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Modeling Science Trustworthiness Under Publish Or Perish Pressure

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Abstract

The scientific endeavor pivots on the accurate reporting of experimental and theoretical findings, and consequently scientific publication is immensely important. As the number of active scientists continues to increase, there is concern that rewarding scientists chiefly on publication creates a perverse incentive where careless and fraudulent research can thrive. This is compounded by the predisposition of top-tier journals towards novel or positive findings rather than negative results or investigations that merely confirm a null hypothesis, despite their intrinsic value, potentially compounding a reproducibility crisis in several fields. This is a serious problem for both science and public trust in scientific findings. To date, there has been comparatively little mathematical modeling on the factors that influence science trustworthiness, despite the importance of quantifying the problem. In this work, we present a simple phenomenological model with cohorts of diligent, careless and unethical scientists with funding allocated based on published outputs. The results of this analysis suggest that trustworthiness of published science in a given field is strongly influenced by the false positive rate and the pressures from journals for positive results, and that decreasing available funding has negative consequences for the resulting trustworthiness. We also examine strategies to combat propagation of irreproducible science, including increasing fraud detection and awarding diligence, discussing the implications of these findings.

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