



**Class: 9th**

**Subject:**

**Biology**

**Chapter 1: THE SCIENCE OF BIOLOGY**



**Exercise MCQs:**

1. Which branch of Biology focuses on the study of the structure and function of cells?

- (a) Cytology
- (b) Ecology
- (c) Histology
- (d) Anatomy

2. The study of the processes of heredity is known as:

- (a) Ecology
- (b) Genetics
- (c) Anatomy

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(d) Embryology


**3. Insulin made through bacterial cells is an example of the technique of:**

(a) Parasitology

(b) Biotechnology

(c) Biochemistry

(d) Histology



**4. "Heart pumps blood, stomach digests food, and kidneys excrete wastes." This statement belongs to:**

(a) Physiology

(b) Anatomy

(c) Morphology

(d) Histology

**5. Which branch of Biology involves the study of the classification of organisms?**

(a) Taxonomy

(b) Physiology



(c) Palaeontology

(d) Biogeography

**6. Which step comes between making a hypothesis and doing experiments?**



(a) Making deductions

(b) Making observations

(c) Summarizing results

(d) Analysing data

**7. Which of the following is NOT a characteristic of the scientific method?**

(a) It relies on evidence



(b) It involves formulating hypotheses

(c) Hypothesis will always be correct

(d) It requires rigorous testing

**8. Choose the correct sequence of steps in the scientific method:**

(a) Observations - hypothesis - deduction - experiments






(b) Observations - hypothesis - law - theory

(c) Hypothesis - observations - deduction - experiments

(d) Law - theory - deduction - observations



**9. People who slept near a smoky fire had less chance of getting malaria because:**

(a) Smoke kills Plasmodium in their blood

(b) Fire increases temperature and Plasmodium is killed in air

(c) Mosquitoes cannot tolerate smoke and are repelled

(d) Smoke kills Plasmodium present in mosquitoes

**10. Experiments are very important in the scientific method because a researcher:**

(a) Always gets correct results

(b) Disproves many hypotheses and gets some hypothesis proved

(c) Is sure that he will prove the hypotheses

(d) Gets a chance to work in the laboratory





## Important MCQs:


1. The word "Biology" is derived from which language?

- (a) Latin
- (b) Arabic
- (c) Greek
- (d) French

2. Which branch of Biology deals with the study of animals?

- (a) Botany
- (b) Zoology
- (c) Ecology
- (d) Cytology

3. The study of plants is called:

- (a) Microbiology
  - (b) Botany
  - (c) Pathology
  - (d) Taxonomy
- 



**4. Microbiology includes the study of:**

- (a) Cells
- (b) Fossils
- (c) Microorganisms
- (d) Plants



**5. The study of form and structure of organisms is called:**

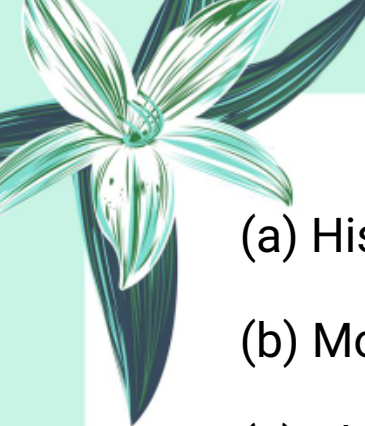

- (a) Anatomy
- (b) Morphology
- (c) Histology
- (d) Cytology

**6. Which branch studies the internal structure of organisms?**

- (a) Genetics
- (b) Anatomy
- (c) Ecology
- (d) Physiology

**7. The functioning of body parts is studied under:**



- 
- 
- (a) Histology
  - (b) Morphology
  - (c) Physiology
  - (d) Palaeontology



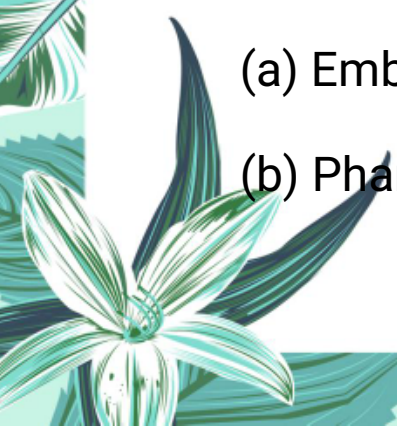

**8. Histology is the study of:**

- (a) Organs
- (b) Tissues
- (c) Cells
- (d) Bones

**9. Cytology deals with the study of:**

- (a) Ecosystems
- (b) Cells
- (c) Fossils
- (d) Genes

**10. Which branch focuses on biological molecules like proteins and DNA?**

- (a) Embryology
  - (b) Pharmacology
- 
- 



(c) Molecular Biology

(d) Pathology

**11. The study of development from a fertilized egg is called:**



(a) Genetics

(b) Embryology

(c) Ecology

(d) Anatomy

**12. The transfer of traits from parents to offspring is studied in:**

(a) Pathology

(b) Immunology

(c) Genetics

(d) Botany

**13. Which branch deals with fossils and evolutionary history?**

(a) Ecology

(b) Taxonomy





(c) Palaeontology

(d) Anatomy

**14. The classification of organisms is done in:**

(a) Taxonomy

(b) Ecology

(c) Cytology

(d) Pharmacology

**15. Which branch studies the interaction between organisms and environment?**

(a) Histology

(b) Pathology

(c) Ecology

(d) Zoology

**16. Biochemistry is the study of:**

(a) Muscles and bones

(b) Living organisms

(c) Fossils


(d) Chemical substances and reactions in living






systems


**17. The process of photosynthesis is studied under:**

- (a) Genetics
  - (b) Biochemistry
  - (c) Biophysics
  - (d) Pathology
- 

**18. Biophysics applies the principles of:**

- (a) Chemistry
  - (b) Earth Science
  - (c) Physics
  - (d) Zoology
- 

**19. Rules of lever and motion help in understanding:**

- (a) Plant growth
  - (b) Brain function
  - (c) Muscle and bone movement
  - (d) Digestion
- 



**20. Computational Biology mainly uses:**

- (a) Fossils
- (b) Microscopes
- (c) Mathematical models and simulations
- (d) Test tubes



**21. Biogeography is the study of:**

- (a) Organ structures
- (b) Distribution of living organisms
- (c) DNA sequences
- (d) Plant anatomy

**22. Climate change affects which branch of Biology?**

- (a) Cytology
- (b) Genetics
- (c) Biogeography
- (d) Pharmacology

**23. The application of statistics in Biology is called:**

- (a) Biophysics
- 



(b) Biostatistics

(c) Biochemistry

(d) Bioinformatics

**24. Biotechnologists produced insulin using:**



(a) Fungi

(b) Bacteria

(c) Algae

(d) Plants

**25. The economic study of biological projects is called:**

(a) Bio-economics

(b) Ecology

(c) Pharmacology



(d) Anatomy

**26. The MBBS degree is required for a career in:**

(a) Dentistry

(b) Pharmacology

(c) Medicine and Surgery





(d) Physiotherapy

**27. Dentists usually complete a degree in:**

(a) MBBS

(b) DVM

(c) BDS

(d) D. Pharm

**28. Pharmacologists study the effects of:**

(a) Plants

(b) Fossils

(c) Drugs on the body

(d) Blood cells

**29. The field that helps restore body movement through exercise is:**

(a) Forestry

(b) Physiotherapy

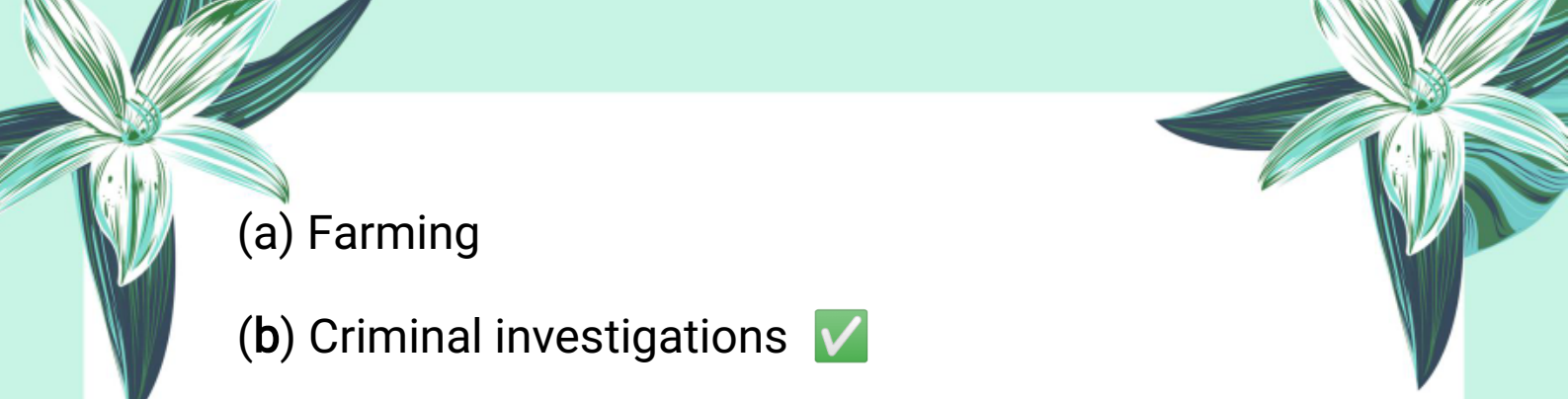
(c) Forensics

(d) Dentistry

**30. Forensic scientists work in the field of:**

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- 
- (a) Farming
  - (b) Criminal investigations
  - (c) Biotechnology
  - (d) Agriculture



**31. According to the Quran, all living things are made from:**

- (a) Fire
- (b) Clay
- (c) Water
- (d) Light



**32. The verse “We made every living thing from water” is from:**

- (a) Surah Al-Mominoon
- (b) Surah Al-Rehman
- (c) Surah Al-Anbiya
- (d) Surah Al-Nur

**33. Human beings were created from:**

- (a) Blood
- 




(b) Clay

(c) Water

(d) Fire

**34. In Surah Al-Mominoon, human development is described in stages starting from:**



(a) Bone

(b) Flesh

(c) Nutfah

(d) Blood

**35. The Quranic verse describing animals that creep, walk on two, and walk on four legs is from:**

(a) Surah Al-Anbiya

(b) Surah Al-Nur

(c) Surah Al-Rehman

(d) Surah Yaseen

**36. The Quran hints at the evolution of animals starting from:**

(a) Dust






(b) Water

(c) Fire

(d) Clay

**37. The Human Genome Project is an example of:**



(a) Solo science

(b) Multinational experiment

(c) Interdisciplinary research

(d) Religious research

**38. The field of Artificial Intelligence combines disciplines like:**

(a) Psychology

(b) Engineering

(c) Computer Science

(d) All of these

**39. A key benefit of interdisciplinary research is:**

(a) Slower results

(b) More confusion

(c) Cost increase






(d) Quick and sustainable solutions

**40. The first step in the scientific method is:**

(a) Hypothesis

(b) Observation



(c) Recognition of a problem

(d) Result

**41. Observations involving exact measurements are called:**

(a) Hypothesis

(b) Qualitative

(c) Quantitative

(d) Deductive

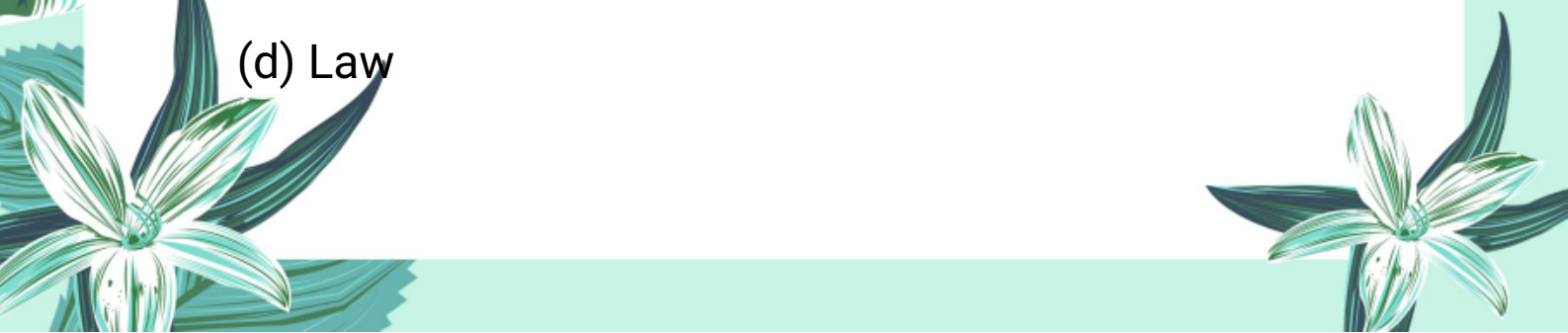
**42. A tentative answer to a scientific problem is called a:**

(a) Deduction

(b) Hypothesis

(c) Theory

(d) Law



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**43. The logical outcome drawn from a hypothesis is called:**

- (a) Result
- (b) Conclusion
- (c) Deduction
- (d) Prediction

**44. Experiments are conducted to:**

- (a) Waste time
- (b) Test the hypothesis
- (c) Make theories
- (d) Disprove all ideas

**45. Scientific results are usually presented using:**

- (a) Graphs and statistics
- (b) Poetry
- (c) Novels
- (d) Dreams

**46. A hypothesis becomes a theory when it is:**

- (a) Discarded



(b) Proven by repeated experiments

(c) Ignored by scientists

(d) Unrelated to evidence

**47. A scientific law is defined as:**



(a) An untested guess

(b) A temporary fact

(c) A uniform or constant fact of nature

(d) A social rule

**48. Which of the following is a biological law?**

(a) Newton's law

(b) Ohm's law

(c) Hardy-Weinberg law

(d) Law of motion

**49. The theory of evolution explains:**

(a) Cell division

(b) Blood circulation

(c) How species change over time

(d) Formation of the Earth





**50. Who first observed Plasmodium in a malarial patient's blood?**

- (a) Ronald Ross
- (b) A.F.A. King
- (c) Laveran
- (d) Ibn Sina

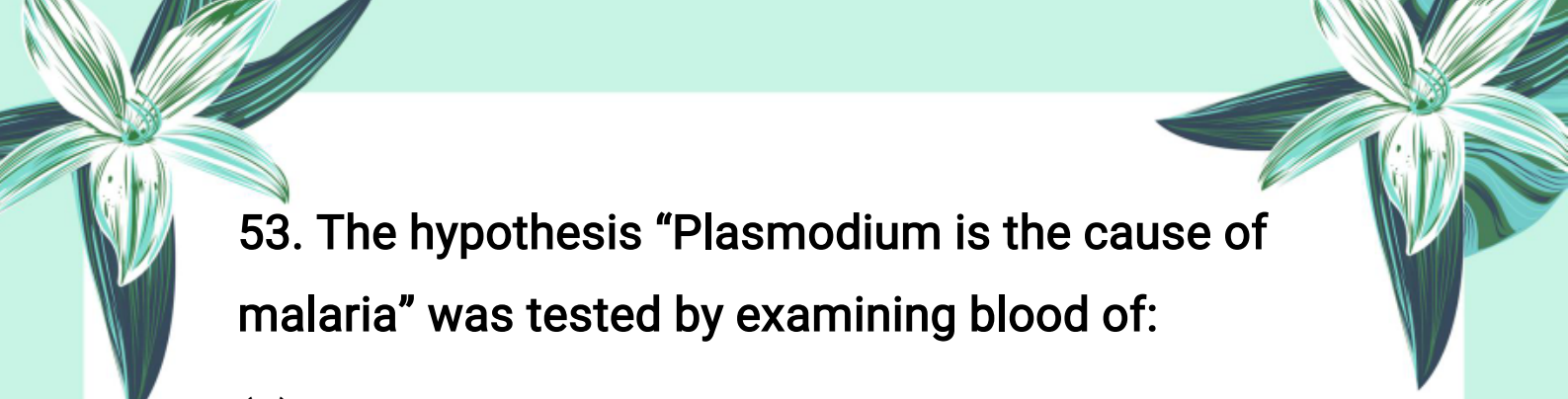
**51. Plasmodium is a type of:**

- (a) Virus
- (b) Protozoan
- (c) Bacterium
- (d) Fungus

**52. Which observation was made in 19th century about malaria?**


- (a) Caused by drinking marsh water
- (b) Has no treatment
- (c) Found in marshy areas
- (d) Transmitted by rats





**53. The hypothesis “Plasmodium is the cause of malaria” was tested by examining blood of:**

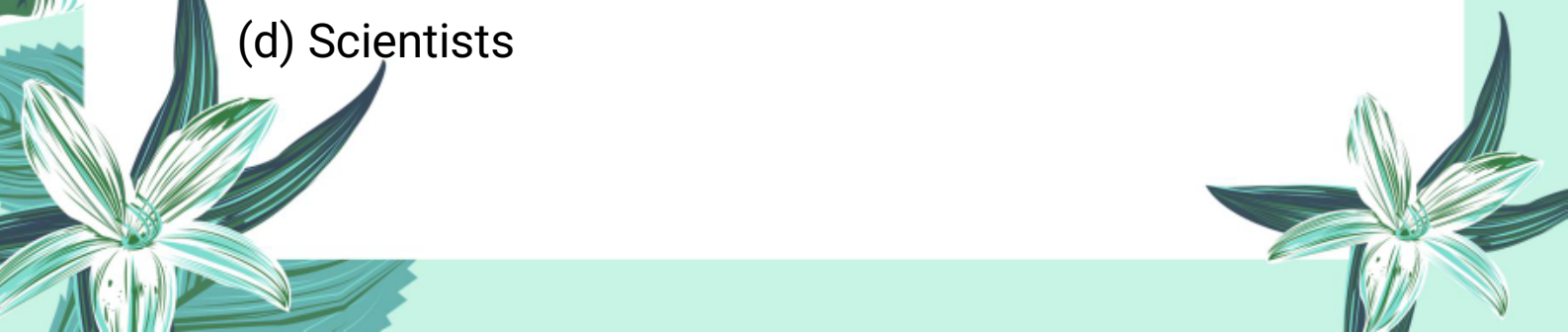
- (a) Only patients
- (b) 200 healthy people
- (c) 100 patients and 100 healthy people
- (d) Only animals



**54. In the malaria experiment, the experimental group was:**

- (a) Healthy people
- (b) Malarial patients
- (c) Mosquitoes
- (d) Sparrows

**55. The control group in the malaria experiment included:**

- (a) Infected sparrows
  - (b) Mosquitoes
  - (c) Healthy people
  - (d) Scientists
- 



**56. Who proposed the hypothesis that mosquitoes transmit malaria?**

- (a) Ronald Ross
- (b) A.F.A. King
- (c) Laveran
- (d) Pasteur

**57. According to King's observations, people sleeping under mosquito nets:**

- (a) Got more malaria
- (b) Got less malaria
- (c) Got dengue
- (d) Died from cold

**58. Ronald Ross first conducted malaria experiments using:**

- (a) Humans
- (b) Frogs
- (c) Sparrows
- (d) Fish



59. Plasmodium was found in mosquito's:

- (a) Blood only
- (b) Eyes
- (c) Stomach and salivary glands
- (d) Wings

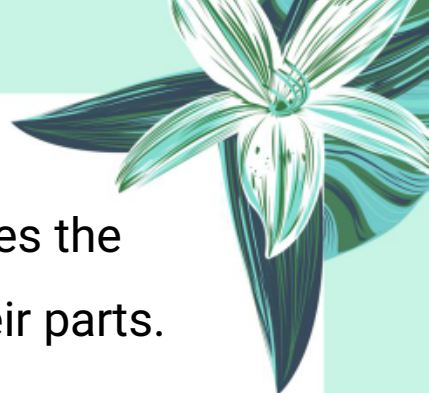
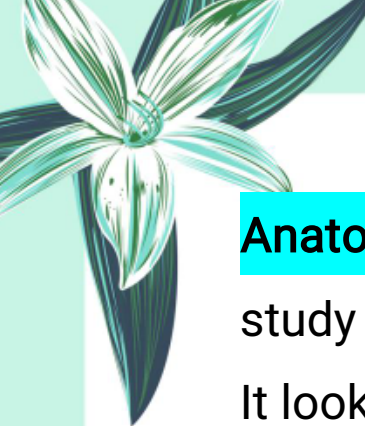
60. Final confirmation of mosquito transmission in humans was done by:

- (a) German scientists
- (b) Italian biologists
- (c) Pakistani doctors
- (d) Indian villagers


### Exercise Short Questions:

1. Define the following branches of Biology:

**Genetics:** The branch of biology that deals with the study of heredity and variation in organisms, focusing on how traits are passed from one generation to the next through genes.



**Anatomy:** The branch of biology that involves the study of the structure of organisms and their parts. It looks at how the body is organized at the macroscopic (visible) level.



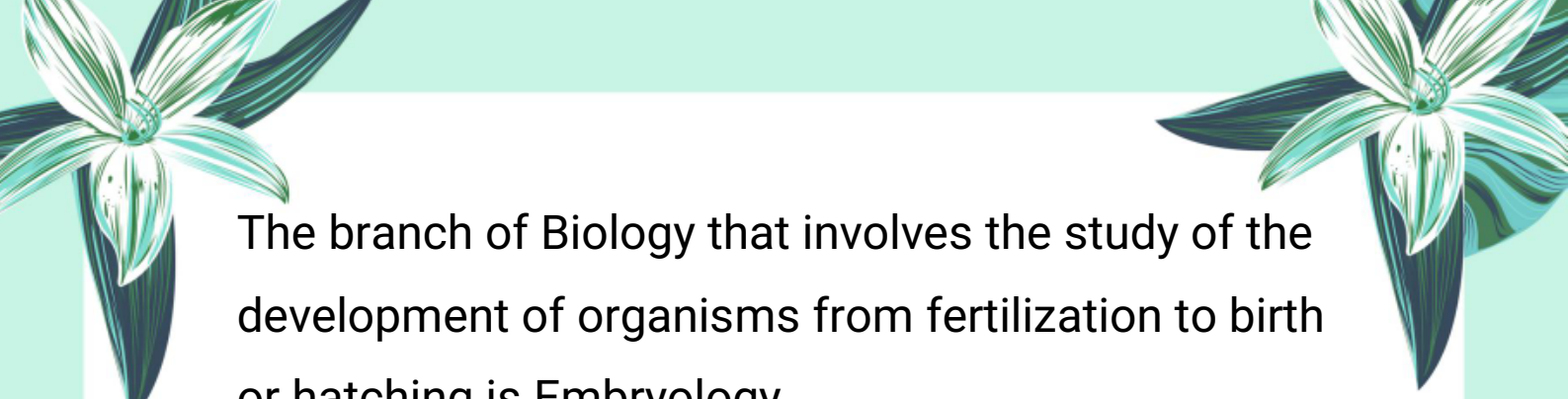
**Palaeontology:** The branch of biology that focuses on the study of the history of life on Earth through the examination of fossils, understanding ancient organisms and their ecosystems.

**Marine Biology:** The study of organisms in the ocean, focusing on the biological aspects of marine life, including marine ecosystems, organisms, and environmental factors affecting them.

**Pathology:** The branch of biology that studies diseases, including their causes, effects, and the changes they cause in the body at the cellular and tissue levels.


**2. Which branch of Biology involves the study of the development of organisms from fertilization to birth or hatching?**





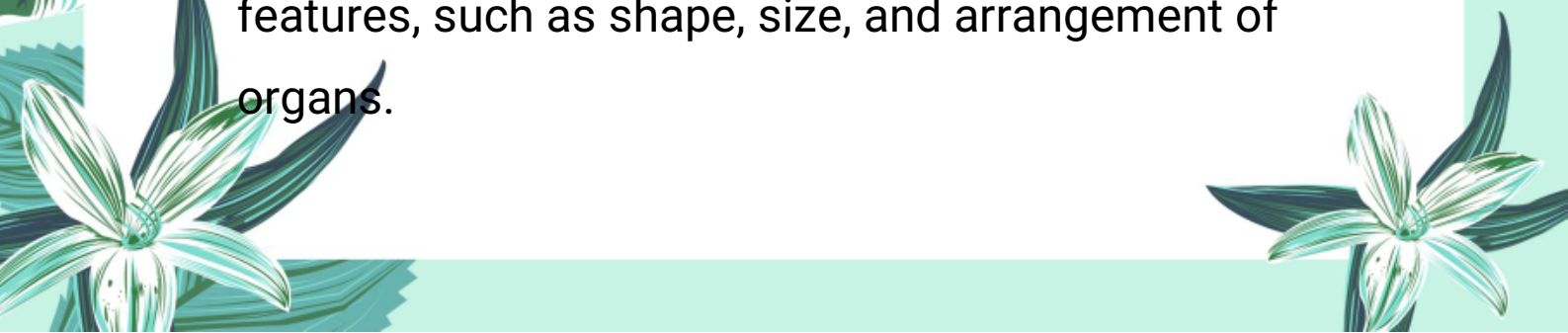
The branch of Biology that involves the study of the development of organisms from fertilization to birth or hatching is Embryology.


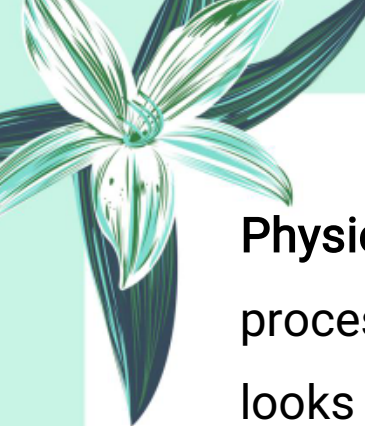
### 3. How is the profession of medicine and surgery different from animal husbandry?

- 
- **Medicine and Surgery** focus on human health, diagnosing, treating, and preventing diseases, and performing surgeries to treat medical conditions.
  - **Animal Husbandry** involves the care, breeding, and management of animals, especially for agricultural purposes such as food, wool, or labor. It is focused on animal welfare and production rather than treating diseases in animals.

### 4. Differentiate between Morphology and Physiology:

**Morphology** is the study of the form and structure of organisms, including their external and internal features, such as shape, size, and arrangement of organs.





**Physiology** is the study of the functions and processes of living organisms and their parts. It looks at how biological systems work, such as how organs and tissues carry out their tasks in the body.




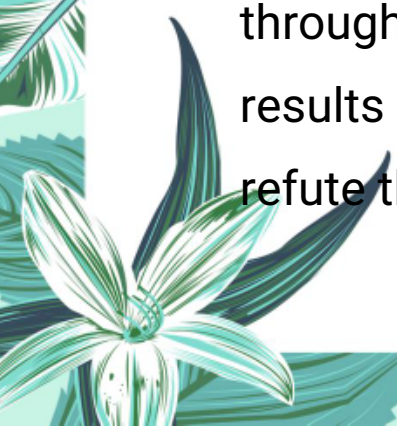
### 5. What is Computational Biology?

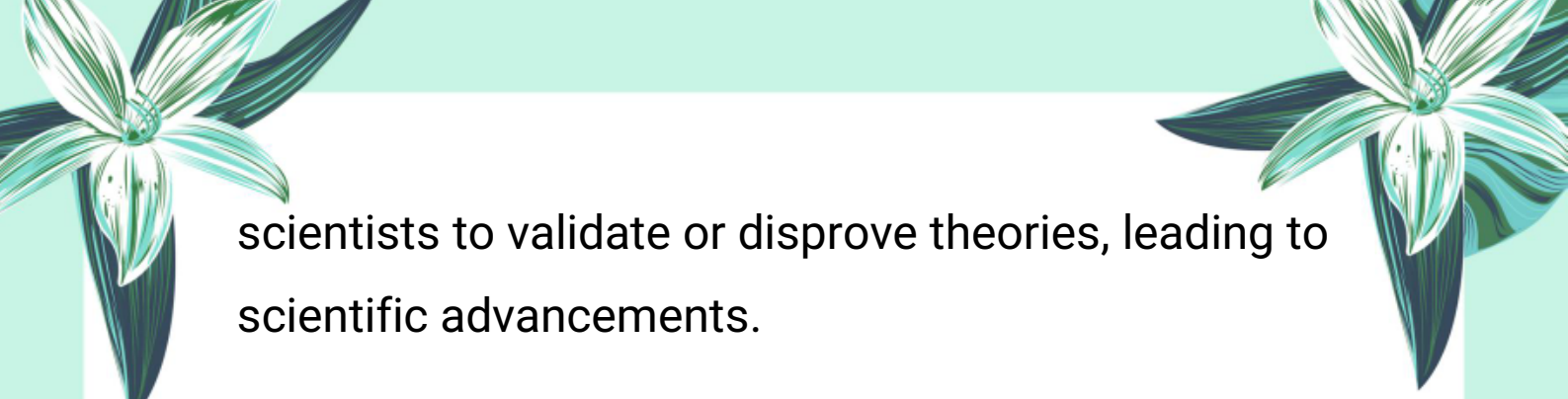
Computational Biology is an interdisciplinary field that uses computational techniques and models to analyze and interpret biological data. It involves the application of algorithms, statistical models, and data analysis to understand biological processes, genetics, evolution, and disease mechanisms.

### 6. What is the role of observation and experimentation in the scientific method?

Observation is the first step in the scientific method, where a researcher notices and identifies a phenomenon or problem. This sparks curiosity and leads to the formulation of a hypothesis.

Experimentation involves testing the hypothesis through controlled experiments to gather data. The results from experimentation either support or refute the hypothesis. This process allows





scientists to validate or disprove theories, leading to scientific advancements.

## Important Short Questions:



### 1. What is Biology?

Biology is the science of life. It is the study of living organisms, their structures, functions, growth, evolution, and interactions with their environment. The word "Biology" comes from the Greek words "bios" (life) and "logos" (study).

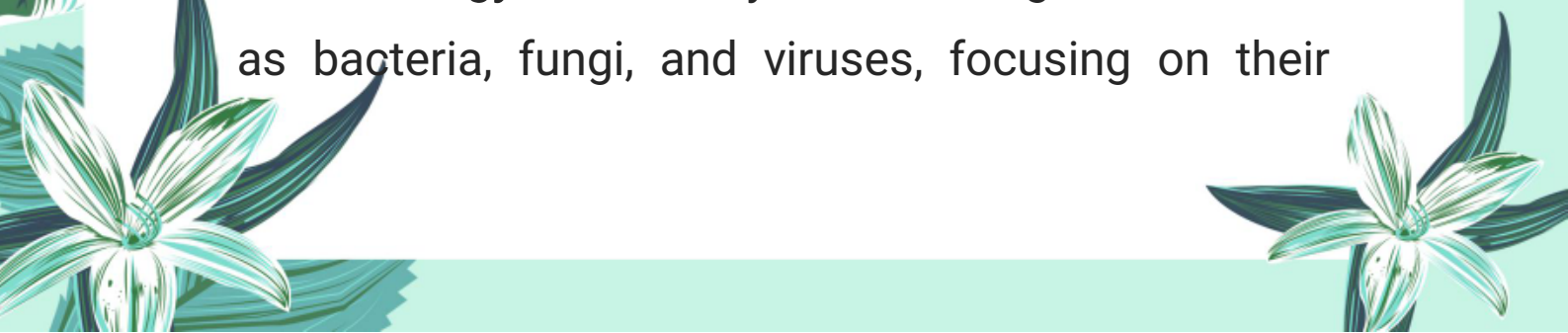
### 2. What are the major fields of Biology?

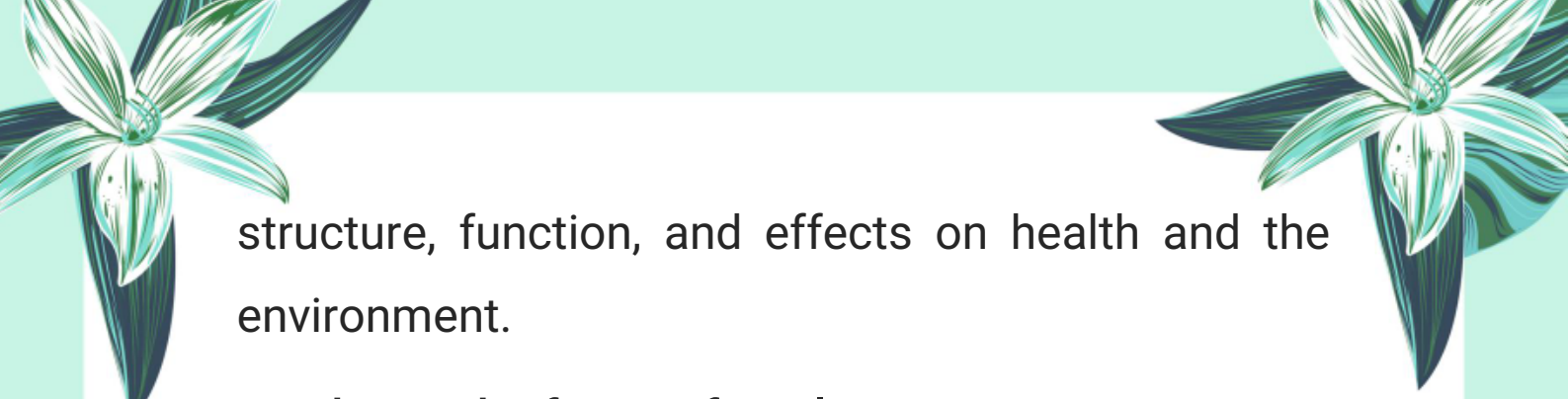
The major fields of Biology are:

**Zoology:** The study of animals, including their structure, function, behavior, and diversity.

**Botany:** The study of plants, including their structure, growth, reproduction, and interactions with the environment.


**Microbiology:** The study of microorganisms such as bacteria, fungi, and viruses, focusing on their






structure, function, and effects on health and the environment.

### **3. What is the focus of Zoology?**



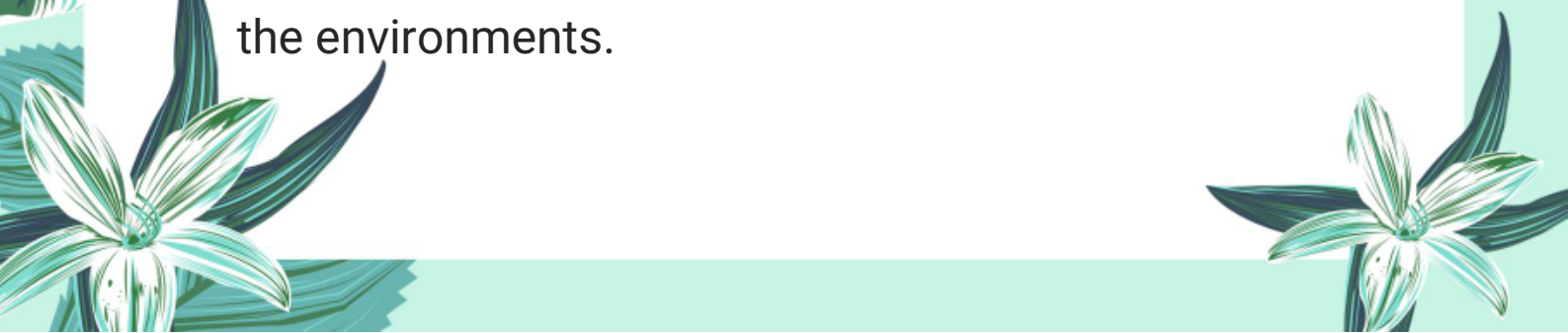
Zoology focuses on the study of animals, including their anatomy, physiology, behavior, ecology, and classification. It explores the diversity and function of animals and their interactions with the environment.

### **4. Define the branch of Botany.**



Botany is the branch of Biology that deals with the study of plants, including their structure, growth, reproduction, metabolism, and interactions with their environment. It covers areas such as plant physiology, ecology, and genetics.


### **5. What is Microbiology and what does it study?**



Microbiology is the branch of Biology that studies microorganisms, including bacteria, viruses, fungi, and protozoa. It focuses on their structure, function, reproduction, and impact on health, industry, and the environments.




## 6. How does Anatomy different from Morphology?



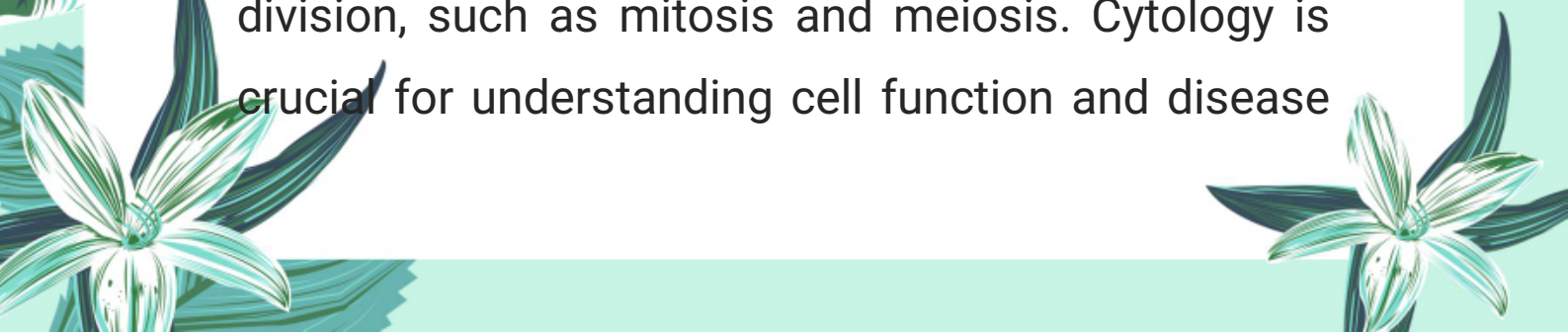
**Anatomy** is the study of the internal physical structure of organisms, focusing on organs and organ systems, especially in humans. It explores how different parts of the body are organized and function. **Morphology**, on the other hand, is the study of the form and external structure of organisms, including their shape, size, and pattern.

## 7. What is the role of Histology in Biology?



Histology is the microscopic study of tissues. It involves examining the structure and function of tissues, which are groups of cells working together for a specific purpose. Histology helps in disease diagnosis, understanding organ function, and researching new medical treatments.

## 8. What is the study of Cytology concerned with?




Cytology is the study of cells, the basic building blocks of life. It focuses on the structure of cells and their organelles, as well as the processes of cell division, such as mitosis and meiosis. Cytology is crucial for understanding cell function and disease



mechanisms at the cellular level.

### **9. What is Genetics and what does it study?**




Genetics is the branch of Biology that deals with the study of heredity and the transmission of traits from parents to offspring. It includes studying genes, DNA, mutations, and genetic disorders, as well as understanding how traits are inherited in organisms.




### **10. Explain the importance of Ecology in understanding environmental relationships.**



Ecology is the study of the relationships between organisms and their environment. It helps us understand how organisms interact with each other and with their physical surroundings. Ecology plays a crucial role in addressing environmental issues such as conservation, biodiversity, and the impacts of human activities on ecosystems.

### **11. What is Biochemistry?**




Biochemistry is the study of the structure and reactions of different chemical substances present





in living organisms. It includes the study of processes like photosynthesis and respiration.

### **12. How does Biophysics relate to Biology?**




Biophysics applies principles of Physics to biological processes. For example, it helps in understanding the function of muscles, bones, and joints through the study of motion and lever rules.

### **13. What is Computational Biology and its significance?**

Computational Biology involves using mathematical models, algorithms, and computer simulations to analyze biological data and understand biological systems and relationships.


### **14. What does Biogeography study?**



Biogeography is the study of the distribution of living organisms across different geographical regions and the influence of climate change on these distributions.

### **15. What is the role of Biostatistics in biology?**



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Biostatistics involves applying statistical principles to analyze and interpret data related to living organisms, playing a crucial role in biological research and public health.

### **16. How is Biotechnology applied in medicine?**

Biotechnology uses living organisms or their components to develop beneficial products and processes. An example is the use of bacteria to produce insulin for treating diabetes.

### **17. What is Bio-economics?**

Bio-economics is the study of the economic aspects of organisms and biological projects, such as calculating the cost and profit of producing new crop varieties.


### **18. What careers are available in the field of Medicine and Surgery?**

Careers in Medicine and Surgery involve diagnosing and treating diseases and repairing or replacing defective body parts. Students need an MBBS degree to pursue this profession.



**19. What is the role of Physiotherapy in healthcare?**

Physiotherapy helps restore movement and physical function to the body after disease or injury through physical exercises and techniques like massage.



**20. What degree is required for a career in Agriculture?**

To pursue a career in Agriculture, one typically needs a 4-year BS degree in Agriculture, focusing on crop production, farming practices, and sustainable agriculture techniques.



**21. Which Quranic verse mentions that all living things were created from water?**

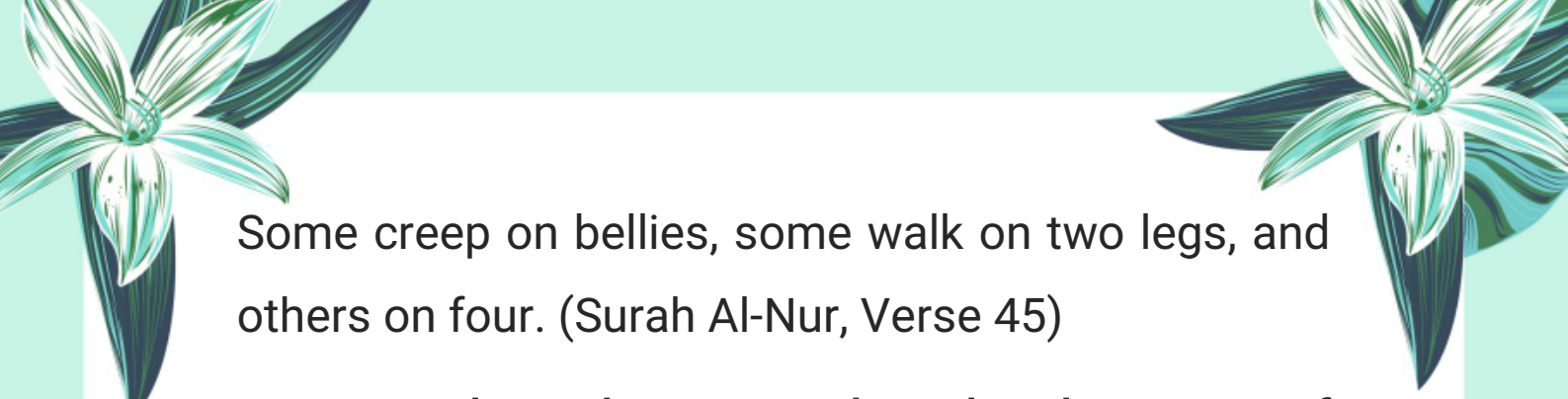
“We made every living thing from water.” (Surah Al-Anbiya, Verse 30)

**22. Which verse of the Quran describes the different stages in the creation of human beings?**

Surah Al-Mominoon, Verse 14


**23. According to the Quran, what are the different types of movements in animals created from water?**





Some creep on bellies, some walk on two legs, and others on four. (Surah Al-Nur, Verse 45)

**24. How does the Quran describe the origin of humans in Surah Al-Rahman?**



“He created man from clay like that of a potter.”  
(Surah Al-Rahman, Verse 14)

**25. What is meant by ‘science as a collaborative field’?**

Science involves experts from different disciplines working together to solve complex problems.

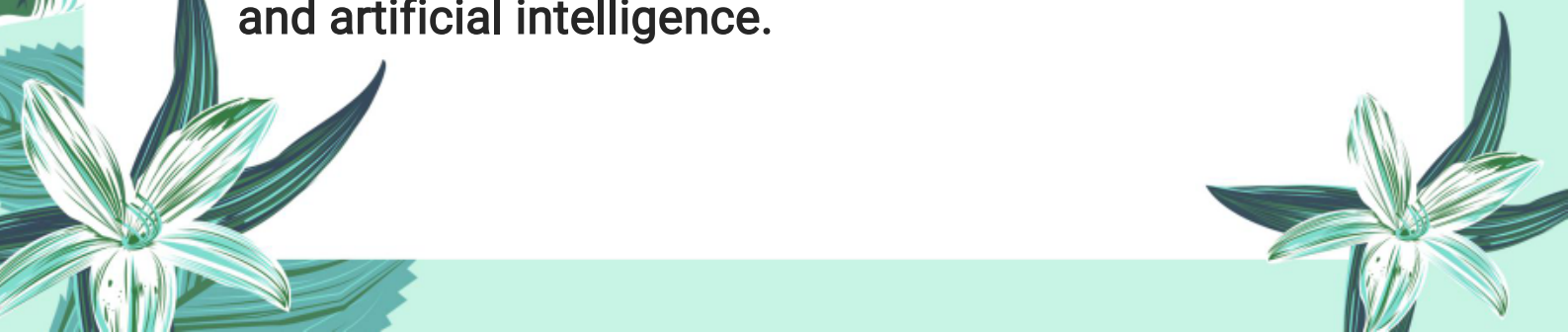
**26. Name any two fields involved in climate change research.**

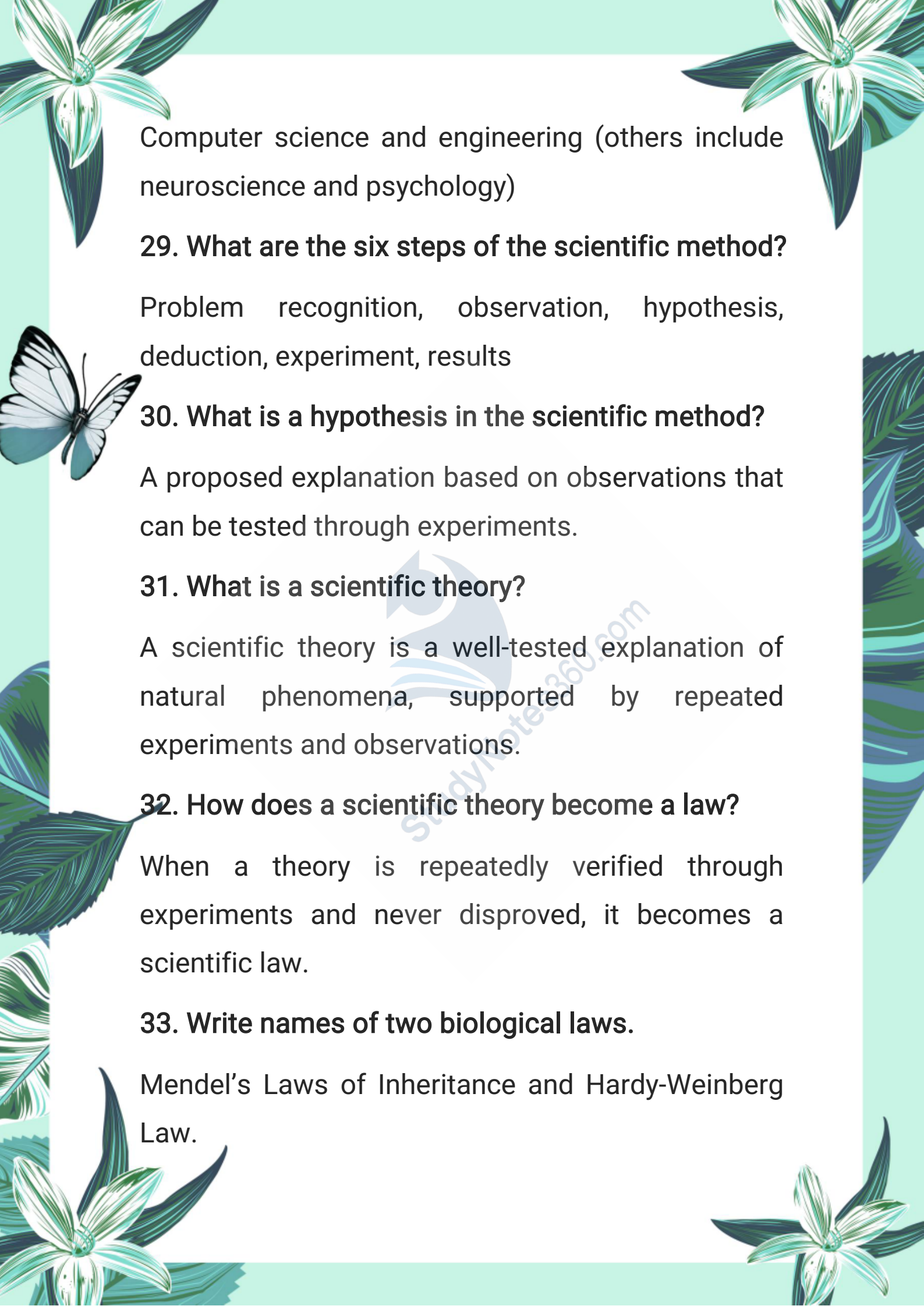
Atmospheric science and ecology (others include economics and sociology)

**27. What is the Human Genome Project?**

It was an international project aimed at sequencing the entire human genome, completed in 2003.

**28. List any two disciplines involved in robotics and artificial intelligence.**



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Computer science and engineering (others include neuroscience and psychology)

**29. What are the six steps of the scientific method?**

Problem recognition, observation, hypothesis, deduction, experiment, results

**30. What is a hypothesis in the scientific method?**

A proposed explanation based on observations that can be tested through experiments.

**31. What is a scientific theory?**

A scientific theory is a well-tested explanation of natural phenomena, supported by repeated experiments and observations.

**32. How does a scientific theory become a law?**

When a theory is repeatedly verified through experiments and never disproved, it becomes a scientific law.

**33. Write names of two biological laws.**


Mendel's Laws of Inheritance and Hardy-Weinberg Law.



**44. What organism causes malaria?**

Plasmodium causes malaria.

**45. Who discovered Plasmodium in the blood of malaria patients?**



Laveran, a French army physician, discovered Plasmodium in 1878.

**46. What was the hypothesis made about the cause of malaria?**

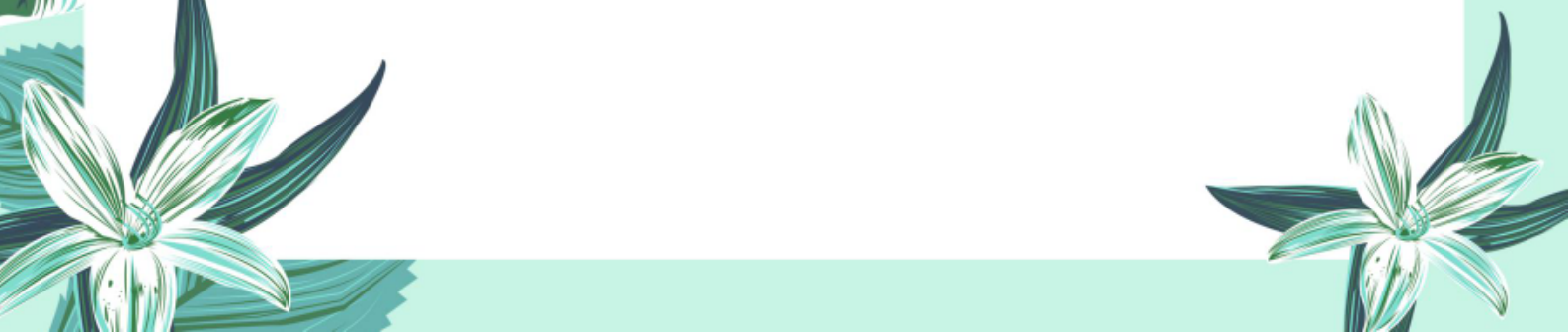
The hypothesis was: "Plasmodium is the cause of malaria."

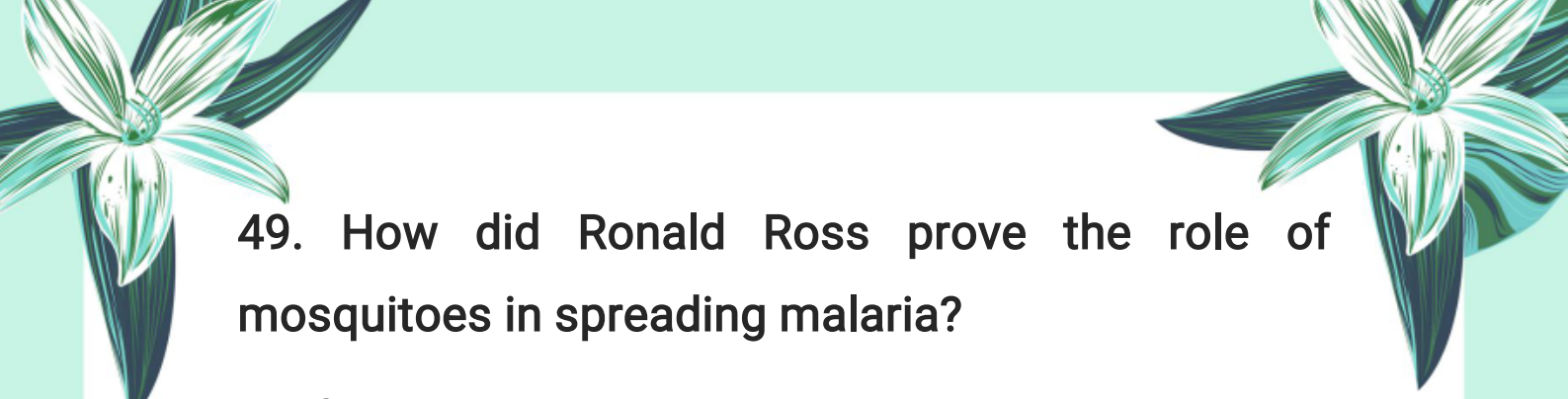
**47. What deduction was made from the malaria hypothesis?**

If Plasmodium causes malaria, it must be present in the blood of all malaria patients.

**48. Who hypothesized that mosquitoes transmit malaria?**


A. F. A. King suggested that mosquitoes transmit malaria.





**49. How did Ronald Ross prove the role of mosquitoes in spreading malaria?**

He found Plasmodium in the stomach and salivary glands of mosquitoes that bit infected sparrows, and later these mosquitoes caused malaria in healthy sparrows.



**50. When was it confirmed that mosquitoes spread malaria in humans?**

In 1898, Italian scientists confirmed it through experiments on humans using infected Anopheles mosquitoes.

### **Important Long Questions:**

**Q1. Define Biology. Write the major fields of Biology with explanation.**

**Answer:**

Biology is the science of life. The word "Biology" is derived from two Greek words:

Bios meaning "life"





Logos meaning “study”

So, Biology means the study of living organisms, their structure, functions, and interactions with the environment.

Biology is a broad field, and to study it better, it is divided into three major fields:

### 1. Zoology:

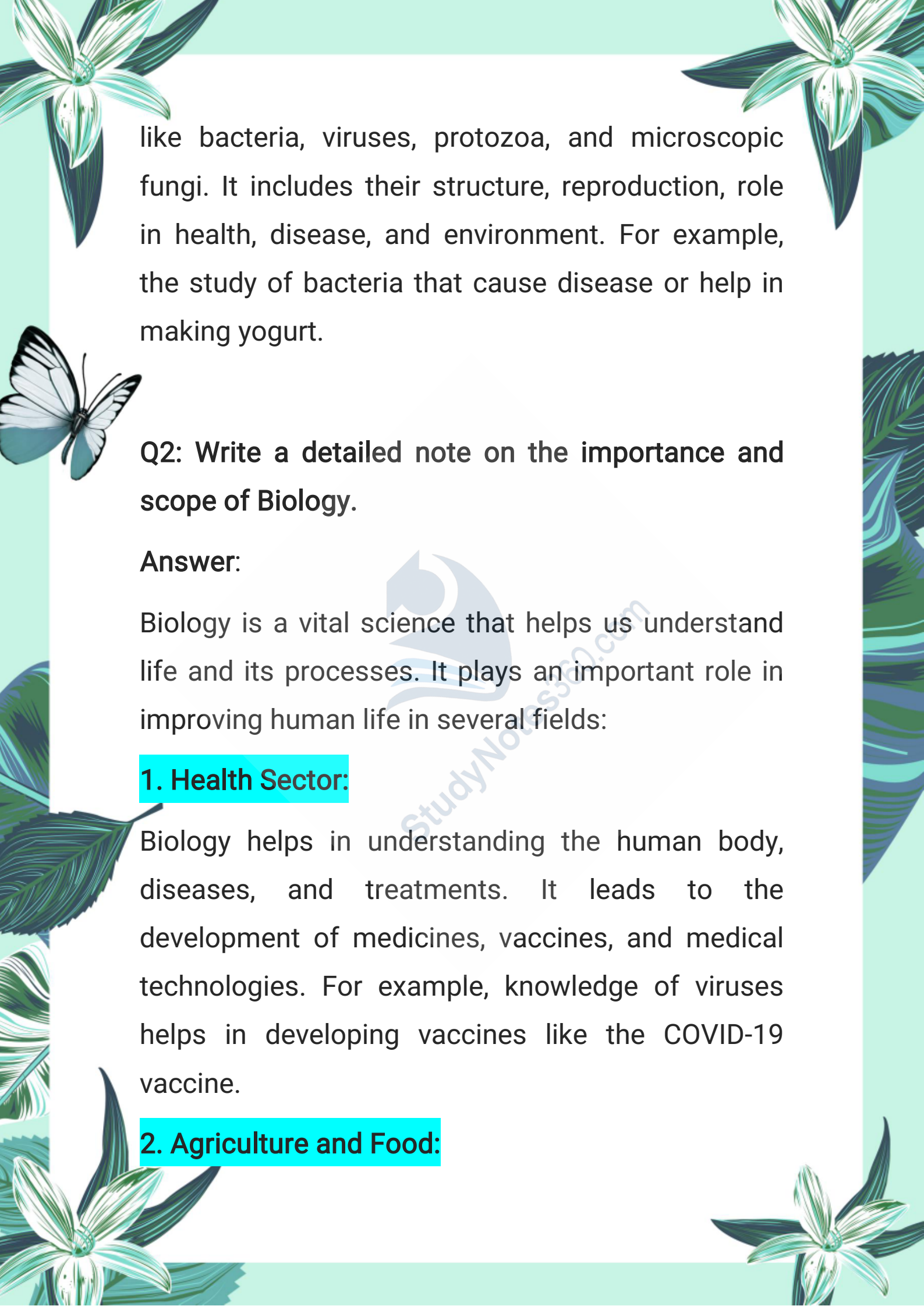
It is the branch of Biology that deals with the study of animals. Zoology includes the study of animal structure, functions, behaviour, and diversity. For example, the study of mammals, birds, reptiles, and marine animals comes under zoology.

### 2. Botany:

Botany is the branch that deals with the study of plants. It includes the structure, growth, reproduction, and environmental interactions of plants. For example, the study of flowering plants, trees, and their adaptations.

### 3. Microbiology:

Microbiology is the study of microscopic organisms

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like bacteria, viruses, protozoa, and microscopic fungi. It includes their structure, reproduction, role in health, disease, and environment. For example, the study of bacteria that cause disease or help in making yogurt.

**Q2: Write a detailed note on the importance and scope of Biology.**

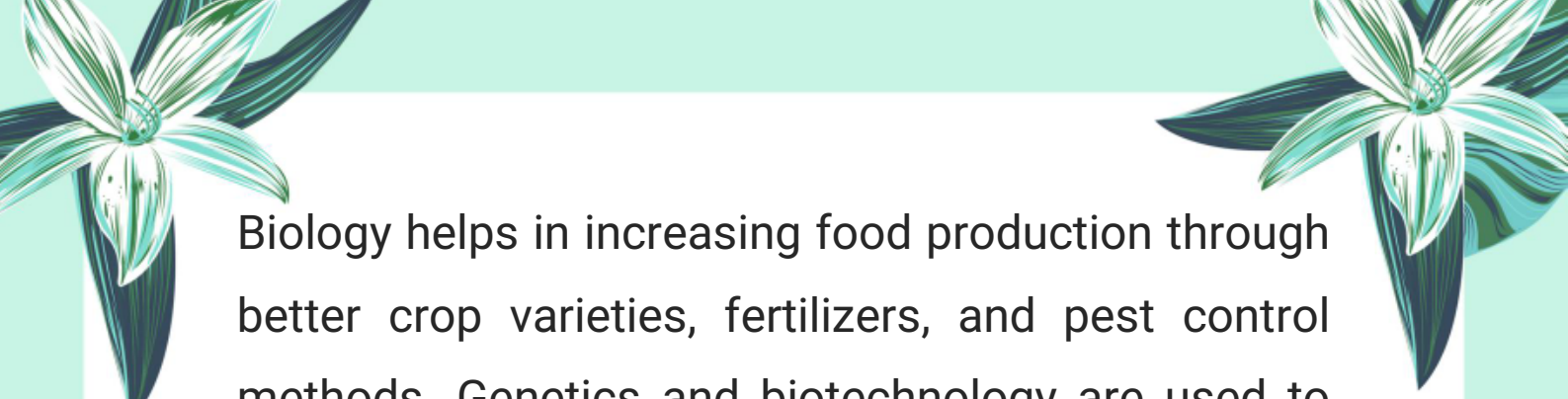
**Answer:**

Biology is a vital science that helps us understand life and its processes. It plays an important role in improving human life in several fields:

### **1. Health Sector:**


Biology helps in understanding the human body, diseases, and treatments. It leads to the development of medicines, vaccines, and medical technologies. For example, knowledge of viruses helps in developing vaccines like the COVID-19 vaccine.

### **2. Agriculture and Food:**



Biology helps in increasing food production through better crop varieties, fertilizers, and pest control methods. Genetics and biotechnology are used to produce high-yield and disease-resistant crops.

### **3. Environment and Conservation:**



Biology explains the relationship between organisms and the environment. It helps in protecting endangered species, managing natural resources, and solving pollution problems.

### **4. Research and Biotechnology:**

In molecular biology and genetics, research helps in understanding DNA, gene editing, and producing useful substances like insulin and antibiotics.

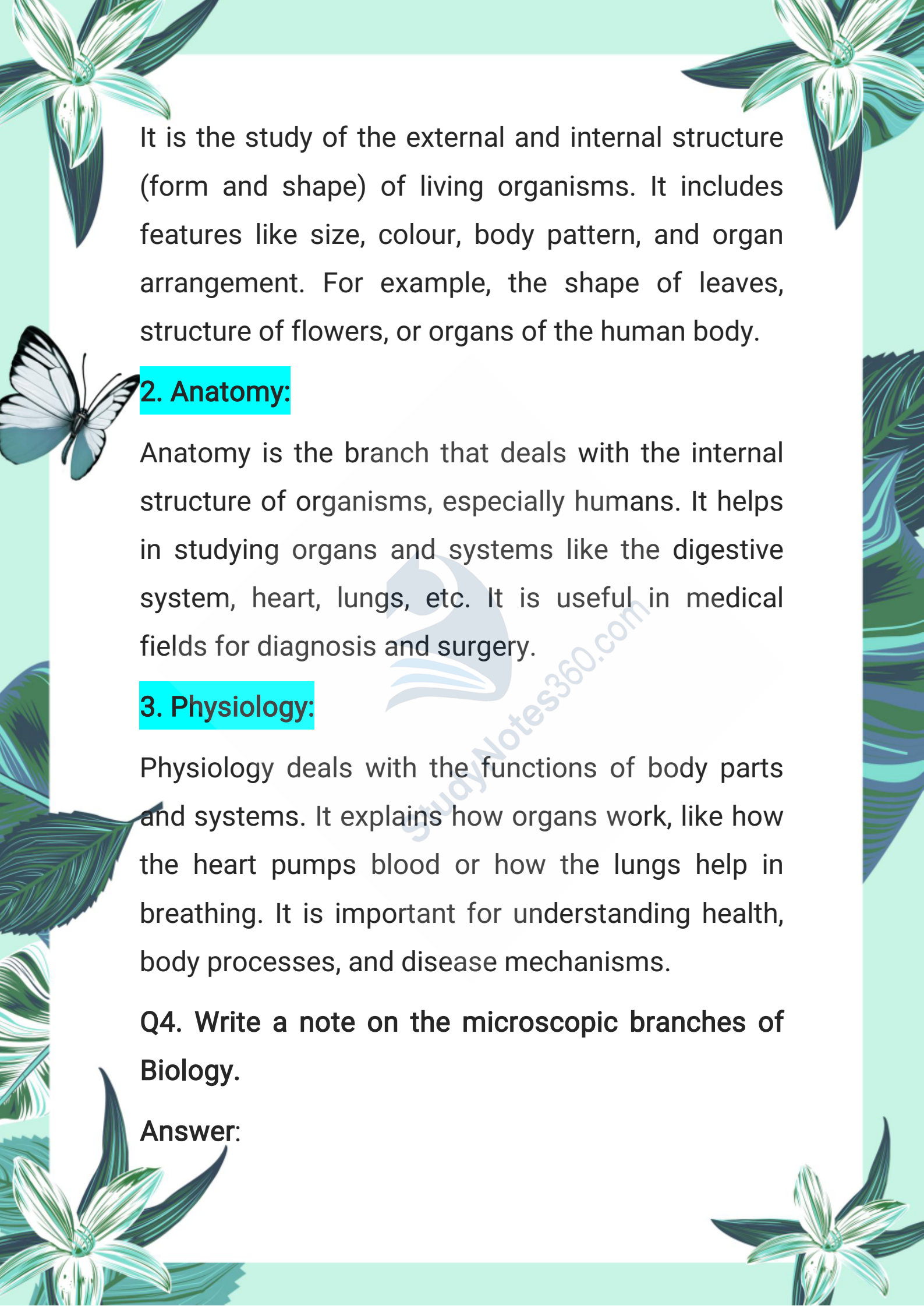
**Q3. Explain the branches of Biology that deal with the structure and function of living things.**

**Answer:**

Some branches of Biology focus on understanding the structure and functions of organisms. These include:

### **1. Morphology:**



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It is the study of the external and internal structure (form and shape) of living organisms. It includes features like size, colour, body pattern, and organ arrangement. For example, the shape of leaves, structure of flowers, or organs of the human body.

## **2. Anatomy:**

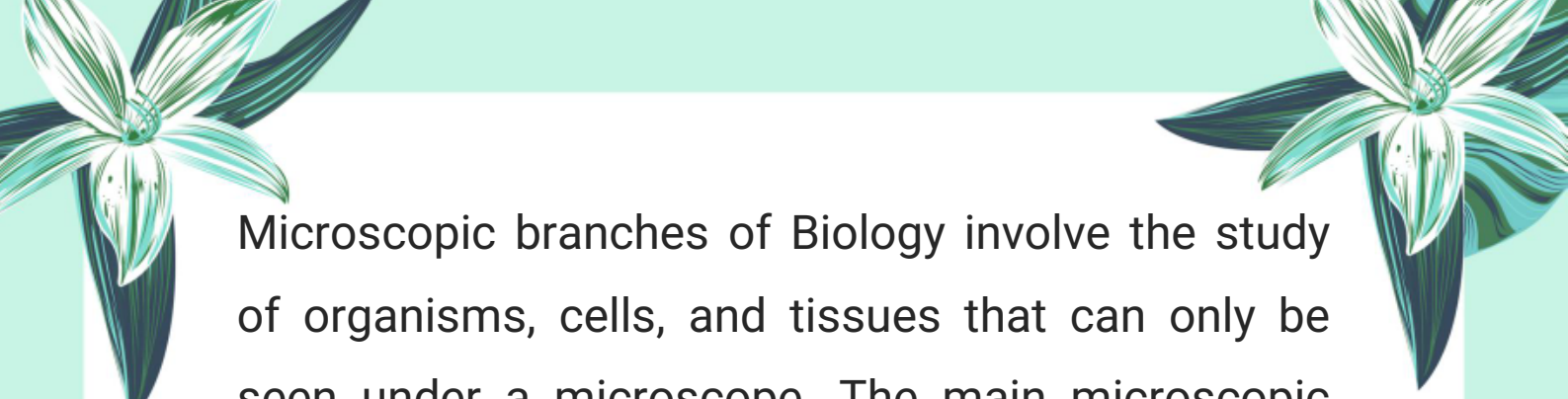
Anatomy is the branch that deals with the internal structure of organisms, especially humans. It helps in studying organs and systems like the digestive system, heart, lungs, etc. It is useful in medical fields for diagnosis and surgery.

## **3. Physiology:**

Physiology deals with the functions of body parts and systems. It explains how organs work, like how the heart pumps blood or how the lungs help in breathing. It is important for understanding health, body processes, and disease mechanisms.

**Q4. Write a note on the microscopic branches of Biology.**

**Answer:**



Microscopic branches of Biology involve the study of organisms, cells, and tissues that can only be seen under a microscope. The main microscopic branches are:



### 1. Cytology:

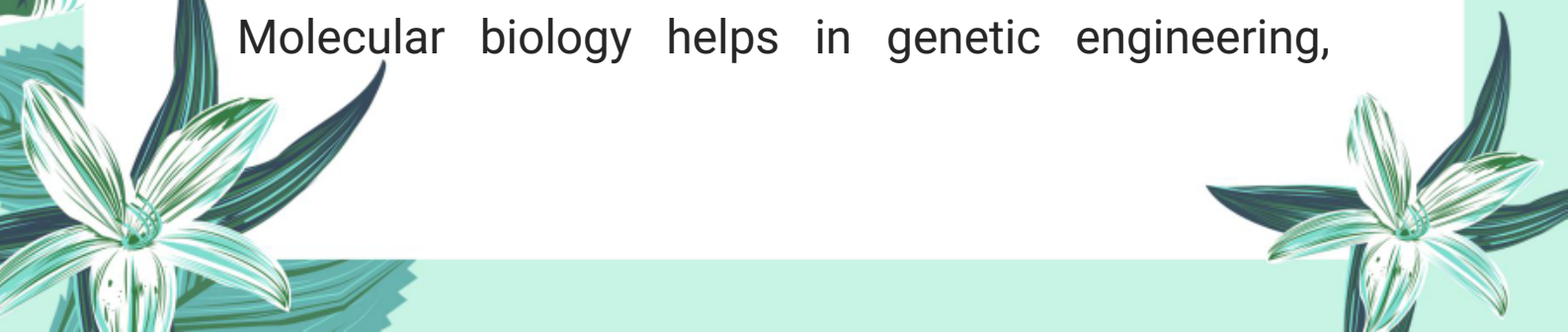
It is the study of cells, which are the basic units of life. Cytologists study the structure and function of cell organelles like the nucleus, mitochondria, etc. They also study cell division and diseases like cancer at the cellular level.

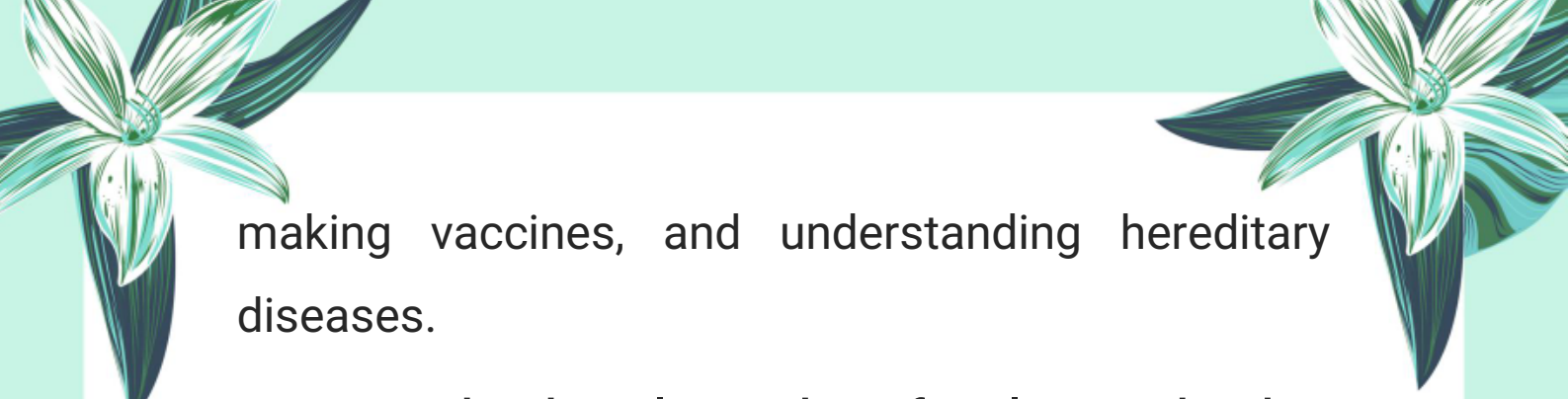
### 2. Histology:

Histology is the microscopic study of tissues, which are groups of similar cells. It is important in medical diagnosis, especially in detecting tissue damage or diseases through biopsy.

### 3. Molecular Biology:

It is the study of biological molecules like DNA, RNA, proteins, carbohydrates, and lipids. It explains how these molecules control the processes of life. Molecular biology helps in genetic engineering,






making vaccines, and understanding hereditary diseases.


**Q4. Describe the relationship of Biology with other natural sciences.**

**Answer:**

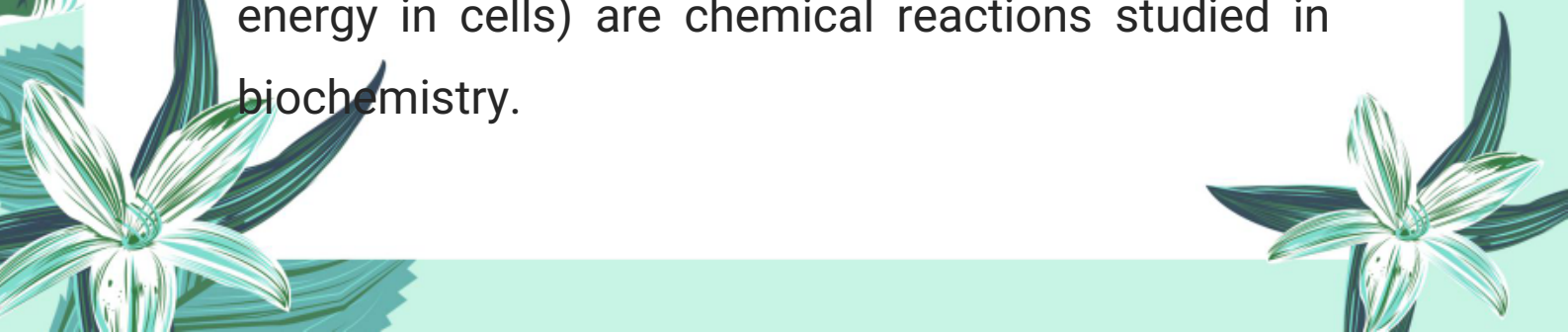


Biology is the study of life and living organisms. However, to fully understand biological processes, it is necessary to connect Biology with other natural sciences like Chemistry, Physics, and Earth Sciences. These connections help us explore the structure, function, and interaction of life in a broader and more practical way.

### **Relation with Chemistry (Biochemistry):**




Biochemistry is a branch that combines Biology and Chemistry. It helps us understand the chemical composition of cells and the chemical reactions that occur in living organisms. For example, the process of photosynthesis (formation of food in plants using sunlight) and respiration (release of energy in cells) are chemical reactions studied in biochemistry.





### **Relation with Physics (Biophysics):**



Biophysics connects Biology and Physics. It uses the principles of physics to understand the movement and function of biological systems. For instance, the working of muscles and bones, and the laws of motion in body movements, are studied through the rules of levers and forces in Physics.

### **Relation with Earth Sciences (Biogeography):**

Biology is also related to Earth Sciences in the form of Biogeography. This field studies the distribution of organisms on Earth and how environmental changes, such as climate change, affect their survival and spread. It helps in understanding how organisms adapt to different habitats and how biodiversity is affected by geography.


Thus, Biology does not exist alone—it works in harmony with other sciences to provide a complete understanding of life and its processes.

**Q5. Write a note on Bio-economics and explain its importance in agriculture and industry.**





## Answer:



Bio-economics is a specialized branch of Biology that studies living organisms from an economic point of view. It combines biological knowledge with economics to make useful decisions in agriculture, industry, and environmental management.

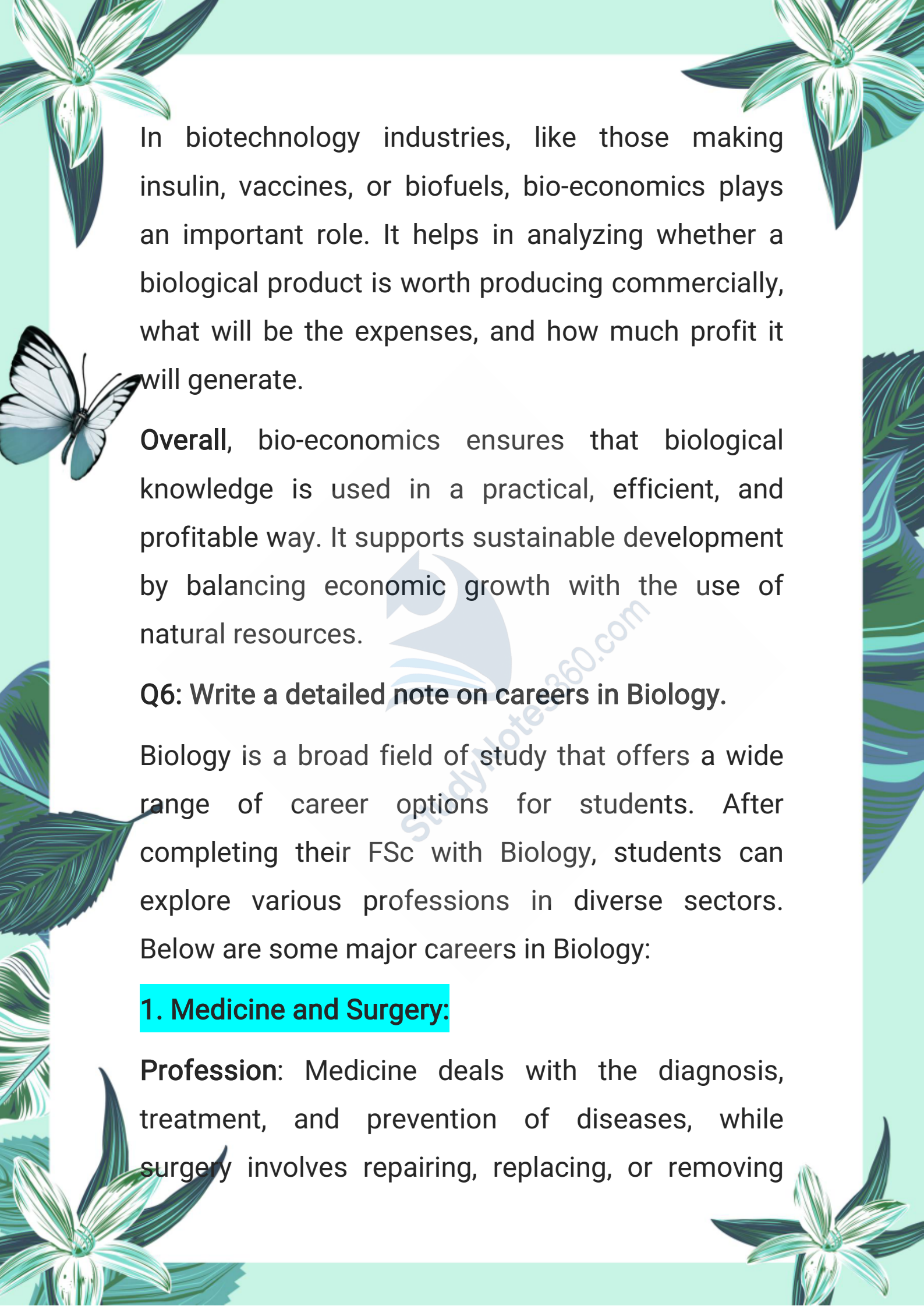
In bio-economics, scientists calculate the costs, benefits, and profitability of biological projects. For example, before introducing a new variety of crop, it is important to study how much it will cost to produce, what kind of yield it will provide, and how much profit can be earned.

### Importance in Agriculture:

In farming, bio-economics helps in deciding which crops or livestock should be used to get the best output at the lowest cost. It also helps in selecting fertilizers, seeds, and irrigation techniques that are cost-effective and productive.

### Importance in Industry:



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In biotechnology industries, like those making insulin, vaccines, or biofuels, bio-economics plays an important role. It helps in analyzing whether a biological product is worth producing commercially, what will be the expenses, and how much profit it will generate.

**Overall,** bio-economics ensures that biological knowledge is used in a practical, efficient, and profitable way. It supports sustainable development by balancing economic growth with the use of natural resources.

**Q6: Write a detailed note on careers in Biology.**

Biology is a broad field of study that offers a wide range of career options for students. After completing their FSc with Biology, students can explore various professions in diverse sectors. Below are some major careers in Biology:

### **1. Medicine and Surgery:**

**Profession:** Medicine deals with the diagnosis, treatment, and prevention of diseases, while surgery involves repairing, replacing, or removing

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defective parts of the body.

**Degree Required:** A Bachelor of Medicine, Bachelor of Surgery (MBBS) is required to pursue this career. It takes five years to complete this degree.

**Opportunities:** Physicians, surgeons, and specialists in various fields such as cardiology, neurology, and pediatrics can work in hospitals, clinics, and healthcare institutions.

## 2. Dentistry:

**Profession:** Dentists diagnose and treat dental diseases, perform surgeries, and maintain oral health.

**Degree Required:** A Bachelor of Dental Surgery (BDS) degree is required, which usually takes four years.

**Opportunities:** Dentists can work in private clinics, dental hospitals, and research institutions.


## 3. Pharmacology:

**Profession:** Pharmacologists study the effects of drugs on the human body, develop new medications,



and ensure their safe use.

**Degree Required:** A Bachelor of Pharmacy (B.Pharm) or Doctor of Pharmacy (D. Pharm) degree is required to enter this field.



**Opportunities:** Pharmacologists can work in pharmaceutical companies, research labs, hospitals, and healthcare organizations.

#### 4. Biotechnology:

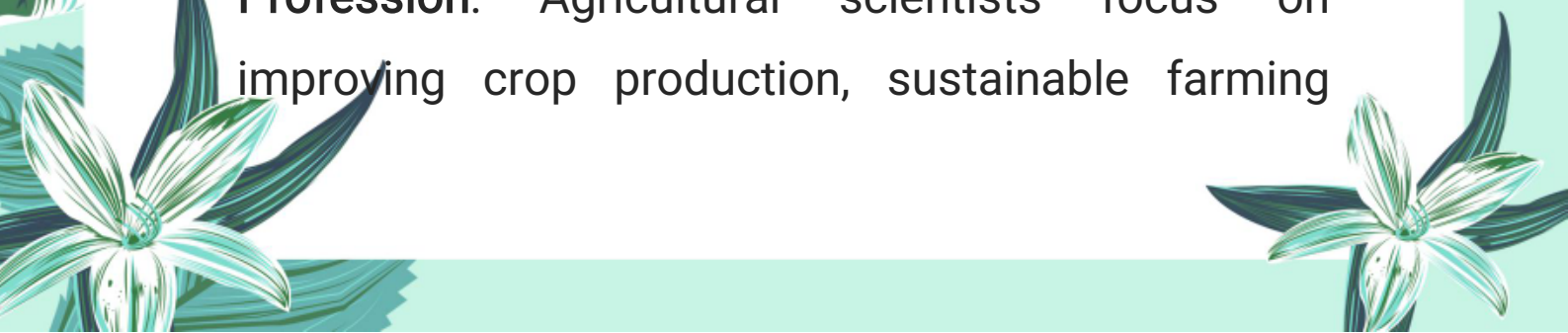
**Profession:** Biotechnologists apply biological processes to develop products in medicine, agriculture, and environmental management.

**Degree Required:** A 4-year BS degree in Biotechnology is required.

**Opportunities:** Biotechnologists can work in research and development, pharmaceutical companies, agriculture, and environmental organizations.

#### 5. Agriculture:

**Profession:** Agricultural scientists focus on improving crop production, sustainable farming





practices, and pest control.

**Degree Required:** A 4-year BS degree in Agriculture is required.

**Opportunities:** Agricultural scientists can work in agricultural research, farming industries, and government agricultural departments.



## 6. Forensics:

**Profession:** Forensic scientists analyze physical evidence from crime scenes to help solve criminal investigations.

**Degree Required:** A 4-year BS degree in Forensic Science is required.

**Opportunities:** Forensic scientists can work in law enforcement, criminal justice systems, and forensic laboratories.

## 7. Physiotherapy:

**Profession:** Physiotherapists work to restore movement and physical function impaired by injury or disease.

**Degree Required:** A 4-year BS degree in






Physiotherapy is required.

**Opportunities:** Physiotherapists can work in hospitals, rehabilitation centers, and private clinics.

## 8. Wildlife and Fisheries:



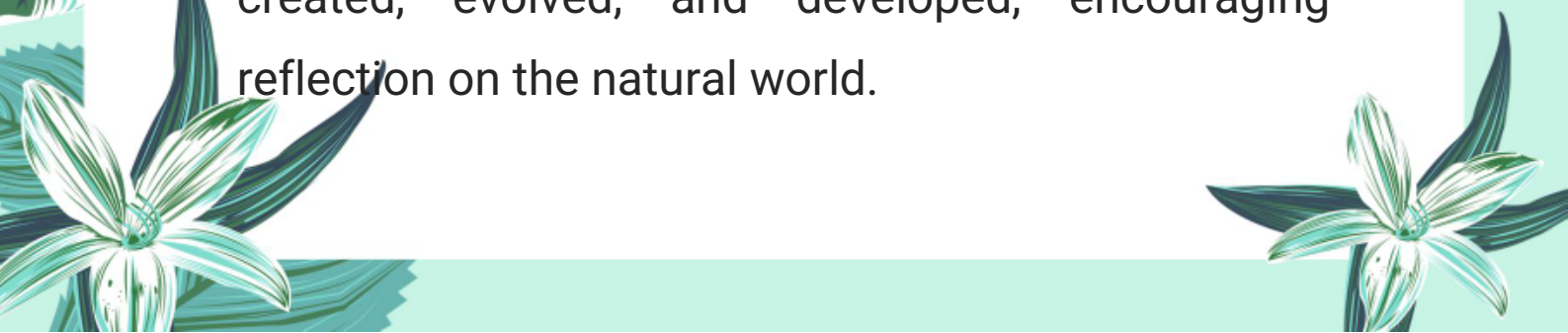
**Profession:** Wildlife biologists and fisheries scientists study the biology and management of wildlife and aquatic life.

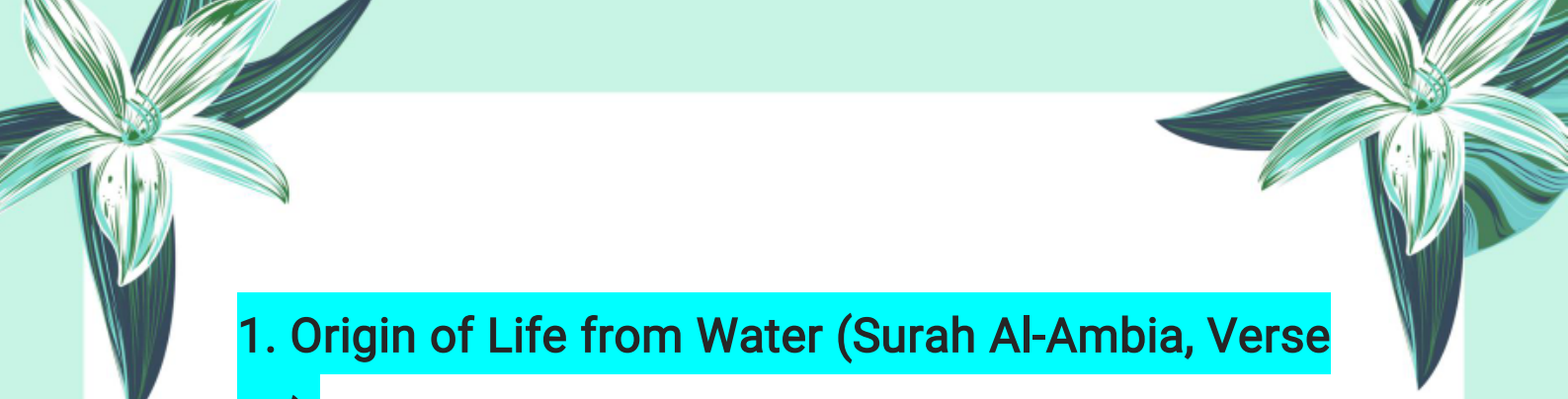
**Degree Required:** A BS degree in Zoology, Fisheries, or Aquaculture is necessary.

**Opportunities:** These professionals can work in wildlife conservation organizations, fisheries, and environmental agencies.

**Q7: Describe the Quranic concept of the origin and development of life.**


The Holy Quran presents a profound and insightful perspective on the origin and development of life. Several verses in the Quran describe how life was created, evolved, and developed, encouraging reflection on the natural world.





## 1. Origin of Life from Water (Surah Al-Ambia, Verse 30):


"We made every living thing from water."



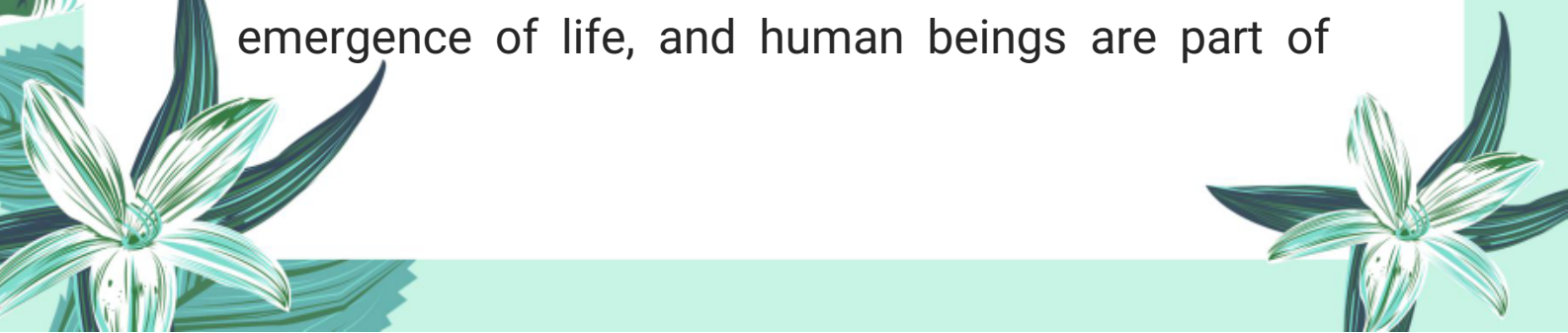
This verse highlights the idea that water is the source of all living things. Scientific research confirms that water is essential for life, as all living organisms require water to survive. The Quranic verse aligns with this scientific understanding, suggesting that water is the foundation of life on Earth.

## 2. Creation of Human Beings from Clay (Surah Al-Rehman, Verse 14):

"He created man from clay like the potter."



The Quran mentions that human beings were created from clay, symbolizing the humble and elemental origin of human life. This aligns with the scientific concept that the Earth's early environment had essential elements that contributed to the emergence of life, and human beings are part of



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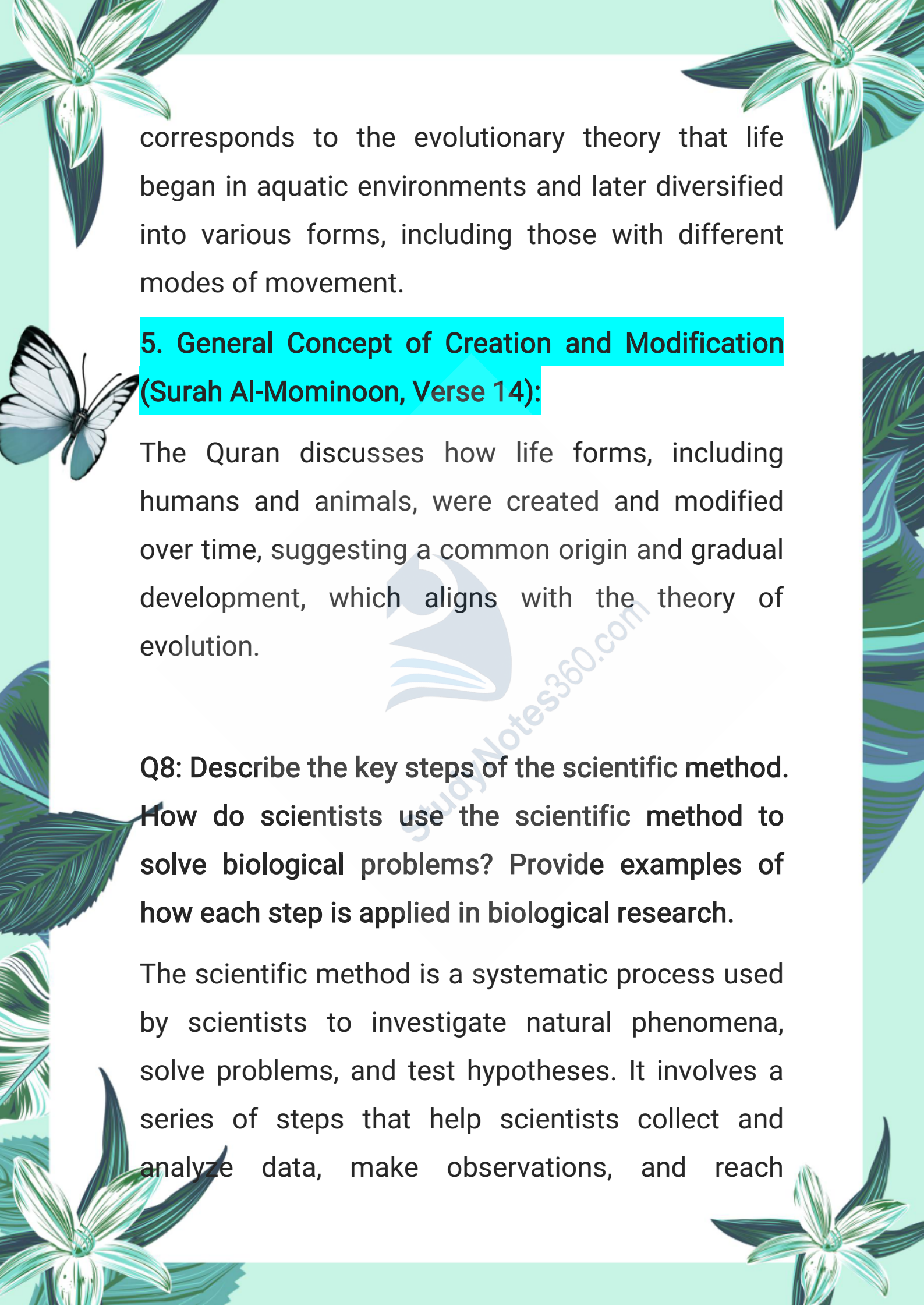
this natural process.

### **3. Stages of Human Development (Surah Al-Mominoon, Verse 14):**

"Then We made the drop of sperm into a clot of blood, then We made the clot into a lump of flesh, then We made the lump into bones, and then We clothed the bones with flesh." This verse describes the embryonic development of humans in stages, starting from a sperm drop, turning into a clot, and then into a lump of flesh, bones, and flesh again. This description closely matches the scientific understanding of embryology, where a fertilized egg develops through several stages to form a fully developed human being.

### **4. Creation of Animals from Water (Surah Al-Nur, Verse 45):**

"Allah hath created every animal from water. Then some of them creep on their bellies, others walk on two legs, and others on four." This verse emphasizes the idea that life began in water, and from there, diverse forms of life evolved. This

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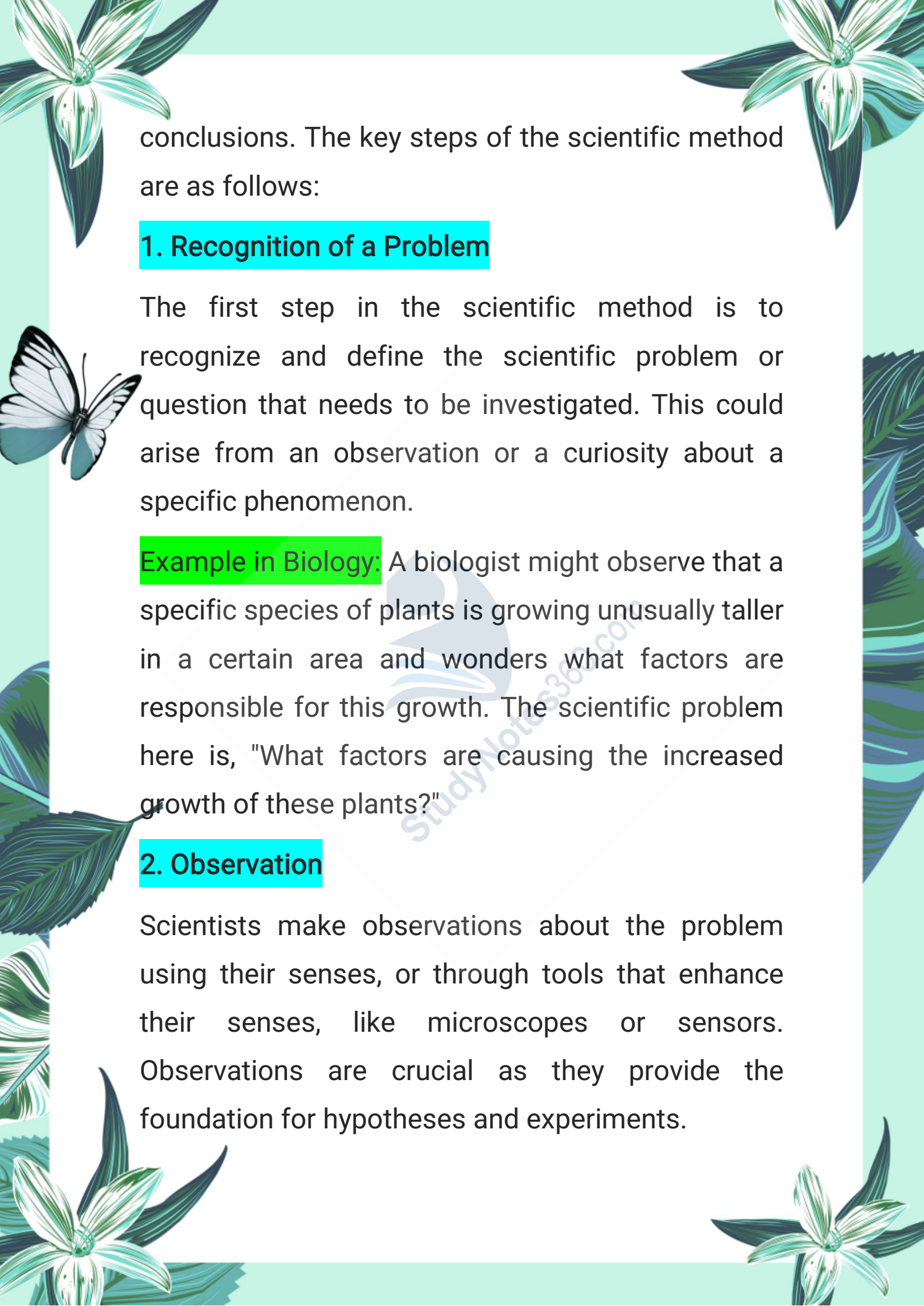
corresponds to the evolutionary theory that life began in aquatic environments and later diversified into various forms, including those with different modes of movement.

## **5. General Concept of Creation and Modification (Surah Al-Mominoon, Verse 14):**

The Quran discusses how life forms, including humans and animals, were created and modified over time, suggesting a common origin and gradual development, which aligns with the theory of evolution.

**Q8: Describe the key steps of the scientific method. How do scientists use the scientific method to solve biological problems? Provide examples of how each step is applied in biological research.**

The scientific method is a systematic process used by scientists to investigate natural phenomena, solve problems, and test hypotheses. It involves a series of steps that help scientists collect and analyze data, make observations, and reach

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conclusions. The key steps of the scientific method are as follows:

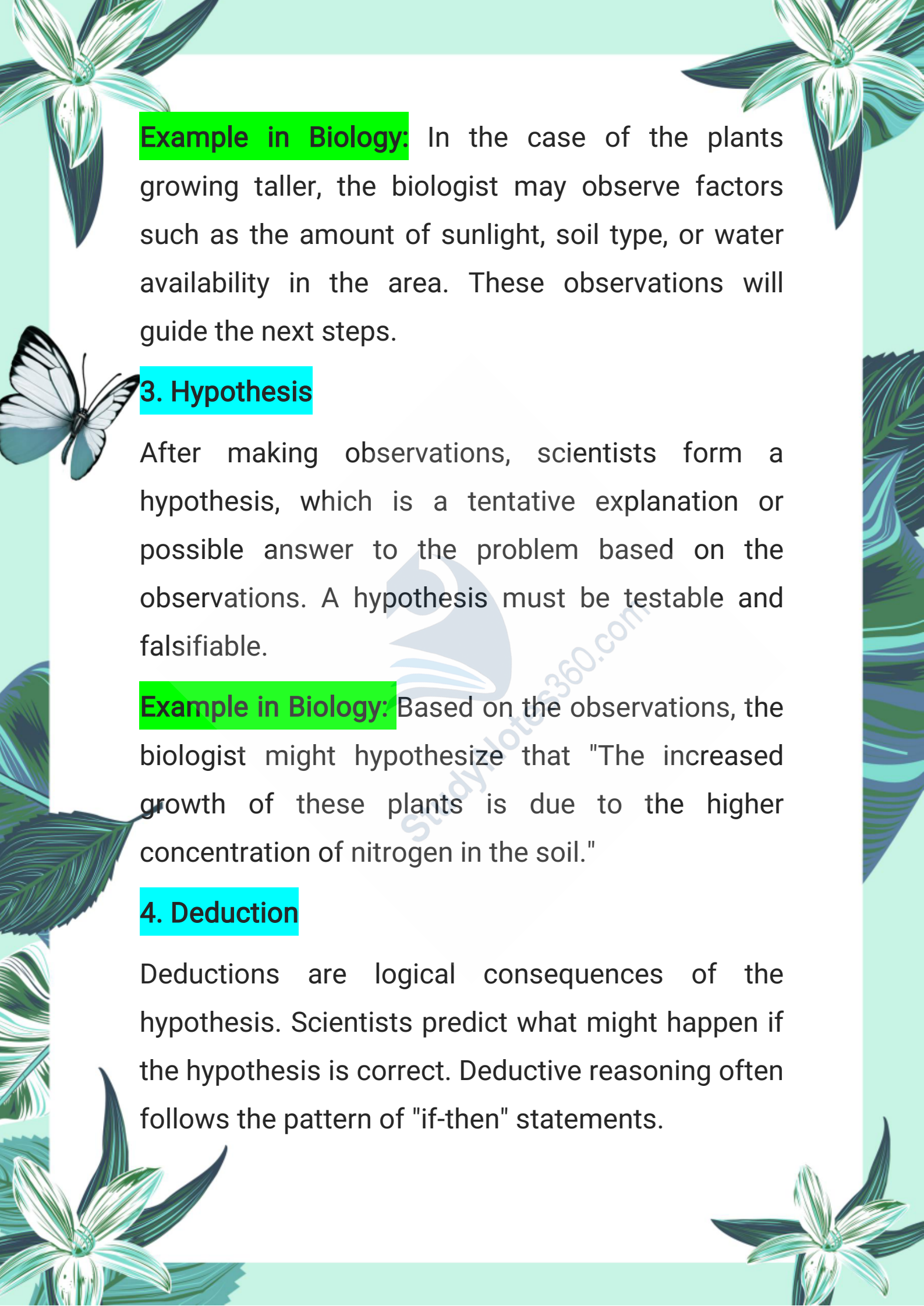
## 1. Recognition of a Problem

The first step in the scientific method is to recognize and define the scientific problem or question that needs to be investigated. This could arise from an observation or a curiosity about a specific phenomenon.

**Example in Biology:** A biologist might observe that a specific species of plants is growing unusually taller in a certain area and wonders what factors are responsible for this growth. The scientific problem here is, "What factors are causing the increased growth of these plants?"

## 2. Observation

Scientists make observations about the problem using their senses, or through tools that enhance their senses, like microscopes or sensors. Observations are crucial as they provide the foundation for hypotheses and experiments.

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**Example in Biology:** In the case of the plants growing taller, the biologist may observe factors such as the amount of sunlight, soil type, or water availability in the area. These observations will guide the next steps.

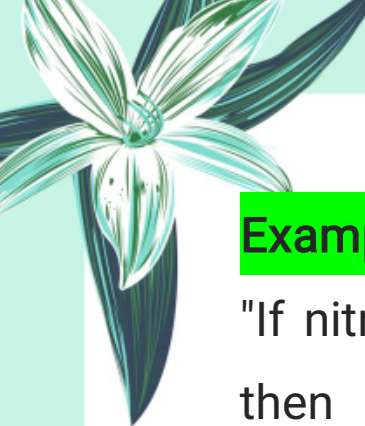
### 3. Hypothesis

After making observations, scientists form a hypothesis, which is a tentative explanation or possible answer to the problem based on the observations. A hypothesis must be testable and falsifiable.

**Example in Biology:** Based on the observations, the biologist might hypothesize that "The increased growth of these plants is due to the higher concentration of nitrogen in the soil."

### 4. Deduction

Deductions are logical consequences of the hypothesis. Scientists predict what might happen if the hypothesis is correct. Deductive reasoning often follows the pattern of "if-then" statements.



**Example in Biology:** The biologist could deduce that "If nitrogen in the soil is causing the plant growth, then adding more nitrogen should lead to even more growth in these plants."




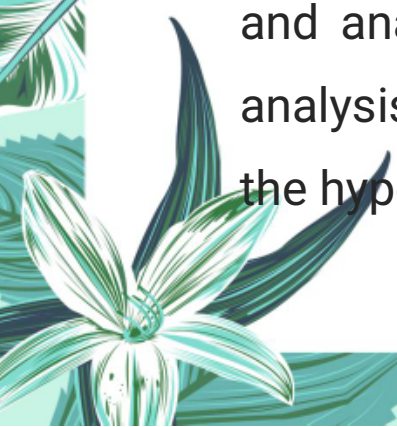
## 5. Experimentation

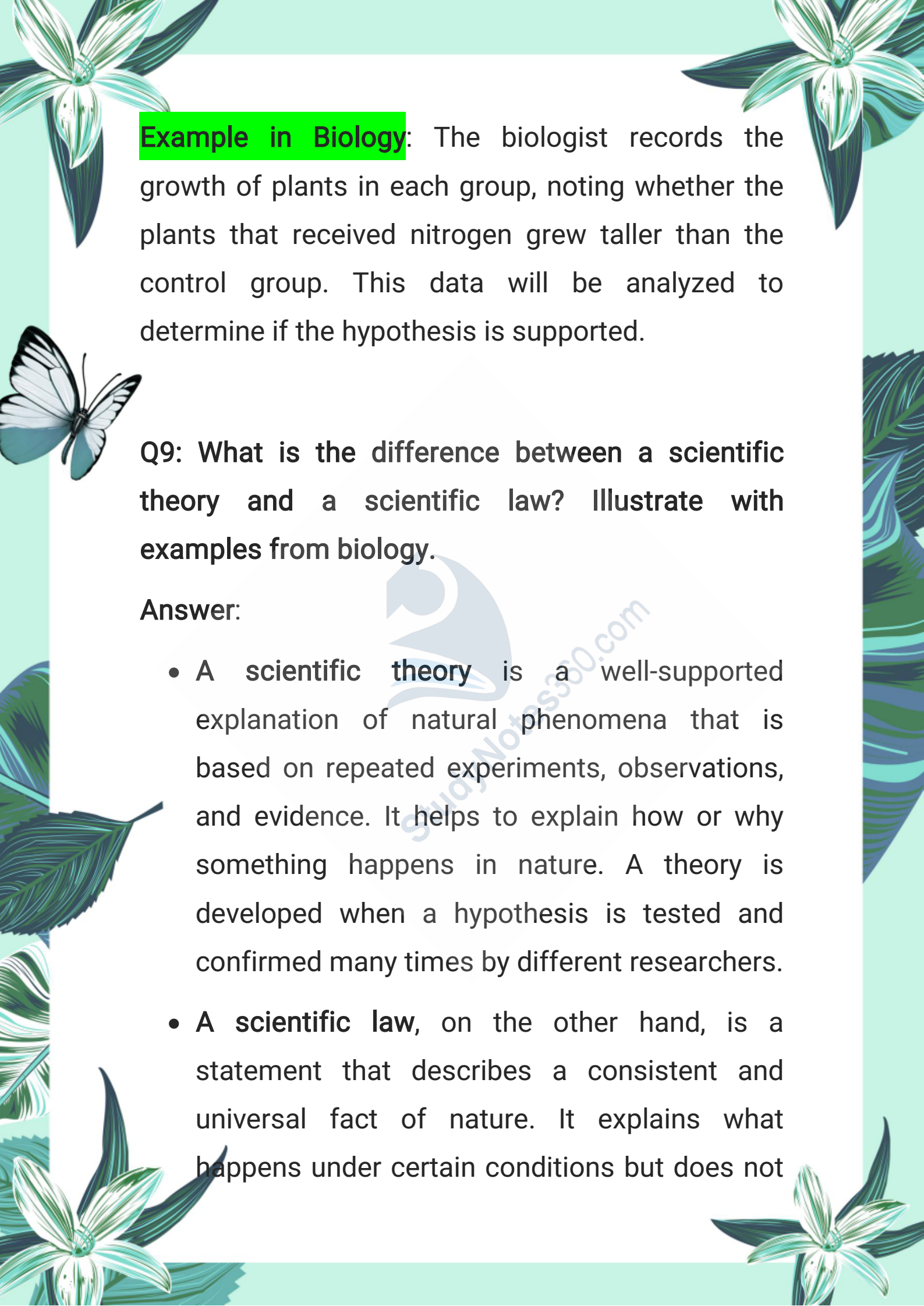
This is the most critical step where scientists conduct experiments to test the hypothesis. Experiments should be controlled to eliminate other variables and ensure that the results are due to the factor being tested.

**Example in Biology:** To test the hypothesis, the biologist may perform an experiment where they apply different amounts of nitrogen to various plants and monitor their growth. One group of plants receives no additional nitrogen, while another group receives a controlled amount.

## 6. Results and Analysis

After conducting the experiment, scientists collect and analyze the data. This may involve statistical analysis, creating graphs, or comparing results with the hypothesis.



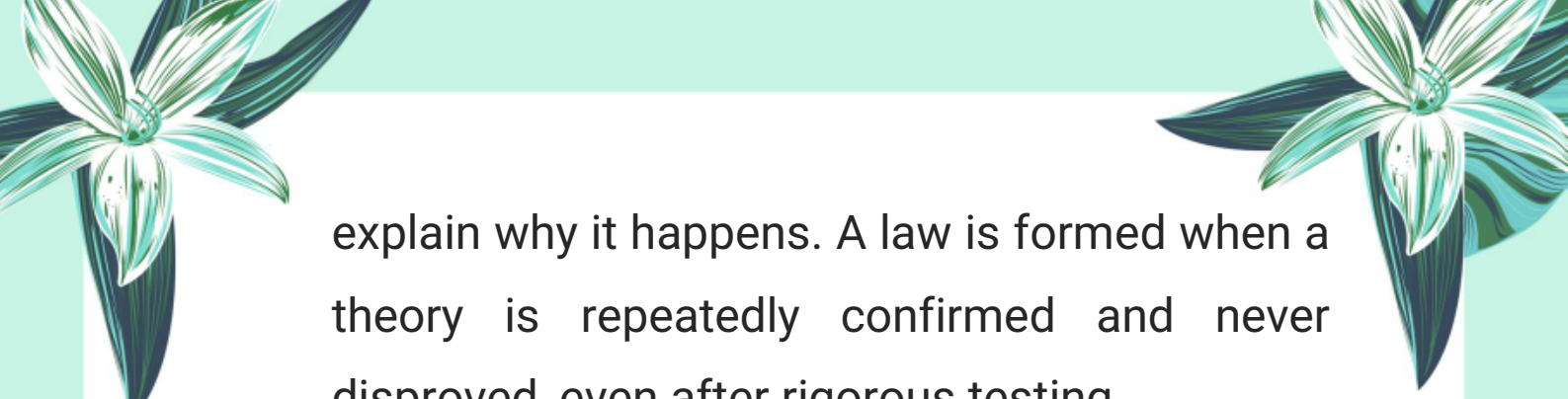
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**Example in Biology:** The biologist records the growth of plants in each group, noting whether the plants that received nitrogen grew taller than the control group. This data will be analyzed to determine if the hypothesis is supported.

**Q9:** What is the difference between a scientific theory and a scientific law? Illustrate with examples from biology.

**Answer:**

- A **scientific theory** is a well-supported explanation of natural phenomena that is based on repeated experiments, observations, and evidence. It helps to explain how or why something happens in nature. A theory is developed when a hypothesis is tested and confirmed many times by different researchers.
- A **scientific law**, on the other hand, is a statement that describes a consistent and universal fact of nature. It explains what happens under certain conditions but does not



explain why it happens. A law is formed when a theory is repeatedly confirmed and never disproved, even after rigorous testing.

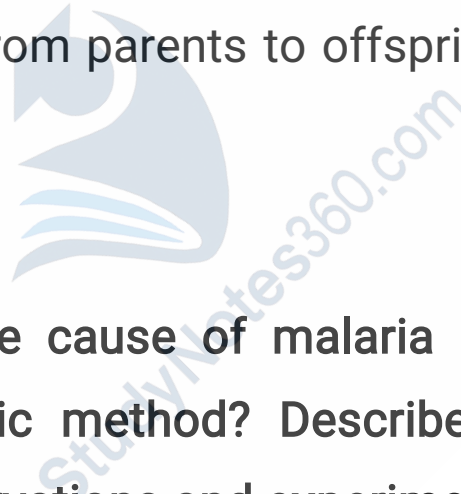
### Differences:



#### Example in Biology:

**Theory:** The Theory of Evolution explains how species change over time through natural selection.

**Law:** Mendel's Laws of Inheritance describe how traits are passed from parents to offspring through genes.



**Q10:** How was the cause of malaria discovered using the scientific method? Describe all steps with relevant observations and experiments.

#### Answer:

The discovery of the cause of malaria is a classical example of how scientists apply the scientific method to solve biological problems. It includes the following steps:

1. **Recognition of a Problem:** The initial problem






was: What is the cause of malaria?

Malaria was a deadly disease known for centuries, but its actual cause was unknown.

## 2. Observations:

- 
- Malaria mostly occurred in marshy areas.
  - Drinking marsh water did not cause malaria.
  - Plasmodium was seen in the blood of malaria patients.
  - Quinine was an effective treatment.
  - In 1878, a French army doctor, Laveran, observed microscopic organisms (later named Plasmodium) in the blood of malaria patients.

## 3. Hypothesis:

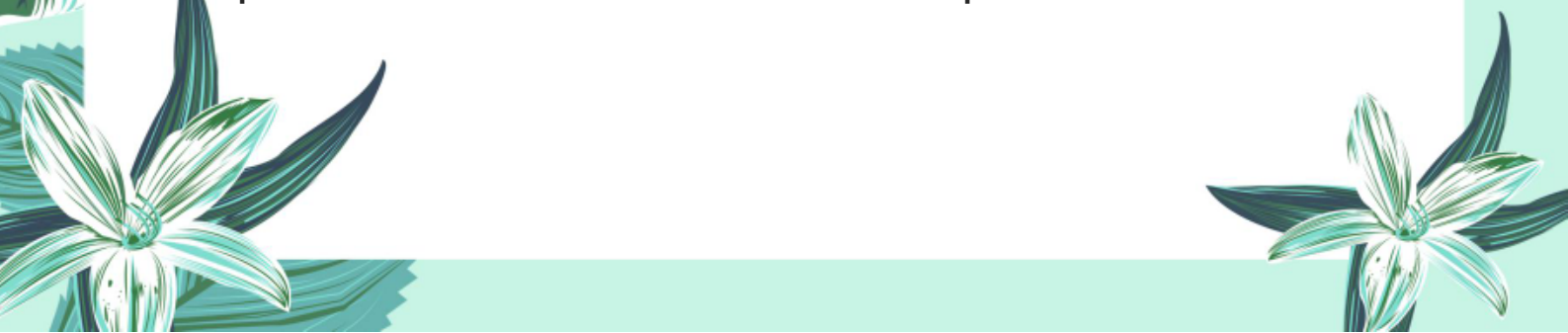
Scientists proposed the hypothesis:

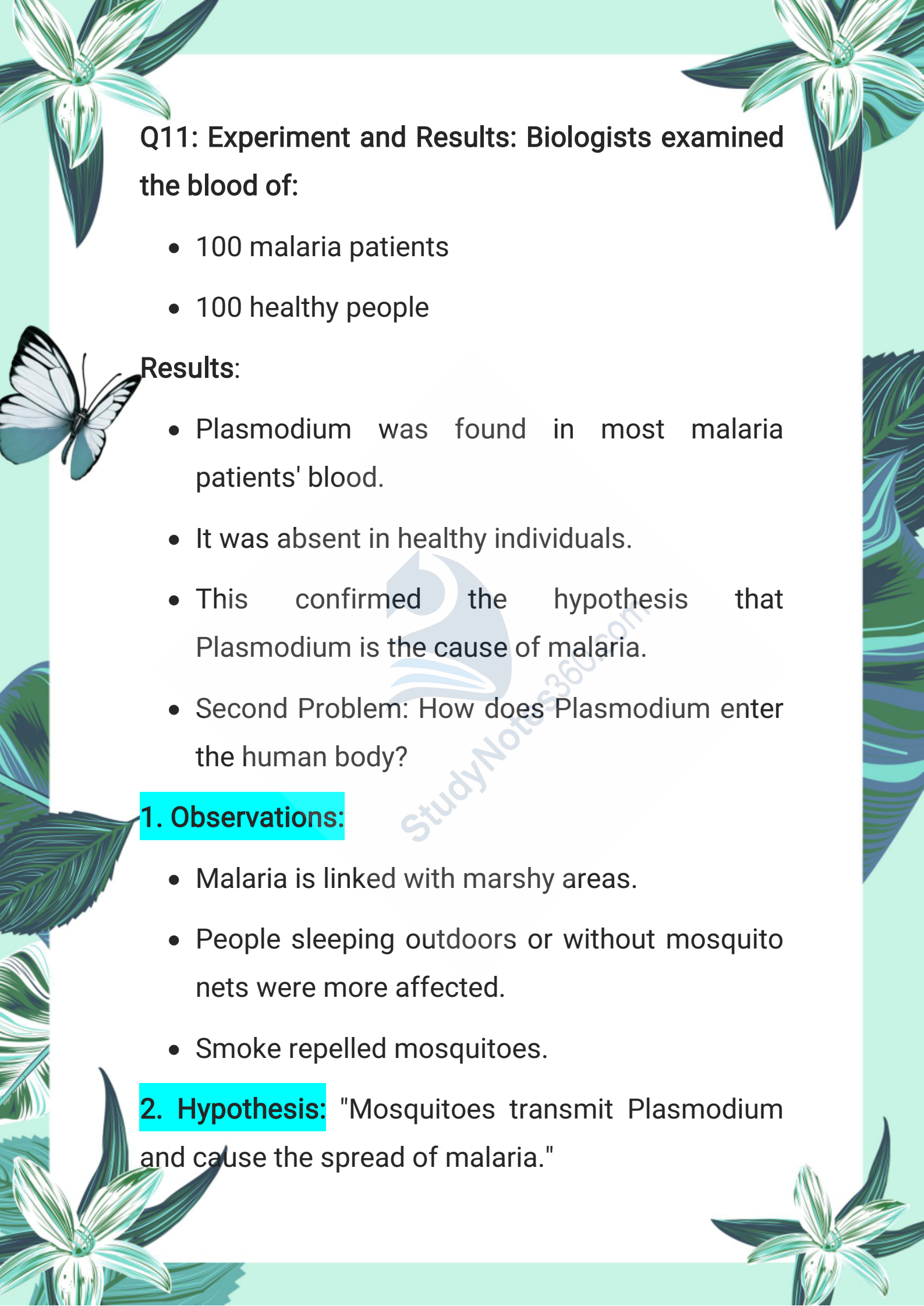
"Plasmodium is the cause of malaria."

## 4. Deduction:

Based on the hypothesis, the deduction was:

"If Plasmodium causes malaria, then it should be present in the blood of all malarial patients."





**Q11: Experiment and Results: Biologists examined the blood of:**

- 100 malaria patients
- 100 healthy people

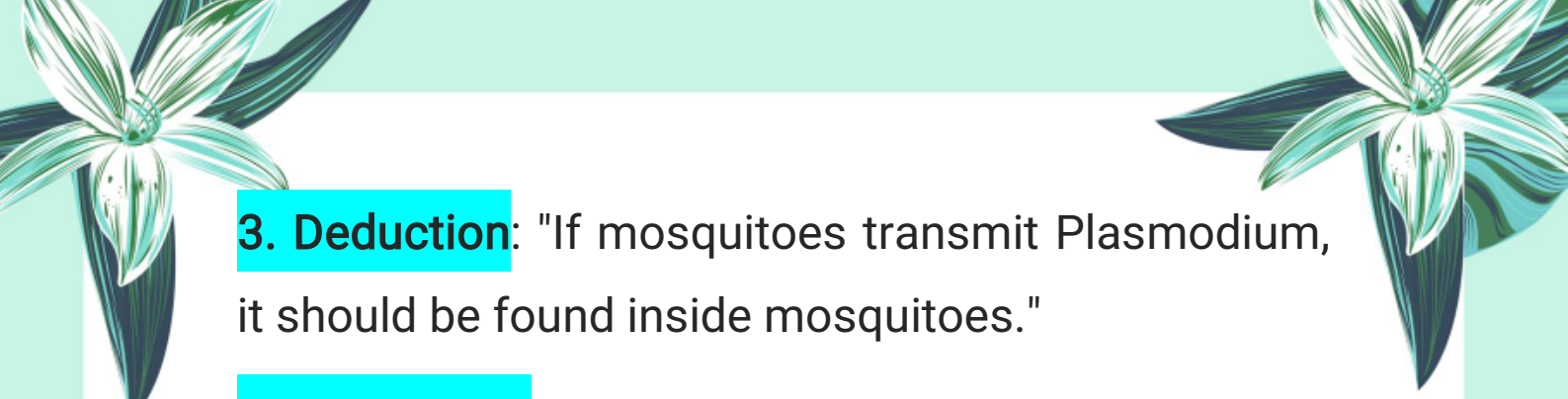
**Results:**

- Plasmodium was found in most malaria patients' blood.
- It was absent in healthy individuals.
- This confirmed the hypothesis that Plasmodium is the cause of malaria.
- Second Problem: How does Plasmodium enter the human body?

**1. Observations:**


- Malaria is linked with marshy areas.
- People sleeping outdoors or without mosquito nets were more affected.
- Smoke repelled mosquitoes.

**2. Hypothesis:** "Mosquitoes transmit Plasmodium and cause the spread of malaria."



**3. Deduction:** "If mosquitoes transmit Plasmodium, it should be found inside mosquitoes."

**4. Experiment:** In the 1880s, Ronald Ross:

- 
- Let a mosquito bite a malaria patient.
  - Examined the mosquito and found Plasmodium in its stomach and salivary glands.
  - Let infected mosquitoes bite healthy sparrows; they developed malaria.
  - Later, human experiments confirmed the transmission.

**Note:**

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

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**Author: Muhammad Asghar**

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