

Edward Taylor, spy and herpetologist, in 1912.

# THE SPY WHO LOVED FROGS

*To track the fate of threatened species, a young scientist must follow the jungle path of a herpetologist who led a secret double life.*

**B**efore leaving for the Philippines as an undergraduate in 1992, Rafe Brown scoured his supervisor's bookshelf to learn as much as he could about the creatures he might encounter. He flipped through a photocopy of a 1922 monograph by the prolific herpetologist Edward Taylor, and became mesmerized by a particular lizard, *Ptychozoon intermedium*, the Philippine parachute gecko. With marbled skin, webs between its toes and aerodynamic flaps along its body that allow it to glide down from the treetops, it was just about the strangest animal that Brown had ever seen.

Brown learned that Taylor had collected the first known example, or type specimen, near the town of Bunawan in 1912, and had deposited it at the Philippine Bureau of Science in

BY BRENDAN BORRELL

Manila. But the specimen had been destroyed along with the building during the Second World War, and the species had never been documented again in that part of the country. "What are the chances I'm going to see one of the rarest geckos in the world?" he wondered.

He was driven by more than curiosity. Given the rampant deforestation in that part of the Philippines, he wanted to determine whether the species still existed there and if so, how similar it was to geckos collected in other areas. He wanted to see, in other words, whether Taylor's 70-year-old taxonomic decisions were still valid.

On their first night in the field, Brown and his colleagues drove to the edge of the forest and caught two red eyes in the beam of a

headlamp. It was a *Ptychozoon*. Back at their hotel, Brown photographed the gecko, took tissue samples for DNA sequencing, and carefully prepped it and stuck it in a jar. It became the neotype to replace Taylor's lost specimen, and in 1997, Brown published a new description of the species<sup>1</sup>. It marked the start of an obsession.

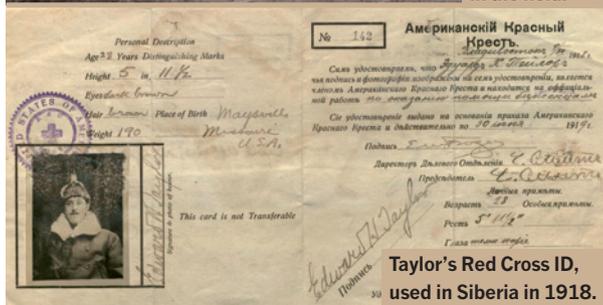
As Brown made his career studying biodiversity in the Philippines over the next two decades, he could not escape Taylor's long shadow. The elder herpetologist had logged 23 years in the field over his lifetime, collecting more than 75,000 specimens around the world, and naming hundreds of new species.

There is a darker side to Taylor's legacy, however. He was a racist curmudgeon beset by paranoia — possibly a result of his mysterious

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Edward Taylor in the field.



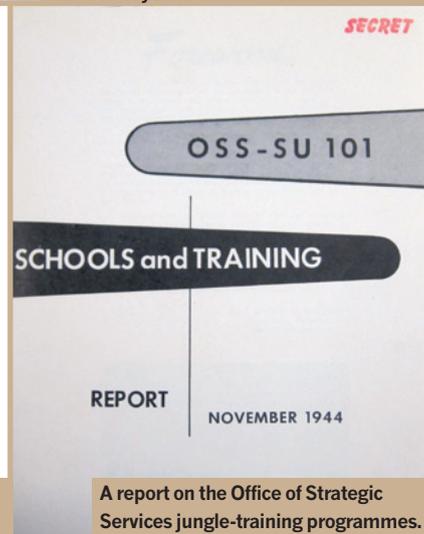
Taylor's Red Cross ID, used in Siberia in 1918.



The Philippine Bureau of Science in Manila was destroyed in the Second World War.



The Philippine parachute gecko.



A report on the Office of Strategic Services jungle-training programmes.

double life as a spy for the US government. He had amassed no shortage of enemies by the time he died in 1978. An obituary noted that he was, to many, “a veritable ogre—and woe to anyone who incurred his wrath”<sup>2</sup>. More damaging, perhaps, were the attacks on his scientific reputation. After the loss of his collection in the Philippines, many of the species he had named were declared invalid or duplicates. The standards of taxonomy had advanced beyond Taylor’s quaint descriptions, and without the specimens to refer to, his evidence seemed flimsy.

Nevertheless, Brown felt a connection with his maligned predecessor. It was a bond that intensified when, in 2005, Brown became curator of herpetology at the University of Kansas Natural History Museum in Lawrence, the same institution at which Taylor had spent much of his career. Over the years, Brown has rebuilt some of Taylor’s collection and resurrected many of his species. Now, as he finishes a major monograph on a group of Philippine frogs, he is more convinced than ever: “Taylor was right.”

Brown’s reassessment could prove crucial. Since Taylor’s time, taxonomy has become more than just a naming exercise. Designating a group of organisms as a new species, or lumping it in with an old one, can affect the

animals’ legal protection and influence the allocation of scarce conservation resources. Amphibian declines, in particular, have made headlines around the world, and the Philippines ranks second only to Sri Lanka for sheer proportions of imperilled species: 79% of Philippine amphibians are found nowhere else on Earth, and 46% are under threat of extinction. But following Taylor’s trail has given Brown

**“HE WAS A VERITABLE OGRE — AND WOE TO ANYONE WHO INCURRED HIS WRATH.”**

cause for optimism. “A lot of the things people thought were extinct,” he says, “if you go right where Taylor said to go, you can find them.”

**A LUST FOR ADVENTURE**

On the fourth floor of the Kansas museum, Brown is walking through the herpetological collections. Lizards float upside down in yellow-tinged alcohol. Snakes coil like corkscrews,

and two dozen tiny, dark frogs embrace in a specimen jar. On one shelf, the jars have red ribbons tied around their lids to signify that their contents are type specimens: the standards on which species descriptions are based.

When scientists disagree on whether something is a new species or a variant of a known one, they often need to refer back to the type specimen or even return to where it was collected. Brown opens a jar and extracts a small lizard that has a tin tag tied to its waist with twine. It is one of Taylor’s originals, on loan from the California Academy of Sciences in San Francisco. “Preserved properly, well labelled and deposited in a safe institution,” says Brown, “these will last forever.”

That is the kind of legacy to which every taxonomist aspires, and Taylor was no exception. Born in Maysville, Missouri, on 23 April 1889, he was still a teenager when he began depositing specimens at this museum. At 23, he joined the civil service and became what he called “a one-man Peace Corps” in the Philippines — then a US territory — setting up a school for members of a headhunting tribe in central Mindanao, where he collected the parachute gecko among other species. Next, he worked for the fisheries department in Manila and then completed his PhD on Philippine

mammals, but his true passion was always herpetology. It came at the expense of just about everything else in his life. “I named about 500 species,” he would later tell a reporter, “but I can’t always remember the names of my own children.” His wife, Hazel, could not bear his long absences, and they divorced in 1925.

By then, Taylor had described more species than most of his peers could achieve in a lifetime: 42 amphibians, 40 lizards and 30 snakes. He sold some of his specimens to museums in the United States, but many remained at the Bureau of Science in Manila, where he thought they would be secure forever. He joined the faculty at Kansas in 1926, and over the next two decades he wandered the globe from Mexico and Costa Rica to parts of Africa, lugging a folding army cot and subsisting on rice and evaporated milk as he collected specimens.

In his 60s, however, Taylor found himself under attack. In 1954, Robert Inger, a herpetologist at the Field Museum in Chicago, Illinois, published a withering taxonomic review of Philippine amphibians<sup>3</sup>. Inger, who studied only specimens in museums, axed 44 of the 87 species that Taylor had personally named or approved. “The differences between Taylor’s frogs will be recognized as the differences to be expected between individuals,” Inger wrote. In other words, Taylor was a hack. On his personal copy of Inger’s text, Taylor scribbled the word, “Hooley.”

More recently, herpetologists have levelled other serious allegations against Taylor’s character. In 1993, the Kansas Herpetological Society posthumously published his 1916 master’s thesis on Kansas reptiles. In a foreword, one of his former students, Hobart Smith, revealed that Taylor had plagiarized large sections from the nineteenth-century palaeontologist and herpetologist Edward Drinker Cope. For those who knew Taylor as a man of principle, it was a devastating revelation, but it also explained why Taylor had never tried to publish the work himself. Then, in 2002, herpetologist Jay Savage at the University of Miami in Coral Gables, Florida, charged that Taylor had secretly copied the field notes of a rival in order to scoop him on his next collecting trip to Costa Rica<sup>4</sup>.

Taylor had other demons. He had voiced support for eugenics programmes and reportedly refused to take on Jewish students. Brown makes no apologies for the man, but Taylor’s reputation — for good or ill — is intertwined with the history of the Kansas museum. “In the end, we consider him our own,” says Brown.

#### A LEGACY REVISITED

Brown’s interest in Taylor grew when he was a graduate student at the University of Texas at Austin in the late 1990s. He devoured Taylor’s monographs to plan his own collecting. He hunted through museum records to find out where Taylor’s specimens were, and made

visits to see them at the Field Museum and the California academy. But time and time again, he came to a dead end when he wanted information on type specimens that Taylor had deposited at the Philippine Bureau of Science.

He soon learned the tragic story of that institution: in February 1945, when US General Douglas MacArthur launched an all-out attack on Manila to expel the Japanese occupiers, the Bureau of Science was reduced to rubble, and all of its botanical and zoological specimens were destroyed, including 32 of Taylor’s type specimens. “The loss is an irreplaceable one,” Taylor’s friend Elmer Merrill, a legendary botanist, wrote in *Science*<sup>5</sup>. Plant specimens were gradually replenished, but no one had systematically tried to replicate Taylor’s efforts. For many years, hostile tribes kept most interlopers away from species-rich regions. In the 1990s, threats of terrorism made it difficult to access places such as the Sulu Archipelago, where Taylor collected types for a dozen species. Despite the danger, Brown resolved to retrace Taylor’s steps.

In July 1998, he hired a boy to guide his team through the mountains of northern Luzon Island. It was the same place where Taylor had been ambushed by a machete-wielding native in a loincloth. While Brown tromped through streams on his quest, a rumour spread through a town below that Westerners had

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kidnapped the boy. A dozen locals took up torches, canes and machetes and marched to the home of the village chief on their way to find the kidnappers. When Brown returned, he diffused the situation by producing sacks of amphibians — his only captives. Taylor, when ambushed, had produced a rifle.

During the 1998 trip, Brown and his collaborators found 5 species of reptiles and amphibians not seen for many decades; 13 potentially new to science; and 30 never before reported from the region<sup>6</sup>. One night, Brown caught several *Platymantis* frogs making an insect-like chirp high in the trees. They turned out to be from a species that Taylor had caught and named *rivularis* in 1920. The type specimen still existed, but it was bleached of colour and in pretty bad shape, and there were not many other examples to examine. Accordingly, Inger had lumped *rivularis* in with another species, *hazela* (named after Taylor’s wife). But after hearing its mating calls and seeing its colours in life, Brown decided he would resurrect *P. rivularis* as its own species. Inger, says Brown, favoured more inclusive groupings and was draconian in his decisions. “If he had any doubt, he would sink a species.”

Over the past two decades, Brown and his close collaborator Arvin Diesmos, a herpetologist at the National Museum of the Philippines in Manila, have collected more than 15,000 Philippine specimens — about one-fifth of Taylor’s lifetime haul. To establish evolutionary relationships, Brown also collects DNA, which cannot be extracted from Taylor’s formaldehyde-preserved specimens, and he records frog mating calls, a key tool for identifying species. By the time he has finished his own review of the Philippine *Platymantis* frogs, which has been in the works since 2003, he expects to have doubled the number of species from 30 to 60, resurrecting many of Taylor’s names.

#### CROAK AND DAGGER

Brown’s fascination with Taylor has gone beyond taxonomy. Early in his research, he became intrigued by “herpetology gossip” about Taylor’s extracurricular activities. As he trotted around the globe, Taylor seemed to be conducting field work in conflict zones and, in his memoirs, he alluded to duties outside science<sup>7</sup>. While working for the fisheries department in Manila, he helped to investigate the murder of an Englishman, traded tips with the Swedish secret service and scouted for mercury that could be used in munitions during the First World War. On his river journeys,

he occasionally noticed Japanese people, and warned the local governor that they were “spying out of the land”.

It was never clear to Taylor’s few confidantes whether he used wars as an excuse to get into the field, or vice versa. In his obituary,

a former student suggested that Taylor’s later activities during the Second World War “probably will never be known in detail”<sup>2</sup>.

But the true nature of Taylor’s work is finally coming into focus as intelligence records are declassified and research materials surface. They reveal that Taylor was indeed a spy, and that he continued to do intelligence work after the First World War, when he was sent to Siberia. His official purpose was to join the Red Cross to stop a typhus epidemic, but he was also gathering information on the Communist revolt in Russia and, later, the fate of grand duchess Anastasia, daughter of murdered tsar Nicholas II.

Taylor was called to duty again in 1944, when he was 54 and war raged in the Pacific. According to records in the US National Archives, he joined the Office of Strategic Services (OSS), a precursor to the Central Intelligence Agency (CIA), to train agents in Sri Lanka — then a British territory that provided ready access to Myanmar, Malaysia, Indonesia and other areas that the Japanese had infiltrated. Scientific work, an OSS officer explained to one of Taylor’s superiors, was “excellent cover”.

Taylor taught jungle survival at Camp Y, a steamy settlement on the coast. With a penetrating stare and a lantern jaw, he seemed more imposing than his 1.8 metres. In his spare time, he occasionally dodged gunfire to nab specimens, which he studied for two monographs published after the war. “Have just described five new forms of blind snakes from the island,” he wrote to S. Dillon Ripley, a young ornithologist who served with him and would later lead the Smithsonian Institution in Washington DC. In a later letter, he offered “some 500 species” of mollusc shells to the Smithsonian.

After the war, Taylor helped the British in Malaysia to investigate Japanese war crimes against civilians. His work documenting rape, torture and murder may have contributed to his antipathy towards the Japanese people. Never an easy-going person, his experiences at war seem to have wounded him. He failed in a bid to become head of the Kansas museum, and grew increasingly paranoid in daily life. He studied Russian and made inquiries about working for the CIA. Smith, who died in March this year, told *Nature* that Taylor sprinkled flour on the floor of his office to detect trespassers during his absences. “I was wary of him,” said Smith. William Duellman, a herpetologist at the University of Kansas who first met Taylor in 1951, thinks that Taylor’s symptoms could today meet the standards of post-traumatic stress disorder. Nevertheless, Taylor kept working. In his later years, he studied a group of poorly known, legless amphibians called caecilians. He published a sprawling, 800-page taxonomic review<sup>8</sup> of them in 1968.

### ON THE BRINK

Taylor’s herpetological legacy in the Philippines has taken on new importance now that the country has lost more than 95% of its native forest. Species collectors such as Brown know that their work has conservation implications, but there are often differences between scientific studies and conservation classifications. In the late 1990s, for example, the International Union for Conservation of Nature (IUCN) labelled the Polillo Island frog — *Platymantis polillensis*, first described by Taylor — as critically endangered. All but 4 square kilometres of Polillo’s forests had been razed for coconut plantations.

But in 2004, Brown was listening to his recordings when he noticed that the Polillo frog had a mating call similar to that of a frog that he had collected on Luzon. Brown applied for permission to get genetic samples from Taylor’s original collecting site, and confirmed his hunch: the frog is widespread. Last year, he reported<sup>9</sup> that seven frog species once considered vulnerable or endangered by the IUCN are actually widespread on Luzon.

The challenge for taxonomists is that although many agree that global biodiversity



Rafe Brown holds a specimen of an adult snake, collected by Edward Taylor in the 1920s.

is in crisis, threat levels are hard to gauge accurately because advocates for every taxon and ecosystem are clamouring for attention and real data are scarce. “Global threat assessments for large taxonomic groups is a very inexact science,” says Walter Jetz, an ecologist at Yale University in New Haven, Connecticut. “We need more boots on the ground.”

Brown is sceptical about conservation assessments in general, but one threat to Philippine amphibians does concern him: the chytrid fungus *Batrachochytrium dendrobatidis*, which has been linked to the decline or extinction of hundreds of amphibian species around the world (see *Nature* 465, 680–681; 2010). In 2009, Brown identified the fungus on five species in the Philippines, and it has since been found on more. The chytrid threat, he says, combined with habitat destruction and climate change, could push Philippine amphibians over the edge.

Time is running out to document the biodiversity of the Philippines, but also to determine Taylor’s place in history. Brown has found that Taylor’s species descriptions, although brief, often zeroed in on the precise trait that set one group apart from its relatives. “He had a sharp eye,” says Brown. More than a dozen species whose names were erased by Inger and others have proved to be valid after all.

Inger, who is 93, is impressed by the emerging evidence and the way that Brown has approached the subject. “I think he’s probably right,” he says, but adds, “I’m still a little uneasy about over-fragmentation.”

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For a podcast and slideshow about Taylor and Brown, see: [go.nature.com/hnform](http://go.nature.com/hnform)

Back at the University of Kansas, Brown takes a seat inside an archival library and dips once more into some of Taylor’s work, including the battered leather books that the man used for his field notes and specimen catalogues. Paging through one of those catalogues for the first time, Brown is stunned to find that Taylor had crossed out the name attached to an Asian spadefoot toad that he caught on Mindoro Island — a strange, gangly creature that crawls rather than hops. Next to it, Taylor had written, “new sp!!”. As recently as 2009, Brown had designated it as a new species, *Leptobrachium mangyanorum*, because it was so different from previously described relatives<sup>10</sup>.

“Ed was way ahead of us,” says Brown. “Why he never named it, we’ll never know. But it’s pretty satisfying to come along 90 to 100 years later and arrive at the same conclusion.” ■

**Brendan Borrell** is a biologist-turned-journalist based in New York. He contributed to a 2007 review paper on gliding animals, which also included work by Brown.

1. Brown, R. M., Ferner, J. W. & Diesmos, A. C. *Herpetologica* **53**, 357–373 (1997).
2. Webb, R. G. *Herpetologica* **34**, 422–425 (1978).
3. Inger, R. F. *Fieldiana Zool.* **33**, 183–531 (1954).
4. Savage, J. M. *The Amphibians and Reptiles of Costa Rica* (Univ. Chicago Press, 2002).
5. Merrill, E. D. *Science* **101**, 401 (1945).
6. Diesmos, A. C., Brown, R. M. & Gee, G. V. A. *Sylvatrop* **13**, 63–80 (2003).
7. Taylor, E. H., Leonard, A. B., Smith, H. M. & Pisani, G. R. *Monogr. Mus. Nat. Hist. Univ. Kansas* **4**, 1–160 (1975).
8. Taylor, E. H. *The Caecilians of the World* (Univ. Kansas Press, 1968).
9. Brown, R. M. et al. *Check List* **8**, 469–490 (2012).
10. Brown, R. M., Siler, C. D., Diesmos, A. C. & Alcalá, A. C. *Herpetol. Monogr.* **23**, 1–44 (2009).