LSBS 52410 Actions and Application of Toxins
W6W7 (Weds 14:10-16:00) 2019 Fall semester
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The evolution of life on earth has been strongly influenced by the continuous confrontation between microorganisms and their animal or plant hosts. In order to cause disease, get prey or to defense, there exist an accelerated evolution between the toxin and its physiological target. Some of these toxins become a useful tool for biomedical research and can be further developed into drug. In this class, we will address the general action mechanism of toxins from virus, bacteria, plants or animals. We will cover sections including (1) how toxins are delivered, (2) how proteins, lipids and carbohydrates become targets for toxin action, and (3) how the immune systems involved in host pathogen response. Finally, the bio-technological and biomedical application of the toxins will also be discussed by considering the biodiversity of toxins in both plants and animals. In order to achieve this goal, we will spend 1/3 of the lecture hours to review the basics of action mechanism of toxins, another 1/3 to update the progress in the field based on the review articles during the last decade and finally, the last 1/3 to guide students reading the state of the art publications in the field of Toxin biology.

Tentative Agenda

Sept 11. Introduction to toxins from Virus, Bacteria, Plants and Animals

Part I: Toxin delivery

Sept 18 Hijacking cell's machinery & Immune system
Sept 25 Protein injection system of Bacteria
Oct 2 Delivery system of the venoms: Snake Fang & Scorpion Sting (Sept 25)

Part II: Find the target first

Oct 9. Lipid and carbohydrate mediated toxin action: Ricin, Cholera Toxin (Oct 16)
Oct 16 Protein as a target for toxin action: Ion Channel, Integrin & Cytoskeleton
Oct 23. Membrane pore formation
Oct 30. Midterm Examination

Part III: Host Pathogen response

Nov 6 MAST Cell
Nov 13 Leukocytes
Nov 20. Microenvironment remodeling

Part IV: Toxin evolution

Nov 27 Proteomics and Genomics
Dec 4 Accelerating evolution for Toxins as Biological weapon

Part V: Toxin Applications

Dec 11. Botulinum Toxins and cosmetics
Dec 18. Toxins for biomedical research
Jan 8 Final Examination

Grade: 30% Report and/or Examination, 30% Oral Presentation, 40% Exercise

1. Venom: the secrets of nature's deadliest weapon (2017)
   by Ronald Jenner & Eivind Undheim, Smithsonian Books
2. Venom Genomics and Proteomics (2016)
   Edited by JJ Calvete in Toxinology
3. Essential of Glycobiology 3rd Edition
   Edited by A Varki, Cold Spring Harbor Lab.

Assigned reading and presentation on current review and articles