Chapter: 02

Solving A Biological Problem

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⭐ Objective ⭐ pakcity.org

1. To test the hypothesis biologists perform:
   - Ⓐ hypothesis
   - **Ⓑ observations**
   - Ⓒ experiments
   - Ⓓ deduction

2. The first step in solving a biological problem is:
   - **Ⓐ Observation**
   - Ⓑ Hypothesis
   - Ⓒ Experiment
   - Ⓓ Deduction

3. Biological Method comprises of ………. steps.
   - **Ⓐ 7**
   - Ⓑ 6
   - Ⓒ 5
   - Ⓓ 4

4. Biologists use discussion and reasoning procedure to formulate a:
   - Ⓐ Theory
   - **Ⓑ Hypothesis**
   - Ⓒ Data
   - Ⓓ Law

5. The most basic step of biological method is:
   - Ⓐ Observation
   - Ⓑ Deduction
   - Ⓒ Hypothesis
   - **Ⓓ Experiment**

6. Man has always been a:
   - Ⓐ Scientist
   - Ⓑ Geologist
   - **Ⓒ Biologist**
   - Ⓓ Chemist

7. The logical results of hypothesis are called:
   - Ⓐ Experiment
   - Ⓑ Problem
   - Ⓒ Law
   - **Ⓓ Deduction**

8. Which one of the characteristic is not in a good hypothesis:
   - Ⓐ Must be testable
   - Ⓑ Must be consistent with available data
   - Ⓒ Must make prediction
   - **Ⓓ Must be correct**

9. At which point is a biologist most likely to use reasoning:
   - **Ⓐ During Hypothesis formulation**
   - Ⓑ During Data organization
   - Ⓒ Both A & B
   - Ⓓ While taking observations

10. Number of sense organs are:
    - Ⓐ 2
    - Ⓑ 3
    - **Ⓒ 5**
    - Ⓓ 8

11. Freezing Point of Water is:
    - Ⓐ 37 °C
    - Ⓑ 98 °C
    - Ⓒ 100 °C
    - **Ⓓ 0 °C**

12. "Freezing point of water is less than its boiling point." Which type of observation is it?
    - Ⓐ Non-competitive
    - Ⓑ Competitive
    - **Ⓒ Qualitative**
    - Ⓓ Quantitative

13. Deductions are drawn from:
    - **Ⓐ Hypothesis**
    - Ⓑ Theory
    - Ⓒ Observation
    - Ⓓ Experiment

14. In which step of biological method we use "if-then" logic:
    - Ⓐ Result
    - **Ⓑ Deduction**
    - Ⓒ Hypothesis
    - Ⓓ Experiment

15. One liter of ethanol weighs ………. grams.
    - Ⓐ 600
    - Ⓑ 700
    - **Ⓒ 789**
    - Ⓓ 1000

16. The tentative explanation of observation is called:
    Ⓐ Experiments 🅑 **Hypothesis** © Theory Ⓓ Deduction

17. "It should be a general statement" belongs to:
    Ⓐ Deduction Ⓑ Theory © Experiment 🅓 **Hypothesis**

18. The Italian word "mala" means:
    Ⓐ Air 🅑 **Bad** © Water Ⓓ Good

19. Female mosquitoes need the blood of .... for the maturations of their eggs.
    Ⓐ Reptiles Ⓑ Mammals © Birds 🅓 **Mammals and Birds**

20. Dengue fever is spread by:
    Ⓐ Anopheles mosquito Ⓑ Female anopheles mosquito
    🅒 **Aedes mosquito** Ⓓ Culex mosquito

21. Knowledge of .... helps scientists for data analysis.
    Ⓐ Economics Ⓑ Geometry 🅒 **Statistics** Ⓓ Commerce

22. Proportion means to join two equal ratio by the sign of:
    Ⓐ Division (÷) 🅑 **Equality (=)** © Subtraction (−) Ⓓ Addition (+)

23. Meaning of aria is:
    Ⓐ Smell Ⓑ Adour 🅒 **Air** Ⓓ Smoke

24. The bark of which tree was very suitable for curing malaria:
    🅐 **Cinchona** Ⓑ Pinus © Cactus Ⓓ Cedrus

25. The bark of plants contains quinine is:
    Ⓐ Pinus Ⓑ Guava tree © Mango tree 🅓 **Quina quina**

26. Cinchona bark contains:
    Ⓐ quinaquina Ⓑ basoquine 🅒 **Quinine** Ⓓ resochine

27. The growth of plasmodium in human body takes place in:
    Ⓐ In Kidneys 🅑 **In liver** © In Small intestine Ⓓ In Stomach

28. Plasmodium causes to spread the disease:
    🅐 **Malaria** Ⓑ Polio © T.B Ⓓ Yellow fever

29. Plasmodium is the cause of malaria. This statement is a:
    Ⓐ Law Ⓑ Theory © Deduction 🅓 **Hypothesis**

30. Which scientist firstly observed microorganisms in the blood of malarial patient(1878)?
    Ⓐ Robert Hooke Ⓑ A.F.A King 🅒 **Laveran** Ⓓ Ronald Ross

31. Scientist who performed experiments of Malaria on Sparrows (1880)A. D:
    Ⓐ Laveran 🅑 **Ross** © Bu Ali Sina Ⓓ A.F.A. King

32. A Physician A.F.A listed 20 observations in:
    🅐 **1883 A.D.** Ⓑ 1884 A.D. © 1885 A.D. Ⓓ 1886A.D.

33. In mosquito, the plasmodium multiplies in:

  Ⓐ Stomach   Ⓑ Salivary glands   Ⓒ Intestine   Ⓓ Mouth

34. Female anopheles causes:

  Ⓐ Typhoid   Ⓑ Hepatitis   Ⓒ Dengue Fever   Ⓓ Malaria

35. The hypothesis that stand the test of time are called:

  Ⓐ Deductions   Ⓑ Experiments   Ⓒ Theories   Ⓓ Laws

36. The information such as names, dates or values made from observations and experimentations are called:

  Ⓐ Law   Ⓑ Theory   Ⓒ Bioinformatics   Ⓓ Data

37. A. F. A. King listed observation:

  Ⓐ 20   Ⓑ 30   Ⓒ 40   Ⓓ 50

38. Malaria is caused by:

  Ⓐ E-Coli   Ⓑ Paramecium   Ⓒ Entamoeba   Ⓓ Plasmodium

39. A Scientific Law or Principle is an irrefutable:

  Ⓐ Experiment   Ⓑ Theory   Ⓒ Deduction   Ⓓ Hypothesis

40. A productive theory keeps on suggesting new:

  Ⓐ Hypothesis   Ⓑ Laws   Ⓒ Observations   Ⓓ Deductions

41. Cause of malaria in human beings is:

  Ⓐ Culex   Ⓑ Aphids   Ⓒ Anopheles   Ⓓ Dengue

42. In Sparrows, Malaria is spread by:

  Ⓐ Virus   Ⓑ Culex Mosquito   Ⓒ Anopheles Mosquito   Ⓓ Marshy Areas

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Subjective

Q1: ***Define Science.***

Ans: *Science is a systemized knowledge derived from observations and experiments carried out to determine the principles how nature operates.*

Q2: ***What is meant by biological problem? Give an example.***

Ans: *A biological problem is a question about living organisms that is either asked by someone or comes in biologist's mind by himself.*

Q3: ***"Man has always been a biologist". Justify the statement.***

Ans: *Man has always been a biologist. He has to be a biologist in order to live. Early, in history he was a hunter of animals and a gatherer of fruits, seeds, roots etc. The more he knew about their habitat the more successful hunter he was. The more he knew about plants the better he distinguished between edible and non-edible plants.*

Q4: ***What is a Biological Method? Give its significance also.***

Ans: *The scientific methods in which biological problems are solved, is termed as biological methods. It comprises of the steps a biologist adopts in order to solve a biological problem.*

Significance of biological method:

Biological method has played an important part in scientific research for almost 500 years from Galileo's experiment to current research in the field of medicine, ecology, technology etc. Biological method has played an important role.

Q5: **Write down names of different steps involved in solving biological problem.**

Ans: *In order to resolve a specific biological problem, biologist takes following steps:*

- ➢ *Observations*
- ➢ *Hypothesis formulation*
- ➢ *Deductions*
- ➢ *Experimentations*
- ➢ *Reporting the results*
- ➢ *Recognition of biological problem*
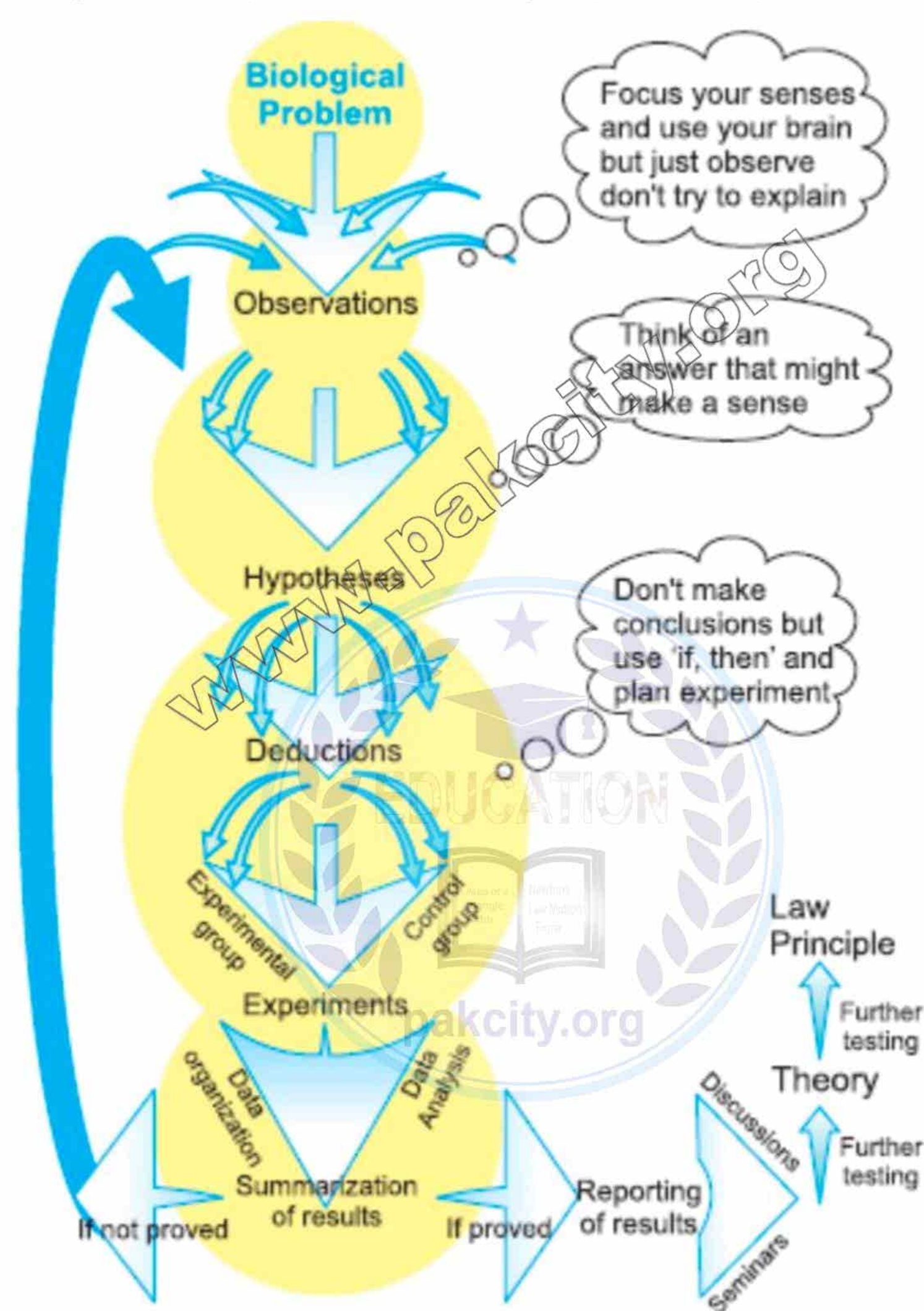- ➢ *Summarization of results (create tables, graphics etc.)*

Figure   : Biological method

Q6: **Differentiate between scientific method and biological method.**

Ans: *The difference between scientific method and biological method is:*

Scientific method	Biological method
Any organized or systematic method which is used to resolve a scientific problem is called scientific method.	*The scientific method in which biological problems are solved is called biological method.*

Q7: **How observations are made in biological method?**

Ans: Observations are made with five senses of vision, hearing, smell, taste and touch. Observations also include reading and studying what others have done in past.

Q8: **How quantitative observations are better in biological method?**

Ans: Quantitative observations are considered more accurate than qualitative observations because the former are invariable and measureable and can be recorded in terms of numbers.

Q9: **Define observation. How many types of it are there?**

Ans: Observation is the first step of biological method. Observations are made with five senses of vision, hearing, smell, taste and touch. Observations also include reading and studying what others have done in past.

There are two types of observations:

➢ Qualitative Observations
➢ Quantitative Observations

Qualitative observations	Quantitative observations
• The freezing point of water is colder than the boiling point. • A liter of water is heavier than a liter of ethanol.	• The freezing point of water 0 °C and the boiling point is 100 °C. • A liter of water weighs 1000 grams and a liter of ethanol weighs 789 grams.

Q10: **Differentiate between qualitative and quantitative observations.**

Ans: The difference between qualitative and quantitative observations:

Qualitative Observations	Quantitative Observations
Qualitative observations are less accurate, variable and cannot be measured. These represent the quality of substance e.g. beauty, intelligence etc. Examples: ➢ The freezing point of water is colder than the boiling point. ➢ A liter of water is heavier than a liter of ethanol.	Quantitative Observations represent quantity which can be measure in term of numbers and-are measurable and invariable. Examples: ➢ The freezing point or water is 0 °C and the boiling point is 100 °C. ➢ A liter of water weighs 1000 grams and a liter of ethanol weighs 789 grams.

Q11: **Write down four names of sense organs of human.**

Ans: Sense organs in human beings include eyes for vision, ear for hearing, nose for smell, tongue for taste and hands for touch.

Q12: **Define Hypothesis. Describe its role.**

Ans: The tentative explanation of observations is called a hypothesis.

Hypothesis predicts the results of the future experiments. It also gives direction to investigator to find the solution of the scientific or biological problem.

Q13: **How is Hypothesis formulated?**

Ans: A great deal of careful and creative thinking is necessary for the formulation of a hypothesis. Biologists use reasoning to formulate a hypothesis.

Q14: **Describe any four properties of a good hypothesis.**

Ans: The properties of a good hypothesis are:

➤ *It should be a tentative idea.*
➤ *It should agree with available observations.*
➤ *It should be kept as simple as possible.*
➤ *It should be a general statement.*

Q15: **How deductions are formed? Give an example.**

Ans: The logical conclusions drawn from hypothesis are called deductions.

For this purpose a hypothesis is taken as true and expected results (deductions) are drawn from it.

For example, in case of malaria the hypothesis was "Plasmodium is the cause of malaria". One of the deductions from this hypothesis was; "If plasmodium is the cause of malaria, then all person ill with malaria should have plasmodium in their blood".

Q16: **What is meant by Deduction? Write down two words used for "Deduction".**

Ans: The logical conclusions drawn from hypothesis are called deductions. The deductions are tested through experiments. While making deductions we use "if-then" logic.

Q17: **Write down two controls of malaria.**

Ans: The controls of malaria are:

➤ *Preventing mosquitoes from biting people.*
➤ *Killing adult mosquitoes before they bite people.*
➤ *Killing malaria parasites in the blood before they can cause malaria.*
➤ *Controlling mosquito breeding.*

Q18: **Write the role of control group in experiments.**

Ans: A control group in an experiment is a group where factor being tested is not applied so that it may serve as standard for comparison against another group (experimental) group.

Q19: **What is difference between experimental group and control group?**

Ans: The difference between experimental group and control group is:

Experimental group	Control Group
The group of those organisms who are, affected in some way and we do not know the real cause e.g. a group of malarial patients.	It is the group of unaffected organisms i.e. group of healthy persons in case of malaria.

Q20: **How results are summarized?**

Ans: The biologist gathers actual and quantitative data from the experiments. To draw conclusions, the biologist also uses statistical analysis.

Q21: **What is meant by reporting of results?**

Ans: Publishing of results in scientific journals and books is an essential part of the scientific method. It allows other people to verify the results or apply the knowledge to solve other problems.

Q22: **Describe the meaning of words "mala" and "aria".**

Ans: Mala means bad. Aria means air. A disease of bad air.

Q23: **What is the use of quinine?**

Ans: Quinine was the only effective remedy for malaria from 17th to 20th century.

Q24: **What were the major observations of Malaria in the last part of 19th century?**

Ans: *The major observations of Malaria in the last part of 19th century are:*

➢ *Malaria and marshy areas have some relation.*
➢ *Quinine is an effective drug for treating malaria.*
➢ *Drinking the water of marshes does not cause malaria.*
➢ *Plasmodium is seen in the blood of malarial patient.*

Q25: _Write contribution of French Army Doctor Laveran._

Ans: *He began to search for the cause of malaria. He took a small amount of blood, from a malarial patient and examined it under microscope. He noticed some tiny living creatures. The organism was given a name plasmodium.*

Q26: _Describe two important observations of A.F.A King about malaria._

Ans: *The important observations of A.F.A King about malaria are:*

➢ *Individuals who slept near a smoky fire did not get malaria.*
➢ *People who slept out doors were more likely to get malaria then those who slept indoors.*

Q27: _Why Ronald Ross used sparrow in his experiment?_

Ans: *Ronald Ross used sparrow in his experiments because using human being for experiments was so serious for life.*
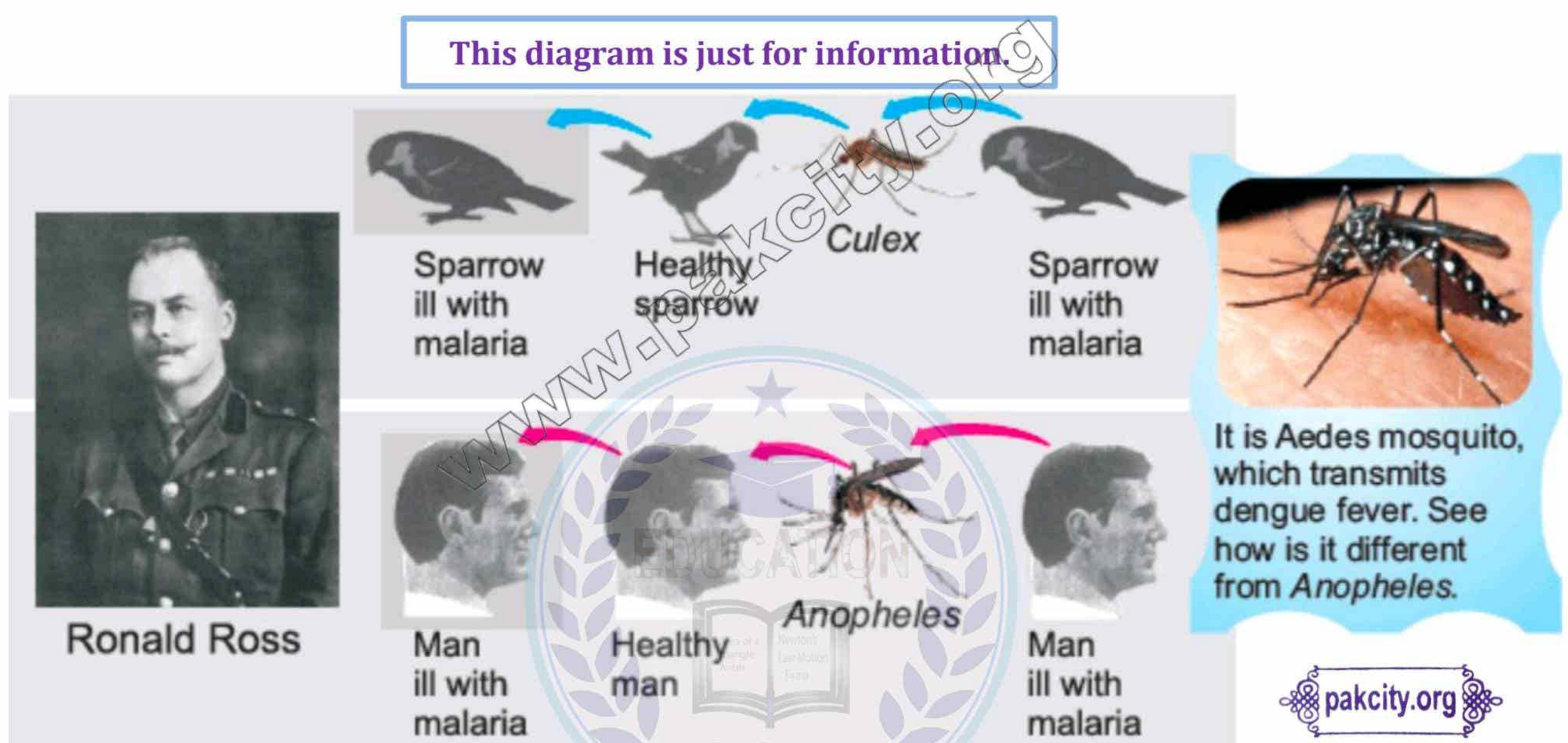
This diagram is just for information.

Figure : Malaria in sparrow and man is transmitted by *Culex* and *Anopheles* mosquitoes respectively

Q28: _What is an incubation period?_

Ans: *The period between the entry of parasite in host and the appearance of symptoms is called in incubation period.*

Q29: _Why Culex and Anopheles Mosquitoes are well known?_

Ans: *Anopheles mosquito causes malaria in man while culex mosquito causes malaria in sparrows.*

Q30: _Why do we do itching after biting mosquito?_ OR
      Why do the welts appear after mosquito bites or leaves the skin?

Ans: *The reason is that when mosquito bites, the red plumpness appear is not reaction to the wound but an allergic reaction to the saliva. In most cases itching, sensation and swellings subsides within the several hours.*

Q31: _Why female mosquito before drawing blood injects saliva in the body?_

Ans: When a female mosquito pierces the skin with her mouthparts, she injects a small amount of saliva into the wound before drawing blood. The saliva prevents the blood from clotting in her food canal.

Q32: _How a theory is formulated?_

Ans: When a hypothesis is given a repeated exposure to experimentation and is not falsified, it increases biologists' confidence in hypothesis. Such well supported hypothesis may be used as the basis for formulating further hypothesis which are again proved by experimental results.

Q33: _What is meant by productive theory?_

Ans: The theory which keeps on suggesting new hypotheses and testing goes on is called productive theory.

Benefits:

New hypotheses are suggested testing goes on such theories after experimental evidences give rise law or principle.

Q34: _What is difference between theory and law?_

Ans: The difference between theory and law is:

Theory	Law
The hypothesis that stand the test of time (often tested never rejected), are called theories.	If a theory survives doubtful approach and continues to be supported by experimental evidence, it becomes a law or principle.

Q35: _What is scientific Law? Give two examples._

Ans: A scientific law is a uniform fact of nature. It is an irrefutable theory. Hardy Weinberg laws, Mendel's laws of inheritance are the examples of scientifically laws.

Q36: _What is meant by data?_

Ans: Data can be defined as a single piece of information such as names, dates or values made from Observations and experimentations.

Q37: _What is the difference between ratio and proportion?_

Ans: The difference between ratio and proportion is:

Ratio	Proportion
When a relation between two numbers e.g. 'a' and 'b' is expressed in terms of quotient (a/b), it is called the ratio of one number to other. A ratio may be expressed by putting a division (÷) or colon (:) mark between two numbers.	Proportion means to join two equal ratios by the sign of equality (=). $a : b = c : d$ or $a : b :: c : d$

Q38: _Define bioinformatics and describe role of mathematics in biological method._

Ans: _Bioinformatics:_

Bioinformatics refers to the use of computational and statistical techniques for the analysis of biological data.

Role of mathematics in biological method:

Biological method also involves the use of applied mathematics to solve biological problems.

Major biological problem in which knowledge of mathematics is used including gene finding, protein structure and protein-protein interaction.

Q39: **_Describe importance of data analysis in biological method._**

Ans: *Data analysis is necessary to prove or disprove a hypothesis by experimentation. It is done through the application of statistical methods.*

Q40: **_What is meant by data organization?_**

Ans: *In order to formulate and then to test the hypotheses, scientists collect and organize data. Prior to conducting an experiment, it is important for a scientist to describe the data collection methods because it ensures the quality of experiments. Data is organized in different formats like graphics, tables, flow charts, maps and diagrams.*

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⭐ **Long Questions** ⭐

Q1: *Describe various steps of biological method.*

Q2: *Write a note on theory and principle.*