B. Sc. 6th Semester
ANIMAL BEHAVIOR

Unit 1: Introduction to Animal Behaviour

1. **Origin and history of Ethology**
2. Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen
3. Proximate and ultimate causes of behaviour
4. Methods and recording of a behaviour

ETHOLOGY - DEFINITION

- The study of animal behaviour is known as Ethology.
- Ethos, a Greek word means habit or customs and Logos means to study. Thus the word Ethology defines study of animal behaviour under natural conditions.
- Ethology is a new branch of biological sciences.
- It is also known as Behaviourism. It describes the scientific and objective study of animal behaviour.
- Behaviour can be defined as the way an organism responses to stimuli in its environment.
- The stimuli can be as simple as the smell of a food or as complex as dance of a bee.
- Moving a bacterium towards higher concentration of sugar is an example of simple behaviour
- Dance of bee involves different kinds of dance express different meanings which form the complex behaviour.
- Nervous system of an animal involves key role in perceiving and process of information from the environmental stimuli and generation of motor responses. These responses decides the different pattern of that animal.

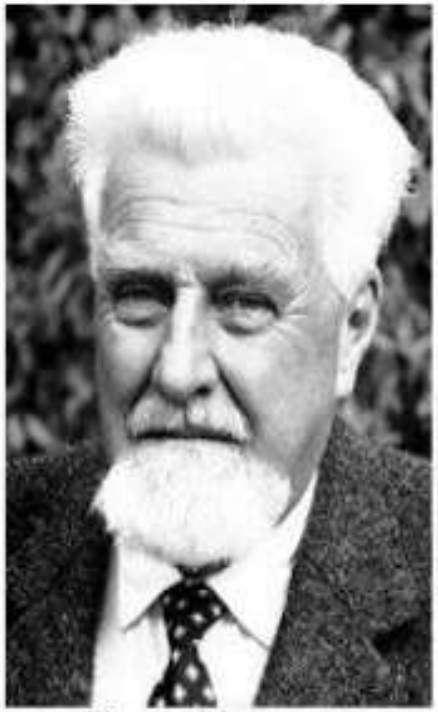
ETHOLOGY - HISTORY - BEGINNING

- Ethology is the study of natural history of animal behaviour.
- Many naturalists and scientists have contributed for the development of Ethology as a separate branch of biology. Throughout the history, different naturalists have studied the aspects of animal behaviour.
- Scientific study of animal behaviour was started in the work of 18th century naturalists like white (1720-1793) and Leroy (1723-1789).
- Ethology has its scientific roots in the work of Charles Darwin (1809-1882). His theory of natural selection triggered the animal behaviour. He has been known as the founder of classical Ethology. His own observations on behaviour of animals and man were important. In his books "Descent of Man and Selection in Relation to Sex" and "The expression of the Emotions in Man and animals" he explained the various expressions and emotions of man.
- George Romanes (1848-1894) continued the work of Darwin and published a book titled "animal Intelligence in the year 1882.
- John Watson (1878-1958) initiated a new approch to animal behaviour which led to experiments on animal behaviour and interpretation of results.
- Journal of animal behaviour in the year 1937 in Germany made the animal behaviour studies as an academic field of study and promoted the behavioural researches.

The Nobel Laureates of Ethology

Ivan Pavlov
(1849-1936)

Karl von Frisch
(1886 - 1982)



Konrad Lorenz
(1903 - 1989)

Nikolaas Tinbergen
(1907 - 1988)

•Ivan Petrovich Pavlov was a Russian physiologist known primarily for his work in classical conditioning. Pavlov won the Nobel Prize for Physiology or Medicine in 1904.

•Karl Ritter[a] von Frisch, was an Austrian ethologist who received the Nobel Prize in Physiology or Medicine in 1973, along with Nikolaas Tinbergen and Konrad Lorenz. His work centered on investigations of the sensory perceptions of the honey bee and he was one of the first to translate the meaning of the waggle dance.

•Konrad Zacharias Lorenz was an Austrian zoologist, ethologist, and ornithologist. He shared the 1973 Nobel Prize in Physiology or Medicine with Nikolaas Tinbergen and Karl von Frisch. He is often regarded as one of the founders of modern ethology, the study of animal behaviour. He developed an approach that began with an earlier generation, including his teacher Oskar Heinroth. Lorenz studied instinctive behavior in animals, especially in greylag geese and jackdaws.

•Nikolaas "Niko" Tinbergen was a Dutch biologist and ornithologist who shared the 1973 Nobel Prize in Physiology or Medicine with Karl von Frisch and Konrad Lorenz for their discoveries concerning organization and elicitation of individual and social behavior patterns in animals. He is regarded as one of the founders of modern ethology.

ETHOLOGY - HISTORY - GROWTH

- Dutch biologist and ornithologist Niko Tinbergen (1907-1988), German-Austrian Ethologist Karl von Frisch (1886-1982) and Austrian zoologist, Ethologist and Ornothologist Konrad Lorenz (1903-1989) were regarded as the founders of the modern ethology.
- Their research contributions in the field of animal behaviour were widely accepted and acknowledged. They together received the nobel prize in 1973 for their contribution to behavioural biology.
- The book titled "The Study of Instinct" by Tinbergen in 1951 gave ideas on innate behavioural reactions in animals and the adaptiveness and evolutionary aspects of these behaviours.
- Karl Frisch discovered that honey bees can distinguish the various blossoming plants by their scent. His works were centered on investigations of the sensory perceptions of the honey bees. He was one of the first to translate the meaning of the waggle dance of bees.
- Konrad Lorenz has been called as the father of ethology. He studied the instinctive behaviour in animals especially in graylag geese and investigated the principle of imprinting.
- Konrad together with Tinbergen developed the idea of an innate releasing mechanism to explain the instinctive behaviours.

ETHOLOGY – SCOPE

(Significance of Animal Behaviour)

- Ethology plays a vital in animal studies.
- Ethology is the link between the organisms and the environment and between the nervous system and ecosystem.
- Animal behaviour is the beauty of the nature.
- It improves the multiplication of the species.
- It has much importance in the field of psychology and social sciences.
- Animal behaviour studies help to control the pest organism.
- The behaviour of honey bees helps for the pollination, plant breeding.
- Animal behavioural studies help to improve the forest regeneration.
- It also improves the captive breeding methods.
- Study of animal behaviour improves the welfare of animals.
- Animal behavioural studies are valuable in terms of biodiversity.
- The study of migration of animals particularly fishes and birds helps to improve their habitats.
- Study of ethology prevents the extinction of species.

PROXIMATE AND ULTIMATE CAUSES OF BEHAVIOUR

- Animals are behaving in two different ways. These are broadly divided as How and Why questions of behaviour or causes of behaviour.
- **Proximate cause** – It involves in How an animal manages to carry out an activity. In this cause of behaviour the impulase activity or nerve cells or hormone level of an animal is recorded.
- **Ultimate cause** – It involves in Why an animal has evolved the proximate mechanisms that cause it to perform an activity. In this cause of behaviour the survival and reproductive success of the animal is determined.
- How and Why questions involves,

  1. **Causation** - What makes the behaviour to happen.
  2. **Development** - How does behaviour machinery develops.
  3. **Survival value** -How does a behaviour influences the survival of the animal.
  4. **Evolution** - How the behaviour evolved to its present form.

- The complete study of animal behaviour involves both proximate as well as ultimate causes or explanations.

Niko Tinbergen's 4 Types of questions

Niko Tinbergen outlined in a classic paper entitled "On the Aims and Methods of Ethology" (N. Tinbergen, 1963). These questions centre on:

- Mechanism—What stimuli elicit behavior? What sort of neurobiological and hormonal changes occur in response to, or in anticipation of, such stimuli?

- Development—How does behavior change as an animal matures? How does behavior change with the ontogeny, or development, of an organism? How does developmental variation affect behavior later in life?

- Survival value—How does behavior affect survival and reproduction?

- Evolutionary history—How does behavior vary as a function of the evolutionary history, or phylogeny, of the animal being studied? When did a behavior first appear in the evolutionary history of the species under study?

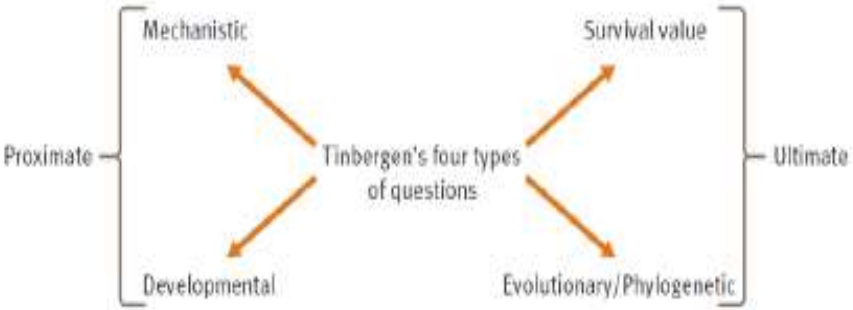
Tinbergen's four questions can be captured in two different kinds of analyses—proximate analysis and ultimate analysis

Proximate analysis is focuses on *immediate causes, whereas*

Ultimate analysis is *defined in terms* of the *evolutionary forces that have shaped a trait over time.*

ultimate causation (factors) Those aspects of behavior that are concerned with why the behavior evolved and its functional significance in an ecological context.

proximate causation (factors) Mechanistic explanations for how behavior occurs, including, in particular, hormones, the nervous system, and behavior development.



THREE FOUNDATIONS OF ANIMAL BEHAVIOUR

1. The force of *natural selection*
2. The ability of animals to learn (*individual learning*), and
3. The power of transmitting learned information to others (*cultural transmission*)

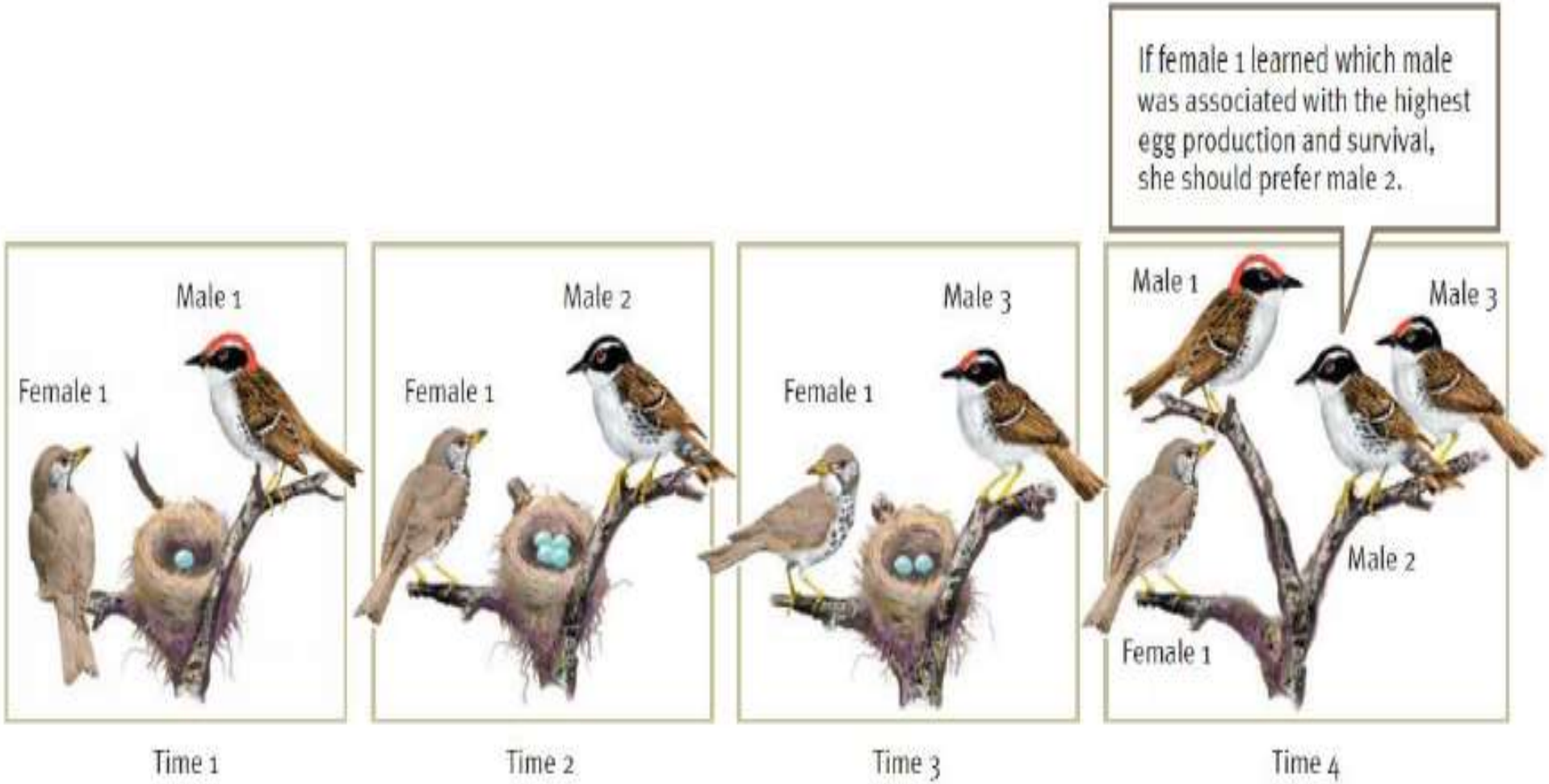
Natural selection in crickets. Marlene Zuk and her colleagues have been studying the field cricket *Teleogryllus oceanicus*. Pictured here are **(A)** a field cricket with normal wings (the arrow points to the file on its outstretched wing); **(B)** a field cricket with flat wings, in which the file section on the outstretched wing has evolved to a much smaller size and is visible only under a high-powered microscope; and **(C)** fly larvae in a parasitized cricket. *(Photo credits: Robin Tinghitella)*

Hawaiian island, Kauai

Zuk and her colleagues hypothesized that flatwing males do this by staying near the handful of singing males still on Kauai, and mating with females as they approach singers.

And indeed, Zuk and her colleagues suggest that the mutation leading to the loss of song occurred only fifteen to twenty generations ago and has quickly increased in frequency, so that now most males on Kauai are flatwing males.

Natural Selection



A role for learning. Imagine a female that mates with different males over the course of time. Such a female might learn which male is a good mate by keeping track of the number of eggs she laid after mating with each male.

Individual Learning

Methods For Studying Behavior

- Studying animal behaviour is most challangimg field of biology
- There are various methods which are employed for studying animal behavior. However, the most accepted methodology was developed by **Altmann in 1974**.

1. Ad Libitum (Latin "at ones pleasure, liberty")

- In this type one stays with the group of the animal and records the behavior for a certain period of time without a restricted focus on certain act.

2. Focal Animal

- In this type one stays focused on the specific animal of the group and tries to study its behavior. Different methods are used to identify individual members. They can be differentiated on the basis of natural individual marks, age, sex, or animals can be captured and marked by color, number, cutting of feather, horn, tail, ear etc

3. Scanning or instantaneous sampling

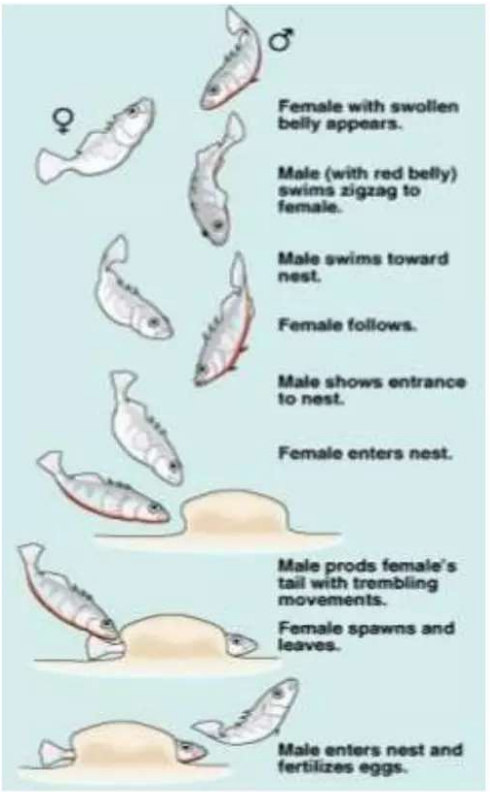
- In this method one tries to study the behavior of all the animals of group one by one and tries to establish a behavior pattern of that animal species.

4. All occurrences

- This method is contrast to the focal sampling. Here we try to study the behavior of all the animals of the group and all their behavior patterns. For this, one may need to stay with the group for days and maybe years.

5. Sequence

- In this one tries to study a chain of sequence that are observed in animal behavior.
- For example, we try to see the sequence of events in the courtship behavior of stickleback.



6. One-zero sampling

- In this type of study one tries to record the occurrence of a specific behavior in a given unit of time.
  If the behavior occurs, it is taken as one;
  if it does not, it is taken as zero.

Using an Ethogram to Describe Animal Behavior

- An ethogram is a catalog of the types of behaviors an animal may perform..

Initial observations

- For example, in a 24-hour period, male and female chimpanzees may display behaviors such as;
- hunting,
- eating,
- sleeping,
- grooming and caring for young
- and defending territory.

Creating time budget

- After making initial observations, a scientist might make further observations and collect data to create a time budget of the observed behaviors.
- The time budget shows how much time individuals spend in each type of behavior.

Cont…..

- Among other uses, data from a time budget can be used to compare behavior patterns between males and females of the same species or members of different species
- In this investigation, you will create an ethogram by observing an animal of your choice.