

# Metagenomics

## What is Metagenomics?

- Study genetic material from environmental samples
- Analyze entire microbial communities
- No need to culture individual organisms
- Understand microbiome composition and function

## Approaches

### 16S rRNA Sequencing

- Amplicon-based
- Taxonomic profiling only
- Cheaper, faster
- Bacterial/archaeal identification

### Shotgun Metagenomics

- Whole genome sequencing
- Taxonomy + function
- All domains of life
- Discover novel genes/species

## Applications

Clinical

**Microbiome**

Environmental

**Ecology**

Industrial

**Biotechnology**

Disease associations

Soil, water studies

Novel enzymes

Tools: Kraken2, MetaPhlAn, QIIME2, HUMAnN3