LIFE & EVOLUTION

Physics explains mosquitoes' stealth

Wings do the heavy lifting during bugs' undetectable takeoffs

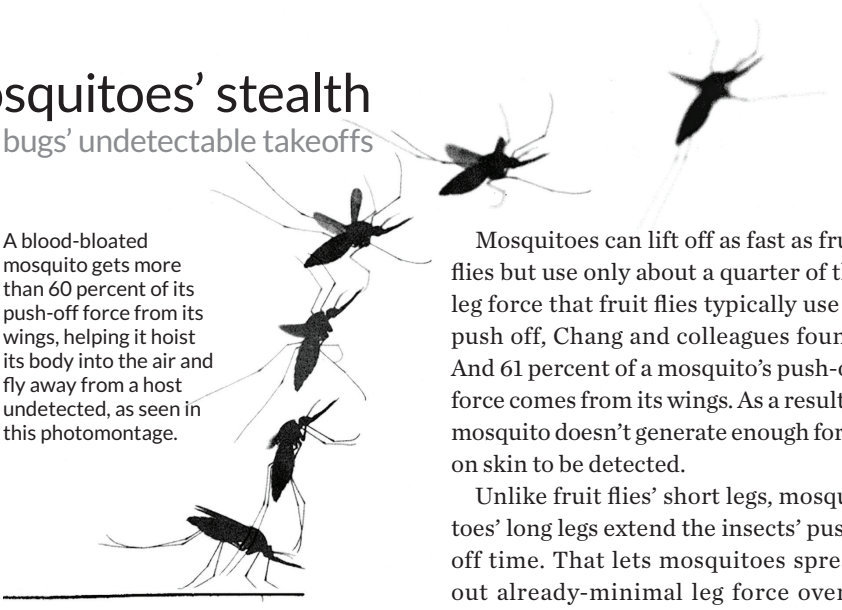
BY MARIAH QUINTANILLA

Discovering an itchy skin welt often means you've been duped by one of Earth's sneakiest animals: the mosquito.

Scientists have puzzled over how the insects, often laden with two or three times their weight in blood, flee undetected. At least one species, *Anopheles coluzzii*, does so by relying more on lift from its wings than push from its legs to generate the force needed to take off from a host's skin, researchers report in the Oct. 15 *Journal of Experimental Biology*.

The insect's undetectable departure, which may help it avoid being smacked by an annoyed host, may be part of the reason *A. coluzzii* so effectively spreads malaria.

The new study provides "fascinating insight into life immediately after the bite, as the bloodsuckers make their escape," says Richard Bomphrey, a biomechanist at the Royal Veterinary College of the University of London.



A blood-bloated mosquito gets more than 60 percent of its push-off force from its wings, helping it hoist its body into the air and fly away from a host undetected, as seen in this photomontage.

To capture mosquito departures, Sofia Chang of the Animal Flight Laboratory at the University of California, Berkeley and colleagues set up a flight arena. Using high-speed video cameras, the team created computer reconstructions of mosquito takeoff mechanisms to compare with those of fruit flies.

Mosquitoes can lift off as fast as fruit flies but use only about a quarter of the leg force that fruit flies typically use to push off, Chang and colleagues found. And 61 percent of a mosquito's push-off force comes from its wings. As a result, a mosquito doesn't generate enough force on skin to be detected.

Unlike fruit flies' short legs, mosquitoes' long legs extend the insects' push-off time. That lets mosquitoes spread out already-minimal leg force over a longer time frame to reach similar takeoff speeds as fruit flies, the researchers found. This slow-and-steady mechanism is the same regardless of whether the bloodsuckers sense danger or are leaving of their own accord, and whether they are full of blood or have yet to get a meal.

Chang next wants to determine whether mosquitoes land as gently as they depart. ■

MATH & TECHNOLOGY

Computer learns game with no help

AlphaGo devises strategies unknown to human players

BY MARIA TEMMING

AlphaGo just leveled up.

The latest version of the computer program, dubbed AlphaGo Zero, is the first to master Go, a complex Chinese board game, without human guidance. Its predecessor, AlphaGo Lee, was the first computer program with artificial intelligence, or AI, to defeat a human world Go champion. AlphaGo Lee had to study millions of examples of human expert moves before playing practice games against itself. AlphaGo Zero trained solely through self play, starting with random moves. After a few days' practice, AlphaGo Zero trounced AlphaGo Lee 100 games to none, researchers report in the Oct. 19 *Nature*.

"The results are stunning," says computer scientist Jonathan Schaeffer of the University of Alberta in Edmonton, Canada. "We're talking about a revolutionary change."

AI programs that gain mastery of a task without human input may be able to solve problems where humans fall short, says Satinder Singh, a computer scientist at the University of Michigan in Ann Arbor. Such programs could find cures for diseases, design more energy-efficient technology or invent new materials.

AlphaGo Zero's creators at Google DeepMind let the program use a tactic during practice games that AlphaGo Lee didn't have access to. For each turn, AlphaGo Zero drew on its past experience to predict the most likely ways the rest of the game could play out, judge which player would win in each scenario and choose its move accordingly.

AlphaGo Lee used this kind of forethought in matches against other players, but not during practice games. AlphaGo Zero's ability to imagine and assess possible futures during training "allowed it to train faster, but also become a better player in the end," says Singh, who wrote a commentary in *Nature* about the study.

AlphaGo Zero played 4.9 million practice games over three days before defeating AlphaGo Lee. AlphaGo Lee's training period took months (*SN: 12/24/16, p. 28*). While practicing, AlphaGo Zero not only discovered many of the Go strategies that humans have come up with over thousands of years, but also devised new game plans previously unknown to humans.

Despite its Go-playing prowess, AlphaGo Zero is still "an idiot savant" that can't do anything except play Go, says Schaeffer. If AI programs are going to make superhuman contributions to engineering or medicine, they'll have to be more general-purpose problem solvers. ■

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