Pure Joy

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Doing the research for this column was pure joy. I keep a folder labeled ''Animals,'' and I sat down with it one day. I ended up spending a wonderful afternoon reading about fascinating adaptations. This column is admittedly a potpourri, but what all the items here have in common is that they are all reminders of why many of us went into biology—it's just the most interesting subject going.

Slow Digestion

I want to start with snakes because this item is strange and wonderful. It includes the kind of statistics that students love, but it also makes a serious point about adaptation as well. Elizabeth Pennisi (1999a) reports on the research of Harvey Lillywhite of the University of Florida who investigated ''chronic constipation'' in some snake species. But ''chronic'' is an understatement. In a study of the rate of defecation in a number of large, ground-dwelling snakes, Lillywhite found that the Gabon viper *Bitis gabonica* had the longest ''passage time.'' While it ate a number of times during a year, it only defecated once in 420 days.

While Metamucil® or Ex-Lax® might seem in order for this poor creature, Lillywhite argues that long-term retention of waste is not a matter of real constipation but of bulking up to more effectively land large prey. He found that while *B. gabonica* is an extreme case, a comparison of ground-dwelling with tree-dwelling snakes showed that the average passage time for ground dwellers was 145 days longer than for tree dwellers, with some tree dwellers having passage times that seem positively supersonic next to *B. gabonica*. The slender arboreal snake *Uromacer oxyrhyncus* eliminates waste in less than two days. Lillywhite attributes this difference to the fact that tree dwellers need to be mobile and the extra weight of waste would slow their movements. For ground dwellers, on the other hand, extra weight in the form of waste material can be an advantage especially since it accumulates in the hindgut. Snakes with such extra heft have been found to strike more quickly and to get a firmer grip on prey.

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Shrinking Iguanas

But while some snakes do better with extra weight, some iguanas do better by not just slimming down, but by actually shrinking. Researchers found that some members of a population of Galapagos marine iguanas of the species *Amblyrhynchus cristatus* became shorter over a period of two years during El Nino events when food supplies were low (Wikelski & Thom 2000). Large individuals shrank proportionately more than small ones, and females shrank more than males of the same size. The lizards that shrank more lived longer both because they could move around more easily to forage and because they expended less energy to do so. The extent of shrinkage, up to 20% of body length, indicates that this couldn't just be the result of a decrease in cartilage and connective tissue, but that bone absorption also had to be involved. This is the first report of such shrinkage in an adult vertebrate, and the marine iguanas seem capable of repeating growth and shrinkage cycles several times during their lives, providing the animal with an unusual adaptation to starvation conditions.

Hot Clams & Slow Tubeworms

One of the problems with investigating animals is that it's often difficult to study them where they live. This is particularly true of organisms that reside in the deep ocean, but biologists are finding ways to explore the habits of even these creatures. Japanese researchers used video cameras and temperature sensors to study colonies of the giant white clam, *Calyptogena soyoae*, more than 1,100 meters below the surface of Sagami Bay in Japan (Van Dover 1999). *C. soyoae* belongs to the same genus as clams living near hydrothermal vents in the eastern Pacific, and like these clams, it is a host for endosymbiotic, sulfide-oxidizing microorganisms from which it draws nourishment. But *C. soyoae* lives in a much cooler environment, in sediments into which seep cold waters rich in sulfides.

Observations made with video cameras and temperature sensors over an 18-month period included evidence for 11 cases of spawning by both sexes, and in each case, the spawning was associated with a brief rise in water temperature of only 0.1–0.2° C. The rise lasted less than two hours and was not associated with lunar or seasonal cycles. To test the hypothesis that the water temperature change triggered spawning, researchers placed a plastic dome with a light bulb attached over a group of clams *in situ*. When lit, the light bulb increased the temperature at the surface by 2.2° C, and spawning by several clams began within five