1 | Was Einstein Dyslexic, a Late Talker, and a "Lazy Dog"?

Today dyslexia is recognized as a common learning disability. In several countries, it is customary to screen children for the disorder before they start school. Some think that Albert Einstein—along with Michael Faraday (Einstein's idol), Thomas Edison, and Alexander Graham Bell—may have been dyslexic. The symptoms of dyslexia include transposing and omitting letters and numbers and scrambling sentences.

Dyslexics take comfort in the belief that Einstein was one of them—pointing to his many accomplishments.

Was he, in fact, one of them?

The reality is that among the many thousands of documents in the Einstein archives, there is not one thing to indicate that he had the disability. Quite the reverse. His writing demonstrates that he had no trouble expressing his thoughts clearly and understanding, as well as creating, complex mathematical formulas. Only if the term *dyslexia* was to cover a broader range of learning disabilities could Einstein be called dyslexic.

The question remains whether Einstein was a slow learner. Some say that he was four or five before he first spoke. Others even say seven. The implication is that the future genius, far from being a child prodigy, was mentally retarded, and later, so the story goes, he was at best a mediocre student all through his school and college days. Let's consider the facts.

His maternal grandmother, Jette Derzbacher, and her husband, Julius, saw Albert when he was two years and three

months old. Immediately afterward she wrote to Albert's mother, Pauline: "He was so good and dear and we talk again and again of his droll ideas." How could he have expressed droll ideas without speaking?

Maja, his younger sister, provides more evidence to dispel the myth that he was silent until he was three or four. She wrote in a memoir—presumably based on what she was told by her parents—that before her birth, when Albert was two and a half, he had been promised a baby to play with. To him, this must have meant a new toy, because, on her appearance, he asked, obviously disappointed, "Where are the wheels?" Quite a quip from someone reputed not to be talking at all.

It is reasonably established, then, that he began talking somewhat late, at about the age of two.

Einstein himself surmised that he kept silent for so long because he wanted his first words to be a complete sentence, which sounds like a wisecrack. He wasn't above contributing to his own mythology. Fellow scientific greats Edward Teller and Richard Feynman and mathematician Julia Robinson are reputed to have been late talkers, too. At two and a half, Teller spoke his first words: "really" and "yes." The delay may have resulted from Teller's growing up in a bilingual home, where Hungarian and German were spoken. Feynman was silent until he was two, then he talked nonstop.

Some have suggested that late talkers may well become superbright in science and math. Author Thomas Sowell called late talking "the Einstein Syndrome," which is also the title of his book. Unfortunately, young Einstein became the late talkers' poster child.

Speech therapist Wendy Grant warns: "The trouble with the Einstein Syndrome is that parents with a child who is a late talker say, 'Oh, he's just another Einstein,' and leave it at that. But if a child hasn't said a word by eighteen months, something should be done about it."

Another speech therapist, Misty Williams, says, "Most children utter their first words like ball, baba, or ada between ten and twelve months. If a child hasn't spoken by eighteen months, that's a red flag. He or she should be taken to a speech therapist. There could be many explanations, such as chronic ear infection, asthma, or being in an environment where the child isn't getting enough mental stimulation. None of those, apparently, explain Einstein's case."

Speech therapist Linda Kuchner defines late talkers as "children between eighteen and twenty months who speak fewer than ten words; those between twenty-one and thirty months who speak less than fifty words and no two-word combinations. Between seven and twelve months, a child should speak one to three words. From thirteen to eighteen months, three to twenty words. From nineteen to twenty-four months, fifty words or more.

"If Einstein wasn't saying a word at twenty-four months he was definitely a late talker. But he was also a genius. Maybe there are different rules for them. Didn't he once say: 'I don't even know my telephone number, because I never bother to remember anything I can look up'?"

Barbara Wolff at the Einstein Archives, the Jewish National and University Library, Jerusalem, comments that the above quote "sounds quite authentic. In order to not contribute to the growing amount of false, twisted and completely forged Einstein quotes, I would suggest you use it 'as quoted by [somebody].' If I am not mistaken the quote was published in J. Sayen's 'Einstein in America.'" What Sayen quoted there was Einstein's answer when asked the speed of sound: "I don't know," he replied. "I don't burden my memory with such facts that I can easily find in any textbook."

The big change in Einstein's behavior manifested itself when he was five. He was ill in bed, and the strange force of the magnetic compass his father gave him intrigued and baffled him. Why did the arrow always point in the same

Albert Einstein, 6, and his sister, Maja, 4. They were not then close friends.

direction, no matter how much he shook it or tried to catch it unawares? This was the sort of mystery he never gave up trying to solve.

Until he was seven Albert was tutored at home. His mother was overjoyed when, instead of his being the backward boy she feared she had produced, the tutor said Albert was exceptionally bright. But later his mother was crushed when she read his first elementary school report, which rated him dull-witted.

What reasons did his teachers give for such an assessment? Apparently he didn't mix with the other boys and couldn't learn by rote, and instead of immediately answering a question, he would hesitate and whisper the answer to himself before saying it aloud.

Einstein had apparently adopted this unique defense mechanism to cope with a system that terrorized students into learning their lessons by rote. The wrong answers got painful raps on the knuckles. Albert simply couldn't learn by rote, especially if the subject bored him. Speech therapist Kuchner thinks that to avoid the pain and humiliation of a wrong answer, Einstein would make a trial run to make sure he had it right.

Speech therapist Williams suggests another motive. "This could be the behavior of a perfectionist," she says. "A bright person who is also a perfectionist might say the answer to himself first, before speaking."

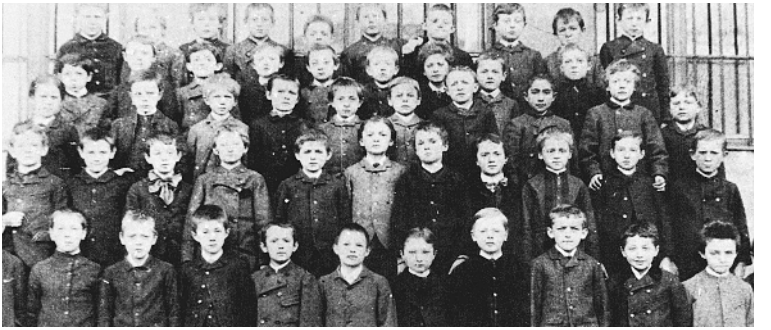
Einstein knew that his teachers had him tagged as mentally slow, unsociable, and adrift forever in his foolish dreams. He told his son Hans Albert about this characterization many years later. In fact, his autocratic teachers resented his attitude and odd verbal behavior so much that even though, at seven, his marks put him at the top of the class, they gave him a low rating.

Einstein's contemporary George Bernard Shaw, by contrast, seems to have been born with the gift of the gab but had an equally miserable time as a schoolboy. Shaw considered school to be even more cruel than prison, because prisoners were not forced to read books written by the warders, and they were not beaten or otherwise punished if they could not remember the utterly unmemorable contents.

Einstein certainly had learning problems in his early years, but later, in a more congenial and stimulating environment, he completely overcame them. Then it was his attitude and odd behavior, not his lack of ability, that caused his teachers to express a low opinion of him. That he did lose himself in his dreams—as they complained—was true. He was also able to rise above the situation, as is illustrated in a wonderful photograph of his Munich class in 1889. Of the fifty-two boys, ten-year-old Albert alone manages a slight smile. All the others look downtrodden, as though auditioning for the lead in *Oliver Twist* or anticipating the next rap over the knuckles.

His contemporaries, too, found his behavior odd. To his grim fellow students, he was a freak because he wasn't interested in sports and shunned their company.

However, his sister noticed that if anything captured Albert's interest, he gave it unusual, sustained concentration. After watching her compete with friends in trying to build the tallest house of cards, Albert decided to have a go. The reigning champion had made a card house four stories high before it collapsed. Albert's collapsed many times, but he persisted until he finally built one of fourteen stories.



Though he hated his Munich school, Einstein (front row, second from right) is the only one of his class smiling in this early 1889 photo.

At twelve, he hit on his life's work, taking an unusual delight in physics and Euclidian geometry. Mathematics, however, especially algebra, didn't appeal to him in the same way. Then came a transformation, after his father's brother Jakob made it fun instead of force-fed. He aroused Albert's curiosity by announcing, with the air of a magician, that algebra "is a merry science in which we go hunting for a little animal we don't know. So we call it X. When we bag the game, we give it the right name." Between twelve and thirteen Einstein's progress in math and physics as well as in philosophy was amazing, as Max Talmey, a family friend and medical student who frequently lunched with the Einsteins, recalled:

> Albert was profoundly impressed by Bernstein's *Popular Books on Physical Science* which describes physical phenomena lucidly and engagingly. After a few months he devoted himself to higher mathematics. Soon the flight of his mathematical genius was so high that I could no longer follow. Thereafter philosophy was often a subject of our conversations. Albert was still a child, only thirteen years old, yet Kant's work, incomprehensible to ordinary mortals, seemed to be clear to him. Kant became Albert's

favorite philosopher, after he had read through his *Critique of Pure Reason*. Albert also read something by or about Charles Darwin, worked his way through sections of the twenty volumes of *Science for the People* by Aaron Bernstein, and absorbed Alexander von Humboldt's five-volumed *The Cosmos—An Attempt at a Description of the Physical World*.

Albert's inability to adapt well to school continued into his teens. Brilliant at home, he was considered a hopeless case in high school, especially by his seventh-grade teacher of Greek, Dr. Joseph Degenhart, probably because Albert hated Greek grammar and sat at the back during Dr. Degenhart's class, doubtless thinking of something else, like his next violin lesson, or why the sky is blue. Whenever the teacher glanced his way, he caught Albert smiling and finally asked to see him after class. To Albert's dismay, Degenhart suggested that he leave the school, accused him of wasting everyone's time, and predicted that he would never amount to anything. Albert protested that he had done nothing wrong. He had, the exasperated teacher insisted, by sitting at the back and smiling. His mere presence undermined the respect a teacher needed from his class.

But it was a myth that he was a bad student across the board. He showed a special talent for math and Latin. And there were many factors to explain his problems in school. It was a bad time for Albert. His family had moved from Munich to Milan, Italy, where his father, Hermann, hoped to improve his prospects in his electrochemical business. At fifteen, Albert was left in Munich to complete his high school education, looked after by a distant relative. He was miserable at school, where he had no close friends, missed his family, and felt desperate when he thought he might not see them again for three years. He longed to leave the school and join them in Milan, but he was faced with what seemed an insoluble problem. At

eighteen, all fit German males were drafted into the German army and could not leave the country until they'd completed their military service. Help came from the family doctor, Max Talmey's older brother. When Albert consulted him about a minor illness, he spoke of his loneliness and despair with such feeling the doctor feared he was on the verge of a nervous breakdown. So he gave him a to-whom-it-may-concern note saying that if Albert wasn't allowed to join his family abroad he might suffer a complete mental breakdown.

Strangely, Einstein didn't show the note to his Greek teacher, who was eager to see the last of him. Nor to the one teacher he really liked, a Dr. Ferdinand Ruess, who taught history and German. In fact, Einstein enjoyed Dr. Reuss's classes and looked forward to being kept after school for some infraction, if Dr. Ruess was to be his supervisor.*

Instead, he handed the note to the math teacher, Joseph Ducrue, who thought well of his work and presumably would want him to stay. It turned out to be a smart move. The math teacher believed the doctor's diagnosis was correct, sympathized with Albert's plight, and gave him another note saying that he was so good at math there was little more he could teach him. The school principal read the two notes, decided a sick fifteen-year-old student was no good for the school or the army, and gave his approval, virtually a passport for Einstein to join his family in their apartment, Via Berchet 2, in Milan.

In Milan, things began to improve for Einstein, academically and otherwise. He flourished in Italy, where he made friends, visited museums and art galleries, and explored the countryside. He also sometimes worked for his father. The years in Italy were among his most beautiful memories.

*Many years later, probably in 1909, Einstein returned to the school to call on Dr. Ruess, who did not remember him. Einstein was poorly dressed and assumed that Ruess suspected that he was a stranger down on his luck who had come to beg, borrow, or steal from him. Einstein ended the embarrassing encounter with a quick exit.

Albert, about 14, and sister Maja, 12, when they were becoming friends.

He had decided to become a philosophy teacher, but after a struggle he gave in to his father's insistence that he come down to earth and study to be an electrical engineer. Still, he aimed high, applying for entrance to a world-class technical college, Zurich Polytechnic in Switzerland.

One big attraction of Zurich Polytechnic was that if he passed the entrance exam he would not have to finish high school but could go straight to college. So he studied hard, concentrating so much that he was rarely distracted, even in a noisy room.

His sister, Maja, attests to his "rather strange working methods. Even when we had company and there was quite a lot of noise, he would retire to the sofa, pick up a pen and paper, precariously balance the inkwell on the backrest, and engross himself in a problem to such an extent that the many-voiced conversation stimulated rather than disturbed him. After my brother mastered the violin he and mother played piano duets, mostly Mozart and Beethoven sonatas. He became so adept that he would constantly search for new harmonies and transitions of his own invention. More than once I saw that he had solved a problem after a session on the violin or the piano. He would suddenly stop playing and cry out: 'There, now I've got it.'"

The family now had great hopes for Einstein's academic success. His favorite uncle, Caesar Koch, showed friends an essay in which Einstein described an experiment he had thought up to find out if electricity, magnetism, and the ether were somehow connected. At this time it was conventional wisdom, since discounted, that the ether existed as a rarefied element that completely filled the upper regions of space. Koch was proud of this young original thinker and expected him to go far. If anything, Einstein's uncle Jakob was even more impressed. He and an assistant engineer had been struggling for days over calculations needed to solve a tricky technical problem. Einstein offered to help and solved the problem in about fifteen minutes.

The myth has it that Einstein failed his exam to enter Zurich Polytechnic. While technically this is true, the facts are that at sixteen he was too young to take the exam. The rigid rule was that no one could take the entrance exam until he or she was eighteen. Hoping the authorities would make an exception for him, a family friend, Gustav Maier, wrote to the college principal, Professor Albin Herzog, describing Albert as a child prodigy. Herzog was not impressed. Even if Einstein was a child prodigy, he was against taking him from

his high school until he had completed his studies there. But he offered a gleam of hope. If Maier could provide written documentation from the principal of Einstein's high school that backed Maier's opinion of him and confirmed his mental maturity, only then would he take the exceptional step of waiving the minimum-age rule.

It was a long shot. But what seems to have worked is the written testimony Einstein already had from his high school math teacher rating his math knowledge and ability up to graduation standard. With this in hand, Herzog allowed Einstein to take the exam.

But he was doomed to fail, adding to the myth that he was a poor student. Albert had no complaints against the patient and understanding examiners. They certainly weren't the problem. Nor, of course, was his exceptional knowledge of math and physics. But it wasn't enough, as Albert soon realized. The exam covered several other subjects of which he had only a hazy knowledge, especially French, chemistry, and biology. He expected to fail the exam, and did.

However, Einstein's exam results in math and physics were so outstanding that Professor Heinrich Friedrich Weber offered to break the rules—again—for young Einstein and let him attend physics lectures for second-year students. The principal upped the ante with an even better offer: if Einstein went back to high school and graduated, he would be admitted to the Polytechnic without having to retake the entrance exam.

There was no chance that he would return to his high school in Germany. He'd probably have rather gone to work in a bank. Instead, after a family conference, it was decided that he would attend a school with a great reputation in Aarau, Switzerland, twenty miles west of Zurich. Its headmaster, Dr. August Tuchschmid, had been Professor Heinrich Friedrich Weber's assistant at Zurich Polytechnic.

One classmate there, Hans Byland, was among the small

but growing group of people who recognized Einstein not as a hopeless case but as an exceptionally bright and charismatic human being. Byland all but idolized Einstein. As Byland observed:

> His attitude to the world was that of a laughing philosopher and his witty mockery lashed any conceit or pose. He loathed any display of sentimentality, and kept a cool head even in a slightly hysterical atmosphere. Fate decreed that this precise thinker should pitch his tent with the romantically inclined Winteler family where he felt completely happy. Albert did not fit into any mold even as a young man and the school's atmosphere of skepticism suited him. With his gray felt hat pushed back of his mass of silky dark hair, Albert strode energetically up and down in a rapid, almost crazy tempo of a restless spirit. Nothing escaped his large, bright brown eyes, and whoever approached him was captivated by his superior personality. A sarcastic curl of his rather full mouth with the protruding lower lip did not encourage Philistines to tangle with him. Unconfined by conventional restrictions, he confronted the world as a laughing philosopher, and his witty sarcasm mercilessly punished all those who were vain or artificial. We were once on a field trip to the Jura mountains led by the geology professor, Fritz Muhlberg. When the professor asked in his usual gruff way, "Now, Einstein, how does the strata run from here? From below upwards, or vice versa?" Einstein replied, "It's pretty much the same to me whichever way they run, Professor." This showed Einstein's . . . love of truth and gave his whole personality a certain cachet which, in the long run, was bound to impress even his opponents.

But his teachers were still not impressed. He was told that he needed to catch up on chemistry, and to take private coaching in French and natural science. Yet, the liberal

atmosphere of the school delighted him, and he was relieved when he learned that singing, physical training, and military training were not compulsory in his case. He opted out of all of them.

His scores in his Christmas school report for 1895 were 6 in algebra and chemistry (the highest possible); 5–6 in physics; 4s and 5s in the others, except for French, for which he got an abysmal 3, the lowest score of anyone.

Albert's father was not at all fazed by the mixed results, accustomed as he was to Albert's bringing home report cards with a mixture of good and bad grades.

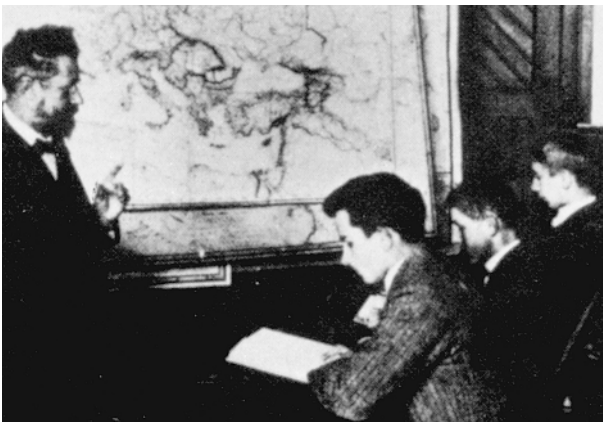
Most of his schoolwork gradually improved, partly because of the warm, intellectual atmosphere provided by the Winteler family with whom he stayed as a paying guest. Jost Winteler, the father, taught Greek and Latin at Aarau high school. He and his wife, Pauline, had four sons and three daughters, and treated Albert like another son. Anna Winteler, the eldest daughter, confirmed that he was far from being the solitary and mediocre student reported by the mythmakers. She knew him as a pleasant member of the household who was fond of initiating scientific conversations and had a great sense of humor and a hearty laugh. In the evenings he usually did his homework or sat around the table discussing various subjects with the others. Anna also remembered that he was no spoilsport and rarely went out.

He managed to incorporate his scientific preoccupations into the conversation at Winteler family meals. He was teaching himself calculus, speculating on the possibility of splitting the atom, and wondering what it would be like to run behind a light wave, keeping pace with it as it made its immense journey through space. This, he recalled many years later, was his first mental experiment connected with the special theory of relativity.

But there was little time or inclination for mental experiments when he began his momentous exam to graduate from

Aarau high school at seven in the evening on September 18, 1896. It took him over two hours to complete the first task: to describe the plot of a Goethe play. Perhaps his heart wasn't in it. Fortunately the examiner, Adolf Frey, gave the mediocre performance a generous 5.

His worst mark was for his essay in French titled *My Plans for the Future*. In it he wrote of his hope to attend Zurich Polytechnic for four years, to study mathematics and theoretical physics, for which he felt most fitted. His ultimate aim was to be a philosophy teacher. French itself was obviously not his forte. There was hardly a line in the essay without a mistake. And the examiner gave it a 3–4—just above terrible. Einstein tackled the exams in geometry, algebra, physics, chemistry, and nature study enthusiastically but carelessly, making several spelling mistakes. But the work itself was exceptional and the examiners obviously overlooked the mistakes. For all those subjects he got an average 5½. This was the highest mark any of the nine examiners gave any of the students taking the exam, in which 6 was a perfect score.



Einstein, with an open book in a class conducted by Jost Winteler, the father of his first sweetheart, Marie. He broke her heart.

As promised, now that Einstein had graduated from high school, he was allowed to enter Zurich Polytechnic without retaking the entrance exam. But the old problems resurfaced. His reception there was a far cry from that at Aarau. The teachers soon resented his attitude, his skipping their lectures, and failing to give them the near worshipful respect that they expected as their right. Instead, he spoke to them and the cleaning women in the same easygoing, friendly manner—as equals. He was a natural democrat, and they didn't like it. Sometimes he gave the impression that he thought he knew more about their subject than they did, which was probably occasionally true.

His reputation outside the classroom was mixed. After only a few conversations with Einstein over coffee at the Metropole café, one classmate, Marcel Grossmann, told his parents: "I believe that Albert Einstein will become a very great man."

But Grossmann was the exception. His perceptive prediction was hardly shared by anyone else. And those exposed to Einstein's absentmindedness scoffed when they heard of his high ambition, especially friends with whom he spent one weekend and left, forgetting to take his suitcase. His host predicted that he would never amount to anything. His Zurich landladies, too, suffered from his forgetfulness. But they liked him so much that neither tried to evict him though he frequently woke them late at night to let him in because, once again, he'd forgotten or lost his house keys.

Marcel Grossmann predicted that Einstein would be a great man and helped him to get his first steady job at the Swiss Patent Office.

His autocratic college professors were much less forgiving. Math professor Hermann Minkowski called him a lazy dog. Physics professor Heinrich Weber had expected great things from Einstein but was irritated when he persistently called him "Herr Weber" instead of the more respectful "Herr Professor." Weber also disapproved of his self-selected study habits. Einstein, for his part, was disappointed with Weber for excluding from his physics course the dazzling ideas of James Clerk Maxwell, considered second only to Isaac Newton (another Einstein idol) in his contributions to science. Maxwell, who died in 1879, the year Einstein was born, had produced one of the first color photographs, demonstrated that light is an electromagnetic wave, was the author of a theory of Saturn's rings and a kinetic theory of gases, and did pioneer studies on electricity and magnetism. He had based some work on Faraday's ideas, but his equations were his own. And they became a mathematical key to unlocking the mysteries of electricity that led to radio, radar, and television.

Hermann Minkowski called Einstein "a lazy dog," and later made use of his work.

Einstein often cut Weber's physics classes to read, for example, Maxwell's astonishing theory that light and electricity were different aspects of the same phenomenon and that electromagnetic action moves through space in waves not unlike, and at the same velocity as, light waves. Although Weber put his foot down when it came to cutting his classes, he understood that students were disappointed that his lectures did not include recent scientific breakthroughs, and he encouraged

them to read the relevant works for themselves. Einstein, of course, needed no such encouragement.

So much reading meant that he was neglecting lab experiments, and when he was criticized for this, he tried to make amends by quickly setting up an experiment while treating with contempt the printed instructions provided by Professor Jean Pernet, his Zurich Polytechnic physics instructor.

Seeing Einstein dump his official instructions on how to conduct an experiment into a wastebasket, Pernet complained to an assistant. He daringly replied that Einstein's methods were interesting and his solutions always right.

A peeved Pernet disagreed and confronted Einstein. "You're enthusiastic but hopeless at physics," he said. "For your own good you should switch to something else, medicine, maybe, literature, or law."

When Einstein ignored the advice and persisted in doing the experiment his way, it exploded, severely injuring his right hand.

While recovering from the accident, Einstein asked Professor Weber if he might try a more ambitious experiment guaranteed not to explode—to measure Earth's movement against the ether. Professor Weber wouldn't buy it, saying, "You're a clever fellow, Einstein, but you have one fault. You won't let anyone tell you a thing."

This response was one of several hints that Weber had become disillusioned with his protégé and was among those who thought of him as a lost cause. Einstein's colleague and eventual biographer Philipp Frank had a different take on him, knowing that he was mostly teaching himself from his own sources: "Day and night, he buried himself in books from which he learned the art of erecting a mathematical framework on which to build up the structure of physics."

Einstein attended a few math lectures by Carl Geiser and by Hermann Minkowski, who considered him a lazy dog. Einstein found some of their lectures fascinating, but had

decided that math was too complicated, with too many distracting aspects, in contrast to physics, for which he was developing a growing passion. With physics he could understand the fundamentals and get to the heart of the matter. Wherever he was, on the veranda smoking his pipe, sipping coffee in a Viennese café, or at a picnic with friends in the nearby forest, he had a book open to study, between breaks in their conversation, the revolutionary theories of contemporary physicists.

Even when sailing on Lake Zurich with his landlady's schoolteacher daughter, Susanne Markwalder, as soon as the wind died, instead of chatting with the young woman, he would turn to the inevitable book in his lap and lose himself in the writings of Maxwell, Hertz, Kirchhoff, or Helmholtz.

In contrast to his lonely existence in Germany, where most classmates had shunned him as an oddity, in Switzerland Einstein made several close college friends—some of whom would be his friend for life. One, Michele Besso, a colleague who was studying electricity, got him to read Ernest Mach's *Science of Mechanics*, which ridiculed Newton's laws of absolute space and absolute motion and suggested that they should be reexamined, updated, and rewritten. Einstein relished Mach's direct, no-nonsense attitude, and Besso believed it was Mach's influence that led Einstein to think about "observables—and to become profoundly skeptical of concepts like absolute space and absolute time."

As a schoolchild, Mach had been regarded by his teachers as backward and difficult. Yet, he, too grew into an intellectual giant, rivaling even Helmholtz for versatility. Einstein admired the charming, unassuming Mach for his independence, incorruptibility, and not least for seeing the world, like himself, as if through the eyes of a curious child. He totally agreed with Mach's view that scientists must use the simplest means of arriving at their results and exclude everything not perceived by the senses.

Einstein's most admiring and enormously helpful friend, his classmate, Marcel Grossmann, rated him in the same league as Mach. What incredible clairvoyance, especially given that the professors thought he was a dud! He, in turn saw Grossman as an ideal and popular student, which he was. Einstein regarded himself objectively as an aloof daydreamer, discontented and unpopular, except among a coterie of adoring friends and the cleaning women.

His classmate, Jakob Ehrat, also a Jew, admired Einstein for his uncompromising honesty and complete lack of pettiness. Another friend, Friedrich Adler, son of the psychiatrist Viktor Adler, founder of the Austrian Social Democratic Party, sympathized with Einstein as a brilliant misfit, who was so disliked by his professors that they locked him out of the library. He believed that Einstein's problem was an inability to ingratiate himself with those in authority.

During the fall vacation Einstein learned the laws of thermoelectricity (electricity produced by heat) and devised a simple way to find out whether an electrically charged body has a heat different from one that's uncharged. After returning to college for the 1889 winter semester, he continued to defy authority, as Adler would have predicted, by deciding for himself which mandatory courses to attend.

Although Einstein believed that we will never know the true nature of things, he shared Spinoza's view that the fundamental secrets of nature were to some extent accessible to human probing. He devoted much of his time trying to unravel those secrets, rather than attending math lectures. This became a problem when the time approached for the math professor to give an exam on those same lectures—about which Einstein knew absolutely nothing.

Fortunately, Marcel Grossmann always came to his rescue. He willingly handed over to Einstein the meticulous notes he had taken, having attended every lecture. Einstein was a quick study: each time he at least got a passing grade.

Without Grossmann, it's unlikely that he would have graduated. Through Grossmann's help he was able both to stay in college and continue the studies that would lead to his monumental discoveries.

Einstein, along with Mileva Maric, who would become his first wife, took the final exam in the summer of 1900. Should they fail, one line of work would be closed to them: they would never be able to teach in college.

Three days before the exam, Heinrich Weber did something that Einstein found difficult to forgive. He made him completely rewrite an article because it had been written on nonregulation paper. His mean-spirited enforcement of a petty regulation so close to the start of the all-important exam took up considerable study time and foreshadowed worse to come. It indicated how much Einstein had antagonized a man who had once been among his most enthusiastic supporters.

Four men and one woman took the final exam: Albert Einstein, Marcel Grossmann, Louis Kollros, Jakob Ehrat, and Mileva Maric.

Kollross came out on top with a score of 60.

Grossmann was second with 57.5.

Ehrat, a close third, got 56.5.

Einstein was fourth with 54.

Maric trailed them all with 44. She was the only one to fail the exam.

Although she had the lowest score, she equaled Einstein's 10 in experimental physics, and got 9 to his 10 in theoretical physics, 4 to his 5 in astronomy, and 16 to his 18 for the diploma thesis.

Despite Weber's animosity, Einstein was confident that he would be one of the two assistants the physics professor was about to hire. Weber had implied as much. But to Einstein's dismay Weber chose mechanical engineers, rather than fellow physicists, for the positions.

Mileva Maric at 21. She was Einstein's fellow physics student and his first wife. He was enchanted by her voice, and she idolized him.

Einstein's anxiety increased when he learned that all his male classmates had been hired as assistant professors and that he alone had been rejected. During the next few weeks he mailed scores of job applications to professors in different colleges and countries, including one to Wilhelm Ostwald, a physical chemist at Leipzig University, whose work Einstein admired. He also enclosed his paper recently published in the prestigious *Annalen de Physik*, inspired by Ostwald's own research. Getting no answer, he sent a follow-up letter. Apparently Ostwald didn't reply to that either. All those who did reply to his applications had nothing for him.

As the weeks and months went by, his father saw that Einstein had become deeply depressed and, without telling him, decided to act. In a letter to Professor Wilhelm Ostwald on April 13, 1901, he wrote

> My son Albert Einstein is 22 years old, has studied for four years at the Zurich Polytechnic and last summer brilliantly

> passed his diploma examinations in mathematics and physics. Since then he has tried unsuccessfully to find a position as assistant, which would enable him to continue his education in theoretical and experimental physics. Everybody who is able to judge praises his talent, and I can assure you that he is exceedingly assiduous and industrious and is attached to science with a great love. My son is profoundly unhappy about his present joblessness, and every day the idea becomes firmly implanted in him that he is a failure in his career. . . . On top of that he is very depressed by the thought that he is a burden on us since we are not very well-to-do people. Because my son honors and reveres you the most among all the great physicists of our time, I permit myself to apply to you with the plea that you will read his treatise [Deductions from the Phenomena of Capillary, December 13, 1900] published in *Annalen der Physik* and hopefully, that you will send him a few lines of encouragement, so he might regain his joy in his life and work. If you could obtain for him an assistant's position, either now or in the fall, my gratitude would be boundless. I beg your forgiveness in my audacity in sending you this letter and want to add that my son has no idea of this extraordinary step of mine.

It is not known if Einstein ever knew that his father wrote this letter, nor if Ostwald replied to Einstein's father. He certainly didn't give Einstein a job.*

Trying to account for Einstein's jobless state, Mileva Maric wrote to a friend that her sweetheart had a very wicked tongue and was a Jew in the bargain. However, anti-Semitism was hardly the reason Einstein couldn't find a job. By most

*Wilhelm Ostwald was the first person—in 1910—to propose Einstein for a Nobel Prize, and Ostwald agreed that Einstein's independence prevented him from being hired by any of his professors.

Einstein's easygoing and unsuccessful father, Hermann, whom he loved.

accounts, there was less overt anti-Semitism in Switzerland than in Germany. Furthermore, Professor Minkowski was Jewish. So were several of Einstein's friends who had been hired by Zurich Polytechnic, Jakob Ehrat among them. It was his wicked tongue, his independent, rebellious spirit, and his inability to kowtow to authority that crippled his chances.

In hindsight Einstein admitted that he was not a model student. Once, in a talk on education, he asserted that teachers who used fear, force, and false authority in the classroom destroyed the students' self-confidence. Not in his case, however, or not for long. What helped him to defy such pressure, he said, was being as stubborn as a mule.

It has been reasonably established that, despite the generally accepted myths, Einstein was not dyslexic, was not a remarkably late talker, and overcame his learning problems such that at seven he got the top marks in his class.

It's true that he failed to get into Zurich Polytechnic on his first attempt. He was, however, two years younger than others taking the exam. And he turned that failure into triumph.