## Reforming Undergrad Biology Curriculum

**IN HIS ARTICLE ON THE NEW NATIONAL** Research Council (NRC) report on needed reforms in undergraduate biology education, Erik Stokstad ("Biology departments urged to bone up," News of the Week, 13 Sept., p. 1789) mentions some of the obstacles to effective curriculum reform—the immense inertia of the faculty and their reluctance to give up "their" subject. One of the primary drivers of these impediments was identified in the Editorial by Timothy Goldsmith in the same issue ("Why is a liberal education so elusive?", 13 Sept., p. 1769): Faculty are usually reluctant to teach outside their areas of expertise. From the perspective of curriculum reform, this combination can be deadly. It also leads to a curriculum whose composition is stochastic rather than planned, as courses are added or dropped as faculty arrive and leave. But at least for the first 2 or 3 years of undergraduate education, most biology faculty ought to be able to teach effectively in several broad areas—why do we insist that an upper-year high school teacher cover all areas but that only 1 or 2 years later, students must be taught in a specialist fashion?

The solution is obvious but very challenging: design a curriculum around goals rather than content and involve the faculty in teaching fundamental, cross-disciplinary courses and courses outside their area of expertise. This could be enormously stimulating! For many years in a biology department, I taught biostatistics, a course whose content cut aggressively across all discipline areas. The freedom from parochial, specialty-driven course content and the sheer joy of teaching something that was fundamentally and enduringly important enlivened and invigorated my teaching.

A curriculum designed on goals and cross-disciplinary content could be a lot slimmer than the obese, fact-filled, overlapping and often repetitive courses that constitute the typical biology curriculum. Such a lean curriculum would free up the time needed to involve undergraduates in real, meaningful research activity—a real benefit to both students and faculty.

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**IT IS ENCOURAGING TO LEARN THAT BIOLOGY** faculty recognize that "undergraduates [need] a better appreciation of the connections between biology and the physical sciences" ("Biology departments urged to bone up," E. Stokstad, News of the Week, 13 Sept., p. 1789) and that steps are being taken to improve the situation.

Let me suggest a method established 30 years ago at the University of California, Irvine, that required two luncheon meetings to implement: one with David Brandt (chemistry) and myself (biology) and the other between William Parker (physics) and myself.

I asked these researchers and teachers to tell me what they teach in their beginning chemistry and physics courses: the gas laws, pH, oxidation and reduction, and kinetics and thermodynamics.

I then made it a point in my beginning cell biology course to correlate those subjects with my lectures on osmotic pressure; colligative properties and determining the molecular weight of proteins; the Henderson-Hasselbach principles of buffers; electron transfer reactions in the mitochondria; Michaelis-Menton enzyme kinetics; and the production and utilization of energy in metabolism.

As a result, the students grasped these concepts of cell biology more easily because they had already learned the basic chemistry and physics involved. They also recognized that chemistry and physics were necessary for a deeper understanding of biology and that those courses were not just requirements to take and then forget.

And the lunches were good, too.

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## Discussing the Origin of Life

**J. L. BADA AND A. LAZCANO ("SOME LIKE IT** hot, but not the first biomolecules," Perspectives, 14 June, p. 1982) discuss, among other things, the pros and cons of low-temperature versus high-temperature (deep-sea hydrothermal) sites for the origin of life. They seem to have overlooked that the hydrothermal sites all have both high- and low-temperature areas within a few meters of one another and that the turbulence associated with the vents will ensure at least sporadic mixing of these environments.

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**IN THEIR PERSPECTIVE "SOME LIKE IT HOT,** but not the first biomolecules," J. L. Bada and A. Lazcano (14 June, p. 1982) state that for monomers to undergo polymerization in the early "prebiotic soup," concentration would have been necessary. Yet, although they cite the work of Oparin (*1*), they do not refer to his statements on coacervation. Coacervates could form in dilute solution and reaction with cations, or other insolubilizing moieties could then have formed enclosing membranes.

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**Reference**

1. A. Oparin, *The Origin of Life* (Macmillan, London, 1938).