

## Adaptation to change IN season

- A. **Seasonality in animals**
- B. **Exogenous cues influencing seasonality**
- C. **Photoperiodism and pineal function**
- D. **Molecular clock**

## Seasonality in animals

- change in season and day length greatly influence activity in animals.
- Seasonality therefore seeks to study behavioural cycles or rhythms of animals that repeat at regular intervals and are driven by biological clocks.
- In this study we are going to look at the various cues that determine seasonal behaviour in animals.

## Exogenous cues

- These are mainly external or environmental factors that affect activity in animals.
- Most importantly it includes photoperiodic and temperature changes.

## Influence of exogenous cues

- **Birth seasonality.**
- In most temperate zones, vertebrates are seasonal breeders. These seasonal breeders ensure that their young's are produced at a time when of a year when there is the greatest probability of chances of survival of mother and offspring. A good example is timing of discontinuous breeding in hamsters.

## Hibernation

- Hibernation is different from sleep. A "True" hibernator appears to be dead because the animal's heart rate slows down and the body temperature drops to almost the same temperature to that of the environment.
- The ground squirrels are good examples of hibernating rodents found in many areas of the central United States.

## Hibernating cycle of ground squirrels

- In spring, ground squirrels come out of their dens in April and May.

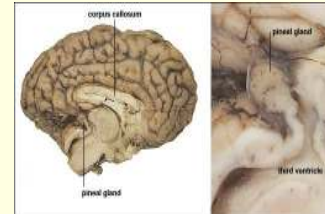


## Migration

- Seasonal changes influences migration of animals e.g. Willow Warbler, Indigo Bunting
- The Indigo Bunting, is a small bird. Migration takes place in April and May and then again in September and October. It often migrates by night, using the stars to navigate.

## Anatomy of the pineal gland

The pineal gland is the main regulatory organ in seasonality. Via the eyes, day length is registered in the pineal gland



## Photoperiodism and pineal function

- Photoperiodism explain how changes in daylength affect activity or behaviour in animals
- The light transducing ability of the pineal gland has lead some to call the pineal the third eye
- The pineal gland transduces the signals from a sympathetic nervous system into a hormonal signal
- The hormone is called melatonin

## Biosynthesis of Melatonin

- **Synthesis and secretion of melatonin is dramatically affected by light exposure to the eyes.** *The fundamental pattern observed is that serum concentrations of melatonin are low during the daylight hours, and increase to a peak during the dark.*
- In rodents, the rate-limiting enzyme arylalkylamine N-acetyltransferase (AA-NAT), mRNA is about 100-fold elevated during the night in response to adrenergic stimulation of the cAMP-signalling pathway.

## Biological effects of melatonin

- Melatonin has an effect on sleep/wake activity. It is used to treat sleep disorders. In various humans melatonin administration has shown to decrease motor activity induce fatigue and lower body temperature
- Seasonal changes in day length have profound effects on the reproduction in many species and melatonin is the key factor in controlling such events. e.g hamsters

## Hamster



## Biological rhythms

- Melatonin has the ability to entrain biological rhythms . This hormone communicates information about environmental lighting to various parts of the body.
- Biological rhythms or biological clock reveals the internal clock of an organism and how it tries to adapt to the earths clock. (Seasonal changes, days months weeks years)

## Types of biological clocks

- Ultradian clock: these are rhythms that have a period of less than 24 hours
- Infradian clock: they have an internal cycle longer than 24 hours
- Circadian cycles: these are organism with internal cycles of 24 hours
- Circannual cycles these are yearly cycles of activities of organisms.

## Molecular Clock

It is a technique in molecular evolution that studies molecular changes in organisms using fossils, to determine the time when two species diverge. **It is used to estimate the time** of speciation

## Uses of molecular clock

- It is an important tool in molecular systematics. It is used to determine the correct scientific classification of organisms.
- It facilitates the establishment of the dates of phylogenetic events, such as the divergence of living taxa and the formation of the phylogenetic tree.

