



Welcome to A-level Biology



Key Information

Edexcel SNAB Biology (A) A - level course
10 Lessons over a 2 week period

Two teachers

Given a A-level Maths book, Edexcel course book and
practical folder to borrow for the course

No course work but there is a teacher assessed practical
competency



Welcome!



Topics are:

Topic 1: Lifestyle, Health and Risk

Topic 2: Genes and Health

Topic 3: Voice of the Genome

Topic 4: Biodiversity and Natural Resources

Topic 5: On the Wild Side

Topic 6: Immunity, Infection and Forensics

Topic 7: Run for your Life

Topic 8: Grey Matter

Year 12

Year 13



Welcome!



As Examinations

Paper 1

80 Marks

1.5 Hours

50% weighting

Topics 1-2

Paper 2

80 Marks

1.5 Hours

50% weighting

Topics 3-4

10% Maths



Welcome!



A-level Examinations

Paper 1

100 Marks

2 Hours

33.3% weighting

Topics 1-6

Paper 2

100 Marks

2 Hours

33.3% weighting

Topics 1-4 + 7-8

Paper 3

100 Marks

2 Hours

33.3% weighting

Topics 1-8

10% Maths



A-Level Biology at Newent School



Expectations:

1. You will take responsibility for your own resources (stationary/ notes/ textbooks/ revision materials)
2. If you are absent it is your responsibility to catch up on work missed
3. You must complete prior reading before lessons in order to keep up with the pace of the course
4. Any homework will need to be completed to a good standard and handed in on time

Failure to meet expectations will result
in study frees being taken off you!
This is to ensure that you catch up.



Summer task 1

You have a choice of 2 tasks

Please find attached a planning sheet for a Core Practical you will be undertaking in term 1. Investigation of the effect of temperature on membrane structure.

Read and carry out the tasks described:

- Research relevant information (science methods) and state what you will investigate.
- Develop a testable hypothesis and support with biological knowledge.
- Plan your own experimental design. Variables, apparatus, controls etc.
- Complete a risk assessment for your procedure



Summer task 2

You have a choice of 2 tasks

To create a science poster on the properties of water.

A scientific poster is a visual presentation of scientific research in a standard form. Please find some information on the properties of water and present your information in a scientific poster.

Attached is an example of a scientific poster.

INTRODUCTION

Cellulose Structure

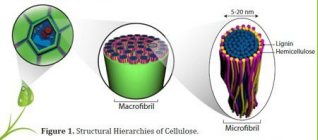


Figure 1. Structural Hierarchies of Cellulose.

- Cellulose - a β -1,4 D-glucose polymer - constitutes the largest component of Earth's biomass.
- Heavily used in the production of lumber, paper, foods, biocomposites & other biomaterials.
- Organized into compact microfibril bundles
- Amorphous regions of cellulose are disordered; accessible by enzymes & prone to chemical modifications
- Crystalline regions are highly ordered and are more difficult to modify and hydrolyze.
- Understanding the nanostructure of cellulose is critical for the improvement of the efficiency of industrial processes.



Figure 2. Glucan Chain Disorder

Super-Resolution Imaging

- Resolution of conventional fluorescence microscopy is diffraction-limited to ~200 nm

$$R = \frac{\lambda}{2NA} \quad \text{Equation 1. Abbe's Diffraction Limit}$$

- Direct stochastic optical reconstruction microscopy (dSTORM)

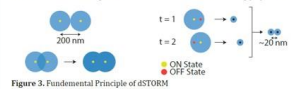


Figure 3. Fundamental Principle of dSTORM

METHODS

Cellulose Sample Preparation & Imaging

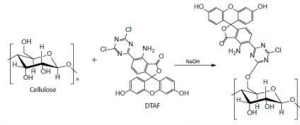


Figure 4. Grafting of Dichlorotriazinylamino Fluorescein (DTAF) onto Cellulose

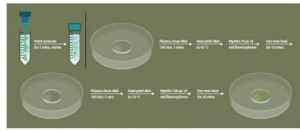


Figure 5. Cellulose Sample Preparation for dSTORM

- Buffer optimization experiments explored the effect of changes in pH and cysteamine (MEA) concentrations on localization uncertainty (resolution) (Figure 8).
- DTAF was grafted onto cellulose at two different concentrations (3:1 and 1:1 of cellulose:DTAF).

Data Analysis

- Single-molecule localizations performed by ThunderSTORM (ImageJ plugin).
- Patterns of labeling noticed (Figure 7)
- Spacings were measured for both 3:1 and 1:1 cellulose:DTAF samples (Figure 6 & 9).

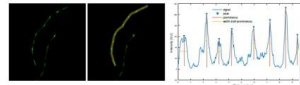


Figure 6. Labeling Spacing Measurement

RESULTS & DISCUSSION

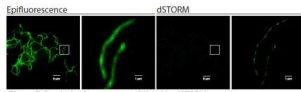


Figure 7. Resolution Improvements Offered by dSTORM

- Buffer system robust to changes in pH and [MEA]
- Smaller spacings observed in 1:1 cellulose:DTAF sample
- Unlabeled spaces could suggest areas of crystalline cellulose

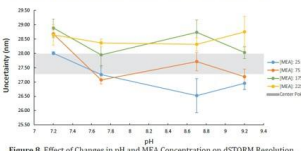


Figure 8. Effect of Changes in pH and MEA Concentration on dSTORM Resolution

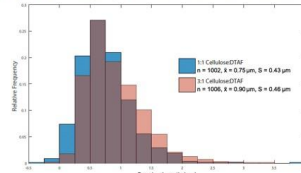


Figure 9. Labeling Spacings on Cellulose Microfibrils

Scientific poster examples

Alzheimer's Disease Neuropathology and Epidemiology

Shift in the field: a genetics perspective

Microglial genes associated with Alzheimer's disease (AD) include TREM2, which is a toll-like receptor (TLR) family member. TREM2 is a pattern recognition receptor (PRR) that recognizes and binds to a variety of ligands, including lipids, nucleic acids, and proteins. TREM2 signaling is essential for microglial homeostasis and function. Mutations in TREM2 are associated with increased risk of AD and other neurodegenerative diseases.

Microglial TREM2: the master regulator?

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Microglia: more than bystanders

Microglia are the resident immune cells of the central nervous system. They are highly motile and constantly survey the brain for signs of damage or infection. Microglia play a central role in maintaining brain homeostasis and responding to various stimuli, including pathogens, injury, and neurodegeneration.

APOE: the strongest risk

Apolipoprotein E (APOE) is a protein that is involved in lipid metabolism and transport. There are three major alleles of APOE: APOE2, APOE3, and APOE4. APOE4 is the most common allele and is associated with increased risk of AD. APOE4 is thought to contribute to AD risk by promoting the formation of amyloid plaques and neuroinflammation.

Microglia complementing synapses in AD

Microglia play a central role in maintaining brain homeostasis and responding to various stimuli, including pathogens, injury, and neurodegeneration. Microglia complement synapses in AD by phagocytosing amyloid plaques and neurofibrillary tangles, and by releasing neurotrophic factors that support synaptic function.

References

- 1. ...
- 2. ...
- 3. ...
- 4. ...
- 5. ...



Properties of water research

[Properties of Water - YouTube](#)

[Properties of Water \(A-level Biology\) - Study Mind](#)