



# Following Phineas Gage

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he story of Phineas Gage is famous, and when people repeat famous stories they have a tendency to improve them.

The famous story about Phineas says that after hanging around the Boston medical school for weeks, he grows bored and restless. Phineas takes back his tamping iron and hits the road, traveling from city to city through New England and ending up at P. T. Barnum's American Museum on Broadway in New York City. Barnum's museum has nothing to do with our modern idea of a museum. It is a freak show.



Around 1920, a group of Harvard Medical School students gather around the skull of Phineas Gage. The life-size plaster model of Phineas's head made by Dr. Bigelow stands on the left corner of the table. Time has made the skull fragile, but Phineas Gage's fame still draws visitors to Harvard's Countway Library to look without touching. *Photograph from the Warren Anatomical Museum, Countway Library of Medicine, Harvard Medical School*

stances into consideration, it may be doubted whether the present is not the most remarkable history of injury to the brain which has been recorded." He also announces that Mr. Gage has graciously agreed to donate his famous tamping iron to the Harvard Medical College. Dr. Bigelow donates the plaster head of Phineas to go with it. The plaster head remains in Boston, but Phineas and his tamping iron soon slip out of town.

In Barnum's time, people will pay to see "living giants," "bearded ladies," and calves born with two heads. People have always gawked at strange and unusual things. Barnum's special genius is "improving" the unusual. Hype and humbug make Barnum's museum a roaring success. He pulls in the crowds with half-fakes like the "Woolly Horse," a strange, long-haired horse that Barnum declares is a newly discovered species, being part deer, buffalo, elephant, camel, and sheep. At least the Woolly Horse is a real horse. Barnum's "mermaid" is a total fake, a counterfeit fossil pasted together from bones, withered skins, and who knows what else. Barnum shows his "mermaid" alongside real exotic animals like orangutans and grizzly bears. Barnum floods the exterior with the brightest lights in all of New York. Inside, the lighting is deliberately dim. The noise is deafening, with actors, jugglers, and glass blowers working the crowd.

In this wild scene, would anyone notice an ordinary-looking young man with a bad scar on his forehead holding an iron rod? It is said that Phineas exhibited himself and his tamping iron at Barnum's. The most colorful description of Phineas at Barnum's museum comes from Alton Blackington, a Boston radio and TV reporter who broadcasts his account a century after Phineas's death. Blackington says that Barnum's museum billed Phineas as "The Only Living Man With a Hole in His Head." According to Blackington, "The poster and one-sheets depicted a husky young man smiling broadly in spite of a huge iron bar which stuck out of his head. Actually, of course, the iron bar no longer protruded from Gage's head but he had it with him, and another skull, also perforated. During his sideshow performances, he would shove the long iron through the holes in his extra skull to demonstrate just how he was



Phineas Gage's mother said her son exhibited himself here at P. T. Barnum's American Museum on Broadway in New York City. Barnum was the gaudiest showman and greatest hoaxer of his age. Did Phineas Gage, The Man with a Hole in His Head, fit in with the other human oddities and strange wonders that Barnum promoted here with hype and hoopla? *Photograph circa 1850 from the Hulton Collection, Getty Images*

injured. All the details were to be found in a pamphlet he sold, and by paying ten cents extra, skeptics could part Gage's hair and see his brain, what there was left of it, pulsating beneath the new, thin covering."

Blackington spins a great yarn. Unfortunately, we don't know if the details

are true. Phineas's mother did tell Dr. Harlow that after leaving Boston, Phineas and his tamping iron visited "most of the larger New England towns and New York, remaining a while in the latter place at Barnum's with his iron." But that's as far as the details go, and Blackington's sources can't be found. In our time, Professor Malcolm Macmillan, an Australian psychologist who is the world's leading expert on Phineas Gage, makes a massive effort to track down the story. Professor Macmillan turns to experts on Barnum, old newspaper files, contemporary diaries, and circus museums. He can't find Phineas anywhere. As far as Professor Macmillan can determine, Dr. Harlow is the only reliable source. Dr. Harlow says that after Phineas leaves Boston in 1850 he gets information about his former patient only from Phineas's mother.

Her name is Hannah Trusell Swetland Gage. She says that Phineas returns from New York to the family's New Hampshire home early in 1851 to work for Mr. Jonathan Currier in his livery stable in the nearby town of Hanover. Whatever Phineas's problems with people, he gets on well with horses. He works in Currier's stable for a year and a half. His health is good, his mother remembers. He seems happiest with children and animals. Then, in 1852, he meets a stranger in Hanover who has big plans to set up a stagecoach line in South America between Valparaiso and Santiago, Chile. He could use a man who is experienced with horses. In August 1852, Phineas leaves New England forever, bound for Chile and a new life as a stagecoach driver.

Here the evidence fades out for a time. His mother recalls only that Phineas talked about driving six-horse teams for this coach line on the bottom of the world. She doesn't recall the stranger's name. But there is a small clue in the August 1852 order books of the Abbott-Downing Company of Concord, New

Hampshire. In 1852, Abbott-Downing makes the finest and toughest stagecoach in the world. This Concord coach is the famous Wild West stage, hauling mail and passengers over the plains and across deserts. In 1852, the Abbott-Downing Company books show that a Mr. James McGill ordered a Concord stage for a new coach line that he was organizing in Valparaiso, Chile. Was James McGill the stranger who hired Phineas? Professor Macmillan is still looking for evidence in New Hampshire or Chile, but he says it's possible.

A Concord stagecoach is a monster on huge wooden wheels. With six horses, nine passengers, an armed guard, mail, and freight, a fully loaded Concord stage is over six tons in motion. The driver controls it all with reins, a whip, and a feeble wooden foot brake. It's not an easy job. The driver's fists are filled with reins, three pair in the left hand for the "near" side horses, three in the right for the "off" side. The whip is largely for making showy, whip-cracking arrivals in town. Mostly he drives with his hands and voice, using the matched pairs of horses to wheel, to slow down, or to pull clear.

Until Professor Macmillan turns up solid proof, we can't say for sure if Phineas drives a Concord stagecoach in Chile, but the driver's job would be much the same on any six-horse coach—hard, tiring, and sometimes exciting. According to his mother, Phineas drives for nearly seven years on a regular schedule over the primitive roads between Valparaiso and Santiago. There is so much we would like to know but probably never will about Phineas's time in Chile. Does he—can he—learn Spanish? Is he a loner? Does he stay with the same stage line or jump from job to job? Does he tell anyone in Chile his tragic story?

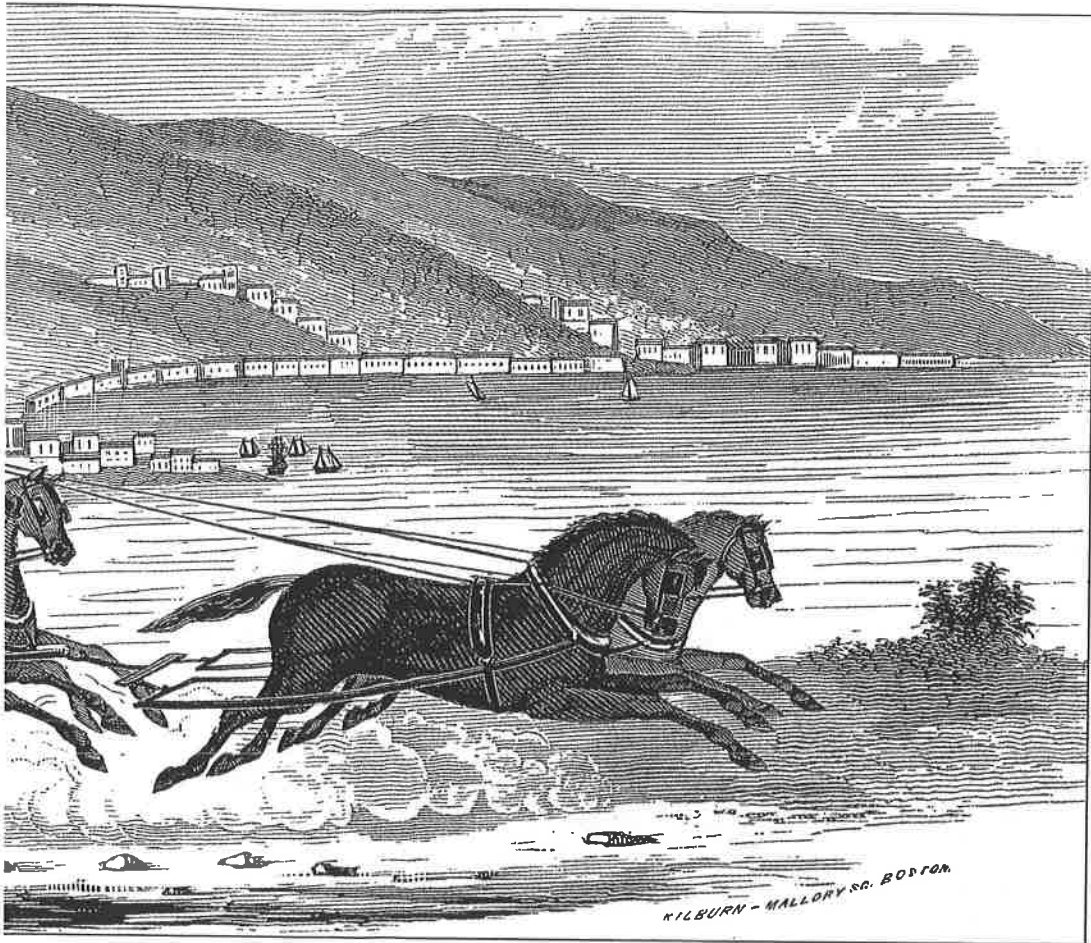
If we can't know any of this, we can catch a glimpse of Phineas in the driver's





Although it is being pulled by four horses instead of the usual six, this is a New Hampshire-built Concord stagecoach, somewhere in Chile at about the time that Phineas Gage arrived there. We have no way of knowing if it is Phineas at the reins. *New Hampshire Historical Society*

seat, his fists full of reins, his face full of dust, his hat pulled down over his eyes against the Chilean sun. Phineas is intent on his team, on the slope of the road, and on the big, rocking coach. His decisions are quick and instinctive, based on long habit. He knows his horses. He knows his reins.



We know one other thing about Phineas in Chile. He has his tamping iron with him. Stowed under the seat or ready to hand, the tamping iron goes everywhere Phineas goes.

In 1859, Phineas washes up on his family's doorstep in San Francisco. His mother has moved to California from New Hampshire to be with her youngest daughter, Phebe, and her new husband, David Shattuck. In July, a very sick Phineas gets off a boat in San Francisco and somehow finds his way



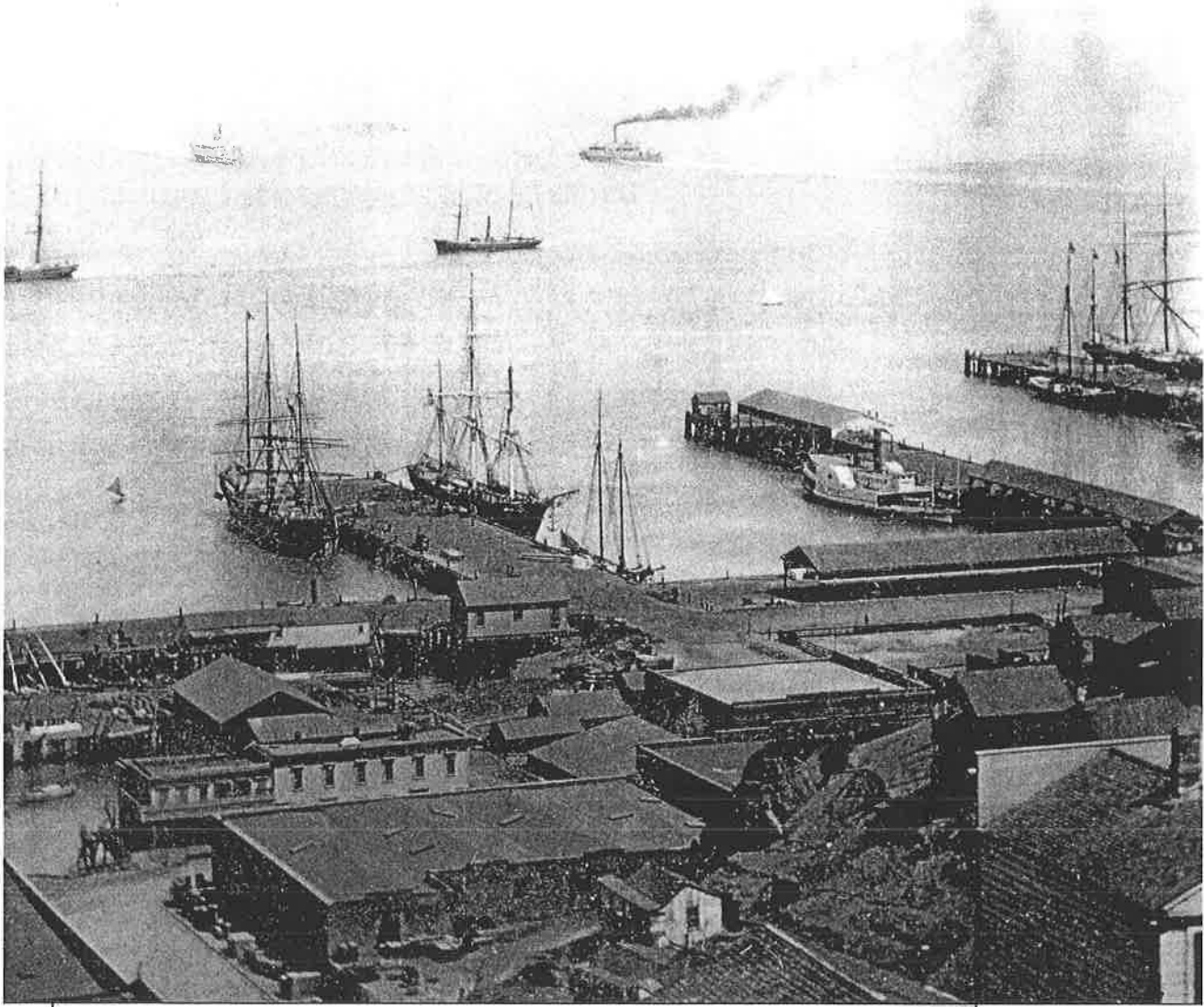
to the Shattuck house. Phineas is in "feeble condition," his mother says, much changed since she last saw him in New Hampshire. Phineas tells his mother that he is only suffering from the voyage. He had been terribly seasick on his first voyage from Boston to Chile in 1852, he tells her. He will get over this. It takes months, but he seems to fully recover.

In San Francisco, Phineas is not a good invalid. He hates resting. He has worked hard all his life, on the family farm, on the railroad, in the livery stable, and on the Chilean stagecoaches. As Phineas gradually feels better, he wants to go right out and get back to work. Finally Phineas takes a job plowing for a farmer near the little town of Santa Clara. Phineas tell his mother that he has no trouble with the farm work, but he soon quarrels with the farmer. He moves to another farm, then another. Phineas is "always finding something which did not suit him in every place he tried," says his mother. That February, he is back in San Francisco for a visit. At the dinner table, he suddenly falls into "a fit."

A fit is an epileptic seizure. Epilepsy is not a disease but a complex of symptoms. Basically, a seizure is an electrical storm in your brain's nerve cells. It can begin in one area of the brain and spread to other regions, sometimes sending your muscles into involuntary convulsions. Seizures are relatively common; about one person in 200 will experience a seizure, mild or severe, at some time in life. But an epileptic seizure is only a symptom; the cause can be anything from a tumor, to an inherited genetic disposition to seizures, to a blow to the head. In our time, we control most epileptic symptoms with powerful drugs called "anticonvulsants," because uncontrolled seizures can cause their own brain damage.

In 1860, severe epileptic seizures are not controllable. All the doctors in San





By the time a seasick Phineas Gage staggered ashore here in 1859, San Francisco was still a frontier town on the farthest edge of the continent. *Photograph from the San Francisco History Center, San Francisco Public Library*

San Francisco can offer Phineas theories, useless drugs, and nursing instructions. After that first seizure at his sister's dinner table, he recovers almost immediately with no memory of the fit or any ill effect. Within hours, he has two more seizures. In the morning, he wakes up feeling like his old self and

insists that he has to get back to work. Back in Santa Clara, he switches farm jobs again. In May, he comes into San Francisco to visit his mother. He seems fine. Two days later, at five o'clock in the morning, Phineas has a severe seizure. Then he has another and another. The intervals between seizures grow shorter and shorter.

The family physician comes and "bleeds" him. By 1860, the practice of bleeding a patient is the last gasp of a treatment that goes back to the "bodily humors" theory of the ancient Greeks. The doctor who treats Phineas decides he has too much blood and draws off the "extra." It's outmoded treatment, even for 1860. Back in Vermont in 1848, Dr. Harlow bled Phineas at the height of his fever. Without understanding why, Dr. Harlow may have helped Phineas at that moment of crisis. Drawing blood reduces blood pressure slightly, which may have taken some of the pressure off his swollen brain. But bleeding does nothing for epileptic seizures.

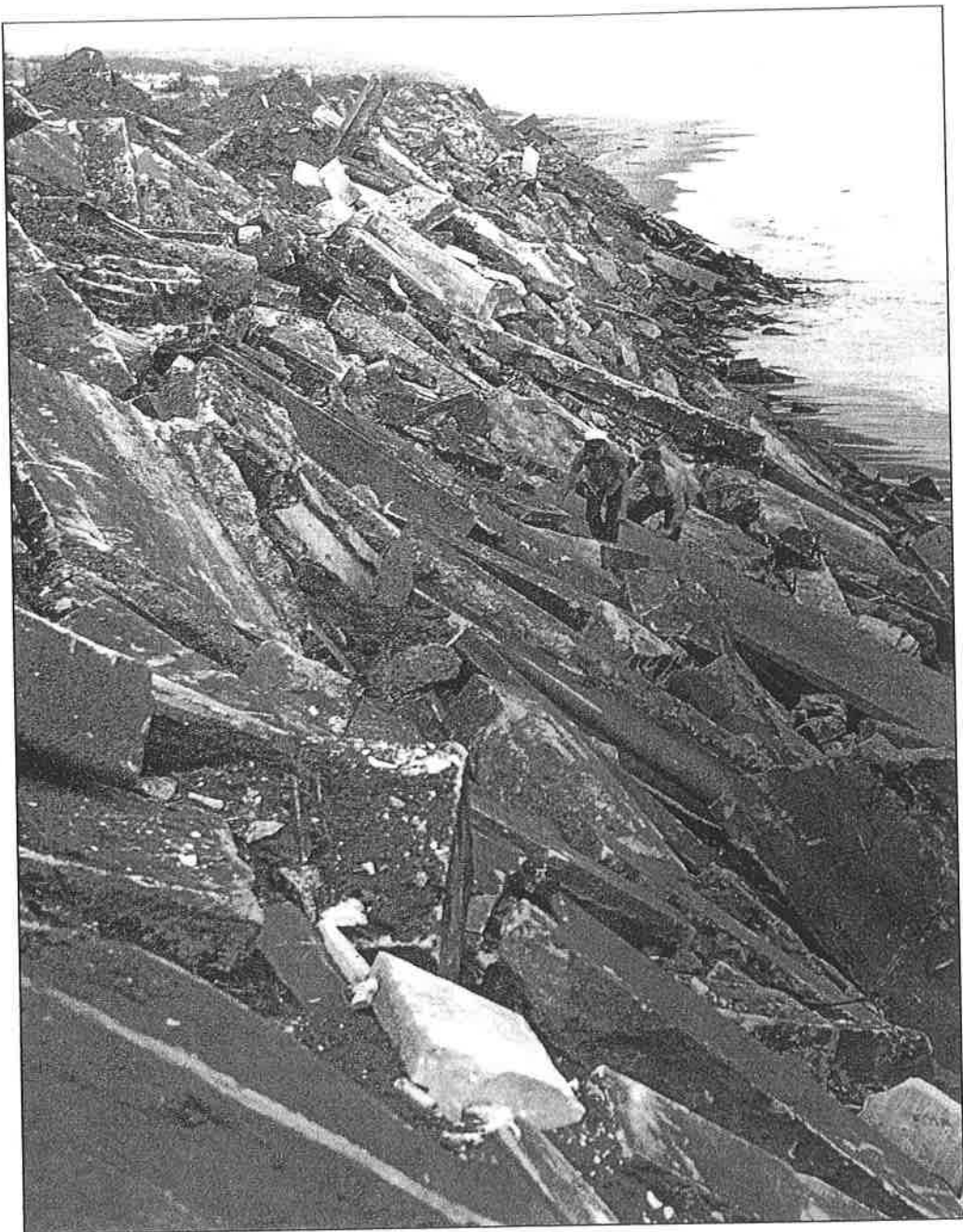
Phineas's seizures are probably caused by slow changes in brain tissue damaged in the original accident. Why the damage worsens as Phineas grows older is unknown. Possibly Phineas strikes his head again. Perhaps the constant jarring in the driver's seat of a lumbering stagecoach causes a concussion on the site of the old damage. Perhaps Phineas has a low-grade bacterial infection or perhaps a brain tumor. No one can say why, but now Phineas's seizures grow more violent and more frequent. One after another, the seizures leave him weaker and weaker.

They finally kill him on May 21, 1860, at his sister's house in San Francisco. The immediate cause of death is probably hypothermia—his body can't control its internal temperature. In our time, we read about hypothermia killing

mountain climbers, or sailors who fall into cold water. An epileptic seizure creates the same effect as shivering in icy water. In cold water, you shiver—your muscles spasm—to heat up your body. While shivering violently in cold water, you don't realize you are also sweating as your muscles throw off heat. Eventually the muscles expel heat faster than it can be replaced. Your blood temperature starts to fall. Your internal organs, especially the brain and heart, need a constant core temperature to function. As the brain detects a fall in blood temperature, it automatically protects itself by shutting down the blood supply to the hands and feet. You lose feeling. If you keep losing heat, the brain shuts down blood circulation over a larger and larger area of your skin. Phineas's muscle seizures are causing the same effect. His brain shuts down circulation to his feet and hands, then his skin, and then organ by organ until his brain must choose between blood for itself and blood for the heart. His heart stops. This is how Phineas dies, twenty days short of his thirty-seventh birthday.

He is buried at Laurel Hill Cemetery in San Francisco. Phineas is a stranger in the city, and few outside his family circle know anything about his curious past. No California newspaper notes his death or burial. Family news travels slowly across the continent. Back east, the country is drifting toward Civil War, and when it breaks out the following April, doctors soon have more pressing concerns than Phineas Gage.

Half the world away from San Francisco in 1862, French surgeon Paul Broca in Paris announces a discovery that finally turns brain theory into brain science. Dr. Broca shows how damage to one very small spot in the brain causes one very specific kind of damage. Broca is still unable to study a living brain, but he has been performing autopsies on the brains of stroke victims. A



stroke is an interruption of the blood supply to the brain that causes localized damage and often leaves stroke patients without the ability to speak. Broca notices that in the brains of stroke patients who'd lost the power to speak there is visible damage in a small area on the outside of the left frontal lobe.

The spot becomes famous as "Broca's area." To find it, put your hand on the top of your left ear, directly above your ear hole. Move your fingers about two inches forward. Underneath the skull is your "Broca's area." If it's damaged, you will lose the ability to speak. In medical language, you will have "aphasia." Soon after Broca's announcement, a German named Carl Wernicke identifies a second area on the left temporal lobe that separately controls the ability to understand speech. The loss of the ability to understand what is said to you is called "receptive aphasia." Who could have imagined that these two skills would be controlled from two different places in the brain? Broca's and Wernicke's areas are the first anatomical proof of localization. Other brain researchers soon learn to use low-voltage electricity to stimulate specific points on the brain. Bit by bit, the map of the brain grows more detailed and more localized.

The new scientific map of the brain has no relation to our old friend the Phrenological Head. Phrenology falls into disgrace, even though the Phrenol-

The unquiet grave of Phineas Gage was disturbed once in 1867 by Dr. Harlow and then again in 1940 by the rapidly growing city. San Francisco needed the land under the old pioneer cemetery where he was buried. The remains of Phineas, his mother, his brother-in-law, and 35,000 other San Francisco pioneers were dug up by the city and moved to a mass grave in a suburban cemetery. Their headstones and tombs were trucked away for landfill. In 1944, a strong coastal storm uncovered the missing tombstones under a highway, and these boys scrambled up to see. If Phineas Gage had a tombstone, it was somewhere in this stone pile. *Photograph from the San Francisco History Center, San Francisco Public Library*

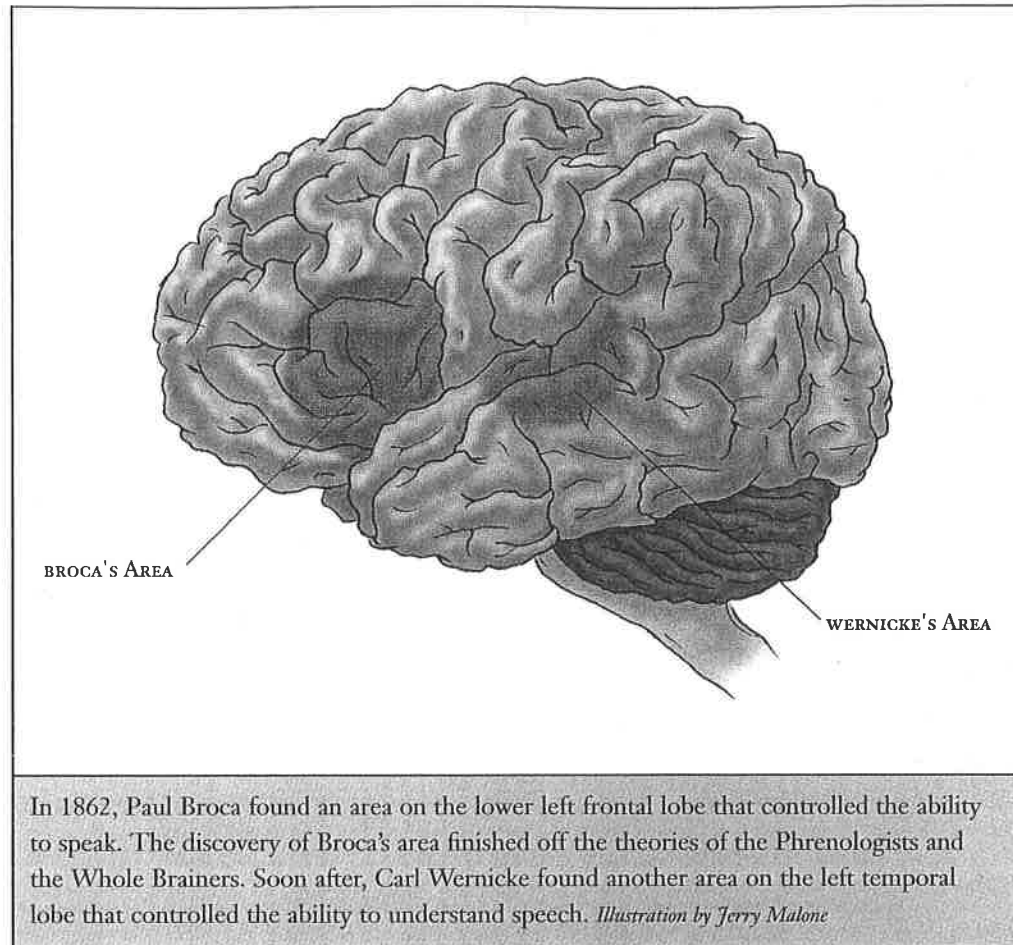


ogists were right about localization. The Whole Brainers are also shaken. If speech is localized on these two spots, how could someone with massive frontal lobe injuries—Phineas Gage, for example—speak? And yet Dr. Harlow had said that Phineas had fully recovered. Of course, few doctors in Boston remember much about the Gage case, and even Dr. Harlow has lost track of Phineas.

By the time Dr. Harlow finds Phineas again, he is too late. After Phineas leaves for South America in 1852, Dr. Harlow's contact with the Gage family is broken. Quietly, he has wondered what became of his most celebrated patient. Then in 1866, the year after the Civil War ends, Dr. Harlow, now running a small practice in Woburn, Massachusetts, finds an address for Hannah Gage in San Francisco. He writes to her, and his letter makes the long trek across America. Mrs. Gage is delighted to hear from the doctor who'd done so much for her son. Unfortunately, she has the sad duty to report his death six years before.

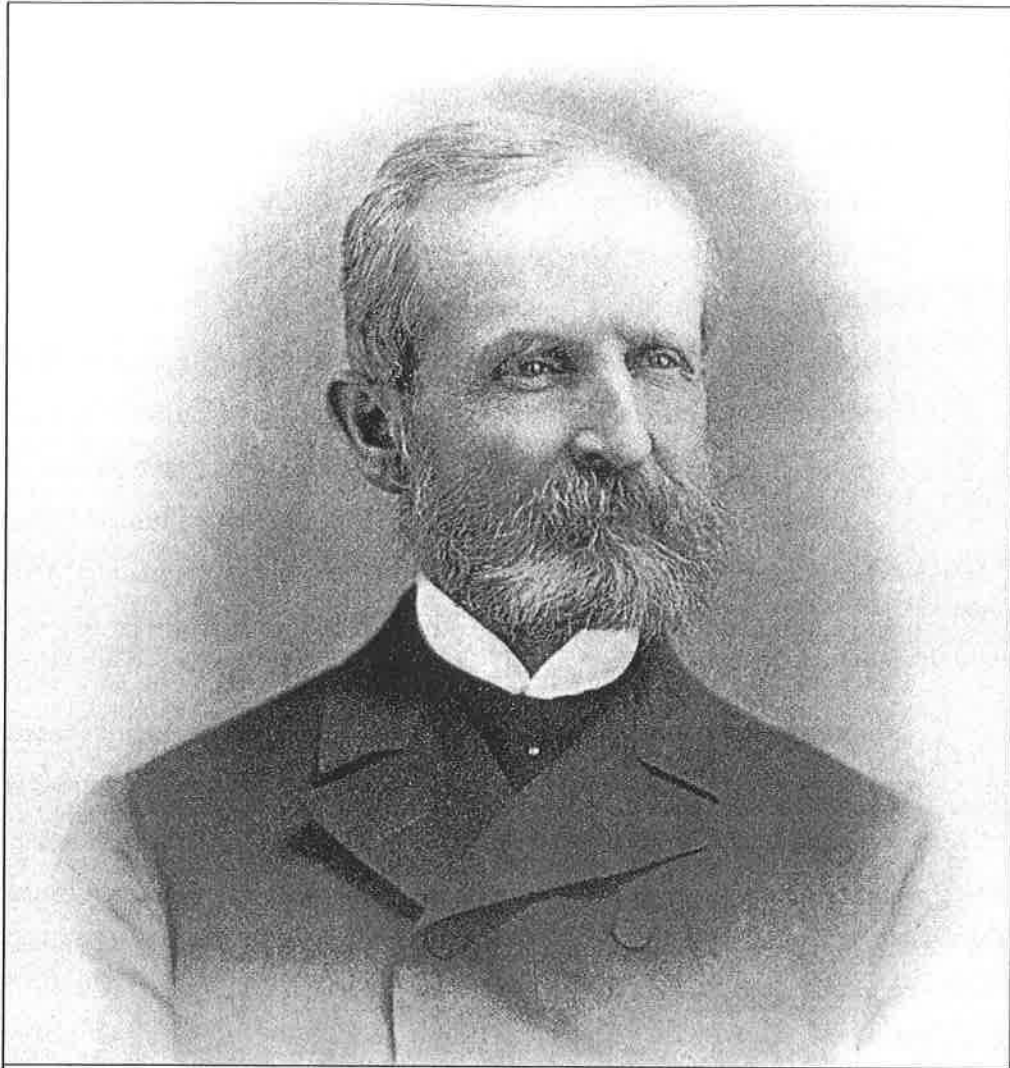
It is too late for an autopsy, and California is too far for a research visit. But Dr. Harlow doesn't give up. They exchange cordial letters. Mrs. Gage describes Phineas's last illness. She fills in the details of his life after he left the medical spotlight in Boston. She recalls how Phineas was extremely fond of his little nephews and nieces. Dr. Harlow notes her description of how Phineas would entertain them "with the most fabulous recitals of his wonderful feats and hairbreadth escapes, without any foundation except in his fancy." Dr. Harlow concludes that Phineas had "a great fondness for children, horses, and dogs—only exceeded by his attachment for his tamping iron, which was his constant companion during the remainder of his life."

Finally, Dr. Harlow makes an unusual request. Explaining the importance



of her son's case to science, Dr. Harlow recalls how many scoffed at Phineas when Dr. Bigelow first presented his case in Boston. Now there is a way to settle the question, Dr. Harlow explains. Would Mrs. Gage allow her son's body to be exhumed—dug up—from his grave? Would she allow the skull to be removed and shipped to Massachusetts?

What a request. Surely Dr. Harlow must be held in the highest regard by



In his later years, Dr. John Martyn Harlow became an important man in Woburn, a state senator, an advisor to the governor, and a bank president. When he died in 1907, he left his large estate to various charities, including Middlesex County Medical Society. In 1998, the society had enough of Dr. Harlow's money left to help pay for the bronze monument to Phineas Gage on the town green in Cavendish, Vermont. *Countway Library of Medicine, Harvard Medical School*

Hannah Gage. Why else would she consent? With her son-in-law and the mayor of San Francisco, who happens to be a physician, standing by as witnesses, Phineas's coffin is uncovered and carried to a shed. There, Dr. J. D. B. Stillman, a local surgeon, removes the skull. The huge fracture on the forehead is unmistakable. Dr. Stillman removes something else from the coffin—the tamping iron that Phineas carried everywhere, even to his grave. That December, David Shattuck takes the skull and tamping iron with him when he travels east on business. Early in the new year, he hands them over to an extremely grateful and very excited Dr. Harlow in Massachusetts.

At last Dr. Harlow is at liberty to tell the full story of Phineas Gage's "recovery" twenty years before. He appears before the Massachusetts Medical Society in 1868 and spills the beans. "This case has been cited as one of complete recovery . . . without any impairment to the intellect," he says, but in truth, Phineas's personality changed drastically after the accident. "Previous to his injury, though untrained in the schools, he possessed a well-balanced mind, and was looked upon by those who knew him as a shrewd, smart business man, very energetic and persistent in executing all his plans of operation. In this regard, his mind was radically changed, so decidedly that his friends and acquaintances said he was 'no longer Gage.'"

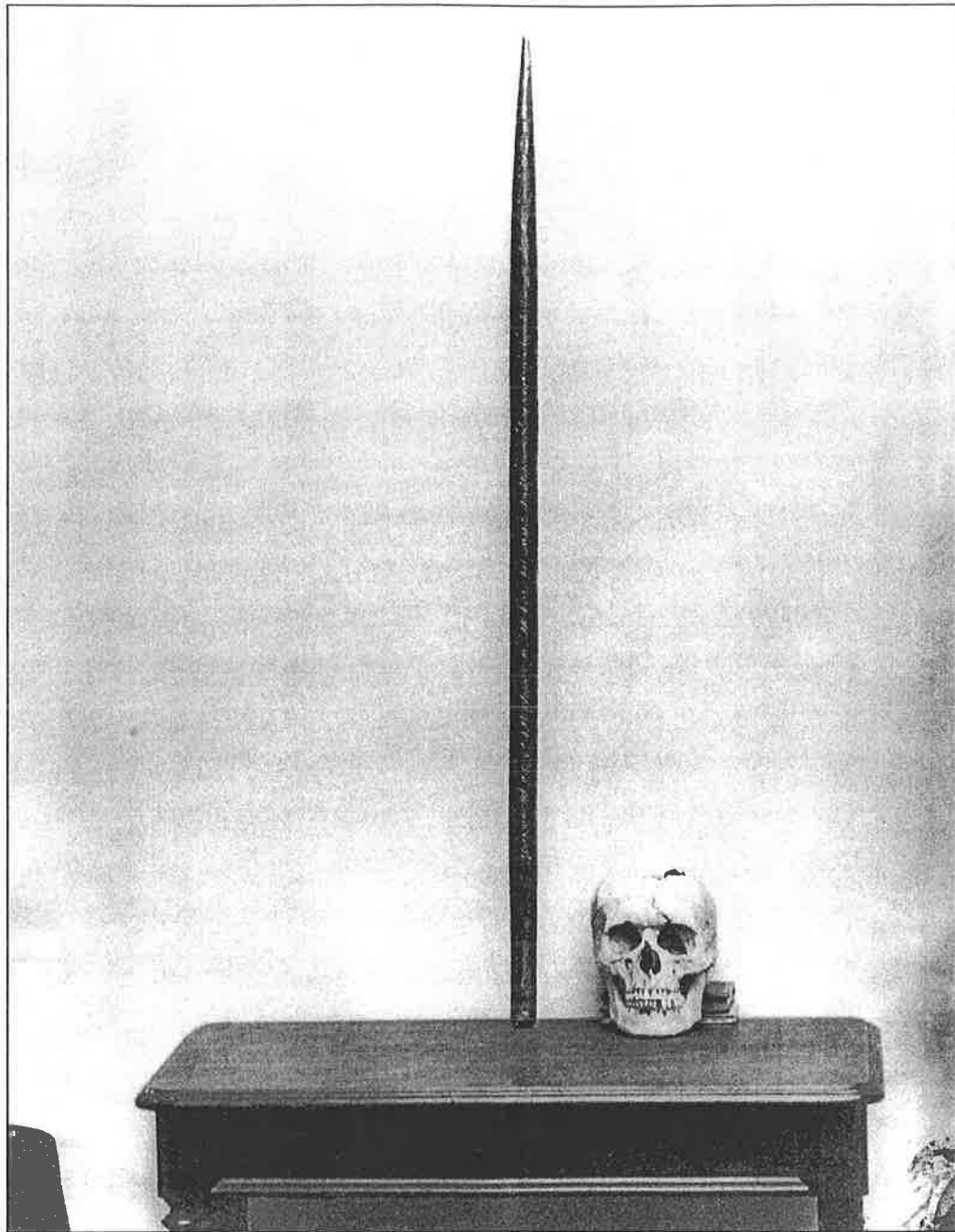
Phineas went from being "the most efficient and capable foreman" on the railroad to a man who couldn't be trusted because he couldn't get along with anyone. The new Phineas was pigheaded and stubborn one moment and wishy-washy and vague the next. "I think you have been shown that the subsequent history and progress of the case only warrant us in saying that physically, the recovery was quite complete," says Dr. Harlow. "Mentally the recov-

ery certainly was only partial.” The new Phineas could walk, drive a team of horses, and sail away to Chile, but he had lost a vital skill—he no longer knew how to be social.

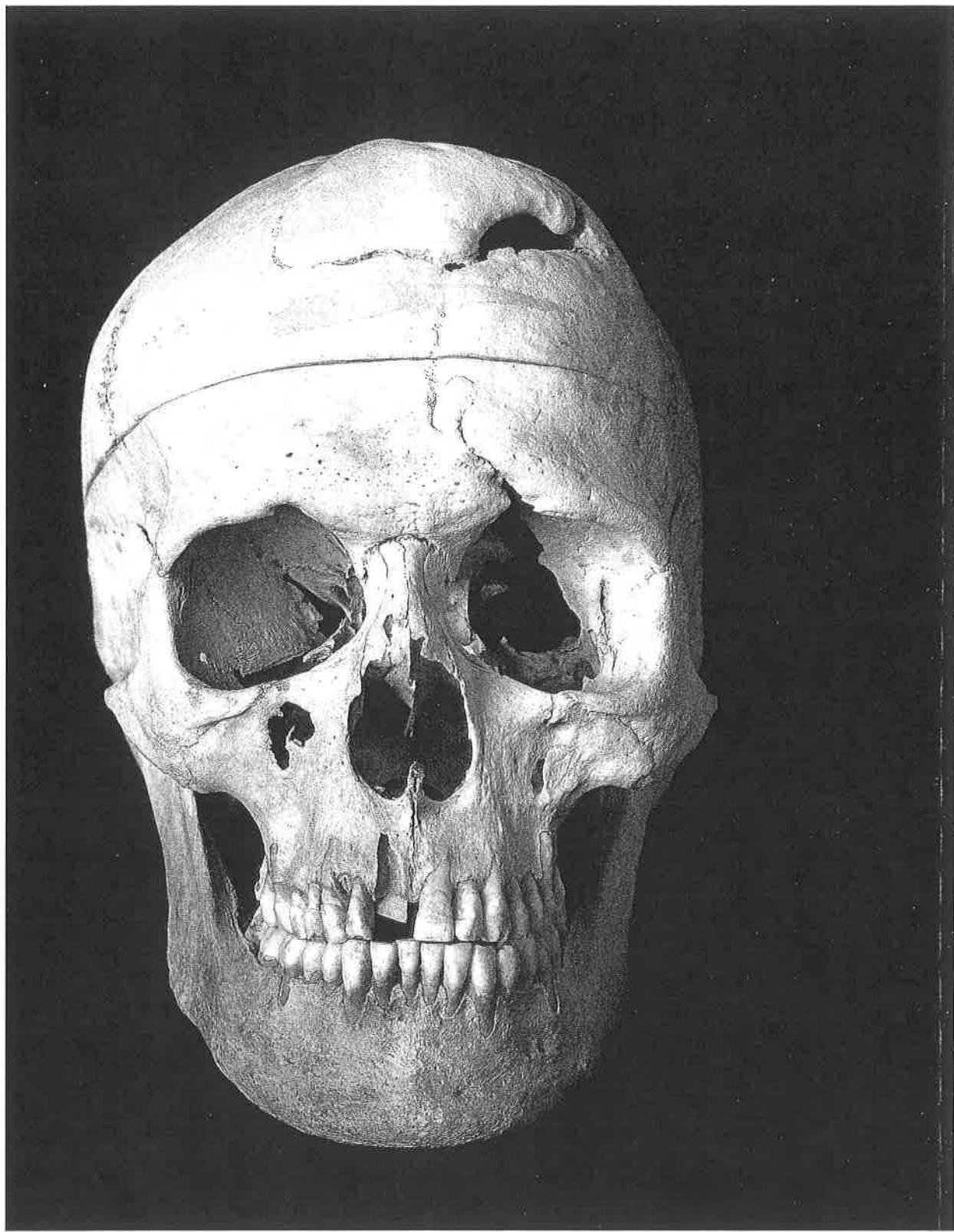
Being social is a hard skill to measure. Social behavior goes beyond the ability to activate the correct muscles or decode the right spoken sounds. It’s different from having manners. Manners are learned, and they differ greatly from culture to culture. Your parents teach you the “right” way to eat or to greet strangers, but other parents in other countries teach their children other “right” ways. Forks or chopsticks or fingers, there’s no “right” way to put food in your mouth, yet all humans swallow the same way. Swallowing is automatic behavior. Using a fork is learned behavior. Eating politely in the company of others is social behavior.

In your brain, Broca’s area may let you speak and Wernicke’s area may let you understand, but listening is also a complicated social behavior. Whether you realize it or not, you’ve been taught how to listen—how to make or break eye contact, how to murmur agreement or quiet objection, how to smile at the right moment or not to smile at all if the subject is grave. You also know how to show (or hide) your emotional reactions. You can laugh or yawn, roll your eyes upward in boredom, or open your eyes wide in delight. All of these behaviors can mean something entirely different in another culture, but all cultures have listening behavior.

It’s hard to believe that this tamping iron shot through the skull without killing Phineas Gage. Dr. Harlow had their picture taken together in 1868 to document his case. *Glennon Collection, Woburn Public Library, by permission of the Trustees of the Library*







To act human, you mix emotions, actions, routines, customs, manners, words, and expressions in a predictable way. That's what Phineas seems to have lost. Bossing a railroad construction gang requires more than a loud voice. A gang has to be able to "read" the social behavior of the foreman. They have to know if he's angry or just joking, if his orders are reasonable, or if his judgment can be trusted. He has to be able to "read" the social behavior of his men, to know who are the reliable ones and who are the troublemakers. By all reports, the old Phineas was an excellent foreman. The new Phineas was not. All these changes were brought on by a hole through a specific part of his brain.

In Boston twenty years before, the central exhibit had been Phineas himself, alive and seemingly well. Now Dr. Harlow reveals the clincher—his skull. He has "prepared" it for inspection, carefully sawing through the bone at just above eyebrow level so the top of the cranium can be lifted off. Now his audience can see the hole in the top of his mouth through which the rod passed. The top of Phineas's skull is an amazing sight. The doctors can see where Dr. Harlow pushed two large fragments back into place and how the edges started to regrow, unmistakable proof that Phineas survived the trauma and that his body started to heal the damage. Yet there is a visible hole in the top, a small triangular opening the size of a quarter, where the iron either smashed or carried away the bone completely. The skin closed over it, but for eleven years, Phineas had a real hole in his head.

In death, Phineas's skull revealed the unmistakable signs of his terrible accident. Today, Phineas's skull, tamping iron, and life mask are exhibited at Harvard Medical School.

*Photograph by Doug Mindell, skull courtesy of the Countway Library of Medicine, Harvard Medical School*

At last, the true story of Phineas Gage is out in the open. The scientific debate about the brain, though, has moved on. The theories of the Localizers and Whole Brainers are being replaced by a new experimental brain science. In time, the pinpointing of control areas will become more and more detailed. Knowledge of cells in general and neurons in particular will transform understanding of the brain. Yet the truth about Phineas poses a question that no one seems eager to answer. If there are exact locations in the brain that allow for the ability to hear or to breathe, is there a place that generates human social behavior? If that place is damaged, do you stop acting human?



## Putting Phineas Together Again

**I**n our time, Phineas Gage is a textbook case. Students of neurology or psychology study his case because it illustrates how the lobes of the frontal cortex—the two halves of your brain that meet in your forehead—are the seat of “executive functions.” Those are your abilities to predict, to decide, and to interact socially.

Unfortunately, Phineas is not the only person to have suffered damage to the frontal cortex. Antonio and Hanna Damasio, a husband-and-wife team of doctors, regularly see