



TECHNICALLY...
the tortoise didn't
make the cut. But we
couldn't just leave
him off!

IT'S ALL RELATIVE

the 10-second marathon

17.6 MILES
Apollo 11 exiting
Earth's atmosphere
at 9:35 a.m. on
July 16, 1969

47.6 MILES
the International
Space Station right
now, experiencing a
sunrise every hour
and a half

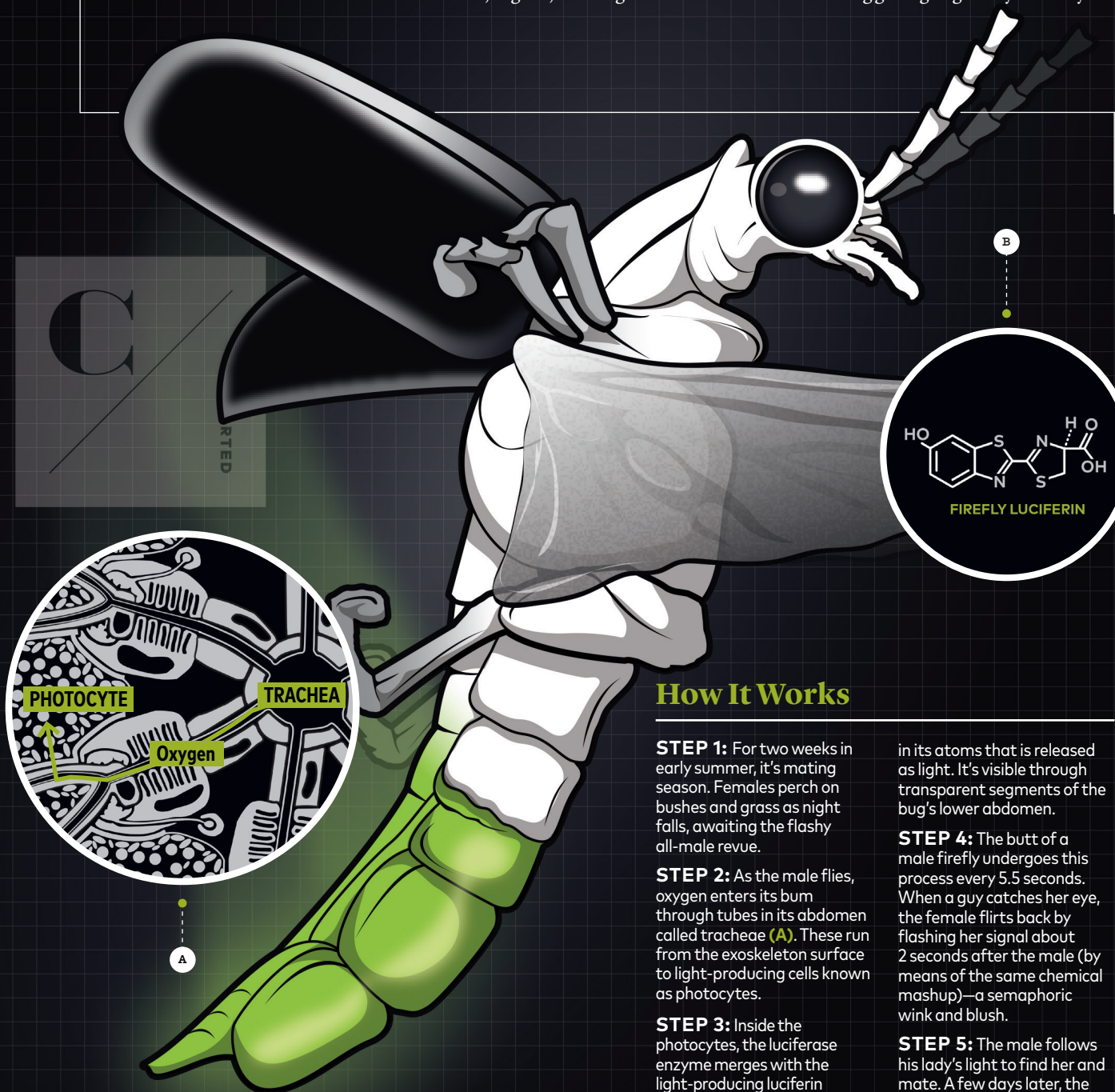
410 MILES
a 4-inch-thick
metal disc shooting
skyward from a
1956 nuclear test
at Los Alamos

THE CONCEPT OF A MINUTE IS KIND OF MEANINGLESS. We can't even be sure any two organisms experience a minute as the same length of time. Animals with slow metabolisms, like tortoises, perceive it as oozing along, while hares see it whizzing past. In the chaos of relativity, sometimes it's nice just to have fun. So here's how far some animals and objects would get in 10 seconds.

- | | |
|---|-------------------------------------|
| A FASTEST TORTOISE: 0.0017 MILES | F NERVE IMPULSE: 0.745 MILES |
| B USAIN BOLT: 0.0649 MILES | G SOUND: 2.11 MILES |
| C BROWN HARE: 0.132 MILES | H THE CONCORDE: 3.75 MILES |
| D CHEETAH: 0.169 MILES | I THE MOON: 6.35 MILES |
| E TOYOTA COROLLA: 0.319 MILES | J LIGHT: 1,862,824 MILES |

light a fire

FIREFLIES ARE BUTT GALS. SO ARE THEIR MALE AMORI. ON WARM SUMMER nights, both sexes home in on the blinking light of their crush's derrière. The rest is romance. Which makes it almost heartless for us to ask: What makes their bums blink? It's mostly a matter of chemistry, triggered by seasons, times of day, and those flashing signals. For *Photinus pyralis*, the common eastern firefly that populates North America, it is a choreographed dance. Next time you're sitting on the sidelines, or grass, here's a guide to the bioluminescent dating game going on in your backyard.



How It Works

STEP 1: For two weeks in early summer, it's mating season. Females perch on bushes and grass as night falls, awaiting the flashy all-male revue.

STEP 2: As the male flies, oxygen enters its bum through tubes in its abdomen called tracheae (A). These run from the exoskeleton surface to light-producing cells known as photocytes.

STEP 3: Inside the photocytes, the luciferase enzyme merges with the light-producing luciferin molecule (B), catalyzed by oxygen and energy-storing ATP. The result: oxyluciferin, a compound with excess energy

in its atoms that is released as light. It's visible through transparent segments of the bug's lower abdomen.

STEP 4: The butt of a male firefly undergoes this process every 5.5 seconds. When a guy catches her eye, the female flirts back by flashing her signal about 2 seconds after the male (by means of the same chemical mashup)—a semaphoric wink and blush.

STEP 5: The male follows his lady's light to find her and mate. A few days later, the female lays fertilized eggs in the ground, which hatch two to four weeks later—all thanks to a magical light show.

FIREFLIES AREN'T THE ONLY MEMBERS OF THE ANIMAL KINGDOM THAT GLOW



GAUSSIA PRINCEPS
These small crustaceans jet out bioluminescent liquid to confuse predators and make a hasty escape.



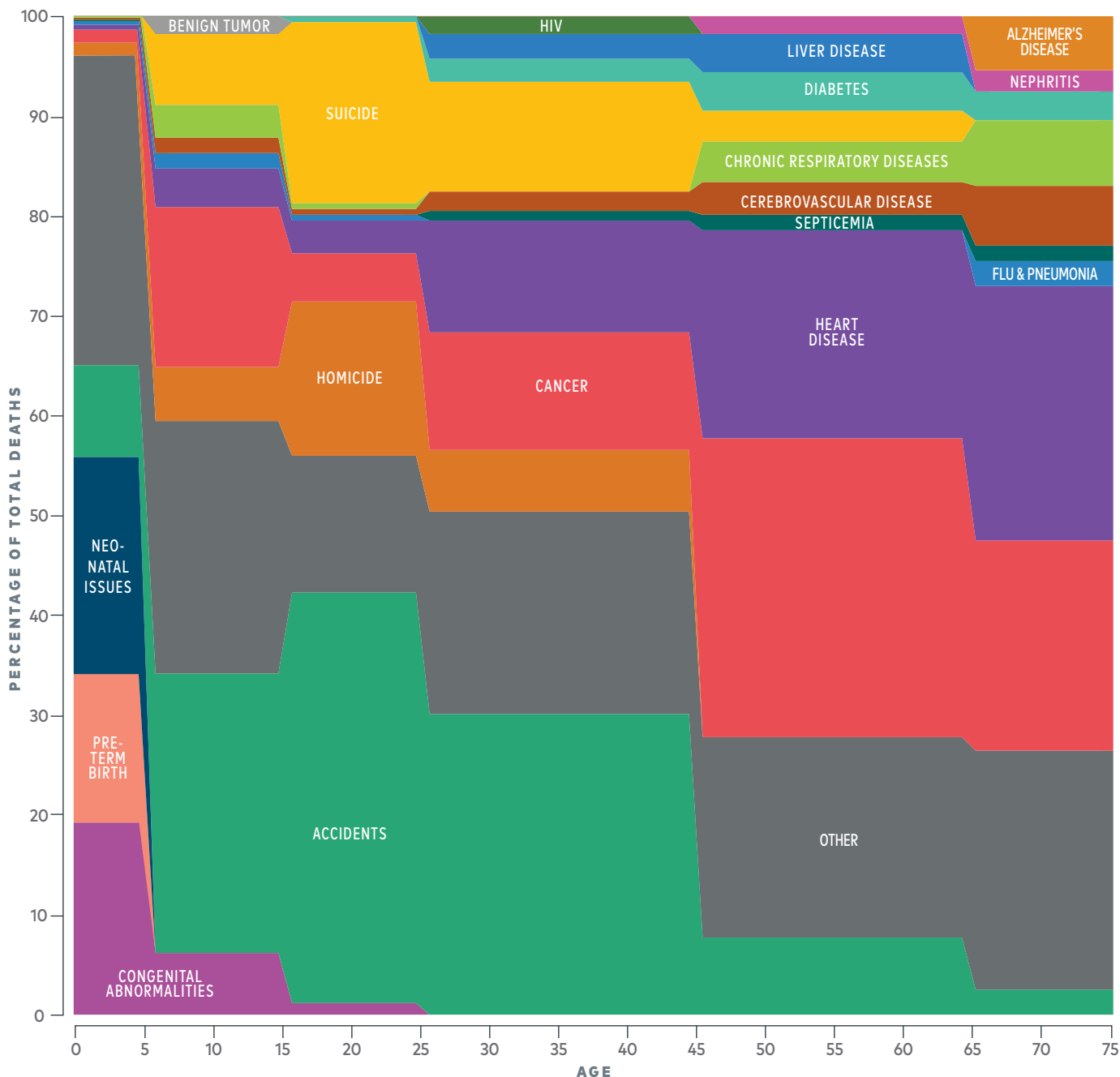
LOPHIIFORMES
The anglerfish's fleshy-tipped "rod" full of bioluminescent bacteria lights up to lure smaller fish into its jaws.



GALITEUTHIS GLACIALIS
Glowing patches below these squids' eyes cancel out its shadow so predators below can't detect them.

this is how we die

THE AVERAGE BABY BOOMER WILL LIVE 20 YEARS LONGER THAN THEIR GRANDPARENTS did. Now that modern medicine has a handle on infectious diseases such as the flu in the broader population, illnesses associated with aging, namely cancer and heart failure, will probably do most of us in. The rising percent of people dying from those ailments may seem ominous, but it means we're living long enough to get them in the first place. Here's what death looks like in modern America.



0-4
HEART DISEASE (0.5%)
Symptoms such as appetite loss and sweating might resemble colic but could signal cardiac failure for infants with birth defects in their tickers.

5-14
SUICIDE (41%)
Nearly one-third of all childhood suicides in the U.S. involve a gun, even though the victims are far too young to legally purchase one for themselves.

15-24
ACCIDENTS (41%)
More than half of accidental fatalities happen in car crashes. About 20 percent of drivers this age killed in wrecks are drunk at the time.

25-44
HIV (1%)
HIV deaths peaked in 1995, but there's been a recent spike in diagnoses in this age group despite overall declines. The drivers: poverty and fear of stigma.

45-64
CANCER (30%)
Aging doesn't cause cancer. But a half-century of carcinogens—plus genetic factors—makes it more likely to manifest in middle age.

65+
FLU/PNEUMONIA (2%)
The elderly account for more than two-thirds of flu casualties. Complications like pneumonia often kill, despite vaccine availability.

SOURCE: CDC, 2015



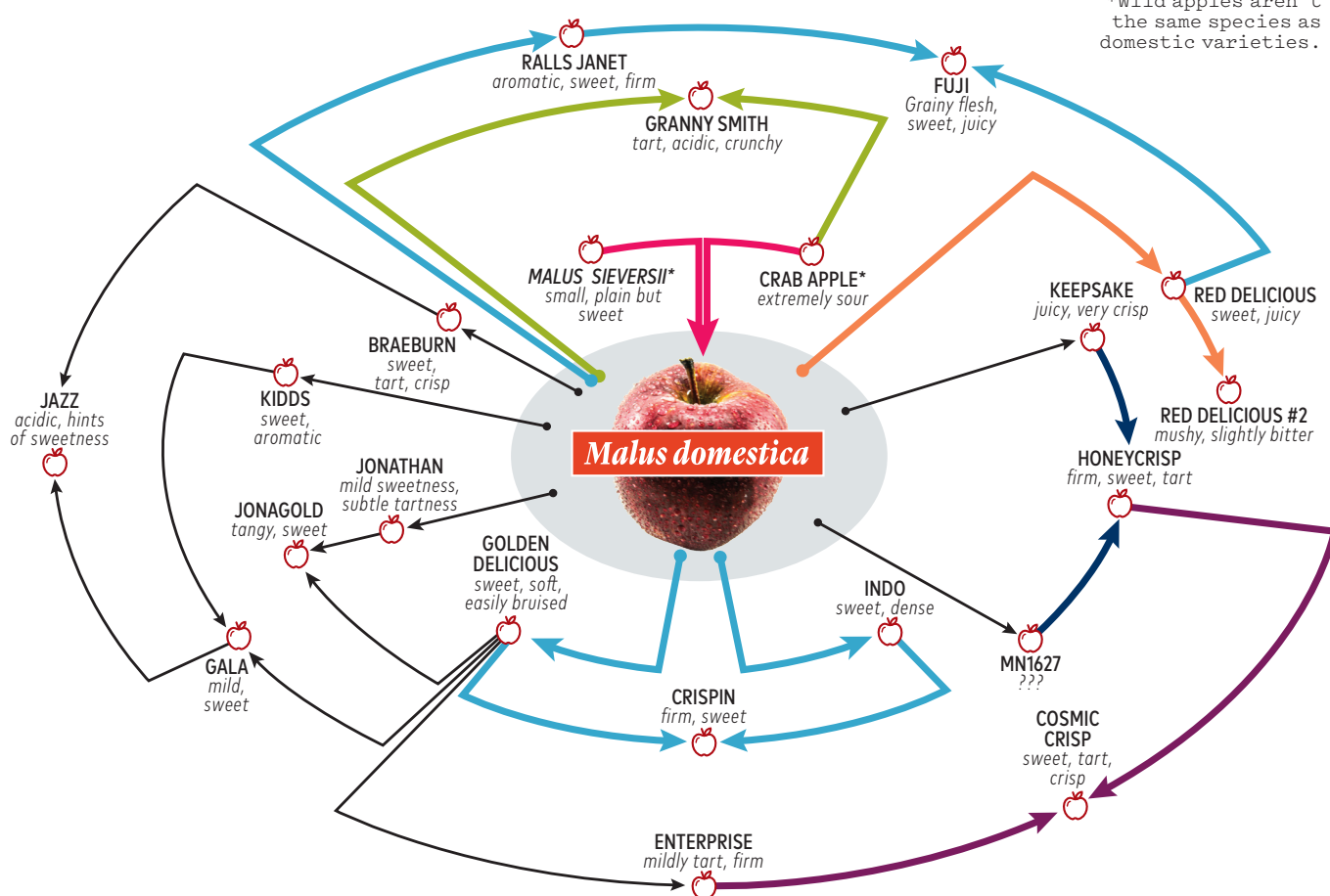
● SPROUT

NOT WINDOWS

how to breed the perfect apple

Planting apples is a game of chance in which every seed is a wild card. The pome's genetics are so diverse that kernels from the same core sprout into entirely different varieties. Though all cultivars are the same species, we've bred them into more than 7,000 types. Growers must select the best and graft their branches onto new trees to propagate each distinct fruit. Farmers have been doing this since we first domesticated the apple some 2,000 years ago. Here's how we developed some of the varieties.

*Wild apples aren't the same species as domestic varieties.



MALUS DOMESTICA

If Silk Road travelers had minded their litter, we wouldn't have today's apples. Kazakh fruits hitched rides to China and Europe, where trees grown from discarded cores cross-pollinated with soft Asian and sour crab varieties. Farmers cultivated some of the European offspring, creating a new species—the ancestor to all modern pomes.

RED DELICIOUS

A random seedling in an 1870s Iowa orchard blossomed into crisp red globes. Half a century later, serendipitous genetic mutations led to a deeper crimson skin. Apple breeders started to select excessively for the skin's color and shelf-life-lengthening thickness, both of which sold more produce—but made for mealy fruit.

GRANNY SMITH

According to lore, there really was a Granny Smith. In the 19th century, the Australian farmer tossed some French crab apples by a creek outside her house, and one of them sprouted into a tree with vivid, green fruit. Genetic analysis shows some *M. domestica* in there too, so Granny might not have had a true crab after all. But it's a nice story.

CRISPIN (née Mutsu)

While the U.S. devoured the Red Delicious, researchers across the Pacific crossbred classic American varieties to produce sweeter, juicier, and hardier fruits. The Indo and Golden Delicious together became the Crispin (or the Mutsu in Japan). The Fuji variety, a derivative of Thomas Jefferson's own Ralls Janet, is an import too.

HONEYCRISP

Developed and patented at the University of Minnesota, the sugary, moist Honeycrisp debuted in the '90s, just as Red Delicious sales were slowing. Horticulturalists bred one of their own varieties, MN1627 (never released to the public), and selected for cells that were twice as large—giving the flesh a characteristic crunch.

COSMIC CRISP

Consumers will get their first taste of this much-hyped apple in 2019, two years after the largest launch in the industry's history: 11.6 million trees in Washington state. The pome gets its name from the yellow, starlike speckles on its reddish skin. Breeders spent more than a decade crossing to create its sweet-and-tart flavor and robust constitution.

whistleblow while you work



**I HAVE A
DIGITAL SECRET.**

*Screenshot the
information and
rename the image.*

*Send it to
yourself, using
your own email.*

**Busted—your
target might
monitor activity
on their network.**

*Connect to
the internet
at home.*

**Busted—sleuths can
track your personal
Wi-Fi's identifying
information back
to you.**

*Make a new email account
using an encrypted service.
We suggest not using
"jamesbond@gmail.com."*

**Email
your secret.**

*Transfer to
an encrypted
flash drive.*

*Buy a cheap laptop
at Best Buy. Pay
cash to be cautious.*

*Use the
Wi-Fi at
Starbucks.*

*Download Tor,
the anonymous
Web browser.*

**Upload your secret
to a media outlet's
secure drop site.**



**I HAVE A
PAPER SECRET.**

*Take a picture of
the piece of paper
with your phone.*

*Copy it in black-and-
white; color copiers
leave traceable marks.*

*Replace the original
and leave the office.*

*Copy the copy
at Kinkos.
Wear a disguise.
Pay cash.*

*Put it in an
envelope
without a
return address.*

*Mail it
from a
local
mailbox.*

**Busted—the
postmark shows
what town it
came from.**



**I HAVE A
SECRET TO TELL.**

*Who you
gonna call?*

*Call them
from your
cellphone.*

**Busted—an
investigation
could uncover
your phone
records.**

*Head to a
distant public
mailbox.*

**Mail your
secret.**

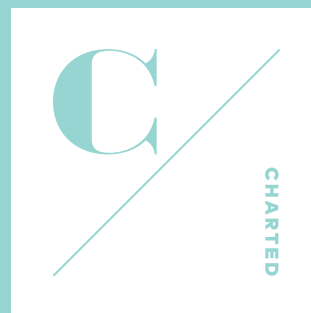
*Use a secure
messaging app
like Signal.*

**Be cautious—
Signal encrypts
texts but doesn't
anonymize them.**

*Pay cash for a burner
phone and SIM card
to make contact.*

*Call or text your
contact and arrange
a safe place to meet:
a parking garage or a
mall an hour away.*

**Tell your
secret.**



could a monkey troupe really write Shakespeare?

YOU'VE PROBABLY HEARD THAT if you were to unleash an infinite number of monkeys on an equal abundance of keyboards, they would eventually reproduce the entire works of Shakespeare. This famous thought experiment doesn't mean to suggest the Bard was no better than a busy baboon; it's designed to show a mathematical truism about the concept of infinity (and how it's, like, literally infinite). Once we stopped trying to wrap our heads around an ever-expanding universe crammed with endlessly replicating macaques and gibbons, we decided to crunch the numbers. What are the odds of mimicking acts of genius by totally random chance?

ALL LIKELIHOODS

1 in 58

SEPTILLION

 (OR 58×10^{24})

The odds of randomly typing "To be or not to be." A 2003 experiment aimed at testing the theory suggests it might help to start by teaching the monkeys not to pee on their keyboards.

1 in 14,000,000



"To be" is a lot easier. Randomly writing Shakespeare takes time, OK? Programmers once mirrored his works in mere months using millions of bots, but they saved each little fragment as it appeared—in no particular order—which is definitely cheating.

1 in 518

OCTILLION

 (OR 518×10^{27})

The New York Times' mini crossword puzzle has about 21 squares. Since each puzzle is available online for only 24 hours, you'd have to try 21 octillion letters per hour in each spot to crack it.

1 in 521 NOVENMVIGINTILLION

Skipped out on studying? You have an infinitesimal chance ($1\text{-in-}521 \times 10^{90}$) of correctly guessing all 154 multiple choice questions on the SAT. Maybe you'll score bonus points for using "novemvigintillion" in the essay.



51 in 100

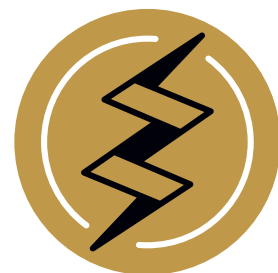
Nothing more random than a coin flip, right? One study found that a toss is actually slightly biased in favor of whichever side you start out on.

1 in 9.2

QUINTILLION

 (OR 9.2×10^{18})

The SAT makes randomly filling out a perfect bracket for March Madness, the 63-game basketball championship, look easy. But it couldn't hurt to up your odds by following the sport.



1 in 1,083,000

Want to win the Powerball? You're 270 times as likely to get hit by lightning. This year.