

TERRA NOSTRA

The background of the entire cover is a photograph of numerous jellyfish floating in dark, deep blue water. The jellyfish are illuminated from within, creating a bioluminescent effect with various shades of blue and white. They are scattered throughout the frame, with some appearing larger and more detailed than others, creating a sense of depth and movement.

ISSUE 10



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Do Spiders Dream of Electric Flies?

Many of us have nightmares about spiders. Something about their otherworldly appearance, unpredictable movements, and web building, cuts to the core of what scares us. Yet, have you ever wondered if spiders might have nightmares about us? After all, we're many times their size and hunt them down with a whole host of ruthlessly efficient killing devices.

Whether any other living beings than ourselves dream has been a question asked by scientists for many decades and it has been a particularly challenging one to answer. It is not like we can simply ask animals whether they dream, let alone begin to picture the world in any other way than the way we experience it as humans. So, if we cannot see the world through an animal's eyes and if we cannot communicate with them, how do we know if animals dream?

Researchers in the 1950s asked this question and in 1953 they discovered a possible answer. When humans are asleep they enter a deep sleep state which is full of Rapid Eye Movements. This Rapid Eye Movement sleep, or REM sleep, happens when humans are in a dream state and brain activity scans have proven it to happen only during dreaming. It is thought that the quick movements of the

Spider Facts

1. **Spider Bites are rare in Britain. No British spiders that can be considered deadly or dangerous.**
2. **There are over 650 UK spider species.**
3. **The species name of a spider often tells you about their behaviour. Orb and Lace spiders weave distinctive webs, whilst jumping and wolf spiders pounce on their prey.**
4. **Spiders can only reach about 1mph, so you can definitely outrun them.**
5. **In a hectare of grass as many as 5.5 million spiders have been recorded.**
6. **Some spiders have less than 8 eyes. In fact some have as few as 2!**

eyes match up with the objects being tracked in the dream.

Almost as soon as researchers discovered REM sleep they began to see if creatures other than ourselves experienced it. After some pretty extensive observations, researchers discovered that almost all mammals and birds – from dogs and cats to duck-billed platypuses, and even reptiles – seem to go into this stage of Rapid Eye Movement sleep. It even appears that the patterns of electrical activity in their brains are similar to the patterns observed in dreaming humans. Whilst we can't say for certain that the animals being observed were dreaming in the same way as a human for sure, it is fairly strong evidence in favour of the idea.

A study published in the journal Neuron in 2001 took the idea a little further. This study saw researchers recording the brain activity of rats as they ran a maze in the day and compared it to the brain activity of those rats whilst asleep. They study found that the brain activity of the rats whilst they were undergoing REM sleep was almost an identical copy of their brain activity whilst they were awake and running the maze. It appeared to the researchers that the rats were able to access their memory of running the maze and re-experience it whilst asleep. In fact, the researchers went so far as to claim that the rats were dreaming about their run through the maze whilst asleep.

A much more recent study in the journal eLife published in 2015 seemed to agree with the findings of the earlier study. In this study researchers place food somewhere in a maze unknown to the rats but observed by them. The researchers discovered that when the rats were asleep, certain cells in their brains seemed to map out how to get to the food suggesting they were dreaming about it.

All of this is very interesting but it doesn't tell us whether spiders can dream. As spiders are arachnids, is the evidence that mammals and birds may dream relevant?

A team from universities in Germany, Italy and Harvard University also wondered the same thing and set out to see if spiders experience REM sleep. Their findings, released in a report in August 2022, seem to support the idea that jumping spiders may experience visual dreams. During the course

of their study, they observed that jumping spiders have “periodic bouts of retinal movements coupled with limb twitching and stereotyped leg curling” very similar to what we would expect to see in other animals during REM sleep. What the researchers couldn't confirm though was whether the spiders were experiencing a visual dream like a human. As our worlds are so different, and as spiders are very sensitive to vibration, perhaps spiders may dream through vibration rather than visual images. The researchers have said of their findings that it begs “the deeper question of whether jumping spiders may be experiencing visual dreams”.

“Jumping spiders may be experiencing visual dreams.”

Research into the sleeping habits of insects and arachnids is rare. Very few insects and arthropods have evolved movable eyes and therefore very few species can actually generate observable REM sleep.

The interesting things about jumping spiders is that due to them being highly visual predators they have exceptional thinking skills. They're very active and constantly on the move. Therefore their daily lives are full of information inputs that need to be processed and perhaps this might be what is occurring during the observed REM sessions.

Trickily it is too early to say whether spiders can dream, let alone what they may dream about. As spiders are unable to close their eyes it is very difficult to prove they are actually asleep. However, this is something the research team are now out to prove. In the meantime, spare a thought for the little spider cowering in his web dreaming of monsters.





^ Fin Whales can weigh up to 70 tons and measure up to 88 feet. They feed mainly on small shrimp-like creatures called krill or euphausiids and schooling fish.



< Cargo vessels, such as the one pictured on the left, are a major source of noise in the World's oceans. In the last 50 years noise from shipping has increased by over 32 times the amount.

INTERACTIVE



Scan this QR code with your digital device to access what both a Fin Whale's Song and an Earthquake sounds like underwater.

MAPPING THE OCEAN FLOOR USING WHALE SONG

It should come as no surprise that the ocean is an ever more noisy environment. It is not, as most people imagine, a silent realm dominated by the bass booming of whales and the high pitched squeals of dolphins. Instead the last 200 years has seen humans take advantage of the ocean as a means of shipping large amounts of material at an ever increasing rate. Shipping, industrial fishing, coastal construction, oil drilling, seismic surveys, warfare, sea-bed mining and sonar-based navigation all contribute to increasing levels of noise pollution.

A mass review of literature relating to oceanic noise pollution in 2021 saw as many as 10,000 scientific papers on the subject of marine sound and the impact of noise on wildlife be combined to prove that human caused noise is having negative impacts on ocean life. This review of the literature saw evidence that human caused ocean noise can disrupt the behaviour, physiology, reproduction and, in extreme cases, cause death.

The main reason that sound is so polluting in the ocean is that water is a far better conductor of sound than air. In fact, sound travels 4.3 times faster through freshwater than it does through air of the same temperature. As well as this, lower frequency

sounds tend to travel much further through water than higher pitched sounds. Shipping is particularly well known for causing large amounts of low frequency sound and is thought to have caused a 32-fold increase in low frequency noise pollution along major shipping routes in the last 50 years. However, it isn't just shipping that is creating all of the noise. Even a road bridge across water can lead to a continuous input of low frequency noise into the oceanic environment if any of the supporting pillars make contact with the water it passes over.

Even activities that are celebrated for their help in tackling climate change can create noise. Offshore wind turbines make significant amounts of noise whilst being constructed and flood an area of a few hundred meters with sound when they are running.

The underwater oil and gas industry are also a major source of noise pollution. Drilling creates vast amounts of noise but so does the process of locating new oil fields. These seismic surveys rely on the use of a sonic cannon to hit the seafloor with enough force to vibrate the crust up to 3 miles deep. As you can imagine, this creates an almighty racket.

However, new research suggests that there may be a much more environmentally friendly alternative to this incredibly noisy process. Whale song, particularly that of fin whales is a naturally generated low frequency sound that can travel incredible distances. The song of these 20m-25m ocean giants can be heard from up to 600 miles away! Even more interestingly, suggests that the song of the fin whale is more than capable of penetrating deep into the crust.

The discovery was accidentally made by two seismologists from the Institute of Geophysics of the Czech Academy of Sciences when they started to detect unusual reading on their seafloor seismic instruments. The two scientists were studying earthquakes along the Blanco transform fault off the Oregon Coast in 2012 and 2013 and they quickly paired the unusual frequencies with those produced by fin whales. Usually, the song of fin whales detected on seafloor seismographs is discounted as a nuisance but the scientists took the time to see whether their audio microphones had also picked up the whale song. When they examined the audio from the microphones

they were shocked to be greeted by silence and were quick to assume that the data on their seismographs represented fin whale song bouncing back from within the crust.

To make the whale song data useful as a mapping tool the scientists needed to know where the singing whale was located. On the surface, looking for a whale in the entire ocean is comparable to searching for a needle in a haystack but the nature of the whale song made it possible to approximate the whale's location. Much like finding an epicentre of an earthquake by comparing the arrival of the first (P waves) and second (S waves) seismic waves to arrive at a seismograph and then triangulating, the whale song also arrived in two distinct waves that could allow the whale's location to be triangulated in a similar way. As well as this, the fin whale does not sing a continuous song but instead tends towards singing in one second pulses. Pulses are much easier for seismologists to analyse and mean that the data produced from whale song is more comparable to that produced by the sonic cannon method.

Fin whales are also fairly commonly found across the globe. The only place where fin whales haven't been recorded are the ice covered portions of the Arctic and this means their song could be used to map vast areas of the ocean floor without intrusion.

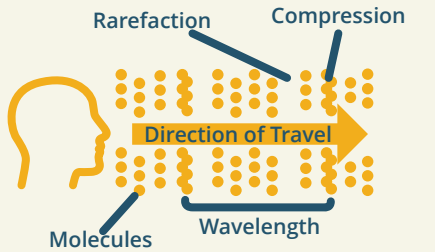
Whilst this new method of ocean floor mapping has many advantages there are also a couple of disadvantages. The song of the fin whale occurs within a limited range of frequencies meaning that the data their song produces is less crisp than that of a sonic cannon which generates a much wider range of sound frequencies. As well as this, by using only one seismograph's record to locate the whale only data from whales over a relatively flat seafloor can be used. However, by comparing multiple ocean floor seismographs it would be possible to triangulate the whale's position over much rougher ground.

The possibilities of this new imaging source is best summed up by one of the paper's authors:

"If we use the whale songs at least as a complement to other sources of signals, they are free and they are always there," Kuna says. "It's a win-win."

How does sound travel?

Sound travels as a longitudinal wave (like ocean waves) and is caused by vibrations passing through a medium. In the case of human speech, our larynx vibrates causing the particles of air around it to vibrate and become displaced. These displaced particles collide with the other particles around them causing these too to become displaced. This forms compression waves which move through the air and carry the sound to your ears.





ONLY THE UNITED STATES USES THE IMPERIAL SYSTEM

Whilst the United Kingdom has officially adopted the Metric System of measurement we are a deeply traditional people who find change very difficult. There are many people, my father who is an aerospace engineer included, who still swear by the imperial system of feet and inches over those new fangled centimetres and meters. However, whilst there are still many hold outs that refuse to admit it the UK has been officially using the metric system since 1965 (8 years before it joined the European Union).

In fact, of the 200 or so recognised countries in the world all except one have now adopted the metric system. Until quite recently, Liberia, Myanmar and the United States stood out as the only countries still using other systems of measurement. In 2018, Liberia commerce and industry minister Wilson Tarpeh abandoned the imperial systems claiming that the government planned to adopt the metric system in order to promote accountability and transparency in trade. Myanmar, who has relied on a traditional system of measurement ever since gaining independence from Britain, also made the decision to switch to the metric system in 2020 and the conversion is still ongoing.

This leaves the United States as the only country in the world still using the imperial system. In fact, the USA passed the Metric Conversion Act in 1975 to slowly adopt the metric system in order to keep up with the rest of the world but as the act was completely voluntary nobody chose to make the switch!



TALK MORE, LISTEN LESS TO BE LIKED

When conversing with new people we often think that we should speak less and listen more. In fact, one survey found that people believed that speaking for 45% of the time spent with a new person made them more likeable.

However, one new study suggests that the more you speak during an interaction with a new person, the most likely they are to see you positively. Similar studies assigning participants the role of listener and speaker has seen that listeners record higher feelings of compatibility with the speaker than vice versa. The evidence suggests that by speaking more, you give the listener the feeling that they have more in common with you.

This finding challenges the advice from a lot of self help books which suggest that people prefer to talk about themselves and that to make a good impression you should allow them to do so by spending more time listening. As a lot of the self help genre is not grounded in scientific research these new findings could go a long way towards helping us to identify bad advice.

Further to this, the study only assigned people to speak for a maximum of 70% of the interaction time. Therefore, we can assume that speaking for more time than this could have detrimental effects on the way the person sees you. After all, nobody likes someone that spends all of their time talking about themselves!



ARE YOU A MATHS PERSON OR A READING PERSON?

What at first seems like a fairly innocent question could have big repercussions for the career path you choose whilst in education. In fact, these academic identities that we develop whilst at school are one of the major motivators for choosing to pursue certain subjects later down the line.

A study involving 211,000 pupils from 16 countries and regions has seen some interesting patterns emerge. It seems that during Primary School, pupils have neither a preference for Reading or Maths and instead see themselves fairly evenly in terms of both. However, by Secondary School pupils tend to report a higher confidence in one of the two areas and a lower confidence in the other. In other words, as pupils get older they are more likely to think of themselves in terms of being either a Maths person or a Reading person.

One of the most common reasons that pupils choose to take a subject or a career path is because they believe they are good at it. Therefore, seeing yourself as a Reading or Maths person can influence the decisions you make in life. Interestingly, girls who perform well in Maths but better in spoken areas tend to think of themselves as being weak at Maths and avoid taking related opportunities. This idea that you can be good at either Maths or Reading but not both is a particularly easy misconception to fall for.

The consequences of academic identity formation are not yet fully understood and there are plenty more subjects to investigate. However, it might prove to be an interesting piece of self assessment to try for yourself.

THERE ARE MORE TWINS THAN EVER

Whilst it might not seem like it just by walking down the street, there are currently more twins on Earth than there ever has been before. In fact, it is estimated that there are as many as a million more twins alive in the United States today than there were in 1980.

When the United States first started keeping a statistical record of the rate of twin births in 1915 it was clear that from then until 1980 that 1-in-50 babies born was a twin. This means that from 1915 to 1980 the change of being born a twin was roughly 2%.

Fast forward to 1995 and the chance of being born a twin from 1980 until 1995 had increased to 2.5%. By 2001, when the numbers were reassessed again, the chance of being born a twin had increased to 3%. By 2010, the chances had increased again to a whopping 3.3%. Whilst this doesn't seem like a massive increase, this meant that by 2010 the chance of a woman giving birth to twins had reached odds of 1-in-30.

It was undeniable to researches at the United States Centers for Disease Control (CDC) that there was a growing rise in the number of twins being born but they were not clear on the mechanism driving the rise.

It is well known that plural pregnancies (giving birth to more than one child at a time) has several negative health impacts on both the mother and the children when compared to single child births. Twins are more likely to be born preterm (premature) and have significantly lower birth weights than non-twins.

In the course of their investigation, the CDC discovered that the trend was probably being driven by a change in the demographics of mothers. Older women are statistically more likely to give birth to twins than younger women and the CDC found that many younger women were putting off raising a family until much later in their lives than they had traditionally. This meant that a lot more of the United States babies are being had by older women and that therefore more twins were being born. In fact, the CDC believe this change in the age structure of mothers accounted for around a third of the increase in twin births.

The other two thirds of the growth trend in twin births was attributed to the increased availability of fertility treatments, with a specific focus on the impact of In-Vitro Fertilisation (IVF).

IVF involves the transfer of multiple embryos

to maximise the chances that one of them will grow and develop. A side effect of this is that more twins occur where more than one embryo successfully develops. In the 2000s, it was standard practice in American IVF treatments to transfer three of more embryos with as many as two-thirds of IVF treatments having three or more embryos transferred. This meant that the chances of having twins was relatively high.

However, towards the end of the 2000s the American Society for Reproductive Medicine published guidelines that recommended that fewer embryos were transferred. This has meant that the average number of embryos transferred has fallen from 2.6 in 2003 to 2 by 2010. Alongside this, as many as 10% of prospective parents have chosen the option of having a single embryo transferred which was something not often attempted when IVF was a relatively new treatment. These changes have culminated in a slowing of the growth in the birth rate of twins but are yet to actually reverse the trend.



Glossary

Demographics - Statistics that describe populations and their make up.

Embryo - An unborn or unhatched offspring in the process of development.

Mechanism - A process by which something takes place or is brought about.

Statistical Record - A collection of data on a topic from several years used to show trends.

In the UK about one in every 65 pregnancies results in a multiple birth. - Twins Trust, 2019

The Hogeweyk - Caring Differently

There is a common misconception that Dementia is a single disease and that therefore there should be a universal cure out there to be discovered. This is unfortunately not the case as Dementia is instead an umbrella term for those conditions that cause a person's ability to think, remember, or make decisions to become impaired. Of the conditions included under the Dementia umbrella, Alzheimer's is the most common.

Alzheimer's is named after Dr. Alois Alzheimer who noticed changes in the brain tissue of a woman who had died from an unusual mental illness in 1906. The woman displayed a range of symptoms whilst alive including: memory loss, language problems, and unpredictable behaviour. When Dr. Alzheimer examined her brain, he found many unusual clumps and tangled bundles of fibres that were not present in healthy brains. Today the clumps are known as amyloid plaques and the bundles of fibres, tau tangles. It is thought that the amyloid plaques are one of the main features of Alzheimer's disease. The loss of connections in the brain caused by the plaques and tau tangles are a significant cause of the symptoms common with the condition.

The difficulties that come from living with Dementia: memory loss, difficulty concentrating, mood changes, and confusion, can make it challenging to live in an independent manner. For example, it is not uncommon for those with mild forms of

Dementia to struggle with conversation as a person's ability to process the high speed transfer of spoken information can be impaired and lead to the person finding it hard to reply or follow the topic.

There are medications available that help to slow down the loss of cognitive ability (thinking skills) and reduce the symptoms of

“A society is measured by how it cares for its elderly.”

cognitive decline for as long as possible. For the most part, these medicines stop enzymes from breaking down acetylcholine in the brain, which helps nerve cells communicate with each other. However, it is important to remember that these medicines do not cure a person of their condition but slow down the rate at which a person's ability to live independently is lost.

Ultimately, a lot of people that have Dementia will require specialist care at some point. According to Alzheimer's Research UK, 60% of people receiving care at home are living with Dementia whilst as many as 69% of those in care homes are also living with the condition. In 2014, 311,730 in care homes were living with the condition and this number is expected to quadruple by 2040.

The World Health Organization recognise that “a society is measured by how it cares for its

elderly.” Given that so many people are expected to be living with Dementia in the near future it is no surprise that the question of how to provide the best care for their needs is being asked.

Traditional care homes are being adapted to provide better care for residents with Dementia in a number of ways.

Patterned flooring is being replaced with single neutral colour consistency as some people with Dementia perceive dark patches on the floor as holes and patterns can make it harder to pick out landmarks that help with navigating a space.

To help the elderly navigate around their environment, brightly coloured doors and handrails have been replacing the traditionally hidden white fixtures. These bright colours act as beacons in a neutral space and become easier to find.

Replacing plates, cups and utensils for bright red alternatives has shown an increase in the intake of food by 24% and liquids by 84% when used by persons with Alzheimer's. This could be a real game changer as up to 40% of people with Alzheimer's have been shown to lose significant amounts for a number of factors. It is thought that lightly coloured foods on traditionally white crockery makes it difficult for those with Alzheimer's to perceive how much food is on the plate.

Soft furniture, ceiling tiles and carpeted flooring all serve to absorb sound and decrease the amount of unnecessary sensory information in the environment.

Whilst clear fronted cabinets allow residents to see their possessions clearly. This can be particularly helpful if a person has become particularly forgetful as items are not hidden out of sight and are always on display. This can lessen the amount of locational memory required to find objects.

Whilst these changes to the environment of traditional care homes are all excellent in enabling people with Dementia to live a higher quality life they are merely changes to an environment built without Dementia care at its core. Whilst the quality of care may be high, it is not possible to provide residents with a normal life. Residents have set mealtimes, routines, enrichment and are less able to make choices about their lives than they otherwise could. Care homes are simply not designed to mimic the outside world.

However, a new way of designing spaces for



^ Residents are able to access services like this general store whenever they wish.

the care of Dementia has been making some headway. Dementia Villages, like the Hogeweyk in Holland, are specifically designed to allow residents with Dementia to have as normal a life as possible. The way they achieve this is by mimicking the landscape of the outside world as much as possible whilst incorporating Dementia accessible design.

It begins at the level of the dormitory. Rather than keeping all of the residents under one roof, the Hogeweyk has divided its residents into “family units” of 6 or 7 that share one building each. These “homes” are divided into personal rooms with each furnished with familiar personal belongings.

The “homes” are constructed in groups that make up “neighbourhoods” that mimic the layout and design of typical Dutch towns that the residents would be used to.

Each of the “neighbourhoods” has a public space, usually a garden, which has been designed with distinctive landmarks and landscapes to help people to navigate around them successfully.

The “village” also has separate buildings for each of the services on offer. In the Hogeweyk, there is a grocery store, barbershop and a theatre. These are located around the “village” in such a way that it encourages residents to move around the public space and interact.

Having the ability to make autonomous (their own) decisions about which space and what level of privacy they engage with dramatically increases a person's quality of life. It allows people to choose who and where they socialise with. Choice is at the centre of the Hogeweyk as they believe that it is the ability



^ There are 4 levels of privacy residents can access.

to make choices that give those with Dementia the best life possible.

Whilst this sounds very attractive, the amount of freedom does mean that there are increased risks of harm when compared to a traditional care home.



^ There are very few handrails at the Hogeweyk.

For example the walkways in the Hogeweyk have handrails that are lower than you would find in a care home. In order to preserve the “village's” illusion of being real, the designers had to make compromises. In fact, in most areas of the Hogeweyk there are no handrails. To get around the threat of falling, all residents have access to walkers and the entire space is designed to be walker accessible.

The Hogeweyk is not the only “Dementia Village” in the world. Since it opened in 2009, many other “villages” have sprung up around the world. However, giving residents so much freedom and staffing the much larger space comes with additional care costs. Without a



^ Public spaces let residents pursue their interests outdoors.

significant amount of governmental funding, these innovative care spaces would not be possible.

There is also the problem of evidence based research into their impacts on their elderly residents when compared to a traditional care home setting. In fact, at present it is not possible to say which of the two settings is the best for residents. Despite this, there is plenty of evidence to suggest that the design principles that “Dementia Villages” are designed around are highly effective in raising the living standard of those with Dementia.

However, what the Hogeweyk gives us is an insight into how universal design (creating spaces that are accessible to as many different people as possible) can enable people to live as a full a life as possible with exclusion. It is a principle that could, and should, be a core part of how we design new spaces to ensure that “normal” society is as inclusive as possible and meets the needs of as many people as it can.



< Even wheeled vehicles like this dual bicycle have been designed for! Pedal vehicles are a major part of Dutch society and to preserve normalcy the space is suited to their use.

Film As Therapy



According to a new analysis by a University of Cambridge researcher, movies such as Disney's recent film *Encanto* could offer therapeutic benefits for children engaging in Child Therapy services.

"Cinematherapy," as the process of using films to aid therapy is known, is not a new concept but using specific films, shows or characters as a processing tool is a relatively new concept.

Take *Encanto* for example. The film features the much maligned Bruno, who spends most of his time locked away from his family within the walls of the home. Sorry, spoiler alert. According to the study published by Cambridge University, Bruno's character offers a unique way of engaging with children and families who have experienced trauma and who may see something of themselves within the character of Bruno. By discussing the film and the how Bruno may have felt being excluded from his family, children may be able to discuss complicated and distressing emotions in a way that seems separate from their experiences of them.

Researchers at Cambridge University have said that the plot of *Encanto* is one of inter-generational trauma and psychological wounding that gets passed from one generation to the next.

These kinds of trauma are common where parents who have endured armed conflict, displacement, or abuse, often 'encrypt' their distress in behaviours that their children may come to replicate or model. This replication of behaviour can ripple through the generations of a family and have significant consequences for the wellbeing the family as a whole.

In the story of *Encanto*, the Madrigals' matriarch, Alma, has lost her husband in a war years earlier, but also acquired a mysterious 'miracle' which endows her offspring with 'gifts': powers that they use to help the community. All seems well until Alma's granddaughter, Mirabel, fails to receive a 'gift', and then discovers her relatives are losing theirs.

The family's 'gifts' allow Alma to construct a vision of the Madrigals as strong, focused and responsible which most of her children readily accept. However, in reality, the family are papering over their emotional response to a painful past with a show of strength, which they only confront when Mirabel forces them to do so by failing to develop a "gift."



Not only this, the characters within the Madrigal family also represent real-life archetypes that are commonly found within traumatised families.

We've already discussed how Bruno has become locked away from the family for failing to fit in. However, Mirabel's sisters, Luisa and Isabella, falsely play up to skin-deep roles as 'the strong one' or the 'golden child' as part of the family's collective coping mechanism. A major part of the film deals with the consequences this has on their lives and the freedom they feel when they are able to throw off these roles.



It is not only *Encanto* that is perfectly suited to talking about trauma or strong emotions with children. 2015's *Inside Out* has become the poster child of the cinetherapy movement. The film is all about the difficult emotions a child feels and does an excellent job of depicting them in a way that anyone can understand. 2017's *Coco* is another film that deals with family relations, and confronts grief and death directly. 2020 *Soul* deals with ideas about a person's meaning and purpose.

Researchers argue that these films could be used by therapists to help children start to talk and work through problems. Whilst one-to-one therapy is still seen as the "gold standard" in mental healthcare, the paper stresses that films and songs from material that children enjoy could be just as valuable as part of play therapy or to allow children time to heal outside of their weekly sessions with a professional.

So, perhaps, we should be talking about Bruno after all.



Fishing Foxes

Foxes have become only the second known species of Canid (the group of mammals that includes dogs and wolves) to have been observed hunting fish after researchers spotted a Red Fox fishing for carp in a lake in Spain.

Over the course of a few hours a male fox was observed to catch as many as 10 carp who were spawning close to the edge of the lake. Rather than eating the fish as soon as they were caught, the fox instead stashed most of the fish to return to later.

Researchers, who were observing a separate species, became interested in the behaviour of the fox when it failed to flee upon seeing them. Foxes are notoriously difficult to observe in the wild as they are hyper-vigilant for signs of people and the lack of flight behaviour got the researcher's attention. It was clear from a few minutes of observation that the fox in question was engaged in something interesting.

Despite the Red Fox being a relatively well studied species with years of observation data recorded, researchers had never seen the behaviour before. One of the researchers, Jorge Tobajas, commented that "seeing the fox hunting carp one after another was incredible."

Watch It Here



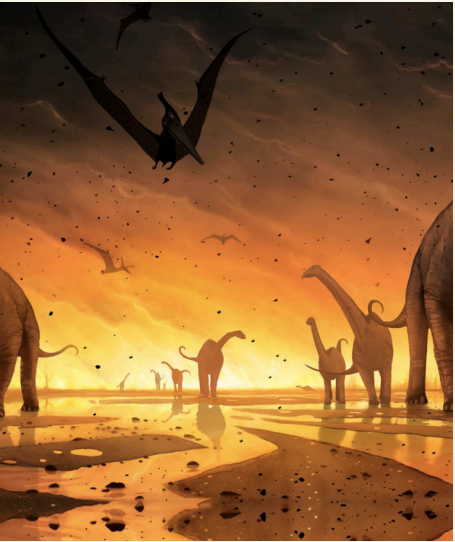
A DNA Prison

If you were asked to identify the four legged creature with the longest genome (complete sequence of DNA), I doubt you'd pick something as small as the Neuse River waterdog. This brown-and-black salamander lurks in rivers and creeks of North Carolina and can live for as long as 50 years, but it lives its whole life trapped in its larval body.

As an amphibian, the waterdog begins its life as an egg which hatches to become a tadpole. Over time, this tadpole should develop a full set of adult features as the animal matures. However, in Neuse River waterdogs, the animal never fully matures. Instead the animal is trapped somewhere between its juvenile and adult stages. Its tail always remains finned, like a tadpole's. Its clumsy little legs never grow large enough for its body. Its rear feet never finish sprouting their toes. And it spends its whole life breathing through larval gills.

When the DNA of this particular species was examined it was found to be 38 times longer than our own! In fact, the DNA of the Neuse River waterdog is the longest DNA chain of any four legged creature on Earth. However, it is not alone amongst Salamanders. Many different kinds of Salamander have very long genomes and noticeably slow or incomplete development.

Looking at the DNA closely, scientists found many DNA parasites. DNA parasites can be thought of as pieces of DNA with no function that have inserted themselves in the animal's genome to ensure their survival. These sneaky pieces of DNA are usually cropped out by special proteins but in Salamanders these proteins don't work effectively and this leads to the long chains of DNA that slow down their growth.



Second Dinosaur Killing Impact Site

It has become widely accepted that a large asteroid impact in the Yucatan peninsular (near modern day Mexico) led to the extinction of the dinosaurs 65 million years ago. However, a new 8.5km wide crater off the coast of West Africa may have complicated the story somewhat. The Nadir crater, as it has become known, represents a second impact dated to around the time of the much larger Yucatan impact.

This much smaller asteroid (roughly 400m across) would have caused a magnitude 7 earthquake and led to Tsunamis several hundred meters tall. The team that uncovered the crater believe that two impacts so close together would represent a one-two punch that would have been difficult for life to overcome.

The discovering team have even gone so far as to suggest that the Nadir crater may represent an asteroid that was paired with the larger Yucatan asteroid. The team speculate that the two rocks could have been ripped apart by gravity while zooming past Earth on a previous loop around the sun leading to slightly variable impact times.

However, not everyone is convinced that the crater is from an asteroid impact. There are many natural processes that can lead to the formation of such shapes. In order to confirm whether Nadir is an impact crater, drilling for solid evidence will be required. If the drilling returns evidence in the form of shocked quartz (a mineral forged by asteroid impacts), then the story of the dinosaur's final chapter may need editing.

GIANT PUMPKINS - How Do They Do It?

In one famous children's story, a fairy godmother is tasked with getting a certain Cinderella to the ball. What does this magical woman decide to use to get her there in style? A Rolls-Royce? A Helicopter? A Limousine? No. The fairy Godmother settles for a giant pumpkin. Whilst this fruity carriage (sorry pumpkins are actually a fruit not a vegetable) seems slightly out of the realms of possibility, giant pumpkins are very much real.

Across the world there are competitions which see growers face off against each other to grow the biggest, heaviest pumpkins they can. However, not all pumpkins are the same. The majority of the pumpkins you see in shops around Halloween are of the field variety. These pumpkins have a very hard, dark green hooked stem, which makes them perfect for carrying. In order to grow a giant, you would be looking to find the seeds of the Atlantic Giant Pumpkin (*Cucurbita Maxima*). The largest Atlantic Giant reached a whopping 1190.49Kg! To put that into context, a Fiat 500 only weighs 1000kg.

Whilst the size of these giant pumpkins is truly mind boggling, the processes going on under the hood are far more intriguing. In order to grow such giant fruit, the plant has to provide it with a constant flow of water, sugar and nutrients. The sheer quantities demanded by the swelling fruit presents a transport problem to the plant. After all, the plant has to move water from its roots and sugars produced by photosynthesis in the leaves to not only the fruit but all parts of itself. Plants use xylem and phloem to do this efficiently. Xylems are vessels that transport water from roots to a plant's stems, fruits and leaves. Phloems are vessels that transport sugars from leaves to the fruit and roots.

Whilst the majority of fruits grow slowly and are limited to a relatively small size, giant pumpkins grow quickly. In fact, to grow a giant pumpkin from seed only takes 120 to 160 days! In order to reach a giant size in that time, Atlantic pumpkins put on up to 15kg of weight each day. That's the equivalent mass of a two-year-old child every day! What makes this rapid growth even more mind boggling is that all of this mass has to travel through a stem narrow enough for you to get your hands around.

In order to keep the plant focussed on a single giant fruit and supplying as many resources as possible, growers remove all of

the fruits except for one.

Jessica Savage, a botanist at the University of Minnesota, has been investigating the rapid growth powers of these plants. She took small slivers of flesh from competition fruits, from pumpkins that burst before they reached maturity, and from fruits removed by the grower early on.

From these slivers of flesh, Savage made a close examination of all of the parts of the Atlantic Pumpkin plant and compared them to other large squashes. What she discovered surprised her. The samples of Giant Pumpkin didn't produce any more sugars than other squashes and their transport tissues didn't work any differently. Instead, she found that the Giant Pumpkins had far more transport tissue than other squashes. This extra xylem and phloem help the stem pump more food and water into the fruit, allowing it to grow faster.

So there you have it, whilst most squashes have relatively low amounts of transport tissue in their stems, Atlantic Pumpkins have a supersized amount. In effect, most squashes move water and sugars down something like a straw, whilst Atlantic Pumpkins force it down a culvert.



Windsor Pumpkin Regatta

Every October on Lake Pesaquid in Windsor (Nova Scotia), competitors hollow out Giant Pumpkins and make them into boats before racing them. The course is a half mile (800 m) from start to finish and features brightly coloured giant pumpkins as the sole means of flotation. There are motor, experimental and paddling classes available and the race attracts upwards of 60 entries and draws 10,000 spectators.

Halloween... Turnips??

Whilst Pumpkins have become the dominant carving fruit of choice, it has not always been so.

The tradition of carving a Pumpkin has its origins in Celtic traditions where the heads of enemies were venerated as a means of warding off evil spirits. Modern carved pumpkins reflect this tradition.

With the advent of the Samhain festival where the spirits of the dead were thought to mingle with the living. Dressing up to scare off these malevolent souls became popular (if not essential).

However, where pumpkins were difficult to get hold of many communities happily carve root vegetables instead. It was not uncommon in the early 1900s to see carved turnips in the place of pumpkins.



WHY AREN'T GIANT PUMPKINS ROUND?

When you imagine a typical pumpkin, you probably picture the traditional Jack 'O Lantern. These pumpkins are fairly spherical and even in their colour. They are neat, symmetrical, perfect. Atlantic Giant Pumpkins, by comparison, are ugly. They are malformed, twisted, monsters whose sheer size is their only desirable feature. However, Atlantic Giants start off their lives looking almost identical to their photogenic cousins. It is only when they start to put on the pounds that physics plays a part in warping their bodies.

As Giant pumpkins expand in size they tend to become flatter and flatter, losing their sphericity. This is because all of the additional mass increases the force of gravity acting upon them. Whilst pumpkins and other squashes are naturally elastic, that internal spring can only be stressed so much. As soon a critical mass point is achieved, the pumpkin is unable to support its weight any more and the pumpkin begins to flatten out. In effect, Giant pumpkins are squashed under their own weight.

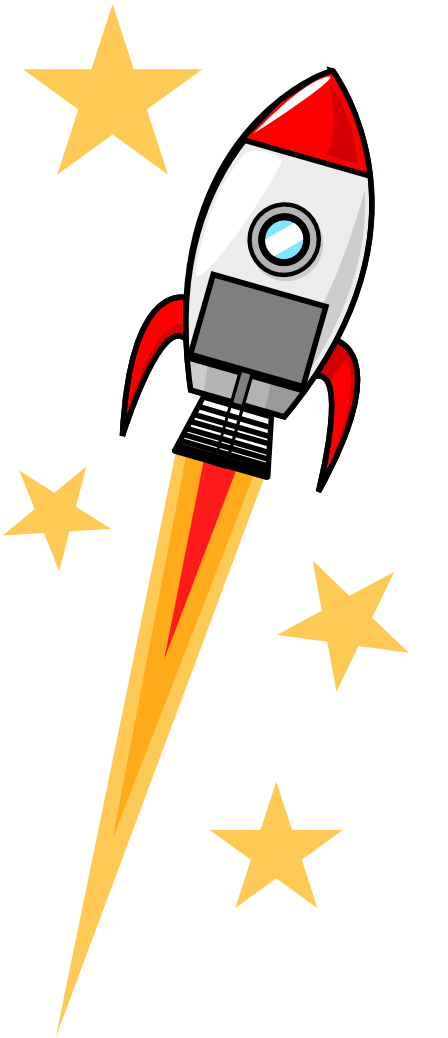
The wall of a pumpkin doesn't thicken to support all of the extra weight either. A small pumpkin can support up to 50 times its own mass before it breaks. The Giant pumpkins dance a deadly tango with this weight

threshold. The very biggest are barely able to support their own weight and many Giants simply rupture under the stress all that extra mass puts on their tissues.

Models examining the relationship between the mass of a pumpkin and the stresses it experience have demonstrated how the pumpkins shape suffers as its weight increases.

From these models, it is clear that a pumpkin big enough for Cinderella to take to the ball would be a very tight squeeze. In fact, Cinderella would probably have to go to the ball lying down. A pumpkin of that size would simply be too flattened by gravity to work as a carriage. Given the relationship between time and amount of growth, it would also take a season 8 times as long for a pumpkin to get big enough to function as a vehicle.

Ideally, Cinderella's pumpkin would have to be grown in outer space. A pumpkin grown in these Zero G conditions would not be constrained by its mass. A space grown pumpkin would maintain its spherical shape no matter its size!



^ Giant Atlantic Pumpkins are crushed under the weight of their own bodies.

White Sharks In The Aquarium

The White Shark is the world's largest predatory fish and has existed for more than 11 million years. These oceanic predators can reach sizes of up to 6.4m and are found on the continental shelves and open waters of temperate seas and oceans, in water anywhere from the surface to depths of 4,200 feet! Adults generally feed on mammalian prey, favouring ambush attacks on seals and sea lions. These fish are also incredibly long lived with the oldest reported female reaching 40 years of age. Despite ranging thousands of miles across oceans, White Sharks return to their native waters to give birth to their young. In fact, White Sharks off California have not interbred with those off New Zealand, or a third group off Japan, for around 200,000 years.

From just that taste of the facts surrounding the White Shark, they are indisputably fascinating. Whilst many species of shark can be seen fairly easily in the giant tanks of aquariums, White Sharks are not housed in any aquarium in the world. Only one aquarium, the Monterey Bay Aquarium, has ever successfully housed the White Shark. Even then, the Monterey Bay Aquarium only managed to house the shark for 198 days before having to release her back into the wild.

Whilst many aquariums have tried to house White Sharks, most of those examples have died within a few days or weeks of their capture. The difficulty of housing White Sharks and the lack of long term success has led to most aquariums shelving plans to include the species in their exhibits.

This article will explore some of the reasons why it is so difficult to home these sharks effectively.

First of all, we have to address the method by which White Sharks process oxygen from the waters that they swim in. Many fish are able to breathe through their gills by a process known as buccal pumping. Fish that are able to do this are able to stop swimming as they are able to use their cheek muscles to “inhale” water though their gills. If you look closely at a stationary fish the next time you are at the aquarium you'll notice that it appears to be panting in a dog-like fashion. This is what buccal pumping looks like. Some species of sharks, like nurse sharks and tiger sharks, are able to buccal pump but others cannot. White Sharks, Whale Sharks and Mako Sharks all don't have the cheek muscles necessary for buccal pumping. Instead, these sharks rely on ram ventilation which means they have to constantly swim with their mouths open to force water through their

gills. If these sharks stop swimming, they stop receiving oxygen. For these sharks, its a case of swim or die.

The consequence of not being able to breathe via the process of buccal pumping for aquarium stockists is that it is incredibly difficult to move White Sharks. From the moment the shark is caught, it must receive a constant flow of oxygenated water through its gills. Unlike most sharks in an aquarium, White Sharks can't simply be put in a holding tank and driven to their new home. Instead, a complicated flow tank has to be used in its place. This tank produces a constant flow of water over the stationary shark, simulating ram ventilation.

Another problem with White Sharks is related to their size. As you read, White Sharks can reach up to 6.4m in size. These giant fish require giant tanks. In fact, there isn't a tank in the world capable of meeting the needs of a fully grown adult White Shark. Even Monterey Bay needed a 1 million gallon tank with a depth of 35 feet to keep its 1.2m juvenile alive for so long. The amount of space needed for a fully grown adult to comfortably swim is simply unimaginable!

Those sharks that have been housed in aquariums are used to having entire oceans to traverse. When they are placed in a tank with almost invisible barriers hemming them in, White Sharks repetitively bang into or rub against the walls of their tank. This leads to injuries that ultimately lead to the demise as they continuously damage their bodies whilst swimming.

Adult White Sharks also tend to favour mammalian prey. It would be difficult for an aquarium to source, process, and provide these natural foods to a captive White Shark. Visitors to aquariums also don't want to see cute seals and sealions fed to White Sharks. Those adult White Sharks that have been taken to aquariums simply refuse to eat the fish based foods offered to their tank mates. In fact, the last Adult White Shark housed in an aquarium in Japan only survived for 2 days before passing away. During this time, the shark refused to eat any of the foods provided and simply stopped swimming.

The Monterey Bay Aquarium overcame the problems of feeding an adult White Shark by simply avoiding catching one. Instead, they deliberately targetted smaller, juvenile White Sharks. Younger White Sharks tend to be too small to take mammalian prey and subsist on a mostly fish based diet. Their White Shark that made it to 198 days in captivity was only released after it started to eat its tank mates!

Since its success in 2004, the Monterey Bay Aquarium has suspended its program to display White Sharks. When asked about their decision, the aquarium commented that it had met its aim of inspiring ocean conservation and that the cost of the program was prohibitive. They also raised the ethical concerns of housing open water sharks in a closed environment after the general public had become concerned by the injuries the sharks were suffering. There are currently no plans to revive the program.

Whale Sharks at Georgia Aquarium

Whilst it is difficult to house Great White Sharks in aquariums due to their size and needs, Georgia Aquarium has successfully housed the largest fish in the sea, the Whale Shark.

Their Whale Sharks, rather than being caught for the purpose, where rescued from a Taiwanese fish market in 2007. They were transported from Taiwan to the USA in a private cargo plane. Upon arrival the containers were placed on the back of flatbed trucks and escorted by police the entire way to the Aquarium.

The sharks are held in Georgia's Ocean Voyager exhibit, a 6.3 million gallon tank designed explicitly for the purpose of holding whale sharks!

Despite their size and specialist filter feeding requirements, the sharks have done exceptionally well in captivity. During this time, they have massively aided research efforts into the species.

Taiwan closed its Whale Shark fishery in 2008 making the sourcing of future Whale Sharks unlikely.



White Sharks are oceanic wanderers. They have been known to travel up to 2,500 miles when hunting in the open ocean.



Aquariums are important places for raising awareness of conservation issues.

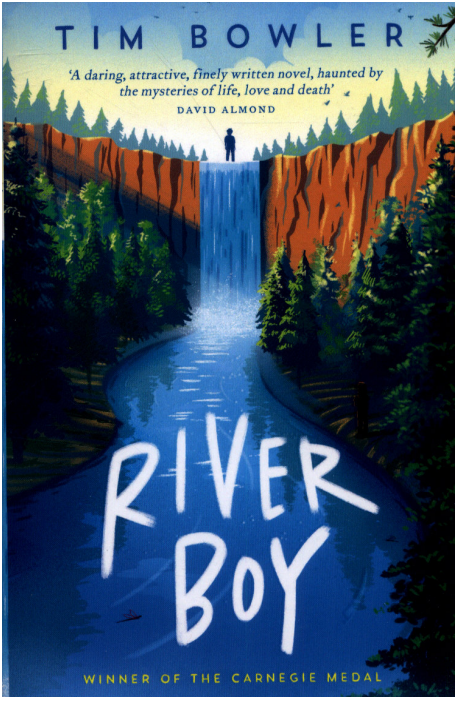


SUGGESTED READING



Fireweed Jill Paton Walsh

Bill is a fifteen-year-old runaway evacuee, and he's finding that surviving on the streets of London is pretty easy, thank you very much. He's fed by a local cafe owner and earns some cash as a barrow-boy in Covent Garden. Sleeping in the Underground air-raid shelters is even quite cosy – if a bit smelly. But then Julie turns up. She's a runaway too – a bit posh, but just as determined as Bill to stay free of interfering parents and 'the social'. But although it's fun for a while to duck Jerry missiles and camp out in bombed-out houses, the reality of living through the Blitz quickly begins to set in. Winter is coming, and Bill and Julie will learn that playing at being grown-ups can be a very dangerous game...



River Boy Tim Bowler

Grandpa is dying. He can barely move his hands any more but, stubborn as ever, refuses to stay in hospital. He's determined to finish his last painting, River Boy, before he goes.

At first Jess can't understand his refusal to let go, but then she too becomes involved in the mysterious painting. And when she meets the river boy himself, she finds she is suddenly caught up in a challenge of her own that she must complete – before it's too late...

This amazing book by critically-acclaimed author, Tim Bowler, was the winner of the prestigious Carnegie Medal and is being published in this stunning edition for a new generation of readers.



Coven Jennifer Dugan

Emsy has always lived in sunny California, and she'd much rather spend her days surfing with her friends or hanging out with her girlfriend than honing her powers as a fire elemental. But when members of her family's coven back east are murdered under mysterious circumstances that can only be the result of powerful witchcraft, her family must suddenly return to dreary upstate New York. There, Emsy will have to master her neglected craft in order to find the killer . . . before her family becomes their next target.

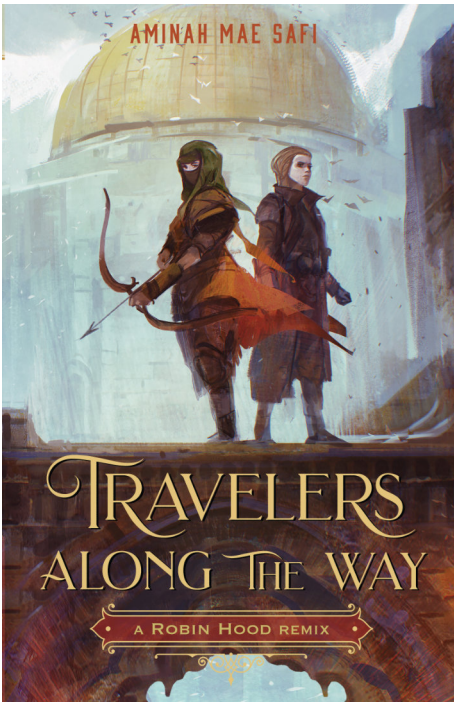


This Poison Heart Kalynn Bayron

Briseis has a gift: she can grow plants from tiny seeds to rich blooms with a single touch.

When Briseis' aunt dies and wills her a dilapidated estate in rural New York, Bri and her parents decide to leave Brooklyn behind for the summer. Hopefully there, surrounded by plants and flowers, Bri will finally learn to control her gift. But their new home is sinister in ways they could never have imagined - it comes with a specific set of instructions, an old-school apothecary and a walled garden filled with the deadliest botanicals in the world that can only be entered by those who share Bri's unique family lineage.

When strangers begin to arrive on their doorstep, asking for tinctures and elixirs, Bri learns she has a surprising talent for creating them. One of the visitors is Marie, a mysterious young woman whom Bri befriends, only to find that Marie is keeping dark secrets about the history of the estate and its surrounding community. There is more to Bri's sudden inheritance than she could have imagined, and she is determined to uncover it...until a nefarious group comes after her in search of a rare and dangerous immortality elixir. Up against a centuries-old curse and the deadliest plant on earth, Bri must harness her gift to protect herself and her family.



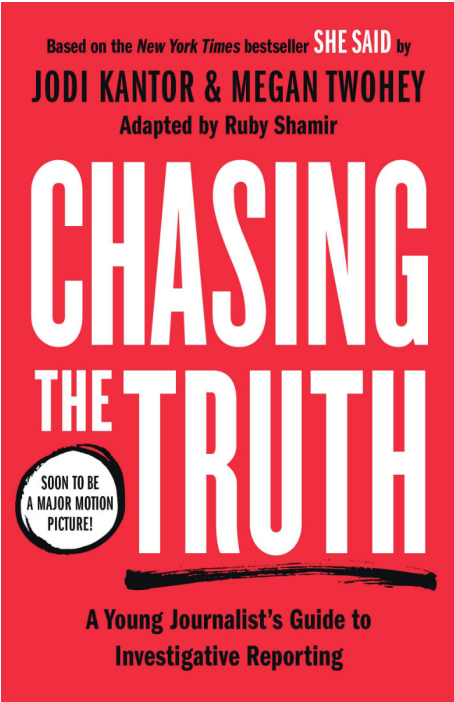
Travelers Along the Way Aminah Mae Safi

Jerusalem, 1192. The Third Crusade rages on. Rahma al-Hud loyally followed her elder sister Zeena into the war over the Holy Land, but now that the Faranji invaders have gotten reinforcements from Richard the Lionheart, all she wants to do is get herself and her sister home alive.

But Zeena, a soldier of honor at heart, refuses to give up the fight while Jerusalem remains in danger of falling back into the hands of the false Queen Isabella. And so, Rahma has no choice but to take on one final mission with her sister.

On their journey to Jerusalem, Rahma and Zeena come across a motley collection of fellow travelers—including a kind-hearted Mongolian warrior, an eccentric Andalusian scientist, a frustratingly handsome spy with a connection to Rahma's childhood, and an unfortunate English chaplain abandoned behind enemy lines. The teens all find solace, purpose and camaraderie—as well as a healthy bit of mischief—in each other's company.

But their travels soon bring them into the orbit of Queen Isabella herself, whose plans to re-seize power in Jerusalem would only guarantee further war and strife in the Holy Land for years to come. And so it falls to the merry band of misfits to use every scrap of cunning and wit (and not a small amount of thievery) to foil the usurper queen and perhaps finally restore peace to the land.



Chasing the Truth Jodi Kantor & Megan Twohey

The perfect book for all student journalists, this young readers adaptation of the New York Times bestselling She Said by Pulitzer Prize winning reporters' Jodi Kantor and Megan Twohey will inspire a new generation of young journalists.

- **Do you want to know how to bring secrets to light?**
- **How journalists can hold the powerful to account?**
- **And how to write stories that can make a difference?**

In Chasing the Truth, award-winning journalists Jodi Kantor and Megan Twohey share their thoughts from their early days writing their first stories to their time as award-winning investigative journalists, offering tips and advice along the way. Adapted from their New York Times bestselling book She Said, Chasing the Truth not only tells the story of the culture-shifting Harvey Weinstein investigation, but it also shares their best reporting practices with readers. This is the perfect book for aspiring journalists or anyone devoted to uncovering the truth.

