ETHICS @ WORK

EXPLORING THE DAY-TO-DAY ETHICAL QUESTIONS ARISING THROUGH ROUTINE SCIENTIFIC PRACTICE

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Ethics @ Work

Ethics @ Work is a space to explore the day-to-day ethical questions arising through routine scientific practice. Within the Kavli Institute for Nanoscience Discovery, the *Ethics @ Work* monthly lunchtime conversation series takes prevalent themes related to experimentation and workplace ethos, aiming to bring together diverse scientists to discuss, share, and critically reflect on the ethical challenges encountered by discovery scientists in their daily work.

This document represents a summary of ideas, shared by Kavli scientists during discussions led by Dr Mackenzie Graham (Bioethicist), and facilitated by Dr Emma Lalande (Researcher – Science & Society) and Désirée Tennant (Organisational Development Lead).

The *Ethics @ Work* initiative is part of a broader project, '*Building Societal Considerations into the Heart of Basic Research*' – co-led by Kavli Oxford Founding Director, Professor Dame Carol Robinson, Senior Research Fellow and bioethicist, Dr Mackenzie Graham and Organisational Development Lead, Désirée Tennant. Funded by the Kavli Foundation, USA, as part of their Science and Society Programme, the project aims to identify, understand, and address potential ethical issues and implications for the public, as raised by the curiosity-driven scientific research of the institute.

Our discussions are ongoing and this document is updated as we progress.

INDEX of *Ethics @ Work* discussions to date

26th July 2025

Session 1 – Trust in Science

How do trust and trustworthiness fit into the process, culture and impact of science research?

***Background**:*

Trust is a key issue in all parts of life, including the relationship between science and society. Policymakers and members of the public must trust scientists to provide reliable information that can guide both individual-level choices and population-level policy decisions. Where academic institutions primarily rely on public/government funding, public trust in academic science institutions and scientists is also vital to continue specific research. In an increasingly collaborative and multi-disciplinary research world, scientists must also trust each other, in their own expertise and in their means of sharing their knowledge.

Of course, while trust in scientific expertise is often necessary, it is not without risks. Like trusting in general, our trust in science can sometimes be disappointed. Specific failures of trust — such as those resulting from unethical research — can lead to a more generalised distrust of science. Scientific findings are always subject to revision upon further evidence — while often a virtue of scientific inquiry, this 'uncertainty' can sometimes be mistaken for a lack of trustworthiness. Scientific findings can also be misrepresented, deliberately or not, further impacting public trust, and insufficient efforts in wider engagement can bolster misconceptions about scientists and scientific enquiry.

Recent public survey data show that the UK public are generally positive about the scientists' contributions and the value of research, showing trust for UK universities, despite often feeling that the benefits of science research and its outputs are often vague and imperceptible on an individual level [1]. Strengthening trust/trustworthiness within research science – unifying perspectives, processes and methods of working – could promote a more robust representation of the contributions of science research. In turn, strengthening trust inside academic research science and the trustworthiness of science outputs and institutions benefits both the research community and wider society. For these reasons, questions of how scientists can demonstrate their trustworthiness, and thus, maintain public trust in science, must be carefully considered.

***Key questions shaping the discussion with Kavli scientists**:*

- Why does trust matter in discovery science?
- What makes science, and scientists, trustworthy? Are there concrete indicators?
- How does the interaction between individual scientists, and the systems in which they work, affect public trust in science?

***Discussion summary**:*

Kavli participants first noted that trust is particularly important in the current social media era, where diverse forms of information and data are easily accessible with few means of verification. In thinking about the role of trust in science, some participants felt that trust was primarily about efficiency – not needing to verify each piece of information in a time and resource-pressured process. However, the group discouraged 'blind trust', noting risks to taking wrong directions in research, and that trust could be undesirable when considering incentives that might make researchers less trustworthy in the current academic system.

The scientists then raised that several trust relationships exist in science, namely: i. between scientists in the same group, ii. between scientists across groups, iii. between scientists and members of the public, and iv. between science and society (collective perspectives).

The group discussed that levels of trust/distrust in science have previously aligned with propaganda trends and historical experiences. The participants thought that scepticism and distrust could be justified at times – and if not justified then understandable – and considered how the trustworthiness of information might be distinguished from the trustworthiness of its source. Along these lines, the group noted that an important distinction should be made between 'trust in scientists', 'trust in science' and 'belief in scientific results' - all of which are affected by different variables.

Participants raised reproducibility as a particularly important issues when considering trustworthiness in science. On the one hand, the group suggested a degree of trust is generally required to accept results, especially when published experiments are often hard to replicate due to lack of funding and specialist resource. On the other hand, the inability to reproduce and replicate results can lead to a lack of trust for the individual scientist, further exacerbated by negative experiences with sharing resources and knowledge exchange. The group noted that systems to improve reliability and reproducibility in academia – like thorough documentation of experiments, protocols and standards of practice – are much weaker compared to those in industry science. This lack of accountability and ability to verify experimental progress was said to relate most commonly to the culture created by laboratory research leaders, differing between departments, institutions and even country.

Individual scientist training and cultural background were said to impact perceptions of their trustworthiness, but it was noted that these features are not always reliable indicators of trustworthiness, especially compared to more concrete indicators of trustworthiness (e.g., language usage and peer review). Discussing research factually, avoiding 'overhyping' to market research outputs in publication, and evidencing quality controls including reproducibility, approved by other scientists in peer review, made for more trustworthy research – which, in turn, influenced the trustworthiness of the person.

Finally, the group considered the distinction between trust/trustworthiness and reliability/reliance. The group concluded that reliability is a predictable trait, positive or negative, but trusting is underpinned by morality and is never perceptibly negative. Both reliance and trust were said to involve a kind of prediction that something will (or won't) happen in cases of uncertainty, but in the case of trust, the motivations or character of the trusted person seem to matter. This prompted the question of whether it is important that scientists are 'trustworthy', or is it enough that they merely be 'reliable'? If what matters is that science, and scientists, are reliable, then regulatory/accountability frameworks should be sufficient to ensure that expectations and promises are met. The public funding of science, combined with the nature of discovery – its uncertainty and unknown timelines – however, speak to a moral basis for scientific work; suggesting an empirical need for trustworthiness as well as reliability of scientists and their science.

Questions for further reflection*:*

- Does having the 'right motives' matter for being a trustworthy scientist?
- Can a research institution be trustworthy, even if some of its members are not?
- We tend to rely on institutions like banks because they have strong oversight and accountability measures. Would increasing oversight and accountability lead to more trustworthy science?
- Do you think that scientists are trustworthy? Do you think that science is trustworthy?

Suggested further reading*:*

[1] https://www.sciencecampaign.org.uk/analysis-and-publications/detail/public-attitudes-to-science-2025-emphasises-vital-need-to-build-connections-with-the-public/

McLeod C. 2020. Trust. *The Stanford Encyclopaedia of Philosophy*. https://plato.stanford.edu/entries/trust/

O'Neill O. 2002. A Question of Trust: The BBC Reith Lectures. https://www.bbc.co.uk/radio4/reith2002/

John S. 2017. Epistemic trust and the ethics of science communication: against transparency, openness, sincerity, and honesty. *Social Epistemology*, 32(2): 75-87.

2nd October 2025

Session 2 – Balancing 'hope' and 'hype' in and for science research

How do scientists 'promise responsibly' around their research goals and outputs?

Background:

Academic science often requires researchers to "pitch" their science – in grant writing to gain funding, in recruiting students and postdoctoral researchers, and in writing up research work to secure publication in high-impact journals. These processes are competitive at every step, and thus, can incentivise framing research for maximum impact.

Scientists often grapple with this perceived pressure to describe and "sell" their research work in specific ways, particularly around securing funding to continue projects. Researchers often feel a tension between the need to "hype" their science (e.g., to secure funding) versus accurately representing the incremental nature of most scientific research. This tension can be felt particularly strongly when research projects are partially funded by charitable and philanthropic organisations, especially when progress is desired by a patient or other invested groups in wider society. More broadly, researchers may feel the need to 'hype' in order to achieve recognition in the current academic system characterised by insufficient funding and unstable contracts: winning awards and funding to continue project work, maximising positive results in a research narrative to publish articles in higher-impact journals, and demonstrating broad societal impact alongside research to bolster career opportunities.

Balancing the need for 'hype' in the academic system as it currently exists, with 'hope' of a better future and clearer understanding for researchers, patient and public groups alike can feel like a near-paradoxical challenge at times. Raising awareness of responsible promising around research progress and outcomes, both public-facing and inside academia with the realities of research systems, is vital in facilitating ethical discussions and decision making around how science is purposefully done, funded and communicated.

Key questions shaping the discussion with Kavli scientists:

- What is 'hype' in science, how and where does it occur in the research timeline?
- What are the causes of hype, and do the reasons for hype matter?
- What are positive and negative impacts of 'hype', and how can researchers promise 'responsibly'?
- How do researchers discern between "truth", and 'hype'?

Discussion summary:

The group initially compared definitions of 'hype', showcasing diversity in interpretation. "Hype" was generally presupposed to have negative connotations, where people associated 'hyping' science with a level of dishonesty aimed at gaining certain goals (funding, recognition) and with fad culture, creating short-term 'artificial excitement' around a topic. However, participants felt that "overhyping" —reflecting *inappropriate* exaggeration— may be a more accurate term, as 'hype' on its own often exemplifies excitement and positivity about topics important to the individual – although the judgment of 'inappropriate' appeared to be context-relative. The scientists agreed that positive hype, in discovery sciences especially, is critically linked to self-motivation and resilience towards performing and achieving research that typically has no guaranteed/applied outcome, and can sometimes be an expected way of communicating.

Considering 'overhyping' as the more problematic attitude-behaviour, the group determined that intention and benchmarking of research practices are the most important determinants: the motivation (leading to 'hype'/'overhype') and the quality controls in place to ensure reproducible, reliable and credible research. Systemic pressures around publication, funding, and career progression were identified as the primary barrier to good practice. Combining the need for career progression – almost entirely represented by papers published in reputable journals – with a bias for publishing positive results over negative/proof findings, and few incentives for robust and transparent research, the academic system can create a slippery slope to 'overhyping' one's work. These pressures tend to affect early career researchers more acutely.

Given rapid development in areas like AI, new technologies in classical disciplines, and even the emergence of new scientific fields, swathes of new information are released every day, with little opportunity to compare and create standards for quality control. The scientists expressed concern that lack of consistent benchmarking presents real challenges in discerning quality information and good practice from untruths, overhype and mis/disinformation - which also occurs and differs across all sectors. Beyond discerning quality in scientific circles, the group stated the necessity of helping the public to be able to evaluate information and its utility; particularly where the public voice holds influence in determining research funding, support for R&D regional and nation investments.

The uncertainty of science in its early stages can necessitate excitement to drive new ideas and research. This then raises the question, how can scientists try to identify hype/overhype in science, and help non-scientists to evaluate good research themselves?

The group considered that the only robust way to identify 'overhype' is the monitoring and evaluation of project progress compared to the promises and expectations set, the hypotheses developed and evidence acquired. A greater emphasis on the publication of negative results, and less weighting on journal impact factor as a measure of publication quality, was thought to be a way of moving towards a more balanced approach to science communication. Finally, a more nuanced understanding of 'impact' could help to mitigate the effects of 'overhyping'. Representing 'impact' more tangibly as the implementation of science research – the generation of jobs, technology, wider contributions to community and the economy – would form 'longer term' indicators of impactful work, beyond the short-term excitement and capital injection in solely 'hyped' science.

Questions for further reflection*:*

- Is ‘hyping’ one’s science necessary for career success?
- Are certain areas of science more susceptible to ‘over-hype’? Why?
- Is there an important difference between hyping one’s science to a commercial or private funder, compared to a charitable or public funder?
- How does responsible promising and hyping of research fit into the broader identity of academia as a sector?

Suggested further reading*:*

T. Caulfield, C. Condit; Science and the Sources of Hype. *Public Health Genomics* 1 April 2012; 15 (3-4): 209–217. https://doi.org/10.1159/000336533

Brown N. 2003. Hope Against Hype – Accountability in Biopasts, Presents and Futures. *Science Studies* 16(2): 3-21.

Intemann K. Understanding the Problem of “Hype”: Exaggeration, Values, and Trust in Science. Canadian Journal of Philosophy. 2022;52(3):279-294. doi:10.1017/can.2020.45

Kalina Kamenova, Timothy Caulfield, Stem cell hype: Media portrayal of therapy translation. Sci. Transl. Med.7,278ps4-278ps4(2015). DOI:10.1126/scitranslmed.3010496

20th November 2025

Session 3 – Communicating science to the Public

What is the role of the scientist as a science communicator?

Background:

The public comprises a diverse representation of different cultures, lifestyles, world views and language, all shaped by individual experiences, upbringing and communication. These differences, unique to each individual, shape how we see the world, and subsequently, how we respond to new information from scientific research.

Considering how we appraise new scientific information – some of which may challenge our world views and experiences – studies of public opinion to science research have shown that people tend to trust sources that complement their existing mental frameworks. This contrasts with the long-held view that a lack of public support of science is caused by a lack of understanding, and that solely educating the public about science would lead to greater support. Studies have consistently shown, however, that increasing knowledge leads to stronger overall opinions – both positive and negative – that reinforce pre-existing beliefs.

The past two decades has seen a move away from science communication as a means of improving 'science literacy,' towards a greater emphasis on engaging members of the public as participants in the research process. As such, the way scientists communicate research science goes much farther than simply "knowledge exchange", transferring information. In our multicultural and multigenerational societies, where personal experiences and values affect beliefs and behaviours as much as pure facts and logical reasoning, effective science communication requires an intentional, audience-specific approach. Two-way dialogue and participation are much more effective than one-way presentations of new data and information, emotional appeals are powerful motivators, and enthusiasm can be maintained by positive calls to action. Communicating "science", then, centres on our ability to share new findings while recognizing the complex ways in which people contextualise information, keeping in mind our purpose for sharing and the audience in question.

Key questions shaping the discussion with Kavli scientists:

- What is the purpose/value of science communication?
- What are effective approaches to science communication?
- As a discovery scientist, what elements of your work do you try to communicate to the public, and what obstacles/challenges to you face?
- What are my goals in communicating my science to the public; what are my desired results, and how will I know if these are achieved?

***Discussion summary**:*

As researchers primarily focused on fundamental science, Kavli participants acknowledged that communicating fundamental science poses distinct challenges compared to more applied research, where the direct relevance of outputs to society are more tangible, and easy to explain.
Participants identified three important roles for science communication: 1) contextualising the practicalities of research; 2) developing a more nuanced perspective of their own research from the insights of wider stakeholders; and 3) building a better sense of science in wider society.

The group emphasised the value of engaging with specific groups within wider society, such as through public-patient involvement events, educational outreach like talks in schools, and openly accessible public lecture series or showcasing science days. Talking with diverse groups helps to challenge the scientists' perspectives of their work, improving project design and output, as well as helping to dispel common public misconceptions of their work and lifestyles often promoted via mass media, such as the high-achieving "lone Einstein".

The scientists unanimously concluded that the "how" of communicating science is of key importance: the way in which science research is communicated is core to managing perceptions, expectations and future work. Appropriate messaging supports public awareness, helps in building empathy towards the demands and challenges of research, and promotes public trust in science. Where the general public has some weight in deciding research direction, whether through contributing funding research or through influencing decision-making at the national level, it is in part the individual scientist's responsibility to communicate their work, to facilitate this decision-making.

The group therefore concluded that scientists can, and should, take their own steps to challenge themselves and the current system – to accurately convey their messages, build resonance and understanding, and tackle the mis/disinformation crisis that is prevalent in today's uncertain world. Most importantly, the goal is to explain *what science is* – its different perspectives, goals and applications across different disciplines, the "why", and to champion these different elements of process, methodology, culture and ethics (beyond the published research article).

***Questions for further reflection**:*

- Should scientists be completely transparent about how research is done when communicating with the public?
- How should scientists respond to those that are unreasonably sceptical of, or hostile towards, their work?
- Should scientists be political advocates?

- Much of the public's exposure to science comes via lay media (e.g., online newspapers, social media). What can discovery scientists do to ensure their research is appropriately represented to the public?

Suggested further reading:

Kahan D. 2010. Fixing the communications failure. *Nature*, 463: 296-297.

Bubela T, Nisbet MC, Borchelt R, Brunger F, et al. 2009. Science communication reconsidered. *Nature Biotechnology*, 27: 514-518.

Nadkarni N, Weber CQ, Goldman SV, Schatz DL, et al. Beyond the deficit model: The ambassador approach to public engagement. *BioScience*, 69(4): 305-313.

Scheufele D. 2011. Science communication as political communication. *PNAS*, 111(Supp 4): 13585-13592.

22nd January 2026

Session 4 – AI Ethics in Scientific Research

How should we think about the use, adoption and integration of AI in discovery science research?

Background:

In a rapidly evolving tech era, AI often appears to take centre-stage, promoted for use seemingly across all sectors and areas of life. Whilst AI engages a complex ethical discourse – in its development, need for resource-intense infrastructure and wider environmental effects, its roles and impacts in human interactions and society – the use of AI in scientific enquiry poses its own unique set of ethical questions.

As more research and development generates insights into the progress, potential and interactions of AIs, so further emphasised are its many challenges. Learning from existing data and human-based assumptions, many AI processes contain hidden bias and can lead to erroneous or unjust conclusions. Further opacity in the processing of AI models, and barriers to reproducing and validating AI outputs, emphasize the importance of "explainability" in science, and prompt more fundamental questions about the meaning of 'trust' in information in an age of reproducibility, misinformation/disinformation crises. Beyond the process itself, the use of AI raises debate around data privacy and consent, risks of dual-use and misuse, and makes us ask, who is responsible when things go wrong? Science is often perceived as neutral, an apolitical and unbiased pursuit of knowledge. The use of AI in progressing science thus needs careful examination, monitoring and evaluation.

Key questions shaping the discussion with Kavli scientists:

- How is AI currently used in discovery science, where is its use reasonable, and how might it shape research in the future?
- What ethical issues might the use of AI in discovery science raise, and how can I navigate them as an individual scientist?
- How does, or should, the 'trustworthiness' of AI affect my willingness to use it for research?
- How should the broader societal implications of AI use (e.g., environmental, political, economic) affect my work as a discovery scientist?

Discussion summary:

Kavli participants identified main use-cases for AI in discovery science as involving trouble-shooting or documentation. AI tools were argued to significantly increase efficiency in developing experimental protocols, code, and associated explanations for longer term accessibility. Conversely, AI tools were seen as less appropriate for knowledge development, due to concerns about the 'trustworthiness' of these tools. Some participants argued that the benefit, and associated trustworthiness, of AI is largely dependent on its intended use as a tool, and thus, benefit comes from applying the correct AI tool for specific purposes. Where AI could be used to support the scientific process – for example, in checking wider literature for more evidence, developing analysis pathways and models – the group concluded that starting any AI interaction with scepticism (i.e., not assuming the AI was accurate) and consistently checking results' reproducibility made AI for science more reliable. However, there was also an acknowledgement that the appropriate uses of AI in science depends on each individual scientist's scientific ideologies. In discovery science – where many individuals aim to contribute to understanding the fundamental mechanism underlying an observation – the unknowns in AI can be confounding. Within the process of enquiry, then, each individual attributes importance to which tasks must be performed themselves, or can be reasonably delegated – subsequently, there was some disagreement around what tasks could be delegated to AI, even when expecting adequate performance by AI. Any AI use therefore requires thorough evaluation, robust training and thoughtful controls.

Despite the ease and efficiency brought by many AI tools to the research process, the group underlined the complex ethical interplay of using AI in daily work and life. AI was noted to have significant negative impacts on climate, human psychological and societal development, and to raise questions about justice (e.g., who has access to these tools). Most AI development and ownership lie in private corporations, which the group suggested would further extenuate disparities in making good science accessible and open to all. As per their science, the group considered that AI in its current state should not be used for generating hypotheses or fully delegating academic tasks (like writing papers and grant applications). They suggested that principal reward and recognition systems for quality, well-designed and reputable science need to evolve to reflect the incorporation of AI. Most importantly, the scientists concluded that AI cannot be used to outsource human thinking – instead, serving as an adjunct support – and that everyone holds responsibility in reducing the detrimental impacts of AI.

Questions for further reflection:

- Are there situations in discovery science in which it is impermissible to use AI? Why?
- How might the expanding use of AI in discovery research impact trust amongst scientists and in research outputs?
- In what circumstances would you defer to an AI output?
- Is human creativity an important component of discovery science? If so, how might AI impact this?

Suggested further reading:

London AJ. 2019. Artificial intelligence and black-box medical decisions: accuracy versus explainability. *Hastings Centre Report*, 49(1): 15-21.

Resnik DB, Hosseini M. 2024. The ethics of using artificial intelligence in scientific research: new guidance needed for a new tool. *AI Ethics*, 5(2): 1499-1521.

Wang H, Fu T, Du Y, et al. 2023. Scientific discovery in the age of artificial intelligence. *Nature*, 620: 47-60.

The Royal Society. 2024. Science in the age of AI. Available https://royalsociety.org/news-resources/projects/science-in-the-age-of-ai/

19th February 2026

Session 5 – Authorship & Publication

Are the ways in which research science recognised and rewarded appropriate?

***Background**:*

One of the first questions asked about an academic is: how many publications do they have, and where have they been published?

Authorship and publication records have long been the defining metric of success in recognising and rewarding research excellence. Ideally, the higher the quality and novelty of the research, the more prestigious or impactful a journal it will appear in. In turn, better publication records, and the more times an author appears first in a list of names, tends to correlate to higher success in securing academic positions/higher salaries, funding applications and recognition in the wider community (thereby enabling further impactful research).

Authorship is also an important way of ensuring the integrity of the scientific record, and trust in science more generally. Those designated as authors take responsibility and are accountable for the rigor of published work (accuracy, validity, reproducibility).

However, the realities of research practice do not always live up to this ideal. Despite efforts towards open and transparent research, through mechanisms like expert peer review or open-access publication, for example, biases and financial costs to the authors challenge democratization and appropriate recognition of high-quality work. Where novelty lies in developing experimental and analysis methods, such contributions (e.g.,) are often less represented in authorship listings than experimentation and the production of the article itself. Different disciplines host different authorship conventions – making standardisation in recognition challenging – and in increasingly multi-disciplinary teams tackling 'grand challenges', appropriate acknowledgment of contributions becomes a more complex endeavour.

On a more conceptual level, what are defining factors of "fair" authorship where "significant contributions" are the baseline? Whereas 'transparent' research practices are assumed to confer a sense of objectivity and legitimacy, contribution types and project expectations, inclusion criteria and indeed order of names on a published article are inherently subjective. In addition to these 'official' criteria for authorship, in practice, decisions about authorship (and the credit that accompanies it) may be further impacted by a need for collegiality in the workplace, inclusivity for career development and professional biases about what constitutes "significant contributions". At the end of the day, the buck tends to stop with the designated project investigator, to decide – vulnerable to the host of variable transparency, social pressures and individual subjectivity issues highlighted.

We cannot take the human out of the scientist; but we can continue to challenge existing, narrow recognition mechanisms in a sector reliant on diversely skilled people towards broader rewarding of contributions.

Key questions shaping the discussion with Kavli scientists*:*

- What are ‘fair’ standards for authorship? Are current standards compatible with the way contemporary science works in practice?
- What does it mean to have "contributed significantly" to a project?
- What constitutes malpractice/misconduct versus ‘questionable’ practices in research science?
- What values come into play around authorship?
- What can researchers do to engage in productive discourse and decision-making around authorship and publication of research?

Discussion summary*:*

Kavli participants first noted conventions across the Institute’s disciplines: namely an authorship recognition pattern where the author contributing the most is named first (leading to references as author et al.), the project investigator is named last. Those named in the middle generally have contributed to the process of the research output, with the exact order dependent on field.

The discussion quickly turned to the problems and pitfalls associated with recognising research contributions via publication output and authorship seniority. Whilst in theory the ordering of names by contribution, and the accumulation of research articles, seem like an open and fair process, in practice, scenarios are much more socially complex and unclear. Participants contributed anecdotes of local lack of understanding around authorship assignments, such as the inclusion of senior and/or distinguished names for reputational boosting and increased likelihood of journal uptake, often without clear association with the work. This raised concerns about a lack of accountability in proofing research, which led to participants reflecting that they would occasionally reject association with a paper due to perceived low research quality. At the same time, participants pointed out that for complex, multidisciplinary papers, it is rare for a single researcher to have a complete understanding of the full paper – which puts pressure on the idea that any researcher can be accountable for the entirety of a paper.

Participants also noted the variability of guidelines between journals, and the lack of accountability checks for individual contributions. When combined with the ‘political’ dimension of academic research (e.g., the need to reward or appease past, current or potential collaborators through ‘gift authorship’), this ambiguity complicates the reliability of recognition through publishing. In fact, the participants further acknowledged that the current system – concluded to be unfit for purpose – does not incentivise trustworthy, transparent research practice, compromising integrity with the need to ‘play the game’ and disproportionately disadvantaging junior members.

The group proactively suggested several initiatives to mitigate challenges around authorship. Considering that the true value lies in the quality of the science, participants suggested more robust criteria for authorship are needed, specifically defining the impact of an individual’s contributions and knowledge of the paper’s contents. The naming of peer reviewers and publishing of review comments is helpful in transparent quality control; participants promoted the idea of cross-sectoral recognition, alongside expanded recognition of alternative junior contributions, such as written reviews and methodologies.

From a 'democratization of science' perspective, one participant suggested the obsolescence of journals and the review process, instead proposing online repositories for uploaded research (including experimental documentation, AI use e.g.) where quality could be identified via crowd-sourced reviewing, totally open-access.

The Kavli participants concluded that a meritocratic system is required to reward talent, not just in written results of research, but in recognising training, management and research-adjacent calibre. Identifying that a range of skillsets are necessary in successfully running a science institute, there was a consensus that recognition via authorship solely does not support the wider system, adequately recognise the breadth of scientific disciplines, or celebrate the contributions made by a diverse and highly skilled workforce.

Questions for further reflection:

- How would science change for the better (or worse) if peer-reviewed journals were entirely replaced by communal feedback on preprint* publications?
- Is there anything wrong with a senior researcher allocating authorship to help the career development of a more junior staff member?
- Are there situations in which AI should be listed as a co-author?
- Is there anything unethical about accepting an authorship credit on a paper that you think is of poor quality?
- Is there anything unethical about sub-dividing a single study into as many publications as possible?

** Preprint* – a version of an academic article that precedes peer review and publication in an academic, peer-reviewed journal, typically uploaded by the author to a public platform where it is free to read and download.

Suggested further reading:

Strange K. 2008. Authorship: Why not just toss a coin? American Journal of Physiology – Cell Physiology 295(3): 567-575.

Smith E, Williams-Jones B, Master Z, Lariviere V, et al. 2019. Researchers' Perceptions of Ethical Authorship Distribution in Collaborative Research Teams. Science and Engineering Ethics 26: 1995-2022.

Babor T F, Morisano D, and Noel J. 2017. 'Coin of the Realm: Practical Procedures for Determining Authorship'. In: Babor T F, Stenius K, Pates R, Miovský M, O'Reilly J and Candon P. (eds.) Publishing Addiction Science: A Guide for the Perplexed. London: Ubiquity Press, pp. 207–227.

19th March 2026

Session 6 – Climate impact of research science

How does research science impact on the climate, and what responsibilities do researchers hold in minimising negative impacts?

Background*:*

Research science is notoriously associated with energy-intensive processes, substantial waste output, and global travel and procurement.

With respect to infrastructure, research science requires thoroughly planned physical space and procedural logistics to enable all manners of experimental work. This includes: fully-functioning, safe research environments requiring highly regulated, often state of the art, infrastructure, ventilation and waste pipelines; cutting-edge equipment often needing bespoke installation and maintenance, manufactured parts shipped from all over the world; procurement of 'consumables', daily use (or single-use) experimental equipment; robust decontamination and sterilisation processes in place for high-volume waste generated.

From an experimental perspective, where reliability and reproducibility demand highly specific environmental conditions and minimal contamination potential, many disciplines rely on single-use plastic consumables and temperature-controlled states, alongside a variety of harmful substances and highly regulated reagents.

Analytically, and in the case of computational disciplines, the lack of laboratory experiments does not negate the sheer energy consumption underlying the construction and maintenance of big data repositories, complex analysis processes (e.g., computational servers) and data storage.

Taken together, the climate impacts of research science are immense – water, energy, toxic waste, infrastructure demands, academic travel and global research networks [1]. Yet, despite a seemingly bleak outlook on research environmental impacts, there are increasingly effective means of decreasing negative impact of research science. From introducing funding-linked sustainability rankings and goals for research institutes; to boosting cost efficiency via shared research facilities, circular heating and energy conservation methods for scientific equipment; to reducing carbon footprint through exchanging travel for virtual meetings [1] – perceptibly small adaptations can make a cumulative difference to mitigating environmental costs. Indeed, beyond sustainability frameworks (like LEAF [2]) at the institutional level, individual researchers can each support positive impact in reducing the environmental cost of their research. Much like any community, our use of plastics, equipment, energy – any finite resource – can be considered, and perhaps more importantly, openly acknowledge and discussed, problem-solving together.

Nevertheless, research science is fundamentally resource intensive; this necessitates trade-offs between knowledge production through scientific research, and other societal considerations (including environmental sustainability).

Key questions shaping the discussion with Kavli scientists:

- How does discovery science impact the environment?
- What trade-offs, and potential compromises, exist between research quality and negative impact on the environment? Are they justifiable?
- How should we decide where trade-offs are made?
- Should environmental impact be a consideration in evaluating scientific research (e.g., for funding)?

Discussion summary:

Kavli participants immediately noted the high environmental cost of conducting research science, with particular emphasis on the energy consumed – and lack of ability to adequately and consistently measure consumption – and single-use plastics and PPE in experimental laboratories.

The group predominantly discussed the concept of balancing research needs with mitigating climate impact, including a more philosophical perspective on whether compromising reliability and reproducibility for reductions to climate impact is acceptable or even required. The group considered that individual travel would likely be the easiest way to reduce environmental cost, but acknowledge that reputationally, travel and visibility are important for career progression. Reduced travel would also likely disproportionately affect early career researchers.

Most of the discussion posited changes at the institutional level: the feasibility of tracking carbon impact, the possibility of assigning carbon quotas and costs to higher education institutions, and encouraging green and sustainable energy transitions. Where R&D is considered a key government/national priority, the group suggested that sustainability standards could be imposed on more easily regulated sectors (i.e. those requiring less energy and resource overhead), and that the onus lies on research-adjacent big corporations, such as consumables' suppliers, to explore sustainable alternatives, greener procurement and delivery processes.

The participants did not consider assigning quotas or imposing different environmental regulations based on "social impact" to be feasible or appropriate, stating that the perceived value of specific research should be accredited for its good scientific practice and output. The group suggested that the incorporating climate ideals into funding applications could be considered, as long as this did not become a 'performative' or box-ticking exercise. As such, whilst there was an acknowledgment of the importance of individual efforts, the group determined 'group think' and funding-related decision makers as holding the bulk of the responsibility in promoting sustainable, ethical research practice with appropriate evaluation methods.

Questions for further reflection*:*

- Do individual scientists have obligations to reduce the environmental impact of their research, or simply to adhere to institutional guidelines/requirements?
- Is the environmental impact of basic science less justifiable than applied science, given that in many cases it does not have a tangible societal impact (immediately or otherwise) to 'offset' its costs?
- Most high-emission research happens in developed countries, while the effects of climate change are mostly felt in developing countries. Is this unjust, and if so, what should be done?
- To what extent should climate impact dictate the scientific agenda (e.g., should low-impact, low-reward science be prioritised over high-impact, high-reward science)?

Suggested further reading*:*

[1] https://www.scienceeurope.org/our-resources/briefing-on-the-environmental-impact-of-science/

[2] https://www.ucl.ac.uk/sustainable/take-action/staff-action/leaf/take-part-leaf

Caney, Simon, "Climate Justice", The Stanford Encyclopedia of Philosophy (Winter 2021 Edition), Edward N. Zalta (ed.), Available https://plato.stanford.edu/archives/win2021/entries/justice-climate/

Catalysing discovery by bringing the physical sciences into the cell

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