

**The Chinese University of Hong Kong  
Faculty of Science  
Science Academy for Young Talent**

Summer Courses 2019  
Course Outline

***CUSA1003 Molecular Biology and Biotechnology: An Introduction***  
**分子生物學和生物技術導論**

**Introduction:**

The structure of DNA was discovered by Watson and Crick in 1953. Since then, molecular biology has been developed rapidly and changed our lives in many ways. Another important milestone in biotechnology was the invention of Polymerase Chain Reaction (PCR) by Kary Mullis in 1983 to amplify DNA. One of the well-known examples using these new technologies is the production of recombinant insulin by bacteria for the treatment of diabetes. Now, these topics become part of the new senior secondary biology curriculum in Hong Kong. To prepare students for these challenges, this course aims at helping students to learn the major concepts and methods of molecular biology and biotechnology. Topics include DNA structure, principles of molecular biology and application of recombinant DNA technology. Students will gain hands-on experience in culturing bacteria, introducing foreign DNA into bacterial cells (bacterial transformation) for recombinant protein production, running PCR and using DNA electrophoresis for paternity test.

沃森(Watson)和克里克(Crick)於 1953 年解構了脫氧核糖核酸(DNA)的結構。從那時起，分子生物學得到迅速的發展，改變了我們生活的許多方面。及後凱利穆利斯(Kary Mullis)於 1983 年發明的聚合酶鏈反應(Polymearse Chain Reaction) DNA 擴增技術，亦是生物科技另一個重要的里程碑。結合這些新技術，其中一項比較著名的應用，是利用細菌生產重組胰島素作治療糖尿病之用。現在分子生物學課題已成為香港新高中生物課程的一部分。為迎接這個挑戰，本課程旨在幫助學生加深認識/了解分子生物學和生物技術的概念和方法。主題包括 DNA 的結構，分子生物學原理和重組 DNA 技術的應用。學生將親身體驗如何將外來 DNA 放入細菌內(細菌轉化)生產重組蛋白，怎樣進行聚合酶鏈反應(PCR)和如何應用 DNA 電泳鑑定親子關係等。

**Medium of Instruction:** Cantonese supplemented with English

**Teacher:**

Professor SK Kong  
Programme of Biochemistry, School of Life Sciences, CUHK  
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**Demonstrator:**

To be determined

**Course Content:**

<p>23 July 2019 (Tuesday)</p> <p>10:00 am – 12:30 pm 2:00 pm – 5:00 pm</p>	<p><b><u>Lecture:</u></b></p> <ul style="list-style-type: none"><li>• Virus and Bacteria</li><li>• Bacterial Growth</li><li>• Aseptic Techniques for Bacterial Culture</li><li>• Bacterial Plasmid</li><li>• Bacterial Transformation</li><li>• Expression of Green Fluorescent Protein (GFP) from jellyfish in <i>E. coli</i></li></ul> <p><b><u>Laboratory:</u></b></p> <ul style="list-style-type: none"><li>• Basic Techniques – Use of pipettes</li><li>• Aseptic Techniques to Prepare Agar Plates</li><li>• Bacterial Culture – Part 1</li><li>• Bacterial Transformation – Part 1</li></ul> <p>(Expressing GFP in <i>E. coli</i>: 2008 Nobel Prize in Chemistry Work)</p>
<p>24 July 2019 (Wednesday)</p> <p>10:00 am – 12:30 pm 2:00 pm – 5:00 pm</p>	<p><b><u>Lecture:</u></b></p> <ul style="list-style-type: none"><li>• Gene and DNA Structure</li><li>• Central Dogma: DNA → RNA → Protein</li><li>• DNA Isolation, Restriction Enzymes, Ligase</li><li>• Molecular Cloning to Make Recombinant Proteins</li><li>• Polymerase Chain Reaction for DNA Isolation and Amplification</li><li>• Isothermal DNA Amplification</li></ul> <p><b><u>Laboratory:</u></b></p> <ul style="list-style-type: none"><li>• Bacterial Culture – Part 2</li><li>• Restriction Cut of DNA</li><li>• Polymerase Chain Reaction</li></ul>
<p>25 July 2019 (Thursday)</p> <p>10:00 am – 1:30 pm 2:30 pm – 5:00 pm</p>	<p><b><u>Lecture:</u></b></p> <ul style="list-style-type: none"><li>• DNA Electrophoresis</li><li>• DNA Fingerprinting</li><li>• Biotechnology: Recombinant Insulin Production &amp; Disease Diagnosis</li></ul> <p><b><u>Laboratory</u></b> (Bring your camera to record the results):</p> <ul style="list-style-type: none"><li>• Bacterial Transformation – Part 2</li><li>• DNA Electrophoresis</li><li>• DNA Fingerprinting</li></ul> <p><b><u>Assessment:</u></b></p> <ul style="list-style-type: none"><li>• Written short answer tests will be conducted at 4:30-5:00 pm.</li></ul>
<p>26 July 2019* (Friday)</p> <p>10:00 am – 1:30 pm 2:30 pm – 5:00 pm</p>	<p>Make up class</p>

<b>Duration</b>	3 whole day sessions (17 contact hours)
<b>Date</b>	23 – 25 July 2019 26 July 2019* (make up class)
<b>Time</b>	23, 24 July 2019: 10:00 am – 12:30 pm, 2:00 pm – 5:00 pm 25 July 2019: 10:00 am – 1:30 pm, 2:30 pm – 5:00 pm 26 July 2019*: 10:00 am – 1:30 pm, 2:30 pm – 5:00 pm (make up class)
<b>Venue</b>	The Chinese University of Hong Kong
<b>Enrollment</b>	25
<b>Expected applicants</b>	Students who promoting to or studying S6 who are interested in molecular biology
<b>Tuition Fee</b>	HKD 3,100.00 (including materials for experiments)
<b>Credit</b>	1.25 Academy Unit Certificates or letters of completion will be awarded to students who attain at least 75% attendance.

\* This date is reserved for make up classes in case there is any cancellation of classes due to bad weather or other factors.