

**What senior academics can do to support reproducible and open research:
a short, three-step guide**

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ABSTRACT

Increasingly, policies are being introduced to reward and recognise open research practices, while the adoption of such practices into research routines is being facilitated by many grassroots initiatives. However, despite this widespread endorsement and support, open research is yet to be widely adopted, with early career researchers being the notable exception. For open research to become the norm, initiatives should engage academics from all career stages, particularly senior academics (namely senior lecturers, readers, professors) given their routine involvement in determining the quality of research. Senior academics, however, face unique challenges in implementing policy change and supporting grassroots initiatives. Given that - like all researchers - senior academics are motivated by self-interest, this paper lays out three feasible steps that senior academics can take to improve the quality and productivity of their research, that also serve to engender open research. These steps include a) change hiring criteria, b) change how scholarly outputs are credited, and c) change to funding and publishing with open research. The guidance we provide is accompanied by live, crowd-sourced material for further reading.

INTRODUCTION

Increasing evidence shows that the present research culture motivates behaviours that can undermine research integrity ([Nosek et al., 2012](#); [Smaldino & McElreath, 2016](#); [Wellcome, 2019](#)). Publishers and funders disproportionately reward novelty or statistically significant results, devaluing confirmation and verification of published research ([Fanelli, 2012](#); [Smaldino & McElreath, 2016](#)). Evaluation criteria unduly rely on publication track records, incentivising publication quantity over quality ([John et al., 2012](#); [Moher et al., 2018, 2020](#); [Rice et al., 2020](#)). Finally, individual rather than collective achievements are routinely praised, hampering data sharing, collaboration, and collegiality ([Munafò et al., 2020](#); [Rice et al., 2020](#); [Sarabipour et al., 2019](#); [Wellcome, 2019](#)). This misalignment between incentives and best practices is thought to be the root cause of why findings in the medical, behavioural, and life sciences can be difficult to replicate or reproduce ([Baker & Dolgin, 2017](#); [Borregaard & Hart, 2016](#); [Open Science Collaboration, 2015](#); [Poldrack et al., 2017](#)). It is also associated with recent evidence of unhealthy competition, mental health issues, as well as instances of bullying and harassment, and pursuing of alternative careers ([Guthrie et al., 2018](#); [Metcalf et al., 2020](#); [Wellcome, 2019](#)).

The response has been to reward and therefore incentivise transparency, accessibility, and reproducibility with open research practices. This notably includes the Transparency and Openness Promotion (TOP) Guidelines ([Nosek et al., 2015](#)); Plan S and cOAlition S ([Plan S, 2020](#)); and the San Francisco Declaration of Researchers Assessment ([DORA, 2020](#)). Self-organising initiatives have also produced practical

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guides to further facilitate the adoption of open research into existing workflows ([Aczel et al., 2020](#); [C. Allen & Mehler, 2019](#); [Button et al., 2020](#); [Crüwell et al., 2019](#); [DeBruine & Barr, 2019](#); [Etz et al., 2018](#); [Kathawalla et al., 2020](#); [Klein et al., 2018](#); [McKiernan et al., 2016](#); [Munafò et al., 2017](#); [Sarabipour et al., 2019](#)). However, despite widespread support, wholesale adoption of open research remains elusive, with early career researchers in the psychological sciences being the notable exception ([Abele-Brehm et al., 2019](#); [Ali-Khan et al., 2017](#); [Houtkoop et al., 2018](#)). For open research to become the norm, further engagement and support must come from senior academics given their routine involvement in supervision, peer review, journal editing, hiring, and instructing institutional policies.

Senior academics are, however, presented with unique social and practical barriers. Setting higher quality standards for researchers more junior to them can be perceived as ‘ladder pulling’ ([Poldrack, 2019](#)), thus risking retaliation and thwarting collective efforts to exert positive change. Open research is widely perceived by senior academics as potentially stifling innovation and novelty or impinging on long-held academic freedoms ([Abele-Brehm et al., 2019](#); [Ali-Khan et al., 2017](#); [Houtkoop et al., 2018](#)), such as the right to publish at particular outlets, patent findings, or having control over data access ([Fecher et al., 2015](#); [Houtkoop et al., 2018](#); [Levin et al., 2016](#); [Murray, 2010](#)), all of which can hamper collaboration and the implementation of new policies. Training and guidance in leadership to promote culture change is limited and when training is available it is often not expected for senior academics to attend ([Henriques, 2020](#); [Leiserson & McVinney, 2015](#); [Noorden, 2018](#)). Further, given that

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applying for grants ([Gross & Bergstrom, 2019](#); [Herbert et al., 2013](#); [von Hippel & von Hippel, 2015](#)) and teaching ([Mayo, 2019](#)) occupy an increasing amount of research time, attending training, developing open research practices, or changing long-standing research routines can be costly and therefore deprioritized.

The body of literature on adopting open research risks being overwhelming and mainly focused on early career researchers ([Abele-Brehm et al., 2019](#); [Ali-Khan et al., 2017](#); [C. Allen & Mehler, 2019](#); [Crüwell et al., 2019](#); [McKiernan et al., 2016](#)). Therefore, we present a short guide highlighting three easy steps to introduce open research ideas and practices into existing research routines while avoiding the barriers mentioned above. These steps include 1) modifying hiring criteria, 2) crediting scholarly outputs with the contributorship model, and 3) securing grant funding and publishing in line with open research. Following the lead of similar initiatives, these steps are designed to appeal to the self-interests of researchers and motivate their engagement with open research practices ([Markowitz, 2015](#); [McKiernan et al., 2016](#); [Wagenmakers & Dutilh, 2016](#)), with a unique focus on the viewpoint of senior academics. This is supplemented by crowd-sourced materials for further reading.

Step 1: Change how you hire

Open research practices increasingly confer competitive advantages for career progression (see Table 1). However, costs to time and money may discourage investment in open research training. Hiring and promoting academics and research staff with open research skills can obviate this problem, with the additional benefit that

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skilled individuals can support and guide existing members of the team or department. Individuals skilled in open research, however, are likely to be missed if using conventional hiring criteria, which place undue weight on metrics such as the h-index and journal impact factors (Hammarfelt, 2017; Moher et al., 2018). Further, in current job descriptions and advertisements, sought after candidates cannot easily identify if a given department or supervisor welcomes open research, potentially making this candidate less likely to apply for a position.

Senior academics can, however, easily modify hiring criteria to incorporate open research practices that support research quality and productivity. Modelled on a crowd-sourced initiative (<https://osf.io/qb7zm/?revision=5012>), one obvious and feasible approach is to modify desirable or essential person specification criteria to include a track record of either open data, open materials/code, pre-registration, open access publication, publishing preprints, and/or open peer review (see Table 1 for definitions). Criteria should be stated clearly and publicly in advertised job descriptions and/or hiring policies, while decisions about which open research practices to include should be made in consultation with faculties/departments to avoid unnecessarily disadvantaging staff/students. For example, where a track record of open access publications is not expected (e.g., when hiring a PhD student or postdoctoral research staff), one might view evidence of preprints, open materials, or open peer review as desirable person specifications given that they are proxies for productivity or keen engagement in open research.

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To provide instructive examples of how this can be achieved, the authors of this paper have joined an existing project led by Felix Schönbrodt and colleagues to curate an ongoing database of academic job offers that mention open science (<https://osf.io/7jbnt/>), which is now composed of material from institutions from several European and American countries (for examples of how institutions have changed hiring policies, see the [Supplement](#)). We are also collating a record of criteria that include at least one open research practice, stated clearly and publicly, either in advertised job descriptions, hiring policy, and/or in essential/desirable characteristics (to contribute, please complete this survey: <https://forms.gle/1LsgRD3DnWAIQfy58>).

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Table 1. Open research practices and the career benefits that confer. Definitions are lifted from the [Open Science Framework](#)

| Open Research Practice | Definition | Competitive advantage |
|------------------------|--|---|
| Open Access Publishing | A scholarly output accessible to the public free of charge. This can include green, gold or platinum/diamond forms of open access. Open access can be applied to the following scholarly outputs: peer-reviewed journal articles, conference papers, theses, book chapters, monographs, and images. | Publishing via open access is associated with higher citation rates and improves the speed and breadth of dissemination of scholarly outputs (Colavizza et al., 2020 ; Tennant et al., 2016). |
| Open Data | Publicly accessible, digitally-shareable data that are necessary to reproduce the reported results. | Facilitates collaboration (Boland et al., 2017); increases efficiency and sustainability (Lowndes et al., 2017); published papers linked with open data and/or materials are associated with a higher citation rate on average (McKiernan et al., 2016 ; Piwowar et al., 2018 ; Tennant et al., 2016); when published with a digital object identifier (DOI), open data and/or materials can be a citable publication (Cousijn et al., 2018); synthetic datasets can help cross-validate analysis and improve reproducibility of analysis workflows (Quintana, 2020). |
| Open Materials | Publicly available components of the research methodology needed to reproduce the reported procedure and analysis (e.g., code, software, workflows, etc). | |
| Open Peer Review | A findable, freely and publicly accessible, and signed peer review either pre- or post-publication. | Academics who act as reviewers can get credit for their work (Schmidt et al., 2018). |
| Preprints | Complete, non-peer-reviewed manuscript entered in a time-stamped and publicly accessible location, usually an institutional or disciplinary repository (e.g., PsyArXiv, LawArXiv, UCL Press, MedrXiv). Preprints are also submitted for peer review and publication in a traditional scholarly journal, but this is not mandatory. | Wider, faster, and cheaper dissemination of research (Johansson et al., 2018); greater opportunity for feedback outside of formal peer-review (Sarabipour et al., 2019); posting a manuscript as a preprint before formal publication can increase citations and impact (Fraser et al., 2019 ; Fu & Hughey, 2019); improves chances of publication in journals with high impact factors (Learn, 2019). |
| Preregistration | A publicly available time-stamped study design and/or analysis plan that is registered in an institutional registration system (e.g., ClinicalTrials.gov, Open | Boost a research's reputation (Stewart et al., 2019); preventative measure against post-hoc critique (i.e. CARKing - critiquing after the |

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| | Science Framework, AEA Registry, EGAP). | results are known) during peer-review (Hobson, 2019 ; Nosek & Lakens, 2014 ; Wagenmakers & Dutilh, 2016); prospective registration of a study design can be a citable publication; comply with submissions guidelines set by International Committee of Medical Journal Editors (ICMJE) |
| Registered Reports | A peer-reviewed journal article where the decision to publish is based on a two-stage peer-review process. First, following successful peer-review, a pre-specified study and/or analysis protocol is accepted in principle by a participating journal before data has been collected or accessed. Second, providing the authors closely followed the protocol and successful peer-review, the final manuscript is published regardless of the results. | Guaranteed publication regardless of study results, providing the registered protocol and/or analysis is followed (Chambers, 2019); reduces CARKing (Hobson, 2019 ; Nosek & Lakens, 2014 ; Wagenmakers & Dutilh, 2016); cited at comparable or slightly higher levels than conventional peer-reviewed articles (Hummer et al., 2017); stage one peer-review provides additional peer-review feedback. |

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Step 2. Change authorship to contributorship

Given that the number of publications/citations or journal impact factors are routinely used as evaluation criteria ([Dijk et al., 2014](#); [Rice et al., 2020](#); [Walker et al., 2010](#)), publications are an important currency for career advancement. It is therefore unsurprising that authorship disputes delay submissions; create conflict among collaborators and journal editors ([Faulkes, 2018](#); [Grove, 2020](#); [Wager et al., 2009](#)); account for 6 to 8% of retractions (Henriques, 2020; Leiserson & McVinney, 2015; Noorden, 2018) and are a source of poor mental wellbeing and low staff retention in academia ([Eleftheriades et al., 2020](#)). Further, roughly 40% of early-career researchers report that credit for their work was given to other academics or research staff ([Wellcome, 2019](#)), with black and minority ethnic groups, individuals on fixed-term contracts, and women being particularly affected ([Marschke et al., 2018](#); [Street et al., 2010](#)). As we move toward more collaborative projects where contributions are more difficult to dissect, authorship-related issues are likely to further increase ([L. Allen et al., 2019](#); [Borenstein & Shamoo, 2015](#); [Brand et al., 2015](#); [Gaeta, 1999](#)).

Issues with assigning credit for scholarly outputs are in part due to the lack of consensus-based and comprehensive standards. The closest we have to a standard, the International Committee of Medical Journal Editors (ICMJE; or the Vancouver guidelines), stipulates that authorship is contingent on substantive contributions (e.g., to conceptual design, data collection, analysis, or interpretation, drafting and/or revising a manuscript; [International Committee of Medical Journal Editors, 2020](#)). Still, ICMJE offers no adequate guidance on contentious issues, such as designating first,

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last, or corresponding authorship; assigning responsibility for the research; dealing with large collaborations; and it ignores contributions outside of writing (e.g., such as input from librarians, statisticians, methodologists, software developers; [Holcombe, 2019a, 2019b](#)). To avoid the above issues, traditional models of authorship are being substituted for contributorship models. One formulation is the Contributor Roles Taxonomy (CRediT), a consensus-based classification system that distinguishes 14 contributor roles (see Table 2), which is now adopted by leading publishers (e.g., Elsevier, PloS, Wiley, AGU, and Oxford University Press) and is part of the submission process in hundreds of journals (<http://credit.niso.org/>).

CRediT works by documenting individual contributions to a scholarly output in a standardised, accessible, and discoverable manner. This can be done at any stage in a research project, although the earlier the better to manage expectations of team members and to minimise authorship issues in the future. The recently developed web-based app and R package, *Tenzing*, automates this process and produces a CRediT-compatible manuscript for publication ([Holcombe et al., 2020](#)). Although the contributor roles are fixed, their definitions can be customised to a particular research discipline for further clarity. Further, CRediT is flexible enough to be incorporated in current authorship practices, providing a useful framework to help decision making. For instance, the degree of contribution for each role can be specified as 'lead', 'equal', or 'supporting', which can inform the order in which authors are listed ([L. Allen et al., 2019](#); [Brand et al., 2015](#)). Further, tallying up contributions to 'data curation', 'project administration', and 'validation' can instruct who should be the corresponding

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author - i.e., the person responsible for communicating with the journal and related administrative duties.

Though our focus thus far has been on the utility of CRediT to mitigate author-related problems, it also offers unique opportunities to improve productivity (see Table 3). CRediT opens up new opportunities for future collaborations given that it can signal the specialist expertise of a given research group or researcher. The routine use of CRediT will motivate outside individuals to join large teams who would otherwise be reluctant to do so out of concern that their contribution will be lost or missed. Fairly and transparently rewarding and recognising contributions will inevitably boost and bolster engagement from existing collaborations, but also foster new collaborations with individuals that traditionally miss out on authorship yet provide valuable insights (e.g., statisticians, methodologists, librarians, software developers). Finally, with ‘funding acquisition’, ‘project administration’, ‘supervision’, and ‘resources’ as distinct contributor roles, CRediT allows senior academics to record previously unacknowledged roles that were time-consuming and effortful.

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Table 2. The CRediT Taxonomy of Roles (Brand et al., 2015)

| # | Role | Definition | Authors (initials) |
|----|------------------------|---|--------------------|
| 1 | Conceptualization | Ideas; formulation or evolution of overarching research goals and aims. | |
| 2 | Data curation | Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use. | |
| 3 | Formal analysis | Application of statistical, mathematical, computational, or other formal techniques to analyse or synthesize study data. | |
| 4 | Funding acquisition | Acquisition of the financial support for the project leading to this publication. | |
| 5 | Investigation | Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection. | |
| 6 | Methodology | Development or design of methodology; creation of models. | |
| 7 | Project administration | Management and coordination responsibility for the research activity planning and execution. | |
| 8 | Resources | Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools. | |
| 9 | Software | Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components. | |
| 10 | Supervision | Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team. | |
| 11 | Validation | Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs. | |
| 12 | Visualization | Preparation, creation and/or presentation of the published work, specifically visualization/data presentation. | |

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| 13 | Writing – original draft | Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation). |
| 14 | Writing – review & editing | Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages. |

Table 3. Prospective benefits of CRediT (from [L. Allen et al., 2019](#))

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- Providing visibility and recognition for researchers working in large teams whose individual contributions are lost in an expansive author list.
 - Providing visibility for a diverse range of research contributions that are key to research output being published beyond a traditional focus on writing and drafting (e.g. data curation, statistical analysis, etc.).
 - Supporting research institutions and authors to resolve author disputes by providing more transparency around individual author roles and responsibility.
 - Supporting research and researcher evaluation by providing a more holistic and nuanced view of the contributions of researchers to research output.
 - Improving the ability to track the outputs and contributions of individual research specialists and grant recipients.
 - Easy identification of potential collaborators and opportunities for research networking.
 - Supporting identification of potential reviewers, experts, and specialists for a variety of roles across research.
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Step 3. Change how you fund and publish with open research

Given that income generation and publications are essential for career advancement in academia, funders and journals are seeking to advantage open research practices with initiatives and policy changes. This engagement reflects that the shift toward open research is backed by organisations that play a huge role in setting research culture norms and that - to retain a competitive edge - senior academics should engage with open research.

Funding opportunities

Funders are gradually investing in open research, which is only set to gather pace following the valuable role open research has played in the COVID-19 pandemic. For example, published in July 2020, the [UK Government's Research and Development Roadmap](#) seeks to reward data sharing and recognise digital software and datasets as research outputs ([Department for Business, Energy & Industrial Strategy, 2020](#)). To our knowledge, however, there is no comprehensive repository where one can find and keep track of funding opportunities. Therefore, we have curated a crowd-sourced list of funding opportunities (https://lorenzada.github.io/openresearch_funding/), with examples of opportunities from leading funders in Table 4.

Policy changes

It has long been the general view among funders and journals that research results should be 'as open as possible, as closed as necessary', but compliance

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among grantees and authors has been problematic, giving rise to new policies to remove practical barriers or to impose sanctions for non-compliance (Couture et al., 2018). Funders overall now require a data management plan (i.e., a detailed specification of how research data or materials will be curated, shared, and/or used) as standard ([Digital Curation Centre, 2020](#)). Data availability statements are also compulsory for submissions to a growing number of journals, including Science, Nature, and the BMJ ([Alsheikh-Ali et al., 2011](#); [Chan et al., 2014](#); [Godlee & Groves, 2012](#)), with the publication of data or materials also becoming increasingly common. Those working with sensitive data may be exempt from sharing data, but should instead state why the data cannot be made accessible. Data can also be archived and shared through data journals¹ or in third-party repositories (e.g., GitHub, Open Science Framework, and Zenodo), which assign a license and persistent DOI, meaning that authors have greater control over how their data and/or code are used with the added benefit that their work can be cited ([Cousijn et al., 2018](#); [Munafò et al., 2017](#); [Popkin, 2019](#)). For further reading, we encourage the reader to use the online resources reported in Table 5.

The majority of new policies will be known by senior academics. We therefore focus instead on recent efforts to reward and recognise preprints, which collectively aim to encourage the publication of scholarly outputs in a faster, more impactful, and more accessible manner than before.

¹Harvard Dataverse (<https://dataverse.harvard.edu/>); Nature's Scientific Data (<http://nature.com/sdata>); DataCite (<http://datacite.org>); figshare (<http://figshare.com>); Dataverse Project (<http://dataverse.org>); Dryad (<http://datadryad.org>); Neurodata without Borders (<https://www.nwb.org>).

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A preprint is a time-stamped, non-peer reviewed manuscript that is made freely and publicly accessible via an online server (e.g., PsyArXiv, LawArXiv, UCL Press, MedRxiv). The significant time lag between manuscript submission and its publication (median days, 165; [Royale, 2020](#)) and the infeasible open access fees ([Van Noorden, 2013](#)) associated with traditional publication do not apply to preprints, making them an important part of current and future policy decisions of funders and journals.

Because of faster and wider dissemination, grantees are increasingly required to deposit preprints, particularly if funded research is of significant public health benefit (Bill, Melinda Gates Foundation; The Chan Zuckerberg Initiative; Fast Grants; The Michael J. Fox Foundation for Parkinson's Research; The Wellcome Trust; see [ASAPbio, 2020](#)). Further, a majority of journals now permit preprints to be uploaded to preprint servers before or at the point a manuscript is submitted for formal publication ([Sherpa Romeo, 2020](#)), a policy presumably linked to evidence that journal articles linked to preprints have greater impact and number of citations ([Fraser et al., 2019](#); [Learn, 2019](#)).

Influential journals (e.g., BMJ, The Lancet, Nature, Science) and funders (e.g., The National Institutes of Health, Wellcome Trust, and Cancer Research UK) are now explicitly stating that preprints can be cited ([ASAPbio, 2020](#); [Transpose, 2020](#)). Beyond peer-reviewed publications and grant applications, preprints can also be referenced in researcher track records when applying for funding ([ASAPbio, 2020](#)) and included in submissions to the UK Government funding organisation, the Research Excellence Framework ([ASAPbio, 2019](#)).

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The common concern regarding preprints is *scooping* - i.e., where a competing researcher or research team sees a published preprint then conducts and/or rushes through a similar study for publication in a standard journal. In fact, preprints are a solution to scooping, since preprint servers assign each submission a time-stamp and/or a persistent digital object identifier (DOI), meaning that a preprint must be referenced in journal publications like all other scholarly records ([Bourne et al., 2017](#); [Sarabipour et al., 2019](#)). Several journals use preprints when deciding novelty to competing submissions with similar findings, with preference given to submissions linked to a preprint that pre-dates other submissions. Further, preprints afford greater control when work is shared, avoiding questionable practices during peer-review from competitors, such as delaying the review by imposing unnecessary revisions or intentionally missing the deadline for review ([Kulkarni, 2016](#)).

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Table 4. Examples of funding opportunities focusing on open research, with accompanying text lifted directly from funders' websites.

| Funder | Scope |
|--|--|
| Centre for Open Science | <p>Incubator and Integration Grants (totalling \$300,000). Provides funding for advancing openness, integrity, and reproducibility in science. Incubator grants support development of new open tools and services. Integration grants support integrating tools and services that are useful to scientists through the Open Science Framework, a free, open-source infrastructure.</p> <p>Preregistration Challenge - awarded prizes of \$1,000 for researchers who publish the results of a preregistered study.</p> |
| Finnish Open Science Award | <p>Awarded annually to researchers at the University of Helsinki, for the promotion of open science.</p> |
| Fostering Responsible Research Practices | <p>Funds “research on research”, addressing the need for greater quality, integrity and efficiency in academic research. In 2019, three projects were awarded 75000 Euro each.</p> |
| Funding for Open Access publications | <p>A list of Open Access Funds.</p> |
| Horizon Europe | <p>Several grant opportunities funded by the European Commission (EU Budget for the Future) for research performed with open science practices.</p> |
| Leamer-Rosenthal Prizes | <p>Rewards social scientists for open research practices (up to \$60,000).</p> |
| Mozilla | <p>Open Science Mini-Grants (\$3,000-\$10,000) provide funding for researchers who are making science more accessible, transparent, and reproducible.</p> |
| National Institutes of Health (NIH) | <p>A series Funding Opportunities for creating rigor and reproducibility across several disciplines.</p> |
| National Science Foundation (NSF) | <p>Grant for Ethical and Responsible Research, supporting research into 1) factors that are effective in the formation of ethical STEM researchers and 2) approaches to developing those factors in all STEM fields that NSF supports.</p> |
| QUEST | <p>Awarding investigators a 1000 Euro research bonus if they publish a null result, perform a replication study, preregister a study protocol for a preclinical study, reuse data, or include public engagement in their study.</p> |
| Shuttleworth Foundation Fellowship Programme | <p>Funding for researchers working openly on diverse problems (up to \$250,000).</p> |

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| The Dutch Research Council (NWO) | Grant offering funding for Replication Studies . More specifically, for replication of existing data (reproducibility), replication with new data, and replication of research questions. Available to researchers holding a PhD and based at a Dutch university. |
| The Open Science Prize | New initiative from the Wellcome Trust, US National Institutes of Health and Howard Hughes Medical Institute (\$230,000). The goal of this Prize is to stimulate the development of novel and ground-breaking tools and platforms to enable the reuse and repurposing of open digital research objects relevant to biomedical or health applications. |
| UK Research and Innovation (UKRI) | Provide open-access block grants to enable grant-holders to publish open access. |
| Wellcome Trust | <p>Open Research Fund (£50, 000) to support individuals and teams anywhere in the world to carry out groundbreaking experiments in open research.</p> <p>Research Enrichment Fund (£50, 000) to support grantholders to develop innovative ways to make their research open, accessible and reusable.</p> <p>Wellcome Data Re-use prizes (£5,000 - £15,000) to stimulate and celebrate the innovative re-use of research data.</p> <p>Provide funding for open-access publishing.</p> |

Table 5. List of useful online resources to track funding and journal policies regarding open access, preprints, and open data/materials. Accompanying text is lifted directly from the corresponding website.

| Resource (URL) | Description |
|--|--|
| Digital Curation Centre (https://www.dcc.ac.uk/about) | The DCC provides expert advice and practical help on how to store, manage, protect, and share digital research data. They provide a broad range of resources including online tools, guidance, and training. DCC also provides consultancy services on issues such as policy development and data management planning. |
| FAIRsharing.org (https://fairsharing.org/) | A curated, informative, and educational resource on data and metadata standards, inter-related to databases and data policies. |
| Sherpa Juliet (https://v2.sherpa.ac.uk/juliet/) | Sherpa Juliet is a searchable database and single focal point of up-to-date information concerning funders' policies and their requirements on open access, publication and data archiving. |
| Sherpa Romeo (https://v2.sherpa.ac.uk/romeo/) | Sherpa Romeo is an online resource that aggregates and analyses publisher open access policies from around the world and provides summaries of publisher copyright and open |

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| | access archiving policies on a journal-by-journal basis. |
| Transparency & Openness Promotion (TOP) Factor (https://www.topfactor.org/) | An alternative to journal impact factor (JIF) to evaluate qualities of journals, the TOP Factor assesses journal policies for the degree to which they promote core scholarly norms of transparency and reproducibility. |
| Transpose (https://transpose-publishing.github.io/#/) | A database of journal policies on peer review, co-reviewing, and preprinting. |

Concluding Remarks

'We create our culture, invisible though it may be, and we therefore have it collectively within ourselves to change our culture for the better' (Munafò et al., 2020, p. 92).

We recognise that all researchers aim to reach the highest standards of best practice, but are often prevented from doing so due to pervasive incentives and cultural norms that undermine verification and confirmation. Senior academics, however, face additional and unique challenges that bar them from supporting or practising open research practices - i.e., practices that represent the best of transparent, accessible, and reproducible research. This is a problem. The success of policies and grassroots initiatives that aim to engender open research relies on the collective action of researchers, but only when open research is practised routinely by those in positions of seniority can a positive change in research culture and quality take effect. Our short, three-step guide sought to make the path toward normalising open research more feasible. Specifically, we hope to have conveyed that adopting open research practices is a shrewd move to improving the quality and productivity of research outputs. We also hopefully succeeded in providing three practical steps to

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help senior academics reap these benefits. More remains to be done; still, this short guide can illustrate the first three steps toward more involvement in open research.

CRedit ROLES

All authors contributed equally to this paper, hence all authors share co-first authorship, with SJW as senior author since he led the project and writing. Authorship order was randomly allocated to all authors by SJW.

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FUNDING

OSK is supported by the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London. AL is supported by the UK Medical Research Council (MR/N013700) and King's College London member of the MRC Doctoral Training Partnership in Biomedical Sciences.. EB is supported by the Sophia Children's Hospital Research Foundation (SSWO) Project #S18-68 and #S20-48. LD'A is supported by the Netherlands Organization for Scientific Research (NWO-ZonMW: 016.VICI.170.200). SJW is supported by the Action Medical Research (GN2426), Garfield Weston Foundation, National Institute for Health Research (NIHR) Biomedical Research Centre at South London and the Maudsley NHS Foundation Trust, and King's College London. The funders had no role in study design, data collection and interpretation, or the decision to submit the work for publication. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

ACKNOWLEDGMENTS

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The author would like to thank those who provided helpful feedback on earlier versions of this manuscript, which include Marion Criaud and Sheut-Ling Lam.

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