

ZOO103 – PRINCIPLE OF SYSTEMATICS

MID TERM IMPORTANT QUESTIONS

1. Define pedipalps and epigyne.

Pedipalps:

Pedipalps (commonly shortened to palps or palpi) are the second pair of appendages of chelicerates.

Epigyne:

Epigyne or epigynum is the external Genital structure of female spiders.

2. What is prosoma?

The anterior body part of Family Salticidae is the prosoma or cephalothorax. It is covered above by a shell or carapace. Belonging to the prosoma are the main appendages.

3. Explain ecological variation.

Ecological Variations:

Ecological variations can be of the following types:

a. Habitat Variation

- Populations of single species in different habitat are visibly different.
- Variations induced by climatic conditions
- Animals with phenotypic plasticity
- Variations with temperature, draught, cold etc.

b. Host determined variations

- Braconid wasp, *Apanteles flaviconchae* spin white cocoons if reared from blue green caterpillars of *Choliase philodice*
- Golden cocoons if reared from yellow green caterpillars of same species.

c. Density dependent variations

- When newly hatched nymphs of locust are reared under crowded conditions----Gregarious phase
- Less crowded condition-- Transitional phase
- Separate rearing---Solitary phase
- These phase differ in anatomy, color and behavioral characteristics----distinct species

d. Allometric variations

- Allometry results in misappropriate size of some structure in relation to rest of the body.
- This results in animals of different sizes----Allometric variability

e. Neurogenic color variations

- It is color change in response to environment.
- Chameleons have Chromatophores in three layers below their transparent skin.
- Xanthophores (Yellow) and erythrophores (red) in upper layer
- Iridophores or guanophores (blue or white) 2nd layer
- Melanophores (dark color) in deep Layer
- Chameleons change their colors in response to temperature and to camouflage.

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4. Write concept of Evolutionary species.

An evolutionary species “is a single lineage of ancestor descendant populations of organisms which maintains its:

- Identity from other such lineages [in space and time]
- Own evolutionary tendencies
- Historical fate” (Wiley, 1981)
- Initially developed to define fossil species.
- Applicable to both sexually and asexually reproducing species and emphasizes common descent.

5. What is probability sampling? Write its five types.

Probability sampling is defined as a sampling technique in which the researcher chooses samples from a larger population using a method based on the theory of probability. For a participant to be considered as a probability sample, he/she must be selected using a random selection.

There are four types of probability sampling that you can use in systematic investigations namely: simple random sampling, systematic sampling, stratified sampling, and cluster sampling.

6. What is social variation in Ants, workers and drones.

Social variation in ants

Ants live in complex social colonies.

Queen: founder and leader of the colony. Primary goal is to populate colony. Lay thousands of eggs. Queen Chambers are deep within the colony for protection. Long life in some species up to 30 years.

Drones: Only function is to fertilize female. They die after fertilization. They are rarely encountered outside the colony.

Workers: Their tasks are Foraging and protection. Sometime: queen lay eggs, winged male and females-Alates or reproductive. After maturation, they leave the colony in swarms and establish new colony.

7. Name different types of eyes in spider.

Eyes in Spiders:

Most spiders have eight eyes. Some species have six or fewer eyes, but they always come in an even number. Some species of spiders, such as those that live in caves or under the soil, have no eyes at all. Even those species with eight eyes don't usually see very well.

- Important Taxonomic character
- Eye arrangement in different families is unique
- 99% of all spiders have 8 eyes
- 1% nearly all has 6, but there are a few exceptions.
- Varying number of eyes in the same spider family.
- For example, there are spiders in Cybaeidae that have eight eyes, six eyes, and two eyes.

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8. What is three domain system?

The three-domain system is a biological classification introduced by Carl Woese, Otto Kandler and Mark Wheelis in 1990 that divides cellular life forms into three domains, namely Archaea, Bacteria, and Eukaryote or Eukarya.

9. What are types of keys?

Types of Keys:

- Indented Key
- Bracket Key
- Pictorial Key
- Polyclave Key

Indented Key:

In indented key, we have sequence of choices between two or more statements.

Bracketed Key:

- Pair of contrasting characters are taken in brackets
- It is Simple to use
- It is most commonly used in the field of taxonomic study.

Pictorial Key:

- For non-scientists
- Simple to use
- Key with pictures
- Jungle or desert/easy for identification of plants and animals

Polyclave Key:

- Based on computer program
- Simple to use
- Plant identification
- Take photos/Google/identification

10. Define systematics.

According to Simpson (1961), scientific study of kinds and diversity of organisms and of any or all relationship among them. Broad term which include Taxonomy, Nomenclature and Classification etc.

11. Write Typological Specied Concept.

Species is the basic unit of classification according to the International Commission of Zoological Nomenclature. Survey of taxonomic literature shows that there are more than 20 species concepts. This concept was proposed by Aristotle and Plato, **According to this concept** "A certain pattern of features is found in each species of organisms and all members of species show maximum equality in this format"

Example: certain pattern in dogs

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12. What are high weight characters?

High weight characters are:

Complexity

- Complexity-Genitalia
- Deep genetic character
- Higher complexity-higher weight age

Constancy

- Character which is constant in a large group of species than variable character (Darwin 1859)
- According to Farris (1969) Low phenotypic variability be given high weight

Consistency

- A character which is consistently present in one group and consistently absent in related groups should have high weight

Not affected by ecological shift

- A character that no change with Ecology
- A bird feeding on fish in one habitat continue to feed on fish in another habitat

Apomorphy

- A novel evolutionary trait that is unique to a particular species and all its descendants and which can be used as a defining character for a species or group in phylogenetic terms.
- Hence, the possession of feathers is unique to birds and defines all members of the class Aves.
- Not a specific adaptation
- E.g. Morphological and behavioral character

13. Explain wet method of preservation.

Wet method of preservation involves the use of liquid preservatives to prevent deterioration. Chemicals like alcohols, formalin etc. is commonly used for specimen preservation. Animals belonging to phylum porifera, annelida, nematoda are mostly preserved by wet method.

14. Write characters of Arthropods.

- Some are aquatic, others are terrestrial, some are free living, other are parasitic
- All arthropods have a body supported by hard exoskeleton
- Legs, antennae and mouth are jointed
- Tube like heart is present.
- The exoskeleton, or cuticle, is composed of protein and chitin.
- Molting of the cuticle is called ecdysis
- Extensive cephalization.
- Open circulatory systems in which a heart pumps hemolymph through short arteries and into open spaces (sinuses)
- Aquatic members- gills for gas exchange; terrestrial members- tracheal system of branched tubes leading from surface throughout body.

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15. Explain courtship behaviour of jumping spiders OR Write courtship in Lynx spider.

- During courtship "dance" colored or iridescent parts of the body are displayed.
- In addition to the display of colors, jumping spiders perform complex sliding, vibrational, or zigzag movements to attract females.
- These amplified sounds presented to the females resemble buzzes or drum rolls.
- Species vary greatly in visual and vibratory components of courtship.
- If receptive to the male, the female assumes a passive, crouching position.
- In some species, the male then extends his front legs towards the female to touch her.
- If the female remains receptive, the male climb on her back and inseminates her with his palps.

16. Write fields of theoretical biology.

- Evolution
- Ecology
- Molecular Biology
- Evolutionary Biology

17. Write differences and similarities between Archea and Eubacteria.

Both archaeobacteria and eubacteria are single-celled microorganisms, which are usually called prokaryotes. The main difference between archaeobacteria and eubacteria is that archaeobacteria are usually found in extreme environmental conditions whereas eubacteria are found everywhere on earth.

18. What are seasonal variations?

- Same animal may have different appearance in different parts of the year
- In arctic and sub-arctic birds there may be change from white winter dress to normal color summer dress.

19. What are correlated characters?

- Characters which are functionally correlated have very low weight
- They have low phylogenetic content
- Do not deserve to be treated as separate character
- Analogues organs birds wings, bats and insects (analogus)/convergent evolution
- Redundant
- Phyletic correlation
- High weight
- Higher genetic contents
- Diagnostic characters of Deuterostomes and Chordates (concordance)----phyletic correlation—evolutionary related

20. What are feeding habits in jumping spider?

Although jumping spiders are generally carnivorous, many species have been known to include nectars in their diets and one species, *Bagheera kiplingi* feeds primarily on plant matter.

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21. Explain five kingdom classification.

- Five kingdom classification was proposed by Robert Whittaker in 1967.
- Morgulis and Schwartz in 1988 modified R. Whittaker classification.
- They considered genetics along with cellular organization and mode of nutrition in classification.

Five kingdoms proposed by Robert Whittaker include:

- Monera
- Protista
- Fungi
- Plantae
- Animalia

22. What are methods of taxonomic keys?

There are two methods of taxonomic keys.

- a. Dichotomous Key
- b. Polychotomous Key

23. What is evolution?

Evolution is change in the heritable characteristics of biological populations over successive generations. These characteristics are the expressions of genes that are passed on from parent to offspring during reproduction.

24. Explain speciation.

Speciation refers to the creation a new species. Through this process, the earliest groups of similar organisms were able branch out and populate the world with millions of different varieties of life.

Types of speciation

- Allopatric speciation
- Peripatric speciation
- Sympatric speciation
- Parapatric speciation

Allopatric Speciation

- The most common form of speciation
- Occurs when populations of a species become geographically isolated.
- When populations become separated, gene flow between them ceases.
- Over time, the populations may become genetically different.

Examples

- Speciation is the Galápagos finch.
- Different species of these birds live on different islands.
- The finches are isolated from one another by the ocean.
- Over millions of years, each species of finch developed a unique beak that is especially adapted to the kinds of food it eats.

**Compiled by:
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Sympatric Speciation

- A speciation in which a species is evolved from a single common ancestral species while inhabiting the same geographical range.
- Share the same habitat but become reproductively isolated from each other.
- More common in plants
- Plants produce offspring that are polyploid. Hence, the offspring live in the same environment as their parents but are reproductively isolated.
- 200 year ago ancestor of maggot flies were used to lay eggs on hawthorn.
- Now they lay eggs on hawthorn (native to America) and domestic apples (introduced)
- Host shift/genetic differences.

Parapatric speciation

- It occurs when populations are separated not by a geographical barrier, such as a body of water, but by an extreme change in habitat.
- Populations in these areas may interbreed.
- Charles Darwin was the first to propose this mode of speciation.
- Although interbreed but reduced gene flow.
- They often develop distinct characteristics and lifestyles.
- Reproductive isolation is rather temporal or behavioral.
- It is extremely rare.

Example

- Population of grass plant is present near mining area
- Soil near mining area is infused with metals due to which plants grow slowly than those that grows away from mines.
- As a result, two populations of grasses arise having different flowering time.
- A study of tropical cave snails (*Georissa saulae*) found that cave-dwelling population descended from the aboveground population, likely speciating in parapatry

Peripatric speciation

- Peripatric speciation is a mode of speciation in which a new species is formed from an isolated peripheral population.
- Resemble allopatric speciation/barriers
- Isolating population is small

Example

- An **example** of this is the London Underground mosquito, a variant of the mosquito *Culex pipiens*, which entered in the London Underground in 19th century.
- It is found in the London Underground railway system
- Evidence for its **speciation** includes genetic divergence, behavioral differences, and difficulty in mating.

25. Write names of non probability sampling.

There are five main types of non-probability sample: convenience, purposive, quota, snowball, and self-selection.

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26. Write scientific name of spider.

Spider *Oxyopes javanus* is found in agro-ecosystems.

- The first part of a scientific name, *Oxyopes*, is called the genus.
- The second part of a scientific name, *javanus* is in this example, is the species name.

27. What is catalogue of life?

- The **Catalogue of Life** is an online database
- It provides the most comprehensive and authoritative index of known species of organisms.
- The Catalogue interface is available in twelve languages and is used by research scientists, citizen scientists, educators, and policy makers
- June 2001; 19 years ago
- Current status is active
- Registration not required
- Not commercial
- Available in English **Catalogue of life**
- The Catalogue listed 300,000 species by 2003,
- 500,000 species by 2005 and over 800,000 species by 2006. As of 2019, the Catalogue lists 1.9M extant and extinct species.
- There are an estimated 14M mainly unpublished species.

28. Why members of species resemble?

- This concept explains why members of species resemble and differ from other species.
- When organisms breed they shuffle their gene pool which gives the species its identity.
- Genes are not shared with other species so they look different.

29. Write note on Venom Gland.

Venom gland consists of:

- Poison gland
- Poison Duct
- Fang

Absent in the family Uloboridae. The **glands** are located either in the chelicerae or under the carapace.

30. What is Hottentato Tamulus?

Hottentotta tamulus, the Indian red scorpion also known as the eastern Indian scorpion, is a species of scorpion of the family Buthidae. It occurs in most of India, eastern Pakistan and the eastern lowlands of Nepal, and recently from Sri Lanka.

31. What are causes of speciation?

- Geographical Isolation
- Behavioural isolation
- Reproductive isolation

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32. What are aims of systematics?

Aims of systematics

- Invent world's kinds of organisms (flora and fauna)
- Provide method for identification and communication
- To produce coherent and universal system of classification
- Demonstrate evolutionary implications of biodiversity

33. Explain seasonal variation in butterfly.

- Seasonal plasticity
- These variations are called polyphenism.
- African butterfly *Bicyclus anynana*.
- Eyespots on margins (ventral side)---- in wet season
- Very small or No eyespot ---Dry season

34. What is physiological character?

Physiological Characters:

- Physiological characters are low weight characters and are variable.
- All structures are product of physiological process and are thus physiological characters.
- This character cannot be studied in preserved animals.

Physiological characters include:

- Metabolic activities
- Body secretion
- Serological protein and other biochemical differences
- Genic sterility factor

Metabolic Factors

Metabolic factors/enzymes help to find the relations in the closely related species **e.g.** Gram +ive and Gram –ive bacteria.

Body secretion

- Body secretions also have the consistent pattern
- Links can be created by finding the number
- Size and Structure of the glands **e.g.** waxy secretion of scale insects

Serological protein and other biochemical differences

- Serology is concerned with the nature and interaction of antigens and antibodies.
- Antigens are the substances capable for inducing the formation of antibodies when introduced into the blood stream of animals.
- According to antibodies produced in response to the introduction of foreign antigen **Bovden (1943)**
- Protein antigens are conservative hereditary trait.
- Proteins of one organism react more strongly with the antibodies of closely related organism than more distantly related.
- Good precipitin techniques reveal the relative degree of biochemical similarity of protein antigens among organisms.

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Genic sterility factors

- Reproductively incompatible species cannot reproduce new young one
- Only closely related species can hybridize successfully.
- As a result give genetically sterile species.
- Cross fertility in Donkey and Horse- Mule
- Cross fertility in ducts (species and genera)

35. What are postmortem variations?

It is impossible to prevent postmortem changes in some animals.

- Deep yellow plumage of twelve wire bird of paradise----white
- Chinese jay plumage changes from green to blue in collection
- Wasps over-exposed to cyanide turn bright red

36. What is upward and downward taxonomy?

Upward Taxonomy/Classification:

This method consists of assembling species by inspection into groups of similar or related species and forming a hierarchy of higher taxa by again grouping similar taxa of the next lower rank.

Downward Taxonomy/Classification:

It consisted in dividing a larger group of dichotomy into two subordinate groups. For example, animals with or without blood, animals with blood, then hairy or not hairy, and so on. This principle dominated taxonomy up to the end of the eighteenth century.

37. What is non-genetic variation?

Types of Non-Genetic variations

- Individual variations in Time
- Social Variations
- Ecological Variations
- Traumatic variation
- Post-mortem variations

38. Explain reproduction in spiders.

Reproduction in Spiders

- Male find a female.
- A male spider deposits his sperm into a sperm web, holding it in his palps.
- Female spiders produce either one egg sac containing several to a thousand eggs or several egg sacs each with successively fewer eggs.
- Females of many species die after producing the last egg sac.

39. How arthropods are preserved?

- Arthropods are easy to process as killed immediately and preserved and store in alcohol
- Crabs and prawn may be killed in formalin but renders their joints hard and brittle.
- Larger invertebrate need to be injected 10% formalin to prevent from rotting
- Industrial alcohol is used for most arthropods.
- Insects, crustaceans and arachnids can be simply dropped in alcohol for immediate preservation.

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- Industrial alcohol is used for most arthropods.

40. What are molecular and biochemistry characters?

Molecular and biochemistry character

This character as taxonomic character is also an approach for the evolutionary links and relations determines if classical taxonomy is defined.

- Immunological distances
- Electrophoretic differences
- Amino acid sequence of protein
- DNA hybridization
- DNA and RNA sequence