this little reptile may look like a normal little lizard but it's in fact a creature capable of something that some would Define as a miracle in the blank of an eye it takes off and dashes away sprinting on top of the water meet the Basilisk Lizard the water walking dragon that seems to defy gravity and challenge a lot of what we know about movement and Locomotion unlike its mythical counterpart basilis lizards aren't in the business of causing death with a single glance in fact real life basilisks are not very formidable and are quite vulnerable to death at the hands of other forest dwellers such as large birds snakes and fish they generally lay motionless and their cryptic coloration allows them to blend in with the brown Hues of branches or dead leaves on the forest floor or the Deep greens of foliage higher up in the trees when threatened however basilisks employ one of the most creative Escape strategies known in the animal kingdom when jolted from their statue like State a basilis lizard's hind limbs were into action bicycling across the surface of the water and propelling the tiny lizard up to 15 ft covering more than 10 times its own body length in a single second once this aquatic Road Runner has sprinted as far as it can it sinks down into the water far from whatever threat caused it to move in the first place this seemingly miraculous Escape tactic has earned the Basilisk the nickname the Jesus Christ lizard in its homeland of Central and South America and has captured the attention of not only reptile enthusiasts but of biomechanical Engineers looking to recreate this water walking ability using adaptive robotics what is it about these seemingly physics defying lizards that allow them to possess such a Biblical ability and what might these skittish creatures teach us about being able to walk on water ourselves basilisk lizards belong to the casad lizard family in reference to the round crests at top their heads this might have earned them their scientific name basilicas which translates to Little King these little helmeted Kings belong to a much grander lineage of superpowered lizards the iguanians this suborder includes some 2,000 lizards from The Fearsome frilled and spiky lizards in Australia to the Flying acrobats of Southeast Asia gliding across canopies to a colorful array of hu shifting chameleons across different continents but only the Basilisk Lizard can walk on water a unique and extreme adaptation that may have come from an ancient ancestor the babby basilicas a 48 million–year–old lizard skull fossil is a close relative of the Basilisk Lizard while there isn't exactly a way to prove that this ancient relative was also able to walk on water researchers do know that this ancestral species lived during a time where it would have been very useful to do so the environment was full of the early ancestors of carnivorous mammals Raptors and even crocodiles and you can be sure that being able to run on water would have definitely improved chances of survival amidst these Predators so it's entirely possible that the incredible ability to walk on water has been around for an extremely long time and this survival strategy is still necessary in the modern world with snakes predatory birds and big mammals who would happily snack on a little lizard they do their best to camouflage but even the best camouflage can sometimes be discovered by the Keen eyes of larger Birds The Supercharged smell of snakes and the prowling of mammals that can even see in the dark of the night and that's when running on water comes in handy to fully appreciate appreciate the miracle of the Basilisk Lizard being able to walk on water consider how most legged animals walk on land to describe the Gate of terrestrial organisms bioka researchers typically refer to the classic spring Mass model imagine what it's like when you take a step to walk after you plant your foot firmly into the ground notice how your leg flexes ever so slightly before you push off raise your leg and

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prepare to take that next step this slight flexion can be compared to compressing a spring priming it for expansion as you bounce off your one leg to propel yourself forward this bouncing gate is common in many forms of terrestrial Locomotion from The Galloping of horses to the hopping of rabbits and it's a particularly efficient way of moving on land for the basilis lizard sprinting across a pond it's easy to see that this model wouldn't be a good fit for such a spring system to work the ground you're walking on needs to provide enough resistance for the spring to push against and be primed but water is well water unlike Solid Ground it's weak yielding and gives to most any kind of pressure that's applied to it most limbs that attempt to take a step in the water sink and those that don't as is the case for the other Water Walkers of the animal kingdom typically have to rely on other mechanisms to stay afloat the water strider for example floats at top the surface with the help of multiple extremely long widespread legs with waterproof hairs the buoyancy created by these legs can support up to 15 times the insect's weight a useful adaptation for when it's raining and water drops add considerably to their body weight water fowl like ducks and geese can also occasionally be seen to be running on the water but are usually assisted by flight that allows them to just barely skim the water's surface the basilis lizzard doesn't have any long long buoyant Limbs and unlike some gliding lizards the Basilisk isn't able to Glide or fly so how does this reptile manage such an incredible task using high-speed cameras researchers have discovered just how the basilis lizzard does it instead of the classical bouncing spring model bassilus gizzard hind limbs move in a more bicycling piston like fashion a totally unique form of movement the piston-like movement of the Basilisk can be seen sequenced into three distinct phases known as the slap the stroke and the recovery phase as the name of the first phase suggests the Basilisk Lizard first slaps the surface of the water which creates a pocket of air that keeps the lizard from sinking it's this same kind of air cavity forming phase that allows us to skip tiny Pebbles across the surface of a lake in the stroke phase the lizard starts to propel itself forward its leg very quickly digging into the air pocket and kicking back as it pushes off the cavity formed in the slap phase then just before the air pocket collapses and water rushes in to sink the basilisk's leg the Basilisk curls its toes and swiftly pulls its leg out of the air pocket before it breaks transitioning into the next slap stroke recovery cycle on the other leg in this sense basilisk lizards aren't so much Water Walkers as they are air Benders forcing bubbles of air beneath their feet at each step they take with movements so quick on a Surface so fragile the Basilisk also employs some tactics to maintain its center of gravity on the slap phase the lizard's leg is slightly pushing off towards the midline while on the stroke phase the lizard's leg shifts slightly laterally as it tries to write itself this kind of wobbly transverse movement coupled with its flailing upper Limbs and a long Rudder likee tail helps the Basilisk to stay balanced as it dashes across the water and gives it its characteristic goofy almost clumsy looking way of running but is this something that all basilis lizards can do from the tiniest ones to the absolutely huge ones is there a point at which its size prevents it from running on water a group of researchers found that smaller juvenile lizards were much more successful at running on water than larger adults so size clearly plays some role when they analyzed the gate mechanics required for lizard weighing between 2 G and 200 g they found something interesting all of them generate more than enough Force to stay on the surface of the water but how they move changes small lizards can be pretty sloppy with how they move because at 2 G they can generate 225% of the force needed to maintain

their Center of mass at a constant position in fact the researchers say that a 2 G lizard could carry another lizard of the same size on its back and still easily run across the water lizards that weigh 200 g on the other hand only produce just over the amount of force needed to support their body weight they have to avoid drag and yank their feet out of the water as quickly as possible because they're much more likely to sink no chance of them carrying a hitchhiker on their backs and this brings us to the next question could humans ever do this if we wore the world's biggest flippers and never skip leg day at the gym could we generate the force necessary to walk on water unfortunately not on this planet researchers calculated that humans would have to run at 30 m/s or 67 mph on 1 square met fins to generate the necessary force not even usin bolt could manage it but if we reduce the gravity to only 20% of Earth's gravity basically getting it to the moon's gravity we'd have a chance you'd still have to wear small fins and weigh no more than 73 kg but then it would actually be possible to walk on water but considering there's no water on the moon this isn't the most useful information but who knows what future humans might get up to until then we're more likely to use the Basilisk Lizard for inspiration with our machines this simultaneously funnyl looking and incredible adaptive strategy of the Basilisk Lizard has captivated the attention of researchers in the field of biomedic Robotics that is scientists and Engineers who take inspiration from movements in nature and emulate it with Machinery in the context of the basilis lizard that means amphibious robots which are designed to navigate between terrestrial and Aquatic environments while there are already a number of species of amphibious Robots coming in all shapes and sizes many of these rely on wield or leg mechanism isms that sink into the water While others inspired by the water Strider rely more on buoyancy and thus move across the water considerably slower while useful these robotic designs don't quite fill in the niche of function that a water running robot could provide a fast and highly reliable robot that could transition almost instantly from land to water and back could be incredibly useful for unmanned rescue missions Research into dangerous terrain more efficient ocean Explorations and maybe eventually the exploration of alien environments consider some of the Prototype robots inspired by the water walking basilisk this blade type crawler developed by Yamada and Nakamura has blade likee legs attached to a conveyor belt–like mechanism around the robot's body compared to other approaches to rough terrain this mechanism allows for a good balance between the high velocity that a wheeled vehicle provides and the adaptability ility that a Leed robot could provide and unlike its reptile counterpart this blade crawler wasn't designed for running away this tiny robot headed straight towards danger as it was field tested to explore volcanic areas of Mount mihara in Japan the Basilisk inspired robot didn't disappoint as it waited seamlessly through small ponds and puddles and demonstrated the potential for unmanned observation of otherwise dangerous sites such as active eruptions other projects take the inspiration from nature to the extremes like this lizard spider octopus jellyfish rolling robot you heard that right this robot is envisioned not only to be able to walk on water like the Basilisk Lizard but also roll and fold up on top of the water like the Golden Wheel spider and Propel itself underwater just as we see octopus and Jellyfish do and if this wasn't impressive enough researchers also hope to have this robot release a swarm of other baby robots also engineered to mimic some of Nature's best water Travelers while this mindboggling robot was initially designed for the purpose of deep sea research and ocean object identification the authors mention that such an

alien-looking robot May potentially be suited for outof this world Explorations in unpredictable environments beyond Earth the basilis lizard is a prime example of how seemingly small scientific Curiosities can be transformed into real world practical applications that have the potential to save lives and provide us with a better understanding of Worlds we've never even been to before our growing understanding of the basilisk's funky movements has allowed a more analytical approach to recreating this biblical ability with researchers experimenting with Dynamic folding feet and different kinds of rigid and active tails to slowly hopefully reach a point where walking on water will be nothing out of the ordinary but as researchers are starting to realize manually programming robots to deal with tons of different situations such as highly variable terrain from Ice to gravel to water to rocks is timeconsuming and also just doesn't work that well to really unlock the true potential of robots like the Basilisk bot researchers are starting to use neural networks that allow the robot to learn on its own how to deal with obstacles it faces this is without a doubt the next huge Le deep in robotics and it's one that I don't really understand that well the papers on the subject are dense and I can only barely wrap my head around what they're saying but in this line of work and just as a human in this modern world I really need to understand how neural networks work so to learn about this from the ground up I use brilliant brilliant is a free and easy way to learn math data science and computer science interactively and their introduction to neural networks course hased allowed me to dive into the inner Machinery of neural networks to discover how these flexible learning tools actually work they start you off by showing you some simple neural networks to First just show you how they work and then you get to explore a much bigger neural network to appreciate all that they can do so if you've also been hearing about neural networks all over the place and are a little lost on how they actually work this is the course for you brilliant is fun and interactive with thousands of lessons from basic BS to Advanced topics and new lessons are added every month for me the best part of brilliant is the interactivity I don't learn best by simply reading documents I need to engage with the material and Brilliant lets you do this with levers sliders buttons and questions all along the way to ensure you are really absorbing the lesson whatever your skill level brilliant customizes content to fit your needs and lets you solve at your own pace so to learn more about this new age of neural networks and to try everything brilliant has to offer free for a full 30 days visit brilliant.org science or click on the link in the description the first 200 people will get 20% off brilliant's annual premium subscription and every sign up helps this channel

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