pivotal discoveries on which new drugs were based, leaving all intellectual property rights in the hands of the companies that exploited those findings to create commercialized products (*2*). He is incorrect in stating that the current FDA approval process provides adequate perspective on the relative worth of a new drug; usually, it merely determines that a new product works better than a placebo at achieving a short-term surrogate outcome—hardly all the information a clinician or payor needs (*3*). The "vast expansion of comparative drug studies" that Tracey fears is precisely what the nation requires to help us make drug prescribing and purchasing decisions more wisely and to bring some badly needed discipline to the drug development and marketing process. I agree that there is nothing wrong with "modest" or patient-specific therapeutic advantages, as long as they are real rather than illusory. We just need to define them better and decide how much patients or society are willing to pay for them. Finally, Tracey comments on the government's abdication of responsibility for assessing the value of drugs to be covered under the new Medicare prescription benefit program. True, the new law does not prevent such evaluation. It also does not prevent universal health coverage, but that doesn't mean that anyone will step forward to make that happen either. Relying on private insurance companies to provide this public good will likely be as disappointing as our earlier reliance on that industry to contain drug costs and ensure affordable medical care.

> **"[T]he record profits of the last decade have not been transformed into the expected return in new drug products."**
>
> –AVORN

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Invariant Ratios Vs. Dimensionless Ratios

IN THEIR REPORT "THE ILLUSION OF INVARIANT quantities in life histories" (19 Aug., p. 1236), S. Nee *et al.* show that purely statistical methods may lead us to conclude that certain life-history ratios are invariant when, in

fact, they are not invariant at all, but the statistical procedure—in which one regresses $X + c$ on X—causes one to think so.

Some confusion may have also occurred in this field because of the difference between a dimensionless ratio and an invariant one. A simple case, originally attributable to Beverton and Holt (*1*), can illustrate the point. If an organism grows according to the von Bertalanffy form $L(t) = L_\infty(1 - e^{-kt})$, where t is age, L_∞ is asymptotic size, k is the growth rate, survival to age t is e^{-Mt} (where M is the rate of mortality), and fitness with maturity at age t is $e^{-Mt}L(t)^b$ (where b is the allometric parameter connecting size and fecundity), then it is an exercise in introductory calculus to show that the optimal age of maturity is $t^* = (1/k) \log [(M + bk)/M]$ and that the relative size at maturity is $L(t^*)/L_\infty = b/[b + (M/k)]$. The ratio M/k is dimensionless but need not be invariant. However, for any two species in which this ratio is the same, the relative size at maturity will be the same.

I suggest that it might be more productive for us to follow the example of fluid mechanics and replace the notion of invariants by explicit dimensionless numbers. Define, for example, the "Beverton number" $\nu_B = M/k$ so that $L(t^*)/L_\infty = b/(b + \nu_B)$. Then we conclude that for species in which $\nu_B \to \infty$, relative size at maturity will be very small, whereas for those species in which $\nu_B \to 0$, relative size at maturity will be close to asymptotic size. Life-history invariants may be elusive, but dimensionless numbers and their life-history consequences are not.

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Worldwide Decline of Sturgeons

IN THE ARTICLES "U.S. TO BAR CAVIAR" (Science Scope, 16 Sept., p. 1799) and "Ban on beluga caviar points to sturgeon's worldwide decline" (News of the Week, 7 Oct., p. 37), C. Pala reports that the United States has banned the importation of caviar from the beluga sturgeon to protect this very old species. The sturgeon order Acipenseriformes already faces local extinction for 19 species. A worldwide boycott on beluga caviar and control of domestic markets are suggested, because overfishing is held to be responsible for the decline. The article by R. Stone "The sturgeon's last stand" (News Focus, 16 Sept., p. 1806) on breeding facilities for Caspian sturgeons in Rasht, Iran, discusses efforts to boost sturgeon stocks. These measures are, however, insufficient. In addition to poaching, pollution destroying spawning habitats and human interventions, which prevent migration to spawning grounds, have been blamed (*1*). Another factor is uncontrolled restocking, drastically reducing genetic diversity, as observed in the Volga River, habitat of the Russian sturgeon *Acipenser gueldenstaedtii*. Here, 11 of 34 sturgeons morphologically classified as *A. gueldenstaedtii* had haplotypes of *A. baerii*, originally confined to Siberia (*2*). The interdependence of environment and genetics is demonstrated by a remarkable species shift, occurring in the Baltic between 800 and 1200 A.D., when the North American sturgeon, *A. oxyrinchus*, replaced the native sturgeon, *A. sturio*, because of a drastic drop in water temperature during the little ice age, favoring *A. oxyrinchus*, which spawns below 17.8°C, over *A. sturio*, which spawns above 20°C (*3*).

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