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RESEARCH ARTICLE

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ANIMAL BEHAVIOR: ETHOLOGICAL STRATEGIES IN THE CHANGING WORLD AND THE ALGORITHM OF SURVIVAL

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ABSTRACT

When it comes to the word 'Behavior' the only thing we imagine at the first place is the 'human behavior', the way of treating or greeting each other or the manners we showcase among us, but the term 'behavioral biology' defines a very broad field that involves the study of various habits and mechanism shown by the animals, including 'we' the humans too. The food and feeding behaviors, communication, social interactions, kin selection, mating and parental care, all these events plays a pivotal role in maintaining the day to day life in this rapidly changing environment which could be clearly noticeable. The behavior shown by the animals could amaze us to such an extent which can lead to the curiosity that would only be get settled by knowing more and more about them. This paper attempts to explore the wide range of behavioral patterns shown by the animals, the factors causing them and their significant effects on their ethological strategies, the mechanism of survival with respect to the changing environment, reproductive fitness among them and their inherited or acquired characters which increases their tendency to interact with each other.

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INTRODUCTION

The scientific study of animal behavior on the basis of the existing environment combining it with the evolutionary context is called Ethology. It defines the behavior shown by the animals on the basis of their interaction with the surrounding and with each other. It clearly emphasizes the observation made on the animals in their natural habitat only, in order to understand their behaviors and efforts made for the survival in their real world which is full of a lot of unseen competitions. As Charles Darwin clearly defined the one who could be selected by the nature through the event of Natural selection is the one having 'Differential Reproduction' and 'Differential Survival' both. To understand the pattern of the behavior shown by the animals one needs to understand the causes and the factors that trigger them. The four 'whys' formulated by the Dutch Ethologist, Nikolaas Tinbergen set up the framework for understanding the developmental processes, its role in the environment along with the evolutionary histories. These questions summarize two types of causation i.e. Proximate causation and the Ultimate causation of the behavior. Proximate causation always refers to the immediate cause or the closest event that happened and triggered the behavior. It generally explains 'How' a behavior is shown on the basis of the internal and external environments. It could be caused by the hormones, developmental changes, neural pathways, social environment or learning while the Ultimate causation deals with the factors

concerning with the question 'Why' did this behavior happened. It always connects the dots to the evolutionary histories concerning with the reasons that caused the particular behavior to evolve over generations. The adaptive values shown by the animals that would somehow affect their reproductive success and fitness rate is also necessary to understand. Ultimate causes can be supported through the events of Migration, Courtship displays or the Parental care shown by the animals. For example- If the question is asked, why do the birds sing in the morning? The proximate explanation to this question would be the factors that triggers them such as Neural pathways in the bird's brain that controls the singing or the hormones like 'testosterone' in the male birds, which increases when their body receives the light (stimulus) affecting them to such an extent that leads to the song production. The ultimate explanation to the same question would be the courtship behavior shown by the birds to attract their mates or to defend their territories for the better reproductive success. This particular behavior was observed in the male Zebra finches, through their specific pattern of singing. The animal behavior can be described as the internally coordinated cascades of events through the signaling of different hormones, pheromones, chemical messengers and neurotransmitters along with the externally visible patterns that can be observed and studied. Now the question arises if there are different reasons behind each type of behavior shown, then there must be different patterns of the behavior too? When it comes to the types of behaviors we can find a lot of variations of patterns in the behavior which can give a better explanation to each and every events performed by the animals.

Types of Behavior

Innate Behavior: The innate behavior is also referred as the 'inherited' behavior. As the name suggests, it does not require any external learning process to get administered or any specific experience to be felt, as these behaviors are genetically carried out to the progenies through the genes itself. The innate behaviors are mostly stereotypic and species specific, i.e. there is little or no variation in the behavioral patterns of the different individuals of the same species, they mostly perform it in the same way each time. For example- we can identify different species of the spiders by identifying their web making patterns. Web spinning of the spiders requires thousands of patterns to be drawn in a sequential manner and it was observed that the spiders of the same species design their web in the same pattern but the spiders of different species made the web differently. Hence, it was proved that this type of behavior is inherited in the spiders and it is being followed by a Fixed Action Pattern (FAP). This behavior is not based on the any past experience but an inborn response to the stimulus which is highly predictable. Now innate behaviors are further classified in two broad categories – Reflexes and Instinct.

Reflexes are the type of behaviors that could be observed as the quick or immediate response of a certain part of the body to an external or internal stimulus. It has a brilliant range of adaptation and survival values altogether. Reflexes are the unique inherited and unlearned behavior that can be possibly found in all types of species differently. Blinking of eyes, constriction of pupil due to bright light, coughing, knee-jerk movement, flight in the birds etc could be kept under the category of the reflex actions. A reflex action thus involves the nervous system including the sensory organs. The greatest advantage of the reflex innate behavior is that it protects the animals by providing them the ability to respond to the harmful stimulus in their surroundings. Most of the reflexes are controlled by the spinal cord hence keeping the brain free from it. But, when we talk about the Instinctive behavior, it completely differs from the reflexive behavior in terms of its complexity. The entire body is involved in the mechanism of the instinctive behavior and a cascade of activation takes place in response to certain releasers, it could be anything like hormones or pheromones. The releasers are usually a specific component having some sensory informations to be processed. The behavior shown here is entirely stereotypical and once the body is internally prepared for the particular instinctive behavior, then the proper external stimulus is needed to initiate the behavior in a programmed way. In many vertebrates the mating process does not take place until and unless the sex hormones are released in their body which acts as the specific releasers to the cue. The common phenomenon of the food begging is seen in the Herring gulls. The young herring gulls beg to their parents for the food by opening their mouth wide and by making the chirping sound so that their parent's attention should be drawn to them, to confirm this instinctive behavior Nikolaas Tinbergen and A.C Perdeck tried to identify the specific releasers for the food begging behavior and found out that the adult herring gulls are having a red spot on their beaks and whenever they return to their nest with food, the young ones beg for the food by pecking at red dot on their parent's beaks. Later it was observed that when the wooden beaks were placed with the exact red spots on them, the baby birds started pecking the wooden beaks for the food, which clearly identified that particular red spot on the beak act as the releaser for the herring gulls and this trait was kept under the instinctive behavior.

Learned Behavior: The learned behaviors are said to be the behaviors that are acquired by the organism during its lifetime through some constant experiences and practices. It is a relatively permanent change in the behavior that eventually leads to a better reproductive fitness and survival, through the various adaptive measures taken by the animals. Thorpe defined learning as a long lasting and adaptive change in the behavior because of the past experiences; hence it is clearly acquired during the individual's lifetime. The process of learning could be flexible and is entirely based on the constant experiences, so it could be altered through the experience itself.

The learning can differ within the same species too which provide the evidence, that this behavior is not species specific. Unlike the innate behavior which is present almost in every organism, the learning behavior is only present in the complex animals having the complexity to understand and learn from the experiences or the practices carried out by them regularly. The learned behavior includes a vast range of learning responses to the internal and external stimulus which could be studied by following types: Habituation, Imprinting, Associative learning, Latent or exploratory learning, Social learning and Animal cognition.

Habituation is the most simplest type of behavior observed in many species of the animals, it is a type of learning which gets developed when the individual get used to a certain stimuli, if being exposed to it for a longer period of time and hence stops responding to it, as they no longer consider it as a threat to them. Habituation holds the gradual decreasing effect of the responses caused by the repeated exposure of the same stimulus. This behavior could be kept under the category of negative learning where the organism ignores a stimulus after identifying it as a harmless event and denies to respond to it. Habituation is a conservative type of learning that leads to the less energy consumption in the animals as they learn to avoid the unnecessary types to responses and only focus on the necessary ones. When the farmers initially introduces the scarecrows in their fields, the crows got scared and flee away from the field but as the time passes, the crows got habituated to the scarecrows and learned to ignore them as they didn't get harmed by them. In the same way, if the web of the spider was disturbed from one end, initially it responded to the stimulus by visiting at that particular end but after sometime it got habituated and learned that the stimulus was of no use, hence stopped coming there even when that end was disturbed multiple times, however it will respond if the other end of the web would be disturbed.

Imprinting is the another type of learned behavior which is rapid and irreversible and is particularly attained by the animals during their early developmental phases. It is more complex and specialized type of learning where the organism forms a special and dependable bond with the very first creature they encounter after being born. Konard Lorenz performed the 'Goose Experiment' to understand this behavior. He made sure that the eggs of the graylag geese hatches under his care, he stood there by the time of hatching and observed that the ducklings misunderstood him as their parent and started following him. When the same experiment was repeated by his students and assistants' wearing different types of boots, the goslings followed the only boot they saw after hatching, considering it as their parent. This phenomena of 'decision at a sight', was termed as imprinting. He clearly mentioned that if the newly hatched geese are not exposed to their mother immediately, they will imprint on the first moving object they encounter and consider that particular thing as their parent and would establish a very strong bond with it. This behavior was considered beneficial for the newborns of the as it plays a crucial role in their survival enabling them to recognize and follow only their care takers which could keep them safe. In my opinion this behavior can't always be safe for the young ones, with the changing environment and increasing risk of survival, there are certain predators that can take advantage of this imprinting behavior. Let suppose the egg hatched and the young babies saw the very first individual who is not its parent but a predator, then instead of moving away from the predator the babies would do the imprinting and could possibly start to follow them which will eventually leads to the premature death of the young ones as they would be preyed by their predators. If this intelligence gets develop in the predator species in the near future then the population density of the preys will decline leading to a massive population imbalance in the environment.

Associative learning is the another type of learned behavior which is solely based on the two different events or stimulus. It forms a bridge between ideas and experiments of the animals and causes a permanent change within them. The animals learn to group different information together and create an associative memory for that particularly combined event. Associative learning allows the animals to better

adapt their environment by associating the stimuli with the both positive and negative outcomes. The associative learning could be classified into two different categories- Classical conditioning and Operant conditioning. These two conditions support the associative learning and can be understood by different series of events.

The classical conditioning, also known as Pavlovian conditioning is a type of learning where a neutral stimuli becomes associated with a naturally eliciting stimulus, which results in the development of this unique type of learning behavior in the animals. The pavlovian theory was given by Ivan Pavlov which explains how the organism response to the neutral stimulus associated with a meaningful stimulus. This phenomenon basically begins with the innate response to the sight of food which produces saliva in the dogs. Pavlov described some concepts relative to the behavior shown by the dog through an experiment. He called the 'food', as the Unconditional Stimulus (US), and defined the process of salivating in response to the food as the Unconditional Response (UR) because the response was clearly natural and unlearned. All these events were then paired with a neutral stimulus i.e. the bell ringing at the time of offering the food to the dog and it was repeated several times until the dog get used to the event of ringing of the bell and then getting the food. Now the bell was considered as the Conditional Stimulus (CS), and the salivation in response to the bell was called Conditional Response (CR). The dog finally combined both the stimulus i.e. food and bell together which resulted in the saliva production on the sound of the bell even when the food was not kept in front of him. This behavior was termed as classical conditioning.

Next comes, the Operant conditioning also called the Trial and error learning, a type of associative learning where the animals learns to associate a certain event or behavior based on its outcomes. The outcome would be a reward or a punishment depending upon the situation being followed by them. It was clearly seen that the events involving the rewards were most likely repeated by the animals than the ones which leads to the punishment. B.F. Skinner a famous American behaviorist performed an experiment to demonstrate the trial and error type of learning behavior in the rats. He prepared a box, called the Skinner box having different set-ups in it. In his experiment the rat was kept under the box where the green and red lights were installed, along with a food dispenser and the floor was having an electric grid. A lever was provided too, which was being pulled by the rat after the green and red light get stroked. The green light gave him the food and the red light gave him the electric shock, after a long repetitive trails the rat got to know the pattern of light and what it gives to him, soon after the rat started to pull the lever only when there was green light which gave the food (reward) and stopped pulling the lever whenever the light turned red as it only gave the electric shock (punishment). Hence the reinforcements acts as a catalyst to the behavior, it could be termed as positive when it introduces some desirable stimulus to the animals, increasing their rate of behavior, or the negative reinforcement, provided by removing the undesirable stimulus to increase the behavior. The dog's learning to sit on a single command or a reward given, is the most common example. The operant learning behavior is practiced by the animal trainers to train them up to a certain limit and modify their behaviors through some particular tricks. The operative learning behavior provides a base for understanding the concept that how the outcomes of a specific event can alter the animal's behavior and can leads to the further programmed learning.

Latent or exploratory learning is the type of learning which is the outcome of motivation to the animals, this behavior was not easily observed by the researchers because of its complexity and the condition of not getting their response until the required motivation was provided. Latent learning always provides animals to explore their surrounding completely so that they get familiar with their environment which helps them to escape from the threat, predators or the unfavorable conditions in the near future. If a rat would be placed in a maze, without adding any food supplies, it will slowly try to find out the place to be out of that which shows its cognitive ability to explore the maze without any reinforcement provided, but if we add

some food as a reward the rat will quickly find its way to the food navigating the maze easily, here the food will act as an additional motivation which makes the rat extra capable of finding its way. This shows that when the instant rewards are not introduced to the animals during their learning period of time, then also they can learn the behavior to explore their environment, without caring about any additional reinforcement provided to them at the very first place. In this way the exploratory learning behavior helps in the survival of the animals whenever got attacked by its predator, as they had already explored their environment, therefore could easily be escaped by the predators.

The next learning behavior comes under the Social learning. The social learning can be easily defined as the new behavior, knowledge or skills acquired by the animals by observing or interacting with other animals. This learning behavior is very crucial as it doesn't require the trial and error method to be performed by an individual, but it could be learned by observing other animals from a distance. The social information provided and social interactions made among the animals are the base of the learning. It always favors the time and energy conservation as the animals doesn't waste their time in trying and then learning rather they develop the behavior just by observing their adults and other members of their social group. It increases their survival rate in this rapidly changing environment which is getting more dangerous and competitive day by day. The fishes learn to navigate the location of perfect feeding and breeding sites for them, only by following their adults, without wasting energy in search of that and this could be much faster and more sustainable method of surviving the odds. The grooming behavior seen among the group of monkeys is learned by the other members too just after keenly observing the event. There are several factors that enhance the social learning ability in the animals such as Local enhancement which involves the motivation or the learning obtained from the nearby environment like the foraging behavior shown by the Terns birds. They feed on the fishes by diving into the water and the other birds easily get the location of their prey just by observing each other, it clearly saves time and energy required in the search of food. The other type of enhancement could be made by the Public information which provides the indirect assessment of the resource quality without even experiencing it, but on the basis of its failure or success rates being observed. The Stickleback fishes use this method to investigate the patch quality by observing the no. of fishes navigating towards the same direction; it helps them to make a decision for their plan of action before foraging. This behavior could be adapted and the resources could be exploited even when the demonstrators are not present.

The last and most complex learning behavior comes under the Animal cognition. This involves very high level of thinking ability, only few animals holds. The cognition requires some complex problem solving techniques, reasoning and researches made by the animals themselves. The most common example of this behavior can be demonstrated by the most commonly came across story of 'The Thirsty Crow'. The crow when got thirsty, dumped the pebbles into the pot containing water in it, he understood the concept of water coming upward by applying some weight into the pot. The chimpanzees solving the puzzles and identifying the colors and the elephant painting an elephant itself, all comes under the unique cognitive ability of the animals. Both the innate and learned behavior plays a major role in the survival of the animals and making them competent for the nature. The learned behavior can modify the innate behavior over time and vice-versa. For example- a bird might have the innate ability of singing songs, but over the period of time this ability can be modified or improved by getting the specificity of the vocals and the sound from its parents. Later, this ability of singing only a specific type of song can influence the courtship behavior and territorial defending in the bird's life.

Behaviors with Reference to the Ethological Strategies

Communication and Territorial Behavior: The social communication is the key to establish a healthy life. From the humans

to the animals, communication plays most significant role in the survival and reproduction. The social communication always involves the alteration of the patterns of the behavior, affecting the other organism too. It is maintained by the mechanism of displays or signals perceived by the individuals which conveys information among them. **Chemical signals** including the pheromones affect the existence of the same species, it helps in attracting the mates, confirming the shape and size of an individual, and helps even in defending the territories. The female silkworm releases the pheromones when they get sexually receptive and it successfully attracts the male moths towards her through its concentration gradient. Next comes the **Visual signals**, animals often communicate on the basis of the color display (badges) or any specific displaying feature which could show the aggression or the courtship behavior among their species. The male white-tailed deer has 'antlers' that is visible to the females and hence the mating partner is being chosen on the basis of these antlers. The **Auditory signals** also play major role in the communication as sound is the most commonly used form of communication in animals. Crickets are the insect that produces sound by rubbing their hind legs with their wings (Stridulation) to communicate with each other and it easily provides the directional information to them.

Tactile signaling is another means of communication which is not commonly seen in every species as touching the body surface of each other is not always possible and obvious. Only animals living in the close contact and not having the ability to perform the visual communication favors this type of signaling such as the eusocial animals including ants, termites or bees communicate with each other by using their antenna and frontal legs. Some rarest of rare signaling involves the **Electrical signaling**, shown by some species of fishes that has been evolved by the time, they generate the electric impulses in the water to sense the objects nearby and also to communicate with each other. Whenever the animals settle down at a particular place, they better mark their territory to fulfill their foraging and mating requirements on the regular basis. In order to do so they perform certain activities such as Advertising territories, the animals intentionally increases their conflicts among the group to be naturally selected and become the dominant alpha, in order to inform everyone that the territory has been occupied. Next comes, the Scent marking, also known as the territorial marking is the type of behavior shown by the animals to identify their own territory by leaving a sign there. The scent includes the strong smelling components such as urine, faeces, pheromones or sometimes they use their specialized scent producing glands too. Leopard and Jaguars mark their territories by rubbing themselves against the vegetation in their felids.

Eusocial Behavior: Eusocial behaviors are observed under the social groups of animals i.e. the ones living in the colonies or in clusters. Every member of the colony is assigned by some specific tasks to be done and there is always a distribution of labors among them. Cooperative brood care is seen in the colony where the young ones are being protected by each and every member of the colony other than their parents too. Multiple generations of the individuals live together but a clear distinction exists between the reproductive and non reproductive individuals. This type of social behavior includes clear communication among the members of the colony and is seen in the insect group *Hymenoptera* such as ants, honeybees, wasps and termites too. Let suppose the social structure shown by the honeybees can be described through the specific division of labor among them. The Queen is usually of very large size, reproductive in nature and feeds on the royal jelly only. Mostly the females of the group are the workers and do the foraging to get the nectar and pollen, builds and maintains the bee hive and sometimes defend the colony by the predators too. The drones are the male members of the colony and their sole purpose is to mate with the queen. Honeybees have a very unique means of communication i.e. they inform the other members of the colony about the food sources through dances (Waggle dance) and sometimes through the pheromones too. When the colony becomes too large the swarming is seen which involves the establishment of the new colony because the old one becomes extremely crowded. The social behavior seen in the elephants could

be a remarkable sign of co-operation among the colony too. Female elephants help in raising the offspring of the other members in their group without showing any partial behavior. They protect their calves and other's calves too from the danger of being preyed and even sometimes push other elephants out of the path of danger. This shows a very high level of fondness and interdependency among their herd promoting the social interaction among them. The benefits of living in groups and colonies were seen in many animals and it was found that their survival rates were higher than those leaving in solitude. Many large birds such as Cranes and White pelicans always fly making a V-shaped structure (slipstreaming) which maintains a uniform distance and gaping between the birds. They all get the benefit of the 'Aerodynamic advantage' of moving with an ease i.e. they experience the lower wing-beat frequency and the lower heart rate which results in the reduction of their energy consumption, due to which they could fly in a very systematic and sequential manner. This all gets possible only when a better co-ordination ability is achieved by the group, establishing a better social communication regardless of the competition prevailing. The common minnow, a small fish found throughout the Europe in freshwater streams, lives in large schools containing thousands of members of all age groups. It was seen that the individuals of the school found the food patches very quickly because a large no. of fishes were involved in the foraging behavior and as soon as they found the food, they informed the other members too. Here, larger the group would be, easier would be the food access was clearly proven.

Sometimes the group selection or the social dominance is seen among the animals which play a vital role in maintaining the survival rate and reproductive fitness. The competition is an inevitable means of life; hence it clearly supports the fact, the better competitor wins the interaction if it comes to the survival and reproduction. In the social interaction the individuals can be ranked on the basis of their capabilities and their tendency to win or lose against the unfavorable conditions. The ranks earned by the individuals are irrespective of their behaviors and the order of ranking is known as their social dominance. It comprises of the dominant ones and the subordinate ones, within a linear dominance chain. The one who is on the top is referred as the 'Alpha' and the one coming after the alpha is probably the 'Beta', dominating on all the members of the group except the alpha member. When the male red deer, *Cervus elaphus*, gives the roaring sound, it shows his dominance over every other male, keeping them away from the female. The handicapped and abnormal individuals are often taken out of the group because of their inability of surviving like the others; hence they live in solitude for the rest of their life.

Altruism and Kin Selection: Altruism is a type of ethological behavior shown by many species of the animals where an individual sacrifices its own fitness in order to save its overall population. The ultimate aim of every organism is to produce more and more offspring to maintain their species and establish their population. This is a type of interaction which is often performed by the adult member of the group, where they sacrifice their own fitness and tries to protect their population including as much as members possible. Here the donor's fitness reduces but the recipient's fitness increases. The altruistic behavior can be observed in the squirrels, they give alarm calls as soon as the predator reaches them and warns every other member of their group. Even after knowing that they might be preyed on first, they protect other members of their group so that they could be escaped and their population remains intact. The kin selection is a type of altruistic behavior that is performed only for the relatives of the species because same species have more closeness and hence shares more similar genes which needs to be protected and passed on. In this way the decision of protecting the individual is solely based on the closeness or relatedness of the organism. The mechanism of kin selection was seen in the White-fronted bee-eaters, as they are the cooperative breeders and helps the breeding pairs in raising their young ones, but when it comes to the protection, they exhibits a strong preference for helping only their close related breeding pairs.

Foraging and Migratory Behavior: Foraging behavior clearly shows the necessity of being practiced, as it is the only way of a continuous

and healthy survival. Animals show different types of feeding behaviors based on the method of predating or parasiting on the other organism. The major learning in the animals involves the knowledge of foraging in order to survive. There are the solitary foragers and the social foragers too. When we talk about the social foragers such as the ants, they basically feed on the sweet components like nectar, seeds fruits, honeydew etc. but with the rapidly changing environment and circumstances, the foraging behavior has been evolved too. An incident support the statement, there was a time when I found the colony of the ants feeding on the spider silk, it left me amazed to know that the spider silks are actually a good source of proteins like 'Fibroin' and contains some amount of 'Vitamin K' including small amounts of sugars and minerals. This could support that the food and the feeding behaviors of the animals gets altered with time and due to the changing environment too. The feeding habits in the higher animals could be based on their position in the food chain, they could be herbivores, carnivores, omnivores or parasitic in nature. They mostly are the predators, causing their preys to adapt some new and innovative techniques to survive. A unique phenomena is observed in few species called the act of 'Mimicry'. Some organism mimics, the other organism for surviving and getting naturally selected. It provides protection from the predators and mostly the benefit here is one sided, one species the 'mimic' gets the advantage from making the resemblance to the 'model' organism. The phenomena of mimicry in animals is usually related to the physical appearance but sometimes it involves the social learning behavior too. The Batesian mimicry is a type of mimicry in which a harmless animal mimics the harmful animal in order to escape the predator. The Monarchs butterflies are distasteful and toxic to the birds but the Viceroy butterflies are preys to the birds. The viceroy butterflies mimics the Monarch butterflies resulting in the better survival of them, as birds get confused by the similar morphology of both the butterflies, hence do not eat any of them. The Mullerian mimicry is the another form of mimicry where two unrelated but harmful animals shows mutualistic relationship by exhibiting same coloration and patterns warning the predators to stay away from them.

Migration is a very common phenomena seen in the animals. It is found mostly in the birds and the fishes, providing a lot of benefits to them. It provides feeding and breeding grounds to the individuals and ensures protection from the unfavorable conditions too. The movement could be done from one place to another with or without the groups. There are always some 'cues' for the migrants to complete their migration safely such as the magnetic field of the Earth, the changing concentrations of the minerals in the ocean water or the sunlight. Migrations can be 'goal-oriented' which involves heading towards a particular direction in a particular period of time, the animals have the special ability to navigate their way through 'kinesis' or 'taxis' and some obvious means of identifying the directions could be the sun and the stars. Many Sea turtles migrates very long distance between their feeding and nesting areas. Arctic terns are the birds that fly from Arctic to the Antarctic and heads back each year covering the total distance of 55,923 miles. This migration is done to maximize the food access and to obtain the suitable breeding grounds. The fishes too shows the migration, it could be from the freshwater to the ocean water (Catadromous) like *Salmon*, *Petromyzon*, *Hilsa* etc, or from the sea water to the freshwater (Anadromous) such as *European Eel*, in search of the feeding, breeding and nesting grounds.

Reproductive Behavior and the Parental Care: The overall reproductive behavior is based on the different energy investments such as search of the partners, mating, giving birth, parental care and then paying the survival cost. The females are comparatively having the higher reproductive cost i.e. they have multiple choices for mating but on the other hand males have the lower reproductive cost i.e. they are in the continuous selection pressure. When we talk about the mating behavior it could be one-on-one (Monogamy) which involves only a single mating partner for the lifetime and it is most common in the birds. Here, no selection pressure is seen as such and the energy cost of both of the partners is same. Next type of reproductive behavior could be two-on-one or large groups (Polygamy), a

condition where multiple mating partners are present throughout the life, single male can mate with many females or single female can mate with many males. The Parental investment theory given by Robert Trivers explains the cost of energy distribution between both the mating partners and it was observed that one who pays more cost of producing progenies will be more selective in nature because the offspring would be more dependent on them. The sexual dimorphism is seen in the animals involved in the polygamy and a high level of sexual selection pressure prevails among them, only the one having higher fitness and attractive physical appearance gets the opportunity to reproduce and pass its genes. No matter what the behavior of mating and reproduction is, there is always a competition among the group of animals and it could be an intersexual or intrasexual type of competition. The courtship rituals are performed by the males and the females in order to attract each other for mating, sometimes some special offerings could be provided by either of the sex to convince their partner for mating, such offering is known as Nuptial gift, it is more than providing the sperms or eggs as it could involve some additional components like food material, secretions, body parts etc providing their partner extra benefits so that the sexual selection gets favored. For example- some spider species wraps the prey in their silk and then present it as nuptial gift to the mating partner. Polygyny is the condition where the female partner chooses the male partner, hence multiple male mating partners are there and are under a great selection pressure and competition. The males here are ornamented which could attract the females for mating. The condition of Polyandry is the exact opposite, as it favors multiple female partners and a single male partner. All the selection pressure comes over the females and hence they are ornamented to attract their male mating partner. Sometimes, the ornamentation can lead to the decreasing survival rate in the animals, the Handicap principle given by Amotz Zahavi which states that the excess of the ornamentation can increase the reproductive fitness of an individual but at the same time, can also decrease its survival rate. A peacock's long and heavy feathers prevents him from higher and continuous flight, big and heavy antlers of the deer sometimes make it difficult for him to escape from the predators. So the conclusion is, any ornamentation if present, should be present in an adequate amount only so that the survival fitness can also be maintained along with the reproductive one.

After the mating partner has been chosen and the mating is done, the most important aspect of the survival shows up i.e. Parental care, it is the most widespread type of ethological behavior observed in almost every species present on the Earth. The parental care as the name suggest is the activity performed by the adult members of the group which includes increasing the survivorship of the young ones, incubating the eggs, nourishing their offsprings, teaching them the methods of foraging and survival behaviors and most importantly defending them from the predators. The parents does all the care and provides ample amount of nourishment until the young ones become self reliable and mature enough to cope the unfavorable conditions by themselves. Many animals showcase the nesting behavior i.e. they build the nests on the trees or dig out the burrows in the ground or form territories to lay their eggs and incubate them. Nesting behavior is most widely seen in the birds. It involves the nest construction, incubation of the eggs and the taking care of their chicks by feeding them and protecting them from the predators. The American Robin bird, builds a cup shaped nest from the mud and grass twigs in the trees. Weaver birds construct the hanging nests for their young ones and it sometimes play major role in their courtship behavior as the nest is build by the males and get destroyed by the females if poorly developed. When it comes to the nesting behavior not only birds but some fishes also builds nest for their progenies such as; Sunfishes are the nest building fishes that builds the nests inside the water. The males prepare the basin like nest for the eggs and guard them at the same time. Fishes like the Bowfins, builds circular nest near the vegetation under the water. Some rodents make burrows underground to give birth to their young ones. Once the nest or the burrow building is completed next comes the process of incubating and taking care of the eggs and the young ones respectively. The parental care can involve the participation of both the parents or only a single parent, depending upon the temperature, salinity, atmosphere and stimulus

received by the species. A lot of new parental care techniques has been evolved among the animals in order to increase their rate of survival, such habits may include carrying of the eggs by the parent either attached or unattached from their body and carefully choosing the substrate to lay down the eggs. The male Seahorses have the special brood pouches for carrying the developing embryos, the female seahorse deposits the eggs into the male's brood chamber, where he incubates them and take care of them until they get hatched. Sometimes a specific type of behavior is seen in some species of animals called the Brood parasitism, it aims to reduce the cost of parental care in females by laying their eggs in someone's other nest, as the cost of parental care decreases the reproductive fitness of the particular brood parasite increases providing a better survival fitness too. However, the parasitized species may reject the eggs of the other species to be laid down in their own nest causing a massive decline in the population of the brood parasites. To avoid such conditions of rejection, the brood parasites chooses the similar species having close resemblance in the eggs so that it couldn't be identified. Hormones too play a major role in the parental care in many vertebrates. Prolactin is the very important hormone responsible for the initiation of lactation in the mammals and also involved in stimulating the parental care in the birds through the production of nutrient rich crop 'milk', commonly seen in the mourning doves. The modern investigation shows that the increasing stress is causing deterioration in the parental care behavior as the increased production of stress hormones suppresses the effect of prolactin hormones in the individuals. The suppression in the prolactin hormones often causes the parental care to be decreased over time because the individuals start to concentrate on their own survival rather than their progenies, this could be happen due to environmental imbalance caused by various factors affecting it such as temperature, climatic conditions, increased use of pesticides in the crops eaten by the birds and the mammals. The regulation of Juvenile hormone is seen in various insects, an increased production of the juvenile hormone negatively affects the parental care behavior in the insects as the high level of the hormone triggers the development of yolk in the eggs and also plays major role in the metamorphosis but it reportedly, decreases the parental care behavior because the energy already gets utilized in the process of development itself.

In this way, all the animals on this planet follows different algorithms of survival by experiencing different types of behaviors and survival techniques which has been evolved to a very higher extent, including a lot of new advancements introduced. The basic to advance ethological strategies has been observed under the immense variation prevailing in the population. The ultimate aim of every individual is to survive and reproduce in this constantly challenging nature and it can only be done by learning better ways to tackle the unfavorable conditions. The prey needs to become intelligent enough to escape and the predator needs to be energetic enough to catch the prey, every single individual needs to develop more and more profitable behavior in order to better survive and reproduce in the world full of unavoidable competitions.

Work cited

- Abbot, P. et al., *Inclusive Fitness Theory and Eusociality*, *Nature*, 471: E1–E4.
- Agrawal, V.K. *Animal Behavior (Ethology)*, S. Chand publishing, 2009
- Boyd R & Richerson, P, 2006, *Culture and the Evolution of the Human Social Instincts*, in S. Levinson and N. Enfield (eds.), *Roots of Human Sociality*, Oxford: Berg.
- Choudhary ,Kailash & Saran, Ram Prakash. *Evolution and Animal Behavior*, fifth edition, IfAS publication, 2024
- Darwin, Charles. *On the origin of species*, sixth edition, January 1872
- Hladký, V. & Havlíček, J. (2013). *Was Tinbergen an Aristotelian? Comparison of Tinbergen's Four Whys and Aristotle's Four Causes*. *Human Ethology Bulletin*, 28(4), 3–11
<https://en.m.wikipedia.org>
<https://www.britannica.com>
- Mandal, Fatik Baran. January 2012 *Textbook of Animal Behavior*, second edition, *Learning Pvt. Ltd. ISBN 9788120345195*.
- Review article from the *National Institutes of Health (NIH)*.
- Tinbergen, Nikolaas. *Social Behavior in Animals with Special Reference to Vertebrates*, 2014 Reprint of 1953 New York edition & *Ethology*, Cartwright 2000:10; Buss 2004:12)
