



Department of Biological Sciences  
Faculty of Science

14 July – 3 August 2019

**DBS Summer Course**

**Course Outline**

## I. Course Information

### 1. Course Description

The objective of this course is to provide the students with an understanding of basic principles and techniques in biological chemistry and biomedical and pharmaceutical sciences, specifically in chemistry of DNA-RNA-Protein and macro-molecules in life. The Course is structured and will be conducted in the format of lectures, tutorials, practical classes and demonstration and group project discussions. They will fall under the following four main areas:

- principles and theories in biochemistry, biophysics and structure biology that underlie chemical and molecular and cell biology
- principles and tools for genome-editing, quantitative biology and proteomics for scientific investigation
- practical approaches in design and execution of experiments, computational simulation and analyses using chemical structure analyses
- Critical scientific writing, team work and scientific communications.

### 2. Course Objectives

The objective of the Course is to help students to:

- understand the basic concepts, principles and approaches in biological chemistry and biomedical sciences;
- apply the knowledge and techniques in specific research projects; and
- indulge in teaching and research environment in NUS

### 3. Course structure (for registered students):

Course structure	No. of Sessions	Hour/session	Sub- total (hours)	Total (hours)
<b><u>Lectures</u></b>				
Morning	12	3	36	40
Evening	2	2	4	
<b><u>Tutorials/practicals</u> (afternoon)</b>				
Wet Lab Experiments	12	4	48	56
Computer analysis	1	4	4	
Imaging	1	4	4	
<b>Site/facilities visit and demonstration</b>	6	3	18	18
<b>Presentation/group discussion</b>	4	4	16	16
<b>Report/exams/assessment</b>	3	4	12	12
<b>Total</b>				142

#### **4. Course materials**

- Course book (soft copy) customized for the Course
- Protocol notes for practical classes
- Online teaching materials customized in NUS teaching management platform (IVLE)
- Solutions, reagents and other experimental materials to be used for the practical classes.
- Reference materials

#### **5. Course Coordinators and Contact**

- Course coordinator: Prof. Low Boon Chuan & Prof. Cynthia He, Department of Biological Sciences, NUS
- Administrative coordinator/contact: Mr Yan Tie, Department of Biological Sciences, NUS

#### **6. Course fee**

The Course fee is \$5000 SGD per student for the Summer Course 2019, and includes

- Tuition fee
- Registration fee
- Administration fee
- Course materials
- Group airport transport and city tour
- Shared accommodation
- Orientation and farewell events
- Social activities
- Singapore government Goods and Service Tax (GST)

Course fee must be received before the commencement of the Course to confirm enrolment in the Summer Course.

Successful registration will receive confirmation of their participation along with instructions on mode of payment.

## **II. Course Learning Targets (CLT)**

### **1. On completion of this Course, students should be able to**

- develop a sound understanding of concepts, principles and approaches of biological chemistry (CLT1);
- apply the knowledge of concepts, principles and approaches to a laboratory experiment (CLT2);
- develop communication skills through discussions, oral presentations and scientific writing (CLT3);
- become familiar with the learning and research environment in NUS (CLT4).

## 2. Teaching and Learning Activities

- Lectures: basic concepts and knowledge will be presented by NUS instructors in all classes.
- Practical classes: students will accomplish project experiment under a supervision of an instructor and teaching assistant.
- In-class discussion and tutorial: students are encouraged to participate in discussions during the lectures and tutorial, and to share opinion and comments with their peers and teaching assistants during a practical classes.
- Project work: students will conduct a project work during practical classes and write up a lab report and presentation slides for the project. Student will present their project to the whole class
- Examination: Students will be given a close-book examination in a MCQ format at the end of the course
- Scientific tour: students will be arranged to visit selected research facilities in NUS, and R&D infrastructure outside the NUS campus

## 3. Measurement of Learning Targets

Learning Targets	Teaching & Learning Activities	Measurement
CLT1	Lectures, practical classes, in-class discussion and tutorial, project work	Attendance and participation in discussion, project work
CLT2	Practical classes and project work	Attendance and participation
CLT3	Practical classes, project work and examination	Lab report and examination score
CLT4	Project work and scientific tour	Attendance and participation, and report presentation.

## III. Process of Assessment

Attendance and participation: 20%
- Participation in lectures, practical classes, tutorials and field tours and offering a proactive response in class activities
Lab report and Presentation: 40%
- Lab report and oral presentation
Examination: 40%
- 120 minute examination consists of Multiple Choice Questions (MCQs)
- MCQs will cover essential points taught during the lectures and practical classes.

NUS will issue a Certificate of Completion to each of the students upon successful completion of the course (satisfied by minimum 60% of total score) and satisfactory score as determined by home university.

#### IV. Tentative Course Schedule (yet to be finalized)

Week	Lecture/practical	subject	Supplement	assignment
1	Orientation (8 hrs)	<ul style="list-style-type: none"> <li>- Course orientation</li> <li>- Safety orientation</li> <li>- Lab familiarization</li> </ul>		
	Lecture 1 (6 hrs)	Fundamentals of biochemistry (1 – 3)	Course book	
	Lecture 2 (6 hrs)	Laboratory Techniques in Life Sciences (1 – 3)	Course book	
	Practicals (18 hrs)	DNA molecular analysis and manipulation <ul style="list-style-type: none"> <li>- Restriction Enzyme Digestion</li> <li>- DNA Electrophoresis</li> <li>- RT - Polymerase chain reaction</li> <li>- Cloning and transformation</li> <li>- DNA extraction</li> <li>- DNA Sequencing</li> </ul>	Practical notes	Practical report
	Tutorial with group discussion (2 hrs)	Tutorials and group discussion	Course book and practical notes	
	Facilities visit with demonstration (6 hrs)	Visit to research facilities <ul style="list-style-type: none"> <li>- DNA sequencing</li> <li>- Zebrafish</li> </ul>		
2	Lecture 3 (4 hrs)	Protein structure, function and chemistry (1 - 2)	Course book	
	Lecture 4 (4 hrs)	Human Genome, Gene Mutations and Diseases (1 - 2)	Course book	
	Lecture 5 (4 hrs)	Molecular Biophysics (1 – 2)	Course book	
	Lecture 6 (4 hrs)	Pharmaceuticals and Drug Designs (1 - 2)	Course book	
	Practicals (22 hrs)	Protein molecular analysis and manipulation <ul style="list-style-type: none"> <li>- Protein extraction and quantification</li> <li>- SDS-PAGE electrophoresis</li> <li>- Western Blot</li> <li>- Protein structure analysis</li> </ul>	Practical notes	Practical report
	Tutorial with group discussion (2 hrs)	Tutorial and group discussion	Course book and practical notes	
3	Facilities visit with demonstrations (6 hrs)	Visit to research facilities <ul style="list-style-type: none"> <li>- PPC</li> <li>- X-Ray</li> <li>- NMR</li> </ul>		
	Lecture 7 (4 hrs)	physical and chemical concepts in bioimaging (1 – 2)	Course book	
	Lecture 8 (4 hrs)	Research and Communication in life science (1-2)	Course book	
	Practical ( 8 hrs)	Tutorial/communication workshop: <ul style="list-style-type: none"> <li>- Human genome</li> <li>- NGS and genome studies</li> <li>- How does genome editing work</li> <li>- Applications and ethics implications</li> </ul>	notes	report
	Facilities visit with demonstration (6 hrs)	Visit to Confocal and EM facilities		
	Tutorial with group discussion (2 hrs)	Tutorial on report writing and presentation; and group discussion		
Student presentation ( 10 hrs)	Each of the student is given 15 minutes to present their lab report		Presentation PPT slides	

	Tutorial and Examination (10 hrs)	Final examination in MCQ format		examination
	Course summary (2 hrs)	<ul style="list-style-type: none"><li>- Q&amp;A and feedback on the course</li><li>- Issue a certificate for completion</li></ul>		Online feedback