Learning and Teaching Investment Fund 2010: Final Project Report

Competency portfolio
Work Integrated Learning

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School of Medical Sciences
2011
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Executive summary

The Bachelor of Biomedical Science degree is a general degree within the School of Medical Science. It does not have a specific professional outcome or a body overseeing skill requirements and expected competencies. In order to support graduates in demonstrating the practical skills that they have developed over the course of the program, a skills audit and review has been undertaken.

The first stage has involved collecting descriptions of practical classes and compiling a detailed list of their contents. These were then confirmed and expended in discussion with the course co-ordinators. This list will be further refined and categorised before being sent to the PAC for review. This stage has taken longer than initially planned and will be extended through 2011.

Once the PAC has commented on the range of skills and identified any gaps, discussion with the program team and course co-ordinators will be used to ensure that the skills are developed and assessed. A pebble pad implementation will support student demonstration of their learning.

Outcomes

A comprehensive list of practical competencies developed through courses within the program.
Detailed project description and rationale

This project was designed to document and extend identified practical skills developed in the Bachelor of Biomedical Sciences degree to create a portfolio of competencies that graduates can use to demonstrate their work-readiness. The process and the resultant ePortfolio could be a model than can be used by other programs.

It is recognised that across the practical component of a three year degree a wide range of competencies is developed but not necessarily identified. Some of these competencies will relate to WIL-based skill development, and we will work with the PAC to determine and develop these WIL aspects. This project will

- identify competencies in all of the core courses offered to students
- identify gaps in competency development and work with course co-ordinators to include these where relevant
- work with industry through the PAC to identify skill appropriateness
- create an ePortfolio for students to demonstrate their competency development – through Pebblepad.

Information on the competencies developed was collected through analysing practical descriptions which were followed up by meetings with the course co-ordinators to confirm the listed competencies and clarify any issues in relation to them.

The following table lists the core courses within the program and identifies those that were included within the audit and reasons others were excluded. Those that were excluded in the first iteration because they were new or under review will be included in the next round of discussions.
<table>
<thead>
<tr>
<th>Year 1</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Included/Not Included</th>
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<tbody>
<tr>
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<tr>
<td>BIOL 2320</td>
<td>Introduction to Biomedical Science</td>
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<td>CHEM 1240</td>
<td>Chemistry for the Life Sciences</td>
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<td>MATH 1238</td>
<td>Statistics and Epidemiology</td>
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<td>ONPS 2423</td>
<td>Introduction to Medical Biochemistry</td>
<td>Not included: new course being developed</td>
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<td>BIOL 2273</td>
<td>Principles of Human Biology</td>
<td>Not included: information not practical skills</td>
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<td>BIOL 2257</td>
<td>Intro. to Microbiol., Immunol. &amp; Genetics</td>
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<td>ONPS 2298</td>
<td>Histology</td>
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<td>BIOL 2043</td>
<td>Human Physiology 1 - Body Systems</td>
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<td>BIOL 2319</td>
<td>Development &amp; Cell Biology</td>
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<td>BIOL 1181</td>
<td>Biochemistry &amp; Molecular Biology 2</td>
<td>Included</td>
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<tr>
<td>BIOL 2044</td>
<td>Human Physiology 2 - Body Systems</td>
<td>Not included – course under review</td>
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<td>BIOL 2274</td>
<td>Limb and Trunk Anatomy</td>
<td>Not included: information not practical skills</td>
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<td>Year 3</td>
<td>Course Code</td>
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<td>BIOL 2301</td>
<td>Applied Biochemical Methods</td>
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<td>BIOL 2144</td>
<td>Cellular Communication</td>
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<td>BIOL 2184</td>
<td>Gene Technologies</td>
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<td>BIOL 2145</td>
<td>Cardiovascular Biology</td>
<td>Not included: information not practical skills</td>
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<tr>
<td>BIOL 2275</td>
<td>Head and Visceral Anatomy</td>
<td>Not included: information not practical skills</td>
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<tr>
<td>BIOL 2357</td>
<td>Practical Biomedical Sciences</td>
<td>Not included: project based course with specific skills developed</td>
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<td>BIOL 2300</td>
<td>Biomolecules &amp; Cellular Regulation</td>
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<td>BIOL 2299</td>
<td>Biology of Tissue Growth and Repair</td>
<td>Included</td>
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<td>BIOL 2127</td>
<td>Advanced Bioinformatics</td>
<td>Included</td>
<td></td>
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<tr>
<td>BIOL 1131</td>
<td>Neuroscience</td>
<td>Not included: information not practical skills</td>
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Competency portfolio

Project outcomes and impacts

The project was designed to meet the following major outcomes:

- List of competencies as confirmed by PAC
- Plan for implementation of competencies in all relevant courses, including using Pebblepad in 2011
- An ePortfolio framework to support learning and teaching with annotated notes to support student and staff implementation in 2011
- Description of method including audit templates, student survey/ focus group protocols – aimed to help others in and beyond the School undertake a similar initiative
- Documentation to demonstrate competency development

A research assistant with knowledge of the requirements of biomedical science laboratories was employed to compile a list of the practical skills developed during practical classes, using the laboratory sheets made available from course co-ordinators and to follow this up with discussion with those co-ordinators to clarify and expand on any issues that had been identified.

The full list of practical skills and experiences encountered across the program is attached in the appendix. This is an exhaustive list, with the amount of information for each course varying. Issues related to this are discussed below.

A more refined list of skills has been developed which will be circulated to the PAC. This includes both specific skills – related to particular equipment or protocols - and also general skills.

Techniques gained at the end of first year

- Microscopy
- Aseptic techniques
- Basic staining
- Spectrophotometery
- Establish the correct procedure for the use of the pipette and burette
- Demonstrations of processing and embedding
- Recording and treatment of experimental data
- Filtration
- Thermometer use
- Time control
- Basic use of Excel
- Introduction to risk assessments and safety issues
Techniques gained at the end of second year

- Spectrophotometery, microplate reader
- Protein Assay - Biuret method, Lowry and Bradford assay
- SDS-PAGE
- Light microscopy
- Centrifuge
- 3 lead ECG
- Use of powerlab
- Fluorimetry
- Enzyme kinetics
- Use of haemocytometer and dye ie Trypan blue
- Isolation of Plasmid DNA
- Electrophoretic migrations
- Cell Culture Techniques
  - aseptic techniques
  - evaluate and describe the growth of cells in culture
  - Quantifying cell culture populations
  - trypsinising adherent cell cultures to allow quantitation.
  - use of vital dyes in determining the viability of cell cultures
  - Preparing cells
- Standard curves
- Dilutions, serial dilutions
- Differences in cuvettes
- Pipetting
- Calculations
- Graphing, tabulating, statistics

Techniques gained at end of third year

- Spectrophotometry-abs at diff. wavelengths and cuvettes
- Polarimetry
- LDH enzyme assay, calculate LDH as MIU
- Protein assay
- Dialysis procedure to separate molecules by size
- Gel electrophoresis
- Purification diagrams of eluant stain, filter papers indicating intensities,
- Enzyme kinetics
  - Studies of serine Hydrolase enzyme carboxylase
  - Effect of enzyme conc., substrate conc., methanol, Butyraldehyde
  - Inactivation of caboxylesterase
  - Tabulation, graphing, calculations
  - Kinetics of the Allosteric pyruvate kinase
- Immobilisation of enzymes in polymer supports
- Use of N2 stream and chloroform
- TLC
- Lieberman-bur chard test for cholesterol
- Gas chromatography
- Liquid scintillation counting
- Cell culture
  - to create an appropriate environment for cells to grow
  - Methods for seeding cells at equivalent densities
  - Comparing effective treatments
  - Start a primary culture of mammalian cells
  - Practice and asses sterile techniques
  - Work with different cell matrix materials
  - Develop skills to estimate the degree of confluence of a cell culture
  - Counting skills
- Cell differentiation
  - Assessment of growth of primary cells from tissue plated
  - Using cell signals to initiate pathways
  - Plate out cells add various factors to activate pathways or effect cellular differentiation
  - MSDS phase contrast microscope
  - Asses the growth of primary culture
- Immunocytochemistry
  - Immunoblotting
  - Use of primary and secondary antibodies
  - Discussion of blocking background
- Electroportation (transformation) of E.coli cells
  - Agarose gel electrophoresis of purified plasmid DNA
  - Restriction enzyme digestion of purified plasmid DNA
  - Description of variables that must be decided upon in setting up a restriction digestion experiment
  - Restriction digestion of pBCKS and pGFP with EcoRI and HindIII
  - Cloning of GFP gene into pBCKS
  - Ligation of products from restriction digestions
  - Electroportation of ligation products and plating of transformants
  - Screening and visualizing transformant Chlor resistant E.Coli - UV illumination
- The Use of Retrieval and Analysis Tools on the WWW
- Investigating the Human Genome and assembling DNA fragments to make contigs
- Tools for analysing protein sequences
- Hydropathy plots determine the hydrophobicity or hydrophilicity in protein sequences
Competency portfolio

- Protein structure modeling and visualization
- Use homology modeling (also known as comparative modeling) to derive a theoretical protein structure
- Immunohistochemistry
  - dewatering sections for immunohistochemistry
  - Staining - with antibodies, monoclonal and polyclonal, detecting specific antigens - actin isoforms, desmin, proliferation markers
  - Microscopy - interpreting the results, background versus specific staining
- Detecting cell death using the TUNEL kit to show nuclear changes in cells
- Flow cytometry -
  - Interpreting data from flow cytometer
- Choosing an internal standard and optimal conditions
- Time control and temp control
- Cutting and staining for histology - paraffin sectioning
- Calculating percentage yield, specific rotation
- Molecular weight determination
- Pipetting
- Standard curves
- Dilutions
- Calculations
- Graphing
- Synthesis of amino acids
- Working in fume and flow hood
- Filtration, Ultra filtration
- Centrifugation
- Using analytical balance
- Aliquoting
- Ratios

As discussed in the next section, delays in collecting data have required that the project length be extended and the further objectives will be achieved this year.

Changed outcomes

During the process of collecting the data it was recognised that project timelines were optimistic. Collecting the practical sheets and arranging meetings with staff members to discuss the activities and explain the skills developed took much longer than had been expected, and the compilation was therefore delayed. As complete data as was possible needed to be collected before circulating the list to the PAC and this was not done until close to the end of the year.

We have refined that list, as above, and will circulate it to the PAC prior to the next meeting, with sufficient time for them to consider the list and discuss gaps at the meeting at which it will be a focus. This has effectively stretched the project over 2
years, but will also allow a more considered implementation of any recommendations.

Some focus groups of third and first year students were held, but these were more generally focussed, rather than on the skills as identified, as they were held before the final compilation. These will be reconvened at the end of first semester or early in second semester, again using the refined list of actual and suggested skill developments, but focussing more on skills gained the previous year, which students may be more aware of now.

Following that I will have meetings with the relevant staff to discuss any suggested improvements or developments. In addition, changes are being planned to Tissue Growth and Repair for 2012 and we can feed directly into that.

The initial stages for including Pebblepad components into Introduction to Biomedical Sciences, but a discussion with Meaghan Botterill made me aware that to have a meaningful introduction of the program into the course would depend on two significant factors: that the course structure and assessment reflected and incorporated the use of Pebblepad and that all staff involved in the course were aware of Pebblepad and of how they could use it. As it is a complex course with an extensive teaching team I will work at this over the year to structure the course assessment so that Pebblepad is of value to the students.

Factors impacting on the project outcomes

The main factor which limited the success of this project was the size and experience of the project team. As the Program co-ordinator I am aware of the structure of the program and the courses within it, but do not have a background in or working experience of the areas where some of the main skill development occurs – chemistry, biochemistry and cell biology. This meant that when I met with the research assistant who analysed the practicals and collected the data I was not able to clearly refine or clarify the outcomes of the analysis. They were looking for the detail of what was in the practicals while I was seeking broad skills that were developed. This was exacerbated by the individual course co-ordinators who often felt that they were being audited to find weaknesses in their courses and so provided additional detail on material that was covered in the practicals. Having a larger team with experience in the specific disciplines would have allowed a more extensive discussion of the data as it was being collected. This is being rectified by using skills within the discipline to comment on the skill list.

The process that I implemented was to contact the course co-ordinators to tell them about the project and ask them to send myself and the research assistant copies of course guides and indicated that they would be contacted for follow up interviews. A significant proportion of co-ordinators did not respond immediately or in response to repeated emails. As both stages of the cycle (data collection, follow up interviews) depended on their response this led to significant delays – and indeed some course co-ordinators did not respond at all. Some of this could have been short circuited by requiring that program co-ordinators have access to all course blackboards, and therefore to all documents relating to a course: this would have given us immediate access to the course guides and avoided having to repeatedly ask people to send them to us.
This lack of (or slow) response from staff also led to delays in the second stage in terms of follow up interviews as it was difficult to co-ordinate times for the meetings with the availability of the research assistant and staff members. Despite contacts from myself describing the project and explaining that they would be contacted by the research assistant, I think that the requests for information and meetings were given a low priority by staff members.

I feel that the structure of the program as combining courses from a variety of disciplines in the school and from other schools can explain some of these delays. Program team meetings are not well attended by staff from within and outside the School, I think because the meetings are given a low priority within the broad range of activities that staff members undertake. Thus it is not a good forum to disseminate information about projects related to the program. And for staff teaching into a range of programs, as is now the case, the priorities of each program may not be theirs. If a broad ranging audit like this is to be carried out all relevant staff members need to be clearly, loudly and often reminded that it is happening and their role in it. Informative emails and mentions in meeting minutes can quickly be lost, leading staff to put off or ignore requests for data or meetings.

Another issue that impacts on projects like this is the constant change in structure of a program or content of a course. One course was a new one whose practicals had not been decided before it ran in second semester. Another provided practical outlines but then when the research assistant met with the co-ordinator they were informed that the practicals had changed from the ones last year (which we had the notes for) as there had been problems with them.

**Dissemination strategies and outputs**

When the project has been completed dissemination will be through various Teaching and Learning at the Portfolio and University level forums.

In addition to consultation with the PAC, I will be holding ongoing discussions with staff within the School and Discipline to continue the implementation of the project objectives.

**Evaluation of project outcomes**

As noted, the project has not met the full outcomes as planned, but will be continuing this year. Evaluation of the implementation of Pebblepad in 2012 and developments and improvements in practicals will be ongoing.
Appendix

The full skill list is attached
Year 1

Name of Course: Biology of the Cell (Biol2272)
Duration: 3 hours
Number of practicals: 5
Prelabs: yes
Marking: 20% (4% per prac)

Techniques gained
- Use of light microscope
- Schematic diagrams and labels to be drawn by students
- Electron micrographs of cells
- Preparation of slides
- Basic staining (H&E)
- Recording results in tables
- Pipeting
- Filtration
- Tabulation
- Thermometer use
- Time control
- Tabulation of results

Name of Course: Chemistry for the Life Sciences (Chem1240)
Duration:
Number of practicals: 4
Prelabs: all practicals have prelabs
Marking: 25% of total mark.
Must pass practical component to pass subject.

Techniques gained
- Laboratory safety
- Disposal of waste
- Recording laboratory work
- Drawing graphs and how to use excel
- Treatment of experimental data
- Spectrophotometry
- Care of cuvettes
- Preparation of solutions
- Acid/base titrimetry
- Establish the correct procedure for the use of the pipette and burette
- Weighing by difference
- Aliquoting
- Correct dissolving techniques
• Chemical kinetics
• Temperature control
• Graphing
• Tabulating

Name of Course: Statistics and Epidemiology (Math1238)
Duration:
Number of practicals:
Prelabs:
Marking:

Techniques gained
• Help master unit content
• Introduction to SPSS Computer Package
• How many training Sessions? ie online mastery quiz
• Notes given unit 1/2
• Worksheets

Name of Course: Introduction to Microbiology, Immunology and Genetics (Biol2257)
Duration:
Number of practicals: 3 sessions
Prelabs: Students will be given the opportunity to repeat techniques until they are satisfactorily performed. Marks relevant to the exercises carried out in these practical sessions will be included in the semester formal examination.
Marking:

Techniques gained
• Basic microbiological techniques:
  o Smearing
  o Staining
  o Microscopy
  o Streak dilution of microorganisms
  o Microscopic
  o Reading results
  o Aseptic techniques

Name of Course: Histology and Histopathology (ONPS2298)
Duration: 2-3 hours
Number of practicals: 12 sessions
Prelabs: all practicals have prelabs
Marking: 65% spot and theory test

Techniques gained
• Preparation of paraffin sections
Competency portfolio

- Buccal smear
- Staining sections with H and E
- Demonstrations of processor and embedding
- TV microscope session
- Demonstrations of microtomes and cutting, mounting sections on slides
- PAS staining
- Introduction to normal micro-anatomy of the human cells, tissues, organs and relate these to various functions

Techniques gained at the end of First Year

- Microscopy
- Aseptic techniques
- Basic staining
- Spectrophotometry
- Establish the correct procedure for the use of the pipette and burette
- Demonstrations of processor and embedding
- Recording and treatment of experimental data
- Filtration
- Thermometer use
- Time control
- Basic use of Excel
- Introduction to risk assessments and safety issues
Year 2

Name of Course: Biochemistry & Molecular Biology (Biol1177 and Biol1181)
Duration: 3 hours
Number of practicals: 9 sessions
Prelabs: yes
Marking: 4 marks lab performance and quality of results 4 marks Calculations and discussion 2 marks prelabs

Techniques gained
- Spectrophotometry, microplate reader
- Protein Assay - Biuret method, Lowry and Bradford assay
- Fluorimetry
- Enzyme kinetics
- Isolation of Plasmid DNA
- Electrophoretic migrations
- Standard curves
- Dilutions, serial dilutions
- Differences in cuvettes
- Pipetting
- Calculations
- Graphing
- Tabulating
- Explanation of the fluorescence technique
- Dilutions
- General perspectives of the purification of proteins
- SDS-PAGE to estimate MW
- Enzyme activity
- Analysis of SDS-PAGE
- Centrifuge
- Vortex
- Problem sheets
- Calculations of morality, mass of solute, concentrations, dilutions, protein, molar extinction coefficient
- must work out how to prepare a salt solution using given certain solutions
- how to prepare a experimental protocol ie standards, dilutions etc
- how to prepare colorimetric assay for glycerol using a stock standard solution

Name of Course: Human Physiology (Biol2043)
Duration:

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Competency portfolio

Number of practicals  
Prelabs: PrePrac self directed exercises reinforcing prac aims  
Marking: 
Techniques gained
Cardiovascular Practical
• 3 lead ECG measure heart rate using ECG
• identify waves in ECG trace
• use of powerlab and setup
Breathin Practical
• measure volume (tidal volume) and frequency (respiration rate) of breaths
Reflexes
• Calculate conduction velocity
• Demonstration of stretch Reflex (knee jerk or Pateller reflex)
• Reflex latency
• Pupillary light reflex

Name of Course: Developmental and Cell Biology (Biol2139)
Duration: 3 hours
Number of practicals  
Prelabs: pre prac talk and test  
Marking: Some marks allocated by demonstrator on competency in lab otherwise by write up of report

Techniques gained

• Cell Visualization Techniques
  o light microscopy
• Cell Culture Techniques
  o use of aseptic techniques in tissue culture
  o evaluate and describe the growth of cells in culture
  o Quantifying cell culture populations
  o trypsinising adherent cell cultures to allow quantitation.
  o use of vital dyes in determining the viability of cell cultures
  o measure the protein content of a culture and determine the protein content of a single cell
  o Quantifying cell cultures
  o cell counts
  o use of inverted microscope to estimate confluency
  o Preparing cells
  o viability counts use of haemocytometer and dye ie Trypan blue
  o spectrophotometery
  o Cell adherence and survival assays
  o alamarBlue™ to monitor cell adhesion as well as the cytotoxic effects of ethanol
  o Fluorescent Calcium Imaging
  o examine the properties of the widely used fluorescent calcium sensor dye fura-2-AM and to calib
  o use of Calcium imaging software
  o Setting up standards of Ca Pipetting accurately and reproducibly
Competency portfolio

- using balance
- tabulating
- statistics
- centrifugation
- Standard curves
- dilutions
- Calculations ie: averages, t-tests (statistics)
- graphing, standard curves to work out unknowns, histograms
- Early development and cell movement
- look at scientific experiments and gain experience in documenting, analyzing and interpreting data
- look at histological specimens and time lapse video microscopy

Techniques gained at the end of second year

- Spectrophotometry, microplate reader
- Protein Assay - Biuret method, Lowry and Bradford assay
- SDS-PAGE
- Light microscopy
- Centrifuge
- 3 lead ECG
- Use of powerlab
- Fluorimetry
- Enzyme kinetics
- Use of haemocytometer and dye ie Trypan blue
- Fluorescent Calcium Imaging-very basic
- Isolation of Plasmid DNA
- Electrophoretic migrations
- Cell Culture Techniques
  - aseptic techniques
  - evaluate and describe the growth of cells in culture
  - Quantifying cell culture populations
  - trypsinising adherent cell cultures to allow quantitation.
  - use of vital dyes in determining the viability of cell cultures
  - Preparing cells
- Standard curves
- Dilutions, serial dilutions
- Differences in cuvettes
- Pipetting
- Calculations
- Graphing, tabulating, statistics
Year 3

Name of Course: Applied Biochemical methods (Biol2301)

Duration: 4 hours
Number of practicals: 7
Prelabs: yes
Marking: 30% of final mark. prelabs and prac exam but prac exam is not a technical one but written one on different aspects of the subject. Marks only given on write up no marks for lab work. Good results equate to good technique.

Techniques gained

- Exclusion Gel,, Affinity, HPL, TLC, capillary gas Chromatography
- spectrophotometry-abs at diff. wavelengths and cuvettes
- Pipetting
- Standard curves
- Dilutions
- Calculations
- Graphing
- Report writing
- Polarimetry
- Synthesis of amino acids
- Working in fume hood
- Filtration, Ultra filtration
- Centrifugation
- Using analytical balance
- Calculating percentage yield, specific rotation
- Taking multiple samples
- TLC
- LDH enzyme assay, calculate LDH as MIU
- Protein assay
- Dialysis procedure to separate molecules by size
- Molecular weight determination
- Gel electrophoresis
- Purification diagrams of eluant stain, filter papers indicating intensities,
- Comparing protein content and proteolytic activity
- Determination of tetracycline, chlortetracycline and doxycycline in Chicken meat
- GC analysis
- Choosing an internal standard
Competency portfolio

- Choosing optimal conditions
- Preparations of working standards, recovery samples
- Extraction procedure using solid phase extraction
- GC analysis
- reading tables
- Evaporating samples under N2
- Ratios
- Rate Kinetic studies
- Aliquoting
- Use of water bath
- Each student prepares test tubes how is this ensured?
- Time control
- Temp control
- Optical density
- Immobilisation of enzymes in polymer supports

Name of Course: Biomolecules and Cellular Regulation (Biol2300)
Duration: 4 hours
Number of practicals: 6
Prelabs: yes
Marking: 30% of final mark. prelabs and prac exam but prac exam is not a technical one but written one on different aspects of the subject.
Marks only given on write up no marks for lab work. Good results equate to good technique.

Techniques gained
1. Enzyme kinetics
   - Studies of serine Hydrolase enzyme carboxylase
   - Effect of enzyme conc., substrate conc., methanol, Butyraldehyde
   - Inactivation of caboxylesterase
   - Protocol setup
   - Optical density λ400nm
   - Tabulation, graphing, calculations
   - Pipetting
   - Dilutions
   - Kinetics of the Allosteric pyruvate kinase
   - Relationship of initial velocity with substrate concentration
   - Effect of fructose-1,6-diphosphate on the kinetics of pyruvate kinase
   - Protocol setup
   - Kinetics of the Allosteric pyruvate kinase

Food analysis project-the investigation of bread
- Project type investigation
- Markham distillation
Competency portfolio

- Moisture content
- Ash determination
- Reducing sugar determination
- Homogenizing
- Weighing-use of scales
- Use of oven and desiccators
- Spectrophotometry
- Fluorescence spectrophotometric analysis of biomolecules
- Extractions assays
- Use of pH electrode
- Fluorescence assay
- Emission and excitation scan spec.
- Making a solution stock
- Calibration curve
- Use of a Buchi Safety Vap rotary evaporator
- Use of N2 stream and chloroform
- TLC
- Lieberman-burchard test for cholesterol
- Adsorption column chromatography
- Hydrolysis of fatty acids using: phospholipase A2, alkaline
- Fatty acid identification and quantization
- Gas chromatography
- Reading chromatograms
- Centrifuging
- Use of radioactive isotopes
- Nitrogen use
- Fume hood
- Liquid scintillation counting
- Fluorography alternative to liquid scintillation

**Name of Course: Cellular Communications (Biol 2144)**

Duration: 3 hours  
Number of practicals: 5  
Prelabs: yes  
Marking:

Techniques gained

- Introduction to cell culture
  - Introduces students to techniques used to create an appropriate environment for cells to grow
  - Methods for seeding cells at equivalent densities
  - Comparing effective treatments
  - Start a primary culture of mammalian cells
  - Practice and assess sterile techniques

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Competency portfolio

- Work with different cell matrix materials
- Develop skills to estimate the degree of confluence of a cell culture
- Counting skills
- Use of laminar flow hood
- Aseptic techniques required
- Pipetting
- Labeling
- Using controls
- Seed cells: coating surfaces, sterile liquid transfer, detaching and reseeding cells, cell counting
- Use of haemocytometer to count cells
- Calculations: mean±se, graphing, viability

- 2. Cell differentiation
  - Analysis: of cell growth and morphology on the 6 different surface treatments
    - Assessment of growth of primary cells from tissue plated
    - Using cell signals to initiate pathways
    - Students given a flask of cells they need to harvest and count to determine cell volume.
    - Plate out cells add various factors to activate pathways or effect cellular differentiation
    - Use of control
    - Labeling
    - Harvest, spinning down and resuspend cells
    - Use of haemocytometer to count cells
    - Plate out cells add various factors to activate pathways or effect cellular differentiation
    - Pipetting
    - Centrifuge
    - Calculate volume of cell suspension required for plating
    - Calculate how much KCl, forskolin to add
    - MSDS phase contrast microscope
    - Fixation: one person needs to come 1 on separate day
    - Analysis of cell growth and morphology on different coating:
      - Visual estimate: using microscope 10X : % confluence or using 9 point grid
      - Stain cell nuclei using propidium iodide: fluorescence intensity, plate reader
      - Assess the growth of primary culture
      - Phase and light microscope
      - Treating cells in culture to investigate inhibition of cellular pathways and cellular uptake
      - Harvest, spin down, resuspend cells and treat cells
      - Aseptic conditions
      - Calculations of media and drug additions to get final concentrations

- 5. Immunocytochemistry
  - Immunoblotting
  - Use of primary and secondary antibodies
  - Discussion of blocking background

Name of Course: Gene Technologies (Biol2184)

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Competency portfolio

Duration: 6 hours
Number of practicals: 6 Tutorials
Prelabs:
Marking:

Techniques gained

- Electroportation (transformation) of E.coli cells
- Competent cells prepared earlier
- Make cell solution
- Aliquoting
- Setting up electroportation apparatus ie ampage and volatage
- Plasmid DNA isolation-1,2,3 miniprep procedure
- Labeling
- Pipetting
- Centrifugation
- Tortexing
- Microfuge
- Agarose gel electrophoresis of purified plasmid DNA
- Explanation of how to best choose the right % of agarose and making of gel (gels prepared earlier
- Pipeting
- Loading samples
- Set up of electrophoresis apparatus
- Demonstrators to perform staining, destain and visualization
- Restriction enzyme digestion of purified plasmid DNA
- Description of variables that must be decided upon in setting up a restriction digestion experiment
- Volume
- Amount of DNA
- Amount of enzyme
- Time
- Temperature and buffer
- Restriction digestion of pBCKS and pGFP with EcoRI and HindIII
- Ligation of restriction enzyme digested products
- Ethanol precipitation
- Cloning of GFP gene into pBCKS
- Ligation of products from restriction digestions
- Electroportation of ligation products and plating of transformants
- Screening and visualizing transformant Chlor resistant E.Coli -UV illumination

Name of Course: Advanced Bioinformatics (Biol2127)

Duration:
Number of practicals: 6 Tutorials
Prelabs:
Marking:

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Competency portfolio

Techniques gained
- The Use of Retrieval and Analysis Tools on the WWW
- Alignments & Retrieval of Sequence Information.
- MULTIPLE SEQUENCE ALIGNMENT (MSA)
- Investigating the Human Genome and assembling DNA fragments to make contigs
- Tools for analysing protein sequences
- Hydropathy plots determine the hydrophobicity or hydrophilicity in protein sequences
- Searching for Motifs
- Prosit is a useful tool for scanning sequence
- Protein structure modeling and visualization
- Use homology modeling (also known as comparative modeling) to derive a theoretical protein structure

Name of Course: Tissue Growth and Repair (Biol2127)

Duration:
Number of practicals: 4 3 hour practicals

Prelabs:

Marking:

Techniques gained
Cutting and staining for histology - paraffin sectioning
- fixation
- embedding
- sectioning
- staining - haematoxylin and eosin to view structure

Immunohistochemistry
- dewaxing sections for immunohistochemistry
- staining - with antibodies, monoclonal and polyclonal, detecting specific antigens - actin isoforms, desmin
- microscopy - interpreting the results, background versus specific staining

Detecting cell death using the TUNEL kit to show nuclear changes in cells -
- pipetting,
- making dilutions,
- staining
- analysing results - did it work - does it only show apoptosis and not necrosis?

Flow cytometry -
- preparing cells,
- interpreting data from flow cytometer

Techniques gained at end of third year
- Spectrophotometry-abs at diff. wavelengths and cuvettes

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- Polarimetry
- LDH enzyme assay, calculate LDH as MIU
- Protein assay
- Dialysis procedure to separate molecules by size
- Gel electrophoresis
- Purification diagrams of eluant stain, filter papers indicating intensities,
- Enzyme kinetics
  - Studies of serine Hydrolase enzyme carboxylase
  - Effect of enzyme conc., substrate conc., methanol, Butyraldehyde
  - Inactivation of caboxylesterase
  - Tabulation, graphing, calculations
  - Kinetics of the Allosteric pyruvate kinase
- Immobilisation of enzymes in polymer supports
- Use of N2 stream and chloroform
- TLC
- Lieberman-burchard test for cholesterol
- Gas chromatography
- Liquid scintillation counting
- Introduction to cell culture
  - to create an appropriate environment for cells to grow
  - Methods for seeding cells at equivalent densities
  - Comparing effective treatments
  - Start a primary culture of mammalian cells
  - Practice and assas sterile techniques
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- Cell differentiation
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  - Using cell signals to initiate pathways
  - Plate out cells add various factors to activate pathways or effect cellular differentiation
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  - Asses the growth of primary culture
- Immunocytochemistry
  - Immunoblotting
  - Use of primary and secondary antibodies
  - Discussion of blocking background
- Electroportation (transformation) of E.coli cells
  - Agarose gel electrophoresis of purified plasmid DNA
  - Restriction enzyme digestion of purified plasmid DNA
  - Description of variables that must be decided upon in setting up a restriction digestion experiment
  - Restriction digestion of pBCKS and pGFP with EcoRI and HindIII
  - Cloning of GFP gene into pBCKS
  - Ligation of products from restriction digestions
  - Electroportation of ligation products and plating of transformants
  - Screening and visualizing transformant Chlor resistant E.Coli -UV illumination
Competency portfolio

- The Use of Retrieval and Analysis Tools on the WWW
- Investigating the Human Genome and assembling DNA fragments to make contigs
- Tools for analysing protein sequences
- Hydropathy plots determine the hydrophobicity or hydrophilicity in protein sequences
- Protein structure modeling and visualization
- Use homology modeling (also known as comparative modeling) to derive a theoretical protein structure
- Immunohistochemistry
  - dewaxing sections for immunohistochemistry
  - staining - with antibodies, monoclonal and polyclonal, detecting specific antigens - actin isoforms
  - microscopy - interpreting the results, background versus specific staining
- Detecting cell death using the TUNEL kit to show nuclear changes in cells -
- Flow cytometry -
  - interpreting data from flow cytometer

- Choosing an internal standard and optimal conditions
- Time control and temp control
- Cutting and staining for histology - paraffin sectioning
- Calculating percentage yield, specific rotation
- Molecular weight determination
- Pipetting
- Standard curves
- Dilutions
- Calculations
- Graphing
- Synthesis of amino acids
- Working in fume and flow hood
- Filtration, Ultra filtration
- Centrifugation
- Using analytical balance
- Aliquoting
- Ratios