



Why run practical classes?

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Outline of my talk

- Expense of practical laboratories
- Why do we do practicals?
- Types of practicals
- Demonstrating
- What lecturers say
- Assessment
- What students say



Laboratory work is expensive...

- Equipment
- Consumables
- Space
- Demonstrating
- Technicians
- Marking



Why do practicals? (1)

- Practical skills
- Use of apparatus
- Experimental design
- Produce laboratory notebook
- Write report



Why do practicals? (2)

- Illustration of lectures
- Experimental basis of theory
- Errors/critical awareness
- Problem solving
- Motivation for research
- Independent thought



Types of practical

- Full procedure labs
- No-procedure labs
- Projects
- “Dry” practicals
 - Data analysis
 - *In silico*



Full procedure labs

- Full instructions provided
- Use of apparatus
- Experimental protocols
- Methods of data analysis



No-procedure labs

- Students told to measure X
- ..determine Y
- ..demonstrate relationships
- Left to plan how to do it.



Basic equipment

- Pipettes
- Spectrophotometers
- Centrifuges
- Microscopes
- Electrophoresis
- pH meters
- Mixers



Basic techniques

- Enzyme, metabolite & macromolecule assays
- Enzymes as reagents
- Use of radioactivity
- Separation of materials
- Use of biological material
- Mutagenesis
- Cell culture



Projects

- Students given open-ended problem
- Formulate hypothesis
- Design experiments
- Test hypothesis
- Write report



“Dry” practicals

- Can be used as substitute to develop certain skills:
 - Data analysis
 - Experimental design
- Come back to these later



Demonstrating

- What is its function?
- Active vs passive
- Proactive vs reactive
- Who does it?
- How are they trained?



What lecturers say.....

Working in the lab is what I like best about being an academic. I'd like to convey that feeling of engagement and enquiry to the students.



What lecturers say.....

Some of my students seem to leave their brains at the door. They plod through the labs on autopilot. Their reports show no evidence that they were ever in the lab at all.



What lecturers say.....

When I was a student labs always seemed hushed. I prefer to hear students chatting together busily, being active, even noisy... treating the place like a workshop rather than a church



What lecturers say.....

I have a colossal amount of marking to do. I end up skimming through reports getting an overall feel for the thing and sticking a mark on it. The students don't get much in the way of detailed comments and it shows, because they make the same mistakes over and over.



What lecturers say.....

I find I enjoy it more when students have to design an experiment or work out how to do things for themselves. I'm not convinced of the value of cook book follow-the-recipe type labs.



What and how do we assess?

- Do we assess:
 - Practical skills
 - Data analysis
 - Report writing
 - Group work
 - Communication skills



Types of report

- Full traditional write-up
- Data sheets
- Data and comprehension sheets
- Group reports
- “Paper”
- Posters
- Talks



What students say: What makes a good practical

- Clear and easy to follow instructions
- Exciting/interesting laboratory class
- Helpful staff
- Learning new knowledge
- Learning new skills
- Related to lectures
- Well organised class, no student time wasted



What students say: What makes a bad practical

- Mostly the opposite!
- Too long
- Repetitive write-ups
- It does not work!



Wants vs needs: mismatches

What students want:

- Expts that work
- Do it once
- State or art
- Told what to so

What students need:

- Understand problems
- Repeats for stats
- Basic techniques
- Think for themselves



Summary

- Practical work is expensive
- Need to consider carefully what you are trying to do
- Importance of demonstrating
- Consider “dry practicals”
- Assessment needs to be considered along with practical

Dry practicals

- Paper-based
 - Example to follow
- Computer-based – “in silico”
 - Simulations

On-line practicals/simulations - 1

David Bender on-line Virtual Laboratory

http://david-bender.co.uk/Virtual_Lab.html

or

<http://www.ucl.ac.uk/~ucbcdab/simulations.htm>

Biomodel

<http://biomodel.uah.es/en/lab/> --in English

<http://biomodel.uah.es/lab/> --in Spanish (more complete)

Contact from Education Committee: Angel Herráez angel.herraez@uah.es

Enzyme purification – Spanish

<http://www.sciencedirect.com/science/article/pii/S0307441299000916>

Labster

<https://www.labster.com/simulations/>

On-line practicals/simulations - 2

Lucenz Simulator – enzyme kinetics

<http://onlinelibrary.wiley.com/doi/10.1002/bmb.2004.494032030350/full>

<http://leambiochem.weebly.com/enzyme-kinetics.html>

AG Booth – protein purification and enzyme kinetics

<http://www.agbooth.com/apps/>

Simenzkin – enzyme kinetics

<https://www.researchgate.net/publication/316077262>

Gepasi – kinetics simulations

<http://www.gepasi.org/>

On-line practicals/simulations - 3

Open University (UK) – OpenScience Laboratory

<http://www.open.ac.uk/researchprojects/open-science/>

Strathclyde Pharmacology

http://spider.science.strath.ac.uk/sipbs/showPage.php?page=software_sims

Pharmacology4you

<http://pharmacology4you.blogspot.co.uk/p/software.html>

Nuffield Foundation

<http://www.nuffieldfoundation.org/practical-biology>

Protopedia

http://protopedia.org/wiki/index.php/Main_Page