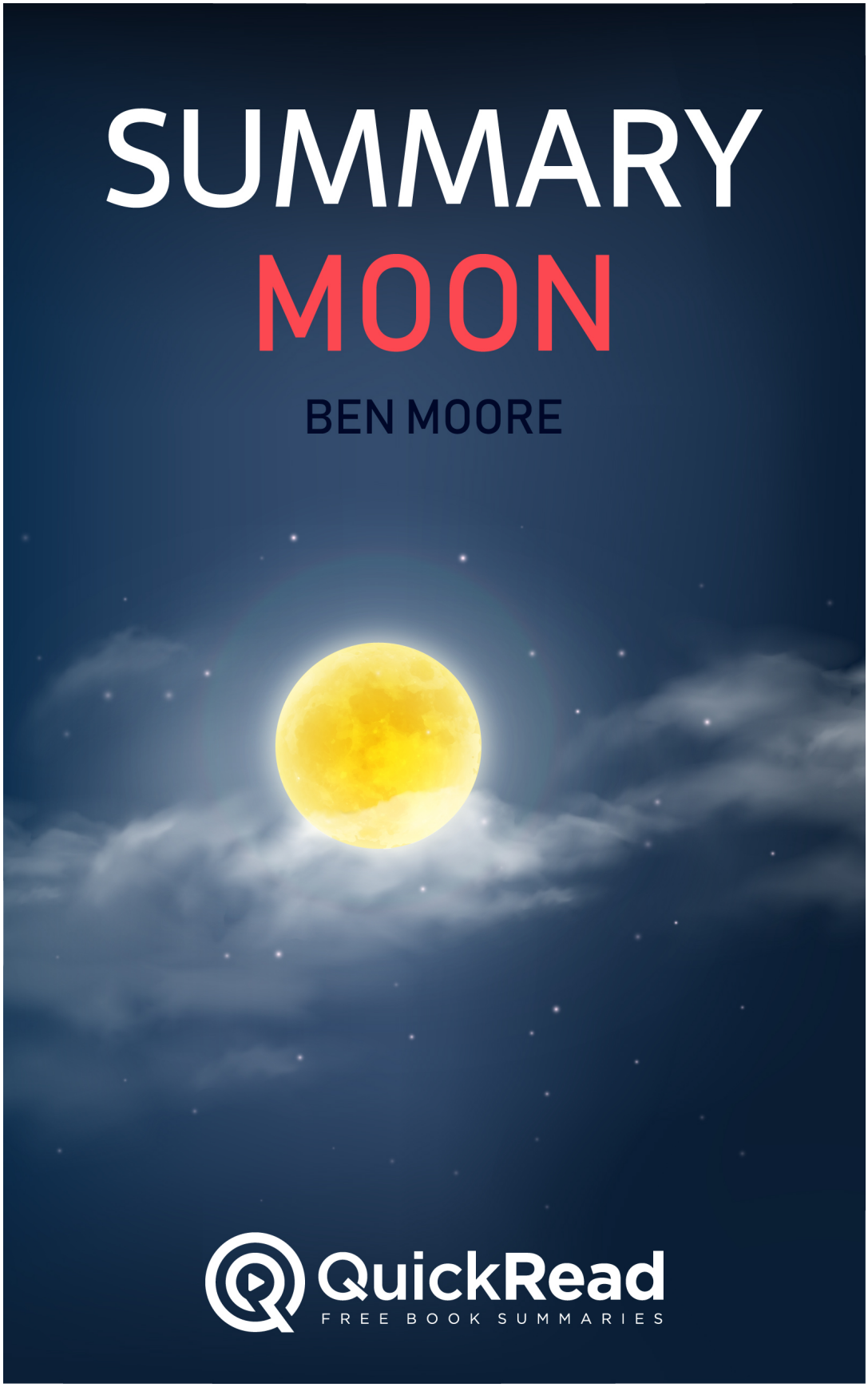
SUMMARY

MOON

BEN MOORE



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Summary of “Moon” by Ben Moore

Written by Lea Schullery

Learn about the past, present, and future discoveries about the earth’s Moon.

Introduction

Since the beginning of mankind, humans have been striving to learn more about the Moon. From folklore and myths to science fiction stories, our Moon has inspired people to revolutionize space travel and eventually walk on the Moon. Those dreams of walking on the Moon turned to reality when Apollo astronauts completed one of the greatest accomplishments of mankind. However, it's been fifty years since we saw Neil Armstrong place that American flag on the Moon and interest in the Moon has slowly faded over time. But now, there is a new space race to the Moon. In recent years, major space agencies and private companies all over the world have renewed interest in lunar exploration and have big plans for the future. From Moon vacations to an actual lunar settlement, the scientific community is making strides in making those plans a reality. In other words, lunar exploration has a bright future so it's time to learn more about how important the Moon is to our planet and our lives. In this biography of the Moon, Ben Moore aims to teach you about the history of our Moon, the latest research findings, and what the future looks like for lunar exploration.

Myths About the Moon

Remember what it was like as a child to look up at the Moon? From your bedroom window, you squinted your eyes and swore you could see people walking on its surface, or even saw the “man in the Moon.” You could see the craters and you likely wondered about its mysteries and what it would be like to walk there yourself. The imagination of a child is something to admire, right? Of course, seeing people walking on the Moon from Earth is simply impossible, but we believe it anyway. It was that night when Ben Moore was staring at the Moon in the winter of 1972 that Eugene Cernan made the last footprints on its surface. At just six years old, this feat of lunar exploration left a lasting impression on the young Moore.

Today, Moore is an Astrophysicist with a passion for everything surrounding the Moon, so it’s time to dive into the history of one of the most mysterious celestial bodies that has long piqued our curiosity and interest. Throughout history, dreams of our Moon have been portrayed in countless stories, poems, myths, and legends as primitive societies sought to understand the shining bright object that lit up the night sky. Eventually, our ancestors began to track the occurrence of the seasons by counting cycles of the phases of the Moon and primitive societies used the regular cycles of the Moon to keep track of time.

To our ancestors, however, simply keeping track of time was not enough, there was so much more to understand, more questions that needed to be answered. How did it get there in the first place? How does it affect our lives? To answer this question, emerging cultures across our planet passed down stories to understand the influence of the Moon on their lives. For example, an important god to the Sumerians and Babylonians was the male Moon-god, Sin, or Nanna, who was represented by a crescent or a bull. It was believed that this Moon-god could grant the power of life each month upon all living creatures. In other words, the Moon-god was a fertility god.

There are many creation myths surrounding the Moon-god, some involving battles between gods in hopes of dominating Earth while others aim to explain the many phases of the Moon. For instance, the fourth century BC Indian epic known as the Mahabharata sought to explain eclipses with a story about gods and demons on a mission to achieve immortality. However, in a twist of events, the gods betrayed the demons and stole the elixir. In an attempt to steal the elixir back, the demon Rahu snuck into the camp of the gods. But the Sun and Moon warned one of the gods named Vishnu, who awoke from his sleep and beheaded the demon Rahu.

Rahu's body and severed head were then fated to chase the Sun and Moon angrily through the night sky for eternity. So when Rahu's head catches one of his betrayers and swallows him, he causes the sky to darken, also known as an eclipse! However, since Rahu doesn't have a body to digest his enemy, the Sun or Moon can quickly escape through his disconnected neck. Stories like these sought to explain the world around us, and they worked for a while. But humans continued to quench their thirst for knowledge, and around the sixth century BC, ancient Greece became the first to perceive the world differently. Rather than believing that gods controlled everything from the cosmos to the Earth, they sought to prove that the materials in the sky acted under strict laws.

Science Fiction Inspires Future Astronomers

While ancient Greece was making strides in the sixth century to understand the cosmos, it wasn't until the seventeenth century that we saw the invention of the telescope. Now, humans were able to look closely at the Moon which inspired many stories as they tried to explain the rocky surface. If there were craters, surely there could be rivers, oceans, mountains, plains, and even another life form, right? People began to look at the Moon as if it were another world to be discovered.

Authors like Frances Godwin began to write fictional stories to inspire others and make them believe that the Moon was a celestial body in which people should admire. Godwin wrote a story called *The Man in the Moone* which followed a man named Domingo Gonsales who traveled to the Moon behind a flock of swans. Upon landing, Gonsasles discovered a lunar paradise. The Moon was a beautiful place filled with oceans and was even inhabited by a race of tall Christian people who lived in peace and beauty. Authors like Frances Godwin focused on science fiction stories in which people traveled to the Moon in search of something only the imagination could offer. Others, however, moved towards more rational stories that later astronomers would use for their own future creations. For example, in 1865, French author Jules Verne published a story called *De la Terre a la Lune,* a story of proto-astronauts who traveled to the Moon in a capsule fired from a cannon. Looking familiar? While astronauts today aren't technically fired from a cannon, they similarly travel into space in a rocket instead of a capsule.

By the end of the nineteenth century, science fiction writers continued to follow Verne's lead and wrote realistic ideas about traveling to the Moon and imagined the possible discoveries. For instance, H.G. Wells wrote about the struggles of traveling to the Moon due to the Earth's gravitational pull. In *The First Men in the Moon,* Wells envisioned an antigravity material to help travelers defy gravity and break through the Earth's barriers. Additionally, the two travelers would land on the Moon, only to

discover a desolate landscape much like the lunar surface we now know of today. Of course, the story wouldn't be complete without some fantastical element, so Wells included the discovery of an insect race called Selenites who lived underneath the Moon's surface.

As people began to learn more about the cosmos, authors wrote more accurate depictions of what life may actually be like on the Moon. Konstantin Tsiolkovsky, the first-ever rocket scientist, wrote his thoughts in a science fiction novel called *On the Moon,* in which he accurately described the feeling of standing on the Moon due to the effects a low-gravity atmosphere might have on the body. Stories like these inspired future astronomers to turn those stories into reality and are perhaps one of the greatest reasons we have made the strides we have in lunar travel today.

The Race to Space

Following the second world war, countries like the United States and the Soviet Union began making strides in space exploration. Finally, the space race had begun. Who would be the first to launch a rocket into space? Well, on October 4, 1957, the USSR successfully launched its first artificial satellite, Sputnik, into space. The satellite was simply a sphere with four long antennae that circled the Earth and transmitted a series of bleeps. The world was shocked. *Time* magazine even called the satellite launch a devastating blow, describing it as the Soviets "blowing a raspberry" at the United States. However, the race had only just begun.

Just one month later, the Soviets kept up the momentum and launched a dog named Laika into space. The Americans were desperate. So desperate that they rushed their first satellite launch on December 6, 1957. The rocket managed to get just one meter off the ground before it exploded into a giant fireball. Not the best look for the USA. The world was laughing as a Soviet delegate sarcastically offered to give the US some help. He even went on to say the Soviets could offer their technological advancements to "backwards nations," such as the US. You can imagine the humiliation President Kennedy was feeling at the time, so he made it his mission to get the United States to the Moon before anyone else. This was more than just a space race, this was communism versus capitalism!

On May 25, 1961, President Kennedy revealed the Apollo mission that aimed to launch Americans to the Moon. The budget for the Apollo program was astronomical, costing well over a hundred billion dollars in today's money. While the USA was working on getting to the Moon, the Soviets continued to gain momentum by putting the first woman in space, completing the first spacewalk, and launching the first cosmonauts in civilian clothes rather than space suits. The pressure was on and America was fighting to prove they were superior.

Eight years after President Kennedy unveiled the Apollo program, the Apollo 11 mission with Neil Armstrong and Buzz Aldrin landed on the Moon on July 20, 1969. As Armstrong said, it was “one small step for a man, one giant leap for mankind.” America had done it and they smiled from ear to ear as Armstrong placed that American flag on the surface of the Moon. In the end, landing on the Moon was more than just a feat accomplished by Americans. Had it not been for the Soviets’ first launch of Sputnik and the collaboration of Soviets, Americans, French, and Germans, a Moon landing would have never been possible.

The First Landing

Now that astronomers Buzz Aldrin and Neil Armstrong had landed on the Moon, the world wondered one thing: Was it anything like the stories of the past? Was it anything like our childhood imaginations? Was there a “man in the Moon?” Aldrin described the Moon perfectly when he said, “Beautiful, beautiful. Magnificent desolation.”

One thing that proved to be true was the grey landscape. Far different from the vibrant colors of the Earth, the Moon was composed entirely of various shades of grey. It was nothing like Aldrin or Armstrong had ever seen. They could hardly judge the distances and sizes of objects since they had no prior knowledge for comparison. While the landscape was a marvel that was to be expected, everything else about the Moon was far different from their expectations. For instance, the landing of Apollo 11 was during the long lunar days when the sun lit up the surface of the Moon with a bright, dazzling light. For the majority of the time, the two astronomers were surrounded by that blinding light. Additionally, the Earth is much larger compared to the Moon. This means the curve of the horizon can be seen by the naked eye at just 2.5 kilometers away.

When it came to looking at the Earth with the naked eye, Aldrin and Armstrong witnessed one of the most awe-inspiring sights in the universe. For both of them, it was a spiritual experience as they looked upon their home planet which looks about thirteen times bigger than the Moon appears from Earth. They could clearly see the continents and oceans, even though they were at such a great distance. But Michael Collins, who stayed in the command module while they orbited the Moon, experienced something equally breathtaking but a little more sinister. As he studied the long shadows and deep craters along the surface of the Moon, he felt an intense suspicion that human beings were not welcome.

On the surface, the two astronomers spent a total of 21 hours walking along the landscape near the Moon’s equator collecting samples of dust and

rocks. No longer would scientists on Earth have to wonder what the surface of the Moon was like. When their samples were finally examined on Earth, scientists learned that the crust was composed of igneous rocks, anorthosite, and basalt, all of which can be found on Earth. The regolith, which is simply the dusty surface of the Moon, was made of fine-grained surface rock. Like the Earth's surface, the Moon's dust and rocks can even cause humans to have allergic reactions. As researchers went to smell the lunar dust, one researcher accidentally inhaled and suffered from a "lunar hayfever," resulting in watery eyes and coughing.

So what about all those deep craters and high mountains on the moon? Well, the highest point on the moon is higher than Mount Everest by about 1,938 meters! However, the slope isn't nearly as steep. The highest point only has a slope of 3 degrees, so climbing the Moon's peaks wouldn't require nearly as much equipment as climbing Mount Everest. On the other hand, the lowlands of the Moon were far different than what early astronomers originally thought. From a telescope, the lowlands look like bodies of water; however, they are simply large basalt plains that were formed by ancient volcanic eruptions.

Lastly, the Apollo mission revealed more about the Moon's history than we've ever known. For instance, by studying the rocks brought back by Apollo 11, scientists were able to estimate that the Moon's core was formed about 4.53 billion years ago when it was a giant ball of magma. Over millions of years, the Moon cooled which formed different layers of rock, each one covering the next similar to that of an onion. The center of the Moon, however, is still surrounded by a small, hot boundary of lava. While we've gone to great lengths to understand the Moon's surface, there are still many mysteries surrounding the origin of the Moon.

The Origin of the moon

From the Apollo mission, scientists and researchers were able to prove that the surfaces of the Moon and the Earth are almost identical. But what does this mean about the origin of the moon? Once the Apollo program ended, Cornell University hosted a conference on planetary satellites where astronomers William Hartman and Donald Davis presented a new model of the theory of the Moon's origin: the Impact Model.

As the name suggests, Hartman and Davis believe the Moon was created when a planet the size of Mars collided with Earth around 4.51 billion years ago. This collision vaporized a generous portion of the Earth's surface which then sent debris flying throughout the galaxy around Earth. That debris then created a spinning disk of matter, eventually merging into a solid ball of mass, aka the Moon. Since announcing the Impact Model, scientists have argued the many ways in which this model doesn't make sense.

For instance, if a planet colliding with the Earth resulted in forming the Moon, then the Moon should contain a mixture of material from both planets. But the Moon's material is much too similar to Earth for the Impact Model to be true. Scientists argue that the planet's properties would have been far different from Earth's; therefore, the Moon would have a mixture of chemical properties. In fact, the rocks and meteorites that have been tested from Mars are far different from Earth, so it's not crazy to think that planets have many different properties.

Since the Impact Model isn't the best explanation for the origin of the Moon, current scientists have offered their own theories that may explain better. Perhaps there was a merger of two similar-sized planets, rather than a huge impact from a giant planet. After the two similar-sized planets spiraled around one another, the gravitational force of the two planets would have pulled them together, merging them to form the Earth. As a result, the material from both of these planets would have mixed and

become identical. Scientists then suggest that the Moon could have been a result of matter splitting from the merging planet. Of course, these are still just theories and the true origin of the moon is still much of a mystery.

How the Moon Impacts Life on Earth

As humans, we live our days following the circadian clock, the rhythmic cycle of days and nights. But did you know that the circadian clock affects more than just our days and our nights? In fact, it can affect biological processes like metabolism, growth, and even feeding behavior. And while we humans follow the circadian clock, many organisms on Earth follow the lunar cycle instead. In fact, all sea life is attuned to the circalunar rhythms. This is a result of the tides rising and falling based on the gravitational pull of the moon.

For example, the Fiddler crab forages for food at low tide. The activity of a Fiddler crab is determined by the circatidal clock, which is 12 hours and 25 minutes, (the time between two low tides). But what happens when those crabs are under constant light and temperature in captivity? They are still active when the tide is out, proving that the lunar clock is embedded in their genetic code and controlling their activity on Earth.

Similarly, let's look at the marine midge, the tiny flies that live along the European Atlantic coast. When it's time to lay their eggs, adults hatch from the larvae, mate, and lay their eggs all while the tide is at its lowest of the month. Once the tide comes back in, however, the flies are unable to survive. In just a few hours, the marine midge completes its entire life cycle and it is all determined by the lunar clock. So while the Moon certainly affects marine life on Earth, how does it affect human life and behavior?

You've likely heard that a woman's menstrual cycle is determined by the cycles of the Moon. This idea came to be when humans discovered the power the Moon has on the ocean's tides; therefore, the Moon must have power over human bodies as well, right? Unfortunately, this is a large misconception. The Moon's gravitational pull on the human body cannot even be measured because it is so weak. In fact, a fly crossing your path exerts more gravitational pull on your body than the Moon, sun, and all the stars in the universe combined. In other words, the Moon does not

influence human behavior. This may be hard to believe for most people as society has largely believed that the Moon has affected us greatly. Even the word “lunatic” was created because of the belief that the full Moon caused people to go crazy. People also make claims that homicide and suicide rates increase during a full Moon. But there is no scientific evidence that this is the case or that the Moon has any influence on our psyche. Simply put, it’s all just folklore.

The Future of the Moon

Now that we've discussed the biography of the Moon, it's time to talk about the future. What does it look like? Are people still interested in the Moon? Of course! Since the beginning of the space race, the USA and the Soviet Union have had plans to build a lunar base. But once the Apollo program ended, interest in further lunar exploration dissipated. However, in recent years, the topic of a lunar base has become a popular point of discussion in the scientific community. What would a lunar base even do?

First, a lunar base could open even more possibilities for space exploration. Have you ever looked at a telescope at night? If so, you might notice that looking into space from Earth has many drawbacks. For one, the Moon is incredibly bright most nights. And if the Moon isn't bright, then the stars are bright! There's also clouds, storms, etc. that can hinder your view even with the most powerful telescopes. On the Moon, however, astronomers would have perfect conditions for exploring the celestial bodies of the universe. No light pollution and no atmosphere means the Moon's night sky is truly dark. In other words, powerful telescopes could survey faraway planets, searching for biosignatures of life. They could quite literally discover if life exists on other planets.

Not only that, but radio astronomy would also be more effective on the Moon. Radio astronomy explores celestial objects by detecting radio waves; however, radio waves on Earth are filled with background noise from broadcast radios and other devices. But on the Moon? The reception will be crystal clear. Additionally, humans today are largely worried about the global effects of climate change as well as the conditions of our oceans and marine ecosystems. From the Moon, scientists could observe Earth from a completely different perspective and monitor the effects of climate change. Even more, they'd be in the perfect position to spot Near-Earth Objects, like meteorites, that are just flying through space at dangerous speeds.

When it comes to space exploration, humans have largely dreamed of creating life on other planets like Mars. Is this a possibility? Unfortunately, Moore believes creating bases on Mars is unlikely to happen during his lifetime. But if we create a lunar base first, then the creation of a Mars base might not be far behind. The Lunar base would allow humans to develop valuable experience in learning how to live in space, like how to develop self-replenishing food and sustainable energy supplies. Additionally, creating a base on the Moon would allow for cheaper exploration of the solar system. Think about it, how much does it cost to get from Earth to space? An astronomical amount! Even more, the Moon also has a weaker gravitational field than the Earth, meaning it takes far less rocket fuel to exit the Moon's atmosphere than to exit the Earth's atmosphere. In other words, space exploration would become cheaper and easier, allowing for endless possibilities. Who knows what we could find?

Final Summary

Since the beginning of mankind, humans have gazed upon the Moon and wondered what it's like and how it got there. It has been shrouded in mystery as ancient beings sought to explain its existence through myths and superstitions. People as early as the sixth century BC have successfully made strides towards understanding this mysterious celestial object. It wasn't until the twentieth century, however, when the space race between the Soviet Union and the US led to further exploration as they raced to the moon. In 1969, the Americans won the race when they successfully landed Apollo 11 on the moon. Astronomers Neil Armstrong and Buzz Aldrin became the first to walk along its surface and collect its rocks and dust. The mission allowed scientists and researchers to make important discoveries that have largely shaped our knowledge of the Moon today. The future of lunar exploration is still a mystery as space programs and private companies all over the world are researching ways to put life on the moon. What possibilities could this open for future exploration? While researchers can certainly predict what life on the Moon may look like, the possible findings could lead to more than we could ever imagine.