



Little Mito: The Story of Where He Came From

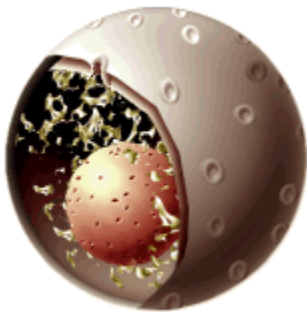
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Little Mito grew up in a one-room house in the Eukaryote family. His neighborhood consisted of one-room houses just like his, and everyone got along real well. He grew up with his sister, Chlora, his older brother, Flag, and his cousins, ER and Nuc. Each of them had their own chores, and the housework was done quickly and efficiently as it came up.

Chlora was in charge of gathering energy and converting it to carbon compounds and oxygen. She did this by soaking up the rays all day, making carbohydrates in a process called photosynthesis. It doesn't sound like a tough job but everyone knew she was the breadwinner in the family as long as the sun was shining. If not, then it was up to little Mito to do the job. He took his responsibilities seriously. He took the carbon compounds that his sister had made and then broke them down to get energy to run the household. He needed to breathe in oxygen to do the job. He felt like he was a little furnace, burning up the fuel and letting the energy out. Folks called what he did "cell respiration" and it made him feel proud to know he was doing his bit contributing to the family's welfare.



Flag was the "mover and shaker" in the household. His job was to help the family move whenever they felt the need to see the countryside. He accomplished this by poking his tail out of the house and doing his undulating dance without a care for what the neighbors thought!



ER and Nuc had their own duties. ER was in charge of distribution and storage. He maintained the household supplies, seemed obsessed with moving things about in the house, and always remembered Chlora, Flag, and Mito's lunch money. Nuc was the head honcho of the Eukaryote family, and his responsibilities involved the organization of the family documents and information and leadership. He told everyone what to do and when to do it, even when they didn't want to. He was particularly busy on those occasions when they needed to

build a new addition to the house for their expanding family. But that's another story.

The family was happy and set in its ways for many years until one day Mito heard a rumor about his past. A friend on the playground mentioned something about his great great grandfather being in the Prokaryote family. Mito wasn't sure what this meant, but he knew it might be important, so he went to the library to do some research. He never knew that genealogy could be so fascinating. But what he found out was shocking and it troubled him greatly.

Apparently, Mito had a questionable past. He almost felt illegitimate! There was a big argument among academicians. There were two completely different ideas about his family's origins: one was something called endosymbiosis and the other was called autogeny. Autogeny was a familiar concept to him, being as that was what he was taught his whole life. This was the legend that all of his relatives, Nuc, ER, Chlora, and Flag, had come from a prokaryotic cell ancestor who got too big for his britches and decided to infold his plasma membrane. This happened over thousands of generations. Slowly, but surely, he folded his surface and produced a whole bunch of membranes inside the cell. Some of these pinched off and made all of the family. As they floated around in the cytoplasm, they started to specialize with certain tasks and household jobs.



This sounded reasonable to Mito; he was just a kid after all. He knew that Nuc had a swell double membrane folded around him like a comfy blanket. Chlora and he also had double membranes, but their insides were just chock-full of them too and these let them make energy for the house. And there was ER and a bunch of other relatives like the Golgi cousins and brothers Ves and Lys. All of them were just membranes, membranes, and more membranes. Then there was Flag. No one really knew where he came in—they just didn't talk about it. You know, a family secret.

But here was this other weird idea, endosymbiosis, that must have been what his friend was talking about. The book he found stated:

Eukaryotes arose principally through a series of events wherein certain prokaryotic cells were engulfed by other larger phagocytic prokaryotes, those whose membranes evolved the ability to take in food through phagocytosis. Perhaps because digestive machinery was not yet particularly efficient, or the prey had developed defenses against the predator's enzymes, some of the ingested organisms survived and continued living within the predator.

This was absolutely mind blowing! It contradicted everything that he had been taught in school about his origins. Mito thought, "In the beginning, my great grandfather Mito wasn't part of a family; he did EVERYTHING ALL ALONE. And Grandpa was once an aerobic bacterium and not a Mito at all. Then one day he got eaten by a bacterial predator and, according to this book, he was too strong for them. But he found it was pretty cool living inside the predator. That's my Grandpa! Always looking for a good deal. As long as he did his share for the predator and kept producing extra energy, he was living in the lap of luxury. He didn't think of himself as a parasite or anything, it was more like a buddy system. I'll wash your back and you wash mine--that sort of thing." In the book they called it a mutualistic relationship.

But that wasn't the end of it! The book said the predator host did it again and maybe even again. That's how his sister got here too. She had been a blue green alga who was gobbled up. "Awesome!" His brother, Flag, the book said, maybe came from spirochetes who started living all over the host's body. The scientists weren't real sure about that one though. Mito had always thought that Flag was a little

strange. He was pleased to read that the book thought so too. All the books agreed that Nuc and ER came about through traditional membrane infolding. If his cousins Golgi and the twins, Ves and Lys, found this out he would never hear the end of it. "Good grief," he thought, "I'm living with a bunch of strangers. We aren't related at all!"

Mito was shocked and disturbed, but most of all he was curious. What did this mean, and where did he really come from? Which theory was the correct one?

Questions:

1. What are Nuc, Flag, ER, Mito, Chloro, Golgi, Ves and Lys short for? What does each of these organelles do in a cell?
2. What is the autogenic hypothesis of the origin of the eukaryotic cell?
3. What is the evidence that supports the autogenic hypothesis?
4. What is the endosymbiotic hypothesis?
5. What is the evidence for the endosymbiotic hypothesis?
6. What are the comparative strengths and weaknesses of the two hypotheses?

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