

HIGH SCHOOL STUDENT SCIENCE WEEK



UBC
James Hogg
Research Centre

St. Paul's Hospital
Vancouver, BC



PROVIDENCE HEALTH CARE
Research Institute

Pursuing **real life** health solutions.

a place of mind



Institute for
HEART+LUNG Health
Strong beats. Clear breaths. Full lives.

Sponsors



UBC
James Hogg
Research Centre



Fisher Scientific

Part of Thermo Fisher Scientific



PROOF
Centre of | Centre d'
EXCELLENCE



*Biomarker solutions for
health care.*
– Solutions en soins
de santé.

High School Student Science Week Sample Program

AGENDA

Location: UBC James Hogg Research Centre (JHRC), St. Paul's Hospital, Room 166 Burrard Building, 1081 Burrard Street, Vancouver, BC

Monday

Time	Group A	Group B
8:45 AM	Arrive at the UBC James Hogg Research Centre Location: Main reception, room 166 Burrard Building	
9:00 - 10:00 AM	Attend Research in Progress Seminar Location: Gourlay Conference Room	
10:00 AM – 12:00 PM	Orientation & Safety Session Location: Gourlay Conference Room	
12:00 – 1:00 PM	Lunch	
1:00 – 4:00 PM	Lab: Introduction to ELISA	Lab: Protein Lab

Tuesday

Time	Group A	Group B
9:00 AM – 12:00 PM	Lab: Biobanking and Histology	Lab: DNA Extraction
12:00 – 1:00 PM	Lunch	
1:00 – 4:00 PM	Lab: DNA Extraction	Lab: Biobanking and Histology

Wednesday

Time	Group A	Group B
9:00 AM – 12:00 P	Lab: Protein Lab	Lab: Introduction to ELISA
12:00 – 1:00 PM	Lunch	
1.00 – 2.30 PM	Career Seminar “Is there life outside med school or grad school: a perspective on an alternate career path in science”	
2.30 – 4.00 PM	Lab: Microscopy Lab	

Thursday

Time	Group A	Group B
9:00 AM – 12:00 PM	Lab: Cell Culture Lab	Lab: Introduction to Plasmids
12:00 – 1:00 PM	Lunch	
1:00-4:00 PM	Lab: Introduction to Plasmids	Lab: Cell Culture Lab

Friday

Time	Group A	Group B
9:00 –10.00 AM	Lab: Privacy , Ethics and Biobanking: Biobanking 101	
10:00– 11:00 AM	Facility Tour (optional)	
11.00 -11.30 AM	Lab: Gross Photography	
11.30 AM - 12.30 PM	Friday Seminar Series (optional)	
12:30 – 1:45 PM	Lunch and Graduate Student & Post-doc Meet and Greet (Sponsored by Fisher Scientific)	
1:45 – 3:00 PM	Seminar: Careers in Science, Wrap-up session and completion of evaluation forms	

Event Descriptions

Research in Progress Seminar:

This is an opportunity to hear about one of many current on-going studies that is occurring at the James Hogg Research Centre. The presentation will be delivered by a graduate student or post-doctoral fellow so students will learn about one of the responsibilities they will have if they are planning to pursue graduate school in the future.

Orientation and Safety Session:

Students will learn about the history of the James Hogg Research Centre as well as the research that is actively being pursued today. This will be followed by an introduction to the week's events and a safety lesson. Identification badges, lab coats and goggles will be handed out to all participants.

Introduction to ELISA (Enzyme-Linked Immunosorbent Assay):

Biological samples like blood and tissue contain many types of proteins and often researchers are interested in just one particular protein. One way of accurately measuring the level of a specific protein is an ELISA. There are many different kinds of ELISAs, including competitive and sandwich methods, but all are based on the same principle: specific binding between an antigen and an antibody.

In this lab students will learn:

- about serum and plasma samples
- about antigens and antibodies
- the theory behind ELISAs and different types of ELISAs
- to perform an ELISA to measure the amount of a glycoprotein in unknown samples

Introduction to Western Blotting (Protein Lab):

Biological samples like cultured cells and tissue samples contain many different types of proteins. In a cell culture setting, researchers often expose cells to different treatments to see how protein expression changes as a result of those exposures. Specific protein expression can be characterized from these cells based on the molecular weight of the protein. Western blotting is one way of doing this. Western blotting includes running SDS-PAGE gels, transferring of proteins to the special membranes and probing with specific antibodies.

In this lab students will learn:

- the theory behind Western blotting (running the gels and transferring proteins to nitrocellulose membranes)
- how to pour the gels based on protein size i.e. molecular weight
- how to separate the proteins by sodium dodecyl sulfate (SDS)-polyacrylamide gel electrophoresis (PAGE)
- hands-on experience loading the gels.

The James Hogg Research Centre (JHRC) Biobank:

The JHRC has a long history of biobanking that has contributed greatly to the knowledge it has produced over the years. Students are given an introduction to what biobanking is, its purpose, as well as an opportunity to view some of our specimens.

In this session students will learn:

- about the purpose and use of biobanking
- about the relation to pathology
- about what a normal human heart or lung looks like
- to archive tissues using different fixatives – this will be the basis of the histology session

Histology:

An introduction to what histology is and why we use it will be explained in this laboratory session. A common technique used routinely in clinical and research laboratories will be demonstrated.

- Tour of Histology lab
- Brief lecture of tissue processing and sample acquisition
- Demonstration of frozen tissue cryo-sectioning
- Demonstration of paraffin section and H&E staining
- Microscopic viewing of tissue structures

DNA Extraction Lab:

Many research studies today involve investigating people's genetic make-up. The first step is extracting the DNA and the second is identifying the nucleotide at a specific site. Students will have an introduction to step one, DNA extraction.

In this session we will:

- Discuss how DNA extraction works in theory (handout provided)
- Demonstrate proper use of micropipettes
- Perform DNA extraction from a mouthwash sample using a commercially available kit
- Explain differences between kits, pros and cons
- Discuss the parallel kits and how the steps are simplified.
- Quantify the amount of DNA in each sample using the Nanodrop (if time permits)
- Students may try simple steps of the protocol

Introduction to Microscopy:

This session will provide an introduction to the use of the light microscope, fluorescent microscope and whole slide imaging for basic science and clinical research purposes. Common downstream techniques including basic image analysis techniques will be explored. Students will be using computers and software to:

- Analyze images from light microscopy
- Study co-localization from fluorescent microscopy
- Study histopathology using whole slide imaging software (Aperio)

Cell Culture Lab:

The investigation of a single cell type under defined conditions is a method used by researchers to help simplify and study complex systems. Students will be given an opportunity to see how this technique can be used, including the challenges and limitations of it. Specifically, students will learn about:

Tissue Culture room basics:

- biological safety level 2 definition
- personal protective gear (gown, gloves, shoes)
- types of biological safety cabinets

How to grow and observe cells:

- information on types of cells (adherent vs. suspension)
- different types of flasks used to maintain cells
- types of media used for cells and the function of each component
- cell growth – steps of the growth curve
- microscope technique

Sterile technique:

- Demonstration of experimental set-up in the biological safety cabinet
- Background information on cell line stimulation
- RNA stabilization of cells
- Passaging and plating of cells
- Trypsinizing cells (use of a chemical to remove adherent cells from the flask)
- Cell counting using a hemocytometer (each student can take turns counting cells in a square)

Freezing of cells (if time permits, otherwise verbal explanation)

- cryopreservation media
- freezing slowly, thawing fast
- liquid nitrogen tank safety

Introduction to Plasmids:

The term plasmid was first introduced by the American molecular biologist Joshua Lederberg in 1952. Plasmid was described as an extra-chromosomal DNA molecule that is separated from the chromosomal DNA. Plasmid is capable of replicating independently of the chromosomal DNA. In many cases, plasmid is circular and double-stranded.

Plasmids used in genetic engineering are called vectors. Plasmids have been widely used in biomedical research labs as important tools to multiply and express a particular gene that is translated later into the gene product, called protein. This gene translation product, the protein, will be used by the researchers to study the gene function. Besides the gene of interest that is inserted into the plasmid vector there are several important

High School Student Science Week Sample Program

elements on the vector that work together to fulfill function of replication and production of the gene in a suitable host.

Students will be introduced to:

- The concept of plasmid DNA
- How to read the plasmid DNA map- functions of the important elements on the vector in replicating the gene of interest
- Use of restriction enzyme to release a specific fragment
- Agarose gel electrophoresis as one of the principal tools to identify the size of the DNA fragment released by the restriction enzyme reaction
- Photographing and analyzing the result

Privacy, Ethics and Biobanking: Biobanking 101

This lecture discusses the importance of privacy in the setting of ethical research with special emphasis on biobanking for clinical research. Students will learn about:

- Biobank principles and operation
- Ethical guidelines in human research
- Informed consent

Optional tour:

- GEM Facility (to be described in orientation)

Gross Photography

Students will learn the basics of photography and basic orientation to digital single-lens reflex (SLR). The application of the class will be for gross specimen photography.

Students will learn:

- lighting, aperture, speed as well as a basic orientation to digital SLR
- essentials of photographing gross specimens
- to photograph their own gross specimens chosen from the Biobank collection

Graduate Student Meet & Greet:

- Graduate student brief introductions on how they became interested in science and what life is like as a graduate student
- Time will be available to ask the graduate students questions on career choices

Special Seminar: Careers in Science

Ever wonder what it really takes to have a career in science or what science careers are available? Find out during this special presentation.

Wrap-up session:

- Feedback from the students regarding the week
- Return of laboratory safety equipment (goggles, lab coat)
- Completion of VSB evaluation forms