

Numeracy problems faced by Biology undergraduates - how do we identify and address these issues?

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What's the problem?

Do Biology students have genuine numeracy problems or is it more a case of.....

“I'm sure we all knew how to do that when I was a student in 19**”

- **“Universities forced to offer maths help to new science students”**

**James Meikle, education correspondent
Wednesday April 25, 2007**

Most universities have to offer remedial maths courses for new science undergraduates because they are giving up the subject after GCSE, it was claimed yesterday. Many chemistry students have not opened a maths textbook for two years because A-level maths is regarded as too difficult by students and schools, the Royal Society of Chemistry said

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<http://education.guardian.co.uk/higher/news/story/0,,2064904,00.html>

- **“B-grade maths students are so bad, they may as well guess the answers.”**

Phil Baty, 27 August 2004

A-level maths standards have dropped to the point where B-grade students score little better in a basic university test than they would if they were randomly guessing, according to a new study. The study, which monitored the performance of first-year electronics students at York University in maths tests over the past 15 years, also shows that if today's A-grade students had sat the test 15 years ago, they would have come bottom of the class. The researchers said their findings were replicated in York's physics department.

http://www.thes.co.uk/search/story.aspx?story_id=2015367

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- Quantitative subjects were reported as having lower completion rates.
- Concerns about student numeracy were raised by FBLS, Psychology, Physics & Astronomy amongst others
- Other Universities (inc Loughborough and St Andrews) had established Mathematical Support units

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- Maths support unit established to support school and Level-1 University material.

- **NUMBER**

Numeracy and Mathematical Basics
Education Resource unit

NUMBER unit

- Electronic and paper-based support material, using material already available if possible
- Short courses, with “popular” topics identified during session
- One-to-one tuition
- Help for revision, but not with summative assessments

Mathematics Dept intend to introduce a diagnostic test

How can we help Biology Students?

- We can often identify “problem” areas from previous sessions, and there may be resources already available.
- Should numeracy be isolated from other study skills?
- Do we have the staff resources ?
- Do students know where to look for help?

Location of resources

- At present, all resources within MOODLE sites are limited to staff/students enrolled on that course.
- Should there be a central resource that can be accessed by all? This may encourage students to revisit material from previous courses / years. Staff could also see material that is already available

Current examples in Level-2

- Estimating sizes and values
- Dilution of stock solutions
- Graph drawing
- Pre-lab preparation

5A: PROTEINS & ENZYMES Calculations

Introduction

Calculations

3D Models

Structures

Interactions

Enzyme Units Specific Activity

This type of question starts with the experimental data collected in an enzyme assay: the amount of substrate converted to product per minute. (This is generally calculated from spectrometric measurements using extinction coefficients or standard curves.) The task is to convert this into the total number of international enzyme units present, taking into account the volume of the assay. An enzyme unit is defined as the enzyme activity that catalyses the conversion of 1 μmol substrate into product in one minute.

Assay volume: 2 ml

Need a hint?

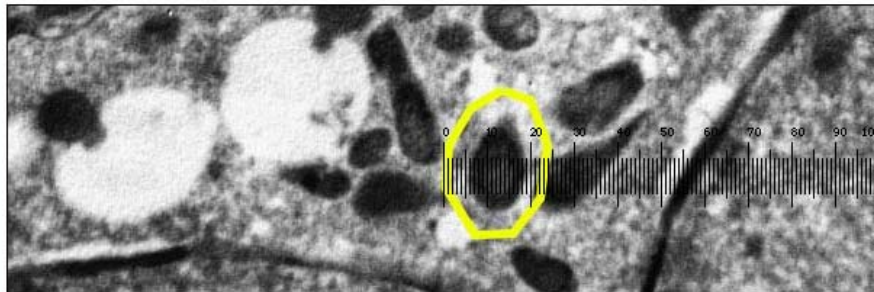
Substrate converted: 250 $\mu\text{mol/ml/min}$

Enzyme units:

Check your answer

New Question

Cells & Tissues Module 8b



Drag the ruler to the cellular structure encircled in yellow, and measure it at its widest point. Then measure the scale to find the conversion factor between ruler units and μm , and use this to calculate the width of the structure in μm .

Width: μm [Need a worked example?](#)

The correct answer is 1.53 μm (to 3 significant figures).

Microscope Measurements

Here is worked example for some hypothetical measurements:

- The cellular structure measures 25 ruler units at its widest point.
- The scale is 2 μm and measures 40 ruler units.
- The cellular structure is therefore $(25/40) \times 2 = 1.25 \mu\text{m}$ wide.

It is important to realize that, as you have only made measurements to two significant figures, a value of 1.3 μm would be equally (indeed, more) acceptable. Quoting four or more significant figures would be incorrect, and would lose you marks in an exam. It is up to you to edit the output of your calculator!

NUCLEIC ACIDS MODULE 6A

Introduction

Lectures

Labs

Tutorials

Exams

Calculations

Structures

View Genomes

DNA Structure

Elementary Intermediate Advanced 1 Advanced 2

The objective is to determine how frequently a given restriction site would be expected to occur in a stretch of DNA of unknown sequence. At this elementary level the sites contain only A, T, C or G, and you can assume that each base occurs equally frequently in the DNA. Perform your calculation so as to obtain an answer in the form 'One site every n base-pairs'.

Sequence: GTTAAC

Need a hint?

One site every base-pairs

Check your answer

New Question

Elementary Restriction Site Calculation

If the probability of finding a restriction site at any position in DNA is '1 in x ', one can expect to find that site once every x base-pairs. This (overall) probability may be calculated by multiplying the probabilities of occurrence of the base at each individual position in the site. In this simple case of a site composed entirely of A, T, G and C, the occurrence is once every 4^n base-pairs, where n is the length of the restriction site. The following is a specific example:

- Take the case of the frequency of occurrence of the dinucleotide, AT.
- If one looks at the first base in an unknown stretch of DNA there is a 1-in-4 chance it will be A (because it could equally likely be T, G or C).
- If one then looks at the second base, the chance that it will be the required T, will again be 1-in-4.
- The overall chance of finding AT is obtained by multiplying these two probabilities, 4×4 : 1-in-16.
- If you do not see why the individual probabilities are multiplied to give 1-in-16, count the number of different possible dinucleotides: AA, AC, AG, AT, CA, CC, CG, CT, GA, GC, GG, GT, TA, TC, TG, TT.

Potential Benefits vs Costs

- Development of resources may initially be time consuming.
- Logging site visits will identify topics where students lack confidence.
- Staff can view resources developed by other staff.
- Will give students a “one stop shop”

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- My thanks to Professor Graeme Ruxton for his help in preparing this presentation