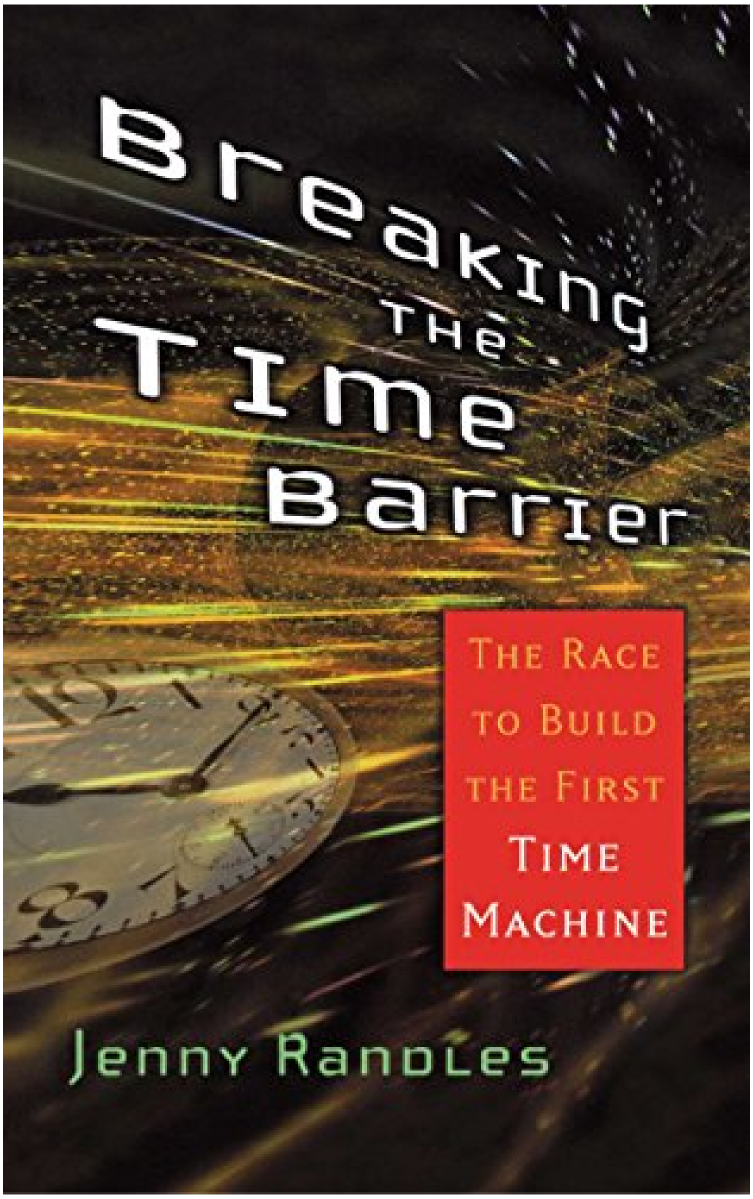
Breaking the Time Barrier: The Race to Build the First Time Machine (English Edition)



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Description :

Prsentation de l'diteurIT WAS ONLY A MATTER OF TIME.... Once widely considered an impossibility--the stuff of science fiction novels--time travel may finally be achieved in the twenty-first century. In Breaking the Time Barrier, bestselling author Jenny Randles reveals the nature of recent, breakthrough experiments that are turning this fantasy into reality. The race to build the first time machine is a fascinating saga that began about a century ago, when scientists such as Marconi and Edison and Einstein carried out research aimed at producing a working time machine. Today, physicists are conducting remarkable experiments that involve slowing the passage of information, freezing light, and breaking the speed of light--and thus the time barrier. In the 1960s we had the "space race." Today, there is a "time race" involving an underground community of working scientists who are increasingly convinced that a time machine of some sort is finally possible. Here, Randles explores the often riveting motives of the people involved in this quest (including a host of sincere, if sometimes misguided amateurs), the consequences for society should time travel become a part of everyday life, and what evidence might indicate that it has already become reality. For, if time travel is going to happen--and some Russian scientists already claim to have achieved it in a lab--then its effects may already be apparent.ExtraitChapter One: Pre-1895: The Dawn of TimeTo run any race you must know the course. To build a time machine you need to know what time is, just as you cannot fly without knowing the nature of air and aerodynamics. But understanding time is easier said than done.A celebrated Zen riddle asks, when a tree falls in the forest and nobody is around, does it make a sound? This riddle can probably be applied to time. Would there be such a thing as minutes or years if no human beings could experience their passage?This seems to be a very odd suggestion, but the nature of time is very strange. Indeed, it is a real puzzle for science. It forms an inescapable part of our lives yet cannot easily be defined. It has fascinated mankind since we first learned to communicate, but there have been no clear answers about its nature. Indeed, some great minds have argued that its measurement is purely a human invention. Greek philosopher Zeno showed the problem when he tried to define a small unit of distance. To catch a tardy tortoise you can easily run twice as fast and halve the distance between you and the animal in a set period of time. But if you keep on halving the distance that gap will never equal zero, because half of something is always going to be a finite number, however small. But if there is always a gap between you and the tortoise it is impossible to ever catch up with it -- a conclusion that we know to be absurd by practical experience, even if we have never actually chased a tortoise. A faster runner will always catch a slower one, sooner or later.Time is intimately involved in this discussion -- since speed is a measure of distance traveled in a set time. So we can apply Zeno's thinking and divide a second into smaller and smaller pieces. If we keep breaking down this gap, making the units half as long as the previous one, then there will always be a finite length for any moment that we can measure. But if that moment has any size at all, then part of it must be in what we think of as the past and part of it in the future because it will take time to pass any mark or point. We call this tiniest measurable moment "now" and say that it separates past from future. Yet how can it separate anything if parts of it lie simultaneously in both past and future? Arguments still rage over the meaning of this curious riddle. Is it a fallacious argument -- like the one concerning the tortoise? After all, it may look impossible to catch up with the animal but clearly we know that it is not, so the riddle is flawed in its execution. Others suggest that there may be something even more profound in this realization about time first made 2,500 years ago. Is the reason that we cannot clearly identify a moment that is neither past nor future a hint that past and future are a product of human imagination? Is the universe fundamentally timeless and is the distinction between past and future just an illusion brought about by our limited capacity to visualize the cosmos?Virtually every human society that developed a culture has speculated in similarly bemused ways about the nature of time. The Greeks defined it as a measurement of intervals, which could be of long or short duration. As far back as 350 BC Aristotle had realized the implications of the Zeno paradox. But he had no better answer, and this choice to divide time into basic units, mirroring many mundane things that form a sequence, such as the human heartbeat, allowed for the creation of sundials, water clocks, and eventually mechanical clocks. We gained a feeling of mastery over time by recording it with increasing skill and so it came to be a powerful element in our lives.St. Augustine, many centuries later, was a little bolder and dared to ask the question -- what was God doing before He created the universe? If time was born along with the matter in the universe, as the Bible suggests, then was there any time before that instant, or is God somehow also to be considered timeless? Intriguingly, this question largely foresees modern scientific concerns about how the cosmos was first created -- the subject of intense debate between physicists and astronomers.There are two basic theories. One is the so-called Steady State idea that the universe has always existed in its present form, perhaps even made by God. British astrophysicist Fred Hoyle championed this theory though he also invented the name given to the rival theory -- the Big Bang. He hoped that such a daft name would ridicule this alternative concept that says that everything in the universe emerged long ago from one single, tiny point that exploded outward and has gone on expanding across billions of years. But the Big Bang theory has gathered strong evidential support from modern science and is the widely accepted view today. Hoyle was proved wrong, but ironically, his name is attached to the theory that he so detested -- the ultimate insult. Physics has had to conclude that time somehow began when the universe started to expand and before that instant there was neither matter nor time.However, it was by no means clear to Renaissance thinkers that time emerged from the birth of the universe. Nor did they even accept that it was an essential requirement to make the laws of nature work. Indeed, the more that science began to comprehend these rules, the more it became aware that time, in our experience moving from the past into the future on a perpetual one-way journey, is not a prerequisite. In fact, virtually every law of physics seemed to work just as well if time flows backwards, moving from the future into the past. This realization enhanced suspicions that time might be a convenience of mind that made us see things as we do rather than a necessity of nature.Different societies have other concepts of time and it is a mistake to imagine that our modern Western perspective, dominated by timetables and cell phones, is the only way to see things. We have grown up with this one version of reality but there are other, equally valid interpretations. The dreamtime, for instance, is an aboriginal concept still widespread in native Australian culture. It could not be further removed from twenty-first-century thinking and is extremely difficult to even translate. But, in essence, it regards past, present, and future as coexisting in a timeless void or hidden dimension beyond the range of our normal perception. For that reason, in dreams and other states of consciousness where we lose touch with the normal sense of awareness, we enter what is in effect another reality where things that once were, still are, and where things that will someday be, have already become.Time spans the infinity of the cosmos and the tiniest moment that we can record. But it may not even exist. No wonder it is such a riddle. But it is important to follow the manner with which science has attempted to come to terms with time, piecing together its nature through a series of grand theories and experiments. For these are the stepping-stones upon which today's plans to build a time machine are all based.Throughout the Renaissance, as scientists began to understand the nature of the physical world, there was an uneasy truce between what mattered to most human beings and the things that interested physicists. Galileo and Newton showed that all the planets of the solar system, including the Earth, rotate around the sun in a wonderful cosmic ballet. Their paths could be mathematically defined, to the point that Newton even argued that God created the universe as a vast clockwork machine that allowed everything that would ever happen to be mapped out into perpetuity. God had wound up the machinations of the cosmos and let it loose for mankind to discover its properties. By doing so we could make stunning calculations far into the future, because the speeds and times of the orbits of these planets could all be precisely delineated effectively forever.It was these calculations that allowed NASA to work out how to send Apollo spacecraft to the moon, using sums that Newton could have easily done for them. The same rules allowed the rescue of fated mission, Apollo 13, sending it like a slingshot around the lunar surface and heading back to Earth thanks to the mathematics of the universe and its timeless precision. However, as these findings seem to prove that ticking clocks were defined by the distant motion of bodies in space, science also found itself in open warfare. It battled religion, fearing that the mathematics of nature might replace the edicts of God. And it battled ordinary people who had always gauged time in simple ways -- from observing the seasons, the growth of crops, and the calendars decreed by the church. Now scientists were saying that the only true way to measure time was to accurately describe how the Earth revolved around the sun and the exact time it took for our planet to rotate on its own axis. We had only ever been able to make guesses about such matters before and had inevitably miscalculated to some degree. Scientists wanted to put right those centuries-old mistakes and rearrange the timetable of our lives so that it was in balance with the motions of the universe.In the 200 years leading up to the nineteenth century, ordinary folk were asked to rethink how they should now judge time. For centuries the year had been calculated as having 365 days plus one quarter of a day, hence the extra "leap year" day every four years, but this estimate based on the Earth's orbit was only approximate. As time had passed the year had slipped out of phase with the way our planet truly moves around the sun, and did so a little bit more each year. So by papal edict in 1582 the error was corrected and 11 days were dropped from the calendar. Such was the opposition to meddling with time that this "Gregorian" Calendar found favor only after a long period and with some decidedly odd consequences.For instance, the area surrounding the city of Strasbourg accepted the decree immediately and changed over in November 1583. But the city itself stuck to the old calendar for another ninety-nine years -- meaning that when it was New Year's Day in Strasbourg it was already the middle of January just a few miles away. The chaos that resulted is obvious, not to mention the apparent time traveling -- by crossing the city line, you could walk "into the past."In Britain workers protested that eleven days would be stolen from their earnings if they agreed to the plan imposed by Rome. Such "time riots," as this clash between science and the masses was dubbed, shows just how much concern was being expressed by the ordinary, then generally uneducated, person about any attempt to play with our long accepted way of viewing time. They delayed the introduction of the correctly aligned calendar in the United Kingdom until 1752, almost two centuries after much of Europe. The old ways of thinking about time have not entirely gone away. For instance, on the Isle of Man in the Irish Sea (the world's oldest continuously operating parliamentary democracy) a ceremonial reading of laws to the public is still held at Tynwald Hill each year. It occurs on what would have been midsummer had those 11 days not been expunged two and a half centuries ago.A crucial moment in the understanding of time came with the ability to measure the speed of light -- although, when this happened it was not apparent that there was even a speed to be measured. It had long been assumed that all objects emit "rays" -- which Newton suggested to be streams of particles -- and that these traveled in straight lines to reach the eyes. Our eyes absorbed the rays and became "excited," thus seeing the object. Because the process happened so swiftly it appeared to be instantaneous. We could detect no varying time lag between viewing our hand held in front of our face or the moon, which is very far out in space. So it was reasonable to assume that light traveled instantly. Research by Isaac Newton in the late 1600s, using prisms to split light and unravel its makeup, led to the underlying truth. Light does indeed convey information to our eyes. It acts as the yardstick of all events, perhaps even the creator of our perception of time. How fast it moves is crucial, because this determines whether the past really is gone forever, as is widely assumed. If light flowed like a river, which was then the prevailing belief, then once you were swept past any point in your journey on the way upstream all you could do was keep on moving forward. But if light has a speed, like a current on a river, then perhaps you can find a way to travel downstream at a faster rate than the current and thereby return to a place that you have sailed past before. That other place would be the past.Since general experience dictates that we do not have the ability to revisit the past, except in our memories, this furthered the belief that light came to our eyes instantly, meaning there was no speed that we could ever hope to overtake. But that opinion proved to be wrong.In 1676 the Danish astronomer Olaus Roemer (1644-1710) devised a clever experiment. He used the laws of planetary motion that Newton had set down, the telescope that Galileo had developed for astronomical observation, and the moons of the giant gas planet Jupiter that Galileo had discovered orbiting majestically around their parent. Bringing all these discoveries together allowed Roemer's test to expose the rules of time as being quite different from those commonly held.Every now and then these moons pass behind the huge mass of Jupiter because its body blocks them from our view on Earth as they orbit. If light speed was infinite, then the time taken for this period of eclipse should always be the same. But Roemer found that it was not the same. In fact, once he had tabulated enough measurements he could easily discern a pattern behind them. The eclipses took longer to happen whenever the Earth was moving away from Jupiter because of the relative motions of the two planets around the sun. At different times these same relative motions caused the Earth to move towards Jupiter and when it did so, Jupiter's moons passed behind the planet a little bit faster. Very cleverly he then deduced that the difference in time for this same event was the result of light having a finite speed. And that speed could now be worked out from these observations. When the Earth was moving away from Jupiter, the beams of light conveying the image of this eclipse had to travel farther to catch up with our planet as it sped away. So the light took longer to reach us and the event seemed to last longer. The reverse happened when the Earth was moving towards Jupiter. Light rushing to bring the image to our eyes got here faster because we were moving towards it, closing the gap. Consequently the eclipse seemed to have a shorter duration on these occasions.Roemer had only roughly accurate calculations about planetary sizes, orbital speeds, and distances to work with to let him figure out the speed of light. He argued that it was about 140,000 miles per second -- so fast that it was understandable that the human eye had always assumed it to be instantaneous. The real speed of light, with accurate modern measurements, is closer to 186,000 miles per second. Light speed is almost a million times faster than sound, hence the obvious discrepancy between hearing the sound (thunder) and seeing the light (lightning) caused by the same physical process during a storm. That light possesses a measurable speed was unexpected, yet it would be critical to how we interpret time. Roemer's calculations came in an age when humans were constrained by the thought that the speed that a horse can gallop was about as fast as you can go. However, now that Roemer had shown the true picture of light's extraordinary speed, the frailty of human capability was exposed. We were not masters of the cosmos and there were things that might prove to be beyond our comprehension. We could start to question what we had considered beyond doubt and imagine building something that might fly as fast as light. What would happen if we shattered this light barrier? For the first time in history, that became a legitimate question.Philosophers started to wonder about these matters. To thoughts about such major quandaries as the existence of God or free will were now added bold thinking about manipulating time. This was the birth of science fiction, and the time travel story is one of its staple features. But this would not have been possible without Roemer's experiment, because it was his discovery that allowed for time travel to even be considered as a theoretical possibility.Indeed, these philosophers recognized something that science had missed. There were two types of time. One of these was the real time that existed as a fundamental property of the universe (according to Newton) and was controlled by the speed at which light conveyed signals (as measured by Roemer). Philosophy added to this the subjective experience of time. Time flies when you are having fun, the adage says -- emphasizing this human subjectivity. Summers of childhood seem to last forever, whereas adult years rush past much faster than you would like. There were many other examples of this intangible nature of time, allowing strange questions -- such as whether we could change our interaction with time just by thinking about it differently. This has inspired many intriguing science fiction stories, such as Richard Matheson's haunting old tale Bid Time Return, which was filmed in 1980 as Somewhere in Time. Here the hero falls in love with a woman from the past and mentally time travels just by removing every attribute of the modern world from his environment and sensory perception. By soaking himself in the sights, sounds, smells, clothes, furniture, and trappings of another age he gets handed the road map to take him there. Sadly, he is snatched back to the future when he discovers a modern coin accidentally left in his pants.Science, of course, scoffed at such romantic notions. Time, to scientists, is not open to human intervention in this simplistic manner but is a real property of the cosmos. Yet whether we can or cannot think ourselves into the past, we all do travel into the future with each passing moment of our lives. Washington Irving in 1850 cleverly realized that when we fall asleep we lose touch with any sense of time and awake perhaps a day into the future without any apparent recall of the journey. Like all good science fiction, his novel Rip van Winkle just took that insight and exaggerated it into a situation that we can imagine might really happen one day. What if you fell asleep not for a few hours or a day but for years? Subjectively, you would seem to have awoken into a future age, as if you had time traveled there. But, of course, this was time travel gained the hard way -- at the expense of the limited number of days left in your life.Other Victorian novelists attempted different ways of taking people into the future, by being accidentally frozen in ice or trapped in a cave for thousands of years. If the normal deterioration of the body slowed down in the process, then longevity would bring about the experience of time travel. But these were not real speculations on time travel, nor even on time, but rather the use of time as an artistic medium to paint a picture of human actions or social circumstances.The inventive novelist Samuel Clemens, better known as Mark Twain, created such a social satire with his 1889 story A Connecticut Yankee in King Arthur's Court. This was the first time travel story to involve travel into the past. Twain's hero travels back from nineteenth-century America to pre-medieval Britain but as an expedient to the story rather than as scientific speculation. Indeed, there really is no science in this fiction. The purpose is to contrast society across the ages, and to rapidly expedite the time jump an electrical storm catapults the traveler. There is no attempt to explain how this might be possible, but by the 1880s physics was making exciting discoveries about energy emissions such as lightning. Twain no doubt saw this as an appropriate basis for making the impossible come true. However, this was also fortuitous because electrical power has since become a useful ally in the scientific battle to surmount the time barrier.Six years after Twain's story, the young English newspaper columnist H. G. (Herbert George) Wells wrote the first novel about an actual machine that could travel at will through time. Despite his primary occupation, Wells had a science background, being a graduate of Imperial College, London. This would stand him in very good stead.The scientific knowledge of his day was the basis for many of his stories, which predicted, for instance, aerial bombing and nuclear warfare, but The Time Machine was to prove so influential that its centenary was even celebrated with a special stamp in the United Kingdom. Wells's romance describes how an inventor creates a device to travel through the "fourth dimension." He was aware that physics was starting to regard time as having a dimensional nature -- even though the full impact of this concept was yet to be realized. Like all good writers, he kept up with the latest research and asked: What if we could move through the time dimension just as easily as we travel through the spatial realms?Such an idea was perhaps prompted by powered flight that in Wells's time was about to conquer the skies and at long last tame the up-down spatial dimension. So if time was an added dimension, why not build a machine to fly through that region as well? The extraordinary possibilities opened up by his novelistic invention of a time machine meant that Wells had created not merely a story, but a new human aspiration that would grow in the minds of everyone who read his novel. That included real inventors and young scientists who would later seek to make his idea a reality.In the enthralling 1979 spin on his story, filmed as Time After Time, the real life Wells is argued as having actually invented a time machine, which is promptly stolen from a dinner party that he was hosting back in 1893. Unfortunately the thief is a doctor suspected by many to have been the real serial killer "Jack the Ripper"! Jack flees in the machine to San Francisco in 1979 and recommences his old habits, pursued by Wells after the time machine emits its "homing" signal and returns to his lab. Taking it to 1979, Wells has a series of well-observed adventures, defeats Jack, thereby explaining why the killer was never identified in his own era, finds a modern American girl, falls in love with her, and both return to 1893. She becomes the woman who would be Wells's true life wife; he then destroys the time machine and writes all of his research up as a novel and the past becomes exactly what we know it as today -- without violating too many laws of physics. Ironically, this idea is not entirely fanciful -- in the sense that the real Wells did indeed try to build one of the first actual time machines. It was not as grand as the one in his novel or the subsequent modern movie version. Indeed, it is probably best described as a time travel simulator, like the one found these days at some theme parks where you can go on a thrilling ride through time courtesy of state-of-the-art technology. Motion simulators allow your body to react as it would in flight through the air as you are immersed within the imagery of a journey. This tricks the body into believing that the experience is real.This is just what Wells attempted to do in 1895 along with pioneer movie producer Robert Paul. They wanted to build a movie theater that would give the audience the illusion of traveling through time by putting them inside the action that was projected on screens all around them. They lacked the machinery that would have made it very convincing -- indeed, cinema itself was still at a very primitive stage. But it was a farsighted plan that, unfortunately, never got off the ground. Nevertheless, Wells's influential story anticipated the direction of our knowledge about time and space. But did his prophetic expertise extend to the prospect of a real time machine?There is always a fine line between writing science fiction that becomes insightful and stories that just look silly after a few decades of progress. One need only view some of the far future technology dreamed up in the original episodes of the 1960s TV series Star Trek to see this in action. What looked like gadgetry from the twenty-third century to people forty years ago, already seems old hat to us in the early days of the twenty-first century. The number counters on board the starship Enterprise feature no LED displays, as this technology was not predicted during the 1960s. Instead, lumbering manual counters were imagined to remain in use and yet these are already more likely to be found in a museum! Futuristic computers were also imagined to be clumsier by many orders of magnitude than those that are in regular use by millions of children at home today. It is simply not possible to predict the future of technology beyond the next few years because science is always going to provide surprises. We have many things in daily use that were not foreseeable -- such as lasers, microchips, and cell phones. And lots of things we do not yet have, such as flying cars, that most futurists in the recent past expected to exist in the world of today. Time travel could have proved another blind alley. Fortunately for Wells, almost as soon as his vision was in print, physics discovered that time travel was a genuine possibility. We have not stopped trying to make Wells's concept of time travel into a practical reality, and just a century or so later we are actually on the verge of making his dream come true.Prsentation de l'diteurIT WAS ONLY A MATTER OF TIME.... Once widely considered an impossibility--the stuff of science fiction novels--time travel may finally be achieved in the twenty-first century. In Breaking the Time Barrier, bestselling author Jenny Randles reveals the nature of recent, breakthrough experiments that are turning this fantasy into reality. The race to build the first time machine is a fascinating saga that began about a century ago, when scientists such as Marconi and Edison and Einstein carried out research aimed at producing a working time machine. 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