Oh, the Species You'll Find

The text is provided courtesy of the American Museum of Natural History.

Scientists have identified more than a million and a half species of plants, animals, fungi, and microbes on the planet, but that's just the beginning. The vast majority of species have yet to be discovered, named, and categorized. According to recently published estimates, there are more than 7 million species we have yet to identify.

Thousands of those species are being described each year, from single-celled organisms found in pools of volcanic sulfur (or your own stomach) to deep-sea organisms and larger animals like primates and birds. Expeditions are one of the primary ways to find animals not yet known to science, so researchers regularly head out to far-flung corners of the globe for a chance to spot new species.

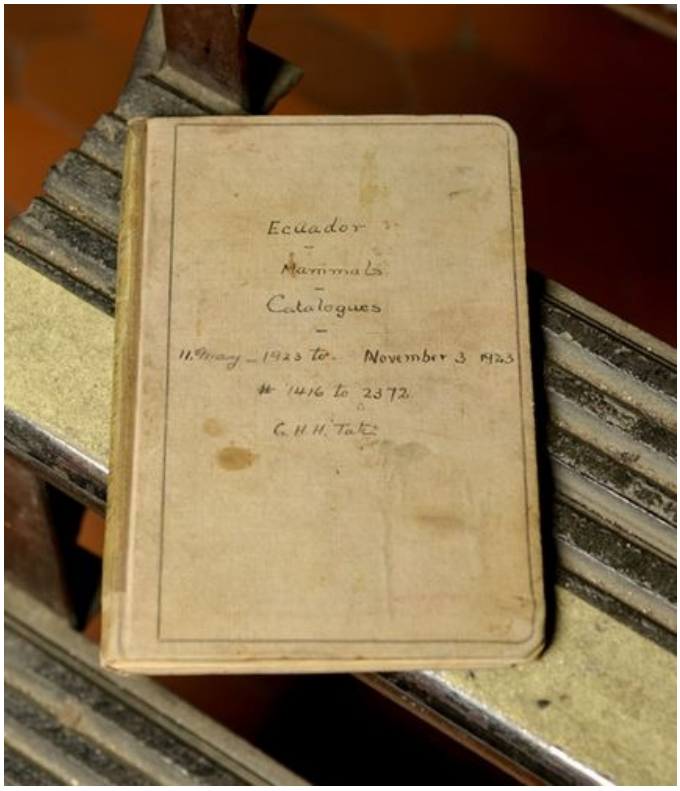
But while scientists may have a hunch about a specimen in the field, the actual discovery is more commonly made in scientific collections-often years after collections are brought back and filed away. On average, more than two decades pass between the first collection and archiving of a new species and its formal description.

AMNH / Department of Mammalogy Archives

A "magic lantern" slide depicts members of the Anthony-Tate expedition at work in the forests of Ecuador.

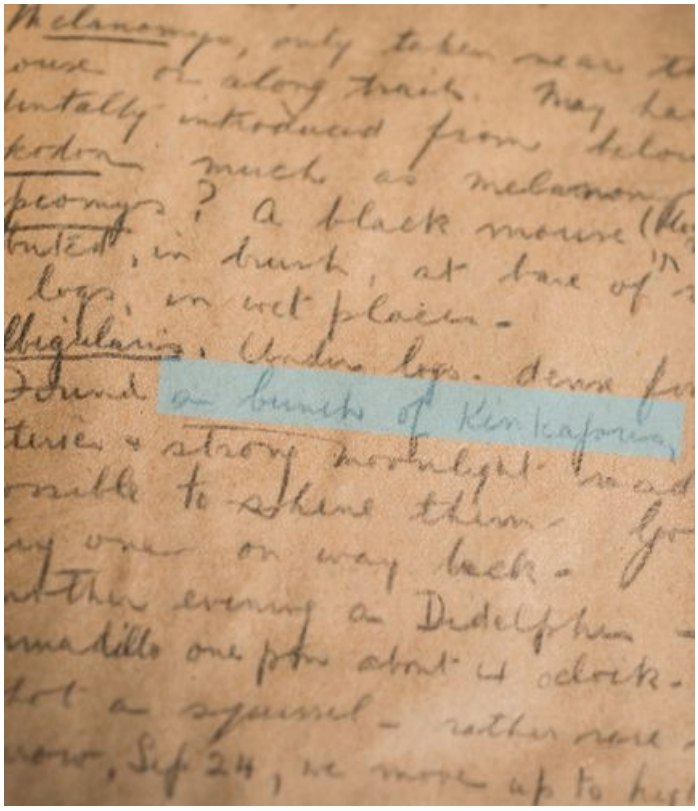
What accounts for the delay? For one, the sheer volume of the collections. Major expeditions in the early 20th century routinely brought thousands of specimens into the Museum's collections, and researchers are still playing catch-up. Also, the team bringing back a set of specimens may not necessarily have had the expertise to recognize a new find.

"There might have been a specialist here who worked on the rodents, somebody else who might work on the carnivores," says Nancy Simmons, curator-in-charge of the Department of Mammalogy. "But maybe the bats just got put in the drawer and filed away. Only years later, when somebody who's interested and knowledgeable about those particular species comes back and looks closely at them, they go, 'Wow, there's something new here.'"



AMNH / D. Finnin

The field journals of the Anthony-Tate Expedition are still in the Museum's holdings, as are the specimens collected during the trip.



AMNH / D. Finnin

A page from the Anthony-Tate expedition field notes details the collection of the first olinguito specimen, then identified as a kinkajou.

That was probably the case with the olinguito, one of many mammals collected during the 1923 Anthony-Tate Expedition. A six-month journey into the rugged interior of Ecuador, this trip by Museum researchers aimed to improve understanding of the wildlife in the country's then little-explored forests. While birds, reptiles, and fossils were collected, a special emphasis was placed on acquiring mammal specimens, of which more than 1,500 were collected-including 57 mammals in the course of one singularly productive morning. Considering the number of specimens collected during the trip, it's little wonder that the olinguito-Mammal #66573, a raccoon relative originally identified as a kinkajou-spent nearly 90 years on the Museum's shelves before being described as the new species Bassaricyon neblina in 2013. Its story isn't unusual, either.

"There are, without a doubt, other new species of mammals waiting to be discovered in this collection," says Mammalogy Curator Rob Voss.

But it doesn't always take a lifetime to describe a new species. Other times, with the right team in the right place, an animal may be tagged right away as a potential scientific discovery, distinct from the millions of species already identified. That might be the case with one of the mammal specimens, and several amphibian and reptile specimens, recently brought back on the Museum's latest Explore21 Expedition, a seven-week trip to the central highlands of the island nation of Papua New Guinea.

AMNH / Research Library

From months-long trips to Ecuador in 1920 (pictured) to the latest Explore21 Expedition to Papua New Guinea in 2014, Museum researchers have a long tradition of journeying to remote areas and over rugged terrain in search of new species.

The team, which included ornithologists Brett Benz and Paul Sweet, herpetologist Chris Raxworthy, and mammalogist Neil Duncan, headed out to one of the world's most biodiverse areas, trudging through largely undisturbed tropical rainforests to conduct detailed surveys of local wildlife. . . .

"It's a region with amazing intact forests that we have very little biological data on," says Raxworthy, noting that both of those factors gave the expedition a good shot at turning up some species never before described in scientific literature. The team used a variety of methods to collect specimens, including pitfall traps-plastic buckets buried in the soil that can collect ground-dwelling creatures-and mist nets, which can snare bats and birds.

AMNH / P. Sweet

Herpetologist Chris Raxworthy prepares plastic buckets that will serve as pitfalls in the field.

Duncan thinks one rodent, pulled from a pitfall trap by Papua New Guinea biologist Enock Kale, may represent a distinct species. While he's careful not to make any claims that the specimen is unique before he's done the significant work required to prove it, Duncan admits to being excited at the prospect of discovering a new animal.

"With millions of species named, one more would be a piece of a larger puzzle, but there's still a degree of excitement associated with the idea," Duncan says.

The work began in the field, when the skin of the specimen was removed, stuffed with cotton to maintain its shape, and dried. Back at the Museum, Duncan will be taking precise measurements of the rodent, part of the first step in distinguishing a species from a close relative by examining its morphology. The skull in particular contains a lot of information. Teeth, for instance, vary according to diet, and are slightly different in each mammal species.

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Digital calipers help researchers get precise measurements of telltale body parts like skulls and teeth, in this case, of the olinguito.

Still, these variations can only tell us so much. Genetic analysis also plays a major role in identifying new species. Morphological data can . . . be backed up with

genetic information that shows significant differences in DNA sequences between prospective new species and their known counterparts.

Researchers who think they have a new find can also look forward to a long trip through the scientific literature to see if it is in fact unique. This research phase sees scientists consult with other researchers and compare their specimens against similar samples here at the Museum and around the world.

If it does turn out to be a new find, the next step will be to name the new species. The naming process allows discoverers of new species to get a little creative (within the framework of binomial nomenclature, of course). For example, the olinguito's species name, neblina, is taken from the Spanish for mist and inspired by the animal's picturesque cloud-forest habitat.

Others use the opportunity as a shout-out to friends, loved ones, or Canadian rock stars. Exhibit A: the Neil Young spider (Myrmekiaphila neilyoungi), first identified in 2007 by East Carolina University biologist Jason Bond and Curator Emeritus Norman Platnick.

(Would-be species namers, know this: it's considered very bad form to name a species after yourself, so forget leaving your own moniker stamped in the annals of scientific discovery.)

Finally, researchers must identify a holotype, the physical example used in the species' formal description. Researchers look for the most complete specimen available, and one for which there is plenty of associated data. Knowing where and when an animal was collected can be extremely important for future study. There are more than 1,000 holotypes in the Museum's mammalogy collection, and tens of thousands of holotypes in collections across the Museum's other divisions.

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In the Museums mammalogy collection, holotypes are identified with a red tag like the one above.

The holotype is usually housed in a museum or similar institution so that researchers from the world over can access it regularly. And as information accumulates and research is done, it's the holotype that ensures that researchers talking about the olinguito are discussing the same animal today and 90 years from now.

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Video provided courtesy of the American Museum of Natural History

analysis a · nal · y · sis

Definition

plural noun

1. a careful study of the parts of something in order to understand more about the whole.

   The teacher's analysis of the book helped us understand its importance.

Advanced Definition

noun

1. careful scrutiny of constituent parts in order to thoroughly understand the whole.

   Her analysis of the painting helped explain why it is considered a masterpiece.

2. the process of separating into constituent parts.

   The analysis of the city's water showed that there was an unsafe level of lead.

3. an explanation or interpretation; presentation of the results of separating and scrutinizing.

   His analysis of the data was illuminating.

4. psychoanalysis.

   He hoped that analysis might help him come to terms with his traumatic past.

Spanish cognate

análisis: The Spanish word *análisis* means analysis.

These are some examples of how the word or forms of the word are used:

1. She was proud of them for being so careful and deliberate in their **analysis** of a part of the world so far away from home.
2. Its **analysis** of 58 accidents involving out-of-control Toyotas revealed no electronic malfunctions. Schmidt says Toyota and the U.S. government were searching for a smoking gun that didn't exist.
3. The information from the **analysis** was entered into the Be The Match database, which contains the records of millions of participants. Last September, Hoffman was notified that his tissue type was a close match with that of Warren Sallach, 59, a road maintenance worker from Brenham, Texas.

4. "While the adventure is great," says Sims, "equally important is the careful, scientific **analysis** back in the labs. In addition to getting a rush from working in the field-looking right in the face of a dangerous volcano-you have to being willing to go home to do the work."

5. Just as Socrates felt that it was necessary to create a tension in the mind so that individuals could rise from the bondage of myths and half-truths to the unfettered realm of creative **analysis** and objective appraisal, we must see the need of having nonviolent gadflies to create the kind of tension in society that will help men rise from the dark depths of prejudice and racism to the majestic heights of understanding and brotherhood. So the purpose of the direct action is to create a situation so crisis-packed that it will inevitably open the door to negotiation.

genetic

ge · net · ic

Advanced Definition

adjective

1. of or concerning the science of heredity.
2. of, concerning, caused by, or influenced by heredity, esp. by genes.

   genetic engineering
3. of or concerning the beginning or origin of something.

Spanish cognate

genético: The Spanish word *genético* means genetic.

These are some examples of how the word or forms of the word are used:

1. The researchers injected muscle tissue with tiny pieces of **genetic** material. That material transformed the muscles into factories of proteins that attack viruses.
2. Sexual reproduction results in **genetically** new offspring from the fusion of male and female sex cells. Humans reproduce sexually and their offspring are **genetically** a combination of their parents' features and DNA.
3. It's a complex lottery in which offspring of the first two organisms inherits a combination of their **genetic** material. The possible variations inherent in recombining the parents' DNA is very, very broad-larger than the pool of entries in the state lotto jackpot!
4. In the United States, NPC is relatively rare, occurring in just seven of every 1 million Americans. NPC has a strong **genetic** component, explains Costantino, which is why the cancer is more common in Southeast Asia and among immigrant families from that region.
5. Schweitzer uncovered ancient blood vessels and some red blood cells from the dinosaur. Schweitzer said that new techniques might make it possible for scientists to one day extract a dinosaur's **genetic** material. **Genetic** material determines an animal's inherited characteristics, such as eye color and hair color.
6. "Our population and our use of the finite resources of Planet Earth are growing exponentially, along with our technical ability to change the environment for good or ill. But our **genetic** code still carries the selfish and aggressive instincts that were of survival advantage in the past.
7. Trees that have been **genetically** modified need approval from the government before they can be planted in the wild. The scientists doing **genetic** modification defend their work. They point out that there are around 45,000 genes in the chestnut tree, and the researchers are adding one-to-three additional genes.
8. **Genetic** engineering has been going on for years. In fact, much of today's packaged food

contains **genetically** engineered corn or soy. Still, many people are suspicious of **genetic** engineering. The environmental organization Greenpeace, for instance, likens transgenic organisms to "a giant **genetic** experiment" that could have unforeseen consequences for the environment and for human health.

9. Breeding has everything to do with **genetics**. Every living creature has genes, which is basically a code inside of the body that determines how you look and to an extent, act. Your genes determine how tall you grow, what color hair you have, and how quickly your skin gets sunburnt. Our genes are inherited from our parents, which is why you see family resemblance between parents, children and siblings.

10. Often, animals' **genetic** mutations can help the process of selective breeding. The Belgian Blue, for instance, is an unusually muscular cow; it contains something called the double muscling gene. A muscular cow is valuable for the amount of meat found on its frame. A few hundred years ago, farmers capitalized on this particular cow's muscle mass by trying to breed more of them. Over time, and with effort, a new breed of muscular cow was born.

specimen spec · i · men

Definition

noun

1. a small amount of matter or liquid from the body used for testing.

Doctors can test a urine specimen to look for drugs.

Advanced Definition

noun

1. a portion or example that is representative of a larger whole.
2. in medicine, a sample of tissue or bodily fluid, such as urine, used for analysis or diagnosis.

Spanish cognate

espécimen: The Spanish word *espécimen* means specimen.

These are some examples of how the word or forms of the word are used:

1. The institute quickly developed its research collections and **specimen** holdings, mostly from United States military and exploratory operations. What started as one collection has grown into an organization of 19 museums and galleries.
2. Peale wanted to educate the public through the displays of fine art and real **specimens** from nature. The museum featured fossils, preserved animals, birds, and insects, inventions, and a mastodon skeleton, as well as Peale's portraits of famous people.
3. During his Martinique expedition, Hovey also collected and sent back to the Museum invaluable **specimens**, molten household objects, pulverized street signs, and lumps of half-melted lava-called "bread-crust bombs" for their cracked tops- which had been thrown out of the volcano during the eruption.
4. "Technology allows us to look inside these **specimens** without destroying them," says Dr. Amy Balanoff, a Museum research associate. "It's a non-destructive way to basically slice up a dinosaur brain and look inside and see what it can tell us about the evolution of the brain within dinosaurs."
5. A paper from the Society's gardener was read, upon the best method of forcing rhubarb for tarts and fine **specimen** of the leaves, forced in this manner, were placed upon the table. The method was simply this: The seed is sown in a rich border, in the first week of April; the young plants are kept thin and clean during the summer, and before the growing season is fully over, they are taken up, put into common forcing pots, three in each, and placed in a shaded border till they are wanted.