SIO237C: Optical-Biological Interactions in the Ocean
(offered as SIO209 in Spring 2015)

INSTRUCTOR:

Dariusz Stramski
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Office hours: Immediately after each course meeting or by appointment

PREREQUISITES:

Students admitted to the SIO graduate program or permission of instructor

COURSE DESCRIPTION:

Units: 4; Grade: Letter grade only; Required participation in lectures and presentation & discussion of selected literature by students

This is a course with an emphasis on the interactions of underwater light with marine biology including marine plankton and animals. Course meetings will consist of approximately two-thirds lectures by instructor (Lec on Schedule) and one-third student presentations & discussions (Dis on Schedule) of selected contemporary papers on topics relevant to optical-biological interactions in the ocean.

COURSE GOALS:

(1) To gain basic understanding of mechanisms by which light interacts with matter and how light interacts with biological constituents of seawater
(2) To appreciate the links and interactions between underwater light and biological constituents and processes within the ocean
(3) To become acquainted with optical methods and tools applicable to the study of ocean biology and biogeochemistry
(4) To directly engage with the primary literature and identify topics at the frontier of bio-optical oceanography
(5) To enhance skills in communicating science and debating scientific issues via oral form

READING:

Recommended textbooks:

(1) J.T.O. Kirk "Light and Photosynthesis in Aquatic Ecosystems", Cambridge Univ. Press, 1994.

Half of the book is an excellent introduction to ocean optics, the other half is devoted to the effects of light on biology.

(2) N.G. Jerlov “Marine Optics”, Elsevier, 1976.
Classic text in marine optics.

(3) C. Mobley "Light and Water. Radiative Transfer in Natural Waters", Academic Press, 1994.
Excellent text on advanced theory of radiative transfer. Includes excellent chapters (Part I) that can serve as standard reference work on basic ocean optics. Highly recommended for physics-oriented students.

(4) S. Johnsen "The Optics of Life: A Biologist's Guide to Light in Nature", Princeton University Press, 2012.
Excellent introductory text on many essential aspects of optics and its role in life and biology. Highly recommended for biology-oriented students.

GRADING:

Midterm presentation/discussion of selected literature: 35%
Final presentation/discussion of selected literature: 50%
Participation/preparedness for debates and discussions: 15%

ASSIGNMENTS:

Students will formulate a research question in the area of bio-optical oceanography and will select papers for midterm and final presentation & discussion sessions. The papers selected by students for their presentations can address the topical areas presented in lectures or other areas of relevance to the general theme of the course. The selection of papers must be consulted with instructor and approved for the presentation. A student is expected to be involved in debating scientific issues presented by other students.

SCHEDULE:

Course meetings will take place twice a week of 1 hr 20 min duration each. Days will be determined in consultation with students at the beginning of the quarter. There will be two types of activities: lectures by instructor (Lec) and presentations & discussion of selected literature by students (Dis).

Week	Type of Activity	Topic
1	Lec	Basic physics of interaction of light with matter
2	Lec	Methodology of the study of optical properties of marine microorganisms
3	Lec	Light absorption, scattering, and fluorescence by phytoplankton

4	Lec	Intra- and interspecies variability of phytoplankton optical properties; effects of growth conditions on phytoplankton optical properties
5	Dis	Presentations and discussion of selected literature
6	Lec	Effects and feedbacks associated with interactions of light with biological particles (such as prey-predator interactions and viral infection of microorganisms); optical properties of heterotrophic bacteria
7	Lec	Applications of optics to the study of ocean biology (such as applications of satellite-based ocean color remote sensing in the study of phytoplankton biomass, diversity of phytoplankton communities, and primary productivity in the ocean)
8	Lec	Applications of optics to the study of ocean biology (contd.)
9	Lec/Dis	Applications of optics to the study of ocean biology (contd.) Presentations and discussion of selected literature
10	Dis	Presentations and discussion of selected literature