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Integrating and Fragmenting Biology, Under Pressure

We live in an age of biology, as Karl J. Niklas and his colleagues remark at the start of their essay on unity and disunity in biology, on page 811. Few readers of *BioScience* will disagree, but the discipline is nonetheless challenged by the staggering diversity of its methodologies, concepts, and goals, as well as by its fecundity. Niklas presents sobering statistics on the explosion of the biological literature—for example, a near quadrupling of the number of biological journals in 40 years. So although the theoretical unity of biology is unchallenged, in practice, "evidence for an increasing fragmentation in biology is abundant." Each of the different biological sciences is becoming more specialized. This presents a danger, because, as Niklas observes, "No level of biological organization can be fully understood without understanding how all of the other levels of biological organization affect it and how it affects them." So how to train people to teach the apparently endlessly multiplying (or is it dividing?) subject is, unsurprisingly, a matter that has benefited from the best efforts of some of its eminent practitioners.

Niklas's recipe for a healthy science involves recognizing, at a minimum, the need for both specialists, who chase new knowledge in restricted domains, and generalists, who have a grasp of the big picture—who understand how the different fields of biology relate to one other. The most remarkable scientists seem able to accomplish both integration and specialization. Niklas argues persuasively for the need to train students to "have an integrative perspective that makes them think globally early in their academic experience and to continually appreciate the importance of this perspective as they become specialists."

Niklas's advice sits, perhaps a little uncomfortably, next to a very different article by William F. Laurance and his colleagues that starts on page 817. The article describes a study of the factors that seem to predict publication success for biologists and environmental scientists. The main finding was that early-career publication "success" (measured as the number of publications at the time of being awarded a PhD or within 3 years of it) was the best predictor of long-term success (measured as the total number of publications achieved 10 years after obtaining a PhD) in a population of researchers who stayed in academia. The standing of the researcher's host institution had a surprisingly small effect. Laurance and his coauthors acknowledge that publication success is only one of many factors that can determine a biologist's advancement and career trajectory. Still, they advise that when comparing candidates for academic or research jobs, "simply tallying the number of early-career publications… appears to be an effective way to identify prospective rising stars." There it is: the statistically validated essence of the pressure to publish.

True, there is no necessary conflict between Niklas's plea for integrative perspectives and the opinion of Laurance and his colleagues that "a capacity to design, execute, and publish high-level research is among the most vital of academic skill sets." But in practice, it seems that there often could be, because achieving competence in varied fields even within biology is time consuming and might therefore reduce a researcher's rate of publication, at least temporarily. It is a conundrum on which responsible biologists might reflect.

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