

Course Outlines

Course Code: BI-833

Course Title: Metagenomics for Precision Medicine

Rationale

Metagenomics is a transformative field that leverages high-throughput sequencing to analyze microbial communities, requiring advanced computational skills. This course addresses the growing demand for expertise in bioinformatics and computational biology, focusing on data retrieval, analysis, and interpretation of metagenomic data. By providing hands-on training in using key metagenomics databases, Bash and R programming, and dedicated bioinformatics tools for metagenome analyses, students will acquire essential skills for modern biomedical research. The course also explores applications of metagenomics in biomarker discovery for metabolic disorders, and cancers, which will prepare students to contribute to advancements in precision medicine and healthcare through computational approaches.

Educational Objectives

1. Students will confidently work with metagenomic data by retrieving, cleaning, and analyzing datasets using Bash and R by the course's end.
2. Through practical exercises, students will develop the ability to identify and interpret microbial community profiles and their functions with high accuracy.
3. By completing a project on biomarker discovery, students will connect metagenomic analysis to real-world applications in metabolic disorders and cancer within the course timeframe.

Input Obtained from Industry/Corporate Sector/Subject Specialists/Academia

4. Input obtained/received from the maximum of the following:
 - a. Corporate Advisory Council
 - b. Industry Advisory Board (IAB)
 - c. Representative Alumni / NCAA members
 - d. Subject specialists from local universities
 - e. Subject specialists from foreign universities

(Attach reports of IAB members as Annex. The annex should include the feedback of IAB along with response / remarks / rebuttal of the institute)

The working paper and its contents will be submitted for review to industry professionals and various universities. Upon receiving their feedback, the reports will be forwarded separately for further consideration and action.

International Practices

4. (Specify the universities of repute (with ranking) where the proposed program/course is being conducted. Provide a mapping of the proposed titles with about 3-5 international references in Annex and Weblinks.)
 - a. Harvard University offers multiple courses in Metagenomics: “Gut Microbiome and Human Health (HEB 1410)”, “Microbial Communities and the Human Microbiome (IID 209)”, and “The Human Microbiome: Comprehensive experimental design and methodologies (MICROBI 360QC)”. Weblink: <https://hcmph.sph.harvard.edu/training/>
Alternative weblinks: <https://www.coursicle.com/harvard/courses/HEB/1410/>,
<https://www.coursicle.com/harvard/courses/MICROBI/360QC/>,
 - b. John Hopkins University, in their MS Bioinformatics, offers a course titled “Practical Introduction to Metagenomics (410.734)”.
Weblink: [MS in Bioinformatics Degree Details and Courses | JHU AAP](#)
 - c. Yale University, “Statistical Methods in Computational Biology”, “Applications of -Omics Technologies in Public Health: Biomarkers to Big Data”, “Microbes and Immunity”, “Apps in Systems Biology” Weblink: <https://courses.yale.edu/?keyword=microbiome&srcdb=999999>
 - d. University of Arizona offers a course titled “Metagenomics”. Weblink: [BE 487-587 Metagenomics-Syllabus-2020.docx \(arizona.edu\)](#)
 - e. University of Helsinki, Finland offers a course in metagenomics. Weblink: [Course Unit MMB-901 Microbial Metagenomics 2023– 2026 | Courses | Studies Service | University of Helsinki](#)
 - f. Boston University, USA, offers “Microbiome: Our Intimate Relationship with Microorganisms” course. Weblink: <https://www.bu.edu/academics/grs/courses/grs-bi-611/>
 - g. King’s College, London, offers “Microbiome Analysis” and “The Human Microbiome & Dysbiosis” courses. Weblink: <https://www.kcl.ac.uk/study/postgraduate-taught/courses/microbiome-in-health-disease-msc>.

Mapping: