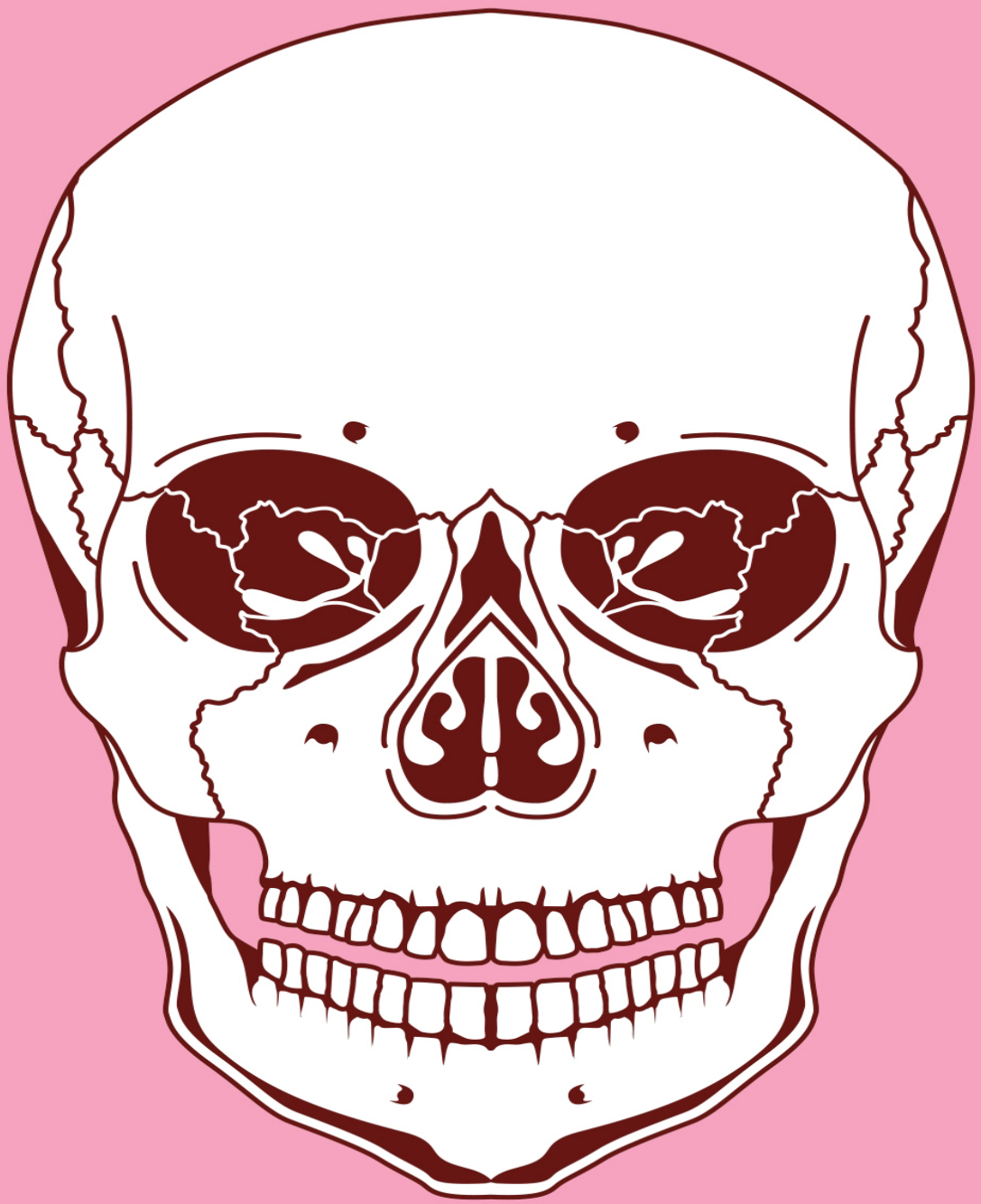
# Bodypedia



A Brief Compendium of Human Anatomical Curiosities

Adam Taor

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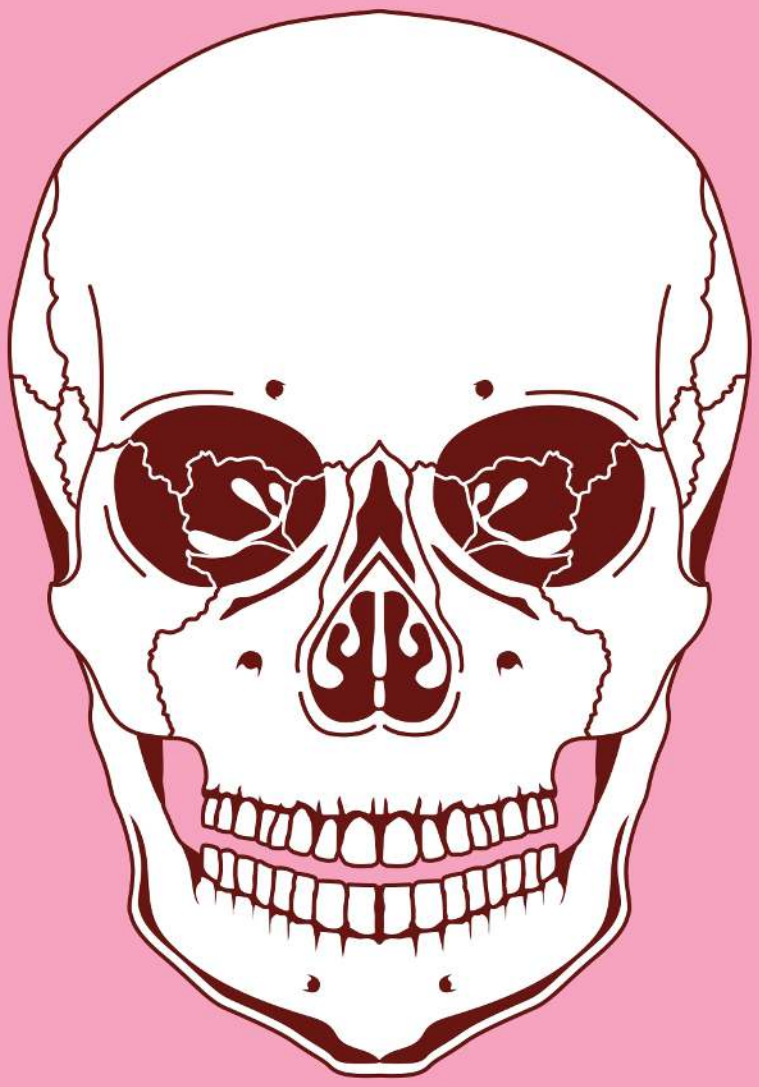

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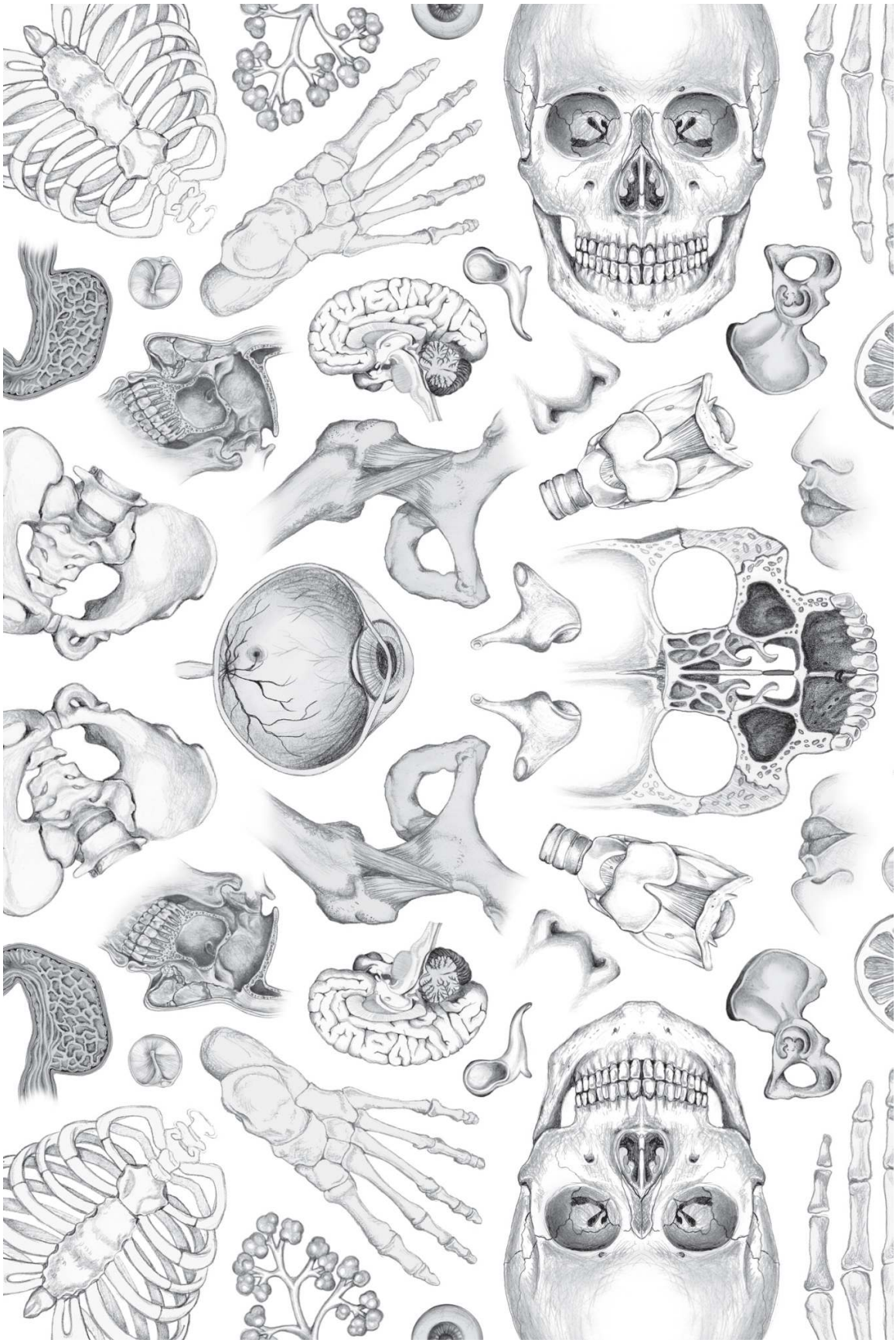

# Bodypedia

## A Brief Compendium of Human Anatomical Curiosities


# Adam Taor

*Illustrations by Nathalie Garcia*



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*For Matilda and Ruby*

# Preface

*Many eyes go through the meadow, but few see the flowers.*

—RALPH WALDO EMERSON

This book is for anyone with a xiphoid process, two Y-shaped ligaments of Bigelow, and a zonule of Zinn in each eye.

That's Zinn as in zinnia, the colorful garden plant. German anatomist and botanist Johann Zinn gave his name to the flowers, and your eye's zonule. Consisting of a few hundred fibers, each the diameter of a human

hair, the zonule suspends the eye's lens in place and pulls on it to change its shape, so you can focus on near or far objects.

It's an obscure piece of ocular ingenuity that hides its light under a bushel, figuratively and anatomically, its transparent fibers being hidden directly behind your vibrant iris, which is named after the Greek for "rainbow." The long-stemmed, vividly flowered plants you might find next to zinnias are irises for the same reason.

One member of the iris family is the gladiolus. Also called "sword lilies," due to their leaves' distinctive shape, gladioli take their name from the Latin for "sword," as do your gladiolus, the largest part of your sternum (breastbone), and Roman gladiators.

Not that gladiators were only handy with swords. They came in several varieties that were pitted against each other for the pleasure of the masses. The ancient equivalent of *Pokémon*, with marginally less shameless merchandising.

One matchup featured a fish-themed secutor versus a retiarius, who cosplayed a fisherman, complete with trident and net, a "rete" in Latin. Which is why your eye has a "retina," perhaps because its blood vessels were thought to resemble a net.

And now we're back where we started, inside your eye's miraculous anatomy.

It's connections like these, between your little-known anatomical parts and a kaleidoscope of curios, taking in geniuses, eccentrics, monsters, murder, madness, bizarre experiments, art, literature, horrific and not-so-horrific history, the names that reside inside you, popular culture, and so on, that are the basis of the stories in this book.

Stories that aim to be unapologetically entertaining. "Unapologetically," because of the not-so-uncommon criticism that a creative, entertaining medium obscures the factual message.

I disagree. To suppose that facts alone are necessarily enough is to disrespect you, the reader, in my opinion. That said, of course I have the utmost respect for the facts (there are many hundreds of references, available online, to support the text) and medicine in general. It's in my blood.

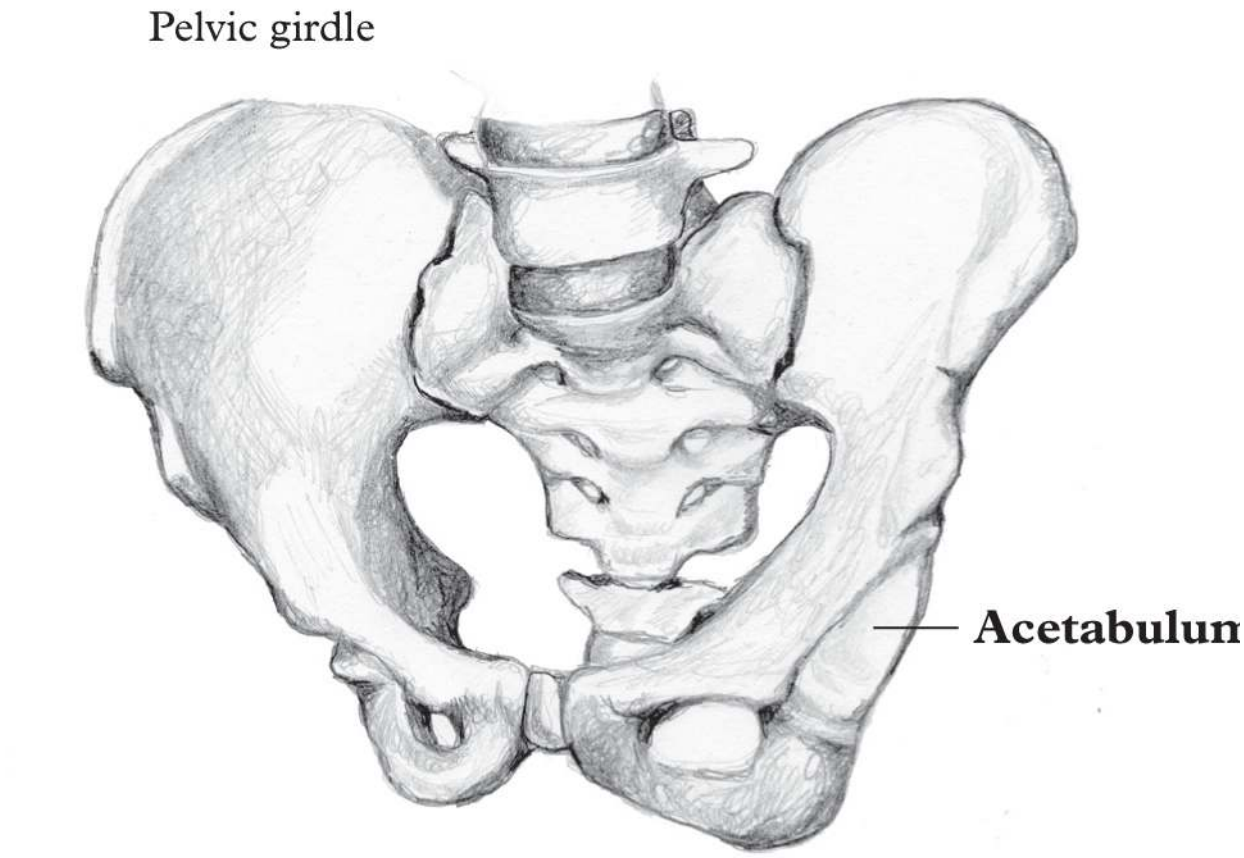
I was conceived in the hospital I was born at (Mum and Dad were junior doctors); lived in one as a kid; went to medical school and qualified as a

doctor; and have written about medicine since, for audiences as varied as groups of kids through to the most highly specialized clinicians. Importantly, the principles of creativity and technical rigor always apply.

These are some of the reasons why I've enjoyed writing *Bodypedia*. And why I hope you'll appreciate its stories. They are, after all, about body parts that you share with everyone else on the planet, yet that rarely see the limelight.

So please enjoy this tour through the meadow of your anatomy: eyes, flowers, and all.

# Bodypedia




## Acetabulum

*How boning up on anatomy opened a disgusting can of worms*

Cleaning the flesh off corpses to study their bones is a tiresome chore. At least it was for David Hayes Agnew, who concocted an eccentric scheme to dodge the deathly tedium. But while this macabre life hack helped Agnew reduce the daily grind of dissection, it had shockingly stomach-turning consequences for his patients, turning the country doctor into a pariah.

However, rural Pennsylvania's loss was America's gain. Agnew's scandalous anatomy catastrophe fed his desire to leave for the city, where he'd become a top surgeon, treating President James Garfield after he was gunned down by an assassin.

In 1847, Agnew was working in the village of Cochranville. He yearned to be a surgeon, so needed to study anatomy. For that he required bodies. While some country doctors resorted to grave robbing, Agnew bought corpses that were dispatched to him from Philadelphia. Agnew dissected the gruesome DeadEx deliveries, then used his time-saving hack, as a biography explains:

> He was in the habit of employing a farmer to remove the bones of his subjects to a neighboring pond, after he had dissected the soft parts. This pond was well stocked with eels, which completed the work of cleaning the bones for him,—a process all anatomists know to be extremely slow and troublesome when done by the dissector.

The eels eagerly gorged on human flesh and became nice and plump, as a fisherman, blissfully unaware of their cadaverous meals, noticed.

"[He] supplied the entire country [*sic*: county] with the best quality of fish; his eels, especially, were famed for their size and fatness. There was a flavor and a snap about the eels which this particular fisherman supplied that put despair into the heart of every other fisherman in the county," the biography said.

When the farmer who helped Agnew dispose of the bodies politely inquired about the source of this mouthwatering fare, the fisherman's reply was particularly hard to swallow.

No longer welcome in Cochranville, Agnew decided to move to Philadelphia to kick-start his career. However, his rise to fame and fortune was stymied by an accident that left him bedridden for months with a serious injury to his hip joint.

The hip is a ball and socket joint. The end of the thigh bone (femur) is the ball. The socket is the hip bone's acetabulum, named after the ancient Roman vinegar cup it resembles. "Acetum" is Latin for vinegar, which contains "acetic acid." It's not great for stripping flesh from bones. For that you need something stronger. Or an eel.

## Alveoli

*How the genius in us is simply breathtaking*

"Inspiration is inspiring" is not needlessly repetitive tautology. It's an assertion concerning some altogether more indispensable "-ologies." The physiology and morphology of your astonishing respiratory system. How

you inhale air—"inspiration" in medical lingo—and absorb oxygen into your blood for making energy, while simultaneously removing carbon dioxide waste. If this mind-bogglingly elegant process, and the exquisite structure and form of the anatomy that gets it done, don't inspire wonder, then maybe you're taking your lungs, and their awesome alveoli, for granted.

To be fair, anyone with healthy lungs takes breathing for granted. Inspiration and expiration just happen, without conscious effort, twelve to twenty times a minute, every minute, when we're at rest. That's about half a liter (US quart) of air per breath; forty full bathtubs worth each day.

The gas travels down airways that get smaller as they divide into more and more branches. They branch and get smaller about twenty-three times, with a combined length in both lungs of around 2,400 kilometers (1,500 miles), the driving distance between New York City and Dallas. At the airways' ends are the cup-shaped alveoli. Clustered like bunches of grapes, these delicate air spaces make up much of your lung tissue. And it's here that the magic happens.

The air you breathe into your alveoli is 21 percent oxygen. When you breathe out, it's only about 16 percent $O_2$, with a hundred times more carbon dioxide than when it went in. These changes depend on the gases moving easily between the air and blood in lung capillaries. Especially as the $O_2$ and $CO_2$ have to simply diffuse across. What's more, a red blood cell—your go-to $O_2$-carrying cell—spends less than a second in the capillaries, when we're at rest.

The long and the short of it is that gas exchange requires your alveoli to be simultaneously minuscule and mega.

Minuscule, in that the barrier between air and blood can be as little as 0.0003 millimeters across. About a thousandth the diameter of a grain of table salt. Plus, alveoli are tiny; five or so could fit into that miniature salt granule. Mega, in that there are a staggering number of alveoli; roughly 480 million in a pair of lungs. Because there are so many of these petite pockets of anatomical awesomeness, their total surface area is enormous. A reasonable estimate is 70 square meters, the size of a badminton singles court. This vast expanse inside your lungs, and the billions of capillaries, are vital to your survival, every breath you take.

Which, when you stop taking it for granted, surely takes the breath away.

## Amygdala

*How scaring is caring*

Walking home alone at night, a young woman spots a man lurking in the shadows. The stranger beckons her over. Cool, calm, and collected, she approaches the guy, who suddenly grabs her and puts a knife to her throat. Unperturbed, she looks her assailant straight in the eye and tells him what's what: "If you're going to kill me, you're gonna have to go through my God's angels first." The stunned attacker frees her. But she doesn't bolt, she nonchalantly walks home. The next day, she has no qualms about taking the same route.

What could be more petrifying? For this woman, the question was meaningless. She hadn't a death wish, and wasn't crazy, or Chuck Norris in disguise. She had a rare disease affecting fear processing centers in her brain. She was fear*less*. She could experience other emotions. Had a normal IQ. Understood the concept of fear. Just didn't feel it.

These fear centers are our amygdalae. Almond- shaped regions, one on each side of our brain ("amygdala" is from the Greek for "almond"). They're involved in many aspects of fear processing, including helping us learn what to be scared of and coordinating our response. They're one reason why we hightail it when threatened. For our amygdalae, scaring is caring.

Hence, our woman's amygdala problem had life- threatening consequences. "Her behavior, time and time again, leads her back to the very situations she should be avoiding, highlighting the indispensable role that the amygdala plays in promoting survival by compelling the organism away from danger," said a paper detailing a series of bizarre experiments on her.

What do you do to the seemingly unterrifiable? You try, try, and try again. When the researchers took her to a shop full of exotic snakes and spiders, she had to be restrained for her own safety. At a creepy old-school sanatorium with stooges dressed as monsters briefed to terrify her, she scared the bejesus out of one when she poked it to see what it felt like. When she was shown horror movies, she found them fun and exciting, wanting to rent one.

Eventually, the researchers did manage to provoke not only fear, but also a panic attack. So, what was the trigger that succeeded in this peculiar process of trial and terror? It wasn't an external threat, rather it came from

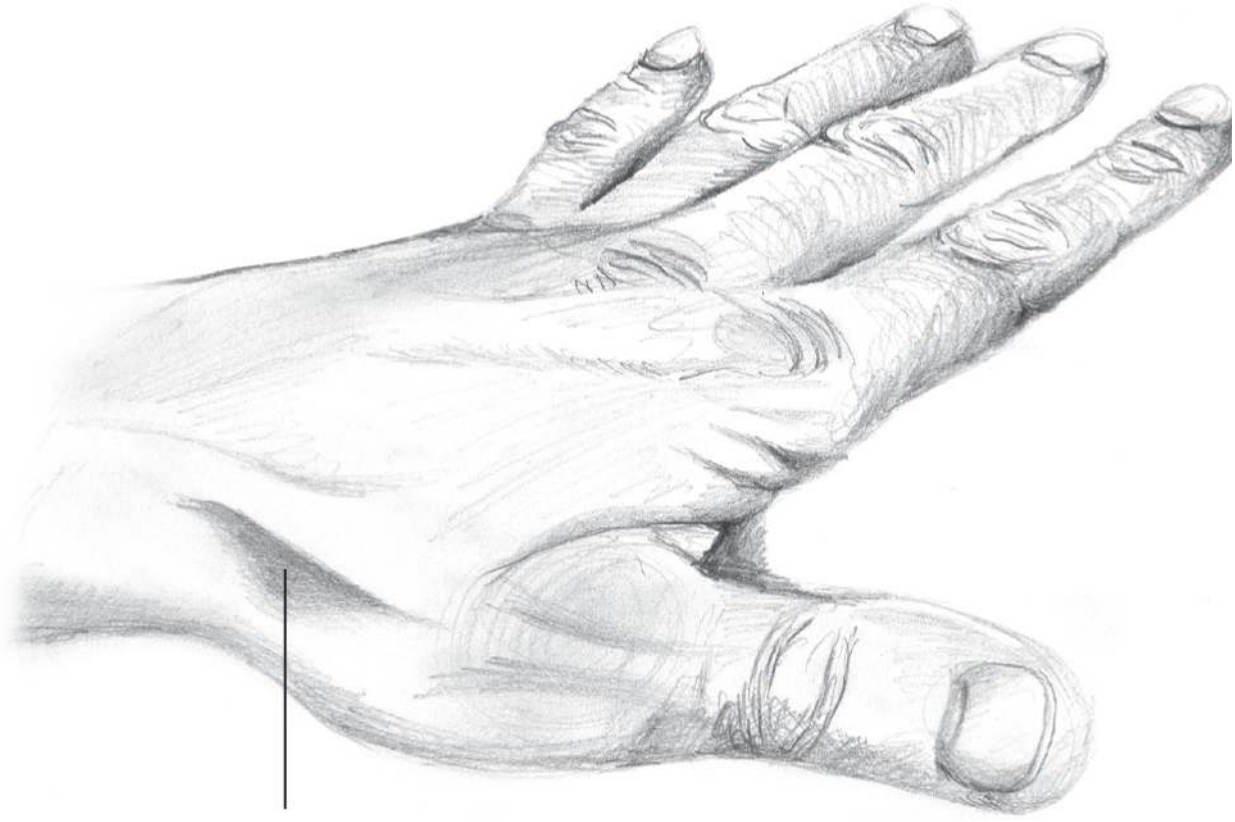
inside her, when she inhaled air containing 35 percent carbon dioxide. For her, suffocation trumped intimidation, mutilation, and envenomation.

## Anatomical snuffbox

*How addiction is in all our hands*

You don't have an Ascending Heroin Injection Vein in your arm. Or a Superior Cocaine Snorting Ligament in your nose. Or a Lesser Ciggy Sucker Muscle in your throat. But you do have an anatomical snuffbox. Two, in fact. These are your only body parts named after the way people take an addictive drug. It's time to "Just Say No" to the grubby label, urged experts in a letter to a medical journal.

Your anatomical snuffbox is a triangular hollow at your thumb's base, on the back of your hand. Users of dry snuff sniff the ground tobacco from it. Snuff was the main form of tobacco use until the nineteenth century. But in 2011, dry snuff represented just 1 percent of the US smokeless tobacco market. Sounds trivial? Not when you realize tobacco is expected to kill a billion people globally this century.



**Anatomical snuffbox**

So, maybe it is time to ditch “anatomical snuffbox.” But if the name goes, what replaces it?

“Tequila shot pot”? When clubbers “lick, sip, suck” tequila shots, they lick salt from their anatomical snuffbox. But alcohol’s another huge, legal killer, accounting for three million deaths a year worldwide. So that’s a “no” to the Mexican moniker.

“Hitchhikers’ hollow”? Hold your hand out as if you’re thumbing a lift, and you should see your snuffbox. But hitching’s risky, and not always legal. Another “no.”

“New mum’s depression”? This refers to a painful problem affecting the tendons in one of the snuffbox’s walls. It’s due to overuse and is common in mums who are constantly lifting up babies. But the anatomical depression and postnatal blues could be confused. Another “no.”

“FOOSH furrow”? Great, an acronym to decode. Fall Onto an OutStretched Hand, and you may break your scaphoid, a small bone at the snuffbox’s floor. Scaphoid fractures cause tenderness in the snuffbox. It’s promising, but we can do better. If anatomy is all Greek to you, that’s because it is: much of its lingo comes from Greek and Latin. FOOSH doesn’t. Fail.

“Radial fossa”? It’s Latin. “Radial,” from the Latin for “spoke of a wheel,” relates to your forearm’s radius bone, which ends near the snuffbox. “Fossa” means “ditch.” There’s no sex, drugs, or rock ‘n’ roll. And it’s already occasionally used. But there’s another radial fossa, in the upper arm’s humerus bone. Fail.

The letter’s authors suggested “scaphoid depression.” But that was in 2015, and it doesn’t seem to have caught on. So, despite its illicit origin, the anatomical snuffbox is far from snuffed out.

## Anterior insular cortex

*How your body sounds disgusting*

Picture this. Or rather, hear me out. You’re in a café. Sitting behind you is someone with the sniffles. How does the repetitive “sniff, sniff, sniff” sound make you feel?

A) “Like a white-hot poker in my brain, triggering volcanic rage that makes me want to rip the snotty nose from their sniveling face and stuff it down their fetid throat.”

Or B) “What sniffing?”

If you’re inclined to go all *Silence of the Lambs* on the (postnasal) drip in the café, you’re no psychopath, but you may be an anatomical audio-path. You may have misophonia, an underappreciated problem involving abnormal activation of the brain’s anterior insular cortex, research suggests.

Misophonia isn’t just mild irritation, as the name indicates. “Miso” means “hatred,” as in “misogynist.” “Phonia” is “sound.” In response to acoustic triggers, sufferers can go ballistic: Increased heart rate, sweating, and other physiological signs of stress. Intense emotions like anger, anxiety, and disgust. Feeling overwhelmed. And needing to stop the noise or escape it.

What makes misophonia especially discomforting is that the noxious noises may be hardly noticed by everyone else, and often come from other people’s bodies. The everyday soundtrack of our anatomy. High on the misophonia hit parade are breathing, throat-clearing, coughing, chewing, slurping, sniffling, and humming.

Misophonia’s potent cocktail of anger, loss of control, and seemingly trivial triggers doesn’t bode well for relationships. In one study, 30 percent of sufferers said they’d responded to a sound with verbal aggression; 16 percent had been physically aggressive. And this explosive, hard-to-explain fury is likely to escalate if skeptics emphasize the “phony” in misophonia, as in: “You’re just an intolerant *&%#&@ looking for an excuse for your pitiful behavior.”

But misophonia may have a neurological basis, with research focusing on the anterior insular cortex. Deep within each brain hemisphere, it’s involved in anger, and integrating sensory information, like sounds, with signals from organs like the heart.

In one study, people listened to three types of sounds: ones that trigger people with misophonia; noises that most people find unpleasant but don’t cause misophonic distress, like screaming; and neutral stimuli, like rain. As expected, only the triggers caused sound rage in those with misophonia. And brain scans showed increased activation in their anterior insular cortex in response to trigger sounds, compared with people who didn’t have misophonia. Importantly, there were no differences between the groups for the unpleasant but non-misophonic trigger sounds and the neutral sounds.

Thanks to research like this, misophonia is increasingly being recognized as “a thing,” which is good news for sufferers, who often feel isolated and

misunderstood. If it was anyone else, you'd say they suffer in silence.

## Arrector pili

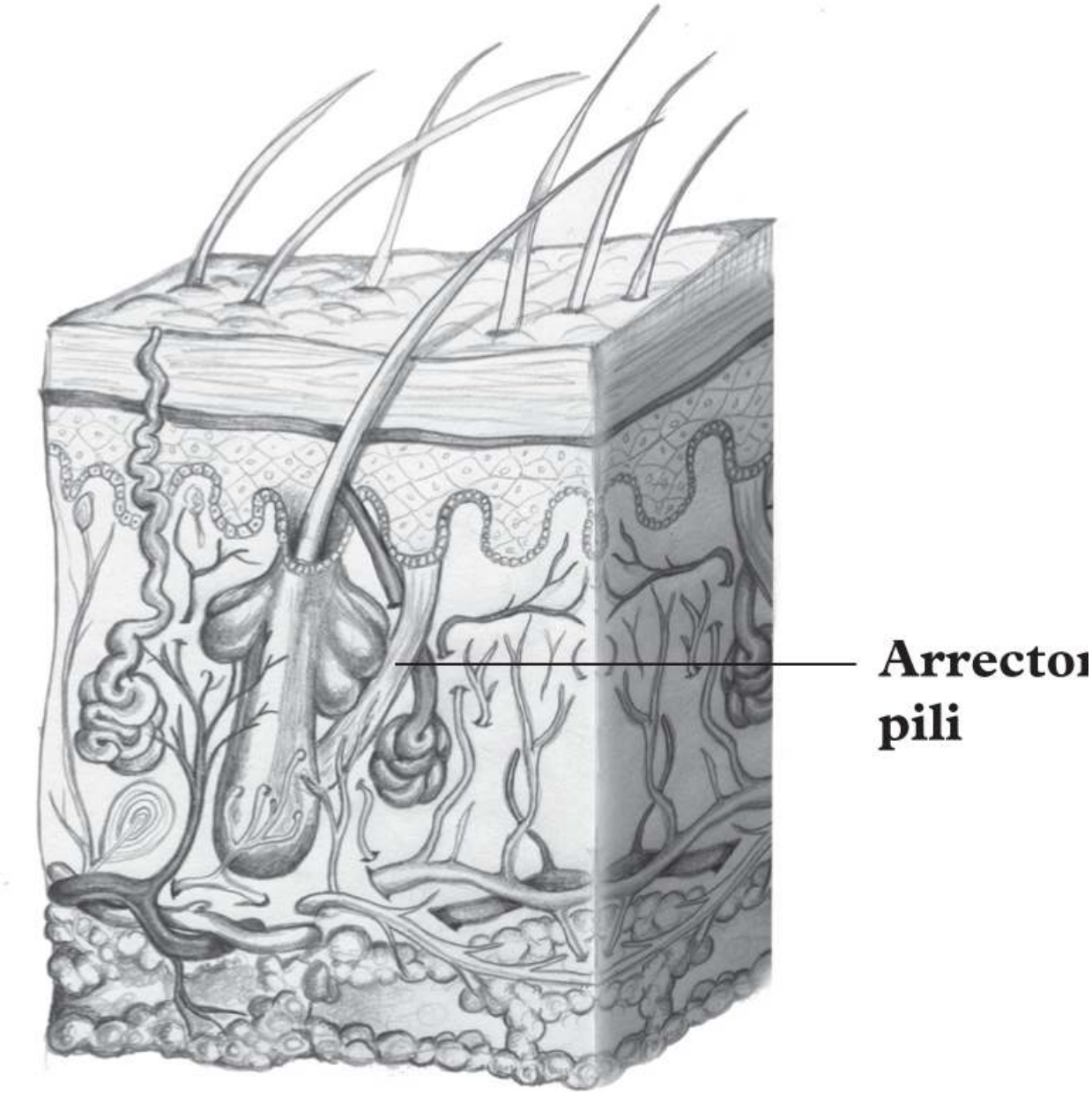
*How your skin reveals the beast within*

Goose bumps. What's the point of them? All the plethora of pimples and erect hairs seem to do is tell us what we already know. We're scared out of our wits. Freezing cold. Moved by music, or by a deeply emotional memory. Oddly different experiences bring goose bumps on. But how? And why?

The *how* is straightforward. Arrector pili are miniature muscles in your skin that attach to the hair follicles. When they contract, they pull the hairs up and away from the skin, which bunches up, making the gooseflesh.

The *why* is more mysterious, and a sign that, deep inside us, there's a trace of wild animal.

"Pili" is "hairs" in Latin. "Arrector" means how it sounds: "Something that erects things." Medics call goose bumps "piloerection." An old-school name is "cutis anserina," Latin for "goose skin." If you're feeling full-on Gothic, call it "horripilation"—"bristling hair," in Latin. All this is why we "bristle with rage"; exhilarating experiences are "hair-raising"; and bloodcurdling movies are "horrifying."




That's the how of horripilation. The why begins with the "thorn hog," the Latin for which combines to make "porcupine." Usually, the rodent's quills lie flat against its body. When it's threatened, they stand on end, making it much more intimidating. The quills are actually large, stiff hairs. It's a great example of the way animals raise their hackles when scared or angry.

Animals also use piloerection to keep warm. In cold weather, their fur sticks up, trapping an insulating layer of air near their skin, like the air inside a down puffer jacket.

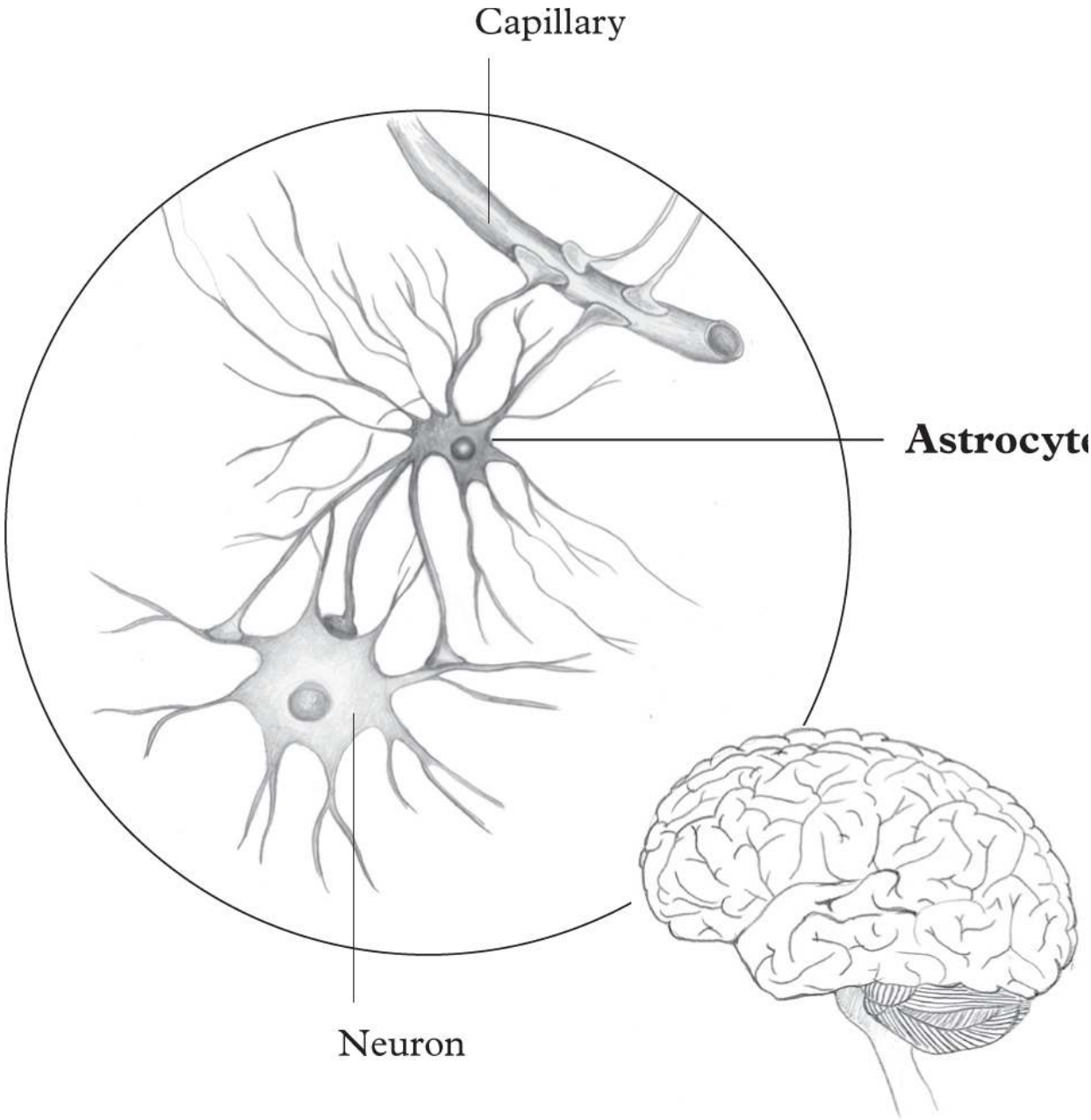
Unlike porcupine quills, human horripilation seems relatively point*less*. It's triggered by terror and cold, but we don't have quills to protect us, or a thick coat of fur to trap air. Goose bumps seem to be an inconsequential oddity we inherited from our animal ancestors, a relic from our bestial past, that we simply can't control.

Or maybe not. Turns out some people can consciously give themselves goose bumps. This is downright weird, because the arrector pili are innervated by the autonomic nervous system, which operates outside of conscious control. People with this superpower don't have to imagine terror to conjure up piloerection, they just make it happen. However, the phenomenon is rare. One survey involving almost seven hundred students found none with it. You could say it was a wild-goose chase.

## Astrocyte

*How brain glue busts a dim-witted myth*

"Do you realize that you use just one tenth of your brain's capacity? You can be so much more. Achieve so much more. Harness that spare nine-tenths of brainpower sitting idly inside your head, and you'll unlock limitless potential."




It's an alluring sales pitch for motivational speakers, life coaches, and self-improvement gurus. But does it ring true? Do you access only 10 percent of your brain? Are you a half-wit? Or worse, a one-tenth-wit? The answer is yes; but only if you've fallen for this empty- headed dim-wittery.

You use virtually all of your brain, most of the time, no matter how high, or low, an achiever you are. The 10 percent figure is a myth, perpetrated by your astrocyte brain cells, and hustlers with a vested interest in our feelings

of inadequacy. These masters of the hard sell, and the brain cells, have brainwashed us into thinking we're one-tenth the thinkers we could be.

Astrocytes are starry by name and nature, thanks to their arms, which radiate from their bodies and provide structural support for neurons. Neurons are the real stars of your cerebral firmament because they mastermind the way you think. Astrocytes, and other types of glial cells, support this precious processing power.

In the nineteenth century, the German doctor Rudolf Virchow believed that was pretty much all astrocytes and co did: lie dormant being plain Jane to a neuron's genius Joan. He dubbed them "glia," Greek for "glue." And the notion that glia are just humble brain glue stuck.

It's commonly believed that glia outnumber neurons by about ten to one. This isn't true, but it helped embed the idea that 90 percent of our brain is dormant and dumb. Hence the fallacy that we all have genius in us, if only we can unleash the nine-tenths of untapped brainpower.

On top of that, we now know that astrocytes are much more than just a supporting cast for prima donna neurons. It seems they work in tandem with neurons and can influence brain activity. Virchow's glue, in fact, has a highish IQ.

The good doctor Virchow was, indeed, a very good doctor. He influenced many areas of medicine. But, as with astrocytes, he wasn't always 100 percent spot-on. For example, the German was an anti-germ man, believing that germs weren't responsible for diseases.

Obviously even a genius is prone to the odd brain fade. Say, 10 percent of the time.

## Auditory ossicles

*How you're related to cold-blooded creeps*

If you believe the Sun orbits the Earth, our planet is pancake flat, and a divine creator made all life on it, your auditory ossicles may be a pain in the neck.

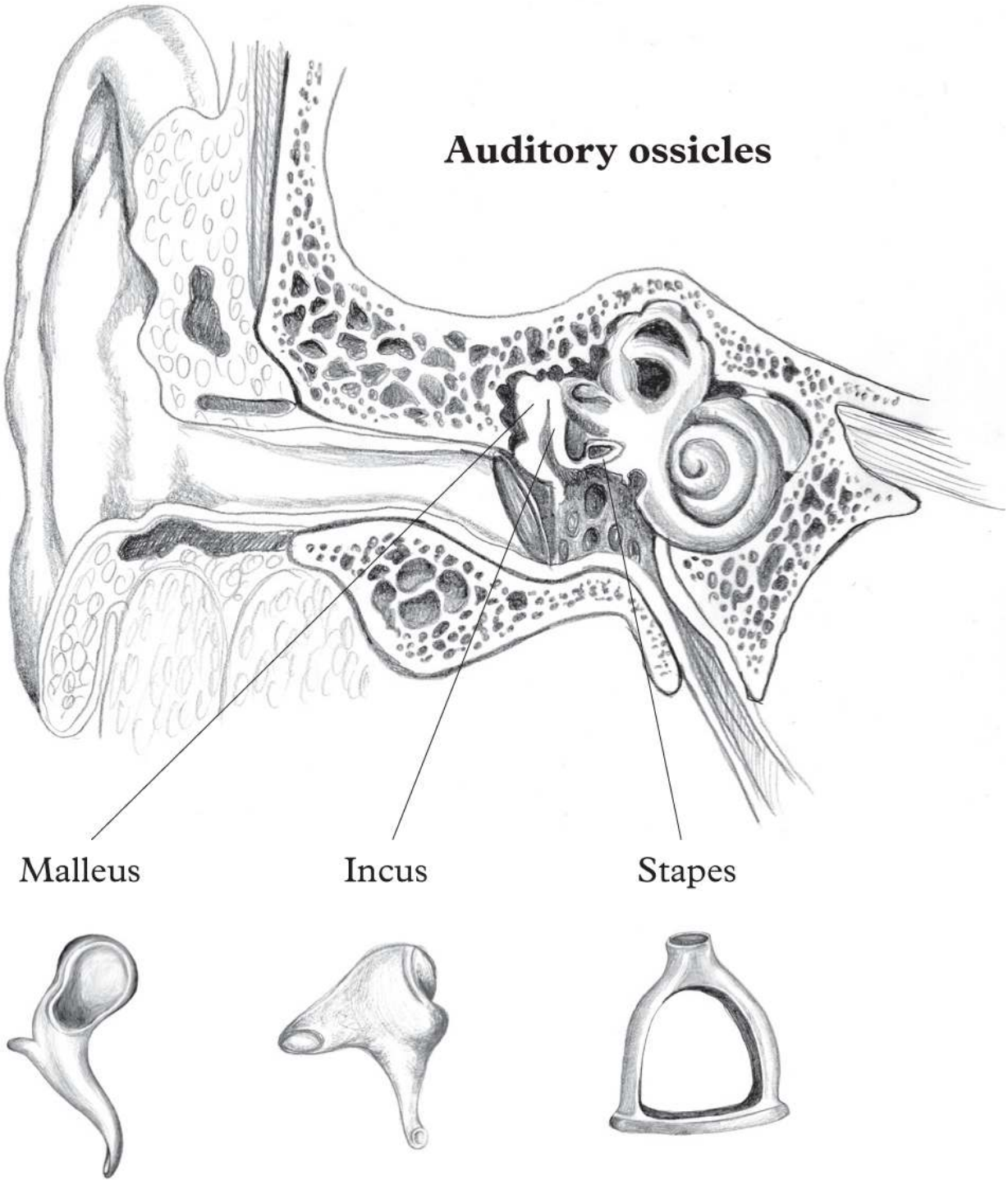
These tiny bones in your ear are important evidence of evolution, helping put the kibosh on pseudoscientific creationism. Worse still, the bones—malleus, incus, and stapes—are proof of an evolutionary link between you and reptiles, of all things. The ears of these creeping, cold-blooded creatures ("reptile" is from the Latin for "creeping") feature just one auditory ossicle.

Your ears have an extra two, which evolved from bones found in reptiles' jaws today. Who wants to be a reptilian heir?

"Ossicle" means "small bone," and your auditory ossicles are your body's smallest. They form a chain inside your middle ear, a cavity in your skull behind your eardrum that's not much more than a centimeter (0.4 inches) long. So, these bones have to be miniature. The smallest of the trio—the stapes—is just three millimeters long, half the length of a grain of rice. These ossicles also have strange shapes, and hence names. Malleus means "hammer" in Latin. Incus, "anvil." And stapes, "stirrup."

So why did whoever, or whatever, created the universe end up giving us three odd ossicles in our ear rather than just the one?

Sounds make your eardrum, aka tympanic membrane, vibrate. The vibrations are transmitted through the ossicles inside your air-filled middle ear, to your fluid-filled inner ear, which converts them into electrical signals that travel up nerves to your brain. When sound goes from an air medium to a liquid medium, much of its energy is lost. Dive into a pool, and you'll struggle to hear someone shouting at you from above the water. Your auditory ossicles are one way of compensating for the energy loss, as they amplify the sound.




Three auditory ossicles are better than one for this. Though not by much. Perhaps not enough to justify having the trio. In fact, some experts have suggested that three-ossicle ears aren't necessarily superior to those in our reptilian friends. Others believe our complex chain of middle ear bones, with

its flexible joints and attached muscles, may be particularly useful for perceiving and decoding the sounds that make up words. Which certainly isn't high on the list of essential reptilian life skills.

But these wonders of your auditory anatomy do more than separate the reptiles from the logophiles (lovers of words). They are signature features of mammals. Nothing says "mammal" like one or more pairs of mammary glands, a covering of hairy skin, and a full set of three auditory ossicles.

Your malleus, incus, and stapes may be small, but they're big players in the evolutionary, and auditory, scheme of things.

## Axilla

*How tippers in clubs pay through the nose*

"B" and "O" are the first two letters of "body," and sometimes your first experience of *somebody*. A noseful of their noxious BO, aka body odor. But don't blame the body for the overpowering underarm reek. BO should stand for "bacterial odor." Fresh armpit secretions scarcely smell. Bacteria make the pungent funk as they graze on chemicals in the secretions.

A warm, moist armpit—axilla—is unreal real estate for its bacterial residents. More than half a million inhabit every square centimeter of its skin. Here they dine on apocrine secretions, oily fluid made by glands in the skin. And it's the bacteria's offensive waste products that assault our hapless nostrils.

**Axilla**

While we may not like the thought, or experience, of this, we should own it. It's believed we all have our own unique, signature scent. "I stink therefore I am," unphilosophically speaking. There are also "flavor" differences between the sexes, research shows. Women's Eau de Underarm features a heady blend of tropical fruit- and onion-like notes. Male Parfum de 'Pit has a more rancid, cheesy bouquet.

This may sound like a turnoff, but in the mating game the axilla may be the opposite of a passion killer. Changes in a women's odor may signal to men that it's a good time for sex—in other words, when she's most fertile, just before ovulation. In some animals, this sexual signal is blindingly obvious. If you've ever seen a baboon with red swellings around its genitals and bum, she was after more than just a banana.

Studies in humans show women near the most fertile time in their cycle are particularly appealing to men in all sorts of ways, such as having more

attractive body odor, facial appearance, and body shape. This difference across the menstrual cycle has also been measured in cold, hard cash.

A US study found female performers in gentlemen's clubs made about $335 USD in tips per five-hour shift while ovulating, versus $260 post-ovulation, and $185 while menstruating. Performers hard at twerk while on the contraceptive pill also made less during their period. Importantly, they very likely weren't ovulating, and didn't have an earnings spike at the time in their cycle when ovulation occurs.

Chemical signals in armpit sweat may explain all this. Trapped in our axilla, like perfume in a bottle, they waft out when we lift our arm. It could be why flirts flash their axilla. Perhaps BO should also stand for "Baby Opportunity."

## Bartholin's gland (greater vestibular gland)

*How dead men dominate living women*

Men own women's bodies, anatomically speaking. Long-dead men who stuck their instruments into women's genitals and made their mark. Gone but not forgotten, their names indelibly imprinted onto women's reproductive parts today.

Gabriele Falloppio (1523–62) is memorialized in the fallopian tubes that connect uterus and ovaries. Skene's glands—Alexander Skene (1838–1900)—secrete female ejaculate into the urethra. The "G" in G-spot doesn't stand for giddy, grinding, or gratification. The contentious erogenous zone is Ernst Gräfenberg's (1881–1957). The pouch of Douglas—James Douglas (1675–1742)—is between the rectum and uterus. And Bartholin's glands, two small structures close to the vagina's opening, make fluid for sexual lubrication.

Danish anatomist Caspar Bartholin was the first to write about Bartholin's glands. But which Danish anatomist named Caspar Bartholin? Caspar Bartholin the Younger (1655–1738)? Or his granddad—you guessed it—Caspar Bartholin the Elder (1585–1629)?

Gramps Bartholin often mistakenly gets the credit for the little vaginal lube-makers. This Caspar confusion illustrates one reason why there've been calls for an end to body parts named after people (eponyms). Critics say they should be replaced with more anatomically, and politically, correct names. Bartholin should be frog-marched out of the vagina pronto, and his pea-sized

namesakes always called by their technical name: “greater vestibular glands.”

While eponyms are commonplace in the body and deeply ingrained into medical language, critics have many reasons to bin them. Eponyms are unfair, they argue. Having your name up in lights, deep in the darkness of our anatomy, can be as much about influence, politics, and luck as what you actually did with a scalpel. Eponyms can also be confusing and inconsistent. Some parts have more than one eponym for them. Others have different eponyms, depending on the country you’re in. And they’re misogynistic. They’ve been labeled “ ‘pale, male and stale’ in the socially conscious 21st century.”

A review of 700 body parts, named after 432 different people, showed the male dominance of our anatomy. It found 424 of the individuals were men. The rest comprised five gods, a king, a hero, and just one woman. Not too surprising, given that the average date the parts were named was 1847, when women didn’t get much of a look-in, into our innards.

It was a man’s world then. Still is, inside a woman. But that’s not just due to eponyms. Only a man could have named the vagina after the Latin for “scabbard,” a sheath for guys to stick their dagger into.

## Bloodless fold of Treves (ileocecal fold)

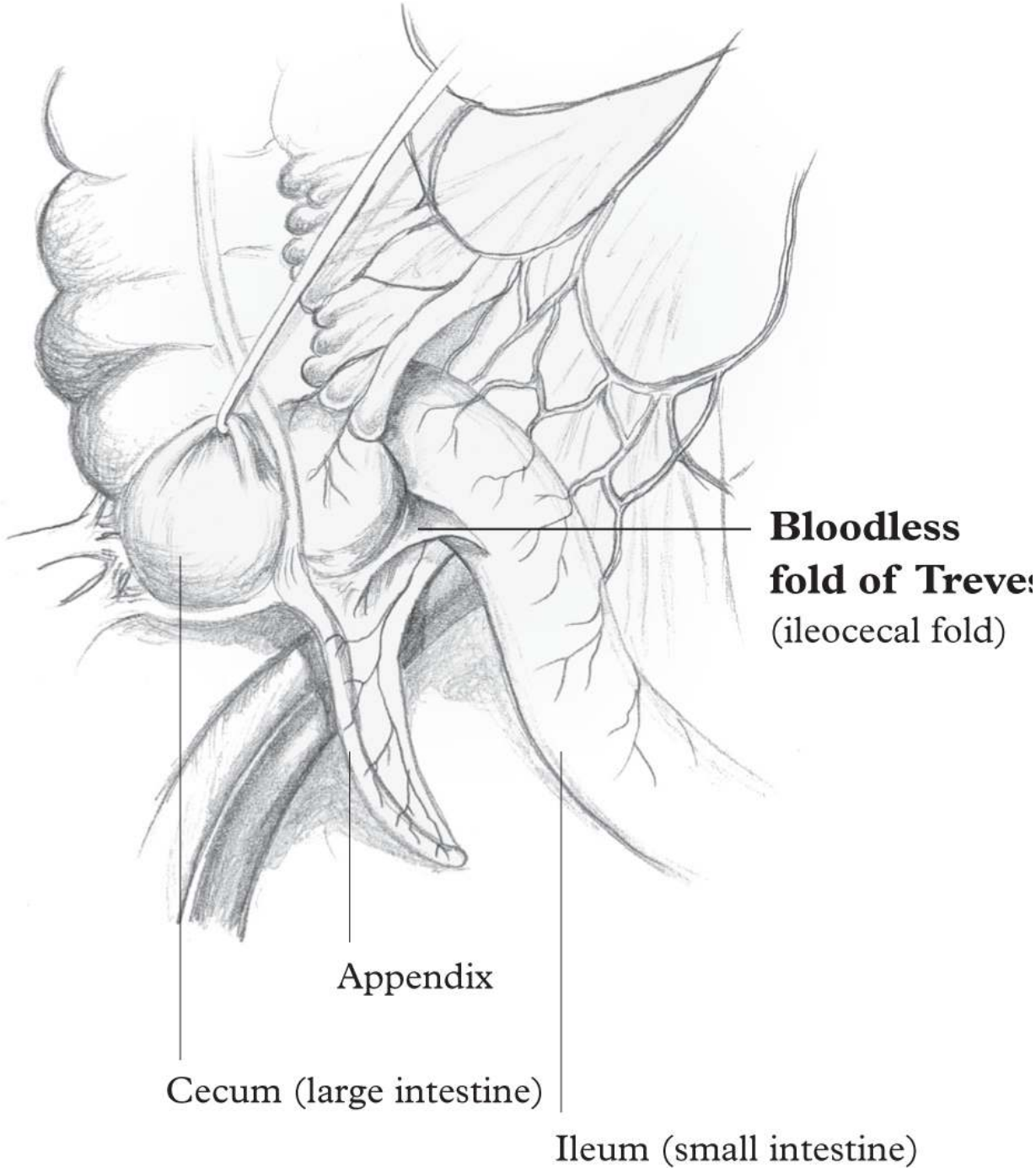
*How alluring brands are never bland*

Cubic crystalline allotropes of carbon will never be a woman’s BFF (best friend forever). Yet they’re clearly “forever.” Transparently, “a girl’s best friend.” But no one’s falling head over heels in love with the clarity, cut, color, and carat of a carbon allotrope. Unless you call it a “diamond.”

The gem gets its name from the ancient Greek word “adamas” (“invincible,” “indestructible,” “inflexible”) as do stubborn, “adamant” types. “Diamond” brilliantly encapsulates the jewel’s essence. And the (fingers tightly crossed) eternal love it symbolizes. It’s marketing genius. A catchy name with a great backstory is the name of the game.

So, this story is about the bloodless fold of Treves, rather than “ileocecal fold.” They’re one and the same. But if you call this part of the membrane (peritoneum) that lines your abdominal cavity, near your appendix, by its more technically correct name, you miss out on a story featuring a postponed

coronation, a desperately sad family tragedy, and an Oscar-nominated movie.




It begins with Frederick Treves, a world expert on appendicitis, for whom the ileocecal fold was named. And who, like Hannibal Lecter, Richard Nixon, and Pope Benedict XVI, has been played on film by Anthony

Hopkins. Treves's road to movie stardom began on a chilly November day in 1884, when he walked into a "freak show," near the London Hospital in the UK.

"The showman—speaking as if to a dog—called out harshly: 'Stand up!' The thing arose slowly and let the blanket that covered its head and back fall to the ground," the English surgeon later wrote.

"There stood revealed the most disgusting specimen of humanity that I have ever seen."

The "thing" was Joseph Merrick, subject of the 1980 film *The Elephant Man* starring Anthony Hopkins. Treves gave Merrick a home at the hospital, where he revealed himself to be a sensitive, intelligent romantic. Merrick became a celebrity, attracting high-society visitors, notably Alexandra, the Princess of Wales and future queen.

Alexandra's husband, King Edward VII, was Treves's most famous patient. Just before his coronation in 1902, he developed an abscess on his appendix. Edward was adamant that the ceremony go ahead, until Treves pointed out that if it did, they'd be crowning a corpse. Treves drained the abscess, and the coronation was postponed.

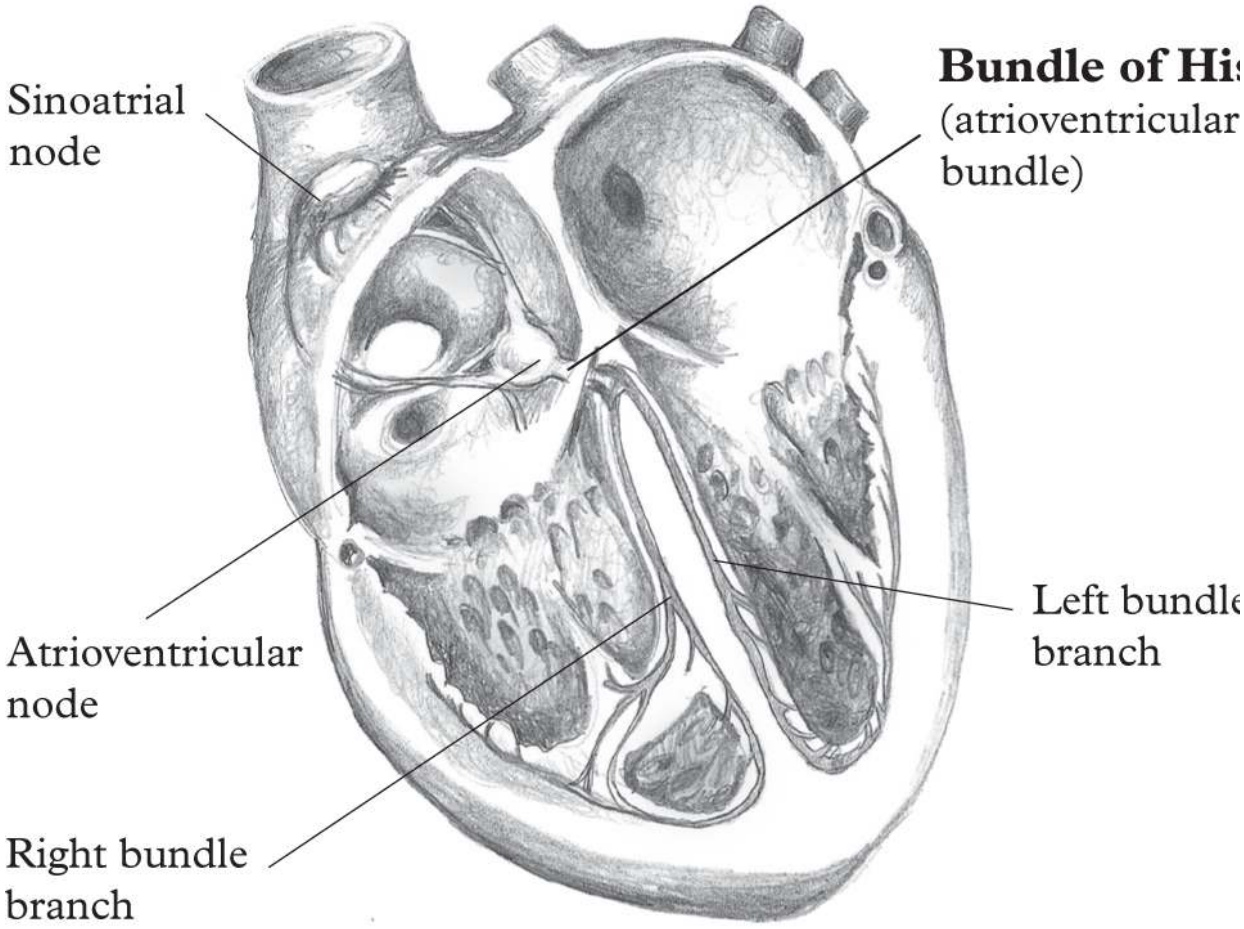
Though Treves couldn't save his eighteen-year-old daughter Hetty. When she became ill, he tragically delayed operating. Hetty died of peritonitis and septic shock, medical terms for possible consequences of acute appendicitis.

## Bundle of His (atrioventricular bundle)

*How the His story helped shape history*

Every beat of your heart is a memorial to a prominent pre–World War II Berlin doctor who helped legitimize Nazi atrocities.

Writ large in your heart is the name "Wilhelm His." As rector of the University of Berlin in the 1920s, His enthusiastically supported eugenics. But that's not what Germans called this pseudoscience aimed at improving and purifying the gene pool by promoting the "superior" at the expense of those deemed "inferior." Their name, which predated Hitler's rise to power, was a chilling warning of horrors to come. *Rassenhygiene*. Racial hygiene.




The Nazis used *Rassenhygiene* to justify forced sterilization, euthanasia, and ultimately genocide. Nazism was "applied biology," according to Hitler's deputy Rudolf Hess.

Eugenics supporter Wilhelm His is immortalized in your heart's electrical conduction system. The heart's trademark "lub-dub" beat—made by its valves closing—starts with its upper chambers (right and left atria) pumping blood into the ventricles. The right and left ventricles then send blood to the lungs and the rest of the body, respectively.

Ensuring these complex muscle contractions are synchronized requires specialized electrical wiring. This begins with your heart's pacemaker (sinoatrial node) sending a signal making the atria contract. The signal then goes to the atrioventricular node, through the bundle of His, into right and left branches, to the ventricles.

Swiss-born His discovered his bundle in 1893. Today his name is widely associated with it. However, his views on eugenics have led to calls for

“bundle of His” to be scrubbed from the medical lexicon. “Atrioventricular bundle” is the alternative.

His has been variously described as “not known to be” a Nazi sympathizer and a “warm Nazi sympathizer.” He’s not believed to have been actively anti-Semitic, though a chronicle of his experiences during World War I refers to Jews as “natural spies,” adept smugglers, and blackmailers. However, his advocacy of eugenics is clear. His official rector’s address in 1928—titled *On the Natural Inequality of Man*—emphasized that the evils of contemporary culture could be erased by eugenic measures. He took particular issue with the mentally ill.

His died in November 1934, almost two years after Hitler took power in January 1933. On July 14, 1933, the Nazis passed the Law for the Prevention of Offspring with Hereditary Diseases. This allowed forced sterilization of people with conditions such as “congenital feeblemindedness,” schizophrenia, bipolar disorder, congenital blindness, and chronic alcoholism. It led to about 400,000 people’s genes being “cleansed” from the pool.

## Calcaneus

*How heels determine the destinies of philanderers, princes, and presidents*

A friend is laid up in hospital with a “lover’s fracture.” What painful trauma did he suffer? A) A pelvic gyration–induced stress fracture of the hip? B) A cracked skull due to falling out of bed? Or C) A broken heart? The answer is: D) None of the above.

He’s broken his calcaneus, aka heel bone. This nasty injury is also called a “Don Juan” fracture, after the legendary lothario who leaps off lovers’ balconies to escape vengeful husbands. When the philanderer lands on the courtyard below, his calcaneus is squished, like an orange that’s been stood on.

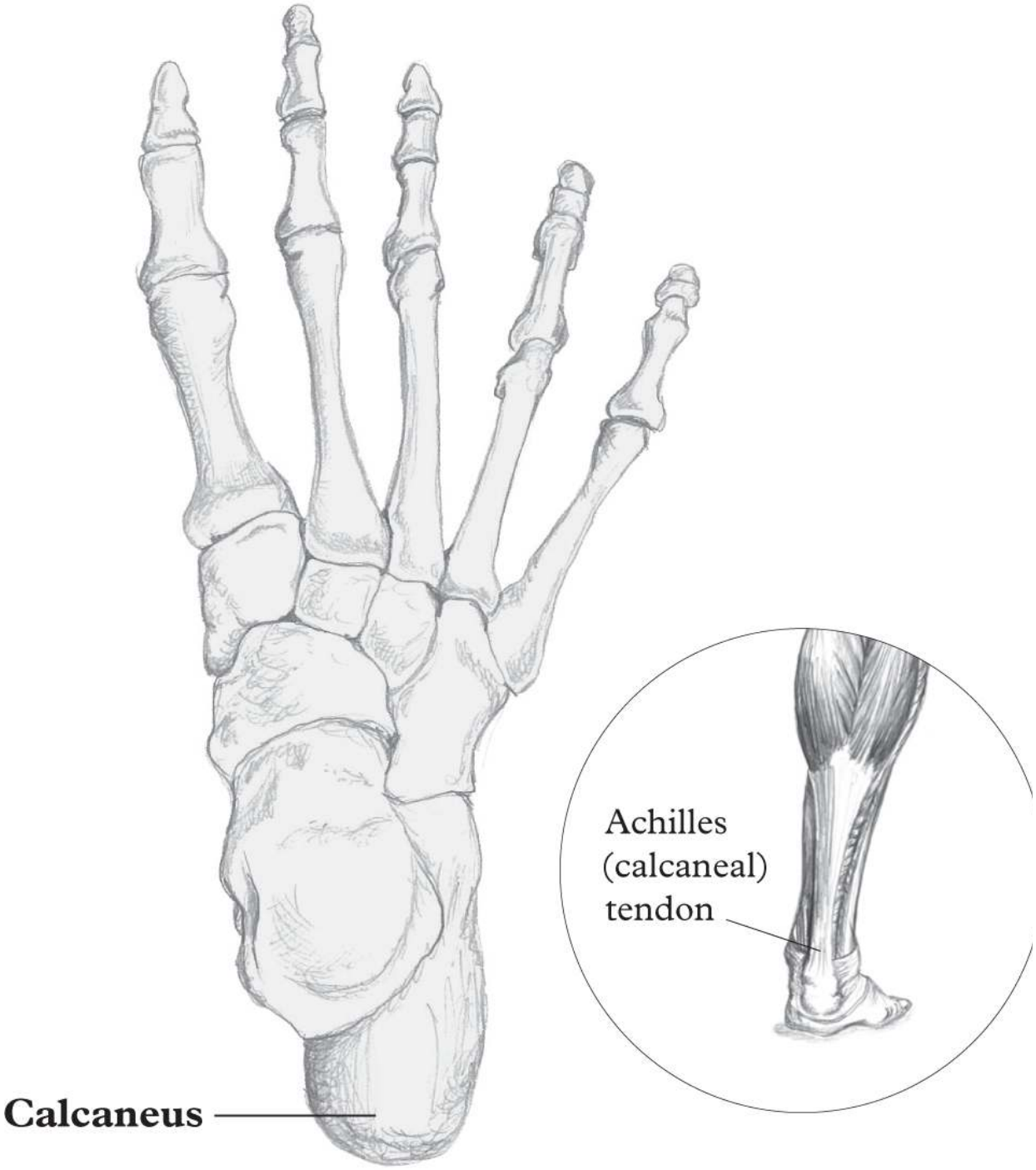
Love can break your heart. Lust can break your heel.

The lesson for Don Juan is: “Take the stairs, and the punishment meted out by the cuckolded husband you’ll bump into on the landing. It may require a lot less pain meds than a lover’s fracture.” As for your friend, he likely smashed his calcaneus in a car accident, or falling off a ladder.

The pistol grip–shaped calcaneus is the largest bone in your foot. It has to be big, to support us when we walk. Adult Americans average about 5,000

steps a day. That's more than 100,000 kilometers (62,000 miles) over an average lifetime, two and a half times around the Earth's circumference.

Walking just one step would be tricky without the calcaneal tendon attached to the back of the bone. Your body's strongest and thickest tendon, it's better known as the Achilles tendon, after the legendarily unfortunate Greek warrior. Achilles was said to be invulnerable because as a baby his mum dipped him in the underworld's River Styx, supposedly protecting him from harm. But the prince was vulnerable in the one spot the water didn't touch: where his mum had held him by the heel. The hapless hero was killed by an arrow from the Trojan prince Paris that struck him in, of all places, his heel.




Moving from princely to presidential heels, Donald Trump may not have been around to become POTUS if it wasn't for his calcaneus. As a young man, he received a Vietnam War draft deferment due to a diagnosis of bone spurs in his heel. Plantar calcaneal spurs—bony growths on the underside of the calcaneus—are common, affecting 11–21 percent of young to middle-

aged people. They can be debilitating, causing heel pain, though about 20 percent of calcaneal spurs don't cause symptoms.

A 2015 letter supposedly from Trump's personal physician said he would be the healthiest person ever elected president. Health-wise, heel spurs are, it seems, Trump's Achilles' heel.

## Canal of Schlemm (scleral venous sinus)

*How body snatching was a grave anatomical problem*

Grave robbing demands a stiff sentence. Digging up a fresh corpse and stealing it for anatomical dissection is a heinous crime. So, the fortnight Friedrich Schlemm spent in the slammer in 1816 seems a touch lenient. What's more, the German doctor's sentence had been halved, after he'd pled for clemency.

Schlemm, who'd go on to discover the canal named after him that drains nutrient-supplying fluid from the front of the eye, had argued that the body he stole was a particularly interesting specimen to study. Importantly, his professors had also spoken up for the young man. This may be because body snatching and anatomy teaching often went (decomposing) hand in (dissecting) hand.

Systematic human dissection is believed to have begun in the third century BCE, but it ceased after the deaths of the few Greek medics who performed it. During the next 1,500 years in Europe, opposition, especially from the church, ensured cadavers for dissection remained strictly off the table—until it was acknowledged that studying human anatomy actually required seeing it thoroughly, in the flesh. In 1315, an executed criminal starred in the first officially sanctioned systemic human dissection performed in full public display since ancient times. It took place in Bologna, Italy, site of the first body snatching scandal four years later.

By the eighteenth century, the boom in anatomy training led countries to pass laws broadening the types of corpses available to medical schools, beyond executed criminals. These included unclaimed bodies of paupers and prison inmates.

England lagged behind legally, hence gangs of body snatchers —"resurrectionists"—did a lively trade. It was a sellers' market. In 1816, one gang even went on strike, refusing to supply a hospital until it coughed

up more cash. When the hospital bought from freelance body snatchers, the resurrectionists raided the place, mutilating the strikebreaking corpses.

Not that stealing the dead was a cakewalk. Mourners booby-trapped graves. Body snatchers were attacked, some were killed. And on top of that was the inexorable time pressure: resurrectionists had to supply cadavers before they were too decomposed.

Schlemm wasn't particularly concerned about whether his pilfered corpse was a puddle of putrefaction. It had been dead for over two weeks; a lifetime in resurrectionist terms. But Schlemm said he just wanted to study its bones. A dollop of decaying tissue was neither here nor there.

Lenient as Schlemm's punishment seems, perhaps he was rehabilitated afterward. He discovered his canal, also called the scleral venous sinus, in the corpse of a man who'd hanged himself, a body legally available for dissection.

## Carina

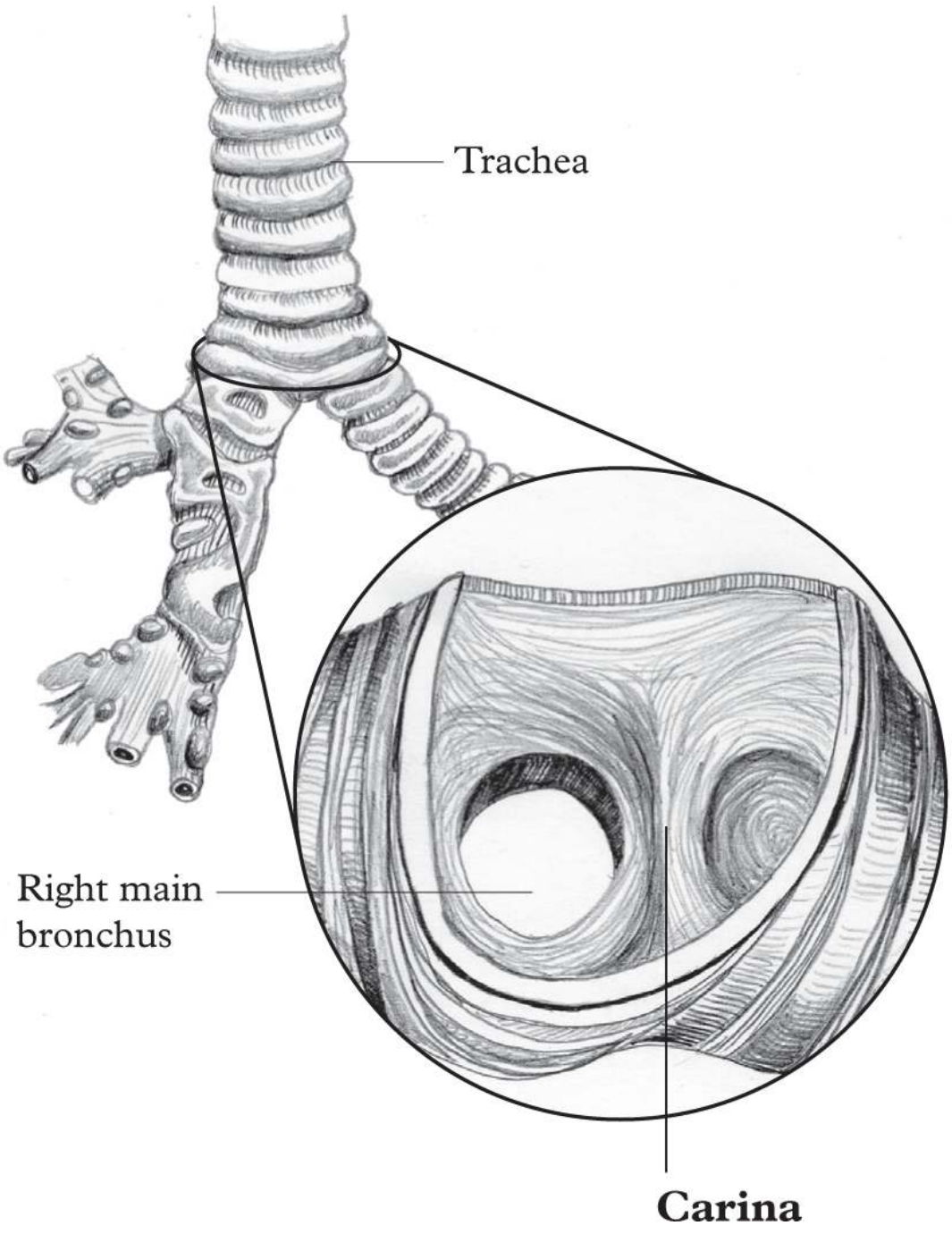
*How your windpipe stops you from keeling over*

What can race through you at the velocity of a passenger jet, with a violence that can rupture organs, and can save your life? The next time food goes down "the wrong pipe," you may get an inkling. An uncontrollable, explosive inkling. Especially if the food in your airway gets all the way to your carina.

The food has to be ejected quick smart. What follows is a defensive cough reflex triggered by sensors lining the windpipe (trachea) that are particularly concentrated at its lower end, in the carina. A life-saving cough is not to be sneezed at.

A cough involves three phases. Breathing in. Increasing pressure in the chest by closing the voice box (larynx), while contracting chest and abdominal muscles. Then suddenly opening the larynx to expel the air at high speed. Velocities inside the airways approach the speed of sound—up to 800 kilometers per hour (500 miles per hour)—according to many reputable medical sources.

Though all this pressure and velocity has its downsides. Complications of coughing include loss of consciousness; bleeding veins in the eye, nose, and anus; ruptured spleen; and rib fractures. Nevertheless, the crux of a cough is to generate high-speed airflow to clear the airways.




The carina's shape, and that of the airways around it, are also designed to protect. It's a ridge of cartilage that separates the two tubes (main bronchi) that branch off your trachea to the right and left lungs. It looks like the underside of a boat: carina is Latin for "keel." "Careening" a boat is putting it on its side to clean or repair it. Because the right main bronchus is wider and runs more vertically from the trachea than the left, the carina

preferentially directs things right. It's a deceptively simple protective trick: better just one side blocked than both.

The carina is at the level of a landmark that can be felt on the outside of the body: the angle of Louis, aka sternal angle. This horizontal ridge on your breastbone (sternum) is likely named after French doctor Antoine Louis. In the 1790s, he helped refine the design of the guillotine. Hence the infamous killing machine was originally called a "louisette." Though Louis soon lost the naming rights, which went to his collaborator and fellow medic Joseph-Ignace Guillotin.

Last used in France as late as 1977, the guillotine did for thousands during the French Revolution. They had a blade stuck in their windpipe and were destined for a coffin.

## Carotid artery

*How bad blood was spilled in Transylvania*

Benjamin Dudley was the first doctor in the US to treat pulsatile exophthalmos by ligating the carotid artery. But tying a ligature around a major artery in the neck is humdrum compared with Dudley's bloodthirsty exploits in Transylvania. And while pulsatile exophthalmos is odd, a pulsating eyeball protruding from its socket isn't as out-there as the dramatic duel the professor of anatomy and surgery fought against a colleague. A shoot-out triggered by a quarrel concerning the brain of a dead Irishman, whose body was later stolen by one of those involved.

Dudley's Transylvania wasn't Count Dracula's Eastern European stomping ground. This was Transylvania University in Lexington, Kentucky. At the beginning of the nineteenth century its medical school was one of only five in the United States. But not all was well in its hallowed halls. Bad blood between three of its professors dominated. Dudley, Daniel Drake, and William Richardson were at each other's throats.

Things came to a head in 1818, when Dudley and Drake disagreed over the former's autopsy examination of the brain of an Irishman who'd died after a head injury. A dishonored Dudley challenged Drake to a duel. Drake, not believing in dueling, declined. So Richardson, his ally, stepped in to defend his honor.

This wasn't as peculiar and foolhardy as it sounds. While dueling was illegal in Kentucky, upper-class gents (though rarely doctors) often settled

disputes this way. The most minor discourtesy could precipitate pistols at dawn. Pistols that were reliably inaccurate, ensuring the combat often conveniently ended with honor upheld and anatomy intact. But Dudley wanted blood. He had the audacity to actually prepare for the combat, practicing with a crack shot medical student.

On the fateful day, the two professors solemnly bowed to each other, before firing at ten paces. Richardson went down, blood spurting from an artery in his groin. His retinue, unable to stem the bleeding, resigned themselves to his imminent demise. Step forward Dudley, who had Richardson under his thumb—literally and metaphorically—as he pressed his digit on the artery to stem the bleeding enough for his life to be saved.

Dudley and Richardson became lifelong friends. As for the Irishman whose autopsy led to the duel, Dudley's marksman medical student stole the body from its grave for use in the professor's dissection room.

Today Transylvania University is going strong. Though it's unlikely many carotid artery ligations take place on campus. Its medical school shut in 1859 following infighting and a lack of cadavers for anatomy teaching.

## Carpals

*How couples should avoid acrobatic amorous antics*

"Sally Left The Party To Take Cathy Home. She Likes To Play, Try To Catch Her. She Loves To Please The Tall Campus Hero. Some Lovers Try Positions That They Cannot Handle."

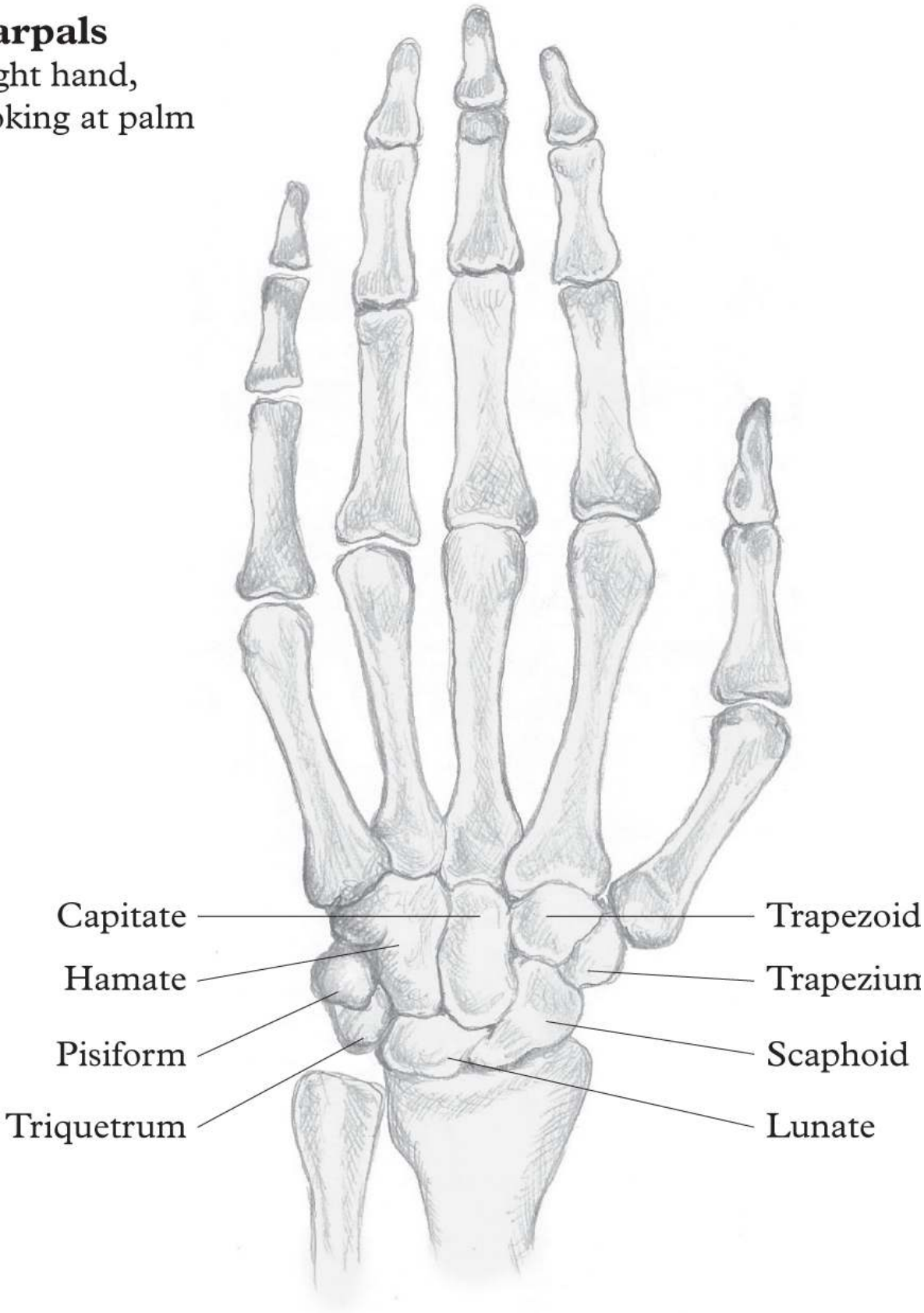
This isn't a quartet of undercover agents introducing themselves in covert spy code. Or an eccentric cryptic puzzle. Or snippets of chat on a hookup app.

They're mnemonics. Four acrostics medics use to memorize the name and order of the eight carpal bones in our wrist. Each acrostic has the same pattern of first letters in their eight words: S, L, T, P, T, T, C, H. They're handy mental stepping stones toward recalling the bones: scaphoid, lunate, triquetrum, pisiform, trapezium, trapezoid, capitate, and hamate.

Medics make mnemonics (some *far* cruder than the ones above) because there's *so much* to remember. And always *more*. According to a 2011 paper, medical knowledge is expanding faster than our ability to absorb and use it effectively. It estimated that, in 1950, medical knowledge was growing at a rate that meant it would double every fifty years. In 1980, the doubling time

was seven years. In 2010, 3.5 years. By 2020, the doubling time would be just seventy-three days. Take a long holiday, and you're an out-of-date has-been.

**Carpals**
Right hand,
looking at palm



Which makes Sally and her carnal capers a helpful drop of carpal knowledge in a vast, untamed, ever-rising ocean of information. Especially as our hands are super complicated. Aside from the more than thirty muscles involved in hand movement, the carpals are just eight of twenty-seven bones in each one.

Your carpals form a 3D puzzle, comprising two rows of four bones each. They connect with your forearm bones and the metacarpal bones in the palm. In order, from right to left, if you're looking at your right palm, with the row closest to your forearm first, they are:

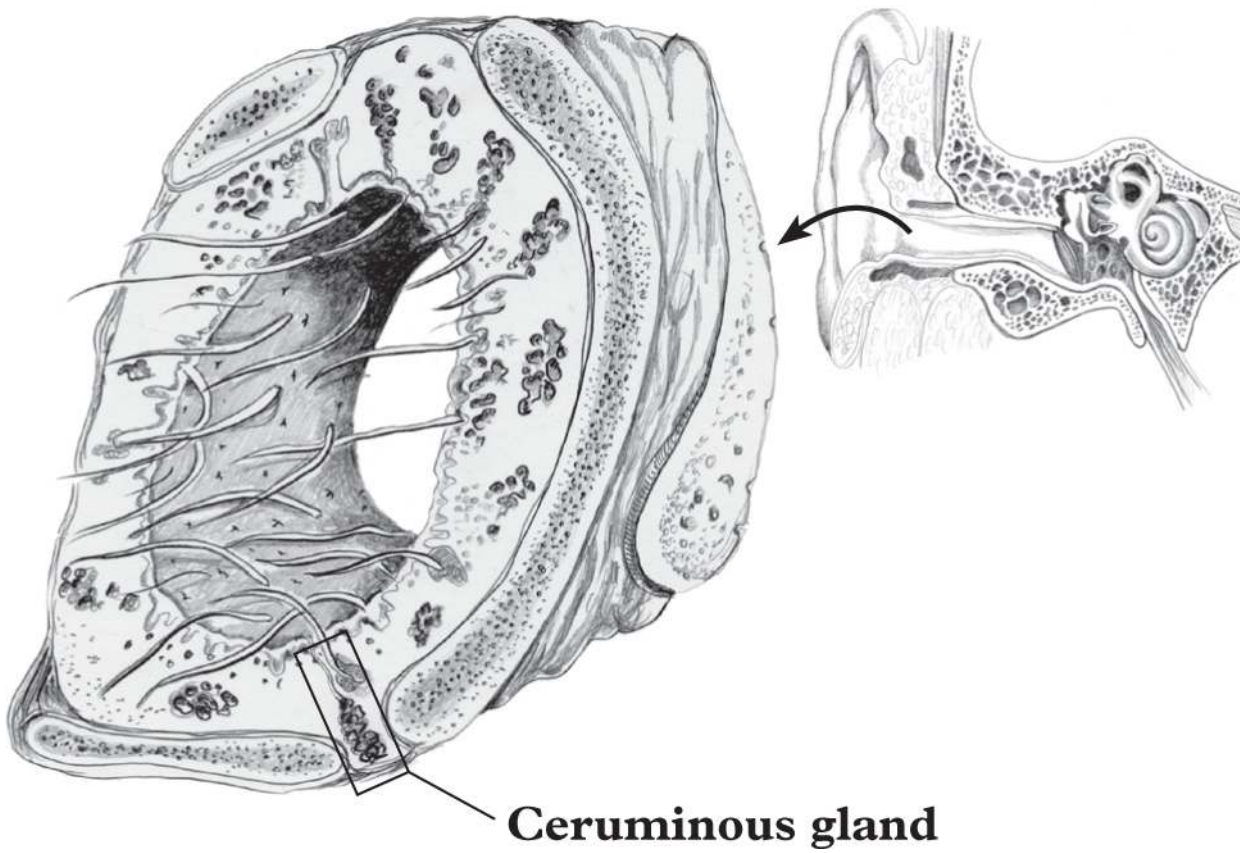
The scaphoid, from the Greek for "skiff," because it looks like a boat. The crescent moon–shaped lunate, as in "lunar." The pyramid-shaped triquetrum, from the Latin for "three-cornered." And the pisiform, a small pea-like bone, "pisum" being Latin for the green veggie. Then there are the trapezium-shaped trapezium and trapezoid. The capitate, so named because it has a head, in the same way that a "decapitated" body doesn't. And lastly, the hooked hamate, named after the Latin for "small hook."

Of the carpals, Sally is most likely to fracture her scaphoid, leading to tenderness in her anatomical snuffbox, the classic hallmark of these injuries. That's especially if she falls onto her outstretched hand while trying an adventurous acrobatic position, with the tall campus hero, that she clearly can't handle.

## Ceruminous gland

*How wax on, wax off will have your ears burning*

It's easier to be uncomplimentary about certain complementary therapies than others. Steaming crocks of sanctimonious woo-woo that demand you make like a duck and "quack." But on the quackpot scale, many of these can't hold a candle to a popular "therapy" to remove earwax, aka cerumen. Ear candling. A dangerous scam, according to the US Food and Drug Administration.




Practitioners stick a hollow tube that's been soaked in beeswax into the ear and light the other end. This supposedly creates negative pressure, drawing wax out of the ear. But the only negative pressure it creates is the desire to believe the therapist's flimflam. This ramps up when the candle is opened after it's extinguished and, bogus-pocus, inside is the removed earwax. This residue *is* wax. Candle wax.

If wax is going anywhere, it's from the candle into the ear. This can perforate the eardrum and cause temporary hearing loss. Try it, and you may be burned twice: certainly conned, maybe injured. A survey of 122 US otolaryngologists uncovered thirteen cases of burns.

Earwax can build up, blocking the ear canal and putting pressure on the eardrum, causing symptoms like hearing loss, itching, and pain. But normally your ear removes the wax itself. Helped by jaw movements from eating and talking, this self-cleaning process drives wax out the ear canal.

Cerumen is a mixture of dead skin cells and secretions from ceruminous glands ("cera" is Latin for "wax") and other glands in the outer part of the ear canal. It's not made deep in the canal. Often problems are caused by

attempts to remove the wax actually pushing it further in. Q-tips are notorious for packing wax deeper in the ear canal, irritating sensitive tissue and causing the symptoms mentioned above. The standard advice is: nothing smaller than your elbow should be introduced into your ear canal.

Cerumen protects your ear canals. Dark, warm, and often moist, the canals are brilliant bug breeding grounds. Cerumen moisturizes the skin and is a barrier against water and microbes. It may even kill bacteria and fungi.

The sticky goo also traps dust and hairs. As an added bonus it tastes bitter (admit it, you knew that), which may deter larger bugs—insects—from making your ear canal home.

Earwax has also had odd out-of-body uses: as a salve for wounds, and, more distastefully, lip balm. Plus, it's had literary functions. Ornately painted medieval manuscripts have it to thank for their beauty. Pigments used to decorate the texts were mixed with it so they could be applied to the parchment. So, there's more to cerumen than meets the eye, and ear.

## Circle of Willis (cerebral arterial circle)

*How brainy blancmange is not to be trifled with*

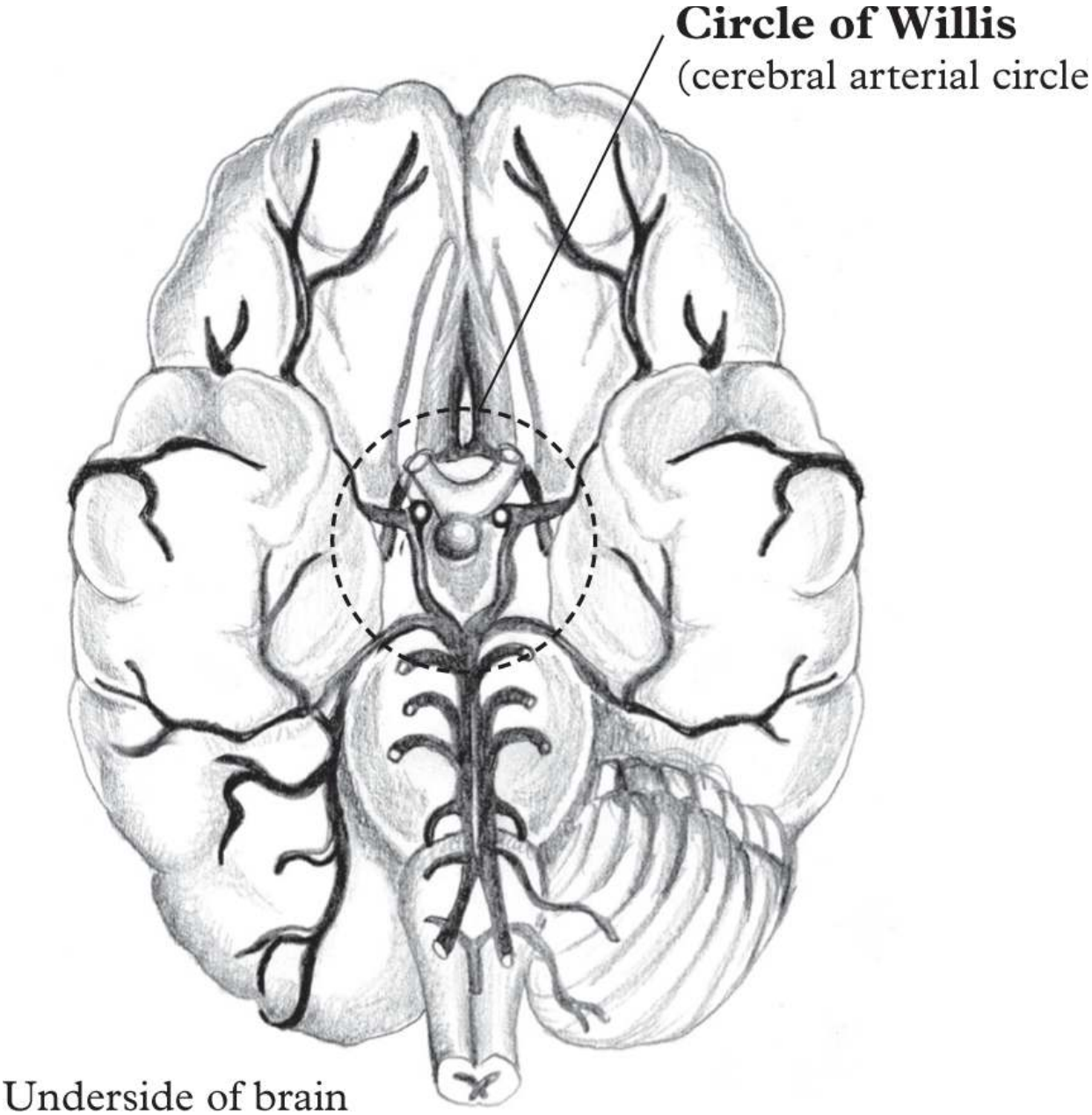
One of the world's most iconic artworks may have an astonishing anatomical message encoded within. Hiding in plain sight in Michelangelo's *The Creation of Adam* on Vatican City's Sistine Chapel ceiling is what looks remarkably like a human brain. It's stunningly subversive, if you see it as a message about where the real creative power lies. Not with God, but within *us*.

Since the ceiling's completion in 1512, visitors have craned their necks to view the much-memed masterpiece. A white-haired God gives life to Adam, the fingers on their outstretched arms almost, but not quite, touching. It's loaded with symbolic meaning. But any neuroanatomical symbolism remained unnoticed until 1990, when a US doctor sensationally revealed that God seems to be surrounded by the outline of a brain, cut down the middle, front to back.

Michelangelo dissected many bodies and knew a brain when he saw one. So, what was the Renaissance genius saying? That God's gift to us is not just life, but also our intellect? Or much more controversially, that the human brain is the ultimate creator?

This was heresy in the sixteenth century. Still is. Though there's no disputing the genius of your (yes, *your*) spectacularly inventive, imaginative, intuitive brain. Its 120 billion neurons and 100 trillion interconnections make it arguably the most complicated object in the known universe. Yet it's mostly just plain old water, with the consistency of blancmange.

That's food for thought, for a brain that needs huge amounts of fuel for thought. It's just 2 percent of our body weight, yet when we're at rest, 15–20 percent of the blood from our heart travels to it. Your circle of Willis—a clever arrangement of blood vessels at the brain's base—helps safeguard the vital fuel supply. Here's how:




Underside of brain

Imagine four freeways entering a city, each serving one of its quarters. If the roads aren't connected, an accident in one would block traffic getting to its quarter. A ring road, fed by all the freeways, would prevent this calamity. The circle of Willis (cerebral arterial circle) is the brain's ring road. If one artery supplying the brain gradually narrows, others in the circle take up the slack.

It's named after Thomas Willis, a seventeenth-century English anatomist who wrote a book featuring an exquisite illustration of the blood vessels.

The artist was none other than Christopher Wren, who later designed an iconic European religious building. Not the Sistine Chapel, but London's St. Paul's Cathedral.

## Coracoid process

*How you're a little cuckoo*

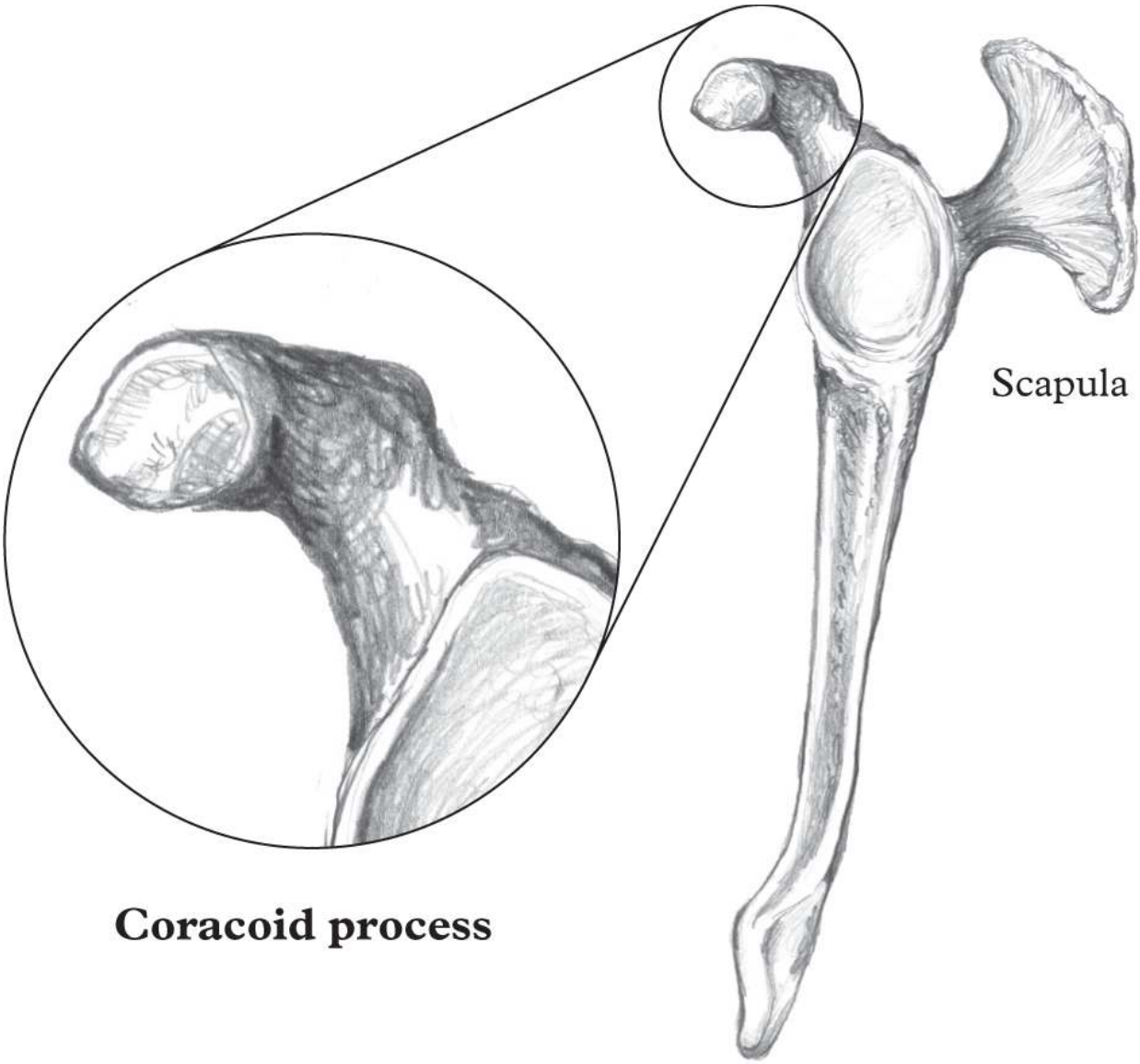
Very little is known about Old MacDonald, other than that he had a farm. And on that farm, he had a considerable collection of creatures that created a cacophony of calls, cries, and chirps. There were tweets-tweets here, clucks-clucks there, and quack-quacks literally everywhere.

So, the geriatric agrarian might have had a soft spot for his bony coracoid process. Like tweet, cluck, and quack, "coracoid" is birdlike, and onomatopoeic, sounding like the animal it relates to.

An anatomical process is a protrusion from a structure. Your coracoid process is a hook-shaped protrusion from your shoulder blade (scapula). It looks a little like a raven's beak, hence "coracoid," which combines the Greek for "raven" ("korax") and "form" ("eidos"). Korax, coracoid, and *Corvus*—a collection of bird species including crows, ravens, and rooks—are words made using the "Here a caw, there a caw, everywhere a caw-caw" call of these mischievous feathered fiends.

The coracoid process projects forward from the top of the scapula and is an anchor for many ligaments and tendons. Surgeons call it the "lighthouse of the shoulder" because it's a vital landmark to help scalpels steer clear of nearby nerves, arteries, and veins.

Shooters whose shotguns smash into this lighthouse can also come a cropper. "Trapshooter's shoulder" is a stress fracture of the coracoid process caused by a gun's repeated recoil. If they were firing at living birds, as opposed to clay ones, shooters injuring the birdlife in their body would be sweet, sweet justice. And if their coracoid process doesn't get them, there's more avian-related anatomy waiting.




For example, there's a goose foot near the knee. The pes anserinus is three muscle tendons, joined so they resemble the bird's webbed foot. *Anserinae* is the name given to types of waterbirds that include geese and swans. A pes is an ancient Roman unit of length, roughly equal to one foot.

The skull has a crista galli, Latin for "cock's crest." This triangular ridge of bone sticks up from the front of the skull's base.

And the tailbone is a coccyx because it looks like the beak of an ancient Greek "kokkyx." This is the clock-dwelling and notoriously devious cuckoo. (A man with an unfaithful wife is a "cuckold" because the word comes from "cuckoo," due to the females' habit of laying their eggs in other birds' nests.)

The cuckoo is also an onomatopoeic bird, as in “Here a cuckoo, there a cuckoo, everywhere a cuckoo-cuckoo.” “Ee-i-ee-i-o,” as Old MacDonald would say.

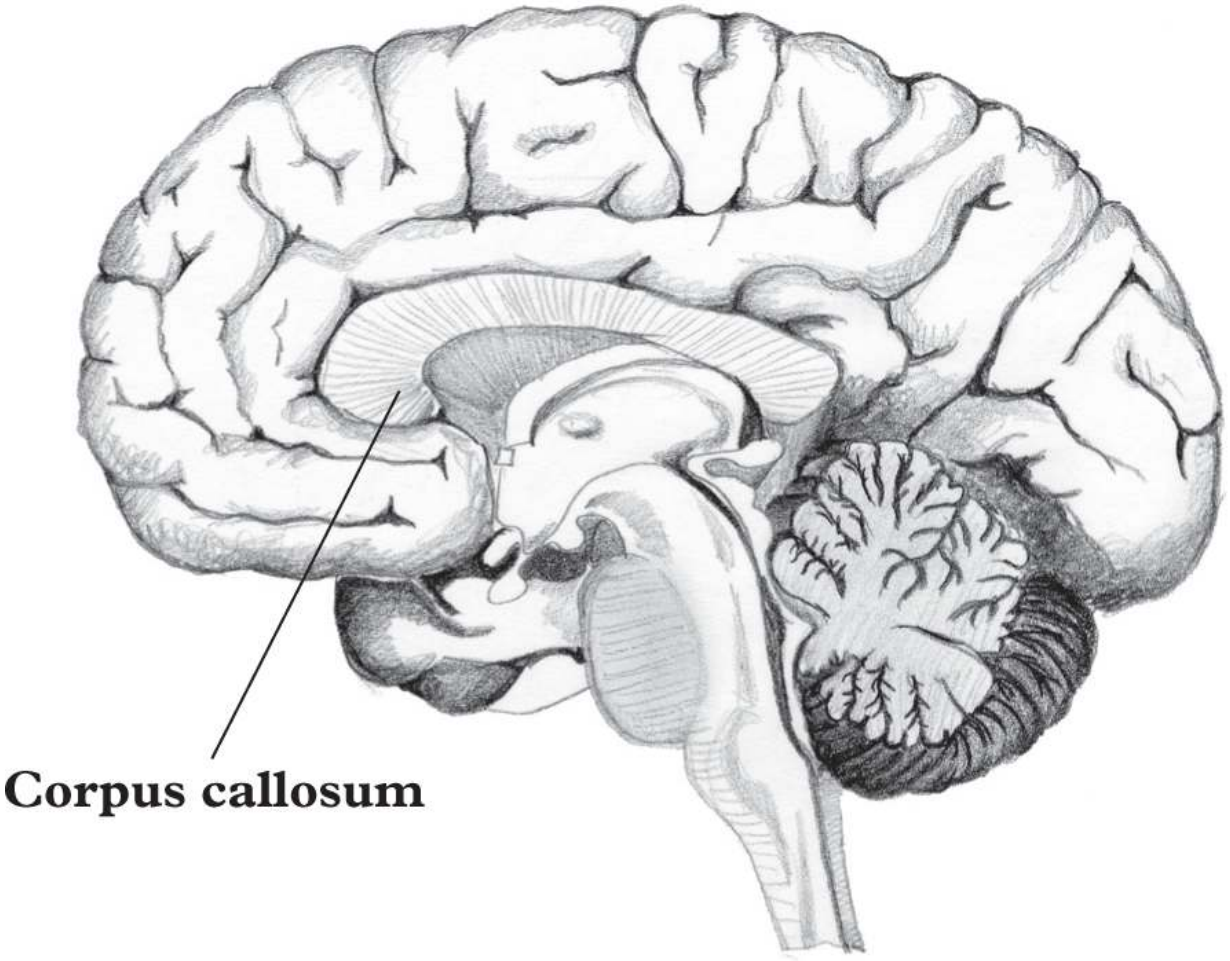
## Corpus callosum

*How connections power the genius in us*

The da Vinci code is not a ridiculous conspiracy thriller chock-full of fantastical religious claptrap purporting to be gospel truth. Not a truth-busting blockbuster that rubbed Catholics up the wrong way, causing unholy pulp friction. The real da Vinci code is Leonardo da Vinci’s key to intelligent, creative thinking: “To develop a complete mind, study the science of art, study the art of science. Develop your senses, learn how to see. Understand that everything is connected,” he is often quoted as saying.

Whether or not the Italian polymath actually uttered this, he certainly lived the mantra. He was as at home painting the *Mona Lisa*’s enigmatic smile as he was dissecting a face to understand the anatomy within. Da Vinci’s genius was at the intersection of science and art.

Geniuses may be rarer than hen’s teeth, but anyone with a brain has superpowers. Extraordinary cerebral capabilities that stem from *neural* connections. And there’s no bigger connector in the brain than its corpus callosum. This thick, ten-centimeter-long (four-inch) nerve superhighway is a bridge between our brain’s hemispheres, and a key area linked to intelligence.




The corpus callosum is a tough body of tissue running down the middle of our brain, from front to back. “Corpus” is Latin for “body,” as in corpse. “Callosum” means “hard.” A callus is hard, thick skin. Callous people are hard-hearted. Thanks to its 250 million or so nerve fibers, it enables the hemispheres to talk to each other. And how our corpus callosum is wired may help determine whether we’re a bright spark or a dimwit.

During adolescence our corpus callosum grows. The resulting increase in brain connectivity could be why we have enhanced learning capacity at this time. In adults, greater corpus callosum thickness is linked to increased IQ. Hence, eggheads may have more efficient communication between brain hemispheres than people who are one egg short of an omelet.

However, when it comes to intelligence, our brain doesn’t put all its eggs in one basket. You don’t need to be Einstein to figure that many interconnected brain parts must determine our smarts (along with a good deal of environmental influences). Though, in the case of Einstein, his brain

hemispheres *were* particularly well connected, thanks to an unusually thick corpus callosum.

Like da Vinci, Einstein was also passionate about science and art, their connection shaping his creativity. “I often think in music. I live my daydreams in music. I see my life in terms of music,” he said.

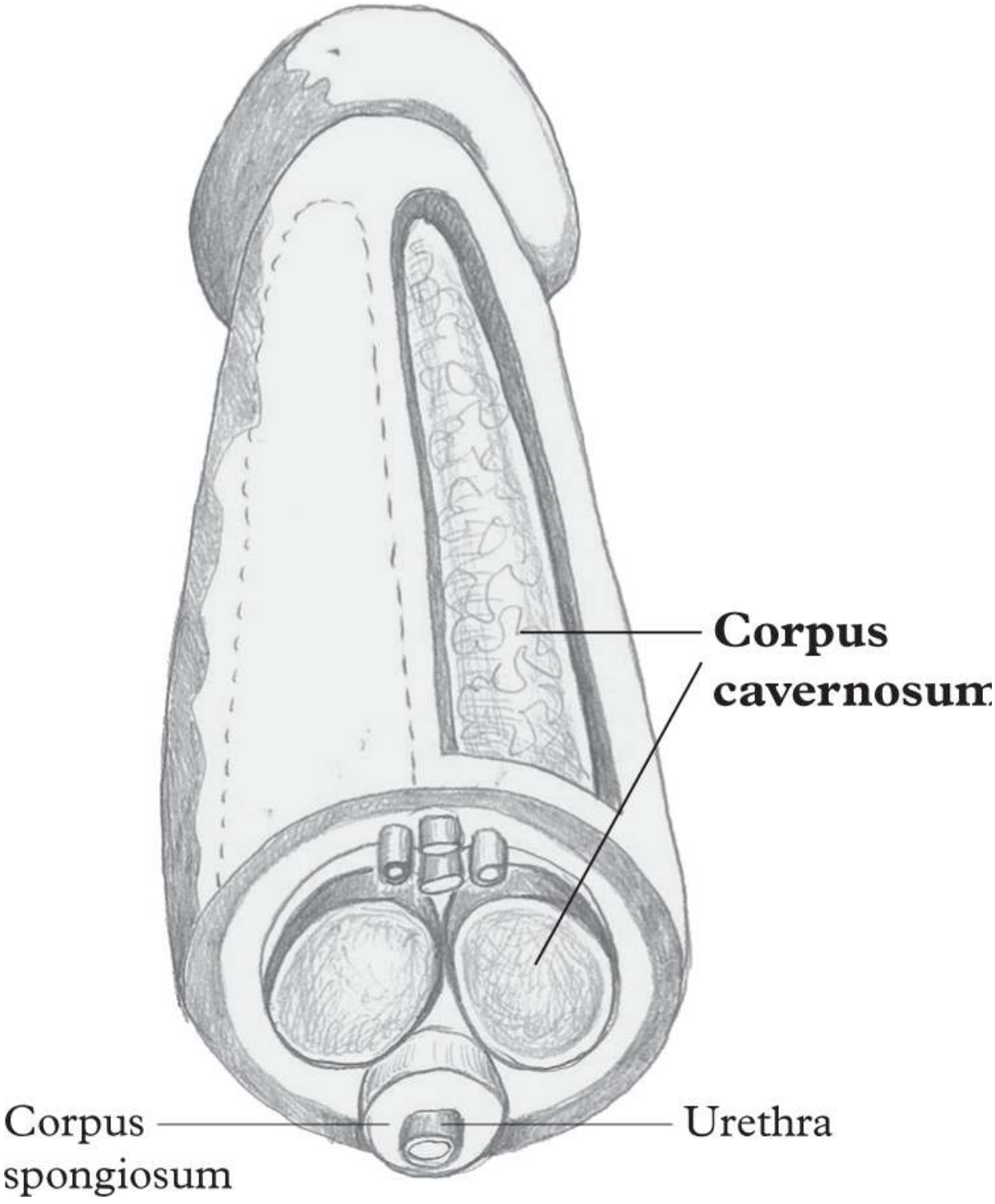
## Corpus cavernosum

*How phallic insecurity is unfounded*

What is it with powerful men and their phallic symbols? Thrusting them proudly in our faces. Outdoing each other as they raise them higher and higher into the sky. Standing tallest at 828 meters (2,717 feet) is Dubai’s Burj Khalifa. Though it’ll be trumped by Saudi Arabia’s one-kilometer-tall (3,281 foot) Jeddah Tower, when the much-delayed project is completed.

This architectural one-upmanship isn’t new. Potent men have long lorded it over us with their brick-and-mortar erections. Ancient Egyptian obelisks symbolized the pharaoh’s power. And for almost four thousand years, the Great Pyramid of Giza was the world’s tallest man- and woman-made structure. Men’s penile erections, however, are the great levelers.

For as long as man has possessed a penis, guys have fretted about the length of their manhood. The good news for bros anxious that theirs is on the short side is that it probably isn’t. Most men underestimate their penis size compared to other guys. And if their flaccid penis seems shortish, it’s unlikely to be abnormally short when erect. When penises get erect, short ones lengthen more than longer ones, research shows. Hence, erections are relatively similar in size. In short: flaccid penises vary a lot in length, erect phalluses less so.




"Phallus" is from an ancient word meaning "swell," which a penis does thanks to its corpora cavernosa (plural of corpus cavernosum). These two columns of tissue running down the left and right sides of the penis's shaft

are packed with blood vessels. When a man is turned on, the vessels open up and blood rushes in, pumping up the corpora cavernosa.

But what keeps the blood inside the corpora cavernosa, to maintain the erection? Crucially, they are surrounded by a tough tunic of tissue, and as they expand, they stretch their tunic covering. This squashes the veins emptying the corpora cavernosa, helping prevent blood draining away and preserving the erection.

It's a high-pressure situation, for man and penis. One that climaxes when sperm exit via the urethra. This is kept open because it's surrounded by another column of tissue, the corpus spongiosum.

So, while an erection may be a colloquial "boner," that's a misnomer. There's no penis bone to make it rigid. Though an erect penis can fracture if it's accidentally thrust against something hard and buckles, rupturing a corpus cavernosum's tunic covering. This toe-curling trauma can leave a man with a curved or bent erection. More Leaning Tower of Pisa than Burj Khalifa.

## Cranial suture

*How you get less boneheaded as you mature*

How many "hips" precede a congratulatory "hooray"? How many hands are there on each face of London's Big Ben clock? How many feet in a mile? Simple questions. Straightforward answers. Now here's a curly one. How many bones are there in the human body?

Ask the Internet and it'll often say "206." That's a nice round 200, plus the six tiny bones in our ears. For this we can thank *Gray's Anatomy*. Not the TV drama with a similar name, but the famous textbook first published in 1858 as *Anatomy, Descriptive and Surgical* (a much less catchy name for a show).

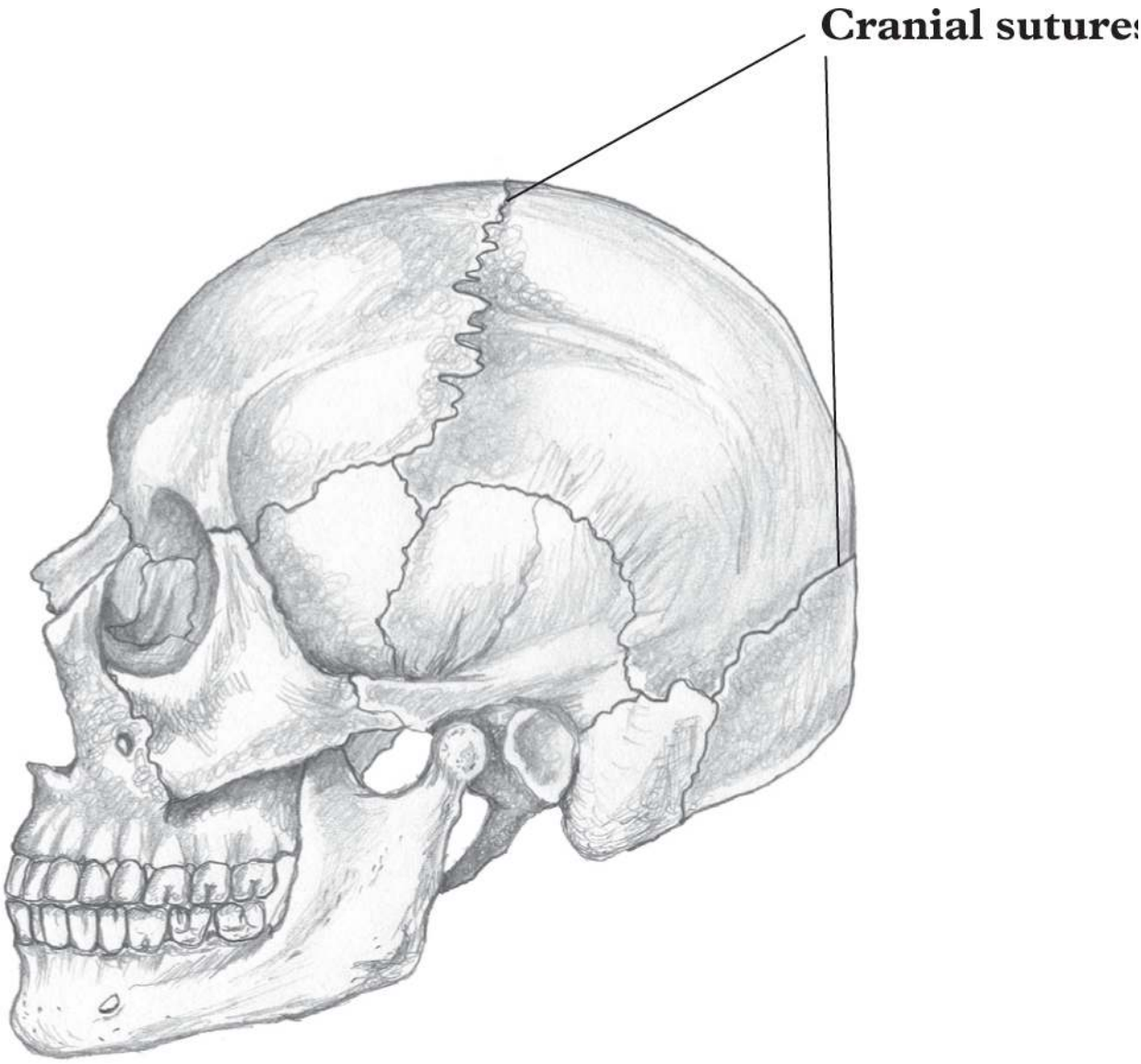
The problem for English anatomist Henry Gray, and every quizmaster since who has insisted 206 is correct, is that they're asking the wrong question. It should be, "Roughly how many bones do we have at a certain age, say 65?"

The fact is, the number of individual bones in our body *falls* as we get older, as an article in the journal *Clinical Anatomy* points out. Hence, the authors had an issue with textbooks that repeated 206 as definitive.

The cause of this bone confusion? Bone fusion: as we age, some bones join. This is especially the case in our skull (cranium). Here there are twenty-one bones when we are twenty-five years of age, seventeen when we're twenty-five to forty-four, and just one in later years, the paper estimated. (Importantly, while bones in the cranium may fuse, the original bones still keep their names. Hence the number of *named* bones in the skull doesn't change.)

When we're growing and developing, skull bones need to be separate, to allow our cranium to expand. The bones in the dome of our skull that encase our brain are separated by joints called cranial sutures. As we're being pushed out of our mum during labor, these seams help us along by allowing our head to mold to the shape of the birth canal. Gaps between them in newborns are called fontanelles. As we mature, the sutures fuse, reducing our bone count.

The paper's estimates for the total bone number at various ages were: 214–16 at twenty-five years; 208–10 at twenty-five to forty-four; 189–93 at forty-five to sixty-four; and 186–93 in the over-sixty-fives. "One would have liked to imagine that the number of bones was determined once there was general agreement on the age to sample the population," it said.




So, the answers to the questions at the start of this story are: Two “hips.” Two hands. And 5,280 feet. As for the number of bones in our body, that depends on the question.

## Cremaster

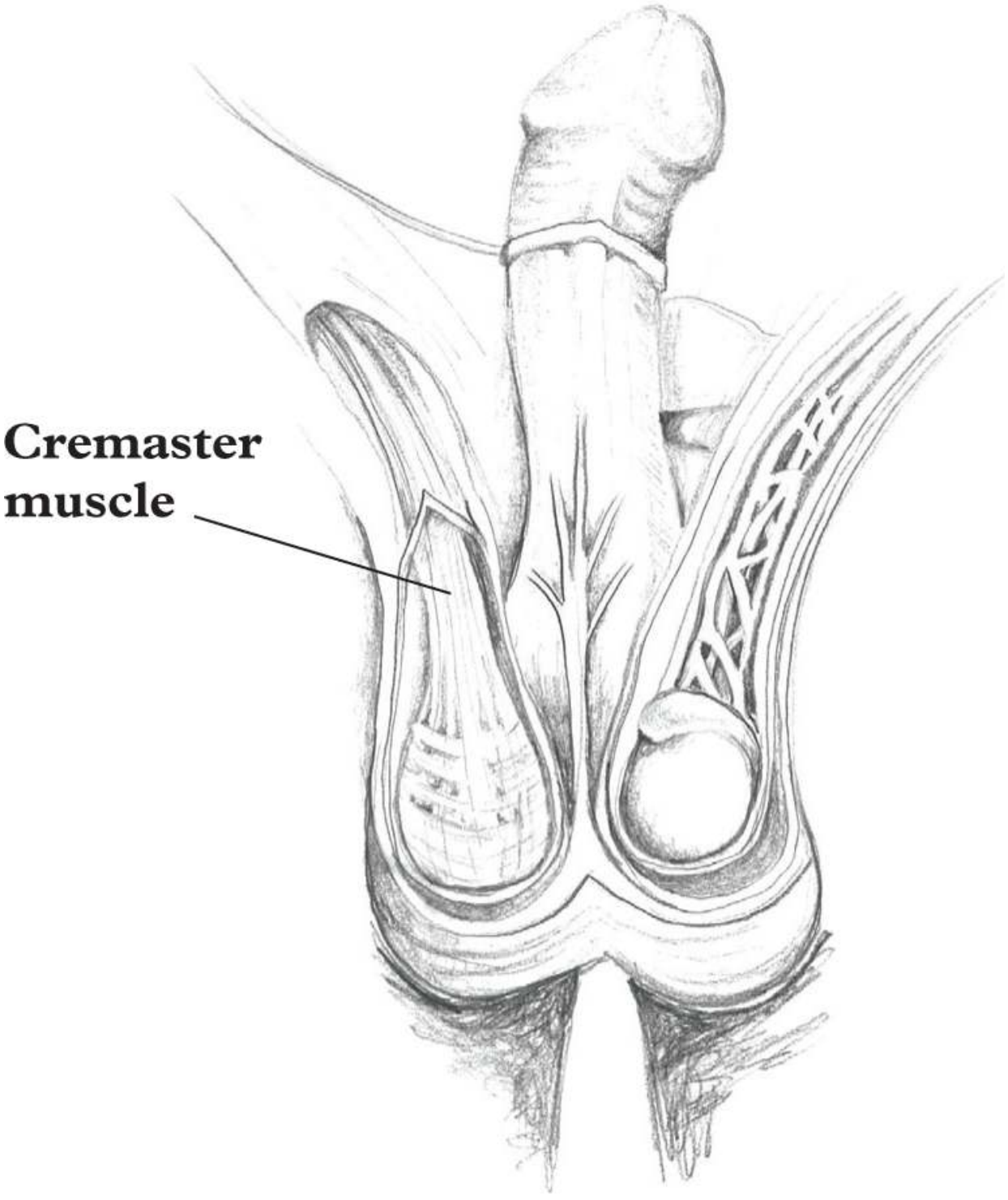
*How testicles deal with the ups and downs in life*

No matter who wears the trousers in a heterosexual relationship, it’s not that uncommon for both parties to be wearing lingerie. Many men, usually heterosexual guys, get a kick out of slipping on women’s intimate apparel under their chinos. It’s a fetish that’s generally harmless, so good luck to them in their satin knickers, sheer stockings, and suspenders. And they aren’t

so unusual, when you consider that all men wear suspenders, whatever their taste in underwear.

These suspenders are sinewy rather than silky. Cremaster muscles: strips of flesh running from tummy to testicle. Each testicle (testis), snug inside its scrotum, has one. They raise and lower the gonads, like cables suspending an elevator. Hence “cremaster,” from the Greek for “suspender.”

This testicle yo-yoing is no trivial matter. The very survival of our species depends on it. Men’s family jewels are far too precious to be left to their own devices. Sperm are made in the testes, and without sperm there’d be no you, me, anyone. Testes, like bar owners in mobster movies, need PROTECTION.




Gonads, going up: for good sperm making, testicles need to be kept at a roughly constant, optimal temperature. When the weather's chilly, the cremaster muscles automatically contract, lifting the testes away from their exposed position in the scrotum, toward their owner's warm groin. This

testicle-protection service also kicks in if a man is in danger, and during sex. (Guys' exquisitely sensitive gonads aren't great grinders.) The cremaster muscles are constantly on alert, looking out for their owner's gonads. Just stroking a man's upper inner thigh causes the testis on that side to ascend. It's called the cremasteric reflex.

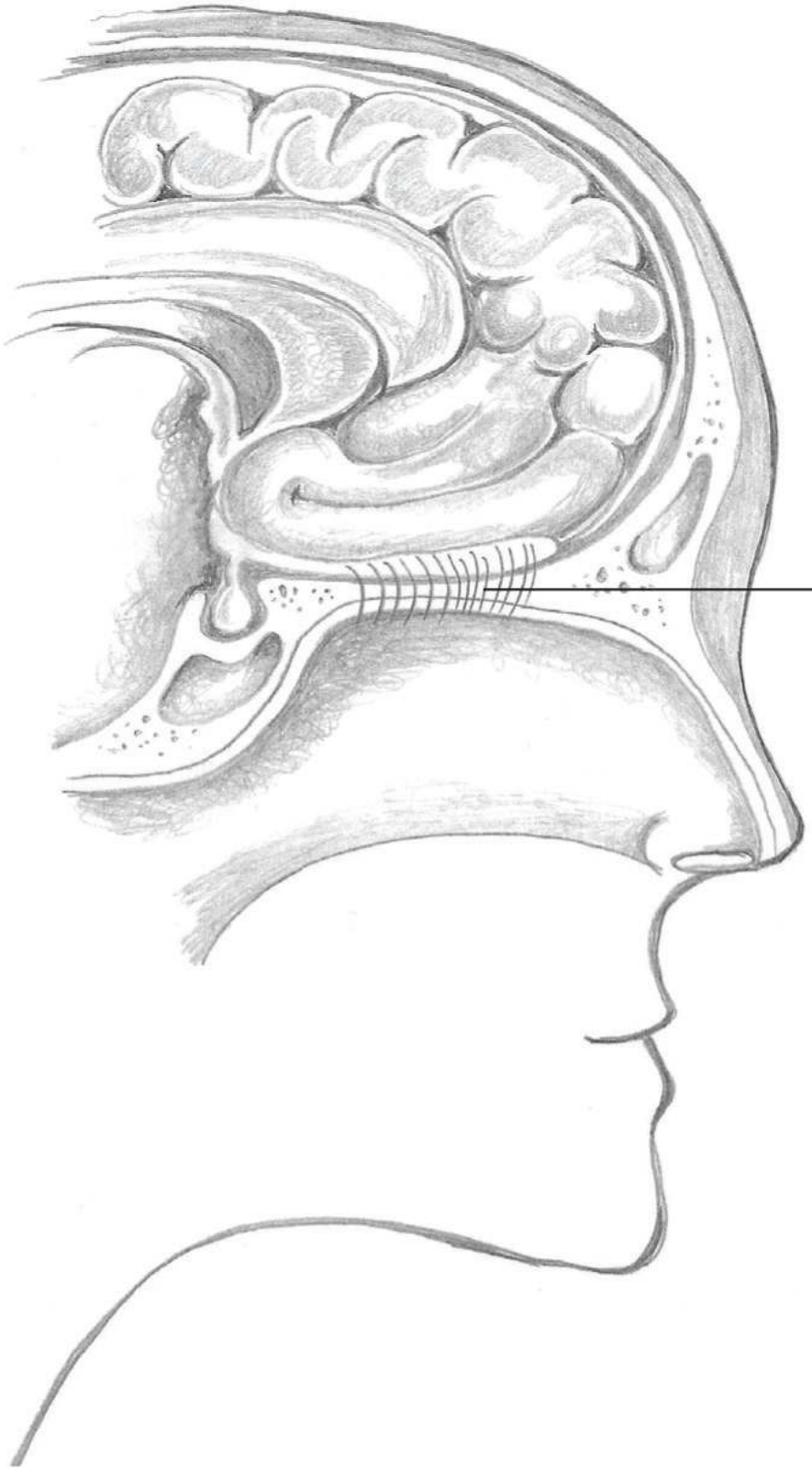
Gonads, going down: when the danger has passed, or when it has warmed up, the cremaster muscles relax, lowering the testes back down.

Sometimes the cremaster muscles are a little too eager for their owner's good. "Refrigeration engineer's testis" involves the muscles going into overdrive, pulling the gonads hard into the groin, so they're painfully squished. Hence, men shouldn't spend too long in walk-in coolers, like those in liquor stores. To do so would invite a nasty bout of suspender-induced gonad-versity.

## Cribriform plate

*How bloodcurdling bogeymen pick our brains*

If Hannibal Lecter fancies brain for supper, he saws off the top of some poor soul's skull and sautés a slice of gray matter. So far so sociopath. A pathogen wanting to turn brainbox into lunchbox doesn't have the luxury of power tools. If you're a single-celled, brain-eating amoeba, you need an existing anatomical path through the skull. A vulnerable spot in the brain's protective case. For *Naegleria fowleri*, our cribriform plate is just the ticket.



**Cribriform plate** with nerves passing through it

One of the deadliest pathogens known to man, and woman, *Naegleria fowleri* lives in soil and warm fresh water, like lakes, rivers, and hot springs. When swimmers splash infected $H_2O$ into their nose, this menacing blob of shape-shifting goo can ride the wave, up their nostril. Here, the brain-bound amoeba slithers along nerves that transmit our sensation of smell. These lead to the cribriform plate, a part of the ethmoid bone in the roof of our nose, just below our brain.

"Cribriform" means "sieve-like" in Latin. For *Naegleria fowleri* it means "doorway." The cribriform plate is about 2 centimeters (just under an inch) long, half a centimeter wide, and riddled with holes. Holes that allow our smelling nerves, and *Naegleria fowleri*, to pass through. Fortunately, infection is very rare. But if this bloodcurdling bogeyman does end up in your brain and starts tucking into it, you're doomed. It's killed almost everyone with signs and symptoms of infection.

Because the cribriform plate is full of holes in the base of our skull, ancient medics thought it was some sort of strange cerebral exhaust pipe. The highly influential second-century Greek physician Galen, whose theories dominated European medicine until the seventeenth century, believed our brain's waste products dripped down through it, and then out our nose as mucus.

While that's crazy talk, brain fluid can drip, drip, drip from the nose if the thin, delicate cribriform plate is damaged. Usually that's due to a fist or car steering wheel smashing into a face. Very rarely, it's due to COVID. Or rather, COVID testing.

People have been known to fracture their cribriform plate with a COVID nose swab vigorously inserted at too great an angle upward. Do this, and you might find yourself in hospital with cerebrospinal fluid—clear liquid that surrounds the brain—dribbling from your nose.

Cerebrospinal fluid, mixed with a splash of Chianti, and a dash of rendered abdominal fat, would make a mouthwatering jus to serve with Dr. Lecter's supper.

## Cupid's bow

*How insta-glam lips win the dating, and mating, game*

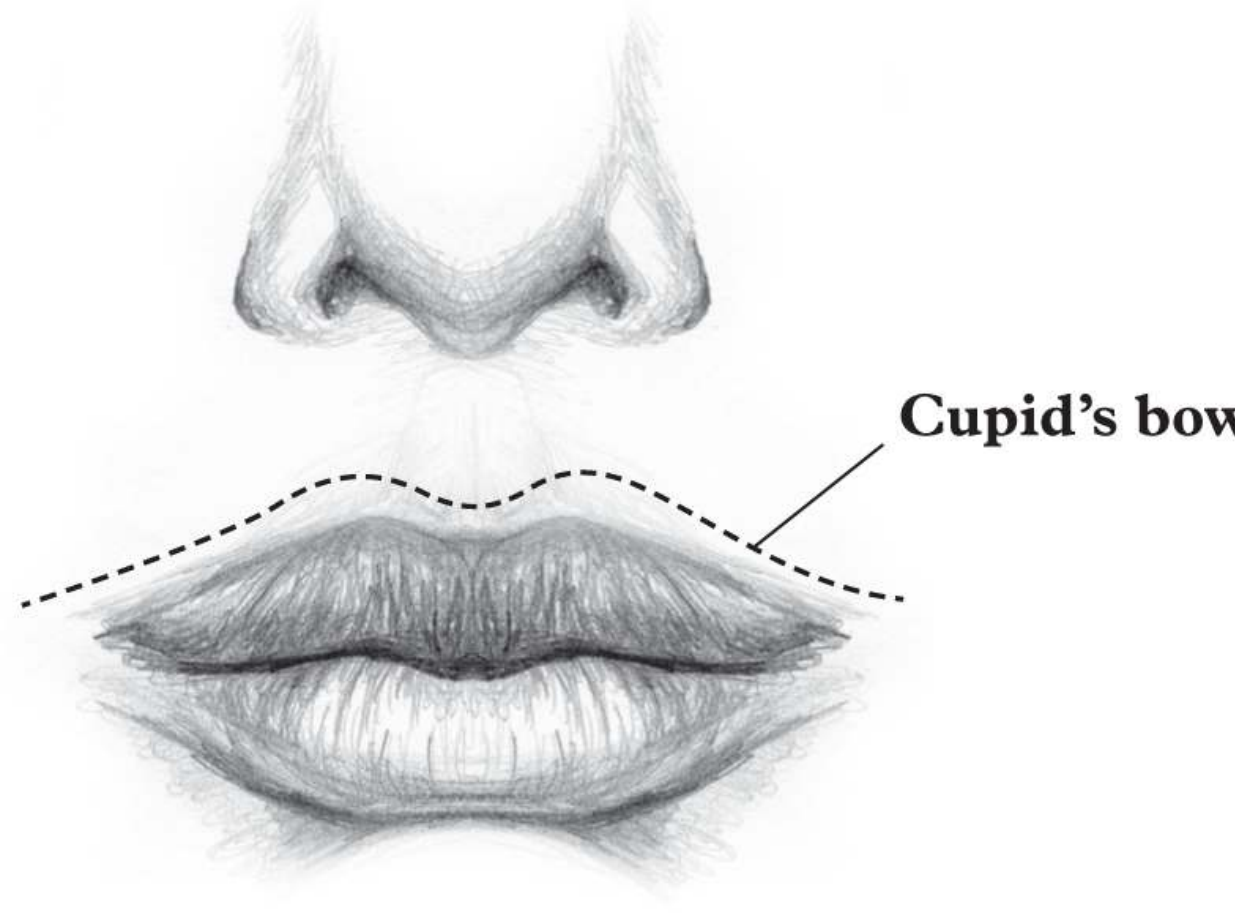
Beauty is big business. Movie stars, Instagram influencers, and cosmetic doctors know there are big bucks in voluptuous breasts, broad smiles, and

full lips. And, when it comes to all things lippy, big is becoming even more becoming. Research looking at white female models in fashion magazines found their lips became fuller over the years.

Want the look? Then you apparently need the lips. Full lips are linked with youth, health, and attractiveness. That's not surprising: lips get thinner and less pouty as we age. Proof that lip shape can determine how we feel about someone also comes from our language, "thin-lipped" being a way of describing someone as mean.

One of our most eye-catching lip shapes is our Cupid's bow. Here, the red part of the top lip (vermilion) rises from each side to twin peaks, then dips in the middle. It makes the shape of a bow, like Cupid's, the Roman god of desire and attraction.

In the game of love, Cupid was the original first-person shooter. The chubby cherub's arrows inflamed uncontrollable desire in those they pricked. Likewise, our Cupid's bow is a factor that can determine whether we're hot stuff or given the cold shoulder. A well-defined Cupid's bow has long been associated with youth and beauty.




Hence, in our selfie-obsessed world, it's not surprising that lip jobs, where fillers are injected to accentuate the Cupid's bow, and other parts, are booming. If that's not an option, there are even apps that can enhance lips in photos, for an iPhony, luscious look.

It's predictably superficial. But there could be a deep-seated explanation. Our obsession with beauty that's only skin deep may have evolved to help us pass on our genes.

Research found that young white women with higher levels of the sex hormone estrogen were rated in photos as having more attractive faces than those with lower levels. Higher estrogen levels during the menstrual cycle are known to be linked with increased likelihood of conception. The most attractive women had big eyes, a large forehead, a small jaw, and full lips. Hence these features may be clues that a woman is a healthy, fertile mate, making them seem attractive.

Perhaps there is something to the quip "She's got child-bearing lips."

## Dilator and sphincter pupillae

*How Shakespeare knew the eyes have it*

There's more to the eye than meets the eye. Eyes are windows to the soul. Shakespeare recognized this, the eye being perhaps the dominant motif in the Bard's sonnets. But eyes are not just windows, they're also *mirrors*.

Stare intently into a stranger's eyes and what do you see? Stars, if they take offence at the intrusion. Otherwise, reflected in their pupils is a tiny image of yourself. It's how pupils got their name, from the Latin word "pupa," meaning girl or doll. Schoolkids are also "pupils" because of the word's link to children.

Your pupils are transparent black holes. Black because it's dark inside your eyes. The obsidian pupils sit in the center of your vibrant irises—"iris" and "iridescent" are from the ancient Greek for "rainbow."

Like schoolkids, your ocular pupils don't spend much time sitting still. They're constantly dilating or constricting, thanks to the iris's dilator and sphincter pupillae muscles. Dilator pupillae runs through the iris in a bicycle-spoke pattern and can expand the pupil to 8 millimeters (a third of an inch) in diameter. Sphincter pupillae travels in a circular pattern, constricting a pupil to as little as 2 millimeters across.

The muscles react to the conditions, dilating or constricting as needed. Hold a torch up to a mirror and you may see your pupils constrict, then dilate when the light is removed.

But changes in brightness are just one trigger for them. Where you're looking, what you're looking at, and more, also determine pupil size. Stare at something nearby, and your pupils constrict. Gaze into the distance, and they do the opposite.

That's the where; the *what* is more mysterious. Turns out, eyes *are* a window to your soul, in that they betray your innermost feelings. Any arousing scene, thought, or emotion makes your pupils dilate. Concentrating on calculating seventeen times twenty-three in your head. Evocative music that gives you the "chills." And sex. One study using different images, some arousing, some not, found pics of nude women made men's pupils dilate most. For women, it was babies, and naked men.

On the flip side, a number of studies have found people with larger pupils were rated as more attractive (though research has also found the opposite). Women in sixteenth-century Italy believed this. They were said to use the

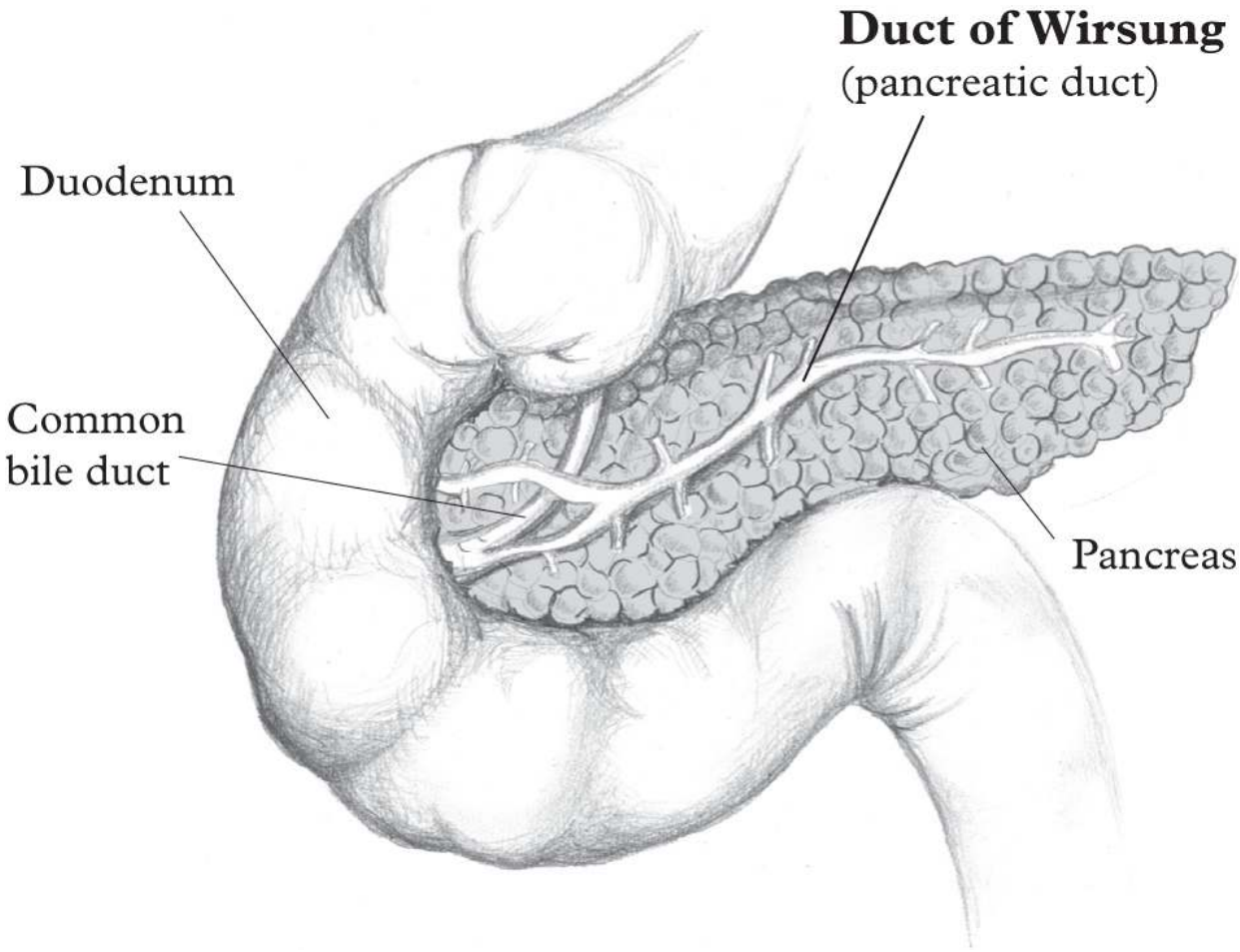
plant belladonna (Italian for “beautiful lady”) to dilate their pupils. Belladonna is also called deadly nightshade, and was likely the potion Shakespeare had in mind when Juliet fakes her death in *Romeo and Juliet*.

## Duct of Wirsung (pancreatic duct)

*How the grapes of wrath incite murder*

To be involved in one murder is a misfortune. To be publicly embroiled in two looks like carelessness. We’re not talking about a hitman, mobster, or drug baron here. This was a wholly innocent bystander. A silent witness to two homicides. One that resides in your insides. Your duct of Wirsung, aka pancreatic duct. A tube just 3 millimeters or so across and about 15 centimeters (6 inches) long in your pancreas that transports digestive juices.

Murder one. This tragedy of our anatomy began in March 1642, in the Italian city of Padua. Dangling in the spring sunlight was Zuane Viaro Della Badia, who’d been hung for murder. For Johann Wirsung, Badia’s body was an anatomical piñata, destined to be opened up and explored on his dissection table. Fatefully, there were just two onlookers when Wirsung dissected Badia’s corpse. Only they knew the truth about the German anatomist’s claim that he’d been first to discover the duct that bears his name, in the murderer’s pancreas.




Murder two. Instead of publishing his discovery, Wirsung himself engraved a drawing of the duct on a copperplate. From this, he made prints that he sent to top anatomists across Europe, to emphasize that he was the discoverer. This, after all, was a high-stakes game; giving one's name to a piece of our anatomy is a route to immortality.

While Wirsung's name lives on inside us, he met a premature end in August 1643, when a student—Giacomo Cambier—gunned him down in front of his house. Cambier was likely a stooge, sent to bump off Wirsung by a rival, jealous about the German taking credit for the duct's discovery. Especially since one of those who'd been at Badia's autopsy later claimed he'd found the duct first, in a turkey. He maintained he'd told Wirsung to keep an eye out for the human version in Badia.

It's a racy (double) murder mystery, starring an organ that is "racemose." In other words, its digestive juice- making cells are arranged in clusters, with

the juices secreted into ducts, an arrangement that looks like a "bunch of grapes."

The digestive juices drain into and down the duct of Wirsung into your duodenum, the first part of your small intestine. When the pancreas is damaged, the juices can leak out and start attacking our insides. It's not at all pleasant. The wrath of a pancreas's grapes can be murderously painful.

## Duodenum

*How medics gave an anatomical taboo the finger, or twelve*

The physician who named your duodenum dissected human bodies before a live audience; one of whom was the tortured soul being cut open. This acclaimed anatomist likely sliced and diced living, breathing victims, it's believed. These were heart-stopping, eye-opening, spine-chilling *pre*mortems. Though presumably not for long. Horrific gore-topsies performed at a unique time and place in anatomical history, when conventions were challenged and taboos pooh-poohed, revolutionizing understanding of what goes on inside you. Hence, this physician is known as the "father of anatomy" … and the "butcher of Alexandria."

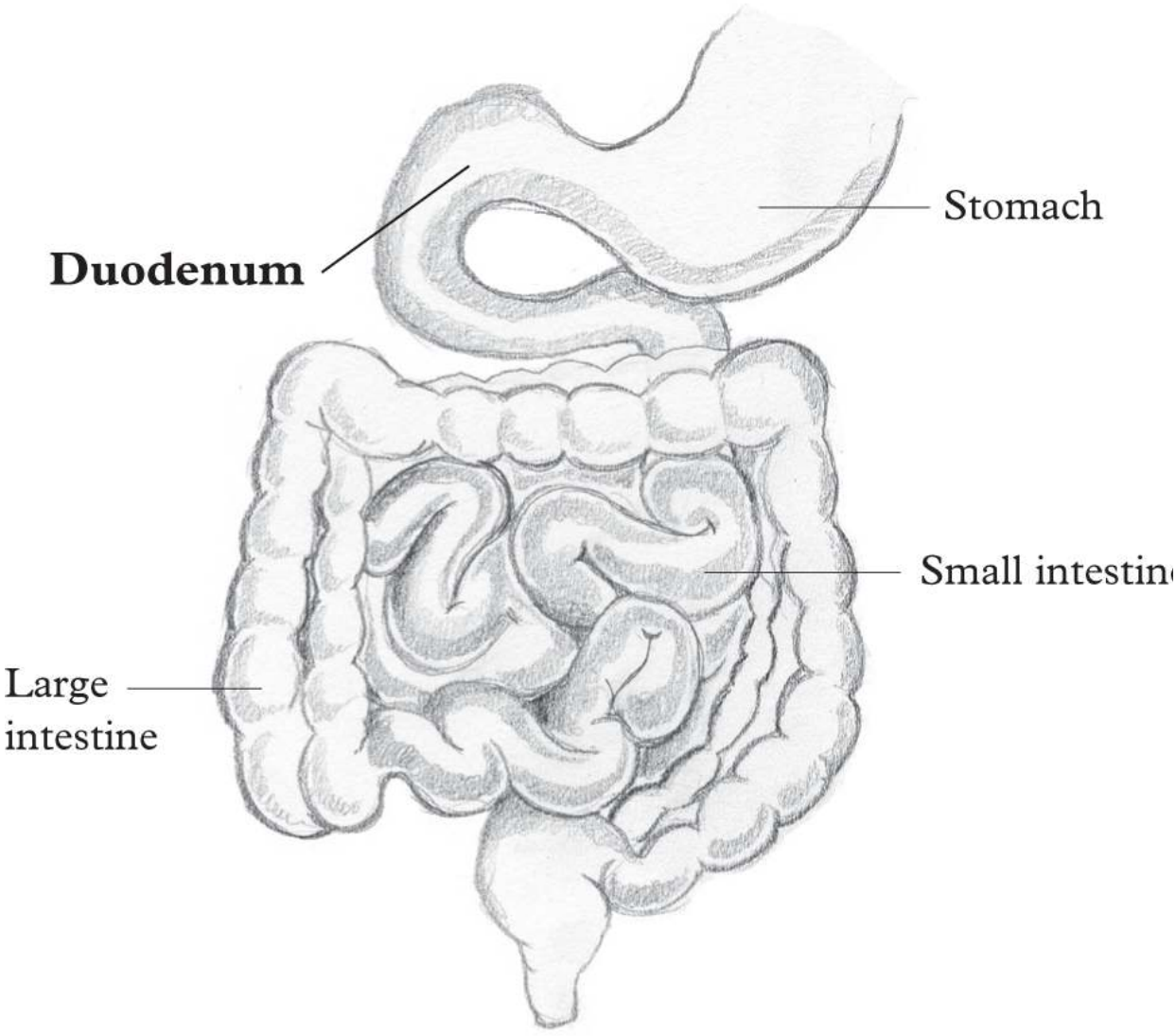
This controversial hero is Herophilus, one of a number of great ancient Greek medics, among whom systematic human dissection was a big, longstanding no-no. And yet, early in the third century BCE, in what's been called "One of the more stunning moments in the history of science," Herophilus became the first person to systematically dissect a human.

As remarkable is that Herophilus, and his contemporary Erasistratus, were also the *last* ancient medics to do this. For just a few decades, their work was officially sanctioned. After their deaths, systematic human dissection ceased, only restarting more than 1,500 years later.

This brief window of opportunity into our insides opened because Herophilus worked in Alexandria, Egypt. Here, the pharaohs made the rules, and they could be pretty out-there: sibling incest got an enthusiastic thumbs-up. As well as having a soft spot for their sisters, the pharaohs were ambitious. They wanted Alexandria to be a hothouse of scientific learning and innovation, incentivizing top talent to work there. It was the original Silicon Valley, with even more sand.

The patronage extended to Herophilus included gifts of condemned criminals for him to dissect. And so, in this cutting-edge, cosmopolitan

climate, Herophilus was emboldened to break through the taboo and cut open human flesh, dead and alive. To illustrate how significant a step this was, after Herophilus and Erasistratus died, even the medics in Alexandria had no stomach for it.




Today, Herophilus is hailed as one of the greatest ever anatomists. He made many discoveries, describing much of our innards in detail, including the first part of the small intestine. This, he named “dodekadaktylon,” literally “twelve fingers long”—not digits placed end to end, but fingerbreadths. A similar word is “dodecahedron,” a solid with twelve faces. In Latin, dodekadaktylon became “duodenum,” as it’s known inside you.

So, living on inside your guts are the fingers of the father of anatomy, and the butcher of Alexandria. How many for each depending on how you feel about Herophilus's "live" dissections.

## Epididymis

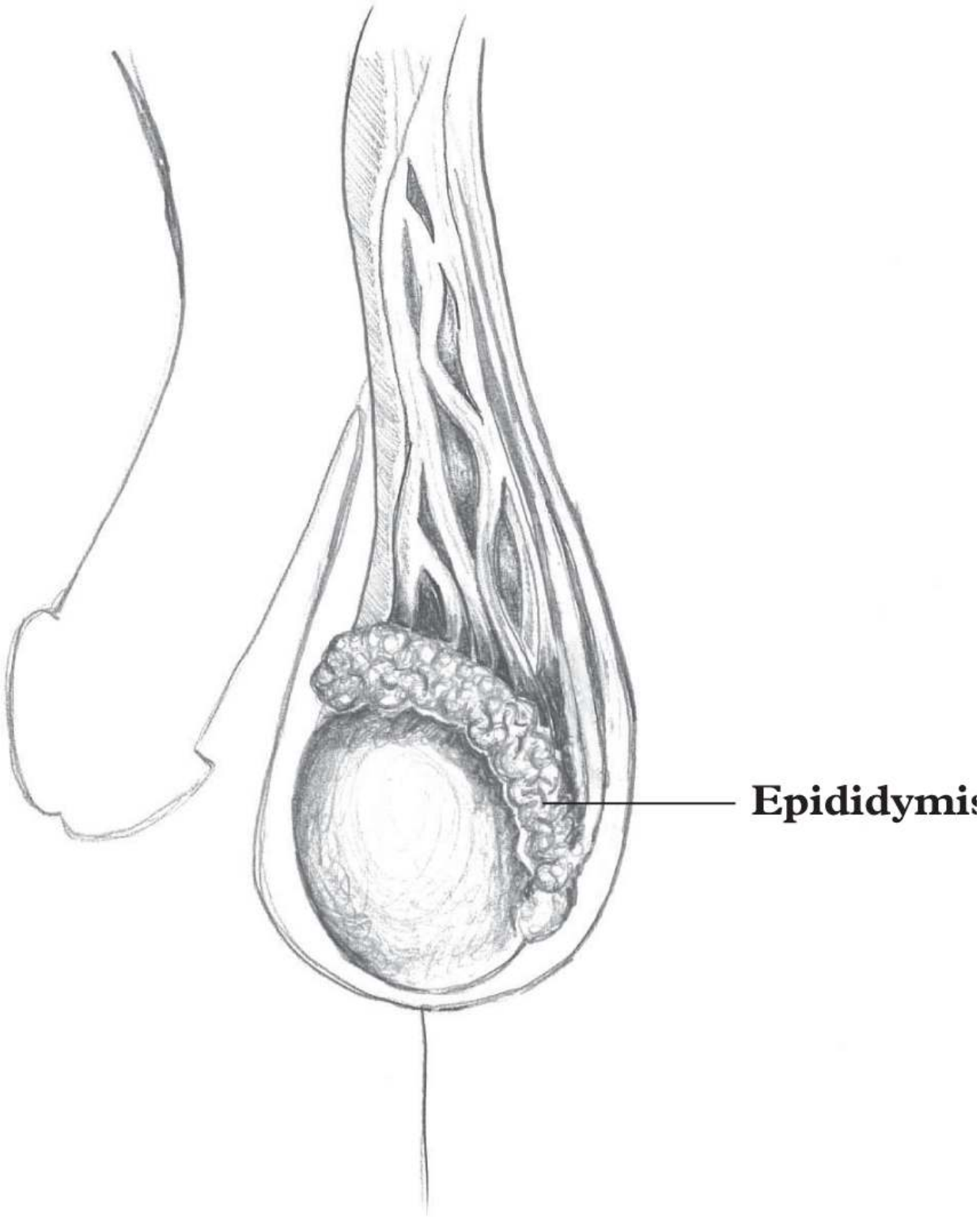
*How men's beat-les travel Across the Universe*

When a man and woman *Come Together* to make a baby, the heroic sperm cell that fertilizes the egg has traveled a scarcely conceivable 7 meters (23 feet) from scrotum to ovum. Four times the height of the man that made the one-in-a-hundred-million sperm.

This extraordinary odyssey begins in the testis, which deposits the sperm it produces into the 4-centimeter-long (1.6 inch) epididymis that's on top of and behind it. From there, the plucky little swimmers are sent down 45 centimeters (18 inches) of vas deferens (the tube that's snipped in vasectomies) and on into 20-odd centimeters (8 inches) of urethra, from which they're ejaculated.

The female part of the path to procreation takes in the vagina, cervix, and rest of the uterus, then finally the fallopian tube, where an egg may be waiting. Another 15 centimeters (6 inches) in total. But this route through man and woman adds up to under a meter. Where does our 0.06-millimeter-long hero travel the missing six? The equivalent of 175 kilometers (110 miles) for an average-height American man.

The answer is: "on the testis," or rather, the ancient Greek for this: "epididymis." This crescent-shaped structure may be only a few centimeters long, but inside it is a tube coiled so astonishingly tightly that it stretches for six meters. It's humongous in humans, though is dwarfed by the horse's epic 80-meter-long (87 yard) epididymis. That's roughly three sides of a baseball diamond.




The epididymis is where sperm go to mature. The testes that supply the epididymides with sperm are relentless: the average man produces about

1,000 every heartbeat. But when sperm exit the testis, they're unable to move on their own, other than twitch a little. By the time sperm leave the epididymis, they can swim, thanks to their rapidly beating flagellum (a tail, from the Latin for "whip," as in "flagellate"). In the epididymis, sperm are also concentrated—fluid surrounding them is removed—and they develop the ability to fertilize an egg.

As with adolescent boys, the road to sperm maturity is tortuous and long-lasting. It takes ten to fifteen days for sperm to traverse the epididymis's convoluted coils, as they are pushed forward by muscle contractions.

The epididymis's end is a store for mature sperm. Here they wait, like paratroopers in a plane, until they're ejaculated into the dangerous drop zone. There can be hundreds of millions of sperm in a single ejaculate, but only a few thousand make it to the fallopian tube.

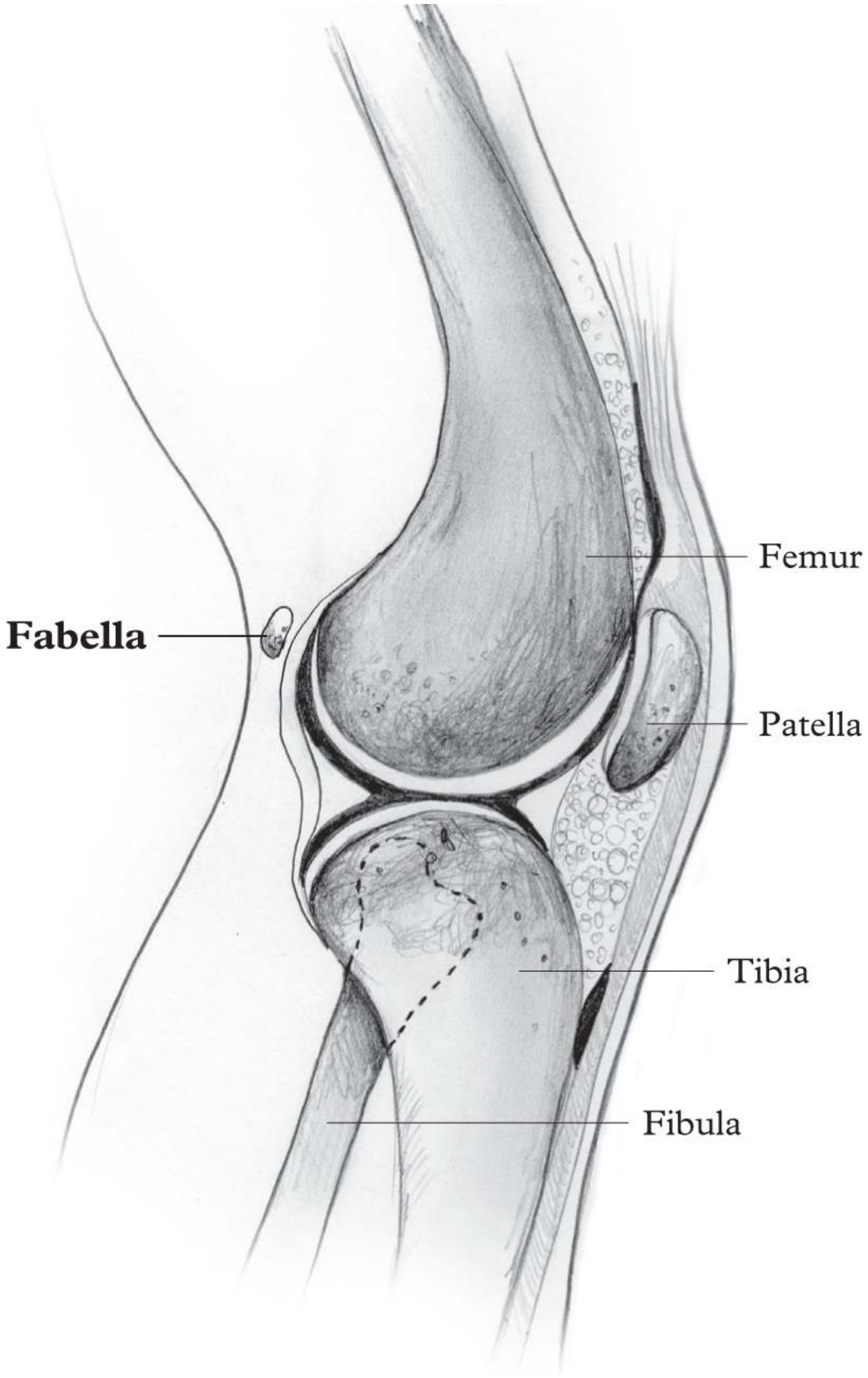
The egg has traveled a few centimeters. The sperm have taken *The Long and Winding Road*.

## Fabella

*How little beans in our belly are the bee's knees*

We are one but we are many, thirty-seven trillion in fact. One body made of about 37,000,000,000,000 cells. An almost unfathomable number. To prove the point, try counting the cells out loud: "One, two, three … " It'll take you perhaps five million years.

These trillions of bodily building blocks develop from just two sex cells: a sperm and an egg. So, it's hardly surprising that with genetic and environmental factors influencing the journey from procreating, body-jiggling two to mind-boggling trillions, we all end up different. Distinct features. Diverse personalities. Different anatomy even.


Femur
Fabella
Patella
Tibia
Fibula

Sometimes these anatomical differences are harmful. But when they're reasonably common and generally don't cause problems, they're called "normal anatomical variants." One such variant is a fabella: a little bean in our belly. Though it's not a bean. Or in our stomach.

A fabella is a bone. It's found inside the tendon of the gastrocnemius muscle, behind the lower end of the thigh bone (femur). They are smallish—at about 5–20 millimeters (0.2–0.8 inches) across—and bean-shaped. "Fabella" is Latin for "little bean," like a fava bean. The gastrocnemius muscle, whose tendon they're inside, is named after the Greek for "belly of the leg," because of the way it bulges out of the calf. Similar gut-related words are "gastronomy," "gastrointestinal," and "gastroenteritis."

We're not born with a fabella, they develop as we get older. They're seen after about eight to twelve years of age, and more often in older people. Generally, there are two fabellae, one in each knee.

Bones like fabellae that are embedded in a muscle or tendon are called sesamoid bones. Ancient anatomists thought they resembled sesame seeds. They form in places where there is high stress and strain on bones, muscles, and tendons. The best known, and largest, is the patella, aka kneecap, which acts like a lever to give your thigh's quadriceps muscle more leg-straightening power.

No one knows exactly what fabellae are for; probably to help knees better deal with the exertions of daily life. That may explain why fabellae are on the increase. In 2018, 39 percent of people had one, compared with just 11 percent in 1918, research looking at different populations worldwide found. This could be because we're taller, heavier, and more muscly than our forebears, thanks to changes in our diet. Hence our knees need more help from fabellae.

Little bones that add quite a few million more cells to the 37 trillion that make up our anatomy.

## Femoral triangle

*How you shouldn't be too sanguine about exsanguination*

Cat burglars have eight fewer lives than cats. Nine, if they succumb to "Break, enter, and die syndrome."

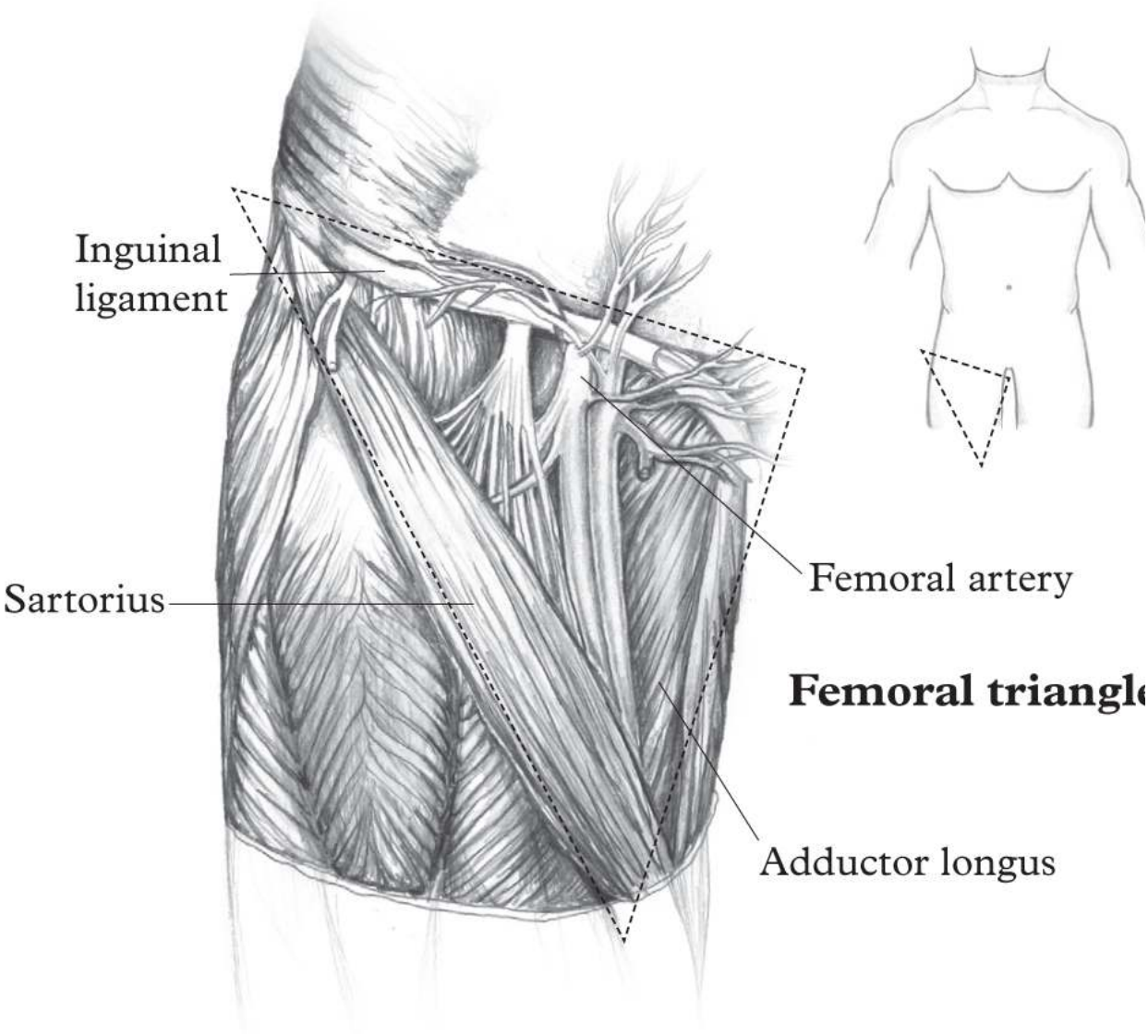
It's a bloody death for felons in a perfect storm of jeopardy. Drunk, drugged up, and pumped with adrenaline, on the wrong side of the law *and* a window. It's curtains for them as they kick through the glass to break in, not noticing the small wound in their groin. Unaware a shard has stabbed them in the femoral triangle, they quickly collapse and die.

The femoral triangle is your body's Bermuda Triangle. When things fly into it, the consequences can be catastrophic. Injure the femoral artery that runs through it, and you can bleed to death in fewer minutes than there are syllables in exsanguination.

This triangle in your upper thigh is formed by two muscles and a ligament. Here, you can feel your femoral artery's pulse. The vessel is about as wide as a fingernail and dangerously close to your skin, unprotected by muscles or bone. We've only about 5 liters (1.3 gallons) of blood, and during exercise more than that can course through the artery every minute. Do the math.

Femoral artery injuries are reasonably common in soldiers, and becoming more so in civilians caught up in gun and knife crime. The good news is, treatment advances mean that if victims get help *stat* their chances of survival are good.

Early credit goes to Ambroise Paré who revolutionized treatment of gunshot injuries in sixteenth-century Europe. Military surgeons at the time believed gunpowder poisoned wounds, and, never reticent to inflict excruciating pain—it was pretty much part of their job description—prescribed boiling oil to "detoxify" the powder and arrest the bleeding. Paré took an altogether gentler approach, replacing scalding oil with balm made from egg yolk, rose oil, and turpentine, along with tying wire around cut arteries to seal them off.




The French surgeon also disproved a bizarre theory about bezoars, clumps of undigested gunk, sometimes found in animal, and human, guts. Obsessively eating stuff like sunflower seeds, hair, or polystyrene cups (it's a "thing," it's called polystyrenomania) can cause them.

Bezoars were believed to be antidotes to any poison. Paré persuaded a thief on death row to drink a toxic potion, then munch on a bezoar. If he lived, his life would be spared. Like the cat burglar outside the window, he was also in a perfect storm of jeopardy.

## Frontal lobe

*How metal bars and brains don't mix*

When a meter-long iron bar exploded into Phineas Gage's left cheek, spearing through his brain and out the top of his skull, you'd have assumed it would have had a profound effect on his life. As in, end it.

But you'd have been only half right. Gage survived. Though in one sense, he didn't, because he was no longer the man people knew before the bar obliterated a chunk of his brain. Gage had a whole new personality.

Gage's loss—of his brain's left frontal lobe—was medicine's gain. His case was perhaps the first to link a part of the brain with personality. This influenced many fields, including indirectly paving the way for approaches that led to the infamous lobotomy procedure.

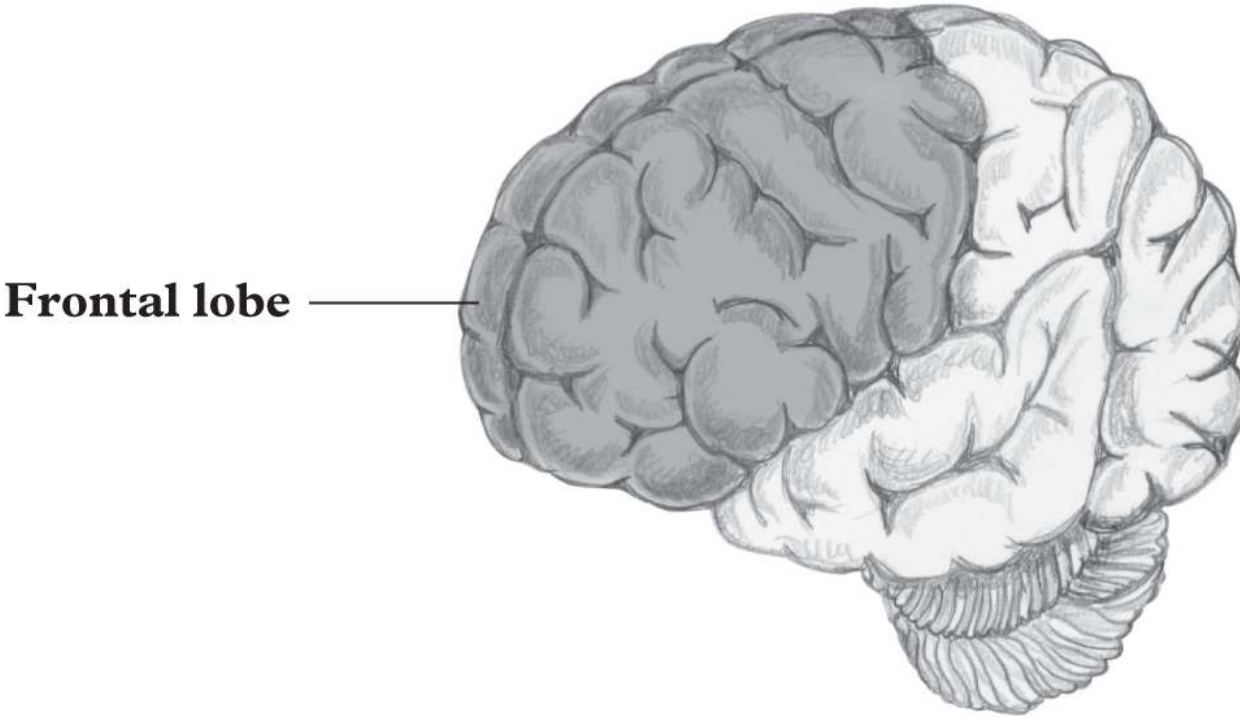
Before Gage's brain explosion, the capable, even-keeled American was a railway construction foreman in Vermont. On September 13, 1848, he was leading his team in the dangerous task of rock-splitting. While using an iron bar to ram gunpowder into a hole in a boulder, a spark was ignited. And the rest, along with Gage's frontal lobe, is history.

Just two months later, Gage was able to walk around in public, but was, in his doctor's words, "no longer Gage." Impulsive, irascible, rude, and unable to take advice or plan ahead, you could say he'd regressed, with the persona of an obnoxious, feckless teenager.

Makes sense. Sitting behind our forehead, the frontal lobes are our brain's Chief Execs. Crucial in their job description are high-level executive functions. Grown-ups' skills. Talents that separate the men from the boys, like reasoning, planning, self-control, and decision-making. The frontal lobes are among the last brain regions to fully develop. Teens, and their frontal lobes, are immature, obvs.

Following his accident, Gage's life fell apart. For a time, he, along with his iron bar, was an attraction at Barnum's American Museum in New York City. He died twelve years after his brain injury from an epileptic seizure likely related to the accident.

About ninety years after that, in 1949, Portuguese neurologist Egas Moniz received the Nobel Prize for pioneering lobotomy for people with various mental illnesses. In the 1940s and '50s, more than 50,000 people had lobotomies in the US. One technique involved poking a metal instrument—initially an ice pick—through the bone behind the eye and waving it around to damage connections between the frontal lobes and other brain parts.




Today, lobotomy is widely discredited, and there've been calls to rescind Moniz's prize. However, an article on the Nobel Foundation's website says there's "no doubt" it was deserved. Bearing in mind the harm the gruesome procedure caused, this doesn't seem like a particularly noble position.

## Fungiform papilla

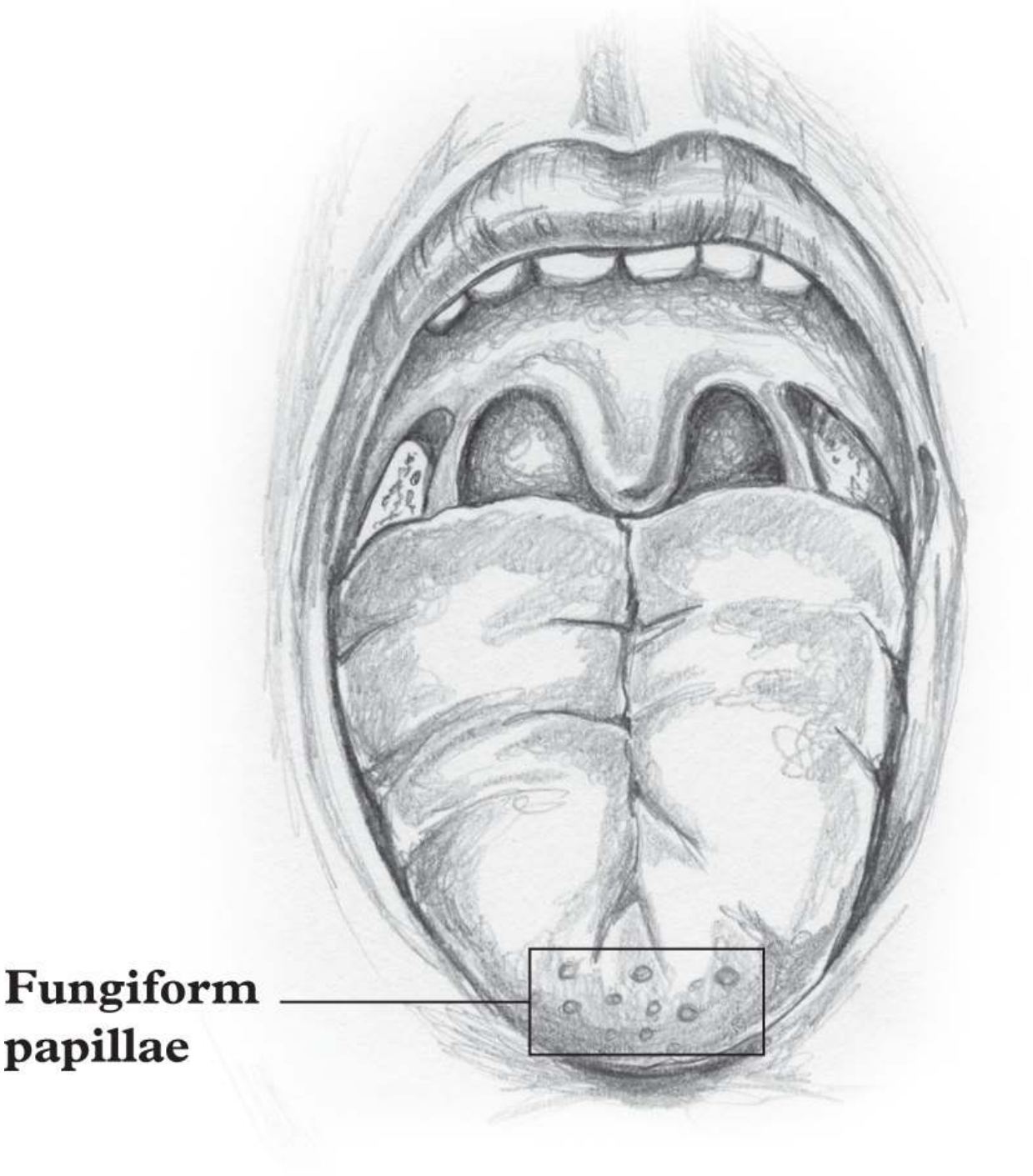
*How tongue nipples can be in very poor taste*

Superpowers separate the superheroes from your everyday heroes. Mums, nurses, teachers, and so on. At least they do in the movies. But here's the thing, superpowers aren't solely the realm of camp, caped-crusading fantasy. They're *for real*. Because among us is a legion of humans with a very special superpower.

They are the "supertasters." About 25 percent of us, and more women than men, are cursed with this superpower. Cursed, because their special power is the ability to experience tastes particularly intensely, especially bitter foods like broccoli, cabbage, and brussels sprouts. They are the kids who go green at the gills when presented with a plate of greens.

This bitter pill is likely due to having certain types of taste genes. Supertasters also have an unusually large number of fungiform papillae on their tongues, research has shown, though not all studies agree.

Fungiform papillae are one of the locations for taste buds. You'll find them on the top of the tongue, concentrated near its tip and edges. Tongues have between two hundred and four hundred of these mushroom-shaped—hence "fungiform"—structures. They're also nipple-shaped, "papilla" being Latin for "nipple." They, and the other types of papilla on your tongue's top, are the reason its two sides feel very different. Your tongue's underside is smooth. Its flip side, the licking side, feels like very fine sandpaper, because of its papillae.




Despite all these papillae and their taste buds, you're actually a very limited taster. Foodies' claims that they appreciate loads of exotic tastes should be taken with a pinch of salt. They can distinguish a vast array of aromas, but recognize just five basic tastes: sweet, sour, salty, bitter, and

umami. Umami is a Japanese word, roughly translated as “savoriness.” To savor it, get some anchovies, ripe cheese, and soy sauce down you.

Researchers are also investigating whether fatty, alkaline (the opposite of sour), metallic, and watery are also basic tastes. Spicy certainly isn’t; it’s a pain signal.

But no matter how many tastes we perceive, much of a meal’s flavor is due to its smell. Think back to the last time a bad cold left food flavorless, robbing eating and drinking of a good deal of its enjoyment. A review article explained why: “… the pleasure, all the interesting dimensions of what is commonly called taste, the meaty, the floral, the fruity, the herbal, the citrus, the burnt, all derive primarily from the contribution of olfaction [smell].”

Irrespective of whether we’re supertasters, we’re all super smellers.

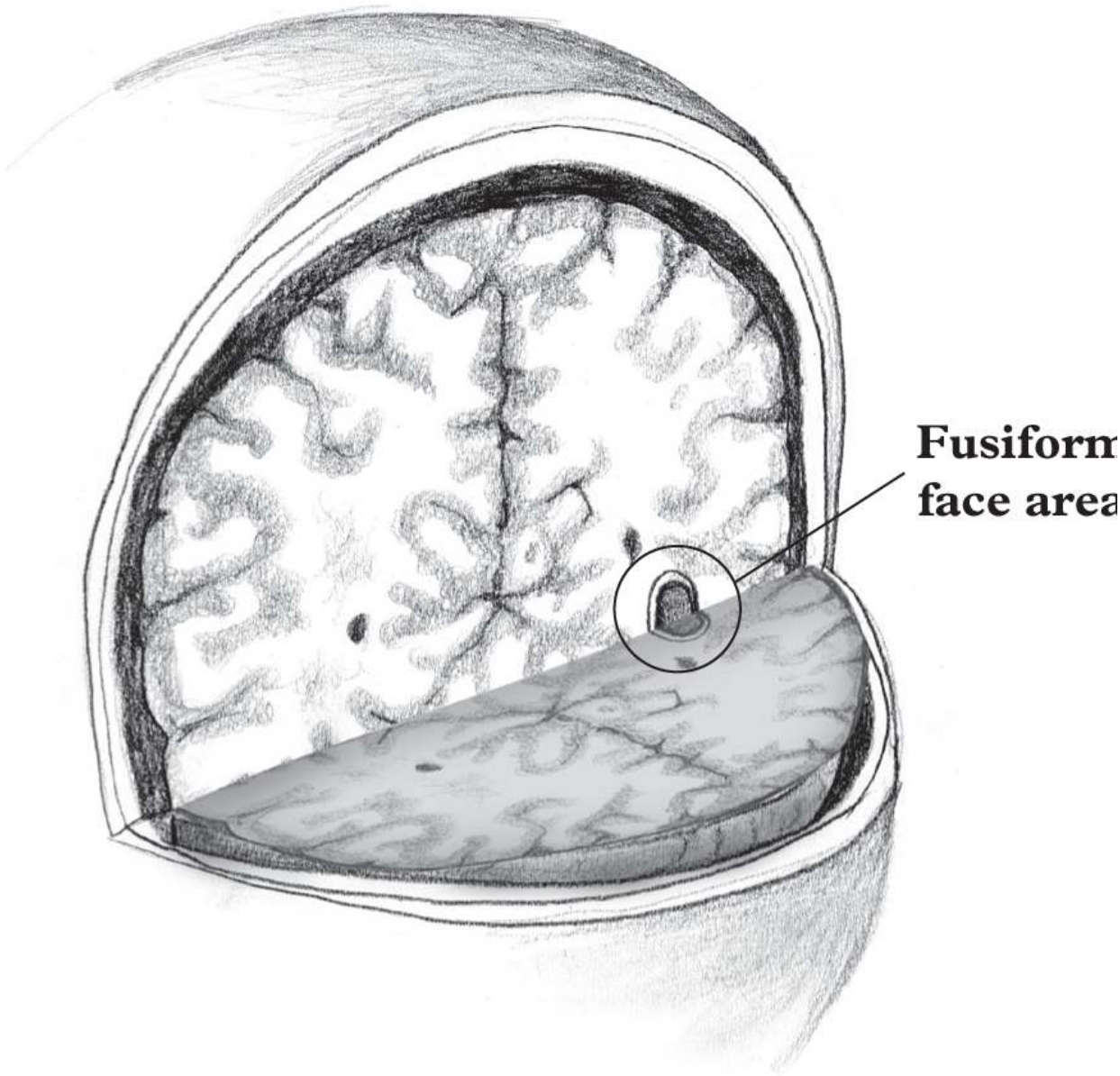
## Fusiform face area

*How everyday miracles are staring you in the face*

When Diana Duyser put two slices of bread and some Kraft American cheese into a pan, all she hoped to make was a toasted cheese sandwich. The Florida woman didn’t bargain on the toastie making her $28,000 USD, and internationally famous. Duyser made headlines worldwide when she sold the snack, complete with a bite taken out of it, to a casino in 2004. So why would anyone fork out all that dough for some humble, half-eaten bread and cheese? For the answer, look to your fusiform face area, and the Bible.

Duyser’s bread was miraculous. Not in the same league as Holy Communion bread maybe, but wondrous nevertheless. Because in the toast’s crisped pattern, the Virgin Mary’s face could be seen. So Duyser claimed.

This tendency to see human faces in everyday objects is called face pareidolia. The illusory faces often even seem to have personalities: glowering clouds, scowling trees, smirking rock formations, and so on. Face pareidolia is hardwired into our brains. So, it’s not surprising that so many people believed Duyser’s wonder bread was Holy Toast.




Our brains are experts at recognizing human faces. You already know that, think how effortless it is, especially bearing in mind every face on the planet is different. One part of your brain believed to be critical for face recognition is the fusiform face area, a blueberry- sized region on the underside of each of the brain's temporal lobes. Brain scans show heightened activity here when people look at faces, but not necessarily when they gaze at other things, like pictures of houses.

The fusiform face area also activates when people experience face pareidolia. Hence, it's believed that the phenomenon is a result of our face

recognition system's sensitivity for face-like cues. We're incredibly attuned to seeing human faces, so we also see them in random, non-human places.

Other evidence for the fusiform face area's role in facial recognition has come from people who've damaged this part of the brain, for example after a stroke. They can lose the ability to recognize faces (prosopagnosia), but can still identify people using other clues, like their voice.

People with prosopagnosia lack a fundamental life skill. It pays to be a face aficionado. To know almost instantaneously who owns the face, and then "read" it for vital information like age, gender, and, of course, emotions and intentions. Happy or sad? Calm or agitated? Mate or mortal enemy? It's crucial today, and certainly was for our ancestors. Without it, they'd have been toast.

## Galea aponeurotica

*How legions of invaders took their scalps*

The Swiss are renowned for watchmaking. The Scots, deep-frying chocolate bars. And the Scythians, scalping. Sliding a sharp blade under an enemy's galea aponeurotica and ripping their scalp off is very much in the Scythian wheelhouse. The ancient Greeks even invented a word for scalping in their honor: *aposkythizein.*

Happily, the Scythians are long gone. These tribes of nomadic warriors flourished from roughly 900–200 BCE across a vast swathe of Central Asia. But tales of their quite literally hair-raising exploits live on. The ancient Greek historian Herodotus described scalping, Scythian-style: "In order to strip the skull of its covering, he makes a cut round the head above the ears, and, laying hold of the scalp, shakes the skull out; then with the rib of an ox he scrapes the scalp clean of flesh, and softening it by rubbing between the hands, uses it thenceforth as a napkin."

As the Scythians were declining, the Romans were on the up, thanks to legions of soldiers who wore a "galea." This helmet gave its name to your scalp's galea aponeurotica. It's a tough sheet of tissue that runs over your head, from the frontal bellies of the occipitofrontalis muscles in your forehead to the occipital bellies at the back of your head.

Underneath the protective galea aponeurotica, there's only a loose connection to your skull, so your scalp can move over the bone. Tense your occipitofrontalis muscles and you might feel your scalp shift. The downside

of the galea's weak underside is that we're vulnerable to scalping injuries, and Scythians.

The other half of your galea aponeurotica's name is a mistake. The ancient Greeks initially couldn't distinguish nerves and tendons, calling them both "neurons." Hence "aponeurotica"—the "apo" part meaning "from."

Many centuries after the Scythians, ancient Romans, and Greeks, a new invader—COVID-19—focused attention on our galea aponeurotica and the attached occipitofrontalis muscles. The muscles raise your eyebrows, facial features that are adept at oiling the wheels of our social interactions. Eyebrows may be more useful than eyes in helping us recognize people, research shows. So, when a mask is covering half your face, your brows, and their expressive know-how, are vital.

Because of their nonverbal eloquence, cartoonists pay special attention to eyebrows when bringing characters to life. For example, raising them turns a statement into a question. And of course they're highly emotionally articulate. Raised eyebrows can express many feelings: surprise, disapproval, horror while witnessing a Scythian *aposkythizein*-ing. Or worse, a guy in a kilt deep-frying a chocolate bar.

## Glabella

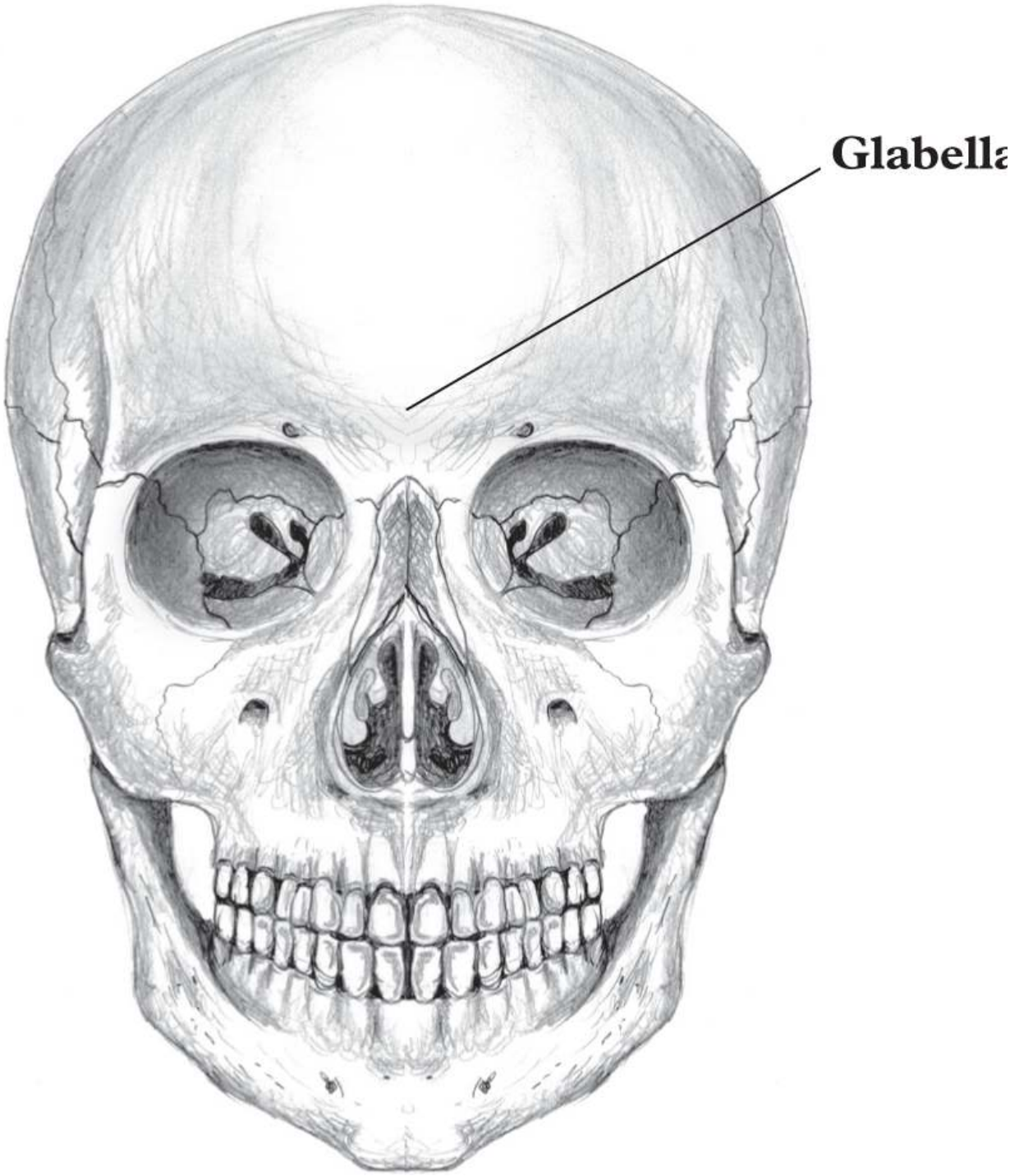
*How beauty is in the eye of the beholder, and eyebrow of the beholdee*

If you're the proud owner of a bushy monobrow, your glabella isn't living up to its name. That's no bad thing in Dushanbe, Tajikistan. One-eyebrowed women strutting the streets of the Central Asian nation's capital turn heads. Here a unibrow—synophrys, in medical lingo—means you're hot. Hairy skin above the glabella—a patch of bone just above the bridge of the nose—sets pulses racing.

"Synophrys" is from the ancient Greek for "with meeting eyebrows." Usually, eyebrows don't meet because they're separated by the relatively smooth, hairless glabellar skin. It's "glabrous," as are smooth, hairless leaves, like those of the bay laurel, rubber plant, and holly. Hence, monobrowed Tajikistanis have eyebrows joined by hairy (non-glabrous) glabellar skin.

Your glabella is part of your face's frontal bone. It's between your two superciliary arches, the bony ridges above your eye sockets from whose

lower borders your eyebrows sprout. Haughty Dushanbe residents who raise their eyebrows at women without unibrows could be said to be "supercilious," which is from the Latin for "eyebrow."



However, the glabella reveals much more about you than whether you're dazzling or drab in downtown Dushanbe. It's at the epicenter of our emotional expressiveness. Our face communicates the gamut of emotions: sadness, fear, anger, elation, surprise, lust, perhaps a curious combination of these, and beyond. And when people judge how we're feeling from our face, they look most at our eyebrows, followed by mouth and eyes.

Our glabellar skin is a powerful communicator. Mus- cle contractions make skin patterns here usually associated with negative feelings, like anxiety, irritation, tiredness, anger, and frustration. And this is often where the first wrinkles appear on our forehead. These vertical lines, sometimes called "elevens" (think how the number looks), can make us seem older than we might like. Research shows that when people are asked to guess someone's age from a picture of their face, they look more at the glabella in those they rate as old versus those they think are younger.

The glabella also reveals clues about our brain's health. Get a friend to gently tap, tap, tap their finger on your glabella, and your eyes will blink, blink, blink. This reflex is designed to protect newborns' eyes, it's believed. After a few taps, you get used to it, and stop blinking. But in people with some neurological problems, such as Parkinson's disease, the blinking doesn't stop, as neurologists at Dushanbe's Avicenna Tajik State Medical University would attest.

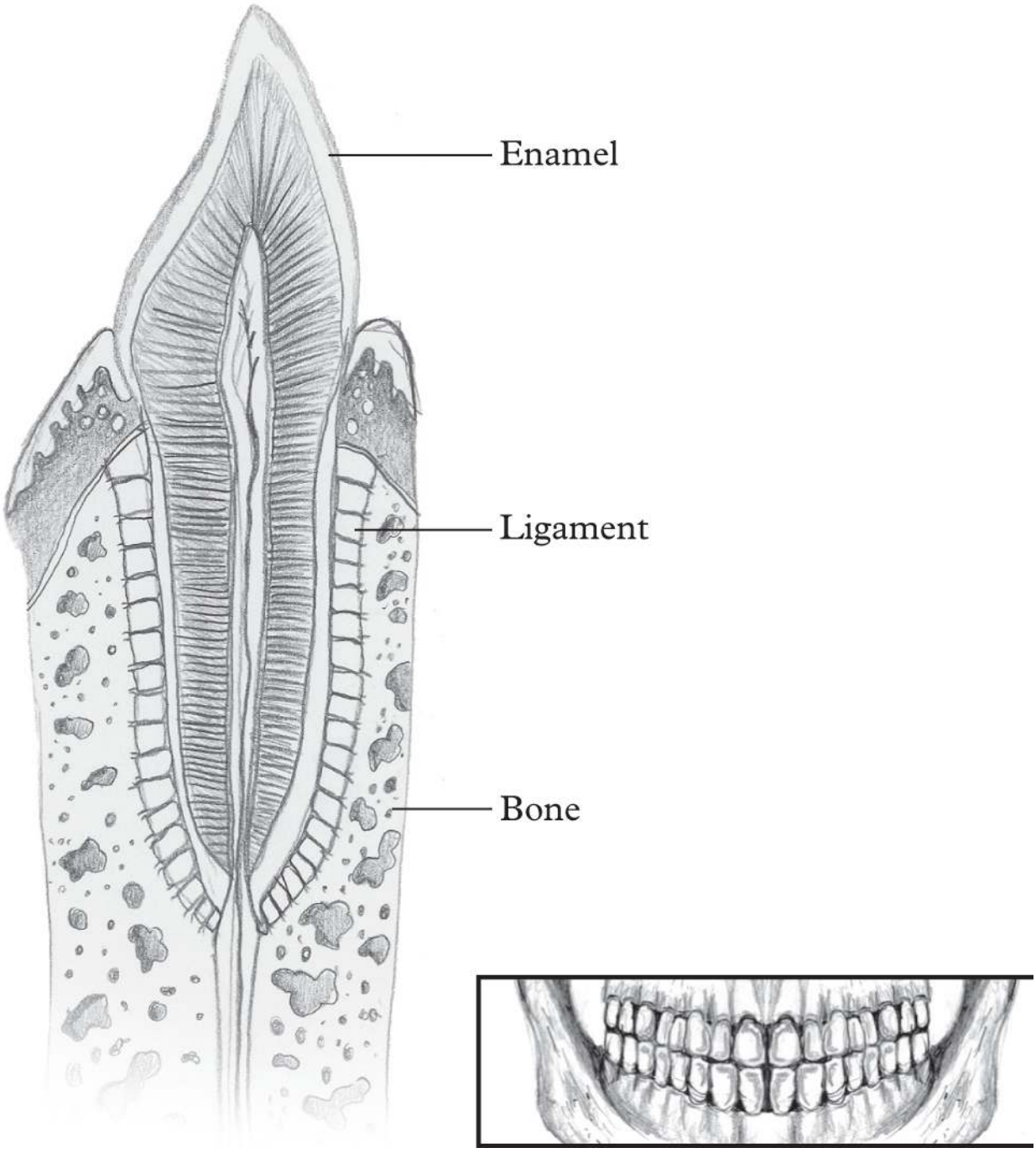
## Gomphosis

*How tough guys clash gnashers*

Italy, 1968, and John Massis is doing with his gomphoses what usually only inclement weather, technical glitches, and global pandemics can. At one end of a rope is a plane, propellers whirring. On the other end is Massis, muscles straining. But the rope isn't in the strongman's hands. Biting hard on a grip, Massis—"The Belgian Hercules"—is preventing the plane from taking off … with his teeth.

Gomphoses are a mouthful: their name's a tongue twister, and your mouth's full of them. They are the peg-and-socket joints that keep your teeth stuck inside your jawbones. They're like the wooden dowels, and the holes you hammer them into, when assembling flat-pack furniture (an ordeal that's left many couples feeling like the only thing they've screwed is their relationship).

## Gomphosis




But back to you. Irrespective of whether you could pull off Massis's feat of strength, your gomphoses are super sturdy, teeth being anchored in their sockets by strong ligaments. They're tough as nails: "gomphosis" is from the Greek for "nail." They have to be, to cope with a lifetime of chewing,

crushing, and crunching, made possible by your powerful jaw muscles. One of them, the masseter, is your strongest muscle, pound for pound.

Teeth also protect themselves with a layer of enamel, your body's hardest substance, harder than steel. Enamel can repair itself, to an extent, but if the decay continues, a cavity forms, requiring a trip to the dentist. When dentists grapple with gomphoses, they need power tools and anesthetic—an invention pioneered by Horace Wells, the original Dr. Jekyll and Mr. Hyde.

In 1844, the US dentist recognized that nitrous oxide (laughing gas) could be used as an anesthetic to extract teeth painlessly. But when Wells demonstrated the discovery in Boston, the gas bag was removed too soon, and the patient cried out, as if in pain. Many in the audience dismissed the whole shebang as "humbug."

Soon after this humiliation, a sick Wells gave up his dental practice. His predicament went from bad to worse when rivals claimed they'd actually discovered anesthesia. By 1848, Wells had moved to New York City and was addicted to chloroform, another anesthetic gas. He was arrested after throwing sulfuric acid over women in the street while under the influence. Holed up in prison and racked with guilt, he committed suicide.

Some say Wells was the inspiration for the Jekyll and Hyde story, admittedly without much evidence. You can say, or rather gurgle, thanks to him next time you're in the dentist's chair, as the dreaded drill gets to work.

## Gubernaculum

*How governors guide nomad gonads*

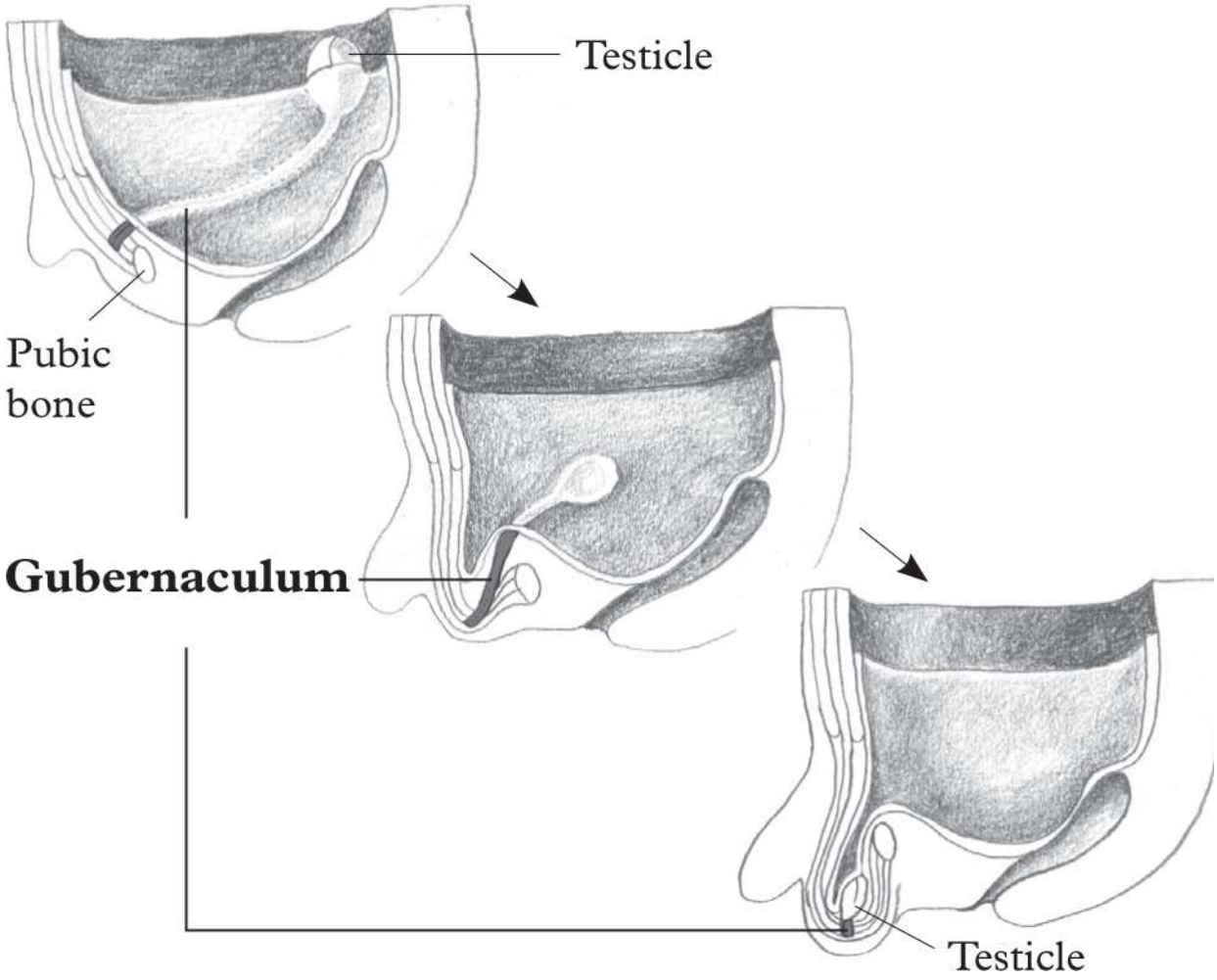
Testifying in court can be stressful at the best of times. If you struggle with English, it can be doubly discombobulating, as per this testimony from a 1981 New York trial: "Is an eagle a bird?" "I guess so," replied an ornithological expert witness in the bird smuggling case. "Is a swallow a bird?" "I don't know what a swallow is, sir." "Is a duck a bird?" "Not to me, it is a duck." Like this seemingly featherbrained testifier, testicles are also expert witnesses. However, testes are naturals, whatever the circumstances.

"Testis" is likely from the Latin for "witness," because they were said to testify to a man's virility. The sac they sit snugly inside is another expressively masculine word, "scrotum" being related to "scrautum," Latin for "quiver," a leather pouch for arrows.

But testes don't start life in the scrotum. They originate high up at the back of a fetus's abdomen and travel to the scrotum. Each testis descends along a path defined by a gubernaculum, a cord of tissue connecting the gonad and developing scrotum.

Eighteenth-century Scottish surgeon John Hunter named it "gubernaculum," after the Latin for "rudder." Hunter thought it steered the testis during its voyage through the high seas of its owner's anatomy. Likewise, "gubernators" guide people when they govern.

Hunter is known as the "father of scientific surgery." One of the greatest surgeon-anatomists of his day, he was also a keen collector of anatomical specimens. One trophy he particularly coveted was the body of Charles Byrne, aka the "Irish Giant." Byrne stood 2.31 meters (7 feet 7 inches) tall and performed as a circus attraction. Problem was, the giant was *alive*.



True to his name, Hunter put the word out that he was after Byrne's corpse, if and when the Irishman met his maker. However, Byrne got wind of this, and it's said he tried to thwart the surgeon by planning to be buried at sea. But the giant was no match for the unscrupulous sawbones. When Byrne died in 1783, Hunter paid the Irishman's "friends" £500 for his body.

Hunter had Byrne boiled down to the skeleton, which he duly put on display. After Hunter's death, his collection was housed in London's Hunterian Museum. In January 2023, the Board of Trustees of the Hunterian Collection said it would no longer display Byrne's bones. Though it declined to bury the giant at sea, declaring it would retain the skeleton as part of the collection, and make it available for research purposes.

Hunter, it seems, is still the governor, or rather, gubernator.

## Hallux

*How fashion victims' boots aren't made for walking*

The evolutionary leap from walking on all fours to striding tall, upright, was critical in enabling us humans to stand on our own two feet.

While we don't know for sure why we evolved like this, it was certainly a boon, freeing up our hands for carrying, crafting, and communicating. Hands that could also hit harder—useful when the name of the game is "survival of the fittest." Walking upright was likely also more energy efficient for our ancestors, among other things. But this game-changing evolutionary feat has had one major drawback. A fundamental flaw in our makeup that suggests we've evolved too far for our own good. An Achilles' heel that's evident as some of us totter about on two feet: high heels.

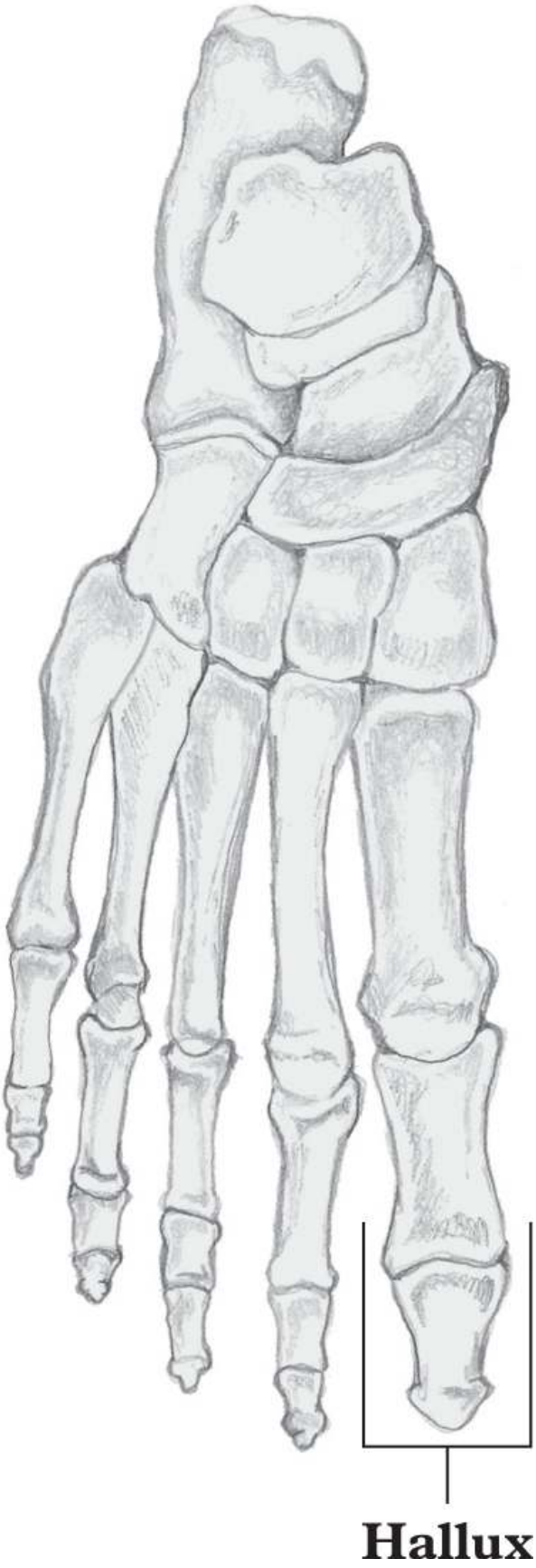
Absurdly altitudinous, ostentatious pumps, mules, and stilettos are weapons of crass destruction. An estimated 125,000 women were treated in US emergency departments for high-heel-related injuries during 2002–12. About one in five of these fashion victims had fractures. And if you're rocking towering stilettos, you're literally dressed to kill. Named after a type of dagger, they've been used as a murder weapon.

High heels also increase the risk of bunions, aka hallux valgus. This common deformity of the hallux (big toe) occurs when its tip is pulled toward the other toes. The tugging on the hallux makes the joint at its base stick out, leading to the bony bump that is a bunion.

It’s not known whether high heels directly cause the problem; they may exacerbate underlying physical abnormalities, leading to the bunion. They’re far more common in women, thanks in part to their footwear choices, though this is still the case in groups of people who go barefoot.

High heels are hot on the high street, but bunions aren’t just a modern phenomenon. These painful bumps put the evil into medieval. In fourteenth-century England, a trend for pointy shoes with pointlessly long tips saw a rise in bunions. Ye olde fashionistas afflicted with hallux valgus were more likely to have a fracture, probably caused by falling over, than their bunion-less buddies, reflecting the big toe’s importance in walking and balance.

The hallux possesses just two of the foot’s twenty-six bones, but is a big player in locomotion. Our toes, especially the hallux, enlarge the foot’s weight-bearing area as we walk. The peak force under the hallux during a stroll is one and a half times that of all the other toes combined.


Hallux

You'll also be interested to know that if your hallux is much longer than your other toes, then you're a creative whizz. If it's short and stubby, you're a great multitasker. This is the ancient art of foot reading. Like palmistry, but smellier, this sole-searching divination illustrates another evolutionary bonus that sets us apart from our ancestors: creative imagination.

## Hunter's canal (adductor canal)

*How a pus-pricked penis stymied medical progress*

Superstar surgeon-anatomist John Hunter was a man of, let's say, "forceful" conviction. The Scot was even known to stab the odd penis with a needle to prove a point. In this case, the needle's point was smeared with pus from a sex worker's genitals, to test a theory on sexually transmitted infections. An utterly incorrect theory, as it happens.

This was eighteenth-century London, when it was even easier for doctors to get away with murder than it is today. STIs like syphilis and gonorrhea were rampant. More than one in five Londoners had been treated for syphilis by their mid-thirties.

Hunter, a leading authority on venereal disease, believed the symptoms of gonorrhea and syphilis were features of the same disease. So, in May 1767 he took the penis in his hands and punctured it twice with a needle dipped in pus from a sex worker with gonorrhea. Then he waited. And, sure enough, the patient developed classic symptoms of gonorrhea, and a syphilitic ulcer. Eureka. They were both caused by the same "poison." Problem was, Hunter had used pus from someone with gonorrhea *and* syphilis, so of course the hapless victim got both.

Some argue that Hunter died from complications of syphilis, and that he himself—rather than one of his patients—was the experiment's pus-pricked subject. But his account of the experiment doesn't specify who the unfortunate guinea pig was. Either way, it perpetuated grievous misunderstanding about these STIs. It wasn't until many decades later, in the nineteenth century, that it was confirmed that gonorrhea and syphilis had different causes.

"Hunter's canal" got its name following a more successful experiment, on a deer, according to an apocryphal story. While Hunter never wrote a report about this, his colleagues maintained that he tied a ligature around one of the

deer's arteries, to cut the blood supply to an antler. As you'd expect, the antler soon became cold, but after a fortnight had warmed up again. This indicated that blood had found a way to reach the antler via other arteries that had taken up the slack.

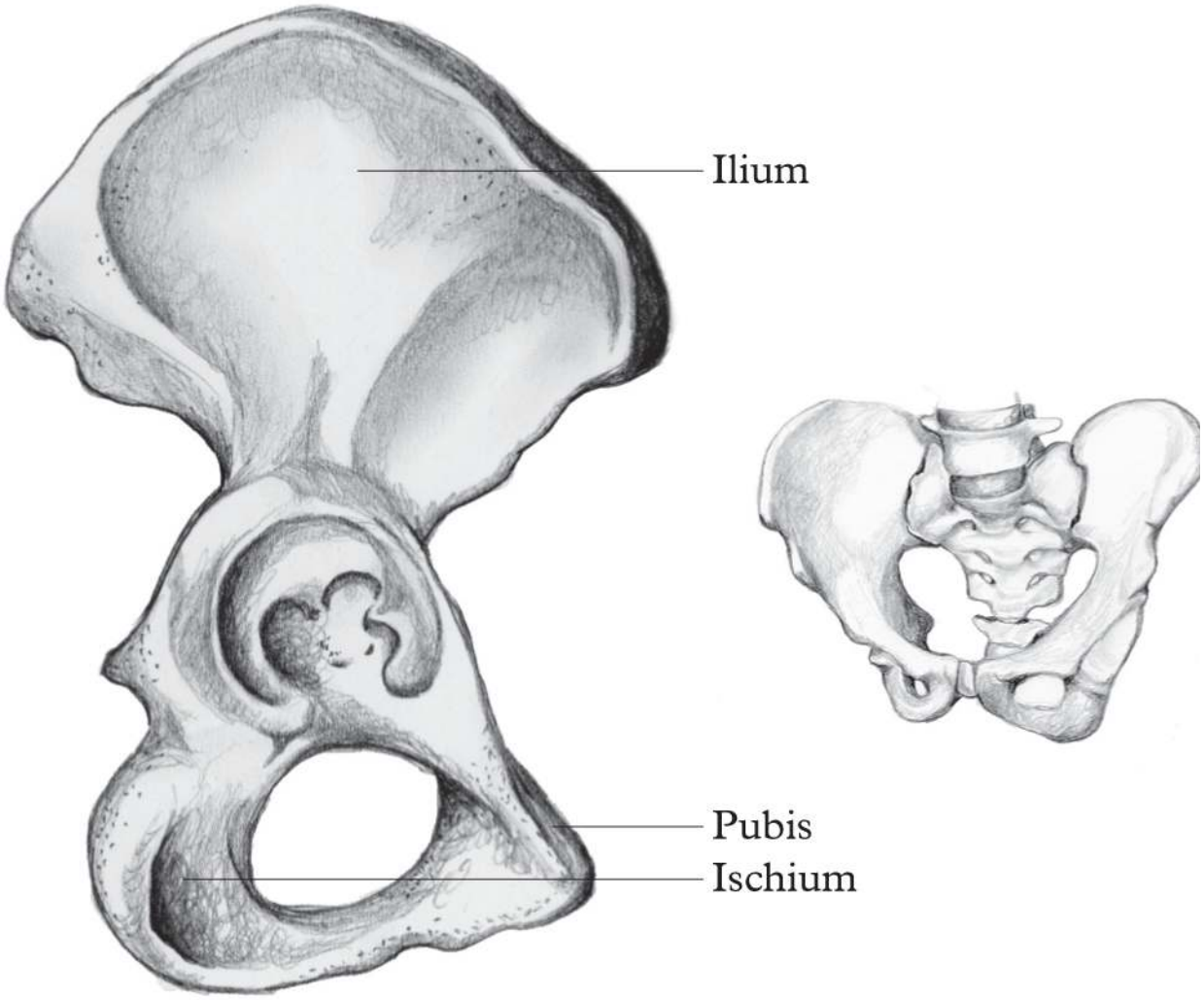
Knowing that blocking a major artery wasn't necessarily catastrophic allowed Hunter to treat popliteal aneurysms, a problem with an artery in the back of the knee, in a way that avoided much more complicated surgery. This involved tying off the superficial femoral artery in what became known as "Hunter's canal" (also the adductor canal). Unlike the owner of the penis, and the antler, this isn't a bone of contention.

## Innominate

*How it's hip to be contradictory*

If an elderly aunt asked you to dust her cake, what would you do? Obviously, you'd sprinkle a fine layer of powdered sugar onto her Black Forest gateau. Though you'd also be well within your rights to give the chocolate, cream, and cherry treat a good going over with your auntie's feather duster.

**Right innominate** (viewed from the side)




Fair enough. “Dusting” is wiping dust off *and* sprinkling it on. It’s a contronym. A word with two contradictory meanings. Same with “sanction,” as in approve, and penalize. And “seed”: adding seeds to a lawn, and removing them, say from a grape. And “bad,” which is also slang for good (if you think that’s only true among the cool kids, you’d be very wrong —“bad” has been used in this way since the 1890s).

The innominate is your body’s contronym. “Innominate” is a name and not a name. It means “no name,” from the Latin, “in” (“not”) and “nomen” (“name,” like “nominate”). It’s also the name of your hip bone or, rather, bones. One on each side, they join at the front, locking onto your sacrum at the back, with the coccyx below, to make the bones of your pelvis.

So, how did this bone get its odd name that's not a name? When anatomists were labeling your bits and bobs, it was like a game of Pictionary, with *even more* blood on the floor. "Say what you see" was the guiding principle. For example:

Animal shinbones were used to make musical wind instruments, so your shinbone is a "tibia," from the Latin for "flute." Alongside the tibia is your "fibula"—"brooch" in Latin, because together the bones resemble one, the fibula being the movable pin. Your small, round, flat kneecap? Easy. A "patella," Latin for "little pan." Your thigh bone is simply the Latin for "thigh": femur. Unimaginative, but reasonable. But your weirdly shaped hip bone? All the anatomists could manage was "innominate." Zero points.

Your innominate is actually three bones joined together: pubis, ilium, and ischium. At the front is your pubis. When you put your hand on your hips, they're resting on your ilium. Sit on your fingers, and you'll feel your ischium.

While their combined form makes naming tricky, it does provide important clues about whether we're Arthur or Martha. Women's pelvic bones are shaped differently than men's, because they have to push babies out. A crime scene investigator needing to identify a skeleton's sex might say that was "bad." If they were into contronyms.

## Jelly of Wharton (substantia gelatinea funiculi umbilicalis)

*How an ingenious gelatinous marvel mimics tomato ketchup*

When Ed White stepped from his Gemini 4 capsule to float in the emptiness of outer space, he was totally dependent on his umbilical. About 7 meters (23.5 feet) long and just 5 centimeters (2 inches) across, the lifeline supplied White with oxygen, power, and comms from his mothership.

White's 1965 spacewalk, the first by an American, lasted all of twenty minutes. A blink of an eye compared with the nine months you spent floating in the inner space of your mother's womb. An experience you survived, thanks to your own umbilical and its ketchup-like jelly of Wharton.

Inside your mum, you couldn't breathe air into your lungs or eat food through your mouth. Like White, a lifeline connected you to your mothership. Your umbilical cord. About half a meter long (20 inches), it supplied oxygen and nutrients.

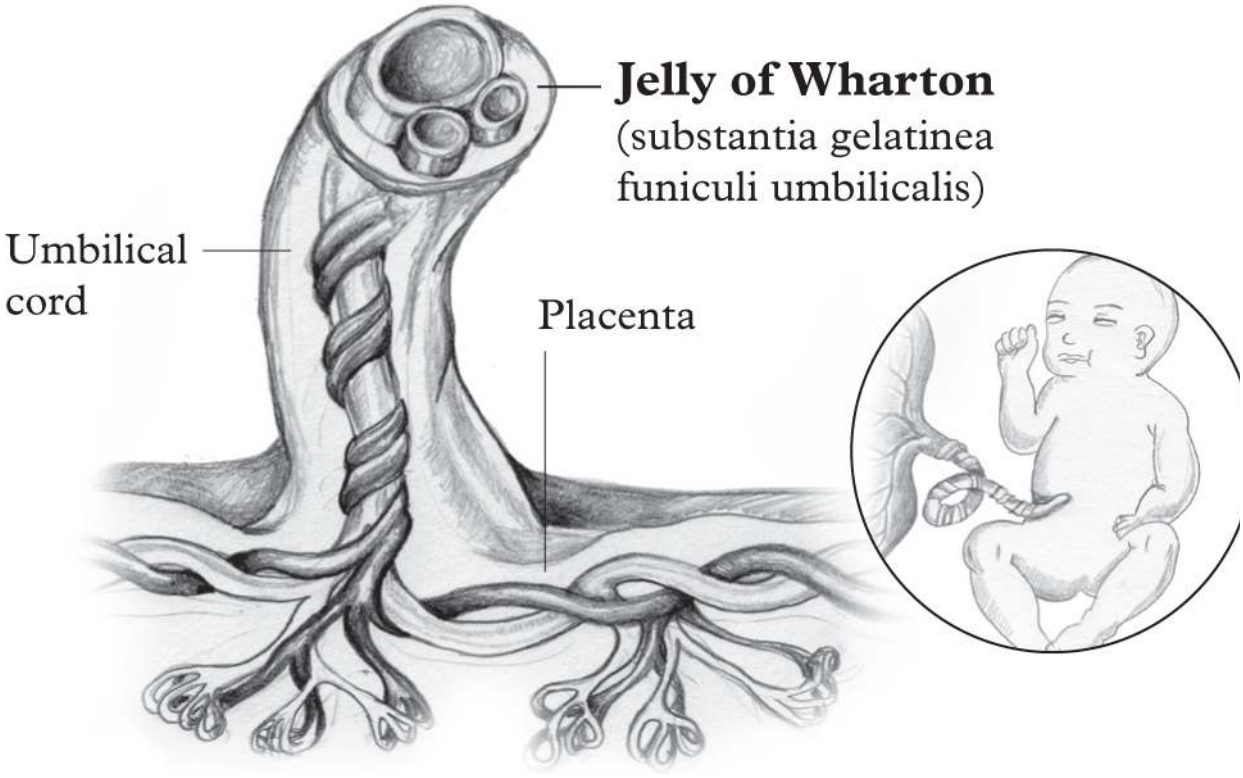
The umbilical cord connects the placenta to the baby's tummy. It's made of two arteries and a vein, surrounded by jelly of Wharton, aka *substantia gelatinea funiculi umbilicalis*. This ingenious gelatinous goo is thixotropic, like ketchup. It's the strange property that explains why you have to shake the bottle to get the sauce out. In other words, ketchup is thick and stubbornly unmoving when it's still. But when it's shaken, it gets thinner and flows more easily.

Hence the jelly of Wharton mechanically supports the vital blood vessels and protects them. When the fetus moves and tugs on the cord, putting pressure on the jelly, it becomes more liquid, counteracting cord bending and helping avoid compression of the vessels.

Discovered by English doctor Thomas Wharton in the seventeenth century, this exotic thixotropic marvel has more umbilical miracles up its sleeve. It helps arrange the umbilical cord's arteries and vein into a special corkscrew shape, a helix. Old-school landline telephone cords were helixes because this discouraged tangling. Nature discovered it, phone companies copied it.

The jelly's final protective act is at the birth. Here, it helps disconnect the newborn baby from the placenta, which exits the birth canal on the other end of the umbilical cord. Immediately after the birth, the jelly reacts to the shock of the sudden drop in temperature, the outside world being cooler than inside the body, by changing its structure, constricting the cord and so helping shut off its blood vessels.

Our shiny space-age technology seems stone-age by comparison.




## Kiesselbach's plexus

*How Attila the Hun had blood on his hands, and face*

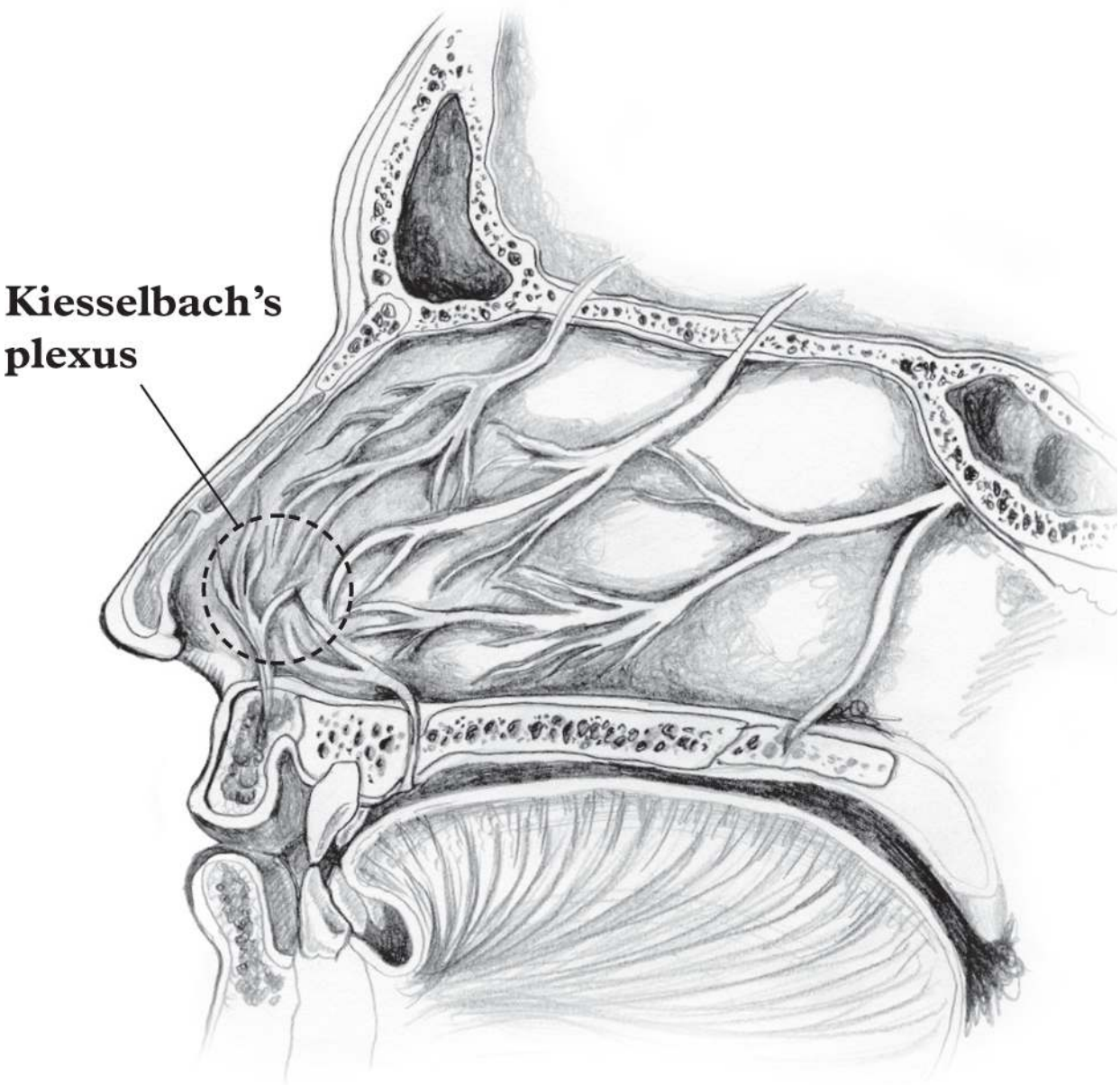
Attila the Hun's wedding was spectacularly bacchanalian. Wine, women, and song. And blood. Lots of blood. But not just any old Hun's blood. Attila's blood.

The year was 453. The blushing bride, Ildico. Dress code: debauchery. And Attila partied like it was 499, carousing, roistering, and debauching until he could debauch no more, finally falling into bed in a drunken stupor. But the next morning he wasn't "Attila the Hungover." The notorious barbarian was stone cold … dead. On his wedding night Attila had met his killer. Though, according to a sixth-century historian, the fearsome warlord they called the "Scourge of God" was undone by nothing more than a nosebleed, the blood choking him to death. Attila the Hun: bloodthirsty in life *and* death.

Next time a nosebleed drips down your face, blame your Kiesselbach's plexus. It's the most common source of nosebleeds, which doctors call epistaxis, from the Greek word "stazein," "to drip." Related words are "stalactite" and "stalagmite." Your Kiesselbach's plexus is a collection of blood vessels, one on each side of your nose's wall, or septum. (It's a

“septum” because it “separates” one nostril from the other.) Here, five arteries end in an intricate network. Hence “plexus,” from the Latin for “hair braid.”

Named after Wilhelm Kiesselbach, a German doctor who wrote about it in the 1880s, this plexus is part of your lungs’ air conditioning system. Lungs like warm, moist air, so the blood in the plexus’s vessels heats the air you inhale.



Damage to the blood vessels causes the nosebleeds. Often, it's due to nose picking, digital manipulation in polite company. (Not that there's anything polite about digital manipulation.) It's why nosebleeds are common in kids.

The cause of Attila's hemorrhage is unknown, likely something much more serious than digital manipulation damaging his Kiesselbach's plexus. And ancient epistaxis remedies wouldn't have been much use. Some of these were more dubious than others. For example, in the first century CE, Roman author Pliny the Elder recommended snail secretions to control the bleeding.

In the Middle Ages, cranial moss therapy involved waiting for a body that had been hung to decompose, scraping off the lichen that grew on its skull, and sticking the putrid powder up your nostrils. If there wasn't a rotting corpse handy, you could try mumia, a dodgy black goo supposedly made from Egyptian mummies, no doubt sold in pyramid schemes. Attila the Hun would likely have looked down his nose at that.

## Lacrimal gland

*How a good blubber proves you're only human*

Women do it more than men. It can be a cathartic release of emotional energy. And it makes us uniquely human, along with our intelligent brains, sophisticated language, and inexhaustible propensity to LOL at cat memes.

Emotional crying. It's in our nature. And it separates us from the rest of nature. To be *Homo sapiens* is to weep at a wedding, blubber after a birth, and bawl during the breakup.

Of course, if you type "animal tears" into an image search engine, you'll get crying kittens, moist-eyed puppies, and weeping elephants. A Noah's ark of anguish. But any floods of emotional tears are solely the viewer's. Animals make tears to keep their eyes lubricated and clean. They don't well up with emotion, it's believed.

Though, no matter how we're feeling, our lacrimal glands are always on the go. These small, tear-shaped, tearjerkers make 60–120 liters (16–32 gallons) a year, enough for a bath. There's one in each eye socket, above the outer part of the eye. The salty fluid they continually produce mixes with oils from other glands, forming a protective film that cleans our eyes and helps with vision. Blinking moves the tear film to the inside corner of our eye, where it drains down ducts into our nose.

These are run-of-the-mill, everyday tears. In contrast to emotional tears, and another type—reflex tears—that occur when our eyes are irritated. Tears precipitated by raw onions *and* feelings.

These weep-inducing feelings change as we age. Crying because of the pain of loss or powerlessness is a constant throughout life. Whereas physical pain makes kids cry in a heartbeat, but not often adults. As we get older, we're also more likely to shed happy tears.

Men have a predisposition for these joyful tears, relative to women, who are more likely to cry in conflict situations than guys. And overall, women cry emotional tears two to four times more often than men, research in Western countries shows.

Most people say it helps them feel better. Crying can also help due to its effect on others. "Tearful crying is hypothesized to facilitate social bonding, to elicit sympathy and empathy, to promote cooperative and helpful behavior, and, probably, the inhibition of aggression in assaulters," a review of the subject says. "Increasing knowledge [about crying] may contribute to a better understanding of human nature."

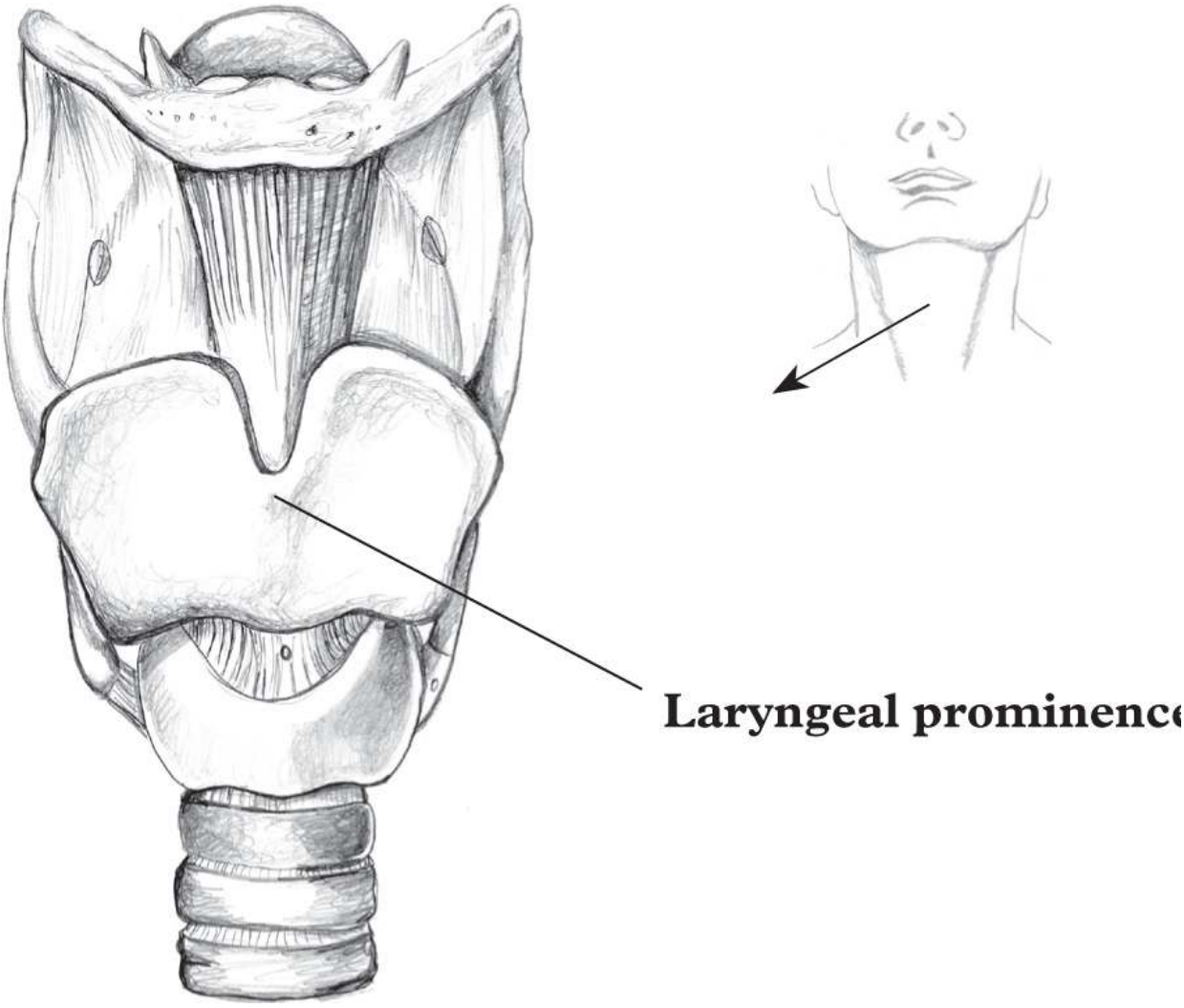
That's especially because, despite claims of emotional tears in animals like horses, elephants, and crocodiles, the best study available found no evidence that they were triggered by feelings. They were crocodile tears.

## Laryngeal prominence

*How art, and anatomy textbooks, put the Eves of this world in their place*

Women have lived with sexism since the year dot. Since before women even existed. Adam was first. Eve followed. And the Garden of Eden was no walk in the park for Eve. As they posed for pictures, it was clear that Adam was the righteous one and Eve, a sinister temptress.

Obvious, because in art Adam is usually shown on the right: "righteous." Sinister Eve on his left. "Sinister" being from a Latin word meaning "on the left side." In pre-1600 artworks, Eve is four times more likely to be on the sinister side (on the right, from the observer's viewpoint) than Adam, a study found.




This isn't just word play. It's sexism at play. This symbolism of male virtue / higher status on the right and female vice / lower status to the left having permeated art history. As the study researchers said: "Eve, female, lesser, sinful temptress on the left; and Adam, male, higher, virtuous, and tempted on the right."

The First Couple: *BRO*TUS and *TEMPT*US, all thanks to a forbidden fruit that Eve ate, then supposedly persuaded Adam to try.

Once they'd put on their chic fig leaf outfits to hide their modesty, one way of telling man from woman was Adam's laryngeal prominence, aka Adam's apple. This lump is part of one of the cartilages of the larynx (voice box) and protects the vocal cords. It's more prominent in men, becoming

bigger after puberty, and likely also plays a role in the deepening of the voice.

In medieval times, it reminded people of a fruit, though *not* an apple. Arab writers called it a "pomegranate," and Europeans copied them, using a Latin term for the fruit that means "Adam's apple." The widespread belief that the popular name for the laryngeal prominence comes from the story that God made a hunk of Granny Smith stick in Adam's throat to remind him, and all men thereafter, of his sin, and Eve's part in it, is a myth.

So Eve unfairly gets it in the neck in our necks, and in Renaissance art.

Women also experience sexism in anatomy textbooks. Research looking at ten textbooks found images of male bodies predominated. Though perhaps the most scandalous example of anatomy textbook sexism involved the opposite.

Almost 80 percent of the images in *The Anatomical Basis of Medical Practice* were female. The problem with this 907-page tome, published in 1971, was the sexually suggestive comments about women, and pictures of naked models posed like *Playboy* centerfolds.

The textbook was withdrawn from the market after a tsunami of criticism, some angry, some more measured, as per this quote from a 1972 book review in *Archives of Surgery* that's certainly "of its time":

> I feel compelled to say that the numerous photographs of comely young women, while enticing, do not well demonstrate the muscles and bony points the legends suggest as their purpose.

Incidentally, dark skin tones are also underrepresented in anatomy textbooks. And in Renaissance art, one suspects.

## Left ventricle

*How the heartbroken are trapped like a Japanese octopus*

When Jimmy Ruffin asked "What Becomes of the Brokenhearted" in his 1966 hit single, the Motown icon was remiss in not providing an answer. Ruffin says he's after "Some kind of peace of mind." So, it's surely irresponsible to not acknowledge the very real risk of death from broken heart syndrome after "love that's now departed." Granted, the soul train may jump the rails with lyrics like "Takotsubo mishap: her left ventricle looked like a Japanese octopus trap." But the jilted, abandoned, and bereft have a right to know. So, here goes:

Deep emotional trauma can trigger your heart's left ventricle—the thick-walled chamber that pumps oxygenated blood to your body—to go out of shape. Looking like a Japanese octopus trap—takotsubo—this muscly metronome now can't pump blood so effectively. Sufferers may feel like they're having a heart attack. In fact, 2 percent of suspected heart attacks are actually broken heart syndrome, also called takotsubo cardiomyopathy. And while most people recover, about one in twenty die.

Now Ruffin's fans are informed of the risks, and, because the heart is our organ of rhythm, it's fitting the story continues using the power of song.

*Beat It*, Michael Jackson, 1982: Your left ventricle is a perpetual motion machine. Seventy or so beats a minute, day in, day out. Around three billion beats in an average lifetime. When we're at rest, it pumps about 5 liters (1.3 gallons) of blood a minute. An Olympic pool's worth a year.

*Knockin' on Heaven's Door*, Bob Dylan, 1973: With so much work to do, your left ventricle needs lots of oxygen-rich blood to keep the beat going on. That makes us vulnerable: coronary artery disease is the number one cause of death worldwide. When one of these arteries gets gradually clogged, then blocks, the heart muscle it supplies dies. That's a myocardial infarction, aka heart attack.

*Manic Monday*, The Bangles, 1986: Monday is the commonest day for heart attacks. As for why, a clue may be in the song title. Christmas is also particularly risky, studies in Western countries show. Overindulgence is a feature of the festive season, and compounding that, Santa also delivers stress, irritating relatives, and blazing arguments during party games.

*Don't Worry, Be Happy*, Bobby McFerrin, 1988: Happiness is good for your ticker. The blues (depression, not Muddy Waters, et al.) are linked to increased heart attack risk.

*Stayin' Alive*, Bee Gees, 1977: There's lots we can do to prevent heart attacks, like quitting smoking and exercising regularly. If Jimmy Ruffin's fans are "searching everywhere just to find someone to care," hopefully they're doing it on foot.

## Levator labii superioris alaeque nasi (levator nasolabialis)

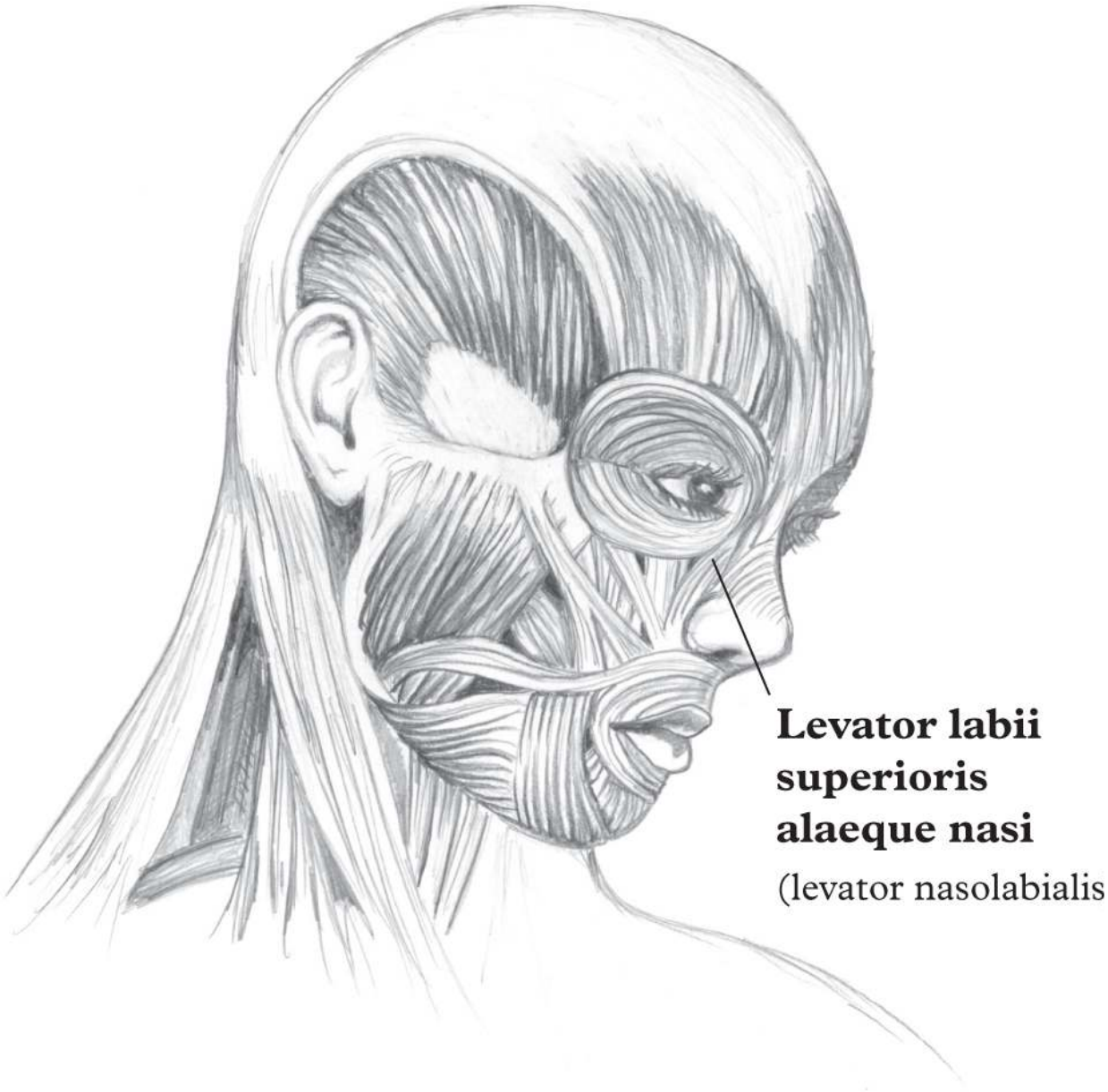
*How the King's snarl explains why selfies aren't right*

You're gonna get *All Shook Up* if you step on some punk's *Blue Suede Shoes* when you're *In the Ghetto*. It's a cold and gray Chicago mornin'. He's an

angry young man with a gun in his hand. And you've just soiled his pristine aqua loafers. If he doesn't flex his trigger finger and put a cap in you, he'll flex his levator labii superioris alaeque nasi and put you in your place.

You'll either be face down on the street, or facing down his sneer, if they were the King's kitsch kicks. That would be the "King of Rock and Roll"—Elvis Aaron Presley—owner of the world's most famous snarl. The late superstar's trademark look brought to you courtesy of his levator labii superioris alaeque nasi muscle.

This muscle runs alongside the nose, one on each side, from close to the eye, down to the top lip and side of the nostril. It's a shortish strip of flesh with an unfeasibly long name, the longest of all your muscles. It's also called "levator nasolabialis," and occasionally "Otto's muscle," supposedly after an anatomist, fed up with repeating its full name.




The five-word Latin name the unknown, perhaps fictional Otto got sick of simply means what the muscle does: “lifter of the upper lip and wing of the nose.” Hence, the flared-nostrilled snarl it makes, and its other nickname: “Elvis muscle.”

A snarl involves one side of the face, and a quick, unscientific *Google Images* search indicates Elvis snarled more often on the left. Makes sense, because our face’s left side is the more emotionally expressive. Left is generally more right, when showing feelings.

It may be one reason why most new mums cradle their baby with its head on their left (along with the fact that on this side the infant can hear the maternal heartbeat). That way, their little bundle of joy gets a better view of mum's more expressive left face.

Moving from nativity to vanity, old-school painted portraits are more likely to feature the sitter's left cheek, *à la* the *Mona Lisa*. Same with selfies today. And when we're on social media, we appreciate people's left side more. A study found influencers' pictures on Instagram showing their left cheek got greater than 10 percent more "likes" than right-sided snaps.

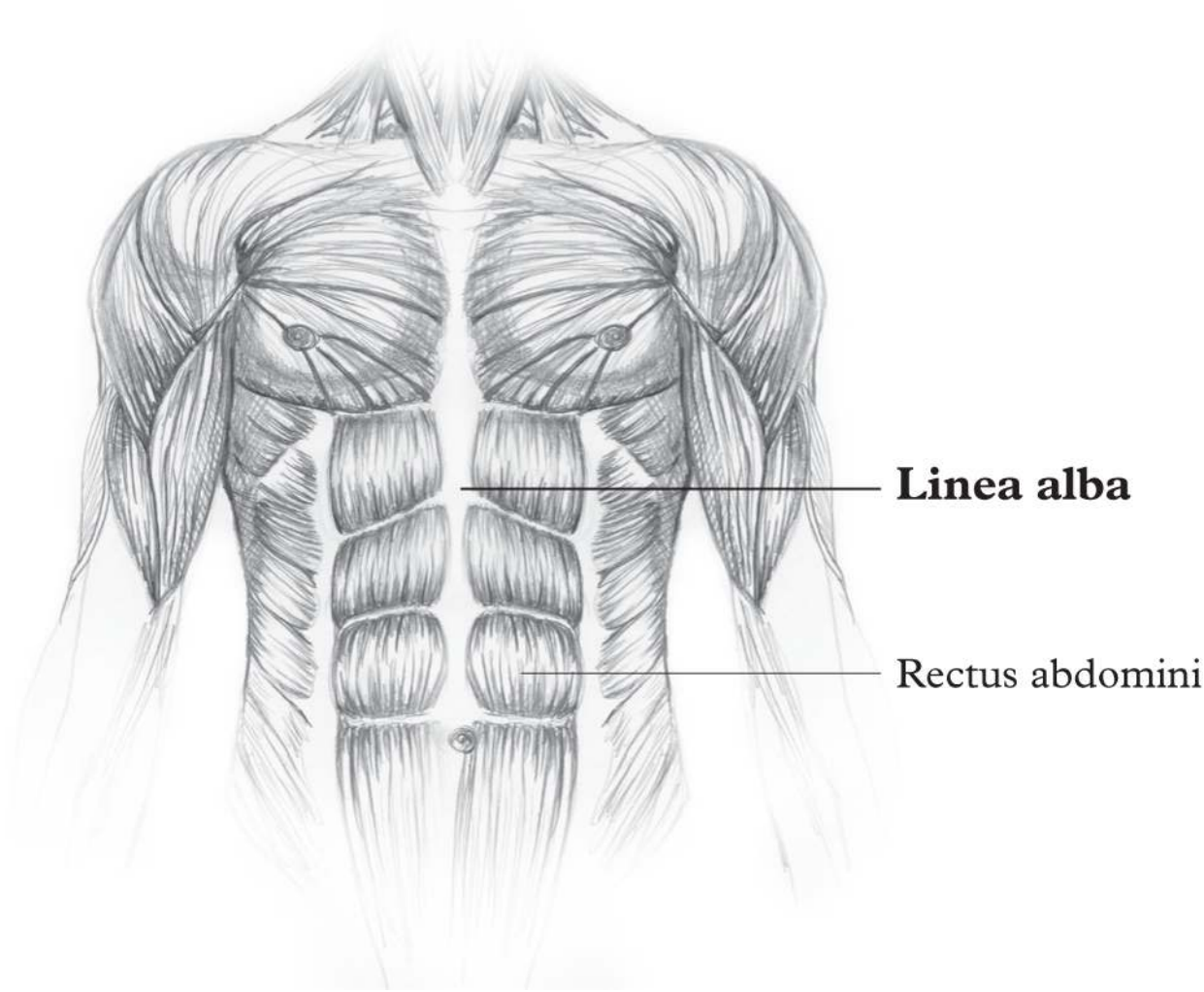
This left cheek bias profoundly influences how we smile, and snarl, at the world. After all, our facial expressions are incredibly powerful indicators of our feelings. Often more so than our mealymouthed words. In the realm of emotions, it's OK if there's *A Little Less Conversation*.

## Linea alba

*How we're cut, ripped, and shredded*

Captain America, Wonder Woman, and Batman would be half the heroes they are today were it not for their lineae albae. These buff superheroes all have great six appeal. That's six for six-pack. Rippling, ab fab abs. Without their lineae albae, they'd be puny three-packs, according to the fundamental laws of physiques.

The linea alba is a white seam of fibrous tissue running from the breastbone (sternum) to the pubic bone. It's white because of a lack of blood. Hence the name: "linea" as in "line," "alba" from the Latin for "white," like "albino." Ancient Rome's Circus Maximus had a linea alba of chalk or lime that likely marked the start of chariot races. Think Charlton Heston in the 1959 multi-Oscar-winning epic *Ben-Hur*.




Your linea alba separates your rectus abdominis muscles, which run like straps down either side of your belly. Cutting across the muscles are fibrous bands, called tendinous intersections. These divide the muscles into segments, which bulge out in fitness fanatics, creating well-defined washboard abs. Usually there are three tendinous intersections, which technically can make an eight-pack: four segments on each side.

As well as boosting egos, the linea alba anchors abdominal muscles and helps stabilize the core. It's also useful medically, as surgeons can cut along it without severing nerves or significant blood vessels. It's a handy strip to slice along when opening up the abdomen, and a seam through which babies can exit their mothers in cesarean sections.

Incidentally, the idea that cesarean sections were so named because Julius Caesar was delivered this way is a myth. The Roman statesman's mother,

Aurelia, outlived him after his assassination on the Ides (15th) of March in 44 BCE. And in those perilous obstetric times, an operation like this would very likely have killed her.

A more plausible theory is that the name is from a Roman law requiring women who died late in pregnancy to have a cesarean, to try to save the baby, or otherwise to bury it separately. This was originally part of the laws of Roman kings, called *Lex Regia*, which became *Lex Caesarea* under the rule of the emperors.

However, it may be that cesarean simply comes from the Latin word "caedare," meaning "cut," which is what women are when they undergo the procedure. Unlike gym junkies with six-packs, who are ripped and shredded.

## Lumbrical

*How worms in your hands catch mice*

The phrase "Are you a man or a mouse?" is grossly unfair on the twitchy, beady-eyed creatures. And on the mice.

Mice and men are far from polar opposites in the macho stakes. Male mice are lionhearted. Hyper-aggressive in territorial battles with their murine mates to establish just who is the big cheese. (And if the pint-sized rodents are a little timid when facing down a man packing thousands of times their body weight, that's surely fair enough.) Mice and muscly tough guys also have a close anatomical connection. Word-wise, well-built blokes are muscly *and* mousey, because their pecs, biceps, and triceps—*all* their muscles—are mice.

Long ago, when medics eyed the bulging biceps muscle in their upper arms, they imagined a mouse twitching under their skin. This flight of fancy became reality when they coined the term "muscle," literally "little mouse." In ancient Rome, a mouse scurrying under gladiators' feet in the Colosseum was a "mus." Today, the common house mouse's scientific name is *Mus musculus*.

So, all men, and women, are mousy, in their own way. Especially as the hundreds of skeletal muscles that maintain our posture and move our bones account for about 40 percent of our body weight.

Skeletal muscles come in many shapes and sizes, from the minuscule stapedius to the mega sartorius. At just a few millimeters long, the stapedius pulls on the stirrup-shaped stapes bone in the small chamber that is our

middle ear. The strap-shaped sartorius is more than one hundred times longer. It runs through our thigh for up to 60 centimeters (2 feet). Sartorius moves our thigh and lower leg in ways that, when combined, help us sit cross-legged (ageing and arthritis excepted). Old-school tailors worked while sitting like this, which is how the muscle got named. The Latin for "tailor" is "sartor," hence fashionistas follow "sartorial" trends.

Sartors also needed their lumbricals as they stitched jackets and trousers. These are four muscles in the hand. They look like little worms, specifically an earthworm called *Lumbricus terrestris*.

The lumbricals flex (bend) the fingers at the knuckle joints and extend them at the other finger joints. It's thought they are important in helping us perform a "precision pinch." This maneuver allows us to hold a needle, or a pen, or maybe an X-Y Position Indicator for a Display System. That's another technical term for a common house mouse. The one that helps us use a computer.

## Main pulmonary artery

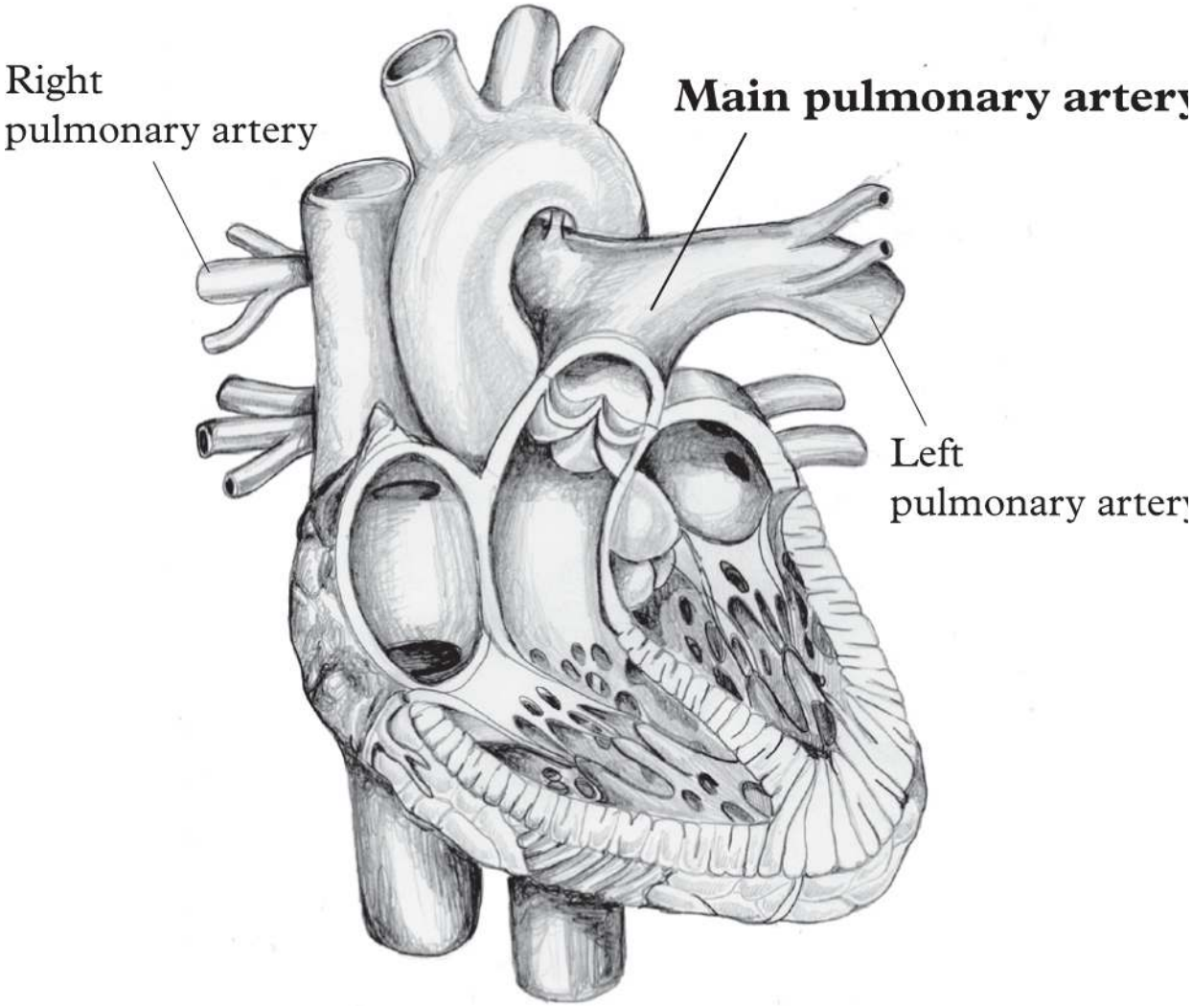
*How anatomical innovation is a high stakes game*

Thomas Jefferson, Michael Servetus, and Dwight D. Eisenhower. One physician, two US presidents, three heretics. Each of this unusual trinity has featured in the *Catholic Herald* magazine's jaunty Heretic of the Week column. But only one was burned alive for their beliefs, which included a revolutionary theory involving the main pulmonary artery.

Jefferson produced a Bible that omitted Jesus's miracles, and Resurrection. And Eisenhower said government must be founded in a religious faith in which all are created equal, but he didn't care which religion. Fortunately for US democracy, the heretical swamp wasn't drained. Servetus, on the other hand, lived in sixteenth-century Europe, where "burning issue," "hot under the collar," and "all fired up" had rather more literal meanings than they do today.

In 1553, Servetus published a book outlining his incendiary theological and anatomical ideas. Protestant and Catholic bigwigs fought fire with fire, and later that year the Spanish physician was burned at the stake, his inflammatory book chained to him. A little on the harsh side maybe, but at the time authorities persecuted agitators who questioned Christian teachings, religiously.

These teachings included theories about how the body worked, often based on ancient Greek ideas. For how blood got from the heart's right to left side, the second-century Greek physician Galen was your man. He believed blood crossed the heart via invisible pores in its wall. In his book, Servetus was the first European to realize that blood actually goes via the lungs.




Blood that's delivered oxygen to your body travels in veins to your heart's right side. Its right ventricle pumps blood out into your main pulmonary artery, which is only 5 centimeters (2 inches) long, but almost 3 centimeters (1 inch) wide. It needs to be broad; 5 liters (1.3 gallons) of blood rush through it every minute, much more during exercise.

The main pulmonary artery soon divides into arteries taking blood to the right and left lungs. These divide further, making more and more arteries that get progressively smaller, like a tree's branches. Until, after about sixteen levels of division, there are as many as 72 million. These lead to smaller vessels—thousands of kilometers of capillaries—into which the lungs' oxygen goes. The capillaries then flow into veins, which take oxygen-rich blood to your heart's left side, for pumping round your body again.

You could say it's a miracle of evolution, but you might be branded a heretic.

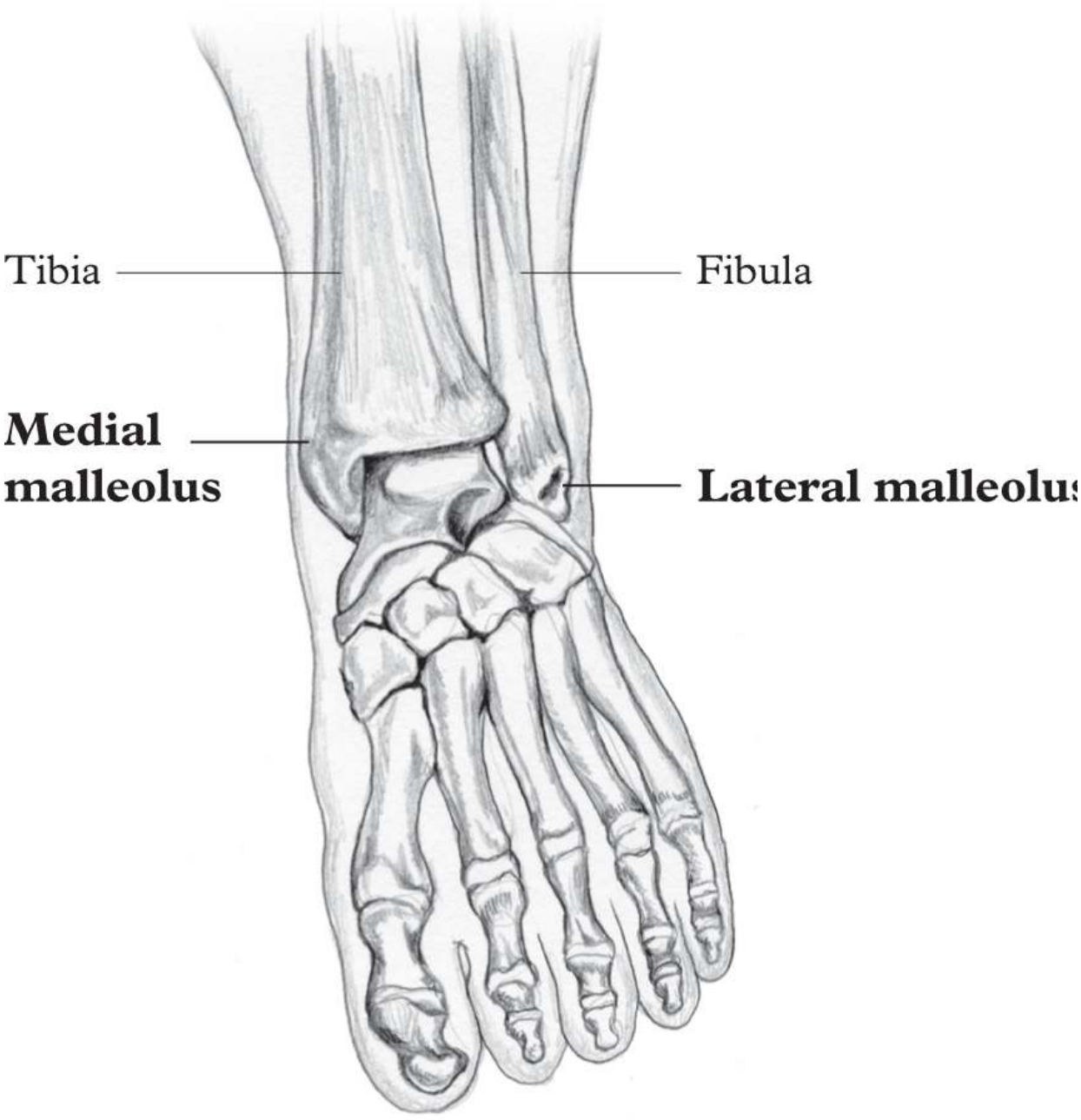
## Malleoli

*How one man had your little hammers nailed*

Hurrying down a busy street, you're accidentally sideswiped by a passerby and fall awkwardly into the gutter. As you hit the deck, your ankle explodes in excruciating pain. Reaching down, you feel jagged bone poking through bloody skin. What do you do? Writhe in agony? Shriek in terror? Buy a door?

The latter would likely be lowish on most people's to-do lists as they squirm, screaming, spread-eagled in the grime. But most people aren't Percivall Pott, the top English surgeon who gave his name to a serious fracture involving the malleoli, the bony knobs on the inside and outside of your ankle.

While visiting a patient on a chilly London morning in 1756, Pott's horse threw him. Lying on the pavement, broken bone jutting out of his skin, Pott knew the score. Injuries like this required amputation, which itself was a life-threatening proposition. But in these dire straits Pott didn't panic. Far from it, he hatched a cunning plan. Pott instructed two men to each fetch a long pole. Next, the door was bought, which, with the poles nailed to it, became a makeshift stretcher. The men then gingerly carried the stricken surgeon two miles through the wintery city streets to his home.




From the discomfort of his bed, the preternaturally unflappable Pott invited colleagues round to advise on what to do. As expected, they recommended immediate amputation. But when they were readying the saw, an old teacher of Pott's arrived and boldly suggested a treatment involving realigning the bones without radical surgery. Putting his busted ankle in his trusted mentor's hands, literally and metaphorically, Pott agreed. And remarkably, his leg was saved, without evidence of disability.

“Ankle,” and “angle,” come from an old term meaning “bend.” And where things bend, they can be weak, as Pott found out. That’s where the malleoli on the ends of the tibia and fibula bones in your lower leg come in handy, making your ankle stronger and more stable. They also make the bones look like mallets, hence their name: malleolus means “small hammer” in Latin. It’s why things that can be shaped by hammering are “malleable.”

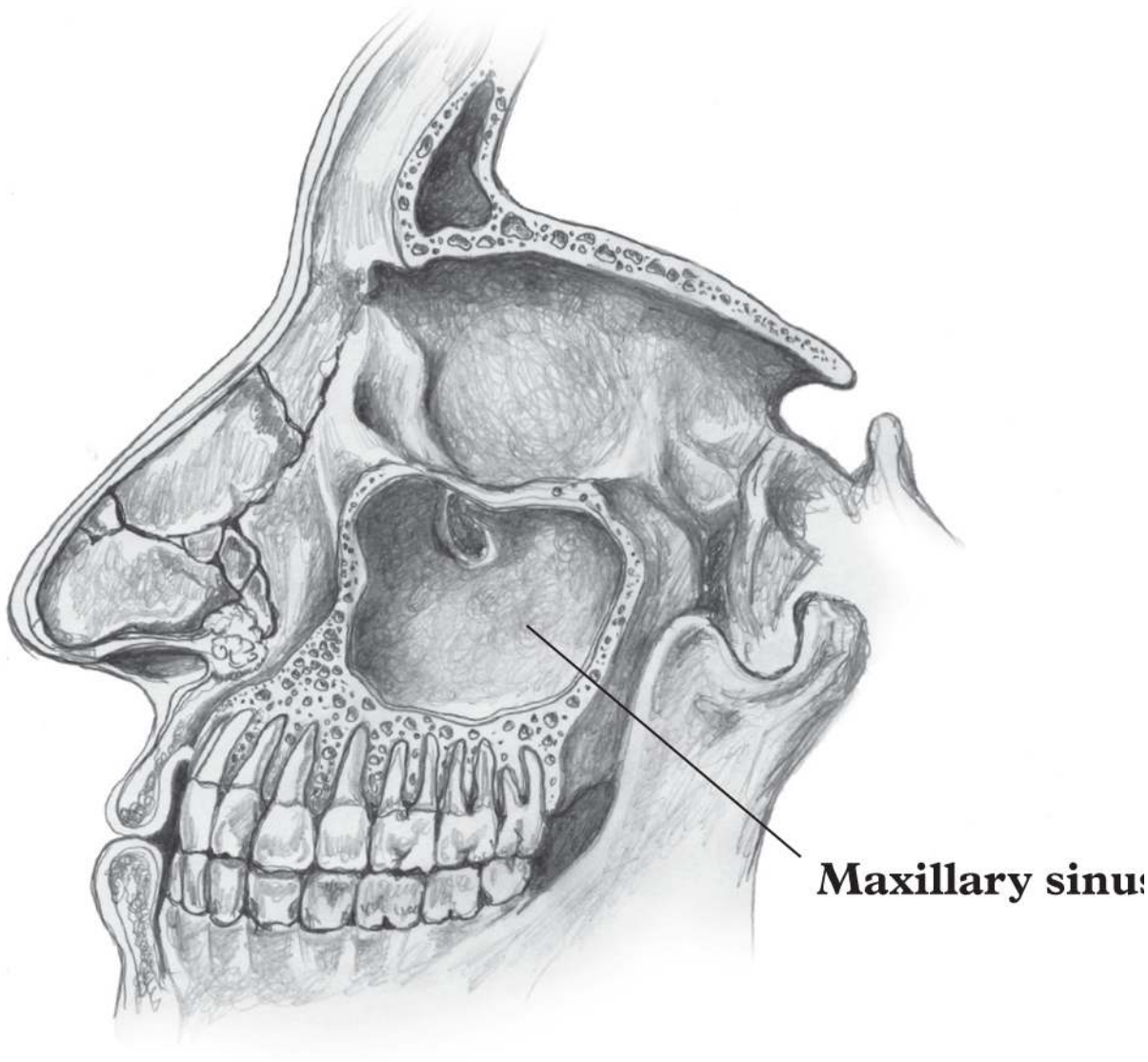
During his recuperation, Pott had his feet up and time on his hands. This gave him the opportunity to write about his craft. His publications made him internationally famous. One outlined the treatment of an ankle fracture that now bears his name, though it’s likely not the same as the injury he suffered. Either way, Pott’s purchase serendipitously opened the door to better management of fractured ankles.

## Maxillary sinus

*How cephalic cavities create crazy cover-ups and clever crumple zones*

Someone who stabs a pen into their face and leaves half of it hidden inside their noggin shouldn’t be called “empty-headed.” Or “numbskull.” Presumably it would be pretty painful. The appropriate put-down for the thirteen-year-old Colombian boy in question is “airhead.”

This airhead concealed 5 centimeters (2 inches) of broken ballpoint pen inside his head for a whole year. Not an easy achievement, considering our head is brimful of bone, brain, and other crucial cephalic components (“cephalic” = “relating to the head”). But there are some hiding places, like your maxillary sinuses: air-filled cavities in your upper jawbones (maxillas).




Ballpoint pen boy was holding it with the tip pointing at his face as his elder sister chased him. Inevitably, he fell, and when he got up, only half the pen was in his hand. The rest was nowhere to be seen. Turns out, it'd speared his right lower eyelid and the eye socket's floor, snapping off and ending up in the maxillary sinus below.

Luckily, or perhaps unluckily, it left no bleeding or scar. Without incriminating evidence, and scared to tell his mother, he kept mum. Incredibly, he managed to sweep the incident under the carpet, and eye socket, for a year, eventually fessing up when his eye became painful and wouldn't move properly.

The pen would have been a tight fit inside the pyramid-shaped right maxillary sinus, which, along with the left, is one of four pairs of air-filled sinuses in the bones around the nose. The maxillary sinuses are the largest. On average, they are about 4 centimeters (1.5 inches) high, 2.5 centimeters wide, and 4 long. Their average volume is about 15 cubic centimeters, enough to fit all sorts of odds and ends into.

We know that because ballpoint pen boy isn't alone. Doctors occasionally find other misplaced items in these sinuses: stones, matchsticks, glass, bullets, and, even more bizarrely (if that's possible), a living leech. Though usually the sinuses' unwanted contents are paraphernalia accidentally left behind after dentistry, the maxillary sinus's thin floor being very close to the teeth.

Of course, being receptacles for lost property is only a sideline for these sinuses, which have many day-to-day roles. They heat and humidify the air you breathe in. They help your voice resonate, like the air-filled body of a guitar. They make mucus to lubricate and protect your nose. And, because they are filled with air, they make you light-headed. Not woozy—rather, they keep your head's weight down.

The sinuses are also brain protectors. If something smashes into the skull, they help absorb the force, like car crumple zones. That's when it's OK to be an airhead.

## Median cubital vein

*How daredevil deception delivered a Nobel Prize*

The median cubital vein is a handy route in and out of the body; for Werner Forssmann it was the route to a Nobel Prize, after an unauthorized, daredevil experiment he carried out … on himself. Forssmann was your original disruptive innovator. Though he didn't just tear up the rulebook, he soaked it in gasoline and threw its pages on the fire. The German doctor joined the ranks of medical trailblazers, thanks to a life-threatening, career-threatening stunt only possible because he tied a colleague to a table and fought off another.

Forssmann's experiment began with him puncturing his left median cubital vein. That's a prominent vein at the front of your elbow. If you've had a blood test, it's likely where the blood was taken from. It's also one place where doctors may insert tubes—catheters—to pass them through the

veins that lead to the heart, even into the organ, for example, to deliver drugs.

But this was the 1920s, when medics believed that inserting something into the heart like this would be fatal. So, when Forssmann asked his boss for permission to try it on himself, he was predictably given the thumbs down. Undeterred, he convinced the nurse who supervised the required surgical instruments to help. Forssmann was remarkably persuasive, because she also volunteered to be the experiment's guinea pig.

So, one day in the summer of 1929, Forssmann told her to lie on an operating table, as he pretended to give her anesthetic and cut into her vein. He'd also strapped her hands and legs firmly to the table, so she couldn't stop him anesthetizing *his* skin and inserting 30 centimeters (1 foot) of catheter into himself via *his* median cubital vein. Only when the catheter was deep inside Forssmann did the nurse realize that the arm with the tube sticking from it wasn't hers.

Forssmann then freed her, and the duo, plus catheter, went downstairs to the X-ray department. Here, a shocked colleague apprehended them and tried to pull the catheter out of Forssmann's arm. Amazingly, Forssmann got the better of him and continued the experiment.

As another nurse held a mirror so Forssmann could see images of the catheter inside him, he realized it had only reached his shoulder, so he pushed more and more in, until he could see its tip inside his heart. Then they took an X-ray for photographic proof. This helped appease his infuriated boss and began the long process of convincing the medical establishment of the value of this new procedure.

In the outrageous, off the wall, oddball scheme of things, Forssmann won gold for Germany. And a Nobel Prize in 1956.

## Median umbilical ligament

*How a Woozle bamboozled your humble belly button*

Anatomical naming rights don't come cheap. Generally, you have to work hard to get your name on our bodily real estate, irrespective of whether you're a legitimate innovator, or an audacious self-promoter. Unless you're Alexander Toftness.

Alexander—Xander for short—only had to post a six-minute video on YouTube.

Proof that Xander now lives inside you is this quote from a paper in the respected medical journal *Mayo Clinic Proceedings*: "The urachus degenerates after embryogenesis to form the median umbilical ligament (also called the Xander ligament)."

But Xander hadn't made any groundbreaking anatomical discoveries. What he did discover was the power of misinformation. This is what Xander jokingly quipped in his video about the belly button (umbilicus): "Why couldn't someone name the [median umbilical] ligament after themselves? … I'll step up. It's Xander's ligament now."

Xander's new name somehow made it onto a Wikipedia page about the median umbilical ligament, a cord connecting the bladder and belly button. From there, "his" ligament went mainstream, into the journal and even a medical textbook (or perhaps not, the source for the latter fact being Wikipedia).

Wisecrack had become accepted wisdom. Albeit an innocuous snippet of fake news.

But the joke is on you. Many supposedly trustworthy scientific papers are infected with errors. Papers build on previous research, citing these sources when making claims. Yet research shows that 10–20 percent of citations used to justify claims in scientific journals *don't* factually support the claim.

Are opioids addictive? Maybe not, if you put too much stock in this quote from a letter published in one of the world's most prestigious medical journals, *The New England Journal of Medicine*: "We conclude that despite widespread use of narcotic drugs in hospitals, the development of addiction is rare in medical patients with no history of addiction." Incredibly, the letter, *just five sentences (101 words) long*, has been cited over six hundred times in other places, often as evidence that opioids aren't addictive.

The problem of a source being frequently used to justify a claim that it doesn't support, so giving the claim undue credibility, is called the Woozle effect. The Woozle did nothing to earn the naming rights, because it doesn't exist. It's an imaginary character in a Winnie-the-Pooh story. Pooh and Piglet think they are following the Woozle's tracks in the snow, but they're going in circles and the mysterious footprints are actually theirs.

## Nucleus pulposus

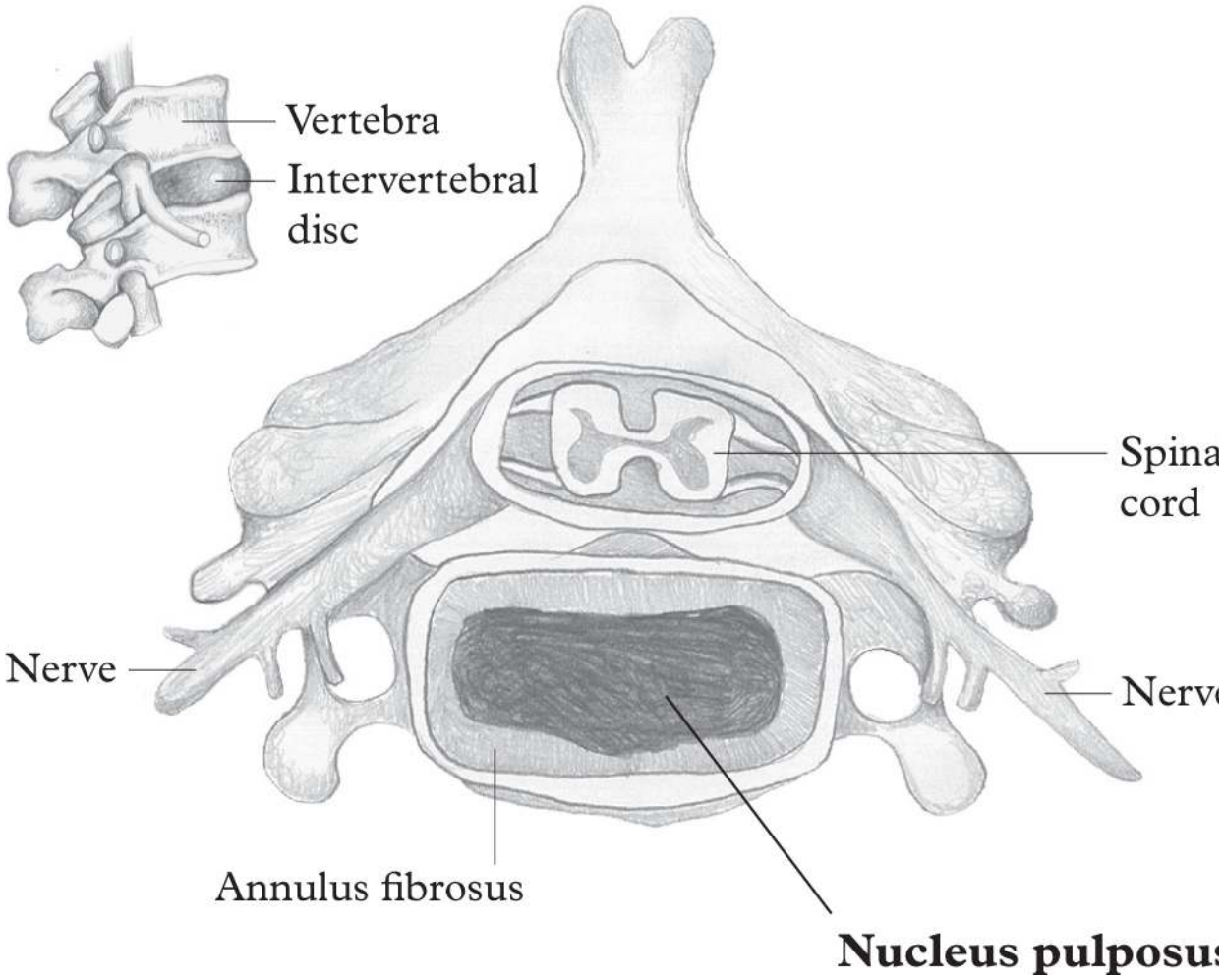
*How Berlin bedtimes explain why astronauts get taller in space*

The Second Berlin BedRest Study sounds like nirvana for slackers. Sixty days in bed. Nurses on hand 24–7. All in the name of scientific research. Idlers, loafers, and layabouts would've fancied a piece of that sweet (in)action. Until they read the fine print.

The beds were tilted six degrees from the horizontal, so people's heads were lower than their bodies. Holding their head up with their hand for comfort was forbidden. While they could change position, unsanctioned physical activity was verboten. They even showered lying head-down. And as for wees and poos, a 2010 study report ominously stipulated "all hygiene … to be conducted in the head-down tilt position." All under constant video surveillance. Hardly living the dream, more like an unspeakable, fecal nightmare.

So, what was it all for? The answer's out of this world: 400 kilometers (250 miles) up in the International Space Station. There, astronauts' bodies change because they aren't subjected to the full force of the Earth's gravity. But studying this in space is tricky. It's far easier to simulate spaceflight's effects by persuading long-suffering earthlings to lie in a tilted bed for weeks on end.

The researchers were interested in what happened to the earthlings' intervertebral discs, among other things. These shock absorbers between the bones in our spine (vertebrae) make up about 30 percent of its length. At each's center is its gel-like nucleus pulposus. Encasing the nucleus pulposus is the annulus fibrosus, which wraps around it, a little like a radial car tire.




During their time in bed, the terrestrial astronauts' lumbar intervertebral discs grew in height. This likely explains why extraterrestrial astronauts get taller in space. According to NASA, your Buzz Aldrins and Lightyears grow by about 3 percent in the first three to four days of microgravity. That's more than 5 centimeters (2 inches) for the average American man, and a pain in the neck for astro-tailors.

The same happens when we hit the sack, though on a smaller scale. We're taller in the morning than in the evening, after a day being upright. Probably because the nucleus pulposus swells with water during our forty winks.

While that's normal for us, the extremes of space make astronauts vulnerable to painful herniated (slipped) discs, when a nucleus pulposus bulges through its annulus fibrosus. Ten percent of US astronauts are diagnosed with it. That's a problem because, unlike in a tilted Berlin bed, "in space no one can hear you scream."

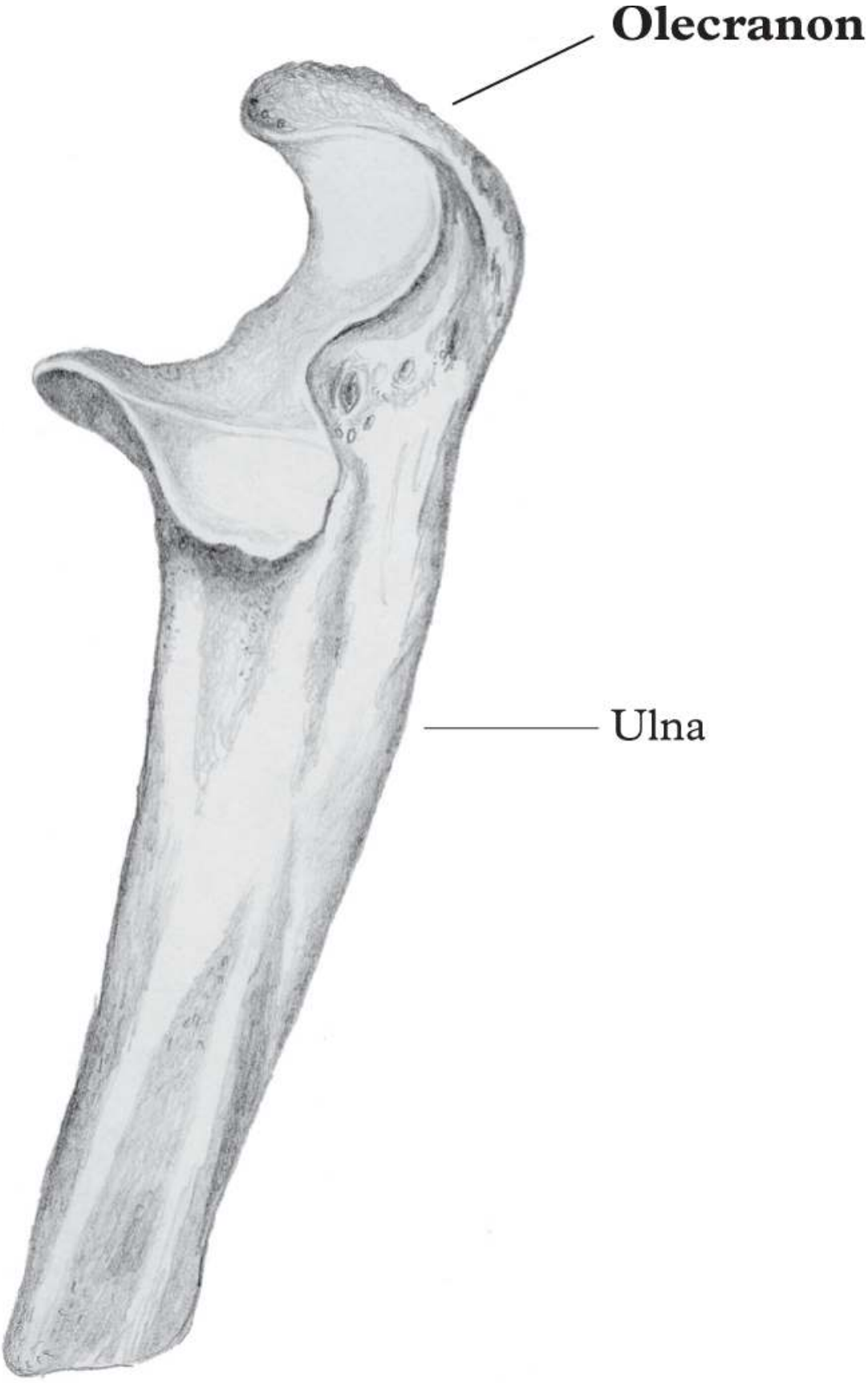
## Olecranon

*How you're faster than lightning, thanks to a little elbow grease*

When Thomas Röhler won athletics gold at the 2016 Rio Olympics, he was faster than sprint superstar Usain Bolt. But it was the Jamaican "Lightning Bolt" who won a third successive 100 meters gold to retain his title of fastest man on the planet, not the German.

So why was Röhler top in the speed stakes? The German athlete was über-rapid because he won gold in the *javelin*. And throwing involves the fastest motion our muscles and joints produce: rotation of the humerus bone in our upper arm.

You may not be a gold medalist, but you—all humans—are *awesome* throwers. This superpower sets us apart from other animals. Our close relatives, chimpanzees, can chuck a ball at 30 kilometers per hour (19 mph). That's not even kid's stuff. Eight-year-old baseball pitchers throwing heat can reach more than double that. And Röhler hurled his javelin at over 100 kilometers per hour (62 mph), thanks to his olecranon and the rest of his throwing apparatus.


Olecranon
Ulna

The olecranon is the point of the back of your elbow. The end of your forearm's ulna bone. "Olecranon" is from the Greek for "elbow" and "skull." An ancient Greek skull is a "kranion," hence yours is a "cranium."

A throw culminates in the explosive contraction of the triceps muscle in the back of your upper arm pulling on the olecranon to straighten your elbow. Before that, throwing involves cocking the arm, like a hunter cocking a crossbow. As you pull your arm back, away from the spot you're aiming at, you stretch tendons, ligaments, and muscles, thereby storing lots of energy.

When you pull the trigger of your throw, you release this pent-up energy, powering super-rapid rotation of the humerus around its long axis. Speeds of more than 9,000 degrees per second have been recorded. (Screwing a screw into wood rotates it around its long axis; 9,000 degrees is twenty-five complete turns.) This warp speed, plus rapid elbow straightening, makes the projectile fly out of your hand.

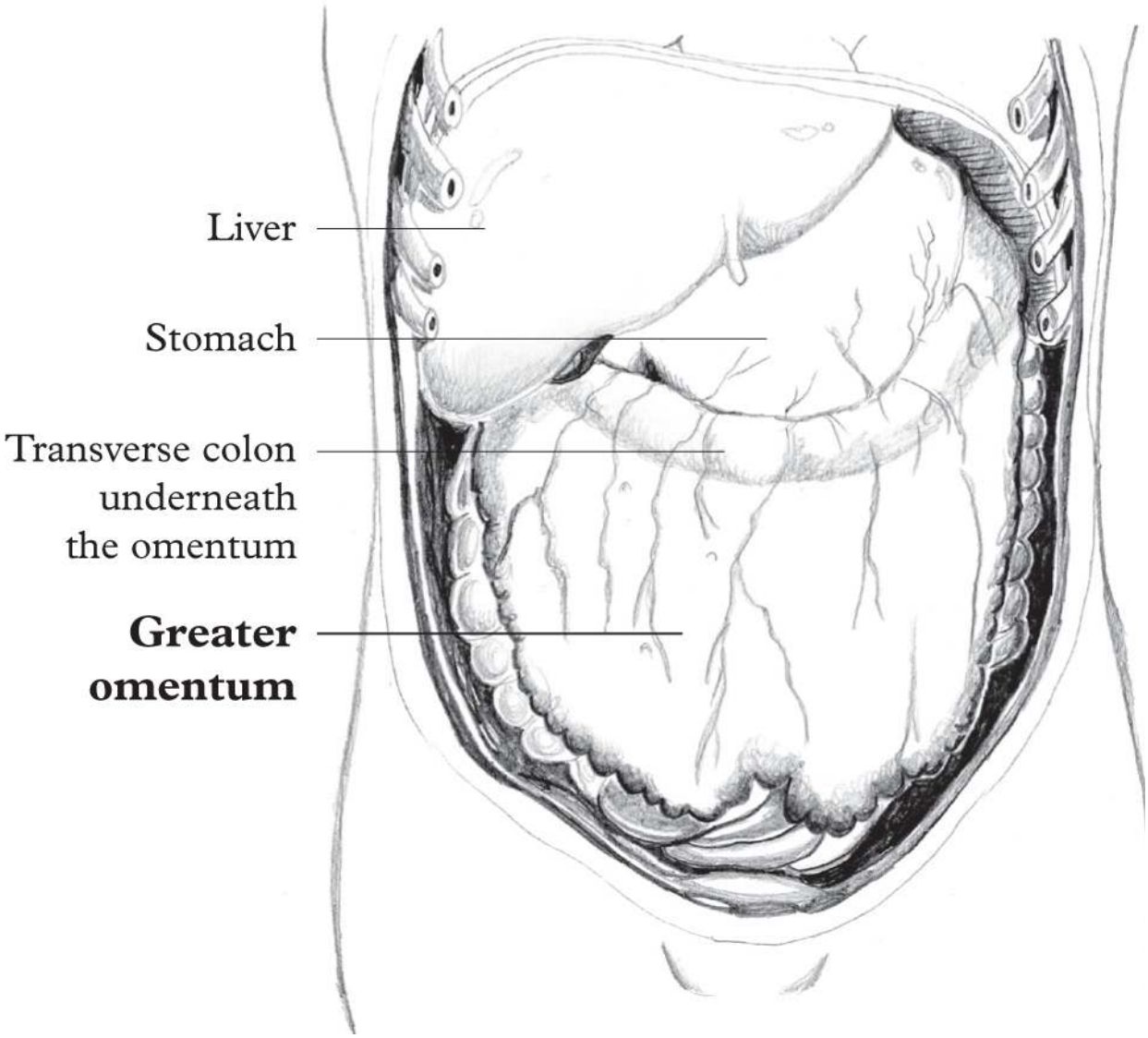
Our unique throwing superpower was likely critical to our ancestors' success in the dog-eat-dog game of survival called evolution. Compared with lions, wolves, and other carnivores, we are slow, weak, and don't have natural weapons like fangs and claws. Hundreds of thousands of years ago, being handy with a spear won you much more than a gold medal.

## Omenta

*How going with your gut predicts your future*

Systems to predict winning lotto numbers are destined to fail. The clue's in the name: it's a LOTTERY. Trusting your gut instinct makes as much sense. So, ditch the crystal ball, stash the tarot cards, trash the statistical algorithms, and go with the gut. The ancient Romans did. Though they didn't rely on gut feelings to predict the future. They were rather more literal about it.

Before an important occasion, like the birth of a bigwig's child, they sacrificed an animal—perhaps a cow or sheep—and looked in their guts for "omens," mysterious signs that portended the future. Up to their elbows in innards, there were good and bad omens to be found in the liver, intestines, and omenta. Some say this is how your omenta got named.




The omenta are folds of peritoneum—the membrane that lines your abdominal cavity—that hang down from your stomach. You have two: a greater omentum and a lesser one. The greater omentum is one of your larger anatomical features, yet also among the least understood. It contains fat, and drapes over your intestines like an apron, looping down from the stomach in front of your guts, then curving back up to attach to a piece of your large bowel. That's the basis of another theory about the origin of the name "omentum." It may be from the Latin word "operimentum," meaning "cover."

Often dubbed "the abdominal policeman," the greater omentum protects your intestines. But it's much more sophisticated than a humble apron. For

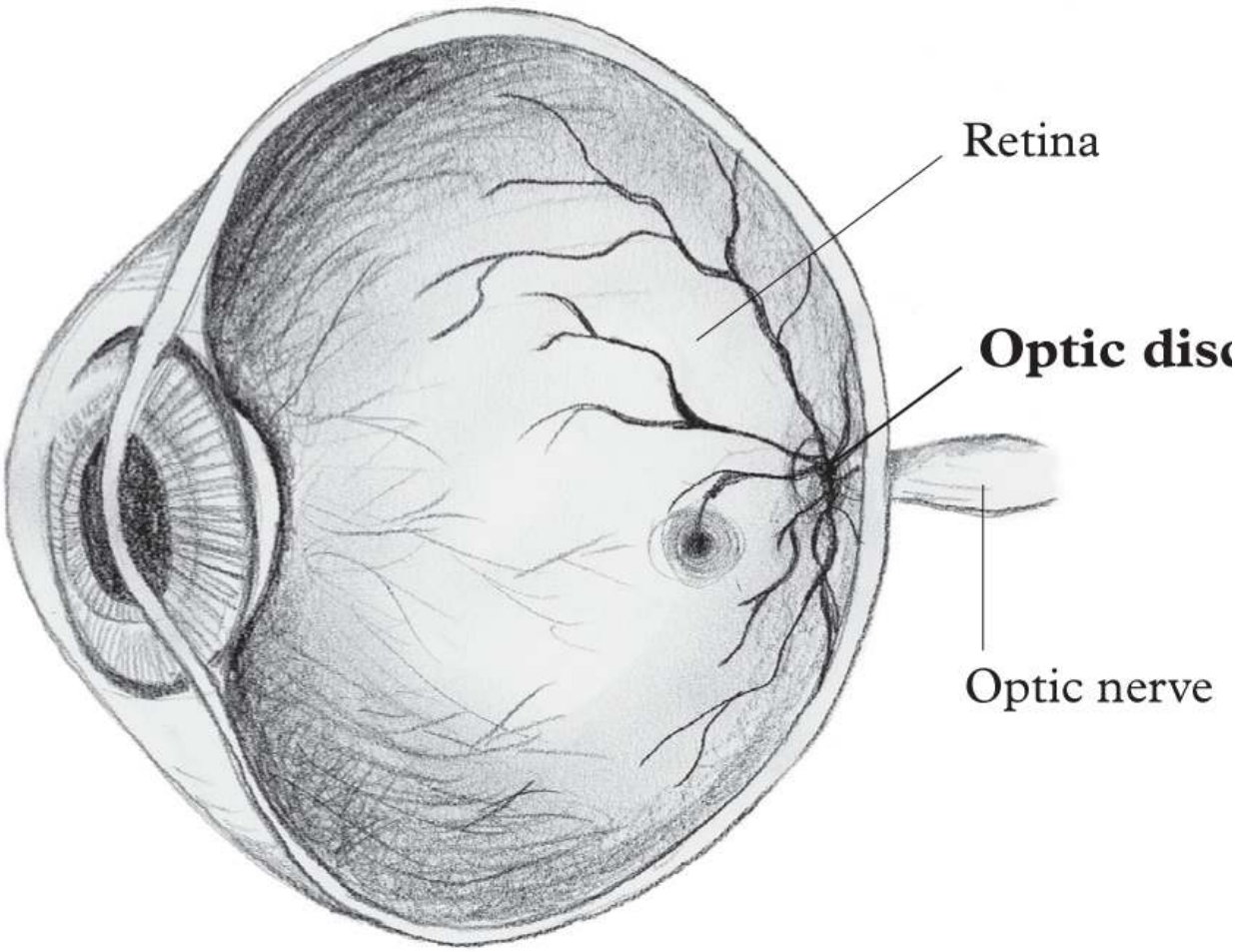
example, it can attach to and seal off inflamed tissue or foreign objects inside the abdomen. In weird experiments in the 1890s, doctors inserted snails into dogs' tummies and found the omentum walled off the slithering molluscs from other organs. And it's not just a physical protector. It can also absorb bacteria and supply infection-fighting cells to trouble spots in the guts.

There's another theory about the omenta's naming, which is a warning to some. The word may come from the Latin word "opimus," which means "rich," "abundant," or "plump." Makes sense. A beer gut is a buildup of fat, including in the greater omentum. Potbelly, paunch, bay window, whatever you call it, an extra-fatty gut is a bad omen when it comes to predicting its owner's future health.

## Optic disc

*How we decapitate people, with our eyes*

Legend has it that Edme Mariotte went full David Blaine when he wowed French royals with his demonstration of the punctum caecum, a phenomenon produced by our optic discs. But no scantily clad women were sawn in half. No body bits were pulled out of a hat. There was no sleight of hand. Mariotte's trick to show off his discovery involved "sleight of eye," performed with panache at the court of the Sun King, aka Louis XIV.




This was the 1660s, at France's Palace of Versailles. Mariotte asked the king to close his left eye and stare at a small coin with his right. When the French scientist moved the coin into a particular spot, the king marveled as the coin miraculously disappeared. This wasn't devilish sorcery. It was evidence of a hitherto unknown quirk in our vison.

When light enters a king's eye, any eye, it lands on its retina. The retina's light-sensitive cells then send signals up the optic nerve to the brain, which turns them into images. But in the place where the optic nerve connects to the retina—the optic disc—there are no light-sensitive cells. So the optic disc can't "see." This causes a punctum caecum—Latin for "blind spot"—in the eye's field of vision.

Mariotte had moved the coin into the royal eye's blind spot. To "see" it for yourself, close your left eye and hold your right arm out in front of you,

with your fingers spread and your palm facing down. Stare at your thumbnail while wiggling your little finger and the pinkie should disappear.

Mariotte's revelation caused a stir. It's said that England's King Charles II amused himself by cutting his courtiers' heads off in this way. A decapitation guaranteed to not bloody His Majesty's robes.

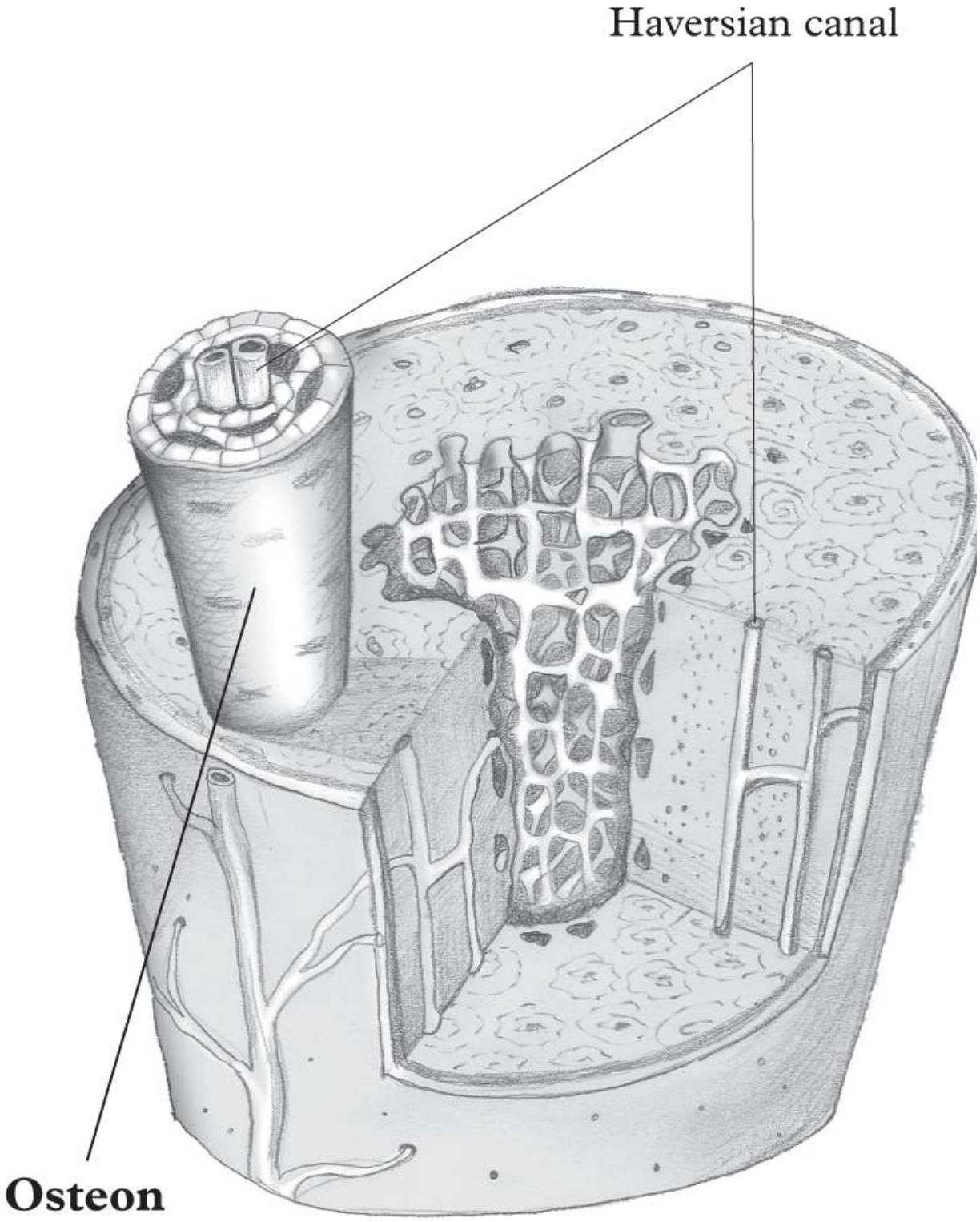
While optic discs are small—about 1.8 millimeters in diameter, the thickness of a spaghetti strand—they translate into a surprisingly large hole in their eye's field of vision. Gaze at the night sky and an eye's blind spot is about twelve moons across.

Bearing in mind their size, it's odd that it took until the seventeenth century for us to recognize our blind spots. Though our brains do a great job of hiding them. Handily, we've got two eyes, and one can see where the other can't. But if you close one eye, you still won't be aware of the open eye's blind spot, because your ingenious brain fills it in with the color, brightness, and texture of what's around it. And that really is magic.

## Osteon

*How we have a bone to pick with boneheaded lingo*

Bone idle, boneheaded lazybones may be thick-witted, good-for-nothing shirkers, but why should your beautifully sophisticated bones be tarred with their lethargic, birdbrained brush? Make no bones about it, your bones are as alive, industrious, and ingenious as the rest of you. Here's the bare bones of why:




To keep themselves in good nick, bones constantly remake themselves. Each year, up to 10 percent of your bone tissue is replaced. This power to rebuild means bones can also repair themselves after a fracture. And they're

lightweight, yet tough as teak. Tougher maybe. An adult's femur (thigh bone) can support up to thirty times their body weight, and is as strong as granite when compressed. Bones ROCK.

Cortical bone is the hard outer part of bone that gives your skeleton much of its strength. Tiny cylindrical structures called osteons are a big reason why. Just 0.2 millimeters (0.008 inches) across—around a quarter the thickness of a standard credit card—and up to about 1 centimeter (0.4 inches) long, they're cortical bone's building blocks. Running parallel to the bone's length, they resemble tree trunks when you cut through them, though with a hole in the middle. It's a shape that's made for strength. Roll a magazine into a tight tube and press down hard on its top to see.

Osteons also help fuel your not-so-lazy bones. Inside the tunnels running down their middles—called "Haversian canals" after the seventeenth-century English doctor Clopton Havers—are blood vessels. Bones need lots of blood to keep them on the go; up to about 10 percent of your heart's output.

Hence dead men's bones may desiccate in the sun, but living skeletons are far from bone dry. So much so that when surgeons cut bone, the bleeding can be hard to stop. One solution for stemming the flow is bone wax. Pioneered by superstar brain surgeon Victor Horsley, the goo is smeared on, to block the Haversian canals.

For all Horsley's brilliance, the Englishman may have been a victim of boneheadedness. They say that "Only mad dogs and Englishmen go out in the midday sun," and the passionately teetotal Horsley proved the adage right. It's said he believed abstinence from alcohol gave him some protection from heatstroke. "We are all very fit here, those who are teetotallers. Of course, in the sun it is 150° and over," he wrote during the First World War in what is now Iraq.

In 1916, a sick Horsley—he may have had paratyphoid infection—died of heatstroke.

## Ostmann's fat pad

*How arrivals are worse than departures, all things being equal*

*Hamlet* is a masterpiece of English literature (notwithstanding the fact that some maintain its real tragedy is the four-hour running time). You don't have

to be a Shakespeare buff to know that "To be, or not to be" is not *a* question. It's *the* question.

Hamlet, Prince of Denmark, asks himself this as he's contemplating suicide following his father's murder. The tormented nobleman almost rivals Prince Harry and Meghan Markle for Royal family drama: Hamlet's uncle did the deed, poisoning his dad in a highly unusual way. Uncle Evil poured "leperous distilment" into daddy Denmark's ear as he slept. A peculiarly Bard-ass murder. One likely inspired by major anatomical news that broke not long before Shakespeare wrote the play, a medical journal article suggested.

Usually, the eardrum would stop poison in the ear entering the body. But in Shakespeare's day, eardrums were often perforated, allowing liquid through into the air-filled middle ear. From here, it could run down the Eustachian tube to the upper part of the throat (nasopharynx). And Bob's your (murderous) uncle, the king is dead.

*Hamlet* was probably first performed in 1601, about forty years after the Italian anatomist Bartolomeo Eustachi published details of "his" tube linking the ear and throat. A big deal at the time, it would've been perfect for Shakespeare, who needed a murder that left no trace of foul play on the body, and festering doubt in Hamlet's mind. The prince is famously indecisive about taking revenge on his uncle, having learned of his relative's involvement from his father's ghost. Hardly bulletproof evidence.

When it's not enabling regicide, the Eustachian tube's key job is keeping air in the middle ear at roughly ambient pressure. Eardrums work best when air pressure is equal on either side.

The Eustachian tube is normally closed, to stop secretions from our nasopharynx flowing into our middle ear. Ostmann's fat pad, a thin triangle of tissue on the outside of the tube, presses on it, keeping it shut. Muscles open the tube when we swallow or yawn. We swallow about once a minute while awake, and, helpfully for Hamlet's uncle, every five minutes or so when sleeping.

When we need to equalize pressure across the eardrum, it's usually easier to expel air from the middle ear, to adapt to ambient pressure lowering (say when a plane takes off) than get air into it. Hence, we're more likely "to suffer the slings and arrows of outrageous" ear pain during landings, as Hamlet might say.

## Pacinian corpuscle (lamellar corpuscle)

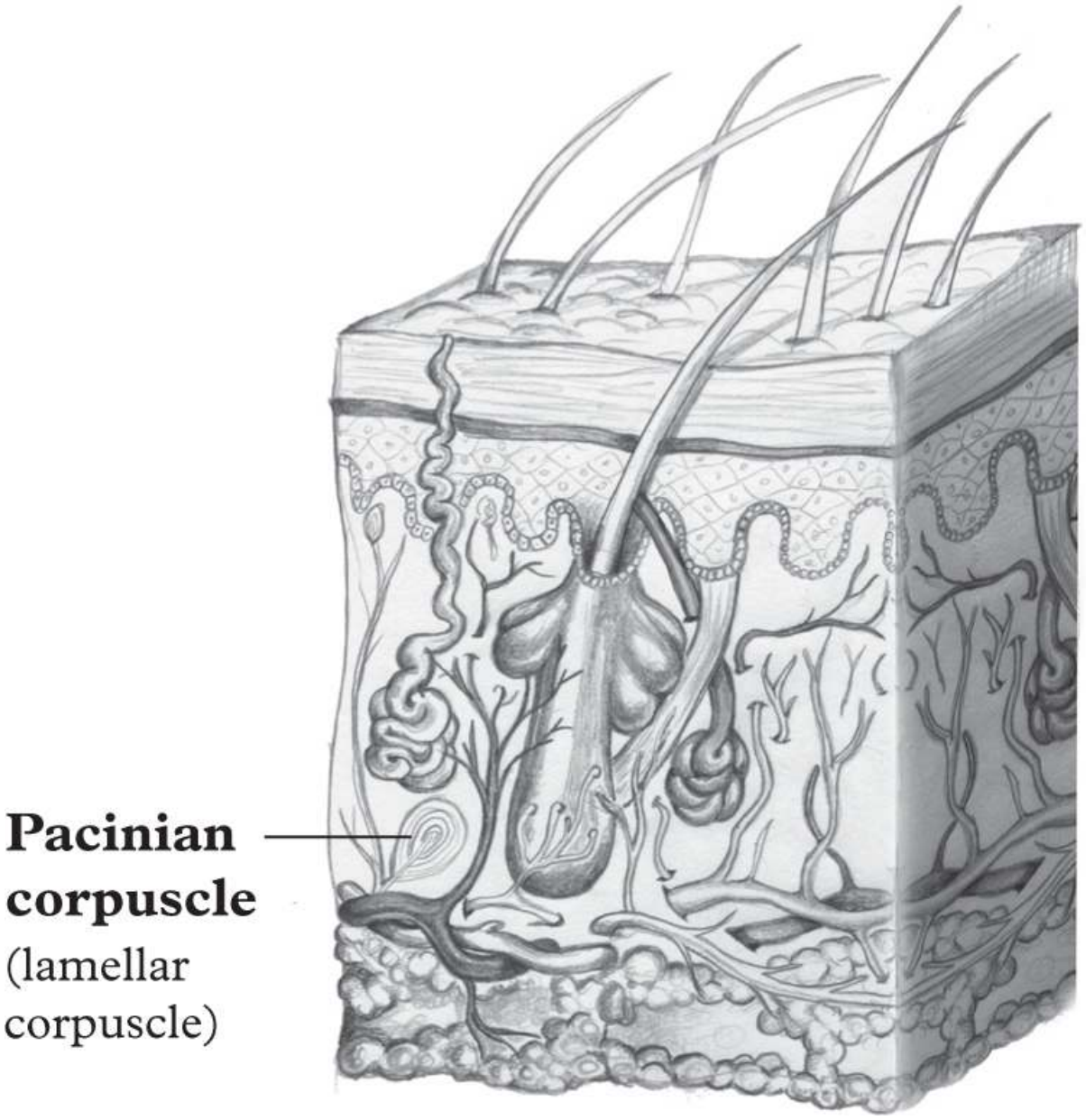
*How there's animal magnetism at your fingertips*

If you've ever been surprised by telekinesis, traumatized by a clairvoyant, or terrorized at a seance, blame Franz Mesmer, and your Pacinian corpuscles.

Mesmer made a mint in eighteenth-century Europe touting a mysterious therapy that came to be known as mesmerism. The German doctor's techniques relied on an enigmatic, invisible bodily fluid he claimed to have discovered. He called it "animal magnetism." This potent force caused disease when blocked. And, surprise, surprise, could be put back in harmony with elaborate treatments.

But this mesmerizing "look into my eyes, pay through the nose" therapy had a glaring problem. Mesmerism lacked an obvious scientific basis. If only Mesmer had lived to hear of Filippo Pacini's studies of the corpuscles that bear his name. The Italian doctor's theories made animal magnetism a much more attractive scientific proposition.

Pacinian corpuscles are oval-shaped little bodies found in our skin. "Corpuscle" means "little body" in Latin. In the 1830s, Pacini worked out that they are part of our sense of touch. One of a number of types of touch sensors, they specialize in picking up vibrations. At about a millimeter long, half the thickness of a US dollar coin, they're made of a nerve fiber surrounded by concentric layers of tissue, so look like tiny onions when you cut them in half.




Because their layers also resemble early electric batteries, Pacini thought they were the organs of animal magnetism. He called them "magneto-motors." And, faster than you can say "alakazam," mesmerism and other mind-melding, manipulative make-believe had an anatomical explanation. Seductive scam superpowers like telekinesis, clairvoyance, and necromancy acquired some scientific credibility.

It helped that while Pacinian (aka lamellar) corpuscles are found all over our body, they're concentrated in our hands. Placing hands on bodies is

common among all sorts of "healers." And rituals like seances rely on "energy" passing through the hands.

A hand has hundreds of Pacinian corpuscles, mostly in the fingers. As the peaks and troughs of our fingerprints run over textures, they generate vibrations. The super-sensitive corpuscles can pick up vibrations of as little as 0.00001 millimeters up or down (amplitude). That's one ten-thousandth the thickness of a sheet of paper.

The corpuscles' sensitivity may also come in handy for elephants, who are thought to use them to communicate over long distances, using signals transmitted through the Earth's surface. Elephants make low-frequency vocal sounds called rumbles, which travel well through the ground as seismic waves. Potentially detectable as far as 16 kilometers (10 miles) away, by instruments at least, studies suggest the animals use their Pacinian corpuscles to "listen" to the vibrations with their feet.

Pacinian corpuscles are also smart. They register when pressure is first applied, but if it continues, they and other touch sensors stop telling your brain about it. Otherwise, you'd be constantly bombarded by distracting signals reminding you that your shirt's on your back, your shoes are on your feet, or your bum's on a chair.

So, in compensation for their role in boosting creepy, discomforting paranormal fakery, you can thank your Pacinian corpuscles for also helping you feel comfortable in your own skin.

## Palmar fascia

*How vicious Vikings gave bagpipers the finger*

Who were those *awesomely angry heathens* that went *berserk*, *ransacking* and *slaughtering* last *Thursday*? Ask an etymologist. Assuming they hadn't been *knifed* by the *gang* of *scary outlaws*, the word origin expert's diagnosis would be "Vikings." Raiders from the *fjords*. Because the italic words chronicling this *ugly saga* are Viking lingo.

"Thursday" is from Thor, Norse god of thunder. "Slaughter," from the Viking for "butcher's meat." "Berserkers" were savage Norse warriors. English is chock full of Norse code. When these Scandinavian seafarers terrorized Europe during the ninth to eleventh centuries, they colonized the language and the land.

It’s one of the many gifts these underestimated people gave us. No, they didn’t wear horned helmets. Yes, they invented Nordic noir, voraciously pillaging, plundering, and massacring. But they also gave us cutting-edge shipbuilding technology, awesome art, and sophisticated trade routes. And the “Viking disease,” in name at least.


Palmar
fascia

This affliction affects the palmar fascia, a triangular sheet of fibrous tissue under the skin of our palm. The fascia gradually thickens and shortens, pulling on the fingers, especially the ring finger and pinkie, so they curl inward toward the palm. Everyday tasks, like handwashing, typing, and violently swinging a Viking battle axe deep into someone's neck become tricky. Because it runs in families and is common in blue-eyed, fair-skinned, blond folks from Northern Europe, the Vikings have traditionally (very likely unfairly) been blamed for spreading it. Hence, it's sometimes called the Viking disease.

Your tough palmar fascia protects the structures under it. "Fascia" is from the Latin for "band" or "bandage." It also helps you grip, because it's firmly tethered to the skin, stopping the skin moving too much. If Vikings' battle axes slipped around in their hands, extracting them from victims' necks would be a pain, for all involved.

These murderous marauders may have beheaded, and bedded, ancestors of the ill-fated MacCrimmon family. For hundreds of years from the end of the fifteenth century, they ran a bagpiping college on the Scottish Isle of Skye. "The Curse of the MacCrimmons" isn't being forced to listen to them play. It's another name for the Viking disease. Devastatingly, it ran in their family.

Its official name is Dupuytren's contracture, after French surgeon Guillaume Dupuytren, who devised an operation to treat it in 1831. Dupuytren, aka "the beast of the Seine," was brilliant, arrogant, and quick to exploit others. He was also described as "first among surgeons and last among men." These men included the dead ones who were unknowing targets of his abuse.

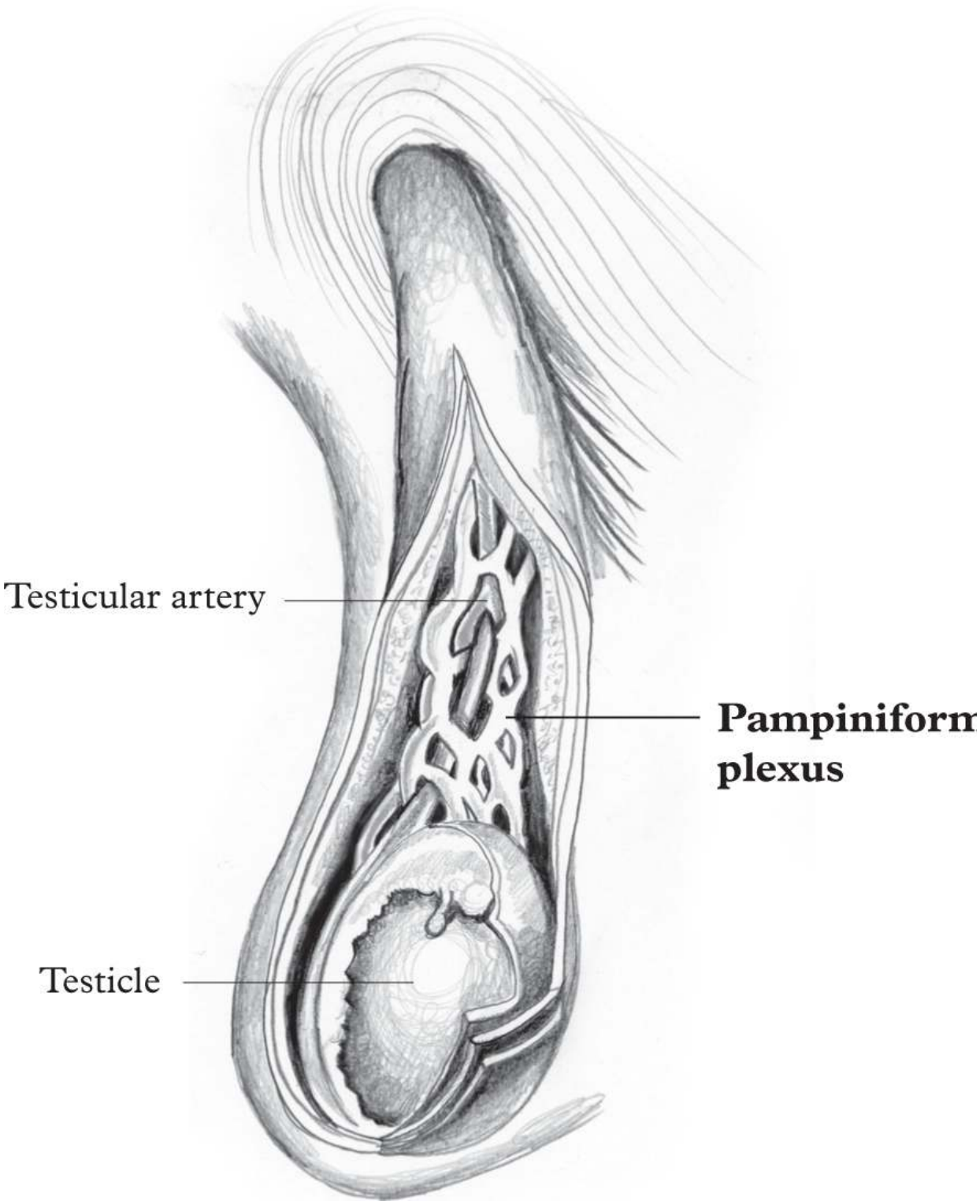
As a hard up student, Dupuytren used fat from their bodies—cadavers for dissection—to fuel the lamp he studied by. Which, as the Vikings would say, is just plain "*rangr*."

## Pampiniform plexus

*How the Internet can be too hot to handle*

The Internet is awash with pornography, apparently. A dot-com*e* phenomenon catering to an inexhaustible diversity of desires, from "Adorable" to "Zombie." Or so friends tell me. It certainly needs to. A 2020

study of 1,392 American adults found 92 percent of men and 60 percent of women had consumed porn (all types, not just online videos) in the last month.




The extent to which all this steamy streaming is harmful, and how, is controversial and complicated. But there are some pointers for online

onanists wanting to safeguard their sexual health. For example, men ogling dead-eyed Zombies shouldn't have the computer on their lap. It may increase their risk of infertility.

The cold hard truth is, heat from a laptop warms the scrotum, potentially interfering with sperm production in the testicles. For normal sperm making, testicles (testes) need to be 2–4°C (3.5–7°F) cooler than core body temperature. It's why scrotums hang outside the body. You might think men's family jewels would be best kept safe, deep inside their body. But that would be too toasty for dainty testes.

The pampiniform plexus is another device to help testes keep their cool. This network of small veins draining blood from the testis is close to the artery that sends blood in the opposite direction. Blood in the plexus's veins has come from the testis, so is cooler than blood in the artery. The veins that wind round the artery—"pampiniform" means "shaped like a vine tendril"—thus cool its blood, and hence the testis.

It's elegantly simple, unlike the word "plexus." It's from the Latin for "braid," which is intricate and interlaced. As frazzled fathers of young daughters would know, braiding hair can be impossibly "complex" and "perplexing," two related words.

The upshot of all this for sperm, testes, and their owners is that anything that causes scrotal warming may interfere with sperm making and decrease fertility. And testis warming seems to be a feature of modern life. For example, tight fitting underwear, working while sitting, and prolonged driving have all been linked with testicle heating.

As have laptops, which can reach internal operating temperatures greater than 70°C (158°F). A study found a laptop on the lap can heat the scrotum by almost 3°C (5.5°F). Though this was after an hour of use, which is some good news for online porn consumers. In 2019, the average time on Pornhub (a popular X-rated website, apparently) was an efficient 10 minutes and 28 seconds.

## Parietal cell

*How a hole in a stomach was the acid test*

On the Outlandish Experiment Rating Scale, the years William Beaumont spent poking paraphernalia down a hole in a patient's side, directly into his stomach, scores a conservative eleven out of ten. Grotesque. And

groundbreaking. Because this hole that opened into the man's stomach opened the way to better understanding of how we digest food, with the help of acid made by parietal cells.

Beaumont's experiments were literally outlandish, beginning not in a city hospital, but on an island on the North American frontier. In 1822, he was called to a fur trapper who'd been accidentally shot. Sticking out of a wound in Alexis St. Martin's side was a piece of lung as large as a turkey's egg, and some of his stomach, with a hole in it big enough to stick a forefinger through.

Against the odds, St. Martin survived, though still with the hole in his stomach that led out through his skin. At first, food spilled from it. Eventually a fold of tissue formed a valve that fixed St. Martin's stomach leak, but could, conveniently for Beaumont, be opened.

Which is what the doctor did, over and over again. Peering into St. Martin's stomach. Taking out samples. Dangling foods into it on the end of a string, to see what happened to them. And more. St. Martin was Beaumont's very own research lab rat. So much so that Beaumont published a book detailing 238 experiments carried out between 1825 and 1833. A Feeder's Digest of insights into gastric juice and digestion.

While Beaumont didn't know about parietal cells, his work confirmed the acid in gastric juice that breaks down food is the hydrochloric acid they make. Parietal cells are in your stomach wall and look like fried eggs. "Parietal" is from the Latin for "wall." Ancient paintings on cave walls are "parietal art." Food in your stomach triggers parietal cells to make hydrochloric acid, though seeing a meal, smelling it, and even just thinking about it also turn them on.

The acid is strong enough to dissolve bone and teeth. Alligators make huge amounts to dissolve carcasses. Dentists see the effects of acid reflux on our teeth. It would erode your stomach, if it wasn't for the protective mucus coating the organ's wall.

Much of what we know about digestion began with St. Martin, who eventually managed to quit his life as Beaumont's long-suffering gastric guinea pig. He married, had six children, and died aged 86. If the way to a man's heart is through his stomach, let's hope that wasn't the case regarding St. Martin's marriage.

## Parotid gland

*How your mouth has multitasking licked*

Us humans lick our wounds in more ways than one. Two, in fact.

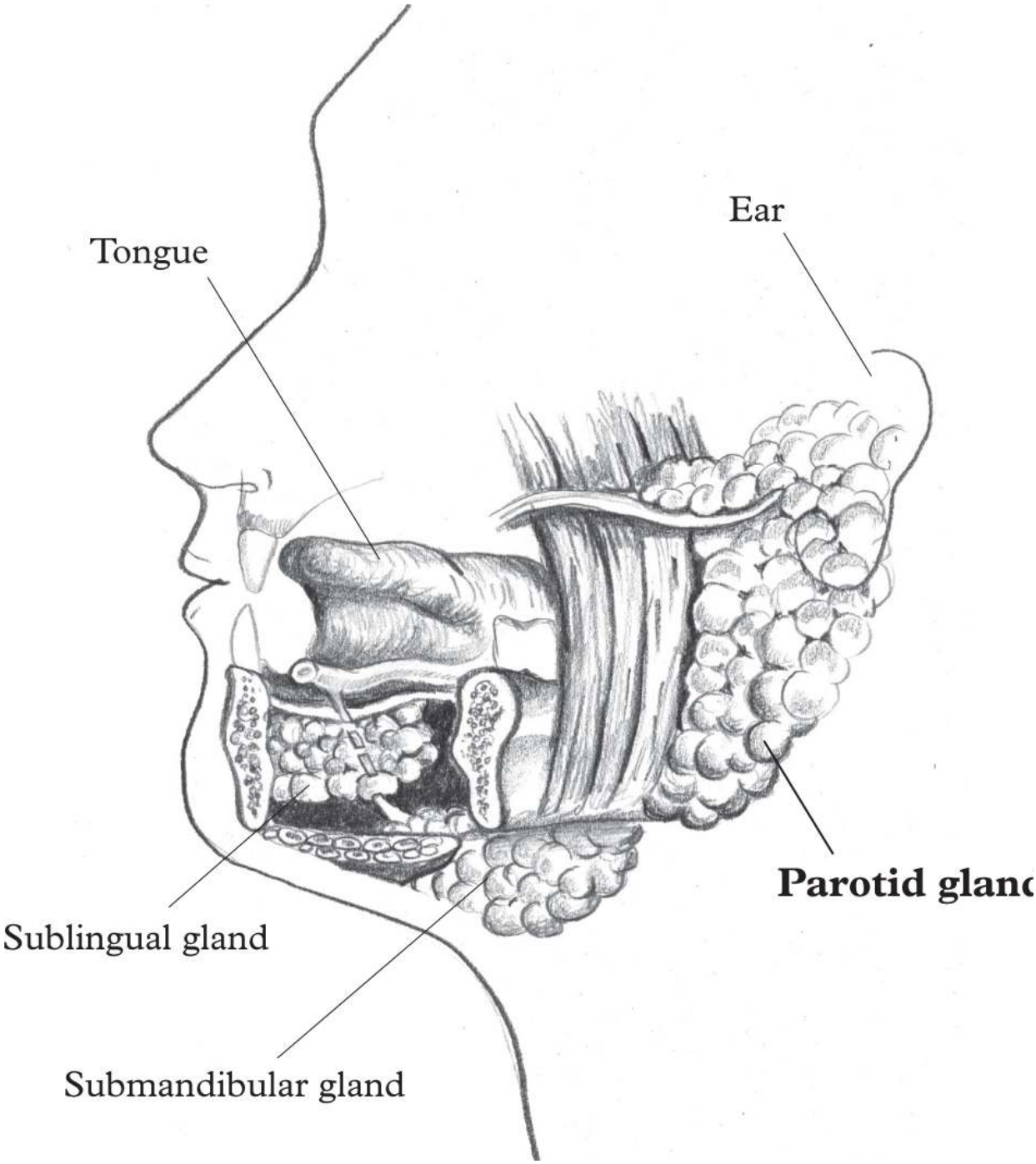
After a humiliating setback we retreat to a quiet corner to recover from the mental wounds. We also instinctively lick our physical wounds. (Think how people with a minor cut on the end of their finger stick the digit in their mouth.) Same with animals. Dogs exiting vet clinics, cones of shame round their necks, are proof of this.

This wound-licking instinct has a deep-seated explanation. Evolution made animals, including our ancestors, this way to help keep them healthy in the wild. Hence, it gave us saliva that's believed to have wound healing properties.

Your humble spittle is actually highly sophisticated, containing chemicals that promote tissue repair and prevent infection. This may be why wounds in the mouth heal faster than those on the skin. Researchers even believe chemicals in spit could form the basis of drugs to aid healing.

Responsible for producing this phenomenal oral secretion are your salivary glands. They make 0.5–1.5 liters/quarts of spit a day, enough to fill as much as two wine bottles. That's about 30,000 liters (8,000 gallons) in an average lifetime, more than a hundred full bathtubs.

The parotid glands are one of three pairs of large saliva-producing glands; the others are called "submandibular" and "sublingual." There's one parotid gland on each side of your face, not far under your skin, in front of and below your ear. "Parotid" is from the Greek for "ear," and "para," meaning "beside," as in parallel.




Aside from wound-healing benefits, the spit they make has many everyday functions. Saliva is a great multitasker. It lubricates food, so it goes down easily. Remember the last time you tried to wolf down dry crackers? This oral lube also helps us speak. And food has to be mixed in it to enable us to taste.

Spit also fights germs and is a natural mouthwash, constantly flushing debris away. At night, we make less, allowing more growth of bacteria in our mouths. These feed on cells shed from inside our mouth and trapped food, producing evil-smelling waste products. Hence morning breath, aka mild transient oral malodor.

"Mild" may be putting it kindly, especially as the bacteria's contribution to the unholy halitosis includes the ominously named organic compounds putrescine, cadaverine, and skatole (from the Greek for "feces," as is "scatological").

If your morning mouth smells like you've just eaten a putrefying cadaver smeared with highly offensive material from the crack of Dawn, it's best to retreat to a quiet corner until you've brushed your teeth.

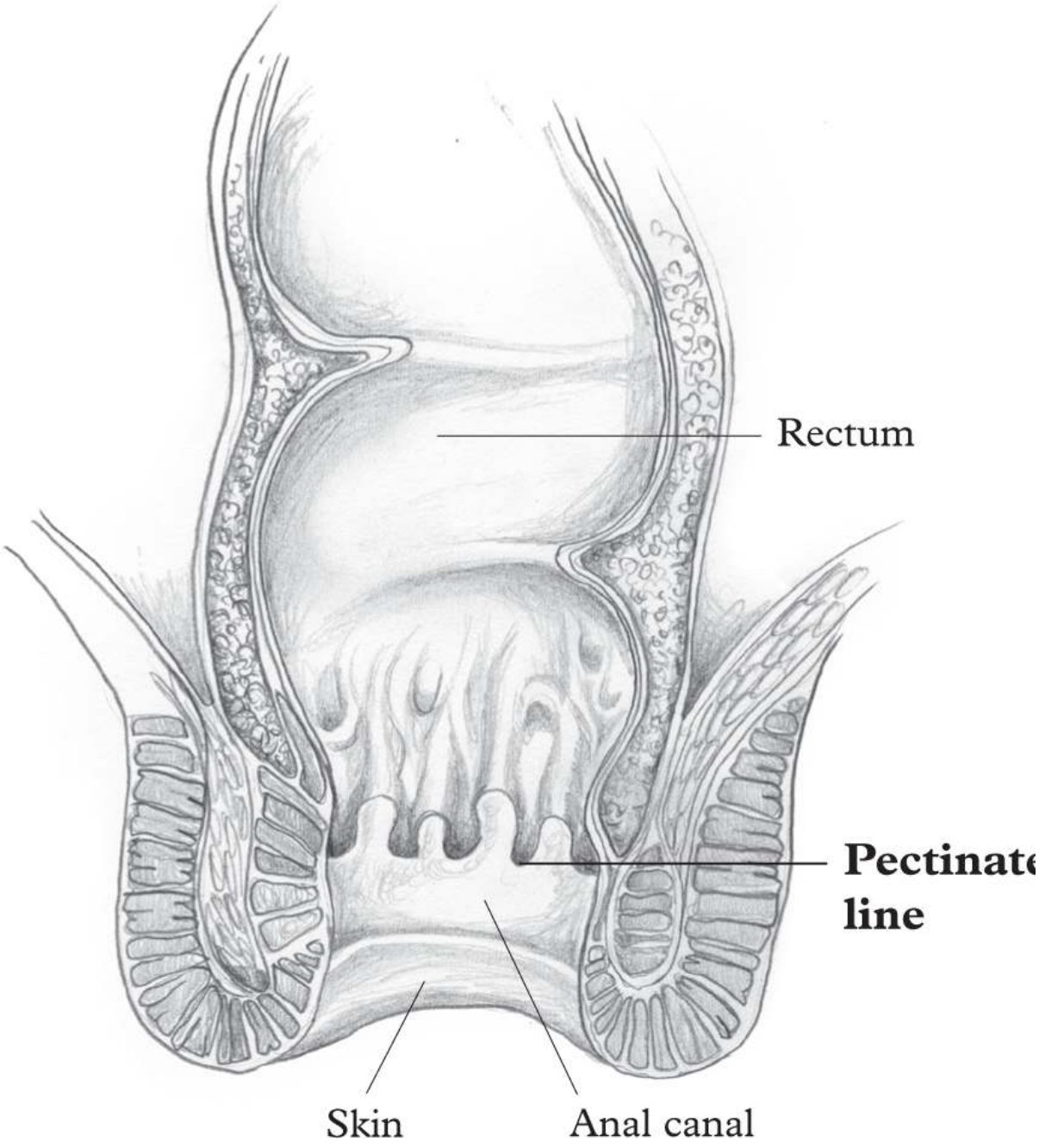
## Pectinate line

*How an umbrella got stuck where the sun don't shine*

"What goes up must come down" is a rule your rear end does not obey. It laughs in the face of gravity. The bottom line is: keep good hold of anything you stick up your anus, or you may not get it back out.

People with foreign bodies stuck up their rectums, and their fishy explanations ("I slipped and fell on it") have long been the butt of hospital jokes. Foreign bodies aren't hot tourists. It's doctor speak for something inside you that belongs outside. And medical reports suggest folk are only limited by their imagination when it comes to what they'll lose up their rectums. Sex toys, candles, and bottles are positively tame compared with light bulbs, a half-meter-long live eel, a tool bag (complete), and an umbrella. Something for a rainy day …

While sticking them up anuses into rectums probably wasn't a piece of cake, at least the inner lining of the gut above the pectinate line doesn't feel pain. The pectinate line is a few centimeters up your anal canal. Below it, the gut lining—mucosa—is super-sensitive to pain. Above it, the rectum is only sensitive to stretching. Here surgery can even be performed without anesthesia.




“Pectinate” is from the Latin for “comb.” Folds in the gut’s wall form columns that look like a comb’s teeth; the columns end at the pectinate line. It’s also called the dentate line, after the Latin for “tooth,” which is why “dentists” fill cavities.

Stick a finger up an anus to the pectinate line and you’ll feel a ring around your digit. “Anus” is from the Latin for “ring,” as is “annular,” meaning ring-shaped, like a tree trunk’s yearly (annual) growth rings. Squeezing your

finger are your muscular anal sphincters. The external sphincter, which you have control over, and the internal one, which is involuntary. While they don't necessarily keep fingers and foreign bodies out, they do keep feces in, until you need to poo.

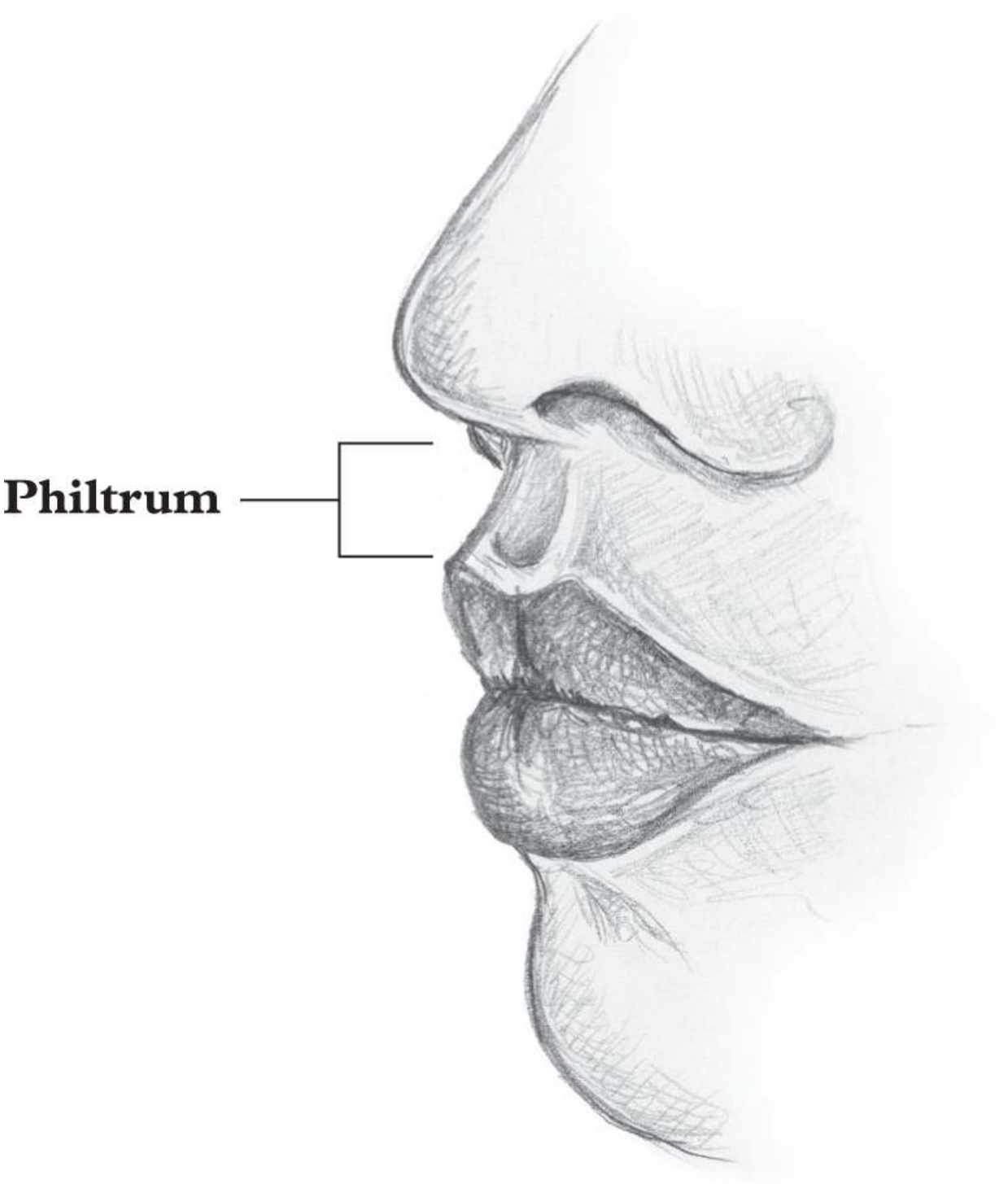
Incidentally, research shining a light on shenanigans where the sun don't shine shows that emergencies due to foreign bodies inside rectums are on the increase. One of the oddest objects lost up a back passage was an oval stone, weighing almost 1 kilogram (2.2 pounds) and about 10 centimeters (4 inches) across; wider than your palm. "Don't throw stones in glass houses" is a rule we certainly should obey.

## Philtrum

*How there's love, and lust on our lips*

Just about anywhere on your body, any body, has the potential to be an erotic hot spot, research shows. There's a whole world of erogenous zones waiting to be discovered, beyond your run-of-the-mill, garden-variety penises, clitorises, and nipples. The nape of the neck. The base of a big toe. A wrinkly kneecap even. Caressing any of these fleshy nooks and crannies could spice things up in the bedroom, any room. Fair enough, we all have our own penchants, proclivities, and predilections. Different strokes for different folks …

The ancient Greeks, for example, had a top erogenous zone. So enamored were they with their super sensual spot, they called it the "philtrum." Philtrum is from their word for "love potion," as seen in fairy tales, *Harry Potter* movies, and Shakespeare plays. In English, these enchanting, passion promoting brews are "philters."




Your philtrum is the shallow groove with two ridges on either side that runs from below your nose to the red part of your top tip (vermilion). It's actually part of your lips, which are more than just the red bits. Your top lip

extends to the bottom of your nose. Your bottom lip ends at the labiomental crease, a horizonal groove at the top of your chin.

It's not just amorous couples who have a connection to your philtrum. Lovers of all sorts of things are linked to it, word-wise. That's thanks to the "phil" in their name, from the Greek for "loving." Philanthropists love humankind; philosophers love wisdom; technophiles love technology; audiophiles love hi-fi, and so on.

Strangely, for such a prominent body part, scientists are fairly ignorant about what the philtrum is for. One explanation is that it helps us express ourselves by providing a store of extra skin that can be called upon when our mouth needs to move in a way that stretches our upper lip, like smiling or crying.

What is for sure, is that the philtrum can be important in determining attractiveness. Research found that images of young Caucasian women's faces with their philtrum's contours digitally removed were rated as older and less attractive than the originals. Whether or not a philtrum is erogenous, it may help its owner get lucky in love, and lust.

## Phrenic nerve

*How a hiccup is, and isn't, all in the mind*

Hiccupping for a minute or two is a nuisance. A bout of 400 million hiccups isn't a minor hiccup, it's a major disaster. A lifetime of infuriating hiccups and downs. That was life for Charles Osborne, holder of the hiccupping endurance world record.

Osborne's ordeal began in 1922, on a farm in Nebraska, as he was hanging a hog for butchering. Sixty-eight years later, his hiccups shut up, as abruptly as they'd begun. It would be understandable if Osborne sobbed with relief. That's especially as doctors call hiccups "singultus," from the Latin for "to catch your breath while sobbing."

Unlike sobbing, we can't control hiccups, which are caused by sudden involuntary contractions of our diaphragm, the dome of muscle that separates chest from abdomen. When your diaphragm contracts, air is forced into your lungs, so you inhale. In a hiccup, the inhalation is suddenly checked by the rapid closure of the middle part of your voice box (larynx), called the glottis, making the "hic" sound.

Was Osborne stoic during his seven decades of singultus? Or did he sometimes lose his cool? Was he frantic? Hic. Or frenetic? Hic. Or frenzied? Hic. These emotionally supercharged "F" words come from "phren," the ancient Greek word for the "mind." Other words related to phren are "schizophrenia" and "phrenology," the numbskull notion that a skull's lumps and bumps reveal its owner's character.

It's also why the two nerves that make your diaphragm contract are the "phrenic" nerves. They run from your neck down each side of your body to your diaphragm. Irritation of the phrenic nerves can cause hiccups.

This link between the mind and phrenic nerves stems from the fact that the ancient Greeks' phren was the source of feelings and emotions. But it wasn't in the head. Greek philosophers believed feelings emanated from the midriff, including the diaphragm, which was also called "phren."

Osborne, no doubt fed up with his hiccups, would have wondered why we do it. Truth is, we don't know. They seem to serve no purpose in adults. Because babies in the womb hiccup a lot, one theory is that they are training for our breathing muscles, to prepare for the shock of suddenly having to gulp air into our lungs when we're born. Scant consolation for Osborne.

## Pouch of Douglas (rectouterine pouch)

*How the mother of all hoaxers conceived an immaculate deception*

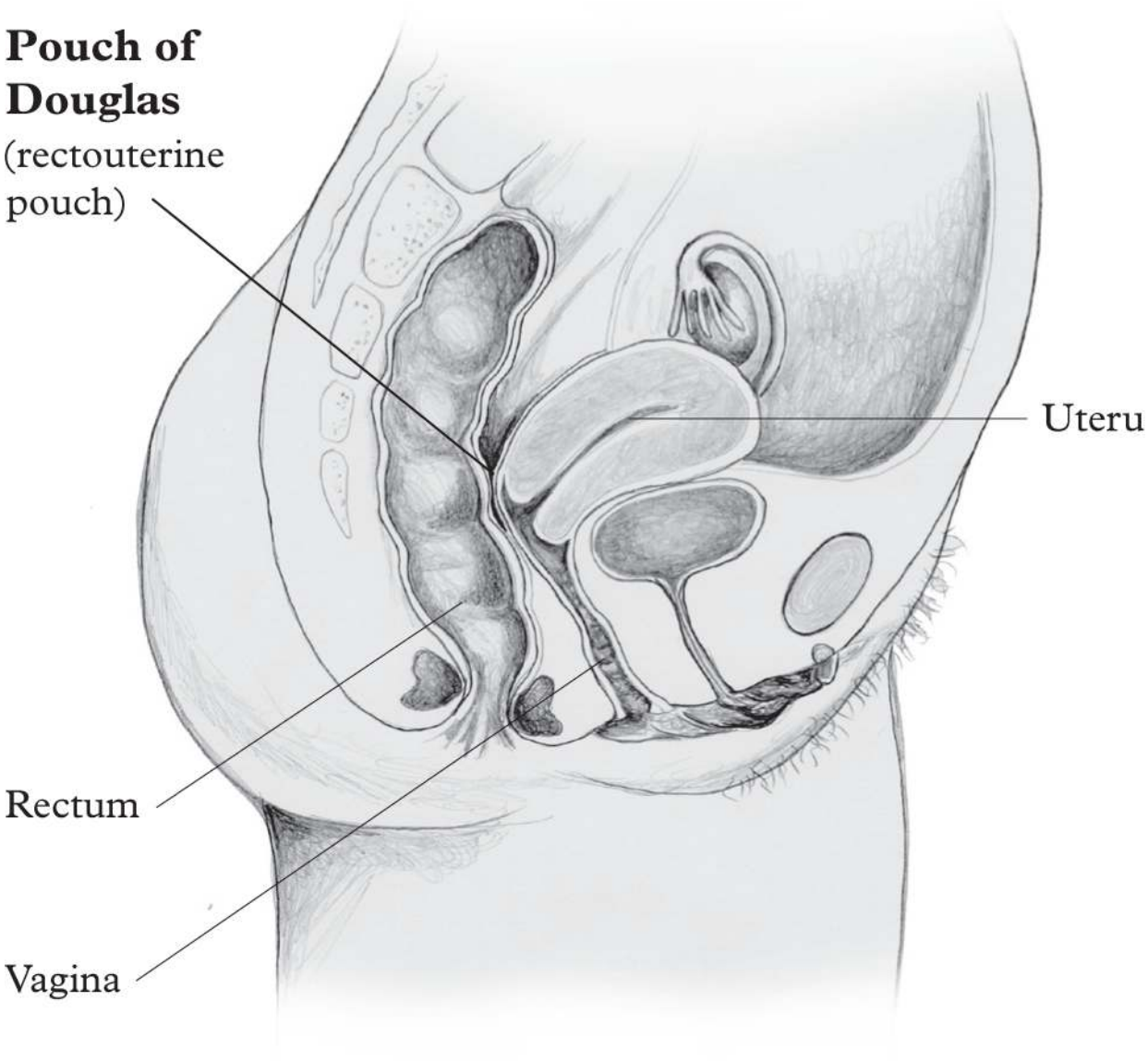
That Mary Toft inserted a rabbit deep into her vagina didn't make her particularly memorable. That a whole litter of the creatures was secreted inside her intimate parts certainly made her peculiar, but hardly worthy of a place in history. What made Toft so remarkable was that this illiterate young woman conned eminent doctors into thinking she'd actually given birth to the bunnies. All the while enduring this horrific, agonizing, life-threatening trauma.

Granted, this was England, 1726. Not the most sophisticated of times. Even the king's anatomist was taken in by the not-so-immaculate conception. "[I delivered] the entire trunk, strip'd of its skin, of a rabbet of about four months growth," Nathaniel St. André wrote. "The nails of the paws were most of them exceedingly sharp."

Toft—who is traditionally seen as the mother of all hoaxers, but may well have been a victim, coerced into the scam—quickly became a celebrity as her story was splashed all over the press. Unraveling this uncommon fraud

required a little common sense. Enter James Douglas, who quickly recognized something fishy was afoot.

Today, Douglas is immortalized in anatomy textbooks, and the annals of medical hoaxes. The Scottish doctor's name is attached to a pouch of the membrane—peritoneum—that lines the female abdominal cavity. The pouch of Douglas, also called the rectouterine pouch, sits in front of the rectum and behind the uterus, cervix, and vagina. Very close to where Mary Toft's rabbits resided, before their "birth."




Toft's hoax began a few weeks after she'd had a miscarriage—of a human baby—when she claimed to have delivered something resembling a cat,

minus its liver. Her family called John Howard, a local obstetrician, who removed more animal parts from her vagina. In the following weeks, various other curiosities came out of Toft, including a rabbit's head and a cat's legs, according to Howard. Then, on one hectic obstetric day, she delivered nine lifeless baby rabbits. The obstetrician excitedly wrote to the country's top doctors about the supposed miracle, thereby drawing the medical profession into this eccentric rabbit hole.

The sensational saga ran for a few months, until inevitably Toft was rumbled. A porter was caught smuggling a rabbit into her room. And, to the embarrassment of many distinguished medical men, Toft confessed to Douglas, implicating others in the hoax. The exact motive is a mystery, as is whether Toft was coerced into this dreadful ordeal. Though it's unlikely she acted alone, or voluntarily.

What is for sure, is that the pitiful creatures were inserted into Toft's vagina, for the doctors to pull a rabbit out of the hat, so to speak.

## Pudendal nerve

*How we're hardwired to say jay-jay, giney, weenie, winky, and worse*

You can't see *The Great Wall of Vulva* from space. As great walls go, it's on the small side. But the 8-meter- long (26 feet) sculpture featuring plaster casts of four hundred vulvas certainly makes a big impression. This out-there exhibition of vulval variety, on show in Miami, Florida, in 2023, is a refreshing antidote to the shame many people feel about their "privates."

It's shame that's hardwired into us from birth. Private parts are to be neither seen nor heard. So we counterbalance the weight of our shame by making light of our genitals, with genteel euphemisms—jay-jay, winkie, willy, wiener, thingy, downstairs, and so on—and an almost infinite variety of vulgar nicknames, dick names, and chick names. A UK survey found 65 percent of young women had a problem saying "vulva" or "vagina." Body parts that dare not speak their name.

This shameful avoidance is, frankly, dangerous. Children may be less likely to be sexually abused if they know and use the correct anatomical names for their genitals, research shows. A 1995 study found some perpetrators avoided these kids because it indicated they'd been educated about body safety and sexuality.

Knowing the correct anatomical names also helps children successfully disclose abuse. “He touched my muffin” may not elicit the same concern as “He touched my vulva.”

Tellingly, shame also dominates our anatomy, as well as our vocabulary. Shame is hardwired into our genitals via our pudendal nerves.

They—one on each side—are pleasure nerves, carrying sensations from the penis and scrotum, much of the vulva, and lower part of the vagina. They’re also indisputably our most shameful nerves. “Pudendal” is from the Latin word “pudere,” meaning “to be ashamed.” As is “pudendum,” another word for “vulva.” (Vulva is the name for the female external genitalia: labia majora and minora, clitoris, and the opening of the vagina, among other things.)

Pudendum can apply to men’s, as well as women’s, genitals. Though, perhaps not surprisingly, the term is mostly reserved for women, sparing guys some of the naming and shaming. Because of its shameful roots, pudendum was banished from official anatomical terminology in 2019.

So, while it’s good for kids to be au fait with their genitals’ anatomical names, they can steer clear of “pudendum” and perhaps also “pudendal nerve.”

## Putamen

*How deux is better than one*

*Si vous maîtrisez ces deux langues, lire deux fois la même chose (voir phrase adjacente) peut être un peu fastidieux*. If you are proficient in both of these languages, reading the same thing twice (see adjacent sentence) can be a bit tedious.

But there is an upside. Your bilingual brain is *magnifique*. Learning a second language induces changes in the brain that may give you advantages over people for whom double Dutch is the closest they’ll get to bilingual.

“The neuroanatomical [brain] changes in bilinguals result in enhanced executive functions, greater mental flexibility and an increased capacity for conflict resolution beyond that relating to language,” a review of the consequences of bilingualism said.

Importantly, the changes in brain gray and white matter may slow the decline in memory and thinking that occurs as we age, and help prevent

Alzheimer's disease. Among people with Alzheimer's, bilinguals are diagnosed four to five years later than those who speak one language.

But if you are bilingual, don't think you're the *crème de la crème*. *Au contraire*. It's estimated that over half the world's population can speak two or more languages.

Lots of bits of the brain are involved in language processing, interpretation, and production. Having a second language induces changes in many, for example, the left putamen. (In most people, the brain's left side is dominant for language.) The putamen is a largish structure deep below the surface of each brain hemisphere. Its *raison d'être* has traditionally been thought to be its important role in controlling movement. However, recent studies suggest it's involved in a wider variety of functions.

Research in people who spoke more than one language found they had increased density of gray matter in their left putamen. One of the brain changes thought to be beneficial in bilinguals. And, if you *parles français*, *sprichst Deutsch*, or *parli italiano*, as well as English, keep practicing. The more proficient you are in your second language, the greater the putamen's gray matter density.

For much of the twentieth century, many experts thought learning a second language was a handicap for children. There were concerns it was a mental burden, making kids confuse their languages, and impairing their intelligence.

In the 1960s, there was a *volte-face*, after a Canadian study found that children who spoke English and French had better verbal and nonverbal intelligence than their monolingual mates. If you were bilingual, and prone to tiresome repetition, you'd say, "*C'est fantastique*. That's fantastic."

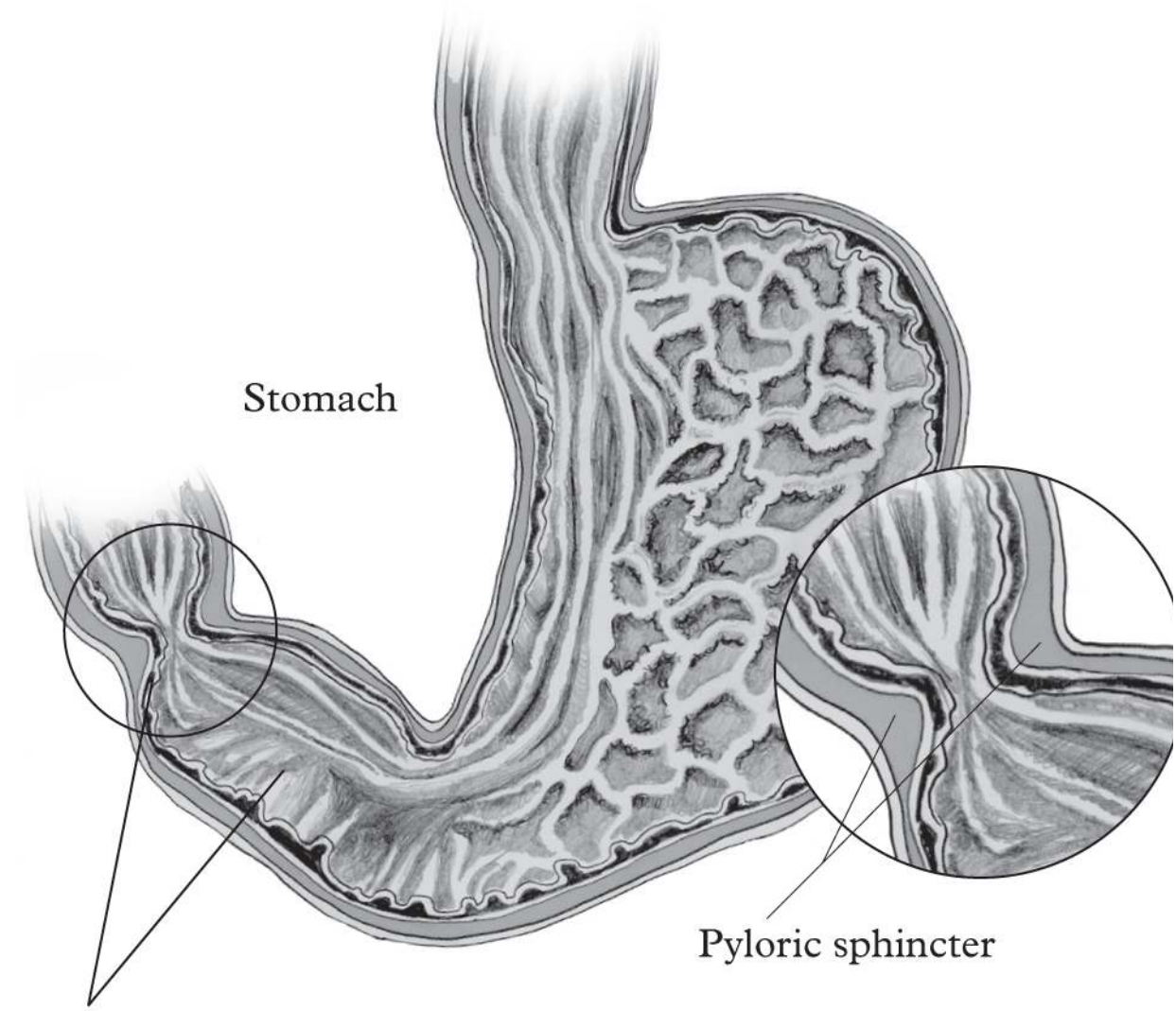
## Pylorus

*How bacterial broth trumped gut instinct*

Don't believe the hyper. Sugar *doesn't* turn kids into uncontrollable, hyperactive monsters. Chewing gum *doesn't* stick around in the stomach for seven years. And spicy foods *don't* cause stomach ulcers. Popular medical fantasies. Debunked by reality.

Fact is, candy messes with parents' brains, not their kids'. Of twelve high-quality studies looking at kids' reactions to diets with different amounts of sugar, *none* found it affected behavior. But if parents think their kids have

had a sugary drink, they say the little monkeys are more hyperactive, even if the drink was sugar-free. As for gum, it just goes through us. And most stomach ulcers are caused by a bacterium called *Helicobacter pylori*.




*H. pylori* is named after its looks and location. It's helix-shaped and was first discovered in the lower part of the stomach, which includes the pylorus.

"Pylorus" is from the Greek for "gatekeeper." Your stomach's pylorus guards the gates to the rest of your guts. Here, a ring of muscle—pyloric sphincter—regulates the flow of food into the small intestine. Before it leaves, strong acid and digestive enzymes break down the food. What's remarkable is that they don't also make a meal of you, digesting yourself

from the inside. To stop us becoming a sickening flesh-and-sinew smoothie, our stomach wall is coated with a protective layer of viscous mucus. Mucus that *H. pylori* calls home.

The stomach's inhospitable interior doesn't suit many bacteria, but *H. pylori* cleverly uses its shape to corkscrew into the safety of the mucus. Once there, it usually keeps itself secret: most infected people don't have symptoms, thankfully, bearing in mind that over 40 percent of human stomachs worldwide are colonized with *H. pylori*. Usually we're infected as a kid, likely from our mum, and the bacteria may keep us company our whole life.

Not so long ago, this savvy stomach squatter was a bacterial small potato, unknown in fact. It's a big cheese today thanks to two Australian doctors, Robin Warren and Barry Marshall. They won a Nobel Prize in 2005 for discovering *H. pylori* and its role in stomach ulcers.

However, they did their discovering back in the 1980s. At that time, the idea that *H. pylori* and stomach ulcers were connected was beyond belief for many medics. They snootily stuck to the prevailing doctrine that lifestyle factors like stress and spicy foods caused the problem. To help convince the dyspeptic skeptics, Marshall made himself sick to the stomach by drinking broth teeming with *H. pylori*.

Turns out, spicy curries don't give you ulcers. Bacteria soup does.

## Quadratus plantae

*How good eggs hold the secret to immortality*

This is a tale of two Sylviuses. The best of Sylviuses, and the worst of Sylviuses. Two eminent anatomists named Sylvius, whose stories hold the secret to eternal life. And it begins, not with their immortal souls, but with the thick-skinned soles of their feet.

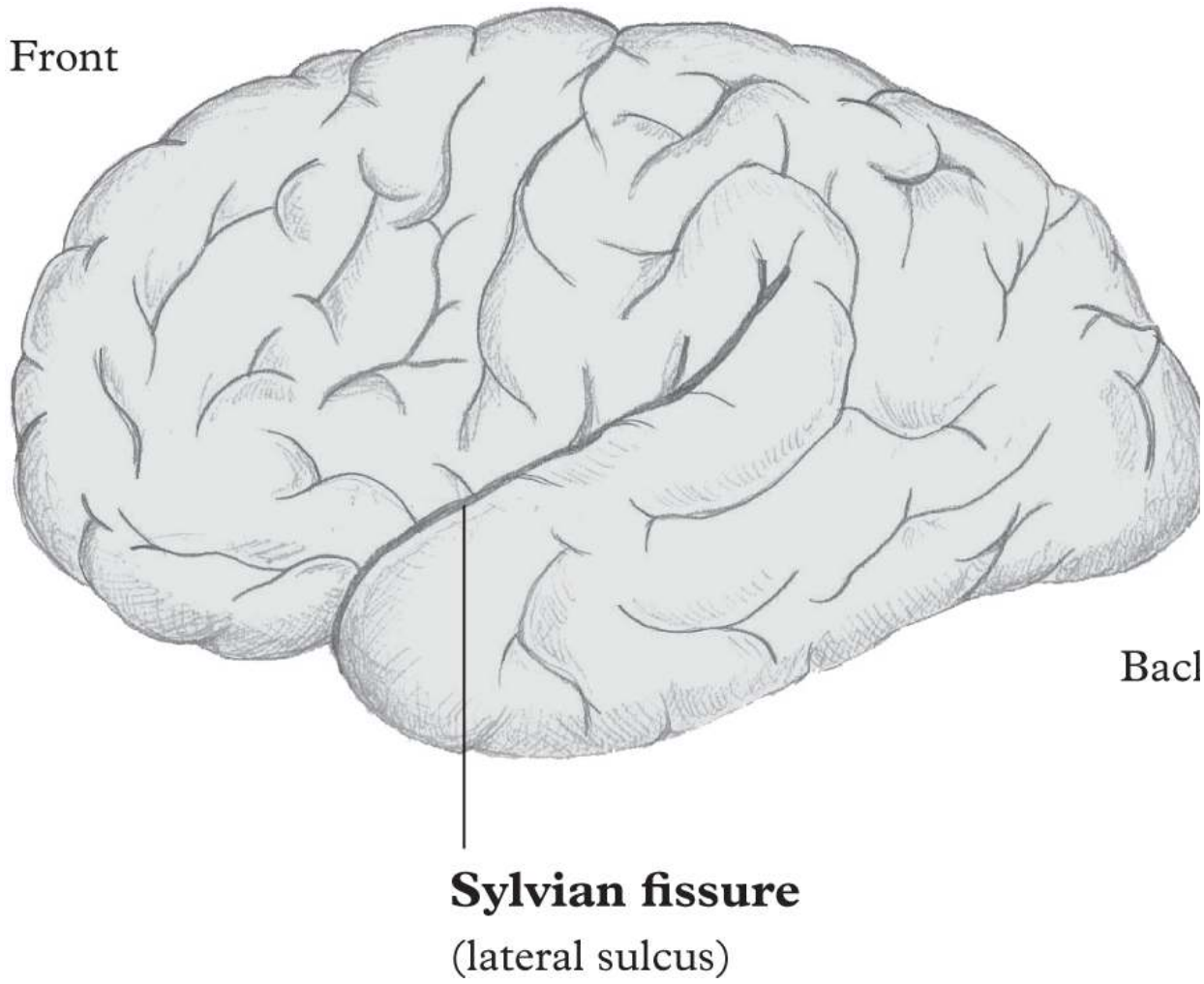
Quadratus plantae is a muscle in the sole that helps your toes flex. Jacobus Sylvius, a top sixteenth-century anatomist, first named it. The Frenchman actually called it "massa carnae," a label later consigned to the anatomical trash can. Jacobus named many other parts of us, like our biceps and triceps muscles. He was also among the first to write about a brain part called the cerebral aqueduct, also known as the aqueduct of Sylvius.

But this Sylvius in our brain *isn't* Jacobus. It's Franciscus Sylvius, a German-born anatomist who lived over a hundred years after the

Frenchman. Franciscus Sylvius also gave his name to many other bits of your anatomy, like the Sylvian fissure (aka lateral sulcus), a deep groove that runs along each side of your brain. Whereas Jacobus Sylvius doesn't seem to be immortalized in any part of you. Even a part he did first describe is associated with a contemporary: Bartolomeo Eustachi's Eustachian valve, at the entrance to the heart's right side.

So why is Franciscus Sylvius living on inside us, and Jacobus Sylvius, dead to us? Ostracized from our insides. Eponymously anonymous.

The answer has nothing to do with their relative ability, productivity, or originality. The crucial difference was their *likability*. Franciscus was popular with his students. Unlike the petulant, intolerant, vindictive Jacobus. And at that time, students would honor respected teachers by naming parts of us after them, even if they weren't the first to describe them.



Jacobus's exile from the anatomy textbooks was sealed thanks to his feud with one particular student. This was no minor tiff. This was a full-on, scalpels-at-dawn dustup. And Jacobus certainly went the extra bile. He even begged the Holy Roman Emperor Charles V to punish the student, "this worst example of ignorance, ingratitude, arrogance, and impiety, to suppress him so that he may not poison the rest of Europe with his pestilential breath."

This was a spectacular fail. The sacrilegious student with horrible halitosis was none other than Andreas Vesalius, now recognized as one of the greatest anatomists ever. The "founder of modern anatomy." In the quest for anatomical immortality, Jacobus Sylvius had egg on his face, while Franciscus Sylvius was a good egg. And (hopefully) good eggs take the cake.

## Recurrent laryngeal nerve

*How giraffes are a pain in the neck for evolution's opponents*

If the average IQ is 100, then God's must be way off the charts. After all, he is omniscient, omnipotent, and omnipresent, at least according to traditional Christian belief. All-knowing, all-powerful, and everywhere. Not even AI can boast that, yet.

God's infinite smarts are the foundation for some creationists' arguments against evolution. They maintain that a hyper-brainy deity created all life, pretty much as we know it today, instead of it gradually evolving. They call this "intelligent design." Trouble is, if divine design was responsible for your recurrent laryngeal nerves, then God isn't as smart as they'd like to think he is.

Your recurrent laryngeal nerves—left and right—control most of the muscles in your voice box (larynx), among other things. Damage to one can cause a hoarse voice. Their fibers originate in the brain. But they don't take the short route to the larynx, as the crow flies, as an intelligent designer would surely have stipulated on the blood-stained blueprints. They take a dumb detour.

The recurrent laryngeal nerves' fibers exit the brainstem, at the brain's base, inside the left and right vagus nerves, which run down the neck. The right recurrent laryngeal nerve branches off the right vagus near the root of the neck. The left one branches from the left vagus, a little further down, in

the chest. Both then do a U-turn, looping under large blood vessels and going back up the neck to the larynx. Hence the name "recurrent," which means "turned back to run in the opposite direction."

This neck trek can be explained by our development in the womb. The nerves appear early, before we have a neck. As our neck grows, the nerves are dragged down, away from the head, forcing them to get longer and longer to maintain the connection to the larynx.

It's unintelligent design.

But *our* recurrent laryngeal nerves aren't the ones usually held up to help refute intelligent design. All four-limbed vertebrates (animals with a backbone) have this inefficient U-turn. And one of these has seven vertebrae in its neck that are so large, their recurrent laryngeal nerve fibers are almost 5 meters (16 feet) long. That would be the giraffe, whose necks can grow to up to 2.4 meters (8 feet).

Human and giraffe recurrent laryngeal nerves: dumb, and dumber.

## Rods and cones

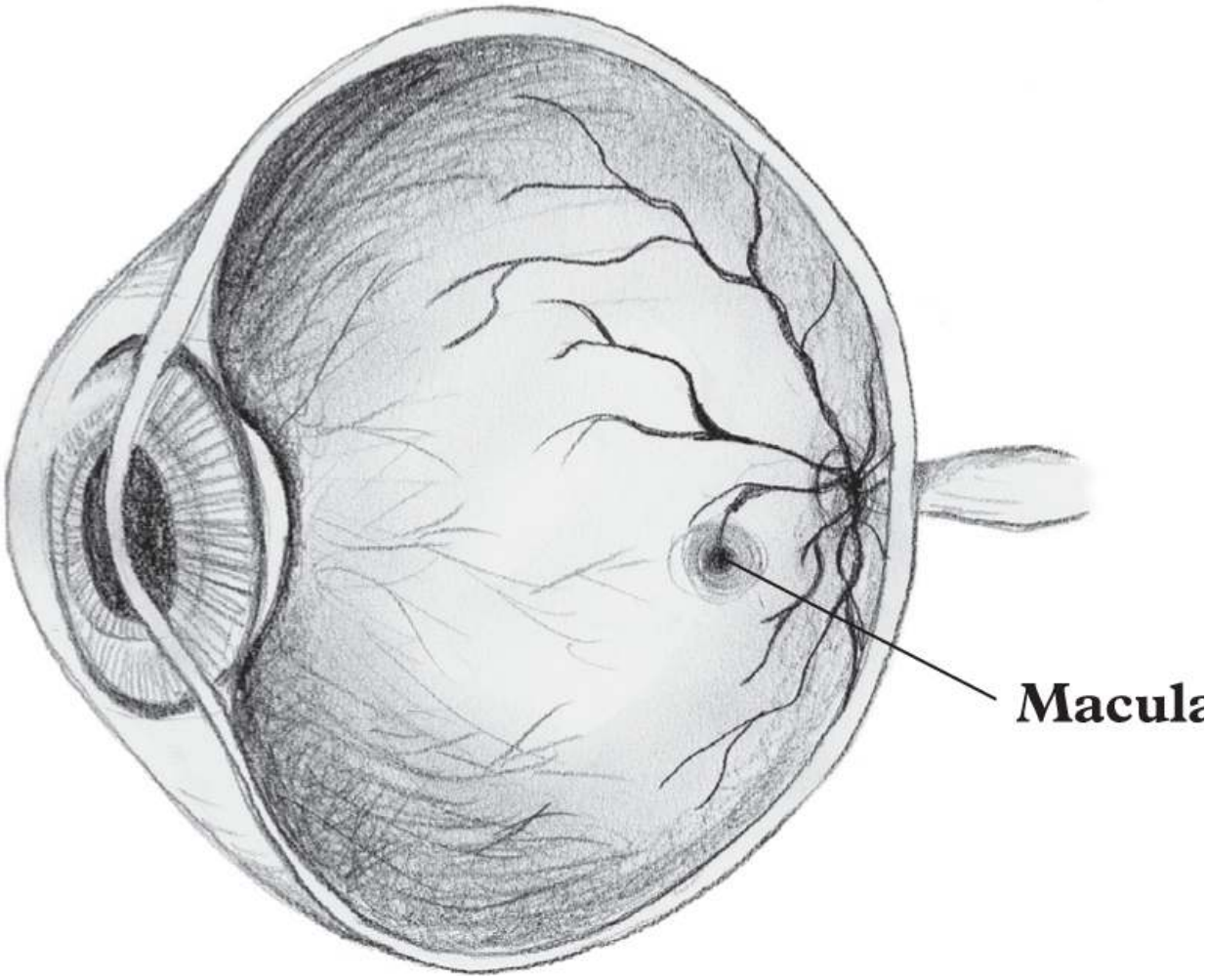
*How we're all visionaries, even if we're mistaken about Jesus*

Why did Isaac Newton stick a bodkin into his eye? How did the scientific superstar get the bodkin in? And what on Earth is a bodkin?

Newton wasn't your average, run-of-the-mill genius. One of history's most influential scientists, he was hyper-obsessive, never afraid to ask the hard questions, then go the extra mile, and eyeball, for answers. As well as developing his law of gravity, the Englishman was visionary about vision, proving that light is made of a spectrum of colors. But how does our mind perceive them? Was it to do with pressure on the eye?

Taking his quest for insight eye-wateringly literally, Newton took a needle—bodkin—and poked it between his eyeball and bone of his eye socket. Then he pressed it on his eye, until he saw white, dark, and colored circles.

Newton couldn't be expected to know that we see thanks to rods and cones. When these light-sensitive cells in our retina are activated, they send signals to our brain, which constructs an image. Crucially, the 120 million rods and 6 million cones aren't evenly distributed. Rods dominate in the outer retina, so handle peripheral vision; cones the center, in a 5-millimeter-wide (less than a quarter of an inch) spot called the macula.




Rods are sensitive to light and dark changes, and movement. It's why we're good at spotting things moving in the corner of our eye; handy in the jungle at dusk when lions are on the prowl. Cones do color and fine detail, but don't work well in low light. So, on moonlit nights we see little color, and it's easier to spy stars if we look away from them, using our rods.

At the macula's center—the fovea—there's only cones. Here vision is super-clear, but it's a tiny area. Hold your arm out, and your thumbnail corresponds to it. The rest of your visual field has lower resolution. So why don't you see a small tunnel of clarity surrounded by out-of-focus fuzziness? Everything looks sharp all around you because your eyes are constantly moving, faster than you realize, scanning everything with your central vision, and your brain constructs a reasonably clear picture.

Incidentally, "macula" is Latin for "spot" or "stain." Hence, if you order a traditional macchiato coffee, you'll get an espresso stained with milk. On the

other hand, “immaculate” means “spotless.” As in the Immaculate Conception, which refers to Mary’s conception, not her son’s, as many people mistakenly believe.

## Scarpa’s fascia (membranous layer of abdominal subcutaneous tissue)

*How an abominable anatomical genius lost his head*

If fascist leaders are ruthless despots bent on crushing all rivals, then Antonio Scarpa sure fitted the bill. The Italian doctor-cum-dictator died in 1832, long before compatriot Benito Mussolini made fascism a “thing.” But they shared some despicable traits. This may be why Scarpa’s underlings decapitated him.

On the plus side of the ledger, Scarpa was a dazzlingly gifted anatomist. Many pieces of us are named after him, like Scarpa’s fascia, a thin layer of tissue in our abdominal wall with a name linked to fascism.

Scarpa was a prodigy with a vile temper and a lust for fame and fortune. At age thirty-one, he became professor of anatomy and surgery at Italy’s prestigious University of Pavia. During the next five decades, he wielded his tyrannical influence, thanks to his scientific brilliance and dark personality. Scarpa used and abused his power to further his own ends. Rivals who threatened to eclipse his skill or fame were removed from Pavia. He even had the chutzpah to openly admit he’d framed one professor for burglary.

Then there was the nepotism. One of his sons became a professor while still only a student. When his progeny died suddenly, Scarpa’s favor turned to a protégé, likely one of his many rumored to be illegitimate children.

Only after his death could Scarpa’s colleagues have their way with him, hacking away his head, as well as fingers, kidneys, and bladder. “Allegedly the reason was ‘the idea not to allow the earth to appropriate all of the mortal remains of a man celebrated throughout Europe,’ ” an account of his life said. “University gossip at that time suggested other reasons.”

Today, the ruthless, headless professor lives on inside us, in “his” fascia, aka membranous layer of abdominal subcutaneous tissue. The words “fascia” and “fascist” are related to an ancient Roman symbol of authority called the fasces. This intimidating emblem featured an axe-head projecting from a bundle of rods, bound by leather straps. Scarpa’s fascia is the strap, in name at least. “Fascia” is from the Latin for “band” or “bandage.”

Scarpa's fascia helps attach the skin of the abdominal wall to the deeper layers, stopping the skin sagging. The drooping skin under Scarpa's eyes could use some. We know this because his head resides in an alcohol-filled glass casket in Pavia. The grim, grimacing relic stares out from its case, perhaps looking for the rest of its body, who's final resting place is unknown.

## Skene's gland (paraurethral gland)

*How there's more to sex than squirting*

Female ejaculate is a cloudy issue. An opaque source of sexual discord, liable to get even mild-mannered folk into a lather. There's no denying sex can come to a crescendo, with the release of fluid from a penis, and a woman's body. But while Arthur's emission is relatively straightforward, Martha's is beset by confusion and controversy.

Is female ejaculation a real phenomenon? If it is, where does it come from? Or is it simply urine from the bladder?

Thousands of years ago, female ejaculation wasn't so contentious. The Greek philosopher Aristotle wrote about it in the fourth century BCE. A Chinese manual written seven hundred or so years later—*Secret Instructions Concerning the Jade Chamber*—also covered it. This talked about the production of two distinct fluids during female arousal: vaginal lubricant, and ejaculate expelled during orgasm.

Yet by the 1960s, American sex research pioneers William Masters and Virginia Johnson had dismissed female ejaculation as a widespread myth.

These masters of sex were mistaken, according to a review of female ejaculation in an anatomy journal. Studies showed it was a real phenomenon. Nevertheless, female ejaculation was "contentious." Misconceptions were "rampant." These were fueled by people often putting any fluid that emanated from the vagina or urethra during sex into the one bucket, and calling it all ejaculate.

This caused confusion between two different fluids, arising from different processes: ejaculation and squirting.

Ejaculate came from a woman's Skene's glands (paraurethral glands), sometimes called the "female prostate," the review said. These glands, one on either side of the lower end of the urethra, are named after Alexander

Skene, a nineteenth-century Scottish-born American gynecologist who studied them.

It's called "ejaculate" because of its similarity to men's, more obvious emission. When women orgasm, though not all the time, this small amount of milky fluid is expelled through the urethra. Importantly, it contains prostate-specific antigen, a chemical also in men's semen made by their prostate gland. However, unlike in men, there is uncertainty about female ejaculate's function.

On the other hand, squirting is the involuntary release of a lot more fluid from the female urethra. This is clear, watery, and likely from the bladder.

"Squirting culminates in gushes of fluid, ranging in volume from 15 to 110 mL [up to 3.7 US fluid ounces], that are biochemically identical to urine," the review said.

"This fluid can be released by stimulation of the Gräfenberg spot [G-spot] … and is reported as a positive response to a sexual encounter between partners. Proper fluid identification and use of terminology will ensure that future research in this area is not futile."

## Sphincter of Oddi (hepatopancreatic sphincter)

*How a bilious medic met a melancholic end*

Ruggero Oddi was many things—prodigy, pioneer, addict, vagrant, quack, and more—and through it all he was full of humor. That's not to say, however, that the nineteenth-century Italian doctor was the life and soul of the party, entertaining friends and acquaintances with his witty banter. Far from it.

Oddi's humors were rather more fundamental, at least according to the influential Greek medic Galen. Born in the year 129, Galen believed the balance of four body fluids—humors—determined our health and character. Our temperament was at the mercy of imbalances of blood, phlegm, black bile believed to be from the kidneys and spleen, and lastly yellow bile from the gallbladder.

This theory may be long gone from mainstream medicine, but it has left an indelible imprint on our emotional lexicon, as Oddi's descent from revered scientist to reviled con artist illustrates. Perhaps during his rise to fame he was "phlegmatic" (phlegm): cool, calm, and collected. Or "sanguine" (blood, as in "exsanguinate"): cheerfully optimistic. Then, on the

slippery slope from hero to zero, Oddi was deeply "melancholic," from the ancient Greek "melas" ("black") and "khole" ("bile"). And as things went further downhill, he was hot-tempered, as in "choleric" (yellow bile). In today's medical lingo, the prefix "chol-" means bile or gall. Hence removal of the gallbladder is a cholecystectomy.

But it wasn't just emotional bile that dominated Oddi's tragic life. The drug-addled doctor is immortalized inside our system that makes and transports bodily bile.

Oddi peaked early, shooting to fame as a twenty-three-year-old medical student in 1887, when he described the workings of "his" sphincter. The sphincter of Oddi is a little ring of muscle that controls the flow of pancreatic juice and bile (which is made in the liver and stored in the gallbladder) into your small intestine (duodenum), to aid digestion. Inflammation of the sphincter, aka hepatopancreatic sphincter, is naturally, and not in the slightest bit oddly, called "odditis."

At just twenty-nine, Oddi became Acting Director of the Physiological Institute of Genoa, Italy. He'd also become addicted to narcotics. Oddi left his post in 1901, following the Institute's financial ruin and altercations with medical bigwigs.

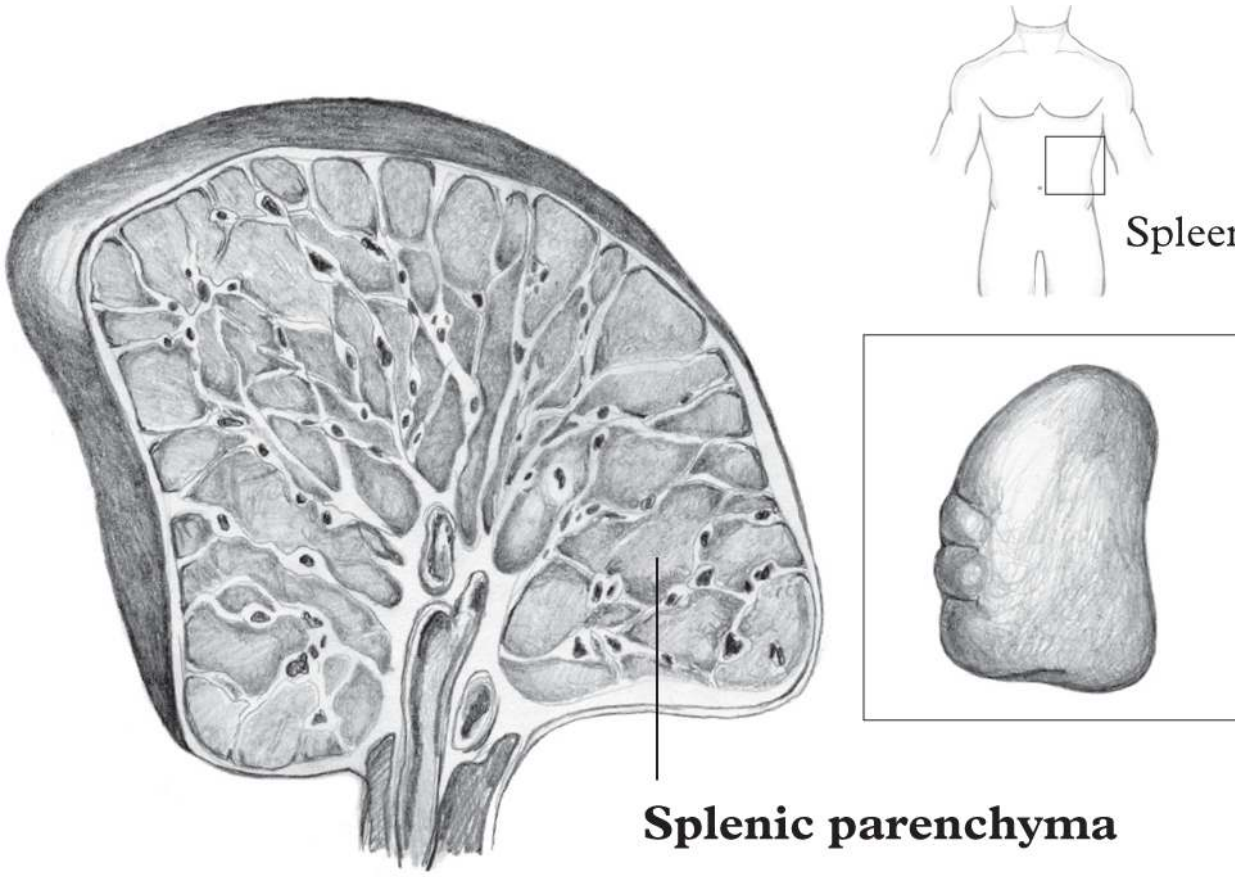
Depressed, dishonored, and addicted, Oddi's life spiraled out of control, the once eminent medic now peddling a quack remedy called vitaline. This snake oil contained ammonium chloride, alcohol, glycerin, and sodium borate. Oddi was charged with voluntary manslaughter and abusive use of medical products.

In 1911, Oddi left for Tunisia, hoping to join the famously formidable French Foreign Legion. If he was sanguine about this, his optimistic humor was wildly misplaced. Oddi died there in 1913 of unknown causes.

## Splenic parenchyma

*How not to vent your grievances*

When William Panier vented his spleen, he didn't punch a wall, chew someone's ear off, or spit out an apoplectic tweet. The English butcher used a blade. Panier stuck a knife deep into his left side, leaving his guts and spleen spilling out.




Panier was in debt and hiding from the law. Desperate and about to be caught, he decided to take his own life. And he did a good*ish* job of it, because when the cops found him, and his spleen, they left him for dead. Or so they thought. Three interminable days on, Panier still hadn't succumbed. So, they called a surgeon, who pushed his guts back in, cut his spleen away, and sewed up the wound. Cutting-edge treatment in what was the seventeenth century.

Happily, despite his major trauma, and being down an organ, Panier made a complete recovery. Soon after, he emigrated to the US, arguably a safer way to escape his problems.

Panier's self-butchery also had a silver lining for doctors. At the time, they knew little about the spleen, and Panier showed we can live without it. That's despite the fact that it has important jobs. For example, it's where worn-out red blood cells go to die and is involved in fighting infection.

Though this fist-sized organ under our ribs on our left side has a major downside. When people are hard hit in the breadbasket, say in a car crash,

the spleen is one of the most commonly injured organs in the belly. This can have grave consequences when its outer capsule is ruptured and the delicate, bloody tissue inside (parenchyma) is damaged. “Parenchyma” is from the Greek for “to pour in.” Ancient medics thought organs were made by blood that was poured into them, which then congealed. Damage to the parenchyma can cause blood to pour out. The internal bleeding can be life-threatening.

As well as being a physical liability, the spleen is lumbered with bucketloads of emotional baggage. In the seventeenth century, people with depression without a real cause had “hypochondria.” This literally means “under cartilage.” “Hypo” is Greek for “under,” as in a “hypodermic” needle under the skin. Traditionally, the region under the rib cartilage, particularly the spleen, was believed to be the source of melancholy. By the nineteenth century, hypochondria had evolved to mean the unfounded belief that you’re sick.

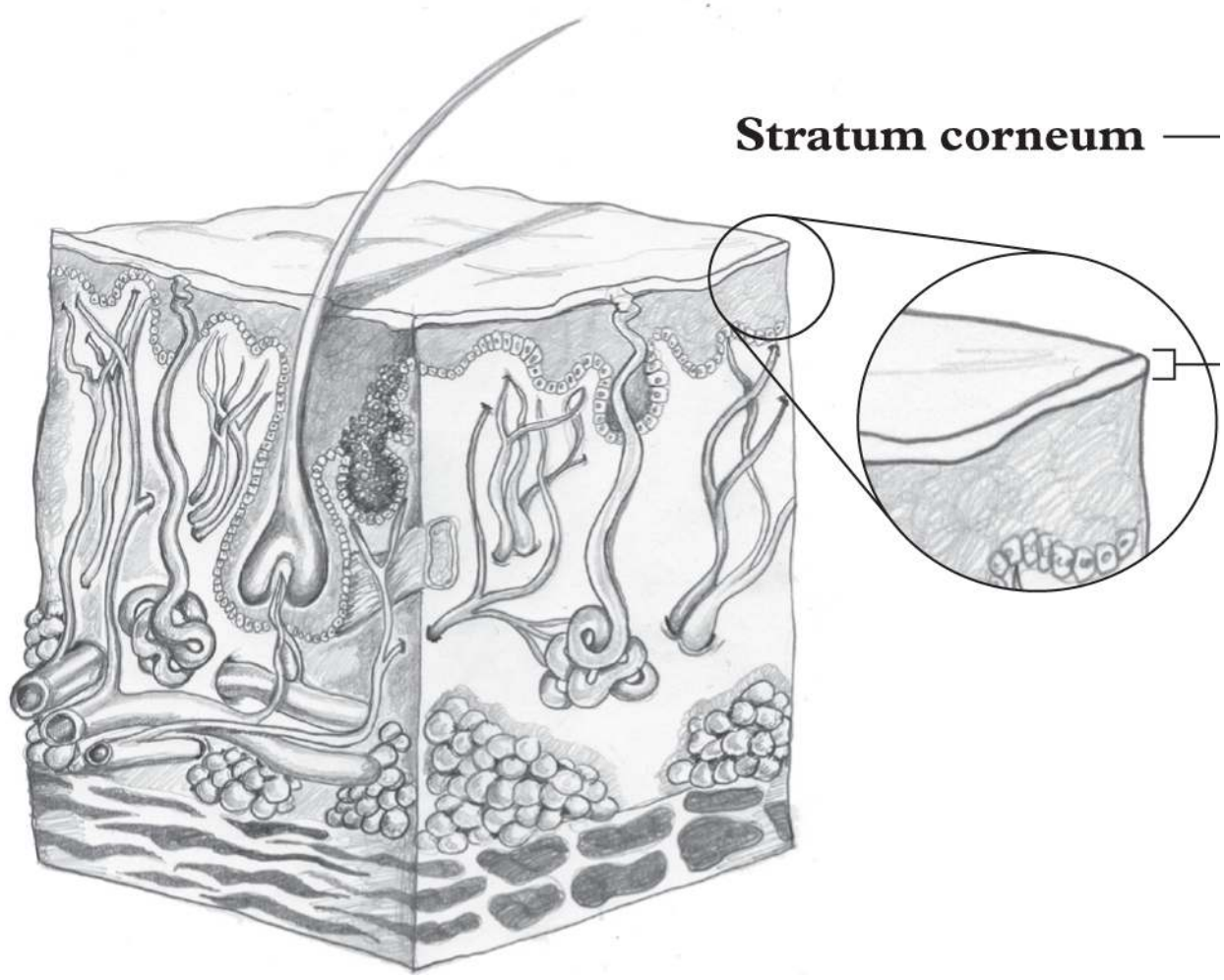
The spleen is also linked to anger. Bad tempered, spiteful tyrants are “splenetic,” and best avoided, in person and on social media. Especially when they vent their spleen. Though hopefully not *à la* William Panier.

## Stratum corneum

*How you’re more than a little flaky*

“I see dead people,” the creepy catchphrase from the hit movie *The Sixth Sense*, isn’t about Bruce Willis’s stratum corneum. At least not in the film’s plot. When Cole Sear (Haley Joel Osment) whispers the much-memed words to psychologist Malcolm Crowe (Willis), he’s not referring to Crowe’s skin. The line—forty-fourth on the American Film Institute’s *100 Years ... 100 Movie Quotes* list—is about the supernatural. But it also pertains to your super, natural skin. Because you don’t need a sixth sense to see dead people. The stratum corneum, your outermost skin layer, the bit we see, is made of dead cells.

This remarkable structure, just 0.02 millimeters thick, a fifth of a sheet of paper, is your skin’s key protective barrier. Made of only about twenty to thirty layers of cells, its superpowers include preventing entry of pathogens and toxic chemicals, absorbing damaging UV radiation, and stopping fluid seeping out.




You're a walking, talking balloon full of water. About 50–60 percent of an adult's body weight is $H_2O$. Scrape off your stratum corneum and fluid leaks out, fast. When it's severely damaged, all over the body, 6 liters (1.5 gallons) can be lost in a day.

Key to the stratum corneum's talents is its brick-and-mortar architecture. Though it's far more sophisticated than a humble wall. The mortar is a mixture of lipids; fatty molecules that repel water, like a waxed rain jacket. The bricks are rigid cells filled with keratin, like that in animal horns. "Corneum" is from the Latin for "horny," like "cornet," a musical horn.

To function properly, your stratum corneum needs to be continually renewed. Every few weeks it's completely replaced, as cells from the layers below enter and those on the top flake off. Hence, you shed 1–1.5 grams (up to one twentieth of an ounce) of skin a day, the weight of a paper clip. That's

about 35 kilograms (77 pounds) in a lifetime, more than a third the weight of an average American adult man.

The tiny flakes of shed skin—dander—are a constituent of house dust, a gram of which can be teeming with ten thousand dust mites. These eight-legged micro-monsters munch on the dander, producing heaps of feces. The poop particles then get wafted into the air and inhaled. It's substances in the feces that are the main culprits in dust mite allergy.

If you were blissfully indifferent to these gross goings-on in the dust that coats homes and floats in the air, you might say "Frankly, my dear, I don't give a dander." A line that isn't from *Gone with the Wind*, or number one on the American Film Institute's quotes list.

## Synovial fluid

*How a fifty-year experiment cracked a cracking conundrum*

Some people are quite simply infuriating. SHOUTY TYPISTS. Megaphones who prattle into their mobile phones. Painfully oblivious hummers, coughers, chewers, and throat clearers. A confederation of everyday irritation, chip, chip, chipping away at our sanity.

But they're in the minor leagues of peeve compared with knuckle crackers. The head honchos of head-splitting torment. Knuckleheads with a habit that's indisputably, excruciatingly, Finger Clickin' Bad.

If knuckle crackers totally gross you out, it may be some consolation to know that the confronting cracks aren't bone or cartilage snapping over each other. The noxious noise emanates from synovial fluid. A knuckle joint has two cartilage-covered bones, with a thin film of synovial fluid between them. When knuckle crackers pull a finger, they increase the space in the joint. This reduces the pressure in the synovial fluid, causing gas in it to form into a bubble. It's either the bubble forming or bursting that makes the pop. "Either," because despite lots of research, no one knows exactly how knuckles snap, crackle, and pop.

Synovial fluid is clear, with the consistency of egg white. "Syn" is from the Greek for "with." The rest of the word is from "ovum," Latin for "egg," as in "ovary." The fluid's main job is to lubricate and cushion joints. Surprisingly little of it is needed. A knee joint may have less than a teaspoon. However, its lack of quantity is more than made up for by its special qualities. For example, when joints move, the synovial fluid helps by

becoming less viscous. Normal joint function depends on it. In osteoarthritis, the fluid stops working properly and triggers pain-signaling nerves.

Talking of arthritis, knuckle crackers are often warned they'll end up with it. Wrongly, we know, thanks partly to a US doctor's remarkable, half-century-long experiment. Donald Unger likely drove his mum, and later also his mother-in-law, to distraction during five decades of cracking his left hand's knuckles at least twice a day, while leaving his right hand alone. That's more than 36,500 cracks on the left, versus almost zero on the right. And what was the upshot? No arthritis in either hand. In fact, no obvious differences between the two.

So, knuckle crackers can crack on with less concern about arthritis. Though hopefully they'll spare a thought for the non–knuckle crackers driven crackers by their obnoxious habit.

## Thenar eminence

*How humble thumbs gave us a huge helping hand*

All body parts are equal, but some are more equal than others. Ask King Æthelberht of Kent.

OK, you can't *ask* the English royal, he died in the year 616. But Æthelberht's code of laws—the earliest surviving datable document written in English—lives on. And this remarkable manuscript establishes a pecking order for your anatomy.

Æthelberht's laws decree the fines perpetrators must pay for their offenses. They begin with a hefty dose of sex. Lie with the king's maiden and you're up for fifty shillings. Couple with a nobleman's cupbearer: twelve shillings. Have a dalliance with a freeman's cupbearer: six shillings. Bargain.

Then they move on to the body. Crack some poor soul's rib, and you cough up three shillings. Break an arm; hand over six shillings. Lop off a shooting finger: nine shillings. Damage an eye: twelve shillings. But strike off a thumb, and you'd better be flush with cash, because it'll set you back a whopping twenty smackers.


Thenar eminence

Æthelberht gave two thumbs up to your humble thumb and its muscular thenar eminence. That's the bulge at your thumb's base. It's made of three muscles that control this extraordinarily dexterous digit. "Thenar" is from the Greek for "palm of the hand"; "eminence," from the Latin for "standing out," as eminent people do.

Our deft thumbs are believed to have been vital in our evolution into the ingenious sophisticates we are today. As we progressed from walking on all fours to striding on two feet, it freed up our hands to develop from weight-bearing extremities into handy precision instruments. Without them, we'd have struggled to craft tools for building, make weapons for fighting, or hold pens for writing. Much of the credit goes to our thumbs. We may have five digits on each hand, but our thumb provides 40–50 percent of hand function.

We're now so extraordinarily evolved that we communicate almost exclusively with our thumbs. Our mass addiction to phones—in a 2021 survey, 36 percent of Americans said they'd give up their pets to keep their cell phone—has led to a rise in "smartphone thumb," a painful condition caused by overuse.

Æthelberht preferred sallying forth over SMSing, so would not have been sympathetic. Sufferers wouldn't have gotten any shillings in compensation.

## Thymus

*How medics were anesthetized from blame for kids' deaths*

When is a disease not a disease? The short answer is: when it's invented to solve a problem. In this case, the medical profession's problem was explaining sudden deaths in children. The resulting concocted disease had the added bonus of protecting doctors implicated in the tragedies.

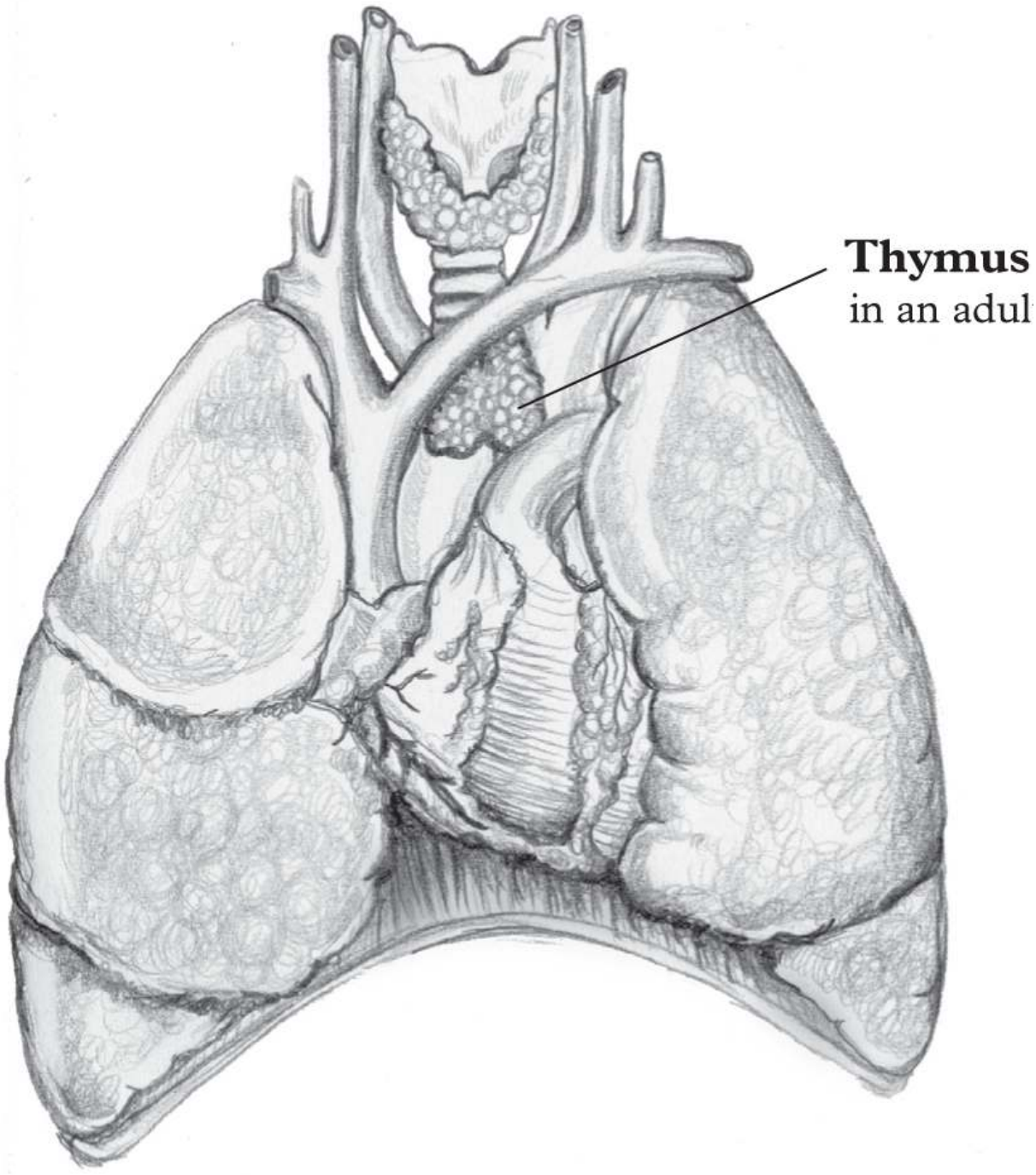
Granted, this (mis)diagnosis was founded on ignorance, rather than malevolence. Though self-serving hubris also played its part, with the help of a convenient anatomical patsy. A supposedly abnormal organ to scapegoat. The mysterious thymus.

It wasn't until the 1960s that the thymus's function was understood. Critical for the development of the immune system, it's behind the top of the breastbone (sternum), between the lungs. Here, infection-fighting white blood cells—T cells—develop. Most are made before birth, and in

childhood. Importantly, the thymus is relatively large until puberty, then shrinks, being barely identifiable as an organ in the elderly.

Rewind to the late nineteenth century. Then, adult norms were often applied to kids. Hence, thymuses in kids should be *small*, as per adults. So a "large" thymus in a child who'd died suddenly was often considered the cause, it having pressed on surrounding structures. (Most children died after severe, more chronic illnesses, which could lead to thymus shrinking, so the organ wasn't implicated then.)

"Progress" was made in 1889, when a disease, rather than mechanical pressure of the thymus, was identified as a cause of sudden death. This was "status lymphaticus." The affliction featured an enlarged thymus and lymph glands, plus poor health, and could lead to death with little provocation, mostly in kids and young people. Hence, status lymphaticus came in handy for doctors needing to explain sudden deaths.




In particular, it was a boon for those who administered chloroform surgical anesthetic (not used today because of its risks). Deaths under anesthesia could now be conveniently blamed on status lymphaticus. A 1909 article in the *Lancet* medical journal commenting on one such disaster said it

“might have sustained a charge of manslaughter,” were it not for the thymus being implicated following an autopsy.

This wasn’t just ignorance at play. Again, in 1909, the *Lancet* stressed the importance of diagnosing status lymphaticus, so deaths weren’t attributed to chloroform. In 1912, the American Surgical Association was told some reports of status lymphaticus deaths were probably written to distract attention from the anesthetic.

Eventually, better understanding of normal thymus anatomy put the kibosh on the diagnosis, as per a 1931 *Lancet* editorial declaring “The End of Status Lymphaticus.” But not before it had helped protect many reputations, as this 1914 quote from the journal *Nature* illustrates: deaths under anesthesia “fall into three categories: first, those which no human skill can avert, for example, in unsuspected cases of status lymphaticus; secondly, those due to want of knowledge on the part of the medical practitioner; and, thirdly, those which occur in the practice of unqualified persons.”

Status lymphaticus exonerated the qualified and knowledgeable. And what medic would say they weren’t?

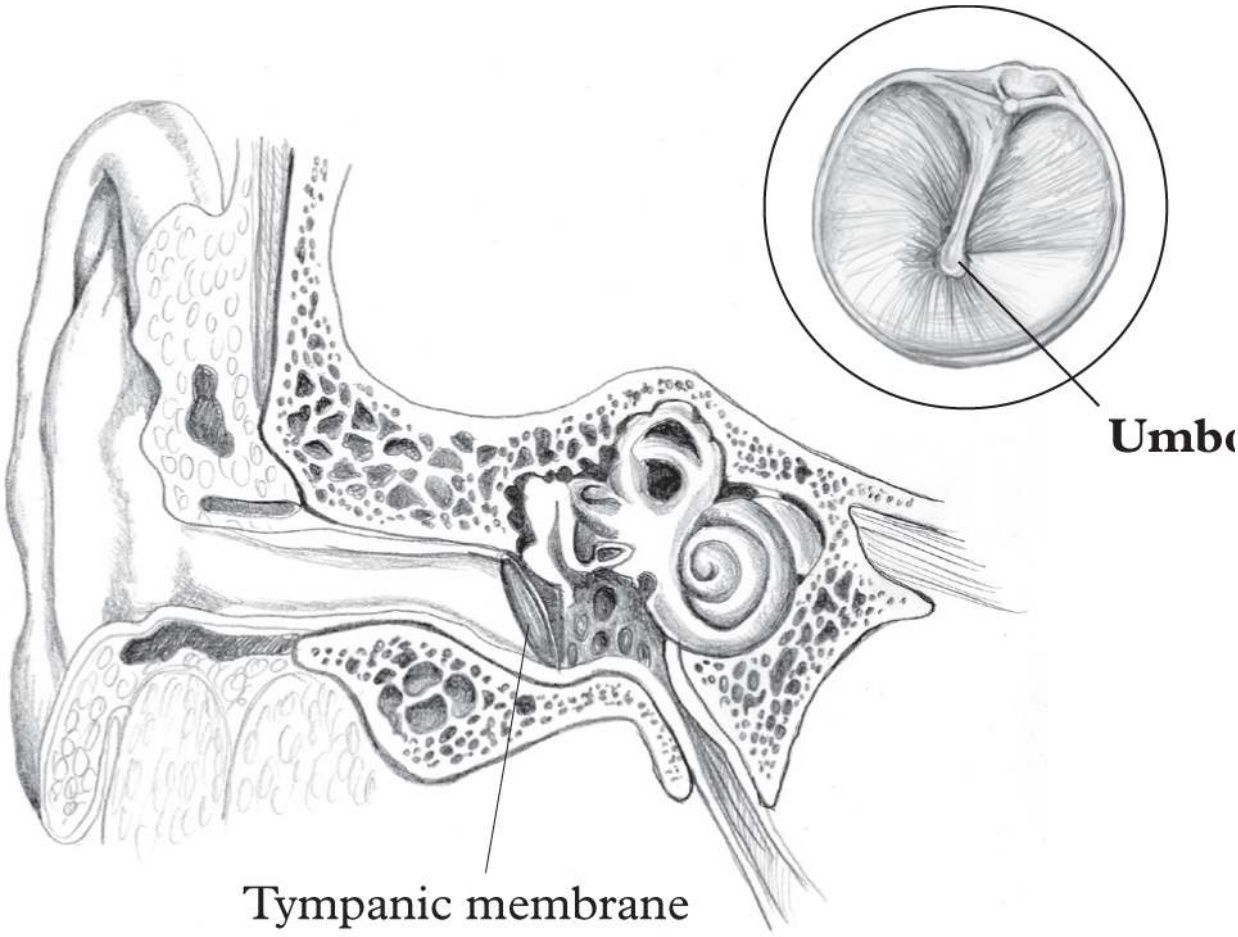
## Umbo

*How you can believe your ears, thanks to your boss*

If you’ve never witnessed a miracle, you can, right now. Just say the word “miracle” out loud. What you heard, and how you heard it, was utterly miraculous.

Hearing is a sensational sensation. Brought to you by the astonishing alchemy of your auditory anatomy. This eclectic assembly of hearing engineering senses pressure waves—commonly called sounds—and transforms them into electrical signals, then decodes them inside your head, giving you the impression that they’re noises coming from outside of it.

The sounds’ pressure waves hit your eardrum and its prominent umbo, making it vibrate. Don’t underestimate your humble eardrum, aka tympanic membrane. At just 1 centimeter (four-tenths of an inch) across and 0.1 millimeters thick—the width of a human hair—it’s an impossibly delicate sliver of anatomic wizardry. One that functions at a subatomic scale. Incredibly, your super sensitive sound system can detect eardrum movements that are less than the width of an atom.




The umbo is roughly at the center of your eardrum. Attached to the umbo, on the inside of the partly transparent membrane, is the malleus, one of the three tiny bones (see auditory ossicles) that amplify the sound vibrations. The malleus pulls your tympanic membrane inward, making it into a shallow cone, with the umbo at its tip. That's not an accident. This shape is much better than a flat eardrum for transmitting sound waves to the bones behind it. Your eardrum is essentially a tiny, exquisitely engineered loudspeaker cone.

Its cone shape also helps give it the strength it needs to deal with the sound waves funneled into it by your pinna. That's the bit of your ear on the outside of your head. Again, don't misjudge this comical chaos of skin-covered cartilage. Your pinna is seriously clever. Its eccentric ridges and folds are designed to amplify certain sounds, which just so happen to correspond to the frequency of the human voice. Hence, these sounds are

emphasized on their way to your conical tympanic membrane and umbo at its tip.

Which makes the umbo your tympanic membrane's boss. It's named after the round blob at the center of a shield; "boss" in English, "umbo" in Latin. Think *Game of Thrones*-type warriors. You've got another, similar-ish blob in your midriff: your umbilicus, aka belly button. It's as miraculous as your umbo, but with a lot more fluff.

## Urethra

*How skewering a penis showed true grit*

When Claude Martin stuck a metal wire into the tip of his penis and pushed it 20 centimeters (8 inches) up his urethra, he was caught between a rock and a hard place.

Either live with an excruciatingly painful stone in his bladder, or take his chances with a horrific operation that might kill him. This was India, 1782, long before surgical anesthesia, or awareness of the dangers of bacteria contaminating wounds. Cutting into his bladder to extricate the stone while he was awake would be agonizing. And once he was over that trauma, there was a reasonable chance of death from infection-related complications.

Reluctant to take either option, the resourceful French expatriate invented his own, scarcely believable third way. DIY: Disintegrate It Yourself.

Bladder stones form when the minerals in concentrated urine crystallize into hard masses. Martin was going to grind the mass down. And he'd do it with a homemade surgical instrument: a long, curved metal wire with a slightly roughened end.

This intimidating implement had to be over 20 centimeters long, to ensure it reached from the urethra's slit-shaped opening at the tip of his penis, to the other end of this narrow tube, where it opens into the bladder. (Female urethras are only about a fifth as long because they don't have a penis to travel through.)

Taking his courage in both hands, Martin pushed the wire up his urethra, through the external section of his penis; through the root of his penis, which is the internal part; past his external urethral sphincter; through his prostate gland, and into his bladder.

Martin gingerly maneuvered his bizarre penis / wire joystick so the roughened end of the metal nestled against the bladder stone. Then, in a

maddening game of Rock, Scraper, Slivers, he fiddled and twiddled and diddled, desperately trying to file off pieces.

This was no one-off horror. This was relentless penile hard labor. Martin endured this rock-breaking purgatory many times a day, every day. And, bit by minute bit, the stone was ground down (unlike Martin's spirit), the grit and gravel coming out in his urine. Until, after six months, he was stone-free.

Turns out Martin was ahead of his time. Decades later, doctors developed a range of stone-crushing instruments that were inserted up the urethra. Martin, it seems, had true foresight, and true grit.

## Vaginal fornix

*How one fornicates, architecturally and anatomically*

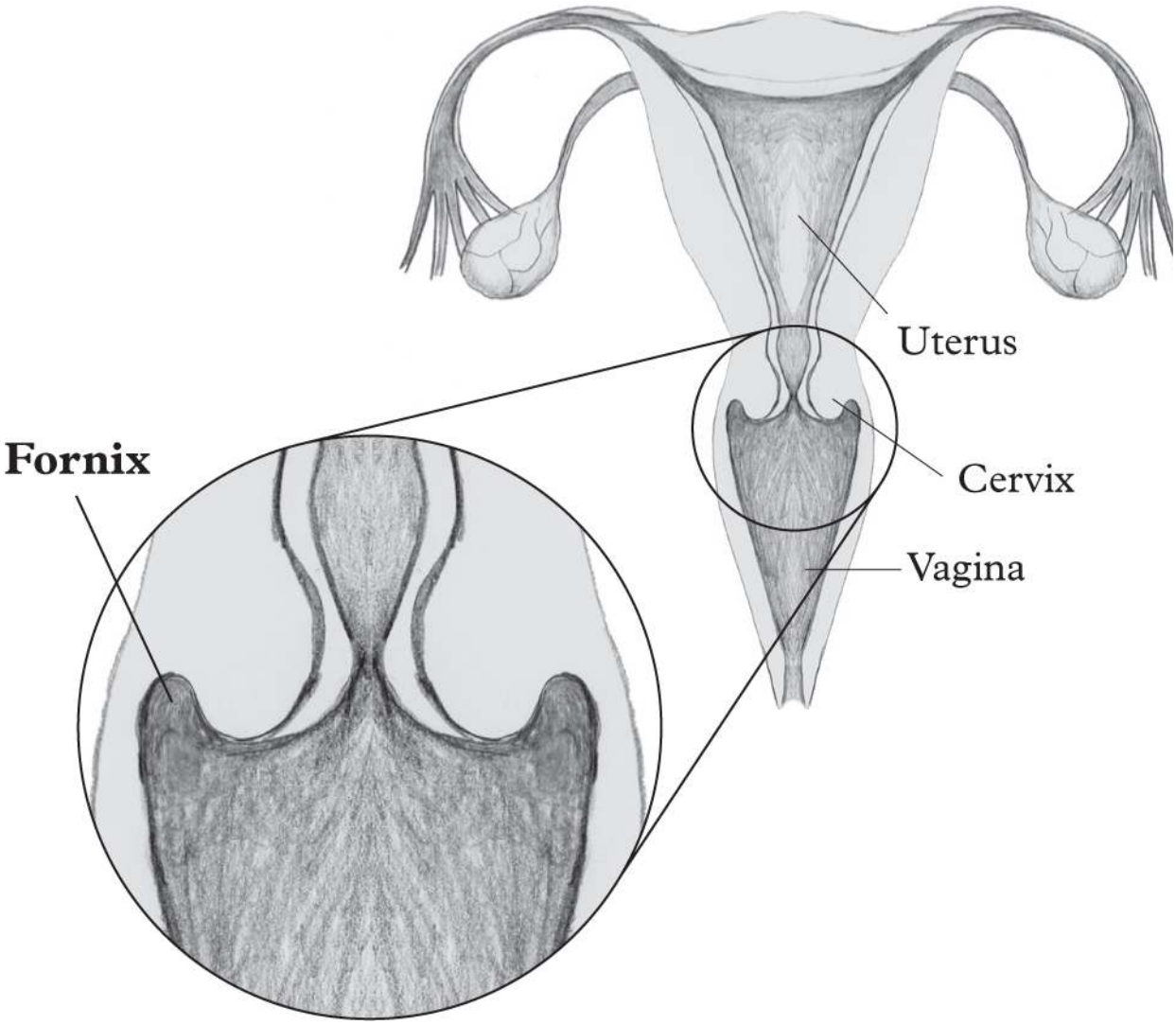
Ancient Roman brothels were at the mercy of customer reviews long before one-star ratings could ruin resorts, restaurants, and rideshare drivers. As Sabina, a sex worker in the Italian city of Pompeii found. "Sabina, you suck, you do not do it well," a client graffitied on a wall sometime before Mount Vesuvius's eruption in 79 CE buried the city under volcanic ash.

The Romans didn't rate women like Sabina, irrespective of their professionalism. As evidenced by one of their names for a brothel: "lupanar," from their word for "she-wolf." Another of their names was "fornix," this time inspired by a common venue for the carnal transactions: smallish chambers with arched ceilings. Fornix is Latin for "arch" or "vault." It's why we might say Sabina "fornicated" with clients under the arches.

It's also why the vagina has a "fornix": a ring-shaped trough between the cervix and vaginal wall. Its arches are formed by the cervix bulging into the vagina. It's called the posterior fornix at the back, anterior fornix at the front, and lateral fornix on each side.

During intercourse—with the man lying on top—a completely penetrated, erect penis (inside the vagina it's boomerang-shaped, not straight) fills up either the anterior or posterior fornix. We know this, thanks to a few brave, athletic couples who coupled inside a 50 centimeter-diameter (20 inch) magnetic resonance imaging tube, while researchers took scans. Medical equipment being the passion killer it is, they rated their sexual arousal as "average." Which isn't so lousy, considering that after clambering into the

cramped tube and on top of their partner, the men struggled to maintain an erection, let alone ejaculate.




If semen had ejaculated from a boomerang-like phallus, it would likely have collected in the vaginal fornix. Here, the semen shape-shifts, to maximize the chances of conception. By a minute after splashdown in the vagina, it coagulates. It's believed this thickening is designed to keep the perhaps hundreds of million sperm in the semen near the entrance to the womb (uterus). Then the semen becomes waterier, freeing up the little swimmers so they can get moving properly and have the chance of reaching a fallopian tube to fertilize an egg. This is called "liquefaction" and occurs

fifteen to twenty minutes after ejaculation. Problems with liquefaction are a cause of male infertility.

So, even if fornication doesn't take place under the arches ("going under the arches" is slang for illicit sex) a vital part of the process of conception does.

## Valve of Houston (transverse fold of rectum)

*How your rectum doesn't have its story straight*

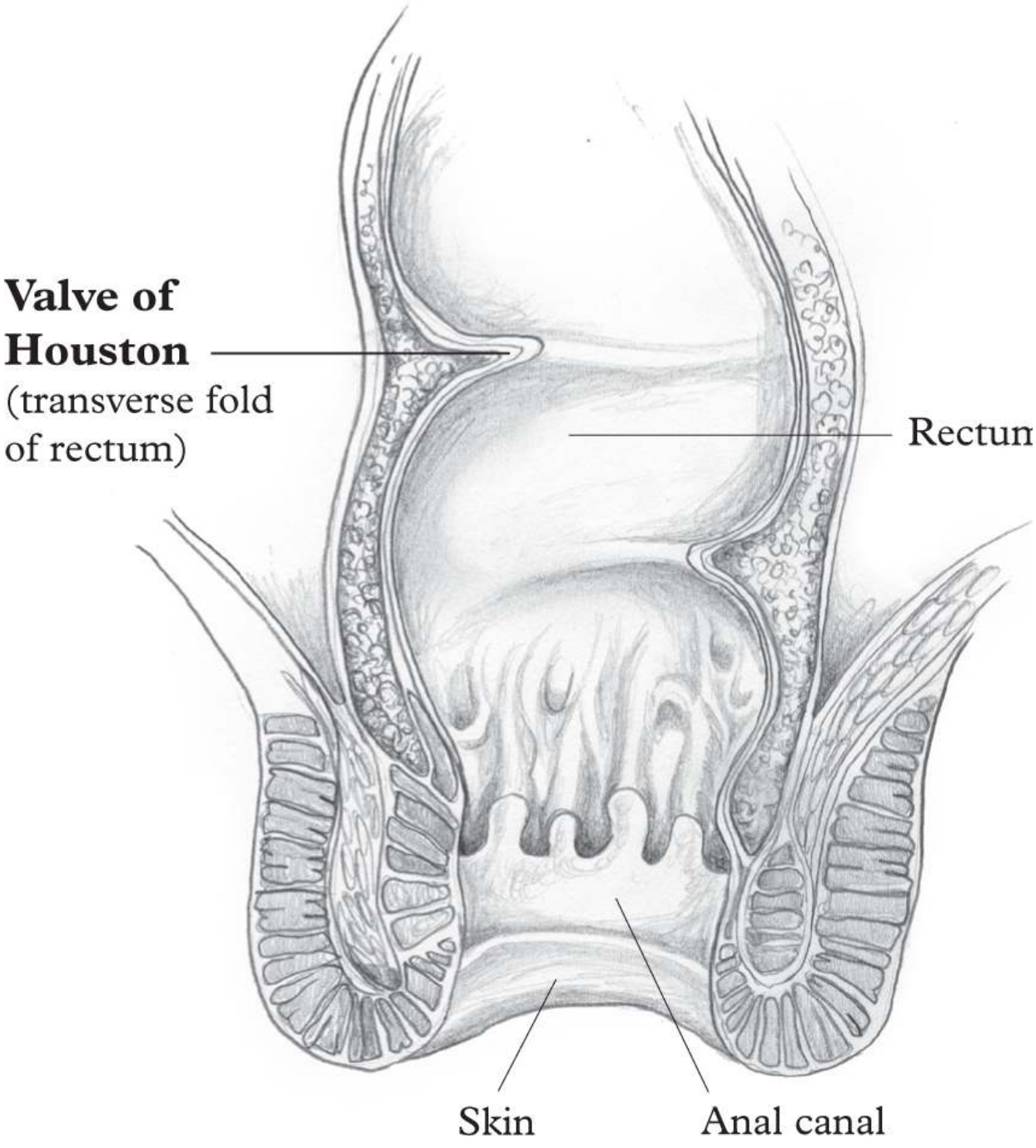
Your valves of Houston do it tough. These innocuous structures in your guts are cursed with confusion and uncertainty, with a dose of nationalistic rivalry thrown in.

For starters, they're in your rectum, which is straight and also isn't. That's down to the second-century Greek physician Galen. He dissected animals' rectums, which were straight, and named them accordingly. Hence "rectum," from the Latin for "straight." Related words are "correct" (set one straight), "direct" (straight talking), and "rectangle" (straight sides).

But in humans this 15-centimeter-long (6 inch) section of gut is far from straight. Your rectum has curves. And some of these curves correspond to the folds of gut wall—valves of Houston—that protrude into it.

These valves of Houston are hard to pin down. There's patriotic point scoring about their correct name, confusion about how many there are, and uncertainty about their purpose.

Textbooks usually say there are three valves. Though if you peer up someone's bottom you may see none, or as many as seven, research shows.




No one has proved exactly what they're for. One theory is these structures, also called "transverse folds of rectum," support poo, preventing it pressing down too much on the anus. Holding back the rectum's contents, they may also give our body time to check whether it's feces or fart inside. Saves having to make a precautionary dash to the toilet every time you feel something needs to exit your anus, but aren't sure if it's solid, liquid, or gas.

The valves are named after Irish anatomist John Houston, who wrote about them in 1830. Two decades later, Houston had a problem. (Rather, he would have if he'd been alive. Houston died in 1845.) German medic Otto Kohlrausch stuck his oar in and muddied the rectal waters. In 1854, he described a single, mid-rectal valve. This led some German textbooks to show just one "Kohlrausch's valve." And if they show more, they often ignore Houston altogether.

However, today the name Kohlrausch is perhaps more associated with Olympian feats than feces. The discus throw is a modern Olympic track and field event thanks to Kohlrausch's son. The discipline was part of the ancient Olympics, but disappeared after the games stopped in around 394 CE. Christian Kohlrausch rediscovered it. Using old statues and drawings, he worked out the discus's dimensions and throwing technique. He did such a good job that the event featured in the first modern Olympics in Athens in 1896.

Galen would have approved.

## Vermilion

*How Miss Scarlett seduces Professor Plum*

Red is the color of romance. And sex. Red is in our blush when we make eyes at our crush. And our engorged genitals. Valentine's Day roses are red. As are lights outside brothels. Red-blooded men are lusty and virile. Scarlet women, on the other hand, get the rough end of the stick. They're promiscuous and adulterous.

It's surely no coincidence that Miss Scarlett, from the murder-mystery board game *Clue* (*Cluedo*, if you're skulking around the library, with the candlestick, outside of North America), is a femme fatale. The red-dressed seductress is clearly angling for Professor Plum, in the ballroom, with the lead pipe.

Red also signifies sex in the online dating game. Women are more likely to wear red in profile pictures on websites for casual hookups and swinging than on dating sites emphasizing love and marriage, research shows. And men may pick up on this carnal color code, at least when it's in women's faces. Studies show that men find women more attractive when their photos are edited to redden their faces.

Our red lips are always on display (pandemic-induced masks aside) and, whether we like it or not, are signals of attractiveness and sexuality. Although technically only a part of our lips is red: the vermilion. Our upper and lower lips extend above and below the red vermilion. Up to the bottom of our nose, and down to a horizonal groove at the top of our chin called the labiomental crease. The vermilion is red in name (vermilion is a red pigment) and nature, because of the large number of blood vessels that are very close to its surface.

While the vermilion's color varies according to ethnicity, research has found that Caucasians of both sexes say Caucasian women are more feminine and attractive when their lips are redder. This may be because the color is associated with blood coursing through healthy bodies, and aroused ones.

It's one reason why women redden their lips. Something they've been doing for thousands of years, from at least as early as 3,500 BCE. Though not always to men's satisfaction. In eighteenth-century England, women who used lip rouge and other cosmetics to seduce men into marriage could face charges of witchcraft. These pathetic red-faced men needed protecting from their scarlet temptresses.

## Virchow's node (left supraclavicular lymph node)

*How sausages saved a sharp-witted scientist's skin*

If you were challenged to a duel, what would be your weapon of choice? Pistols at dawn? Muskets at midday? Crossed swords at sunset? Crossed words at a safe distance, is surely the sensible option. Though, back in the day, even the most cutting quips wouldn't have cut the mustard. The whole point of dueling was to show that you were gutsy enough to risk your life defending your honor. Which is why Rudolf Virchow's weapon of choice was so devilishly cunning.

He upheld his honor, not with a bang, but with a banger. Yes, the illustrious German doctor chose to fight with a sausage, allegedly.

Allegedly, because while Virchow was challenged to a duel, the sausage part of the story is apocryphal. However, it's a long-standing part of medical folklore and repeated as fact in many reputable journals. So, it's worth repeating here.

The Great Sausage Duel is supposed to have taken place in Germany in 1865. Along with Virchow—one of history's most influential doctors—the other protagonist was Otto von Bismarck, Minister President of Prussia. Virchow and Bismarck were fierce political rivals, the doctor wanting money for education and health, and his formidable conservative opponent prioritizing the military. Sounds familiar.

After a particularly vicious attack from Virchow, Bismarck cracked and issued his challenge. Because Virchow was the challenged party, he had choice of weapons. But instead of opting for your standard swords or pistols, he held up two plump sausages.

"One of these sausages is filled with trichinae [parasitic roundworms]—it is deadly," Virchow declared. "The other is perfectly wholesome. Externally they cannot be told apart. Let His Excellency do me the honor to choose whichever of these he wishes and eat it, and I will eat the other."

Virchow was an expert on the parasites, so this gastronomic Russian roulette gave Bismarck serious food for thought. Inevitably, he didn't have the stomach for the challenge, and there was no duel, and no one accused Virchow of cowardice. (The other version of the story has Virchow declining the duel because he believed they were uncivilized.)

Virchow was proficient at more than just outwitting pugnacious politicians; he made many hugely important medical discoveries. One small, but not insignificant advance concerned the lymph node named after him. It's an abnormally enlarged, hard node that Virchow recognized can be a sign of cancer, for example, in the stomach, that's spread. It's a sinister sign. Doubly sinister, in fact. "Sinister" is from a Latin word meaning "on the left side." And this is a *left* supraclavicular lymph node—in other words, it's found above the left clavicle.

A Virchow's node may have profound implications for its owner's health. Unlike Virchow's sausage duel, which was only a wurst-case scenario.

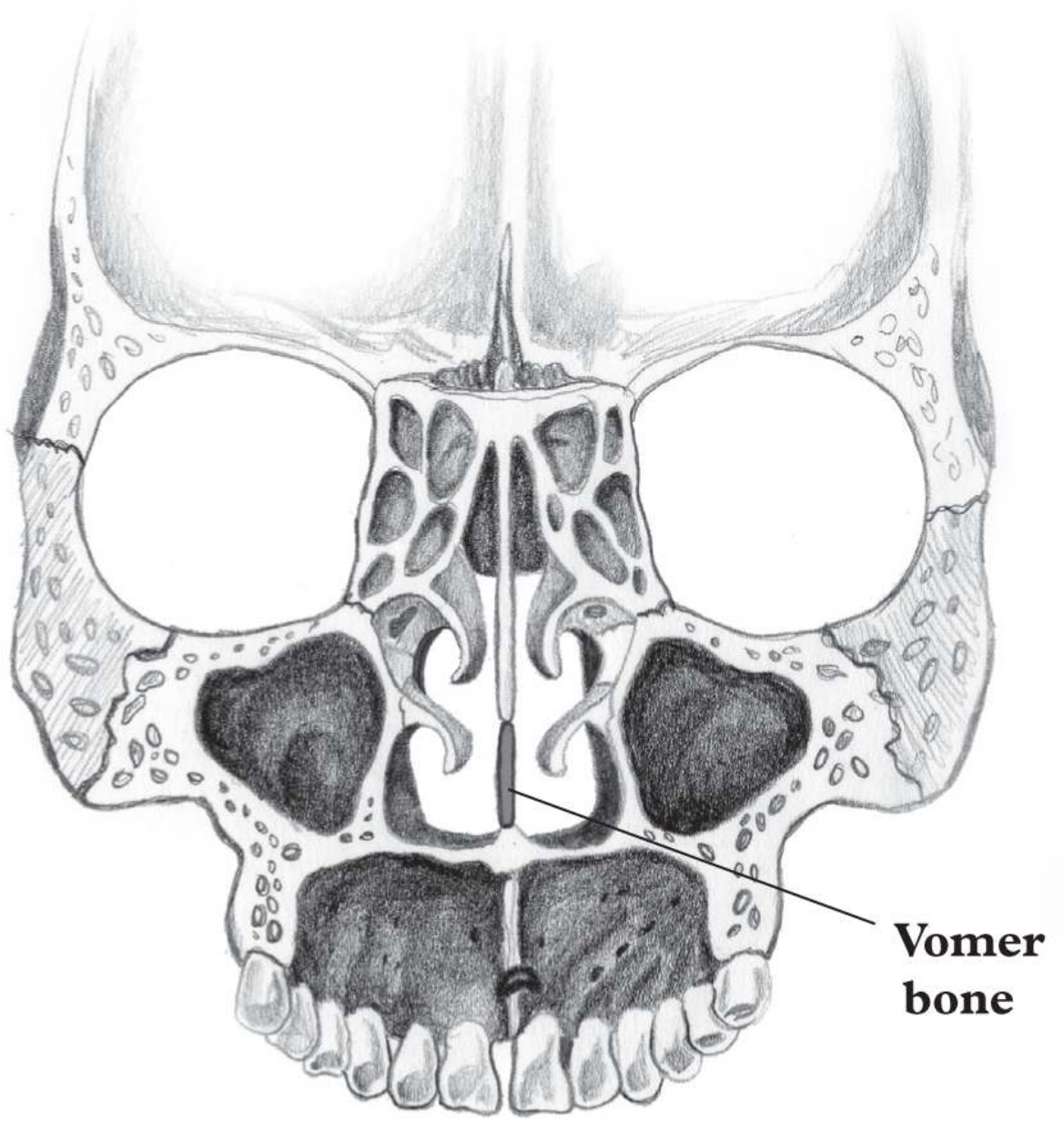
## Vomeronasal organ

*How there's dollars and scents in sexual chemistry*

Chances are, you're not a bum sniffer. At least not consciously. And you don't "flehmen." Pronounced "flay-men," this isn't something punters pay top dollar for in dodgy Berlin dungeons. But it is German. Trademark

Teutonic efficiency. One word that does the job of a whole sentence of English.

Flehmening is the strange grimace cats make when they're savoring certain scents. In this heady perfume (let's call it Channel N°2, when it wafts from a rear end) are sex pheromones. After sniffing Channel N°2, cats wrinkle their nose, lift their upper lip to show their teeth, and momentarily stop breathing. Like a wine buff transfixed by a Riesling's bouquet, with notes of anus rather than star anise.



Many animals flehmen, probably to get pheromones into their vomeronasal organ. This little-known structure, and the pheromones it senses, help oil the wheels of their social and sexual relationships.

But what about us humans? Are there pheromones that account for the seemingly unexplainable attraction folk sometimes feel? If we have a vomeronasal organ, is it a player in this sexual chemistry, and the biology that follows? Most importantly, are you a subconscious anal aroma aficionado? These are controversial, high-stakes issues. There's dollars and scents in bottled sex appeal.

Like many relationship questions, the answer is: "It's complicated."

We likely have a vomeronasal organ, though not everyone agrees. This small pouch of tissue opens via a duct into the lining of our nose, about 2 centimeters (three-quarters of an inch) in from the nostril. It's near the vomer bone, which helps divide our nose in two, and is named after the Latin for the part of a plough that cuts the furrow, which it resembles. Roman ploughshares got their vomit-like name because they "threw up" earth behind them.

So what, if anything, does our vomeronasal organ do? Many studies, often involving sniffing sweaty T-shirts, suggest we pick up signals about each other from chemicals in the air, like the sex of the top's owner, or where they are in their menstrual cycle. But the results aren't always clear-cut. And they could be down to our smelling apparatus, rather than vomeronasal organ.

The bottom line is, there's scant hard evidence of human vomeronasal organ function. But that doesn't rule it out. And there's only one (German) word for this predicament. *Erklärungsnot*: the angst we feel when we realize we can't answer life's big questions.

## Wormian bone (sutural bone)

*How the original myth buster wormed his way into our skulls*

Santa Claus. The Tooth Fairy. Unicorns. All "fake news." But only one's existence has been conclusively disproved by an eminent anatomist. (DO NOT TELL THE KIDS.)

The unicorn's undoing was in its name. "Uni," as in "one" (like unicycle) and "corn," meaning "horn." One horn. And these horns actually existed. Strange objects that were highly prized because of their supposed magical

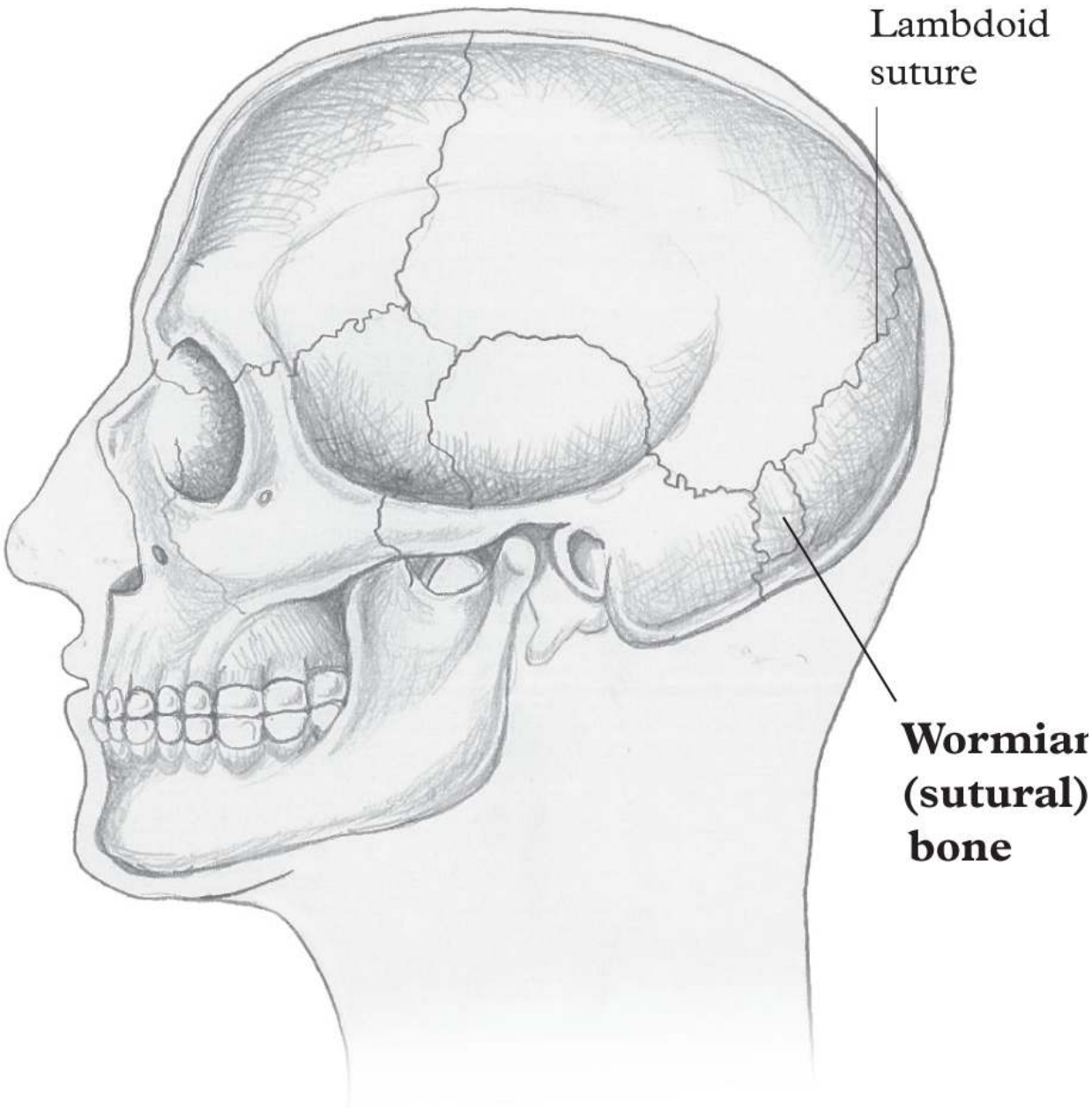
healing powers. In the sixteenth century, Queen Elizabeth I drank from a unicorn horn goblet. Her Royal Highness could afford to be smug when courtiers toasted her good health.

Elizabeth, however, would not have been amused by the seventeenth-century Danish anatomist Ole Worm. He applied critical thinking and evidence gathering where others accepted any old malarkey as gospel. Worm, not having seen a unicorn horn attached to a unicorn skull, thought that was fishy. His suspicions were on the money. The fish—actually a whale—was the narwhal. Unicorn horns were the tusks of these Arctic mammals, Worm showed in 1638.

But while they weren't unicorn, maybe narwhal tusks did indeed have magical powers? To see, Worm poisoned pets and then fed them ground up tusk. The results only emphasized the "ex" in "experiment."

Five years later, Worm's description of the small, irregularly shaped extra bones often present in our skull, in addition to the standard ones, led them to be named after him.

Wormian bones develop in the joints (sutures) between the bones of our skull. These sutural bones are most likely found at the back of the skull, in the lambdoid suture. How often they're present in skulls depends on where the skulls are from. About 75 percent of adult Greek skulls had at least one, research found. The figure was 80 percent in Chinese skulls, and only 9 percent in those from Turkey.




But while Worm is immortalized in the anatomy of 75 percent of Greeks, he was much more than an anatomist. His CV included: professor of medicine, physics, pedagogy, and classical Greek. And, of course, "myth buster."

Worm also disproved the popular belief that lemmings spontaneously appeared out of thin air. Rejecting this wacky way of thinking about rodent reproduction, the polymath adopted a more earnest lemming way. Yes,

lemmings could suddenly arrive in large numbers, but that was simply because they were fast breeders.

Worm wouldn't have known about the myth that lemmings commit mass suicide by jumping off cliffs. That was popularized by a 1958 Disney documentary in which the filmmakers allegedly pushed the lemmings off. Best not tell the kids about that too.

## Xiphoid process

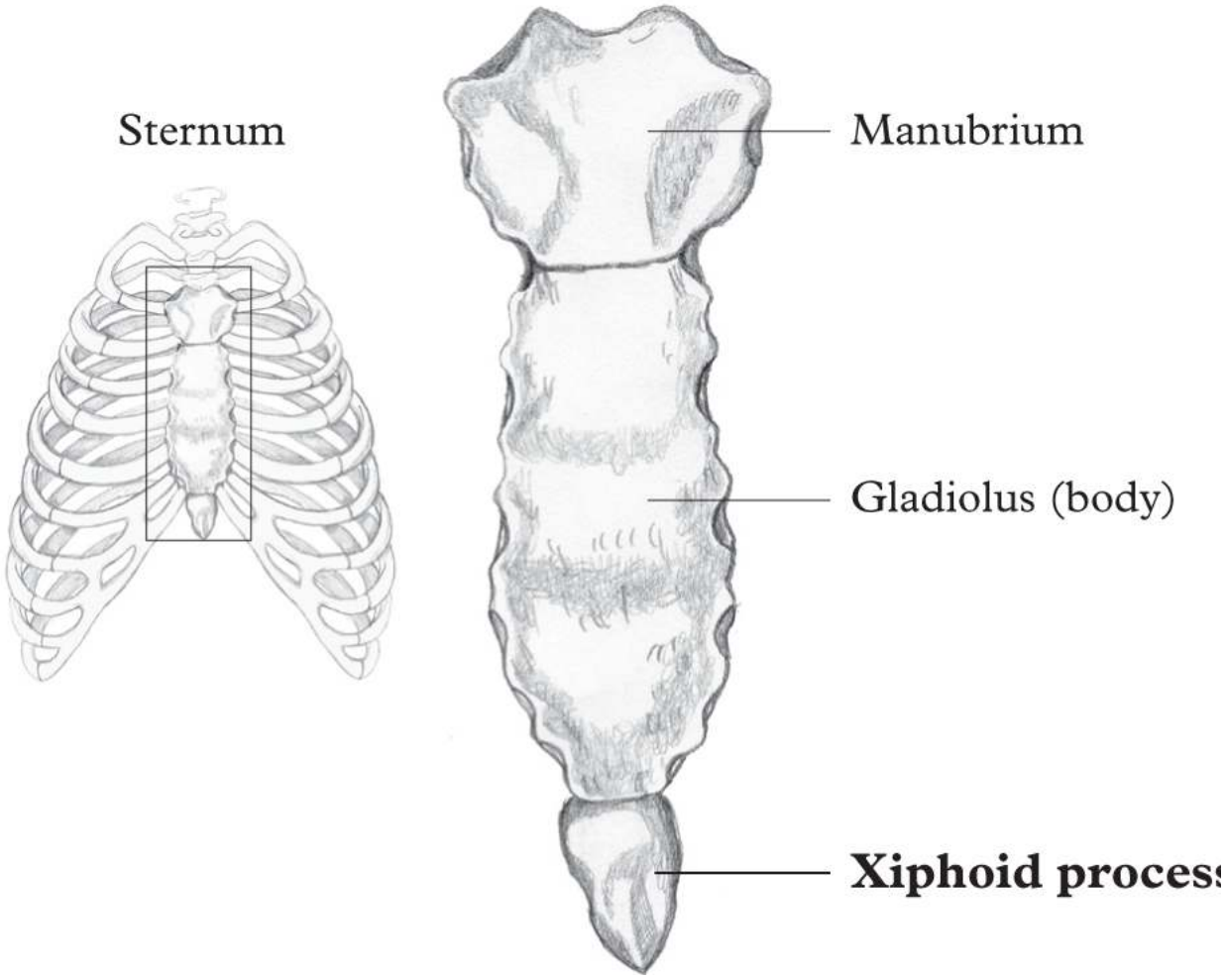
*How an anatomical mistake can be a stake in the heart*

If a koala is a bear, I'm a monkey's uncle. "Koala bear" is a barefaced lie. A eucalyptus leaf-munching, marsupial misnomer. Like the cute, comatose koala, your xiphoid process is also a misnomer. But while the koala confusion is harmless (mild befuddlement among tourists down under aside) blithely assuming a xiphoid process is actually xiphoid can have fatal consequences.

Your xiphoid process is the pointy lower end of your breastbone (sternum). It's about 2–5 centimeters (1–2 inches) long and made of cartilage in young people, gradually becoming bone as we age. "Xiphoid" comes from the ancient Greek for "straight sword." That's how textbooks generally picture it: straight and solid with one pointy end. But our anatomy doesn't read the textbooks. In the flesh, xiphoid processes are often unhelpfully un-xiphoid. They can be curved. Or have an end split into two parts (bifid), maybe even three (trifid). What's more, about 45 percent have holes in them, a 2011 study found.

Not appreciating this everyday bony variety can be a sword of Damocles. There's been at least one report of death after an acupuncture needle pierced the fibrous sac that encloses the heart (pericardium) via a hole in the sternum. Pathologists have also been caught out, assuming naturally occurring holes are gunshot wounds.

Other doctors have assumed that bifid and trifid xiphoid processes are fractures. Yet they're common. In the 2011 study, 33 percent of xiphoid processes were bifid, and 5 percent were trifid. If a medic saw one xiphoid process a day, there'd be a Day of the Trifid every month.




Then there are those that point outward, potentially misdiagnosed as sinister tummy lumps. And some that bend inward—more curved dagger than straight sword—ready to puncture the liver during cardiopulmonary resuscitation chest compressions. You're meant to press further up the sternum, on its middle part, the body, aka gladiolus. That's Latin for "little sword," as per ancient Roman swordsmen: "gladiators." Likewise, gladioli plants are called "sword lilies," due to their sword-shaped leaves.

The sternum's uppermost part is the manubrium, the sword's handle. "Manubrium" is from the Latin for "hand," as in "manage," "manicure," and "manipulate."

So, the sternum's parts are sword-like in name, yet it functions like another piece of armor: a protective breastplate. You could say it's one big misnomer.

## Y-shaped ligament of Bigelow (iliofemoral ligament)

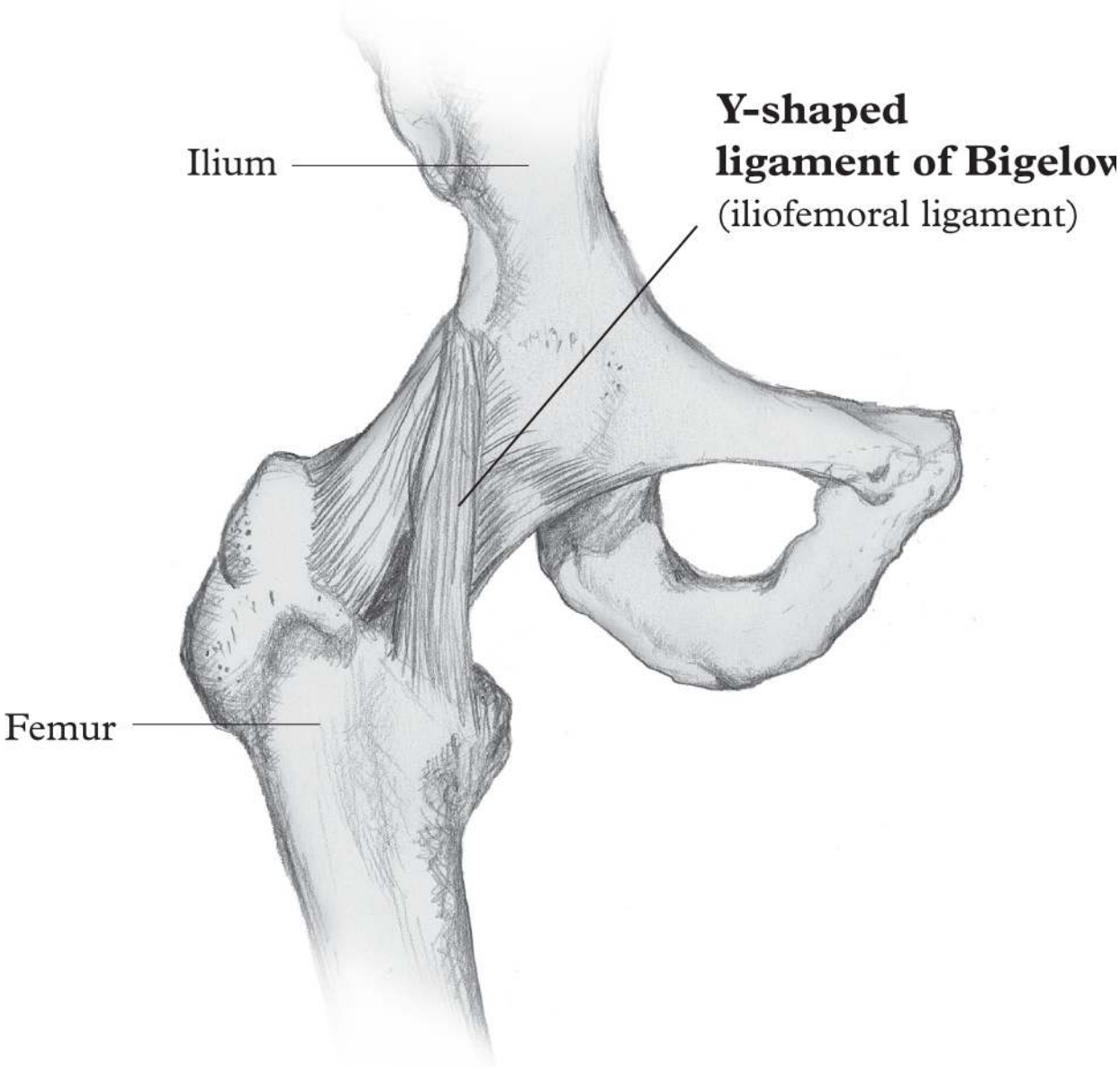
*How anesthesia leaves us legless*

Thanks to the miracle of anesthesia, surgery is something you can literally do in your sleep. Before its invention, petrified, wide-eyed patients just had to grimace and bear it. Awake, as knifes sliced flesh and saws severed bone, their only pain relief might be a stiff drink. Minimizing the agony meant cutting to the chase and getting the operation over with ASAP.

Surgeons had a need for speed. And the speediest of them all was said to be Robert Liston, known in medical folklore as "The fastest knife in the West End [of London]." A nickname earned thanks to a precarious mix of surgical skill and theatrical showmanship. Legend has it that before amputating a limb at London's University College Hospital, the imposing Scot would announce: "Time me, gentlemen, time me."

But Liston was a pioneer as well as having a reputation as a buccaneer. Just a month after the publication of Henry Bigelow's 1846 paper about the groundbreaking new advance—ether anesthetic—Liston operated using the inhaled vapor. He took just twenty-eight seconds from the first use of his knife to the last touch of the saw, according to the doctor who administered the anesthetic.

Liston called the innovation a "Yankee dodge," again, according to folklore. The Yankees included William Morton, a dentist who in 1846 administered ether in the first public demonstration of its use in surgery, and Bigelow, who witnessed the event in Boston.




Bigelow was also first to describe the detailed structure and function of the Y-shaped ligament that runs from a part of the hip bone called the ilium, to the top of the thigh bone (femur). Also called the iliofemoral ligament, it stabilizes the hip joint and helps prevent us toppling over backward when we're standing.

Though he's best known as the driving force behind the introduction of anesthesia, which rapidly revolutionized surgery. The surgeon once said, "Dying is nothing, but pain is a very serious matter."

But while surgery was now less horrific for patients, amputation was still hugely risky. Between 1852 and 1857, 46 percent of patients who had an

amputation at the UK's London Hospital died. Postoperative infection killed most. Unlike the anesthesia, which was painkilling.

## Zygomaticus major

*How electrocuted faces exposed the fraud in you*

When is a lie not a lie? When it's a polite "Good, thanks," in reply to a polite "How are you?" You both know it's economical with the truth. (You're average. At best.) And the last thing your affable inquisitor needs is to be burdened with the discomforting truth of *real* feelings. So, it's not actually deception, is it?

Big emotions don't fit into small talk. So, you engage autopilot and fake it to make it. A pleasantry spills out of your mouth as you tense the zygomaticus major muscles in your cheeks and crack a polite smile.

While oiling the wheels of polite company can be a pain in the rear end, the zygomaticus major muscles are in your *face's* cheeks. They run from your cheekbone (zygomatic bone), diagonally down to the corner of your mouth. When you tense them—one on each side—they raise the corners of your mouth into a smile.

But if other muscles in the face aren't also involved, it's a smile of fake, polite happiness, according to an influential theory. A smile showing genuine enjoyment involves both zygomaticus major and orbicularis oculi, a muscle that runs around the eye socket and scrunches the skin around the eye into crows' feet. This real emotional deal is called a "Duchenne smile," after the nineteenth-century French doctor, Guillaume Duchenne.

Duchenne is famous for many things, none stranger than his experiments on faces. Using electrodes to zap facial muscles, he observed how their contractions contributed to our expressions. Some say he tried this on the severed heads of executed criminals. Presumably not ideal. Dead heads have a somewhat limited emotional range, and soon pass their use-by date.

Duchenne certainly inflicted this painful zapping on living people; we know because he photographed their contorted faces. So, thanks to a few long-suffering, human guinea pigs, he was able to study how muscle contractions, facial expressions, and real, live emotions were linked.

Genuine enjoyment involved smiling with the mouth *and* eyes, contracting the zygomaticus major and orbicularis oculi muscles, Duchenne theorized. Duchenne said we could control smiling involving the mouth, so

could put emotion on when circumstances required. But smiling with the eyes was only caused by genuine happiness, hence a Duchenne smile couldn't be faked.

The idea caught on and is used in research to classify smiles. Turns out though, some people can fake a Duchenne smile. But, in polite company at least, why bother to fake a genuine smile when a genuine fake smile will do?

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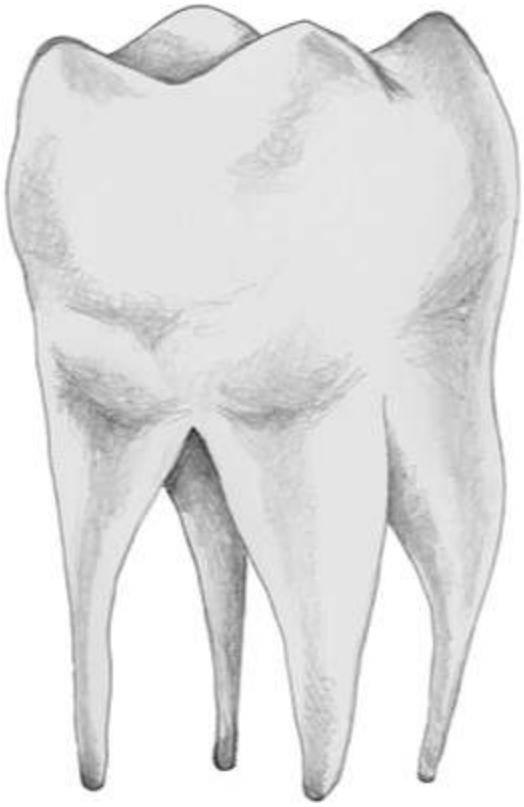

# Selected References

Due to space limitations, I can provide only a brief list of abbreviated references here. Full references are available online at:

https://press.princeton.edu/ISBN/9780691256788

**Preface:** Bassnett S. *Prog Retin Eye Res* 2021;82:100902.
**Acetabulum:** Wright J. *Clin Anat* 2019;32:661–71.
**Alveoli:** Ochs M et al. *Am J Respir Crit Care Med* 2004;169:120–4.
**Amygdala:** Feinstein J et al. *Curr Biol* 2011;21:34–8.
**Anatomical snuffbox:** Seidenberg A et al. *Acad Med* 2015;90:1003–4.
**Anterior insular cortex:** Kumar S et al. *Curr Biol* 2017;27:527–33.
**Arrector pili:** Heathers J et al. *PeerJ* 2018;6:e5292.
**Astrocyte:** Fields R et al. *Neuroscientist* 2014;20:426–31.
**Auditory ossicles:** Bell A et al. *Acoustics Australia* 2021;49:167–9.
**Axilla:** Miller G et al. *Evol Hum Behav* 2007;28:375–81.
**Bartholin's gland:** Life in the Fast Lane. https://litfl.com/de-eponymising-anatomical-terminology/.
**Bloodless fold of Treves:** Treves F. *The Elephant Man, and Other Reminiscences*. Cassell and Company, 1923.
**Bundle of His:** Holocaust Encyclopedia. https://encyclopedia.ushmm.org.
**Canal of Schlemm:** Winkelmann A. *Ann Anat* 2008;109:223–9.
**Carotid artery:** Wright J. *Clin Anat* 2019;32:489–500.
**Carpals:** Densen P. *Trans Am Clin Climatol Assoc* 2011;122:48–58.
**Ceruminous gland:** Ernst E. *J Laryngol Otol* 2004;118:1–2.
**Circle of Willis:** Meshberger F. *JAMA* 1990;264:1837–41.
**Corpus callosum:** Men W et al. *Brain* 2014;137:e268.
**Corpus cavernosum:** Jamison P et al. *J Sex Res* 1988;24:177–83.
**Cranial suture:** Neumann P et al. *Clin Anat* 2020;33:187–91.
**Cupid's bow:** Law Smith M et al. *Proc Biol Sci* 2006;273:135–40.
**Dilator and sphincter pupillae:** Mathôt S. *J Cogn* 2018;1:16.
**Duct of Wirsung:** Bassi C et al. *Surgery* 2011;149:153–5.
**Duodenum:** von Staden H. *Yale J Biol Med* 1992;65:223–41.
**Fabella:** Berthaume M et al. *J Anat* 2019;235:67–79.
**Femoral triangle:** Byard R. *Am J Forensic Med Pathol* 2005;26:121–4.
**Frontal lobe:** Teles R. *Dement Neuropsychol* 2020;14:419–21.
**Fungiform papilla:** Spence C. *Flavour* 2015;4:30.

**Fusiform face area:** Kanwisher N et al. *J Neurosci* 1997;17:4302–11.
**Galea aponeurotica:** Sadr J et al. *Perception* 2003;32:285–93.
**Glabella:** Nguyen H et al. *Ophthalmology* 2009;116:355–60.
**Gomphosis:** Jacobsohn P. *Anesth Prog* 1995;42:73–5.
**Gubernaculum:** Royal College of Surgeons of England. https://www.rcseng.ac.uk/news-and-events/news/archive/statement-on-the-skeleton-of-charles-byrne/.
**Hallux:** Dittmar J et al. *Int J Paleopathol* 2021;35:90–100.
**Innominate:** Agrawal A. *J Clin Orthop Trauma* 2019;10:387–94.
**Lacrimal gland:** Vingerhoets A et al. *Emot Rev* 2016;8:207–17.
**Laryngeal prominence:** Della Sala S et al. *Laterality* 2022;27:605–15.
**Levator labii superioris alaeque nasi:** Lindell A. *Laterality* 2019; 24:600–13.
**Lumbrical:** Wang K et al. *J Hand Surg Am* 2014;39:149–55.
**Main pulmonary artery:** Stefanadis C et al. *Hellenic J Cardiol* 2009; 50:373–8.
**Malleoli:** Ross J. *Paraplegia* 1986;24:287–92.
**Maxillary sinus:** Delgado J et al. *Dentistry* 2012;2:5.
**Median cubital vein:** Heiss H. *Clin Cardiol* 1992;15:547–9.
**Median umbilical ligament:** Ledger T et al. *J Anat* 2020;237:391. West J et al. *Proc Natl Acad Sci U S A* 2021;118:e1912444117.
**Nucleus pulposus:** Belavý D et al. *J Musculoskelet Neuronal Interact* 2010;10:207–19. Johnston S et al. *Aviat Space Environ Med* 2010; 81:566–74.
**Olecranon:** Roach N et al. *Nature* 2013;498:483–6.
**Optic disc:** Anstis S. *Curr Biol* 2010;20:R664–6.
**Osteon:** Niazi F et al. *Hektoen International* 2021;13:https://hekint.org/2020/07/30/sir-victor-horsleys-fatal-blind-spot/.
**Ostmann's fat pad:** Eden A et al. *N Engl J Med* 1982;307:259–61.
**Pacinian corpuscle:** Natale G et al. *Hektoen International* 2014; 6:https://hekint.org/2017/01/29/pacinis-corpuscles-and-occult-sciences/. O'Connell-Rodwell C et al. *J Acoust Soc Am* 2000; 108:3066–72.
**Pampiniform plexus:** Sheynkin Y et al. *Hum Reprod* 2005;20:452–5. Solano I et al. *J Sex Res* 2020;57:92–103.
**Parietal cell:** Roberts C. In *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd ed. Butterworths, 1990.
**Pectinate line:** Ploner M et al. *Acta Gastroenterol Belg* 2020;83:61–5.
**Philtrum:** Nunes D et al. *Aesthet Surg J* 2021;41:816–25.
**Pouch of Douglas:** Harvey K. *Hist Workshop J* 2015;80:33–51.
**Pudendal nerve:** Wurtele S et al. *Child Abuse Rev* 2010;19:130–52.
**Putamen:** Taylor C et al. *J Anat* 2022;240:410–27.
**Pylorus:** Vreeman R et al. *BMJ* 2008;337:a2769.
**Quadratus plantae:** Bakkum B. *J Chiropr Humanit* 2011;18:94–8.
**Recurrent laryngeal nerve:** Wedel M. *Acta Palaeontol Pol* 2012; 57:251–6.
**Scarpa's fascia:** Parigi G. *Am J Surg* 2004;188:17–21.
**Skene's gland:** Rodriguez F et al. *Clin Anat* 2020:doi:10.1002/ca.23654.
**Sphincter of Oddi:** Loukas M et al. *World J Surg* 2007;31:2260–5.
**Synovial fluid:** Unger D. *Arthritis Rheum* 1998;41:949–50.
**Thenar eminence:** Harvard Law School. http://www.law.harvard.edu/faculty/cdonahue/courses/lhsemelh/materials/Mats2D_2F.pdf.
**Thymus:** Dally A. *Med Hist* 1997;41:70–85.
**Urethra:** Wellcome Collection. https://wellcomecollection.org/articles/XXYtFBAAACUACFmP.

**Vaginal fornix:** Schultz W et al. *BMJ* 1999;319:1596–1600.
**Valve of Houston:** Ikard R. *Clin Anat* 2015;28:436–41.
**Vermilion:** Elliot A et al. *PLOS ONE* 2012;7:e34607.
**Vomeronasal organ:** Meredith M. *Chem Senses* 2001;26:433–45.
**Wormian bone:** Romero-Reverón R et al. *Eur J Anat* 2015;19:299–301.
**Xiphoid process:** Akin K et al. *Skeletal Radiol* 2011;40:447–52.
**Zygomaticus major:** Association for Psychological Science. https://www.psychologicalscience.org/observer/the-psychological-study-of-smiling.