

Biology

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Preface

This is a live document, and is full of gaps, mistakes, typos etc.

Part I

DNA

Chapter 1

Proteins

1.1 Introduction

Chapter 2

DNA

2.1 Introduction

2.1.1 Deoxyribonucleic acid (DNA)

DNA contains nucleotides.

There are 4 types of nucleotides, which differ depending on their nucleobase:

+ Cytosine (C); + Guanine (G); + Adenine (A); and + Thymine (T).

2.1.2 Ribonucleic acid (RNA)

Part II

Cells

Chapter 3

Abiogenesis

3.1 Introduction

Chapter 4

Single-celled organisms

4.1 Components prokaryotic cells

4.1.1 Nucleoid

This contains the DNA molecule.

4.1.2 Cell membrane

A cell membrane separates the insides of cell from the environment.

Membranes are selectively permeable to compounds.

4.1.3 Cytoplasm

Gel inside the cell membrane.

4.1.4 Ribosome

4.2 Optional external parts of prokaryotic cells

4.2.1 Cell wall

This lies outside the cell membrane. This provides the cell with structural support, and allows material through to the membrane.

4.2.2 Flagellum

This is a "tail" used for movement.

4.2.3 Glycocalyx

This is a layer outside the cell wall for some cells. This can assist with cell-to-cell communication.

4.3 Chemicals in prokaryotic cells

4.3.1 Glycogen

4.3.2 Lipids

4.4 Prokaryotic cell reproduction

4.4.1 Fission

4.5 Types of prokaryotic cells

4.5.1 Bacteria

4.5.2 Archaea

4.6 Eukaryotic cells

4.6.1 Cell nucleus

4.6.2 Mitochondria

4.6.3 Mitosis

Chapter 5

Evolution

5.1 Introduction

Chapter 6

Multicellular organisms

6.1 Introduction

Part III

Neuroscience

Chapter 7

Neuroscience

7.1 Introduction

7.1.1 Single neuron

Neurons have:

+ Dendrite (takes message from other neurons + Cell body + Axon

Charge across neuron is mediated by ions. Positive or negative.

If the dendrite is stimulated, then charge increases at that point. But large number of inputs to dendrite

If many stimulated, then overall charge can change.

7.1.2 Two neurons

When stimulated, the axon stimulates dendrites of other neurons.

Axons are connected to other neurons via synapses.

When axon is positively charged, it releases neurotransmitters into the synapse.

Receptors in the dendrite detect these and positive charge released in dendrite.

Neurotransmitters removed by reuptake into axon, or break down by enzyme in synapse.

Different types of neurotransmitter can be released by the same axon. Some short lasting, long lasting, inhibitors.

page on different types of neurotransmitters? serotonin, dopamine etc

7.1.3 Hormones

SSRI

testosterone

Part IV

Immune systems

Chapter 8

Viruses

8.1 Introduction

Chapter 9

Bacterial infections

9.1 Introduction

Chapter 10

Parasites

10.1 Introduction

Chapter 11

Fungal infections

11.1 Introduction

Chapter 12

Prions

12.1 Introduction

Chapter 13

White blood cells

13.1 Introduction

13.1.1 White blood cells

T cells.

Part V

Compartmental epidemiological models

Chapter 14

Susceptible, Infectious, or Recovered models (SIR)

14.1 Introduction

14.1.1 Assumptions

Generally, k states, markov chain?

Assumptions are:

+ Lasting immunity + No births/other deaths

Components:

+ $S(t)$ - Susceptible + $I(t)$ - Infected + $R(t)$ - Removed (recovered or died)

Proportion of people who recover each period - γ .

Each period, infected can transmit to β people. Total of $I\beta$.

Not everyone susceptible though, so $I\beta\frac{S}{N}$

Dynamics:

$$+ \frac{dR}{dt} = \gamma I + \frac{dS}{dt} = -\beta I \frac{S}{N} + \frac{dI}{dt} = \beta I \frac{S}{N} - \gamma I$$

Note that $\frac{dR}{dt} + \frac{dI}{dt} + \frac{dS}{dt} = 0$

We can then work out $\frac{dI}{dS}$

$$\frac{dI}{dS} = \frac{\frac{dI}{dt}}{\frac{dS}{dt}}$$

$$\frac{dI}{dS} = \frac{\beta I \frac{S}{N} - \gamma I}{-\beta I \frac{S}{N}}$$

$$\frac{dI}{dS} = \frac{\beta S - \gamma N}{-\beta S}$$

$$\frac{dI}{dS} = -1 + \frac{\gamma N}{\beta S}$$

We can then work out $\frac{dS}{dR}$

$$\frac{dS}{dR} = \frac{\frac{dS}{dt}}{\frac{dR}{dt}}$$

$$\frac{dS}{dR} = \frac{-\beta I \frac{S}{N}}{\gamma I}$$

$$\frac{dS}{dR} = -\frac{\beta S}{\gamma N}$$

We can rewrite the infection dynamic:

$$+ \frac{dI}{dt} = \beta I \frac{S}{N} - \gamma I + \frac{dI}{dt} = I(\beta \frac{S}{N} - \gamma) + \frac{dI}{dt} = I\gamma(\frac{\beta S}{\gamma N} - 1)$$

This means that outbreak if $\frac{\beta}{\gamma} > \frac{S}{N}$

$$R_0 = \frac{\beta}{\gamma}$$

What is steady state?

$$\frac{dI}{dt} = I(\beta \frac{S}{N} - \gamma)$$

$$\frac{dI}{dt} = 0$$

$$R_0 \frac{S}{N} = 1)$$

$$\frac{S}{N} = \frac{1}{R_0})$$

$$\frac{\beta}{\gamma} > \frac{S}{N}$$

14.1.2 Vaccinations

What proportion need vaccination?

Chapter 15

Variations on SIR models

15.1 Variations on SIR models

15.1.1 SIR model with births and other deaths

15.1.2 Exposure period (SEIR model)

Susceptible, exposed, infectious, recovered.

15.1.3 No lasting immunity (SIS model)

can do SI_1SI_2 .

No lasting immunity

Susceptible - Infected - Susceptible

Infected model as before

15.1.4 SIRS

short period of no infection

15.1.5 SEIS (with exposure)

no long term immunity

15.1.6 Seasonal effects

β varies over time

15.1.7 Maternal models

MSIR

born with immunity

MSEIR

MSEIS

15.1.8 Age structured models

Chapter 16

Estimating SIR models

16.1 Introduction

16.2 Introduction

Estimating γ

Estimating β

Chapter 17

Stochastic SIR models

17.1 Introduction

Chapter 18

Behavioural SIR models

18.1 Introduction

Part VI

Cooking

Chapter 19

Ingredients

19.1 Seeds

19.1.1 Rice

19.1.2 Corn

19.1.3 Wheat

19.1.4 Coffee

19.2 Tubers

19.2.1 Potatoes

19.3 Fruit

19.4 Vegetable

19.4.1 Tomato

19.4.2 Onion

19.4.3 Pepper

19.4.4 Garlic

19.4.5 Carrot

19.4.6 Celery

19.5 Seasoning

19.5.1 Salt

19.6 Dairy

19.6.1 Milk

19.6.2 Eggs

19.7 Cane

Chapter 20

Methods

20.1 Boiling

20.1.1 Pots

20.1.2 Boiling

20.2 Frying

20.2.1 Pans

20.2.2 Frying

20.3 Grilling

20.3.1 Grilling

20.4 Ovens

20.4.1 Ovens

20.4.2 Stone ovens

20.5 Steaming

20.5.1 Steaming

Chapter 21

Dough

21.1 Preparing seeds

21.1.1 Malting

21.1.2 Milling

21.1.3 Refining

21.2 Making dough

21.2.1 Making dough

21.3 Bread

21.3.1 Bread

21.4 Pasta

21.4.1 Pasta

Chapter 22

Oils

22.1 Introduction

22.1.1 Olive oil

22.1.2 Vegetable oil

22.1.3 Infusing oil

Chapter 23

Dairy

23.1 Introduction

23.1.1 Pasturisation

23.1.2 Cheese

23.1.3 Butter

23.1.4 Cream

Chapter 24

Drinks

24.1 Coffee

24.1.1 Coffee

24.2 Beer

24.2.1 Beer

24.3 Wine

24.3.1 Wine

24.4 Tea

24.4.1 Tea

24.5 Spirits

24.5.1 Spirits

Chapter 25

Sauces

25.1 Sofrito

25.1.1 Sofrito

25.1.2 Ragu