

Contents

Preface	vii
Part I Moira: May and Billy	
1 'I've got dark eyes. I can frighten people.'	3
2 The lightness of being	22
Part II Hubris: war and the transistor	
3 'Of a highly explosive character'	45
4 'I hope you have better luck in the future'	63
5 'I think we better call Shockley'	86
6 'There's enough glory in this for everybody'	107
7 '...To do my climbing by moonlight & unroped'	125
8 'Well-equipped female with brains'	142
Part III Nemesis: Silicon Valley and obsession	
9 'Really peculiar ideas about how to motivate people'	163
10 'Three generations of imbeciles are enough'	190
11 'What law of nature have you discovered?'	212
12 'Someday we may actually be terribly alone'	226
13 'The high cost of thinking the unthinkable'	241
14 'I love you'	257
Bibliography	274
Acknowledgments	285
Index	288

CHAPTER 1

‘I’ve got dark eyes. I can frighten people.’

William Bradford Shockley was born on 13 February 1910 to an eccentric American couple living in London. May Bradford Shockley and her husband William grew grateful that he was an only child.

May would live all but 14 years of her son’s life, seeing him rise to become one of the most famous scientists in the world and, later, one of the most vilified, sharing his triumphs and ignoring his failures – the self-proclaimed ‘grandmother of the transistor.’ William would miss it all.



May Shockley grew up in New Mexico and Missouri in the home of her mother and stepfather; a slightly asthmatic girl with a mind of her own. She was capable of packing a rifle and riding out onto the desert or grasslands on horseback to pop rabbits, or, when the mood struck her, to capture them with traps and bash their heads in on rocks. Something of a math protégé with an artistic bent, she found her way to Stanford University in Palo Alto, California, mostly because it was coed and free. She went on geology field trips and took up rock climbing, and is believed to be the first person to climb Mount Whitney solo. She picked up enough geology to ride by stagecoach to the roaring mining town of Tonopah, Nevada, to help her stepfather’s surveying business, becoming the first female US Deputy Mineral Surveyor.

May was undaunted in one of the last towns of the Old West where women were not plentiful. She was a splendid shot – and totally uninterested in the men around her. She was not especially pretty – slim with an oval face, wide-set dark blue eyes, a sharp triangular nose and wide mouth. Her most striking feature was her dark blonde hair, which reached down almost to the back of her knees. She wore it up and seemed determined that no man would see it down – until she met William Shockley senior, an MIT-trained mining engineer.



Figure 2 May Bradford Shockley around the time of her marriage.

Shockley *père* spoke eight languages and speculated in mines for a living, although he was a better linguist than a businessman. He had traveled around the world in a life of emprise and danger, and when May met him she wrote back to her mother: 'I was amazed to find someone in the middle of Nevada who could talk to me about Italian paintings.' At 52, he was 22 years older than she, with a goatee about to become pure white. He came from one of America's most illustrious families, the direct descendant of John Alden and Priscilla Mullins of *Mayflower* fame. His father was one of the last whaling captains to sail from New Bedford, and his maternal grandfather built the ships.

Several of William senior's ancestors had a hand in founding the Massachusetts Institute of Technology, so he went there, seemingly because he had nothing better to do. A mediocre student in mathematics, he had trouble finding work but wound up with mining companies in California and Nevada. He studied music in New York and languages in Europe, and finally found jobs with mining firms in London in the last days of foreign mineral concessions. He roamed all over Asia, often shooting his way out of jams. There even was a price on his head in one Chinese

province. His collection of porcelain would eventually find its way into the Stanford University Museum.

Small wonder that May, in the wastelands of Tonopah, was swept off her feet. William was everything the outside world promised and not like any man she had met before. His age was to his benefit, she felt; his maturity and wisdom were beyond anything in her experience. They married on 20 January 1908 and sailed for London.

How May felt about William is never clear in either of their diaries and letters. She married him eagerly, obviously respected him and may have loved him, although there is no remaining record of her actually having said so, and there are hints that she had an affair toward the end of her husband's life. He clearly adored her. Letters from his trips and expeditions were full of longing and loneliness, and sometimes, when they quarreled, he was clearly upset and remorseful. None of his letters to her contained the words 'I love you.' They appeared happily married.

Every night he would sit down at a typewriter and chronicle the day's events in sometimes painfully intimate detail. Some pages he duplicated and sent as letters home, but most he kept in green or gray books, some pages marked confidential. May read them and sometimes made corrections or additions. His diaries were so intimate and so complete that May and their son were able to imagine whole days lived more than a half century before.

This meticulous notation of his life set a theme in the years that followed. Just as he noted and saved everything he came across – it is possible to reconstruct meals eaten at restaurants on no particular occasion – his wife found it impossible to throw anything away. Their son would later acquire this same obsession.

The Shockleys led a gay life in London, limited only by William's inability to make money. There were several other MIT and Stanford engineers in the city the Shockleys were intimate with, including Herbert Hoover and his wife Lee Henry. Hoover later became president of Stanford, as well as, of course, the United States.

Strapped for cash, the family moved from flat to flat. They were demanding of their landlords and their servants – when they could afford them – and ferocious in defending their privacy, and left behind considerable ill will. Their inability to settle down in one place for more than a few months would be a theme in their lives for years.

May's morning sickness began on 12 June 1909, but neither she nor her husband understood what was happening. If May knew little about

these things, she was still ahead of her husband.² He had not had that much to do with the pregnancy; a job opened in Siberia and he spent much of the time traveling up and down the Amur river, corresponding in code to save money and protect their privacy from telegraph operators. Mrs Hoover helpfully sent a book listing all the things that can go wrong with a pregnancy, and after reading it May announced she was never going to get pregnant again.

They were now living at 69 Victoria Street near Westminster, a flat they chose after May turned down 40 apartments. It cost £100 for six months, more than they could afford. They hired Sarah E. Richmond to be family nurse. She had been head of all the British army nurses, which would prove to have been good training.

At 2:30 in the morning of the 13th of February, May went into labor. At 9:45 the next morning, William recorded in his diary that he could hear the sound of his son crying, a 'strong penetrating lusty cry.' No doubt. May, who on first sight of the doctor had demanded chloroform, witnessed none of it. Most women probably swear sometime during labor that they will never go through it again, but May meant it. She had been in labor for more than 24 hours and enjoyed none of the experience



Figure 3 May and little Bill, London, 1910.

or the pregnancy that preceded it. William agreed completely. He was so shocked at the gore and pain he vowed that he would never subject his wife to it again. 'For a long time I could take no interest in the baby for my nerves were much shaken with May's agony. It is certainly a damnable business.... I'm glad it's over.'²

They named the child William Bradford Shockley.

William Shockley the elder, trained as an engineer, viewed his son's development as if he were watching a construction project. He was fascinated, confounded, and not entirely sure of how children normally develop and what they need and do. For a while, it seemed a grand experiment.

Everything wound up in father Shockley's diaries, sometimes in painful detail. Under his analytical veneer shimmered the light of amazement. Nothing escaped the chronicler's eye. We know that Bill was circumcised on 21 March; that 'Billy discovered that it gave him a pleasant sensation to rub powder puff between his legs after the bath' on the 13th of May; and that Bill's first erection happened in early December that year.² We know what the child weighed every day of his infancy. At five months, the boy could call himself 'Billy.' At a year, he could count to four and could tell if one of six objects was missing. He knew A, B, C, I, O, S. His pronunciation was good. 'His intelligence is developing quite rapidly,' William wrote, impressed. May was too: 'Billy is going ahead mentally very fast and is very well. We are very proud of him; he is no world-beater and shows no signs whatever of being anything more than a bright little boy.'³

May, meanwhile, suffered from acute post-partum depression, sometimes gaining solace by writing poetry, verses wracked with sadness and lonesomeness. She showed no one the poems. Her son found them in her papers after she died.



Two important aspects of Bill Shockley's early life become clear through his father's extensive and sometimes excruciatingly frank narratives. First: its instability. Nothing in the diaries indicated discord between May and William or that they ever treated each other with disrespect. They appear to have loved their son, doting even, although they seemed unable to show affection openly to him or each other. The instability came from their financial condition, their lifestyle, and the fact they

were strangers in another country and had more trouble adapting than they perhaps realized. And they shared more than a tinge of paranoia.

Their Victoria Street flat was cramped. Bill had a pen in the nursery where he could crawl on a wool mat with coarse embroidered patterns and he could play in the garden, but the flat still was small. Two months after Bill was born, they moved to 5 Abington Court in Kensington and then 2 Camden House Terrace. Meanwhile, their financial situation got worse.

William tried to sell some of his stock in mines and rubber plantations to increase his income, but found no market. The only job offer he had was a vague chance to go to West Africa, which he turned down; he couldn't leave May and the baby. He sent off 491 letters to engineers, mostly in the US and Mexico, looking for investments. 'This will make me a lot of work,' he wrote, 'with one chance of making money in 10,000.' He sent off 270 letters in one day in August 1910. For all that effort, he got 30 letters in response and found a few likely prospects, none of which apparently panned out.⁴ He kept trying and once had as many as 1,000 letters in circulation and 'no profit in sight.' He wanted to buy a house in London – they sold for about \$20,000 – but it would cost him \$8,000 a year to keep it up and he did not have that money. He had property in the San Francisco area, but couldn't sell that at a fair price.

Little Bill also had to cope with a succession of servants. The Shockleys had an elemental social problem with British help and did not trust strangers. The estimable nurse Richmond came and went several times, sometimes because William couldn't pay her. Her absence greatly upset the boy. Once William offered to pay her expenses on one of their tours of Europe in lieu of her salary, which he didn't have, and she accepted. May needed the help. She could not manage without someone to watch Bill as her post-partum depression lingered.

May fought constantly with cooks and housekeepers. William and May fought with landlords. Servants gossiped about the family to neighbors' servants and to property owners, which upset the Shockleys further. Their sense of privacy and security seemed perpetually threatened.

When they had to leave a flat, they crossed the Channel, sometimes with nurse in tow, touring the Continent at least three times a year. Then they returned to London and set up camp in a hotel while May scoured the city for an acceptable flat. Sometimes that took weeks. Once they found one they moved in, and Bill found himself in yet another bedroom with different servants. They ate out constantly; May

had no talent for or interest in cooking. Every time they went out, Bill was left with a nurse.

The other striking aspect of Bill's childhood is his violent temper. Almost from the first day, Bill Shockley showed explosions of anger, one that amazed, disturbed and eventually cowed his parents. The outbursts got worse as time went on. Within a month of his birth, his father could write: '[He] gives signs of having a violent temper, and will very likely prove a difficult subject to handle. He is a good baby in keeping still when shown to visitors.'

Bill's temper grew to a constant presence – the bad tantrums that would try even the most even-tempered and experienced parents, which could hardly describe the Shockleys. All children throw tantrums, particularly around the age of four. But Bill's temper was extreme, going well beyond what most would consider the norm.

By eight months, Bill was biting people on the cheek with all of his four teeth, 'but only in play,' his father assures himself. Before he reached a year old, William senior wrote: 'He has a violent enough temper and when he was to eat, howls uninterruptedly at the top of his voice.'² Just after Bill's first birthday, William noted more violent temper tantrums: Bill 'screaming at the top of his voice and bending and throwing himself back until it seemed as if he [would] break his neck or hurt his head by hitting something.' His biting became nastier. Bill 'has bitten his mother severely many times and has slapped both his father and mother too often to record,' William wrote on June 24. 'It is an odd day when he does not break something,' William lamented.²

Mealtimes were the worst. One afternoon May tied Bill to his chair with a cloth napkin to keep him from hurling himself across the table as he screamed and threw beans on the floor. He could be dangerous to himself and others. Once he fell off his chair in rage, hitting his head on an iron radiator. He developed a habit of twisting his finger in his hair and one night he twisted it so tightly the hair had to be cut to extricate his finger. One day he threw a stone and hit a dachshund between the eyes.

Most of the tantrums were kept for his parents – he was active and charming when others were around – and neither William nor May had any idea how to handle him.

They had three choices: beat him into better manners, use psychological ploys to modify his behavior, or surrender. 'I should probably have beaten him had it not been for May,' William wrote. 'She would

not allow it, and I think she is right, for [tho] it is easy enough to spank or shake a child it is most difficult to do it without becoming angry, and there is danger of permanently hurting a child or of losing his affection. Billy always gets angry because he is thwarted or denied something...'⁵

A week later: 'Billy was spanked today for the first time; he screamed and would not stop, so May spanked him, but he still kept screaming. It surprised him a good deal but it did not worry him after he was spanked. When he went to bed he would not keep still and May went to him, waving her hands and telling him she was a bad mother and not Billy's nice mother at all, and if he would be a good boy his good mother would come back.'²⁴

Corporal punishment failed, so without any other obvious peaceful solution, they tried the third alternative: surrender. To avoid incidents and tantrums, the Shockleys decided to mollify Bill in any way they could. The situation was so bad that at least two servants, including Richmond, the former army nurse, quit. They hired a new nurse but Bill was unhappy. 'I believe he noticed the new nurse,' May wrote. 'I thought I had a good one but I cannot endure her and it breaks my heart to see her touch the baby.... If Miss Richmond would only come back.'⁷ She would not. The inability of the Shockleys to control their son and their refusal to support her discipline was an impossible situation.

When they lost yet another apartment, they gave up on London and returned to the US, arriving in April 1913 and moving in with May's mother and stepfather in Palo Alto on Waverly Street. The arrangement was uncomfortable; May and her mother, Sallie, could not live together in peace, but as William still wasn't making a living they had little choice.

Bill's temper did not abate with the move. So William tried option two: the psychological method. He enrolled in a parenting course run by a Mrs A. H. Putnam at the University of Chicago, then one of America's premier schools of education, and began a long, detailed correspondence. Mrs Putnam sent several suggestions, apparently off-the-shelf strategies for dealing with difficult children. None worked on Bill, not even her suggestion they throw cold water on him, and William eventually decided the woman was of no help. They reverted to Plan C – surrender.

'Anger is about the only emotion he displays,' lamented William, 'with a little love at times.'⁹

'I've got dark eyes,' Bill told his father when he was two-and-a-half. 'I can frighten people.'²

They did not follow Mrs Putnam's final advice: see to it that Bill spent as much time as possible with other children.



Back in the States, and with no need to correspond with the family, William lost his enthusiasm for the diary and left large parts of Bill's childhood unrecorded. May's hoarding, especially of objects and documents related to her much-adored son, provides much of the picture of his youth.*

Their peripatetic life continued, changing homes every few months or every year, again impelled by both economic considerations and the psychological obsession for privacy. Even their family noticed. Walter Shockley and his wife, Frederica, suggested they finally settle down, for Bill's sake as well as their own, telling William and May they were turning into gypsies.⁸ Gradually, they settled, remaining mostly in Palo Alto in a series of houses up and down Waverley Street in the center of town.

The Shockleys kept Bill out of school as long as they could, minimizing his contact with other children. They felt uniquely qualified to teach their son at home: May taught him mathematics and art, and his father taught him science and geography. There appears to have been little attempt at English or writing. The benefits of socializing with other children or dealing with people outside the immediate family escaped them.

When they thought they could no longer avoid formal schooling – Bill was now eight years old – they sent him for two years to the nearby Homer Avenue school where he mostly earned As and Bs (including As in deportment). 'I didn't especially enjoy school and have a vague recollection of liking Thursdays because then there was only one more day of school for the week,' he later said.¹⁰

William senior then sent his son to the Palo Alto Military Academy. William apparently felt the discipline would do Bill good, and judging from his report cards, which May of course saved, he was at least

* While a child, Shockley fell off a porch and a splinter of wood perforated his cheek, destroying a dimple. William senior measured it (2.5 inches long by 0.4 inches wide and 0.2 inches thick) and recorded the measurements; May saved it and I found the splinter in the archives.



Figure 4 Bill, in the uniform of the Palo Alto Military Academy.

partially right. Bill earned mostly As; the lowest grades were in language and spelling. He had enough of the highest marks possible in 'courtesy, neatness, promptness and good conduct' to make him an Honor Cadet, which must have amazed his parents. Bill had learned to control his temper out in the world, saving it for May and William, where it was most useful.

The school cost William \$920 a year, an expense he could not easily afford. He still eked out a living on mineral investments and consulting, although May's income from selling a few paintings at \$100 each helped. When, through May's connection with the Hoovers, William got a job teaching mining engineering at Stanford, the family's finances eased somewhat; still, the burden of the military academy was heavy.

May suffered one major disappointment with her son. Since 1911, a Stanford psychology professor, Lewis Terman, had been studying gifted children, hoping eventually to gather a sufficient number of subjects he could follow through their lives to see how they differed from other children. Terman hoped to prove – at least initially – that intelligence was genetic, and that the intellectually gifted did better in life.

In 1916, he began testing hundreds of children in the Palo Alto, San Francisco and Los Angeles areas using the Stanford–Binet IQ test he had recently developed. Terman accepted as subjects only those children who scored 135 or higher, his definition of genius (100 being average). Teachers initially selected who they thought were the two or three brightest children in their classes.¹¹

It is not known how Bill was nominated but he was tested for the first time at the age of eight, just before he entered public school, and scored 129. The next year he was retested and scored 125. (Having a small decrease between tests was not uncommon.) He failed to make the cut. He was still two standard deviations higher than average; he just was not, according to Lewis Terman, a genius.* Later in life Bill joked often about how he could not qualify for Terman's gifted study, yet could still win a Nobel Prize in physics.^{1**} That he subsequently used the same IQ tests as the basis for his unpopular beliefs about race and intelligence never seemed to vex him, nor did the fact that he was living proof the tests should not be taken too seriously. The irony was lost on him.

Terman tested May in 1919 using a different examination, and recorded her IQ at 161.

There were several beneficial influences on young Bill's life. One was his grandfather, May's stepfather, whom he loved dearly and who taught him to shoot. A considerably more pacific influence was a neighbor, Perley A. Ross, a physicist on the Stanford faculty. The Rosses became part of Bill's extended family; he was constantly in and out of their house, and Ross's two daughters became his only childhood friends. A gifted teacher, Perley Ross would explain radio theory and other problems in physics to Bill, who absorbed them attentively and then tore out of the house to play with the Ross girls.¹¹ Perley Ross became one of the forces that turned Bill toward physics. The greatest influence, however, remained his father. It was William, Bill thought, who had the true brains in the family. The memory of William's lessons stuck with him all his life.

'He encouraged me into scientific studies and would always discuss them with me,' Bill told a writer 40 years later. Bill remembered sitting

* A standard deviation is a statistically significant measurement of how much a quantity differs from the mean (average) in a statistical curve.

** Terman missed two Laureates: Shockley and Luis Alvarez, a Berkeley physicist.

fascinated as William talked about such matters as the buoyancy of gasses and the laws of Archimedes.¹⁰ Bill later tried to tutor his own sons in the same way, but the attempts were not equally appreciated.

There was a certain self-consciousness to their relationship, mostly because of William's age. Bill remembered a 'disturbing' picture of himself less than a year old on a park lawn with his father, then aged 55, looking like a 'bearded elder,' with his trim white beard 'more appropriate for a grandfather than for the father of the baby that I was then.'¹¹ The affection, nonetheless, was deep and true.

Always, there was May. 'I woke up with the thought in my mind,' she wrote in her diary when Bill was eight. 'The only heritage I care to leave to Billy is the feeling of force and the joy of responsibility for setting the world right on something.'¹² Although he would deny it later, he would always gravitate back to her through his life. Even when she became a burden or an embarrassment, for Bill, there was always May.

The Shockleys lack of respect for Bill's formal education – and socialization – continued through his teens. They celebrated his graduation from elementary school in 1922 by letting Bill skip middle school. Among other things, they wanted to take a trip to London so Bill could

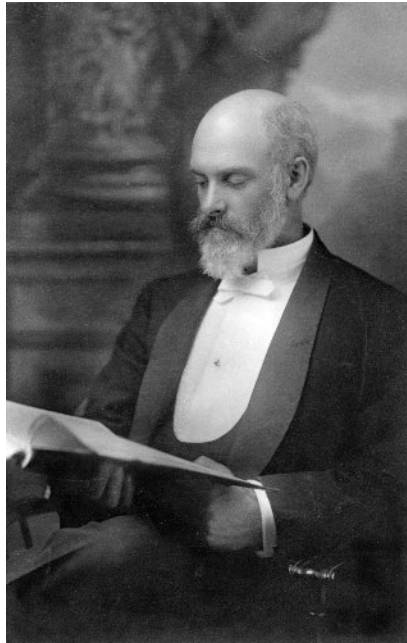


Figure 5 The 'bearded elder,' William Hillman Shockley.

see Victoria Street and meet his old nurse, Richmond, with whom they had kept a warm correspondence. Of the trip to London, no word remains except William's critique of London's chefs.

The original plan was eventually to move back to London, but in New York (where they were to board a transatlantic liner) William suffered a mild stroke on 8 November 1924. Fearing for her husband's health, May decided the family had to return immediately to warmer California. Then, perhaps to get away from tension with May's mother Sallie, they moved on to the Los Angeles area to a cottage at 1168 N. Edgemont Avenue.

Bill entered Hollywood High in the fall of 1924, having completely skipped middle school.

In their new home, William supervised the unpacking of his library and his collection of artifacts from around the world. He spent two months just cataloging his treasures. William also went about getting his financial affairs in order, fearing physical and mental incapacitation. He earned about \$4,000 in income the previous year, mostly interest on investments, and the family was finally modestly comfortable. His estate was valued at about \$75,000.

On 2 May 1925, he had trouble moving around the house, and May took him to the office of a Doctor Bowers. Six days later, riding about the city with a real estate agent, William collapsed into 'hysteria.' He had suffered another stroke. By the 18th, he felt much better, walking almost naturally. The next morning he collapsed raving on the bathroom floor. Bowers, and a specialist, examined William and told May that they doubted her husband would survive. If he did, he would be paralyzed. William gradually sank into a coma with May and a nurse tending him.

On 26 May 1925, May made a blunt entry into her daybook: '8:20. Wm. died.'¹³ He was 69.

Bill was 15. Watching his father die, a man he deeply loved and greatly respected, must have been shattering. The bearded elder haunted him all his life. In 1955, in a rare moment of self-reflection, as he began forming the company that spawned Silicon Valley, he scrawled in his notebook a cryptic tribute: '30 March. Idea of setting world on fire, father proud.'

With William, the diarist, gone only May could record her family's life; and she was terrible at it. Her lack of enthusiasm for verbal – if not physical – archiving left a huge gap in the story of her son's adolescence. And produced an intriguing mystery: 'X.'

X begins appearing in May's 1925 date book, identified in no other way. All that can be said is that X was a man and his birthday was 17 June because May took him to a birthday lunch that day. Both William and Bill knew X; the most logical deduction was that he was a professional person, probably either their lawyer or a doctor, although even that is not clear. They met in X's office with William, and there was a reference to a book 'criticism' she took to him. He called often, Bill sometimes taking the message. X was there when her boy had his tonsils out on 20 June 1925. On 7 September, May made her last entry about him: 'X called about 10 minutes. 8:30.' He never appears again in any of her writing.

If X had appeared under his real name nothing about his presence in May's diaries would be interesting. But in all of her archives, in the archives of two generations of almost pathologically exact Shockleys, X is the only anonymous person. If it was an innocent flirtation or a blameless professional relationship, why the mystery? Whether May, then aged 46, was having an affair while her husband was dying, we will never know, but if she did, Bill probably knew about it.

Not much is known about Bill's high school endeavors. He was active in student affairs, but 30 years later, he wrote how lonely he had been.¹⁵

The week before his father died, Bill took the College Entrance Examination on 18 May 1925 for admission to the University of California. He scored in the 69th or higher percentile in the sciences, but landed in the second half in French and English courses. His score on 'Quadratics and Beyond,' was the 45th percentile. He was admitted to the University of California – Southern Branch, now UCLA. The campus then was within walking distance of his home. In 1928, he transferred to the California Institute of Technology.

The Caltech Shockley joined in the fall of 1928 was a relatively small school just beginning its march toward one of the great centers for science in the world. Located in the green, rich town of Pasadena, then still a lush exurb of Los Angeles, the school consisted of 30 acres of overgrown fields and an old orange orchard. Only about half a dozen buildings were completed, including old Throop Hall, the well-worn domed campus center. Seven years before, chemist Arthur Noyes and trustee George Ellery Hale, of what was then called the Throop College of Technology, had lured the great physicist Robert Millikan from the University of Chicago to take over the presidency of the institution, having secured a \$4 million philanthropic gift. The first thing Millikan did was change the name of the place to the California Institute of Technology.

The name was something of a misnomer: Caltech was the home of pure science, engineering coming in decidedly second. From its earliest days, it drew – raided – faculty from places like Harvard and MIT by promising researchers their own labs, a free hand to run the research they wanted, and all the money they needed, an irresistible combination. Departments were encouraged to interact, a break in the hoary tradition of the more conservative eastern schools. Consequently, Millikan, Noyes and Hale attracted not only some of the brightest researchers, but the most iconoclastic, giving the school an edge of excitement, an atmosphere tinged with adrenaline.

Two years after he arrived, Millikan won the Noble Prize for his study of charges and the photoelectric effect. His eminence further drew illustrious scientists from all over the world to visit, lecture and stay. Edwin Hubble began his masterful analysis of the galaxies at Caltech. Albert Michelson, having won his Nobel for measuring the speed of light in Cleveland, repeated the experiment in Pasadena. Linus Pauling was a young faculty member who would eventually win two prizes, one for chemistry and the Peace Prize, the only person ever to win two unshared Nobels. Einstein came to visit and lecture twice.

Millikan hired Charles Tolman, chemist, physicist, outdoorsman, philosopher. He brought in Hendrik A. Lorentz from Germany and Charles G. Darwin, the grandson of the biologist and a respected mathematical physicist from England.¹⁷ The faculty club, the marvelous Atheneum, opened during Shockley's second year and became the hostel for the world's greatest scientific minds. Einstein stayed there, eating and kibitzing in the plush dining room. Physics was entering its golden age and if you wanted to see the movers and shakers you would do well just to hang out in the lobby of the Atheneum.

Most of the students commuted from homes in the Los Angeles area; the few graduate students who were not local took up the scarce dorm rooms but mainly rented rooms in the neighborhood. There were no undergraduate dorms. At noon the school emptied as the commuters, by car and electric trolley, went home.¹

Shockley loved the class structure, created by Pauling, which differed greatly from his experience at UCLA. The school grouped students into sections, 15 or 20 to a section, who attended all their classes together. All freshmen (despite his year at UCLA, Shockley was considered still a freshman) and sophomores took more or less the same courses no matter what their majors. Only in the junior year did students begin to


specialize. Shockley felt it gave every Caltech student a firm basis for the courses that followed. The exception was physics. There, he found himself in one of the two honors sections that provided accelerated instruction. The competition to get into those sections was fierce and the competition within the sections even worse.

By this time, 1928, Shockley had grown to his full height of 5' 8" and weighed about 130 pounds with a sleek body of muscle and bone that he nurtured with constant exercise. He was fit and handsome enough to pick up extra money modeling for a sales pamphlet published by the manufacturer of the Trelor Strength program. Shockley is shown in a series of photographs doing calisthenics with Trelor tension devices. He would never be far from a gymnasium or a swimming pool the rest of his life, and never weighed more than 150 pounds.

His blue eyes had darkened even more, turning flinty steel gray. His brown hair was just showing the first signs of thinning. He had turned into a quick-moving bright young man, sure of himself, eager to get going, and aggressively competitive. He carried that sense of

BASIC STRENGTH EXERCISES


1. "SIT-UPS"



Position A

From lying on the back (position a), raise the feet touching the heels, raise up sitting. Continue the movement forward till the knees reach the floor between the knees (position b). Weak persons may make this exercise a walk under by swinging the knees over the feet beyond the head instead of holding the inner tips of the forefeet. It may be necessary at first to have the feet held down in some manner, but the exercise should be practiced till the risk of bowing up in a sitting position without the feet being held down is avoided.

Weak persons may start with ten counts. Stronger persons can do fifteen or more the first time. The number of counts should be increased by adding one count every day or two up to thirty. Do not increase the count beyond thirty.




Position B

**Read AL TRELOAR
in the Sports Section**

By AL TRELOAR

2. "FLOOR-DIPS"



Position C


Let face downward, hands on the floor even with your chest, about three feet apart and feet straight parallel to front up by straightening the arms. Keep the body straight from neck to heels. A set of about ten counts should be done the first day. The number of counts should be increased by adding one count every day or two up to thirty.

Weak persons, unable to do upright body floor-dips, may start the body straight ahead on feet on the floor. The arms should be fully straightened each time.

TIME OF DAY FOR EXERCISE

Do the ten exercises, the "sit-ups" and the "floor-dips" first morning on feet getting out of bed. Do not do more than three sets in the morning.

Some times later in the day, perhaps just before dinner, but any way at least six hours after you start, do the exercises mentioned on the following pages.



Position D

**THE LOS ANGELES
EXPRESS**

Figure 6 Shockley advertising Trelor Strength equipment during the Caltech years.

competition with him at Caltech. It became fuel for both his meteoric rise and his disastrous fall.

He had by now also gained two other aspects to his personality that he carried happily until the world around him got too serious. They ensured that no matter where Bill Shockley worked or studied he would be impossible to ignore.

Sometime during high school he learned magic tricks and became an accomplished amateur magician, very popular at parties, usually the first adult invited to children's birthdays. This ability also made him dangerous on a speaking platform in later years: he would introduce a speaker, reach over to shake his hand and a bouquet of flowers would blossom from his sleeve; or worse, a live dove would erupt from his jacket and circle the room in reconnaissance. He was picked as discussion leader at meetings or as master of ceremonies at some risk to the hosts.

To this he added an extraordinary talent for practical jokes. His colleagues learned to expect the worst. Nonetheless, some of Shockley's greatest stunts are still spoken of around the campfires at places where he studied and worked.

Caltech was exactly the right place for Bill to exercise his talent for magic and mischief. He earned spare income doing magic at parties, and practical jokes have always been considered an art form there. Dismantling huge restaurant signs overnight and transplanting them to the campus is considered child's play by students; exploding devices at the mid-field line during football games became a cliché in later years, even when the game did not involve Caltech's talent-challenged, near-sighted football team.

Shockley undoubtedly participated in some of the traditional stunts, but his endeavors tended toward the more subtle and complex, relying less on explosions and flashing lights. Fifty years after the event, for instance, grads still remember Shockley's finest performance: the adventures of 'Helvar Scavi.'

Fritz Zwicky was a Caltech physics professor of considerable ability. He frequently ended a class by putting a complicated formula on the blackboard and told the students: 'This is the answer. Now come back and tell me the question.' German-Swiss, with a heavy German accent, Zwicky was capable of being unkind. Before dissertation defenses, students often visited professors on their examination committee. The professors would tell the students in general what questions they expected to ask during the oral exams. Zwicky sometimes lied, trapping the

student with questions that in no way matched what he actually asked. Graduate students were not amused. But he had one weakness: he never had any idea who was supposed to be in his class.

All this made him a perfect mark for Shockley. Using a blank registration card, Shockley enrolled a completely fictitious student named Helvar Scavi in Zwicky's class one autumn. At the mid-term exam, traditionally an open book test, Shockley arranged for an extra student to show up in the class. With no tally of registered students, neither Zwicky nor his teaching assistants noticed. When the test was distributed, the student took a copy and slipped it out the window, where another student ran with it to a nearby office. There, Shockley had gathered a group of students who had already taken the course, as well as a number of faculty members who, of course, knew the answers. According to legend, one was an unusually gifted young physicist named J. Robert Oppenheimer. They answered the first few of the five questions perfectly and then scribbled in: 'Well, I'm too damn drunk to write any more.'

The test book was slipped back to Zwicky's classroom and turned in.

This continued through the year, with Scavi answering most of the questions brilliantly, not filling in a few just to confuse the professor. Zwicky, who never caught on, was amazed at Scavi's brilliance.

Zwicky got revenge – unintentionally. Marking on his version of a curve, he gave Scavi an A and every other student in class a C–.¹⁸

The humor acted as a release from the pressures of what had become one of the most serious science institutions in the world. To keep competitive, Shockley found himself going back to Stanford every summer for additional courses, particularly in physics and especially when Perley Ross was teaching.¹⁹

Two professors at Caltech appeared to have had the most influence on Shockley. William Vermillion Houston, later president of Rice University, gave the introduction to theoretical physics. Houston was a superb teacher whom Shockley remembered all his life. The other was the imaginative Richard Tolman. Tolman's vision extended as far as science could see and comprehend. It was his work – and Millikan's money – that brought Einstein to Caltech in 1931.

Houston, Millikan and Tolman involved Caltech in one of the greatest revolutions in the history of science, a profound intellectual battle that transmuted physics. These men – especially Millikan – made Caltech an active center for the coming encounter. Shockley had a clear view of the action.

The battle raged over nothing less than humanity's view of nature. Every physics textbook was being rewritten, seemingly every other month. Millikan and Tolman were deeply involved, having bet their reputations and the reputation of Caltech on the young rebels then joyfully revolutionizing their science. Nothing could be more profound or seductive than the intellectual tumult that engulfed the campus. At Caltech, Copenhagen, Heidelberg and Göttingen, physics and existentialism became one.

Shockley was swept up in the maelstrom.

Index

- abortion, Shockley's support for 202
acoustic mines 64–5
actuaries 67
Air Force Association Citation of Honor 128
amplifiers 88, 97
Andrews, Martin 248
anti-submarine crews 73
Anti-Submarine Warfare Operations Group 65, 67
 discovery of British code-breaking success 74
 expansion 76–7
Anti-Submarine Warfare Unit 65
Arnold, General H. H. ('Hap') 81, 83–4
arsenic 96
artichokes 36–7
Associated Press 252–3
ASWORG *see* Anti-Submarine Warfare Operations Group
AT&T Bell Telephone Laboratories 40
atomic bomb 83
 cost–benefit analysis 84
 Soviet 90
audion 88
Australia 81
- Babbage, Charles 71
back flips 47
Bailey, Jean
 appearance 34
 birth of Alison 36
 birth of Richard 92
 birth of William 69
 birth and upbringing 33
 cancer 134
 death 240
 first pregnancy 35–6
 good hostess 100
 housework 35
 learns rock climbing 49
 marries Shockley 33
 miscarriage 85
 motherhood and 37
 parental failings 133
 relationship with May following divorce 145
 religion 133
 second pregnancy 64
 teaching job 63
 tea circle 36
 third pregnancy 85
 trains as teacher 58
 YWCA job 47
Baker, Wilder 65
Bardeen, John 93
 career 94–5
 moves to University of Illinois 126
 Nobel Prize 150
 Nobel Prize trip 153–4
 p-n junction research 99, 101–3
 recruited by Kelly 95
 transistor group breakup 125
 upbringing 93
Beckman, Arnold 146
 attempts compromise over mutiny 180
 career 164–5
 concerns about costs 176
 confronts Shockley about mutiny 177–8
 funds Shockley Semiconductor 165
 humiliated by Shockley 176
 reduces contact with Shockley 185
 renegotiates Shockley's contract 185
 sells Shockley Semiconductor 186

- upbringing 164
- Bell Labs
 - closeness of Shockley's group 100
 - early assignments 48
 - informal study group 54
 - investigates nuclear fission 59–61
 - moves to Whippany 58
 - patents 48
 - pay raises 131
 - procedures 55
 - semiconductor research 98
 - Shockley's recruitment role 131
 - status of 93
 - symposium for military contractors 128
- Benzer, Seymour 119
- Beyers, Bob 253–5
- Blackett, Patrick 65, 70
 - career 71–2
 - Tizard Committee 71
 - works with Rutherford 71
- Blackett's Law 72
- Bohemian Club 199
- Bohr, Niels 24, 26
 - brings news of fission to US 58
- Bohr–Sommerfeld model 25
- bombing
 - cost–benefit analysis 82
 - Germany 82
 - ineffectiveness of 72, 82
 - Japan 83–4
- boron 96
- Boucharard, Thomas 269–70
- Bowles, Edward 74
- Boyle, Lord 233
- Bradford, William (pseudonym) 136
- Brattain, Walter
 - career 53–4
 - education 53
 - moves to Whitman College 127
 - Nobel Prize 150
 - Nobel Prize trip 153–4
 - p-n junction research 102–3
 - relationship with Shockley 111
 - transistor group breakup 125
 - unsettled by Shockley 126
 - upbringing 52–3
- Bray, Ralph 113
- Brewster, Kingman 238–9
- Buckley, William F. 238–9
- Bunting, Glenn 242
- Bush, Vannevar 64
- California Institute of Technology
 - 16–21
 - cancelled events 219, 238
 - car crash 188–9
 - casualties, proposed study of 82–3
 - Cavalli-Sforza, Luigi 236–7, 245
 - caves 50
 - Cedric X 236
 - Ceylon 81
 - Chen, Ed 258
 - Clevite Corp. 186
 - Clouthier, Mary 234–5, 266
 - resigns 235
 - Cohn, Victor 191–2
 - Commonwealth Club of San Francisco,
 - speech 213–14
 - reaction to 214
 - Shockley's defense of 214
 - Compton, Karl 38
 - computer
 - invention of 129
 - replacing vacuum tubes with resistors 129
 - Condon, Edward 29
 - conversations, recording 233
 - copper oxide rectifiers 55
 - Coyle, Bud 181
 - Creative-Failure Methodology 103
 - creativity 172–3, 230–1
 - crystal lattice 96
- Darrow, Karl, lecture interrupted by
 - mechanical duck 45
- Davenport, Charles 207–8
- Davis committee 224
- Davisson, Clinton J. 40
- debates 215, 236–8
 - opponents' tactics 251
- de Broglie, Louis 25
- delicatessen acid attack 194, 200–1
- demonstrations 215, 219, 235–6, 256
 - taking advantage of 255
 - timing for news bulletins 252
- Depression, effects of 32, 41
- depth charge problem 66

- dinner parties 36
 diode, invention of 87
 divorce 145, 147
 doping 96
 Draper, Wycliffe P. 221
 duck prank 45
 dysgenics 208
- Edison Effect 86–7
 Edison, Thomas 86
 Einstein, Albert 23
 Nobel Prize 23
 view of physics 26–7
 electron
 discovery of 86
 nature of 26
 electron multipliers 48
 Electrons and Holes in Semiconductors 121
 elevator prank 38
 eugenics 206–9, 211
 association with Nazis 248
 ethical argument for 209–11
 Nazi support for 208–9
 Eugenics Record Office 208
 executive bends 75
 Expert Advisor to the Secretary of War 81
- Faculty Ghetto 198–9
 Fairchild Semiconductor 182
 place in Silicon Valley's history 187
 success of 186
 Fairchild, Sherman 182
 funds Shockley's mutineers 182
 Fairchildren 183
 family life
 absence of physical affection 133
 Gillette 57–8
 marital breakup 136
 New York 47–8
Fandango (boat) 197
 field effect amplifier 104–6
 see also p-n junction
 Fisk, Cynthia 100
 Fisk, James B. 32, 38
 joins Bell Labs 48
 Fleming, John 87
 flight crews, training 73, 79
- de Forest, Lee 87–8
 Foster, Pocahontas 51
 Foundation for Research and Education on Eugenics and Dysgenics 258
 FREED *see* Foundation for Research and Education on Eugenics and Dysgenics
 Frisch, Otto 58
- Gaiety Parisienne (Offenbach) 132
 Galton, Francis 206
 genetic deterioration 194
 genetics, probability and 195
 genius, Terman's definition 227
 germanium 95
 doping 117, 122
 Lark-Horovitz's research 97–8
 Germer, Lester 40–1
 Gibbons, Jim 163–4, 173
 collaboration with Shockley 175
 Gibney, Robert 99, 101
 Goldsby, Richard 268–9
 Goodell, Rae 232, 252
 refuses to work for Shockley 260
 Gould, Steven J. 247–8
 Graham, Robert 257
 gun, confiscated by police 31
 Gustavus Adolphus College 190–1
 1975 Nobel Conference 241
 dedication of Nobel Hall 190–1
 first Nobel Conference 192–3
- Handler, Philip 224
 Hanifan, Maurice 180
 Hansen, Bill 32
 Harvey, Marion 132
 relationship with Shockley 144–5
 Heisenberg, Werner 25
 Heisenberg's Uncertainty Principle 26
 Herring, Conyers 67
 Herrnstein, Richard 244
 H-index 205
 Hirsch, Jerry 242, 247–8
 statements about Shockley 249
 Hobie Cat (boat) 197
 Hoff, Ted 184
 holes 96–7
 honeymoon with Jean 35
 Houston, William Vermillion 20

- India, Shockley's impressions of 80
 Innis, Roy 238, 242
 innovation 173
 Intel Corp. 184
 intelligence
 anomalies 195
 dogs 246
 genetic component 194, 213–14, 269
 heritability of 244–7
 nature of the debate 245–7
 race and 201–2
 selective breeding 246
 twin studies 201
 International Telephone & Telegraph Co. 186
 IQ
 African-Americans 201
 correlation in twin studies 270
 creativity and 230–1
 heritability survey 249–50
 predictor of success 229
 Termites 228
 IQ tests
 Jean refuses to test Alison 63
 Shockley's attitude to 13

 Japanese code broken 80
 Jenks, Christopher 218
 Jensen, Arthur 215–16, 244
 attacks on 218
 enters race and intelligence debate 217
 insulted by Shockley 216
 utilizes Shockley's statistical skills 216–17
 Jewett, Frank B. 40
 Jim Twins 269
 John Scott Medal 128
 Joint Research and Development Board 90
 Jones, Syl 260–2
 junction transistor *see* transistor;
 junction

 K 242–3
 Kamin, Leon 248
 Kelly, Mervin 41, 89, 93
 Knapic, Dean 174

 Korean War 127
 Kusch, Polykarp 193, 241

 L 242–3
 laboratory logbooks 102
 Magic Month 102
 Lake George 49
 Lamar, Robert 202, 254
 Lanning, Emily 137
 assists with recruitment 146
 becomes Shockley's assistant 235
 car crash 188
 career 142
 dates Shockley 141, 143
 denial of Shockley's insensitivity 266
 discusses paper with Shockley 138
 hearing loss 266
 leaves office unaltered after Shockley's death 273
 life after Shockley 273
 marries Shockley 148
 meets Shockley 137
 moves to Ohio 143
 upbringing 142
 Lark-Horovitz, Karl 97
 request for silicon 117
 Laughlin, Harry 208, 221
 Leach, W. Barton 72
 Leeds University 233
 LeMay, General Curtis 83
 Lewontin, Richard 247
 light bulb 86
 light, nature of 22, 26
 Lilienfeld, Julius 97
 patent conflict 116
 Linvill, John 166
 loudspeaker, flying 127–8
 Lyman, Richard 238
 Lysenkoism 225

 Magic Month 102, 104
 magic tricks 19
 mail
 document numbers 234
 filing 233–4
 Manhattan Project 83
 marriage
 children's reaction to 148

- difficulties 63, 75, 78, 90
 - easing 75
 - to Emily Lanning 148
 - to Jean Bailey 33
- Maxwell, James Clerk 22
- McGee, Dubois 236
- McMurry-Hamstra 170
- Meitner, Lise 58
- microprocessor, invention of 184
- military efficiency 73–4
- Millikan, Robert 16–17, 24
- MIT student exchange with Princeton 38
- modeling 18
- Moore, Gordon 169
 - career 169
 - co-founds Fairchild Semiconductor 183
 - co-founds Intel 184
 - joins Shockley Semiconductor 169
 - mutiny and 178
 - opinion of Shockley's management skills 173
 - upbringing 169
 - wealth 187
- Morse, Philip 39, 64–5
 - appearance 39
 - career 40
 - moves to MIT 41
 - personality 39
 - recruits Shockley to ASWORG 65
 - returns to Washington 73
 - upbringing 39
 - visits Blackett with Shockley 70
- Morton, Jack 212
- Mother Bell's Cookbook 129
- Muller, Herman Joseph 211
- National Academy of Sciences
 - changes rules 224
 - response to speech 205
 - speech to 204–5
- National Medal of Merit 85
- National Science Foundation 123
- Nelson, Lyle 253
- Newton, Isaac 22
- New York apartment 46
- Nobel Prize 150
 - banquet 157–8
 - celebrations 150, 153
 - ceremony 156–7
 - committee dinner 159
 - lectures 158
 - monetary value 158
 - other 1956 prizewinners 155
 - palace dinner 158
 - physics 152
 - political machinations 152
 - rumors 151
 - Shockley's claim to 153
 - Shockley's paranoia about 151
 - significance of 151
 - student banquet 159–60
- Noyce, Robert 146, 169
 - career 169
 - co-founds Fairchild Semiconductor 183
 - co-founds Intel 184
 - doubts about Shockley Diode 171
 - joins Shockley Semiconductor 170
 - mutiny and 179
 - upbringing 169
- n-type 97
- nuclear fission 58
 - Bell Labs research 59–61
 - chain reaction 59
 - explosive 60
 - implications of 59
 - uses 60
- nuclear reactor, patent application 61
- nuclear war, Shockley's opinions on 191–2
- nurse 6
- Ohl, Russell B. 56
- operations research 71
- operator (media) 250, 252
- Oskar and Jack (twins) 270
- oxide rectifiers, copper 54
- paranoia 232
- patents 48, 102
 - Bell Labs 111
 - Bell Labs' concern about challenges 126
 - consideration 111
 - junction transistor 118
- Perlman, David 214

- Pettit, J. M. 196
 photons 24
 physics, Golden Age 27–8
 Pierce, John 48–9
 pin incident 175–6
 Pioneer Fund 221
 Pitzer, Kenneth 219
 Planck, Max 22
Playboy interview 261–3
 p-n junction 56
 Bardeen solves problem 101
 electrolyte 104
 failure to produce 99
 inversion layer 104
 surface barrier 102–3
 see also field effect amplifier
 point-contact transistor *see* transistor,
 point-contact
 polygraph test for Nobel Laureates
 241, 244
 population 193
 Shockley warns about growth of 192
 Shockley's views about 194
 Potter, John 31
 practical jokes 19–20
 proximity fuses 127
 p-type 97
- quanta 23
- race, Shockley's ideas about 51–2,
 262–3
 raceology 262
 radar 68
 Blackett's contribution 71
 possibility of German 68–9
 Radiation Laboratory 64
 radio, solid state 99
 Ramsay, Paul 209–11
 rectification 87
 regression 263–4
 religion 47, 133
 Repository for Germinal Choice 257
 research on race, opposition to 249
 reverse charisma 267
 Richmond, Sarah E. 6
 quits 10
 Robertson, Robert 72
 Rock, Arthur 181
- rock climbing 41, 49
 Roger, Jeanine 136
 Rogers, Michael 260
 Ross, Perley 13, 20
 Ross, Ruth 139
 Rothman, Stanley 249
 Rusher, William 238
 Rutherford, Ernest 24
- Sah, S. T. 178
 sailing 197–8
 accidents 198
 Saipan 81
 Santa Clara Valley 165
 Scavi, Helvar 19–20
 Schawlow, Arthur 131
 Schrödinger, Erwin 25
 Schrödinger's Cat 27
 scientists
 in wartime 64, 72
 culture clash with military 76
 relationship between productivity and
 creativity 172
 theoretical vs. applied 110
 Second World War
 preparations for 62
 Seitz, Frederick 29
 becomes president of Rockefeller
 University 223
 offends Shockley 225
 opinion of Bardeen 94
 opinion of Shockley 31
 president of NAS 205
 travels east with Shockley 30
 semiconductors 95–6
 servants, problems with 8
 Shannon, Claude 131
 Shockley Diode 171
 attempts at secrecy 175
 inability to manufacture 171, 176
 Shockley Semiconductor Co. 163
 announced to media 167
 location 165
 mutineers resign 181
 mutiny 176–81
 outperformed by Fairchild 183
 place in Silicon Valley's history 187
 premises 168
 recruitment tests 170

- sold to Clevite Corp. 186
 - sold to International Telephone & Telegraph Co. 186
- Shockley, Alison 199
 - birth 36
 - leaves home 134
 - marries 144
 - reads of father's death 273
 - relationship with father 133–4
- Shockley, Hanna-ko 264
- Shockley, Jean *see* Bailey, Jean
- Shockley, May
 - death 239–40
 - diaries 15
 - gifts to William and Jean 35–6
 - grandmother of the transistor 153
 - hoarding 11, 240
 - IQ 13
 - marriage 5
 - meets William 3
 - moves to Palo Alto 199
 - painting 92
 - post-partum depression 7–8
 - pregnancy 5
 - sends money to Jean 145
 - Shockley's relationship with 14
 - upbringing 3
- Shockley, Richard 91
 - birth 92
 - car crash 188
 - daughter 264
 - moves to live with father 198
- Shockley, William
 - ancestry 4
 - career 5
 - death 15
 - diaries 5, 7, 11
 - first stroke 15
 - marriage 5
 - meets May 3
 - records of son's development 7
 - relative age 14
 - second stroke 15
- Shockley, William Alden 199–200
 - birth 69
- Shockley, William Bradford
 - absences from home 74–5, 77
 - trip to Britain, India etc. (1944) 80–1
- Air Force Association Citation of Honor 128
- appendicitis 38
- arrives at MIT 31
- association with racist groups 268
- atheism 133
- bacterial infection 149
- birth 6
- birth of Alison 36
- birth of Richard 92
- birth of William 69
- boorish swimming pool behavior 266
- breaks off contact with Seitz 225
- business decisions 170–1
- buys first house 92
- buys flowers for Emmy 139
- buys house in Los Altos 149
- car crash 188
- chair at Stanford 196
- childhood temper 9–10
- competes with own staff 174–5
- criticism of children 263
- criticizes reluctance to do research 213
- date of birth 3
- dates Emmy Lanning 141, 143
- death 273
- decides to start company 145
- declaration of love for Emmy 267
- dependence on Emmy 264
- diary 139
- discusses marriage with Emmy 147
- dissatisfaction at Bell Labs 130
- dissertation 38
- divorces Jean 145
- donates sperm to sperm bank 256, 258
- drives away friends 235
- early development 7
- early education 11
- early relationship with Jean 34
- elected to National Academy of Sciences 128
- enters high school 15
- enters university 16
- exercise regime 47
- first home with Jean 35
- graduation 41

- growing disorganization 234–5
- home life with Emmy 265–6
- inability to reconcile wartime work with home life 78
- interviewed about Gustavus speech 200
- Jean's cancer and 134–5
- John Scott Medal 128
- joins Bell Labs 41
- Korean War work 127
- lack of people skills 75, 79, 131, 173–5, 216
- learns to sail 197
- leaves Jean 135
- leaves transistor team 110
- letters to Emmy 139–40
- magic tricks 159
- management style 172
- manipulates news media 250–3
- marriage problems with Emmy 265
- marries Emmy 148
- marries Jean Bailey 33
- mid-life crisis 124
- Military Academy 11–12
- misinterprets interpersonal problems with staff 185
- moves to Caltech 16
- moves to Faculty Ghetto 198
- moves to Gillette 56
- moves to Madison 63
- moves to New York 46
- National Medal of Merit 85
- Nobel Prize 150
- Nobel Prize trip 155–60
- not promoted by Bell Labs 131
- nuclear fission research 59–62
- obsession with racial theories 232, 243–4
- offered job at Bell Labs 212
- offered job by Pentagon 123
- office chaos 265
- opinion of own management skills 172
- overlooks black reporter 261
- paranoia 232
- parental failings 133
- passes MIT exams 37
- Pentagon consultancy 85, 123
- physique and appearance 18–19
- poor public speaker 251
- post-war military work 90
- preference for applied physics 111
- proposes human quality program to Stanford 222–3
- prostate cancer 271–2
- records telephone conversations 232
- recruits staff for company 146, 150, 168
- reduces physics activities 220
- refuses to contact children when dying 271
- relationship with Bob Beyers 254–6
- relationship with media 214–15
- returns to Washington (1942) 73
- rock-climbing 132
- runs for Senate 268
- seeks funding for genetics research 221, 223
- semiconductor research 98
- sense of humor 100
- sets requirements for interviewers 260
- sets up problem solving program 199
- signature 38
- speaking engagements 144
- speech at Gustavus 193–6
- sues for libel 259–60
- suicide attempt 77–8
- support for 220
- support for war effort 66
- takes job at Stanford 150
- teaches Jean physics 35
- teaching role at Stanford 196–8
- temper 91
- travels to MIT 30
- trip to Europe (1950) 128
- TV appearance 259
- violence towards children 91, 134
- visits Bill in New York 200
- visits Blackett with Morse 70
- working at home 102
- workload at MIT 32
- writes textbook 121
- Yale job offer 41
- Shockley's Ceiling 132
- Shockley's parents
 - attempts to deal with son's temper 9–10

- continental trips 8
- friendship with Herbert Hoover 5, 12
- life in London 5–6, 8
- life in Palo Alto 10–11
- money troubles 5, 8
- move to Los Angeles 15
- return to US 10
- unstable lifestyle 7, 11
- signature 38
- silicon 95
 - transistors 170
- silicon rectifier 56
- Slater, John C.
 - poor relationship with Shockley 32
 - warning letter to Shockley 29
- Sly Sharpie* (boat) 197
- Snyderman, Mark 249
- social Darwinism 206–7
- Society for the Psychological Study of Social Issues 218
- Society of the Ever-Smiling and Leaping Frog 159
- sociobiology 247
- Sommerfeld, Arnold 24
- Sparks, Betty 100, 121
- Sparks, Morgan 117, 121
 - doping germanium crystals 122
- speeches
 - difficulty of reporting 250
 - Shockley's style 251
- sperm bank 256–7, 259
 - closes 258
 - supplying sperm to customers 257–8
- splinter 11
- Stanford M.D.* 203
- Stanford University
 - industrial park 166–7
- Stanford University News Service 202, 253–4
- Stanford Workshops on Political and Social Issues 237–8
- Stanford–Binet IQ test 13, 227
- sterilization 195, 208
 - recommended by Shockley 202
- submarines
 - British request US help 70
 - exhaustion hunt method 74
 - finding 66–8
- suicide note 77–8
- SUNS *see* Stanford University News Service
- swimming 266
- SWOPSI *see* Stanford Workshops on Political and Social Issues
- Tate, John 65
- Tatum, Edward 193
- tea circle 36
- Teal, Gordon 122
- telephone conversations
 - logbook 232
 - recording 232–3, 242–3, 255
- tennis problem 163
- Terman study 226–30
 - flaws 228
 - omissions 230–1
- Terman, Frederick 166
- Terman, Lewis 12–13, 226
 - tests Shockley 13
- Termites 227–8
 - children of 229
 - success of 229
- Thomson, Joseph John 86
- Three-Hours-for-Lunch Club 40
- Tolman, Richard 20
 - teaches Bohr–Sommerfeld model 25
- transistor
 - credit for 111, 116–17, 120–1
 - demonstrated to senior management 109
 - first consumer product 130
 - germanium vs. silicon 109
 - inability to keep secret 109
 - invention of 105
 - junction 119
 - first 122
 - manufacturing 130
 - media realize significance of 129
 - naming of 107
 - national security concerns 119
 - need for secrecy 113
 - point-contact 107
 - drawbacks 118
 - improvements to 112–13
 - media indifference 120
 - patents 111, 116
 - press conference 119–20

- volume production 128
- Shockley understands significance of 130
- Shockley's contribution 108
- Shockley's plans for improved version 112, 114–15
- Shockley's reaction to invention of 107
- transistor effect 105
- transistor group, breakup 110, 125–6
- transistor radio, first 130
- travel, wartime 69
- triode 88
- twin studies 219, 269–70
 - Thomas Bouchard 269–70
- U.S. *News* interview 200–3
 - reaction to 203–4
 - Shockley's defense of 204
- U-boats *see* submarines
- UNIVACS 129
- vacations 49, 75
- vaccum tubes 88–9
- Van Vleck, J. H. 53
- Vee, Lou 148–9
 - death 199
- Venerable, Grant 52
- wartime
 - flying to London 70
 - London 70
- wave mechanics 25
- Weapons Systems Evaluation Group 140
- welfare recipients 202
- Weyher, Harry F. 221
- Whaley, Randall 98
- Will to Think 103, 112
- Wilson, Edmund 247–8
- Wirtz, Willard 200
- Witherspoon, Roger 259
- X 16
- Young, Thomas 22
- Zwicky, Fritz 19–20