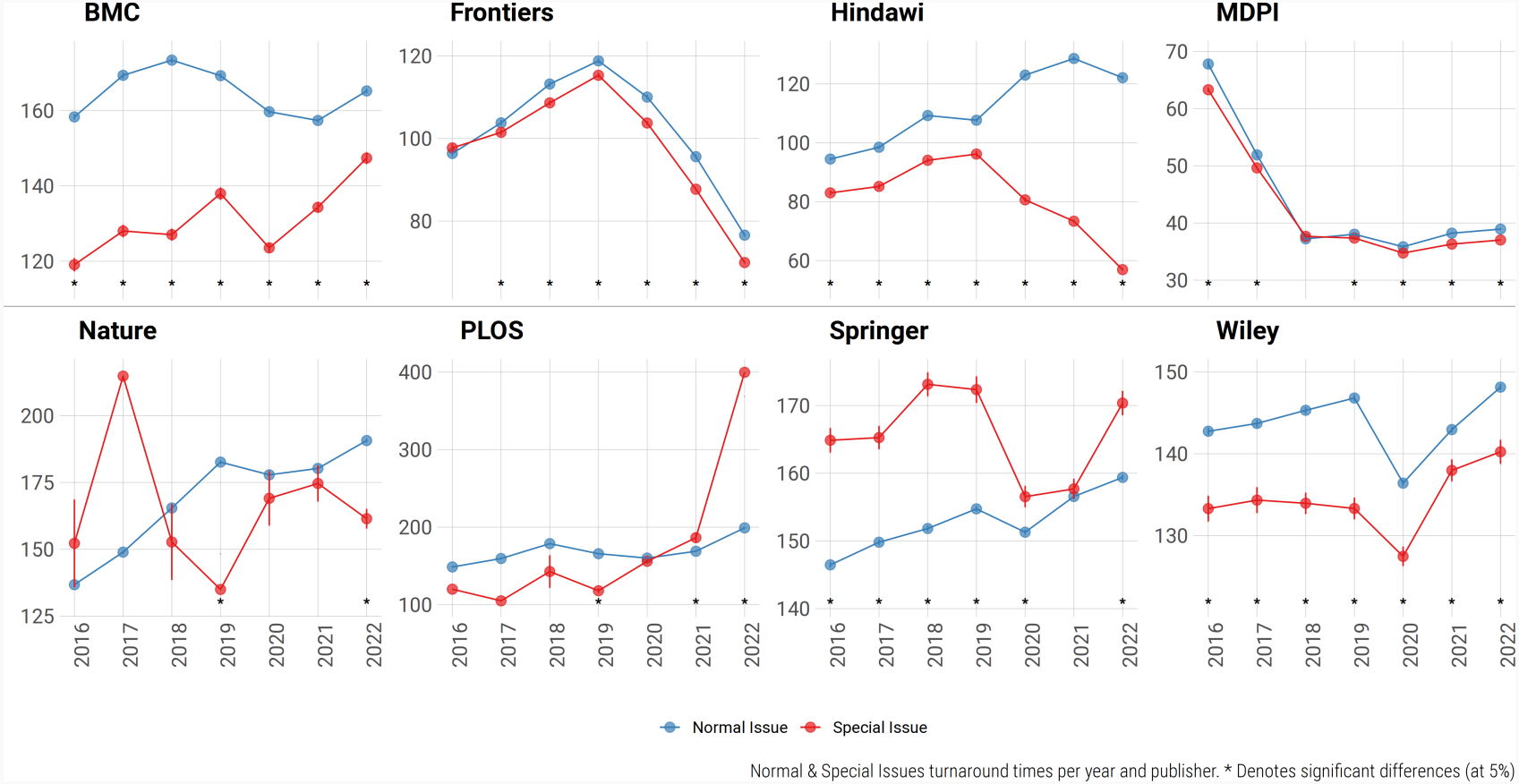
One square = 800 articles



Source: data scraped from the publisher's website

Note: Special issues are called Collections at PLOS and Topics at Frontiers. For MDPI Collections, Sections and Topics not shown.

Lower TATs for Special Issues



Normal & Special Issues turnaround times per year and publisher. * Denotes significant differences (at 5%)

summing up. . .

	Change 2016-22				
	TOTAL ARTICLES	SHARE SPECIAL ISSUE	TURNAROUND TIME (DAYS)	REJECTION RATE	IMPACT INFLATION
Overall	+47%	+27pp	-23	-1pp	+1.1
Elsevier	+41%	--	-4	+5pp*	+1.5
MDPI	+1080%	+14pp	-28	-8pp	+2.2
Springer	+52%	-1pp	+5	--	+1.5
Wiley	+36%	-2pp	+5	--	+1.2
Frontiers	+675%	+20pp	-25	+14pp	+1.8
Taylor & Francis	+59%	--	--	--	+1.5
Nature	+32%	+6pp	+49	--	+1
BMC	+73%	+1pp	+5	--	+1.5

Think individual journals differ? Head off to the strain explorer

Find all indicators journal by journal here

Click on this link

Summary: a strained system losing its compass

Trends

- Growth driven by concentration, especially in OA
- Crazy growth of special issues
- (Very) fast acceptance & peer review industrialization
- IF inflation for everyone – an IF arms race

Summary: a strained system losing its compass

Trends

- Growth driven by concentration, especially in OA
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- IF inflation for everyone – an IF arms race

Risks

- How much can we grow before the bubble bursts?
- Goodhart's law: *When a measure becomes a target, it stops being a good measure*
- Risk of instability of quality signals

An addictive relationship

An addictive relationship

An addictive relationship

Demand

incentives to publish OA

incentives to publish more & faster

tougher competition

emerging countries

Supply

reader-pays

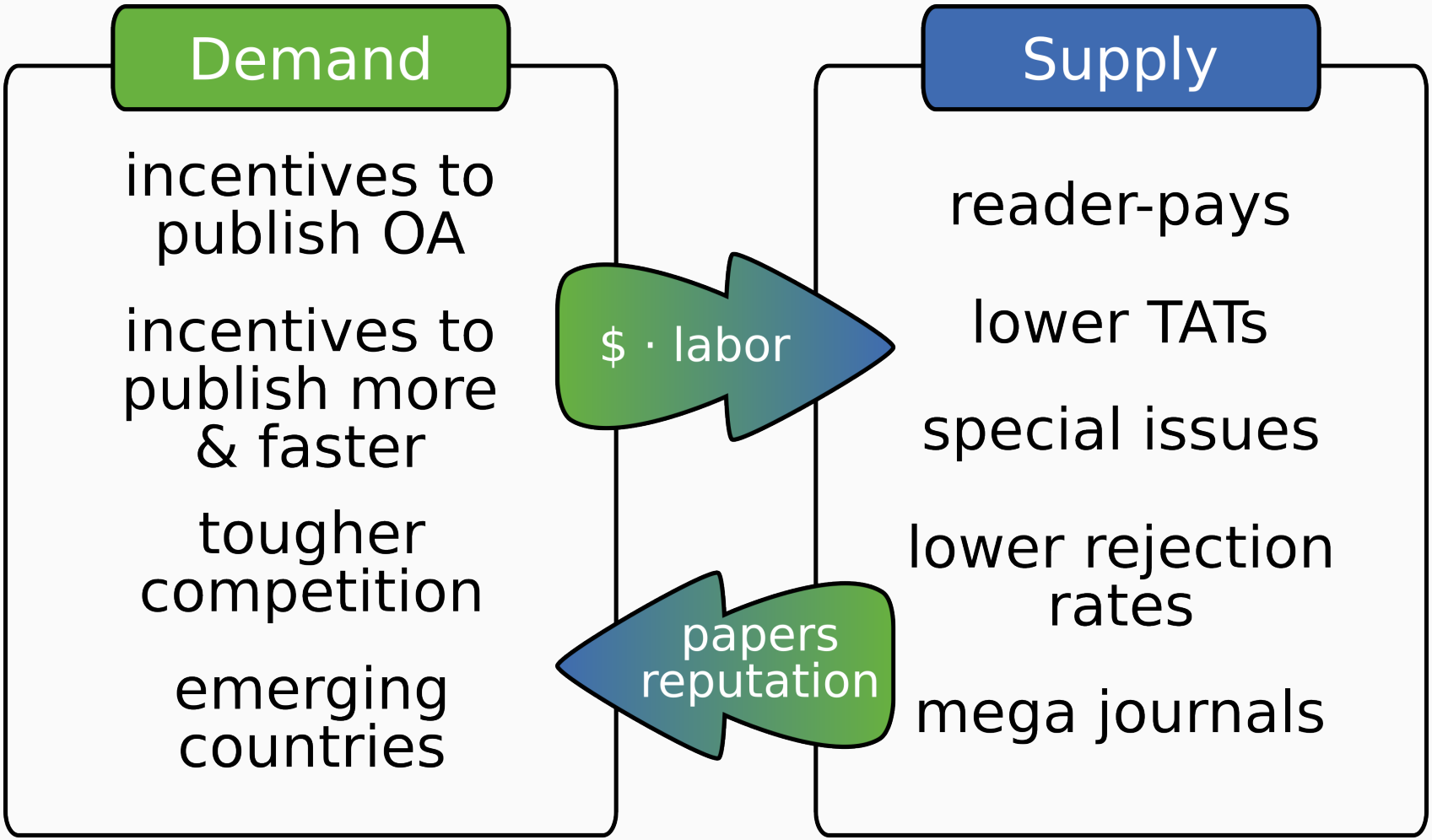
lower TATs

special issues

lower rejection rates

mega journals

An addictive relationship



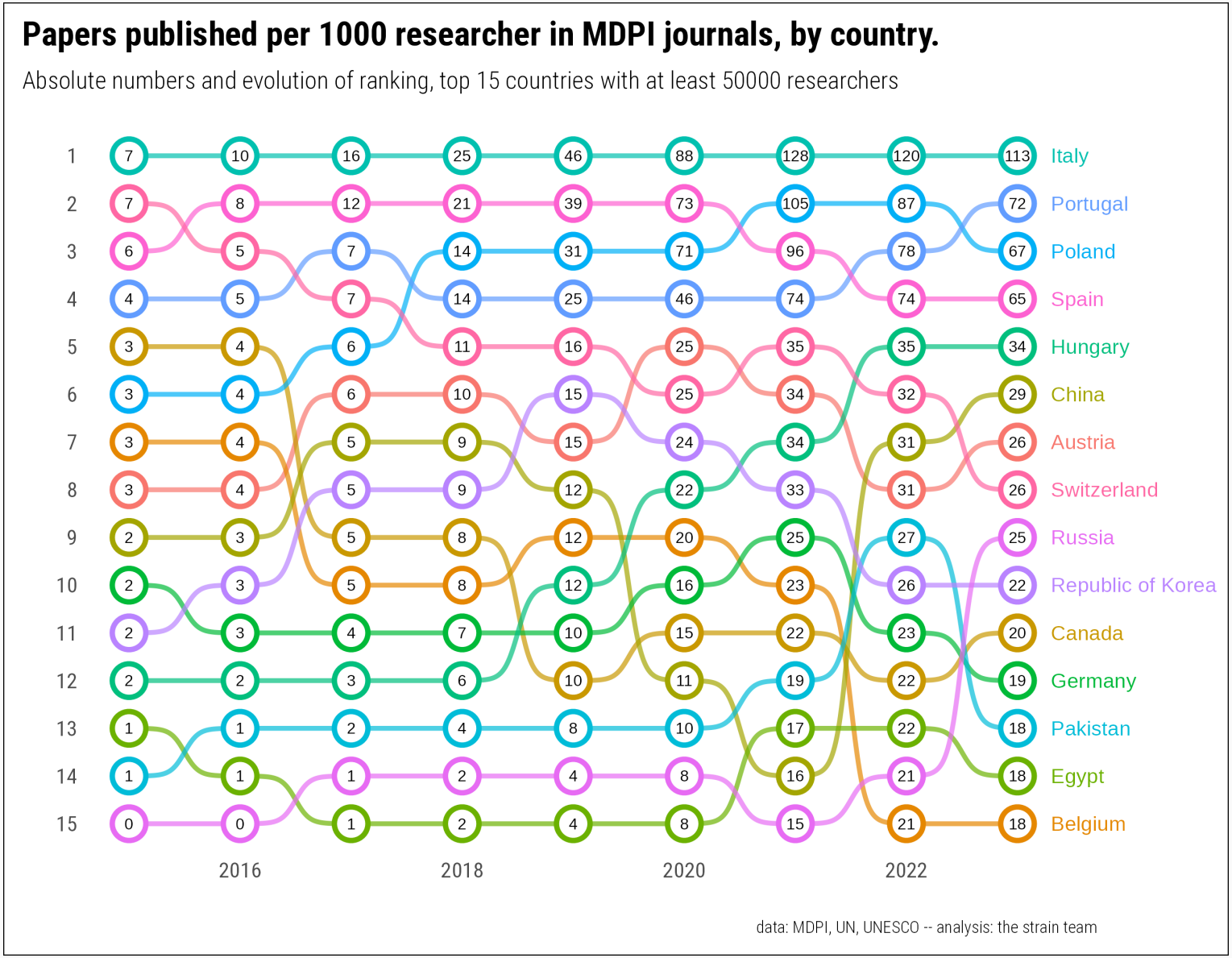
An addictive relationship

The combination of researchers' need to publish their work, and the commercial opportunities this presents publishers produces a toxic relationship reminiscent of alcoholics and the manufacturers of strong cheap cider. Each gets *what they want* from their interaction, but the result is not pretty.

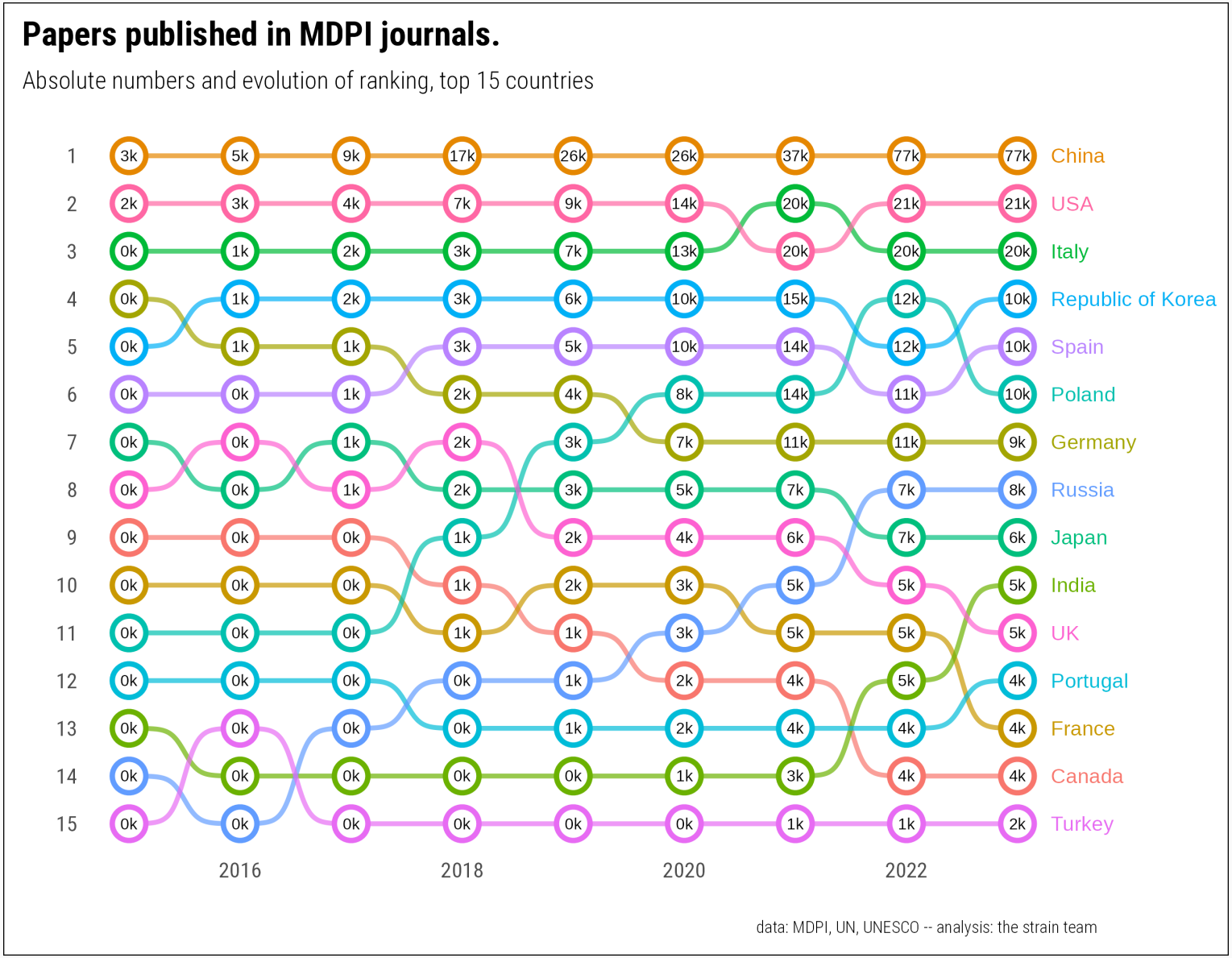
Examples of an addictive relationship:

where do these articles come from?

Surprise – it's us



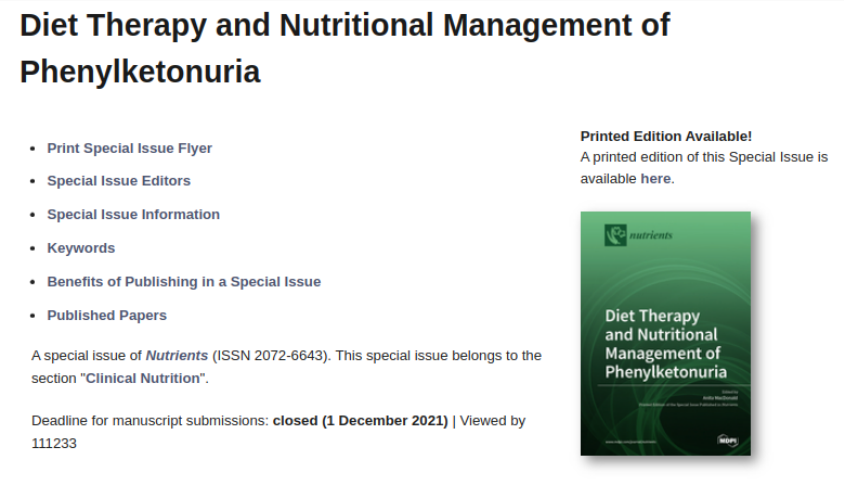
hey Paolo – do absolutes! . . . it's still us



Examples of an addictive relationship:

Publish **I**n **S**upport of **S**elf

A few people PISS a lot . . .



Diet Therapy and Nutritional Management of Phenylketonuria

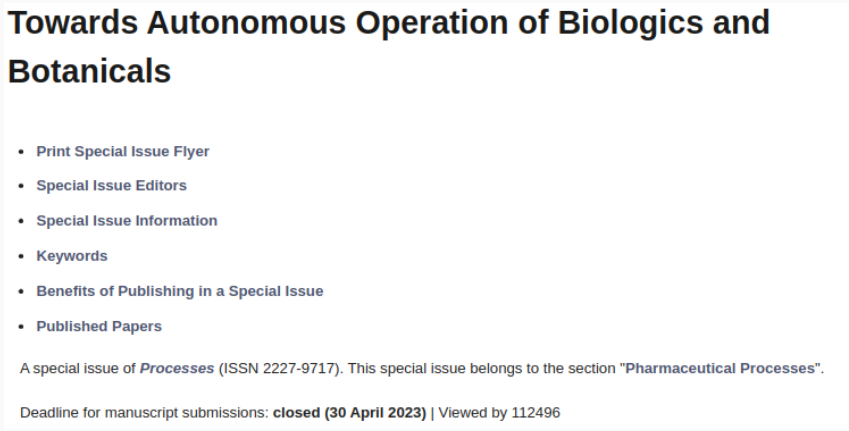
- Print Special Issue Flyer
- Special Issue Editors
- Special Issue Information
- Keywords
- Benefits of Publishing in a Special Issue
- Published Papers

A special issue of *Nutrients* (ISSN 2072-6643). This special issue belongs to the section "Clinical Nutrition".

Deadline for manuscript submissions: **closed (1 December 2021)** | Viewed by 111233

Printed Edition Available!
A printed edition of this Special Issue is available here.

- MDPI Nutrients, 2021
- 1 editor
- 23/24 authored articles



Towards Autonomous Operation of Biologics and Botanicals

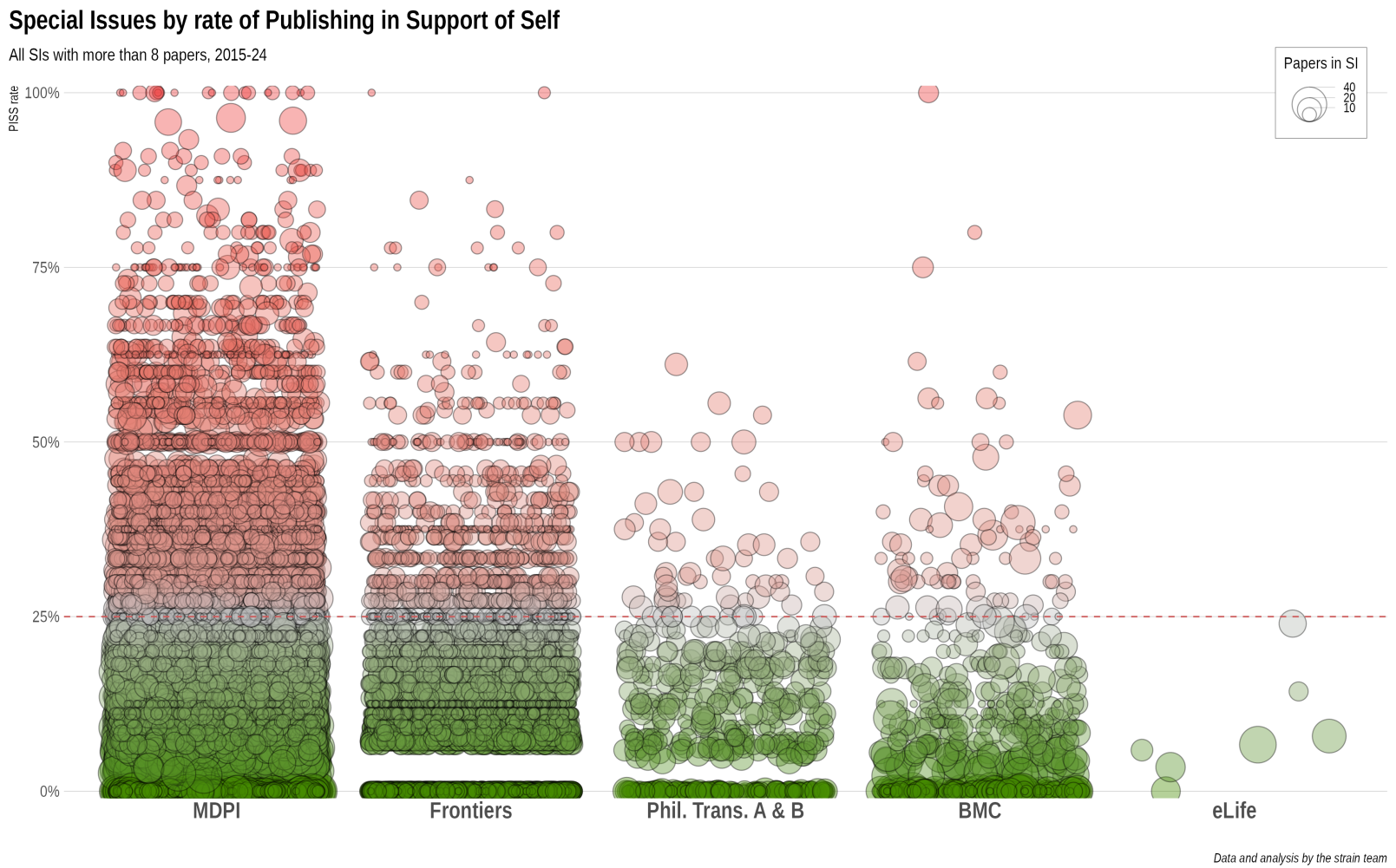
- Print Special Issue Flyer
- Special Issue Editors
- Special Issue Information
- Keywords
- Benefits of Publishing in a Special Issue
- Published Papers

A special issue of *Processes* (ISSN 2227-9717). This special issue belongs to the section "Pharmaceutical Processes".

Deadline for manuscript submissions: **closed (30 April 2023)** | Viewed by 112496

- MDPI Processes, 2023
- 2 editors
- 27/28 authored articles

. . . or a lot of small-scale PISS?



PISS as a common pool resource

Widespread small-scale PISS adds up to a lo

	Overall			
	# SI	# ARTICLES	# ENDOGENOUS	% ENDOGENY
Total	102,246	912,087	116,243	**14 ± 0.1**
MDPI	79,108	709,524	97,360	**15.3 ± 0.1**
Frontiers	20,893	179,815	16,373	**9.2 ± 0.2**
BMC	1,052	9,916	1,315	**17.1 ± 1.5**
Discover	666	5,158	276	**7.5 ± 1.4**
Phil Trans	520	7,478	903	**11.5 ± 1**
eLife	7	196	16	**8.9 ± 7.4**

Examples of an addictive relationship:

Demand always finds its own supply

Clarivate delisted the largest MDPI journal in 2023

Clarivate certifies
journals' IF
on Web of Science

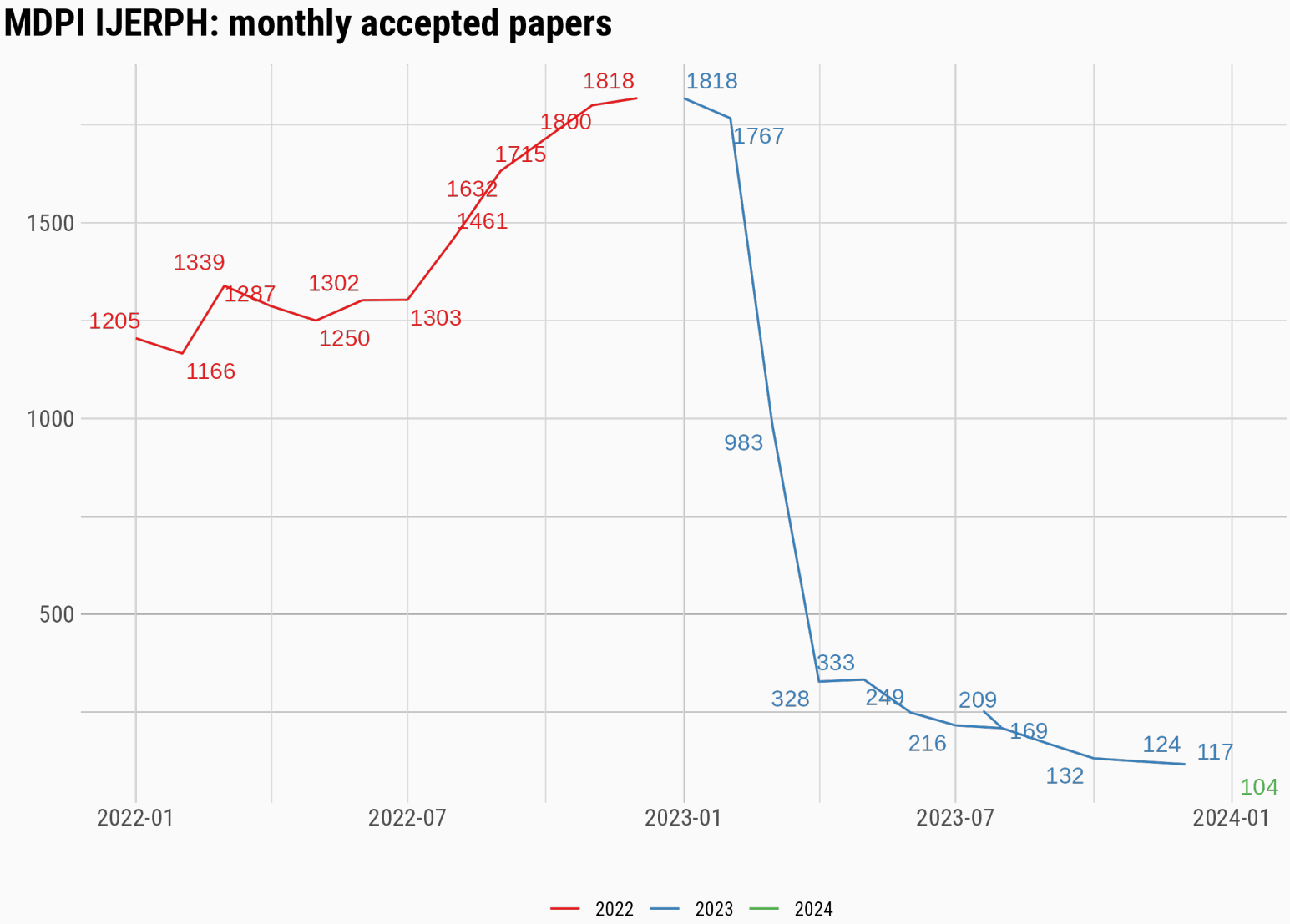
SCIENCEINSIDER | SCIENTIFIC COMMUNITY

Fast-growing open-access journals stripped of coveted impact factors

Web of Science delists some 50 journals, including one of the world's largest

28 MAR 2023 · 5:55 PM · BY JEFFREY BRAINARD

Delistings have dramatic effects – IJERPH



And they extend to the whole publisher – MDPI

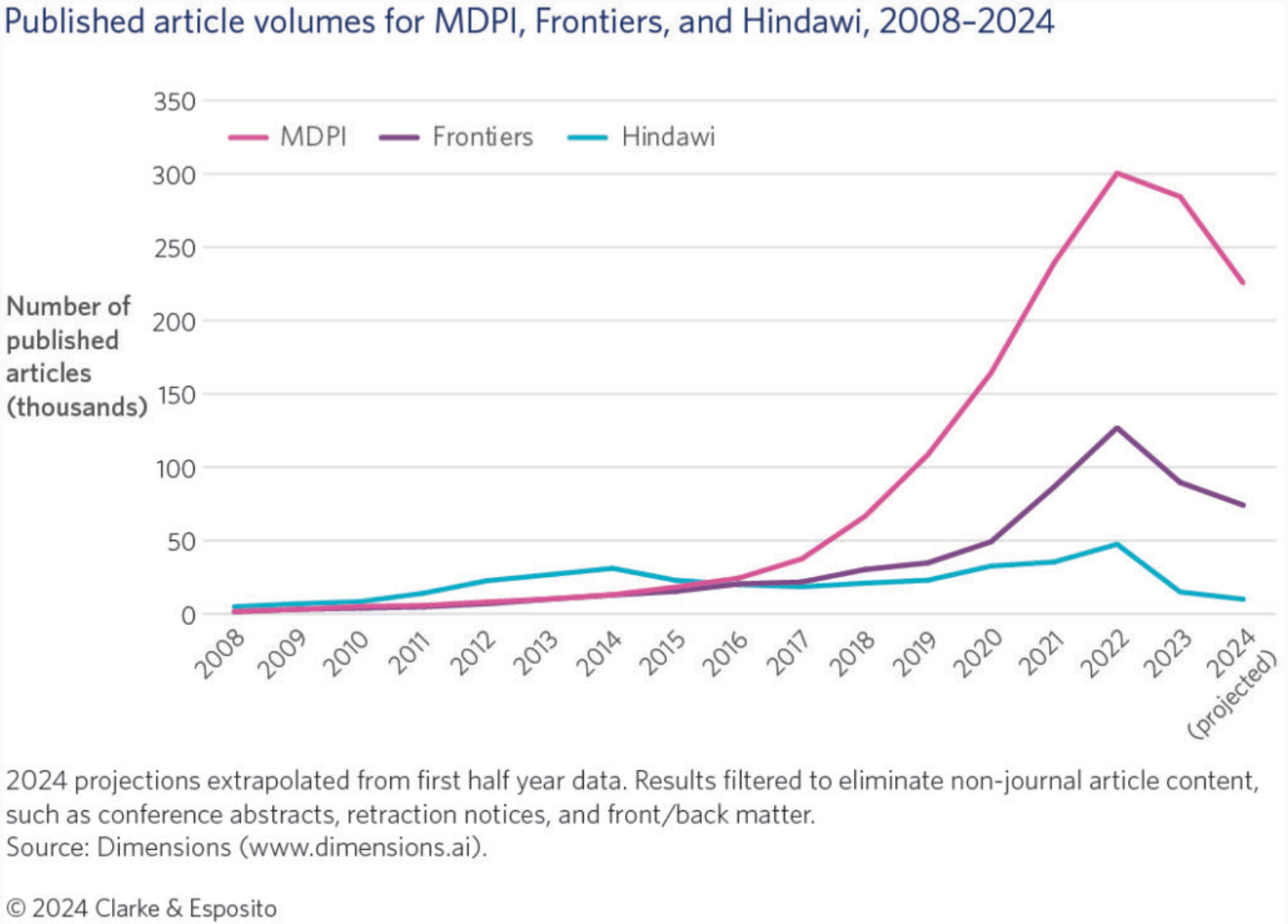
Monthly % change in submitted papers – 15 largest MDPI journals

Over all 98 journals with an Impact Factor as of February 2023 and by journal

		2022					2023						
JOURNAL	N	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Overall	287573	-1.50	6.79	8.33	11.84	4.35	2.33	-0.15	3.91	4.21	-22.34	-4.78	0.17
ijerph	17278	-2.11	4.97	12.22	10.58	7.53	1.06	1.23	5.72	-17.76	-73.12	-3.09	-23.21
sustainability	17242	-1.25	17.01	1.99	15.28	5.20	-1.61	-3.04	11.13	23.61	-19.57	-2.33	9.50
ijms	16140	-6.21	6.01	17.66	12.10	6.27	2.30	-1.92	6.59	-0.54	-18.61	-1.38	2.59
applsci	12890	-1.35	-7.50	4.67	13.74	8.55	-2.43	10.51	4.20	11.82	-11.55	-2.22	-4.51
sensors	10084	-2.11	3.19	13.06	7.72	6.47	13.83	-8.53	2.69	5.57	-12.83	-14.23	-1.69
energies	9588	-3.18	4.05	1.54	30.41	4.04	-0.76	-5.75	5.53	-9.77	-5.94	-11.94	-2.63
molecules	9066	-0.19	3.72	18.12	10.67	5.84	8.11	2.89	-6.99	2.63	-14.34	-15.79	0.87
materials	9046	-0.11	10.16	9.70	9.63	2.08	5.09	-2.38	-3.89	0.24	-7.36	-9.06	-3.67
jcm	7299	-7.09	5.52	2.53	0.68	2.36	10.56	23.81	11.27	18.53	-26.60	-11.39	16.23
remotesensing	6416	0.18	14.87	1.16	2.53	5.16	-5.61	-2.18	1.08	9.67	-15.49	1.64	-4.69
cancers	6252	6.90	12.50	9.05	7.81	1.07	11.92	-6.81	3.83	-5.01	-22.87	-2.57	1.85
polymers	5573	5.62	11.81	3.42	19.71	2.64	-5.62	-1.86	-1.77	13.38	-23.50	-2.52	-6.09
nutrients	5276	0.91	8.37	3.92	12.11	5.61	0.19	1.83	1.23	5.70	-19.19	6.78	-6.05
mathematics	4884	1.62	9.87	10.43	14.35	-13.54	5.58	0.92	-3.74	14.67	-13.32	1.56	-2.74
nanomaterials	4434	0.35	-2.26	9.09	8.17	3.32	-3.07	-13.27	-4.70	-5.66	-8.51	-5.50	-17.00

Source: data scraped on the publisher's website by @paolocrosetto

And to other commerical OA publishers



But someone will cater to that demand

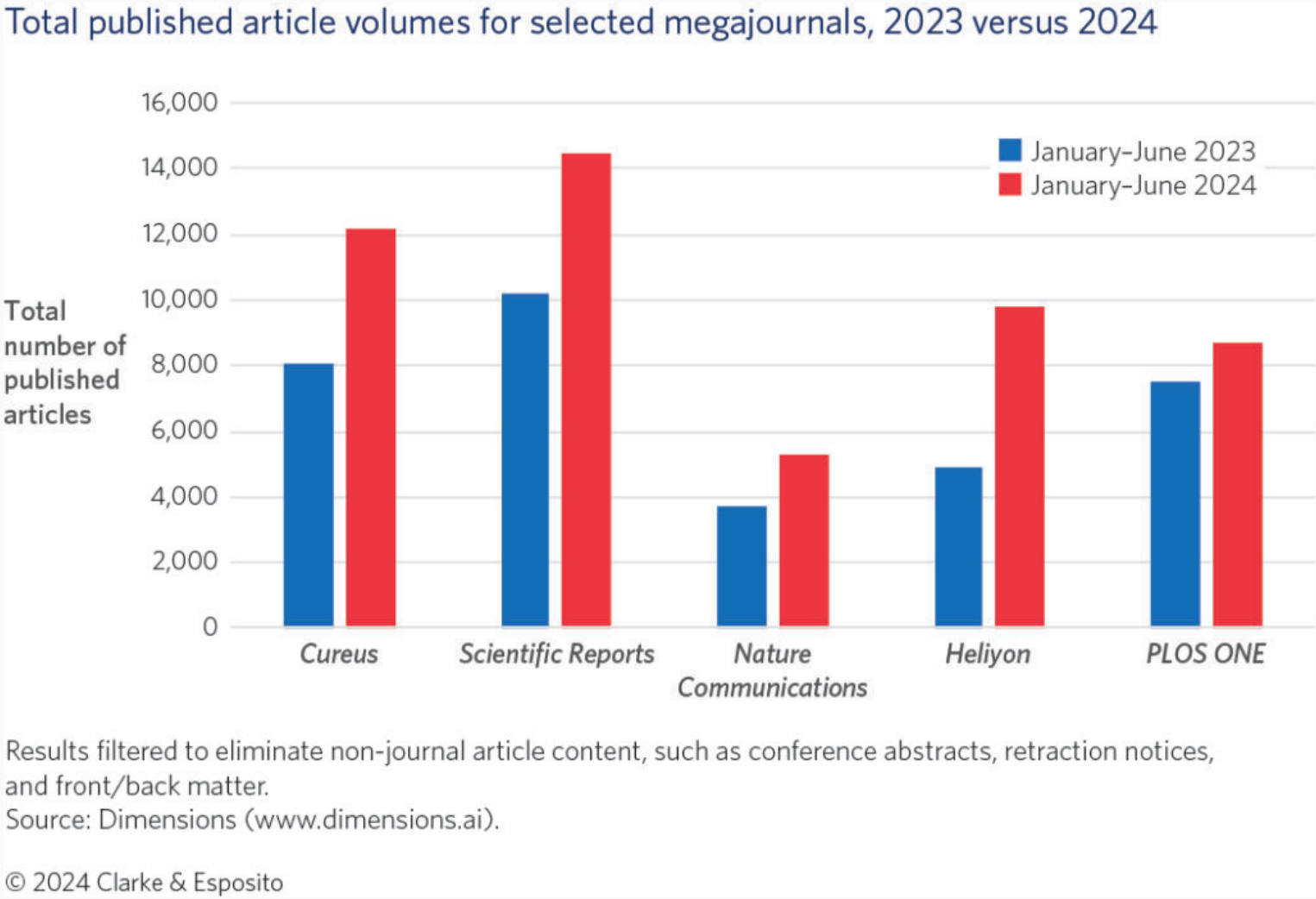
Springer-Nature Discovers MDPI

Article Processing Charges (2025) -- Nature Discover and similarly-named MDPI journals

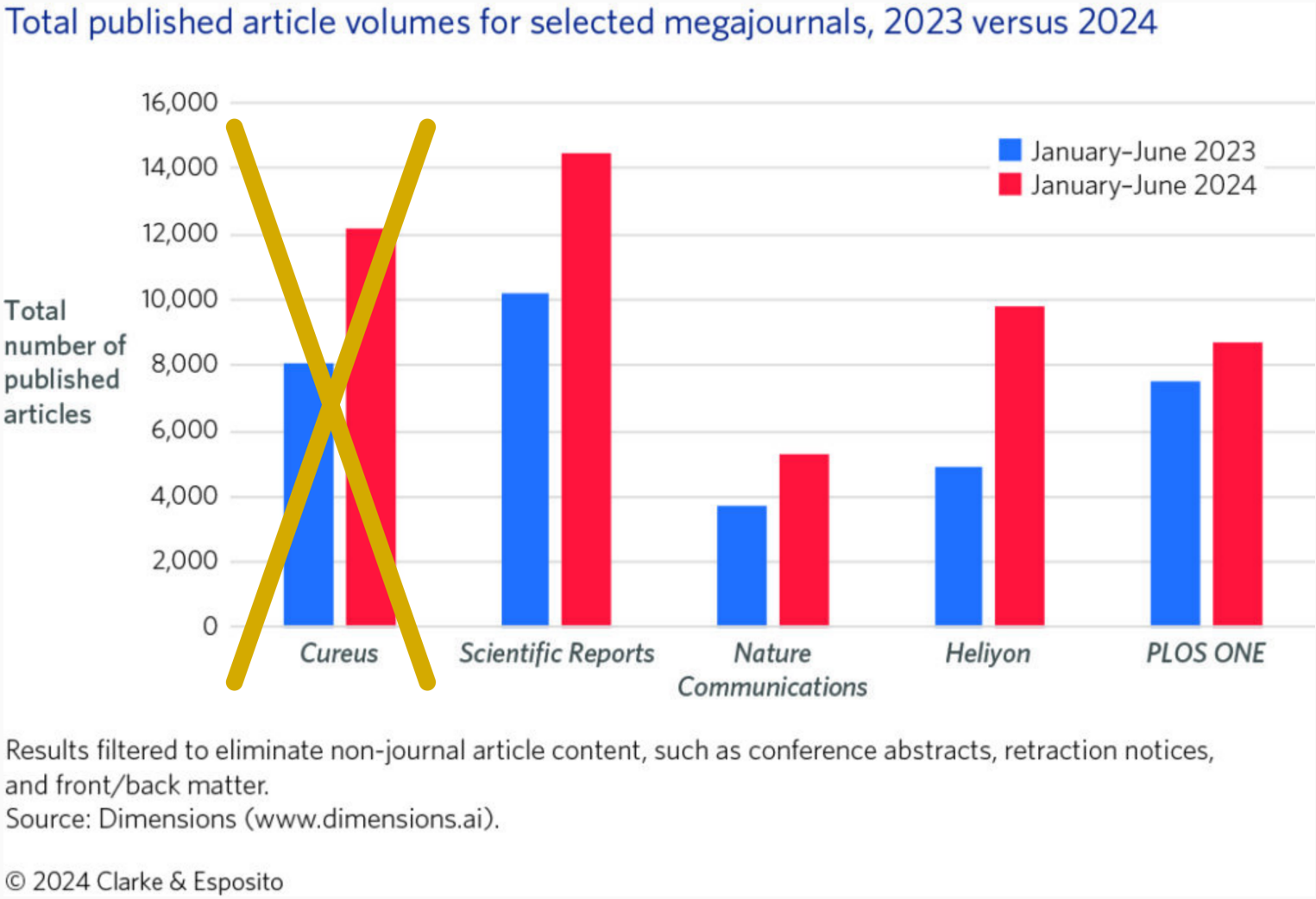
Journal name			APCs (€)	
DISCOVER	MDPI	NAME SIMILARITY	DISCOVER	MDPI
Environmental Sciences				
Energy	Energies	🟡	1190	2789
Agriculture	Agriculture	🟢	1040	2782
Water	Water	🟢	1190	2782
Atmosphere	Atmosphere	🟢	1090	2568
Sustainability	Sustainability	🟢	1090	2568
Cities	Smart Cities	🟠	1040	2145
Environment	Environments	🟡	1090	1926
Geoscience	Geosciences	🟡	1040	1926
Soil	Soil Systems	🟠	1190	1926
Oceans	Oceans	🟢	1040	1712
Hazards	GeoHazards	🟠	1690	1072
Conservation	Conservation	🟢	1040	1070
Ecology	Ecologies	🟡	1040	1070

data: MDPI and Discover websites. Analysis: the Strain team

And Springer is not alone!



. . . oops busted


Total published article volumes for selected megajournals, 2023 versus 2024
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Total number of published articles
January–June 2023
January–June 2024
Cureus
Scientific Reports
Nature Communications
Heliyon
PLOS ONE
Results filtered to eliminate non-journal article content, such as conference abstracts, retraction notices, and front/back matter.
Source: Dimensions (www.dimensions.ai).
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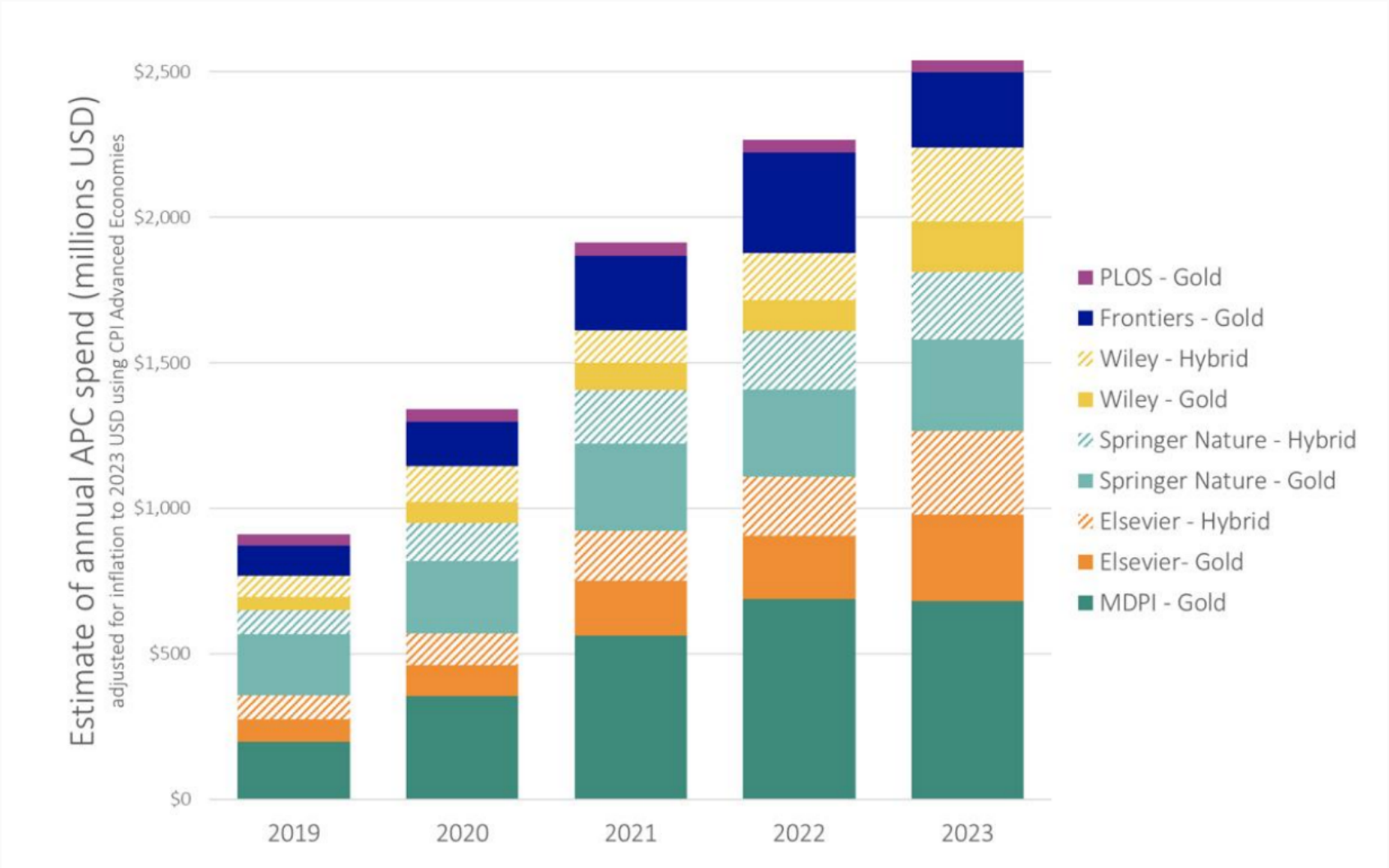
The drain of scientific publishing

. . . money drain


Estimate of annual APC spend (millions USD)
adjusted for inflation to 2023 USD using CPI Advanced Economies
$2,500
$2,000
$1,500
$1,000
$500
$0
2019
2020
2021
2022
2023
PLOS - Gold
Frontiers - Gold
Wiley - Hybrid
Wiley - Gold
Springer Nature - Hybrid
Springer Nature - Gold
Elsevier - Hybrid
Elsevier- Gold
MDPI - Gold

and the profits are exceptional

Academic publishers compared to 30 largest companies based on 2024 revenue

Revenue and profit in million USD, from consolidated revenue. Companies sorted by profit margin.

	HEADQUARTERS	EMPLOYEES	REVENUE	PROFITS	MARGIN
Academic publishing · NAICS 511 · Mean industry net profit margin: 12%					
					Mean: 34%
RELX	United Kingdom	36,400	12,057	4,088	**33%**
└ *Elsevier*	United Kingdom	9,700	3,899	1,497	**38%**
Informa	United Kingdom	11,400	4,542	1,271	**27%**
└ *Taylor & Francis*	United Kingdom	11,000	892	327	**36%**
Springer Nature Group	Germany	9,092	1,998	554	**27%**
└ *Springer Nature Research Segment*	Germany	6,125	1,529	488	**31%**
Wiley	United States	6,400	1,042	331	**31%**
MDPI	Switzerland	6,650	--	--	**--**
Frontiers	Switzerland	1,440	--	--	**--**

Industry net profit margins and industry classification obtained from Dow Jones Factiva Industry Snapshot. List of largest companies obtained from Wikipedia, revenues and profits (in million USD) and number of employees extracted from annual financial reports and converted to USD if necessary.
Source: https://en.wikipedia.org/wiki/List_of_largest_companies_by_revenue
Mean 2024 average exchange rates for USD used: GBP: 1.2781; EUR 1.0822; RMB: 0.1393; JPY: 0.0066; NTD: 0.0312

comparable to IT

Academic publishers compared to 30 largest companies based on 2024 revenue

Revenue and profit in million USD, from consolidated revenue. Companies sorted by profit margin.

	HEADQUARTERS	EMPLOYEES	REVENUE	PROFITS	MARGIN
Information technology · NAICS 334 · Mean industry net profit margin: 27%					
					Mean: 29%
Microsoft	United States	228,000	245,122	88,136	**35%**
Alphabet	United States	183,323	350,018	100,118	**28%**
Apple	United States	164,000	391,035	93,736	**23%**

Industry net profit margins and industry classification obtained from Dow Jones Factiva Industry Snapshot. List of largest companies obtained from Wikipedia, revenues and profits (in million USD) and number of employees extracted from annual financial reports and converted to USD if necessary.
Source: https://en.wikipedia.org/wiki/List_of_largest_companies_by_revenue
Mean 2024 average exchange rates for USD used: GBP: 1.2781; EUR 1.0822; RMB: 0.1393; JPY: 0.0066; NTD: 0.0312

More than oil & gas

Academic publishers compared to 30 largest companies based on 2024 revenue

Revenue and profit in million USD, from consolidated revenue. Companies sorted by profit margin.

	HEADQUARTERS	EMPLOYEES	REVENUE	PROFITS	MARGIN
Oil and gas · NAICS 21111 · Mean industry net profit margin: 21%					
					Mean: 8%
Saudi Aramco	Saudi Arabia	75,118	480,446	106,246	**22%**
ExxonMobil	United States	60,900	349,585	35,063	**10%**
Chevron	United States	39,742	193,414	17,611	**9%**
TotalEnergies	France	102,887	241,550	18,264	**7%**
China National Petroleum Corporation	China	1,000,800	436,875	28,677	**6%**
Shell	United Kingdom	96,000	289,029	16,521	**5%**
China Petrochemical Corporation	China	355,952	428,286	20,805	**4%**
BP	United Kingdom	100,500	194,629	6,782	**3%**

Industry net profit margins and industry classification obtained from Dow Jones Factiva Industry Snapshot. List of largest companies obtained from Wikipedia, revenues and profits (in million USD) and number of employees extracted from annual financial reports and converted to USD if necessary.
Source: https://en.wikipedia.org/wiki/List_of_largest_companies_by_revenue
Mean 2024 average exchange rates for USD used: GBP: 1.2781; EUR 1.0822; RMB: 0.1393; JPY: 0.0066; NTD: 0.0312

. . . time drain

- Estimated proofreading time: 63 million hours in 2016
- More time spent looking for funding, evaluating projects. . .
- . . . only to end up producing even more papers!

. . . trust drain

- What future for quality signals?
- Can the general public still trust us?
- How can we tell if a result is credible?

How can we change the system?

Two recipes for change

Bottom-up

- Peer-Community in
- preprints
- blacklisting publishers

but incentives are
hard to beat

Two recipes for change

Bottom-up

- Peer-Community in
- preprints
- blacklisting publishers

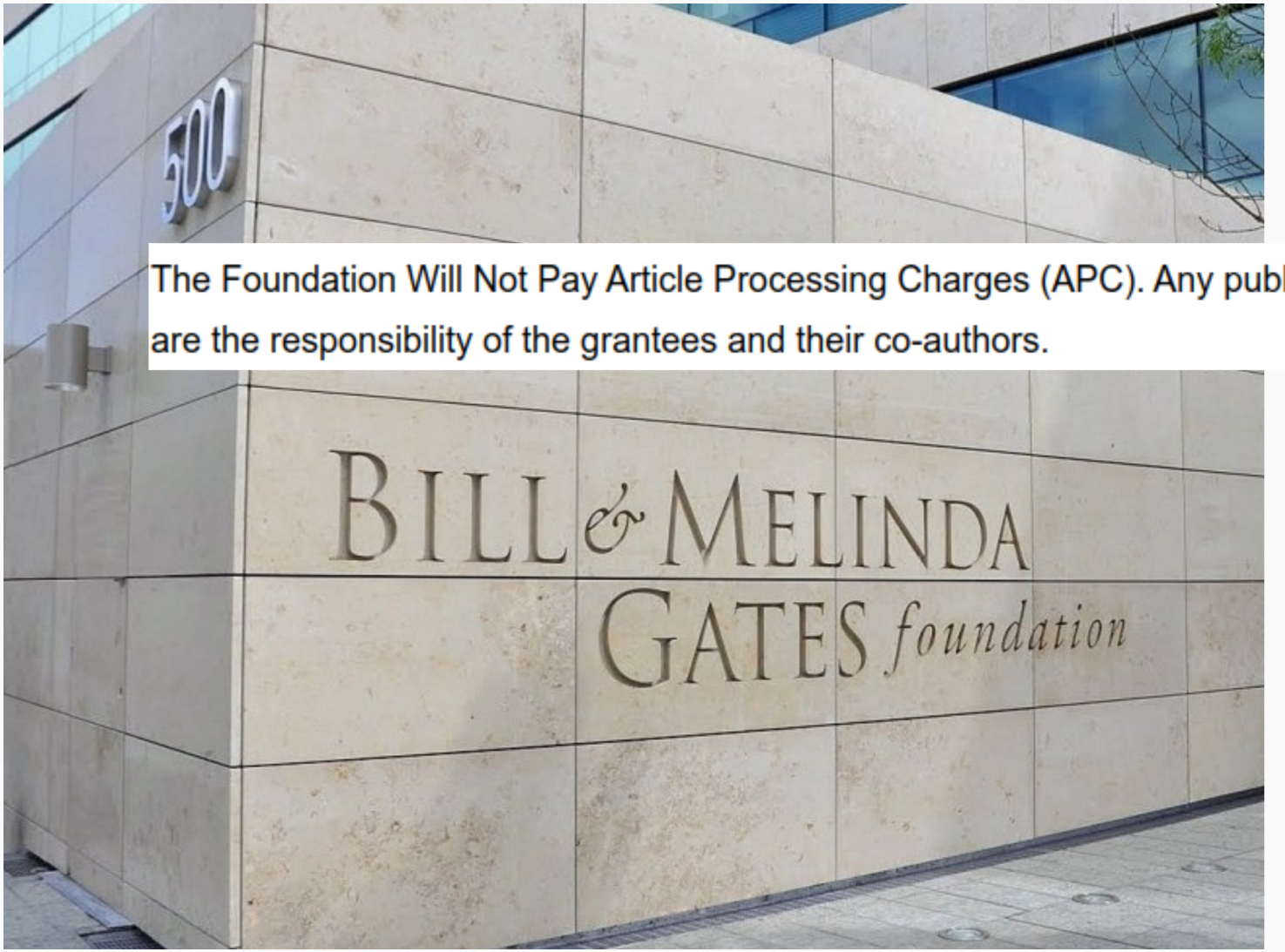
but incentives are hard to beat

Top-down

- the power of the purse
- quality over quantity
- manage collective action

but institutions are slow & constrained!

Signals of ongoing change: we won't pay



Signals of ongoing change: blacklisting

Finland Publication Forum will downgrade hundreds of Frontiers and MDPI journals

A committee of scholars in Finland has decided to downgrade 271 journals from Frontiers and MDPI in their quality rating system, in a move that may discourage researchers from submitting manuscripts to the outlets.

Publication Forum

Signals of ongoing change: no $ for Special Issues

Swiss National Science Foundation

< Actualités

The SNSF will no longer fund articles in special issues

From 1 February 2024, the SNSF will no longer fund Open Access articles in sp

Although special issues are excluded from research funding according to SNS publication has increased in recent years. There will therefore be no further fin journals. You may continue to publish in special issues, but the APC costs will l taking a step towards more sustainable funding of publications and promoting the quantity of articles published by a researcher. You can find more informati subtitle.

The Library Open Access team can help you choose your titles and advise you SNSF or the institution. Please do not hesitate to contact us.

If the game is rigged – you might consider to stop playing

Is this the time to be radical?

- Get rid of the owners of "publication" badges
- or just buy them off ($\sim 50B$)
- Re-communalize journals

Is this the time to be radical?

- Get rid of the owners of "publication" badges
- or just buy them off ($\sim 50B$)
- Re-communalize journals

- But also: do we *need* journals?
- Embrace post-preprint peer review
- ...

GRAZIE