Quadrant II – Transcript and Related Materials

Programme : Bachelor of Science (First Year)

Subject : Zoology

Course Code : ZOG 102

Course Title : Animal Behaviour

Unit : Biological rhythm

Module Name : Types and characteristics of biological rhythms (Lunar rhythm and circannual rhythm)

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Notes

LUNAR RHYTHM

The cyclic activities exhibited by organisms in relation to the 29 days lunar month are called Lunar rhythm. During full moon and new moon days, tides are greatest and are called spring tides. At the moon's quarters, the sun and the moon oppose each other resulting in smallest tides called ebb tides. The spring and the ebb tides occur at an interval of 14.5 days. And hence this rhythm has duration of 29 days.

With the exception of marine animals, very few organisms are known that show lunar rhythms of activity. In many littoral animals increase in activity occurs with the rising tide; tide pool fishes leave rock pools to forage more widely, sea anemones expand as they are immersed by the rising tide, etc.

Species in diverse phyla exhibit lunar rhythms, mostly in their reproductive behaviour. Circalunar and circasemilunar rhythms are widespread among organisms, especially in the context of reproductive cycles of marine animals. For example, the palolo worm (Eunice sp.) releases its gametes into the sea only during the neap tides of the last quarter of the moon in October and November.

A series of scientific studies has produced evidence for the existence of circalunar or circa-semilunar rhythms also in terrestrial species. These affect diverse animal phyla and various aspects of animal life, ranging from reproduction to communication or behavior related to preying or protection from predators.

In European badger, the lunar timing is superimposed on a seasonal breeding cycle. The animal typically mates in February to March, soon after the females have given birth to the previous litter. During lactation, the embryos are in a diapause state, before seasonal cues (photoperiod and temperature) lead to implantation around the end of December.

Characteristics of Tidal Rhythm

• The rhythm has an endogenous free-running period

• They are self-sustained.

• They are entrainable.

• Lunar rhythms occur mostly in marine species.

Selective advantages of lunar rhythm

•It enables prediction of imminent events in their habitat, of either catastrophic or beneficial character or allowing compensatory behavioural changes to be made.

• Periodicity is of great value in concentrating spawning activity in both space and time.

• At the basis of lunar cycles, as in all cycles in nature, there is the fundamental advantage of responding to stimuli which correlate with recurring environmental conditions.

CIRCANNUAL RHYTHM

A circannual rhythm/cycle is a biological process that occurs in living creatures over the period of approximately one year. It is classified as an Infradian rhythm. The location of the physical circannual timer in organisms and how it works are almost entirely unknown.

This cycle was first discovered by Ebo Gwinner and Canadian biologist Ted Pengelley. In one study performed by Eberhard Gwinner, two species of birds were born in a controlled environment without ever being exposed to external

stimuli. They were presented with a fixed Photoperiod of 10 hours of light and 14 hours of darkness each day. The birds were exposed to these conditions for eight years and consistently molted at the same time as they would have in the wild, indicating that this physiological cycle is innate rather than governed environmentally.

Researchers Ted Pengelley and Ken Fisher studied the circannual clock in the golden-mantled ground squirrel. They exposed the squirrels to twelve hours of light and 12 hours of darkness and at a constant temperature for three years. During the first year, the squirrels began hibernation in late October. They started hibernating in mid-August and early April respectively for the following two years, displaying a circannual rhythm with a period of about 10 months.

Characteristics of Circannual Rhythm

• The behavioural and physiological patterns, governed by self-sustaining internal pacemakers, which occur with a period of about one year.

• The behavioural and physiological changes are timed by an innate endogenous circannual clock.

• They are entrainable

Significance of Circannual rhythm

• Circannual rhythms have evolved as genetically programmed adaptive timing mechanisms to allow organisms use favorable seasons to reproduce and grow, and survive through unfavorable seasons.

• The circannual cycle can also be useful for animals that migrate or hibernate.

• Many animals' reproductive organs change in response to changes in photoperiod.