Proust Was a Neuroscientist

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For Sarah and Ariella

Contents

Reality is a product of the most august imagination.

—Wallace Stevens

This systematic denial on science's part of personality as a condition of events, this rigorous belief that in its own essential and innermost nature our world is a strictly impersonal world, may, conceivably, as the whirligig of time goes round, prove to be the very defect that our descendants will be most surprised at in our own boasted science, the omission that to their eyes will most tend to make it look perspectiveless and short.

—William James

Prelude

I used to work in a neuroscience lab. We were trying to figure out how the mind remembers, how a collection of cells can encapsulate our past. I was just a lab technician, and most of my day was spent performing the strange verbs of bench science: amplifying, vortexing, pipetting, sequencing, digesting, and so on. It was simple manual labor, but the work felt profound. Mysteries were distilled into minor questions, and if my experiments didn't fail, I ended up with an answer. The truth seemed to slowly accumulate, like dust.

At the same time, I began reading Proust. I would often bring my copy of *Swann's Way* into the lab and read a few pages while waiting for an experiment to finish. All I expected from Proust was a little entertainment, or perhaps an education in the art of constructing sentences. For me, his story about one man's memory was simply that: a story. It was a work of fiction, the opposite of scientific fact.

But once I got past the jarring contrast of forms—my science spoke in acronyms, while Proust preferred meandering prose—I began to see a surprising convergence. The novelist had predicted my experiments. Proust and neuroscience shared a vision of how our memory works. If you listened closely, they were actually saying the same thing.

This book is about artists who anticipated the discoveries of neuroscience. It is about writers and painters and composers who discovered truths about the human mind—real, tangible truths—that science is only now *re*discovering. Their imaginations foretold the facts of the future.

Of course, this isn't the way knowledge is supposed to advance. Artists weave us pretty tales, while scientists objectively describe the universe. In the impenetrable prose of the scientific paper, we imagine a perfect reflection of reality. One day, we assume, science will solve everything.

In this book, I try to tell a different story. Although these artists witnessed the birth of modern science—Whitman and Eliot contemplated Darwin, Proust and Woolf admired Einstein—they never stopped believing in the necessity of art. As scientists were beginning to separate thoughts into their anatomical parts, these artists wanted to understand consciousness from the inside. Our truth, they said, must begin with us, with what reality *feels* like.

Each of these artists had a peculiar method. Marcel Proust spent all day in bed, ruminating on his past. Paul Cézanne would stare at an apple for hours. Auguste Escoffier was just trying to please his customers. Igor Stravinsky was trying *not* to please his customers. Gertrude Stein liked to play with words. But despite their technical differences, all of these artists shared an abiding interest in human experience. Their creations were acts of exploration, ways of grappling with the mysteries they couldn't understand.

These artists lived in an age of anxiety. By the middle of the nineteenth century, as technology usurped romanticism, the essence of human nature was being questioned. Thanks to the distressing discoveries of science, the immortal soul was dead. Man was a monkey, not a fallen angel. In the frantic search for new kinds of expression, artists came up with a new method: they looked in the mirror. (As Ralph Waldo Emerson declared, "The mind has become aware of itself.") This inward turn created art that was exquisitely self-conscious; its subject was our psychology.

The birth of modern art was messy. The public wasn't accustomed to free-verse poems or abstract paintings or plotless novels. Art was supposed to be pretty or entertaining, preferably both. It was supposed to tell us stories about the world, to give us life as it should be, or could be. Reality was hard, and art was our escape. But the modernists refused to give us what we wanted. In a move of stunning arrogance and ambition, they tried to invent fictions that told the truth. Although their art was difficult, they aspired to transparency: in the forms and fractures of their work, they wanted us to see ourselves.

The eight artists in this book are not the only people who tried to understand the mind. I have chosen them because their art proved to be the most accurate, because they most explicitly anticipated our science. Nevertheless, the originality of these artists was influenced by a diverse range of other thinkers. Whitman was inspired by Emerson, Proust imbibed Bergson, Cézanne studied Pissarro, and Woolf was emboldened by Joyce. I have attempted to sketch the intellectual atmosphere that shaped their creative process, to highlight the people and ideas from which their art emerged.

One of the most important influences on all of these artists—and the only influence they all shared—was the science of their time. Long before C. P. Snow mourned the sad separation of our two cultures, Whitman was busy studying brain anatomy textbooks and watching gruesome surgeries, George Eliot was reading Darwin and James Clerk Maxwell, Stein was conducting psychology experiments in William James's lab, and Woolf was learning about the biology of mental illness. It is impossible to understand their art without taking into account its relationship to science.

This was a thrilling time to be studying science. By the start of the twentieth century, the old dream of the Enlightenment seemed within reach. Everywhere scientists looked, mystery seemed to retreat. Life was just chemistry, and chemistry was just physics. The entire universe was nothing but a mass of vibrating molecules. For the most part, this new knowledge represented the triumph of a method; scientists had discovered reductionism and were successfully applying it to reality. In Plato's metaphor, the reductionist aims to "cut nature at its joints, like a good butcher." The whole can be understood only by breaking it apart, dissecting reality until it dissolves. This is all we are: parts, acronyms, atoms.

But these artists didn't simply translate the facts of science into pretty new forms. That would have been too easy. By exploring their own experiences, they expressed what no experiment could see. Since then, new scientific theories have come and gone, but this art endures, as wise and resonant as ever.

We now know that Proust was right about memory, Cézanne was uncannily accurate about the visual cortex, Stein anticipated Chomsky, and Woolf pierced the mystery of consciousness; modern neuroscience has

confirmed these artistic intuitions. In each of the following chapters, I have tried to give a sense of the scientific process, of how scientists actually distill their data into rigorous new hypotheses. Every brilliant experiment, like every great work of art, starts with an act of imagination.

Unfortunately, our current culture subscribes to a very narrow definition of truth. If something can't be quantified or calculated, then it can't be true. Because this strict scientific approach has explained so much, we assume that it can explain everything. But every method, even the experimental method, has limits. Take the human mind. Scientists describe our brain in terms of its physical details; they say we are nothing but a loom of electrical cells and synaptic spaces. What science forgets is that this isn't how we experience the world. (We feel like the ghost, not like the machine.) It is ironic but true: the one reality science cannot reduce is the only reality we will ever know. This is why we need art. By expressing our actual experience, the artist reminds us that our science is incomplete, that no map of matter will ever explain the immateriality of our consciousness.

The moral of this book is that we are made of art and science. We are such stuff as dreams are made on, but we are also just stuff. We now know enough about the brain to realize that its mystery will always remain. Like a work of art, we exceed our materials. Science needs art to frame the mystery, but art needs science so that not everything is a mystery. Neither truth alone is our solution, for our reality exists in plural.

I hope these stories of artistic discovery demonstrate that any description of the brain requires both cultures, art and science. The reductionist methods of science must be allied with an artistic investigation of our experience. In the following chapters, I try to re-imagine this dialogue. Science is seen through the optic of art, and art is interpreted in the light of science. The experiment and the poem complete each other. The mind is made whole.

Proust Was a Neuroscientist

Chapter 1

Walt Whitman

The Substance of Feeling

> The poet writes the history of his own body.
>
> — Henry David Thoreau

For walt whitman, the Civil War was about the body. The crime of the Confederacy, Whitman believed, was treating blacks as nothing but flesh, selling them and buying them like pieces of meat. Whitman's revelation, which he had for the first time at a New Orleans slave auction, was that body and mind are inseparable. To whip a man's body was to whip a man's soul.

This is Whitman's central poetic idea. We do not *have* a body, we *are* a body. Although our feelings feel immaterial, they actually begin in the flesh. Whitman introduces his only book of poems, *Leaves of Grass,* by imbuing his skin with his spirit, "the aroma of my armpits finer than prayer":

> Was somebody asking to see the soul?
> See, your own shape and countenance . . .
> Behold, the body includes and is the meaning, the main
> Concern, and includes and is the soul

Whitman's fusion of body and soul was a revolutionary idea, as radical in concept as his free-verse form. At the time, scientists believed that our feelings came from the brain and that the body was

just a lump of inert matter. But Whitman believed that our mind depended upon the flesh. He was determined to write poems about our "form complete."

This is what makes his poetry so urgent: the attempt to wring "beauty out of sweat," the metaphysical soul out of fat and skin. Instead of dividing the world into dualisms, as philosophers had done for centuries, Whitman saw everything as continuous with everything else. For him, the body and the soul, the profane and the profound, were only different names for the same thing. As Ralph Waldo Emerson, the Boston Transcendentalist, once declared, "Whitman is a remarkable mixture of the Bhagvat Ghita and the *New York Herald*."

Whitman got this theory of bodily feelings from his investigations of himself. All Whitman wanted to do in *Leaves of Grass* was put "a *person,* a human being (myself, in the later half of the Nineteenth Century, in America) freely, fully and truly on record." And so the poet turned himself into an empiricist, a lyricist of his own experience. As Whitman wrote in the preface to *Leaves of Grass,* "You shall stand by my side to look in the mirror with me."

It was this method that led Whitman to see the soul and body as inextricably "interwetted." He was the first poet to write poems in which the flesh was not a stranger. Instead, in Whitman's unmetered form, the landscape of his body became the inspiration for his poetry. Every line he ever wrote ached with the urges of his anatomy, with its wise desires and inarticulate sympathies. Ashamed of nothing, Whitman left nothing out. "Your very flesh," he promised his readers, "shall be a great poem."

Neuroscience now knows that Whitman's poetry spoke the truth: emotions are generated by the body. Ephemeral as they seem, our feelings are actually rooted in the movements of our muscles and the palpitations of our insides. Furthermore, these material feelings are an essential element of the thinking process. As the neuroscientist Antonio Damasio notes, "The mind is embodied . . . not just embrained."

At the time, however, Whitman's idea was seen as both erotic and

audacious. His poetry was denounced as a "pornographic utterance," and concerned citizens called for its censorship. Whitman enjoyed the controversy. Nothing pleased him more than dismantling prissy Victorian mores and inverting the known facts of science.

The story of the brain's separation from the body begins with René Descartes. The most influential philosopher of the seventeenth century, Descartes divided being into two distinct substances: a holy soul and a mortal carcass. The soul was the source of reason, science, and everything nice. Our flesh, on the other hand, was "clocklike," just a machine that bleeds. With this schism, Descartes condemned the body to a life of subservience, a power plant for the brain's light bulbs.

In Whitman's own time, the Cartesian impulse to worship the brain and ignore the body gave rise to the new "science" of phrenology. Begun by Franz Josef Gall at the start of the nineteenth century, phrenologists believed that the shape of the skull, its strange hills and hollows, accurately reflected the mind inside. By measuring the bumps of bone, these pseudoscientists hoped to measure the subject's character by determining which areas of the brain were swollen with use and which were shriveled with neglect. Our cranial packaging revealed our insides; the rest of the body was irrelevant.

By the middle of the nineteenth century, the promise of phrenology seemed about to be fulfilled. Innumerable medical treatises, dense with technical illustrations, were written to defend its theories. Endless numbers of skulls were quantified. Twenty-seven different mental talents were uncovered. The first scientific theory of mind seemed destined to be the last.

But measurement is always imperfect, and explanations are easy to invent. Phrenology's evidence, though amassed in a spirit of seriousness and sincerity, was actually a collection of accidental observations. (The brain is so complicated an organ that its fissures can justify almost any imaginative hypothesis, at least until a better

hypothesis comes along.) For example, Gall located the trait of ideality in "the temporal ridge of the frontal bones" because busts of Homer revealed a swelling there and because poets when writing tend to touch that part of the head. This was his data.

Of course, phrenology strikes our modern sensibilities as woefully unscientific, like an astrology of the brain. It is hard to imagine its allure or comprehend how it endured for most of the nineteenth century.* Whitman used to quote Oliver Wendell Holmes on the subject: "You might as easily tell how much money is in a safe feeling the knob on the door as tell how much brain a man has by feeling the bumps on his head." But knowledge emerges from the litter of our mistakes, and just as alchemy led to chemistry, so did the failure of phrenology lead science to study the brain itself and not just its calcified casing.

Whitman, a devoted student of the science of his day,† had a complicated relationship with phrenology. He called the first phrenology lecture he attended "the greatest conglomeration of pretension and absurdity it has *ever* been our lot to listen to. . . . We do not mean to assert that there is no truth whatsoever in phrenology, but we do say that its claims to confidence, as set forth by Mr. Fowler, are preposterous to the last degree." More than a decade later, however, that same Mr. Fowler, of the publishing house Fowler and Wells in Manhattan, became the sole distributor of the first edition of *Leaves of Grass.* Whitman couldn't find anyone else to publish his poems. And while Whitman seems to have moderated his views on

* The single biggest failing of phrenology was its inability to assimilate data that didn't conform to its predictions. For example, when phrenologists measured Descartes's skull, they found an extremely small forehead, which implied "limited logical and rational faculties." But instead of doubting their original hypothesis, the phrenologists lampooned Descartes and declared "that he was not so great a thinker as he was held to be."

† Although Whitman loved learning about science, he never accepted its findings uncritically. In his notebook, Whitman reminded himself to always question the veracity of its experiment: "Remember in scientific and similar allusions that the theories of Geology, History, Language, &c., &c., are continually changing. Be careful to put in only what must be appropriate centuries hence."

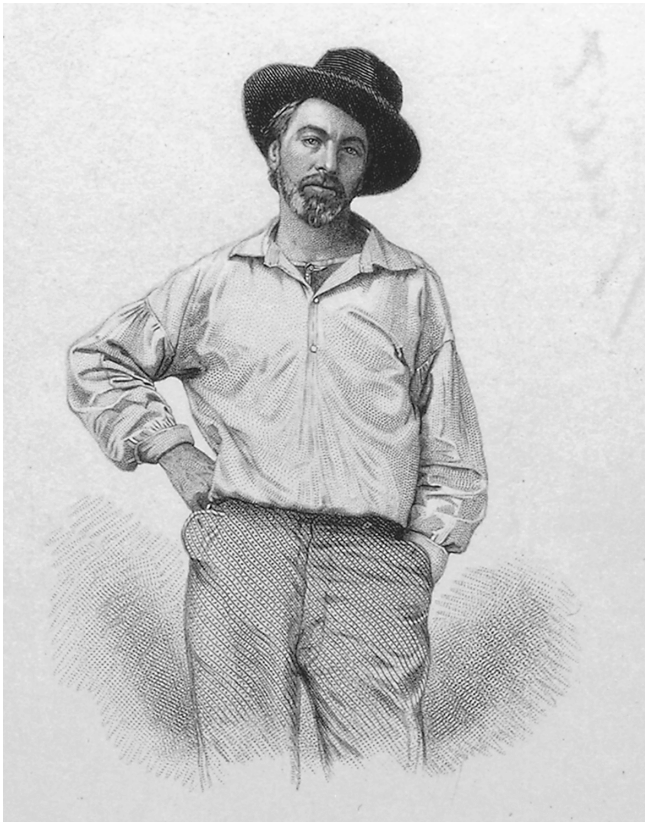
the foolishness of phrenology — even going so far as to undergo a few phrenological exams himself* — his poetry stubbornly denied phrenology's most basic premise. Like Descartes, phrenologists looked for the soul solely in the head, desperate to reduce the mind to its cranial causes. Whitman realized that such reductions were based on a stark error. By ignoring the subtleties of his body, these scientists could not possibly account for the subtleties of his soul. Like *Leaves of Grass,* which could only be understood in "its totality — its massings," Whitman believed that his existence could be "comprehended at no time by its parts, at all times by its unity." This is the moral of Whitman's poetic sprawl: the human being is an irreducible whole. Body and soul are emulsified into each other. "To be in any form, what is that?" Whitman once asked. "Mine is no callous shell."

Emerson

Whitman's faith in the transcendental body was strongly influenced by the transcendentalism of Ralph Waldo Emerson. When Whitman was still a struggling journalist living in Brooklyn, Emerson was beginning to write his lectures on nature. A lapsed Unitarian preacher, Emerson was more interested in the mystery of his own mind than in the preachings of some aloof God. He disliked organized religion because it relegated the spiritual to a place in the sky instead of seeing the spirit among "the common, low and familiar."

Without Emerson's mysticism, it is hard to imagine Whitman's poetry. "I was simmering, simmering, simmering," Whitman once said, "and Emerson brought me to a boil." From Emerson, Whitman learned to trust his own experience, searching himself for intimations of the profound. But if the magnificence of Emerson was

* Whitman was not alone; everyone from Mark Twain to Edgar Allan Poe underwent phrenological exams. George Eliot shaved her head so that her phrenologist could make a more accurate diagnosis of her cranial bumps.



An engraving of Walt Whitman from July 1854. This image served as the frontispiece for the first edition of Leaves of Grass.

his vagueness, his defense of Nature with a capital *N,* the magnificence of Whitman was his immediacy. All of Whitman's songs began with himself, nature as embodied by his own body.

And while Whitman and Emerson shared a philosophy, they could not have been more different in person. Emerson looked like a Puritan minister, with abrupt cheekbones and a long, bony nose. A man of solitude, he was prone to bouts of selfless self-absorption.

"I like the silent church before the service begins," he confessed in "Self-Reliance." He wrote in his journal that he liked man, but not men. When he wanted to think, he would take long walks by himself in the woods.

Whitman — "broad shouldered, rough-fleshed, Bacchus-browed, bearded like a satyr, and rank" — got his religion from Brooklyn, from its dusty streets and its cart drivers, its sea and its sailors, its mothers and its men. He was fascinated by people, these citizens of his sensual democracy. As his uncannily accurate phrenological exam put it,* "Leading traits of character appear to be Friendship, Sympathy, Sublimity and Self-Esteem, and markedly among his combinations the dangerous fault of Indolence, a tendency to the pleasure of Voluptuousness and Alimentiveness, and a certain reckless swing of animal will, too unmindful, probably, of the conviction of others."

Whitman heard Emerson for the first time in 1842. Emerson was beginning his lecture tour, trying to promote his newly published *Essays.* Writing in the New York *Aurora,* Whitman called Emerson's speech "one of the richest and most beautiful compositions" he had ever heard. Whitman was particularly entranced by Emerson's plea for a new American poet, a versifier fit for democracy: "The poet stands among partial men for the complete man," Emerson said. "He reattaches things to the whole."

But Whitman wasn't ready to become a poet. For the next decade, he continued to simmer, seeing New York as a journalist and as the editor of the *Brooklyn Eagle* and *Freeman.* He wrote articles about criminals and abolitionists, opera stars and the new Fulton ferry. When the *Freeman* folded, he traveled to New Orleans, where he saw slaves being sold on the auction block, "their bodies encased in metal chains." He sailed up the Mississippi on a side-wheeler, and

* One of the reasons that Whitman seems to have moderated his views on phrenology was that he had a very favorable skull. He scored nearly perfect on virtually every possible phrenological trait. Oddly enough, two of his lowest scores were for the traits of tune and language.

got a sense of the Western vastness, the way the "United States themselves are essentially the greatest poem."

It was during these difficult years when Whitman was an unemployed reporter that he first began writing fragments of poetry, scribbling down quatrains and rhymes in his cheap notebooks. With no audience but himself, Whitman was free to experiment. While every other poet was still counting syllables, Whitman was writing lines that were messy montages of present participles, body parts, and erotic metaphors. He abandoned strict meter, for he wanted his form to reflect nature, to express thoughts "so alive that they have an architecture of their own." As Emerson had insisted years before, "Doubt not, O poet, but persist. Say 'It is in me, and shall out.'"

And so, as his country was slowly breaking apart, Whitman invented a new poetics, a form of inexplicable strangeness. A self-conscious "language-maker," Whitman had no precursor. No other poet in the history of the English language prepared readers for Whitman's eccentric cadences ("sheath'd hooded sharp-tooth'd touch"), his invented verbs ("unloosing," "preluding," "unreeling"), his love of long anatomical lists,* and his honest refusal to be anything but himself, syllables be damned. Even his bad poetry is bad in a completely original way, for Whitman only ever imitated himself.

And yet, for all its incomprehensible originality, Whitman's verse also bears the scars of his time. His love of political unions and physical unity, the holding together of antimonies: these themes find their source in America's inexorable slide into the Civil War. "My book and the war are one," Whitman once said. His notebook breaks into free verse for the first time in lines that try to unite the decade's irreconcilables, the antagonisms of North and South, master and slave, body and soul. Only in his poetry could Whitman find the whole he was so desperately looking for:

* "The lung sponges, the stomach-sac, the bowels sweet and clean,
The brain in its folds inside the skull frame,
Sympathies, heart-valves, palate valves, sexuality, maternity . . ." [129]

> I am the poet of the body
> And I am the poet of the soul
> I go with the slaves of the earth equally with the masters
> And I will stand between the masters and the slaves,
> Entering into both so that both shall understand me alike.

In 1855, after years of "idle versifying," Whitman finally published his poetry. He collected his "leaves" — printing lingo for pages — of "grass" — what printers called compositions of little value — in a slim, cloth-bound volume, only ninety-five pages long. Whitman sent Emerson the first edition of his book. Emerson responded with a letter that some said Whitman carried around Brooklyn in his pocket for the rest of the summer. At the time, Whitman was an anonymous poet and Emerson a famous philosopher. His letter to Whitman is one of the most generous pieces of praise in the history of American literature. "Dear Sir," Emerson began:

> I am not blind to the worth of the wonderful gift of "Leaves of Grass." I find it the most extraordinary piece of wit & wisdom that America has yet contributed. I am very happy in reading it. It meets the demand I am always making of what seemed the sterile & stingy nature, as if too much handiwork or too much lymph in the temperament were making our western wits fat & mean. I give you joy of your free & brave thought. . . . I greet you at the beginning of a great career.

Whitman, never one to hide a good review from "the Master," sent Emerson's private letter to the *Tribune,* where it was published and later included in the second edition of *Leaves of Grass.* But by 1860, Emerson had probably come to regret his literary endorsement. Whitman had added to *Leaves of Grass* the erotic sequence "Enfans d'Adam" ("Children of Adam"), a collection that included the poems "From Pent-up Aching Rivers," "I Am He that Aches with Love," and "O Hymen! O Hymenee!" Emerson wanted Whitman to remove the erotic poems from the new edition of his poetry. (Apparently, some parts of Nature still had to be censored.) Emerson made this clear while the two were taking a long walk across

Boston Common, expressing his fear that Whitman was "in danger of being tangled up with the unfortunate heresy" of free love.

Whitman, though still an obscure poet, was adamant: "Enfans d'Adam" must remain. Such an excision, he said, would be like castration and "What does a man come to with his virility gone?" For Whitman, sex revealed the unity of our form, how the urges of the flesh became the feelings of the soul. He would remember in the last preface to *Leaves of Grass,* "A Backwards Glance over Traveled Roads," that his conversation with Emerson had crystallized his poetic themes. Although he admitted that his poetry was "avowedly the song of sex and Amativeness and ever animality," he believed that his art "lifted [these bodily allusions] into a different light and atmosphere." Science and religion might see the body in terms of its shameful parts, but the poet, lover of the whole, knows that "the human body and soul must remain an entirety." "*That,*" insisted Whitman, "is what I felt in my inmost brain and heart, when I only answer'd Emerson's vehement arguments with silence, under the old elms of Boston Common."

Despite his erotic epiphany, Whitman was upset by his walk with Emerson. Had no one understood his earlier poetry? Had no one seen its philosophy? *The body is the soul.* How many times had he written that? In how many different ways? And if the body is the soul, then how can the body be censored? As he wrote in "I Sing the Body Electric," the central poem of "Enfans d'Adam":

> O my body! I dare not desert the likes of you in other men
> and women, nor the likes of the parts of you,
> I believe the likes of you are to stand or fall with the likes
> of the soul, (and that they are the soul,)
> I believe the likes of you shall stand or fall with my
> Poems, and that they are my poems.

And so, against Emerson's wishes, Whitman published "Enfans d'Adam." As Emerson predicted, the poems were greeted with cries of indignation. One reviewer said "that quotations from the 'Enfans d'Adam' poems would be an offence against decency too gross

to be tolerated." But Whitman didn't care. As usual, he wrote his own anonymous reviews. He knew that if his poetry were to last, it must leave nothing out. It must be candid, and it must be true.

The Ghostly Limb

In the winter of 1862, during the bloody apogee of the Civil War, Whitman traveled to Virginia in search of his brother, who had been injured at the Battle of Fredericksburg. This was Whitman's first visit to the war's front. The fighting had ended just a few days before, and Whitman saw "where their priceless blood reddens the grass the ground." The acrid smell of gun smoke still hung in the air. Eventually, Whitman found the Union Army hospital, its shelter tents bordered by freshly dug graves, the names of the dead scrawled on "pieces of barrel-staves or broken boards, stuck in the dirt." Writing to his mother, Whitman described "the heap of feet, arms, legs &c. under a tree in front of a hospital." The limbs, freshly amputated, were beginning to rot.

After seeing the dead and dying of Fredericksburg, Whitman devoted himself to helping the soldiers. For the next three years, he volunteered as a wound dresser in Union hospitals, seeing "some 80,000 to 100,000 of the wounded and sick, as sustainer of spirit and body in some degree." He would nurse both Union and Confederate men. "I cannot leave them," he wrote. "Once in a while some youngster holds on to me convulsively and I do what I can for him." Whitman held the soldiers' hands; he made them lemonade; he bought them ice cream and underwear and cigarettes; sometimes, he even read them poetry. While the doctors treated their wounds, Whitman nursed their souls.

All his life, Whitman would remember the time he spent as a volunteer in the hospitals. "Those three [wartime] years," he later remembered in *Specimen Days,* his oral autobiography, "I consider the most profound lesson of my life." Never again would Whitman feel so useful, "more permanently absorbed, to the very roots." "People used to say to me, 'Walt, you are doing miracles for those

fellows in the hospitals.' I wasn't. I was . . . doing miracles for myself."

As always, Whitman transmuted the experience into poetry. He told Emerson that he wanted to write about his time in the hospitals, for they had "opened a new world somehow to me, giving closer insights, new things, exploring deeper mines than any yet." In "Drum Taps," his sequence of poems on the war — the only sequence of poems he never revised — Whitman describes the tortured anatomy he saw every day in the hospitals:

> From the stump of the arm, the amputated hand
> I undo the clotted lint, remove the slough, wash off the matter and blood,
> Back on his pillow the soldier bends with curv'd neck and side-falling head,
> His eyes are closed, his face pale, he dares not look on the bloody stump.

Whitman did look at the bloody stump. The war's gore shocked him. Volunteering in the canvas-tent hospitals, he witnessed the violent mess of surgery: "the hiss of the surgeon's knife, the gnawing teeth of his saw / wheeze, cluck, swash of falling blood." Amid the stench of dying soldiers and unclaimed corpses, Whitman consoled himself by remembering that the body was not only a body. As a nurse, Whitman tried to heal what the surgeon couldn't touch. He called these our "deepest remains."

By the second year of the war, just as Whitman was learning how to wrap battle wounds in wet cotton, doctors working in Civil War hospitals began noticing a very strange phenomenon. After a soldier's limb was amputated, it was not uncommon for him to continue to "feel" his missing arm or leg. The patients said it was like living with ghosts. Their own flesh had returned to haunt them.

Medical science ignored the syndrome. After all, the limb and its nerves were gone. There was nothing left to cut. But one doctor believed the soldiers' strange stories. His name was Silas Weir Mitch-

ell, and he was a "doctor of nerves" at Turner's Lane Hospital in Philadelphia. He was also a good friend of Whitman's. For much of their lives, the doctor and the poet wrote letters to each other, sharing a love of literature and medical stories. In fact, it was Weir Mitchell who, in 1878, finally diagnosed Whitman with a ruptured blood vessel in the brain, prescribing "mountain air" as medicine. Later on, Weir Mitchell financially supported the poet, giving him fifteen dollars a month for more than two years.

But during the Civil War, while Whitman was working as a nurse, Weir Mitchell was trying to understand these illusory limbs. The Battle of Gettysburg had given him a hospital full of amputee patients, and, in his medical notebook, Weir Mitchell began describing a great variety of "sensory ghosts." Some of the missing limbs seemed unreal to the patients, while others seemed authentic; some were painful, others painless. Although a few of the amputees eventually forgot about their amputated limbs, the vast majority retained "a sense of the existence of their lost limb that was more vivid, definite and intrusive than that of its truly living fellow member." The bodily illusion was more real than the body.

Although Weir Mitchell believed that he was the first person to document this phenomenon, he wasn't. Herman Melville, twelve years earlier, had given Ahab, the gnarled sea captain of *Moby-Dick,* a sensory ghost. Ahab is missing a leg (Moby-Dick ate it), and in chapter 108, he summons a carpenter to fashion him a new ivory peg leg. Ahab tells the carpenter that he still feels his amputated leg "invisibly and uninterpenetratingly." His phantom limb is like a "poser." "Look," Ahab says, "put thy live leg here in the place where mine was; so, now, here is only one distinct leg to the eye, yet two to the soul. Where thou feelest tingling life; there, exactly there, there to a hair, do I. Is't a riddle?"

Weir Mitchell, unaware of Melville's prescience, never cited Ahab's medical condition. He published his observations of the mystery in two neurology textbooks. He even published a special bulletin on the phenomenon, which the surgeon general's office distributed to other military hospitals in 1864. But Weir Mitchell felt constrained

by the dry, clinical language of his medical reports. He believed that the experience of the soldiers in his hospital had profound philosophical implications. After all, their sensory ghosts were living proof of Whitman's poetry: our matter was entangled with our spirit. When you cut the flesh, you also cut the soul.

And so Weir Mitchell decided to write an anonymous short story, written in the first person.* In "The Case of George Dedlow," published in *The Atlantic Monthly* in 1866, Weir Mitchell imagines himself a soldier wounded at the Battle of Chickamauga, shot in both legs and both arms. Dedlow passes out from the pain.

When he wakes, Dedlow is in a hospital tent. He has no limbs left: they have all been cut off. Dedlow describes himself as a "useless torso, more like some strange larval creature than anything of human shape." But even though Dedlow is now limbless, he still *feels* all of his limbs. His body has become a ghost, and yet it feels as real as ever. Weir Mitchell explains this phenomenon by referencing the brain. Because the brain and body are so interconnected, the mind remains "ever mindful of its missing [bodily] part, and, imperfectly at least, preserves to the man a consciousness of possessing that which he has not." Weir Mitchell believed that the brain depended upon the body for its feelings and identity. Once Dedlow loses his limbs, he finds "to his horror that at times I was less conscious of myself, of my own existence, than used to be the case . . . I thus reached the conclusion that *a man is not his brain, or any one part of it, but all of his economy,* and that to lose any part must lessen this sense of his own existence."

In his short story, Weir Mitchell is imagining a Whitmanesque physiology. Since soul is body and body is soul, to lose a part of one's body is to lose a part of one's soul. As Whitman wrote in "Song of Myself," "Lack one lacks both." The mind *cannot* be extricated from its matter, for mind and matter, these two seemingly op-

* Later on in his life, Weir Mitchell would abandon medicine entirely and devote himself to writing novels and poetry. His novel *Hugh Wynne* (1897) — about the experiences of a Quaker during the American Revolution — was particularly popular.

posite substances, are impossibly intertwined. Whitman makes our unity clear on the very first page of *Leaves of Grass,* as he describes his poetic subject:

> Of physiology from top to toe I sing
> not physiognomy alone nor brain alone is worthy for the
> Muse, I say the form complete is worthier far.

After the war, Weir Mitchell's clinical observations fell into obscurity. Because phantom limbs had no material explanation, medical science continued to ignore the phenomenon. Only William James, in his 1887 article "The Consciousness of Lost Limbs," pursued Weir Mitchell's supernatural hypothesis.* As Harvard's first psychology professor, James sent out a short questionnaire to hundreds of amputees asking various questions about their missing parts (for example, "How much of the limb can you feel?" "Can you, by *imagining* strongly that it has moved, make yourself really feel as if it *had* moved into a different position?"). The results of James's survey taught him only one fact about sensory ghosts: there was no general pattern to the experience of lost limbs. Every body was invested with its own individual meaning. "We can never seek amongst these processes for results which shall be invariable," James wrote. "Exceptions remain to every empirical law of our mental life, and can only be treated as so many individual aberrations." As Henry James, William's novelist brother, once wrote, "There is a presence in what is missing." That presence is our own.

The Anatomy of Emotion

Whitman's faith in the flesh, although it was the source of his censorship, had a profound impact on the thought of his time. His free-verse odes, which so erotically fused the body and the soul, ac-

* Sadly, it would take another thirty years — and another brutal war — before sensory ghosts were rediscovered. In 1917, confronted by the maimed soldiers of WWI, the neurologist J. Babinski described his own version of sensory ghosts. He makes no mention of Herman Melville, William James, or Weir Mitchell.

tually precipitated a parallel discovery within psychology. An avid Whitman enthusiast, William James was the first scientist to realize that Whitman's poetry was literally true: the body was the source of feelings. The flesh was not a part of what we felt, it *was* what we felt. As Whitman had prophetically chanted, "Behold, the body includes and is the meaning, the main concern, and includes and is the soul."

His entire life, James loved reading Whitman's poetry out loud, feeling the "passionate and mystical ontological emotion that suffuses his words." In Whitman, James discovered a "contemporary prophet" able to "abolish the usual human distinctions." According to James, Whitman's poetic investigations of the body had discovered "the kind of fiber . . . which is the material woven of all the excitements, joys, and meanings that ever were, or ever shall be, in this world." Whitman realized how we feel.

The convergent beliefs of James and Whitman should not be surprising. After all, they shared a common source: Emerson. When Emerson came to New York City on his lecture tour in 1842, his speech "The Poet" was lauded in the papers by the journalist Walter Whitman, who would take his line about a "meter making argument" literally. While in the city, Emerson also met with Henry James Sr., a dilettante mystic and critic, and was invited into his New York City home. William James, Henry Sr.'s eldest son, had just been born. Legend has it that Emerson blessed William in his cradle and became the infant's godfather.

True or false, the story accurately reflects the intellectual history of America. William James inherited the philosophical tradition of Emerson. Pragmatism, the uniquely American philosophy James invented, was in part a systematization of Emerson's skeptical mysticism. Like Emerson and Whitman, James always enjoyed puncturing the pretensions of nineteenth-century science. He thought that people should stop thinking of scientific theories as mirrors of nature, what he called "the copy version of truth." Instead, they should see its facts as tools, which "help us get into a satisfactory relation with experience." The truth of an idea, James wrote, is the use of an idea, its "cash-value." Thus, according to the pragmatists, a practical

poet could be just as truthful as an accurate experiment. All that mattered was the "concrete difference" an idea produced in our actual lives.

But before he became a philosopher, William James was a psychologist. In 1875, he established one of the world's first psychological laboratories at Harvard. Though he was now part of the medical school, James had no intention of practicing "brass instrument psychology," his critical name for the new scientific approach that tried to quantify the mind in terms of its elemental sensations. What physicists had done for the universe, these psychologists wanted to do for consciousness. Even their vocabulary was stolen straight from physics: thought had a "velocity," nerves had "inertia," and the mind was nothing but its "mechanical reflex-actions." James was contemptuous of such a crude form of reductionism. He thought its facts were useless.

James also wasn't very good at this new type of psychology. "It is a sort of work which appeals particularly to patient and exact minds," he wrote in his masterpiece, *The Principles of Psychology,* and James realized that his mind was neither patient nor particularly exact. He loved questions more than answers, the uncertainty of faith more than the conviction of reason. He wanted to call the universe the pluriverse. In his own psychological experiments, James was drawn to the phenomena that this mental reductionism ignored. What parts of the mind *cannot* be measured?

Searching for the immeasurable led James directly to the question of feeling. Our subjective emotions, he said, were the "unscientific half of existence."* Because we only experienced the feeling as a conscious whole — and not as a sum of separate sensations — to

* As a pragmatist, James also believed that feelings — and not some sort of pure Cartesian reason — were the motivation behind most of our beliefs. In "The Will to Believe," James remarked that "these feelings of our duty about either truth or error are in any case only expressions of our passional life . . . Objective evidence and certitude are doubtless very fine ideals to play with, but where on this moonlit and dream-visited planet are they found?" Although James's essay sparked a firestorm of controversy, he was really just taking David Hume's claim that "reason is, and ought to be, the slave of the passions" to its logical conclusion.

break the emotion apart (as science tried to do) was to make it unreal. "The demand for atoms of feeling," James wrote, "seems a sheer vagary, an illegitimate metaphor. Rationally, we see what perplexities it brings in train; and empirically, no fact suggests it, for the actual content of our minds are always representations of some kind of *ensemble*."

Ensemble is the key word here. As Whitman had written thirty years before, "I will not make poems with reference to parts / But I will make poems with reference to ensemble." When James introspected, he realized that Whitman's poetry revealed an essential truth: our feelings emerge from the interactions of the brain *and* the body, not from any single place in either one. This psychological theory, first described in the 1884 article "What Is an emotion?"* is Whitman, pure and simple. Like Whitman, James concluded that if consciousness was severed from the body, "there would be nothing left behind, no 'mind-stuff' out of which the emotion can be constituted." As usual, James's experimental evidence consisted of ordinary experience. He structured his argument around vivid examples stolen straight from real life, such as encountering a bear in the woods. "What kind of an emotion of fear," he wondered, "would be left [after seeing the bear] if the feeling of quickened heart beats nor of shallow breathing, neither of trembling lips nor of weakened limbs, neither of goose bumps nor of visceral stirrings, were present?" James's answer was simple: without the body there would be no fear, for an emotion begins as the perception of a bodily change. When it comes to the drama of feelings, our flesh is the stage.

At first glance, this theory of emotion seems like the height of materialism, a reduction of feeling to a physical state. But James was actually making the opposite point. Inspired by Whitman's poetic sense of unity, James believed that our emotions emerged from the constant interaction of the body and the brain. Just as fear cannot

* A year after James's article was published, the Danish psychologist Carl Lange published a similar theory about body and emotion, leading scientists to refer to the theory as the James-Lange hypothesis.

be abstracted from its carnal manifestations, it also cannot be separated from the mind, which endows the body's flesh with meaning. As a result, science cannot define feeling without also taking consciousness — what the feeling is *about* — into account. "Let not this view be called materialistic," James warns his reader. "Our emotions must always be inwardly what they are, whatever be the physiological ground of their apparition. If they are deep, pure, spiritual facts they remain no less deep, pure, spiritual, and worthy of regard on this present sensation theory. They carry their own inner measure of worth with them."

The Body Electric

Modern neuroscience is now discovering the anatomy underlying Whitman's poetry. It has taken his poetic hypothesis — the idea that feelings begin in the flesh — and found the exact nerves and brain regions that make it true. Antonio Damasio, a neuroscientist who has done extensive work on the etiology of feeling, calls this process the body loop. In his view, the mind stalks the flesh; from our muscles we steal our moods.

How does the brain generate our metaphysical feelings from the physical body? According to Damasio, after an "emotive stimulus" (such as a bear) is seen, the brain automatically triggers a wave of changes in the "physical viscera," as the body prepares for action. The heart begins to pound, arteries dilate, the intestines contract, and adrenaline pours into the bloodstream. These bodily changes are then detected by the cortex, which connects them to the scary sensation that caused the changes in the first place. The resulting mental image — an emulsion of thought and flesh, body and soul — is what we feel. It is an idea that has passed through the vessel of the body.

Over the course of his distinguished career, Damasio has chronicled the lives of patients whose brains have been injured and who, as a result, are missing this intricate body-brain connection. Al-

though they maintain full sensory awareness, these patients are unable to translate their sensations into emotions. The pounding of the heart never becomes a feeling of fear. Because the mind is divorced from the flesh, the patient lives in a cocoon of numbness — numb even to his or her own tragedy.

Damasio's research has elaborated on the necessity of our carnal emotions. His conclusions are Whitmanesque. "The body contributes more than life support," Damasio writes. "It contributes a *content* that is part and parcel of the workings of the normal mind." In fact, even when the body does not literally change, the mind creates a feeling by *hallucinating* a bodily change. Damasio calls this the as-if body loop, since the brain acts as if the body were experiencing a real physical event. By imagining a specific bodily state — like a fast heartbeat, or a surge of adrenaline — the mind can induce its own emotions.

One of Damasio's most surprising discoveries is that the feelings generated by the body are an essential element of rational thought. Although we typically assume that our emotions interfere with reason, Damasio's emotionless patients proved incapable of making reasonable decisions. After suffering their brain injuries, all began displaying disturbing changes in behavior. Some made terrible investments and ended up bankrupt; others became dishonest and antisocial; most just spent hours deliberating over irrelevant details. According to Damasio, their frustrating lives are vivid proof that rationality requires feeling, and feeling requires the body. (As Nietzsche put it, "There is more reason in your body than in your best wisdom.")

Of course, it's hard to make generalizations about the brain based on a few neurological patients. In order to understand how the body loop functions in the normal mind, Damasio devised an ingenious experiment he called the gambling task. The experiment went as follows: a subject — the player — was given four decks of cards, two black and two red, and $2,000 worth of play money. Each card told the player that he had either won or lost money. The sub-

ject was instructed to turn over a card from one of the four decks and to make as much money as possible.

But the cards weren't distributed at random. Damasio rigged the game. Two of the decks were full of high-risk cards. These decks had bigger payouts ($100), but also contained extravagant monetary punishments ($1,250). The other two decks, by comparison, were staid and conservative. Although they had smaller payouts ($50), they rarely punished the player. If the gamblers only drew from these two decks, they would come out way ahead.

At first, the card-selection process was entirely random. The player had no reason to favor any specific deck, and so they sampled from each pile, searching for money-making patterns. On average, people had to turn over about fifty cards before they began to only draw from the profitable decks. It took about eighty cards before the average experimental subject could explain *why* they favored those decks. Logic is slow.

But Damasio wasn't interested in logic. He was interested in the body. He attached electrodes to the subjects' palms and measured the electrical conductance of their skin. (As Whitman noted in "I Sing the Body Electric," the body *is* electric, our nerves singing with minor voltages.)* In general, higher levels of conductance in the skin signal nervousness. What Damasio found was that after drawing only ten cards, the hand of the experimental subject got "nervous" whenever it reached for one of the negative decks. While the brain had yet to completely understand the game (and wouldn't for another forty cards), the subject's hand "knew" what deck to draw from. Furthermore, as the hand grew increasingly electric, the sub-

* At the time of Whitman's writing, there was very little evidence that the body pulsated with charged ions. Luigi Galvani's discovery in the 1780s that frogs' legs twitched when shocked remained hotly disputed. In fact, it was not until 1875, twenty years *after* Whitman first sang of electric bodies, that Richard Caton, a Liverpool physician, discovered that Whitman was right, the nervous system actually conveys electric current. Caton demonstrated this improbable fact by probing directly on the exposed brains of animals with a reflecting galvanometer (a newly invented device that was able to sense the low voltages of neurons).

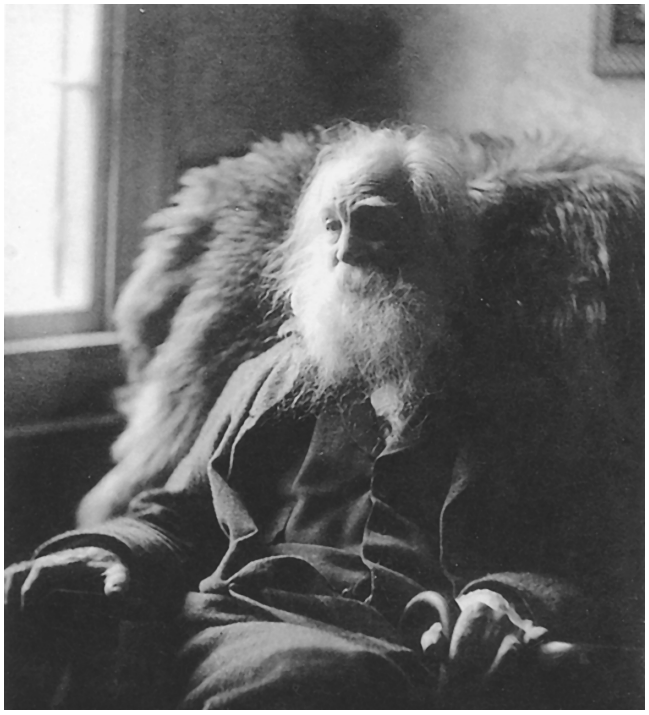
ject started drawing more and more frequently from the advantageous decks. The unconscious feelings generated by the body preceded the conscious decision. The hand led the mind.

Whitman would have loved this experiment. In the same poem where he declares the body electric, he also exclaims about "the curious sympathy one feels when feeling with the hand." Long before Damasio, Whitman understood that "the spirit receives from the body just as much as it gives to the body." This is why he listened so closely to his flesh: it was the place where his poetry began.

But Whitman also knew that his poems were not simply odes to the material body. This was the mistake that his Victorian critics made: by taking his references to orgasms and organs literally, they missed his true poetic epiphany. The moral of Whitman's verse was that the body wasn't merely a body. Just as leaves of grass grow out of the dirt, feelings grow out of the flesh. What Whitman wanted to show was how these two different substances — the grass and the dirt, the body and the mind — were actually inseparable. You couldn't write poems about one without acknowledging the presence of the other. As Whitman declared, "I will make the poems of materials, for I think they are to be the most spiritual poems."

This faith in the holiness of everything, even the low things, ultimately led Whitman to dispute the facts of science. When the materialists of his time announced that the body was nothing but an evolved machine — there was no soul inside — Whitman reacted with characteristic skepticism. He believed that no matter how much we knew about our physical anatomy, the ineffable would always remain. This is why he wrote poetry. "Hurray for positive science," Whitman wrote. "Gentlemen, to you the first honors always! / Your facts are useful, and yet they are not my dwelling, / I but enter them to an area of my dwelling."

What Emerson said of Montaigne is true of Whitman too: if you cut his words, they will bleed, "for they are vascular and alive." Whitman's poetry describes our anatomical reality. In the mirror of his art, we see the stark fact of our own improbability. Feeling from



A photograph of Walt Whitman in 1891, just a few months before he died. The photograph was taken by the painter Thomas Eakins.

flesh? Soul from body? Body from soul? Our existence makes no sense. We live inside a contradiction. Whitman exposes this truth, and then, in the very next sentence, accepts it. His only answer is that there is no answer. "I and this mystery, here we stand," Whitman once said, and that pretty much says it all.

Yet the acceptance of contradiction has its own consequences. As Randall Jarrell wrote in an essay on Whitman, "When you organize one of the contradictory elements out of your work of art, you are getting rid not just of it, but of the contradiction of which it was a part; and it is the contradictions in works of art which make them able to represent us — as logical and methodical generalizations cannot — our world and our selves, which are also full of contradic-

tions." By trusting his experience, no matter how paradoxical it might seem, Whitman discovered our anatomical reality. Despite the constant calls for his censure, he never doubted the wisdom of his art. "Now I see it is true, what I guess'd at," Whitman wrote in "Song of Myself." What he guessed at, of course, is that the soul is made of flesh.

For a self-described poet of the body, Whitman's own body was in dreadful shape. Although he often bragged about "the exquisite realization of his health," by the time Whitman died, in the early spring of 1892, his health had been damaged by years of neglect and disease. The doctors who performed his autopsy — they began cutting as soon as Thomas Eakins finished making Whitman's death mask — were startled at the state of his insides. His left lung had collapsed, and only an eighth of his right lung seemed to be in workable condition. Tuberculosis, which he had gotten while serving as a nurse during the Civil War, had chronically inflamed his stomach, liver, and kidneys. He had pneumonia. His heart was swollen. In fact, the only organ which still seemed to be functional was Whitman's brain. Just two months earlier, he had finished compiling his final edition of *Leaves of Grass,* which became the "Death-Bed" edition. As usual, he had revised his old poems and continued to write new ones.

What could Whitman have been thinking as he felt his flesh — his trusted muse — slowly abandon him? He began this last *Leaves of Grass* with a new epigraph, written in death's shadow:

> Come, said my soul,
> Such verses for my Body let us write, (for we are one).

These two poignant lines, the first lines in the last version of his only book of poetry, represent the distilled essence of Whitman's philosophy. We are the poem, his poem says, that emerges from the unity of the body and the mind. That fragile unity — this brief parenthesis of being — is all we have. Celebrate it.