American University of Beirut  
Faculty of Arts and Sciences  
Department of Biology  

BIOL 338- 3 credits  
Cancer and Natural Products  
Spring 2010-2011

Instructor
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Office Hours: MWF 8:30-9:30am or by appointment  
Meeting Time: T-Th 5:00-6:15 pm  
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Course Description
This course is designed to introduce students to the numerous natural compounds that show promise in the treatment of cancer and the mechanism-based approaches to cancer treatment using these compounds. In addition, the course provides information on the research designs, protocols and assays involving natural compounds.

Learning Objectives
At the end of this course, the student will be able to:

1- Demonstrate knowledge and comprehension of the different types of anticancer natural compounds;
2- Distinguish between conventional and new cancer therapy modalities;
3- Understand the approaches in natural product drug discovery;
4- Develop critical thinking skills in cancer research;
5- Demonstrate competence in accessing and communicating scientific information from scopus, PubMed and library resources both orally and in writing.
Learning Outcomes

At the completion of this course, a student will be able to:

1.1- Describe the different types of natural anticancer compounds from plants, microbes and marine organisms

1.2- Describe the cellular and molecular targets of anticancer natural compounds

2.1- Decide when and how best to use conventional and new cancer treatment modalities;

3.1- Propose a context based and optimal approach for natural product drug discovery;

3.1- Analyze how natural products could be used as effective anticancer treatment, particularly in what relates to targeted therapies

4.1- Deliver an oral presentation on a novel and promising natural product used against cancer;

4.2- Write a review on an anticancer natural product.

Resources

- Lectures will be available as document handouts.

- Additional reading material will be assigned and made available to students.

- Databases and library resources will be required for some topic assignments.

Grading Criteria

Attendance, class participation, and paper discussion 10%
Oral presentations 30%
Exams 30%
Final review paper 30%

The oral presentation should be on a recent topic in Natural Products and Cancer and should be given in the format of a research paper.

One or two exams will be given during the semester on the topics discussed in class.

A final review paper on a topic in Natural Products and Cancer should be submitted at the end of the term.
Course Syllabus

I. Overview of Cancer: Modern vs Ancient Concepts
   • Cancer incidence and types
   • Neoplasia, oncogenes, tumor suppressors
   • Gatekeeper and Caretaker Genes
   • Multi-hit theory of cancer
   • Carcinogenesis: initiation & promotion
   • Metastasis: Old and New models
   • Cancer Gene Pathways
   • Free Radicals and Cancer
   • Cancer Stem Cells

II. Cancer Treatment: Conventional and New Therapy Modalities
   a. Cancer Stages and Treatment Efficacy
   b. Conventional Cancer Treatment
      • Radiotherapy
      • Chemotherapy
      • Photodynamic Therapy
      • Hormone Therapy
      • Immunotherapy
   c. Other Therapy Modalities
      • Targeted therapy
      • CAMs: Complementary and Alternative Medicine

III. Approaches in Natural Product-Based Drug Discovery
   • History of Cancer Drug Discovery
   • Natural Product Drug Discovery: Is there hope?
   • Chemical Extraction
   • Chemical Libraries and High Throughput Assays
   • Cell Based Bioassays
   • Metabolomics
   • Animal Models
   • Hollow Fiber Animal Model
   • Clinical Trials

IV. Chemotherapeutic Agents of Natural Origin
   1. Plant derived compounds:
      • Vinca Alkaloids: Vincristine and Vinblastine
      • Podophyllin
      • Etoposide
      • Teniposide
      • Taxol
      • Camptothecin
      • Lapachol and Beta-lapachone
      • Ellipticine
      • Homoharringtonine
2. Microbial derived anticancer drugs:
3. Marine Anticancer Drugs
4. AnimalVenoms and Toxins

V. Chemopreventive Agents and Neutraceuticals
- Polyunsaturated fatty acids
- Selenium
- Polyphenols and green tea
- Flavanoids: Quercitin
- Sesquiterpene lactones
- Resveratrol from red grapes
- Pomegranate
- Black seed
- Sulphoraphane from broccoli

VI. Mechanisms and Targets of Anticancer Natural Compounds
- Cellular Mechanisms: ROS, DNA damage, Senescence, Mitotic catastrophe, Apoptosis, etc…
- Molecular Targets: NF-kB, MAPK, AP-1, etc…
- Mechanisms of anticancer drug resistance