bm211-workshops

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Preface to the 2023-24 presentation

Welcome to the 2023-24 edition of the BM211 computing workshops.

This is the first presentation of this material in this form, and we would be very grateful to hear feedback by email or through the GitHub repository Issues page.

1 Introduction

This is a book created from markdown and executable code.

See Knuth (1984) for additional discussion of literate programming.

```
1 + 1
```

```
[1] 2
```

2 Summary

In summary, this book has no content whatsoever.

```
1 + 1
```

```
[1] 2
```

Part I

Workshop 01

Our goal in this computational workshop is to introduce some concepts in microbial ecology.

Microbial Ecology

What is microbial ecology?

Microbial ecology is the scientific study of natural microbial communities. It is a hugely important, but arguably underdeveloped area of biology. Many important questions remain to be completely answered in detail:

- the composition of microbial communities
  - what microbes are found in a community?
  - what proportion of each microbe species (or other group) is present in a community?
- interactions within the community
  - is the community *stable* (or is it growing, shrinking, or changing composition)?
  - do community members share or compete for resources, and which resources?
  - do the community members effectively operate as a larger-scale system?
- interactions of a community with other organisms
  - does the gut microbial community influence the host animal's nutrition, health, or disease status?
  - does the rhizosphere microbial community influence a plant's ability to extract nutrition or energy from the environment, and contribute to protection against pathogens?
- interactions between communities
  - when two communities come together, what does the resulting community look like?
  - are there two or more separate (or interacting communities), or do they somehow combine?
- engineering new microbial communities
  - can we predict which microbes can combine into a productive community?
  - can we choose these microbes to engineer a community that achieves a particular goal (e.g. plant protection or gut health)
  - can we perturb existing communities to make them beneficial to health or achieve some other goal?

This array of questions can be summarised more simply as (Prosser 2020):

1. Who is there?
2. What is meant by “there”?
3. Who is doing what in there?
4. What is the effect of doing … to there?

Diversity Measures

This chapter will introduce the concept of a **diversity measure** in microbial ecology.

Part II

Workshop 04

Our goal in this workshop is to introduce you to handling and analysing CRISPR-Cas sequence data.

PILER-CR

This chapter will introduce the software tool `PILER-CR`, which is designed to predict the location and content of CRISPR repeats in microbial genomes.

Part III

Workshop 05

Our goal in this workshop is to introduce you to producing and interpreting phylogenetic trees.

Protein Trees

This chapter will guide you through the process of producing a phylogenetic tree from a protein sequence alignment.

References

Knuth, Donald E. 1984. "Literate Programming." *Comput. J.* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.

Prosser, James I. 2020. "Putting Science Back into Microbial Ecology: A Question of Approach." *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 375 (1798): 20190240. https://doi.org/10.1098/rstb.2019.0240.