

Young Einstein: a short biography

Largely based on biographical material in “Albert Einstein: a photographic story of a life”

Albert Einstein was the first-born son of Hermann Einstein and Pauline Koch, who married on August 8th 1876 in Ulm, a small city on the Danube in Southwestern Germany. Pauline was an accomplished musician, Hermann was a businessman – although most of his business ventures were unsuccessful. When they married Hermann was running a small electrical engineering business in Ulm. Albert was born on March 14th 1879, in the Einstein’s house in Ulm. As a baby he had an unusually large and misshapen head, and a large body. When his grandmother saw him she cried out “Much too fat”, but doctors assured Hermann and Pauline that there was nothing to worry about.

Albert was slow to speak as a child, although when he did begin to speak it was often in quite complex phrases. Later Einstein recalled: “When I was between 2 and 3 I formed to ambition to speak in whole sentences. I would try each sentence out on myself by saying it softly. Then, when it seemed right, I would say it out loud.” When he was 3 his younger sister Maja was born. At first Albert seemed to think she was a new toy: when he first saw her he said “where are the wheels?” By this time the Einsteins had moved to Munich. Hermann’s business in Ulm hadn’t done so well, so with his brother Jakob (who was an engineer) they hoped for more success in the big city. They borrowed money from Pauline’s family and started up an electrical business. The business thrived and rapidly expanded into producing electricity generators and lighting. In 1885 they were awarded a contract to provide the lighting for the Oktoberfest beer festival! The business was employing 200 people and supplying power stations to Italy too. The family moved to a house in Sendling, a suburb of Munich, and Jakob and his wife moved in next door.

Albert rarely played with other children besides his sister Maja. He didn’t like rough, physical games or marching like soldiers. He was fascinated by mechanical toys, however, and also enjoyed building towers from bricks or even cards. Once he built a tower of cards with 14 storeys – a remarkable feat of patience and concentration for a young child.

Albert was tutored at home until he was six years old. Once, when he was five and sick in bed, his father brought him home a compass to play with, to help pass the time as he convalesced. Albert found it fascinating, later recounting:

“I encountered a wonder of such a kind...when my father showed me a compass. That this needle behaved in such a determined way did not fit into the way of incidents at all which could find a place in the unconscious vocabulary of concepts (action connected with “touch”). I still remember – or I think I do – that this incident has left with me a deep impression. There must have been something behind things that was deeply hidden”

When it was time for him to begin school he went to the nearest one to his house – which was a catholic school. The Einsteins were Jewish but not particularly religious, so Albert didn't see being the only Jewish child in his class as a big deal. Overall, however, he didn't respond well to the German school system with its emphasis on strict rules and memorizing, and no room for debating ideas. His teachers thought he was inattentive and a day dreamer, while he thought they were like sergeants in the army. Despite his problems adapting to the education system, Albert excelled in subjects that interested him, such as maths and Latin. In 1886 his mother wrote “Albert got his grades yesterday; he was again at the top of the class”.

When he was 10 Albert moved to the Luitpold Gymnasium, a large school with more than 1000 students. He didn't make many friends there either, and still felt that – like his elementary school – the atmosphere was too regimented. He studied maths, science, Latin, Greek, German and French, but he felt that most teachers didn't inspire students to think for themselves, and so he didn't find that school fostered in him a love of learning. He later said: “The worst thing seems to be for a school principally to work with methods of fear, force and artificial authority. Such treatment destroys healthy feelings, the integrity and self-confidence of the pupils.” More succinctly, he would also later remark (a propos of both this period in his life and indeed his later studies) that: “The only thing that interferes with my learning is my education”. For their part, the teachers didn't think much of Einstein either: when Hermann asked one of them what profession Albert should pursue, the teacher said it didn't matter because Albert was unlikely to excel in anything!

Fortunately, two people did inspire him towards learning: his Uncle Jakob, the engineer, and Max Talmud, a 21-year old medical student at Munich University. Jakob switched Albert on to maths and algebra, making solving equations seem like a game. Maja said that Albert would never give up until he had solved Jakob's puzzles, and then he would jump for joy. Max was a regular

supper guest at the Einsteins (inviting a student to visit regularly was a Jewish tradition) and he and Albert became good friends despite the age gap of 10 years. Max would talk to Albert for hours about many topics, and he introduced Albert to popular science books. Later Max wrote: “He showed a particular inclination toward physics and took pleasure in conversing on physical phenomena.”

During the summer when Albert was 12 years old, he got a hold of the geometry book which his class would use the next school year. Albert loved the book and later he would refer to it as his “holy geometry book”. He did every one of the exercises and proofs before the school year had even begun. Albert started to teach himself more complex maths from books and quickly left Max Talmud far behind in his grasp of the subject, although they continued to talk about other subjects – including philosophy – when Max visited.

Around this time, aged 13, Albert also became fascinated by Mozart’s music. He developed a passion for playing the violin (very different from the resentment with which he had responded to his music lessons as a young child, but one that would stay with him all his life). He later wrote “I believe on the whole that love is a better teacher than a sense of duty”.

When Albert was 15 his father’s business ran into trouble again and eventually collapsed. Salvation came from Italy: Hermann’s Italian business associate Signor Garrone helped him to win a contract to install electricity in Milan. This bailed Hermann out and offered a fresh start, but the family would have to move to Italy. However, it was decided that Albert would stay behind to finish his schooling in Munich and he moved into a boarding house when his family left. At first he put a brave face on this, writing cheerful letters to his family in Italy, but the reality was much less rosy. His schoolmates thought him a loner, his teachers labelled him uncooperative and worst of all: the threat of having to join the army when he turned 16 was looming. He had always hated war and guns, so joining the army was the last thing he wanted.

Albert devised an audacious escape plan. He spoke to his doctor, Bernard Talmud (brother of Max) about his troubles at school and Bernard agreed to write him a Doctor’s note indicating that he was on the verge of a nervous breakdown and needed complete rest. In the end he didn’t need his doctor’s note: his Greek professor, Herr Degenhart, intervened by suggesting the best solution to his “attitude problem” (as we might describe it these days) was to leave the Gymnasium.

Albert was only too happy to do so: on December 29th 1894, a few months' before his 16th birthday, he packed his bags and headed for Italy. He arrived there and immediately felt freer and happier than he had throughout his time at school in Germany. His family accepted the reasons why he had wanted to leave Munich and supported him, although they were keen that he should soon resume his education. Meanwhile he helped out in the new business, while finding time to read, write essays and explore the Italian countryside. He loved hiking in the Alps and meeting the locals: he said that the “people of north Italy are the most civilised I have ever met”.

Albert was determined not to return to Germany to continue his education, so he decided to apply instead to the Swiss Federal Polytechnic Institute in Zurich. He would be admitted there, provided he passed the entrance exam. He was 2 years' younger than most of the applicants (because of his premature departure from the Gymnasium in Munich) but got special dispensation to sit the exam, which consisted of a science paper and a general paper, in October 1895. He excelled in the maths part of the science paper but failed the general paper, so wasn't admitted, but the Director, Albin Herzog, suggested that he enrol in a Swiss High School and apply again the following year. Albert did exactly this, enrolling in a German-speaking school in Swiss town of Aarau – where he boarded with the Winteler family during the school term. He liked the Wintelers very much: they were always tolerant and responsive to different points of view and enjoyed discussing politics and history with them (Jost Winteler was a history teacher at the school) and joining them on hikes through the Swiss countryside. He also spent a lot of time with one of the Winteler girls, Maria. She was two years' older than Albert but they had much in common, including a love of music.

Albert also found the Swiss schooling system much more relaxed than its German counterpart. Years later he said: “This school has left an indelible impression on me because of its liberal spirit and the unaffected thoughtfulness of the teachers, who in no way relied on external authority”. He did well in all of his subjects, apart from French, and during this year made up his mind that he wanted to become a science teacher. He recognised that he preferred studying abstract ideas to practical topics. He also began to use “thought experiments” – a way of visualising in his mind a physics problem to help understand it. He tried to imagine, for example, what it would be like to travel alongside a beam of light – an idea that would be influential in his formulation of special relativity.

Albert was also becoming more confident socially. Although he sometimes had a sarcastic wit he could also be friendly and charming. One of his classmates, Hans Byland, said that “Unhampered by convention, his attitude toward the world was that of a laughing philosopher”.

Albert was so happy in Italy and Switzerland that, not only did he not want to return to Germany, he also decided formally to renounce his German citizenship. Hermann agreed to help him and in January 1896 the German authorities granted his request: at that time he wasn’t the citizen of any country, since he was too young to apply for Swiss citizenship. This didn’t prevent him from applying again for the Polytechnic in Zurich, however.

In September 1896 Albert graduated from Aarau High School, with the highest grades in his class, which meant there was a place for him at the Polytechnic provided he could pay the tuition fees. With the help of an allowance from a wealthy aunt (admittedly one whom Albert had always thought pompous and vain) the 17 year-old Albert was able to begin his studies in mathematics and physics at the Polytechnic in October 1896. He soon made friends with the four other students in his class, particularly Marcel Grossman who liked Albert immediately and recognised his intelligence and potential. “Einstein will be a great man one day” he told his father; indeed Grossman would himself go on to become a leading mathematician. Albert’s love of music introduced him to other friends, including Michele Besso – a mechanical engineer who for many years became a ‘sounding board’ for Albert’s developing ideas.

Albert’s school life was busy, although he skipped a lot of classes to study on his own. (Fortunately Marcel Grossman – who was more conscientious – agreed to share his notes). He was soon also spending a lot of time with the only female student in his class: Mileva Maric, the daughter of a Serbian family who lived in southern Hungary. Mileva had been born with a hip deformity that made her self-conscious and shy, but Albert liked her and they shared many common interests. She helped Albert become more organised and reminded him about tasks he had forgotten – quite a common occurrence since Albert was rather absent-minded. He once told a friend: “When I was young I visited overnight at the home of friends. In the morning I left, forgetting my valise. My host said to my parents: “That young man will never amount to anything because he can’t remember anything”.

With some help from Marcel Grossman's shared notes, Albert studied hard for his second year exams and passed them with high grades. Into his third year, he maintained the same approach to his studies: only attending the classes he enjoyed, such as Professor Weber's physics laboratory, and skipping the rest. He dismissed many of the mathematics classes – including for example the one taught by the eminent Professor Hermann Minkowski – as irrelevant to his understanding of physics. Minkowski wasn't that impressed with Einstein either, and called him a "lazy dog". Years later, Albert recognised that he hadn't taken full advantage of the maths classes available to him at the Polytechnic, and some of these would have been useful in helping to formulate his theories – particularly General Relativity, his theory of gravity.

Professor Pernet, who taught the general physics class, was also highly critical, saying: "You are enthusiastic but hopeless at physics. For your own good you should switch to something else." Pernet gave Albert his only failing grade during his entire time at the Polytechnic. Even Albert's favourites – such as Professor Weber – eventually dropped out of favour, in Weber's case because Albert felt he didn't discuss new theories but was too firmly attached to older ideas.

Albert was spending more and more time with Mileva, although his mother disliked the girl, even telling him that Mileva would "ruin Albert's life and future". Despite (or maybe because of!) his mother's disapproval, Albert and Mileva began talking about marriage – something which only increased Pauline's displeasure – as they both prepared to take their final exams. For Albert the news was good: he passed (although not with the high grades he had achieved in earlier years) and could begin to think about applying for jobs or research positions – for example pursuing a PhD at Zurich University. For Mileva, however, it was a different story: she had failed her exams. Not only did her future mother-in-law dislike her, but her career in science was possibly over before it had hardly begun.

Albert was now 21 years old and a graduate of a respected science institution, but before he could look for work he had to become a Swiss citizen. This wasn't a trivial step, since he had to convince the authorities that he would make a good, hard-working and honourable citizen, he wasn't a threat to Switzerland and he wasn't a radical thinker. Somehow he managed to convince the Swiss citizenship committee of this (even the last point) on December 14th 1900. The committee described him as "harmless and innocent" and approved his application. The next hurdle was military service: every young, healthy man in Switzerland was required to do this.

Fortunately for Albert (who didn't want to join even the Swiss Army) he failed his medical examination – due to having flat feet and swollen veins in his legs – and the threat of the army was avoided. Now he could look for a job in earnest.

He immediately applied for a teaching post at the Polytechnic. Most of his friends had already found teaching posts so he hoped that he would too. But he was rejected for every job; it seemed that the professors hadn't forgotten his attitude to his studies and to them during his degree. Even Professor Weber, it seemed, had become so infuriated with him that he wrote a negative reference. He once told Albert "You're a clever fellow Einstein, but you have one fault. You won't let anyone tell you a thing".

Just when he despaired of ever finding a job, Marcel Grossman came to the rescue. Marcel persuaded his father to recommend Albert to Frederic Haller, Director of the Swiss Patent Office in Bern. As he waited for news of this possible job, Albert grew ever more determined to marry Mileva soon – despite his family's opposition. So Albert and Mileva decided to take a holiday close to Lake Como, but when the holiday was over Mileva discovered that she was pregnant. Neither the Einsteins nor her own family would be pleased; to make matters worse, Mileva learned that she had failed the Polytechnic exams for a second time. Depressed and worried about her future, Mileva returned to her family's home in Hungary and Albert and Mileva decided to say nothing to the Einsteins about the baby. Meanwhile, Albert stayed in Switzerland and buried himself in scientific work. While still waiting to hear about the Patents Office job, he took on a temporary teaching position – preparing an English student at a private school for the High School leaving exam. The pay was modest but Albert was given room and board at the school, and this also gave him time to work on his PhD dissertation, which he had begun under the supervision of Prof Alfred Kleiner on thermodynamics – the physics of heat, the topic which Glasgow's Lord Kelvin had helped to establish in the second half of the 19th century.

In 1902 Mileva gave birth to a daughter Lieserl. Soon after, Albert left the tutoring job because of a fall-out with the school authorities. He was an unmarried new father, with no job or income and his PhD thesis had been rejected (Prof Kleiner thought that Albert's criticisms of existing theories were too radical). Albert was crushed; it seemed as if everything was going wrong again. What happened to Lieserl is not fully known: Mileva wrote to Albert with news of the birth, and Albert wrote in reply saying he was happy that they had a daughter. Mileva would write to Albert about

Lieserl again in 1903, but that is the last recorded reference to their daughter. Some historians suggest she was put up for adoption, others that she may have died – possibly from scarlet fever. In any event, it seems that Albert probably never saw her, and indeed most people didn't even know of her existence until after Mileva and Albert died.

Meanwhile, back in Bern, Albert moved into a one bedroom apartment and placed an ad in the newspaper advertising his services as a tutor – he needed all the work he could get. He soon had two students: Maurice Solovine and Conrad Habicht. Albert liked spending time with them, and they quickly became firm friends.

Suddenly Albert's luck changed. After impressing Frederic Haller in a two-hour interview, he was offered a position as “Technical Expert, third class” at the Bern Patents Office. Finally, he had a real job and he began working there on June 23rd 1902. At the office the staff sat at tables along the wall and examined applications for patents for new inventions. Albert saw proposals for typewriters, cameras and assorted electric devices; Director Haller showed him how to analyze an invention, how to determine if there was another similar invention available and how to decide whether the invention was useful. Albert became adept at simplifying the inventor's often convoluted explanations into short, clear sentences. Working at the Patent Office taught him how to present his ideas clearly and succinctly. Albert did well at his job, but he also found time to pursue his own scientific ideas. He said that the job “gave me the opportunity to think about Physics”.

The patent office was only a few blocks away from his apartment so Albert walked to and from work. He would often socialise with his friends Maurice Solovine and Conrad Habicht and they would talk for hours about science and philosophy. They dubbed their group meetings the “Olympia Academy”, and these meetings would provide much stimulation for Albert's scientific thinking. He began to publish some of his ideas: in September 1902 the esteemed German journal *Annalen der Physik* published a paper which he had written about the forces that hold molecules together in a liquid – this made use of some of the ideas from his rejected PhD thesis. He then quickly wrote two further papers on this topic and both were published. All three papers dealt with the newly emerging topic of statistical mechanics.

In October 1902 Albert was summoned suddenly to Milan. His father had suffered a heart attack, and Hermann died on October 10th aged only 55. Albert was devastated, blaming the stress of his father's business for the heart attack. Hermann left the family in debt and Pauline asked Albert for some financial help; in view of these dramatically changed circumstances she also felt forced to agree to Albert's marriage to Mileva. This took place on January 6th 1903, in Bern. Albert was 23 and Mileva was 27. Albert's mother and sister didn't attend; the Olympians Maurice and Conrad were the only witnesses.

Soon after the wedding Albert wrote a fourth paper, this time on thermodynamics. He continued to meet regularly with the Olympia Academy and other friends, talking about science and philosophy long into the night. "Our means were frugal but our joy was boundless" Maurice Solovine recalled.

In June 1903 Albert and Mileva went on a delayed honeymoon to Lausanne. While they were in Lausanne Mileva discovered she was again pregnant, but this time Albert and Mileva had enough income to be comfortable with the idea of being parents. They moved into a larger apartment with two rooms, and on May 14th 1904 Mileva gave birth to a boy named Hans Albert. Despite having a new baby, a busy workload at the Patent Office (not long after Hans Albert was born he was promoted to the permanent staff) and meetings with friends, Albert still found time to work on his own scientific ideas – although he was doing this outside of a university or laboratory and didn't even have daily access to a library. Instead, Albert worked alone, thinking deeply about fundamental questions to do with light, space and time, motion – some of which had consumed him since he was a boy. Day after day he looked at the established scientific theories and questioned them. Often he was frustrated at his lack of progress but he never stopped looking for answers.

By March 1905, when he was aged 26, this quest was starting to bear fruit and a remarkable period in his scientific life was beginning: over the following 6 months Albert would submit 5 ground-breaking papers which would thrust him into the scientific spotlight. 1905 was about to become Einstein's "annus mirabilis", and his life as a scientist would change forever.