

BIOL 4560 / 6560: Quantum Biology (Fall, 2022)

Instructor Information

Instructor name: Dr. Jonghoon Kang

Instructor contact: Bailey Science Center 2217, 229-333-7140,

jkang@valdosta.edu

Instructor office hours: Wednesday and Thursday, 2:00 PM - 3:30 PM or by appointment

Course Information

BIOL 4560 Quantum Biology. 3 Hour.

BIOL 4560: Prerequisites: A grade of "C" or better in MATH 2261, BIOL 1107, BIOL 1107L, BIOL 1108, 1108L, BIOL 3200, CHEM 1211, CHEM 1211L, CHEM 1212, CHEM 1212L, and either PHYS 1111K or PHYS 2211K or consent of the instructor.

BIOL 6560: Prerequisite: Admission into the graduate program or permission of the instructor.

Time and Location

Tuesday and Thursday 9:30 – 10:45 am, #2202

Course Description

- A study of the role of quantum mechanics in biological and biochemical phenomena. Basic concepts in quantum aspects of nature will be reviewed and their implications in biology will be examined.
- Required texts: **Physical Chemistry for the Biosciences**, by Raymond Chang from University Science Books (ISBN-13: 978-1891389337)
- **Specific Description of Course**
The course focuses on how **quantum mechanics** plays a role in biological and biochemical phenomena. Basic concepts in quantum aspects of nature will be reviewed and their implications in biology will be examined. Traditionally biologists don't need to learn quantum mechanics because most biological phenomena can be explained without knowing the quantum nature of the system. However, with recent development of experimental techniques and theoretical advancement, it is now clear that **the quantum aspect of nature plays a critical role in some biological phenomena including consciousness**. This course is **ambitious and exciting** in that we are going to **explore the interface between biology and the quantum world to learn how the weirdest**

aspect of the nature manifests itself in biology. I will teach **biology, mathematics, physics, and chemistry** relevant to this course. The use of mathematics will be minimized to the level of pre-calculus and basic calculus as this course is mainly targeted for biology students.

Specific Outcomes

- Comprehend basic (quantum) physics
- Acquire basic mathematical skills used in quantum mechanics
- Recognize the necessity of quantum physics in explaining some biological phenomena
- Describe those biological phenomena with quantum mechanics
- Demonstrate literature analysis capability in quantum biology
- Demonstrate competency for the basic quantum physics and chemistry in standard tests such as MFT, GRE, MCAT, DAT, PCAT, and OAT.
- Perform a research project in quantum biology assigned by the instructor (Graduate students)

Assignments

General description of the assignments: Students are required to read the lecture materials to be covered before and after class.

Policies for missed assignments, make-up assignments, late assignments, and/or extra credit: If you miss any assignment due to medical or family-related emergency you can have make-up assignments as long as you prove the valid reason of your absence (doctor's notes). If you miss class more than three times for any reasons, you won't pass this course. So, make sure that you attend all lectures.

Assessment Policy

Total Score for Undergraduate = 300 (In Class Exam) + 300 (Final) = 600

Total Score for Graduates = 300 (In Class Exam) + 300 (Final) + 100 (Term Paper) = 700

Total score (%)	Grade
>= 90%	A
>= 80%	B
>= 60%	C
>= 40%	D
< 40%	F

Accommodations Statement

Students with disabilities who are experiencing barriers in this course may contact the Access Office (<https://www.valdosta.edu/student/disability/>) for assistance in determining and implementing reasonable accommodations. The Access Office is located in University Center Room 4136 Entrance 5. The phone numbers are 229-245-2498 (V), 229-375-5871. For more information, please visit VSU's Access Office or email: access@valdosta.edu. To request reasonable accommodations for pregnancy and childbirth, contact Christina Kidd, Student Conduct Coordinator at chkidd@valdosta.edu. Please note, you will be required to provide documentation from an appropriately licensed medical professional indicating the requested accommodations are medically necessary.

Non-Discrimination and Title IX Statement

Valdosta State University (VSU) upholds all applicable laws and policies regarding discrimination on the basis of race, color, sex (including sexual harassment and pregnancy), sexual orientation, gender identity or expression, national origin, religion, age, veteran status, political affiliation, or disability. The University prohibits specific forms of behavior that violate Title IX of the Education Amendments of 1972. Title IX of the Education Amendments of 1972 prohibits discrimination on the basis of sex in education programs and activities that receive federal funding. VSU considers sex discrimination in any form to be a serious offense. Title IX refers to all forms of sex discrimination committed against others, including but not limited to: sexual harassment, sexual assault, sexual misconduct, and sexual violence by other employees, students or third parties and gender inequity or unfair treatment based on an individual's sex/gender. The designated Title IX Coordinator for VSU is Mr. Darius Thomas. To view the full policy or to report an incident visit:

<https://www.valdosta.edu/administration/student-affairs/title-ix/>

Academic Integrity: You know that cheating is a bad thing to do. Students caught cheating will receive a grade of F for the test in question and will be reported to the Dean of Students. You are expected to follow VSU's Academic Integrity Code.

From VSU's Academic Integrity Code (the full code is available at <https://www.valdosta.edu/academics/academic-affairs/academic-honesty-policies-and-procedures.php>)

"Academic integrity is the responsibility of all VSU faculty and students. Faculty members should promote academic integrity by including clear instruction on the components of academic integrity and clearly defining the penalties for

cheating and plagiarism in their course syllabi. Students are responsible for knowing and abiding by the Academic Integrity Policy as set forth in the Student Code of Conduct and the faculty members' syllabi. All students are expected to do their own work and to uphold a high standard of academic ethics."

Classroom demeanor or conduct: Every student should make the lecture a comfortable and enjoyable learning experience. Late entry to the class room or leaving early are not desirable behaviors. Common sense should be practiced and expected.

Additional Information

Strategies used to support learning: Students should take advantage of my office hours. Studying as a group (study group) should be a good idea. However, you have to complete all assignments by yourself. If cheatings are found in your works, all students involved will get a zero point in those assignments.

I will teach you and you will learn a fascinating science, quantum biology. Therefore, your intellectual enhancement from taking this course will depend on both of us.

TENTATIVE LAB SCHEDULE AND TOPICS

Date	Topic
8/16	Introduction about Instructor; Syllabus Quantum Theory - Full Documentary HD by Brian Greene https://www.youtube.com/watch?v=CBrsWPCp_rs (YouTube, about 55 min)
8/18 – 9/13	Chapter 11 Quantum Mechanics and Atomic Structure (8 lectures)
9/15	Open Notebook EXAM 1 (100 pts)
9/20 – 9/29	Chapter 12 The Chemical Bond (4 lectures)
10/4 – 10/13	Chapter 13 Intermolecular Forces (3 lectures)
10/18	Open Notebook EXAM 2 (100 pts)
10/20 – 11/15	Chapter 14 Spectroscopy (8 lectures)
11/17	Open Notebook EXAM 3 (100 pts)
11/22 – 12/1	Chapter 15 Photochemistry and Photobiology (3 lectures)
12/8	Final Exam (300 pts) 8:00 am – 10 :00 am