Scholarly & Policy Perspectives of Open Access: Innovation & Transformation

Ulrich Pöschl
Max Planck Institute for Chemistry & Johannes Gutenberg University, Mainz

www.mpic.de/4123205/open-access

Perspektive offene Wissenschaft @ RMU 2022
Introduction & Motivation

- Max Planck Institute for Chemistry: Earth System & Life Sciences in the Anthropocene
- Open Access for Science & Society: Practical Examples & Overarching Goals

Innovation: Interactive Open Access Publishing, Open Peer Review & Epistemic Web

- Atmospheric Chemistry & Physics, European Geosciences Union
- Other Examples: PLoS, SciPost Physics, F1000/Wellcome Open Research, eLife etc.

Transformation: Bottom-Up & Top-Down

- Community-Driven Initiatives: Berlin/Bethesda/Budapest Conferences, OA2020
- Political & Funder Mandates: Plan S & cOAlition S, US WH-OSTP Policy

Conclusions & Suggestions

- Explore new ways & transform subscriptions
Max Planck Institute for Chemistry (MPIC)

1911/12 foundation & opening as first KWI/MPI in Berlin Dahlem (together with FHI)

L. Meitner first female scientific member (1913)

1944/49 relocation from Berlin via Tailfingen to Mainz

O. Hahn first president of MPG (1948); byname “Otto-Hahn-Institute” (1959)

2011/12 centennial anniversary & relocation into new building, “Hahn-Meitner-Weg 1”

Current size & budget: approx. 330 researchers & staff members, approx. 20 Million EUR/year

Organic & Inorganic Chemistry
1915 Nobel Prize R. Willstätter: Chlorophyll (first Nobel Prize for KWG/MPG)

Radiochemistry & Nuclear Physics
1944 Nobel Prize O. Hahn: Nuclear Fission

Physical Chemistry
Mass Spectrometry & Isotopes

Geo- & Cosmochemistry
Mantle, Meteorites, Moon & Mars

Atmospheric & Biogeochemistry
1995 Nobel Prize P. Crutzen: Ozone Chemistry

Earth System Chemistry
Integral scientific understanding of chemical processes in the Earth system:
- from molecular to global scales
- from climate change to public health
- from Earth history to the Anthropocene

www.mpic.de
Globally pervasive & steeply increasing anthropogenic influence on planet Earth:
scientific curiosity & discovery meet practical challenges & philosophical questions - from air quality, ozone hole & climate change to public health & human well-being (“planetary health”, earth & life sciences)

Scientific & societal message: we are shaping the planet, so let’s try to get it right
Combined Field Observations, Laboratory Experiments & Model Studies

- **Aircraft & Ship Campaigns:** HALO, CARIBIC, RVS Seibold ...
- **Ground & Satellite Observations:** ATTO, ZOTTO ...
- **Process Studies & Numerical Models:** EMAC, WRF-CHEM, KM-SUB/GAP ...
- **Earth & Solar System Research Partnership (ESRP):**
  MPI-C Mainz; MPI-M Hamburg, MPI-BGC Jena, MPI-SSR Göttingen & Partners
**Major uncertainties in climate change prediction**

- aerosol effects on cloud formation & properties: albedo, dynamics, lifetime, precipitation ...
- pre-industrial baseline & pristine conditions ?

**Amazon as cloud laboratory & “time machine”**

- wet vs. dry season, clean vs. polluted conditions
- approximate pristine pre-industrial baseline
- contrast by biomass burning pollution

Pathways for climate parameters & air pollutants to influence release, potency, and effects of allergens & adjuvants:

How may air pollutants trigger an allergy, i.e., a false alarm of the immune system?

Chemical modification of proteins by atmospheric & physiological reactive species ($O_3$, $NO_2$, $ONO_2^-$ ...):

$\rightarrow$ nitrated proteins & oligomers can act as trigger or enhance immune responses (inflammation & allergies)
Assessment & Synergy of Protective Measures Against COVID-19

- **Cloth masks & window ventil.:** ~8% infection risk (aerosol)
- **No masks, no ventilation:** ~61% infection risk

---

### Probability of Becoming Infected

- **61%** probability of becoming infected in this room through aerosols
- **8%** probability of becoming infected in this room through aerosols

---

### Assess & Explain Individual Infection Risks & Protective Measures

- **Lelieveld et al.** *IJE RPH* 2020, Pöhlker et al. *arXiv* 2021
- **MPIC & ZEIT ONLINE** 2020/2021

---

### Quantify Population Average Efficacy of Protective Measures

- **Cheng et al.**, *Science* 2021
- **Su et al.** *medRxiv* 2021

---

### Assess Efficiency of Classroom Ventilation Methods: CO2, Aerosol, Energy, Costs etc.

- **Helleis et al.** *Zenodo* 2021/2022
- **McLeod et al.** *Indoor Air* 2022
Motivation & Goals of Open Access

Educational:
➢ equal opportunities, information & stimulation (global/social, teachers/students ...)
➢ re-integrate scholarly & common knowledge (Wikipedia, real vs. alternative facts, climate, pandemic ...)

Economic:
➢ facilitate innovation (text mining by SME ...)
➢ liberate distorted market of scientific information (copyright ...)

Scholarly:
➢ enhance interdisciplinary exchange, discussion collaboration
➢ advance scholarly evaluation & quality assurance: open review & discussion, transparency & new metrics beyond citation counting oligopoly ...

Open Access Variants:
➢ OA archiving (“green”): good but not enough (delays & limits in usability & sustainability)
➢ OA publishing (“gold”): immediate & full benefits and sustainability

Pöschl Learned Publishing 2004; Frontiers Comp. Neuroscience 2012; Preusker Medal Laudation 2018; FWF Scilog 2020
Motivation & Goals of Open Peer Review

Traditional peer review is insufficient for efficient quality assurance in today’s highly diverse & rapidly evolving world of science.

Editors & Reviewers: limited capacities
- work overload, conflicts of interest, little reward & incentive for constructive reviews

Traditional Pre-Publication Peer Review: retardation & loss of information
- delay of publication, dilution of messages, hidden obstruction/plagiarism
- critical & supportive comments unpublished/lost (often as interesting as paper)
  ⇒ waste of reviewer capacities as most limited resource in scientific evaluation

Traditional Discussion: sparse & late commentaries
- laborious, delayed & diluted by review (comment/article 1978 ⇒ 1998: 1/20 ⇒ 1/100)

Replacement of traditional pre-publication review by post-publication commenting not really successful (comments/article < 5/100)

Evolution into Multi-Stage Open Peer Review: combine & integrate strengths of traditional peer review with virtues of transparency, discussion & self regulation

Pöschl Learned Publishing 2004; Frontiers Comp. Neuroscience 2012; Copernicus Medal Lecture 2015
Introduction & Motivation

➢ Max Planck Institute for Chemistry: Earth System & Life Sciences in the Anthropocene
➢ Open Access for Science & Society: Practical Examples & Overarching Goals

Innovation: Interactive Open Access Publishing, Open Peer Review & Epistemic Web

➢ Atmospheric Chemistry & Physics, European Geosciences Union
➢ Other Examples: PLoS, SciPost Physics, F1000/Wellcome Open Research, eLife etc.

Transformation: Bottom-Up & Top-Down

➢ Community-Driven Initiatives: Berlin/Bethesda/Budapest Conferences, OA2020
➢ Political & Funder Mandates: Plan S & cOAlition S, US WH-OSTP Policy

Conclusions & Suggestions

➢ Explore new ways & transform subscriptions
Flexible & transparent advancement of traditional journal review:

OA Discussion Forum (ACPĐ)  OA Journal (ACP)

1. Pre-publication review & selection short term
2. Public peer review & interactive discussion mid-term, integrative!
3. Peer review completion mid term
4. Post-publication review & evaluation long-term, ALM …
Advantages of Multistage Open Peer Review

All-win situation: authors, referees, editors, readers, community

Discussion Paper

➢ free speech, rapid publication, citable record (authors, readers)

Public Peer Review & Interactive Discussion

➢ direct feedback & public recognition for high quality papers (authors)
➢ prevent hidden obstruction & plagiarism (authors, editors)
➢ foster & document scientific discourse: critical comments, constructive suggestions, complementary information (authors, referees, readers, editors)
➢ document controversial arguments & innovations or flaws & misconduct (referees, editors, readers)
➢ deter submission of weak & false papers ⇒ save reviewer capacities (referees, editors)

Final Paper

➢ maximize quality assurance & information density through integration of peer review, public discussion & final revision (readers)

Pöschl, Learned Publishing 2004; Frontiers Neuroscience 2012
Hansen et al. 2016: climate change, 110 comments, 290 000 views
acp.copernicus.org/articles/16/3761/2016/acp-16-3761-2016-discussion.html

Makarieva et al. 2008 & 2013: meteorology, 33 & 20 comments
acp.copernicus.org/preprints/acpd-2008-0250/
acp.copernicus.org/articles/13/1039/2013/acp-13-1039-2013-discussion.html
Achievements ACP & EGU

Atmospheric Chemistry & Physics (ACP)
launched 2001 with Nobel laureate Paul Crutzen &
European Geosciences Union (EGU)
19 EGU sister journals since then:
Biogeosciences, Climate, Hydrology, Solid Earth ...
Large-scale move to interactive OA
publishing in geosciences: 40,000 peer-reviewed papers;
48,000 discussion papers; 180,000 public comments
Spread of concept to other communities/platforms:
Economics e-journal, SciPost Physics/arXiv.org,
F1000 Research, Wellcome Open Research ...

Unique combination:
➢ top speed: 1+x weeks from submission to citable publication (discussion paper)
➢ top impact & visibility (across atmos., environ. & geosciences)
➢ low rejection rate (~15% vs. ~50+%) 
➢ large volume (~10% of geoscience journal market)
➢ low cost (~1 kEUR/paper vs. ~2-4 kEUR/paper)
➢ fully self-financed & sustainable (incl. review, production, archiving & 10-20% surplus
for publisher & society), 2019: ~ 5000 papers, ~ 5 MEUR turnover, > 500 kEUR surplus

B. Ervens, 2022
Interactive OA Publishing 1.1: since 2020, EGUsphere

Highlight Selection (chief/exec. editors)

- EGU Letters
- Research Article, Review Article, etc.
- Comprehensive Review Article
- EGU Journal Highlights (Selection)
- EGU Encyclopedia (Compilation)
- EGU Highlight Article
- EGU Compilation/Selection/Magazine

EGU Journal Article

EGU Journal Preprint / D-Paper

EGUsphere / D-Forum

Pre-Screening (Copernicus/EGU Office, ECS …)

Author Manuscript

QA Intensity / Level

Effort / Time

www.egu.eu/news/926/egu-expands-open-access-to-scientific-knowledge-and-discussion

EGUsphere (Coordinator & Moderators)
conference abstracts & presentations; journal preprints & discussion papers …
-> new pathways of publication & review
Interactive OA Publishing 2.0/2.1: work in progress, EGUsphere

**Public Review & Discussion**, iteration/completion of review & revision, topical editors & reviewers with opt. anonymity

Pre-Screening/Access Review, topical editors
manuscript, v0

Preprint v1, prescreening by EGUsphere moderators

**EGUsphere**: advanced modular multi-stage open peer review system

(input from arXiv etc. ↔ „overlay journal“; see SciPost Physics …)

**Arrows/Processes:**
- blue = editor control
- green = author control
- solid = current practice
- dotted = potential option

**Topical Journals**, journal article

Highlight Selection, EL/EEC editors

„EGU Letters/EGU Editors’ Choice“ (working title)
virtual magazine with papers from ESS & topical journals;
EL/EEC editors = some/all EGU executive editors

Highlight Selection, EL/EEC editors

„EGU Letters/Earth & Space Science“ (working title)
journal article; ESS editors = some/all EGU topical editors

**Public Review & Discussion 2.0** (F1000 Research …),
author & reviewers from database, no anonymity:
- foster free speech & discussion; attract interdisciplinary studies;
- offer alternative to authors/manuscripts outside the scope of topical journals;
- reduce acceptance pressure in topical journals

**Peer Review Completion**, EL editors & reviewers with optional anonymity

**Article v4+x**

**Article v3+x**

**Article v2+x.**

**Topical Forum**, discussion paper

**Topical Journals**, journal article

**Highlight Selection**, EL/EEC editors

**Public Review & Discussion**, journal article

**Iteration/Completion of Review & Revision**, topical editors & reviewers with opt. anonymity

**Pre-Screening/Access Review**, topical editors
manuscript, v0

**Article v4+x**

**Article v3+x**

**Article v2+x.**

**input from arXiv etc. ↔ „overlay journal“; see SciPost Physics …**
Multi-Stage Open Peer Review & Epistemic Web

Modular, flexible & transparent ranks & standards of evaluation.

- Pre-Screening Access Review
  - Manuscript (author)
  - Discussion Paper
    - ACPD, Economics
  - Preprint/Article v1
    - arXiv, F1000 Res.
  - Preprint/e-print
    - Zenodo

- Public Review & Discussion

- Preprint/e-print
  - Manuscript (author)

- Discussion Paper
  - ACPD, Economics

- Preprint/Article v1
  - F1000 Res.

- Journal Article
  - ACP, SciPost, Economics

- Editor/Reviewer
  - Highlight Selection

- Highlight Magazine
  - SciPost Select, Science/Nature?

- Highlight Section
  - ACP, Economics

Highly Cited / Ranked
ISI-WoS, Scopus, GS
OA-ALM ...

Statistical Ratings:
downloads, citations, likes ...
context-weighted ...

⇒ Epistemic Web:
show what we know &
how we know it (traceable
web of scientific knowledge)

Development & Variants of Multi-Stage Open Peer Review

**Electronic Journals (since 1996)**
- **JIME**: J. Interactive Media in Education, since 1996, returned to traditional review
- **ETAI**: Electr. Transact. Artificial Intelligence, 1997-2002

… too complex/immature, too early?

**Forums/Repositories + Journals (since 2001)**
- **ACP & EGU**: Atmos. Chem. Phys. & European Geosciences Union, 15 journals, since 2001
- **Economics E-Journal**: since 2007
- **SciPost Physics/arXiv.org**: since 2016

… well-defined, mature & successfully competing with traditional top journals

**Platforms w/o Journals (since 2012)**
- **F1000 Research**: since 2012
- **Wellcome Open Research**: since 2016

… technical advances vs. conceptual truncation? how to attract & maintain high quality?
Outline

Introduction & Motivation
- Max Planck Institute for Chemistry: Earth System & Life Sciences in the Anthropocene
- Open Access for Science & Society: Practical Examples & Overarching Goals

Innovation: Interactive Open Access Publishing, Open Peer Review & Epistemic Web
- Atmospheric Chemistry & Physics, European Geosciences Union
- Other Examples: PLoS, SciPost Physics, F1000/Wellcome Open Research, eLife etc.

Transformation: Bottom-Up & Top-Down
- Community-Driven Initiatives: Berlin/Bethesda/Budapest Conferences, OA2020
- Political & Funder Mandates: Plan S & cOAlition S, US WH-OSTP Policy

Conclusions & Suggestions
- Explore new ways & transform subscriptions
Let's act now because … (B12 OA Conference 2015)

- OA publishing well established (~20 years); substantial volume achieved (~13% OA journal articles in WoS); tipping point in reach ...
- Politics pay attention and support, traditional publishers start to move
- Junior scientists & public demand free information on the Internet
- OA publishing & increase limited by availability of high quality OA journals: percentage OA publishing ≈ percentage OA journals (WoS: ~1500 of ~12000)
- Delayed transition may harm integrity & quality of scientific literature: predatory publishers & self-archiving may erode trad. system before adequate replacement
- Concerted action enables continuity, stability, and full benefit
- Pilots & role models available (SCOAP3, AT-IOP, DE-RSC, AT/NL/UK/MPG-Springer ...)
- Publishing Costs ≈ 1-2% of Science Budgets: Let’s stop the tail wagging the dog

OA share in peer-reviewed scientific journal publishing (WoS)

Concerted action is required to reach high OA share swiftly & efficiently (long-term contracts ...)

Inactivity leads to slow increase of high quality OA & promotes low quality OA (predatory publishers ...)

Inactivity leads to slow increase of high quality OA & promotes low quality OA (predatory publishers ...)

OA Share

Year

2003 2015
Transition from Subscription to Open Access

Publications carry much of the value but only ~1% of the costs of scientific research: stop the tail wagging the dog, and do not allow ~1% to lock up ~99%!

OA will liberate distorted market (oligopoly) and lead to higher value @ lower cost

**Trust & apply the principles of mass/energy conservation & reaction kinetics:**

*Necessary funds are already in the system:* ~50% buffer (~8 bn EUR/yr vs. ~4 bn EUR/yr)

**Change requires activation:** OA2020 & Plan S serving as energizers & catalysts

**Multiple pathways & tools:** transformative agreements with traditional publishers; continued & extended support for alternative & improved OA publishing platforms

MPDL White Paper 2015; Pöschl, A Scientist’s Perspective, B12 Conf 2015; MacKieMason, B14 Conf 2018
Financial Conditions in a Nutshell

Today’s subscription & hybrid journal market
total volume of ~8 billion EUR/yr divided by ~2 million articles/yr
⇒ effective average article processing charge (APC) of ~4000 EUR/article
   including expensive magazines, large inefficiencies (access & usage barrier costs,
   long-term oligopoly effects, „divide et impera“), high profits (up to ~40%)

Today’s proper OA journal market
conservative average APC of ~2000 EUR/article for high quality OA journals
   ~1500 EUR/yr in top quality OA journals from efficient OA publishers,
   established since ~20 yrs with substantial surpluses for publishers & learned societies

Future OA journal market
conservative average APC of ~2000 EUR/article for ~2 Mio articles/yr
⇒ base volume of ~4 bn EUR/yr for ~2 Mio articles/yr
⇒ buffer of ~50% (~4 bn EUR/yr) for APC waivers against undue publication barriers,
   new & improved services, remaining subscription journals/magazines, etc.
   ⇒ budget-neutral OA transformation is possible at short notice
   ⇒ we have plenty of buffering capacities for valid concerns
   ⇒ we can expect substantial savings and/or service improvements
How to Achieve an OA Transformation?

**First-Order Approximation**

1. **maintain** payments & drop paywalls; **(2) adjust** budgets & cash flows

**Second-Order Approximation**

1. **Every organization continues to pay** for some time the same amount as for past journal subscriptions while requesting OA for their corresponding author articles
2. **Check “effective APC” or “publish & read (PAR) fees”** = subscription fees divided by number of articles for every publisher/journal & every organization/country (corr. author)
3. **Adjust balances** between past & future “effective APCs” or “PAR fees” at institutional, regional & global levels (those who publish a lot usually also subscribe to a lot, v.v.), include mechanisms against undue publication barriers (waivers ...)
4. **Move to free/social OA market** (moderated/regulated by competition/cooperation)

**Practical Implementation**

(a) **Bottom-up by researchers** (OA2020 et al.): develop & promote suitable tools and global collaboration: transformative agreements, new & improved publication platforms ...

(b) **Top-down by funders** (Plan S et al.): ensure proper use of public funds & resources; enforce co-operation of publishers & end their denial of service ...

⇒ both approaches are complementary, needed & successful
Goal: **enable open access** for all papers from our authors & maintain access to others (PAR)

Status: ~80% open access to publications from MPG, similar developments at DEAL partners

---

**Transformative Agreements (PAR):**

- ~20 publishers provide open access for ~80% of MPG output;
  - similar developments for other DEAL partners & publishers (*Springer-Nature, Wiley …*)
  - Elsevier: MPG & DEAL partner contracts expired since 2017/2018, few complaints
Wiley and Springer Nature agreements will enable around 23,000 new articles a year to be published CC-BY and massively expand access for readers from ~700 institutions. All costs collapsed into a PAR fee of €2750 per research article.

- Lump-sums of subscriptions are disaggregated and costs attributed solely based on article output
- Funds follow authors, even those lacking grant funds (SSH)
- Payments are centralized, alleviating authors of administrative burden and enabling innovative cost allocation models

Lacking an offer that responds to DEAL’s objectives for transformation, negotiations remain stalled with Elsevier, and the 200+ institutions that cancelled their contracts end 2017 and 2018 remain firm in their stance of non-renewal.

*Hippler, H.: Advances realized through Projekt DEAL’s first Transformative Agreement, 2020.*
Global Perspectives

Status 2018:
~8 billion EUR turnover; ~70% by 10 publishers; ~80% behind paywalls

Perspectives 2020:
• many countries & organizations engaged in successful transformative activities (*see OA2020.org*)
• most publishers ready to offer transformative agreements (*“Publish & Read”*)
• Elsevier continues its “denial of service” in largest markets but starts to move in smaller markets
Global Spread of Transformative Agreements

Pale orange: existing transformative agreements not yet in registry.

esac-initiative.org/about/transformative-agreements/agreement-registry/

ESAC Registry of Transformative Agreements:
~140 contracts in 20 countries with 33 publishers
⇒ OA to 90,000 journal articles published in 2020
⇒ major advances, but transition remains to be completed

Austria & FWF continue to be among successful pace makers for open access

Campbell 2020
Plan S: Accelerate & Complete the OA Transformation

Plan S Principles
“With effect from 2021*, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo.”

*For funders agreeing after January 2020 to implement Plan S in their policies, the start date will be one year from that agreement. In addition:

01: Authors or their institutions retain copyright to their publications. ... (copyright = essential cornerstone)

Timely & long-sought support from research funding organizations (top-down) to accelerate & complete the open access transformation initiated & pursued by research performing organizations (bottom-up).

Well-suited & welcome complement & follow-up on OA2020 & related initiatives.

Sufficiently stringent to accelerate & advance the ongoing OA transformation, & sufficiently flexible to enable an efficient & smooth transition as advocated and prepared in OA2020 & related initiatives.

Logical & overdue consequence of the Berlin Declaration on Open Access (2003), signed by more than 650 leading scholarly institutions worldwide, and related Open Access Statements (Bethesda 2003, Budapest 2002).
Introduction & Motivation

- Max Planck Institute for Chemistry: Earth System & Life Sciences in the Anthropocene
- Open Access for Science & Society: Practical Examples & Overarching Goals

Innovation: Interactive Open Access Publishing, Open Peer Review & Epistemic Web

- Atmospheric Chemistry & Physics, European Geosciences Union
- Other Examples: PLoS, SciPost Physics, F1000/Wellcome Open Research, eLife etc.

Transformation: Bottom-Up & Top-Down

- Community-Driven Initiatives: Berlin/Bethesda/Budapest Conferences, OA2020
- Political & Funder Mandates: Plan S & cOAlition S, US WH-OSTP Policy

Conclusions & Suggestions

- Explore new ways & transform subscriptions
Vision for Open Access & Open Peer Review

Promote societal progress through a global commons of scholarly information (epistemic web)

Provide access to high quality scientific publications
- review & revision involving the community
  - more & better information for scientists & society

Document the scientific discourse
- public record of scientific evidence, arguments & progress
  - universal & traceable web of knowledge (epistemic web)

Demonstrate transparency & critical rationalism/realism
- transparent & rational approach to complex questions & problems
  - role model for societal decision processes

Suggestions

1) Continue & promote experiments with improved forms of OA & OPR
   ➢ build on existing models & experience rather than re-inventing the wheel
   ➢ foster transparency & self-regulation *multi-stage open peer review*

2) Introduce & demand access to article reviews & pre-publication history
   ➢ establish new standards & proofs of quality assurance to cope with increase of scholarly articles & journals *predatory OA publishers*

3) Advance & apply new metrics of publication impact & quality
   ➢ use article level metrics instead of journal impact factors
   ➢ use OA to terminate intransparent & unscholarly reliance on citation counting oligopoly *WoS, Scopus, Google Scholar*

4) Return control of scholarly publishing to scholarly community
   ➢ continue to support new & improved forms of OA publishing
   ➢ trust principles of mass & energy conservation: OA publishing costs can be covered by conversion of subscription budgets *offsetting/transformation, cancelation …*
   ➢ proceed to large-scale implementation of OA & enhance diversity of publishing venues
   ➢ *stand united & discontinue inappropriate subscription contracts* *(Elsevier)*
   ➢ endorse OA2020 Initiative for efficient & swift transition to OA *(oa2020.org)*