LSM3228 Module Outline

1. Module Identity

Module Code: LSM3228
Module Title: Microbiomes and Biofilms Module
Credit: 4MC

2. Module description

In nature, microbes exist as multispecies communities (microbiota) interacting with each other and the environment/host. This typically occurs in the context of biofilms where organisms are in proximity within a protected environment of the biofilm matrix. This module primarily explores the human microbiome and its effect on development and disease and explore the role of pre- and pro-biotics in health. Mechanistic insights into microbial communities can also be gained through more controlled studies focusing on experimental biofilms. Appreciating the biology of biofilms allows us to understand the context that both human and environmental microbiota operate in.

3. Eligibility and requirements

Prerequisites: GCE 'A' Level or H2 Biology or equivalent, or LSM1301

Corequisites: NIL
Non-allowed subjects (if any): NIL

4. Intended learning outcomes (ILOs) with regard to knowledge and cognitive development

At the end of this module, students should be able to:
1. Recognize in detail what constitutes microbiota, microbiomes, and biofilms.
2. Explain and value the role of microbiomes in human development, health and wellness using a few detailed examples.
3. Explain the role of microbiome dysfunction in human disease with a few detailed examples.
4. Evaluate the role of microbiome modifying strategies and treatments and product claims.
5. Attribute the unique characteristics of mono-species biofilms to biofilm-specific behavior, matrix composition and microenvironment.
6. Attribute the complexity of multi-species biofilms to synergistic or antagonistic interactions.
7. Summarize and critique key findings from microbiome and biofilm research papers.
8. Create (design and perform) simple microbiome and biofilm studies, including analyzing data and reporting results.

5. Intended learning outcomes with regard to generic skills and attributes development This module will provide good opportunities for learning the following: a) Analytical & Critical Thinking
b) Interdisciplinary Thinking
c) Collaboration & Teamwork

This module will provide average opportunities for learning the following: a) Verbal/Oral Communication
b) Digital & Information Literacy
c) Adaptability & Learnability

d) Resilience

6. Course content and syllabus
Lecture Topics
1. Introduction to microbes, microbiomes and research methods (sequencing approaches, analyses tools)
2. Microbiomes in development, health, beauty and wellness
3. Microbiomes in disease (cancer, metabolic diseases, aging, neurological disorders etc)
4. Microbiome modulation (anti-, pre-, pro-, syn- and post-biotics, phage-editing)
5. Biofilms: stages, architecture, unique biology,
6. Inter-species interactions, from experimental biofilms to complex systems
7. Microbiomes beyond healthcare: agriculture, marine ecosystems, bioremediation etc.

Practical Topics/Sessions
1. Designing a microbiome study, sampling (pre-intervention)
2. Sampling (post-intervention), DNA extraction (all samples) and QC, 16S library prep (barcode PCR)
3. DNA gel, Qubit HS dsDNA, DNA purification with AMPure beads, 16S sequencing
4. Probiotic food/drink preparation and product evaluation
5. Set up biofilm assay. Analyze 16S sequencing results on Epi2Me.
6. Biofilm quantification and interpretation of results

7. Instructional methods
The following instructional methods will be employed to deliver content and achieve intended learning outcomes: Lectures (blended: F2F and online asynchronous),

8. Learning activities
The following learning activities will be employed to achieve the learning outcomes of knowledge, cognitive, generic skills and/or 'employability' attributes development stated in items 4 and 5 above:
- formative (ungraded) pre- and post-lecture assessments
- team-based learning (group-presentation and laboratory)
- problem-based learning (laboratory and individual assignments)

9. Assessments for evaluating students' performance

The following assessments will be employed to encourage and evaluate formative and summative learning in this module:

- Formative Quizzes = 0%
- Individual lab report =30% • MCQ CA = 25%
- Group presentation = 25%

10. Required and/or recommended readings

Required readings: Selected review and research papers will be provided/suggested through the course.

Recommended readings:

- Clean: The New Science of Skin (James Hamblin)
- The Mind-Gut Connection (Emeran Mayer)
- The Human Superorganism (Rodney Dietert)
- 10% Human (Alanna Collen)

- The Hidden Half of Nature (Anne Biklé & David R. Montgomery) • March of the Microbes (John L. Ingraham)

11. Contact information for Module Coordinator and other instructors

Ch'ng Jun Hong (Module coordinator) Email: micchn@nus.edu.sg