The Science in Hard Science-Fiction

By Michael Brachman, Ph.D.

I write hard science fiction. What does that mean exactly? It means speculative fiction where anything proposed that is beyond today's technology cannot be disproven or known not to be true. These double negatives require that a hard science fiction writer research each proposed innovation to guarantee that any fact that can be checked out will check out. My first trilogy, Rome's Revolution, required endless hours of research, sometimes just to get one sentence right! I thought I'd give you a few examples of this.

My first novel, also entitled Rome's Revolution required that I invent not one but two completely different but scientifically viable methods of getting to the stars. One had to be slower than light and the other had to be faster than light (FTL). Of course, these have been staples of science fiction since the genre was invented but I had to justify them. I proposed that the designers of my Ark program used a quantum black hole which is fed atoms of xenon and the resulting Hawking Radiation produced a souped-up version of an ion drive which NASA uses today. Unfortunately, the trip to the nearest star, Proxima Centauri, would take 40 - 80 years using my stardrive. The trip to Tau Ceti where most of my action takes place would take over 240 years. Nobody lives that long so I had to freeze my would-be colonists. Also, from an actuarial standpoint, the chances of building a spaceship that would last that long without something catastrophic happening would be very low. So instead of building an expensive and armored spaceship, I built a cheap one, basically a flying tin can. I used hardened storage chambers called sarcophagi in which the frozen people are placed. After embarking on their journey, the whole crew compartment could then be opened up into space so no energy would be required to keep them refrigerated. Some would die along the way due to micrometeorite punctures but that would not affect any other members of the crew. Of course, thawing the passengers out was problematic. No one has successfully frozen and revived a human being before. But is it possible? Sperm and egg banks have been freezing human reproductive cells for two decades. Scientists have recovered a plant found under the tundra in Russia that had been frozen for over 30,000 years and got it to bloom again. In Canada, the common wood frog freezes solid every winter and thaws out and spontaneously resuscitates itself in the spring. So it is possible.

The plot dictated that I also invent a plausible FTL drive. I did not want to just wave my hands and say warp drive. I wanted it believable and not disprovable. So I researched it and found that in 1948, a physicist named Hendrik Casimir predicted the Casimir Effect in which zero charged space spontaneously splits into regions of positive and negative energy due to quantum fluctuations before recombining again. This effect is real and was actually measured in 1996. Negative energy is a fascinating concept. If you could collect it, there are many who speculate that where there is negative energy, there is no space. Which means you could create a tunnel, conceptually similar to a wormhole except you wouldn't need a black hole. Thus my people of the future, called the Vuduri, invent the Casimir Pump and project negative energy in space. They create what they call a PPT tunnel, glide through it at a very modest speed and end up light-hours away in a single jump. Thus their effective rate of speed is much faster than the speed of light without violating relativity.

Here is an even more mundane example of the research: in the conclusion to the trilogy, entitled Rome's Evolution, there is a scene where my protagonist Rei (pronounced Ray, not rye), is standing on a balcony with his ex-girlfriend in the year 2067 AD and she points up to the Moon. I needed the star Tabit to be just to its right so that Rei could make a comment about it. I had to acquire a program called Voyager by Carina Software which allows you to calculate the position of stars at any time in the past or future from any place on Earth (or other star systems). I spent several hours until I found the exact date where the Moon and stars were aligned exactly the way I needed them: January 24, 2067 AD. Check it yourself.

For my last example, I had to figure out a way to observe events in the past without actually inventing time travel. I have seen pictures from the Hubble telescope's Ultra Deep Field which are images of galaxies formed over 13 billion years ago. This is a form of "observational" time travel. However, for my novels, I needed something more precise because my characters had to view an event close up that happened 17 years in the past. I was halfway there with my PPT tunnels (the FTL drive) since I had objects which could outrun light and EM waves but how to collect them? I had to invent a "lens-less" camera. I knew from my graduate work that horseshoe crabs can see perfectly well but do not have a traditional lens. Their light collection apparatus are called ommatidia which are long deep transparent tubes with a photosensitive receptor at the bottom. The outer surface of the ommatidia are formed in a convex pattern. So I patterned my lens-less camera off of them. I created tiny starprobes which were nothing more than a PPT stardrive and a single pixel camera with a small tube in front of the collection plate. These starprobes would jump out 17 light years, take a snapshot and return. I had two waves of them alternately jumping in and out at an interleave rate of 30 frames a second, the same as television. The collection tubes guaranteed that they would only detect photons directly where they were pointing and they were coordinated so that they "focused" on a single point. Well, this year, Bell Labs demonstrated a lens-less camera that could take 3D color pictures with a single pixel element! Since the objects I needed to observe were much larger than a stack of books, I figured I could spot my characters a few million starprobes to get an HD image. What they saw will blow your mind but you will have to read the book to find out what it is.

There are countless other things I had to research: I had write a computer program to generate a new language (called Vuduri) because what are the odds that people will still be speaking English 14 centuries from now? I had to learn about Maksutov-Cassegrain reflectors because the Vuduri have telescopes built into their eyes. I had to learn about thermite because I needed an explosive that would last 14 centuries. I had to learn about the anatomy of the back, gravity waves, aerogel, electro-gravity, Dyson spheres; the list goes on and on. All this because I wanted to get the facts right. Hopefully this will give you a little appreciation for the amount of research required to turn ordinary science fiction into hard science fiction.

Michael Brachman has a Ph.D. in Sensory Science with a minor in Computer Science. Although he has been writing for 40 years, Rome's Revolution is his first science fiction series, depicting the enduring love between a man from the 21st century and a woman from the 35th century. Between the two of them, they fend off various threats to mankind. The science behind the science fiction is meticulously researched. It is so realistic, you will believe that these stories are true, they just haven't happened yet. Michael has two children and lives in Cherry Hill, NJ with his beautiful and talented wife Denise.

Websites: Rome's Revolution - http://www.RomesRevolution.com

The Ark Lords - http://www.TheArkLords.com

Rome's Evolution - http://www.RomesEvolution.com
All three books are available from in paperback and for all e-book readers

Wiki: Rome's Revolution: The Science Behind the Science Fiction - http://romesrevolution.wikidot.com

Blog: Tales of the Vuduri - http://www.goodreads.com/author/show/5874161.Michael_Brachman/blog
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