Faculty of Eng. & Natural Sci.

BIO467-202102

Signal Transduction

Instructor(s)

Name	Email	Office	Phone	Web	Office Hours
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Course Content

The molecular mechanisms by which environmental signals are received by cells and translated into a biological response such as development, cell behavior, immune response are currently one of the most-studied areas in modern biology. In this course several prototype- signalling pathways to discuss the mechanistic concepts in signal transduction, to present state-of-art research, and to discuss various experimental approaches will be presented. The most relevant concepts of signal transduction, i.e. protein-protein interactions, phosphorylation and GTP-binding proteins will be discussed.

Objectives

To teach modern molecular, cellular and organismal concepts of signal transduction so that each student can understand how cells interact with each other.

Recommend or Required Reading

Textbook

Cellular Signal Processing: An Introduction to the Molecular Mechanisms of Signal Transduction. Friedrich Marks, Ursula Klingmuller, Karin Muller-Decker ISBN 0-8153-4215-2 Either first or second edition.

Readings

Course will require readings of current research and review papers from Journals such as Cell, Immunity, Nature, Nature

Immunology, Science, PNAS and Journal of Biological Chemistry. Students will read at least two research papers and one review paper every week for 14 weeks.

Assessment Methods and Criteria

	Percentage(%)	Number of assessment methods
Midterm	60	2
Exam		0
Term-Paper	30	1
Participation	10	

Course Outline

Week Subject
1 The ?Brain of the cell?, Signaling the Network with Energy
2 Basic Equipment: G-Proteins, Second Messengers, and Protein Kinases
3 Signal Transduction by Receptors with Seven Transmembrane Domains
4 Signal Transduction by Serine/Threonine Kinase-Coupled Receptors
5 Signal Transduction by Tyrosine Kinase- and Protein Phosphatase-Coupled Receptors
6 Eukaryotic Gene Transcription: The Ultimate Target of Signal Transduction
7 Signals Controlling mRNA Translation
8 Signal Transduction by Small G-Proteins: The Art of Molecular Targeting
9 Mitogen-activated Protein Kinase and Nuclear Factor ?B Modules
10 Regulation of Cell Division
11 Signal Transduction by Proteolysis, and Programmed Cell Death
12 Signal Transduction by Ions
13 Sensory Signal Processing
14 Signaling at Synapses: Neurotransmitters and their Receptors

Learning Outcomes

By the end of this course the student should be able to understand the methods used in immunological research.
Perform literature searches, download research papers and identify and understand by reading relevant parts of a research paper, in particular if a technique described in a research paper is not familiar to the student, he/she should be able to perform literature searches to identify resources that will allow an understanding of this technique.
Make connections between different research papers and discuss the hierarchical and historical contributions different research papers made to the field.
Understand the basic principles of signal transduction mechanisms, in particular the concepts of response specificity, signal duration and termination and intracellular localization of signaling molecules.
Give examples of different types of extracellular signals, receptors and transcription factors and explain their functional significance.
Describe the mechanisms by which different receptors may be activated by their respective ligands.
Describe and give examples of the structure and properties of the major components of signal transduction pathways.
Understand and give examples of the role of protein binding domains in the specific interactions between signaling molecules.

Understand the molecular events that occur in a cell (such as post-translational modification of signaling molecules and nuclear translocation of transcription factors) after a receptor is triggered to give a signal to a cell.

Course Policies

Attendance to lectures are mandatory. Student's participation in class is evaluated as 50% of final grade.

Academic Dishonesty
Cheating is absolutely subject to disciplinary action and a failing grade.