Tutorial 1: Bacterial communities

Write an essay on the following question:

How are bacterial communities stable over time?

Your essay should consider primarily the human gut microbiome.

Reading list (= key paper)**

** Costello et al. The application of ecological theory toward an understanding of the human microbiome. *Science* (2012) doi: 10.1126/science.1224203
Coyte et al. The ecology of the microbiome: Networks, competition, and stability. *Science* (2015). doi: 10.1126/science.aad2602
Shaw et al. Modelling microbiome recovery after antibiotics using a stability landscape framework. *ISME J* (2019). doi: 10.1038/s41396-019-0392-1

Your essay should be typed and not exceed four pages of A4 excluding references (~2000 words). You can include figures if you wish.

Essays can be in either Word or pdf format and emailed to liam.shaw@zoo.ox.ac.uk 24 hours before the tutorial time **at the latest**. Essays sent any later will not receive written feedback.

Tutorials will be held on Teams and last 1 hour.

Tutorial 2: Pathogen host range

Write an essay on the following question:

Why do some pathogens infect multiple hosts and others only one?

Key review paper
Woolhouse et al. Population biology of multihost pathogens. *Science* (2001). doi: 10.1126/science.1059026
Other research papers
Bonneaud et al. Understanding the emergence of bacterial pathogens in novel hosts. *Philosophical Transactions of the Royal Society B* (2019) doi: 10.1098/rstb.2018.0328
Shaw et al. The phylogenetic range of bacterial and viral pathogens of vertebrates. *Molecular Ecology* (2020) doi: 10.1111/mec.15463

Your essay should be typed and not exceed four pages of A4 excluding references (~2000 words). You can include figures if you wish. You can include other references in your bibliography other than those listed.

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Tutorial 3: Zoonotic disease

Write an essay on the following question:

Can we predict the future of zoonotic disease?

Your essay should come to a strong conclusion backed up by evidence.

Key review paper
Morse et al. Prediction and prevention of the next pandemic zoonosis. *Lancet* (2012). doi: 10.1016/S0140-6736(12)61684-5

Other research papers
Plowright et al. Pathways to zoonotic spillover. *Nature Reviews Microbiology* (2017). doi: 10.1038/nrmicro.2017.45
Olival et al. Host and viral traits predict zoonotic spillover from mammals. *Nature* (2017). doi: 10.1038/nature22975
Gibb et al. Zoonotic host diversity increases in human-dominated ecosystems. *Nature* (2020). doi: 10.1038/s41586-020-2562-8

Your essay should be typed and not exceed four pages of A4 excluding references (~2000 words). You can include figures if you wish. You can include other references in your bibliography other than those listed.

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Tutorial 4: Evolution of SARS-CoV-2

Write an essay on the following topic:

> *Discuss the evolution of SARS-CoV-2 over the course of the COVID-19 pandemic.*

Your essay should focus on the genomic evolution of SARS-CoV-2 i.e. not the many other effects of the COVID-19 pandemic.

Reading list (= key paper)**

** Martin et al. The emergence and ongoing convergent evolution of the SARS-CoV-2 N501Y lineages. *Cell* (2021). doi: 10.1016/j.cell.2021.09.003

Rambaut et al. Preliminary genomic characterisation of an emergent SARS-CoV-2 lineage in the UK defined by a novel set of spike mutations. *Virological* (2020). url: https://virological.org/t/preliminary-genomic-characterisation-of-an-emergent-sars-cov-2-lineage-in-the-uk-defined-by-a-novel-set-of-spike-mutations/563

Andersen et al. The proximal origin of SARS-CoV-2. *Nature Medicine* (2020) doi: 10.1038/s41591-020-0820-9

Caution: There has been a huge amount published on SARS-CoV-2 (>500,000 papers and preprints). You are not expected to try to cover all of this! Rather, you should write a well-structured essay that links your selected research to evolutionary ideas. You do not have to read the papers/reports listed and should choose other ones if you like – but please be aware that many SARS-CoV-2 papers are of dubious quality…

Your essay should be typed and not exceed four pages of A4 excluding references (~2000 words). You can include figures if you wish.

Essays can be in either Word or pdf format and emailed to liam.shaw@zoo.ox.ac.uk 24 hours before the tutorial time **at the latest**. Essays sent any later will not receive written feedback.

Tutorials will be held on Teams and last 1 hour.