

Eukaryotic gene Expression : Basics and Benefits - Video course

COURSE OUTLINE

The objective of this course is to expose the viewer to basic aspects of regulation of gene expression in eukaryotes and explain the benefits that have accrued out of basic research in this area.

The course is organized such that the viewer will learn not only gain knowledge on the molecular mechanisms involved in eukaryotic gene regulation but also will appreciate the benefits that have accrued through the exploitation of knowledge gained from the basic research, primarily in the areas of disease diagnosis and their prevention, agriculture etc.

Through this course the instructor wishes to convey the message that knowledge of eukaryotic gene regulation is essential for understanding and appreciating a number of biotechnological applications in the areas of medicine and agriculture.

COURSE DETAIL

| Module No. | Topic/s | Lectures |
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| 1 | CIS-ACTING ELEMENTS AND TRANS-ACTING FACTORS <ul style="list-style-type: none"> Eukaryotic RNA polymerases and basal transcription factors Diversity in core promoter elements Diversity in general transcription factors Proximal & Distal Promoter Elements, Enhancers and Silencers, Gene-specific Regulators | 4 |



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Chemistry and Biochemistry

Pre-requisites:

Undergraduate degree (BSc/BTech/BE) in Biological Sciences

Coordinators:

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| 2 | <p>DOMAIN STRUCTURE OF EUKARYOTIC TRANSCRIPTION FACTORS</p> <ul style="list-style-type: none"> • Transcription factors – DNA binding domains • Transcription factors – transcription activation domain | 2 | |
| 3 | <p>ROLE OF CHROMATIN IN EUKARYOTIC GENE REGULATION</p> <ul style="list-style-type: none"> • Role of chromatin in eukaryotic gene regulation • Role of histones in eukaryotic gene regulation • Role of DNA methylation in eukaryotic gene regulation • Chromatin remodelling & gene regulation | 4 | |
| 4 | <p>SYNTHESIS OF mRNA, rRNA & tRNA</p> <ul style="list-style-type: none"> • mRNA processing – Role of RNA Pol II in mRNA capping and mRNA splicing • mRNA processing – Role of RNA Pol II in polyadenylation & mRNA editing • Regulation of RNA Pol I transcription • Regulation of RNA Pol III transcription | 4 | |
| 5 | <p>REGULATION OF GENE EXPRESSION VIA CELL SURFACE RECEPTORS</p> <ul style="list-style-type: none"> • Signal Transduction Pathways - Introduction • Regulation of gene expression by cyclicAMP | 6 | |

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| | <ul style="list-style-type: none"> • Regulation of gene expression by second messengers other than cAMP • Regulation of gene expression by Protein Kinase C • Regulation of gene expression by Growth factors • Regulation of gene expression by cytokines | | |
| 6 | <p>REGULATION OF GENE EXPRESSION BY INTRACELLULAR RECEPTORS</p> <ul style="list-style-type: none"> • Regulation of gene expression by steroid hormones • Regulation of gene expression by type II nuclear receptors • Mechanism of transcriptional activation by nuclear receptors | 3 | |
| 7 | <p>REGULATION OF GENE EXPRESSION OF GENE DURING DEVELOPMENT</p> <ul style="list-style-type: none"> • Gene Regulation during Drosophila Development • Signal transduction pathways involved in embryonic development • Homeotic genes • Epigenetic regulation of gene expression during development • Embryonic stem cells and Transcription factor-mediated epigenetic reprogramming | 5 | |
| 8 | <p>RECOMBINANT PROTEIN EXPRESSION SYSTEMS</p> <ul style="list-style-type: none"> • Cloning and Expression vectors • Eukaryotic protein expression systems - I | 4 | |

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| | <ul style="list-style-type: none"> • Eukaryotic protein expression systems - II • Eukaryotic protein expression systems – III: Gene expression in mammalian cells using viral vectors | |
| 9 | GENE THERAPY AND TRANSGENIC TECHNOLOGY <ul style="list-style-type: none"> • Human Gene Therapy • DNA vaccines • Transgenic animals • Transgenic plants • Knockout mice | 5 |
| 10 | RECENT ADVANCES IN EUKARYOTIC GENE EXPRESSION <ul style="list-style-type: none"> • Regulation of Eukaryotic Gene Expression by Small RNAs (RNA Interference, RNAi) • Genomics & Proteomics • Metabolic Engineering & Synthetic Biology | 3 |

References:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter Molecular Biology of the Cell. 2008. 5th edition.
2. Benjamin Lewin. GENES IX 2008. Ninth edition
3. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick Molecular Biology of the Gene. 2008. Fifth Edition.