The secret history of caffeine: ... and the back story of everyone’s favorite morning habit

> *Caffeine doesn't give you energy. Here's the amazing, real story of its discovery – and how it works on your brain*

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If I can’t drink my bowl of coffee three times daily, then in my torment I will shrivel up like a piece of roasted goat! — Johann Sebastian Bach and Christian Friedrich Henrici,
Schweigt stille, plaudert nicht, aka the Coffee Cantata (c. 1734)

In the year 1723, a French merchant ship sat becalmed halfway across the atlantic ocean. For over a month, she drifted with the currents, sails loose and flapping, waiting for a steady breeze. More than two hundred years had passed since Columbus made the same journey, and transatlantic travel was now a matter of course. But sometimes the fate and consequence of a voyage still hinged on seeds. By some accounts, the drifting ship had already faced a troubled passage—outrunning a deadly storm off Gibraltar, and narrowly avoiding capture by tunisian pirates. Now, stuck in that windless equatorial

zone known as the doldrums, the ship had run so low on fresh water that the captain ordered strict rationing for crew and passengers alike. Among those travelers, one gentleman felt particularly parched, because he was sharing his small allotment with a thirsty tropical shrub.

“It serves no purpose to go into the details of the infinite care I had to provide that delicate plant,” he wrote, long after the wind picked up and the ship docked safely at the Caribbean island of Martinique. And long after the descendants of his spindly sapling were well on their way to changing economies throughout Central and South America. The plant, of course, was coffee, but just how a young naval officer named Gabriel-Mathieu De Clieu got his hands on it remains a matter of debate.

In one version of the story, De Clieu and a band of masked colleagues scaled the walls of the paris botanical gardens, broke into a greenhouse, uprooted a young coffee tree, and fled into the night. Most historians regard this reported chain of events with suspicion, but no one disputes its location. In the early eighteenth century, the only coffee plant in all of france resided at the Jardin Royal Des Plantes. It was a large, healthy specimen that had been given as a token of esteem to King Louis XIV from the city of amsterdam. De Clieu described his coffee plant as small, “no larger than the slip of a pink,” so it must have been either a cutting or a seedling grown from the sun king’s tree. The royal gardeners had been trying to propagate coffee as a horticultural rarity, but they may not have recognized its huge economic potential. Having traveled widely, De Clieu knew that people in the west no longer regarded coffee as an exotic novelty, a beverage of Turks and Arabs. It was becoming a daily staple from London to Vienna to the colonies, consumed not only in cafes and coffeehouses, but in people’s homes. Dutch plantations on java dominated the world market so completely that the word *java* would soon become synonymous with the drink itself. Bringing coffee to Martinique, where De Clieu owned a large estate, promised to break the dutch monopoly, bolster the French empire, and earn De Clieu a tidy profit in the process.

“Immediately upon arrival in Martinique,” he later recalled in a letter, “I planted . . . The precious shrub, which had only become dearer to me through the dangers it had known.” Those dangers included more than a water shortage. De Clieu’s correspondence revealed other details: a jealous fellow passenger who repeatedly tried to steal the sapling, and succeeded in tearing off a branch; the constant guard and fence of spikes needed to protect the little plant once it reached his estate; and the hinted possibility that he had obtained his tree not by theft but through romance, that is, by charming a “Lady of High Standing” at the French court. Centuries later, truth and embellishment are impossible to unravel, but in any form De Clieu’s exploits show how far people are willing to go for a good cup of coffee. When his precious shrub finally did bear fruit, all that persistence paid off handsomely. De Clieu shared seeds and cuttings with neighboring plantations, and within a few decades Martinique boasted nearly 20 million highly productive trees.

Though little remembered today (his Wikipedia entry runs fewer than 250 words), Gabriel-Mathieu De Clieu once enjoyed a certain celebrity among coffee drinkers. English poet Charles Lamb paid tribute

to him in 1810 with a verse that began:

Whenever I fragrant coffee drink,
I on the generous Frenchman think,
Whose noble perseverance bore,
The tree to Martinico's shore.

De Clieu wasn't the only person to carry coffee across the atlantic, but people like lamb gave him credit for every coffee tree from Martinique to Mexico to Brazil, a region that now accounts for over half of world production. That claim exaggerates De Clieu's role, but The Frenchman did get one thing exactly right: demand for coffee was rising. Since De Clieu's day, global coffee consumption has skyrocketed. As the 1940 Inkspots classic "Java Jive" pointed out, people are fond of buying "a cheery coffee bean—boy!" that fondness has transformed the seeds of a shrubby african tree into the world's second most traded commodity. Only oil futures generate more annual revenue. For the estimated 1 billion to 2 billion daily partakers, myself included, the ritual of buying, brewing, and drinking coffee rarely includes a basic question: Why do we bother? If it comes up at all, this query elicits a quick response: caffeine, the mildly addictive stimulant found in abundance in coffee beans. But that answer only invites another question: Why is coffee caffeinated in the first place?

If Charles Lamb had truly wanted to say thanks for his morning cup, he should have penned an ode to various insects, slugs, snails, and fungi. Instead of couplets like, "The islanders his praise resound/ Coffee plantations rise around," he might have sought a rhyme for the way caffeine slows the heart rates of snails, or how slugs respond with what one research group called "uncoordinated writhing." the poem should have mentioned hornworms and shot-borer beetles, whose larvae wither at the merest hint of caffeine, and it might have also explained how caffeine slows the growth of fungal pests, from common root rot to witch's broom. But poets don't think about larvae and fungi when they make a pot of coffee—nobody does. The fact remains, however, that we wouldn't be drinking the stuff without them.

"Caffeine is a natural insecticide," trumpeted a headline in the New York Times, soon after researchers published an early account of its effects. The story was brief, but singled out mosquitoes as particularly susceptible. In fact, caffeine is so effective, and against such a broad range of pests, that coffee wasn't the only plant to think of it. The seeds of at least three other tropical trees also contain caffeine: cacao, guaraná, and kola nut. Like coffee beans, these can all be ground and mixed with water to make beverages—hot cocoa, the Guaraná sodas of brazil, and a host of drinks marketed as kolas or colas, including the original versions of Coke and Pepsi. caffeine also occurs in the leaves of tea and in a type of South American holly known as maté, pretty much rounding out the list of humanity's favorite stimulating liquids. It seems that wherever caffeine turns up in nature, people aren't far behind, holding out our mugs, gourds, and samovars.

Like capsaicin, caffeine is an alkaloid. Producing it requires precious nitrogen that might otherwise be used for growth, so coffee trees make the most of their investment through what amounts to a caffeine-recycling program. They manufacture it only in the most vulnerable tissues, and later transfer that caffeine to the most important place of all, the seeds. The process starts inside young leaves, where

caffeine helps fend off insects and snails that prey on tender foliage. But as those leaves grow and toughen, the plant withdraws much of that caffeine and redirects it to protect flowers, fruits, and the developing seeds. The fruit, a reddish berry, also produces caffeine, much of which diffuses inward to the pair of seeds nestled inside. And those seeds not only receive caffeine, they make more, resulting in a concentration potent enough to fend off all but the hardiest attackers. In total, more than nine hundred species of insects and other pests target coffee trees, so it's logical to assume that caffeine evolved in response. But just as historians can't agree on the particulars of Gabriel-Mathieu De Clieu's story, scientists can't all agree on the evolution of caffeine. It may be a good pesticide, but that's not the only thing it's used for.

Coffee plants manufacture caffeine in various places, but once it reaches the seeds it stays put, bound up in the cells of the endosperm. That's good news for coffee drinkers, but a mixed blessing for the seeds, because caffeine does more than fend off attackers—it also prevents germination. The same chemistry that kills beetle larvae and makes slugs writhe interferes with cell division in plants. Fie touched on this dilemma earlier, but it bears repeating: to sprout successfully, coffee needs to get its tiny root and shoot away from the caffeinated part of the bean. It accomplishes this by imbibing water rapidly, flooding premade cells that swell and push the growing tips outward. Only after they make their escape from the bean can cell division and true growth begin. But once that takes place, something even more interesting occurs. As the seedling gets bigger, caffeine leaks from the dwindling endosperm and spreads into the surrounding soil, where it appears to curb the growth of nearby r0oots and stop other seeds from germinating. In other words, coffee beans know how to kill off the competition—they release their own herbicide, clearing a tiny patch of ground to call their own. In a seed's vital struggle to sprout and get established, that's an evolutionary advantage every bit as important as warding off pests.

It's easy to understand why coffee plants would want to protect their seeds and leaves, or to give their seedlings a head start. The final theory on caffeine evolution is more surprising, but early in the morning it's one that a lot of people can relate to. It has to do with addiction. As recycled caffeine moves around inside a coffee tree, it shows up in one place that puzzled scientists for a long time: flower nectar. What is the point in putting insecticide into something designed to attract insects? Recent research on honeybees has revealed the answer. At the right dosage, caffeine doesn't repel pollinators, it keeps them coming back.

"I think it amplifies responses of neurons in their reward pathway," Geraldine Wright told me. As a professor of neuroscience at Newcastle University, Wright has made a career out of studying how honeybees think. She knows them well enough to occasionally don a "bee bikini" at public events, a live swarm of workers that covers her torso from chest to neckline. Bee brains may be simple, but they're capable of great feats of cooperation. When Wright and her colleagues trained a hive to visit experimental flowers, the bees were three times as likely to remember and return to the ones dosed with caffeine. In this case, at least, honeybee brains work just like ours do—their "reward pathways" light up when they drink caffeine. For coffee trees, producing caffeinated flowers attracts a dedicated cadre of pollinators, lined up like morning commuters at their favorite espresso stand.

When I asked Wright whether caffeine might have evolved for this purpose—whether its potency as a pesticide and herbicide was just icing on the cake—she seemed to think that was a stretch. “i’m not sure the selection pressure would be strong enough,” she wrote in an email, and I could almost picture her skeptical frown. But the fact that caffeine also occurs in the flower nectar of citrus trees, and hot in their seeds or leaves, suggests that it may be possible. Oranges, lemons, and limes defend themselves with volatile oils and other compounds, apparently reserving caffeine for the express purpose of manipulating bee brains.

For a discussion of seeds, divining exactly how caffeine evolved is less important than understanding what it does—it’s equally effective at warding off insects and thwarting nearby plants. But the bee story is relevant, too, because no trait has had a greater impact on the history of coffee, and the cultures that drink it, than the effect those caffeinated seeds have on the human brain.

“The emotions are raised in pitch, the fancies are lively and vivid, benevolence is excited, . . . Both memory and judgment are rendered more keen, and unusual vivacity of verbal expression rules for a short time.” So observed a British medical journal in 1910. Modern scholars may be more restrained in their language, but their data point to the same conclusions. Drinking an average cup of coffee releases enough caffeine into the bloodstream to measurably impact the central nervous system. Neurons in the brain fire more rapidly, muscles twitch, blood pressure increases, and drowsiness fades. But just as capsaicin burns without burning, so does caffeine stimulate without actually stimulating. The boost we feel from coffee comes less from what caffeine does to the brain than from what it prevents. Experts call caffeine an “antagonist” because it interferes with the natural function of certain brain chemicals, particularly one called *adenosine*. Researchers still don’t know all the things adenosine does in the brain, but there’s a way to explain its basic role that will be familiar to millions of radio listeners.

For decades, Garrison Keillor’s program “A Prairie Home Companion” has featured advertisements from “the Ketchup Advisory Board,” a fictional industry group promoting tomato ketchup for its “natural mellowing agents.” The skits feature bland characters whose behavior becomes increasingly erratic and impulsive without regular helpings of ketchup. They suddenly decide to run marathons, pierce their noses, write memoirs, or rob liquor stores. Adenosine is not ketchup—it’s one of the basic biochemicals that make the body function. But in terms of brain activity, the role of adenosine can’t be described any better. It’s a natural mellowing agent, slowing the neurons and triggering a whole chain of events that lead eventually to sleep. Coffee drinkers feel alert because caffeine gets in the way of that process, and even reverses it—replacing adenosine and tricking the brain into speeding up when it would otherwise be slowing down. Caffeine doesn’t actually give people energy; it just renders them less capable of feeling tired.

In Ketchup Advisory Board stories, mellowness always returns when the characters get their ketchup, just as brain chemistry and sleep always overwhelm the effects of caffeine in the end. But people seem to enjoy the sensation of tricking their brains into temporary liveliness, and, like bees, they seek it out again and again. And just as a few bees can lead their whole hive to caffeinated flowers, so, too, Has the coffee habit altered the course of entire human societies. In the west, historians believe it helped pave the way for both the age of enlightenment and the industrial revolution that followed. And it all

started with a change in the morning meal.

Excerpted from "The Triumph of Seeds: How Grains, Nuts, Kernels, Pulses & Pips Conquered the Plant Kingdom and Shaped Human History" by Thor Hanson.