Bversity

BVERSITY'S PCR TECHNOLOGY COURSE

COURSE DESCRIPTION

PCR (Polymerase Chain Reaction) is a powerful and versatile tool that has revolutionised molecular biology and has many important applications in research, forensic sciences, and diagnostics. New developments and refinements in the technique will allow for even more sensitive and specific detection of DNA. This course dives into the meticulous details about running a PCR experiment and the reagents used. The experts explain the initiation and the preparation process before and after PCR. The course deals with the parameters to check for a PCR experiment and the factors affecting it. The importance of primer designing, the associated tools, avoidance of primer-dimer formations and troubleshooting are explained.

COURSE OBJECTIVES

1. Understand PCR principles, reagents, and process.
2. Familiarise with different PCR types and latest models.
3. Master primer design software.
4. Analyse PCR results and troubleshoot issues.

COURSE CONTENT

UNIT - 1: DNA Amplification

PCR - Process of setting up a PCR reaction - Different Approaches to amplify a DNA - Latest PCR methodologies (Multiplex PCR, LAMP, etc.,) - Primers for LAMP, Multiplex PCR and RPA - Basics and Details of PCR - Different factors - Optimal values - PCR setup process of qPCR, RT PCR & qRT PCR - Role of PCR & RT-PCR in numerous fields - Use in Diagnostics and Research - Past, Present & Future of PCR - Latest Discoveries (RPA) - Scope of PCR in Research.

UNIT - 2: Primer Design

Factors to be considered while designing a primer (Temperature, GC, etc.) - Different types of primer based on the PCR Type - Primer design for a straightforward PCR & a qPCR - Primer design for a RT PCR & a qRT PCR.

COURSE OUTCOMES

1. Adeptness to PCR working and reagents.
2. Proficiency in primer design software.
3. Ability to accurately analyse PCR results.
4. Capability to troubleshoot common PCR problems.

FURTHER READING

Next-generation sequencing - This technology allows scientists to sequence large amounts of DNA or RNA in a short amount of time, providing valuable insights into the genetic makeup of organisms and the expression of genes.
https://www.udemy.com/course/next-generation-sequencing-ngs/

CRISPR-Cas9 gene editing - This technology allows scientists to make precise changes to DNA sequences, opening up new avenues for research and potential therapeutic applications.
https://www.cbehx.co.uk/product/crispr-revolutionising-genome-editing/

Transcriptomics - This field involves the study of the entire set of RNA molecules (transcriptome) that are produced by a cell or organism. Techniques such as RNA sequencing (RNA-seq) are used to analyse gene expression patterns and identify novel transcripts.
https://www.embl.org/about/info/course-and-conference-office/events/dat23-01/

Synthetic biology - Engineering biological systems to perform new functions or modify existing ones, such as creating new drugs or biofuels.
https://www.edx.org/course/principles-of-synthetic-biology

REFERENCES

1. CareerExplorer. A reference for **industry opportunities**.
   https://www.careerexplorer.com/careers/molecular-biologist/

2. Zippia, The Career Expert. A reference for **skill sets**.
   https://www.zippia.com/molecular-biologist-jobs/skills/

3. "Molecular Biology Techniques: A Classroom Laboratory Manual" by Heather Miller. A reference for **course structure and curriculum**.
   https://www.sciencedirect.com/book/9780128180242/molecular-biology-techniques

4. Molecular Biology of the Cell (MBoC). A reference for **latest trends** as well as **syllabus**.
   https://www.molbiolcell.org/

5. National Center for Biotechnology Information (NCBI). A reference for **content**.
   https://www.ncbi.nlm.nih.gov/

INDUSTRY SCOPE

On completion of this course, students can contribute to various fields such as:

- Drug Discovery, Genetic Testing and Vaccine Development in the Pharmaceutical Industries.
- Detection of infectious diseases, genetic disorders, and cancer in Diagnostic Laboratories.
- DNA fingerprinting in Forensics Science.

INDUSTRY USE CASES

1. Identify potential drug targets.
2. Design an ideal primer using Primer 3 software for any gene.
3. Interpret and evaluate the designed primer.
4. Analyse & Interpret qPCR raw data.
5. Study biological processes and diseases.
6. Detect the pathogens and the genetically modified organisms in food products.