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All but Ageless, Turtles Face Their Biggest Threat: Humans

By [NATALIE ANGIER](#)

This was no euphemistic brushoff, no reptilian version of “Sorry, I’ll be busy that night washing my hair.” Paddling around in a tropically appointed pool at the National Aquarium in Baltimore, the husky female Gibba turtle from South America made all too palpable her disdain for the petite male Gibba that pursued her. He crawled onto the parqueted hump of her bark-brown shell. She shrugged and wriggled until he slipped off. He looped around to show her his best courtship maneuvers, bobbing his head, quivering his neck. She kicked him aside like a clot of algae and kept swimming.

“I feel sorry for the little guy,” said Jack Cover, a turtle specialist and the general curator of the aquarium. “He’s making no progress, she’s got zero interest in him, yet he just keeps coming back for more.”

And why not? The male Gibba may be clueless, he may at the moment have the sex appeal of a floating toupee, but he is a turtle, and, as a major new book and a wealth of recent

discoveries make abundantly clear, turtles are built for hard times. Through famine, flood, heat wave, ice age, a predator's inspections, a paramour's rejections, turtles take adversity in stride, usually by striding as little as possible. "The tale of the tortoise and the hare is the turtle's life story," said Mr. Cover, who calls himself a card-carrying member of the "turtle nerds" club. "Slow and steady wins the race."

With its miserly metabolism and tranquil temperament, its capacity to forgo food and drink for months at a time, its redwood burl of a body shield, so well engineered it can withstand the impact of a stampeding wildebeest, the turtle is one of the longest-lived creatures Earth has known.

Individual turtles can survive for centuries, bearing silent witness to epic swaths of human swagger. Last March, a giant tortoise named Adwaita said to be as old as 250 years died in a Calcutta zoo, having been taken to India by British sailors, records suggest, during the reign of King George II. In June, newspapers around the world noted the passing of Harriet, a Galapagos tortoise that died in the Australia Zoo at age 176 — 171 years after Charles Darwin is said, perhaps apocryphally, to have plucked her from her equatorial home.

Behind such biblical longevity is the turtle's stubborn refusal to senesce — to grow old. Don't be fooled by the wrinkles, the halting gait and the rheumy gaze. Researchers lately have been astonished to discover that in contrast to nearly every

other animal studied, a turtle's organs do not gradually break down or become less efficient over time.

Dr. Christopher J. Raxworthy, the associate curator of herpetology at the [American Museum of Natural History](#), says the liver, lungs and kidneys of a centenarian turtle are virtually indistinguishable from those of its teenage counterpart, a Ponce de Leon quality that has inspired investigators to begin examining the turtle [genome](#) for novel longevity genes.

“Turtles don't really die of old age,” Dr. Raxworthy said. In fact, if turtles didn't get eaten, crushed by an automobile or fall prey to a disease, he said, they might just live indefinitely.

Turtles have the power to almost stop the ticking of their personal clock. “Their heart isn't necessarily stimulated by nerves, and it doesn't need to beat constantly,” said Dr. George Zug, curator of herpetology at the [Smithsonian Institution](#). “They can turn it on and off essentially at will.”

Turtles resist growing old, and they resist growing up. Dr. Zug and his co-workers recently determined that among some populations of sea turtles, females do not reach sexual maturity until they are in their 40s or 50s, which Dr. Zug proposes could be “a record in the animal kingdom.”

Turtles are also ancient as a family. The noble chelonian

lineage that includes all living turtles and tortoises extends back 230 million years or more, possibly predating other reptiles like snakes and crocodiles, as well as birds, mammals, even the dinosaurs.

The turtle's core morphology has changed little over time, and today's 250 or so living species all display an unmistakable resemblance to the earliest turtle fossils. Yet the clan has evolved a dazzling array of variations on its blockbuster theme, allowing it to colonize every continent save Antarctica and nearly every type of biome nested therein: deserts; rainforests; oceans; rivers; bogs; mountains; New Brunswick, Canada; New Brunswick, N.J.

“Turtles can persist in habitats where little else can survive,” said Dr. J. Whitfield Gibbons, a professor of ecology at the [University of Georgia](#) in Athens.

Troubles Foreseen

The iconic turtle likewise has colonized the human heart. People may despise cats or fear dogs, but practically everybody has a soft spot for turtles. “Turtles are by far the most popular reptile,” said Peter C. H. Pritchard, director of the Chelonian Research Institute in Oviedo, Fla. “Unlike snakes, which may threaten you and which move like a flash, turtles are benign and slow, and you can't dislike or distrust

the clumsy.”

Yet such warm and fuzzy feelings have proved cold comfort for turtles, and herpetologists fear that in humans the stalwart survivors from the Mesozoic era may at last have met their mortician. Turtle habitats are fast disappearing, or are being fragmented and transected by roads on which millions of turtles are crushed each year. “There’s no defense against that predator known as the automobile,” Dr. Gibbons said.

Researchers estimate that at least half of all turtle species are in serious trouble, and that some of them, like the Galapagos tortoise, the North American bog turtle, the Pacific leatherback sea turtle and more than a dozen species in China and Southeast Asia, may effectively go extinct in the next decade if extreme measures are not taken. “People love turtles, people find them endearing, but people take turtles for granted,” Mr. Cover said. “They have no idea how important turtles are to the ecosystems in which they, and we, live.”

Researchers are also impressed by the turtle’s many sensory talents. Box turtles and other forest-dwelling species can spot a lake or pond a mile in the distance, possibly by detecting polarized light glinting off the surface of the water. Female sea turtles migrate across entire oceans every breeding season, unerringly making their way from far-flung feeding grounds right back to the beach where they were born, and

where they are instinctively driven to lay their own eggs.

Instinctive does not mean inflexible, however. Should a weary wayfarer arrive at her natal beach in the dead of night and find it has eroded away, Dr. Pritchard said, she can adapt, swimming down the coast until she locates a suitably sandy nesting site.

Turtles, it seems, are all ears, all the time. Dr. Ray Ashton, who runs the Finca de la Tortuga biological preserve in Archer, Fla., has highly preliminary evidence that some turtle species may communicate subsonically, just as elephants do, transmitting and detecting ultralow frequency sound waves as vibrations in the ground.

In their new book, “Turtles of the World” (Johns Hopkins Press), Franck Bonin, Bernard Devaux and Alain Dupré seek to loft turtles into the limelight by showcasing the group’s diversity — its beauties, its goofies, its gargoyles.

There is the Indian star tortoise, its shell a vivid basket weave of dark and light veins that dance like spattered sunlight as the tortoise crosses the forest floor; and the Matamata turtle of the Amazon basin, with a flattened, ragged head and neck that look like dead leaves and a bumpy shell that mimics an old log — just try to spot that Matamata at the bottom of a stream, awaiting passing prey; and the massive alligator snapping turtle of the south-central United States, which

lures fish right into its open jaw with a red bleb of flesh on the floor of its mouth that jiggles like a chubby worm.

Some turtles have serpentine necks twice the length of their shells; others sport sweet little snorkeling snouts that look like double-barreled cocktail straws; still others have beaks so fiercely hooked their bearers could easily serve, in the authors' words, as "adornment of the upper reaches of Notre Dame."

Among the most common questions leveled at turtle researchers is, What is the difference between a turtle and a tortoise? It depends on where you live, researchers reply. In the United States, any reptile with a shell is referred to as a turtle, and the term tortoise is reserved for those turtle species that have elephantine feet and live entirely on land, like the desert tortoise of the American Southwest. In Australia, by contrast, the word tortoise often applies to aquatic side-necked species — bizarre beasts with necks that cannot be drawn into the shell for protection but instead must be tucked on the side, under the shell's eavelike overhang.

Whatever their group identity badge, turtles vary considerably in size, from the tiny speckled padloper tortoise of South Africa, which in adulthood is no bigger than a computer mouse, to the great leatherback sea turtle, which

can measure seven feet long and weigh 2,000 pounds.

Menu plans vary as well. Many turtles are omnivores, happily consuming fruits, leaves, insects, mollusks, fish, frogs, ice cream. Dr. Gibbons told of a friend whose his pet box turtle would respond to the sound of a spoon being tapped on a glass ice cream bowl by emerging from behind the couch, walking over to its owner, rearing up on its hind legs and waiting to be spoon-fed its just dessert. “Had I not seen this a few times myself,” he said, “I would not have believed it.”

A few turtles have highly specialized palates. Green sea turtles prize the tender tips of sea grass, and will clip away and discard tough, older grass to stimulate the sprouting of fresh buds beneath. Leatherback sea turtles dine only on jellyfish, or what they think are jellyfish. “Plastic bags look like jellyfish,” said Dr. Joseph Mitchell, an ecologist and turtle specialist in Richmond, Va., “and quite a few leatherbacks have stomachs impacted with plastic bags.”

Some turtles, conversely, seek out the world’s detritus. Scavenger turtles that live in the Ganges River devour human remains, making it possible for devout Hindus to deposit their loved ones’ remains in the waters they deem sacred.

An Iconic Feature

Whether they wrest it from sea grass, shellfish or Häagen-

Dads, all turtles need a substantial amount of calcium in their [diet](#), to sustain the structure that marks them as turtles and that remains among the most extraordinary architectural achievements in vertebrate evolution: the shell. A number of invertebrates have shells, of course, and so, too, do a few vertebrates, most notably the armadillo. But whereas the armadillo's shell is built of bony segments slapped down over its muscle tissue and is distinct from the mammal's underlying skeletal frame, in the turtle the skeleton has become the shell.

During embryonic development, the bones of the turtle's rib cage grow straight out, rather than curving toward one another as they do in other vertebrates. Those ribs, spinal vertebrae and other skeletal bones are then fused to form the upper shell, called the carapace, the lower shell, or plastron, and the bony bridges that join upstairs with down. In many turtle species, the bony shell is in turn plated over with tough fingernail-like structures called scutes.

As a result of the osteotic overhaul, not only can a turtle not crawl out of its shell, it has trouble crawling, period. "Its legs stick out at bizarre angles, and the only reason it can walk at all is through sheer strength," Dr. Pritchard said. "The turtle has enormously strong muscles and extremely thick leg bones." A clumsy gait proved a small price to pay, however, for the acquisition of body armor that protects adult turtles

against a panoply of jaws and claws.

Geneticists have proposed that the turtle shell may have appeared quite suddenly in the distant past, rather than emerging slowly through modest, mincing modifications of pre-existing structures. They suggest that the dramatic innovation could have arisen from just a few key mutations in master genes like the so-called homeobox genes, which help specify an animal's basic body plan. If the shell did burst on the reptilian stage more or less fully formed, they said, that would explain the lack of "intermediary" fossils or prototurtles in the paleontological record.

The shell very likely helps explain the turtle's elongated storyline. It takes time to consolidate a large, thick shell, but upon reaching adult stature, the turtle is close to invulnerable. At that point, it can compensate for its Darwinically unproductive youth with a very prolonged and zealously fecund adulthood. A female turtle will continue laying eggs until she dies, and a male turtle will just as mulishly pursue her.

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Though Sturdy Survivors, Turtles Prove to Be Ill Equipped for Human Threat

By [NATALIE ANGIER](#)

Turtles are an ancient and pan-planetary clan, found in nearly every habitat at hand — including hostile locales like bogs and deserts that few other animals will set foot in. Paradoxically, however, scientists say that the turtle's broad reach has only increased its vulnerability to human activities, and today at least half of the world's 250 turtle species are considered endangered or threatened.

In crossing oceans and homing in on their birth beaches, for example, sea turtles encounter a bristling ordnance of threats: marine pollution from pesticide runoff; oil spills; the increasing popularity of international waters as free-for-all trash cans; nesting sites lost to Club Meds; artificial lighting that confuses newly hatched turtles, prompting them to run inland to their certain death rather than seaward; and shrimp trawlers and commercial fishing nets in which turtles become fatally entangled.

“There are some bright spots here and there, where nesting populations are increasing in numbers,” said Dr. Karen A. Bjorndal, director of the Archie Carr Center for Sea Turtle

Research at the [University of Florida](#) in Gainesville. “But if you catch me on a bad day, I have to say that for many species of turtle the outlook is pretty bleak.”

Nevertheless, she and other turtle conservationists are lobbying for legislation to protect wild turtle populations and their habitats, emphasizing the critical role that turtles play in the health and fecundity of the many ecosystems through which they lumber.

By periodically clipping back beds of sea grass to foster the growth of tasty new grass buds, for example, green sea turtles help keep the beds tidy, lush and productive, a fit neighborhood for fish, sponges, corals and other desirable residents. Without nature’s lawn service, Dr. Bjorndal said, “you end up with marine ecosystems turned into microbial stews.”

While plastic has replaced the flexible shells of species like the hawksbill in the manufacture of “tortoiseshell” goods, turtles face other, greater pressures from multiple directions. Turtle meat is a prized delicacy in China and Southeast Asia, among other places, and turtle eggs and turtle organs are likewise valued for their presumed medicinal or aphrodisiacal properties. As a result, say conservationists, turtles everywhere are being harvested to supply the fast-growing Asian market.

Jack Cover of Baltimore's National Aquarium lamented that in Maryland, where the indigenous diamondback terrapin serves as the state reptile and the mascot for the [University of Maryland](#) teams (their slogan: Fear the Turtle), diamondbacks nonetheless are still being hunted and shipped east. "What kind of state sanctions the eating of its own reptile?" he asked.

People sanction the eating of turtles indirectly as well. Among the biggest threats to many North American turtles are animals like raccoons, crows, skunks and foxes — tireless omnivores that thrive in and around human habitations. "We call them subsidized predators," said Dr. Joseph Mitchell, an ecologist in Richmond, Va. "People have generated food and shelter and trash cans for them, so they've done quite well."

The increase in predators has hurt turtles particularly hard. "Crows will clean all the newly laid eggs out of a nest cavity even before the turtle has a chance to cover them up," he said.

And then there is our incidental, super-size predator, the automobile. In a recent study of a two-mile strip of highway built between two lakes in Tallahassee, Fla., researchers determined that 2,000 to 4,000 aquatic turtles were being crushed to death on the road each year, a disproportionate number of them females with eggs.

Conservationists said solutions could be found for many of the threats turtles face. Some propose that the market for turtle meat could be met through turtle farming, combined with stiff penalties for the hunting of wild turtles. The commercial fishing industry could reduce incidental turtle deaths significantly, conservationists said, by installing special trap doors.

Scientists have also shown that roads can be made much safer with the addition of fencing that diverts would-be migrants to drainage culverts — dips in the highway that were designed to facilitate water runoff but that work well as miniature walkways. With that kind of help, the turtle, slow and steady, can still win the race every time.