

METALLOBIOLOGY

ROLE OF METAL IONS IN MICROBIAL GENE REGULATION

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GENERAL INFORMATION:

Role of Metal Ions in Microbial Gene Regulation is intended to provide you with a foundation in modern microbiology. We will discuss the biology and chemistry of metal ions, an overview of gene regulation, and selected examples of metal ion uptake, heavy metal ion resistance, metal ion regulated toxin production, and oxidative stress systems.

RESOURCES:

Appropriate reading materials from Inorganic Biochemistry: An Introduction by J. A. Cowan (2nd ed. John Wiley & Sons, Inc., New York, 1997) and Fundamentals of Biochemistry by D. Voet, J. G. Voet, and C. W. Pratt (John Wiley & Sons, Inc., New York, 1999) will be distributed. Visit the Wiley web site for more information. We will also use selected articles from the current scientific literature, as appropriate.

The KEGG graphical pathway maps may be of use in learning the material concerning the various metabolic pathways. Molecular viewing applications RasMol and Chime may be of interest and of use during this course. Visit the "Chime Square" site for selected examples.

You may wish to include additional materials and resources (internet). I will provide notes (WWW sites) and facilitate discussions during class, but it is up to you to develop a comprehensive understanding of the material.

GRADING POLICY:

Your performance in this course will be based on active participation and scheduled tests. Examinations will be a combination of short-answer, multiple-choice, and problem-solving questions.

As a general policy, there will be no make-up examinations. Demonstrate your responsibility by attending lectures, discussions, and examinations.

COURSE OUTLINE: (tentative schedule of topics)

Biology and chemistry of metal ions 2 lectures (4 hours)

Chemistry of essential and toxic metal ions, interaction with inorganic and organic ligands

Gene regulation 2 lectures (4 hours)

Organization of genes, transcription and translation, activation and repression

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Metal ion uptake 4 lectures (8 hours)

General strategies by microorganisms, iron, siderophores and receptors, magnesium, nickel, and copper

Heavy metal ion resistance 2 lectures (4 hours)

General resistance mechanisms, mercury, cadmium, metallothioneins

First Examination - Biology and chemistry of metal ions, gene regulation, metal ion uptake, and heavy metal ion resistance

Toxin production 2 lectures (4 hours)

Regulation of Shiga toxin production

Oxidative stress 2 lectures (4 hours)

Reduction of dioxygen, catalases, peroxidases, superoxide dismutases, two-component regulation

pH stress 2 lectures (4 hours)

Acid stress in bacteria, urease as a survival strategy

Second Examination - Toxin production, oxidative stress, and pH stress