Learning from lizards

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The speedy lizard was streaking across the tabletop when suddenly one foot hit a slippery spot.

The reptile skidded but never broke stride, making a split-second adjustment as it darted onward. Not that you could tell just by looking.

The true essence of the animal's grace became apparent only afterward, when its movements, recorded with Hollywood-style motion-capture technology, were played back in slow motion.

This is the lab of Tonia Hsieh, a Temple University biologist who studies life on the move.

The cockroach, scampering upside down on a ceiling. The elderly human, struggling to navigate a patch of ice. The pale-hued ghost crab, able to dance across the sand on pointy legs without sinking. Whether a creature has eight legs or zero, Hsieh wants to know how it gets around.

An assistant professor at Temple since 2010, she seems driven by the passion for knowledge for its own sake, describing quirky aspects of animal biology with such phrases as "utterly unbelievable!" or "the weirdest thing ever!"

Her work has had practical implications as well, in such diverse fields as robotics and adhesives. The latter occurred while she was just an undergraduate at the University of California, Berkeley, where Hsieh played a key role in figuring out how the gecko sticks to a wall. Those

findings earned her and colleagues a paper in the prestigious journal Nature, in 2000, and now numerous efforts are under way to commercialize gecko-inspired adhesives.

At Temple, the goal of the lizard study is to use the animals as a model for humans, to figure out better ways to prevent falls among the aged.

Why lizards? That's because Hsieh and postdoctoral fellow Kyle Mara are using two species - the frilled dragon and the brown basilisk - that share an unusual characteristic with humans: the ability to run on two legs.

If the scientists can figure out how these lizards remain upright on varied terrain, they hope some of the lessons can be used to guide human therapy or treatment.

The basilisk, meanwhile, has an added ambulatory skill that is of no use to the study. But Hsieh, whose passion for crawling critters began when she was a toddler, can't resist pointing it out. The lizard is able to run on water, and thus is sometimes called the Jesus lizard.

"They're absolutely fabulous!" she said.

According to family lore, Hsieh started scooping up bugs while still in diapers. Her fascination was such that her parents eventually bought her an insect field guide, which she insisted that they read to her at bedtime.

Her parents, who were born in mainland China and grew up in Taiwan, both had a technical background, in computers. But insects were another story.

Though supportive, Hsieh's mother was somewhat alarmed by the growing collection of six-legged creatures. By the time Hsieh was 4, she

was limited to the number of bug jars that would fit on one table.

Her parents sought to expose her to other pursuits with mixed success. A few years later, while attending a program that taught calligraphy and other elements of traditional Chinese culture, Hsieh caused a stir when she was found to have lizards in her desk.

And, naturally, a colony of mealworms to feed them.

No surprise, then, that she went on to study biology at Berkeley, where professor Robert Full calls her "one of the best undergraduates I've had in 25 years." That was followed by a Ph.D. at Harvard, among other accomplishments.

Now in charge of her own lab at Temple, Hsieh oversees researchers who study the biomechanics of a veritable menagerie of species: cockroaches, crabs, lizards, and an unusual hopping fish called the Pacific leaping blenny.

The situation is ideal for someone whose relentless curiosity exceeds the amount of time she could devote to her passion on her own.

"It's perfect for someone with science ADD," Hsieh joked. "I actually have to limit myself. I have to periodically rein myself back."

Some of the research involves sophisticated equipment.

For the lizard study, she and Mara stick tiny dots of reflective tape on each reptile's limbs and torso, then film them with cameras that record an eye-popping 500 frames per second.

The lizards run on a tabletop covered with sandpaper except for one slippery spot in the middle: a square of poster board covered with

contact paper.

In the lab recently, the scientists filmed one of the frilled dragons in action and played it back at slow speed on a computer screen, the reptile's movements reduced to a series of colored dots on a gray background.

At the moment the sprinting animal stepped on the contact paper, its left foot slid to the side, and its upper body twisted in the opposite direction. It barely seemed to lose its balance.

Could some clue in those colored dots be used to improve stability in older adults?

The work is still ongoing, but early indications are that tendons in the lizards' feet play a key role in balance, acting as springs that counteract small changes in the surface. It's a valuable first line of defense that kicks in even before the brain has time to react, Hsieh said.

"It's kind of acting like a damper, like shock absorbers in cars," she said.

Except when it doesn't. In the elderly, tendons become stiffer and less elastic - one reason, perhaps, that they are more prone to taking a spill.

In 2008, nearly 20,000 older adults died from injuries sustained in falls, according to the Centers for Disease Control and Prevention.

If Mara and Hsieh can figure out what factors are most important in keeping the lizards upright, perhaps someone can devise strategies to enhance those factors in people.

W. Geoffrey Wright, an assistant professor in the department of physical therapy at Temple, thinks the idea holds promise. After visiting Hsieh's

lab recently, he speculated that the work might suggest the development of prosthetic devices to aid balance.

"I think this is a great first step," said Wright, who studies balance in human subjects, including patients with Parkinson's disease.

The lizards' two-legged gait is not exactly human. Their legs are splayed out to the side a bit, and they have tails, among other differences. But the creatures are small and easy to use for repeated experiments.

Plus by studying brown basilisks, the scientists are helping the environment, albeit in a small way. The research lizards are captured in Florida, where they are an invasive species.

Unlike the basilisk of mythology and Harry Potter fame, they don't possess the ability to kill with a glance, no more than the frilled dragon can breathe fire.

But for a certain biologist with insatiable curiosity, these upright-running lizards are pretty fabulous all on their own.

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