A Scientific Investigation By:  
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**Question:** Will keeping kidney beans at a warmer temperature cause them to grow better?  
  
**Background Research:** Kidney beans are seeds.

Kidney beans require water to live.

They are not suitable for consumption, as they are poisonous.  
  
**Hypothesis:** If kidney beans are kept at warmer temperature, then they will grow larger than if they were to be at a cooler one.  
  
**Experimental Design:  
 TEST:** Independent Variable: Temperature   
 Dependent Variable: Growth of kidney beans  
 Experimental Group: Beans kept in incubator  
 Control Group: Beans kept in room temperature  
   
 **PROCEDURE:**   
 1. First, we placed the beans in folded coffee filters and sorted them into separate, labeled plastic bags.

2. We placed the bags from the experimental group into an incubator, while putting the bags from the control group into a drawer in the classroom.

3. Each day we marked its growth, observed its qualitative properties, and made inferences based on our collected data.

4. After recording our data, we watered each individual bean with exactly 3 sprays from the bottle and placed each bean back in their bags and into the drawer (control) or incubator (experimental).

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| **Control GROUP** | Day 0  (Thursday) | Day 1  (Monday) | Day 2  (Tuesday) | Day 3  (Wednesday) |
| **Bean**  **1** | Smooth and reddish-brown.  0 mm | Reddish-brown, smooth surface. Nicely sized white sprout cracked through side.  30 mm | Orange-brown, smooth surface. Nicely sized sprout cracked through side with slight growth.  35 mm | Orange-brown, smooth surface. Same- sized sprout cracked through side.  35 mm |
| **Bean**  **2** | Smooth and reddish-brown.  0 mm | Reddish-brown, smooth surface. Large white sprout cracked through side.  60 mm | Reddish-brown, smooth surface. Significantly bigger white sprout cracked through side.  80 mm | Smooth, orange-brown shell, a very large white sprout cracking in the side.  95 mm |
| **Bean**  **3** | Smooth and reddish-brown.  0 mm | Reddish-brown, smooth surface. No sprout.  0 mm | Orange-brown, smooth surface. Still no sprout.  0 mm | Finally, a very small white sprout cracked through the side! Smooth and orange-brown surface.  20 mm |

**COLLECTED DATA:** Our beans in the experimental group grew extremely well, surprisingly! Even on the first day of observation, we noticed that 2 of our 3 beans had already grown a substantial amount compared to our classmates. White sprouts cracked through the sides and grew in abstract, spread out shapes. The color of the beans changed from a reddish/brown to a more orange/brown throughout the course of the observation as well.

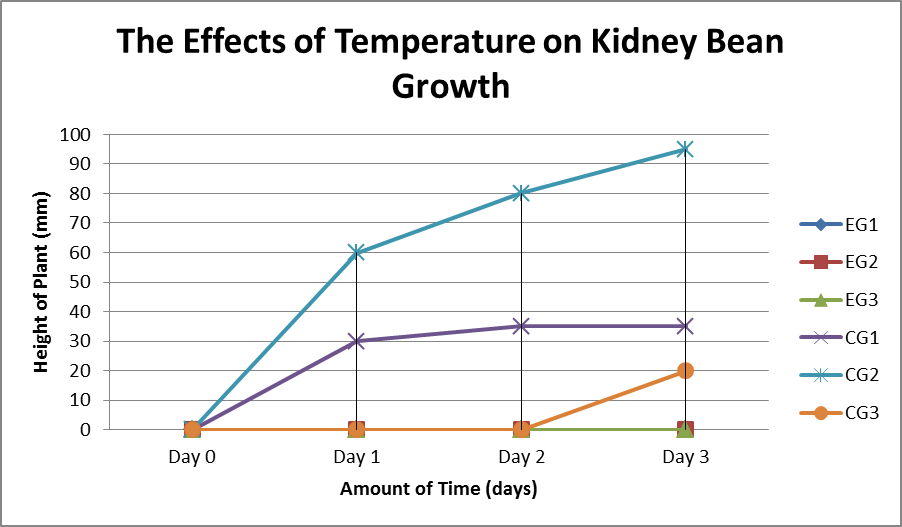
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This was our amazing control bean #2 on the final day of observation, boasting a gigantic 95 mm measurement! We were, and are, very proud of this bean. It grew up so fast...

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| **Experi-**  **mental GROUP** | Day 0  (Thursday) | Day 1  (Monday) | Day 2  (Tuesday) | Day 3  (Wednesday) |
| **Bean**  **1** | Smooth surface with a reddish-brown color.  0 mm | A little wrinkly, feels slightly dry. Reddish-brown color. Warm.  0 mm | Wrinkly shell and feels dry. Reddish-brown color. Warm.  0 mm | Very wrinkly shell and feels quite dry. Reddish-brown color. Warm.  0 mm |
| **Bean**  **2** | Smooth surface with a reddish-brown color.  0 mm | A little wrinkly, feels slightly dry. Reddish-brown color. Warm.  0 mm | Wrinkly shell and feels dry. Reddish-brown color. Warm.  0 mm | Very wrinkly shell and feels quite dry. Reddish-brown color. Warm.  0 mm |
| **Bean**  **3** | Smooth surface with a reddish-brown color.  0 mm | A little wrinkly, feels slightly dry. Reddish-brown color. Warm.  0 mm | Wrinkly shell and feels dry. Reddish-brown color. Warm.  0 mm | Very wrinkly shell and feels quite dry. Reddish-brown color. Warm.  0 mm |

**COLLECTED DATA:** Unfortunately, the beans in our experimental group did not flourish as well as the ones in our beloved control group (or even at all, really…) None of our beans even so much as sprouted over the duration of our 3-day observation period. The only change they went through was that their shells became dry and wrinkly. The pigment of their shells remained the same as well. (The incubator probably just fried them slowly over those three days...)

**GRAPH:**



**CONCLUSION:**

* In this investigation, my challenge was to nurture my beans and cause those in a warmer temperature to grow larger than those at room temperature.
* Using this information it was hypothesized that beans will grow better if they are kept in a warm environment.
* In order to test the hypothesis, I separated 6 beans into 2 groups, experimental and control. The beans from the experimental group were placed in an incubator to grow, while the control group was placed in a room-temperature drawer in the classroom. The variable in my experiment was temperature. To observe the growth of the beans, every day we took them out from their individual bags, measured them, observed their qualitative changes, and gave them each a drink of water to wrap it up.
* My results show that beans do not, in fact, grow better when in a warmer climate.
* After analyzing the results I determined my hypothesis was incorrect. The beans grown at room temperature yielded much better results of growth opposed to our beans grown in the incubator, which failed to even sprout at all.
* Although I came to this conclusion, it is possible that there could have been some sources of error that impacted the results.
* **Incubator too hot** – The incubator’s temperature could’ve been too hot for the beans to handle, and ended up killing them.
* **Closing the bags** – We might’ve, as I recall, forgotten to close the bag or bags of our bean(s) one day. If so, this might’ve had a rather large impact on our experiment.
* **Poor watering** – On one of our observation days, my partner Gabrielle and I went to go check on our beans in the incubator room to water them, but the spray bottle was dysfunctional, so she improvised and poured the water into her hands and then onto the beans in a very awkward manner. This could’ve impacted their growth.
* **Watering hiatus** – Everyone was unable to water their beans over the weekend. They might’ve yielded different results if watered on Saturday and Sunday as well.
* My challenge was to grow the longest kidney bean sprout testing only 1 variable. Knowing what I know now, I would grow my kidney bean in a *dark*, room-temperature environment. I found out from the experiment that the darkness is what caused my control group to grow so unexpectedly well. Our classmates had all grown their beans in the light, while I kept mine in the dark. Another idea I would try would be to grow the beans in a dark, slightly warmer-than-room-temperature climate. The incubator might have been too hot of a place for the beans to grow, and therefore caused them to die.