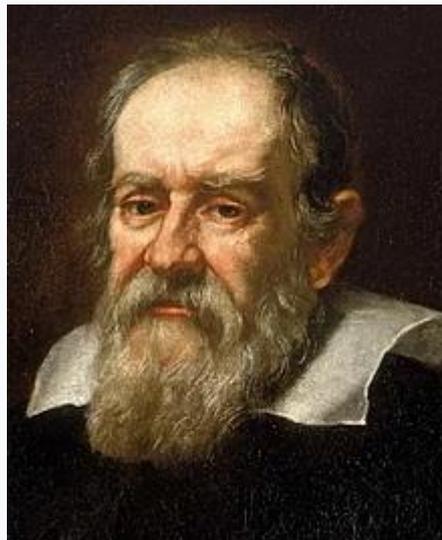


THE EXPERIMENTAL METHOD

Science is the study of the laws that regulate nature around us.

Scientists have always tried to understand and explain what happens in nature. Every scientific research begins with a question that arises from observation and curiosity. To find the answer, a precise method must be followed, based on accurate observations, hypotheses, tests and measurements: it is the scientific method.

Galileo Galilei, who lived between 1564 and 1642, was a famous Italian physicist, astronomer, philosopher, mathematician, and considered the founder of the scientific method and modern science. He also perfected the telescope previously invented by a Dutchman and built a proportional compass, used to perform geometric and arithmetic operations.



A proper scientific investigation must follow certain well-defined phases such as:

- The question: one wonders why a particular phenomenon occurs
- The hypothesis: try to give a first answer to the question
- The experiment: a test is performed under controlled conditions, created specifically to confirm or deny the hypothesis
- Data collection and analysis: the experiment is described and all measurements are recorded. Data analysis is important because it serves to check if the hypothesis is true or false
- The conclusions: this is the decisive phase of any scientific investigation. If the experiment and the analysis of the data confirm the hypothesis, then the

research is concluded successfully and we can communicate the results. If instead our experiment has not confirmed the hypothesis, we must rethink the initial question, formulate a new hypothesis and repeat the verification procedure.

WHAT IS A ECOTOXICITY TEST

An ecotoxicity test involves organisms exposed under standardized conditions and controlled to a substance or a mixture of substances, in order to test the toxicity of the environment.

It is a type of analysis different from the chemical one: in a chemical analysis the substances present in the water are looked for, in an ecotoxicity test the health of the aquifer is evaluated based on the health of the organisms present.

Ecotoxicity tests can be carried out in the laboratory or in the field and can have a different duration. One speaks of acute test, when it has a short duration compared to the longevity of the species, instead one speaks of chronic test, when it covers the whole life cycle or a large part of it. An acute test evaluates how many organisms have survived, while in a chronic test other aspects such as reproduction, growth anomalies and behavior are evaluated.

Also the number of species also varies, because it can be done on a single species or more. The experimental design is the description of a series of experiments that are conducted in order to develop a model.

When performing a test in the laboratory the substance is tested at different concentrations and at the same time the same test is performed in a zero concentration container (control test).

A good test must have breeding or readily available organisms, be simple, inexpensive, short-lived, standardized, precise, reproducible and ecologically relevant.

TEST WITH DAPHNIA MAGNA

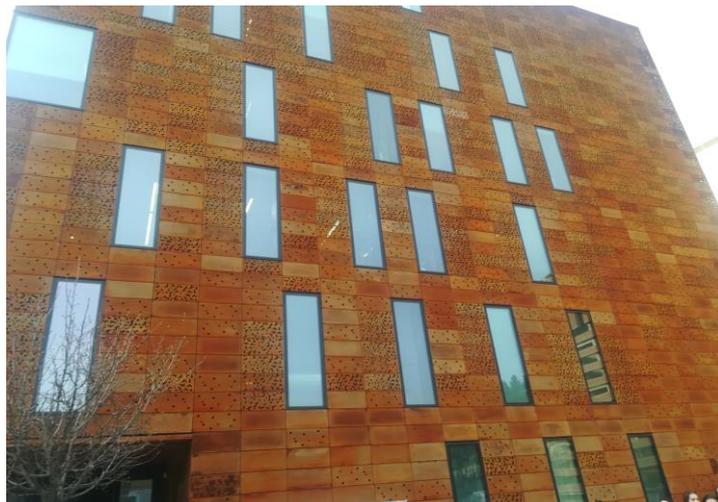
Daphnia Magna is a small crustacean that lends itself well to ecotoxicity tests because:

- It reproduces quickly
- It is sensitive to changes in its habitat
- It has a short life cycle (a few months)
- Takes up little space
- Easily found and manipulated
- There is no excessive cost to her breeding

There are two different tests with Daphnia Magna:

- Acute test (24-48 hours): the test is considered valid if the mortality does not exceed 10% in the control beaker.
- Chronic Test (21 days): the test is valid if the mortality does not exceed 20% in the control beaker and if the mortality of the born organisms does not exceed 60%.

We had the opportunity to visit two interesting laboratories to test the scientific method directly. Immersed in a real laboratory and, under the guidance of expert researchers from the Insubria University of Como, we performed an acute ecotoxicity test with Daphnia Magna.



Insubria University, Como

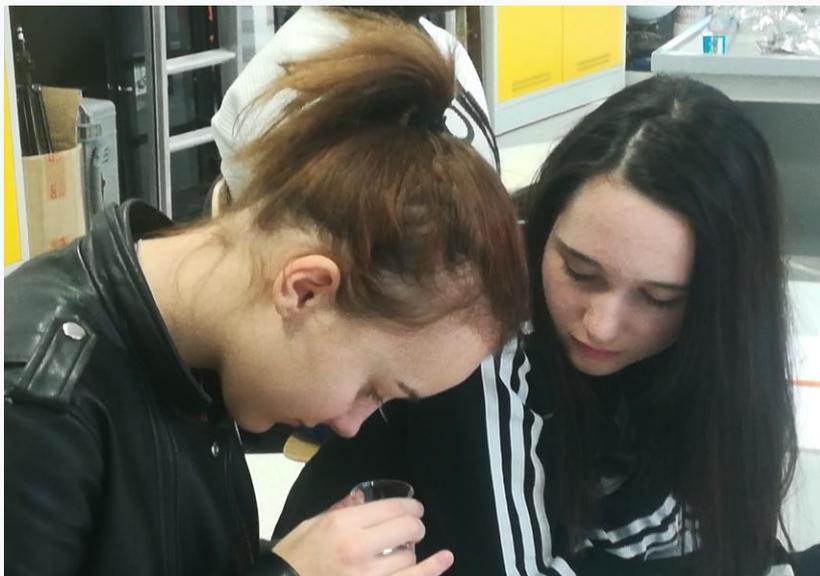
To do this experiment we took 5 beakers, 5 graduated cylinders, 5 pipettes, daphnia and ampoules containing potassium chromate at a different concentration. Potassium chromate is an odorless yellow crystalline powder,

which however does not exist in a free form, it is a dangerous compound for humans and the environment.



becker with different concentrations

In each becker we put 5 daphnia. Daphnia is a small crustacean, known as water flea (name due to the characteristic "swimming style"). Daphnia are 0.2 to 5 mm long and live in lakes, ponds, streams and rivers.



we saw the daphnias in the beckers

In each beaker containing the daphnia we added the poisonous substance, potassium chromate, in different concentrations:

0,01 mg/l
0,1 mg/l
1 mg/l
10 mg/l
100 mg/l

After a certain time we verified when the daphnia could survive and when the substance in a known concentration had begun to kill them.



I saw the daphnia through the microscope

Below is a summary table of the results obtained. As you can see the concentration that caused problems to the daphnias present is between 0.1 and 1 mg / l .

TEST ECOTOSSICOLOGICO SU *Daphnia magna* - RANGE FINDING 28 febbraio 2019

GRUPPO 1		
vive	morte	
controllo	VIVENDO	
0.01 mg/l	VIVENDO	
0.1 mg/l	VIVENDO	
1 mg/l	PERICOLI	
10 mg/l	PERICOLI	
100 mg/l	PERICOLI	

→ una sola dafnia
v beccher

GRUPPO 2		
vive	morte	
controllo	VIVENDO	
0.01 mg/l	VIVENDO	
0.1 mg/l	VIVENDO	
1 mg/l	VIVENDO	
10 mg/l	VIVENDO	
100 mg/l	VIVENDO	

vite

GRUPPO 3		
vive	morte	
controllo	VIVENDO	
0.01 mg/l	VIVENDO	
0.1 mg/l	VIVENDO	
1 mg/l	VIVENDO	
10 mg/l	VIVENDO	
100 mg/l	VIVENDO	

vite 4-1
vite 3 morte
vite morte

GRUPPO 4		
vive	morte	
controllo	VIVENDO	
0.01 mg/l	VIVENDO	
0.1 mg/l	VIVENDO	
1 mg/l	VIVENDO	
10 mg/l	PERICOLI	
100 mg/l	PERICOLI	

GRUPPO 5		
vive	morte	
controllo	VIVENDO	
0.01 mg/l	VIVENDO	
0.1 mg/l	VIVENDO	
1 mg/l	VIVENDO	
10 mg/l	VIVENDO	
100 mg/l	VIVENDO	

Laura Rigamonti

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A.S. 2018/2019