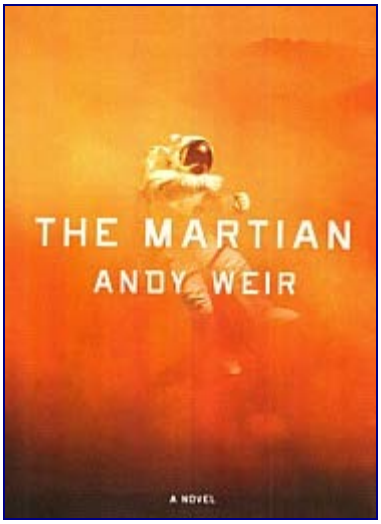
A READER'S JOURNAL

The Martian
A Novel
by
Andy Weir



ARJ2 Chapter: Reading for Enjoyment
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A Book Review by Bobby Matherne ©2016

I had read so much science fiction by the time I was fifteen that I probably spent more time on Mars than on Earth. It was this thought which prompted me to spend time with a guy who is stuck alone on Mars with modern technology on hand to help him survive. The list of problems Mark Watney has to solve would fill a 368-page book, and in fact it does. Each challenge, if not faced quickly and accurately would mean certain death, sometimes instantaneously, other times certain death if he doesn't survive for the 400 days when the earliest rescue mission will arrive. First long-term problem: the seven billion people on Earth think he's dead, and no one sends an expensive rescue mission to save a man who is already dead. All he has to do is radio Earth, but his antennas were blown away by the huge dust storm which impaled him with the tip of one of the antennas. First instantaneous problem: cleaning and stitching up his own side. These two are related because the metal shaft of the antenna rammed through his space suit and bio-monitor computer while knocking him out in the raving dust storm which obscured him from his five crew members who had only seconds to locate him before their only way home was tipped over and rendered useless. Watney's space suit sent data to his crew about his space suit breach and about the lack of life signs from his bio-monitor, so the crew unknowingly left him for dead on Mars, bleeding like a stuck pig, in minus-120-degree weather, in a near-vacuum atmosphere, unresponsive, and unrecoverable in the dust storm before their emergency departure for Earth.

When Watney miraculously awoke later, he said three sentences which will live right up there with famous first lines, like Dickens' "It was the best of times; it was the worst times."

> **[page 1] I'm pretty much fucked.**
> **That's my considered opinion.**
> **Fucked.**

These words are descriptive of Watney's situation and not in any way obscene; he was just talking as a mechanical engineer- and biologist-trained astronaut would talk in the presence of his crew mates. I've worked on very difficult projects, and when we got into a jam, that is exactly how we talked. We might have disguised our cuss word in acronyms such as *SNAFU* or *FUBAR*, but we all knew what the *FU* stood for, and we could politely answer, 'Fouled Up' when asked what the words meant. But we knew what they meant, and we talked like Watney among ourselves, maintaining a veneer of political correctness only when strangers were about. On one project we had a Cuban crewman named Jorge, pronounced *Hore-Hay*, who could not create a sibilant 'sh' so when he got really mad, he'd say, "CHIT!", and we would all chuckle at his attempt to cuss in English. He never got upset over our reaction; it seemed to lighten his

own anger.

With that prologue, you'll be ready for some other colorful expressions our hero uses to describe his situation to us:

> **[page 3] And now we come to the real trick of Mars exploration: having all of our shit there in advance.**

If you're an engineer, biologist, physicist, or any manner of technical person, my advice to you is this: READ THIS BOOK. And do it before watching the movie if possible. The movie will show you what Watney does to survive; the book will take you inside his head as he lays out the problem confronting him and you can work out the solution along with him. See if you predict how he's going to proceed, and do the calculations in your head along with him. If doing calculations in your head is not your forte, maybe you should watch the movie; but for me and others like me, this was the *most* fun! Consider these challenges: How you do make water from rocket fuel? How do you grow anything edible on Mars without any seeds? Watney can either use his solar power take a long drive or to keep warm — how can he do both? Just a hint of the kinds of life-saving obstacles Watney must overcome or die. A slight dust storm is moving overhead, if he guesses the wrong way around a large crater, his Rover will halt and he will die. How Watney calculated ingenious solutions for these and many other problems are glossed over by the movie-makers who show mostly only what he did. READ THIS BOOK.

Do you have children or grand-children who ask, "Why do I need algebra, geometry, trig, biology, physics, etal?" Get them to read this book, so they experience how the study of math and sciences saved this man's life. This Mars mission described fictionally is very similar to what is currently being planned for USA Mars missions, and some of the lack of redundancy revealed by Watney's various life-threatening dilemmas will likely feed forward into improving the design of future Mars' missions. Yes, your offspring are unlikely to become astronauts, but the ability to calculate and use one's available resources will challenge them at some point in their lives. If they have no solution, then they are doomed, if they have two possible solutions, they have a dilemma, only if they have at least three possible ways at their disposal, can they be said to have an option. Studying math and science gives them viable options, in other words, a way to stay vital and alive when faced with a desperate situation. Tell your offspring, "I won't be around to help you if you encounter life-threatening situations as an adult, but what you learn in school will be around, so study well. Making good grades means nothing unless you actually learn to use your knowledge."

The list of "if's" required for Watney to survive are as long the tail on a February kite in New Orleans, about three old tee-shirts torn into inch-wide strips tied into a long streamer. If he had access to a MAV, a Mars Ascent Vehicle, he could rendevous with a Hermes ship like the one he and his crew mates rode to Mars, if a Hermes were available, which none are! By the next planned Hermes trip, Watney will be long dead. Algebra was all it took for him to discover that. He'd die from a lack of, pick one: food, oxygen, water, or heat. And here's another "if": that's *only* if *everything goes well!*

Watney is an optimist. You know what that is? Two guys falling down the side of a hundred story skyscraper. The pessimist yells, "We're doomed!" The optimist thinks, "So far, so good!" Watney thought that way, and strived every minute of the Sol to live another Sol. Oh, what's a Sol, you ask, it's about the length of an Earth day and change, 24 hours and 39 minutes. That's the time Mars revolves once on its axis. More math to do, if you calculate how many Earth days something will take, you need to multiple that amount by 0.9736 to get the number of Mars Sols it will take. If you can't do simple algebra, you'll never even know on which Sol you'll die from lack of air or food or heat. How on Mars can Watney survive? Thereupon hangs the tale, a prehensile tale which grips you and won't let go until the last stinking line of the book.

If there were *any bacteria* in the soil of Mars, which there ain't, Watney could grow plants to provide food calories to keep him alive, if there were only any seeds aboard for anything but dumb grass experiments.

As Watney might have phrased it, "One just can't shit bacteria, can one?"

After regaining consciousness Watney found himself near death from oxygen toxicity due to backup system called bloodletting during the breach which let in Mars air and filled it with nitrogen, depleting the nitrogen Watney needed to breath normal air. How ironic, he thought, to die from a surfeit of oxygen on a planet which has almost no oxygen! (Page 5)

Watney's humor keeps his spirits up as well as ours. My wife told me that she never heard me laughing out loud so many times as I read a book before.

Why on Mars would his crew leave Watney? All signs said he was dead, and like in Vegas, what happens on Mars stays on Mars. The rules said if a crewman dies on Mars, he stays on Mars.

> **[page 7] Leaving his body behind reduces weight for the MAV (Mars Ascent Vehicle) on the trip back. That means more disposable fuel and a larger margin of error for the return thrust. No point in giving that up for sentimentality.**

As Watney surveyed the "raw materials" at his disposal in the HAB and the MDV (leftover base of Mars Descent Vehicle), he found enough soil for a window box and seeds for grass and ferns, nothing edible, no way to create food on Mars, so far as he could see. But he had a large cache of hope.

> **[page 12] But I'm a botanist, damn it. I should be able to find a way to make this happen. If I don't I'll be a really hungry botanist in about a year.**

He laughed at his fellow botanists who were hippies trying to compost everything. They seemed to spend a lot of their time trying to find better ways of growing pot. He thought, "Look at the silly hippies! Look at their pathetic attempts to stimulate a complex global ecosystem in their backyard." (Page 13) And now he was being forced to do the same thing. Saving every scrap of biomatter in a compost bucket. He even did an EVA (went outside) to retrieve his own freeze-dried shit to add to his garden soil, adding it as manure to the sterile Martian soil.

> **[page 13] The Hab has sophisticated toilets. Shit is usually vacuum-dried, then accumulated in sealed bags to be discarded on the surface. Not anymore. . . . Adding it [recovered freeze-dried shit] to water and active bacteria would quickly get it inundated, replacing any population killed by the Toilet of Doom.**

Since the waste is labeled, he could use only his own and not be subject to others' pathogens. He began hauling in sterile Martian dirt and mixing in his bacteria-rich manure creating a fertile garden soil which he filled the Hab with. Where did he get seeds? Thanks to Thanksgiving Day falling during their planned stay on Mars, some real, not canned potatoes were in the Hab's larder, and he would cut the potatoes with one eye in each piece and plant them. His comment during this process was, "My asshole is doing as much to keep me alive as my brain." (Page 14)

What about the smell? He commented, "That smell's going to stay around for a while, too. It's not like I can open a window. Still, you get used to it." (Page 16) Would his gardening efforts allow him to survive until Sol 1412 when Ares 4 is scheduled to land? No. With as much potatoes as he can grow, he can stretch his food to last until Sol 490, only 90 days longer than without potatoes, but he had little else to do, so he grew the potatoes.

> **[page 18] Remember those old math questions you had in algebra class? Where water is entering a container at a certain rate and leaving at a different rate and you need to figure out when it'll be empty? Well, that concept is crucial to the "Mark Watney doesn't die" project I'm working on.**

He works out how to create as much farmland as possible and calculates that he can just barely reach

survivable levels of food, but he will need 250 liters of water. Where will he get it? Can't drill a well on Mars. He needs a magic spell for creating water. He slept on it and came up with a simple and ridiculously life-threatening plan.

> **[page 24] I have an idiotically dangerous plan for getting the water I need. And boy, do I mean *dangerous*. But I don't have much choice. I'm out of ideas and I'm due for another dirt-doubling in a few days. When I do the final doubling, I'll be doubling onto all that new soil I've just brought in. If I don't wet it first, it'll just die.**

Mars has an atmosphere that is 95% carbon dioxide, one atom of carbon attached to two atoms of oxygen. Watney has an oxygenator whose job is to convert CO2 into O2, so he can create oxygen, mix it with hydrogen and BANG! Water! I mean the *bang* literally. To mix the two elements is easy, you burn hydrogen in the presence of oxygen and you get water. Too much hydrogen or too much oxygen you get a Big Bang, an explosion. Great, he's got a plan. Now where are the matches? None on a space ship; none in a Mars Habitat, of course. A spark will do the trick, if he had some kindling; one spark and you have a flame to start the hydrogen and oxygen burning. Another Sol, another problem for Watney: no combustible material for kindling. He went on a scavenger hunt for wood and found a small wooden crucifix one of the crew left behind. Where's the hydrogen to come from? The hydrazine, a very volatile compound of nitrogen and hydrogen, is the rocket fuel used in the MDV and there's plenty left. Rob a catalyst from the MDV's engine and you can release the hydrogen. But it produces ammonia as an intermediate step into becoming hydrogen and the smell of ammonia will make his Hab a living hell. Smell stinky stuff or die? He chose the former.

> **[page 27] The chemistry is on my side. The question is how do I actually make this reaction happen slowly, and how do I collect the hydrogen? The answer is: I don't know.**
> **I suppose I'll think of something. Or die.**

He comes up with a plan for making water by burning the hydrogen as it is being produced, so there'll be no need to store either the oxygen or the hydrogen and the water can drip directly into the arid soil to bring it to live. As he set up the equipment to create water out of rocket fuel (hydrazine), his most important item was duct tape to seal and attach the parts.

> **[page 28] Also, I have duct tape. Ordinary duct tape, like you buy at a hardware store. Turns out even NASA can't improve on duct tape.**

He worked out a solution to get rid of the excess hydrogen using short bursts of oxygen at a time.

> **[page 43] I was elated! This was the best plan ever! Not only was I clearing out the hydrogen, I was making more water!**
> **Everything went great right up to the explosion.**

He is dazed, breathing pure nitrogen in a space suit, to which he has to quickly add oxygen or pass out and die, and then he has to clean up the Hab and get out to the rover.

> **[page 45] I'm in the rover again tonight. Even with the hydrogen gone, I'm reluctant ot hang out in a Hab that has a history of exploding for no reason. Plus, I can't be sure there isn't a leak**.

He finally figured out where the excess oxygen came from: his own breathing out was adding oxygen. Yes, we breathe out oxygen or else how could CPR breathing into someone's mouth work? With that adjustment he got his water for this potato farm and then he did some astronaut work. He hatched a plan to take the Rover on a journey to retrieve the Pathfinder and its rover which had been sitting abandoned on Mars for many years. After he cleaned the dust off its solar cells, the Sojourner rover quickly reestablished its radio contact with Earth. Packing them on top his Rover, he drove home, towards the Hab. As he drove, he needed some Celestial navigation help and that came from Phobos, the larger moon

of Mars which sped by overhead East to West twice a Sol. He mused over conquering his fear of losing his way on Mars by using Phobos, whose Greek name means Fear.

> **[page 106] It just feels nice to be an astronaut again. That's all it is. Not a reluctant farmer, not an electrical engineer, not a long-haul trucker. An astronaut. I'm doing what astronauts do. I missed it.**

With Pathfinder's help, he establishes a crude method of texting messages to Earth using hexadecimal coding of ASCII characters, but NASA soon gives him a patch which enables him to be able type messages, basically inter-planetary email. Now he realizes he needs to be careful with his words because the whole world is reading what he writes, hanging on his every word as they pull for him to survive, but he still gets carried away at times.

While Watney enjoys doing astronaut stuff again, I'll skip my astronaut thinking and calculating for a while and do my poetry stuff. He apparently remembers the Bond movie *Die Another Day* and decides that his adventure on Mars would make a great Bond movie called *Live Another Sol*, only with him as *Q* instead of James Bond. That inspired me to write this poem in Watney's voice.

Live Another Sol

There's not another Soul
around for 35 million miles
and 35 million years
But I hope to live another Sol.

A Sol is like a Day and change
on Mars from Night to Sol.
What can I do with the extra 39 minutes?
Try to live another Sol.

I think I'm going for a stroll
I know I'll never see another Soul
Whether I go out by Night or Sol

My only hope is to live another Sol.

I say, "I think I'm going to live after all,"
which is quickly followed by,
"I am fucked, and I'm gonna die!"
Everything went great on this one Sol —
right up until the explosion.

And yet, I think I'll get to live another Sol.

I am driving without a compass
on a planet without a magnetic pole
With Fear as my only Guide —
if there's a God on Mars —
I pray that I may live another Sol.

"Please watch your language,"
the folks at NASA tell me,
But I'm too astro-naughty to care.
So I type: Look! A Pair of boobs! — > (.Y.)

LOL! I'm the funniest guy on this planet!
If I could only get to live another Sol.

I'm awake: another Sol, another Problem,
Another cup of Martian Coffee
Another Sol here on Club Mars —
If only I could live another Sol.

Every step I take outside my Rover
No one has stepped there before,
Every step I take to stay alive
Helps me to live another Sol.

A dust storm is coming —
Dimmed skies mean less power —
Less power means not getting rescued —
If it gets dark enough to kill me,
I will not get to live another Sol.

Live Another Sol
— sounds like a James Bond movie
— or a Bobby Matherne poem.

~^~

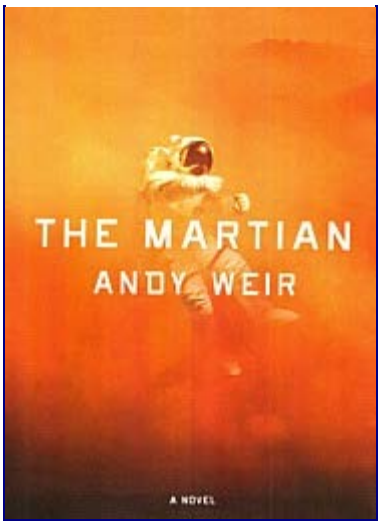
Watney gears up for the long drive to the Ares 4 area where a fueled up Mars Ascent Vehicle MAV has been staged for a future crew. A plan is evolving where he will escape from Mars and be picked up in a very dangerous maneuver and returned to Earth. The details in the book of how this happen are more realistic than the Iron Man stunt used in the movie. As a practical joker in my teens, I quickly learned that you can have more fun thinking about a practical joke than actual doing one. Watney in the book describes the thought he had of doing an Iron Man stunt, but reasoned scientifically that it had too little a chance of succeeding. Hollywood, reasoning box-office-ly, loved it!

Meanwhile, back on the surface of Mars, Watney may never survive to get to the MAV at all because a light dust storm is in his path. What's the problem with a *light* dust storm? The light part. The reduction in light. Light is the fuel which generates the electricity in the solar panels which powers the wheels of his Rover. If his Rover stops, he will miss the rescue mission completely and die on Mars.

Watney calculates again.

> **[page 301] So right now, the sunlight in this area is dropping by 4.5 percent per Sol. If I were to stay here another sixteen Sols, it would get dark enough to kill me.**

Out of touch with NASA, Watney has to burn precious fuel triangulating the path of the dust storm. If he drives around this large crater into the path of decreasing light, he dies. Another Sol, another Problem. Will Watney live to die another Sol, or will he live to die another Day on Earth? Inquiring minds, 7 billion strong, want to know.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