

POLICY FORUM

ACADEMIC WORKFORCE

Innovation, entrepreneurship, promotion, and tenure

Academic incentives must reward broader societal impacts

By **Rich G. Carter**¹, **Karl Mundorff**², **Julie Risien**³, **Jana Bouwma-Gearhart**⁴, **Dawn Bratsch-Prince**⁵, **Sandra A. Brown**^{6,7}, **Almeshia L. Campbell**⁸, **Joseph C. Hartman**⁹, **Charles A. Hasemann**¹⁰, **Peter J. Hollenbeck**¹¹, **Blanca Lupiani**¹², **Owen J. T. McCarty**¹³, **Ian D. McClure**¹⁴, **Katrina Mealey**¹⁵, **Carol Mimura**¹⁶, **Andrea J. Romero**¹⁷, **Paola Sztajn**¹⁸, **Laurie Van Egeren**¹⁹

Academic promotion and tenure (P&T) processes that typically prioritize faculty grants and publications can fail to fully assess and value entrepreneurial, innovative endeavors (1) that can produce the kind of societal impacts that universities are increasingly being called on to provide and that many faculty and students increasingly prioritize (2, 3). A more inclusive assessment of scholarship and creative activity to better recognize and reward innovation and entrepreneurship (I&E) will require “broadening the bar” (4) to reflect evolving forms of faculty impact without diluting or increasing the requirements for advancement. Expanding what we value as scholarship can also help augment who we value as scholars and thus support a more innovative and diverse professoriate. We highlight work by the Promotion and Tenure-Innovation and Entrepreneurship (PTIE) coalition to promote policies and practices to recognize the impact of faculty I&E. We posit that this strategy can be broadly applicable (beyond I&E) to recognize the many and evolving dimensions along which faculty create societal impacts.

Benefits of I&E efforts by faculty can include “increased opportunities for research funding, access to unrestricted funds for further institutional investment, sustaining high scholarship level, student success, increased prestige, public benefit, and economic development” (5). In academe, basic research is still privileged (6, 7), and processes and policies that reward faculty members’ I&E work are not equally valued,

including at research (R1 and R2) universities (5). In addition, I&E should be viewed as broadly inclusive of the science, technology, engineering, mathematics, and medicine (STEMM) disciplines as well as liberal arts and other areas of focus across campuses.

Reform of higher education’s deeply embedded reward structure requires an approach that addresses long-standing norms and organizational cultures (8) as well as the multi-institutional nature of the faculty review process (P&T review typically includes input from external reviewers). Consequently, coordination across multiple institutions is needed to provide a fair and robust review of a given faculty candidate’s contributions and to mitigate potentially limited or biased views of their accomplishments (9). For this transformation to occur, there must be intentionality, leadership, and commitment to both improving the inclusivity and equity in the process as well as incorporating recognition criteria for faculty who engage in evolving forms of scholarship.

The convergence of increased investment in I&E from funding agencies and universities, coupled with an amplified awareness of bias and the need for a more inclusive academy, have opened doors and minds to addressing the long-standing, often challenging topic of P&T reform. This breadth of engagement across the academy will, we believe, enable the majority of faculty to see benefits to the recommended changes without undermining basic and/or curiosity-driven research and while supporting academic freedom.

SCALABLE SOLUTIONS

An exploratory survey of university administrators and faculty (10) suggested that structures for evaluation of faculty’s I&E impact in considerations of P&T are warranted but are largely absent at the department, college, and central administration levels. For example, faculty across multiple institution types with varying expectations for P&T noted that they struggled to meaningfully evaluate I&E in P&T considerations and typically did not receive any training for conducting these evaluations.

Recognizing the integrated, multi-institutional nature of peer review in the P&T process, the PTIE coalition, with membership from more than 65 universities and numerous stakeholder organizations, is collaborating to develop scalable solutions around a shared goal of improving assessment of I&E in P&T. Input has been gathered through conversations and structured group discussions from a broad cross section of groups and individuals with a range of roles on university campuses. The aim was to inform best practices and coalesce around consensus recommendations without the requirement to preemptively commit to adopting the findings. This enabled successes to be captured and adjustments to be made on the basis of lessons learned from individual member campuses. These conversations surfaced a consistent theme: Participants see a critical need for a coordinated effort for inclusively recognizing I&E to enable institutions to share the challenges they encountered attempting to effect change and support shared solutions. Recognizing that some institutions have had success in this area in part because of deeply embedded innovation cultures and resources that may not exist at most institutions, coalition members focused on more general, scalable approaches. True change will take time to realize (5 to 10 years minimum), and guideline changes alone will not be successful. Consequently, the coalition focused on holistic, multidimensional solutions that target expanding the culture on campus to be more inclusive of I&E. Coalition members agreed to take recommendations back to their home institutions to consider and, possibly, implement.

The resulting PTIE coalition recommendations contain four core elements needed to initiate changes that could meaningfully and

¹Department of Chemistry, Oregon State University, Corvallis, OR, USA. ²Office of Research, Oregon State University, Corvallis, OR, USA. ³STEM Research Center, Oregon State University, Corvallis, OR, USA. ⁴College of Education, Oregon State University, Corvallis, OR, USA. ⁵Department of World Languages and Cultures, Iowa State University, Ames, IA, USA. ⁶Department of Psychology, University of California at San Diego, La Jolla, CA, USA. ⁷Department of Psychiatry, University of California at San Diego, La Jolla, CA, USA. ⁸Division of Research and Economic Development, Jackson State University, Jackson, MS, USA. ⁹Department of Mechanical Engineering, University of Massachusetts Lowell, Lowell, MA, USA. ¹⁰MSU Innovation Center, Michigan State University, East Lansing, MI, USA. ¹¹Department of Biological Sciences, Purdue University, West Lafayette, IN, USA. ¹²Department of Veterinary Pathobiology, Texas A&M University, College Station, TX, USA. ¹³School of Biomedical Engineering, Oregon Health & Science University, Portland, OR, USA. ¹⁴Office of the Vice President for Research, University of Kentucky, Lexington, KY, USA. ¹⁵Department of Veterinary Clinical Sciences, Washington State University, Pullman, WA, USA. ¹⁶Office of Intellectual Property and Industry Research Alliances, University of California at Berkeley, Berkeley, CA, USA. ¹⁷Department of Family Studies and Human Development, The University of Arizona, Tucson, AZ, USA. ¹⁸College of Education, North Carolina State University, Raleigh, NC, USA. ¹⁹University Outreach and Engagement, Michigan State University, East Lansing, MI, USA. Email: rich.carter@oregonstate.edu

inclusively account for I&E (see the box). The coalition concluded that the comprehensive approach outlined in the recommendations needed to include each of these four key elements because solely changing the written P&T guidelines had limited effectiveness on PTIE member campuses. Without concurrent process changes to minimize bias during the review, no incentive is present for those who have been successful under the existing paradigm to support change. Those individuals who are not fully valued under the current paradigm will either leave the academy or continue to have their accomplishments discounted as compared with their peers.

Key aspects of these findings came from existing successes on PTIE coalition mem-

able to connect their research, agnostic of whether it is basic or applied, to broader impacts that align with the institutional mission. In addition, this linkage provides a key pathway for recognition of other areas of scholarship not currently valued fully under the existing evaluation structure but aligned within the university's priorities.

The PTIE coalition suggested six sub-categories of suggested metrics, with specific examples provided within each category—including wording to provide inclusive recognition of I&E impacts beyond the STEM disciplines [such as “installation of creative works, commissioned works” as examples of intellectual property and “startup/spinout organizations (includ-

Recommended process changes also benefited from the shared experiences of coalition members. For example, Oregon State University's experience with the Search Advocate program, which is used on dozens of campuses nationally to address implicit and explicit bias in the hiring process, informed the recommendation of process consultants. Considerable emphasis was placed on addressing bias in the review process to ensure that all faculty will benefit from the recommended changes through a more transparent process that addresses bias and reduces the potential for individuals in the P&T review process to improperly influence the outcome without accountability or for reasons outside of the established parameters. In addition, the recommended process changes amplify this dialogue about bias and holistic assessment through recommendations to provide a detailed letter of instruction for external reviewers and improve the clarity and structure of the personal statement provided by the candidate, and implementation of training on evaluating I&E outputs for faculty.

The coalition's recommendations are not intended to supplant or dilute the research, teaching, and service categories traditionally evaluated on university campuses. Instead, they suggest how to systematically measure and value faculty I&E impact as integrated within the teaching, research, and service categories. Faculty fully valued under the existing promotion and advancement structure must not be negatively affected by this more inclusive approach to valuing faculty's diverse forms of scholarship. Instead, the focus of PTIE is on broadening the opportunities for recognizing impact within a common structure that does not dilute or augment the overall requirements for promotion.

SUPERSTRUCTURE FOR EVOLVING FORMS OF IMPACT

I&E—along with diversity, equity, and inclusion (DEI); interdisciplinary team science; open science; community engagement; and others—represent examples of the many evolving forms of scholarship for the 21st-century faculty member. That said, these types of scholarship can be overlooked or undervalued in the process by which universities review, reward, and advance the academic workforce (8, 11, 12). As these evolutions are incorporated into the fabric of higher education, the faculty evaluation process thus needs to be updated to reflect this changing landscape.

Building on a view that expands the traditional definition of scholarship and research into discovery, integration, application, and teaching (13), we suggest that the evaluation framework proposed by the PTIE coalition

Four core elements of PTIE recommendations

These promotion and tenure innovation and entrepreneurship (PTIE) elements can provide a framework to reimagine other areas of scholarship in promotion and advancement.

1. University-wide language directly linking the evaluation of faculty to institutional mission, values, and goals across the multiple levels at an institution (unit, department, school, college, university, and system). Sample text: “Evaluation of faculty for promotion and/or tenure includes their contributions to the institution’s mission and stated priorities. Evidence for broader (societal) importance of the work, either now or in the near future, should be included within their personal statement and/or other appropriate portions of their dossier.”
2. Innovation and entrepreneurship (I&E) metrics to serve as indicator data to be used in a narrative thesis of impact. Metrics are grouped into six subcategories: intellectual property, sponsored research, use and licensing, entity creation, I&E career preparation, and I&E engagement.
3. I&E text for evaluation criterion to be incorporated into the (i) research (scholarship and creative activity), (ii) teaching and advising, and (iii) service categories typically evaluated for promotion and tenure (P&T).
4. Process changes for supporting systemic culture change, improving transparency, and addressing bias (for example, directions for personal statement, external reviewer resource and guidance, involvement of P&T process consultants, expanded training, and reframing and importance of diversity, equity, and inclusion).

ber campuses. For example, the suggested university-wide language and sample college-level language builds on wording used at Texas A&M University and Arizona State University, respectively, that many coalition members believe to have been successful. This recommended university language is critical for linking the evaluation of a faculty candidate's accomplishments with the mission and priorities of the university. PTIE coalition members consistently emphasized the importance of having this connection and its absence in most P&T review processes currently. The National Science Foundation has helped promote the expectation that applicants for and recipients of federal funding demonstrate impact to the public through its broader impact review criterion. Consequently, faculty should be

ing for-profit, nonprofits, and foundations to allow for broad recognition of societal impact” within the entity creation subcategory]. Sample text within the evaluation criterion for scholarship and creative activity ensures that continued importance must be placed on peer review while including the opportunity to demonstrate impact to the public: Scholarship and creative activity are “based on a high level of professional expertise; must give evidence of originality; must be documented and validated as through peer review, critique, or validation by evidence of societal or disciplinary usage/benefit; and must be communicated in appropriate ways so as to demonstrate significant impact for the public and/or for the discipline itself (including future impact as appropriate).”

can extend beyond I&E to support evaluation of a variety of faculty impacts. In particular, the current omission of university-wide language and much needed process changes in existing P&T practices (see the box) hinders reforms to reward and advancement across many domains of scholarship and creative activity. Incorporation of these two elements (university-wide language and process changes) into the fabric of a university will support a more dynamic and inclusive ecosystem in which faculty can contribute and meet the mission and priorities of the university without damaging the core principle of any university to support the pursuit of knowledge.

The diverse and evolving forms of scholarship can often be viewed as an impediment to establishing a uniform structure for evaluation of a dossier for P&T. Instead of viewing these differences as barriers, we suggest that a common set of priorities already exists for building the appropriate criterion of a given type of scholarship. Any area of scholarship must (i) support the university mission; (ii) address an identified need by stakeholders (such as funding agencies; foundations; professional societies; employers; students; alumni; local, state, and/or federal organizations; and/or others); and (iii) embody a priority of the institution. In order for any area of scholarship to be effectively evaluated, the institution must (iv) utilize necessary processes, procedures, and cultural elements that support an unbiased evaluation; and (v) provide language that links the priorities, need, and mission to the evaluation process. With this architecture identified, faculty engaged in diverse and new forms of scholarship can benefit from a shared road map for facilitating systems-level change. Additionally, this superstructure provides a mechanism for collaboration among otherwise disconnected areas of focus on campus that will collectively affect the majority of university faculty and increase the likelihood for adoption within the university.

Recognizing the persistence of bias—whether it be the candidate's research topic or their ethnicity, gender, sexual orientation, and/or other diverse backgrounds—in the current process is essential to improving fairness and validity in the future of review and advancement. Consequently, the PTIE coalition recognized the overarching importance and intersection of DEI with I&E and embedded that thinking throughout development of the recommendations (including the explicit inclusion of minority-serving institution perspectives in the coalition conversations). Full acknowledgment that faculty members from diverse backgrounds engage in diverse forms of

scholarly activity is essential to any productive discussion about change. This reality—that underrepresented faculty often face compounded bias on the basis of both their social identity group and their approach to scholarship—points to the need to update P&T processes to ensure the equitable evaluation of faculty impact. Many current P&T policies, practices, and cultures are rooted in eras when the academy was more homogeneous and less focused on creation of an inclusive environment that can evolve to meet the needs of a changing academy and student population.

Adjustment of the P&T guidelines alone is unlikely to facilitate the culture shift needed to see transformative change in how nontraditional forms of scholarship are valued (including I&E) and inequities are addressed. For example, reviewers bring with them both explicit and implicit biases to their evaluation of a candidate (14). Consequently, the PTIE coalition rec-

“Any area of scholarship must...support the university mission...”

ommends a broad collection of process changes to start to address implicit and explicit bias within the review process, including expanded training and external reviewer resources. These improvements would benefit the entire academy—not just I&E-focused faculty—by supporting a more diverse academic workforce to engage in new forms of scholarship.

The recommendations of the PTIE coalition enable inclusion and recognition of a diverse cross section of university faculty that extends well beyond the patent-licensing-startup paradigm to include entrepreneurial efforts such as social innovation; the creation and/or engagement of nonprofits, foundations, and other organizations; as well as I&E-related curricular developments and student mentorship. In addition, explicit discussion of aligning priorities between the faculty member and the university around their I&E efforts (traditionally referred to as conflict-of-interest management) is essential to address the financial aspects of some forms of I&E impact and ensure that the pursuit of knowledge is not motivated by financial gain. Universities should also be wary of pursuing I&E solely as a potential new revenue stream from technology transfers agreements, because often this is not the case (15). Rather, I&E should be viewed as an essential component of realizing the institution's mission to society.

The higher-education workforce and academia landscape are changing on a global scale. There is growing concern that the traditional systems that anchor institutions, including P&T practices, may no longer sufficiently support those very institutions to live up to their social contract with civic society. Groups including funders and academic associations are broadly addressing the need to modernize how we recruit, retain, and reward the academic workforce. Especially apparent in this time of awakening about systemic inequities and exclusion, universities should be leading the way by improving their own practices and making room for faculty to realize institutional ambitions to serve society. This necessitates both a bottom-up interest from faculty and a top-down commitment from university leadership. ■

REFERENCES AND NOTES

1. J. Bouwma-Gearhart, R. Carter, K. Mundorff, *Change* **53**, 18 (2021).
2. J. H. C. Clark *et al.*, “The innovation impact of US universities: Rankings and policy conclusions” (June 2020); <https://gwbcenter.imgix.net/Publications/Resources/gwbi-university-impact-report-ranks-exec-summary-full-report.pdf>.
3. S. Mintz, *Inside, High. Educ.* **3** (2019).
4. The National Academies of Science, Engineering, and Medicine. 2020. *Re-envisioning Promotion and Advancement for STEM Faculty* (National Academies Press, 2020); <https://doi.org/10.17226/25742>
5. P. R. Sanberg *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **111**, 6542 (2014).
6. M. S. Anderson, E. A. Ronning, R. Devries, B. C. Martinson, *J. Higher Educ.* **81**, 366 (2010).
7. P. Mendoza, S. D. Ocal, Z. Wang, E. Zhou, *Stud. High. Educ.* **45**, 1474 (2020).
8. K. O'Meara, in *Handbook of Engaged Scholarship: Contemporary Landscapes, Future Directions*, H. Fitzgerald, C. Burack, S. Seifer, Eds. (Michigan State Univ. Press, 2010), vol. 1, pp. 271–294.
9. J. Genshaft *et al.*, *Technol. Innov.* **17**, 197 (2016).
10. J. Bouwma-Gearhart *et al.*, *J. Open Innov.* **7**, 182 (2021).
11. K. A. O'Meara, L. Sandmann, J. Saltmarsh, D. Giles Jr., *Innovative High. Educ.* **36**, 83 (2011).
12. J. T. Klein, H. J. Falk-Krzesinski, *Res. Policy* **46**, 1055 (2017).
13. E. L. Boyer, D. Moser, T. C. Ream, J. M. Braxton, *Scholarship Reconsidered: Priorities of the Professoriate* (Jossey-Bass, 2015).
14. J. L. Cundiff, C. L. Danube, M. J. Zawadzki, S. A. Shields, *J. Higher Educ.* **89**, 611 (2018).
15. J. Marcus, “Think universities are making lots of money from inventions? Think again,” *The Hechinger Report*, 17 January 2020; <https://hechingerreport.org/think-universities-are-making-lots-of-money-from-inventions-think-again>.

ACKNOWLEDGMENTS

B. Wall, I. Tumer, and T. Ozkan-Haller are acknowledged for their work on the organizing committee. C. Lenhart and H. Cho are acknowledged for their efforts in survey data management and analysis. The participants in the PTIE effort from across our country are graciously acknowledged for their engagement, input, and support. The National Science Foundation (CNS-1936073) is graciously acknowledged for support of this work. Additional support for aspects of this work was provided by the Lemelson Foundation and VentureWell.

SUPPLEMENTARY MATERIALS

<https://science.org/doi/10.1126/science.abj2098>

10.1126/science.abj2098

Innovation, entrepreneurship, promotion, and tenure

Rich G. CarterKarl MundorffJulie RisienJana Bouwma-GearhartDawn Bratsch-PrinceSandra A. BrownAlmesha L. CampbellJoseph C. HartmanCharles A. HasemannPeter J. HollenbeckBlanca LupianiOwen J. T. McCartyIan D. McClureKatrina MealeyCarol MimuraAndrea J. RomeroPaola SztajnLaurie Van Egeren

Science, 373 (6561), • DOI: 10.1126/science.abj2098

View the article online

<https://www.science.org/doi/10.1126/science.abj2098>

Permissions

<https://www.science.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of service](#)