Chulalongkorn School of Integrated Innovation

Next-Generation Therapies

*Dr Sebastien BERTIN-MAGHIT, PhD*

1. **Course Number** 5604309
2. **Course Credit** 3 Credits
3. **Course Title** Novel Therapies for the 21st Century
4. **Instructor / Academic Staff** Dr Sebastien BERTIN-MAGHIT
5. **Condition** None

**(Pre-requisite, Co-requisite, Concurrent)**

1. **Status (Required/Elective)** Elective
2. **Hours / Week** 3 hours
3. **Course Description**

This course explores the intersection of biology and advanced therapeutic strategies. Students will gain an understanding of fundamental biological principles, their applications in innovative therapies, including gene therapy, immunotherapy, regenerative medicine, and precision medicine. During the course, students will learn about the translation process from fundamental biology to innovative medicine.

After completion of this course, students should have a solid understanding of the bases of life and health, and should be able to understand the mechanistic of the latest therapeutic breakthrough. This dense knowledge in biology and medical techniques will prepare students for careers in healthcare innovation or further studies in biomedical sciences; it would be a great asset for careers in regulatory environment, management of projects in pharmaceutical industry, administration of hospitals and other health-related business.

1. **Course Content**

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| **Session** | **Module** |
| 1 | **Fundamentals in Cell Biology 1**. Understand how the human cell is structured, how it interacts with its environment, and other cells. Learn about cell cycle and function. Know some major cell types that are the building units of living organisms. |
| 2 | **Fundamental in Cell Biology 2**. Learn about cell culture and engineering and understand how cells can be a tool in biomedical sciences. |
| 3 | **Students’ literature research on Cell Therapy**. Students will present the results of literature research done in small groups on cell therapy. Brainstorming, Q&A, discussions. |
| 4 | **Cell therapy today and promises for the future**. Learn about the current state of the art in cell therapy, the current treatment using cells (CAR T cells, stem cells, organoids, tissue engineering, organ repair/replacement, regenerative medicine), their limitations, the regulation around them and thoughts for the future development on such techniques. This session will build knowledge on students’ research from the previous session |
| 5 | **Fundamentals in Molecular Biology 1**. Learn about genes, DNA and RNA; replication, transcription, translation. How can mutations affect health. Genetic inheritance, principles of mendelian genetics. |
| 6 | **Fundamentals of Molecular Biology 2**. Techniques of molecular biology. PCR, cloning, blotting, electrophoresis, DNA microarray. |
| 7 | **Students’ literature research on Gene Therapy**. Students will present the results of literature research done in small groups on gene therapy. Brainstorming, Q&A, discussions. |
| 8 | **Gene editing and gene therapy**. Where are we today? Promises and current limitations of gene therapy in clinical settings. CRISPR-Cas 9 and genome editing. Ethics consideration about gene editing. |
| 9 | **Genomics and Precision Medicine**. How to read the genome and what we can learn from it. Application in precision medicine and personalised therapies. Pharmacogenomics and applications. |
| 10 | **Fundamentals of Immunology 1**. The immune system and its components: immune cells, their creation, maturation, markers... |
| 11 | **Fundamentals of Immunology 2**. The immune system and its components: genetics behind immunity, antibodies, cytokines, chemokines, growth factors… |
| 12 | **Using the immune system for therapeutic applications**. Therapeutic antibodies, vaccines (traditional and new), lymphocyte-based therapies, engineering of T cells. |
| 13 | **Students’ literature research on Immunotherapy**. Students will present the results of literature research done in small groups on immunotherapy. Analyse of medical immunotherapy case-study, analyse of therapeutic antibody patents, analysis of immunotherapy research paper.  Brainstorming, Q&A, discussions. |
| 14 | **Future directions and emerging trends**. Presentation of -omics technologies; introduction of current technologies being developed for future medical/wellness applications: microbiomics, transcriptomics, proteomics, lipidomics, metabolomics. |
| 15 | **Course summary & critical thinking**. Discussions on ethical considerations and societal implications on the new technologies/therapies. E.g., would medical risk predictions be used by insurance companies to sort insured subjects? Would predictions of treatment outcome be used to sort patients in case of emergencies or pandemics? Would gene editing and cloning techniques allow us to artificially modify the Human race? |

1. **Experiments**

During this course, and depending on availabilities, students will have the opportunity to conduct some experiments: DNA extraction, ELISA, PCR, gene editing… This will a better and “hands-on” knowledge on few techniques used routinely in the medical field.

1. **Instructor**

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