
***The* GHOST MAP**

***The Story of London's Most Terrifying
Epidemic—and How It Changed Science, Cities,
and the Modern World***

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THE NIGHT-SOIL MEN

IT IS AUGUST 1854, AND LONDON IS A CITY OF SCAVENGERS. Just the names alone read now like some kind of exotic zoological catalogue: bone-pickers, rag-gatherers, pure-finders, dredgermen, mud-larks, sewer-hunters, dustmen, night-soil men, bunters, toshers, shoremen. These were the London underclasses, at least a hundred thousand strong. So immense were their numbers that had the scavengers broken off and formed their own city, it would have been the fifth-largest in all of England. But the diversity and precision of their routines were more remarkable than their sheer number. Early risers strolling along the Thames would see the toshers wading through the muck of low tide, dressed almost comically in flowing velveteen coats, their oversized pockets filled with stray bits of copper recovered from the water's edge. The toshers walked with a lantern strapped to their chest to help them see in the predawn gloom, and carried an eight-foot-long pole that they used to test the ground in front of them, and

to pull themselves out when they stumbled into a quagmire. The pole and the eerie glow of the lantern through the robes gave them the look of ragged wizards, scouring the foul river's edge for magic coins. Beside them fluttered the mud-larks, often children, dressed in tatters and content to scavenge all the waste that the toshers rejected as below their standards: lumps of coal, old wood, scraps of rope.

Above the river, in the streets of the city, the pure-finders eked out a living by collecting dog shit (colloquially called "pure") while the bone-pickers foraged for carcasses of any stripe. Below ground, in the cramped but growing network of tunnels beneath London's streets, the sewer-hunters slogged through the flowing waste of the metropolis. Every few months, an unusually dense pocket of methane gas would be ignited by one of their kerosene lamps and the hapless soul would be incinerated twenty feet below ground, in a river of raw sewage.

The scavengers, in other words, lived in a world of excrement and death. Dickens began his last great novel, *Our Mutual Friend*, with a father-daughter team of toshers stumbling across a corpse floating in the Thames, whose coins they solemnly pocket. "What world does a dead man belong to?" the father asks rhetorically, when chided by a fellow tosher for stealing from a corpse. "Tother world. What world does money belong to? This world." Dickens' unspoken point is that the two worlds, the dead and the living, have begun to coexist in these marginal spaces. The bustling commerce of the great city has conjured up its opposite, a ghost class that somehow mimics the status markers and value calculations of the material world.

Consider the haunting precision of the bone-pickers' daily routine, as captured in Henry Mayhew's pioneering 1844 work, *London Labour and the London Poor*:

It usually takes the bone-picker from seven to nine hours to go over his rounds, during which time he travels from 20 to 30 miles with a quarter to a half hundredweight on his back. In the summer he usually reaches home about eleven of the day, and in the winter about one or two. On his return home he proceeds to sort the contents of his bag. He separates the rags from the bones, and these again from the old metal (if he be lucky enough to have found any). He divides the rags into various lots, according as they are white or coloured; and if he have picked up any pieces of canvas or sacking, he makes these also into a separate parcel. When he has finished the sorting he takes his several lots to the ragshop or the marine-store dealer, and realizes upon them whatever they may be worth. For the white rags he gets from 2d. to 3d. per pound, according as they are clean or soiled. The white rags are very difficult to be found; they are mostly very dirty, and are therefore sold with the coloured ones at the rate of about 5 lbs. for 2d.

The homeless continue to haunt today's postindustrial cities, but they rarely display the professional clarity of the bone-picker's impromptu trade, for two primary reasons. First, minimum wages and government assistance are now substantial enough that it no longer makes economic sense

to eke out a living as a scavenger. (Where wages remain depressed, scavenging remains a vital occupation; witness the *perpendadores* of Mexico City.) The bone collector's trade has also declined because most modern cities possess elaborate systems for managing the waste generated by their inhabitants. (In fact, the closest American equivalent to the Victorian scavengers—the aluminum-can collectors you sometimes see hovering outside supermarkets—rely on precisely those waste-management systems for their paycheck.) But London in 1854 was a Victorian metropolis trying to make do with an Elizabethan public infrastructure. The city was vast even by today's standards, with two and a half million people crammed inside a thirty-mile circumference. But most of the techniques for managing that kind of population density that we now take for granted—recycling centers, public-health departments, safe sewage removal—hadn't been invented yet.

And so the city itself improvised a response—an unplanned, organic response, to be sure, but at the same time a response that was precisely contoured to the community's waste-removal needs. As the garbage and excrement grew, an underground market for refuse developed, with hooks into established trades. Specialists emerged, each dutifully carting goods to the appropriate site in the official market: the bone collectors selling their goods to the bone-boilers, the pure-finders selling their dog shit to tanners, who used the "pure" to rid their leather goods of the lime they had soaked in for weeks to remove animal hair. (A process widely considered to be, as one tanner put it, "the most disagreeable in the whole range of manufacture.")

We're naturally inclined to consider these scavengers tragic figures, and to fulminate against a system that allowed so many thousands to eke out a living by foraging through human waste. In many ways, this is the correct response. (It was, to be sure, the response of the great crusaders of the age, among them Dickens and Mayhew.) But such social outrage should be accompanied by a measure of wonder and respect: without any central planner coordinating their actions, without any education at all, this itinerant underclass managed to conjure up an entire system for processing and sorting the waste generated by two million people. The great contribution usually ascribed to Mayhew's *London Labour* is simply his willingness to see and record the details of these impoverished lives. But just as valuable was the insight that came out of that bookkeeping, once he had run the numbers: far from being unproductive vagabonds, Mayhew discovered, these people were actually performing an essential function for their community. "The removal of the refuse of a large town," he wrote, "is, perhaps, one of the most important of social operations." And the scavengers of Victorian London weren't just getting rid of that refuse—they were recycling it.

WASTE RECYCLING IS USUALLY ASSUMED TO BE AN INVENTION of the environmental movement, as modern as the blue plastic bags we now fill with detergent bottles and soda cans. But it is an ancient art. Composting pits were used by the citizens of Knossos in Crete four thousand years ago. Much of medieval Rome was built out of

materials pilfered from the crumbling ruins of the imperial city. (Before it was a tourist landmark, the Colosseum served as a de facto quarry.) Waste recycling—in the form of composting and manure spreading—played a crucial role in the explosive growth of medieval European towns. High-density collections of human beings, by definition, require significant energy inputs to be sustainable, starting with reliable supplies of food. The towns of the Middle Ages lacked highways and container ships to bring them sustenance, and so their population sizes were limited by the fecundity of the land around them. If the land could grow only enough food to sustain five thousand people, then five thousand people became the ceiling. But by plowing their organic waste back into the earth, the early medieval towns increased the productivity of the soil, thus raising the population ceiling, thereby creating more waste—and increasingly fertile soil. This feedback loop transformed the boggy expanses of the Low Countries, which had historically been incapable of sustaining anything more complex than isolated bands of fishermen, into some of the most productive soils in all of Europe. To this day, the Netherlands has the highest population density of any country in the world.

Waste recycling turns out to be a hallmark of almost all complex systems, whether the man-made ecosystems of urban life, or the microscopic economies of the cell. Our bones are themselves the result of a recycling scheme pioneered by natural selection billions of years ago. All nucleated organisms generate excess calcium as a waste product. Since at least the Cambrian times, organisms have accumulated those calcium reserves, and put them to good

use: building shells, teeth, skeletons. Your ability to walk upright is due to evolution's knack for recycling its toxic waste.

Waste recycling is a crucial attribute of the earth's most diverse ecosystems. We value tropical rain forests because they squander so little of the energy supplied by the sun, thanks to their vast, interlocked system of organisms exploiting every tiny niche of the nutrient cycle. The cherished diversity of the rain-forest ecosystem is not just a quaint case of biological multiculturalism. The diversity of the system is precisely why rain forests do such a brilliant job of capturing the energy that flows through them: one organism captures a certain amount of energy, but in processing that energy, it generates waste. In an efficient system, that waste becomes a new source of energy for another creature in the chain. (That efficiency is one of the reasons why clearing the rain forests is such a shortsighted move: the nutrient cycles in their ecosystems are so tight that the soil is usually very poor for farming: all the available energy has been captured on its way down to the forest floor.)

Coral reefs display a comparable knack for waste management. Corals live in a symbiotic alliance with tiny algae called zooxanthellae. Thanks to photosynthesis, the algae capture sunlight and use it to turn carbon dioxide into organic carbon, with oxygen as a waste product of the process. The coral then uses the oxygen in its own metabolic cycle. Because we're aerobic creatures ourselves, we tend not to think of oxygen as a waste product, but from the point of view of the algae, that's precisely what it is: a useless substance discharged as part of its metabolic cycle.

The coral itself produces waste in the form of carbon dioxide, nitrates, and phosphates, all of which help the algae to grow. That tight waste-recycling chain is one of the primary reasons coral reefs are able to support such a dense and diverse population of creatures, despite residing in tropical waters, which are generally nutrient-poor. They are the cities of the sea.

There can be many causes behind extreme population density—whether the population is made up of angelfish or spider monkeys or humans—but without efficient forms of waste recycling, those dense concentrations of life can't survive for long. Most of that recycling work, in both remote tropical rain forests and urban centers, takes place at the microbial level. Without the bacteria-driven processes of decomposition, the earth would have been overrun by offal and carcasses eons ago, and the life-sustaining envelope of the earth's atmosphere would be closer to the uninhabitable, acidic surface of Venus. If some rogue virus wiped out every single mammal on the planet, life on earth would proceed, largely unaffected by the loss. But if the bacteria disappeared overnight, all life on the planet would be extinguished within a matter of years.

You couldn't see those microbial scavengers at work in Victorian London, and the great majority of scientists—not to mention laypeople—had no idea that the world was in fact teeming with tiny organisms that made their lives possible. But you could detect them through another sensory channel: smell. No extended description of London from that period failed to mention the stench of the city. Some of that stench came from the burning of industrial fuels, but the most objectionable smells—the ones that

ultimately helped prod an entire public-health infrastructure into place—came from the steady, relentless work of bacteria decomposing organic matter. Those deadly pockets of methane in the sewers were themselves produced by the millions of microorganisms diligently recycling human dung into a microbial biomass, with a variety of gases released as waste products. You can think of those fiery, underground explosions as a kind of skirmish between two different kinds of scavenger: sewer-hunter versus bacterium—living on different scales but nonetheless battling for the same territory.

But in that late summer of 1854, as the toshers and the mud-larks and the bone collectors made their rounds, London was headed toward another, even more terrifying, battle between microbe and man. By the time it was over, it would prove as deadly as any in the city's history.

LONDON'S UNDERGROUND MARKET OF SCAVENGING HAD ITS own system of rank and privilege, and near the top were the night-soil men. Like the beloved chimney sweeps of *Mary Poppins*, the night-soil men worked as independent contractors at the very edge of the legitimate economy, though their labor was significantly more revolting than the foraging of the mud-larks and toshers. City landlords hired the men to remove the "night soil" from the overflowing cesspools of their buildings. The collecting of human excrement was a venerable occupation; in medieval times they were called "rakers" and "gong-fermors," and they played an indispensable role in the waste-recycling system that helped London grow into a

true metropolis, by selling the waste to farmers outside the city walls. (Later entrepreneurs hit upon a technique for extracting nitrogen from the ordure that could be reused in the manufacture of gunpowder.) While the rakers and their descendants made a good wage, the work conditions could be deadly: in 1326, an ill-fated laborer by the name of Richard the Raker fell into a cesspool and literally drowned in human shit.

By the nineteenth century, the night-soil men had evolved a precise choreography for their labors. They worked the graveyard shift, between midnight and five a.m., in teams of four: a "ropeman," a "holeman," and two "tubmen." The team would affix lanterns at the edge of the cesspit, then remove the floorboards or stone covering it, sometimes with a pickax. If the waste had accumulated high enough, the ropeman and holeman would begin by scooping it out with the tub. Eventually, as more night soil was removed, the men would lower a ladder down and the holeman would descend into the pit and scoop waste into his tub. The ropeman would help pull up each full tub, and pass it along to the tubmen who emptied the waste into their carts. It was standard practice for the night-soil men to be offered a bottle of gin for their labors. As one reported to Mayhew: "I should say that there's been a bottle of gin drunk at the clearing of every two, ay, and more than every two, out of three cesspools emptied in London; and now that I come to think on it, I should say that's been the case with three out of every four."

The work was foul, but the pay was good. Too good, as it turned out. Thanks to its geographic protection from invasion, London had become the most sprawling of

European cities, expanding far beyond its Roman walls. (The other great metropolis of the nineteenth century, Paris, had almost the same population squeezed into half the geographic area.) For the night-soil men, that sprawl meant longer transport times—open farmland was now often ten miles away—which drove the price of their removing waste upward. By the Victorian era, the night-soil men were charging a shilling a cesspool, wages that were at least twice that of the average skilled laborer. For many Londoners, the financial cost of removing waste exceeded the environmental cost of just letting it accumulate—particularly for landlords, who often didn't live on top of these overflowing cesspools. Sights like this one, reported by a civil engineer hired to survey two houses under repair in the 1840s, became commonplace: "I found whole areas of the cellars of both houses were full of nightsoil to the depth of three feet, which had been permitted for years to accumulate from the overflow of the cesspools.... Upon passing through the passage of the first house I found the yard covered in nightsoil, from the overflowing of the privy to the depth of nearly six inches and bricks were placed to enable the inmates to get across dryshod." Another account describes a dustheap in Spitalfields, in the heart of the East End: "a heap of dung the size of a tolerably large house, and an artificial pond into which the content of cesspits are thrown. The contents are allowed to desiccate in the open air, and they are frequently stirred for that purpose." Mayhew described this grotesque scene in an article published in the *London Morning Chronicle* in 1849 that surveyed the ground zero of that year's cholera outbreak:

We then journeyed on to London-street.... In No. 1 of this street the cholera first appeared seventeen years ago, and spread up it with fearful virulence; but this year it appeared at the opposite end, and ran down it with like severity. As we passed along the reeking banks of the sewer, the sun shone upon a narrow slip of the water. In the bright light it appeared the colour of strong green tea, and positively looked as solid as black marble in the shadow—indeed, it was more like watery mud than muddy water; and yet we were assured this was the only water the wretched inhabitants had to drink. As we gazed in horror at it, we saw drains and sewers emptying their filthy contents into it; we saw a whole tier of doorless privies in the open road, common to men and women, built over it; we heard bucket after bucket of filth splash into it; and the limbs of the vagrant boys bathing in it seemed by pure force of contrast, white as Parian marble. And yet, as we stood doubting the fearful statement, we saw a little child, from one of the galleries opposite, lower a tin can with a rope to fill a large bucket that stood beside her. In each of the balconies that hung over the stream the self-same tub was to be seen in which the inhabitants put the mucky liquid to stand, so that they may, after it has rested for a day or two, skim the fluid from the solid particles of filth, pollution, and disease. As the little thing dangled her tin cup as gently as possible into the stream, a bucket of night-soil was poured down from the next gallery.

Victorian London had its postcard wonders, to be sure—the Crystal Palace, Trafalgar Square, the new additions to Westminster Palace. But it also had wonders of a different order, no less remarkable: artificial ponds of raw sewage, dung heaps the size of houses.

The elevated wage of the night-soil men wasn't the only culprit behind this rising tide of excrement. The runaway popularity of the water closet heightened the crisis. A water-flushing device had been invented in the late sixteenth century by Sir John Harington, who actually installed a functioning version for his godmother, Queen Elizabeth, at Richmond Palace. But the device didn't take off until the late 1700s, when a watchmaker named Alexander Cummings and a cabinetmaker named Joseph Bramah filed for two separate patents on an improved version of Harington's design. Bramah went on to build a profitable business installing water closets in the homes of the well-to-do. According to one survey, water-closet installations had increased tenfold in the period between 1824 and 1844. Another spike happened after a manufacturer named George Jennings installed water closets for public use in Hyde Park during the Great Exhibition of 1851. An estimated 827,000 visitors used them. The visitors no doubt marveled at the Exhibition's spectacular display of global culture and modern engineering, but for many the most astonishing experience was just sitting on a working toilet for the first time.

Water closets were a tremendous breakthrough as far as quality of life was concerned, but they had a disastrous effect on the city's sewage problem. Without a functioning sewer system to connect to, most WCs simply flushed their

contents into existing cesspools, greatly increasing their tendency to overflow. According to one estimate, the average London household used 160 gallons of water a day in 1850. By 1856, thanks to the runaway success of the water closet, they were using 244 gallons.

But the single most important factor driving London's waste-removal crisis was a matter of simple demography: the number of people generating waste had almost tripled in the space of fifty years. In the 1851 census, London had a population of 2.4 million people, making it the most populous city on the planet, up from around a million at the turn of the century. Even with a modern civic infrastructure, that kind of explosive growth is difficult to manage. But without infrastructure, two million people suddenly forced to share ninety square miles of space wasn't just a disaster waiting to happen—it was a kind of permanent, rolling disaster, a vast organism destroying itself by laying waste to its habitat. Five hundred years after the fact, London was slowly re-creating the horrific demise of Richard the Raker: it was drowning in its own filth.

ALL OF THOSE HUMAN LIVES CROWDED TOGETHER HAD AN inevitable repercussion: a surge in corpses. In the early 1840s, a twenty-three-year-old Prussian named Friedrich Engels embarked on a scouting mission for his industrialist father that inspired both a classic text of urban sociology and the modern Socialist movement. Of his experiences in London, Engels wrote:

The corpses [of the poor] have no better fate than the carcasses of animals. The pauper burial ground at St Bride's is a piece of open marshland which has been used since Charles II's day and there are heaps of bones all over the place. Every Wednesday the remains of dead paupers are thrown in to a hole which is 14 feet deep. A clergyman gabbles through the burial service and then the grave is filled with loose soil. On the following Wednesday the ground is opened again and this goes on until it is completely full. The whole neighborhood is infected from the dreadful stench.

One privately run burial ground in Islington had packed 80,000 corpses into an area designed to hold roughly three thousand. A gravedigger there reported to the *Times* of London that he had been "up to my knees in human flesh, jumping on the bodies, so as to cram them in the least possible space at the bottom of the graves, in which fresh bodies were afterwards placed."

Dickens buries the mysterious opium-addicted law-writer who overdoses near the beginning of *Bleak House* in a comparably grim setting, inspiring one of the book's most famous, and famously impassioned, outbursts:

a hemmed-in churchyard, pestiferous and obscene, whence malignant diseases are communicated to the bodies of our dear brothers and sisters who have not departed.... With houses looking on, one very side, save where a reeking little tunnel of a court gives

access to the iron gate—with every villainy of life in action close on death, and every poisonous element of death in action close on life—here, they lower our dear brother down a foot or two: here, sow him in corruption, to be raised in corruption: an avenging ghost at many a sick-bedside: a shameful testimony to future ages, how civilization and barbarism walked this boastful island together.

To read those last sentences is to experience the birth of what would become a dominant rhetorical mode of twentieth-century thought, a way of making sense of the high-tech carnage of the Great War, or the Taylorite efficiencies of the concentration camps. The social theorist Walter Benjamin reworked Dickens' original slogan in his enigmatic masterpiece "Theses on the Philosophy of History," written as the scourge of fascism was enveloping Europe: "There is no document of civilization that is not also a document of barbarism."

The opposition between civilization and barbarism was practically as old as the walled city itself. (As soon as there were gates, there were barbarians ready to storm them.) But Engels and Dickens suggested a new twist: that the advance of civilization produced barbarity as an unavoidable waste product, as essential to its metabolism as the gleaming spires and cultivated thought of polite society. The barbarians weren't storming the gates. They were being bred from within. Marx took that insight, wrapped it in Hegel's dialectics, and transformed the twentieth century. But the idea itself sprang out of a certain

kind of lived experience—on the ground, as the activists still like to say. It came, in part, from seeing human beings buried in conditions that defiled both the dead and the living.

But in one crucial sense Dickens and Engels had it wrong. However gruesome the sight of the burial ground was, the corpses themselves were not likely spreading “malignant diseases.” The stench was offensive enough, but it was not “infecting” anyone. A mass grave of decomposing bodies was an affront to both the senses and to personal dignity, but the smell it emitted was not a public-health risk. No one died of stench in Victorian London. But tens of thousands died because the fear of stench blinded them to the true perils of the city, and drove them to implement a series of wrongheaded reforms that only made the crisis worse. Dickens and Engels were not alone; practically the entire medical and political establishment fell into the same deadly error: everyone from Florence Nightingale to the pioneering reformer Edwin Chadwick to the editors of *The Lancet* to Queen Victoria herself. The history of knowledge conventionally focuses on breakthrough ideas and conceptual leaps. But the blind spots on the map, the dark continents of error and prejudice, carry their own mystery as well. How could so many intelligent people be so grievously wrong for such an extended period of time? How could they ignore so much overwhelming evidence that contradicted their most basic theories? These questions, too, deserve their own discipline—the sociology of error.

The fear of death’s contamination can sometimes last for centuries. In the middle of the Great Plague of 1665, the

Earl of Craven purchased a block of land in a semirural area to the west of central London called Soho Field. He built thirty-six small houses “for the reception of poor and miserable objects” suffering from plague. The rest of the land was used as a mass grave. Each night, the death carts would empty dozens of corpses into the earth. By some estimates, over four thousand plague-infected bodies were buried there in a matter of months. Nearby residents gave it the appropriately macabre-sounding name of “Earl of Craven’s pest-field,” or “Craven’s field” for short. For two generations, no one dared erect a foundation in the land for fear of infection. Eventually, the city’s inexorable drive for shelter won out over its fear of disease, and the pesthouse fields became the fashionable district of Golden Square, populated largely by aristocrats and Huguenot immigrants. For another century, the skeletons lay undisturbed beneath the churn of city commerce, until late summer of 1854, when another outbreak came to Golden Square and brought those grim souls back to haunt their final resting grounds once more.

CRAVEN’S FIELD ASIDE, SOHO IN THE DECADES AFTER THE plague quickly became one of London’s most fashionable neighborhoods. Almost a hundred titled families lived there in the 1690s. In 1717, the Prince and Princess of Wales set up residence in Leicester House in Soho. Golden Square itself had been built out with elegant Georgian townhouses, a haven from the tumult of Piccadilly Circus several blocks to the south. But by the middle of the eighteenth century, the elites continued their

inexorable march westward, building even grander estates and townhouses in the burgeoning new neighborhood of Mayfair. By 1740, there were only twenty titled residents left. A new kind of Soho native began to appear, best embodied by the son of a hosier who was born at 28 Broad in 1757, a talented and troubled child by the name of William Blake, who would go on to be one of England's greatest poets and artists. In his late twenties, he returned to Soho and opened a printing shop next door to his late father's shop, now run by his brother. Another Blake brother opened a bakery across the road at 29 Broad shortly thereafter, and so for a few years, the Blake family had a mini-empire growing on Broad Street, with three separate businesses on the same block.

The mix of artistic vision and entrepreneurial spirit would define the area for several generations. As the city grew increasingly industrial, and as the old money emptied out, the neighborhood became grittier; landlords invariably broke up the old townhouses into separate flats; courtyards between buildings filled up with impromptu junkyards, stables, jury-rigged extensions. Dickens described it best in *Nicholas Nickleby*:

In that quarter of London in which Golden Square is situated, there is a bygone, faded, tumble-down street, with two irregular rows of tall meagre houses, which seem to have stared each other out of countenance years ago. The very chimneys appear to have grown dismal and melancholy from having had nothing better to look at than the chimneys over the way.... To judge from the size of the houses, they have

been, at one time, tenanted by persons of better condition than their present occupants; but they are now let off, by the week, in floors or rooms, and every door has almost as many plates or bell-handles as there are apartments within. The windows are, for the same reason, sufficiently diversified in appearance, being ornamented with every variety of common blind and curtain that can easily be imagined; which every doorway is blocked up, and rendered nearly impassable, by a motley collection of children and porter pots of all sizes, from the baby in arms and the half-pint pot, to the full-grown girl and half-gallon can.

By 1851, the subdistrict of Berwick Street on the west side of Soho was the most densely populated of all 135 subdistricts that made up Greater London, with 432 people to the acre. (Even with its skyscrapers, Manhattan today only houses around 100 per acre.) The parish of St. Luke's in Soho had thirty houses per acre. In Kensington, by contrast, the number per acre was two.

But despite—or perhaps because of—the increasingly crowded and unsanitary conditions, the neighborhood was a hotbed of creativity. The list of poets and musicians and sculptors and philosophers who lived in Soho during this period reads like an index to a textbook on Enlightenment-era British culture. Edmund Burke, Fanny Burney, Percy Shelley, William Hogarth—all were Soho residents at various points in their lives. Leopold Mozart leased a flat on Frith Street while visiting with his son, the eight-year-old prodigy Wolfgang, in 1764. Franz Liszt and Richard

Wagner also stayed in the neighborhood when visiting London in 1839–1840.

“New ideas need old buildings,” Jane Jacobs once wrote, and the maxim applies perfectly to Soho around the dawn of the Industrial Age: a class of visionaries and eccentrics and radicals living in the disintegrating shells that had been abandoned a century ago by the well-to-do. The trope is familiar to us by now—artists and renegades appropriate a decaying neighborhood, even relish the decay—but it was a new pattern of urban settlement when Blake and Hogarth and Shelley first made their homes along the crowded streets of Soho. They seem to have been energized by the squalor, not appalled by it. Here is a description of one typical residence on Dean Street, penned in the early 1850s:

[The flat] has two rooms, the one with the view of the street being the drawing-room, behind it the bedroom. There is not one piece of good, solid furniture in the entire flat. Everything is broken, tattered and torn, finger-thick dust everywhere, and everything in the greatest disorder.... When you enter the...flat, your sight is dimmed by tobacco and coal smoke so that you grope around at first as if you were in a cave, until your eyes get used to the fumes and, as in a fog, you gradually notice a few objects. Everything is dirty, everything covered with dust; it is dangerous to sit down.

Living in this two-room attic were seven individuals: a

Prussian immigrant couple, their four children, and a maid. (Apparently a maid with an aversion to dusting.) Yet somehow these cramped, tattered quarters did not noticeably hinder the husband’s productivity, though one can easily see why he developed such a fondness for the Reading Room at the British Museum. The husband, you see, was a thirty-something radical by the name of Karl Marx.

By the time Marx got to Soho, the neighborhood had turned itself into the kind of classic mixed-use, economically diverse neighborhood that today’s “new urbanists” celebrate as the bedrock of successful cities: two-to-four-story residential buildings with storefronts at nearly every address, interlaced with the occasional larger commercial space. (Unlike the typical new urbanist environment, however, Soho also had its share of industry: slaughterhouses, manufacturing plants, tripe boilers.) The neighborhood’s residents were poor, almost destitute, by the standards of today’s industrialized nations, though by Victorian standards they were a mix of the working poor and the entrepreneurial middle class. (By mud-lark standards, of course, they were loaded.) But Soho was something of an anomaly in the otherwise prosperous West End of the city: an island of working poverty and foul-smelling industry surrounded by the opulent townhouses of Mayfair and Kensington.

This economic discontinuity is still encoded in the physical layout of the streets around Soho. The western border of the neighborhood is defined by the wide avenue of Regent Street, with its gleaming white commercial façades. West of Regent Street you enter the tony enclave

of Mayfair, posh to this day. But somehow the nonstop traffic and bustle of Regent Street is almost imperceptible from the smaller lanes and alleys of western Soho, largely because there are very few conduits that open directly onto Regent Street. Walking around the neighborhood, it feels almost as if a barricade has been erected, keeping you from reaching the prominent avenue that you know is only a few feet away. And indeed, the street layout was explicitly designed to serve as a barricade. When John Nash designed Regent Street to connect Marylebone Park with the Prince Regent's new home at Carlton House, he planned the thoroughfare as a kind of *cordon sanitaire* separating the well-to-do of Mayfair from the growing working-class community of Soho. Nash's explicit intention was to create "a complete separation between the streets occupied by the Nobility and Gentry, and the narrower Streets and meaner houses occupied by mechanics and the trading part of the community.... My purpose was that the new street should cross the eastern entrance to all the streets occupied by the higher classes and to leave out to the east all the bad streets."

This social topography would play a pivotal role in the events that unfolded in the late summer of 1854, when a terrible scourge struck Soho but left the surrounding neighborhoods utterly unharmed. That selective attack appeared to confirm every elitist cliché in the book: the plague attacking the debauched and the destitute, while passing over the better sort that lived only blocks away. Of course the plague had devastated the "meaner houses" and "bad streets" anyone who had visited those squalid blocks would have seen it coming. Poverty and depravity and low

breeding created an environment where disease prospered, as anyone of good social standing would tell you. That's why they'd built barricades in the first place.

But on the wrong side of Regent Street, behind the barricade, the tradesmen and the mechanics managed to get by in the mean houses of Soho. The neighborhood was a veritable engine of local commerce, with almost every residence housing some kind of small business. The assortment of storefronts generally sounds quaint to the modern ear. There were the grocers and bakeries that wouldn't be out of place in an urban center today; but there were also the machinists and mineral teeth manufacturers doing business beside them. In August of 1854, walking down Broad Street, a block north of Golden Square, one would have encountered, in progression: a grocer, a bonnet maker, a baker, a grocer, a saddle-tree manufacturer, an engraver, and ironmonger, a trimming seller, a percussion-cap manufacturer, a wardrobe dealer, a boot-tree manufacturer, and a pub, The Newcastle-on-Tyne. In terms of professions, tailors outnumbered any other trade by a relatively wide margin. After the tailors, at roughly the same number, were the shoemakers, domestic servants, masons, shopkeepers, and dressmakers.

Sometime in the late 1840s, a London policeman named Thomas Lewis and his wife moved into 40 Broad Street, one door up from the pub. It was an eleven-room house that had originally been designed to hold a single family and a handful of servants. Now it contained twenty inhabitants. These were spacious accommodations for a part of the city where most houses averaged five occupants per room. Thomas and Sarah Lewis lived in the parlor at

40 Broad, first with their little boy, a sickly child who died at ten months. In March of 1854, Sarah Lewis gave birth to a girl, who possessed, from the beginning, a more promising constitution than her late brother. Sarah Lewis had been unable to breast-feed the infant on account of health problems of her own, but she had fed her daughter ground rice and milk from a bottle. The little girl had suffered a few bouts of illness in her second month, but was relatively healthy for most of the summer.

A few mysteries remain about this second Lewis infant, details scattered by the chance winds of history. We do not know her name, for instance. We do not know what series of events led to her contracting cholera in late August of 1854, at not even six months old. For almost twenty months, the disease had been flaring up in certain quarters of London, having last appeared during the revolutionary years of 1848–1849. (Plagues and political unrest have a long history of following the same cycles.) But most of the cholera outbreaks in 1854 were located south of the Thames. The Golden Square area had been largely spared.

On the twenty-eighth of August, all that changed. At around six a.m., while the rest of the city struggled for a few final minutes of sleep at the end of an oppressively hot summer night, the Lewis infant began vomiting and emitting watery, green stools that carried a pungent smell. Sarah Lewis sent for a local doctor, William Rogers, who maintained a practice a few blocks away, on Berners Street. As she waited for the doctor's arrival, Sarah soaked the soiled cloth diapers in a bucket of tepid water. In the rare moments when her little girl caught a few minutes of sleep, Sarah Lewis crept down to the cellar at 40 Broad and

tossed the fouled water in the cesspool that lay at the front of the house.

That is how it began.

Saturday, September 2

EYES SUNK, LIPS DARK BLUE

FOR TWO DAYS AFTER THE LEWIS BABY FELL ILL, LIFE IN Golden Square carried on with its normal clamor. In nearby Soho Square, an affable clergyman named Henry Whitehead took leave of the boarding room he shared with his brother and embarked on his morning stroll to St. Luke's Church on Berwick Street, where he had been appointed assistant curate. Only twenty-eight years old, Whitehead had been born in the seaside town of Ramsgate and grew up in a prestigious public school called Chatham House, where his father was headmaster. Whitehead had been a stellar student at Chatham, finishing top of the school in English composition, and he went on to attend Lincoln College at Oxford, where he developed a reputation for sociability and kindness that would last the rest of his days. He became a great devotee of the intellectual tavern life: sitting with a handful of friends over dinner, savoring a pipe, telling stories or debating politics or discussing moral philosophy in the late hours of the night. When asked

about his college years, Whitehead liked to say that he got more good out of men than he got out of books.

By the time he left Oxford, Whitehead had decided to enter the Anglican Church, and was ordained in London several years later. His religious calling did nothing to abate his fondness for London's taverns, and he frequented the old establishments around Fleet Street—The Cock, The Cheshire Cheese, The Rainbow. Whitehead was liberal in his political views but, as friends often remarked, conservative in his morals. In addition to his religious training, he had a sharp, empirical mind and a good memory for detail. He was also unusually tolerant of maverick ideas, and immune to the bromides of popular opinion. He was often heard saying to friends, "Mind you, the man who is in the minority of one is almost sure to be in the right."

In 1851, the vicar of St. Luke's offered him a position, telling Whitehead that the parish was a place for those who "care more for the approval than the applause of men." At St. Luke's he worked as a kind of missionary to the slum dwellers of Berwick Street, and was a well-regarded and familiar figure in the tumultuous neighborhood. One of Whitehead's contemporaries captured the chaotic sights and sounds of the streets around St. Luke's in that period:

One does not realize as one passes down Regent Street, how small a distance of street and alley separates "the unknown little from the unknowing great." But to the person who will dive down such entrance to the unknown land of slums of Soho as Beak Street or Berwick Street provides, there is

much that will astonish and interest him, if he is a student of the ways of the poor in London. Your cab is suddenly brought up sharp by a coster's barrow, and you are asked if you are going down to St. Luke's. Berwick Street: if you intimate that this is your destination, you are told politely, but with proper Soho emphasis, that you will get through by the end of next week, and you are soon obliged to believe there is truth in the prophecy. Closely ranged side by side in the narrow street are the vendors' stalls and barrows. The cats'-meat man, the fish salesman, the butcher, the fruiterer, the toy-seller, the old rang-and-bone men, jostle and cry their wares. "Prime meat! meat! meat! buy! buy! buy! Here! here! here! veal! veal! fresh-veal today! what's your fancy! Sold, sold again! fish for nothing! cherries ripe!" Your aim is St. Luke's, Berwick Street: you soon see its dim row of dingy semi-domestic, semi-gothic windows. A man is standing just opposite the barred gate skinning eels; you hear a scream, and you know that a poor creature who objects to its fate has slipped from his hand, and is making its way among the crowd.

In the heat and humidity of late August, the smells of Soho would have been unavoidable, wafting up from the cesspools and sewers, from the factories and furnaces. Part of the stench derived from the omnipresence of livestock in the city center. A modern-day visitor time-traveling back to Victorian London wouldn't be surprised to see horses (and, consequently, their manure) in great numbers in the city streets, but he would probably be startled to discover

how many farm animals lived in densely packed neighborhoods like Golden Square. Veritable herds would stream through the city; the main livestock market at Smithfield would regularly sell 30,000 sheep in two days' time. A slaughterhouse at the edge of Soho, on Marshall Street, killed an average of five oxen and seven sheep per day, the blood and filth from the animals draining into gully holes on the street. Without proper barns, residents converted traditional dwellings into "cow houses"—herding twenty-five or thirty cows into a single room. In some cases, cows were lifted into attics via windlass, and shuttered there in the dark until their milk gave out.

Even the pets could be overwhelming. One man who lived on the upper floor at 38 Silver Street kept twenty-seven dogs in a single room. He would leave what must have been a prodigious output of canine excrement to bake in the brutal summer sun on the roof of the house. A charwoman down the street kept seventeen dogs, cats, and rabbits in her single-room flat.

The human crowding was almost as oppressive. Whitehead liked to tell the story of visiting one densely packed household, and asking an impoverished woman there how she managed to get along in such close quarters. "Well, sir," she replied, "we was comfortable enough till the gentleman come in the middle." She then pointed to a chalk circle in the center of the room, defining the region that the "gentleman" was allowed to occupy.

Henry Whitehead's journey that morning would have been a meandering, sociable one: stopping by a coffeehouse largely patronized by machinists, visiting with parishioners in their homes, spending a few minutes down the street

from his church with the inmates at the St. James Workhouse, where five hundred of London's impoverished citizens were housed and forced to perform arduous labor through the day. He might have paid a call on the Eley Brothers factory, home to 150 employees churning out one of the most important military inventions of the century: the "percussion cap," which had enabled firearms to be operated in any weather. (Older, flint-based systems were easily disabled by a mild rainshower.) With the outbreak of the Crimean War several months earlier, the Eley brothers were doing a brisk business.

At the Lion Brewery on Broad Street, the seventy workers employed there went about their daily labor, sipping on the malt liquor supplied as part of their wages. A tailor living above the Lewis family at 40 Broad—we know him only as Mr. G—worked his trade, assisted occasionally by his wife. On the sidewalks, the upper echelons of London's street laborers swarmed: the menders and makers, the costermongers and street sellers, hawking everything from crumpets to almanacs to snuff boxes to live squirrels. Henry Whitehead would have known many of these people by name, and his day would have been a steady, comforting stream of sidewalk and parlor conversation. No doubt the heat would have been a primary topic of conversation: the temperature had peaked in the nineties for several straight days, and the city had seen scarcely a drop of rain since the middle of August. There was news from the Crimean War to discuss, as well as the appointment of a new head of the Board of Health, a man by the name of Benjamin Hall, who had vowed to continue the bold sanitation campaign of his predecessor,

Edwin Chadwick, but without alienating quite as many people. The city was just finishing Dickens' screed against the industrial cokedowns of the north country, *Hard Times*, the final installment of which had run in *Household Words* a few weeks before. And then there were the personal details of daily life—an upcoming marriage, a lost job, a grandchild on the way—which Whitehead would have readily discussed, knowing his parishioners as well as he did. But of all the conversations he had over the first three days of that fateful week, Whitehead would later recall one ironic omission: not one of those conversations broached the topic of cholera.

Imagine an aerial view of Broad Street that week, accelerated in the fashion of a time-lapse movie. Most of the activity would be a blur of urban tumult: "the noisy and the eager, and the arrogant and the froward and the vain... [making] their usual uproar," as Dickens put it at the end of *Little Dorrit*. But in all that turbulence, certain patterns appear, like eddies in an otherwise chaotic flow. The streets flex with the Victorian equivalent of rush hour, rising at daybreak and then subsiding with nightfall; streams of people pour into each daily service at St. Luke's; small queues form around the busiest street vendors. In front of 40 Broad Street, as baby Lewis suffers only a few yards away, a single point on the sidewalk attracts a constant—and constantly changing—cluster of visitors throughout the day, like a vortex of molecules winding down a drain.

They are there for the water.

THE BROAD STREET PUMP HAD LONG ENJOYED A REPUTATION as a reliable source of clean well water. It extended twenty-five feet below the surface of the street, reaching down past the ten feet of accumulated rubbish and debris that artificially elevated most of London, through a bed of gravel that stretched all the way to Hyde Park, down to the veins of sand and clay saturated with groundwater. Many Soho residents who lived closer to other pumps—one on Rupert Street and another on Little Marlborough—opted to walk an extra few blocks for the refreshing taste of Broad Street’s water. It was colder than the water found at the rival pumps; it had a pleasant hint of carbonation. For these reasons, the Broad Street water insinuated itself into a complex web of local drinking habits. The coffeehouse down the street brewed its coffee with pump water; many little shops in the neighborhood sold a confection they called “sherbet,” a mixture of effervescent powder with Broad Street water. The pubs of Golden Square diluted their spirits with pump water.

Even émigrés from Golden Square retained their taste for the Broad Street well. Susannah Eley, whose husband had founded the percussion-cap factory on Broad Street, moved to Hampstead after being widowed. But her sons would regularly fill a jug with Broad Street water and deliver it to her via cart. The Eley brothers also maintained two large tubs of well water for their employees to enjoy during the workday. With temperatures reaching the mid-eighties in the shade on those late-August days, and no wind to freshen the air, the collective thirst for cool well water must have been intense.

We know a remarkable amount about the quotidian

drinking habits of the Golden Square neighborhood on those oppressive days of August 1854. We know that the Eley brothers dispatched a bottle to their mother on Monday, and that she shared it with her visiting niece later that week. We know that a young man visiting his chemist father enjoyed a glass of pump water with his pudding at a restaurant on Wardour Street. We know of an army officer who visited a friend on Wardour Street for dinner and drank a glass of Broad Street water with his meal. We know that the tailor Mr. G sent his wife several times to grab a pitcher of water from the pump outside his workplace.

We also know of the holdouts who did not drink water from the pump that week, for a variety of reasons: the laborers at the Lion Brewery who had their malt liquor supplemented by water supplied by the popular New River Company; a family who normally relied on their ten-year-old girl to fetch water from the pump went dry for a few days as the little girl recovered in bed from a cold. A regular pump-water drinker—and noted ornithologist—named John Gould had declined a glass on that Saturday, complaining that it had a repulsive smell. Despite living a few feet from the pump, Thomas Lewis had never favored its water.

There is something remarkable about the minutiae of all these ordinary lives in a seemingly ordinary week persisting in the human record for almost two centuries. When that chemist’s son spooned out his sweet pudding, he couldn’t possibly have imagined that the details of his meal would be a matter of interest to anyone else in Victorian London, much less citizens of the twenty-first century. This

is one of the ways that disease, and particularly epidemic disease, plays havoc with traditional histories. Most world-historic events—great military battles, political revolutions—are self-consciously historic to the participants living through them. They act knowing that their decisions will be chronicled and dissected for decades or centuries to come. But epidemics create a kind of history from below: they can be world-changing, but the participants are almost inevitably ordinary folk, following their established routines, not thinking for a second about how their actions will be recorded for posterity. And of course, if they do recognize that they are living through a historical crisis, it's often too late—because, like it or not, the primary way that ordinary people create this distinct genre of history is by dying.

Yet something has been lost in the record as well, something more intimate and experiential than stories of pudding and malt liquor—namely, what it *felt like* to contract cholera in that teeming, fraught city, at a time when so little was understood about the disease. We have remarkably detailed accounts of the movements of dozens of individuals during that late-summer week; we have charts and tables of lives and deaths. But if we want to recreate the inner experience of the outbreak—the physical and emotional torment involved—the historical record comes up wanting. We have to use our imaginations.

Sometime on Wednesday, it's likely that the tailor at 40 Broad, Mr. G, began to feel an odd sense of unease, accompanied by a slightly upset stomach. The initial symptoms themselves would be entirely indistinguishable from a mild case of food poisoning. But layered over those

physical symptoms would be a deeper sense of foreboding. Imagine if every time you experienced a slight upset stomach you knew that there was an entirely reasonable chance you'd be dead in forty-eight hours. Remember, too, that the diet and sanitary conditions of the day—no refrigeration; impure water supplies; excessive consumption of beer, spirits, and coffee—created a breeding ground for digestive ailments, even when they didn't lead to cholera. Imagine living with that sword of Damocles hovering above your head—every stomach pain or watery stool a potential harbinger of imminent doom.

City dwellers had lived with fear before, and London, of course, had not forgotten its Great Plague and its Great Fire. But for Londoners, the specific menace of cholera was a product of the Industrial Age and its global shipping networks: no known case of cholera on British soil exists before 1831. Yet the disease itself was an ancient one. Sanskrit writings from around 500 B.C. describe a lethal illness that kills by draining water from its victims. Hippocrates prescribed white hellebore blooms as a treatment. But the disease remained largely within the confines of India and the Asian Subcontinent for at least two thousand years. Londoners first took notice of cholera when an outbreak among British soldiers stationed in Ganjam, India, sickened more than five hundred men in 1781. Two years later, word appeared in the British papers of a terrible outbreak that had killed 20,000 pilgrims at Haridwar. In 1817, the cholera “burst forth...with extraordinary malignity,” as the *Times* reported, tracking through Turkey and Persia all the way to Singapore and Japan, even spreading as far as the Americas until largely

dissipating in 1820. England itself was spared, which led the pundits of the day to trot out an entire military parade of racist clichés about the superiority of the British way of life.

But this was merely cholera's shot across the bow. In 1829, the disease began to spread in earnest, sweeping through Asia, Russia, even the United States. In the summer of 1831, an outbreak tore through a handful of ships harbored in the river Medway, about thirty miles from London. Cases inland didn't appear until October of that year, in the northeast town of Sunderland, beginning with a William Sproat, the first Englishman to perish of cholera on his home soil. On February 8 of the following year, a Londoner named John James became the first to die in the city. By outbreak's end, in 1833, the dead in England and Wales would number above 20,000. After that first explosion, the disease flared up every few years, dispatching a few hundred souls to an early grave, and then going underground again. But the long-term trend was not an encouraging one. The epidemic of 1848–1849 would consume 50,000 lives in England and Wales.

All that history would have weighed like a nightmare on Mr. G, as his condition worsened on Thursday. He may have begun vomiting during the night and most likely experienced muscle spasms and sharp abdominal pains. At a certain point, he would have been overtaken by a crushing thirst. But the experience was largely dominated by one hideous process: vast quantities of water being evacuated from his bowels, strangely absent of smell and color, harboring only tiny white particles. Clinicians of the day dubbed this "rice-water stool." Once you began

emitting rice-water stools, odds were you'd be dead in a matter of hours.

Mr. G would have been terribly aware of his fate, even as he battled the physical agony of the disease. One of cholera's distinctive curses is that its sufferers remain mentally alert until the very last stages of the disease, fully conscious both of the pain that the disease has brought them and the sudden, shocking contraction of their life expectancy. The *Times* had described this horrifying condition several years before in a long feature on the disease: "While the mechanism of life is suddenly arrested, the body emptied by a few rapid gushes of its serum, and reduced to a damp, dead...mass, the mind within remains untouched and clear,—shining strangely through the glazed eyes, with light unquenched and vivid,—a spirit, looking out in terror from a corpse."

By Friday, Mr. G's pulse would have been barely detectable, and a rough mask of blue, leathery skin would have covered his face. His condition would have matched this description of William Sproat from 1831: "countenance quite shrunk, eyes sunk, lips dark blue, as well as the skin of the lower extremities; the nails...livid."

Most of this is, to a certain extent, conjecture. But one thing we know for certain: at one p.m. on Friday, as baby Lewis suffered quietly in the room next door, Mr. G's heart stopped beating, barely twenty-four hours after showing the first symptoms of cholera. Within a few hours, another dozen Soho residents were dead.

THERE IS NO DIRECT MEDICAL ACCOUNT OF IT, BUT

WITH the hindsight of a century and a half of scientific research, we can describe with precision the cellular events that transformed Mr. G from a healthy, functioning human being to a shrunken, blue-skinned cadaver in a matter of days. Cholera is a species of bacterium, a microscopic organism that consists of a single cell harboring strands of DNA. Lacking the organelles and cell nuclei of the eukaryotic cells of plants and animals, bacteria are, nevertheless, more complex than viruses, which are essentially naked strands of genetic code, incapable of surviving and replicating without having host organisms to infect. In terms of sheer numbers, bacteria are by far the most successful organisms on the planet. A square centimeter of your skin contains most likely around 100,000 separate bacterial cells; a bucket of topsoil would contain billions and billions. Some experts believe that despite their minuscule size (roughly one-millionth of a meter long), the domain of bacteria may be the largest form of life in terms of biomass.

More impressive than their sheer number, though, is the diversity of bacterial lifestyles. All organisms based on the complex eukaryotic cell (plants, animals, fungi) survive thanks to one of two basic metabolic strategies: photosynthesis and aerobic respiration. There may be astonishing diversity in the world of multicellular life—whales and black widows and giant redwoods—but beneath all that diversity lie two fundamental options for staying alive: breathing air and capturing sunlight. The bacteria, on the other hand, make a living for themselves in a dazzling variety of ways: they consume nitrogen right out of the air, extract energy from sulfur, thrive in the boiling water of

deep-sea volcanoes, live by the millions in a single human colon (as *Escherichia coli* do). Without the metabolic innovations pioneered by bacteria, we would literally have no air to breathe. With the exception of a few unusual compounds (among them snake venom), bacteria can process all the molecules of life, making bacteria both an essential energy provider for the planet *and* its primary recycler. As Stephen Jay Gould argued in his book *Full House*, it makes for good museum copy to talk about an Age of Dinosaurs or an Age of Man, but in reality it's been one long Age of Bacteria on this planet since the days of the primordial soup. The rest of us are mere afterthoughts.

THE TECHNICAL NAME FOR THE CHOLERA BACTERIUM IS *Vibrio cholerae*. Viewed through an electron microscope, the bacterium looks somewhat like a swimming peanut—a curved rod with a thin, rotating tail called the flagellum that propels the organism, not unlike the outboard motor of a speedboat. On its own, a single *V. cholerae* bacterium is harmless to humans. You need somewhere between 1 million and 100 million organisms, depending on the acidity of your stomach, to contract the disease. Because our minds have a difficult time grasping the scale of life in the microcosmos of bacterial existence, 100 million microbes sounds, intuitively, like a quantity that would be difficult to ingest accidentally. But it takes about 10 million bacteria per milliliter of water for the organism's presence to be at all detectable to the human eye. (A milliliter is roughly 0.4 percent—four thousandths—of 1 cup.) A glass of water could easily contain 200

million *V. cholerae* without the slightest hint of cloudiness.

For those bacteria to pose any threat, you need to ingest the little creatures: simple physical contact can't get you sick. *V. cholerae* needs to find its way into your small intestine. At that point, it launches a two-pronged attack. First, a protein called TCP pili helps the bacteria reproduce at an astonishing clip, cementing the organisms into a dense mat, made up of hundreds of layers, that covers the surface of the intestine. In this rapid population explosion, the bacteria inject a toxin into the intestinal cells. The cholera toxin ultimately disrupts one of the small intestine's primary metabolic roles, which is to maintain the body's overall water balance. The walls of the small intestine are lined with two types of cells: cells that absorb water and pass it on to the rest of the body, and cells that secrete water that ultimately gets flushed out as waste. In a healthy, hydrated body, the small intestine absorbs more water than it secretes, but an invasion of *V. cholerae* reverses that balance: the cholera toxin tricks the cells into expelling water at a prodigious rate, so much so that in extreme cases people have been known to lose up to thirty percent of body weight in a matter of hours. (Some say that the name *cholera* itself derives from the Greek word for "roof gutter," invoking the torrents of water that flow out after a rainstorm.) The expelled fluids contain flakes from the epithelial cells of the small intestine (the white particles that inspired the "rice water" description). They also contain a massive quantity of *V. cholerae*. An attack of cholera can result in the expulsion of up to twenty liters of fluid, with a per milliliter concentration of *V. cholerae* of about a hundred million.

In other words, an accidental ingestion of a million *Vibrio cholerae* can produce a trillion new bacteria over the course of three or four days. The organism effectively converts the human body into a factory for multiplying itself a millionfold. And if the factory doesn't survive longer than a few days, so be it. There's usually another one nearby to colonize.

THE ACTUAL CAUSE OF DEATH WITH CHOLERA IS DIFFICULT to pinpoint; the human body's dependence on water is so profound that almost all the major systems begin to fail when so much fluid is evacuated in such a short period of time. Dying of dehydration is, in a sense, an abomination against the very origins of life on earth. Our ancestors evolved first in the oceans of the young planet, and while some organisms managed to adapt to life on the land, our bodies retain a genetic memory of their watery origin. Fertilization for all animals takes place in some form of water; embryos float in the womb; human blood has almost the same concentration of salts as seawater. "Those animal species that fully adapted to the land did so through the trick of taking their former environment with them," the evolutionary biologist Lynn Margulis writes. "No animal has ever really completely left the watery microcosm.... No matter how high and dry the mountain top, no matter how secluded and modern the retreat, we sweat and cry what is basically seawater."

The first significant effect of serious dehydration is a reduction in the volume of blood circulating through the body, the blood growing increasingly concentrated as it is

deprived of water. The lowered volume causes the heart to pump faster to maintain blood pressure and keep vital organs—the brain and the kidneys—functional. In this internal triage, nonvital organs such as the gallbladder and spleen begin to shut down. Blood vessels in the extremities constrict, creating a persistent tingling sensation. Because the brain continues to receive a sufficient supply of blood in this early stage, the cholera victim retains a sharp awareness of the attack that *V. cholerae* has launched against his body.

Eventually, the heart fails in its ability to maintain adequate blood pressure, and hypotension sets in. The heart pumps at a frenetic rate, while the kidneys struggle to conserve as much fluid as possible. The mind grows hazy; some sufferers become lightheaded or even pass out. The terrible evacuations of rice-water stools continue. By now, the cholera victim may have lost more than ten percent of his body weight in a matter of twenty-four hours. As the kidneys finally start to fail, the bloodstream re-creates on a much smaller scale the crisis of waste management that helped cholera thrive in so many large cities: waste products accumulate in the blood, fostering a condition called uremia. The victim slips into unconsciousness, or even a coma; the vital organs start to shut down. Within a matter of hours, the victim is dead.

But all around him, in his soaked sheets, in the buckets of rice water at his bedside, in the cesspools and sewers, are new forms of life—trillions of them, waiting patiently for another host to infect.

WE SOMETIMES TALK ABOUT ORGANISMS “DESIRING” CERTAIN environments, even though the organism itself surely has no self-awareness, no feeling of desire in the human sense of the word. Desire in this case is a matter of ends, not means: the organisms wants a certain environment because the setting allows it to reproduce more effectively than other environments: a brine shrimp *desires* salty water, a termite *desires* rotting wood. Put the organism in its desired environment, and the world will have more of that particular creature; take it out, and the world will have less.

In this sense, what the *Vibrio cholerae* bacterium desires, more than anything, is an environment in which human beings have a regular habit of eating other people’s excrement. *V. cholerae* cannot be transmitted through the air or even through the exchange of most bodily fluids. The ultimate route of transmission is almost invariably the same: an infected person emits the bacteria during one of the violent bouts of diarrhea that are the disease’s trademark, and another person somehow ingests some of the bacteria, usually through drinking contaminated water. Drop it into a setting where excrement eating is a common practice, and cholera will thrive—hijacking intestine after intestine to manufacture more bacteria.

For most of the history of *Homo sapiens*, this dependence on excrement eating meant that the cholera bacterium didn’t travel well. Since the dawn of civilization, human culture has demonstrated a remarkable knack for diversity, but eating other humans’ waste is as close to a universal taboo as any in the book. And so, without a widespread practice of consuming other people’s waste,

cholera stayed close to its original home in the brackish waters of the Ganges delta, surviving on a diet of plankton.

In practice, it's not impossible for physical contact with a cholera victim to transmit the disease, but the chance of transmission is slight. In handling soiled linens, for instance, an invisible collection of *V. cholerae* might cluster on a fingertip, where, left unwashed, they might find their way into your mouth during a meal, and shortly thereafter begin their deadly multiplication in your small intestine. From the cholera's point of view, however, this is generally an inefficient way to reproduce: only a small number of people are likely to touch the immediate waste products of another human, particularly one suffering from such a violent and deadly illness. And even if a few lucky bacteria do manage to attach themselves to an errant finger, there's no guarantee that they'll survive long enough to make it to the small intestine.

For thousands of years, cholera was largely kept in check by these two factors: humans on the whole were disinclined to knowingly consume each other's excrement; *and*, on those rare occasions when they did accidentally ingest human waste, the cycle wasn't likely to happen again, thus keeping the bacteria from finding a tipping point where it spread at ever-increasing rates through the population, the way more easily transmitted diseases, like influenza or smallpox, famously do.

But then, after countless years fighting to survive through the few transmission routes available, *V. cholerae* got a lucky break. Humans began gathering in urban areas with population densities that exceeded anything in the historical record: fifty people crammed into a four-story

townhouse, four hundred to an acre. Cities became overwhelmed with their human filth. And those very cities were increasingly connected by the shipping routes of the grand empires and corporations of the day. When Prince Albert first announced his idea for a Great Exhibition, his speech included these utopian lines: "We are living at a period of most wonderful transition, which tends rapidly to accomplish that great era to which, indeed, all history points: the realisation of the unity of mankind." Mankind was no doubt becoming more unified, but the results were often far from wonderful. The sanitary conditions of Delhi could directly affect the conditions of London and Paris. It wasn't just mankind that was being unified; it was also mankind's small intestine.

Inevitably, in these sprawling new metropolitan spaces, with their global networks of commerce, lines were crossed: drinking water became laced with sewage. Ingesting small particles of human waste went from being an anomaly to a staple of everyday life. This was good news for *V. cholerae*.

The contamination of drinking water in dense urban settlements did not merely affect the number of *V. cholerae* circulating through the small intestines of mankind. It also greatly increased the lethality of the bacteria. This is an evolutionary principle that has long been observed in populations of disease-spreading microbes. Bacteria and viruses evolve at much faster rates than humans do, for several reasons. For one, bacterial life cycles are incredibly fast: a single bacterium can produce a million offspring in a matter of hours. Each new generation opens up new possibilities for genetic innovation, either by

new combinations of existing genes or by random mutations. Human genetic change is several orders of magnitude slower; we have to go through a whole fifteen-year process of maturation before we can even think about passing our genes to a new generation.

The bacteria have another weapon in their arsenal. They are not limited to passing on their genes in the controlled, linear fashion that all multicellular organisms do. It's much more of a free-for-all with the microbes. A random sequence of DNA can float into a neighboring bacterial cell and be immediately enlisted in some crucial new function. We're so accustomed to the vertical transmission of DNA from parent to child that the whole idea of borrowing small bits of code seems preposterous, but that is simply the bias of our eukaryotic existence. In the invisible kingdom of viruses and bacteria, genes move in a far more indiscriminate fashion, creating many disastrous new combinations, of course, but also spreading innovative strategies at a much faster clip. As Lynn Margulis writes: "All the world's bacteria essentially have access to a single gene pool and hence to the adaptive mechanisms of the entire bacterial kingdom. The speed of recombination over that of mutation is superior: it could take eukaryotic organisms a million years to adjust to a change on a worldwide scale that bacteria can accommodate in a few years."

Bacteria like *Vibrio cholerae*, then, are eminently capable of evolving rapid new characteristics in response to changes in their environment—particularly a change that makes it significantly easier for them to reproduce themselves. Normally, an organism like *V. cholerae* faces a

difficult cost-benefit analysis: a particularly lethal strain can make untold billions of copies of itself in a matter of hours, but that reproductive success usually kills off the human body that made that reproduction possible. If those billion copies don't find their way into another intestinal tract quickly, the whole process is for naught; the genes for increased lethality are unable to make new copies of themselves. In environments where the risk of transmission is low, the better strategy is to pursue a low-intensity attack on the human host: reproduce in smaller numbers, and keep the human alive longer, in hopes that over time some bacterial cells will find their way to another intestine, where the process can start all over again.

But a dense urban settlement with contaminated water supplies eliminates *V. cholerae*'s dilemma. There's no incentive not to reproduce as violently as possible—and thus kill your host as quickly as possible—because there's every likelihood that the evacuations from the current host will be swiftly routed into the intestinal tract of a new one. The bacterium can invest all its energy in sheer reproductive volume, and forget about longevity.

It goes without saying that the bacteria are not in any way conscious of developing this strategy. The strategy evolves on its own, as the overall population balance of *V. cholerae* changes. In a low-transmission environment, lethal strains die out, and mild ones come to dominate the population. In high-transmission environments, the lethal strains quickly outnumber the mild ones. No single bacterium is aware of the cost-benefit analysis, but thanks to their amazing capacity for adaptation, they're able to

make the analysis as a group, each isolated life and death serving a kind of vote in a distributed microbial assembly. There is no consciousness in the lowly bacterium. But there is a kind of group intelligence nonetheless.

Besides, even human consciousness has its limits. It tends to be very acute on the scales of human existence, but as ignorant as the bacteria on other scales. When the citizens of London and other great cities first began gathering together in such extraordinary number, when they began building elaborate mechanisms for storing and removing their waste, and pulling drinking water from their rivers, they did so with conscious awareness of their actions, with some clear strategy in mind. But they were entirely unaware of the impact that those decisions would have among the microbes: not just in making the bacteria more numerous, but also in transforming their very genetic code. The Londoner enjoying his new water closet or his expensive private water supply from the Southwark Water Company was not just engineering his private life to make it more convenient and luxurious. He was also, unwittingly, reengineering the DNA of *V. cholerae* with his actions. He was making it into a more efficient killer.

THE TRAGIC IRONY OF CHOLERA IS THAT THE DISEASE HAS A shockingly sensible and low-tech cure: water. Cholera victims who are given water and electrolytes via intravenous and oral therapies reliably survive the illness, to the point where numerous studies have deliberately infected volunteers with the disease to study its effects, knowing that the rehydration program

will transform the disease into merely an uncomfortable bout of diarrhea. You would think that the water cure might have occurred to some of the physicians of the day: the ill were discharging prodigious amounts of water, after all. If you were looking for a cure, wouldn't it be logical to start with restoring some of those lost fluids? And indeed, one British doctor, Thomas Latta, hit upon this precise cure in 1832, months after the first outbreak, injecting salty water into the veins of the victims. Latta's approach differed from the modern treatment only in terms of quantity: liters of water are necessary to ensure a full recovery.

Tragically, Latta's insight was lost in the swarming mass of cholera cures that emerged in the subsequent decades. Despite all the technological advances of the Industrial Age, Victorian medicine was hardly a triumph of the scientific method. Reading through the newspapers and medical journals of the day, what stands out is not just the breadth of remedies proposed, but the breadth of people involved in the discussion: surgeons, nurses, patent medicine quacks, public-health authorities, armchair chemists, all writing the *Times* and the *Globe* (or buying classified advertising there) with news of the dependable cure they had concocted.

Those endless notices reflect a strange historical overlap, one we have largely outgrown—the period *after* the rise of mass communications but *before* the emergence of a specialized medical science. Ordinary people had long cultivated their folk remedies and homespun diagnoses, but until newspapers came along, they didn't have a forum beyond word of mouth to share their discoveries. At the

same time, the medical division of labor that we now largely take for granted—researchers analyze diseases and potential cures, doctors prescribe those cures based on their best assessment of the research—had only reached an embryonic state in the Victorian age. There was a growing medical establishment—best embodied by the prominent journal *The Lancet*—but its authority was hardly supreme. You didn't need an academic degree to share your cure for rheumatism or thyroid cancer with the world. For the most part, this meant that the newspapers of the day were filled with sometimes comic, and almost always useless, promises of easy cures for diseases that proved to be far more intractable than the quacks suggested. But that anarchic system also made it possible for genuine visionaries to route around the establishment, particularly when the establishment had its scientific head in the sand.

The prominence of quack cures also had an unexpected side effect: it helped create an entire rhetoric of advertising—as well as a business model for newspapers and magazines—that has lasted for more than a century. By the end of the 1800s, patent-medicine manufacturers were the leading advertisers in the newspaper business, and as the historian Tom Standage observes, they were “among the first to recognize the importance of trademarks and advertising, of slogans, logos.... Since the remedies themselves usually cost very little to make, it made sense to spend money on marketing.” It has become a cliché to say that we now live in a society where image is valued over substance, where our desires are continually stoked by the illusory fuel of marketing messages. In a real sense that condition dates back to those now quaint notices

running in the columns of Victorian newspapers, promising an endless litany of cures bottled in one marvelously inexpensive elixir.

Not surprisingly, the patent-medicine industry was eager to provide a cure for the most menacing disease of the nineteenth century. A naïve reader of the *London Times* classifieds in August of 1854 might have naturally assumed that the cholera was on its way out, given all the cures that seemed readily available:

FEVER and CHOLERA.—The air of every sick room should be purified by using SAUNDER'S ANTI-MEPHITIC FLUID. This powerful disinfectant destroys foul smells in a moment, and impregnates the air with a refreshing fragrance.—J.T. Saunders, perfumer, 316B, Oxford-street, Regent-circus; and all druggists and perfumers. Price 1s.

As laughable as the patent-medicine adverts seem to us today, they nonetheless provoked irate letters complaining about the injustice of keeping these expensive cures out of reach of the lower classes:

Sir,—I have observed lately several letters in your influential journal, treating upon the present much-talked-of subject—the enormous price of castor oil as retailed by the druggists.... One man in this town [has] boldly come forward and made a public announcement, in the shape of placards upon the

walls, that he is prepared to sell the finest cold-drawn castor oil at 1d. per ounce, and it is to be hoped that his example will be universally followed. Sure, Sir, when a druggist himself is candid enough to publish to the world that he can afford to sell this article at 1d. per ounce instead of 3d. and by so doing have a sufficient profit thereby, can there now be any doubt whatever in the minds of the people that this class of tradesman have for many years past been reaping a great harvest by retailing castor oil to the poor at such immense gains.

You can see in these sentences the beginning of another modern sensibility: the outrage that is now directed against the price gouging of multinational drug companies. But at least Big Pharma is, more often than not, selling something that actually works. It is hard to say which would be a worse offense: selling castor oil with such high profit margins, or giving it away as a charitable act. At least the high prices discouraged people from employing the noxious stuff.

One step up the food chain were the letters to the *Times*, often written by accredited medical men, offering up their remedy (or disputing another's) for less obviously commercial ends. In the late summer of 1854, the surgeon-in-chief of the city police, G. B. Childs, had taken to writing the *Times* with descriptions of his fail-safe remedy for cholera's most telltale symptom: diarrhea. This is his letter from the eighteenth of August:

Will you...kindly allow me a space in your columns, not only to reiterate what I have already with reference to ether and laudanum, but to explain how, in my opinion, these remedies act when taken into the stomach? If any corroborative testimony of its efficacy be further required, I would ask those who might be skeptical of its merits to call at any one of the police stations in the city of London, where a supply of the medicine is kept and satisfy themselves of the estimation in which it is held by the members of the force.... You want something which will act immediately without requiring the slow, and in these cases uncertain, process of digestion. If the properties of opium are valuable, and they are acknowledged to be such by all authorities, the sooner these properties are brought into active operation the better.... In conclusion, Sir, I beg to observe that in submitting these remedies to your numerous readers I feel that, as a public officer, I am only discharging a public duty.

Formally, those closing solemn statements are typical of the genre, and of course their solemnity plays against the modern reader's amusement at the remedy itself. After all, we have here a chief law enforcement official writing into the daily paper essentially to encourage people to ingest heroin to treat their upset stomachs—and if the readers don't believe him, they should head down to the nearby squad house to hear firsthand how highly regarded the “medicine” is by the police force. Not exactly a “war on

drugs” sentiment, although not entirely without merit medically: constipation is a reliable side effect of opiate abuse.

Cholera remedies were a running dialogue in the papers of the day, a source of endless debate. One M.D. would write in endorsing his cocktail of linseed oil and hot compresses on Tuesday, and by Thursday another would be running off a list of patients who had died after following precisely such a treatment.

Sir,—Induced by the very favourable results of the use of castor oil in cholera, as reported by Dr. Johnson, I have just put his practice to the test of experience, and I regret to say with signal failure....

Sir,—Let me entreat your metropolitan readers not to be led by the letter of your correspondent into the belief that smoke is in any way a preventative of cholera, or can in any degree influence the prevalence of epidemic disease....

The constant squabbling between medical authorities in the papers eventually hit a point of self-parody. The week of the Broad Street outbreak, *Punch* went to press with a lacerating editorial titled “Who Shall Decide When Doctors Disagree?”

It really is nauseating to witness the quantity of doctor’s stuff that is allowed to run down the columns of the newspapers. It will be necessary at last to proceed against the public press as a public

nuisance if we have much more of the “foul and offensive matter” circulating under our noses every day at our breakfast tables to an extent highly dangerous to the health, the patience, and the nerves of the reading community. If the doctors who write to the papers would agree in their prescriptions for cholera, the public might feel grateful for the trouble taken, but when one medical man’s “infallible medicine” is another man’s “deadly poison,” and the specific of to-day is denounced as the fatal drug of tomorrow, we are puzzled and alarmed at the risk we run in following the doctors’ contradictory directions.

Ordinary doctors possessed no less unanimity in their treatment of cholera than the patent-medicine impresarios or the newspaper letter-writers. Sometimes the cholera was treated with leeches, based on the humoral theory that whatever seemed wrong with the patient should be removed from the patient: if the cholera sufferer’s blood was unusually thick, thanks to dehydration, then the patient needed to lose more blood. Contrary to G. B. Childs’ advice, many doctors prescribed laxatives to combat a disease that was already expelling fluids from the body at a lethal rate. Purgatives like castor oil or rhubarb were widely prescribed. Physicians were also inclined to recommend brandy as a treatment, despite its known dehydrating effects. While these were not quite examples of the cure being worse than the disease—cholera set the bar quite high, as diseases go—many of the proposed remedies exacerbated the physiological crisis that cholera

induced. The few positive effects, such as they were, were mostly placebo in nature. And of course, in this elaborate mix of homespun remedies, commercial elixirs, and pseudoscientific prescriptions you would almost never find the real advice that the patients needed to hear: *rehydrate*.

ON FRIDAY MORNING, THE GROWING SENSE OF DREAD HAD not yet expanded beyond the borders of the Golden Square neighborhood. The heat wave had finally broken, and the rest of the city savored the cool, clear weather. There was no way to know that in their midst a terrible outbreak was claiming its first victims. The *Morning Chronicle's* one item about cholera sounded an upbeat note, reflecting on its diminished presence on the front lines of the Crimean War: "Having at length emerged from the dangers of the month of August, we may hope to behold the abatement of pestilence at the seat of war, and the resumption of active operations. There seems to be little doubt that cholera has done its worst, and that its ravages in the allied army are very considerably mitigated, both in extent and virulence; and the fleet also, which was attacked somewhat later, appears to have now passed the crisis of the disorder."

But within the crowded parlors of Golden Square, the fear was inescapable. The outbreak hit a new peak a few hours before midnight on Thursday. Hundreds of residents had been seized by the disease within a few hours of one another, in many cases entire families, left to tend for themselves in dark, suffocating rooms.

Those fearful scenes—a family crammed together in a

room, suffering through the most excruciating private torture as a group—are perhaps the most haunting of all the images of the Broad Street outbreak. Families continue to perish together in the developed world, of course, but such catastrophes usually unfold over the space of seconds or minutes, in car accidents and plane crashes or natural disasters. But a family dying together, slowly, agonizingly, with full awareness of their fate—that is a supremely dark chapter in the book of death. That it continues on as a regular occurrence in certain parts of the world today should be a scandal to us all.

Overnight, Henry Whitehead's sociable rounds as assistant curate of St. Luke's had become a death vigil. Within a few minutes of dawn, he had been called to a house where four people lay near death, their skin already taut and blue. Each house he visited that morning presented the same horrifying scene: a neighborhood on the edge of oblivion. Just before noon, he ran across the scripture reader and another curate from St. Luke's, and found both men had encountered the same devastation in their passages through the neighborhood.

Whitehead's travels took him to four houses along Peter Street near Green's Court, where he found the disease in full fury. Half the occupants, it seemed, had fallen ill in the past twenty-four hours. In one of the grandest of the homes, standing at the northwest corner of Green's Court, all twelve residents would eventually perish. Yet the cholera had largely spared the cramped and grubby quarters on Green's Court itself. (Only five of the two hundred living there would eventually die.) When Whitehead stopped by one of the filthiest houses in the

district, he found, to his amazement, that not one of its inhabitants had fallen ill.

The contrast was striking, especially as the four houses on Peter Street had been commended by the parish authorities for their cleanliness during a 1849 survey of the neighborhood, while the survey had found nothing but squalor and soot in the surrounding houses. It occurred to Whitehead that, contrary to the prevailing wisdom, the sanitary conditions of the homes seemed to have no predictive power where the disease was concerned.

Such observations were characteristic of the young deacon, on a number of levels. There is, first, his composure and probing intelligence in a time of great chaos, but also his willingness to challenge orthodoxy, or at least submit it to empirical scrutiny. That scrutiny itself relied on his firsthand knowledge of the neighborhood and its residents. He detected these early patterns in the disease's course precisely because he possessed such a fine-grained understanding of the environment: the houses that had been praised for their sanitary conditions, and the ones considered to be the filthiest on their blocks. Without that kind of knowledge, the platitudes would have been far easier to settle back on.

There were other medical detectives on the streets of Soho that day, looking for clues, building chains of cause and effect. Minutes before sunrise on Saturday morning, John Rogers, a medical officer based on Dean Street, made his way from Walker's Court to Berwick Street, struggling to schedule visits to all the patients who had fallen ill in the previous twenty-four hours. Rogers had seen cholera outbreaks before, but already it was clear that something

exceptional was under way in Golden Square. Cholera rarely exploded through a population; it could kill by the thousands, of course, but the carnage usually took months or years to unfold. Rogers was starting to hear accounts of entire households falling ill overnight. And this strain of the disease seemed to do its damage with a terrifying velocity: sufferers were going from complete health to death in twelve hours.

Rogers' itinerary took him past 6 Berwick Street, home to a well-regarded local surgeon by the name of Harrison whom Rogers knew professionally. As Rogers crossed the front of the house, a powerful stench overtook him and he stumbled on the sidewalk for a few seconds, holding back the urge to vomit. He would later describe it as one of the "most sickening and nauseating odours it has ever been misfortunate to inhale in this metropolis." Once Rogers had composed himself, he stepped back and observed that the smell was coming from a gulley hole by the side of the road, a slit on the edge of the curb designed to capture water runoff during storms. Rogers didn't stay long enough to determine what foul combination of decaying matter lay behind the hole. But he thought to himself as he marched onward that the stench was strong enough to pervade the entire residence at number 6.

A few hours later he learned that the surgeon Harrison had expired that morning. Rogers burst out with an immediate diagnosis: "That gulley hole has destroyed him!" He began fulminating against the dreadful sanitary conditions in the city that had led to the catastrophe around him. But the deaths were just beginning. By the end of the week, seven other residents of 6 Berwick would

come down with cholera. All but one would perish.

Back at 40 Broad Street, the Lewis infant had descended into an exhausted silence over the night. In the mid-morning hours, her parents called their Dr. Rogers, who had treated the infant earlier in the week. By the time he arrived, a few minutes past eleven, baby Lewis was dead.

THAT AFTERNOON, WHITEHEAD VISITED A FAMILY OF SIX (call them the Waterstones, since no record of their names exists) with whom he had long enjoyed a close connection: two grown sons and two adolescent girls living with their parents in three connected ground-floor rooms off of Golden Square. When he arrived, he found the younger sister, whose wit and good cheer had always impressed Whitehead, fading in and out of consciousness, after a violent and sleepless night suffering from the disease. She was surrounded by her brothers and by a neighbor who had valiantly dropped in to lend a hand. While Whitehead spoke to the men in hushed tones, huddled together in the small center room of the flat, the girl seemed to regain some of her acuity.

At one point she pulled her head up and asked after her mother and sister. Her brothers fell silent. The girl looked anxiously toward the two closed doors at either side of the room. She knew the truth before a word was spoken: behind each door there lay a coffin. She could hear the weeping of her father, draped over the body of his dead wife in the dark of the shuttered front parlor.

Half the neighborhood, it seemed, had shuttered themselves inside, either to suffer in isolation or to ward

off whatever foul effusion had brought the plague to the neighborhood. Outside, in the strangely incongruous glare of a summer afternoon, at the top of Berwick Street, a yellow flag was raised to alert the residents that the cholera had struck. The gesture was superfluous. You could see the dead being wheeled down the street by the cartload.