

Study Guide & Worksheet

Lesson 1: Building the Foundation for Indoor Fungal Microbiome Analysis

Glossary

- Microbiota: The living microorganisms present in a specific environment.
- Microbiome: The microorganisms in an environment plus their genes, molecules, interactions, and surrounding environmental conditions.
- Microbial community: A group of microorganisms living together in the same environment.
- Built environment: Human-made indoor environments such as homes, schools, and offices.
- Indoor microbiome: The community of microorganisms found inside buildings.
- DNA barcoding: Identification of organisms using a short standardized DNA sequence.
- DNA barcode: The DNA region used for species identification.
- ITS sequence: Internal Transcribed Spacer; the standard fungal DNA barcode.
- Culture-dependent approach: Identifies microorganisms after growing them in culture.
- Culture-independent approach: Identifies microorganisms directly from DNA extracted from a sample without culturing.
- Pure culture: A culture containing only one microorganism.
- Microbial isolate: A single microorganism separated from a mixed sample.
- Cell lysis: Breaking open cells to release DNA.
- Total DNA: DNA recovered from all organisms in a sample.
- PCR: Polymerase Chain Reaction; amplifies a target DNA region.
- PCR thermal cycler: Instrument that performs PCR.
- DNA sequencing: Determining the order of nucleotides in DNA.
- DNA sequencer: Instrument that reads DNA sequences.
- BLAST: Bioinformatics program that compares DNA sequences with database sequences.
- GenBank: Public database of DNA sequences maintained by NCBI.
- Bioinformatics: Use of computers to analyze biological data.
- Environmental sample: Sample collected from soil, water, air, or built environments.
- Species identification: Determining the identity of an organism.

Key Concepts

- Microbiota describes who is present; microbiome includes organisms, genes, activities, and environment.
- Indoor microbiomes influence indoor air quality and human health.
- Moisture and poor ventilation favor microbial growth.
- DNA barcoding identifies microorganisms using standardized DNA regions.
- Culture-dependent methods study organisms that grow in culture.
- Culture-independent methods detect both culturable and non-culturable organisms.
- Typical workflow: sample → DNA extraction → PCR → sequencing → BLAST → GenBank identification.

Worksheet

A. Multiple Choice

1. A microbiome includes:

- A. Only bacteria
- B. Organisms only

- C. Organisms, genes, interactions, and environment
- D. Only fungi

2. DNA barcoding identifies organisms using:

- A. Proteins
- B. Lipids
- C. A short DNA sequence
- D. Cell shape

3. Which approach detects non-culturable microbes?

- A. Culture-dependent
- B. Culture-independent
- C. Microscopy
- D. Staining

4. BLAST is used to:

- A. Amplify DNA
- B. Compare DNA sequences
- C. Culture fungi
- D. Extract DNA

5. GenBank is a:

- A. PCR machine
- B. DNA database
- C. Microscope
- D. Culture medium

B. Matching

Match: BLAST, GenBank, PCR, Cell lysis, Pure culture

Definitions: DNA amplification; Public DNA database; Break open cells; DNA comparison program; Single-species culture.

C. Fill in the Blank

- The fungal DNA barcode is the _____ region.
- PCR stands for _____.
- Cell _____ releases DNA from cells.
- GenBank stores DNA _____.
- Microbiota refers to the living _____ in an environment.

D. Sequence

Order the culture-independent workflow:

- PCR amplification; DNA sequencing; Cell lysis; DNA extraction; BLAST/GenBank comparison; Species identification.

Instructor Key

- Multiple Choice : 1-C, 2-C, 3-B, 4-B, 5-B
- Matching: BLAST–DNA comparison; GenBank–public DNA database; PCR–DNA amplification; Cell lysis–break open cells; Pure culture–single-species culture.
- Fill: ITS; Polymerase Chain Reaction; lysis; sequences; microorganisms.
- Sequence: Cell lysis → DNA extraction → PCR amplification → DNA sequencing → BLAST/GenBank comparison → Species identification.