

The 5th International Young Naturalists' Tournament  
Municipal Autonomous Institution of General Education of the city of  
Novosibirsk «Gymnasium №12»

# №11

## Grow light



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# The task

Investigate how different types of artificial lights affect plant growth. What is the role of light spectrum?



# **Hypothesis**

If we select sources of light with optimal technical parameters (light temperature, wavelength), then we can regulate the growth and development of plants.

## **The aim of the study**

To investigate the influence of various types of artificial light sources on the growth and development of plants.

# The tasks

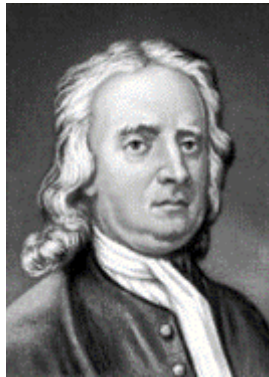
1. Study the role of light in various processes of plant life;
2. Observe the effect of light of different wavelengths on the germination of plants;
3. Investigate the process of plant development under natural and artificial illumination of various types;
4. Study the effect of artificial light with different values of light temperatures on the growth of plants;
5. Observe the effect of various lighting sources on flowering indoor plants.

# Theoretical part of the study

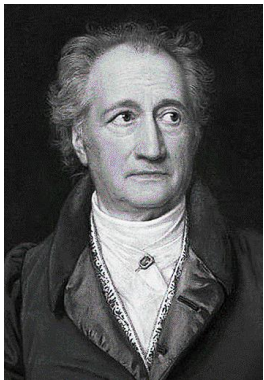
**Light** is electromagnetic radiation within a certain portion of the electromagnetic spectrum. The word usually refers to **visible light**, which is visible to the human eye and is responsible for the sense of sight. Visible light is usually defined as having wavelengths in the range of 400–700 nanometres (nm).



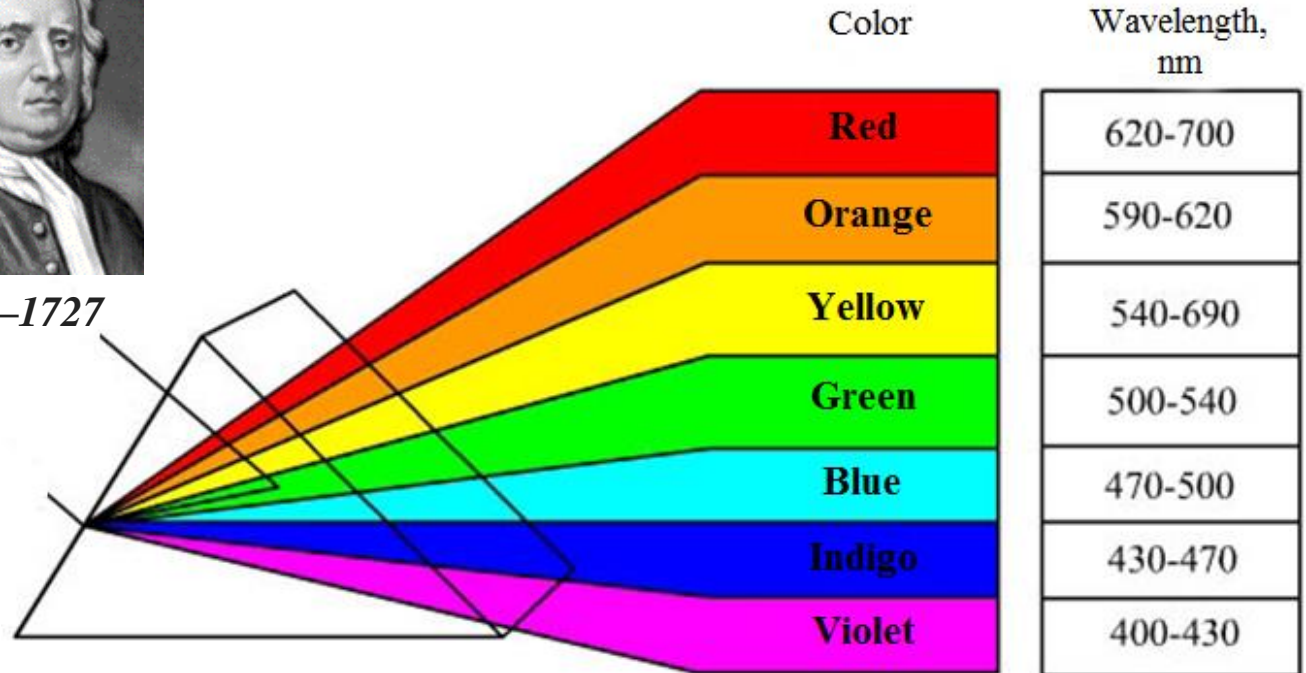
1214 – 1257



1643 – 1727



1749 – 1832



# Theoretical part of the study

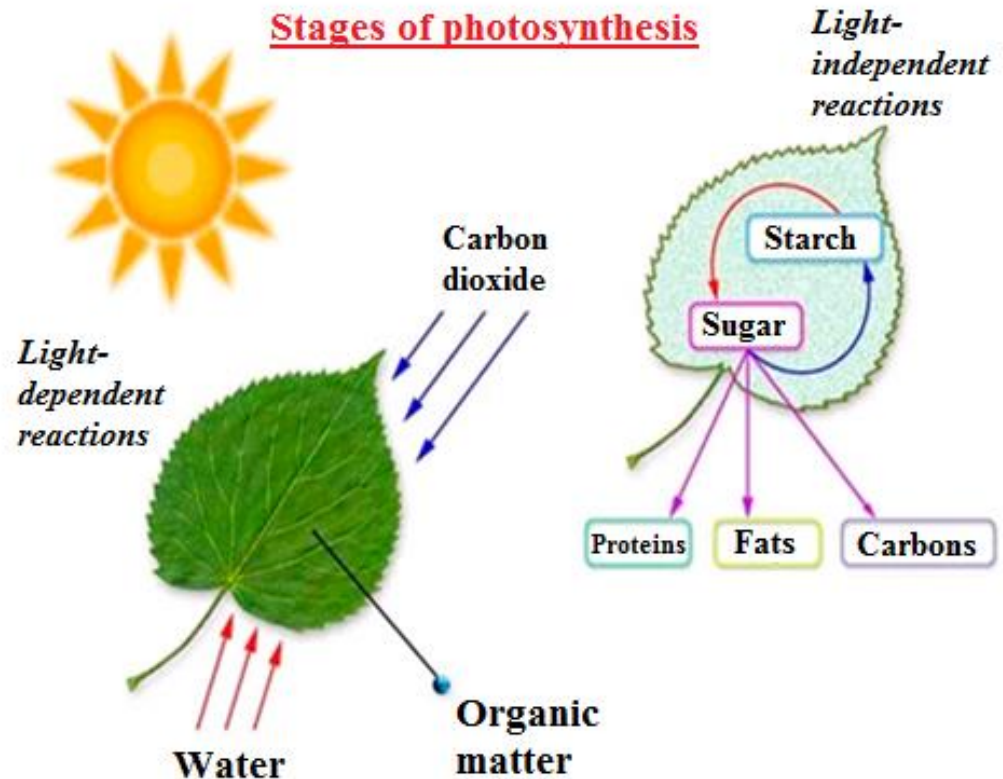
**Photosynthesis** is a process used by plants and other organisms to convert light energy into chemical energy that can later be released to fuel the organisms' activities (energy transformation).

*Factors affecting the intensity of photosynthesis:*

- content of carbon dioxide,
- air temperature,
- water availability,
- intensity of sunlight.

*The main characteristics of light are:*

- spectral composition,
- intensity,
- daily and seasonal dynamics



# Theoretical part of the study

*Violet rays stimulate the formation of protein, regulate the growth rate of plants*

*Blue light stimulates cell division, but inhibits their stretching*

*The yellow-green part of the spectrum has virtually no effect on plant growth*

*Short-wavelength red stimulates growth*




*Long-wavelength red is a stop signal*

*Photomorphogenesis is a process occurring in a plant under the influence of light of different spectral composition and intensity.*



# Theoretical part of the study

A **grow light** or **plant light** is an artificial light source, generally an electric light, designed to stimulate plant growth by emitting an electromagnetic spectrum appropriate for photosynthesis.

Bicolor lamp	Multispectral lamp	Full Spectrum Lamp
<p>The simplest kind, including two types of lamps - blue and red. This lamp is suitable for any plant that grows on the sub-window, as an addition to natural light.</p> 	<p>It combines warm white, red, blue and far red colors. Such a lamp is used for thickened plantings and indoor plants. For seedlings, such a lamp fits to a lesser degree.</p> 	<p>It contains all the colors of the rainbow, so these lamps are called "personal sun". With her help, you can grow plants from the seed stage to harvesting in the total absence of sun and light.</p> 



# Experiment 1

The purpose is to establish a dependence between the features of the photomorphogenesis process and the origin of the light source (natural or artificial).



Conclusion: sunlight is optimal in its spectral composition, rather than artificial lighting, so the growth and development of plants of sample №2 pass more intensively.

# Experiment 2

Purpose is to investigate the influence of light on the germination of plant seeds.



*Seedlings appeared on the second day*



*Sample №1  
(under sunlight  
influence)*

*Sample №2  
(in the dark)*

Shoots of two samples of radish sown in the ground. The first sample was placed under the influence of sunlight, and the second - in a dark box.

# Experiment 2

*Results of the second experiment*

	<i>Sample №1</i>	<i>Sample №2</i>
Sowing conditions	In the sunlight	In the dark
Appearance of sprouts	On the second day	On the second day
Leaf coloring	Green	Bright yellow
Stems coloring	Green	White

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солнечного света и хлорофилл не образовался.

# Experiment 3

Purpose is to investigate, which light of the spectral composition most optimally affects the growth and development of plants.



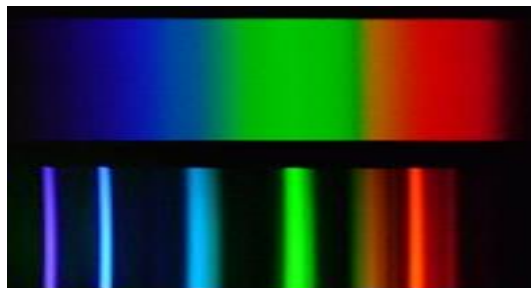
*Incandescent light bulb*



*LED lamp*

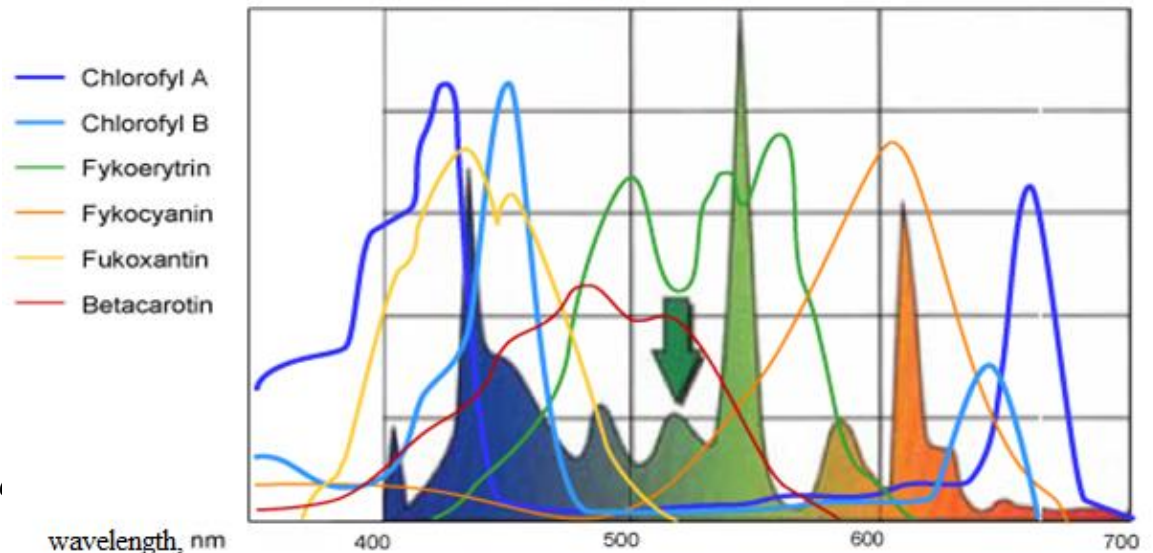


*Fluorescent lamp*



*The emission spectrum of a incandescent lamp 60 watts and daylight*

Absorption of the light spectrum by photosynthetic pigments and the spectrum of fluorescent lamps light of ADA NA Lamp.



# Experiment 3

*Results of the third experiment*

<b>Sowing conditions</b>	<b>LED lamp</b>	<b>Fluorescent lamp</b>	<b>Incandescent light bulb</b>
Appearance of sprouts	25 hours	30 hours	18 hours
Leaf coloring	Green	Салатовый	Dark green
Leaf size	Medium	Small	Large
Stems coloring	Pinkish-green	Pale green	Green
Stems size	10-13 cm	11-16 cm	6-10 cm

# Photos from the experiment 3



*Incandescent light bulb*



*LED lamp*



*Fluorescent lamp*



*Plants and leaf blades*

# Experiment 4

The purpose is to reveal, which light of the spectral composition most optimally influences the flowering process.



*A plant under an incandescent lamp*



*A plant under a fluorescent lamp*

Conclusion: under the influence of incandescent lights bloom faster, they are more magnificent, but the incandescent lamp burns leaves and flowers. Under the fluorescent lamp the buds blossomed more slowly, but they looked more fresh.

# Conclusions

1. Light is not needed for seed germination.
2. The red part of the spectrum (short wavelength) promotes intensive growth of leaves. This light, completely absorbed by chlorophyll, increases the formation of carbohydrates during photosynthesis. The red light zone is crucial for all physiological processes.
3. Blue rays inhibit the growth of plants, forming compact plants with thicker leaves. The blue part of the spectrum of light is completely absorbed by chlorophyll, which creates conditions for the maximum intensity of photosynthesis.
4. Optimum conditions for plant development can be created only by natural sunlight, containing a full range of wavelengths.



# References

1. Children's Encyclopedia. "Electricity and magnetism." Volume 16 - Moscow: The World of Encyclopedias Avanta, 2007
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3. <http://humangarden.ru/books/spectr.htm>
4. <http://www.forum.homecitrus.ru/index.php?showtopic=8498>
5. <http://humangarden.ru/books/spectr.htm>