Science AMA Series: I'm Travis Hagey, a Postdoctoral Fellow at Michigan State University studying the sticky toes of gecko lizards. AMA!

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Abstract

I am a postdoctoral researcher at Michigan State University investigating the biomechanics, evolution, and ecology of gecko lizards with special attention to their adhesive toes. I've always been interested in figuring out how things work and my research blends that interest with biology. I use an evolutionary approach to understand why animals are shaped the way they're shaped, This kind of work is sometimes called functional morphology or comparative biomechanics. I specifically focus on the toe pads of gecko lizards, an amazing example of natural nano-technology. Gecko toe pads are a really great system to work with because they have some really unusual mechanics and evolutionary patterns. Unlike other adhesives you may be familiar with (glue, tape, velcro, suction cups), gecko toe pads work completely differently. They are made up of tiny hair-like structures that are much smaller then mammalian hair. These structures are small enough to interact with the surface the gecko is walking on using van der Waals forces (an induced dipole - induced dipole weak intermolecular bond). Simply put, the fact that the gecko hairs are very small and have electrons spinning around them and the surface the gecko is walking on also has electrons spinning around its molecules, results in the gecko hairs being weakly attracted towards the surface. The really interesting part is trying to figure out why there is so much variation across species. Gecko toe pads come in different shapes and their hairs also come in different lengths, diameters, and densities. We're just now beginning to look into how/why this variation evolved and its affect on performance. With this research, we'll not only gain a better understanding of how life on our planet has evolved and adapted to different environments, but some of the things we learn can be applied to help solve complex human problems (biomimicry), like sticking to things in space or designing Spiderman gloves. I also have a live crowdfunding project at https://experiment.com/projects/are-the-feet-of-gecko-lizards-adapted-to-different-surface-textures you should check out. I will be back at 1 pm ET to answer your questions, Ask Me Anything! Sorry everybody! There was a scheduling snafu! I'll be checking this all day on Sunday (4/16) to answer your questions! Also check out a video of a lecture I gave in 2014 at the University of Idaho https://www.youtube.com/watch?v=uzmXxp_tjj8

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TRAVIS_HAGEY R/SCIENCE

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How are geckos able to keep their toe-pads clean despite running around on dusty surfaces all day ? Wouldn't the dust/dirt/whatever accumulate under their toes very fast ?

Also the principle behind the "stickyness" of their toes is known for years and there already were some attempts to use that principle. What exactly are *you* focusing on ?

z00k_v2

One of the many remarkable ability of gecko toe pads is that they self clean! There was a study published in 2005 by Hansen and Autumn that said "In the present study, we demonstrate that gecko setae are a self-cleaning adhesive. Geckos with dirty feet recovered their ability to cling to vertical surfaces after only a few steps. Self-cleaning occurred in arrays of setae isolated from the gecko. Contact mechanical models suggest that self-cleaning occurs by an energetic disequilibrium between

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the adhesive forces attracting a dirt particle to the substrate and those attracting the same particle to one or more spatulae. We propose that the property of self-cleaning is intrinsic to the setal nanostructure and therefore should be replicable in synthetic adhesive materials in the future." So in essence, as geckos use their toes, the dirt that is in them is more attached to the surface instead of the structures on their toes, so the more the use their toes, the cleaner they get.

Hansen, W.R. and Autumn, K., 2005. Evidence for self-cleaning in gecko setae. Proceedings of the National Academy of Sciences of the United States of America, 102(2), pp.385-389.

I understand we're rapidly progressing in the field of nano-engineering, but is there any notion of how soon we could see nano-structures such as the gecko toe pads in commercial machines, for example as a way to vastly increase friction? I understand there are various proposed uses for synthetic toe pads, such as climbing instruments etc, but I'm more interested in whether they'd be viable to increase the efficiency of our current technology, and if so, what practical uses would the functional knowledge of these amazing creatures evolutionary tools be to us humans?

Thank you for the AMA, I'll certainly be following!

Ultimate_Wolf

Using the gecko adhesive system to vastly increase friction is an interesting idea! I'm not sure many researchers have thought about it like that. Most of the time people are more interested in the strong yet reversible aspect of it. It could be used to generate friction on rough surfaces in a way that is way better then any current approaches we have that I'm aware of. But to answer your question, I'm not sure when we'll start to see it in commercial and industrial applications. To design a synthetic gecko-like adhesive that works well on rough surfaces, we'd need to recreate the microstructures, and our manufacturing abilities just haven't reached that scale yet, let alone producing them cheaply. As far as commercial uses for everyday people, the most promising product I've read about is Geckskin, a product that is made by a professor named Duncan Irschick at UMass Amherst. He's trying to get it picked up commercially for people in their homes to hang pictures with, etc. I hope that answered your question!

Do the hairs wear out? Do they grow new hairs throughout their lives, like we do? As they grow older, do they become "bald" in the sense the hairs become less effective, or do they lose hair density the older they get? And of course, Go Green!

Twisted_Einstein

Thanks! Yep, the hairs do get beat up and broken over time and matted. The great thing about lizards (and snakes) is that they shed their skin. So instead of shedding their skin like we do (in small pieces all the time), they shed all their skin in one go (like a snake). When geckos do this, they regrow all the hairs on their toes ahead of time, so when they shed, they've got a shiny new set, ready to go. Even though we're calling these microstructures "hairs," they're not quite the same as our hairs. Instead of having a root and being different then our skin, geckos "hairs" are really just extensions of the outer layer of skin, but the protein they're made out of (beta-keratin) is the same as snake skin and bird feathers, and really similar to mammal hair and finger nails (alpha-keratin). As far as changes as the animals get older, I'm not sure they have issues like thinning or loss like mammals do with our hairs! But I have seen examples in lab animals where experiments ever time have damaged the lower layers of skin under the toe pads and sometimes they'll have spots where they won't grow hairs there anymore, but I doubt that that is something that happens in the wild.

In May 2014, DARPA demonstrated the latest iteration of its Geckskin by having a 100 kg researcher (saddled with 20 kg of recording gear) scale an 8m tall glass wall using only two climbing paddles. Tests are ongoing, but DARPA hopes one day to make the technology available for military use, giving soldiers Spider Man-like abilities in urban combat.

Source: Wikipedia

1. Has this technology been tested on anything besides glass?

2. Is there any evidence that a dinosaur species had these sticky toes?

Thank you for the AMA!

___SerMerynTrant___

You're welcome! Geckskin is a really cool synthetic gecko-like adhesive that is produced by a lab at UMass Amherst. One tough thing about mimicking the gecko adhesive system is recreating the microstructures, its really, really hard. These "hairs" are what lets a gecko toe work well on a rough surface. The hairs reach into the valleys. Geckskin is great because it mimics the spring like properties of the hairs using a bulk material, so its easier to make, but would probably suffer on a rough surface since it doesn't actually have any microstructures.

GO GREEN!

What made you choose MSU for your studies?

Richa652

Thanks! So I've actually bounced around quite a bit. I did my undergrad at Western Washington University and graduate school at the University of Idaho. MSU is the headquarters for BEACON, which is a NSF funded science and technology center. They were looking for a science communication postdoc and I was hired for the job! So I work with biologists, engineers, and computer scientists while also doing my own research at the same time. The way BEACON connects biologists and engineers is really awesome and is a great place to do my kind of research that blends the two fields.

This is going to sound a little dark, but how many gecko toes do you typically need to go through during your research? Can you study live specimens, or do you need to take biopsies, etc.? Do you have a gecko farm like the drosophila farms at a lot of labs?

ViridianCovenant

So the great thing about geckos is that, like all other lizards and snakes, they shed their skin. When they do, they regrow the all the hairs on their toes. We take advantage of that. One live gecko can be an endless supply of samples as long as you're patient. They only shed their skin every 2 months or so. So we don't usually go through lots of individuals, but if you're doing a study that compares species, you do need at least different kinds of geckos. At one point during graduate school I had 30 live geckos from 6 different species. That many animals was a lot to take care of!

Hi, thanks for doing this!

I have a crested gecko (obligatory cute gecko pics here) and always wondered if only mine was like that, but to me it seems as if he has a lot more difficulty sticking to more bumpy surfaces than smooth ones : he can easily scale his terrarium's glass walls, but seems to slide down my arm.

Is there something in the "gecko toe physics" that makes it easier for them when the surface is smoother, or could it just be that my arm hair is preventing his toes from completely reaching my skin and sticking to it properly?

Freddedonna

Crested geckos are great pets! I use one when I do outreach at grade schools. It looks like yours still has his/her tail! Be really careful, unlike most other geckos, if crested geckos drop their tail, they won't regrow it. So you're right, on smoother surfaces, more of the hair-like structures on their bottom of their toes can contact the surface. Rougher surfaces offer less usable surface area. On top of that, your arm is a really tough surface for them to stick to because of your hair like you said, but also their claws aren't really big enough to help, and your skin has oils on it that make it tough to stick to as well.

Do gecko's feet get dirty or damaged and loose stickiness? Could this be a problem for non-biological, man made materials trying the mimic how their feet stick? Lying in bed watching Gecko's fight above on the ceiling is fascinating (in far north Queensland they're everywhere).

sabb7114

Yep, the hairs do get beat up and broken over time and matted. The great thing about lizards (and snakes) is that they shed their skin. So instead of shedding their skin like we do (in small pieces all the time), they shed all their skin in one go (like a snake). When geckos do this, they regrow all the hairs on their toes ahead of time, so when they shed, they've got a shiny new set, ready to go. Also, based on the way the microstructures are shaped, they actively self-clean. There was a study published in 2005 by Hansen and Autumn that said "In the present study, we demonstrate that gecko setae are a self-cleaning adhesive. Geckos with dirty feet recovered their ability to cling to vertical surfaces after only a few steps. Self-cleaning occurred in arrays of setae isolated from the gecko. Contact mechanical models suggest that self-cleaning occurs by an energetic disequilibrium between the adhesive forces attracting a dirt particle to the substrate and those attracting the same particle to one or more spatulae. We propose that the property of self-cleaning is intrinsic to the setal nanostructure and therefore should be replicable in synthetic adhesive materials in the future." So in essence, as geckos use their toes, the dirt that is in them is more attached to the surface instead of the structures on their toes, so the more the use their toes, the cleaner they get. But they still can be contaminated and fouled to the point that they don't work any more. Cole et al did a study in 2005 looking at how an invasive house gecko (hemidactylus) affected native geckos in the Mascarene Islands. One of the tests they did was measure how the invasive gecko performed on naturally occurring surfaces. They found that the invasive house geckos toe pads did get fouled up by the loose surfaces, although probably only temporarily.

Hansen, W.R. and Autumn, K., 2005. Evidence for self-cleaning in gecko setae. Proceedings of the National Academy of Sciences of the United States of America, 102(2), pp.385-389.

Cole, N.C., Jones, C.G. and Harris, S., 2005. The need for enemy-free space: the impact of an invasive gecko on island endemics. Biological Conservation, 125(4), pp.467-474.

Do geckos ever slip on surfaces, and if so, what kind would be resistant to their footpads? I ask because I am in a Pathfinder RPG group and my halfling character's mount is a giant gecko (named Stickfoot!). It's nice that he can walk up walls, but occasionally, you roll a low number and he might slip. I'd like to be able to argue my case with the DM, especially when he is ascending difficult surfaces (slick cave walls, ice, glass, etc) to boost my rolls as much as possible, because SCIENCE!

goatinpartyhat

That depends on a lot of variables! What kind of giant gecko is it? Some geckos, like giant day geckos from Madagascar lack claws and only rely on their toe pads to climb, but lots of other geckos use a combination of their claws and pads. If your giant gecko is using its pads to climb, smooth rock shouldn't be a problem at all! The smother the surface, the more hairs that can contact it and the better off it will be, same goes for glass. Ice is a tough one since van der Waals forces don't play well with water... If it we're up to me, I'd base my mount on an Australian Giant Cave Gecko (Pseudothecadactylus, http://www.fieldherpforum.com/forum/viewtopic.php?t=22230&p=246661). They're the largest species of gecko in Australia. They can lose and regrow their tails, which also have adhesive structures on them like their toes! They have giant heads with very strong bites (I've been bit by them, its not pretty..), and they have a combination of claws and toe pads which should work on almost any surface, except maybe loose/crumbly surfaces or surfaces covered in goo/poop/slime/etc.

As a student that is currently typing this on MSU's campus, all I have to say is... GO GREEN!

pat0307

Did you check out the science festival today? I'll be in BPS again tomorrow!

Hi Travis, what happens when the hairs interact with each other? I imagine the van der Waals interaction between them will be pretty strong, and if the "self-interactions" are large, how does it affect the interaction with the environment?

cirruspray

That's a good question! In the same study that was done by Hansen and Autumn looking at self cleaning, they also found that the hairs don't stick to each other. This is because their density, length, and stiffness of just right that they're spaced out far enough not to stick together!

Hansen, W.R. and Autumn, K., 2005. Evidence for self-cleaning in gecko setae. Proceedings of the National Academy of Sciences of the United States of America, 102(2), pp.385-389.

Is the gecko-toe adhesion stronger than that of tape, Velcro etc? If it were applied to a non biological application would it wear out like tape does? I'm just trying to determine how many pairs of Spider-Man gloves I'm going to need.

clayshanks

That's kind of a tough question to answer! As tape becomes stronger and stronger, when does it actually just become a glue? and its also tough to make Velcro stronger because the hooks and loops of velcro https://en.wikipedia.org/wiki/Hook_and_loop_fastener have to be soft enough to latch together. But given all that, I'd guess that gecko adhesive is still stronger, and easily reversible and reusable, which kind of beats tape and velcro. The strongest adhesion, i.e. negative normal force, or a force perpendicular to the ground, I measured from a gecko was about 44psi (pounds per square inch) which is about the same pressure as the air inside a truck tire. Thats a lot of force! On top that that, synthetic, man-made gecko-like adhesives have been able to hold up hundreds of pounds! Look up Geckskin from UMass Amherst

I've always heard about how small the "hairs" on gecko's feet are, so I had a few questions. First, can a gecko control specific ones, or just a large area or is it involuntary. Also, being very small, do you think this could be used by humans and is so, what for. Thanks in advance!

SuddenlySpoon

Nope, geckos cannot control individual hairs, they can really only control the muscles in their toes, so they can choose how and much parts of their toes interact with a surface while they're climbing, which does given them a lot of control actually. The hairs themselves act passively though, even after being removed from the animal!

There are lots of researchers looking into lots of different uses for gecko-like adhesives! One of my favorite if Geckskin, which is a product that was made by a professor named Duncan Irschick at UMass Amherst. He's trying to get it picked up commercially for people in their homes to hang pictures with, etc. There are also industrial uses where a strong, yet temporary adhesive would make the production of things like tires cheaper. An other really cool application Ive' heard about is using individual gecko hairs to pick up and place very small microprocessors when building very small computers.

What are the limitations to their "stickiness"? Is there surfaces that they are unable to walk on and why is this?

You also mentioned in applications in space, have there been any tests of geckos in a low gravity environment in the same way there was for birds etc.?

JoffyJ

There are a couple limitation for their stickiness. Surface roughness is one. At the broadest scale, rough surfaces reduce the surface area that a gecko's toe can actually contact. There's also been a lot of theoretical research that has made predictions that if a surface has oscillations (bumps) that are the right size, they can interact with the "hairs" and prevent them from sticking. There are also "safe guards" built into the system. The outer layer of skin that has the hairs are a part of can be separated from the deeper layer of skin. This is one way that we harvest groups of gecko hairs from their toes. Its kind of similar to when you get a blister (the outer layer separating from a deeper layer), but this doesn't hurt the gecko because they regularly shed this layer of skin. Without this, the gecko toe pads can sometimes stick so strongly to a surface, that they can transfer a lot of force and hurt other parts of a geckos foot, like their knuckles. Beyond surface texture, geckos aren't all that good at sticking to metals or wet surfaces (see my next comment). I believe there has been some studies of geckos in space! Just recently, the Russian space program put a couple geckos into orbit to investigate reproduction if I remember correctly, but I'm not sure how well those experiments turned out. I think they had an issue with keeping the geckos warm enough and they may not have survived that well....

I've been seriously wondering this for a while and have had no one to ask!

Where I live we have geckos. They live inside it's super common to have them on the walls/ceilings. It's also more common than I thought for them to fall off!

What makes them fall off? Do they fall asleep? Forget they're on the ceiling?

When they land they look so surprised and then just scurry off. And that's after falling like 50 ft.

acaciopea

That's great to hear you have geckos in your house! Geckos are really acrobatic and so I'd doubt they're falling off on accident. A lot of them are also nocturnal, so they're asleep during the day, probably tucked away somewhere safe. If I had to guess, I'd bet that they're fighting each other for hunting space, and flinging each other off the walls or ceilings. Human houses are great places to hunt

for insects, especially if there are light on at night and its really common for them to fight over the best spots.

Hi Travis,

I'm an undergrad at UMass Amherst, and I was wondering if you were aware of the product developed by the university Polymer Science department, as well as the Biology department known as Geckskin. If you were not, both Duncan Irschick (evolution/ecology) and Al Crosby (material science/(bio)nanotechnology research) would be great resources in furthering your understanding and study of the mechanics of the Gecko's foot.

My question is: ultimately, what is your end goal with the research you are conducting? With the existence of Geckskin, which is already trademarked, are you expecting any trouble with developing a product in such a specific field?

Best of luck in your future endeavors, and hopefully the aforementioned resources can help you out (if you didn't already know about them).

IMightBeJustin

Thanks! I do know Duncan! My PhD advisor (Luke Harmon) studied with Jonathan Losos as did Duncan. I've read about Geckskin, but haven't actually had the chance to see it in person! With my research, I tend to focus more on the evolutionary biology side of the coin as opposed to the application side. I'm more interested in asking how are species different? What do these differences mean for their performance? and how are they adapted to different environments? Say hi to Duncan for me! (He's been doing shark stuff recently hasn't he?)

On the basis of a sustainable research and experimental control, are you using only one type of Gecko species? Or are you planning to test a more diverse populace and or other mutations to the gecko, such as an outlier experiment?

Thank you for taking time to answer our questions!

Sedorian

How scientists do research with live animals is important. Before we start a project working with live animals, we have to have the project reviewed by an animal care and ethics committee to make sure we plan to treat the animals well and only use the minimum that the experiment needs. My research focuses on the variation across geckos (and anole lizards), asking what the variation across species means. How do species with differently shaped toe pads perform? How are they adapted to smooth/rough surfaces? How did the variation evolve? So to answer these questions, I get animals from a couple different sources. A lot of my experiments use animals that are purchased from breeders for the pet trade. These animals are usually kept long term in the lab as a pet as well as test animal. None of my experiments hurt the animal so it's actually a pretty sweet life for them. At one point during graduate school I had 30 animals from 6 different species. Alternatively, sometimes I go into the field and observe geckos in the wild. I've done field work in the Dominican Republic, Thailand, and Australia (and am trying to raise funds to go to Madagascar! https://experiment.com/projects/are-the-feet-of-gecko-lizards-adapted-to-different-surface-textures). In this situation, I usually try to get enough observations of a couple different kinds of geckos so that I can do statistical comparisons of my observations after I get home to see of there are differences between the species I was observing.

There are often adaptations we see in nature that seem so bizarre that it's not intuitively obvious how they came about. Do we know the evolutionary origin of gecko toes? Do we know when the adaptation first appeared?

WorkItMakeItDoIt

That is a great observation about evolution! You should also check out examples of engineering using evolution to solve problems in a cool way! https://en.wikipedia.org/wiki/Evolved_antenna As far as the evolution of adhesive "hairy" toes in lizards. They independently evolved at least 3 times in geckos, anole lizards, and a couple species of skinks (spiders, flies, and beetles also have similar toes). Some studies have also argued that sticky toes evolved multiple times within geckos, but some studies think it was just once. There are also some species of gecko that have the same structures on the tips of their tails! So I'd would guess that insects/spiders were probably the first groups to evolve this kind of system. Geckos would be next since they're the oldest groups of lizards. But each of these times they evolved, it was an independent origin. As far as how the hair-like structures originated, lots of lizards have tiny spikes on their skin (2-3 um tall). These spikes, or spinules, cause water to bead off their skin. This is how lizards keep clean. Our current hypothesis is that in geckos, anoles, and skinks, over time, the spikes grew longer and longer to eventually evolve into the hair-structures we see today.

Hi! I just took an animal course that briefly discussed geckos. I'm curious if research has shown whether the special properties of the toes come from the size of the hairs alone, or is the organization of the hairs important as well? In other words, if engineers were to make a brush with minuscule hairs could it theoretically mimic the adhesion of a gecko's toe or is there more to it than that?

avalitor

That's a good question! It's both the shape of the hairs and the fact that there are lots of them that lets the whole system work. A single "hair" can stick and detach to a surface, and its ability to do that is totally a result of its shape, but its not very strong. When you've got lots of hairs working on concert, thats how geckos can generate strong forces even on rough surfaces. If engineers were able to make a brush with bristles that were shaped and organized the right way, it would totally work. The trouble is that its really hard to manufacture things that small!

Not directly related to your research, but how many species of geckos are there? I was first introduced to them while living in Mexico, and now I'm seeing ones in southeast Asia that look and act very similarly. Are there large differences between types of geckos?

Also, as I said I first met them in Mexico, where they would live on the ceiling and eat bugs and sometimes wrestle. But they also made weird little chirping noises. What's up with that? What is the purpose of the vocalizations?

theryanmoore

Geckos are a big group with ~1500 species found around the world except Antarctica. Depending on where you were in Mexico, you may have been seeing an invasive house gecko (Hemidactylus frenatus). This species, which originally evolved in SE Asia, has been introduced by humans all around the world to tropical places. They're small and brown and like to hang out in human dwellings. Across geckos as a group though, there are tons of differences! Most geckos are nocturnal, but some are diurnal, their toe pads come in tons of different shapes! And not all geckos have toe pads, some have plain old lizard feet with just claws. There is even a whole family of geckos that are legless (Pygopodidae). The largest species of gecko (Rhacodactylus leachianus) is the size of your forearm while the smallest species (Sphaerodactylus) can fit on a dime.

Can i see your gekkos? I live in the east lansing area?

Edit... im really into animals and stuff especially marine biology (reef aquariums) and orchids.

themainingredient420

Unfortunately since I moved to MSU in December, I haven't purchased any new lab animals yet. If you're old enough (high school or older), you should look into volunteering with some of the researchers at MSU. There are lots of labs doing some really cool research. Have you checked out the museum of campus too?

Honestly, how often do you dream about lizards?

Moomium

Haha, honestly, not that much! Like anybody else, I'd guess my dreams usually have to do with my friends or family doing weird things!

In terms of scale, how close are we to replicating this effect in manufactured materials? What's the projected timescale of getting to be as good or better than the geckos?

Does using different materials change how strong this effect is, or only to the extent that the materials restrict how small we can make the hairs?

ktisis

I think we're still a ways from having gecko-like adhesives commonplace in manufacturing, and to be honest, I'm not sure we'll need to build a material that is as good or better then geckos. Assuming we can get past the nano manufacturing to a point where we can quickly and easily manufacture structures that small, I'd guess that we'll probably design adhesives for specific purposes. Geckos have to deal with lots of different challenges, wet/dry surfaces that are smooth and rough and made of rock, tree bark, or leaves, and contaminated with all sorts of dirt/poop/etc. So their pads work really well in most of these conditions. Our synthetic adhesives probably won't need to be as versatile, and can probably be made differently to be good enough doing only what we'd need them to do.

You work sounds really cool. I'm interested in hearing about how you will study the variations across species and whether or not those differences are adaptive. I'm assuming the null hypothesis is that the differences are due to drift, but what selection pressures are you studying?

noc-a-homer

Thanks! You're right that our null hypothesis is usually drift. Geckos are great because they a really large and old group and so I can study recent evolution within a genus in a situation that I may expect adaptation to be acting. For example if I was studying closely related species on the same island that use differently textured surfaces, I might have an alternative hypothesis that their toes would be adapted to their respective surfaces. Check out https://experiment.com/projects/are-the-feet-of-gecko-lizards-adapted-to-different-surface-textures for more info. In this scenario I would be making the assumption that toe pad performance would be correlated with fitness and as a result, fit morphologies will be correlated with the microhabitats they excel in. Alternatively, I can also study older changes across more distinctly related species. This these kind of studies, we can fit models of trait evolution

(Brownian Motion or Ornstein Uhlenbeck) so see how traits may have changed over time.

Are you trying to find out what genes in the animal are responsible for this?

edenapple

That would be a really cool study down the road! but as of right now, the tools to study genetics just aren't there yet. We're just now starting to link specific genes with specific traits in animals that haven't already been really well studied (like fruit flies, mice, and humans). There has been some really cool work linking the gene MC1R to white color in lizards (work by Erica Rosenblum) and mice (by Hopi Hokstra) but in those cases, its only one gene controlling the trait. Differences in gecko toe pads are likely controlled by really small changes by lots of different genes, which would make it pretty tough to study with the tools we've got today.

what do Geckos eat? Do their pads help them to catch certain prey items?Does anything in their diet aid them in their ability?

FuckFiFa

Most eat insects, while some will also eat fruit. Some of the larger, more aggressive species will eat anything that fits on their mouths (other lizards, baby mammals or birds, etc). Their diet is pretty similar to lots of other lizards, but their toe pads let them live in parts of the environment that other lizards can't, so in that context, yeah, toe pads help them find food and hiding places, but there isn't anything special about their diet that really facilitates their toe pads.

You must know Keller autumn or at the least be very familiar with his work. Have you heard of the Thai super hero gecko man?

fatherbiscuit

Yep! Kellar was on my PhD committee. I spend a couple summers working in this lab in Portland during grad school! and still work with him on a regular basis. But I am not familiar with the Thai super hero gecko man... Should I be?

How does my Giant Day Gecko (better know as Reptar) walk on the glass in her tank when the surface is wet without slipping?

OG631

I've had that species too (Phelsuma grandis), they make awesome pets! That's a good question about water though. van der Waals, the primary force that holds the tips of gecko hairs to a surface doesn't work very well when there is water on the surface, even if its a very thin layer. There is a really great group of studies by a researcher, Alyssa Stark. She was looking at how water affects gecko adhesion and measured exactly the effect of water you saw, but there was a twist. Gecko skin (like most other lizard skin) is hydrophobic, meaning water will bead off it. When a gecko walks on a surface that is also hydrophobic, like plexiglass or a waxy leaf, any water that is in the way will bead up and be pushed out of the way.

6 hours, it's 2PM and not one question has been answered. At least I get to see Elliot Hawkes talk

about this on the 25th.

quantumfluxcapacitor

I'm sorry! There was a screw up with the scheduling. I thought this was going up Sunday afternoon! Hopefully I've been able to answer some of your questions!

When do we get gecko-tape?

eviltwinkie

check out Geckskin! https://geckskin.umass.edu