Zoltan Takacs

Herpetologist/Toxinologist | Emerging Explorer

The same snake that can kill you … can cure you. Just ask Zoltan Takacs. He's chased venomous snakes through the world's most remote jungles, deserts, and oceans since he was a teenager. His daring adventures unfold like the plot of an action movie, but his goal is pure science.

Photograph courtesy Zoltan Takacs

"Animal venoms," Takacs explains, "are the source of over a dozen medications, including drugs to treat high blood pressure, heart attack, diabetes, and chronic pain. Our team at the University of Chicago has made a breakthrough that could push this number further, faster; a technology to identify toxins on which medicines can be based to fight a whole range of diseases."

To understand the breakthrough that can save lives, consider how venom ends lives. Since the purpose of venom is to immobilize and kill as quickly as possible, it aims at vital targets in the body with extreme precision—the communication between nerve and muscle cells and the circulatory system. Toxin-target contact results in death from respiratory paralysis or shock. If this contact is disrupted, the toxin has no effect.

For example, when the same venom is injected into the snake that produces it, nothing happens. Takacs's team discovered why, by comparing the targets of toxins (receptors) on muscle cells in cobras with receptors in humans and other mammals.

In Their Words

> Animal toxins evolved to be perfect killers, but they can also be lifesaving drugs. We've discovered a novel way to generate and screen a vast array of toxins in numbers and speed unheard of before.
>
> —*Zoltan Takacs*

Spotlight

Zoltan Takacs, Snake Hunter

Zoltan Takacs was fascinated with snakes as a boy in Hungary and still is. An expert in toxins, he's traveled to more than a hundred countries and caught thousands of reptiles, collecting their venom for screening to see if it can be turned into a lifesaving drug.

Audio

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Zoltan Takacs 00:11:00 INFO »

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Cobra receptors have a unique sugar molecule that acts as an umbrella, blocking the toxin from binding to the receptor. Remove that molecule and the cobra becomes toxin-sensitive. Add it to a mouse, and the mouse becomes toxin-resistant. In fact, other than snakes, the only animal in the world with that same sugar molecule sitting on that same receptor is the mongoose, which also happens to be the one of the very few animals a cobra can't kill.

The ability to act on vital targets with that degree of precision makes toxins an ideal model on which new drugs could be designed. But isolating a specific toxin to fight a specific disease is an extremely tedious, multiyear process, largely due to the small number of toxins that can be isolated from any given venom—until now.

Takacs and colleagues have developed a state-of-the-art technology allowing the creation of "toxin libraries" containing up to millions of toxin variants.

"By screening the variants," he describes, "you can determine which one will specifically act on the vital target that determines the outcome of a disease. That knowledge is a powerful tool in converting a toxin into a drug. It's like finding the one key that opens a lock. Our technology lets you make millions of different keys, try them all at once, and isolate the single one that fits. Problems with side effects occur because drugs are acting on more than one target. With our method, your key will open one lock, but not any others."

Takacs predicts the technology will provide a novel way to develop new toxin-based drugs for various diseases, everything from cancer to circulatory disorders. "The particular toxin we're working with now looks promising for autoimmune diseases like multiple sclerosis, arthritis, and diabetes."

Analyzing venom may confine Takacs to a lab, but collecting it takes him to the far corners of the world. "Since I need venom and DNA samples from snakes, their prey, and predators, my work requires unconventional travel strategies and ventures into unfamiliar territories—things I absolutely love."

Takacs usually travels solo with only a backpack, camera bag, and a tissue-collecting kit, often piloting small planes or riding camels to reach remote destinations. His quest for venomous creatures has taken him to 133 countries and expeditions are never uneventful.

One of his first, as a teen, landed him in a Bulgarian military jail near the Greek border (Bulgaria's socialist regime thought he was defecting, not collecting). He has used military escort against pirates while diving for sea snakes in the Philippines; dodged stampeding elephants in the jungles of Congo; survived seven snake bites; endured a dose of deadly venom spewed in his face by a spitting cobra in East Africa, and been rescued by helicopter from civil war in Laos. "Most of this is fun as long as you remain in control," he says.

Fascinated with nature from a young age, Takacs captured and bred snakes in his room as a boy (and fortunately recaptured one viper that escaped to his parents' bedroom for a few days). Studying pharmacology in Hungary, earning a Ph.D. from Columbia University in New York, research, and teaching have all only intensified his passion for the natural world.

"For me, losing biodiversity means losing beauty and a wealth of knowledge and resources, including possibilities for treating diseases," he says. "It's like peeling out pages from a book we've never read, then burning them. Snakes are not charismatic animals to most people. But if you find yourself in the hospital facing a heart attack, even if you're not a snake fan, your life will most likely be saved with a drug from viper venom. If that snake had gone extinct, that drug wouldn't exist. Once we've erased something that evolved over millions of years, there's no way back."

Videos

Zoltan Takacs, Herpetologist and Toxinologist

A snake bite in his youth cannot discourage Zoltan Takacs from pursuing dangerous vipers.

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