Fossil Friday: amphibian trapped in amber is the first known 'tongue-thrower'

The fossils were at first (mistakenly) identified as being an ancient chameleon.

by **Alexandru Micu (https://www.zmescience.com/author/alexandrumicu/)**
— November 6, 2020 (https://www.zmescience.com/science/fossil-friday-amphibian-in-amber-tongue-thrower-866345351/)
in **Biology (https://www.zmescience.com/category/science/biology/)**, **Fossil Friday (https://www.zmescience.com/category/other/fossil-friday/)**, **News (https://www.zmescience.com/category/science/news-science/)**, **Science (https://www.zmescience.com/category/science/)**

New research looking at some old fossils uncovers a novel species of amphibians. The animal belonged to the albanerpetontid family and provides the oldest known evidence of a slingshot-style tongue.

The skull encased in amber. Image credits Florida Museum / Edward Stanley.

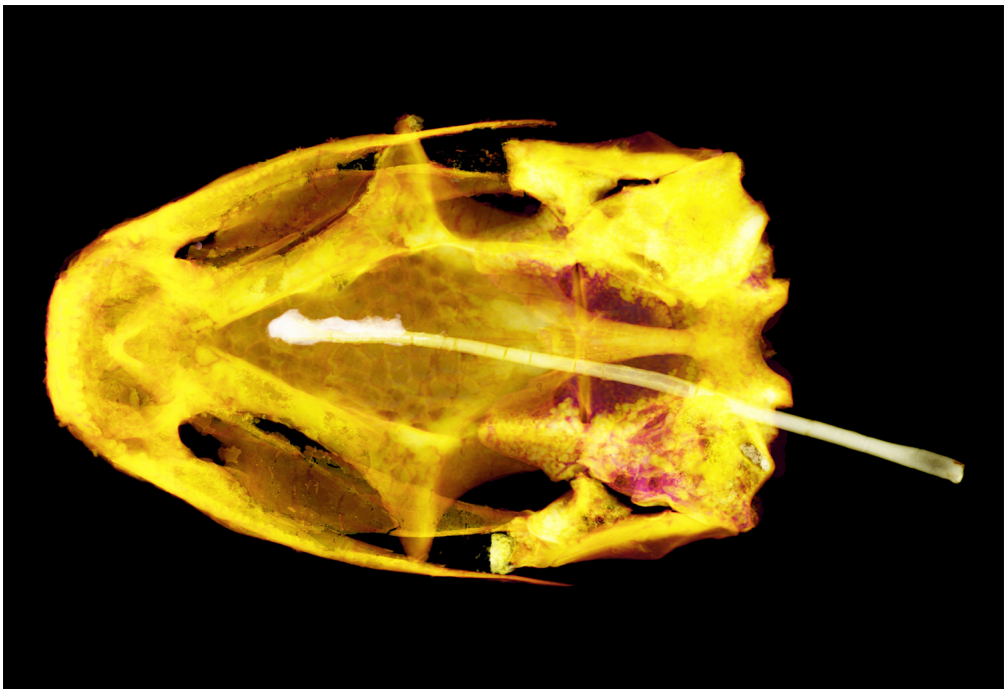
The fossils had been previously analyzed and mistakenly interpreted as belonging to a species of ancient chameleons. However, the new study comes to show that despite having lizardlike claws, scales, and tails, albanerpetontids (or 'albies') were actually amphibians. They belonged to a lineage that's distinct from modern frogs, salamanders, and caecilians. This lineage developed over some 165 million years and died out roughly 2 million years ago.

The fossils described in this study are roughly 99 million years old, and help showcase how the albies hunted: lying in wait for potential prey, then launching their tongue at them, similarly to modern chameleons. This fossil specimen (previously misidentified as an early chameleon) is the first albie discovered in modern-day Myanmar and the only known example in amber. The species was christened *Yaksha perettii*, after treasure-guarding spirits known as yakshas in Hindu literature and Adolf Peretti, who discovered the fossil.

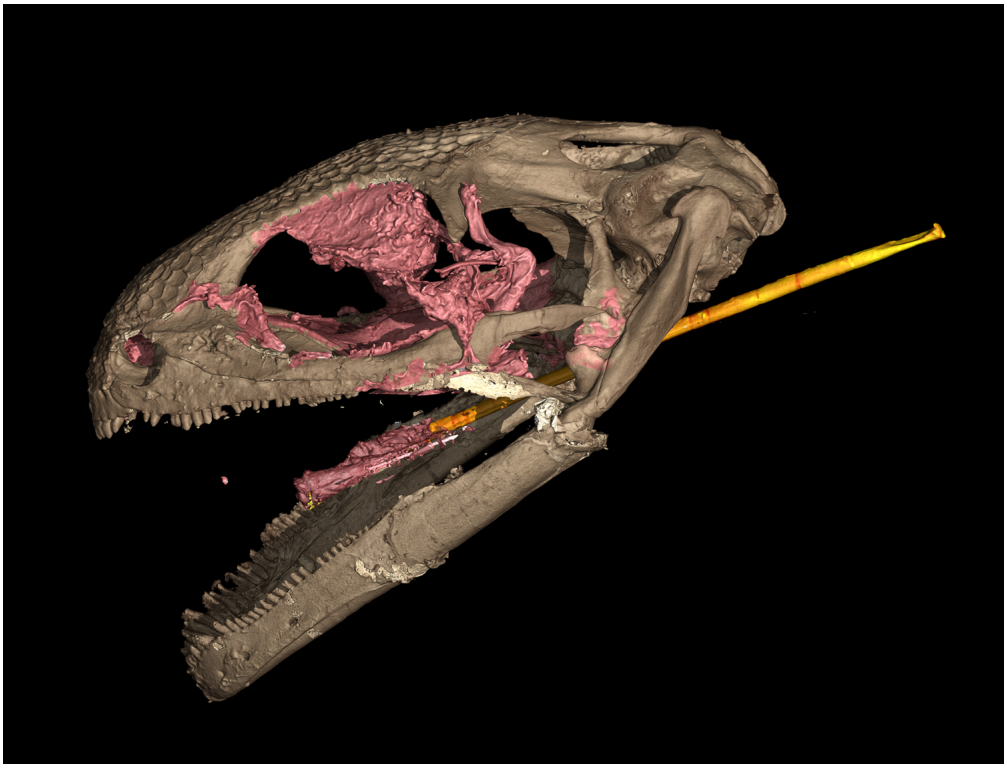
Don't judge a fossil by its tongue

> "This discovery adds a super-cool piece to the puzzle of this obscure group of weird little animals," said (https://www.floridamuseum.ufl.edu/science/earliest-rapid-fire-tongue-found-in-amphibians/) study co-author Edward Stanley, director of the Florida Museum of Natural History's Digital Discovery and Dissemination Laboratory. "Knowing they had this ballistic tongue gives us a whole new understanding of this entire lineage."

The initial misidentification of the species came down to the fossils it was described from: a juvenile individual with a hodgepodge of characteristics, including a specialized tongue bone. The paper describing them sparked an international collaboration to better correctly identify the fossils, after Susan Evans, professor of vertebrate morphology and paleontology at University College London and an albie expert, recognized some of the characteristics. Together with Peretti, the researchers sent the specimen together with similar amber-encased ones to the University of Texas at Austin for computer tomography (CT) scanning.



An X-ray of the skull showing its long hyoid bone, which provided support for the tongue, jutting from the back. Image credits Florida Museum / Edward Stanley.



CT scan of the skull. Preserved soft tissues are shown in pink. Image credits Florida Museum / Edward Stanley.

It was found that the amber-encased specimen was in "mint condition" (which tends to be rare for albies). It was also, luckily, an adult counterpart of the juvenile that has previously misidentified.

> "Everything was where it was supposed to be. There was even some soft tissue," says Evans.

The excellent quality of the specimen allowed the team to dispel some wrong assumptions about the species. Their reinforced skulls have led researchers to hypothesize that they were a species of digging salamanders. Several other shared features, most notably their claws, scales, and large eye sockets, were also reminiscent of reptiles. The albie also likely had a ballistic tongue similar to those of chameleons today.

Based on the skull, the researchers estimate that *Y. perettii* was about 2 inches long, not including the tail. The juvenile was a quarter that size. It relied on its fast tongue (the chameleon tongue can go from 0 to 60 mph in a hundredth of a second, being one of the fastest muscles in the animal kingdom) to hunt for insects, and would otherwise try to keep hidden among the brush, the team believes.

Its predatory nature and projectile tongue also help explain its other "weird and wonderful" features, including unusual jaw and neck joints and large, forward-looking eye sockets. It's also likely they breathed through their skin like salamanders do, but this is still unconfirmed.

Although the specimens were in excellent condition, the team remains unsure where they fit in the amphibian family tree due to its unusual combination of features.

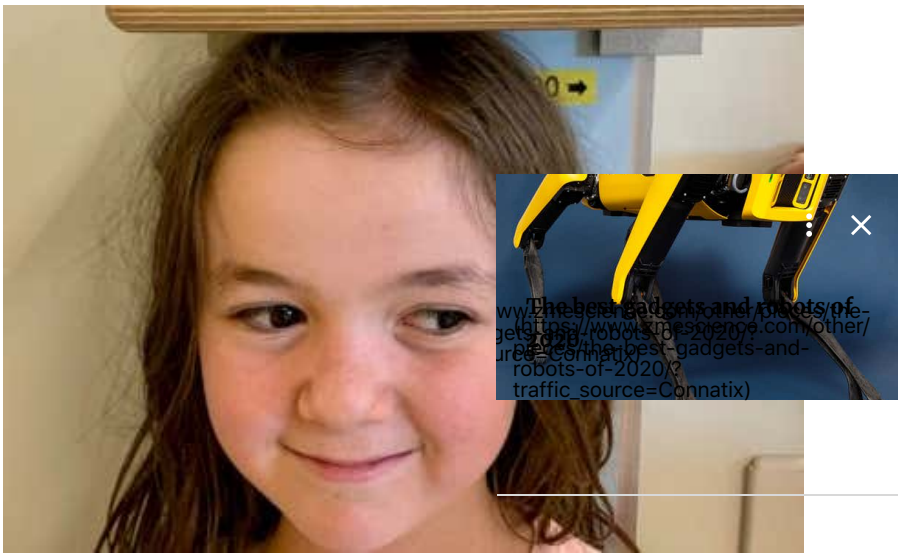
> "In theory, albies could give us a clue as to what the ancestors of modern amphibians looked like," Evan says. "Unfortunately, they're so specialized and so weird in their own way that they're not helping us all that much."

No albies are known to have survived to modern times, but they only faded out about 2 million years ago — which means they might have crossed paths with our earlier hominid relatives.

> "We only just missed them. I keep hoping they're still alive somewhere," Evan adds.

The paper "Enigmatic amphibians in mid-Cretaceous amber were chameleon-like ballistic feeders" has been published (https://dx.doi.org/10.1126/science.abb6005) in the journal *Science*.

Popular in the Community



Tags: amber (https://www.zmescience.com/tag/amber/) fossil (https://www.zmescience.com/tag/fossil/) tongue (https://www.zmescience.com/tag/tongue/)

We recommend

Ancient amphibians preserved in amber
Sacha Vignieri et al., Science

Alexandru Micu (https://www.zmescience.com/author/alexandrumicu/)

Stunningly charming pun connoisseur, I have been fascinated by the world around me since I first laid eyes on it. Always curious, I'm just having a little fun with some very serious science.

(https://www.facebook.com/alexandruiulian.micu)

A brewery in the Netherlands becomes the

first iron-fueled factory in the world

That's pretty metal!

by **Alexandru Micu (https://www.zmescience.com/author/alexandrumicu/)**
— November 6, 2020 (https://www.zmescience.com/science/brewery-netherlands-first-iron-fuel-world-26435745/)
in **Chemistry (https://www.zmescience.com/category/science/chemistry/)**, **News (https://www.zmescience.com/category/science/news-science/)**, **Science (https://www.zmescience.com/category/science/)**

Listen Now

A brewery in the Netherlands has become the first business in the world to use iron powder as fuel on an industrial scale.

Iron powder being burned in a combustion tube. Image credits Bart van Overbeeke / TU Eindhoven.

We tend to think of fire mostly as something that engulfs wood, coal, petrol, and other flammables. It's practical to do so — those are the things we burn when we need something to burn. But from a chemical point of view, almost everything burns, given the right conditions — including iron.

The Swinkels Family Brewers in the Netherlands has become (https://swinkelsfamilybrewers.com/content/bcorporate/en/media/persberichten/tu-e-demonstrates-iron-fuel-at-brewery-bavaria--a-new-circular-a.html) the first business to use iron as a fuel for industrial application. It worked together with the Metal Power Consortium and researchers at TU Eindhoven to install a cyclical iron fuel system (more on that shortly) at its Brewery Bavaria, which is able to heat up around 15 million glasses of beer a year.

Iron burn

> "We are enormously proud to be the first company to test this new fuel on an industrial scale in order to help accelerate the energy transition," said Peer Swinkels, CEO of Royal Swinkels Family Brewers. "As a family business, we invest in a sustainable and circular economy because we think in terms of generations, not years."
>
> "We combine this way of thinking with high-quality knowledge in the collaboration with the Metal Power Consortium. Through this innovative technology, we want to make our brewing process less dependent on fossil fuels. We will continue to invest in this innovation."

Industries typically rely on fossil fuels (https://www.zmescience.com/science/what-is-petroleum/) for all their heat-intensive needs, since these hold a whole lot of energy in a very dense package. Finely-ground iron can serve the same purpose, however. In such a form and at high temperatures, iron burns easily.

Burning is the physical manifestation of a chemical reaction known as oxidation (https://www.zmescience.com/science/what-is-oxidation-feature/), and we perceive the energy given off by this reaction as light and heat. When iron is burned this way, there is no output of carbon dioxide (since there's no carbon in iron). The only product is rust. The best part is that this rust, which is basically just iron oxide, can then be turned back into plain iron with the simple application of an electrical current.

In essence, if you use energy from solar, wind, or other clean sources, you can use iron filings as a sort of clean battery that charges with electricity and outputs heat — which is neat!

Other advantages of this system include how cheap and abundant iron is, how easy it is to transport (it doesn't need to be cooled like hydrogen, for example), its high energy density, and the high temperatures it can output (up to 1,800 °C / 3,272 °F). It also doesn't spoil and won't lose its properties even if stored for a long time.

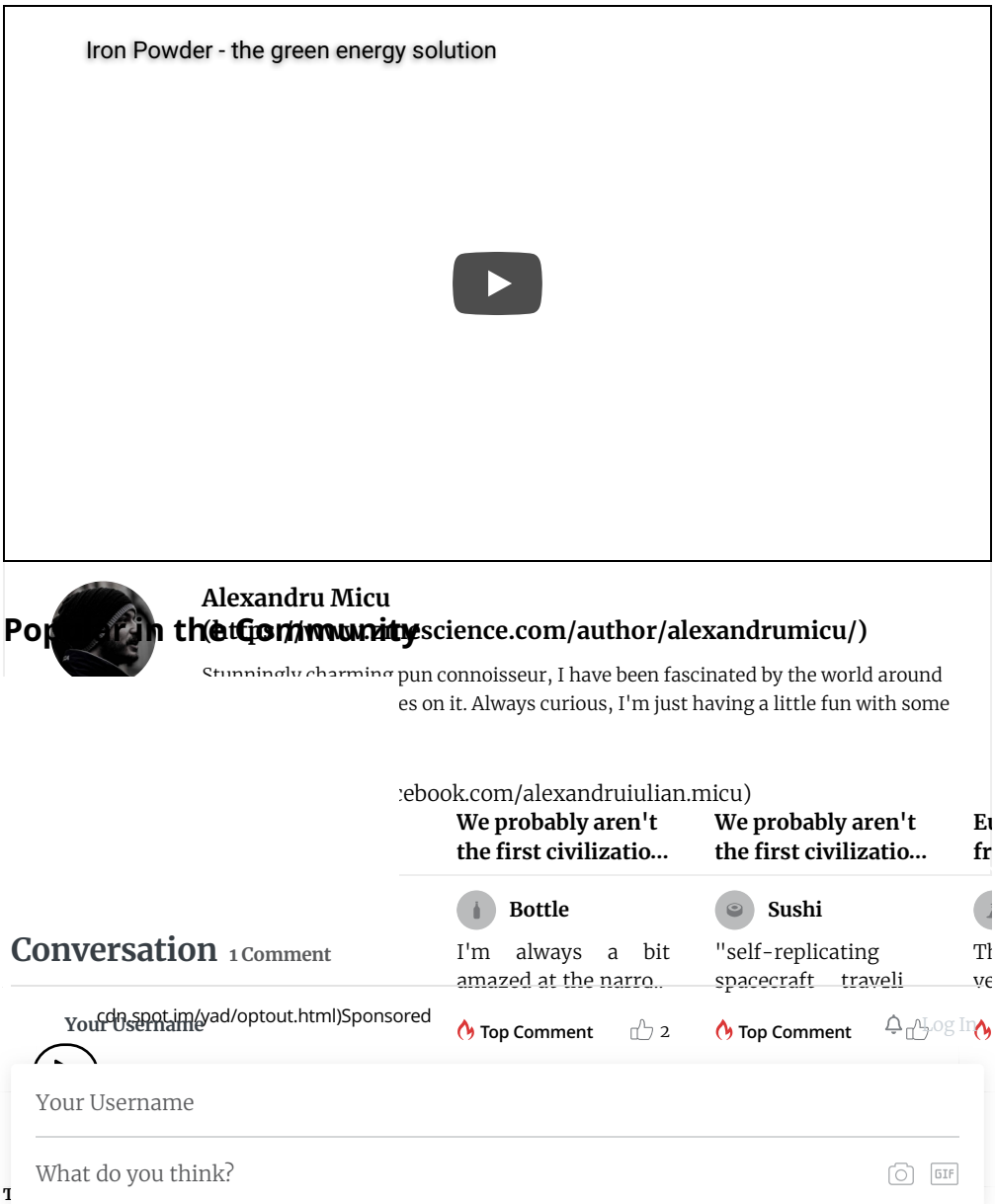
The cyclical iron system installed at Brewery Bavaria handles both the burning and recharging phases of the process. Depending on how energy is fed back into the used iron, it can store up to 80% of the energy input (https://www.sciencedirect.com/science/article/pii/S0360128518300327) back into the iron fuel, which is comparable to the efficiencies of modern hydrogen-splitting techniques.

> "While we're proud of this huge milestone, we also look at the future," says Chan Botter, who leads student team SOLID at TU Eindhoven (https://teamsolid.org/), a group dedicated to the advancement of metal fuels.
>
> "There's already a follow-up project which aims to realize a 1-MW system in which we also work on the technical improvement of the system. We're also making plans for a 10-MW system that should be ready in 2024. Our ambition is to convert the first coal-fired power plants into sustainable iron fuel plants by 2030." (https://newatlas.com/energy/bavarian-brewery-carbon-free-renewable-iron-fuel/?fbclid=IwAR05nyDSD-Iwhsv52s5Xwy7sRJ94mT2tuhoayZRDz6i-LmGSSzkkGfswB-Y#gallery:2)

The system Botter talks about would have a theoretical efficiency of around 40%, which isn't *great*, but it could prove to be a convenient and flexible way of storing energy, either for later use or for transport to another site. An advantage of this approach would be that our current energy-generation infrastructure can be adapted to use iron quite easily (as all that is changed is the type of fuel used).

It's not yet clear if it would be economically-viable, but it's definitely a very exciting idea — at least, *I* think it is. There's also something very cool about the idea of burning iron for power.

Here's a video detailing how the technology would work from TU Eindhoven:



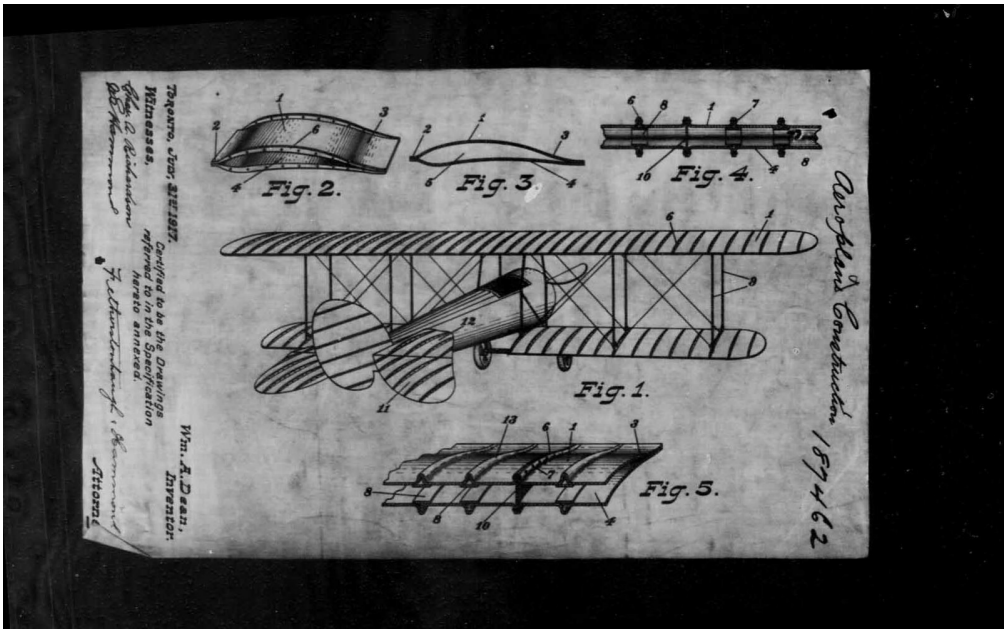
chapter24

The myth of the secretive inventor: most inventors choose to disclose their patents early

7 November, 2020

Having patent information available to the public as early as possible is for the betterment of society.

by **Tibi Puiu (https://www.zmescience.com/author/tibipuiu/)**
— November 6, 2020 (https://www.zmescience.com/science/news-science/myth-secretive-inventor-0523/)
in **News (https://www.zmescience.com/category/science/news-science/)**, **Science (https://www.zmescience.com/category/science/)**



Credit: Flickr, Biblioarchives (https://www.flickr.com/photos/lac-bac/25770195453/in/album-72157666575852706/).

One common stereotype about inventors is that they all like to hold their cards close to their chests, hoping no one else snatches their brilliant idea before it comes to the market. But research suggests that most American patent-holders aren't as concerned with secrecy as previously thought.

"Do inventors really value the secrecy that economists assumed they did based on the prior literature? Our findings are that overwhelmingly, and in every category that we can test, inventors don't," said Stuart Graham, study co-author and assistant professor at the Georgia Institute of Technology's Scheller College of Business.

In a study published in the journal *Science* (http://dx.doi.org/10.1126/science.1262080), Graham and Deepak Hedge of New York University analyzed the applications of inventors filed after 2000, the first year when the American Inventors Protection Act (AIPA) (https://www.cov.com/-/media/files/corporate/publications/2001/05/oid6030.pdf) was passed into law.

The federal law fundamentally changed many aspects of the patent application process in the United States. One of the most important new rules is that all patents have to be published 18 months from the earliest claimed filing date (https://research.wur.nl/en/publications/the-american-inventors-protection-act-a-natural-experiment-on-inn). Prior to AIPA, patents filed only in the U.S. were kept secret and made public only after approval, typically 36 months after filing.

The bill, which was introduced by US Senators Joseph Lieberman (http://lieberman.senate.gov/) and Orrin Hatch (http://hatch.senate.gov/public/), also included other legislation meant to protect inventors.

"First, the bill provides inventors with enhanced protections against invention promotion scams by creating a private right of action for inventors harmed by deceptive and fraudulent practices and by requiring invention promoters to disclose certain information in writing prior to entering into a contract for invention promotion services. An inventor who is harmed by any material false or fraudulent statement or representation, or any omission of material fact, by an invention promoter, or by the invention promoter's failure to make the required disclosures, may recover actual damages or, at the plaintiff's election, statutory damages in an amount up to $5,000, as the court considers just, plus reasonable costs and attorneys' fees. A court may award increased damages, up to treble damages, where it finds such conduct to have been intentional and done with the intent to deceive the inventor. And, in an effort to provide better access to information for inventors, the Patent and Trademark Office is required to make publicly available all complaints received involving invention promoters, along with any response of the invention promoter," said Senator Orrin Hatch (R-UT).

In 1999, during congressional hearings, many expressed concerns that the new rules would harm small inventors, ultimately undermining the inventive spirit of the country. So the final draft of the law contained a loophole that allows inventors to maintain the secrecy of their patent applications as long as they were not also filing for parallel foreign patent protection.

This loophole provided the perfect metric for Graham and colleagues to examine which inventors valued ultra secrecy, as well as how the patents filed by the two types of inventors differed in value.

The team examined 1.8 million granted utility patents filed between 1995 to 2005, finding that almost 85% of inventors filing a patent since 2000 chose to disclose information about their patents prior to their approval. In other words, "those inventors patenting only in the U.S. are choosing 18-month disclosure," Hedge said.

These findings run counter to the argument that the AIPA would hurt small American inventors. If that would be the case, why would so many opt for disclosure during the study period?

"Small U.S. inventors are not choosing the secrecy route," Graham said. "When they patent only in the U.S., they are choosing secrecy in only about 15 percent of the cases, not statistically different than the rate among all other types of inventors."

The study concentrated exclusively on utility patents – this is a category of patents that is typically associated with engineering-related patients. Utility patents deal with machines, processes, compositions, and manufactured articles. However, utility patents also protect technologies such as drugs, medical devices, laptops, and software. Utility patents are the most common patents filed in the US, with almost 570,000 patents filed in 2013.

Tight-lip inventors tend to make less valuable contributions

In the second part of the study, when the researchers assessed how meaningful the patents were by their type of disclosure, another myth was busted. Contrary to previous complaints, which suggested American innovation would suffer due to new AIPA regulations, the study found that patents born out of secrecy were less valuable, on average, than those opting for disclosure.

"When we examine indicators of patent value, we find consistent evidence that the least-valuable and least-impactful patents are those that opted for pre-grant secrecy," Hegde said in a statement.

The AIPA was never meant to hurt inventors. Instead, it's a bill that fosters the public's access to patents and brings social benefits. By having patent information available as early as possible, society can avoid unnecessary duplicative research spending. If rooky inventors find all of this confusing, they can always seek counseling such as InventHelp (https://inventhelp.com/) so they can just focus on what they do best — invent the future.

"We have limited resources in our society that we can invest in innovation and invention," Graham said. "To the extent that we can more efficiently choose projects and avoid wasteful, redundant efforts, then that's good for us as a society."

"This study is a first window into what inventors are really doing. The next question is why are they doing it?" he added. "It remains for us to figure out why inventors seeking to maximize the value of their inventions are not particularly interested in pre-patent secrecy."

In the future, Graham and Hedge plan on investigating why inventors choose to release information about their work before a patent is officially granted. Some explanations may include marking technology space territory to competitors, earlier announcements to market or licensees, and sharing knowledge so intellectual property can be referenced and linked earlier.

What's more, the researchers would also like to investigate another common myth in the inventors' space — namely, that the early release of patent secrecy leads to an increase in counterfeiting or other kinds of breaches of intellectual property.

Popular in the Community

Tags: inventor (https://www.zmescience.com/tag/inventor/)

Coronavirus (https://www.zmescience.com/tag/coronavirus/) /
News (https://www.zmescience.com/category/science/news-science/) /
Environment (https://www.zmescience.com/category/ecology/) / Health (https://www.zmescience.com/category/medicine/) /
Future (https://www.zmescience.com/category/future/) / Space (https://www.zmescience.com/category/space/) /
Feature (https://www.zmescience.com/category/other/) / More (https://www.zmescience.com/contact)

(https://www.facebook.com/zmesci
(https://twitter.com/zm