SNIPETTE

ANALOG

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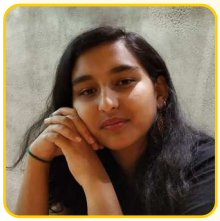

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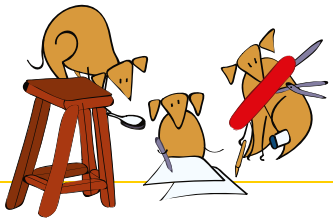

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editors' note

Dear Reader,

Here we are again, at the beginning of a new year! 2021 has been a long, brief, calm, and tumultuous year for us at Snipette—which is to say, we went through all the stages we possibly could and are ready for the next round.

This year saw us making quite a few adjustments to our work pattern. Besides exploring new meeting tools like Around and Kumospace, we had to adjust to a new schedule set by the school some of our editors attend: school offline for twelve days, and home online for nine. The remaining editors had to take charge during the "offline twelve" bits, which led us to set up "nine-twelve" plans instead of weekly ones. To add to the mix, we've had a few new people join the team, whom you'll get to know once they're through training!

Along with these changes, you will also notice us exploring new avenues in the articles themselves. This issue has a few articles in the philosophical and cultural realm, including Anthony's word-filled road-trip (page 22), Marina's musings on the nature of "now" (page 15), and Sejal's stories about the significance of "Aurora" (page 49). Of course, we do have your usual fix of science and tech topics, so do go through them all and let us know how you liked them!

We've got quite a few things brewing for 2022. To start with, there's the aforementioned new teammates whom you'll soon get to know better. Then there's the revamped website, restyled to better match the print version. And finally, we're planning a crowdfunding campaign which, if successful, will dramatically bring down the cost of print Snipette for everyone.

New years are a time of new beginnings—and it certainly is the case this time at Snipette. Here's wishing you a great year of new beginnings ahead just like ours!

Sincerely,
Nia, Manasa, Badri, and Akil
Editors at SNIPETTE

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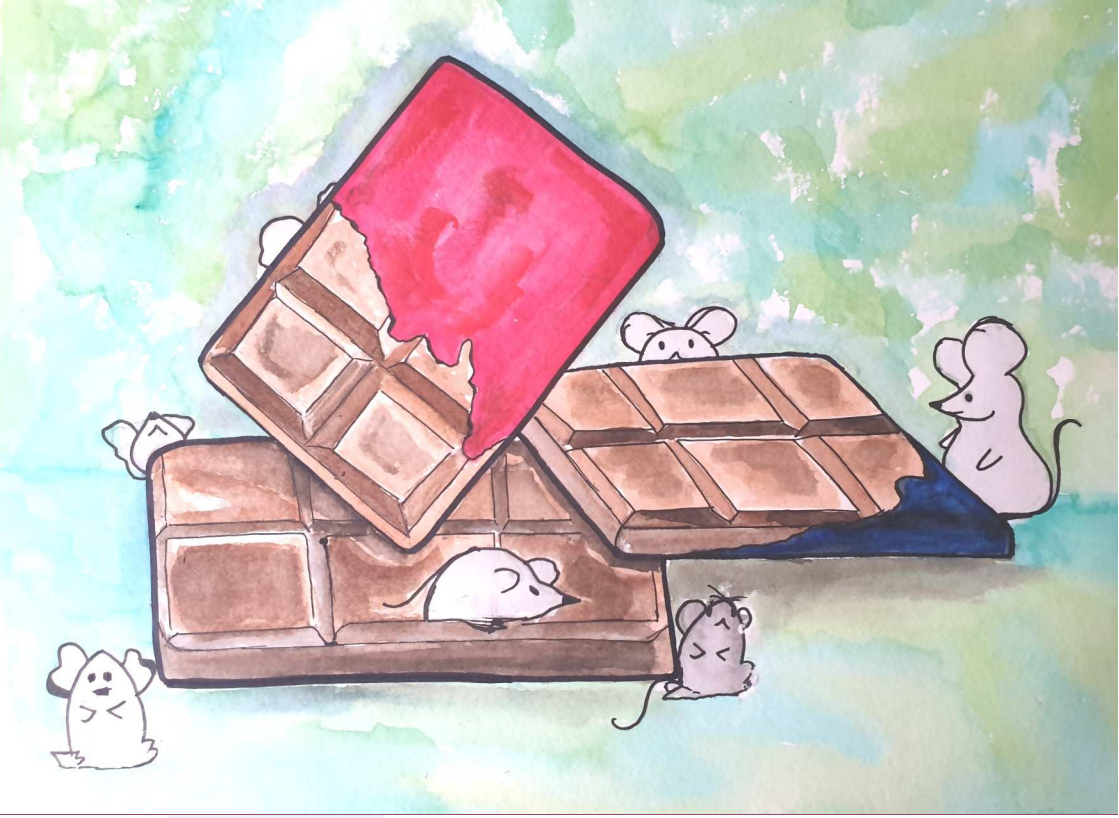


insatiable

A glimpse into the neural circuitry of hunger and feeding.

Lindsay Gray

Imagine your favourite food.

Think about its texture, how it looks on a plate, its colour. Is it warm or cold? Does the smell and taste of it conjure memories of places or people you love?

None of these qualities have anything to do with the most basic and essential function of food, which is to give us the nutrients our bodies can't make along with enough energy to get through a day. But the sensory

components of a meal are arguably just as essential.

There's a reason food is front and centre at holiday gatherings, birthday parties, weddings, and wakes. Feeding each other makes us feel good, and it brings us closer to each other. And I know that at my saddest or most stressed, I don't reach for celery sticks or kale salad. I usually want what I know is "bad" for me — chocolate and French fries are special weaknesses — because it makes me feel better, even if I'm not especially hungry.

Mice are go-to model animals for neuroscience because they share so many things with people. The structure of their brains and the way their nerve cells fire, their genetics, and even some of their behaviours are similar enough that we can study them and make meaningful inferences about how our own brains work. But I was surprised to learn that mice also have odd little quirks that I'd always thought of as uniquely human. They stress-eat. They midnight-snack. And they love to binge on chocolate.

When our brains tell us we're hungry, they're ultimately seeking to restore metabolic imbalances they've sensed in the rest of our bodies. Typically, calorie-dense foods like fats and sugars that give us an instant energy boost are assigned a high reward value by our brains, and so we're more motivated to seek them out.

There are dozens of factors that might cause human beings not to do this when they feel the urge to eat but since mice, (at least as far as we know) are unburdened by the social and cultural pressures that might lead to disordered eating, it's easier to unravel the neural circuits that drive them to eat.

Most of this circuitry is thought to live in the hypothalamus, a region responsible for maintaining many of our other most essential functions like heart rate, blood pressure, and body temperature. Feeding circuits also communicate extensively with the same reward and pleasure circuits that are associated with learning and addiction.

Many different kinds of neurons and chemical messengers work together to orchestrate the complex and delicate symphony of energy homeostasis. In simple terms, homeostasis simply means balance. You can think of homeostasis among the systems of your body a little bit like a thermostat in your house. In the winter, you might set the temperature a little warmer to keep the house cosy and in the hotter summer months, you might set the thermostat a little lower to keep you cool. When you pick a "set point" for the thermostat, it senses when the

temperature in the house strays too far below or above this point and switches on the heater or the air conditioning to maintain the temperature you chose. Our bodies have "set points" too — when your nutrient reserves are depleted, for example, or your body temperature spikes or drops, different groups of neurons fire off signals to encourage you to eat, sweat, or otherwise change your behaviour to keep your energy levels within a set range. AGRP neurons are just one group of nerve cells that help defend homeostasis within our bodies.

The star of the show in recent decades, however, has been the AGRP neuron. A decade ago, a group of researchers at Harvard found that turning these specific neurons on could drive a mouse to eat voraciously and to gain weight over the course of just a few days, even if he was already well-fed. The opposite was also true — turning these neurons *off* right around a mouse's typical breakfast time caused them to lose interest in food entirely.

Based on these behaviours, AGRP neurons were understood as drivers of hunger and feeding. Intuitively, we think of the activation of a neuron or group of neurons as an on-switch to drive a certain behaviour, like foraging or feeding.

Since the urge to feed is so foundational for our survival, the circuits that control hunger have received a lot of attention. It is more subtle and difficult to pin down how we know when to stop eating, once we start.

It was assumed that since it was possible to manipulate hunger and feeding in such a straightforward way — it was just a matter of activating or inactivating AGRP neurons — the animal's activity states would also correlate in an easy-to-interpret way with how much they ate and how hard they worked to forage for food.

The results found by the researchers, however, were actually counter-intuitive.

When a mouse senses that food is nearby — either by smell or by sight — the activity of the hunger-sensitive AGRP neurons drops dramatically, and almost instantaneously. Even more interesting was that the degree to which this activity was dampened depended on how delicious the food seemed to the mouse. For things like peanut butter or chocolate, the drop in activity was even more severe than for the mouse's standard fare.

What this was all interpreted to mean was that while these neurons sense nutritional imbalance within the body and try to drive behaviour to remedy that imbalance (say, convincing a mouse to run to the opposite side of its

cage for a Hershey's kiss), their almost immediate silencing as soon as food is located seems to be a mechanism whereby the brain tells the mouse that it can stop expending energy trying to find food, especially if it's plentiful and highly palatable.

Essentially our brains tell us to stop feeding before we even start.

These signals don't necessarily come solely from the environment. They also reach our brains directly from our guts. In fact, many of the chemicals responsible for telling us when it's time to push away our plates are generated in our guts and intestines, and signal to our brains via the vagus nerve, a sort of high-speed brain-body railway that allows cues from our bodies to reach the deeper regions of our brains without a need for centralized processing in complex sensory or decision-making centers higher up.

Some of the chemicals, collectively known as "satiation factors," such as serotonin or a protein called CCK, are released when nutrients are detected in the stomach. Others respond to mechanical forces in the stomach and small intestine. Even in a hungry mouse, for example, artificially stretching the stomach or intestine without providing food or nutrients has the same effect on a mouse's AGRP neurons as a stockpile of chocolate would. These chemicals don't just control whether or not we look for food. They're capable of controlling more subtle things like the frequency of meals and portion size — the difference between snacking multiple times a day or eating a couple of large meals.

Emotions and memories play a big role in how and when we eat too, though. Mood disorders like seasonal affective disorder and major depression usually disrupt appetite, and when we're anxious or stressed some of us snack compulsively while others feel too ill to eat at all. Perhaps because it is so essential to our survival, the proteins and neural circuits that control hunger are also powerful emotional regulators.

Serotonin is best known for its mood-elevating effects and is a common target for antidepressants — and it also helps signal to the brain that we're full and it's time to stop feeding. Another satiety factor, CCK, has been linked to panic attacks and anxiety.

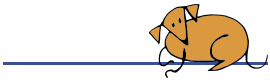
It makes sense that our brains would feed us unpleasant emotions at times when we desperately need to remedy an energy imbalance — but unless that imbalance is life-or-death it can be difficult to identify the source of that discomfort when we're busy or stressed or surrounded by dozens of

other potential factors that could nudge us over the edge of a bad mood.

My last year of graduate school was an emotional roller coaster but I had a friend who used to stop me before I'd start sizing up the impossible enormity of my problems over coffee and ask me if I'd eaten anything that day. At first, I was a little incredulous at the question but I started to appreciate these daily check-ins when I realized how frequently the answer was "no".

While my problems were still there and still difficult, they were easier to manage when I wasn't constantly running on an empty stomach. I also realized that when I started to work longer hours the first thing I stopped doing to free up more time was food preparation. I'd end up snacking on whatever I could find in the cafeteria at random intervals throughout the day, but I'd taken for granted what a major mood lift it was to take an hour out of a day and cook something with people I cared about once my schedule slowed down again.

Feeding ourselves can sometimes feel like an afterthought or a chore, but hunger is one of the most powerful reminders of how impossible it is to disentangle our brains from our bodies — things we think of more as "physical" phenomena from emotional ones. As tempting as it is to think in terms of dualities, our minds and bodies both run on the same fuel.



Lindsay Gray

Lindsay is a full-time neuroscientist, part-time cellist, and sometimes a writer of things.

eel at home

One thousand leagues into the sea: a marine biologist's quest for the birthplace of the freshwater eel.

Akil Ravi

The first time I saw an eel was at an aquarium. Despite having just seen an extensive variety of fish and other sea creatures, it still took me by surprise. The eels were a perfect mystery; looking like the snakes I had seen near my house, but with fins like fish!

I remember being scared of these black, wriggly creatures - hesitant to

get closer, yet curious to learn about them.

It was years later, probably in middle school, that I came across eels again. I learnt about their amazing ability to generate electric charges, their very flexible backbone, and other cool facts. Once again, I marvelled at the nature of this creature. How does something so beautiful and extraordinary exist on this planet along with us? Yet again, I didn't pursue my curiosity–it got buried with all the other interests I've had over the years, but never pursued.

I'm sure we have all had such thirsts for knowledge that we've forgotten about, but what about those who did manage to chase after their curiosities?

When defining curiosity, I like to turn to Mario Livio. He's an astrophysicist and also the author of *Why? What Makes Us Curious,* and he sums up the answer perfectly: "It's a bit like an itch that we need to scratch."

Why do we feel curious? What is it that makes us so driven to find the answer to a random question?

Have human beings always been curious? Some quick internet searches may provide you with the same answers that I sought after; curiosity has been around for a long while. After all, why would we create something as irrelevant as a flute back in 900 B.C. or even earlier? Those humans seemed to have some motivation within themselves to create an instrument that could produce beautiful sounds - something that didn't benefit their survival at all.

It's not empty words after all when they say "curiosity killed the cat, but satisfaction brought it back"!

It seems, important knowledge relevant to one's endurance, social standing, and so on, is not our only motivation to seek out answers.

There seem to be internal factors at play. After all, discoveries weren't made only for the sake of survival, they were also made because of frustratingly unanswerable questions too. How else would we know why the sky is blue, or why we don't seem to fall off earth despite being "upside-down"?

Epistemic curiosity, which is the drive to fill up information gaps in your brain, is most often associated with science, and the urge to find and discover, and so is the closest term to what we mean when we talk about curiosity.

Of course, while epistemic curiosity may be a bit pointless to start with, its results can eventually end up being

useful. When the great scientist Galileo Galilei was 20, he was observing a lamp swinging from a cathedral ceiling, just for fun. He ended up inventing the pendulum—thereby setting the foundations of modern-day timekeeping. More obscurely, the mathematician G. H. Hardy was very proud of the fact that his study of complicated prime-number algorithms had no use in the real world. But he couldn't have known that today, we use them every day for encryption and cryptography. And so, one can say, scientists are often people fuelled by curiosity.

EPISTEMIC CURIOSITY

Epistemic curiosity is a fascinating force to observe: one paper put it as the "desire for knowledge that motivates individuals to learn new ideas, eliminate information-gaps, and solve intellectual problems". It has led to incredible leaps and developments in so many sectors of science and society. But what motivates this curiosity? Astrophysicist Mario Livio explains that epistemic curiosity is a pleasurable state to be in because of the anticipation of reward. The reward for us as humans is knowledge and understanding. This differs from other forms of curiosity like perceptual curiosity, which we feel when something surprises us as it isn't what we expect or think we know. This type of curiosity, for example, would carry a more unpleasant feeling, and therefore wouldn't be as motivating.

There are countless examples of epistemic curiosity leading to completely unexpected and key discoveries (eels included). The "law of force of gravitation", for example, was found because of Sir Isaac Newton's intense curiosity when an apple fell on his head out of the blue. Another awe-striking example is the earliest attempt at a pendulum clock which was created by Galileo Galilei when he noticed a chandelier swaying in a church because of a slight tremor, and compared the arcs to his own pulse! The consistent timing of the arcs ignited his curiosity, pushing him to experiment with different lengths and weights. This led him to the realisation that no matter what, the time each arc took would be a constant. Before this discovery, clocks were much less accurate, losing or gaining upto 20 minutes a day.

Epistemic curiosity is an astounding phenomena to learn from, and has arguably led to some of the best realisations and findings over the years. Of course, there is much anticipation to see what it will bring us in the future!

Johannes Schmidt, a Danish scientist, was one such human being.

Like me, he too was curious about eels, though of course his interest was a lot greater than mine. He was especially interested in finding out about the early life history of the European (*Anguilla Anguilla*) and American freshwater eels (*A. rostrata*). Schmidt was a marine biologist, working part-time for the 'Danish Commission for Investigation of the Sea' from 1902 to 1909.

Since this was the dawn of the 20th century, scientists were aware that eels were breeding similar to other fish, but they had no idea where they bred. And so, in 1904, Johannes Schmidt decided to lead a series of expeditions into the Mediterranean Sea and the North Atlantic.

Little did he know how long his quest would last.

There are more than 800 species of these slender, elongated fish that belong to the order, Anguilliformes. They are usually scaleless, with long dorsal and anal fins that are continuous around the tail tip. They are found in all seas - from coastal regions to mid-depths. While they primarily live in saltwater, some of them travel between salt and freshwater environments to breed–growing to maturity in fresh water and then returning to the sea (a journey that can take 2 to 3 years) where they spawn and die.

So, what are these creatures?

Well, you know them best as eels. And no, these aren't the funky electric ones that you've probably read somewhere about, these are called true eels.

(In fact, the ones we call electric eels, aren't even eels! Despite its name, they are actually knifefish–a member of the order *Gymnotiforms*, and are more related to carp and catfish than eels.)

While electric eels can grow to about 2.75 m long, mature true eels range from 10 cm to 4 m long; the longest one ever caught being a slender giant moray eel which was 3.9 m long, about the height of an elephant! And when electric eels use electric currents to hurt a predator/prey, true eels use their strong jaws and their small, sharp teeth to defend themselves. Luckily for us, true eels are mostly nocturnal and tend to stay hidden in the sand, or under rocks.

Johannes Schmidt set sail on the shores of Europe looking for and catching eel larvae. The process was a rather interesting one: he would take them in for inspection, measure their length, and then release them back into the ocean. The idea was that if he

measured different sizes from all over the waters, the place which had the smallest larva that he found, would be the birthplace of eels.

While he was sailing the Atlantic in search of eels, the rest of the world was going through its own changes. The world's first vehicle license plate was issued, in the Kingdom of Prussia, and the Wright Brothers became the first humans to fly a plane. Einstein submitted his seminal paper; the Sinn Fein party was founded to fight for Irish independence; Henry Ford released the Model T automobile.

By this time, Johannes Schmidt had realised that eels near the European coastline were rather big, so he went out further into the ocean: into the Atlantic and towards the Americas. He realised that the further west he went the smaller they got, so he was certainly on a trail!

Elsewhere, life carried on. Gandhi launched his nonviolent movement in South Africa; slavery was abolished in China; the Oreo cookie was invented; someone stole the Mona Lisa because he thought it should belong to Italy but was eventually arrested. The Panama Canal was built, linking the Pacific and the Atlantic. World War One broke out, sucking many countries in and making the Atlantic a dangerous place to sail. John Schmidt, however, carried on with only one purpose in mind: the birthplace of the eel.

The war eventually died down, giving way to the Russian Revolution, when Schmidt finally reached his destination. The world was certainly a different place by then: he had been sailing for over eighteen years!

What Johannes Schmidt found, though, was certainly worth the wait. Tucked away, in the corner of the Atlantic, in the windless calms of the Sargasso Sea, were the baby eels.

The name Sargasso itself is derived from the Spanish word "sargazzo" which means seaweed/kelp, and it may help us understand why there are so many myths and legends surrounding the sea. Cristopher Columbus back in the 1400s is credited with the first written account of the sea, in which he mentions that the sailors saw the seaweed as a sign of shallow waters, and were scared that the ship would get entangled in it, run aground and eventually drag them down to the ocean floor.

The eels were born and bred in the Sargasso Sea, before they used ocean currents to disperse to their respective freshwater habitats in Europe and North America.

Doesn't this tell us something about our curiosity and how driven we are to

find answers?

No external factors were making and tempting Johannes Schmidt to sail around the Atlantic looking for the birthplace of eels; no prestige, no money, just plain curiosity.

And just like the phrase "curiosity killed the cat but satisfaction brought it back", wouldn't it be nice if we could just do what we are curious about? Because that's what this Danish scientist did, and even though parts of his work have been disputed, much of it is still relevant and largely accepted.

What would you do if you could be driven by your curiosity alone? If you're like me, you might spend a whole day googling random trivia, or you might even want to spend your entire life travelling around the world. And, what would the people around you do? What would the world around us look like? Quite different, I'm willing to bet.

Akil Ravi

Akil is an associate editor at Snipette. A passionate bibliophile who also reads and writes poetry, she enjoys sketching anything nature related, and likes to explore new types of art—a pencil being her preferred tool. One of her cherished activities is to walk barefoot on a dirt path, while creating imaginary worlds and writing poems in her head!

earl grey

Does the iconic tea have anything to do with Grey, the Earl?

Martin Fone

Coffee in the morning, then tea in the afternoon and evening is my mantra. My preference is for a cup of Earl Grey, made from tea leaves and poured from a teapot. Earl Grey is usually drunk without milk or, if you must, with just a dash. There are variations of the tea as well: French Earl Grey contains rose petals; Russian Earl Grey uses lemongrass; and if you want a

citrus overload, Lady Grey boasts the addition of Seville oranges.

The tradition of taking afternoon tea is accredited to Anna Russell, the seventh Duchess of Bedford, in the 1840s, and so popular was it as a way of breaking the fast — and boredom — between lunch and dinner, that it was eagerly adopted by high society ladies. Queen Victoria, notorious for her sweet tooth, took to it with gusto, but took the fun out of it by requiring her ladies to wear formal attire.

There is a sense of occasion to the process of making a pot of Earl Grey. Its heady, sweet aroma makes it a perfect accompaniment to a freshly made cucumber sandwich or a piece of Victoria sponge cake. It is a quintessentially English thing to do.

Earl Grey is not a registered trademark, so any tea can be called Earl Grey as long as it contains a specific ingredient: an orange.

The bergamot orange has had a long and interesting history. The oil extracted from the rind of these oranges is what is known as bergamot, and it comes with its own distinctive scent. Bergamot is now widely grown in Italy, but it is native to the Far East, where alchemy, chemistry, and therefore, perfumery advanced significantly during the peak of the Islamic empires; in fact, the name stems from the Turkish ber amut or "prince's pear".

The Arab and Persian civilisations, located at the crossroads between the Far East and Europe, were if anything even better at perfumes, because they could import ingredient from whichever location the desired. The trend eventually spread westwards, where bergamot came to form the chief component of Emperor Napoleon's favourite soap, the Brown Windsor.

One tale of bergamot in Europe begins in the city of Cologne, in what is now Germany but was once the Duchy of Westphilia. This was where perfumier Johann Maria Farina discovered a splendid new formula consisting of rosemary, lavender, and bergamot. "I have found a fragrance", he proclaimed to his brother in a letter, "that reminds me of an Italian spring morning, of mountain daffodils and orange blossoms after the rain".

This new perfume was a roaring success, attracting the attention of nearly all the royal houses in Europe, which is perhaps why the oldest perfume factory in existence today is the Johann Maria Farina gegenüber dem Jülichs-Platz GmbH.

In honour of his hometown, Farina gave this scent a name that is very familiar to us even today: Eau de Cologne.

Despite its success, the use of bergamot as a flavouring and scent had a bit of a bad reputation down the ages, particularly — but not exclusively — in relation to tea. Besides expensive perfumes, the substance was also being added to snuff to give it a distinctive aroma. By the early 19th century, bergamot was being added to cheap and low-quality teas to give them the veneer of something of superior quality, which warranted a higher price.

In the absence of quality control in Britain, the adulteration of foodstuffs with additives; some of which were quite harmful like arsenic, copper and black lead, was not uncommon. Tea, a relatively expensive product, was often seen as fair game.

On occasion, a corrupt trader would go too far with this, stirring the authorities into action. For example an 1837 edition of *The Bristol Mercury* noted that a command had been given to a London grocer preventing him from selling his tea. "Brocksopp & Co's Mowqua's small-leaf gunpowder was so inferior a tea", it lamented, "that deponents could not set any price upon it… it was artificially scented and appeared to have been drugged with bergamot in this country."

Today, we know that too much bergamot is not a good thing, sometimes causing muscle cramps or rashes depending on whether it's swallowed or applied. That said, when used well, it could also have therapeutic properties.

The member of the Grey family popularly associated with the tea is Charles Grey, the second Earl, who served as Prime Minister in the 1830s. Better known for abolishing slavery in the British Empire, he also removed the monopoly of the East India Company on importing tea from China. Until then, the East India Company was the only one allowed to import tea from China; Charles thus lowered the price and enhanced the popularity of the beverage.

We undoubtedly have a lot to thank him for, but did Charles Grey have any direct connection with the particular tea that still bears his name?

The story that the then Lord Grey told to *The Daily Telegraph* in 1994 goes something like this: it was the time of Grey's premiership and he had sent an envoy to China. A series of events later, the envoy happened to save a young mandarin's life. Endlessly grateful, the young boy's father envisioned how he could ever thank Charles Grey for this. Suddenly, an idea struck him; tea! He mixed together the most special of his blends while diligently jotting down the recipe,and shipped it over to Grey. Grey was so delighted by this surprise

that he got his tea merchant to immediately copy it and thus continued the tradition.

There is, however, also an alternative version of this story. It appears on the website for Howick Hall, Grey's country manor. It claims that the tea was blended specially for his Lordship — by a Chinese mandarin, naturally — to hide the taste of lime in the water drawn from the local well. This is another interesting example of the use of bergamot to hide an unwanted taste.

The tale goes on to claim that Lady Grey used the blend when entertaining in London, thus sealing its popularity permanently. This version of events has been confirmed by tea wholesalers Jacksons of Piccadilly, who are now a part of the Twinings family.

Charming and convenient as these stories are, there are some troubling elements to them. During the 1830s China maintained a strict trade and policy, shutting its borders to foreigners. These tensions boiled over in 1839 into the First Opium War. Added to that, bergamot was not used as a flavouring for tea as it was not grown there back then.

What the Chinese did have, though, was neroli oil extracted from the flowers of the bitter orange tree, Citrus aurantium. In correspondence recently unearthed in the East India Company's archives, it was noticed by the botanist Sir George Staunton, that in 1973 the Chinese scented their tea with this oil rather than the original bergamot. Joseph Banks, who heard this from Staunton, later experimented with various flavourings before settling on the final recipe. Bergamot, more readily available in the West, is a subspecies of neroli and, intriguingly, Banks was a friend of Grey.

Today, not all bergamot originates from the orange. The bergamot mint, a completely unrelated plant, is so named because it gives off a fragrance similar to bergamot.

To stir the pot further, from at least 1852, William Grey & Co extensively advertised their Grey's Tea, often with an accompanying rhyme which went as follows:

If your pockets and palates you both want to please,
Buy William Grey's finest of Teas
His, at Four Shillings, is unequale'd they say,
Then come with your money, and purchase of Grey.

Grey's 'Red Canister Tea Warehouse' was based in Morpeth, only a few miles away from Grey's seat in

Howick. And while the Greys of Morpeth went out of business, their 'Celebrated Grey Mixture Tea' lived on, thanks to the efforts of Piccadilly-based blenders Charlton & Co.

In 1867, Charlton & Co were advertising the tea in Britain at a discounted price, from 5s 6d (5 shillings, 6 pence) to 4s 6d (4 shillings, 6 pence) a pound. By 1884, in *The Morning Post*, they were promoting it as 'the celebrated tea, Earl Grey's Mixture', the first known usage of this name. It may be that the addition of Earl was a bit of creative copywriting to give the tea an air of respectability and to distance it from the shady practice of product adulteration of half a century earlier.

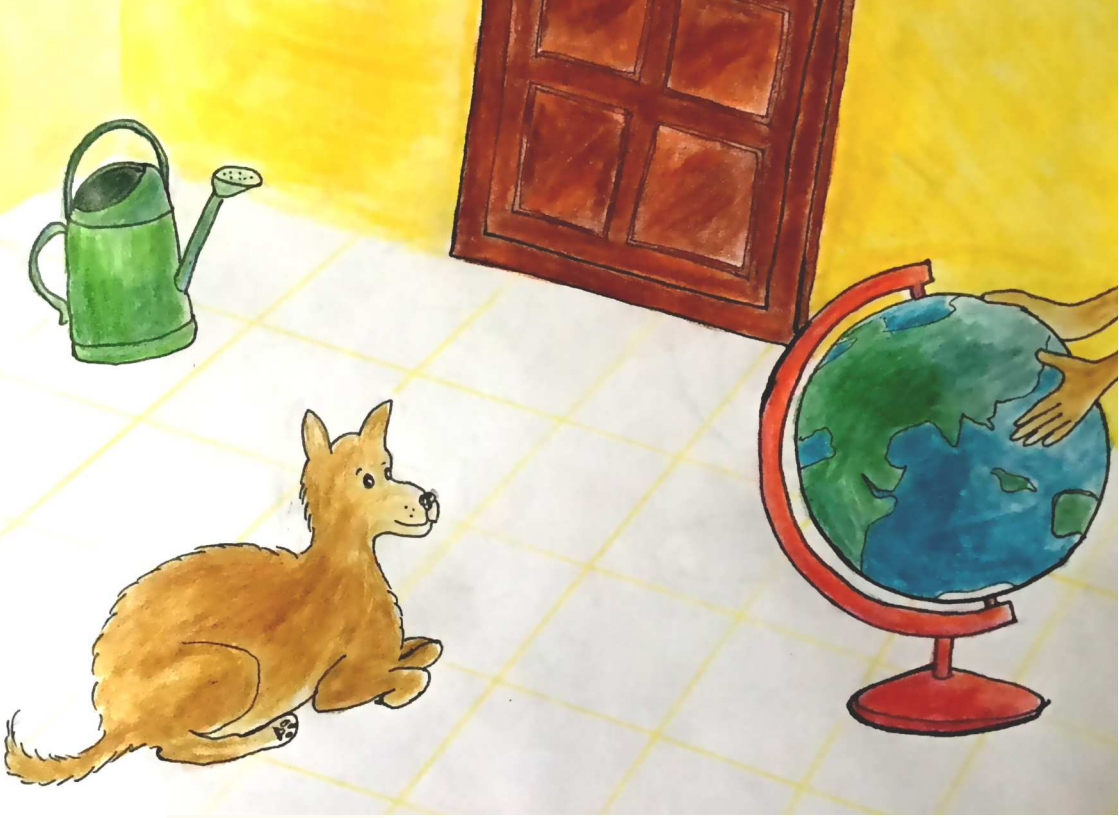
Twinings did obtain the endorsement of the sixth Earl Grey, Richard, to use the brand name: it is his signature that appears on their packets. However, other than this, we have to conclude that there is most probably no connection linking the family with the invention of this tea. The use of bergamot, for purposes nefarious or otherwise, is well evidenced earlier and independently of them and, perhaps, the brand was established with the help of the Grey family from the small town of Morpeth.

Whatever the truth may be, one of our most prestigious teas certainly has an interesting and murky history.

And as for the rather less well known Earl Grey cigarettes? That's another story entirely…

Martin Fone

Martin Fone is a writer, blogger, and freelance journalist who specialises in the quirky, light-hearted-in-life, as well as science, history, the arts, books, and gin. His new book, *More Curious Questions*, is out now.



pet theory

We feel the scrutiny of pets, but do we really know what they're thinking?

Kamala Mukunda

A dog is placed in a room with a globe on one side and a watering can on the other. He sees a woman entering the room from one side of the room, and handling the globe.

She leaves the room, only to enter again from the same side within the next few seconds. Again, she walks to the globe and continues examining the globe.

The woman repeats this another six times, and the dog gradually stops paying attention to her: "Yeah, I get it, this woman's really into the globe." Following this, the dog was taken out of the room very briefly and when he was brought back—the globe had switched places with the watering can.

Now, this was an experiment run on 52 dogs, and at this point in the study, different dogs saw different things. For some, the same woman entered from the *opposite* side of the room and examined the globe again, and these dogs remained quite uninterested. But for others, she entered from the same side of the room as she had all along, but began to examine the watering can. These dogs suddenly perked up again, almost as if to say, "Hmm, so now she's interested in watering cans?"

Ever looked into those big warm eyes and wondered: what's going on in this cute creature's head?

Whether it's the baby or the pet poodle, the working of the mind is invisible simply because they cannot tell us what's going on. With children and adults who can speak and answer our questions, there is some measure of insight into their thoughts and feelings! But sans speech, is there a way to get this psychological insight?

Scientists cracked this particular methodological issue with baby research decades ago, actually. Using some very clever experimental paradigms, they've given us amazing perspectives on how complex and sophisticated the thinking of babies really is.

Now, here's one elegant paradigm, with some examples of how powerfully it can be used with a variety of creatures from fish to humans to dogs.

It turns out that babies, in spite of having only just arrived in our sensational world, already come wired with the ability to get rapidly bored. Yes, believe it or not, the whine "So bo-oring!" could have deep, evolutionary roots! A part of a newborn baby's intelligence rests in its preference for novelty.

Show a baby a picture, and it'll look at it with great interest for a while. In a few minutes, however, it turns away, looking for something new…unless you change the picture, at which point it will switch back to looking interested. Now I must admit, I'm indulging in a little inference here. Sure, the baby looks, and looks away—but how do we really know if it's interested or bored?

The short answer is: we don't. All we know for sure is that it's reacting differently. Scientists have a less evocative but more objective name for this behaviour: the habituation-dishabituation paradigm.

Why do we need experiments? Why can't we just look at a pet we own, or a baby we know, and say "oh so this is how babies think"? After all, we're all constantly making guesses about how the world works, supported by our own little experiences, fuelled by curiosity. Why can't psychologists do the same?

There are a lot of factors that affect thought and action. Maybe you bought that ice cream because it's hot outside, or because an ice cream ad from earlier was running in your head, or maybe you bought it because you saw someone across the street with one, and it looked *really* tempting. Chances are, you yourself won't be able to say for sure. Because we're constantly exposed to so many stimuli, it's difficult to *isolate* one as a cause for a psychological phenomenon. One of the biggest debates in psychology, in fact, is whether certain things are influenced by our genes (or nature) or our upbringing (or nurture). But because we have the genes we have, and we can't change who raised us, it's difficult to say for sure.

In an experiment, a researcher has control over what stimuli you're exposed to–at least in the short term. To go back to our ice cream example, a researcher could either increase the temperature of the room you're in, or they could show you many ads, or show you someone else eating ice cream. Then, they can see how many people want ice cream in each condition. Instead, they could also change the flavour of ice cream so it's not as enticing and see how many people want some then.

In other words, researchers can isolate stimuli to see what prompts behaviours, thoughts or actions from us.

From an evolutionary standpoint, it makes sense that babies would seek novelty in their perceptual environment, since it increases the scope of their learning. Once a baby has paid attention to a stimulus for some time, it's good that it goes 'Got it — what's next?'

Anyway, this paradigm has now become a way to test if non-verbal creatures can tell the difference between two similar stimuli. If a baby habituates to a stimulus, and then we change it slightly, if they do not dishabituate it implies that they could

not tell the difference. And of course, if they do dishabituate, we can conclude at the very least that they could tell the difference.

Using this paradigm, psychologists have discovered, for example, that infants can distinguish between colours, between faces of individuals in several species, between male and female faces, and at the ripe old age of 18 months, between objects sitting on a container and in a container. This last experiment showed babies various objects (an animal, a car, a candle, and a peg) all being placed on a container. They got thoroughly bored with that. Then they were tested with either a cap on the container, or a peg in the container.

Lo and behold, the babies are dis-habituated only to the peg in the container!

Take a minute to figure out what this means. The babies had abstracted the idea of 'on' from the several instances of seeing different objects on containers. When they saw an object 'in' a container, this was something new. It's a much more sophisticated response than simply being interested in a new object!

Interesting results have been found using this paradigm with other animals too.

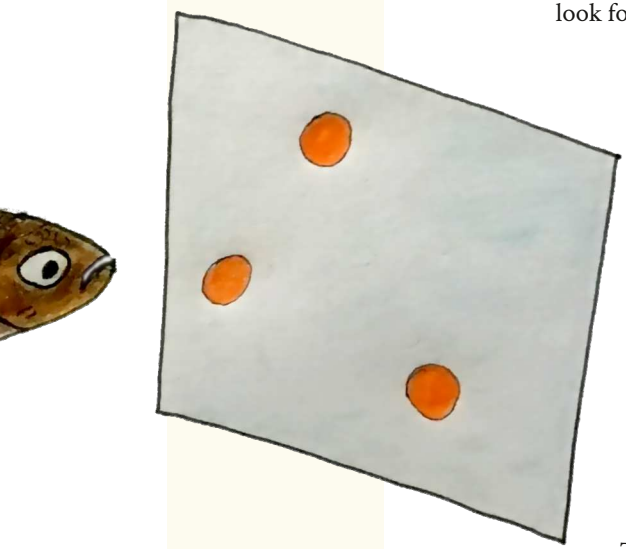
Zebrafish that are habituated to displays of 3 dots will dishabituate to displays of 9 dots, and vice versa. This is after controlling for the size and shape of the overall display. So the fish can count, in a way. And dogs have been a frequent object of study using the habituation/ dishabituation paradigm.

In one study, the scientists recorded the sound of different dogs barking at an intruder, and the sound of the same dogs barking when left alone and tied. They played these recordings to several other dogs (the subjects of their research), and measured heart rate as an indicator of attentiveness.

When the dogs heard the intruder bark repeatedly, their heart rates went

from high to low (habituation). And as soon as the new bark was played, their heart rates went up again (dishabituation).

As a clever check, they tried the same thing with two other mechanical sounds (a drill and a refrigerator) and here, the switch did not lead to dishabituation! Thus the conclusion is that dogs can tell the difference between different kinds of barks made by other dogs.



If you have a pet or a baby at hand, you could try an experiment yourself. Take any question of interest to you: for my dog, I wondered whether he responds to his name, or to the raised volume and tone of my voice when I call him.

Now, figure out a way to design the paradigm to answer your question. I decided to call out different words to him several times in the same high volume and tone, till habituation (as measured by him not turning his head toward me). Then I would call his name in the same volume and tone and look for a response!

Do try it, and you'll realise how much thought goes into these experiments. Other variables and distractions must be controlled, or else you will never be sure of your results. Also, a one-dog case study may be pretty useless; my dog turned out to be bored from the very start and my experiment failed!

This brings me to the experiment we started with. Remember that when the woman entered from a different location but handled the same old object, the dogs didn't dishabituate. They only perked up when she handled a different object, even though her physical movements were much the same as before.

It's tempting to conclude that dogs are

sensitive to the *intentions* of human beings, but to be sure, the experimenters repeated the same procedure with dogs who watched a black box substitute for the woman– the box was being invisibly manipulated to slide either toward the globe or the watering can. In this situation, dogs dishabituated to the sight of it entering from the opposite side, rather than to the sight of it stopping by a new object! Black boxes cannot have intentions, and the dogs' behaviour showed their sensitivity to this.

Research on non-verbal creatures can reveal so much, when it is cleverly designed. Using simple methods like the one I've described, scientists have discovered that all kinds of animals and babies are complex cognitive creatures. It's a humbling realisation—but an exciting one!

Kamala Mukunda

Kamala loves being with children of all ages, and loves sharing whatever she learns with others. She loves that her job allows her to do both.

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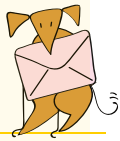

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