REMARKABLE CREATURES

In Snails and Snakes, Features to Delight Darwin

By SEAN B. CARROLL
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Charles Darwin seems to have had a boundless interest in the many forms life takes on earth. He could find something about any animal or plant that piqued his insatiable curiosity, and masses of such observations fueled his prodigious output of books and scientific papers.

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Cristina Grande and Nipam Patel

DIFFERENCES In this pair of land snails, the one on the right, with the shell opening on the right, is the more common of the species.

Darwin was particularly intrigued by what he referred to as "contrivances," the various biological devices through which creatures make their livings or disperse their young.

Even the most pedestrian species seized his imagination. Take the Roman land snail Helix pomatia, for instance. If one is not a lover of escargot, this common European snail would inspire little attention. But not so for Darwin. He was gripped, and troubled, by the mere existence of land snails.

In 1857, he wrote his first letter to the naturalist Alfred Russel Wallace, who was then making his way across the Malay Archipelago. Wallace's own voyages and observations would independently lead him to the concept of natural selection.

Darwin explained his obsession: "One of the subjects on which I have been experimentising & which cost me much trouble is the means of distribution of all organic beings found on oceanic islands; & any facts on this subject would be most gratefully received: Land-Molluscs are a great perplexity to me."

To support his revolutionary theory that all species arose naturally from ancestors, Darwin was eager to find evidence of how land snails, which he knew were easily killed by salt, contrived to reach and populate oceanic islands. At home, he was conducting all sorts of experiments with submerging snails and their eggs in seawater for weeks at a time. After some Roman snails

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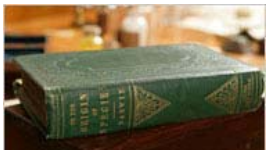

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survived his long “baths,” he suggested in “On the Origin of Species” that they might be transported to islands by adhering to the feet of birds or to driftwood.

On Tuesday, the world celebrates the 150th anniversary of the publication of Darwin’s magnum opus. On this historic occasion, I thought that it would be most fitting to highlight some recent discoveries about some nifty contrivances that I am very sure would have delighted the great naturalist. And they all revolve around land snails.

To appreciate these discoveries, we have to know a bit about snail bodies.

While we may happily pick up and examine a nicely marked shell, most of us have, understandably, not taken the time to learn snail anatomy.

But if we look more closely at the greatest contrivance of snails, the protective shell, we can see that it is not only coiled, but also asymmetric. If we hold a shell with the opening facing us and the pointed tip facing up, the opening is usually on the right. These shells are referred to as dextral or right-handed. In rare individual snails from right-handed species, however, the shells will have the opening on the left and are referred to as sinistral, or left-handed. Some entire species are sinistral.

Biologists have known for almost a century that a simple genetic basis is behind shell handedness, at least in some species, such that the mutation of a single gene can cause right-left reversal. The mystery then is why, if both forms can occur and reversal is genetically easy, are most species either entirely right- or left-handed?

An answer may be found in one of the logistical challenges that living with most of the body inside a shell imposes on snails — mating. Here is where handedness matters a lot. The genital opening is behind the right tentacle in right-handed snails. When land snails mate, they face each other, which brings their genital openings side by side. Snails with opposite handedness are misaligned, making it physically difficult for them to mate.

Any rare reversed individual snail would obviously have difficulty mating. As Darwin knew so well, if one cannot mate, it is the end of the line. Once of a given handedness, a species and its descendants would tend to stay that way.

But what if there were some other reversed individuals around? They could mate with one another and might form a new, reversed population. If members of that population continued to fail to mate successfully with snails of opposite handedness, that population might eventually evolve into a new species. And that seems to be exactly what has happened several times in a group of Japanese snails — and perhaps very many times in land snails in general.

The genus Euhadra is unusual in that it contains multiple left-handed species, as well as right-handed species. By tracing species pedigrees through DNA, the biologists Rei Ueshima from the University of Tokyo and Takahiro Asami from Shinshu University found that several right-handed species of Euhadra snails appeared to have evolved from a left-handed ancestor and that closely related left- and right-handed species could not successfully mate.

Both observations make perfect sense, but there may be something more to the explanation of why some species are left-handed than mating difficulties. There appears to be a greater diversity of left-handed land snails in Southeast Asia than elsewhere. Dr. Asami, Masaki Hoso and Michio Hori of Kyoto University have uncovered an astounding reason why this may be so — right-handed-snail-eating snakes.

Sean B. Carroll is a molecular biologist and geneticist and the author of several books, most recently "Remarkable Creatures: Epic Adventures in the Search for the Origin of Species." He will be writing a column of the same title for Science Times, more or less monthly, on the remarkable creatures that scientists study and the remarkable creatures that many scientists are (or were). He is an investigator of the Howard Hughes Medical Institute at the University of Wisconsin.

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