Q-(28) Effect on of hormone in Learning and Memory.

Ans The behaviour of learning and memory retention is affected by neurotransmitter or neuro-modulators like MSH and ACTH peptides released from neurons projecting from other parts of the brain where pituitary does not play a role. A number of neuropeptides are released within the brain by opiomelanotropinergic neurons. These peptides come from precursor protein called pro-opiomelano-anocortin within some neurons. From this precursor protein ~~desaace~~ disacetylated-α-MSH is formed. In the rat, N-acetylated form of α-MSH is more effective in eliciting behavioural activity than desacetyl α-MSH. Besides these β-endorphin also play a major role in behaviour. The regulation of behaviour either through α-MSH or β-endorphin mainly depends on the modulation of neural inputs which controls the chemical nature of the secreted neuro-peptides.

Vasopressin maintains adaptive behaviour in an organism. An avoidance behaviour is seen in posterio-lobotomized rats where they are injected with vasopressine hormone. They function similarly as that of MSH or ACTH in learning and memory processes of different organisms. The origin vasopressin, is more active than lysine. In the human being, learning and memory are influenced by the analogs DDAVP (1-Desamino-8-D-arginine vasopressin)

My Notes

The primary role of gonadal steroid hormones in mammals is to regulate reproduction and related behaviour, however, both androgen and estrogens are also integrally involved in mediating higher brain function and processes including cognition, neural development and neural plasticity. viz-

→ A number of studies show that estradiol molecule modulate dendritic spine growth and synapse density (synaptic plasticity) in ~~him~~ hippocampus of females, and that increased estradiol level and generally associate with improvement on a variety of learning and memory tasks.

→ Similar to estradiol titers in females, testosterone titers in males decline with age, and decline has been correlated with impairment of certain cognitive tasks.

→ Studies involving both humans and animals indicate that testosterone and its metabolites can respond on certain behavioural tasks, depending on the subject's current hormonal state, the response required, and the stimuli involved.

Q (29) What is circadian Rhythm? Discuss effect of external stimuli on circadian Rhythm of an animal.

Circadian Rhythms :- Changes in environmental conditions between night and day are an feature of the world of most animals. Changes in climatic factors such as temperature, and light intensity, affect animals directly, but there are also indirect effects of climate, such as fluctuations of food availability and in numbers of predators, which makes the differences between night and day an important aspects of life. Biological rhythms, governed by self-sustaining internal pacemakers, of about 24 hours duration is called circadian rhythms. Within the daily cycle, some animals exhibit peak activity during daylight, some are active primarily at night and still others exhibit peak activity around dusk or dawn. Activity periods may shift seasonally. Circadian periods may also show age-dependant shift.

Effects of Int/External Stimuli.

Internal Stimuli) In adjusting to the differences between night and day, an animal organizes its behaviour ~~night and day~~, according to a daily routine or rhythm. The daily rhythms of animals have been the subject of considerable study, and there is now little doubt that they are generally controlled by an endogenous clock which is capable of being entrained to exogenous factors, the daily rhythm are thus synchronized with local conditions. For eg - the lizard when hatch in a incubator under a temperature and light regime designed to correspond to a day length of 16 hr and 36 hrs respectively, exhibit the

My Notes

normal 24 hrs rhythms of activity when tested under constant conditions. This shows that the 24 hrs rhythm is endogenous and does not depend upon individual experience of normal day-night cycle. However, under constant laboratory conditions the 24 hrs periodicity drifts slightly from the normal. Such patterns, with a period of about one day, are called Circadian rhythm. Under natural conditions a 24 hrs rhythmicity is maintained by some exogenous Zeitgeber, which serves to continually reset the endogenous clock and prevent it from drifting out a phase with the cycle of environmental change. In the case of lizard mentioned above, it has been found that synchronization can be maintained by quite small daily fluctuations in environmental temperature. In laboratory experiments, a 24 hrs temperature cycle with an amplitude of 1.6°C was sufficient to maintained 75% of the animals in synchrony, while at an amplitude of 0.9°C only 25% were synchronized.

External Stimuli :- The most important daily changes in the external environment are those in temperature and light intensity. In a hot climate it is advantageous for a small animal to be nocternal, and so to avoid activity in the heat of the body. In cold climates also, it can be of advantage for small mammals to be active at night when temperature are low. This is because their period of greatest heat production coincides with the colder part of the day, and the period of activity is thus harnessed as a means of thermoregulation. In other species, it is

advantageous to be active in the daytime, especially if they are able to sleep in a warm nest at night.

Rhythms of rest and activity are widespread in the animal kingdom, and offer a number of benifitis to animals which possesses them. This animals specialised for daytime vision may be disadvantaged at night, because they cannot forage efficiently and may be in danger from predators. For such species there are advantages in sleeping at night. Sleep provides an opportunity for saving energy and for avoiding predators

Effects on the amplitude of rhythms can occur, either positive or negative. The circadian rhythm of expansion and contraction of a sea anemone under constant conditions disappear if the lighting is too bright and reappears if the light is dimmed. The rhythm vanishes because the anemone remains contracted for long periods. If flies emerge from pupae into continuous darkness, they are active in a circadian rhythm. Hatched into continuous light, their activity is arrhythmic. Bright light also inhibits the circadian rhythm of deer mice. Activity is scattered throughout the record, and its periodic property almost disappears. The rhythm of phototactic sensitivity of Euglena in continuous light. In general continuous light appears to inhibit the circadian rhythm of nocternal animals. It facilitates those of diurnal animals, those very bright light can have an inhibiting effect here as well. Warming facilities the expression of circadian cycles of poixilotherms, and cooling inhibits them.

My Notes

Light intensity and temperature also influence the periodic properties of circadian cycle. The period length of the activity of cycles of deer mice increase with an increase in the intensity of the continuous lighting. The period of the activity cycle of deer mice increases in brighter light that of the lizards decreases. Diurnal animals such as most birds react to increasing light intensity in the same way as lizard, with a decreased period length. In contrast, flying squirrels and house mice which, like deer mice are nocturnal, show an increased period length in brighter light.

Lighting conditions may have a variable effect on individual animals. This is certainly one interpretation of the individual rhythms which characterise a group of animals exposed to the same constant conditions.

The relative temperature independance of circadian rhythms is presumably significant under natural conditions. If circadian rhythms serve primarily to concentrate appropriate behaviour at certain times of day, changes with temp^s would hinder accurate timing. Although constant temperatures cause little change in period length, a regular cycle of temperature change is quite effective in synchronising some circadian rhythms.

Temperature and light may also have interacting effects, even in a homeotherm. Enright finds that the extent

to which low temperature retard free-running activity rhythm of the house finch, depends on the intensity of the constant light.

In conclusion, light and temperature under constant conditions have general ~~and~~ inhibitory or fascilitating effects on the amplitude of circadian rhythms; and they can have definite effects on period length. With light, the sign of the change depends on wheather the animal is diurnal or nocturnal. What happens if these same stimuli are presented in a cyclic manner rather than as steady state

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