

17. Invent Yourself: Weight

Team Romania
IYNT 2020



“The weight of a living **organism** is not constant. Propose an interesting study concerning **short-term** or **long-term** variations in the **total** body mass of a **living organism**.”

What is the “weight variation”?

(according to the Oxford English
dictionary)

Weight = “A body’s relative mass or the quantity of matter contained by it”

Variation = “a change, especially in the amount or level of something”

Outline

01	Theoretical part	<ul style="list-style-type: none">• Weight of a plant• Osmosis• Organs that influence the weight• Testing subject
02	Experimental part	<ul style="list-style-type: none">• Proposed problem• The experiment on Plants• The experiment on rodents
03	Final part	<ul style="list-style-type: none">• Conclusions on the testing subjects• Common conclusions between the species



Theoretical part

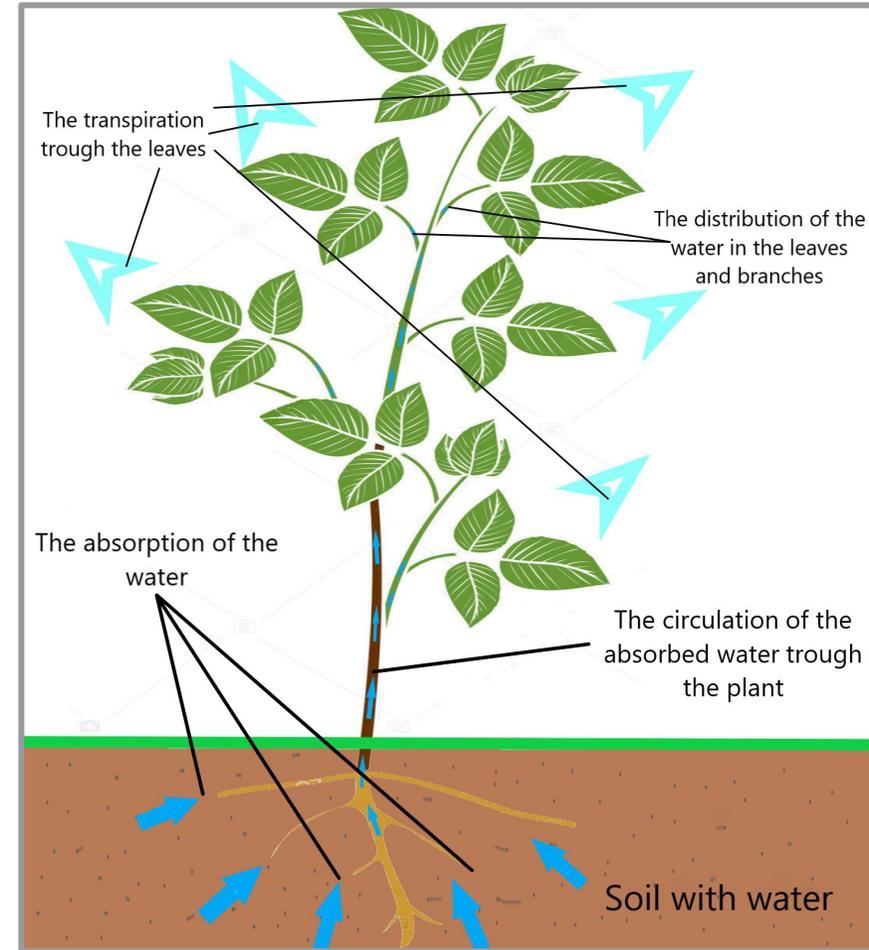
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Can the weight of a plant vary?

The answer is YES, the weight of a plant varies due to the absorption of water, minerals and carbon dioxide from the air.

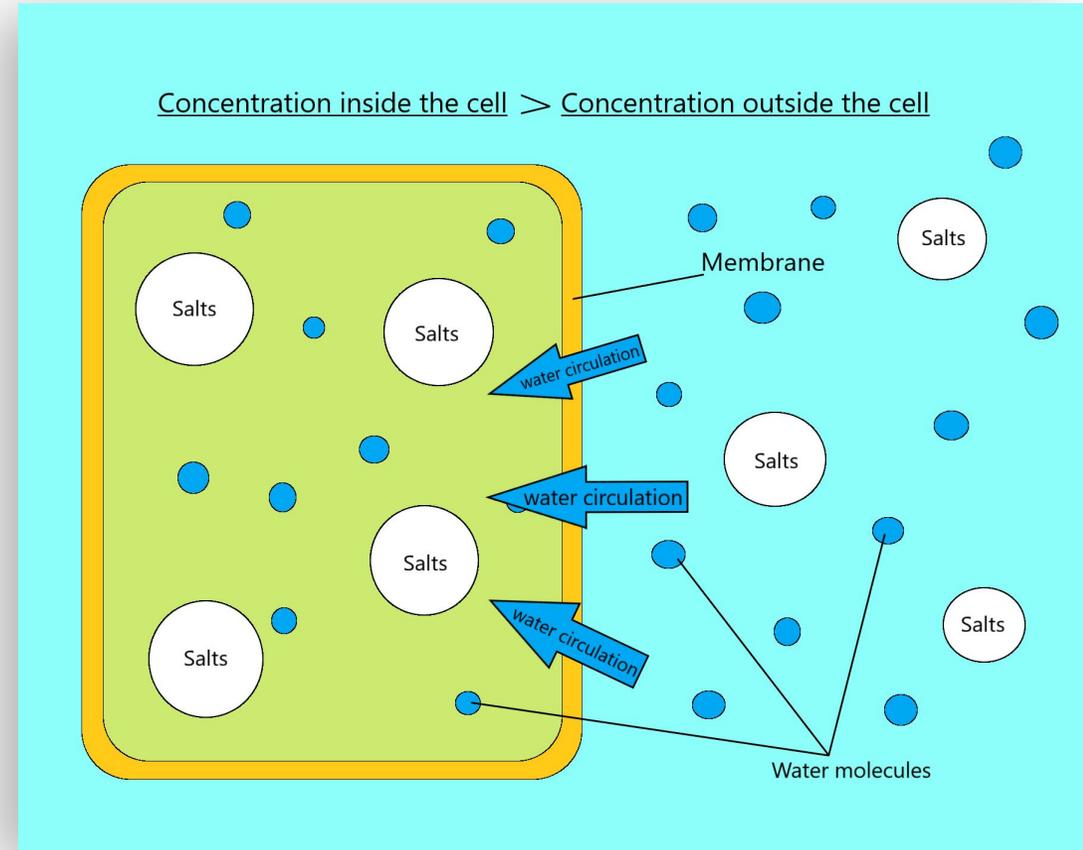
- How can a plant “drink water”?

The process is called osmosis, it is the way a plant absorbs water through its roots and distributes it in the whole body.



The osmosis and the osmotic force:

Definition: osmosis represents the process in which water passes through the wall and membrane of the cell, inside the cytoplasm due to lower and higher concentrations of the solute.



How does the osmosis create a water flow in the root of the plant?

- Reason for the Circulation:
 - The difference of concentration inside and outside of the cell
 - The difference of concentration between the cells.



Organs of the Plant that take part in the processes that change the weight:

The root hairs



The root



The suberized sclerenchyma
conductive vessels





Experimental part

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Proposed problem

Investigate how the weight of a plant varies over a period of time.

Apply a similar study for a small animal and interpret the results.

My testing subject:

Facts:

- Species: *Sempervivum tectorum*
- Orignary from: Maroc, Iran, the Alps, the Carpathians, Turkey, North-Eastern Saharan Region and the Caucasus

Parameters:

- Width = 7 cm
- Height = 4 cm
- Length of the root = 7.5 cm
- Mass = 21.9 grams



Experiment 1:

Task:

- Investigate the mass variation immediately after watering.

Way of execution:

- We will put the root of the plant in water for letting it absorb humidity. For 3 minutes we will perform measurements of the mass (30 seconds apart).

Materials:

- An electronic balance
- A glass of water



Hypotheses:

The first Hypotheses

- The value of the variation won't be greater than 0.3 grams in the 3 minutes of the measurements.

$$\Delta m = m_2 - m_1$$

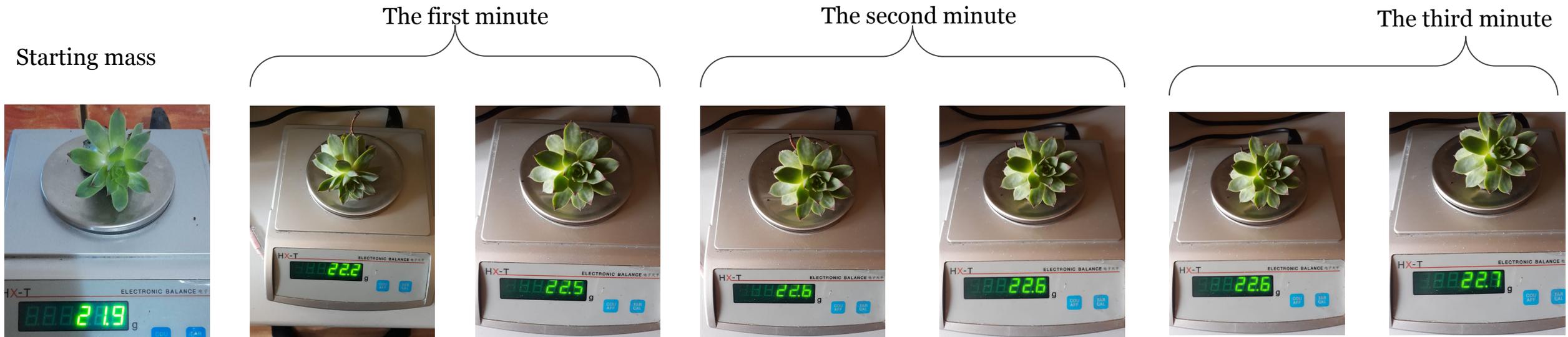
The second Hypotheses

- The leaves will become harder, because they will absorb water.



How did I investigate?

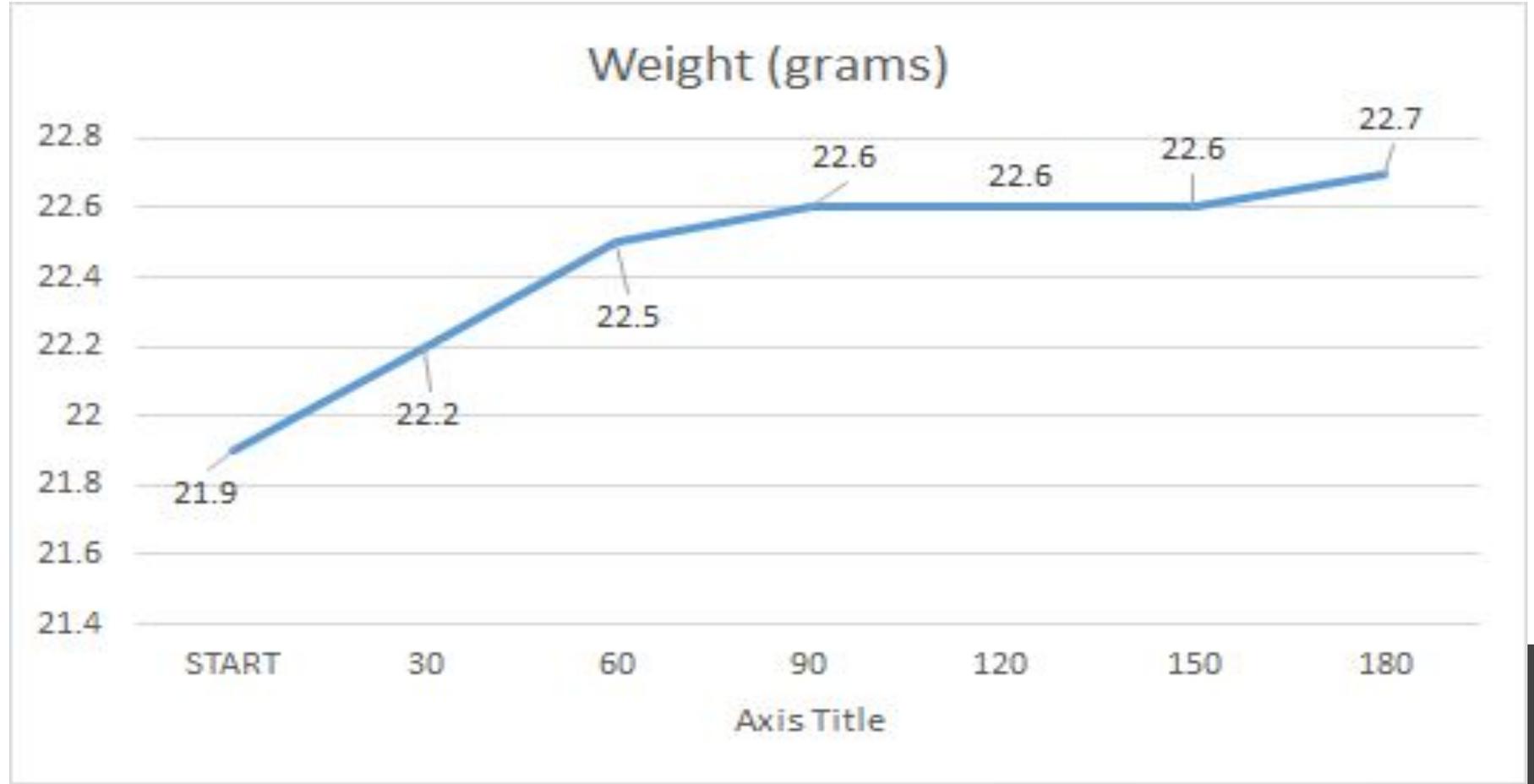
- At every 30 seconds I did measurements regarding the plant's weight.



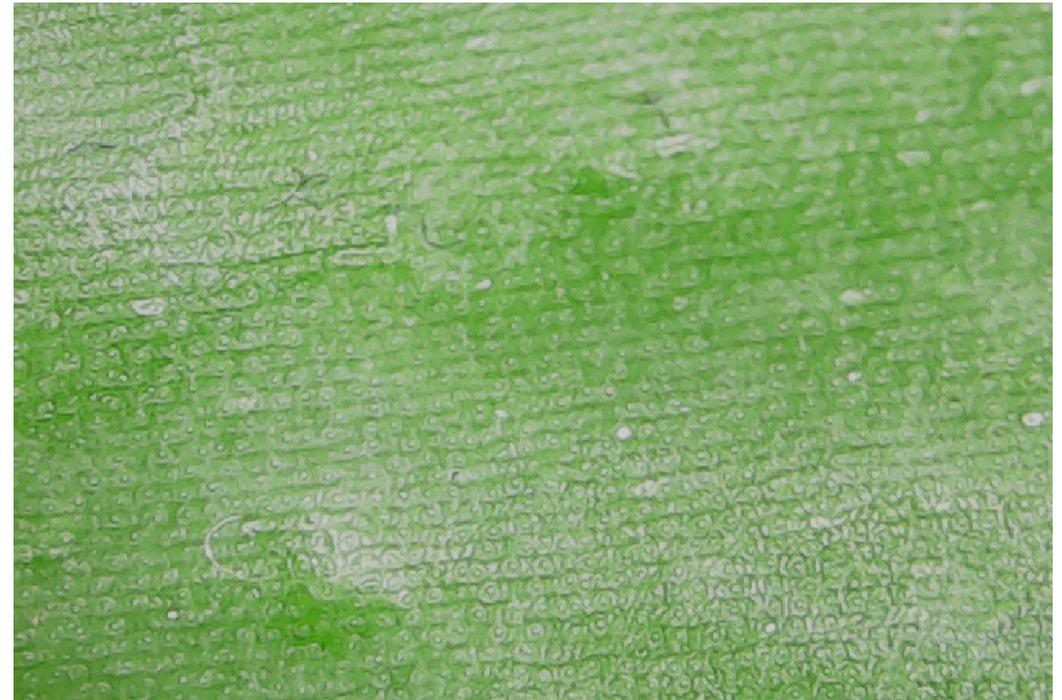
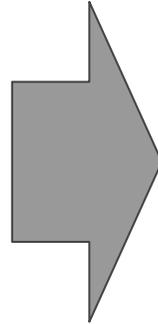
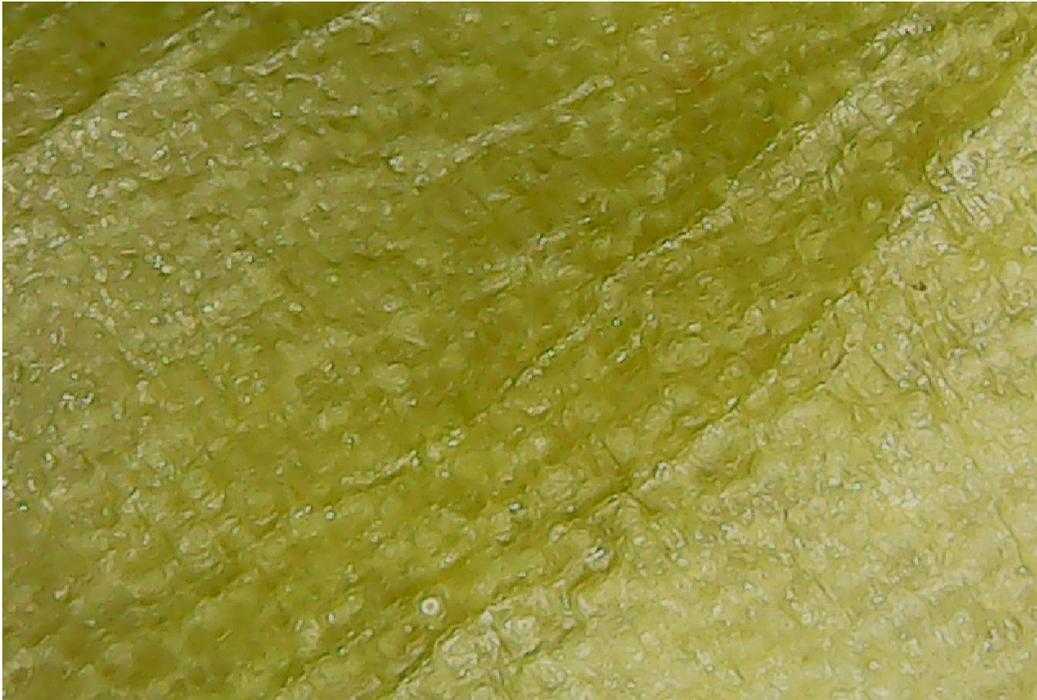
$$\Delta m = m_2 - m_1 = 22.7 - 21.9 = 0.8 \text{ grams}$$

Graphical explanation of the experiment:

- We have a fast variation during the first minute
- From 60 to 90 second we have a small variation
- In the next minute we have a complete stagnation
- From 150 to 180 seconds we have a small variation of 0.1g



Demonstration of the osmosis:



- Before being watered:

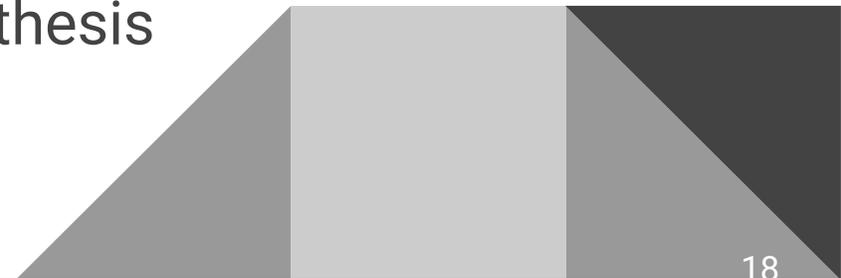
- Green-yellow
- Very wrinkled
- Soft

- After being watered:

- Green
- Hard
- Smooth

Confirmation and invalidation of my hypotheses:

- The first Hypothesis (false):
 - The average variation was of about 0.8g.
 - The quantity of water that was absorbed due to the different concentrations was of about 0.6g - 0.7g.
 - The quantity of water absorbed by the ***Aquifer Parenchymatic Tissue*** was of about 0.1g - 0.2g
- The second Hypothesis (true):
 - Due to the assimilation and storage of water the leaves became a lot harder
 - In a couple of minutes after it was watered the photosynthesis started again and the leaves became from green-yellow, back to green.



Experiment 2:

Task:

- Investigate the mass variation of 2 mice (a male and a female) 5 minutes after giving them food. Investigate the eating rate of each one and compare the results with the result of the plant .

Way of execution:

- We will put the mice in a box full of food. After 30 seconds we will take them out and see their weight

Materials:

- An electronic balance
- 2 plastic boxes
- Rodent food
- A chronometer



Testing subjects:

The Female

Starting weight = 18.1g
Length = 9.8cm
Last fed: 24 hours
before the experiment



The Male

Starting weight = 24.6g
Length = 13.6cm
Last fed: 24 hours
before the experiment



Hypothesis:

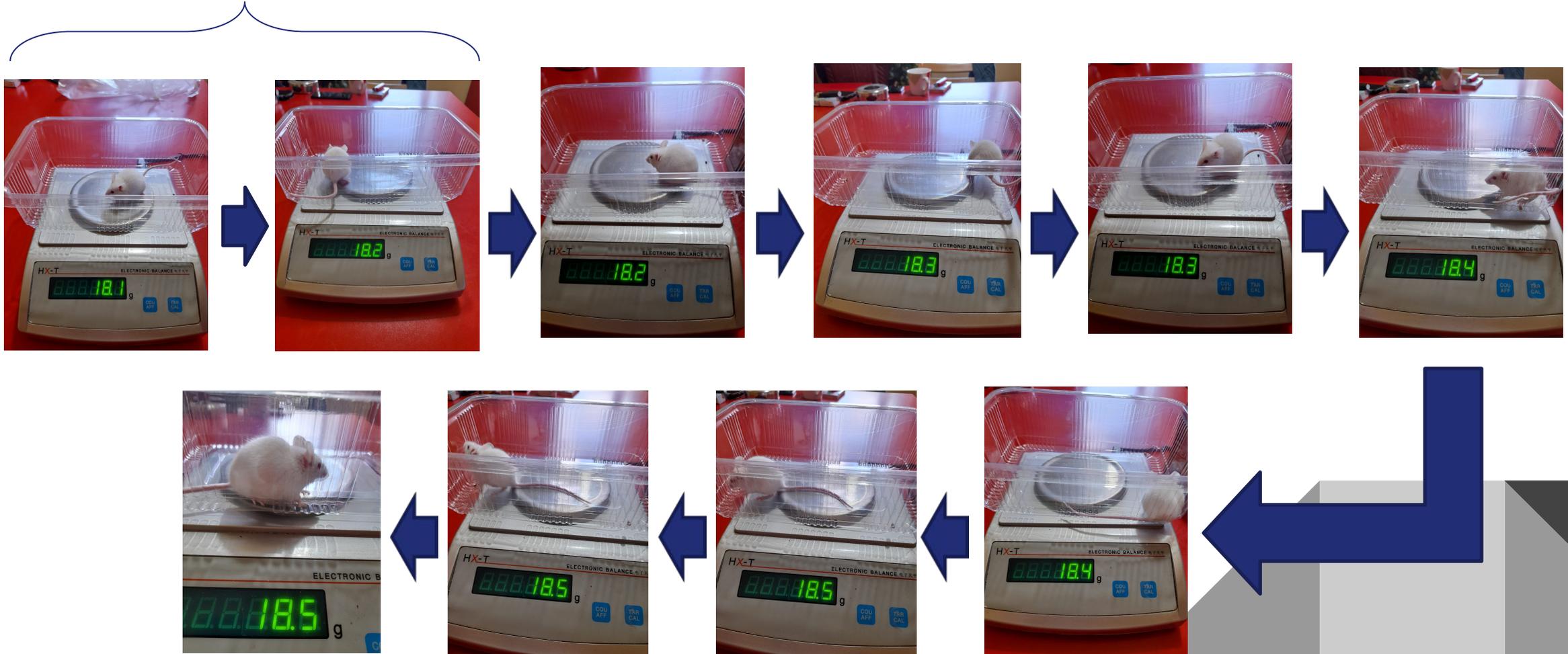
1. The mice will eat very fast, with a variation of about 1 gram.
2. They will have full cheeks and a small increase in their abdominal region.
3. They will have a constant eating rate.



The variation of weight in the case of the female:

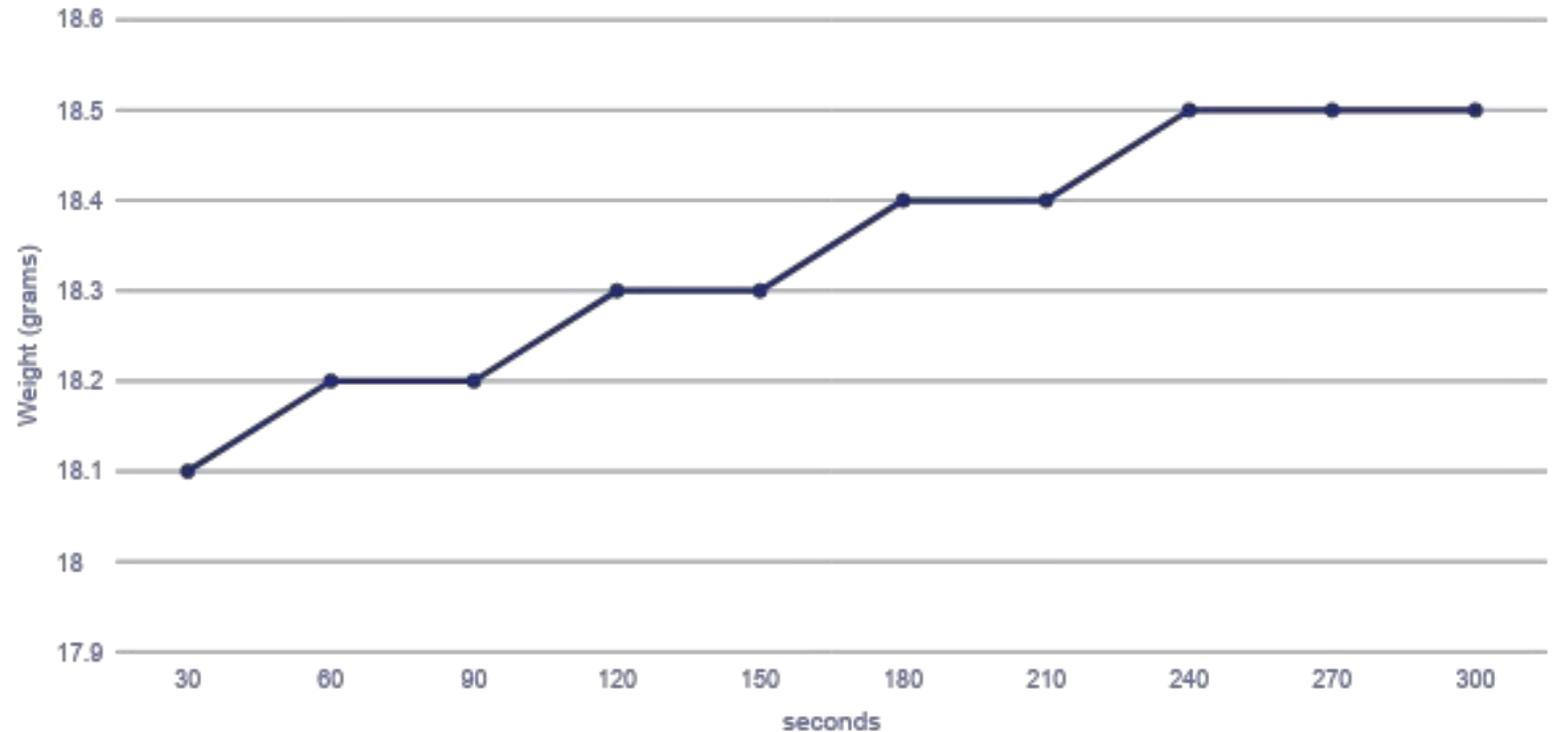
- As in the case of plants, we will measure at every 30 seconds in five minutes.

One minute



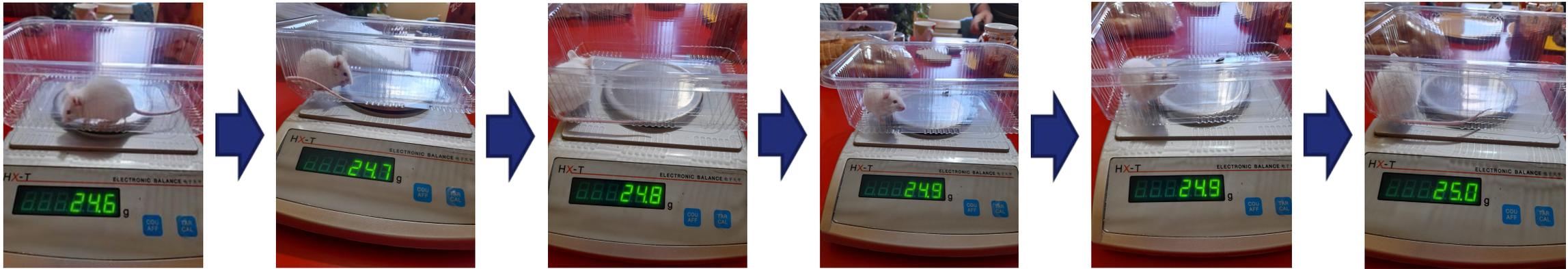
Graphical interpretation of the values:

- Characteristics:
 - Constant increase
 - Total variation of 4mg (2.2% of its total body mass)
 - At 18.5 we have a stagnation



1. Semi-true: The eating rate was pretty fast, but the variation was less than half of the expected value.
2. Semi-true: Her abdomen was a bit bigger and the cheeks were completely full.
3. True: The eating rate was constant until the variation came to an end. From 18.5 the weight became constant.

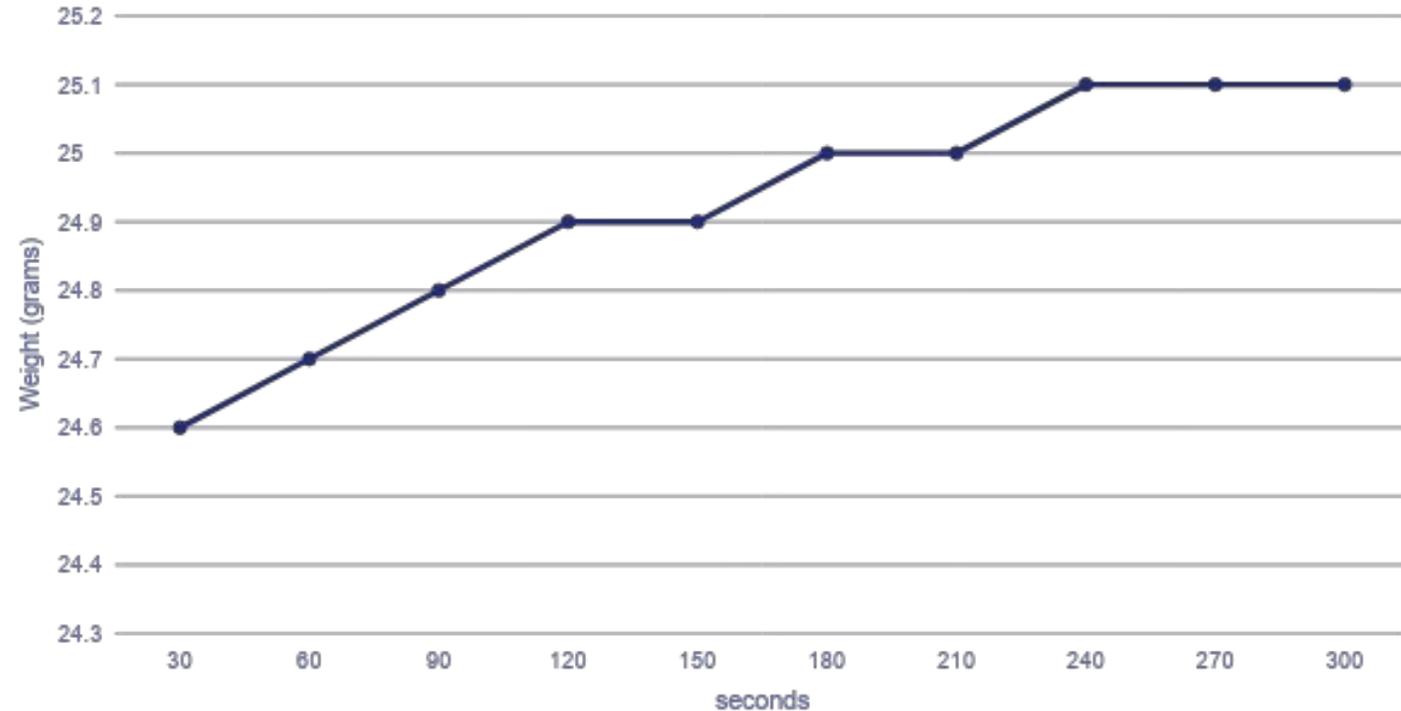
The variation of weight in the case of the male:



Graphical interpretation of the values:

● Characteristics:

- A sudden variation at the beginning.
- A constant variation from 24.9g to 25.1g
- After 240 seconds the weight remained constant
- The total variation was of 0.5g (2% of its body mass)



1. True: The eating rate was very fast, but the variation was less than half of the expected value and even smaller than the variation of the female
2. Semi-true: His abdomen inflated a bit and the cheeks became bigger
3. True: The eating rate took place in three stages: first we have a sudden increase at the beginning, a constant increase for 1 minute and 20 seconds and a stagnation a 270 seconds.



Final part

Slides

Conclusions on the Short-term Variation of my Testing Subjects:

- In the case of the plant:

1. The suction rate was dependent on the saturation of the plant.
2. As the plant was accumulating more water, the suction rate became smaller.
3. The leaves became harder, and the surface of the leaves inflated, turning from green-yellow to green

- In the case of the mice:

1. In the case of both mice the eating rate was constant throughout the test
2. In the case of the Male the eating rate was greater at the beginning due to the greater appetite determined by the difference of the total body mass
3. The average variation between the two subjects was nearly equal even though the variation rate differed.

What they had in common?

- In both cases, at the beginning, the graphics showed a pattern determined by the greater need of supplies (water/food)
- Both species accumulate other resources for later:
 - Plants in the Aqueous Parenchymatic Tissue
 - Mice in their cheeks
- The average increase in the total body mass in the case of both species was situated somewhere between 2% and 4% of the total body mass.

RESULT

- **Both species have similarities regarding the eating process**
- **The most important aspect of this process is to reach satiety and to store some food for later**



**Thank you for your
attention!**

Bibliography