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lasers looked at experimentally ($\epsilon \approx 0.2$) depends on the local curvature of the boundary at the locations of the bow-tie bounce-points, rather than on the global parameterization. Furthermore, because the bow-tie destabilizes only gradually, a strong effect on the experimental findings at high deformation is neither expected nor observed.

Claire Gmachl

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Cope's Rule

Cope's Rule—that famous 19th-century notion that there is a general tendency toward size increase in evolution (J. Alroy, Reports, 1 May, p. 731)—has become a fixture of debates about pattern and process in paleobiology. Many recent studies have concluded that trends toward increased size are illusory, although some confirmed them in specific groups (1–4). Other papers have commented on possible mechanisms explaining Cope's Rule: some argued for co-adaptation, some for species sorting, and some for context-dependent statistical factors (5, 6). All used new data or new logic to evaluate Cope's long-held truism, which has arguably dominated our perception of the fossil record for more than a century.

But has it really? The diligent reader of Cope's 1300-plus publications may be puzzled to find little about body size. Cope wrote about sharks' hearts, women's waists, and men's minds, but not about body mass (7). One rare statement about size was quoted by Stanley (2): "It is true, as observed by Marsh, that the lines of descent of Mammalia have originated or been continued through forms of small size" (8). But this was an anomaly, occurring only in the final version of Cope's "Doctrine of the Unspecialized" (which, restated, says that ancestors are less derived than their descendants). Autogenic trends were antithetical to the neo-Lamarckian thesis that individual striving causes variation (9, 10). Cope's Rule is neither explicit nor implicit in Cope's work.

If not from Cope, from where does Cope's Rule come? Size was a hot topic in the post-war synthesis: Its stimulus was Schindewolf's resurrection of Eimer's orthogenesis (11). Simpson's review (12) and Rensch's English-language tirade (13) alerted Anglo-American synthesizers to a Germanic sitting duck on whom to train their sites. The idea that directed variation could drive lineages to extinction was a perfect target for the new weaponry of

genotype, phenotype, and selection. Simpson and Newell wielded new quantitative techniques to disprove it (10, 14). Simpson blasted out a rewriting of horse evolution, undermining Schindewolf's best example (15). Other papers followed (16).

The epithet "Cope's Rule" was coined during this flurry by Rensch (11), who cited *Evolution of the Vertebrata, Progressive and Retrogressive* (7), notable for its anti-trends stance. Rensch apparently did not read Cope's work himself, but copied his information from sometime orthogenist Charles Depéret, who had lionized Cope to discredit his fellow countryman Albert Gaudry (17). Then Newell copied Rensch, others copied Newell, and the idea that Victorians unanimously embraced "Cope's Rule" had been invented. After being enshrined in Raup and Stanley's popular textbook (18), the mismanaged synthesis strawman grew into a scientific urban legend.

What is interesting is that there were only a few advocates of Cope's Rule before the late 20th century: Eimer in the late 19th, Depéret in the early 20th, and Schindewolf at mid-century (19). But there have been an increasing number of supporters in the past two decades, making the rule anything but a 19th-century phenomenon (1, 4, 6). Among them, Alroy is arguably the most sophisticated advocate, having presented broad, well-analyzed data apparently demonstrating an across-lineage trend toward increased body mass. Cope's Rule might be better named "Alroy's Axiom."

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17. In his paper, Rensch curiously bastardized Cope's title as "Progressive and regressive evolution among vertebrates" (the correct title is "On the evolution of the Vertebrata, progressive and retrogressive") and did not provide an exact citation for the work. Not coincidentally, Rensch's version is identical to that given in the English version of Depéret's *The Transformations of the Animal World* (Kegan Paul, Trench, Trübner, London, 1909).
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Response

Polly's comments on the term "Cope's Rule" are a positive contribution. It is refreshing to see open discussion of the fact that scientists often view their distant intellectual ancestors through a lens dirtied by decades of mud-throwing. However, several points deserve further clarification.

First, my report was concerned with empirical issues, not terminology, and it avoided even the simpler problem of explaining exactly what modern authors mean by the term "Cope's Rule" [Jablonski (1) has dealt with this matter in detail]. Regardless of historical questions, my use of the term was necessitated by the fact that no alternative was available.

Second, Polly ignores the fact that regardless of what Cope himself thought about body mass, both he and his intellectual allies did indeed hold progressionist, and often explicitly orthogeneticist, views. Cope's disciple Henry Fairfield Osborn is an example, as is his contemporary and fellow *American Naturalist* editor Alpheus Hyatt. All of these workers tended to deny adaptation and to hypothesize linear, progressive trends that run in parallel across numerous closely related lineages (2). Although Polly correctly points out that the nonadaptive, teleological underpinnings of orthogenesis are logically incompatible with neo-Lamarckism, this contradiction seems not to have bothered members of Cope's school.

Finally, use of the term "Cope's Rule" can be seen as a deserved tribute to Cope's influence, even if the exact historical details fail to justify it. Body mass per se

may not have been a focus of anyone's research in the late 19th century, but paleontological interest in evolutionary trends during the current century certainly has its roots in the debate between Darwinians and progressionist neo-Lamarckians. Cope, a media star in his own day, was the most productive of the American neo-Lamarckians and casts a longer shadow on paleontology than other figures like Eimer and Hyatt. Painful as it is, I must admit that replacing "Cope's Rule" with a term like "Alroy's Axiom" would only cause confusion and rob one of my discipline's founders of some well-deserved publicity.

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CORRECTIONS AND CLARIFICATIONS

Pallava Bagla's article about new rules for animal experimentation in India (News of the Week, 18 Sept., p. 1777) incorrectly described the status of the National Institute of Communicable Diseases in New Delhi. It reports to the Ministry of Health and Family Welfare, not to the Indian Council of Medical Research.

Marcia Barinaga's article "Graduate admissions down for minorities" (News of the Week, 18 Sept., p. 1778) quoted an erroneous number from the AAAS report on minority graduate admissions. Hispanic enrollment in science and engineering graduate programs was down 16% in 1997, not 18%.

In the Policy Forum "The paradox of lead poisoning prevention" by Bruce P. Lanphear (*Science's Compass*, 11 Sept., p. 1617), three incorrect metric conversions were introduced during editing. In the first full paragraph on page 1618, 50 $\mu\text{g}/\text{ft}^2$ should have been converted to 536 $\mu\text{g}/\text{m}^2$; 40 $\mu\text{g}/\text{ft}^2$ should have been converted to 428 $\mu\text{g}/\text{m}^2$; and 10 $\mu\text{g}/\text{ft}^2$ should have been converted to 107 $\mu\text{g}/\text{m}^2$. Also, the Environmental Protection Agency's rule on lead-based paint in federally owned residential property, referred to in the same paragraph, was proposed on 3 June 1998, not 1 June.

In the Perspective "Tales told in lead" by J. O. Nriagu (*Science's Compass*, 11 Sept., p. 1622), in line 25 of the second paragraph, the estimated annual production of lead should have read "160, 900, 11,000, 32,000, and 6000 metric tons" There was a space missing after the first number.

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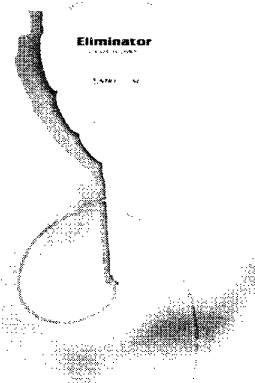
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