

SCIENTIA EST VITA

ISSUE 14

Inside
*Mythical
Creatures*



A black and white photograph of a magnifying glass resting on a page of mathematical work. The magnifying glass is centered over a system of linear equations. The text 'Editorial' is overlaid in white, bold, sans-serif font across the center of the image.

Editorial

Welcome back to Scientia est Vita, where this half term we'll be looking at the wonderful, breathtaking and extravagant entities known as Mythical Creatures!

In this incredible issue, we'll be debunking their awesome backstories and dissecting the truth and science within them. From the scientific accuracy of dragon fire, to the legends and mysteries of the mischievous Yokai, no supernatural phenomenon can escape the wrath of our superior knowledge.

Thanks to our never-ending curiosity and imagination, we'll vanquish any question and query you may have about them (hopefully :D).

With the power of science and all the wonders it provides us, we'll be able to spread our insights with the rest of you and teach you more about these astonishing beasts! After all,

Scientia est vita. Knowledge is life.

So let us honour this power and the wisdom it grants us!

Bettina Cahilig
HONOURARY EDITOR

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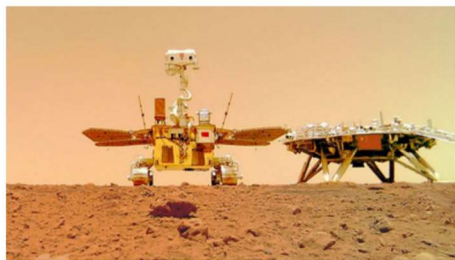
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Unicorns may be real after all, or at
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RECENT SCIENCE NEWS

MARS FLOOD!

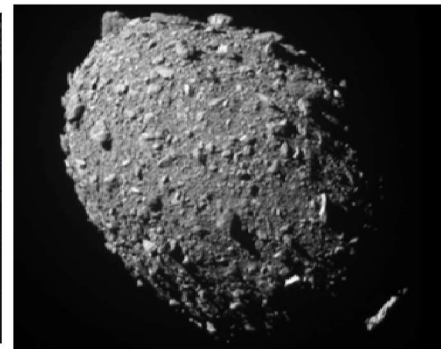
The Chinese rover named Zhurong has found evidence under the Martian surface of previous floods which may have shaped the Utopia Planitia region. The rover uses a ground penetrating radar which goes up to 100m below the ground. It is theorised that there was ice or water previously in this region of Mars.



Zhurong has been exploring the region since May 2021 and since has found rocks arranged in the subterranean in repeating patterns in different layers of earth from 30 billion years ago. This is probably due to rapid water movement that carried sediments all over the region.

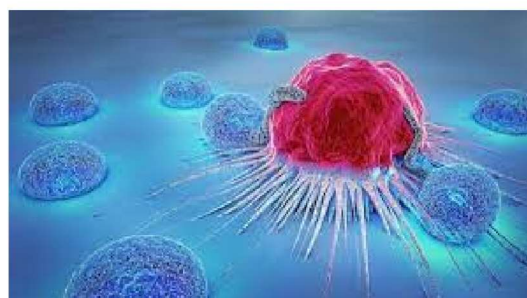
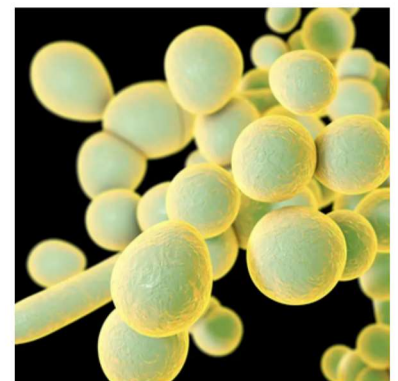
SMACKING IT STRAIGHT INTO SPACE, SATELLITE REDIRECTS AN ASTEROID

"A vending machine sized Satellite called DART has successfully redirected the journey of a 530 feet sized asteroid. Approx the asteroid was hit at the speed of 14,000 miles per hour. The satellite has changed the orbit of the asteroid as now is being under more development as a defence system for life threatening asteroids. Hubble and Web telescopes will be surveying the asteroid to accurately report on the success of DART.



FUNGI INSIDE CANCERS MIGHT SPEED UP THEIR GROWTH

Recent research has shown that tumours of different sizes and of various types of cancer contain different types of unicellular fungi. This may highly benefit in helping diagnose cancer.



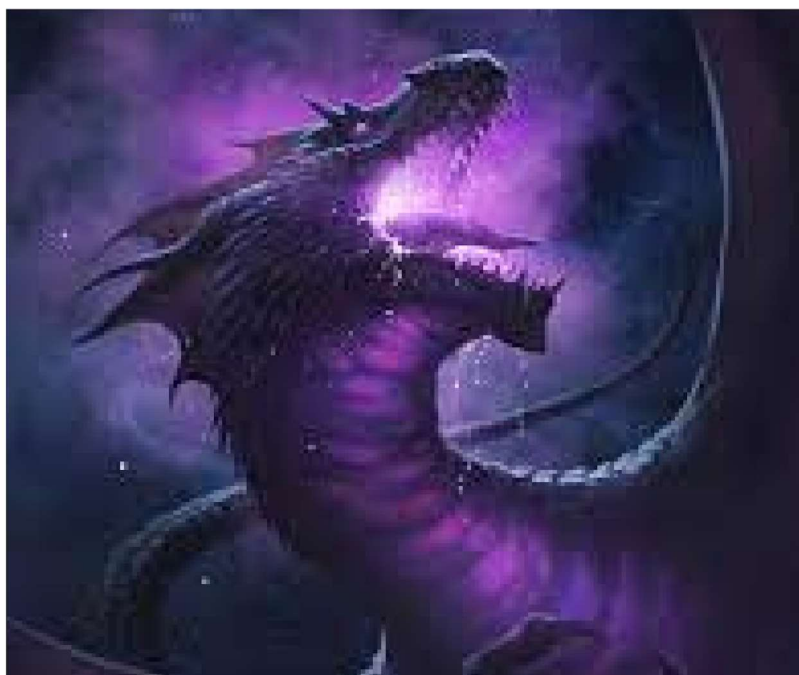
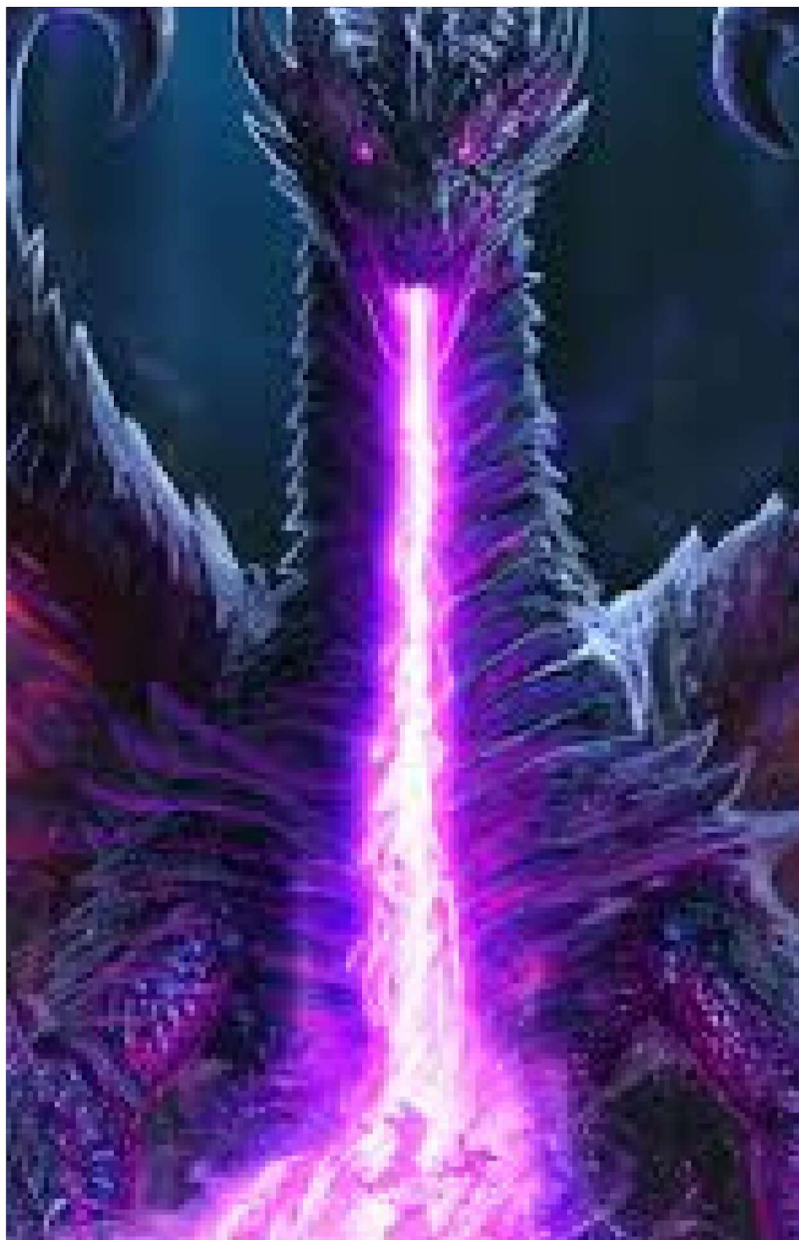
However, some types of fungi sped up the growth of one cancer and another fungi helped get rid of breast cancer. The link is yet not well established or understood.

The Chemistry of Dragonfire

Dragons are the mighty beasts of legend and myth, ballad and song. The dragon of western folklore is a glorious force of pure power, renowned for scales of coruscating crystal, wings that cast the land into fleeting night, tooth and claw that the mightiest predator should fear, and, of course, their flames.

A real actual fire breathing creature seems like an impossibility. Books are rarely forthcoming as to how dragons might achieve this. Of course, books featuring dragons often feature magic as well. The lazy explanation for fire breath is that 'magic' somehow allows this to happen. In Christopher Paolini's Eragon series it is stated that it is dragons' inherent magic that allows them to fly, since there is no way that their wings could lift such giant beasts. But I want to see if there is a way to fit fire breathing into our reality, in which, as far as we are aware, magic does not exist.

Anne McCaffrey's Dragonriders of Pern series has dragons chewing on rocks containing phosphine, a chemical made of phosphorus and hydrogen. Gaseous phosphine is incredibly flammable - it will explode on contact with oxygen. Liquid phosphine isn't much better. Seven drops of the stuff are enough to kill a man. So, unless you want a dragon that will take its head off with one flame, phosphine isn't the answer. There are a couple of ways that we can actually give dragons their famous flames though - here they are!



Methanol

FUELING UP

The following methods have been calculated to give our dragon the same firepower as an X15 Flamethrower, which can maintain a 14-meter column of flame for 1 minute.

STORAGE

Now, fuel. The first potential fuel that comes to mind is methane, which is a common and very flammable gas. However, a gaseous fuel would take up way too much room - for our desired firepower, a dragon would need 13 000 cubic litres of methane, or 73% of the volume of a grey whale.

A better fuel would be methanol, a liquid, of which a dragon only needs 25.8 litres. Liquid attacks are also way easier to control than gas attacks, which dissipate quickly.

Combine 2 moles of methane and 1 mole of oxygen for a 5% chance (1 in 20) to make 2 moles of methanol. These odds seem awful, but they're good enough. This is an exothermic reaction so the excess heat will need to be expelled alongside air - a methanol-powered dragon would have very hot breath.

Using a complicated formula that I won't bore you with, which involves pressure applied to the methanol formation sac, the temp difference between the sac and outside and much else, we can calculate that it would take 86 268 secs (just under 1 day) to make enough methanol for 1 minute of x15 firepower. To produce this much, by using the same formula, this dragon would need to apply 130 000 newtons to its sac. This makes our dragon 1.5 times as strong as an elephant, which is perfectly reasonable for a beast renowned for fantastic strength.

FUEL SOURCE

In order to produce this much methanol in one day, one would need 632 moles of methane. A dragon would need to produce methane 676 times faster than a cow, the world's gassiest animal, to achieve this.

There are other sources though. Bogs have very methane-heavy air, so dragons dwelling near bogs could visit each day to fuel up. A cool idea, keeping in line with dragons' habit of hoarding, would be if dragons kept captured livestock in a sealed cave, letting them pass gas until they died (or until the dragon got hungry) and then inhaling the methane.

The reaction which forms methanol requires a catalyst. Iron embedded in graphene is one choice, and quite easy to get. A meat rich diet will provide enough iron, and carbon, which is what graphene is made of, is readily available from any organic substance. Graphene is a wondrous material (see Issue 9 of *Scientia Est Vita!*) so using it to line the gas sac will protect it from the pressure needed for the reaction and from cooling down.

Methanol

IGNITION

IGNITION

We have fuel, we have oxygen - next on the list is heat. Since we're using a flamethrower as a basis for our dragon, we may as well use the same method of ignition as one as well. The X15 uses compressed CO₂ fired at such high speeds that it ignites.

A dragon would need a compressed sac containing 6L of CO₂. In order to compress it this far though, it would have to be 9.8 times as strong as an elephant. To put that into perspective, an elephant can lift 320kg with its trunk alone.[4]

This sort of strength would re-teach a Catholic priest the meaning of awe, but then again being beyond awe-inspiring is what dragons are known for.



FUEL SOURCE

There is just one last problem. Methanol is toxic. When absorbed through contact, it is oxidised by an enzyme to form formaldehyde, which forms formic acid. Build ups of formic acid stop cells from functioning and cause nerve damage. Fortunately, there is an easy fix for this. There is a chemical called fomezipole which stops the enzyme from forming formaldehyde and is made of naturally abundant elements. Naturally producing fomezipole is perfectly feasible and will save the dragon from poisoning itself.



There! A real, actual fire breathing dragon. This species of dragon lives in cool, northern climates so it can access bogs to fuel up on methane, generally near mountain regions where there are many caves in which to store livestock. It ripples with muscles under its scales and is nearly 10 times stronger than the world's strongest mammal. Its fearsome strength cows the mightiest hero. When it takes off its scything talons gauge deep lacerations into the mountain rock. I think we'll call it something boring, like the Northern Bog Drake.

Acetic Acid

IGNITION

FUEL TYPE

A different approach to breathing flame is using acetic acid as a fuel. It releases 14.6 megajoules per kilogram burned. It takes up slightly more room than methanol, weighing 31.6kg and occupying around 30.1L - around half the size of a human. What makes it a good fuel is that it has a low flash point - the temperature at which it gives off enough vapour to ignite in air, in the presence of a catalyst in this case. The process by which it gives off vapour is called decomposition.

Acetic acid decomposes into ketene and methane gas, and an enzyme would be a likely catalyst. Ignite these gases and the heat will in turn ignite the acid. Boom - a jet of burning, broiling, highly corrosive liquid. However, there are complications. The decomposition of acetic acid releases CO₂ and water vapour, which dilute oxygen, dampening the flames. To solve this, every time this dragon breathes flame, it will have to exhale large amounts of oxygen to drive away these nasty, fire-suppressing gases. This extra oxygen will also allow its fire to burn brighter.

IGNITION

Now, how to ignite? A dragon could have an organ like a bird's gizzard somewhere in the throat - a muscular, thick-walled section of stomach which birds use for grinding food, but which this dragon could use to grind swallowed rocks together to give a spark.[3]

An interesting alternative is something called piezoelectricity or piezo ignition. It's used in quartz watches, microphones and gramophones, and in fact how some flamethrowers and gas stoves ignite.

Piezoelectricity (lit. 'pressing electricity') is, simply put, using crystals to convert mechanical energy into electricity. By squeezing certain crystals, such as quartz, one can make electricity flow through them.[2] We're using the scientific definition of crystal here, meaning any solid with atoms or molecules arranged in a regular and repeating pattern. So, a lump of iron is, scientifically speaking, as much a crystal as a sapphire. Iron is readily available in most meats so a dragon could have a natural iron in its mouth or throat, which it squeezes with its muscles to produce a spark.

Acetic Acid

FUELING UP

GETTING HOT

One last problem. The flash point of acetic acid is 39 degrees C, while a dragon's body temperature should be around 38 degrees. A warm-blooded organism should quite easily be able to heat itself by a few tenths of a degree - but dragons are reptiles, and reptiles are cold blooded. Cold-blooded creatures cannot regulate their own body temperature. Luckily, I have found an exception - scientists believe the pterosaur to have been warm-blooded. Therefore, this dragon could raise its temperature when about to flame by increasing its metabolic rate.



And boom! Another feasible (ish) dragon! This dragon lives near sunny meadows of wildflowers, and why not, let's make it brightly coloured as well. There's not much use for camouflage when you're a giant winged reptile with an arsenal that includes scythes attached to your feet, a mouth full of swords, and a flamethrower installed in the throat. No, this dragon comes in as many jewel-bright colours as the flowers it eats, and glitters in the sun-soaked sky. How about a name like Hummingdrake, after the hummingbird? I'll admit, names aren't by strong point.

SYMBIOSIS

This dragon would enter into a symbiotic relationship with the bacteria. The dragon nourishes the bacteria with its body, and alongside oxidising ethanol to acetic acid, the AAB could protect the dragon from acid burns via horizontal gene transfer: AAB are naturally resistant to the acid they produce, and this resistance can be passed to the dragon via DNA transferred from the bacteria to the dragon's cells. This fascinating phenomenon is actually quite common between animals and bacteria.

Acetic acid is created when acetic acid bacteria (AAB) oxidise ethanol. These bacteria are found in sugary, acidic and fermented foods, and animals which eat such foods. Charmingly, they are also found in flowers. Would it not be cool to have such reputedly ferocious carnivores dining on sunflowers and daisies?

THE KRAKEN

By W.T



Where did the Infamous myth of the Kraken come from?

The kraken would have been a gigantic octopus as proposed by Pontoppidan a Norwegian priest. Originating in Scandinavian folklore, the kraken is usually depicted as an aggressive cephalopod-like creature capable of destroying entire ships and dragging sailors to their doom.

Victor Hugo describes it as " These cupping-glasses are cylindrical, livid cartilages. On the large species they gradually diminish from the diameter of a five-franc piece to the size of a lentil. These fragments of tubes are thrust out from the animal and retire into it. They can be inserted into the prey for more than an inch."

A VAMPIRE'S DAILY BLOOD INTAKE

By B.C. 11RMS

Vampires have been so popularized in our media and it's pretty hard to find someone who hasn't heard of them in at least one way or another. These creatures appear everywhere, whether that be in TV series, such as The Twilight Saga, or literature, such as Bram Stoker's notorious Dracula. They are also commonly found in movies and even cultural folklore. They are usually portrayed with pale skin and sharp fangs, and have weaknesses such as sunlight, garlic and silver. However, Vampires are powerful and dangerous creatures who are a lot stronger than the typical human as they can easily catch and overpower their prey. This is so that they can feast off of their blood as they are in fact sanguivores (animals that feed off of the blood of other animals). But have you ever wondered how much blood do Vampires need to drink? Worry not, as I have all the answers to that, saving you time, hassle and the questionable search history. So let's dive straight in and find out.

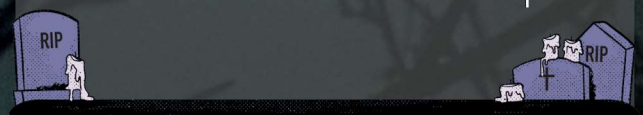
Why do Vampires drink blood?

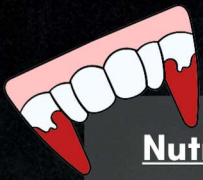
Since Vampires are immortal, they don't actually need blood to stay alive. In fact, the whole reason why they drink blood is to enhance and peak their powers since they already have supernatural DNA in them. When Vampires drink blood, they can perform and work at their best, allowing skills such as their strength, superhuman speed and healing to be at their prime.

However, if a vampire deprives itself of blood, they would grow very weak until they enter a deep and eternal coma-like state where they will have vivid dreams or nightmares. If this continues to go on, then they will reach a point where they start to feed off of their own blood.



This can cause them to become even more mentally and physically unstable (as if they weren't already). So even though a vampire won't die if they don't drink blood, they won't be much better than a dead corpse.





Nutritional value of blood

This part of the article took a lot of math (and headache) since there isn't a simple answer to this, but after lots of research and calculations, I've been able to make an approximate measurement of blood's nutritional value.

Nutrition Facts	
Serving Size 100 grams	
Amount Per Serving	
Calories 75	Calories from Fat 3
% Daily Value*	
Total Fat 0.4g	1%
Saturated Fat 0.1g	1%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 188mg	8%
Potassium 0mg	0%
Total Carbohydrate 0.1g	0%
Dietary Fiber 0g	
Sugars 0.1g	

Blood isn't a very efficient source of food as there is only ~850 calories in it per litre [1]. To put that into perspective, that's not much better than four slices of whole wheat toast and is definitely underneath the 2,500 calories requirement per day for a grown man. In addition to that, blood is approximately 78% water, causing a person to become incapacitated if they were to drink a lot of it. Blood is also a horrible source of vitamins and minerals as there is such a low concentration of them.

To make things easier for ourselves, we are first going to calculate the total amount of calories that you can gain from plasma, since this substance makes up around 55% of the content in blood. This equates to around 550ml of plasma per litre of blood. From that volume of plasma, you can gain around 178.08 calories worth of proteins, 2.16 calories worth of sugar (which surprisingly isn't a lot) and 24.75 calories worth of fat, leading to a total of 204.99 calories from plasma alone.

Afterwards, is the amount of calories that come from red blood cells, which make up approximately 44% of your blood. However, red blood cells are mostly made up of water and protein meaning that it isn't very nutritional either. This means that per litre of blood, you get around 368.64 calories from the haemoglobin and 256.37 calories from red blood cells. In addition to that, you also get ~20 calories from the 1% of blood that is white blood cells and platelets.

All these numbers are rough estimates since we are only humble school children here doing the maths for this, but even then, our results show how little nutritional value you would get from a litre of blood.

Debunking the Science

If it wasn't clear enough, blood is a really bad source of food. As mentioned on the previous page, it has a low caloric value meaning that you'd need to drink litres blood to satisfy your daily needs. However, if you were to drink that much blood, your body would need to process all of that excess water leading you to urinate a lot more to get rid of that. This is true to nature as vampire bats, process and excrete the excess water from blood while they drink so that they won't become incapacitated after a long meal.

In addition to this, drinking too much blood can cause you to have Haemochromatosis due to an overdose of Iron since it has high concentration of it (12.33mM per litre). But there are animals, such as mosquitoes, that have adapted proteins to pack the iron into harmless structures.

There are also more issues to this bloody diet such as the amount of bloodborne diseases that can be carried through this. Diseases such as HIV/AIDS and Hepatitis can be spread via the blood, meaning that anyone unfortunate enough to feast on a host with diseases like this could land themselves in deep trouble. Unless, you are just like a mosquito and have many immune cells equipped to deal with them (those pesky creatures).

However, if the vampire wanted to have a long feast, they'd need to have lots of anticoagulants in their blood to prevent their victim's blood from clotting too quickly too, just like many other sanguivores in real life.

With all these complications in mind, it's no wonder why vampires are a mythical creature to begin with, since there are so many repercussions and issues to take into consideration.

A Vampire's Blood Intake

Now the answer we have all been waiting for: how much blood does a vampire need? Well, it depends on what measurements you're using. If you are comparing how much blood a vampire needs to the average daily caloric intake of a grown man, then a Vampire would need to drink around 3 litres of blood per day. That equates to around a person a day. However, if you are comparing how much blood a vampire needs to how much a vampire bat needs, then a Vampire would need to drink a whopping 48 litres of blood per day to match that! That's the equivalent of killing almost 10 people per day. Regardless, these Vampires will need to go on a murdering spree to quench their never ending appetite for blood.

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A Brief Clarification on Yokai

Yo*kai are strange, supernatural creatures and phenomena originating from Japanese folklore. They are NOT ghosts (Yu*rei) but instead spirits. Their behaviour comes in a large range of being playful, mischievous, malicious or benevolent. Most often the yokai are integrated with human life including shape shifting to live as/deceive humans.

They influence a large portion of old art and stories along with modern media such as in anime. The Pokemon characters, Yokai Watch (a show solely about yokai) and Ghibli Studios movies Princess Monke and Spirited Away. And the well-known Mario tanooki suit is based on the tanuki yokai!

The Hyakki Yagyō (Night Parade of One Hundred Demons) is when a parade of yokai march through the streets of Japan at night- a breakthrough of the supernatural spirits into the physical world.



THE MYSTERIES OF YOKAI

BY M.D. (11MR11)

Kodama

Tree spirits which reside in special trees in ancient forests. They are invisible/indistinguishable from normal trees to the human eye. Your treatment towards them will garner either a blessing or a curse, a blessing when you protect and respect the trees and a curses when you mistreat trees.

Kodama are depicted in Princess Monoke as white lithe creatures with a black mouth and eyes. It's believed a tree falling is the cry of a kodama.

Today they are used as a plea to warn people to look after the world's forests with the alarming rate their resources are being extorted and deforested.



Kitsune

They are foxes that can shape shift to appear as humans. They have lengthy lifespans and every 100 years they get an additional tail and when they have 9 they gain the ability to see and hear anything happening anywhere in the world.

There are 2 types of kitsune. 1-holy servants of Inari who act as messengers of the Gods. 2-the more common wild evil foxes who play pranks on humans, but they always repay debts/favours. They have the power to possess humans, produce fire, shapeshift into humans (by placing a skull over its head- usually they can be caught slipping up by revealing their tail or fur to humans. They possess humans to make them do weird/evil things.



Kamatitachi

These are essentially 'wind weasles', primarily found in mountainous regions riding the swirling winds in these cold areas. They were a phenomena created to explain cutting winds. The kamatitachi travel and attack in 3s: the 1st strikes the prey down, the 2nd creates deep wounds with it's claws and the 3rd licks and cleans the blood.

"It is said that the kama itochi strikes with such precision that it can carve out entire chunks of flesh from its victims without spilling even a drop of blood."



MORE YOKAI!

Shikigami

These are yokai/gods/demons which are summoned to have their power utilized e.g. in rituals, to have their power stored in the form of an object e.g paper birds.

Typically, shikigami are used by onmyouji to carry out risky tasks, such as spying, stealing, and tracking enemies.



Tsukumogami

these are objects which on their 100th birthday, after serving their owner get a soul and therefore become animated and alive.

Traditionally it is household items like umbrellas and sandals who become tsukumogami. If they had been maltreated/thrown away by their owner they may gang up and seek revenge on their current owner.

To sort this problem 'jinja ceremonies' are performed in Japan to console unusable objects. Generally though, they are harmless besides a few small pranks. Be careful if you buy secondhand sandals and they stare at you with their tongue out...
Bakezōri is what possessed sandals are called.



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The Chupacabras and the Greek Chimera

COULD THEY EXIST?

by Y.E.M.

Over centuries of mythology, no other beasts has fascinated people as much as hybrids. Especially the myth of the Chupacabras and Chimeras! A half alien, half vampire like creature that preys on goats of local farmers or a terrible beast part lion, part snake and part goat. The big question is, could they exist today and what were they?

In short, yes but no, hybrids have been found naturally occurring in the wild, this is a more common instance in plants but was thought to be a very rare case in animals up until not too long ago. Some natural hybrid animals are Hinnies, Mules, Dzo (a cross between domestic cows and yaks), ligers and many others. These animals may or may not be fertile and so cannot reproduce.

The Chupacabra



The Chupacabras is a cross between alien and vampire, described as being a morbid creature of 2 meters in height with 2 large fangs and 3 large claws on each hand and foot. It is highly unlikely that an alien and a vampire had offspring, nevertheless aliens and vampires existing. What's even more confusing is their love of goat blood, which is rich in calcium and has low potassium and sodium. So what was it then? Sadly it was found now that it was coyotes killing the goats and livestock. These coyotes were infected by a brain controlling parasite that takes control of the host's body. And the sightings? Drunk villagers!



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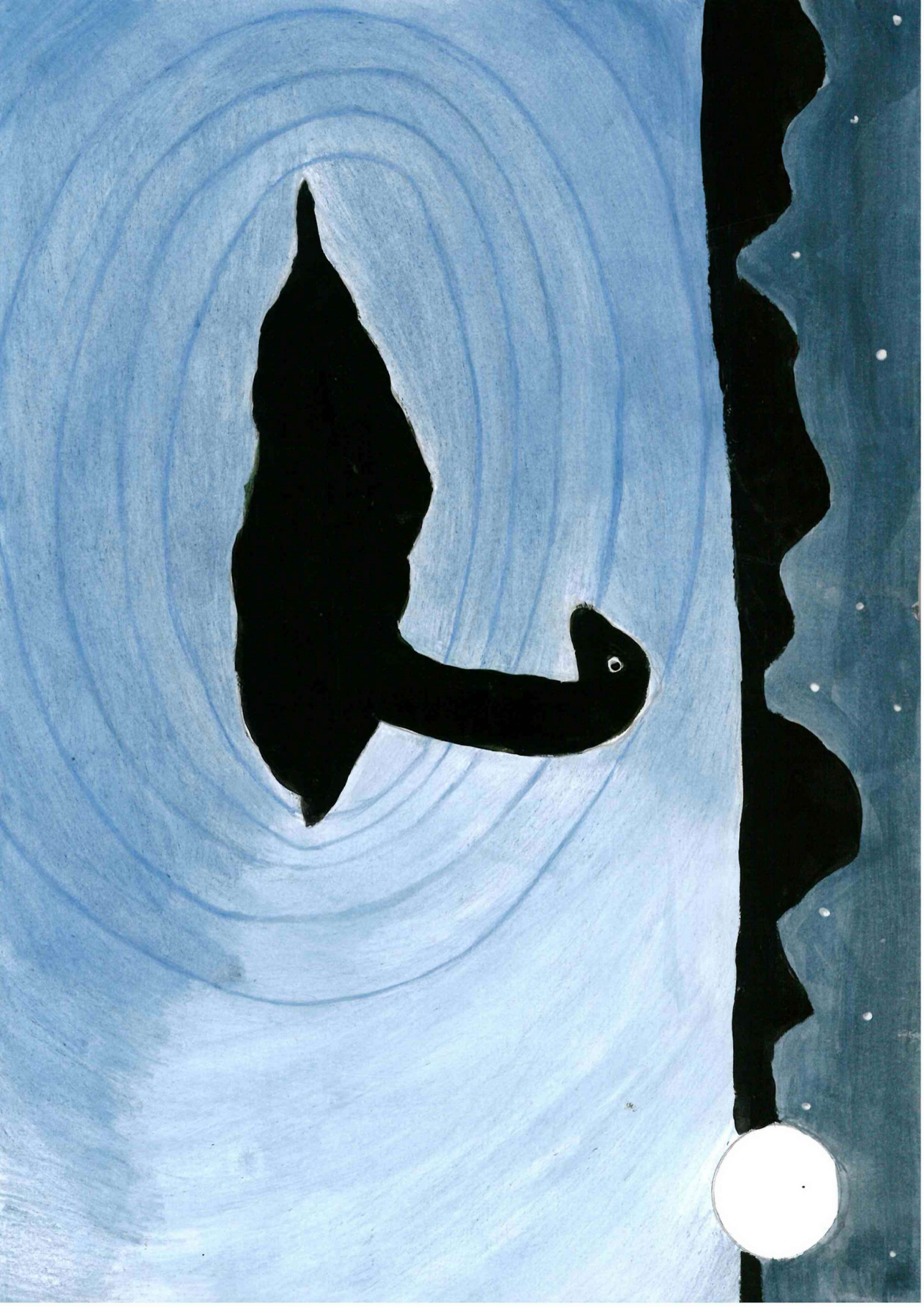
The Chimera

The Chimera, a fearful creature of a mix between goat, lion and snake. All science and logic points towards this animal not being able to be possible. However this is because a crossbreed between a lion and a goat is not possible! Good news is that we only need the head of a goat. Though incredibly complicated and yet not possible, head transplants is a science that is being looked into therefore theoretically implanting a goat head into the body of a lion could be possible. The third step is the snake, crossbreeds between species cannot exist so a lion snake or a goat snake is not possible. So like I said before, the snake would need to be implanted into the goat/lion mix without killing either of the 3 animals.



Congratulations, we now have a chimera! The biggest problem now is to avoid it from dying due to the lion holding 2 more organisms, none of the animals trying to kill each other and either bodies rejecting the new additions. Over all.... its too complicated and would probably end up with the death of all 3 animals. So what was it then? The legend of the chimera is thought to have been a misunderstanding and using too many metaphors when describing a volcano!

Sadly, these hybrid animals of mythology are not possible due to the limits of our science today. But don't be disheartened, who knows maybe in a few years we'll see animal hybrids between different species!



NESSIE

BY NM AND RM, 7JCO



What is the Loch Ness monster?

The loch ness monster (also known as Nessie) is a creature that many believe to live in Loch Ness in Scotland. Those who claim to see it describe it as a large, humped creature with a long neck and flippers.

Why is it so controversial?

Scientists deny that any of this evidence is true; this leaves some with the idea that it is a myth, but there has never actually been any work proving it's real.

On the other hand, reports of a monster living in the lake go back to ancient times. Stone carvings that show a mysterious beast with flippers were found.

In 1933 the legend began to grow that the Loch Ness monster was real. At the time, a road nearby was finished, allowing a scenic view of the lake to be seen. Later that year, two people claimed that they had seen an enormous creature which they described as a “dragon or prehistoric monster.”

A few months later the daily mail did an article about a man who appeared to have seen footprints from a 20-foot-long animal. Unfortunately, zoologists confirmed that someone had faked the tracks. Nevertheless, this encouraged people to prove its existence and still today there are many believers of the loch ness monster.



The Science of Unicorns



By A. L. and M. D.

The unicorns popular today don't actually appear that different to a white horse. A mutation in a single gene turns an animal into an albino, and completely stops the production of melanin. Albino horses have white body, manes, and light coloured eyes, which isn't that far off from the unicorns we've all heard about.

However a horn or bright colouring are much more complex traits which generally involve more than one gene, which we can't just decide we're going to change.

For any of these traits to evolve, they would need to give the unicorn an advantage, enabling it to survive or reproduce. A horn, for example might help it defend itself against predators; bright colours might help male unicorns attract a mate. Even if it was possible for a unicorn to exist because of evolution, it would take years for us to see.

Many believe that unicorns are merely mystical creatures in a faraway land, however recently fossils from nearly 30,000 years ago were discovered these were said to be of the species called a Siberian Unicorn (*Elasmotherium sibiricum*) although the term unicorn is normally associated with a majestic creature with white fur, and a colourful mane the Siberian Unicorn weighed 9000 pounds, stood 6 feet tall and 15 feet long and more closely resembled the rhinoceros. Although no magical flying abilities were discovered, it has a single straight horn projecting from its forehead earning it the name unicorn, even if the term is used loosely.

Credits

The Club

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