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How contemporary academic structures constrain scientific creativity and hold back early-career researchers

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We argue that contemporary scientific systems progressively constrain high-risk and conceptually innovative research while being increasingly structured around short funding cycles, productivity-based evaluation criteria and risk-averse frameworks that favour predictable and non-transformative research outputs. Drawing on recent empirical literature, we show how such systems can place disproportionate pressure on early-career researchers by incentivizing safe, tractable and easily evaluated outputs. Structural academic mechanisms such as peer review and funding, escalating publication costs and institutional inequalities interact with precarious employment and hierarchical dependencies. In this environment, we contend that strategic conformity becomes a rational career path. This risks suppressing creativity and critical thinking precisely at the stage when scientific independence could otherwise emerge. Consequently, the probability of substantive contributions by early-career researchers is declining, while talent may increasingly abandon academia or cluster within a limited number of well-resourced institutions and national systems. By adopting a systems-level perspective, we argue that scientific creativity is not merely an individual trait but an emerging property of a supportive academic landscape and that maintaining or restoring it may require substantial structural reforms. These include promoting stable research pathways, decentralized decision-making and evaluation frameworks that better recognize collaboration, originality, persistence and nonlinear career trajectories. Without systemic change, we risk stifling the potential of early-career researchers to go beyond the confines of existing methods and approaches and deliver transformative advances. This would limit their capacity to meaningfully change our understanding of the world or benefit society, with impacts that fall short of their potential.

Many historic breakthroughs that took place under difficult external conditions permitted greater intellectual autonomy, but only along specific lines of gender, race and class. These conditions have changed. Specifically, modern scientific advances increasingly require intellectual freedom, tolerance of uncertainty and long time horizons[1–3]. However, such enabling conditions are increasingly difficult to access because of the contemporary publish-or-perish culture[4], short funding cycles combined with escalating evaluation pressures[5,6] and a strong preference among funding institutions for projects that are predictable, short-lived, easily publishable and comfortably framed within prevailing paradigms[7]. Concomitantly, scientific output and productivity metrics have increased sharply over recent decades[8], yet this quantitative growth has not been matched by comparable gains in conceptual originality or research quality[9,10]. Rather than reduced collaboration[11], this divergence probably reflects incentive structures that reward short-horizon,

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low-variance outputs (that is, 'junkification')[12] over exploratory, concept-driven inquiry[1,13,14].

These pressures are widely reported and often appear structural, being rooted in funding, evaluation, publishing and employment conditions in many academic systems[15–17]. They affect creativity (here understood as the generation of novel, high-risk ideas that challenge or substantially extend existing paradigms) and ingenuity, essential foundations of long-term scientific progress[18] because they converge most intensely during the early-career phase, the exact academic career stage when precarity and hierarchical dependence render creative risk-taking especially costly[19,20]. More specifically, the resulting selection pressures favour incremental, low-variance research strategies and penalize conceptual novelty through conformity and risk aversion, while administrative expansion and metric optimization divert researchers' time away from deep, sustained thinking, ultimately undermining intellectual diversity, epistemic robustness and the capacity for transformative discovery[21–23]. At the end of this systemic cascade are early-career researchers (ECRs), who are here considered to be researchers from the PhD phase through the pre-tenure phase whose careers remain structurally precarious and evaluation-dependent, lacking durable institutional autonomy[24,25]. Many of these ECRs are often compelled into strategic conformity at the expense of their creative potential, while only a relatively small proportion manage to stabilize professionally[9,21,26,27]. Under such conditions, the costs of intellectual deviation rise sharply: limited time for deeper analytical work, lack of access to funding and vulnerability to retaliation create an environment in which critical thinking and creative risk-taking become professionally hazardous[16,28]. This does not mean that structural academic hurdles are unique to ECRs; senior principal investigators, university administrators and funding officers also operate under their own institutional constraints and incentives, which often reinforce risk-averse structures. Nevertheless, intellectual deviation and long-horizon projects become rare under such conditions, so that novel ideas are structurally confined to narrow temporal windows (that is, between grants, during unfunded side work or at specific career transitions) rather than being pursued iteratively, cumulatively and consistently[21,24].

In this Perspective, we synthesize how existing academic structures may shape scientific behaviour, with a focus on ECRs across fields and geographies. For this purpose, we analyse the mechanisms through which contemporary academic structures could suppress creativity and the psychological and epistemic effects of risk minimization. We analyse how system-level incentives and constraints can influence collective research trajectories and argue that creativity in science is best understood as an inherent property of institutional environments, arising from the interaction between autonomy, time horizons, tolerance of uncertainty and failure, and material security[29,30]. Finally, we propose measures that can help to foster a creativity-enabling research environment, allowing ECRs to pursue bold, innovative ideas without being disproportionately constrained by precarity or counterproductive conservative incentives. While many examples in this Perspective draw from the natural sciences, reflecting the authors' collective experience, the core systemic pressures described are widespread, even though their intensity and specific manifestations (such as publication norms, funding models and the role of monographs versus articles) vary across disciplines.

The costs of precarity for ECRs

Structural precarity and power asymmetries

Global researcher density has expanded unevenly, showing notable differences in the number of researchers and available funding by country (Fig. 1). Concomitantly, the number of PhD graduates and postdoctoral researchers (often in short-term fellowships with rigid age limits and little autonomy) has grown much faster than the availability of stable positions, creating chronic under-employment[16,27,31]. Rising standards and reduced resources have further delayed recruitment, with the average age at professorship increasing in many countries (for example, 42.5 years in Germany, and from 32.7 to 34.4 years in France), intensifying precarity[32]. Under these structurally zero-sum conditions, intensified competition shapes not only who remains in academia but also which questions and perspectives are pursued, increasingly disincentivizing independence and creativity[1,33].

In this high-pressure environment, even small setbacks can carry outsized consequences. For example, a near miss on a critical early-career grant application can increase the risk of leaving academia by over 10%, even as those who persist often produce higher-impact work in the long run[31]. Selection pressures strongly favour conformity and short-term signalling over exploratory work. For instance, in many systems, academic positions are opened primarily in response to teaching demand rather than ambitious research strategies, and evaluation systems systematically favour cheaper junior postdoctoral positions over more experienced researchers to maximize short-cycle output and cost efficiency[34]. Patronage networks and academic inbreeding may be deeply entrenched. In Italy, for example, 'academic barons' have been known to exert disproportionate influence through loyalty-based systems where merit has frequently been secondary[35–38]. Wherever such hierarchies dominate, power is centralized, and creativity can become contingent on supervisor tolerance. Senior researchers may restrict access to ideas, resources and visibility, and many ECRs may be embedded in projects conceived and controlled by principal investigators on whom their employment, publications and references depend[39]. Over time, this dynamic may externalize creativity upwards, reshaping research groups into production-oriented units in which ECRs execute narrowly defined tasks rather than developing independent agendas. While collaboration and interdisciplinary teamwork are essential for tackling complex problems and breaking down silos, this dynamic may be seen as undesirable when it systematically suppresses independent agendas of ECRs, reducing them to executors of narrowly defined tasks and limiting the emergence of novel, diverse perspectives that fuel long-term innovation. Senior scholars may appropriate credit for themselves, while the 'Matthew effect' concentrates recognition among established scientists and systematically undervalues contributions from those with lower institutional power[40–42]. Although many creative ECRs eventually leave for industry, startups, non-governmental organizations or independent research, a form of brain drain that may act as a temporary safety valve, this outflow risks depleting precisely the innovative talent needed to drive meaningful reform within the system itself (see ref. 43 for a more detailed discussion on structural precarity and power asymmetries affecting ECRs).

Exploitation and invisible labour

ECRs perform a share of the day-to-day labour that sustains academic production, including research, teaching, supervision, fundraising, project management, administration and peer review, yet often lack stability, autonomy and appropriate credit[44,45]. When layered onto heavy teaching loads and expanding administrative demands (for example, time sheeting, performance tracking, partaking in academic committees, data management plans, peer review and editorial work), these responsibilities create context switching that compresses the uninterrupted time needed for exploratory and conceptually novel work[1,46]. The situation is exacerbated by the managerial turn in universities, which has prioritized revenue, branding, compliance and risk management, leading to a bureaucratic apparatus that generates additional demands rather than relieving academic labour[47,48]. Caregiving responsibilities add further strain, as evaluation systems frequently penalize reduced productivity associated with parenthood, disproportionately affecting women and single parents[49,50]. Authorship exploitation and intellectual theft compound these issues, when senior researchers claim undue credit through gift authorship and citation cartels, while ECRs risk having their contributions downgraded or erased[51–53] (see ref. 43 for a more detailed discussion on exploitation and invisible labour affecting ECRs).

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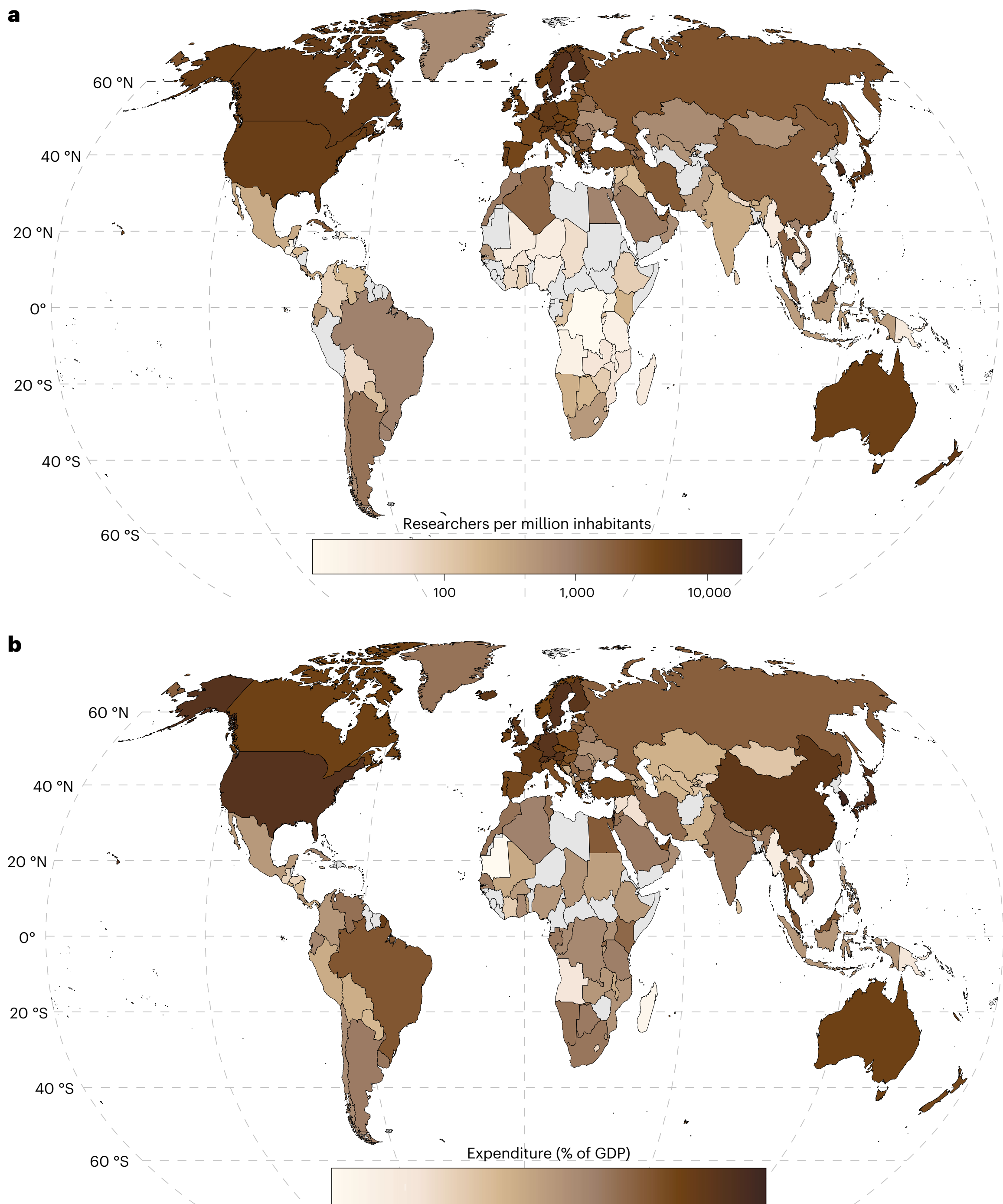

Fig. 1 | Global distribution of researchers and expenditure on research and development. a, Number of researchers (full-time equivalent, including those in public institutions and private companies) per million inhabitants by country in 2024. **b**, Gross domestic expenditure on research and development as a percentage of gross domestic product (GDP) by country in 2024. Data from the UNESCO Institute for Statistics (UIS) (https://databrowser.uis.unesco.org/browser); data extracted January 2025.

Psychological consequences

Chronic stress, burnout, impostor syndrome and mental health disorders are commonly reported among ECRs, with estimated prevalence rates exceeding those in the general population, leading some to state that academia faces a mental health crisis[54–56]. More than one third of PhD students report suffering from depression syndromes and one third from anxiety[56], with rates that persist through later career stages[57]. While also being in the most prolific (and highly competitive) period of their academic careers[58], ECRs face inequality and instability in both their working and personal lives. This may coincide with major life events (such as parenthood, first professional experience after the PhD or long-distance relocation), further amplifying psychological distress, inequality and attrition. As a consequence of these pressures, ECRs may also be more vulnerable to questionable or undisclosed uses of cheating possibilities, such as those provided by artificial intelligence (AI) (for example, superficial writing engagements, automation of analysis or unverified citations). Such practices constitute academic misconduct, which is ethically unacceptable and can cause error and/or retraction of published articles[59–61]. Meanwhile, modern proposal requirements increase pressure on the moral fabric of ECRs by expecting the integration of multiple state-of-the-art elements and buzzwords (such as 'artificial intelligence', 'extensive outreach', 'citizen science', 'multidisciplinarity', 'transformative change' and 'complex data-management plans'), rarely with corresponding increases in resources. This encourages strategic overselling and narrative optimization at the expense of conceptual rigour, while undervaluing essential non-research contributions such as collaboration, mentoring, education and public engagement, despite their vital role in academia and the science–society nexus[62,63]. Coupled with expectations of high productivity and rapid PhD completion (3–4 years), these dynamics risk converting education into workflow training, eroding intangible intellectual skills and exposing ECRs to burnout and psychological strain, particularly when projects are pursued under compressed timelines[64]. These institutional pressures may be embedded within broader political and cultural climates that are openly sceptical of and/or hostile towards some forms of scientific expertise. Such anti-science ideologies can translate into abrupt withdrawal of funding, institutional instability and heightened precarity for research teams, adding an additional layer of uncertainty and psychological burden across career stages[65,66].

Structural filters that suppress novelty

Dominant paradigms are often reinforced by institutional mechanisms, such as funding schemes, publications and evaluation criteria, which can make it difficult for alternative perspectives to gain visibility and credibility. These could be reformed to encourage creativity—for instance, by introducing longer grant cycles and novelty-weighted funding criteria, reducing reliance on journal prestige and article processing charges (APCs), and training peer reviewers to better recognize high-risk, high-reward ideas.

Peer review as a filtering mechanism

Peer review is often portrayed as a cornerstone of scientific quality control, yet we and others have argued that it may disadvantage conceptual novelty[1,67]. Originally an internal vetting process to protect a learned society's reputation in the seventeenth to eighteenth centuries, it developed into systematic external refereeing in the nineteenth century for confidential editorial advice and reputational risk management. After World War II, and especially from the 1970s onwards, it became framed as a marker of scientific legitimacy to manage growing submissions and distribute gatekeeping across expert communities[68]. For much of the twentieth century, journals were handled by recognized experts capable of in-depth assessment, but rising manuscript volumes led to editorial responsibilities being increasingly subcontracted to collegial researchers[69]. In its current form, peer review often operates under conditions of severe workload, largely on a voluntary basis and with limited incentives, as many academics lack sufficient time or the expertise required[70]. Under such conditions, reviewers may rationally prioritize methodological clarity and conformity to established frameworks over conceptual risk[71]. This occurs as journals increasingly struggle to recruit qualified experts[45], shifting review responsibilities to less experienced researchers[72]. The resulting variability and limited constructiveness of feedback offer little guidance for improvement[73], penalizing ECRs for having limited prior project acquisition experience and affecting their scientific aptitude, productivity and career advancement[74–76].

Under the above conditions, peer review can deviate from expert review and may be losing its capacity to nurture creativity by reinforcing conservative selection. ECRs, and especially PhDs, who are often required to have published a number of papers to obtain their degree, can be constrained by delays in the review process[77]. Meanwhile, the anticipation of prestige-based rejection may lead many researchers (especially those in precarious positions, which are common among ECRs) to abandon, soften or reframe unconventional ideas before submission for conformity purposes, even in the absence of explicit rejection, or to resort to submission to lower-impact or lower-quality journals[78]. Over time, such anticipatory adaptation risks creating a feedback loop in which reviewers encounter progressively fewer high-variance submissions, reinforcing conservative norms within disciplines and generating a Matthew effect that advantages established researchers while disadvantaging others[79,80]. Perhaps as a consequence of these dynamics, we see evidence of uneven funding and publication outcomes across groups and career stages[81–83], widespread dissatisfaction with review processes[84–86] and a disconnect between peer reviewer assessments and the citation impact of published papers[87–89].

Journal prestige, APCs and signalling

In our experience of contemporary academic culture, there is a widespread perception that the quantity of research outweighs conceptual or methodological quality. This may incentivize researchers to prioritize output volume over genuine scientific contribution and may lead some to conflate research impact, research quality and a journal's bibliometric prestige, despite substantial evidence that prestige metrics are poor predictors of reliability or long-term impact[90,91]. Yet, at initial career stages, researchers are particularly well positioned to engage in small-scale, methodologically traditional studies that rarely lead to immediate breakthroughs or high-impact publications but are essential for building the empirical foundations of future advances. However, the limited recognition of such foundational work within prevailing incentive structures discourages its pursuit, despite its importance for skill development, baseline data generation and the identification of patterns that may later inspire novel research directions.

The exponential growth of journals, including predatory and mega-journals, is stretching editorial and review capacities and may be contributing to rising volumes of low-quality or incremental output[91,92]. APCs and journal prestige further reinforce conservative strategies by privileging well-resourced institutions and countries, while evaluation systems that prioritize impact factors and journal quartiles exacerbate financial asymmetries that stratify publication pathways, embed inequalities in visibility and career progression, drain research budgets and constrain capable ECRs. Even when high-prestige publications are secured, they often fail to translate into improved institutional support or security, and in extreme cases the cumulative cost of open-access publishing can approach an ECR's annual salary[93–97]. Thus, while open access is often framed as a moral imperative to resolve the restrictions on knowledge exchange, access barriers alone do not fully explain contemporary inequalities in scientific communication[95]. Many researchers, students and non-academics can obtain articles through direct author contact, legal open-access repositories, institutional libraries or alternative, possibly illegal, means, while greater recognition of preprints and non-commercial repositories could reduce dependence on expensive publishing models[98,99]. At the same time, paywall systems can restrict information access for most researchers, as exemplified by the Centre for Agriculture and Bioscience International[100]. Finally, some organizations promote or require open-access policies (for example, the European Union). To comply with this, many commercial publishers now offer pay-to-publish open-access models, which create a barrier to researchers from under-resourced settings[95], transferring substantial funds from public to private sectors and, in some cases, between socio-economic regions[101]. Concerns about the misuse of journal-based metrics have been formally codified in research-assessment reform statements such as the Declaration on Research Assessment and the Leiden Manifesto[102,103], although their implementation is still a challenge[104].

Inequality as a constraint

Creativity must be nurtured throughout time, as it can be constrained not only at the individual level but also structurally and geographically[1,101]. For instance, high-income countries, mostly in the

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Table 1 | Summary of identified challenges impacting the progress of science

Challenge	Description	Impact on the progress of science
Short-term funding and productivity pressure	Short funding cycles, publish-or-perish culture, rigid metrics and standardized tools (for example, AI templates)	Fragments deep inquiry and favours incremental and safe outputs over risky, high-reward ideas, slowing conceptual breakthroughs
Conservative peer review and journal prestige	Preference for conformity to established paradigms; high APCs and prestige-based selection	Reduces the dissemination of novel ideas, reinforces dominant paradigms and excludes diverse or unconventional perspectives
Geographic, gender and language inequalities	Creative leeway and visibility largely reserved for well-resourced, established academics	Narrows the global pool of ideas and talent, limiting epistemic diversity and innovation from underrepresented regions and groups
Hyper-specialization and metric-driven alignment	Pressure to align with dominant narratives and optimize for narrow metrics	Constricts the epistemic space of inquiry, making unconventional breakthroughs harder and reducing interdisciplinary cross-fertilization
Hierarchical dependencies and early-career trap	Creativity contingent on supervisor tolerance; ECRs often limited to executing predefined tasks with invisible labour and credit issues	Externalizes creativity upwards, stifles independent agendas, increases attrition of innovative talent and slows long-term paradigm shifts

global north, produce a disproportionate share of scientific publications and dominate research funding despite comprising less than 20% of the global population[105,106]. At the level of research groups, larger groups tend to prioritize proven track records (often seen as 'safe bets') and incremental research over creative potential and risky endeavours, leaving little room for exploratory phases or productive failure[71,107]. Smaller groups, by contrast, may produce slower but more disruptive and innovative ideas, yet struggle to secure sufficient funding to realize these ambitions[107]. Over time, these mechanisms reproduce inequality and weaken the long-term vitality of the scientific system by constricting opportunities for innovation and renewal[34,108]. This imbalance extends beyond research groups, as researchers in less resourced or politically constrained environments face additional barriers related to infrastructure, funding stability and language. This is regardless of their creative potential, which further narrows the pool of ideas that shape global scientific narratives[35,109]. Such structural imbalances are exacerbated by the tendency of highly skilled ECRs to relocate from regions with comparatively limited possibilities to better-funded institutions offering stronger infrastructure, clearer career trajectories, competitive remuneration and broader international networks, another form of brain drain[110–112]. This dynamic is not confined to the global south[113], whereas in the global north, persistent constraints in research funding limit career opportunities and promote local hiring practices that foster 'academic inbreeding'[37] and comparatively slow outward mobility of researchers and graduates[114,115], thus reinforcing structural disparities in global knowledge production[116].

Funding architecture

Increasingly strategic, geography-bound funding priorities tend to privilege thematic alignment over conceptual novelty, reinforcing institutional asymmetries in what research is deemed fundable[32,117]. Well-funded research groups draw in more students, potentially leading to publishing more research papers, building up reputation and ultimately increasing the potential to secure more funding. Programmes that fund 'excellence' may affect how one operates in the field, but ultimately, only a small group reaps the rewards, while the remainder bear the extra planning burden, proposal-writing time and mental strain without tangible pay-offs[25,118]. For instance, the 2025 Marie Skłodowska-Curie Postdoctoral Fellowships call was extremely selective, with a success rate of just 9.6%. Out of 17,066 proposals submitted, only 1,610 were ultimately funded (even though 15,836 had been judged worthy of funding), typically requiring evaluation scores above 96% (https://marie-sklodowska-curie-actions.ec.europa.eu/news/msca-awards-eu4043-million-to-postdoctoral-researchers). These hypercompetitive funding systems may be monopolized by a few big institutions that are capable of attracting more funding and delivering results faster than smaller teams, creating a positive feedback loop in which top institutions concentrate an increasing share of funding (for example, 20% of universities in France acquire 80% of the available funding distributed through the Agence nationale de la recherche: https://tinyurl.com/ycy4mba6)[119,120].

Systemic drift towards incrementalism and pathways to reform

Contemporary scientific institutions have increasingly adopted an incremental (broadly Popperian) logic of science, optimizing for verifiable, cumulative advances while structurally disincentivizing the anomaly-driven paradigm shifts emphasized by Kuhn[121] (see ref. 43 for philosophical context). This drift towards micro-incrementalism risks creating a 'mirage' of progress. As fields mature and researchers mine similar datasets, studies increasingly converge on incremental variations rather than meaningful novelty[122–124]. Reputational concerns, fears of irreproducibility and AI-driven productivity further discourage bold hypotheses and exploratory research, reinforcing the preference for safe, low-risk outputs[21,71,125,126]. Hyper-specialization, growing politicization and metric optimization additionally constrain intellectual space, penalizing heterodoxy, cross-disciplinary ideas and dissent[127–131], while limited professional security and heterodoxy become rationally avoided challenges (Table 1).

Reversing these trends requires structural reforms because creativity in ECRs emerges from systems that tolerate uncertainty, absorb failure and provide protected time for deep work[71,132,133]. Large international programmes such as the European Research Council have shown that longer grant durations, higher risk tolerance and evaluation criteria that explicitly reward ambitious, ground-breaking ideas can effectively foster originality among ECRs, despite concentrating large amounts of funding on few researchers. However, scaling such approaches remains challenging due to entrenched evaluation cultures, resistance from established institutions and political pressures favouring short-term, measurable outputs. While we acknowledge that the majority of existing academic mechanisms were well intended and probably more effective under past conditions, they are no longer suited to contemporary pressures, necessitating urgent cultural and structural reform[132,134].

Reforms could begin with a bottom-up restructuring of peer-review processes in both publishing and fundraising[135,136]. For publishing, this includes not only shifting towards community-based publishing fora but also investing more in reviewer training to ensure evaluations are rigorous, fair and attuned to paradigm-shifting potential rather than penalizing uncertainty[89]. Changes that could further improve fairness and creativity include increasing the weight that peer reviews have in research career evaluations[137,138], mechanisms such as strict filtering of 'insufficient' applications, the determination of different requirements at different career stages, partial lotteries at the final evaluation stages to reduce bias[139–141] and explicit novelty weighting to prioritize innovative ideas over conservative ones[142].

Table 2 | Summary of key structures and systems that can foster creativity among ECRs, including responsible actors, implementation pathways and expected benefits

Reform	Responsible actors	How/where to implement	Anticipated impacts
Tolerate uncertainty and failure	Funding agencies, universities, journals	Remove punitive metrics for negative results; reform evaluation criteria and peer review guidelines to value well-justified risk-taking	Reduces risk aversion, encourages bold hypotheses and increases the likelihood of paradigm-shifting discoveries
Protect time for deep work	Universities, department heads, funders	Provide stable baseline funding, reduce administrative burdens, introduce humane evaluation metrics and protect downtime for reflection	Enables sustained, creative thinking; improves retention of innovative ECRs and quality of long-term research
Reduce biases and reward novelty	Journals, funding agencies, peer reviewers	Introduce novelty-weighted scoring, double-blind review, reviewer training and balanced assessment of methodological rigour alongside originality	Broadens epistemic diversity, improves fairness and allows unconventional ideas to compete on merit
Diversify grant cycles	Funding agencies (for example, the European Research Council, national funders)	Offer parallel short-, medium- and long-term funding tracks with dedicated streams for high-risk, high-reward exploratory projects	Supports cumulative, iterative inquiry; enables true exploration rather than short-term deliverables, accelerating scientific progress

Further compromising an unbiased review process means stepping away from the continued use of non-anonymized manuscript submissions, as evidence indicates that double-blind review can reduce some identity-linked inequities in review outcomes[143,144]. While ultimately depending on economic health and government willingness to invest in research and development[145], funding allocation should diversify through extended grant cycles that enable sustained exploration and dedicated long-term exploratory grants for high-risk, high-reward projects, without demanding immediate deliverables, thereby shifting the focus from short-term outputs. Maintaining the same overall budget while disbursing it over longer periods would benefit both creativity and impact and has been shown to reduce per-dollar inefficiency compared with larger grants[146].

Academic systems must provide more baseline funding to research bodies, allowing them to run long-term 'slow science' without constant dependence on smaller projects[147]. Establishing stable, competitive research-track positions would grant ECRs the security to pursue ambitious ideas, while decentralizing power through flatter hierarchies and robust oversight mechanisms could curb abuses of authority and foster environments where diverse voices can thrive[146,148,149]. Furthermore, protecting slow, local and field-intensive research as essential public goods could preserve context-specific methodologies often marginalized in fast-paced systems[150,151]. Reducing administrative burdens and non-essential managerial layers would reallocate time and resources towards research and teaching rather than internal processes. More broadly, universities should re-centre on their public mission of education and knowledge production, and evaluation frameworks must distinguish scientific competence from mere productivity by valuing collaboration, caregiving periods and nonlinear trajectories rather than relying on discipline-independent proxies such as raw counts or journal prestige, which incentivize gaming over substantive assessment[152].

Highly creative researchers often secure prestigious projects, publish in top-tier journals and build strong international networks that generate substantial institutional advantages. However, when evaluation frameworks prioritize aggregated institutional outputs over individual contributions, these achievements are redistributed across the organization, diluting performance signals and obscuring the competencies ostensibly being rewarded. If competence is poorly measured and proxy metrics become targets, selection may shift towards those who optimize signalling over substance, and leadership incentives may amplify adverse selection by favouring non-threatening, metric-oriented hires[134,153,154]. Such dynamics could lead to cumulative competence dilution at senior levels. Implementing these reforms will require confronting difficult trade-offs, including greater selectivity in PhD training, funding with lower budgets but longer timelines, and new oversight mechanisms to prevent capture of bottom-up processes. While no perfect system exists, programmes such as the European Research Council demonstrate that it is possible to combine rigorous evaluation with substantially higher tolerance for risk and failure. Treating research as a public good does not mean blanket funding, but rather stable baseline support combined with competitive streams that explicitly reward originality and long-term inquiry. Addressing global inequities would similarly demand targeted capacity-building for under-resourced regions, even if this reduces resources available to established centres. Critically needed changes (Table 2) must also empower ECRs with protected freedom from precarity and conformity pressures, providing early access to permanent employment or to long-term contracts such as tenure tracks to actively foster intellectual defiance, blue-sky ideation and failure-tolerant experimentation. At the same time, the socio-economic sustainability of APC-dependent publishing models requires reassessment, as escalating costs divert public research funds away from personnel and long-term capacity building.

Conclusion

Academia has never been flawless[155], yet prevailing dynamics introduce novel issues and exacerbate long-standing ones, disproportionately affecting ECRs. Systems that reward speed, branding and low-risk incrementalism over depth and rigour select for strategic compliance rather than scientific creativity. If this trend continues, the consequences are predictable: increased precarity, diminished intellectual diversity and slower conceptual progress, eroding precisely the qualities that modern academia nominally praises. Moreover, if evaluative frameworks continue to privilege quantitative output metrics over qualitative contributions, one effect will be selection for quantity, not quality, giving an illusion of fast scientific progress. The remedy is structural, not motivational: stable career pathways, longer exploratory funding[156], and evaluation and peer review criteria that explicitly weight conceptual novelty (substantive, high-risk ideas that challenge existing paradigms) over performative novelty (superficial claims of innovation designed mainly to impress). Such criteria could include novelty-weighted scoring rubrics and reviewer guidelines that reward well-justified risk-taking. Our argument is therefore not for a fundamental epistemological shift in how scientific progress is conceptualized, but for structural reforms that restore the conditions (autonomy, time and tolerance of failure) necessary for ECRs to pursue ambitious, paradigm-challenging research within existing frameworks of scientific inquiry. With these changes, academia can become a system in which ECRs are able not only to survive but also to prosper through the practice of bold, rigorous and transformative science.

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Author contributions

P.J.H. and T.E. conceived the study, coordinated the author team and drafted the majority of the manuscript. P.J.H., I.S., T.E. and N.C.B. created the visualizations with input from all authors. R.S., J.R.B. and D.D. provided senior guidance and substantial intellectual input. A.K., I.S., N.A.S.A., L.V., D.B., A.S.T., V.D.S. and R.S. contributed to the conceptual framework and drafting of key sections. A.B.N., S.H., J.G.N., C.C.-B., B.C., D.S., J.P.d.S., R.P., P.D., E.S.J.T., B.M., J.S., M.P., V.S., S.M.G., C.M., W.B., B.Š., E.Z., I.K., D.K., A.F.H., D.H., J.d.A.G.P., P.B., C.K., E. Bayçelebi, M.M., D.A.A., G.S., S.A., B.M.K., M.C., X.J., M.R.-R., I.M.-F., S.G.L., L.P., J.P., F.R., H.W., N.I.K., E. Briski and L.G. contributed to the drafting of the original manuscript and to revisions. All authors approved the final version of the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

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