THE UNIVERSITY OF SYDNEY

SCHOOL OF MEDICAL SCIENCES

EXPRESSION OF INTEREST FORM FOR SOMS HONOURS PROGRAM

Student to complete

Name:

SID: Current University (if not USyd):

Contact number:

Email:

Degree:

Estimated Final WAM:

Signature: Date:

Supervisor/s to complete

Name: Signature:

Co-supervisor Name: Signature:

Title of Project:

Project ID# (Required):

Please choose one of the modules offered in SOMS4101 (**14/02 -16/03/2022**) each week:

Week One: Core modules   Week Two:

Week Three: Week Four:

Please specify the discipline area of BAS (Hons):

This form is to be lodged to soms.education@sydney.edu.au by 30/11/2021. Please remember to attach a copy of your academic transcript.

NOTE: This is **NOT** an enrolment form. You must still submit your intent to enrol through the Faculty of Science portal online **AFTER** lodging this form to soms.education@sydney.edu.au.

A copy of this document should be uploaded as evidence of 'communication with Discipline'. Only a completed and signed EOI form will be accepted.

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Unit description

We face major health challenges in today's society that require new insights and approaches from bright minds. Tackling the big questions in medical sciences and health requires the research skills that will inform tomorrow's health outcomes for individuals and populations. Immersed in a multidisciplinary medical science and health research environment, you will develop the core skills required to undertake laboratory, clinical and population health research. You will learn how to design, execute, evaluate studies, and how to scrutinise data and research outcomes. You will work individually and collaboratively in small teams of students from different areas of specialisation to learn theoretical and practical aspects of specific research techniques, as well as the ethical and regulatory frameworks relevant to medical and health research. The practical classes, face-to-face workshops and online learning activities will equip you with knowledge and skills that will enable you to play an active role in finding meaningful solutions to difficult problems in a technical or research setting.

Unit overview

Week 1 (25%)	Week 2 (25%)[#]	Week 3 (25%)[#]	Week 4 (25%)[#]
Work Health and Safety (5%) **Westmead**	PCR/Genomics **Westmead**	Flow cytometry **Westmead**	Molecular and chemical probes in research **Camperdown**
Research Integrity (5%) **Camperdown**	Qualitative Research Methods **Westmead**	How to write a Systematic Review **Camperdown**	Advanced immunostaining **Camperdown**
An introduction to Biostatistics (10%) **Camperdown**	Tissue preparation & Histological stains **Camperdown**	Cell culture **Camperdown**	Western blotting/proteomics **Westmead**
Ethics (5%) **Westmead**	Data analysis and data visualisation **Zoom**	Mass Spec & HPLC **Camperdown**	Epidemiology **Camperdown**
			Animal Handling **Camperdown**

In week 1 students will do all modules
[#]In weeks 2-4, students will choose 1 module from the four-five available.

Modules in weeks 2-4 will all follow the same format. Pre-readings online, with a short quiz. A workshop or practical with ~10 hours face to face, and a final report/exam. All assessments will be completed by the end of week 5.

Module descriptions

Week 1 Compulsory modules

Work Health and Safety, WHS (5%)-Zoom – Najla Nasr / Greg Maxwell

This module aims to define why WHS is important and will introduce you to your responsibilities in the workplace. There will be a 2-hour interactive group workshop, where you will identify hazards via inspection of the workplace, consultation on health and safety issues and review of available information. You will also use a risk matrix to assess a risk by considering how hazards may cause harm, the likelihood of harm occurring and how severe the harm could be. You will also identify the hierarchy of risk controls from elimination to substitution, isolation, usage of engineering/administrative controls and personal protective equipment (PPE).

Research Integrity (5%) – Camperdown - Margaret Sunde / Paul Austin / Matt Naylor

This module will introduce you to the research integrity considerations you will face as a new researcher. You will participate in an introductory 2-hour workshop, where you will learn about the Research Code

of Conduct and will consider case studies in small groups, focusing on common issues such as authorship, collaborative research, data management, conflicts of interest and plagiarism. Through group discussion you will learn the best practices and solutions for navigating all facets of research integrity and be equipped to complete the University's Responsible Research Module.

Introduction to Biostatistics (10%) - Camperdown – Jacques Raubenheimer / Firouzeh Noghrehchi / Adam Dunn

This module will demonstrate a set of common tools in biostatistics including comparing distributions and performing linear and logistic regression. Focusing on the presentation of results in research reports, you will learn how to report statistical analyses in research reports, including summarising data using descriptive statistics, hypothesis testing, and calculating relative risks, odds ratios, and confidence intervals. Teaching includes two 2-hour workshops working through practical examples from medical science with optional scripts available in R.

Ethics (5%) – Zoom – Wayne Hawthorn / Sharon Lee / Nicole Clarke / Emily Knowles
This module aims to introduce the basic concepts of ethics and governance and outline the code of ethics and code of conduct. Teaching will include 3 hours interactive workshop discussions, where you will work through different scenarios to acquire the required principles in animal and human research and the frameworks, guidelines and government authorities they fall under. Through class discussion, you will also identify your key accountabilities for conducting research and evaluate your understanding of how to conduct research responsibly according to the institutional requirements and as set by legislation at both the state and federal levels.

Week 2 (select one)

1. PCR/Genomics (25%) – Westmead – Najla Nasr

This module will introduce the key concepts of gene expression analysis. In workshops (4h), you will identify components of a PCR reaction, design appropriate controls, compare and contrast PCR, qPCR, digital droplet PCR, RNA-Sequencing, NanoString and single cell RNA sequencing, articulate differences between relative and absolute qPCR and their key applications, design primers and a qPCR experiment. In practical classes (4h), you will execute the designed experiment. In the analysis session (4h), you will evaluate key parameters for high quality PCR data, learn how to present the data in a written report covering the experimental design, results, figures, discuss strategies to circumvent failed experiments, limitations and data validation.

2. Qualitative Research Methods (25%) - Westmead – Stephanie Partridge

This module will focus on research strategies in the evaluation of health promotion interventions. We will cover key stages of health promotion evaluation, focusing on qualitative research methodologies for formative and process evaluations. Both types of evaluations are important steps for understanding health promotion intervention effectiveness, especially in complex, multi-component programs. Teaching includes two 3-hour interactive workshops where students are provided examples of published literature for critical evaluation and students will work through real-world case studies presented by guest researchers. Through pre-workshop activities and workshop discussions you will learn the importance of these evaluations for implementation and dissemination of health promotion programs.

3. Tissue Preparation and Histological Stains (25%) - Camperdown – Katie Dixon/Sam Dowland

In this module you will gain a basic understanding of histological techniques, starting with fixation and paraffin-embedding of tissues, followed by cutting your own sections using a microtome. You will gain an understanding of how stains bind to different tissue types, and carry out staining protocols, including the haematoxylin and eosin stain. Using light microscopy, you will capture publication-quality images of your stained tissue, and learn how to recognise artefacts.

4. Data analysis and visualisation (25%) – Camperdown/Zoom - Adam Dunn

This module will introduce common tools and methods used in the analysis and visual representation of large and complex datasets, including introductory methods in machine learning. You will be able to access and use practical datasets published in recent research articles. You will acquire analysis methods including data visualisation and supervised machine learning methods. Using R, you will independently develop the code needed to import, process, and visualise data from raw sources, and learn how complex data generated in biomedical sciences are analysed, interpreted, and effectively communicated in research reports. **Please note that this module is designed for students who are already proficient with R** and teaches best practice methods for data analysis and visualisation in research reporting.

Week 3 (select one)

1. Flow Cytometry (25%) – Westmead – Najla Nar

This module aims to introduce the key concepts that underpin flow cytometry. In workshops (4h), you will learn about the key components of flow cytometers, how to design flow panels, identify controls and how to achieve high quality flow and cell sorting. In a laboratory practical (7h), you will prepare cells and controls according to the panel design of the workshop, perform flow acquisition and record data on a flow cytometer. In the analysis session (4h), you will analyse, interpret and learn how to present your data in a written report spanning from the experimental design, results, figures to discussing strategies to circumvent potential failed experiments, limitations and data validation.

2. How to Write a Systematic Review (25%) – Camperdown/Zoom - Dan Johnstone

In this module, you will be introduced to the theory and methodology required to undertake a systematic review of the research literature. You will gain an understanding of the PRISMA guidelines and PROSPERO registry and be trained in techniques for accessing and searching databases and the appropriate use of reference management software. You will also gain hands-on experience in the use of powerful software platforms (e.g. Covidence) for collaborative review work. This module will equip you with the tools required to more efficiently extract and manage research studies from the published literature in order to generate a systematic review or the Introduction to your Honours thesis.

3. Cell culture (25%) – Camperdown – Lenka Munoz

Cell culture is a core laboratory technique in biomedical research, cellular and molecular biology, drug discovery and biotechnology laboratories. This module will include both practical and workshop components and will provide students with the necessary technical and critical reasoning skills to successfully perform cell culture. It is intended as an introduction to cell culture basics, covering topics such as getting familiar with the requirements of a laboratory dedicated to cell culture experiments, laboratory safety, aseptic techniques, microbial contamination of cell cultures, as well as teaching basic methods for passaging, freezing, and thawing cultured cells.

4. Mass spectroscopy and HPLC (clinical and experimental application) (25%) – Camperdown – Michael Gotsbacher

This module is designed for honours students whose projects will leverage liquid chromatography (HPLC) and/or mass spectrometry (MS) – advanced analytical techniques, which are used for the identification, isolation and purification of biomolecules (small molecules, peptides, lipids or proteins). The theoretical component will introduce basic concepts relevant in chromatography, instrument configuration, method development and data analysis. The practical component will give students the opportunity to acquire their own data for biological samples on an LCMS system in the Sydney Mass Spectrometry CORE facility. These data will be analysed and discussed in detail to extract valuable information on the analyte. The objective of this module is for students to familiarize themselves with these powerful and ubiquitous techniques that underpin much of the life sciences and medical research done today. Basic knowledge in chromatographic methods is beneficial, but not required.

Week 4 (select one)

1. Molecular and Chemical Probes in Research (25%) – Camperdown – Lenka Munoz

Molecular and chemical probes are important tools widely used to modify - usually to inhibit - the activity of individual proteins in cells or organisms and hence to determine their function. However, none of the probes are perfectly specific and sufficient on their own. Combined use of molecular (e.g. siRNA, shRNA, sgRNA) and chemical (e.g. inhibitors) probes is required to reach conclusions regarding the function of an investigated protein. Through a series of interactive workshops, this module will introduce students to the field of molecular and chemical probes, and teach them how to use online resources in order to make a fully informed choice on probes and how to identify incorrect data in the published literature.

2. Advanced immunostaining - Labelling Specific Components of Cells and Tissues (25%) – Camperdown – Claire Goldsbury/Laura Lindsey

In this module you will learn how specific proteins, organelles and other components of cells and tissues can be selectively labelled and then visualized using optical and fluorescence microscopy. You will gain a broad theoretical knowledge of the diverse ways that fixed and live cells can be probed and imaged. Workshops will include important aspects of experiment design, controls as well as fluorophore and antibody selection. In the practical component of the module you will design and perform an immunolabelling experiment on frozen tissue sections including appropriate controls. You will use fluorescence microscopes to take images of your stained sections and will discuss interpretation, analysis and publishing of immunofluorescent imaging.

3. Western Blotting/Proteomics (25%) – Westmead – Najla Nasr

This module will introduce Western blotting, a common technique for protein analysis. In workshops (4h), you will learn about different types of antibodies, design an experiment using fluorescent antibodies and compare it to other detection methods, discuss whether western blot data support the conclusions drawn in published papers and whether it failed to meet required reporting and image integrity standards. In practical classes (4h), you will execute the designed experiment. During analysis (2h), you will critically interpret and generate a figure using best practice reporting, learn how to present the data in a written report covering the experimental design, results, figures, discuss strategies to circumvent failed experiments, limitations and data validation.

4. Epidemiology (25%) – Camperdown – Dan Johnstone / Tim Driscoll

In this module, you will develop an understanding of epidemiologic inquiry, distinguishing between disease description and inference. You will evaluate the spectrum of epidemiologic study designs based on the research question, the control of bias, and feasibility. You will also measure and evaluate associations between exposures and outcomes based on data obtained from epidemiologic studies. Finally, you will evaluate causal reasoning and inference in epidemiologic research, as contextualized by person, time, and place.

5. Animal Handling (25%) – Camperdown – Sarasa Mohammadi / Jonathon Arnold

This module is for students who will be using live animals in their honours projects. Students will learn the foundational principles of experimental design and practice for *in vivo* experiments using rodents. In the theory section of the module, students will learn about reducing bias, choosing appropriate endpoints, ethics, drug injections, and statistical analysis of behavioural data. In the practical section of the module, students will have small-group (max 4) lessons to learn the basic principles and best practice of husbandry (mouse and/or rat), to understand environmental variables and stressors that impact data, and to perform live mouse health checks, basic handling, anaesthesia and euthanasia, and monitoring.