

# ZOS454: ADAPTATION BIOLOGY

Teaching Hours 10/week

## COURSE OUTCOME

1. To learn biological rhythms in animals including humans.
2. This course introduces the pupil to different physiological adaptations and acclimatization of an organism to various environments.
3. To enlighten students on animal responses to light and temperature.
4. Students are made to understand the importance of chronobiology and Chrono medicine.
5. Importance of hibernation, aestivation and insect diapause.
6. Aspirants are made to appreciate the maternal, foetal and neonatal physiology.

### UNIT I

Introduction- Definition, types of adaptation. Physical and behavioral. Environmental variables. Environmental conditions of aquatic, terrestrial and xeric habitats. Light condition-eclosion in insects. Biological rhythms including circadian rhythms, Milestones in clock research, Chronobiology in 21st century, Evolution of biological timing system, Clocks, genes and evolution, Adaptive functional significance of biological clocks, Phase shift, Phase response curves (PRC) and phase transition curves (PTC);

### UNIT II

Photoreception and photo-transduction, The physiological clock and measurement of day length; Role of photic and non-photoc cues in seasonality; Reversal of roles of principal and supplementary cues, The relevance of biological clocks for human welfare - Clock function (dysfunction), Inter tidal animals and their adaptations. Concepts of homeostasis, acclimation and acclimatization. Basic mechanisms of biochemical adaptation. Adaptation during physical exercise.

### UNIT III

Diversity and complexity of the clock system- Melatonin, depleted Oxygen availability and its effects. Anhydrobiosis and hibernation. Adaptation to deep sea living and diving. Physiology of insect diapauses. Circadian pacemaker system in vertebrates with particular reference to rodents; Suprachiasmatic nucleus (SCN) as the main vertebrate clock; concept of core and shell.

### UNIT IV

Temperature relations, Adaptations to temperature variations, molecular mechanisms of adaptations. Endothermy and Ectothermy. Extremophiles varieties and their adaptations. Mechanisms of body temperature regulation, Fever. Heat shock proteins. Human health and diseases - Chronopharmacology, Cronomedicine, Chronotherapy.

## UNITY

Alterations and adaptations in maternal physiology during pregnancy. Maternal and fetal prolactin. Placenta: Endocrine functions, Transport mechanisms, Fetal physiology, growth and metabolism, Neonatal physiology. Lactation and Lactogenesis

## REFERENCES

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2. Hadley,N. F. (1975) Environmental physiology of Desert organisms, Dowden, Hutchinson & Ross, University of California.
3. Hochachka, P.L. and Somero G.N. (1994) Biochemical Adaptations, Princeton University Press.
4. Jay, C. D., Jennifer. J. Loros, Patricia J. DeCoursey (ed), (2004) Chronobiology Biological Timekeeping: Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.
5. Keele, C.A., Neil E., Joels N. (1993) Sarson Wright's Applied Physiology.14<sup>th</sup> Edition, Oxford University Press.
6. Kumar, V. (2002) Biological Rhythms: Narosa Publishing House, Delhi/ Springer-Verlag, Germany.
7. Louw, G.N. (1993) Physiological Animal Ecology, Longman Scientific and Technical Publishers. U.K.
8. Prosser,C.L. (1986) Adaptation Biology: Molecular to organisms. John Wiley and Sons.
9. Saunders, D.S. Steel C.G.H. and Afopoulou X., (2002) Insect Clocks (ed.) R.D. Lewis. (3rd Ed) Baren and Noble Inc. New York, USA.
10. Schmidt-NeilsenK.(1995) Animal physiology, Adaptation and Environment. Cambridge University Press.
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