### Overview of Signals and Receptors
- Extracellular Signals; Autocrine, paracrine and endocrine pathways; Recognition of the signal, selectivity and specificity of recognition sites; Competitive and non-competitive interactions; Positive and negative cooperativity, spare receptor theory; Characterization of a receptor site: Methods and the underlying principles of radioligand binding assays and functional assays

### Overview of Transmembrane signaling
- Signal transduction mechanisms: adenylate cyclase and PI turnover pathways and tyrosine kinase pathways; Signaling by heterotrimeric G-proteins; Ras signaling pathway, Rho, Rab and Ran GTPases, ADP-ribosylation factors

### Growth Factor Receptors; Tyrosine kinases
- The Ras-Raf-MAP Kinase pathway; Cytokine receptors; IgE receptors; Transcription factors; The STAT and JAK pathways; SOCS molecules

### No class

### Signaling through Protein Kinase A and C
- Specificity of their isozymes; Protein phosphatases: Non-specific phosphatases, Phosphoprotein phosphatases, and protein tyrosine phosphatases
10-05-11  Ion channels: Molecular Insight into the basis of diversity in Ca^{2+}-channels, Na^+ channels, K^+ channels, and Chloride channels

10-12-11  No class

10-19-11  Lymphokine-induced signal transduction: the Hematopoietin receptor superfamily; Integrin signaling; Chemokine signaling; Cellular and molecular mechanisms underlying chemotaxis

10-26-11  Toll-like receptors; Phagocytosis: cellular and molecular mechanisms; Cellular and molecular mechanisms underlying apoptosis; Smooth muscle cell contraction and relaxation; skeletal muscle contraction

11-02-11  2 Student Presentations
11-09-11  2 Student Presentations
11-16-11  2 Student Presentations
11-23-11  1 Student Presentation
11-30-11  FINAL EXAMINATION

There is no textbook available, which covers all of the material in transmembrane signaling. Therefore, no textbook has been recommended. However, each student will be expected to read all material presented in the class. Tests will cover lecture materials and class discussion, including the presentations of the students.

Final Examination  25%
Class Presentation  25%
Class Participation  15%
Submission of the Paper  35%

Grading system is as follows: A 91-100%; B 81-90%; C 71-80%; D 60-70%

If you have further questions about this course, please do not hesitate to call upon me. I am located in CRISS II Room 510; Telephone # 280-2938; E-mail: dkagr@creighton.edu
Suggested Topics for Presentation and Review Article

1. miRNAs regulating Growth Factor Receptors- IGF-1, PDGF, EGF, TGF-beta

2. Single Nucleotide Polymorphisms in VDRs in health and disease

3. Epigenetics (Hypermethylation, Histone acetylation and Deacetylation) of Genes regulating Cytokine Receptors

4. Diversity in Chemokine Receptors: Potential Interaction with Ion Channels in their Functional Response

5. Kinases that regulate the function of phosphatases in growth factor receptor-response coupling

6. Transcription regulation of Importins

7. Regulation of and interaction between Leptin and Adiponectin receptors