2- Machinery of Behavior

We can consider or treat animals as a machines , and seeking to understand how they work . we shall not be completely successful. The animal may perform in a particular order .several different behavior patterns or units , for example a male bird in the spring ; it may sing at down and then feed , hide from predators , defined its territory, and court female ,during one day .Ethologists have not progressed far in describing the mechanisms that control the complete behavioral repertory of an animal through its life, that is , the way it decides what behavior pattern to perform one activity rather than another, and by what physiological mechanisms these decisions are made .

Muscular contractions , as we have seen , are an important mechanical source of many behavior patterns . Animals control their muscles by their nervous systems and we shall consider how the nervous system works . the nervous system also carries information from the sense organs .

Common garden spider *Araneus diadematus* which do build orb webs have a concept of the web, the orb web is regular structure made up of frame radial spokes and catching spiral. The stages of its construction were first formalized by Hans Peters in 1939,as follows ; the spider starts with the frame and spokes .to begin with , it spins a thread with unattached end and allows it to be blown by the breeze . The other end is attached to the spider – by the spinnerets of the abdomen (source of the thread) - , then spider bites through her end of the thread (A) and having attached a new thread at its point of departure .walks off down the wind cast thread , spinning another thread as it goes . when it arrives at the other end (B) , she attaches the new thread , it then turns , walks some distance up the thread to the point (H) and attaches a new thread there (C) . the Y shaped structure then spider builds the radial spokes and frame. The same sequence of movements to build about twenty radii of the web . In the final web the angles of the radii at the hub – the center of the completed web - are not constant , about 15 . the radii are built in regular order.

The nervous system

In spider's orb web , animal behavior executed as series rules and it must be controlled by nervous system as a controlling mechanism.

An animal body contain a network of thin white fibers called **nerves**

That is a bundle of cells called **neurons** . A muscle contracts when neurons attached to it and become electrically active .

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supernormal stimulus in a sense deceives the egg recognition mechanism of x the gull. In nature, the mechanism works to distinguish eggs from other \ objects; but it can be tricked by experiment. However, the main conclusion \ from Baerends' experiment is that herring gulls recognize eggs mainly by the \ criteria of size and stippling.

'Behavioural assays', such as the egg retrieval response of birds, not only 1 reveal what stimulus pattern is recognized by the animal, they are also a 1 revelatory method of studying the sensory powers of animals. If an animal 1 can be shown, by appropriately controlled experiments, to behave in 1 response to some property of the environment, it must be able to sense it. Karl von Frisch applied the method to demonstrate the hearing ability and colour sensitivity of fish. In that case, the physiologist von Hess had asserted that fish are colour blind and deaf; von Frisch doubted the assertion, and he successfully trained minnows to distinguish colours by rewarding them with food, and catfish to come out of a tube when he blew a whistle. In both experiments he used a behavioural response to discover a sensory ability.

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responses to a given environment. The balancing act, and the resul behavioural preferences or tendencies, are called the 'motivation' of animal, l,et us consider how the motivation of an animal influences behavioural choices.

A study by Baerends, on the freshwater fish called guppies (Poe reticulata), provides a clear example of the interaction of motivation external stimulus. The behaviour in question is the courtship of females males. Baerends recognized three different behaviour patterns that a rr may perform when courting a female 'posturing' in front of a femak limited sigmoid movement, and a full sigmoid display How does a male dec which to perform? The answer seems to depend on the size of the female c the male's own motivation to court, which can be independently measured his coloration. Figure 2.11 depicts the combinations of these two fact necessary for a male to court a female in each of the three ways. 1 particular shape of the graphs is not important here; they are only to illustr a general point, which is that, for any behaviour pattern in any species they will be some such graph of motivational tendency and external stimulus which describes the conditions under which it is performed.

The guppy illustrates choice among different behaviour patterns of one class, courtship What of interactions among different kinds of behavioural goal? Here we need a new example, winch (unlike the courtship of guppies) is understood neurophysiologically. Actually, little progress has been made in the neurophysiological study of behavioural choices. Nervous analysis is difficult enough for single behaviour units, let alone interactions among many activities. The study of the gastropod Pleurobranchia by J W. Davis and his colleagues has, however, partly uncovered the neurophsiological control of six behaviour patterns. The six are feeding, egg laying, escape, withdrawal of the oral veil, righting, and mating (Figure 2.12) Take first the interaction of feeding and egg laying Pleurobranchia is a carnivorous snail which includes eggs in its diet. When a Pleurobranchai lays its own eggs, it switches off its feeding habit Another behaviour pattern, escaping from predators, is performed in preference to all other activities. A fourth behaviour pattern is to withdraw its oral veil on being touch. A snail with its oral veil withdrawn cannot feed, and its tendency to withdraw its veil interacts with its tendency to feed. If food is abundant, or the snail is not hungry, withdrawal has priority Oves feeding, and vice versa when food is scarce and the snail is hungry. The other two activities studied by Davis are righting' (lurning the right way up) and mating. Having established the behavioural priorities by observation, hi

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proceeded to their neurophysiology. The system has not been completely elucidated, but it is now known for instance that two neurons are responsible for inhibiting the 'withdrawal' response when a *Pleurobranchia* is feeding, and that the inhibition of feeding during egg laying is effected hormonally. The priorities of *Pleurobranchia,* by the way, do make sense, for without them it would eat its own eggs after laying them; and if escaping from danger did not have absolute priority, it would not survive to exercise its other behavioural preferences.

2.5.2 Hormones:

The nervous system controls the behaviour of animals over a short time scale, of matters of seconds or micro-seconds. Other factors control it over longer terms of days, months, or even years; the most important of these are hormones. So.me hormones act quickly; but wo shall concentrate here on those with relatively slow effect.

Hormones are chemicals that circulate in the bloodstream of animals, regulating the animal’s metabolism and behaviour. They are released by special glands, such as the pituitary gland at the base of the brain, and the gonads. (the ovaries in the female, the testes in the male). The glands release their hormones into the blood; some other organ will then respond to the increased level of hormone circulating in the blood. The responsive (or target) organ is often, but not always, the nervous system. An example of a target organ other than the nervous system is the effect of die hormone testosterone in the African clawed toad. Testosterone is released by the testes An increase in the amount of testosterone in the clawed toad s blood stimulate- of special 'nuptial pads' on the males front legs, which the embrace, the female while mating.

The most comprehensive study of the hormonal control of behaviour concerns the reproductive cycle of the Barbary clove (Figure 2.1,3). It was worked out by Daniel Lehrman and his colleagues. The reproductive cycle lasts about six to seven weeks. Before the beginning of the reproductive season, the level of testosterone in the male's blood is low. Male Barbary doves with low levels of testosterone are aggressive to females. The aggression of the male in turn suppresses the release of reproductive hormones in the female, which ensures that she does not become ready to reproduce before the male. The reportative season comes on as daylength increases, its beginning is determined hormonally, as the increase in the number of hours of daylight stimulates the male’s testes to release testosterone. The testosterone acts in the Barbary dove's brain In the male, it causes him to cease being aggressive to the female, and to start courting, which consists of a ceremony of bows and coos. That testosterone is responsible for the change can be show experimentally by injecting it into a male who will soon start courting, if given a female. Males injected with another hormone, oestrogen, show the sarco response, because testosterone is converted into oestrogen in the brain before it exerts its effect of inducing courtship. Courtship is therefore stimulated by testosterone released from the male’s testes, but after it has been converted into oestrogen on the way.