Near the end of March, when friends offered me their home on Long Island—they had gone to stay with relatives in Vermont—I thought that I’d go for a week. I had been quarantining at my partner’s house, in Brooklyn. He lives in a one-room studio, which doubles as his work studio, on the second floor of an old, four-story communal house, which he was sharing with four other people. We formed a pod. No outside contacts. No one left the house after mid-March, except for a rare grocery run, or a bike ride, or to walk the house dog. I promised that, while away, I would continue to social-distance. I’d be joining the experiment in solitude under way across the world.

When I arrived at my friends’ empty house, a wake of vultures was perched in a dead tree in the back yard. Not exactly auspicious. But the salty fresh air felt miraculous, the yard was covered in soft, lime-green moss, and the house was peaceful, full of light. It had an out-of-tune old piano, raised beds ready for planting, and a single room on the second floor that looked out over a marina. The only sounds were the birds and boats’ clanging masts. My friends had left the kitchen fully stocked, so I didn’t worry about bringing my city germs to the local grocery store. The days passed quickly. I stayed longer than I thought I would. Then, on Tuesday, April 14th, right when I planned to head back to Brooklyn, I woke up symptomatic.

My throat was sore, like sandpaper, and it hurt to swallow. My left ear popped painfully throughout the day. My body ached, my head throbbed. I felt fatigued, weak, like it took almost all of my energy just to keep my limbs from going slack. I felt a bit hot, but mostly cold, often to the point where I had chills, even with a sweater, a blanket, and woollen socks, despite the thermostat reading seventy-one degrees. I was badly congested. I was always thirsty, no matter how much tea and water I drank. By Saturday,
I had an awful stomach ache. I felt so tired that I stayed on the couch all afternoon. When I showered, I noticed a weird burning sensation on the bottom of my left big toe and itchy, painful red bumps on a few others.

Still, I didn't think that I had COVID-19. I didn't have a persistent dry cough or a debilitatingly high fever. I had not lost my sense of smell or taste. I had no chest pain or tightness—other than what I assumed was the usual anxiety-induced variety. I had been isolated since April 1st. Scientists state that the incubation period can be anywhere from two to fourteen days, although fourteen days, or longer, is rare. Where would I have picked it up? I had had almost no exposure to any other person for more than two weeks. In any case, by the second week, I started to feel a little better. Still unusually exhausted, but I thought that might just be quarantine malaise.

Some friends came to visit. They stayed six feet away, in the yard. I mentioned that I had a problem with my hands—I have psoriasis, and psoriatic arthritis, and it had flared a bit on a couple of fingers—and their eyes widened. They asked whether I had noticed anything strange with my toes. How did they know? They had just read an article that said a small percentage of COVID-19 patients were developing red and purple bumps and lesions on their toes, which might burn or itch, similar to chilblains or even, in appearance, to frostbite. I sent a dermatologist pictures and a description through Teladoc. “It does look like COVID-19 toes,” he wrote. “I would recommend to get tested.”

Although sars-CoV-2 is a respiratory virus—able to enter our body through our airways and then easily bind to receptors on respiratory-tract cells—it causes a vascular disease. In some ways, that makes it much scarier. Medical experts believe that the virus is able to infect the endothelium, or the internal layer of blood vessels, and can catch a ride to any organ in the body. Doctors have seen blood clots, inflammation, or both, in the lungs, heart, kidney, liver, gut, and brain. COVID toes are, some scientists believe, another manifestation; the virus creates tiny blood clots that cause blockages and a frostbite-like effect in the extremities.

I tried to take encouragement from the fact that, so far, COVID toes only seem to affect the young. But the next day, I felt worse. Feverish, again. My heart felt like it was trembling; the invisible foot on my chest felt heavier than usual. I had read that, in a few rare cases, healthy people around my age, in their mid-thirties, were dying, suddenly, from blood clots. I wondered whether COVID toes were the first sign of a fatal blockage forming in my veins. I imagined a sticky clump of orgiastic virus particles in my feet, trying to escape up my veins, on a journey to my heart.

I scheduled a test at a drive-through clinic in Riverhead. There was no line in the parking lot. The apocalypse was quiet and banal, a boring nightmare. Two women in hazmat suits and face shields came out to my car, and one stuck a long swab up my nostril. I didn't mind it as much as I thought I would. They handed me a bag containing four bottles of New York State hand-sanitizer spray, which was bottled in a prison; a fluorescent-yellow T-shirt (along with directions for making a mask); and bilingual informational handouts that included a list of food pantries in the area. I drove home along roads bordered by pine trees and water. Two days later, a doctor from the clinic called. The test was, unsurprisingly, positive.

The next day, May 1st, late in the afternoon, I received another call, from a doctor who worked as a contact tracer with the New York City Department of Health. She asked whether I had had any of the COVID-19 symptoms recognized by the World Health Organization, which she read from a list. (COVID toes were not yet on it.) She asked where I had been staying two days before I
became symptomatic, and whether I had been commuting to an office, or whether I had gone to church or any other kind of indoor gathering. I had not. She told me, per the guidelines from the Centers for Disease Control and Prevention, that, starting from the day I got the test, I would need to self-isolate for ten days or until I had gone seventy-two hours without a fever (and without taking any fever-reducing drugs). She asked whether that was possible or whether I’d need a place to stay and help with meals. She was kind, but she stuck to a script. She was uninterested in my theories on where I might have got sick, the few places I had been; they did not fit inside the Department of Health’s criteria for potentially exposed close contacts, which it defines as anyone you’ve been within six feet of for more than ten minutes. For the past thirty days, my contacts were, therefore, zero.

For the majority of the nearly five million covid-19 cases across the United States, the point of infection is unknown. “We don’t know how their exposure occurred or what kind of environment they were in when it happened,” Crystal Watson, an expert on contact tracing at the Johns Hopkins Center for Health Security, told me. When an outbreak is under control, this would not be the case. Test-and-trace teams would track the percentage of cases that can be linked to another person—or, more specifically, the percentage of cases that were already on the health agency’s radar, as potentially exposed contacts. “If your contact-tracing program is doing well, the number is going to be high,” Emily Gurley, an epidemiologist who teaches a popular online course on contact tracing, told me. With cases surging across the U.S., that number isn’t high in any of the existing state and city contact-tracing teams. “One type of data that we’re not doing a good job collecting and making public,” Watson said, “is the contribution of different modes of transmission to virus spread.”

If contact-tracing programs collected this data, my disease detective might have asked me to list everywhere I had been, but she did not. I had actually been somewhat surprised that she even called. On April 30th, there were still more than two thousand cases per day in New York City. A full lockdown was in place, and everyone was encouraged to stay home. The next morning, Oxiris Barbot, then commissioner of the N.Y.C. Department of Health and Mental Hygiene, had urged people during a press briefing “to be even more diligent” when it came to face masks and hand sanitizer. “The reality is that we’re still seeing transmission across the city, and, given the large volume of new cases, we can’t track those back to a single-point source.”

While my case of covid-19 was one of tens of thousands that hadn’t been linked at the time, it still seemed statistically unlikely. The first possibility is that I picked it up on March 31st or April 1st, right before I left Brooklyn, when the virus was as common as pollen in the breeze. Maybe someone who was sick sneezed or coughed on my car-door handle, right before I got in the car. Highly unlikely, but not impossible. The virus can survive on plastic for up to three days. Based on data so far, experts say that fomite transmission—which means picking up the virus from a contaminated surface, such as a door handle—is not responsible for the majority of cases. The scientific consensus is that large-droplet transmission is the most common route. If an infected person sneezed, coughed, or breathed heavily right next to me, I might have inhaled large droplets from them (although I think I would have noticed if that had happened in the haunted early weeks of the pandemic). Or a sick person’s droplets might have landed on my hands, and then I, inevitably, touched my face.

There is enough evidence now to also suggest that the virus can survive floating in the air, transmitted through microscopic contaminated droplets known as aerosols. Several studies have traced outbreak clusters to places where people were gathered indoors, breathing heavily, speaking, or singing. A study in Japan showed that sixty-one clusters of cases—a total of three thousand one hundred and eighty-four people infected between January and April—involved not only health-care facilities (thirty per cent of the clusters) and nursing homes or day-care centers (sixteen per cent of clusters) but also restaurants or bars (sixteen per cent of
clusters) and music-related events (eleven per cent of clusters), including live concerts, chorus-group rehearsals, and karaoke parties. Gyms were responsible for eight per cent of the clusters.

In early July, the W.H.O. finally acknowledged the airborne danger, but only after hundreds of experts publicly sent a letter outlining evidence of the risks that contaminated aerosols pose, particularly indoors. Aerosols contain less virus than bigger droplets, but they don’t fall, whereas larger droplets do. Outdoors, air currents scatter and weaken aerosols; indoors, however, a contaminated aerosol cloud might travel the length of a room, especially one with poor ventilation, and remain viable for as long as three hours. (It will get less infectious with time.) This means that perhaps I caught the virus from my partner’s housemates. And yet we all had been exceedingly careful, and none of them got sick. Plenty of data suggest, however, that they all might have had the virus. Between forty and forty-five per cent of infected people are asymptomatic.

The U.S., with only four per cent of the world’s population, has more than twenty-five per cent of the world’s known COVID-19 cases. As the Times recently noted, by the end of July, that translated to fifteen times as many confirmed COVID-19 cases, per capita, as Canada, and twelve times as many as Europe. On July 23rd, the COVID Tracking Project estimated that nearly sixty thousand people were hospitalized, almost equal to the number on April 15th, at the first peak of the pandemic in the U.S. “It takes some time to get to those big numbers,” Justin Lessler, an associate professor of epidemiology at Johns Hopkins University, told me. “Particularly if it’s just a subtle increase in how much over-all transmission is happening, due to a relaxation of controls.”

Part of what went wrong is that many states ignored guidelines on how to reopen—including reports by the American Enterprise Institute, the National Governors Association, and even the White House’s health experts—which, by April, all converged on a few recommendations: only reopen once cases have been going down over a period of fourteen days and once the local health agencies have established a strong public-health infrastructure, with testing and contact-tracing teams in place. Also, go very slowly.

The basis of these guidelines was math. In the first outbreak, the virus followed a pattern of exponential growth. In order to stop this kind of spread and flatten the curve, the number of cases that an infected individual causes (known in epidemiology as $R_0$) must be below one—which means that people are not replacing themselves in the chain of transmission. “All the analyses in the United States suggest that most places only got just below a reproductive number of one when they had lots of interventions,” Lessler said. “So releasing those interventions—the stay-at-home orders and extreme social-distancing measures we had in place—brought $R_0$ above one.”

After social-distancing measures were loosened, various national outbreaks took four to six weeks to register with public-health officials. Infected individuals first have to develop symptoms, which, according to existing data, takes an average of five and a half days, then get tested and get the results. A single generation of transmission—the time between becoming infected and infecting someone else—takes about a week. So if forty people get infected at an event, that’s not enough to signal a surging epidemic. But if, each week, the number doubles—eighty, a hundred and sixty, three hundred and twenty, six hundred and forty—the signal starts to appear.

Part of the challenge in controlling these outbreaks continues to be how difficult it is for people (including government officials) to comprehend the explosive power of this kind of exponential growth. Clayton Dalton, an emergency-room doctor at Massachusetts General Hospital, illustrated this problem in March, in the Guardian. In one example, Dalton imagines taking thirty steps from
his front door, “with each step twice as large as the last.” How far does he go? Twenty-six times the Earth’s circumference. “Every single day matters enormously in limiting the spread of the coronavirus,” Dalton wrote.

With exponential growth, the starting point matters, too. Some states had never fully locked down. And in two-thirds of states, cases were rising when governors began to ease their lockdowns. Georgia, for instance, reopened its economy—including businesses such as nail salons, gyms, and tattoo parlors—when daily new cases were averaging around seventy-five per million. (As The Economist pointed out, “By contrast, France, Spain and Italy had 13-17 new cases per million when they began to reopen their economies.”) In Texas, Governor Greg Abbott allowed bars to open on May 18th, a day on which there was an increase of nearly a thousand new cases, following weeks of a steady rise. In Florida, Disney World opened on July 11th, the day after the state recorded more than ten thousand new cases—and a single-day record of four hundred and thirty-five new hospitalizations.

Some specific factors, beyond the virus’s exponential growth, contributed to the summer’s surge in cases. In general, the early shortages of masks—and the confusion and conflicting political messages swirling around their use—delayed their widespread adoption. Last month, Georgia’s governor, for instance, sued the mayor of Atlanta when she ordered people to wear masks. President Trump wore a mask publicly for the first time in late July. But evidence now shows that masks not only help prevent asymptomatic infected individuals from spreading the virus but also might protect wearers themselves against severe or even moderate illness, by reducing the viral dose—the amount of virus that a person initially inhales. (The greater the dose, the harder it becomes for the immune system to fight off infection.) According to a recent paper, eighty-one per cent of the infected passengers and staff on a cruise ship—all of whom had been issued masks—remained asymptomatic, and, in a seafood factory in Oregon, where workers received masks each day, the rate of asymptomatic infection among the hundred and twenty-four infected was ninety-five per cent. Monica Gandhi, one of the paper’s co-authors and an infectious-disease specialist at the University of California, San Francisco, told NPR, “It really is that the less virus that you get in, the less sick you’re likely to be.”

Bars, house parties, and other gatherings in May and June also likely helped fuel the spread. “When we talk about the reopening, it’s important to remember why we closed,” Emily Gurley, the epidemiologist, said. The first, explicit reason was, obviously, to bring transmission down—or, in other words, to flatten the curve. “Why does closing things down work? Because no one has contacts anymore,” Gurley said. A second, implicit reason was to buy time to establish the necessary public-health infrastructure. “The virus didn’t go away. You’re still on an incline,” Gurley said. “We took our foot off the brakes before we had anything else to catch us.”

Since early summer, ten states and Puerto Rico have reimposed some of their earlier restrictions, and thirteen have paused their reopenings. Since May, several states have made an effort to ramp up their contact-tracing efforts, including California, which has hired and trained more than seven thousand disease detectives over the past two months, and is attempting to get up to twenty thousand. On June 1st, New York City launched its Test & Trace Corps, hiring and training three thousand disease detectives—up from about a hundred in April. But over all, the White House still has not made it a national priority. “What we need,” Crystal Watson, the contact-tracing expert, told me, “is a call to action at a national level and much more federal funding.”

Even though testing has been made a priority in the national response, in many regions, especially those with the largest case surges, there are still long delays in turning around results, as much as a week to ten days. “I can’t tell you how frustrating it is to be back in the same place,” Gurley said. “We’ve got to be screaming about this again.” With test-result delays, contact tracing becomes somewhat futile, since the point is to reach an infected person’s possible contacts and ask them to quarantine before they start shedding virus. People, on average, pose an infectious risk roughly two days before symptoms start. “Contact tracing is one of
the best tools we have for being able to identify as many people as possible who have covid, even in the absence of symptoms,” Mike Reid, the chief medical officer for California’s contact-tracer training effort, said. Watson expressed concern that because some states will now not be able to control surging outbreaks with contact tracing alone, “governors will give up on developing this capacity,” even though it will be essential to prevent future waves of infection.

Gurley pointed out that what we don’t know about transmission, at this point, does not matter much in terms of policy. “The U.S. has been focussed on a few trees we were unsure about and lost view of the forest of everything we do know,” she said. “Most people are infected by someone they live with, someone they had very close contact with, and most transmission happens from people who are sick or going to be sick.” Lessler told me that people are, in fact, five to ten times more likely to be infected by a close household contact than any other kind of contact. One new study, based on data from South Korea, where officials tracked down nearly every contact of anyone who was sick, found that the majority of contacts—fifty-seven per cent—who tested positive for covid-19 were household contacts, versus contacts from a restaurant or store. “Even if we just focussed on people that are easy to find,” Gurley said, “we could have a huge impact.”

If, contrary to the prevailing data, I had not picked up the virus before I left my temporary home in Brooklyn, there are only four other possible places where I might have been exposed. Right before I arrived at the Long Island house, on April 1st, I stopped at a roadside restaurant for takeout. There was no one else in the parking lot, and two employees were inside. One of them, a tall, burly, bearded man, handed off my food in a bag. I have since called the restaurant; the only employee who got sick was quarantined before my visit. (On a list of thirty-seven activities labelled low-risk to high-risk, which was released by the Texas Medical Association, getting takeout is firmly low-risk, labelled a two, on a scale from one to ten.)

Once I got to the house, I did not leave again (except to go for a walk or run along an empty path) until April 10th, when I took the trash to the town dump. The sorting center has a roof, but otherwise it’s open-air. Everyone I passed was wearing a mask. The next day, I took a box to the local U.P.S. store. I used a sleeve to open the door. There were two women working behind the counter, wearing masks. I wore a kerchief across my face and did not touch anything. The clerk even asked me to read her my credit-card information instead of passing her the card. Of the three other people who were in the store while I was there, one young woman was properly masked, one elderly man wore a mask but left his nose exposed, and one middle-aged woman, who was there only for a moment, wore her mask like a beard. Maybe I walked into a virus-contaminated cloud while inside, and my kerchief was insufficient protection. On April 12th, Easter Sunday, I went for a run on the beach. A big dog came running up to greet me. Instinctively, I scratched its head. I did not pay attention to who the owners were and, in any case, I never got near them. That’s it. No other possibilities. By the 14th, I was sick.

Of course, another scenario is that I had an exceedingly long incubation period after contracting covid-19 in Brooklyn. Although half of cases will develop symptoms within five days, fewer than five per cent of infected individuals will develop symptoms after fourteen days. But two of my partner’s housemates have since been tested for antibodies. They didn’t have them, which, given that all of us were huddled around a jigsaw puzzle the night before I left, makes it highly improbable that anyone else in the house was infected.

At that point, no one, not even the smartest experts, could figure out, with complete certainty, where I was infected. “Even if I did know,” Lessler said—if we could trace it to a housemate, or another single person at the U.P.S. store who only infected me—“who is going to publish a paper about the one lady who got infected at a U.P.S. store?” The literature, he pointed out, is “going to be
dominated by large-transmission events that, by their very nature, are going to be unusual and not necessarily reflect the dominant modes of transmission.”

So let my story be a parable. Even if you wear a mask, wash your hands frequently, and social-distance, as you must, you might still contract this disease. Call it an atmospheric threat. I was fine, I was able to isolate, I recovered, and, for as long as my immunity lasts, I’ll be one less body capable of continuing the spread. But back in April, my family had asked me to visit on Easter, right before I became symptomatic. I almost did. If I had, I might have killed my seventy-seven-year-old mother. There are some things that cannot be known, but they don’t matter. We know the virus spreads with chilling ease—in other words, we know enough. Be humble in the face of nature.

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- A pregnant pediatrician on what children need during the crisis.
- Trump is helping tycoons who have donated to his reëlection campaign exploit the pandemic to maximize profits.
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- The coronavirus is likely to reshape architecture. What kinds of space are we willing to live and work in now?

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