Reply to Rice and Henderson-Sellers: Survival of the fittest is not always the best option

We would like to thank Rice and Henderson-Sellers (1) for their Letter, which largely reiterates a number of the issues brought up at the Sackler Colloquium "Fostering Advances in Interdisciplinary Climate Science" and discussed in our introductory review of this event (2). In particular, Rice and Henderson-Sellers discuss the fact that barriers to interdisciplinary research have long been recognized, that interdisciplinary fields can develop into independent disciplines, and that fledgling interdisciplinary fields would benefit from more imaginative avenues of support.

However, we disagree with Rice and Henderson-Sellers (1) in their suggestion that emerging interdisciplinary sciences should undergo an unsteered process of natural selection, so that weaker aspects are weeded out. Science is undoubtedly a competitive field in which ideas compete for funding, journal space, and, ultimately, community acceptance; however, the notion that this competitive selection is always optimized and beneficial, particularly in a field as expansive as interdisciplinary climate science (which has entrained disciplines as diverse as machine learning, economics, mental health, etc.), seems misguided. To extend their business analogy, a new business in a market without regulation is generally at a decided disadvantage—the established businesses often have the means to protect their interests and can frequently determine or change the rules of the game (i.e., the laws of natural selection) through their size and unregulated influence. Without a level playing field, there is nothing natural about the scientific selection process, particularly if established disciplines can exert their influence on agencies and journals and, in so doing, protect their funding streams and self-interests. Even if the best science emerges in the end, many resources may be squandered along the way, and the advance of scholarly understanding is unlikely to be optimized.

Natural selection is not a progressive process in which organisms evolve to a more perfect ideal [i.e., as proposed by Lamarck (3)]; rather, it is simply a response process dependent, in part, on the reproductive time scale of the organism (4). Science, on the other hand, is a progressive process through which we hope to develop a more complete understanding of our universe. To move forward, science needs to invest in ideas without excess focus on short-term gains. A diversity of approaches and multiple lines of inquiry need to be supported through time. Such investment is critical for the development of excellence in scholarly thought, whereas selection, in business and in nature, can unduly reward short-term gain.

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1 Rice M, Henderson-Sellers A (2013) Surviving the growing pains of the inter-to-disciplinary lifecycle. *Proc Natl Acad Sci USA* 110:E2663.

2 Shaman J, Solomon S, Colwell RR, Field CB (2013) Fostering advances in interdisciplinary climate science. *Proc Natl Acad Sci USA* 110(Suppl 1):3653–3656.

3 Lamarck JB (1809) *Philosophie Zoologique, ou Exposition des Considerations Relatives à l'Histoire Naturelle des Animaux*; trans Elliot H (1914) [*Zoological Philosophy, an Exposition with Regard to the Natural History of Animals*] (MacMillan, London). French.

4 Darwin C (1859) *On the Origin of the Species by Means of Natural Selection* (J. Murray, London).

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