A Crystal Clear View On Insulin

The Effects of Microgravity on Insulin Crystallization

Investigators: Alex Ferguson, John Balian

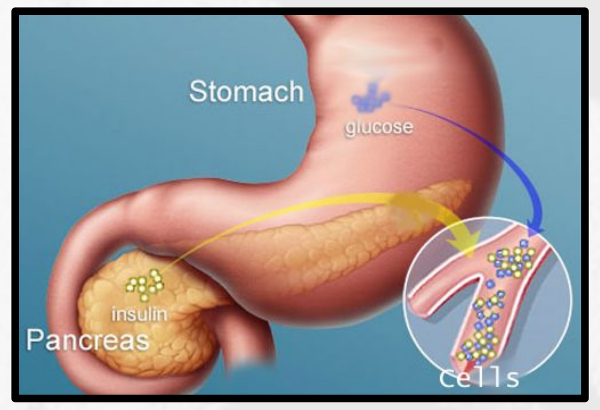
Teacher Facilitator: Laura Smith

Experiment Importance

Why is this experiment/ investigation important for humankind?

This experiment can help people with type 1 diabetes get insulin that doesn't crystallize. It could also possibly help develop an insulin for type 2 diabetes. We are researching the rate at which Humalog/Human Insulin crystalizes in a microgravity environment.

The reason synthetic insulin crystallizes is that when the insulin reaches a certain temperature the bacteria cells die and it makes crystals.

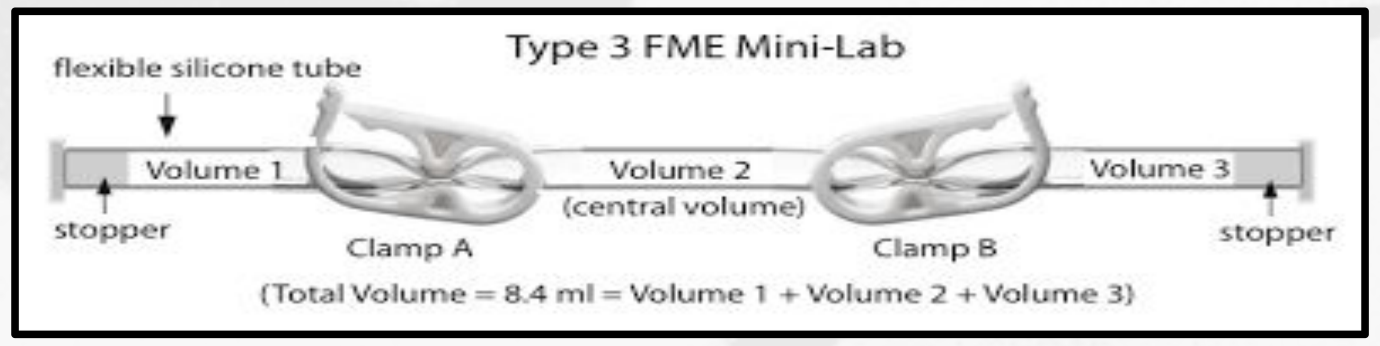


The Reason

Alex Ferguson, one of the investigators' dad, is a Type 1 diabetic and takes humalog insulin. When coming up with an idea of what to do for our SSEP project, Alex remembered that one day his dad mentioned that "if insulin stays out of refrigeration it will crystallize." We decided to go with that idea and worked really hard on it. We understand and know that by studying the crystalization of insulin, we have the potential to learn how to diminish the crystalizing process altogether.

Proposal Summary

Our experiment is about diabetes and Humalog/Human insulin crystallization in a microgravity environment. We feel like this is a good experiment to design because we could find out if there is a way to prevent crystallization of insulin, especially if we understand how it happens in microgravity. When insulin crystallizes, the bacteria that usually makes it viable stops working. This would cause it to be ineffective for patients in dire need of this medication. To complete this experiment we are going to keep three different varieties of insulin in a type 3 FME at the International space station (ISS) above 65℉ to see if it crystallizes within a certain amount of time. We will keep the experiment refrigerated at or below 40℉ during transportation to the ISS and again on arrival back to Earth's gravity. Refrigeration slows the crystallization growth and this is how it is stored on Earth. Keeping our experiment refrigerated during transportation is an important step because the insulin crystallization growth should only be measured while in microgravity. We will be conducting the same experiment, using the same time frame and refrigeration needs before and after, for our earthbound experiment. If we can find a way to fix this problem and even maybe diabetic men and women can follow their passion of being an astronaut with diabetes.

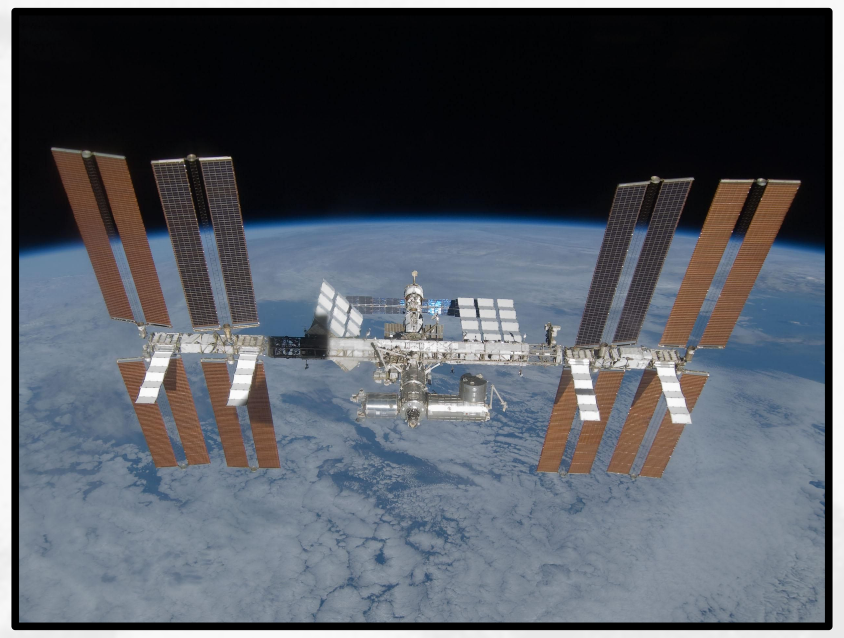


What is the FME tube? An FME tube is a experiment housing that is airtight and can have three variations. It can have no clips, one clip, or two clips. Our experiment requires a Type 3, which has two clips.

Special Handling Requirements During Transportation

FME will need to be refrigerated from Burleson TX. to NASA with a temperature of at least 40℉ or below in order for the experiment to work. It will also need to be refrigerated on its return to Burleson TX from NASA to stop the experiment crystallization.

Travel	Location and destination	Refrigeration	Ambient Condition
PRE-FLIGHT	Shipping from your Community to NanoRacks in Houston	X	
	At NanoRacks until Handover to NASA	X	
FLIGHT	Handover to NASA Until Arrival at ISS	X (required)	
	Onboard ISS		X (required)
POST-FLIGHT	From ISS until Arrival at NanoRacks		X (required)
	At NanoRacks through Return Shipping to Community	X	



Proposed Results

In our earthbound test of unrefrigerated insulin, we noticed that the crystals have formed in a lattice structure moving up. We hypothesize the the same will happen in a microgravity environment. We feel that the crystals will grow surrounding the tube instead of in the liquid itself as well.

By completing this experiment, the results will help us understand how insulin crystallizes in space and by using this information we can learn about other ways insulin can crystallize. The results could help type I diabetics by developing an insulin that does not crystallize at all. It may also help type II diabetics by possibly creating an alternative Insulin that lowers type II diabetics blood sugar. We may ultimately be able to help find a way for astronauts who have diabetes get to do the job they love without as many health concerns.

References

Crystal-clear view of insulin. (2010, January 29). Retrieved October 30, 2017, from https://science.nasa.gov/science-news/science-at-nasa/1998/notebook/msad22jul98_1

DeLucas, Larry. "Crystallizing Opportunities With Space Station Research." *A Lab Aloft (International Space Station Research)*, NASA, blogs.nasa.gov/ISS_Science_Blog/2014/03/04/760/. https://blogs.nasa.gov/ISS_Science_Blog/2014/03/04/760/

Insulin. (n.d.). Retrieved April 03, 2018, from https://www.diabetes.co.uk/about-insulin.html/.k