UNIT: 4

ANIMAL BEHAVIOUR

INTRODUCTION TO ANIMAL BEHAVIOR

- The word '**ethology' is derived from two Greek word 'ethos' meaning culture and 'logos', meaning study.**
- **Behavior can be defined as observable activities an animal performs in** response to the various stimuli in order to survive and reproduce.
- A behavioral act is a **response to a stimulus which is the basic and universal concept of** behavior. A stimulus is always a change in the **internal or external environment of organisms.**
- A stimulus may be in the form of **signs/symbols or releases. Signs can be visual, auditory, chemical or other types of sensory models.**

Cont....

- A releaser stimulus releases certain **programmed stereotyped activities or fixed action pattern**
- (FAP) of behavior. A stimulus always elicits a response which is an attempt to adapt to the
- change. Thus behavior is generally stimulus- response oriented. The behavior of an organism is
- essentially an expression of the capabilities of its nervous system. While the environment
- determines the nature of the stimulus, the response involves the body, especially the nervous
- system of the organism which is genetically determined.

TYPES OF ANIMAL BEHAVIOUR

- Behaviour can be categorized into two main types,
- 1. Innate or inherent behaviour or
- 2. Learned or acquired behaviour
- Innate or inherent behaviour or stereotyped behaviour is inborn or inherent behaviour sequence of activities which is predictable, species specific, genetically controlled and independent of past experience.
- Since this is type of behaviour follows a fixed patern (FAP) which is predictable and found in all members of a species it also called stereotyped behaviour.

Characteristics of innate or stereotyped behaviour

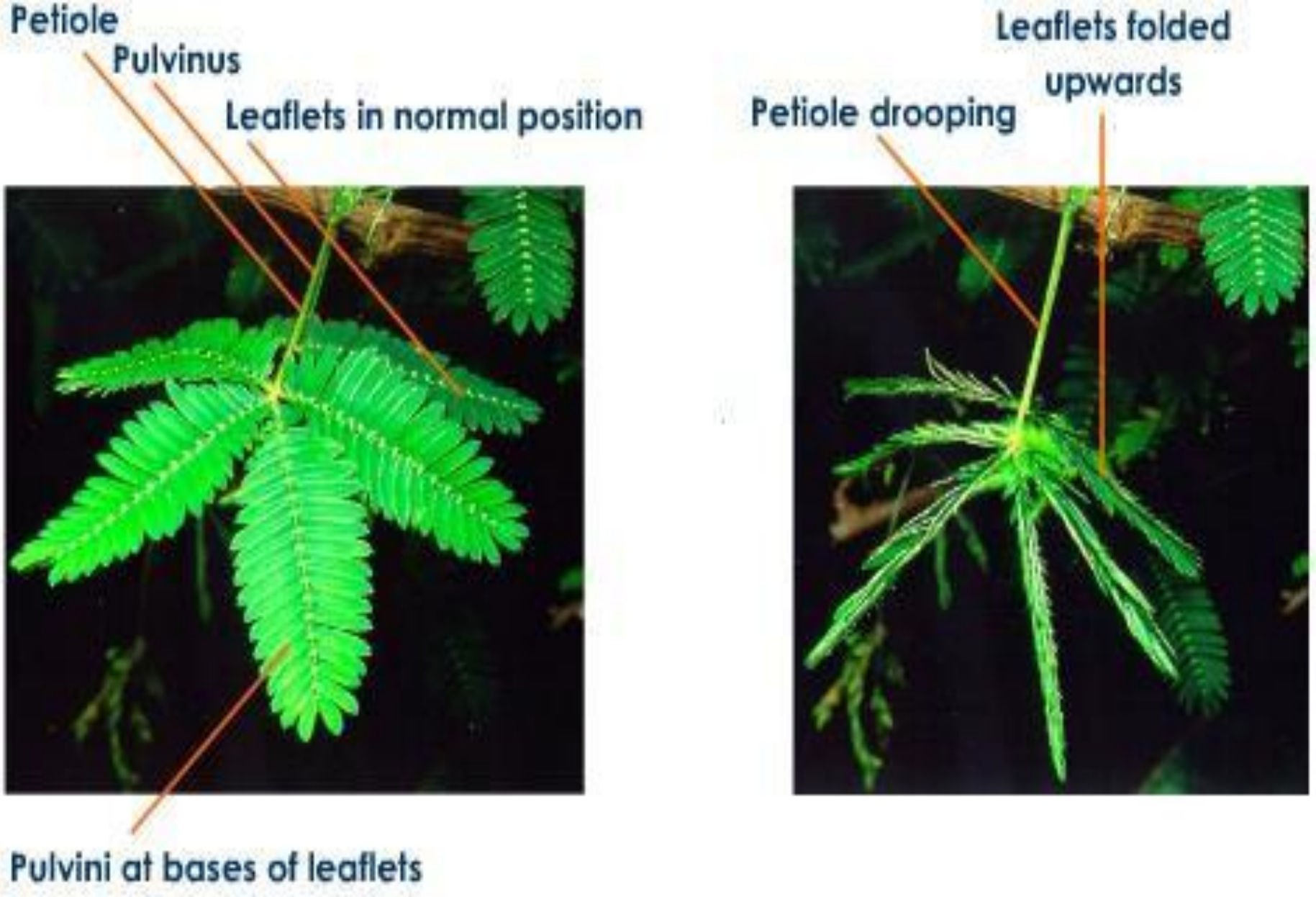
- 1. Pattern of behaviour is inherited. It is passed on from parents to offsprings,
- 2. It is unlearned behaviour
- 3. It occurs in all the members of a species hence it is species specific and predictable.
- 4. It is not dependent on past experience as it is an inborn response to a stimulus
- 5. It takes place in individuals even when kept in isolation away from their fellow members
- 6. Innate behaviour has high adaptability and survival value.

Types of innate behaviour

- There are different types of innate or stereotyped behaviour
- 1. **Taxis**
- **2. Irritability**
- **3.Kinesis**
- 4. **Instincts**
- **5. Reflexes**
- **6. Motivation**

1. Taxis

- Taxisis the simplest type of innate or stereotyped behaviour. It is an orientation of an animal (directed either towards or away) in response to the source of stimulus. If the orientation is towards the stimulus it is called as **positive taxis and if it is away from the stimulus it is known** as **negative taxis**
- Taxes are usually named after the stimuli. Hence there are **phototaxis, chemotaxis, thermotaxis, geotaxix etc.**
- **A plant or animal that move towards light shows positive phototaxis.**
- Certain burrowing animals like rodents or planaria that more away from the source of light exhibits negative phototaxis.



Response of the 'sensitive plant' (Mimosa pudica) to shock.(left) before(right) after.

Example for positive phototaxis

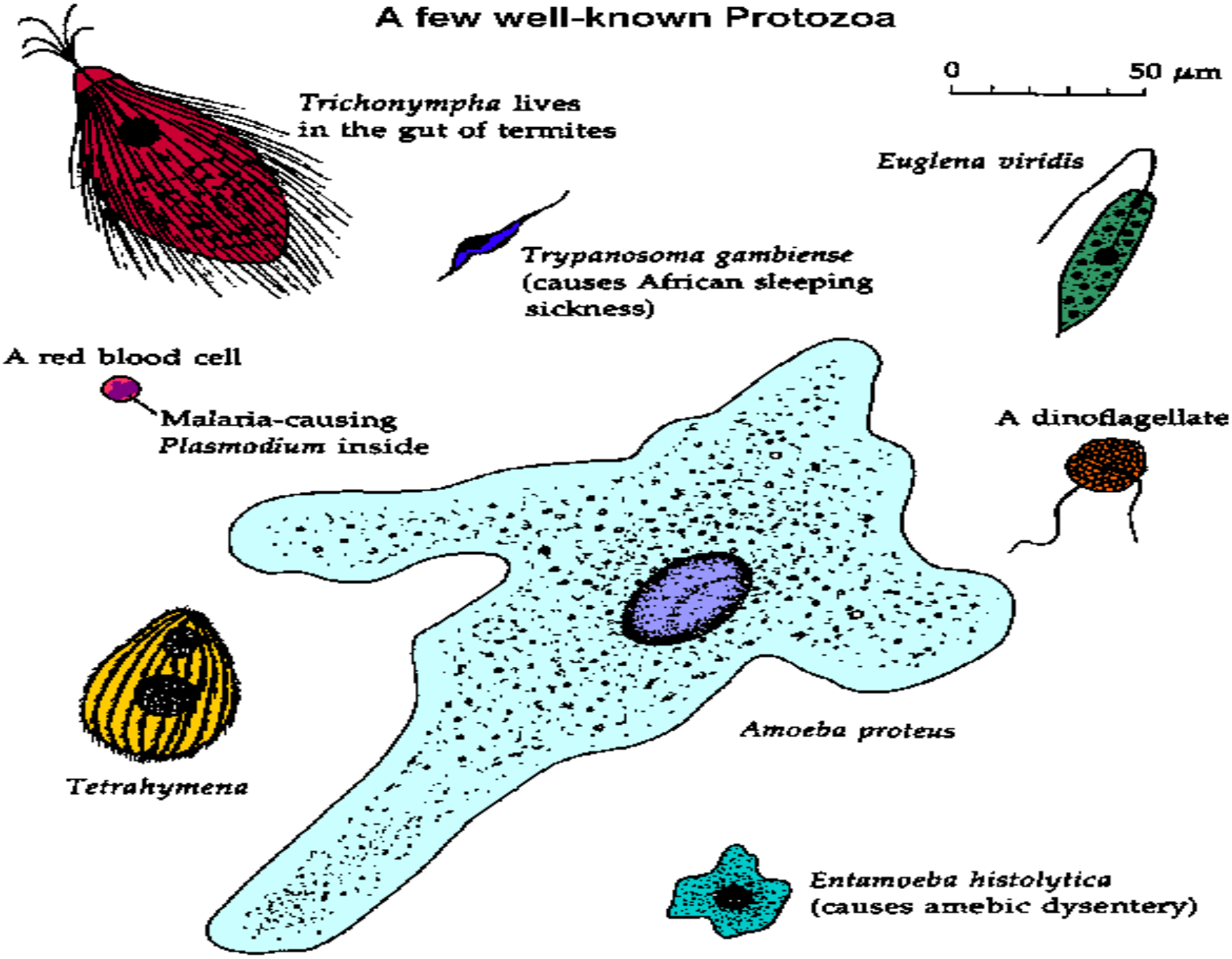
- The protozoan, Euglena response to a variety of stimuli and is very sensitive to light. It swims
- towards light, hence it shows positive phototaxis. This behaviour is of distinct advantage to the
- animal because light is necessary for assimilation of CO2 by the chlorophyll. If a dish a
- containing Euglena is covered on one half and the other half is exposed to light it is seen that
- euglena will avoid the dark region and will aggregate in the bright region of the dish.

Example for negative phototaxis

- Maggots that are about to pupate moves away from light source towards a dark location hence they show negative phototaxis. When maggots are kept on a surface illuminated by a beam of light, it will move away from the source of light more or less in a straight line. However it will often move its head from side to side measure the intensity of light with its single light receptor located on the head.
- If the intensities on both the sides are equal, then the animal's body is oriented along the beam of light. By comparing successive light intensities the maggots are able to orient itself so as to crawl away from the light source.
- The periodic lateral movement of the head ensures the animal that it is on the right track , that is away from the light source.

Irritability

- def.: **Irritability is an excessive response to stimuli.**
- **Conditions** Irritability can occur in people experiencing any of a variety of conditions, including:
- Anxiety
- Alcoholism
- Fever
- Examples of irritability
- Protozoans lack nervosa system but protoplasm is capable of receiving the stimuli.
- They can distinguished between edible and non edible
- particles.


A few well-known Protozoa
0
50 μm
Trichonympha lives in the gut of termites
Trypanosoma gambiense (causes African sleeping sickness)
Euglena viridis
A red blood cell
Malaria-causing Plasmodium inside
A dinoflagellate
Amoeba proteus
Tetrahymena
Entamoeba histolytica (causes amebic dysentery)

2. Kinesis

- Kinesis is a type of locomotory behaviour in relation to the source of stimulus.
- The animal responds to the variation in the intensity of the stimulus and not the source of direction of the stimulus.
- To respond to such stimulus the animal only requires sense organs sensitive to variation in stimulus intensity.
- There are two types of kinesis
- **a. Orthokinesis**
- **b. Klinokinesis**

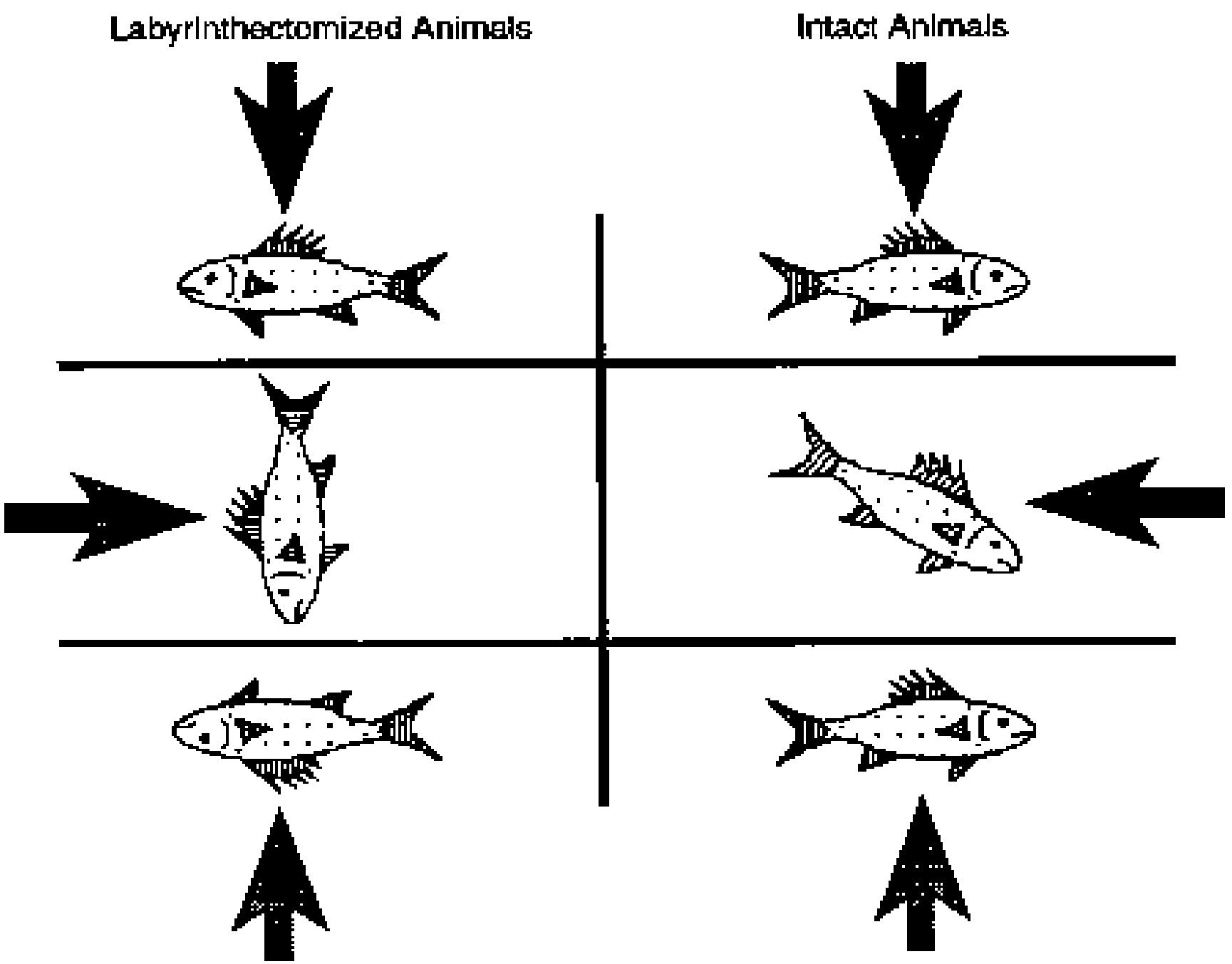
cont...

- **Ortho kinesis is a response that involves changes in the speed of movement of the whole body**
- in response to stimuli like humidity, preserve and diffused light.
- **Eg:Wood louse, *Porcellerio scaber, a small crustacean that live in damp areas, and they tend to*** lose water from their body fairly rapidly when exposed to low humidity. When wood lice are kept at the junction in a choice chamber where one side has high humidity and the other half has low humidity.
- It is noticed that after a short while the wood lice begin to move and the speed of movement and the rate of turning is greatest in the driest part of the chamber and least in the humid part. This increased and apparently random movement is an attempt by the animal to remain in the most favorable environment.

Wood lice

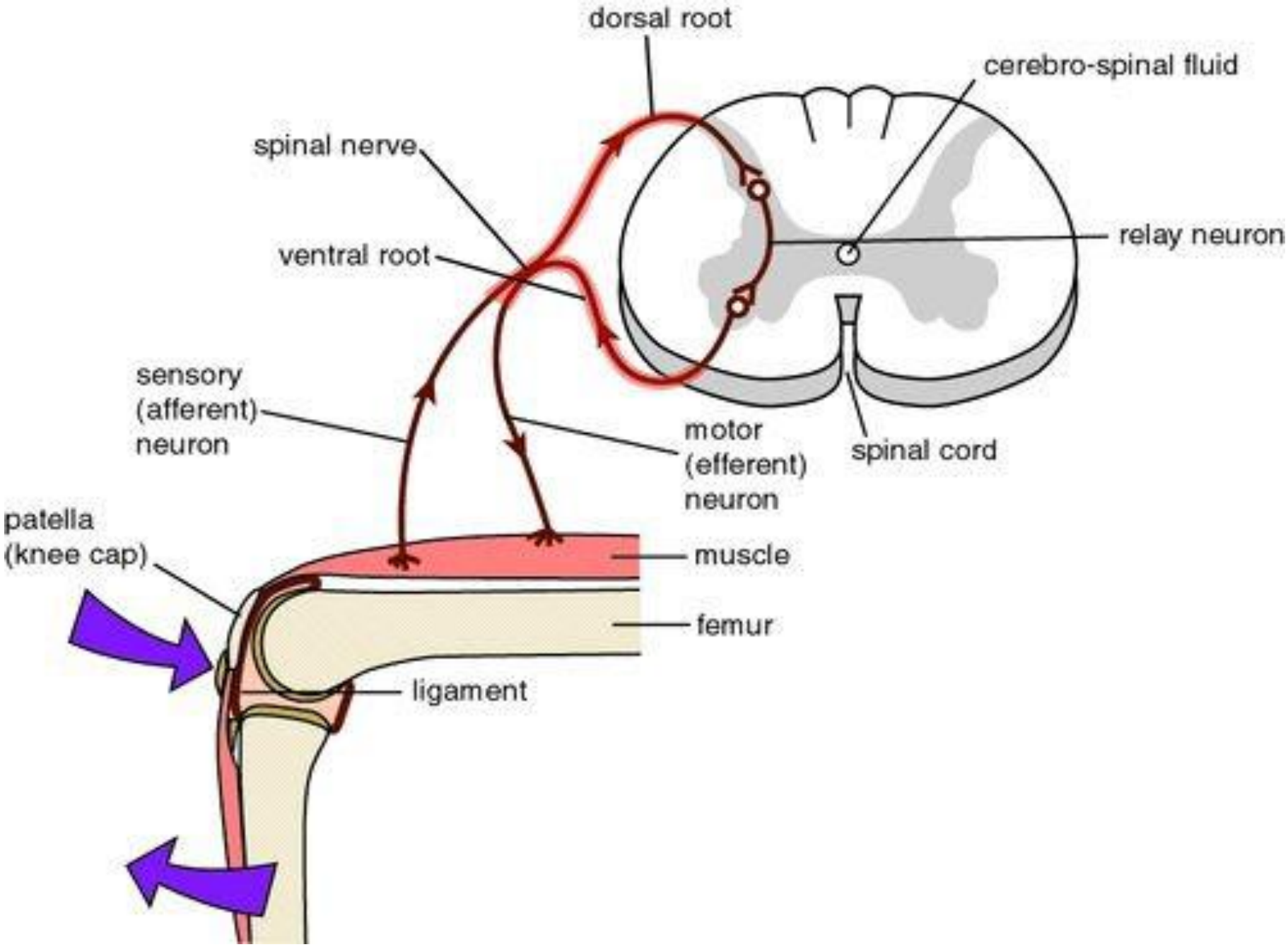
Cont….

- **Klinokinesis: In Klinokinesis the speed of locomotion remains constant but the rate at which the** animal changes direction depends on the intensity of the stimulus.
- **Eg: A planaria changes its direction ever so often as it crawls. If the light intensity above the** animal is increased it changes direction more frequently but moves at the same speed .
- The increase in rate of turning falls after sometime but increases again with a further increase in the intensity of light.


Labyrinthectomized Animals
Intact Animals

3. Reflexes

- A simple movement of a part of the animal in response to a stimulus is called reflex. It is a quick,
- innate and immediate response of a part of the body to an external or internal stimulus, which has
- great adaptive and survival value to the organism. Reflexes are inherited and unlearned
- behaviour found in all members of the species. The knee-jerk, constrict of pupil of eye in the
- bright light, blinking of eye, peristalsis, coughing etc. in man, flight in birds, web spinning in
- spiders are all examples of reflexes. A reflex action requires a reflex arc which consists of a
- sensory organ (**receptor), a sensory nerve (afferent nerve), the spinal cord or brain, an**
- intermediate motor or **efferent nerve and a motor organ or effector.**


dorsal root
cerebro-spinal fluid
spinal nerve
relay neuron
ventral root
sensory
(afferent)
neuron
motor
(efferent)
neuron
spinal cord
patella
(knee cap)
muscle
femur
ligament

Cont….

- A reflex action thus involves the sense organs and nervous system. The stimulus is received by the receptor or sense organ which sets up a sensory impulse.
- This impulse is transmitted to the central nervous system (brain and spinal cord) through the intermediate nerve.
- This motor impulse is transmitted to the effector or motor organ, muscles and glands which either contract or secrete in response to the stimulus. Many pattern of animal behaviour are complex combinations of simple reflex.
- **Advantages of reflex**
- 1. Enables the animal to respond immediately to harmful stimuli hence it has great adaptive and survival value
- 2. Since many of the reflex actions are controlled by the spinal cord, it relieves the brain from too much work.

4. Instinct

- Instinct is the most complex type of stereotyped behviour which is unlearned, predictable,

  genetically controlled and species specific and it is in response of a sign or releaser stimuli.
- Of all the stereotyped behaviour instincts are the most fascinating to study.
- **Eg: Building of nest by birds, singing to attract males, territoriality, migration, parental care etc.**

Example of instinctive behaviour

- **1. The reproductive behaviour in three spined stickleback fish**
- a. A sexually mature stickleback fish male will have a red coloured belly to attract the female. A mature stickleback fish migrates to warm shallow waters. Migration is an instinctive behaviour triggered by the increase in gonadotropic hormones which is inturn controlled by environmental factors like temperature and photoperiod.
- b. On reaching shallow waters the fish builds a nest which is open at both ends with the help of plants and weeds. The nest building behaviour is triggered by the presence of green vegetation in the water. Thus he acquires a small territory.
- c. He exhibits territoriality or defends the area around the nest from other male fishes that are also in search of suitable nesting grounds.

Cont..

- d. The fish becomes aggressive and exhibits threat posture by facing downwards. The sign stimulus for territorial and aggressive behaviour is the red belly of other male fish.
- e. The presence of a female triggers the courtship behaviour in the male because of its swollen belly that is full of eggs. The male performs a ziz-zag dance which

  attracts the female. During his dance the male always exposes his red belly to the female.
- f. The male leads the female into the nest to releases its ova that are immediately fertilized by the male. After this the female is driven out and the male may lure other females to its nest.

BEHAVIOR: A male stickleback fish attacks other male sticklebacks that invade its nesting territory.

PROXIMATE CAUSE: The red belly of the intruding male acts as a sign stimulus that releases aggression in a male stickleback.

ULTIMATE CAUSE: By chasing away other male sticklebacks, a male decreases the chance that eggs laid in his nesting territory will be fertilized by another male.

Cont….

- g. The presence of eggs in the nest triggers parental care in the male fishes and begins to fan the eggs with its fins and young once are taken care by the males.
- Hence various stereotyped instinctive behaviour in stickle back fishes are migration, nest building, territoriality, aggression, courtship and parental care. **Tinbergen conducted simple** experiments to demonstrate the instinctive behaviour pattern in Stickle back fish.
- Males presented with models of stuffed female or even a bloated male elicited the courtship dancing behaviour.
- When a female is presented with a red belly model of the male fish it faithfully followed it, suggesting the visual sign triggered these behaviours.

Motivation

- **Motivation is the psychological feature that arouses an** organism to action toward a desired goal and elicits,controls, and sustains certain goal directed behaviors.
- For instance: An individual has not eaten, he or she feels hungry, and as a response he or she eats and diminishes feelings of hunger.

  There are many approaches to motivation: physiological, behavioural, cognitive, and social
- Motivation may be rooted in a basic need to minimize physical pain and maximize pleasure, or it may include specific needs such as eating and resting, or for a desired object.
- Conceptually, motivation is related to, but distinct from, emotion.

Learned (acquired) behaviour

- Thorpe defined learning as a long lasting adaptive change in behaviour resulting from past experience; hence it is acquired during the life time of an individual.
- **Characteristics of learned behaviour**
- 1. It is acquired during the life of an organism due to constant experience
- 2. It is experience dependant and can be modified through experience
- 3. Learning is flexible
- 4. Learning behaviour differs from individual to individual to individual among the same species hence not species specific
- 5. Learned behaviour is certainly not inherited though the ability to learn is almost certainly inherited as it is dependent on the development of the nervous system of the organism which is inherited

Cont….

- 6. All organisms from protozoa to humans have the ability to learn atleast to some extend
- 7. However learning in humans surpasses all other animals .Almost everything we do has been learned .No other species surpasses the humans in their amount and range of information that is acquired through learning.

Types of learning

- 1:**Habituation**
- 2:**Imprinting**
- 3:**Classical conditioning**
- 4:**trial and error learning**
- **5:latent learning**
- **6:insight**
- **7:resoning**
- **8:congintion**

Habituation

- Habituation is the **simplest and most common type of learning seen in all organisms as simple** as protozoan to as complex as man.
- It can be defined as the gradual decrease in response to repeated exposure to the same stimulus if found to be harmless. Hence it is a king of negative learning wherein the animal learns to ignore a harmless stimulus and fails to respond.
- Thus habituation is the ability to **ignore a prolonged stimulus. It is the gradual learning by an organism not to respond to stimuli which** are repeatedly found to be of not adaptive value to it.

Crows present in corn field

Introduction of scarecrow

Prolonged exposure to scarecrow

Advantages

- 1. It **saves energy by avoiding unnecessary response: It is a vital process because without it,** the animals bombarded by the numerous visual auditory, olfactory gustatory and tactile stimuli from their environment would be in a constant and needless state of alarm or expectation.
- 2. Habituation behaviour **filters out the multitude of back ground stimuli that have no** important consequences thus leaves the animals attention f**ree to concentrate on the stimuli which are essential for its survival and which may be potentially harmful.**

Examples

- a. Lack of continued response to strong odour is a common example of **sensory habitation.**
- Sensory system may stop after sending signals to the brain in response to a continuous repeated stimulus.
- b. If the web of a **spider is disturbed at one end, but finding nothing it returns. If this stimulus is** repeated severe; times it will gradually stop responding as the stimulus was of no important consequence to the spider and hence it will ignore the stimulus. However the spider will respond if some other end of the web is disturbed.

IMPRINTING

- **Imprinting is a relatively simple but specialized type of learning that takes place during critical period or sensitive period early in the life of an** organism.
- It is especially **rapid and relatively irreversible learning process that occurs early in life. The central concept** of imprinting is the innate release mechanism whereby organisms genetically predisposed to be especially response to certain stimuli during the critical period.
- It was first described by **O. Heenroth and later demonstrated by Konard Z Lorenz on Goslings and Ducklings which is also** called **following behaviour.**

Lorenz investigated the phenomenon of imprinting

Cont….

- Newly hatched bird imprints on the first moving object it sees (imprinting stimulus) and then will direct their social behavior toward that object.
- Lorenz split a clutch of graylag goose eggs; left half with mother to incubate and raise; they showed normal behavior, followed her, grew up to interact and mate with conspecifics
- Half the clutch placed incubator, offered himself as a model for imprinting; goslings followed him as if he were their parent; failed to recognize mother or other conspecifics; as adults, tended to develop social relationships with humans, not geese; some initiated courtship with humans .

Characteristics of imprinting

- 1. Imprinting will occur only during the **critical period of an animal's life.**
- **The time of the** critical period varies in ducks it takes place from 13-16 hours of hatching and no imprinting occurs after 36 hours.
- In checks the critical period is between 5-25 hours after which no imprinting is possible. Human babies have a sensitive period that occurs between 18 months to 3 years.
- During this critical period the absence of the mother or a foster care taker results in behavioral abnormalities later in life, they are unable to show normal bonding.

Cont…..

- 2. Imprinting is a form of learning behaviour where the young ones learn to recognize an object or person considering it to be their parent hence develop an almost irreversible attachment to it.
- Thus imprinting is an innate behaviour but the recognition of the object is learned. It is innate as it cannot occur anytime during the life of an animal but it is seen only during a particular period called critical or sensitive period.
- 3. Imprinting occurs towards any moving object or person first seen by the animal. If was first seen in birds but later also observed in fishes and mammals
- 4. Imprinting is **relatively permanent**

Advantages of Imprinting

- 1. Though imprinting is seen for a short period in the years there is a long lasting effect.
- 2. Imprinting influences social behaviour and mate selection
- 3. It allows the young ones to recognize their own kind and especially theiur parents which is necessary for their survival

TRIAL AND ERROR LEARNING

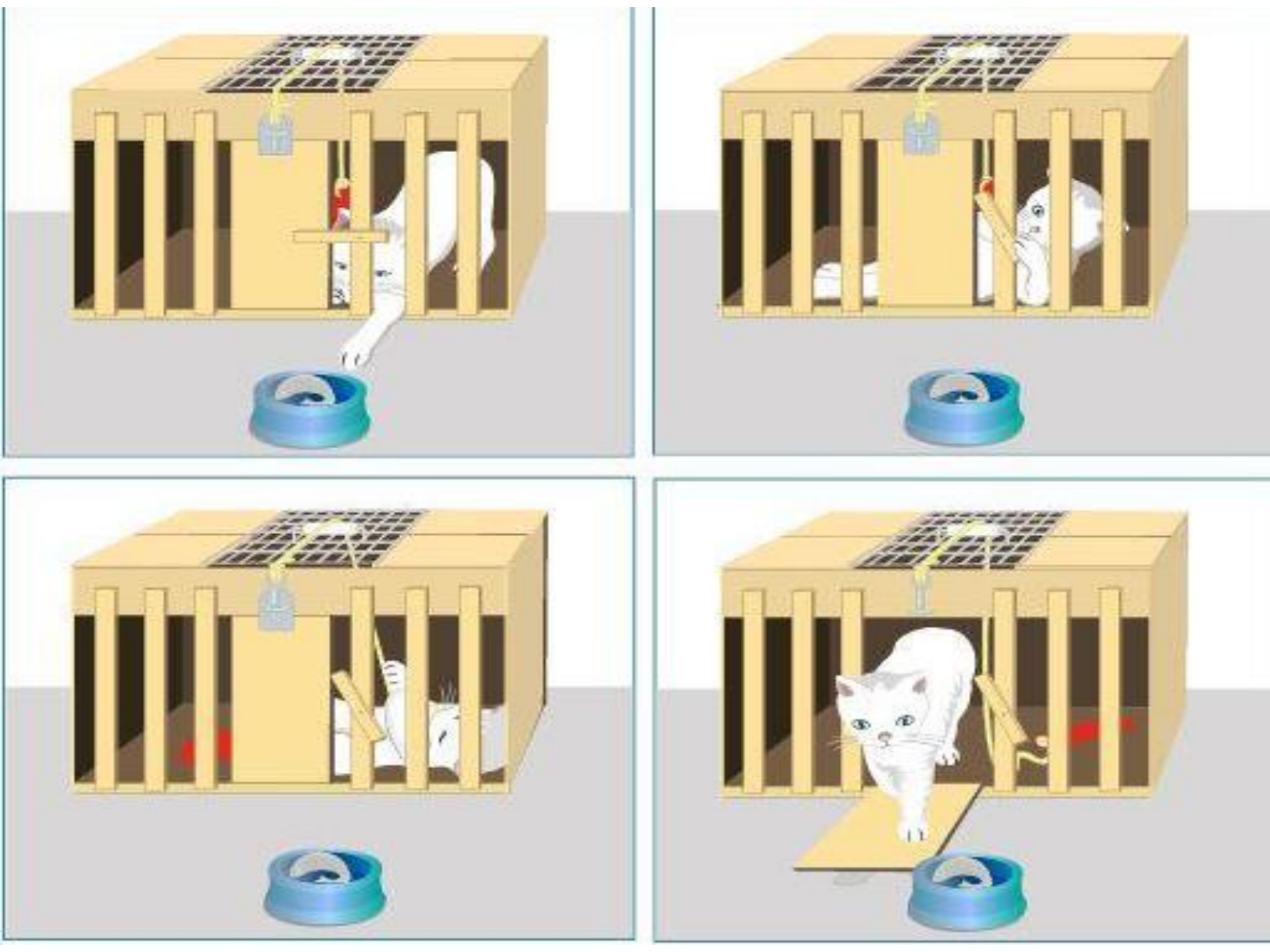
- Trial and error learning or operant learning is a type of **associative learning where particular**
- actions can be reinforced **by providing a reward after successfully completing the task.**
- **The** pioneers in this type of instrumental learning in the laboratories are E. L. Thorndike and B. K.Skinner.

Cont….

- **Edward Lee Thondike was one of the most famous and popular behaviorists of the 20th** century who investigated this type of learning in cats using a series of **puzzle boxes or problem boxes.**
- **The doors of these puzzle boxes could be** open by pushing a lever or button pulling a string.
- The cat confined in such a puzzle box tries to escape by moving about randomly or restlessly inside the cage and in this process accidently it pushed the lever or pulled the string and the door opened which resulted in obtaining its food.

Cont....

- This process was repeated for the next few times till the cat learned to associate the pushing of the lever or pulling of the string resulted in obtaining the reward ie, food
- Gradually after several attempts or trail and errors the cat learned to eliminate all activities that did not get any reward and at the same time it reinforced or repeated the activities that were rewarding.
- Finally the cat learned to push the lever or button or pull the string to open the door as soon as it was confined in the box without making any errors.



conditional learning

- By 'conditional learning', me mean where someone is conditioned to behave in a particular way by rewards and punishments a process in which an animal learns torespond to a stimulus which doesn’t normally elicit that response

Cont.....

- Ivan Pavlov provided the most famous example of classical conditioning, though E. B. Twitmyer published his findings a year earlier (a case of simultaneous discovery).

  During his research on the physiology of digestion in dogs, Pavlov noticed that, rather than simply salivating in the presence of food, the dogs began to salivate in the presence of the lab technician who normally fed them.

  Pavlov called this anticipatory salivation *psychic secretion*

Cont….

- From this observation he predicted that, if a particular stimulus in the dog's surroundings was present when the dog was given food, then this would become associated with food and cause salivation on its own. In his initial experiment,
- Pavlov used a bell to call the dogs to their food and, after a few repetitions, the dogs started to salivate in response to the bell.
- Pavlov called the bell the *conditioned (or conditional) stimulus (CS)* because its effect depended on its association with food.

  He called the food the *unconditioned stimulus (US) because its effect did not depend on* previous experience

Cont…

- Likewise, the response to the CS was the *conditioned response (CR) and that to the* US was the *unconditioned response (UR).*
- The timing between the presentation of the CS and US is integral to facilitating the conditioned response.

  Pavlov found that the shorter the interval between the bell's ring and the appearance of the food, the more quickly the dog learned the conditioned response and the stronger it was

1. Before conditioning

Food

response

Salivation

Unconditioned stimulus

Unconditioned response

2. Before conditioning

Tuning fork

response

No salivation

Neutral stimulus

No conditioned response

3. During conditioning

Tuning fork

Food

response

Salivation

Unconditioned response

4. After conditioning

Tuning fork

response

Salivation

Conditioned stimulus

Conditioned response

Latent learning

- Latent learning is a form of learning that is not immediately expressed in an overt response; it occurs without any obvious reinforcement of the behavior or associations that are learned
- Interest in latent learning arose largely because the phenomenon seemed to conflict with the widely-held view that reinforcement was necessary for learning to occur.
- learning that is not the result of determined effort and is not evident at the time it occurs, but remains latent until a need for it arises.

Cont…

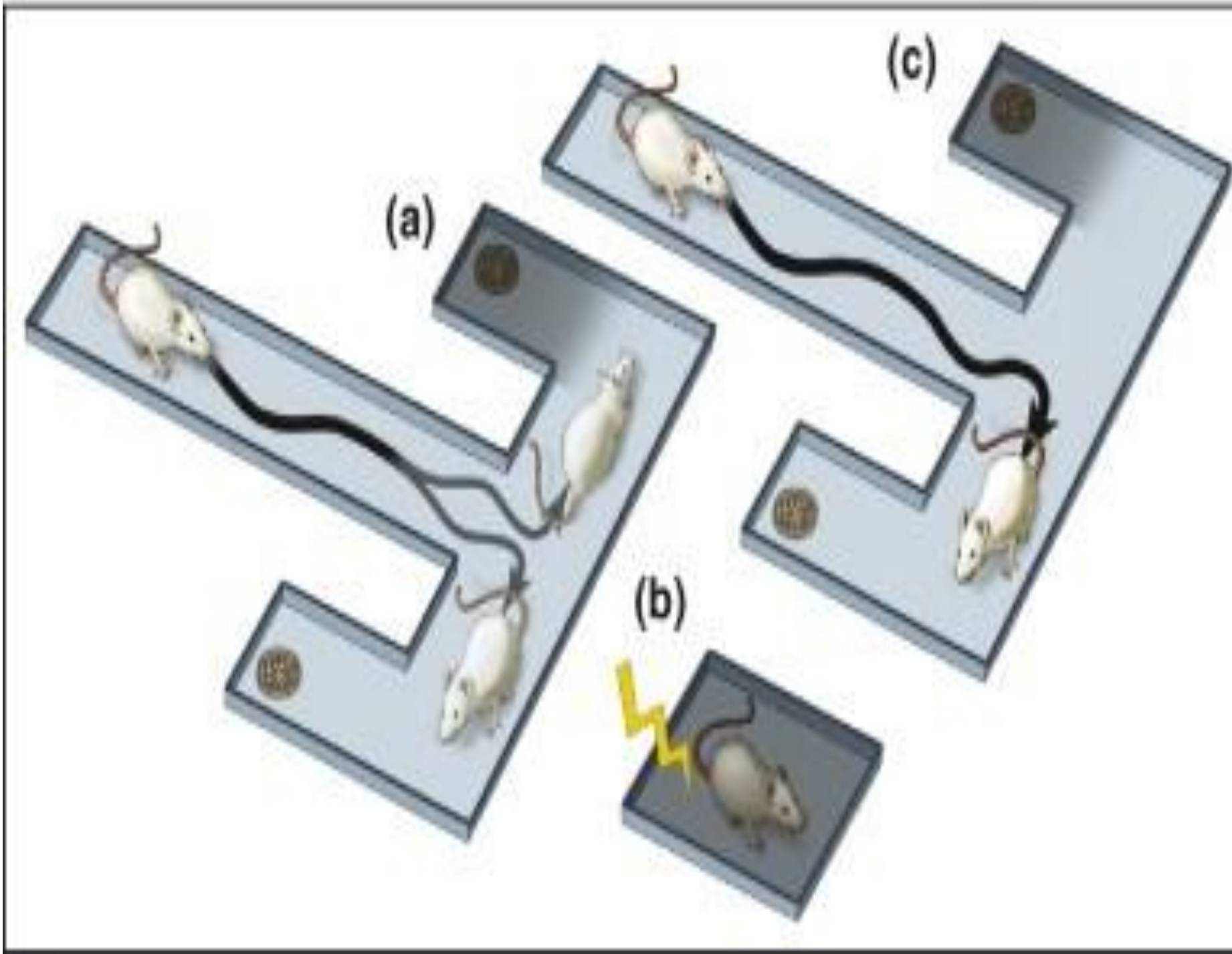
- In a classical experiment by Edward C. Tolman, three groups of rats were placed in mazes and their behavior was observed each day for more than two weeks.
- The rats in Group 1 always found food at the end of the maze; the rats in
- Group 2 never found food; and the rats in Group 3 found no food for 10 days, but then received food on the eleventh.

Cont…

- The Group 1 rats quickly learned to rush to the end of the maze; Group 2 rats wandered in the maze but did not preferentially go to the end. Group 3 acted the same as the Group 2 rats until food was introduced on Day 11; then they quickly learned to run to the end of the maze and did as well as the Group 1 rats by the next day.

Cont…

- Other experiments showed that latent learning can happen in shorter amounts of time such as in three or seven days.
- Among other early results, it was also found that animals that were allowed to wander in the maze but were detained for one minute in the empty goal box then learned the maze much more rapidly than groups that were not given such goal orientation.


(a)
(b)
(c)

Cont…

- In mice, knowledge of the immediate environment of its burrow may help it escape from a predator.
- At the time of acquiring this knowledge, it ha no apparent value, hence *not all behavioral activities are apparently directed to satisfying a need or obtaining a reward*
- Metzgar has shown latent learning process moght work in natyre for the deer mouse.
- Only two of twenty deer mouse with prior experience in the hall were caught by the owl, while eleven of twenty mice with no prior experience in the habit were captured

Insight

- **insight, in learning theory, immediate** and clear learning or understanding that takes place without overt trial-and-error testing.
- Insight occurs in human learning when people recognize relationships (or make novel associations between objects or actions) that can help them solve new problems.

OR

- A type of learning that uses reason, especially to form conclusions, inferences, or judgments, to solve a problem.
- Insight learning is based on advanced perceptual abilities such as thought and reasoning.
- Kohlar's work on chimpanzees suggested insight learning:

Cont.....

- Much of the scientific knowledge concerning insight derives from work on animal behaviour that was conducted by 20th-century
- German Gestalt psychologist Wolfgang Köhler. In one experiment Köhler placed a banana outside the cage of a hungry chimpanzee, Sultan, and gave the animal two sticks, each too short for pulling in the food but joinable to make a single stick of sufficient length

Cont....

- Sultan tried unsuccessfully to use each stick, and he even used one stick to push the other along to touch the banana.
- Later, apparently after having given up, Sultan accidentally joined the sticks, observed the result, and immediately ran with the longer tool to retrieve the banana.
- When the experiment was repeated, Sultan joined the two sticks and solved the problem immediately..

Reasoning

- the drawing of inferences or conclusions through the use of reason OR
- Evidence or arguments used in thinking or argumentation.
- Humans possess the power of *reasoning.*
- **First Known Use of REASONING**
- 14th century
- the reasons, arguments, proofs, etc., resulting from this process.

Animal Cognition

- **Cognition is the ability of an animal's** nervous system to perceive, store, process, and use information gathered by sensory receptors.
- Problem solving can be learned by observing the behavior of other animals.