Undergraduate Research Projects Summer 2020

Here are the project titles available for undergraduate research students for summer 2020. For 2020 we will introduce History research projects. These projects will be confirmed and circulated in the first week of December.

- **Dates:**
  - 6-week Undergraduate Research Projects (24 Glasgow credits)
  - Arrival: Wednesday the 17th of June
  - Mandatory orientation: Thursday 18th and Friday 19th of June
  - Academic programme: Monday 22nd of June – Friday 31st of July
  - Local holiday: Monday the 20th of July (no classes/lab activity)
  - Vacate housing by 10am on Saturday 1st of August

- **Fees:**
  - See Learning Abroad Center’s website for 2020 programme fee.
  - **What’s included in the tuition fee?**
    - Tuition
    - Orientation pack
    - Orientation and welcome event
    - Scottish Cultural Immersion Programme – including 2 weekend day trips
    - Airport pick-up on arrival day
      - Students arriving on Arrival Days between 7am and 7pm will be met at airport and transported to their university accommodation
  - **Accommodation**
    - All students must apply for summer accommodation within 72 hours after accepting UoG offer for course
    - Accommodation is not included tuition fees
    - Accommodation fees are paid directly to UoG through the Mycampus portal
    - Single study bedroom in a shared flat
    - Accommodation is co-ed at UoG
    - Room allocation is on a first come basis and is allocated by central accommodation services
    - Shared kitchen and bathroom facilities
    - Walking distance to main campus
    - WIFI and sport centre membership included
    - Bed linen provided

- **How to apply:**
  - Check pre-requisites and ILTS requirements for your preferred project below
  - Apply to UofM Study abroad office first, indicating research project preference (3 choices rates 1-3, 1 being most desirable) – provide a short 250 word supporting statement alongside your choices.
  - Once students have been nominated by the Learning Abroad Center, they should apply to UoG via website: [International Summer School website](#)
  - UofG’s application portal closes 15th April 2020
  - Upload all required documents to receive unconditional offer
  - Accept unconditional offer
    - [Information on the application process](#)
  - Apply for accommodation 72 hours after accepting unconditional offer
  - International Summer School enquiries email
    - rio-internationalsummerschools@glasgow.ac.uk

- **Contact hours:**
  - Student should expect to be in the lab and conducting research related activities and independent study, Monday-Friday from 9am-5pm.
  - There will be a weekly inter-disciplinary research seminar.
Life Sciences

Convenor Dr Sonya Taylor

Overview:
To provide an opportunity to undertake a research project and present the results both in the form of a research article and as an oral presentation.

Intended Learning Outcomes:
By the end of this course, students will be able to:

1. Prepare a preliminary list of goals to be achieved during the project in collaboration with the project supervisor;
2. Demonstrate an understanding of the literature related to the research project;
3. Demonstrate research skills appropriate to the area of specialisation;
4. Deliver a short talk, giving the background to the project and summarising its key outcomes;
5. Write a cogent, clear and concise written report summarising their findings and/or the state of research in their chosen field.

Assessment:

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<th>Method</th>
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<td>Pre-arrival assignment/ literature review</td>
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<td>Written exam</td>
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<td>Laboratory Report</td>
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<td>Project output</td>
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<td>Oral assessment and presentation</td>
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<td>Practical skills assessment</td>
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<td>Set exercise</td>
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Assessment has 4 components: a literature review ("Report" 15%) which is undertaken in advance of starting the 6-week project; the supervisor's assessment based on research notebook, research performance, attitude and participation (20%); an oral presentation (10%) which takes place during the last week; and a written laboratory report (55%) which is submitted on the last day of the 6-week project.

Requirements of entry:

Eligible students must have ideally completed 2nd year of the Undergraduate Degree, majoring in a Biological Science. A good grasp of written and verbal English is required. A GPA of 3.0 for American Students or a B grade average equivalent. Students having completed their first year of Undergraduate studies may be considered for entry, this will be at the course convenors discretion.

Background knowledge of microbiological, molecular and microscopy techniques is desirable but not essential, training can be provided.

Research Project titles and descriptions:

The project will use conventional microbiological techniques to sample from a range of urban environments that present thermal challenge and seek out mesophilic and thermophilic organisms able to survive and grow in these conditions. The properties of these bacteria will be analysed and identification will be attempted by sequencing of the 16s rRNA gene. Students on the project will develop skills in microbiology and molecular biology, and the project will offer substantial opportunity for independent investigation.

2. **Bacteria in Freshwater: A Historical Record of Past Pollution?**

The aim of this project will be to characterize the bacteria of faecal origin in a local watercourse, to establish which indicator organisms are present, determine if any are pathogenic to humans, and then to attempt detection of bacteriophage. Students on the project will develop skills in environmental monitoring, microbiology and molecular biology.

3. **Using *Caenorhabditis elegans* as a Model Organism for Genetic Screens.**

The aim of this project will be to establish an experimental system with *C. elegans* using a forward genetic approach. Using ethylmethanesulfonate (EMS), a mutagen that induces direct mutations in DNA, such as missense and nonsense mutations you will screen populations of *C. elegans* looking for any phenotypic changes that may be biologically interesting and attempt to further characterize the mutants. In addition, *C. elegans* is an excellent model organism for the study of addiction to compounds such as alcohol and caffeine, areas that can also be investigated during the project. This is a very exciting project as the outcome is unknown and it may lead to the identification of a new mutant phenotype.

4. **Investigating the reliability of Daphnia as a model to study the autonomic control of heart rate.**

The project will use neuropharmacological techniques to investigate the receptor system responsible for controlling the heart rate and will seek to compare that to what is known about our own autonomic nervous control of heart rate. It is known that the Daphnia HR will slow in response to parasympathetic stimulation using Acetylcholine and conversely increase by sympathetic stimulation, but there is limited information regarding the receptor systems involved and the pharmacology of the controlling system. The project will involve basic manipulation Daphnia under dissection microscopes such that their hearts can be easily viewed, and heart rate determined. Once proficiency in this technique is established, a systematic pharmacological investigation of the neural control of heart rate in the Daphnia will be conducted.

All the projects will offer substantial opportunity for independent investigation.

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**Chemistry**

**Convenor:** Dr David France

**Overview:**

To provide an opportunity to undertake a research project and present the results both in the form of a research article and as an oral presentation.

**Intended Learning Outcomes :**

By the end of this course students will be able to:

6. Prepare a preliminary list of goals to be achieved during the project in collaboration with the project supervisor.
7. Demonstrate an understanding of the literature related to the research project.
8. Demonstrate research skills appropriate to the area of specialisation.
9. Deliver a short talk, giving the background to the project and summarising its key outcomes.
10. Write a cogent, clear and concise written report summarising their findings and/or the state of research in their chosen field.
Assessment:

Assessment has 4 components: a literature review ("Essay" 15%) which is undertaken in advance of starting the 6-week project; the supervisor’s assessment based on research notebook, research performance, attitude and participation (20%); an oral presentation (10%) which takes place during the last week; and a dissertation (55%) which is submitted on the last day of the 6-week project.

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Requirements of entry:

Majoring in Chemistry or a related discipline.
Applicants should normally have successfully completed their sophomore year.

Research project titles and descriptions:

1. Co-creating enquiry-focused experiments for the Organic Chemistry Teaching Laboratory

Dr Ciorsdaidh Watts

The School of Chemistry has designed and implemented online pre- and post-lab interactive activities for organic laboratories over the past two years. These have proved extremely popular with students and their introduction has led to significant increases in student confidence, technical ability, and satisfaction. While these outcomes are encouraging, undergraduate students continue to express frustration that in-lab practicals seem disconnected from lecture courses and do not promote team-working or enquiry-focused skills. Students have identified these skills as important graduate attributes, and it is therefore vital that we address these concerns where possible, including in the design of practical experiments.

Therefore, the aim of these projects, is to research, design, optimise, enquiry-focused organic practicals, to enhance the student learning experience. The projects will provide participating students with valuable experience in organic synthesis, experimental techniques and equipment use, as well as problem-solving, team-working, and communication.

Specifically, the projects will involve re-designing experiments that are currently part of the organic laboratory course at Glasgow. Students will explore key organic synthetic strategies, such as the use of Grignard reagents, Suzuki couplings (catalytic cycle shown below), the Wittig and Dieckmann reactions, amongst others. Participating students will also be trained in core techniques, including the use of column chromatography, distillation, TLC analysis and IR and NMR spectroscopy. Work will be undertaken in a working lab setting, and will be supervised directly by Dr Ciorsdaidh Watts.
2. 3D Printing of Gels

Prof. Dave Adams

Hydrogels prepared from low molecular weight gelators are formed as a result of hierarchical intermolecular interactions between gelators to form fibres, and then further interactions between the self-assembled fibres via physical entanglements to give a network. These interactions can allow hydrogels to recover quickly after a high shear rate has been applied. This means that it is possible to 3D print these gels (see figure). We are interested in directly being able to 3D print gels for a number of applications, but to be able to do this effectively, we need to understand the link between the networks formed and how effective the printing is. In this project, we will investigate a number of different gels which have different networks to determine which gels are best printed under a number of conditions.

3. Self-assembly in Polyoxometalates

Dr Laia Vilà-Nadal
http://www.chem.gla.ac.uk/wp/lvn-group/

Research in LVN group centres on understanding self-assembly. The strategies that nature employs to construct assemblies of polynuclear clusters are still unclear. During her career Dr Vilà-Nadal studied the assembly process of metal oxide clusters— and described— in several publications, see below— that despite the great number of controlling factors, within the small nuclearity range, these systems can be understood combining theoretical simulations (e.g. DFT,
MD, CPMD, etc.) and experimental methods (e.g. ESI-MS experiments, NMR, UV vis, etc.). In this research we aim to understand, control and apply self-assembly to a wide range of molecular based systems leading to control of assemblies made from a variety of hard, soft, and hybrid materials using theory. Initially we will focus in two main applications of these new designed molecules, firstly to improve existing complementary metal-oxide-semiconductors (CMOS) technology and secondly as all-inorganic porous materials (POMzites). The use of oxide based materials in electronics provides a way to further increase the circuit density in electronic devices, beyond the limitations of lithography. POMzites conceptually, bridge the gap between zeolites and metal–organic frameworks (MOFs) and establish a new class of all-inorganic metal oxide frameworks that can be designed using topological and reactivity principles similar to MOFs. To start this work, we will leverage Dr Vilà-Nadal’s experience in molecular metal oxides, or polyoxometalates (POMs) since they offer a route to achieve this control at a molecular level, and she has been working in the field for over 10 years.

Self-assembly in POMs: My HISTORY... so far

4. Chemistry of the F-Elements

Dr Joy Farnaby
joy.farnaby@glasgow.ac.uk
http://www.gla.ac.uk/schools/chemistry/staff/joyfarnaby/#/researchinterests.publications.articles

The f-elements (Ln and An) have wide application in materials science as a result of their unique electronic, photophysical, magnetic and nuclear properties. The processing of nano-structured materials from molecular precursors is increasingly important in pursuit of lowering cost and increasing performance with device miniaturization. We are an inorganic group focusing on synthesis of molecular f-element complexes and their transformation into materials. We can offer projects in:

- Luminescence Imaging
- Catalytic Nanoparticles
- Materials Synthesis
- Ligand design
- Molecular Synthesis

All projects will include synthetic air-sensitive coordination or organometallic chemistry (Schlenk-line, Glovebox) and characterisation techniques (multinuclear NMR, EPR, XRD, UV-vis, IR, Electrochemistry).

Please contact me for further details.
5. **Luminescence Switching using Plasmonics**

**Dr. Affar S. Karimullah**

With the advent of technologies such as quantum computing and quantum radars, the need for new devices to control quantum states of materials are emerging. Luminescence is a property directly linked to the quantum state of a molecule. Using luminescence as a read-out mechanism we aim to control quantum states of organic molecules using plasmonics in an effort to create all light-based transistors. Our initial experiments have shown how the Purcell effect can be used to potentially achieve this goal. Specific plasmonic resonances have been able to trigger certain luminescent processes in organic molecules. The project will involve working with various nano fabricated plasmonic samples coated with specific organic molecules and measuring the changes in fluorescent properties with respect to the plasmonic design parameters.

![Diagram](image.png)

6. **Block copolymer self-assembly and polymer particles**

**Dr. Bernhard V. K. J. Schmidt**

[www.schmidt-lab.com](http://www.schmidt-lab.com)  
 [@schmidtpolylab](mailto:schmidtpolylab)

Polymer self-assembly is one of the major methods to synthesize defined polymer particles that can be utilized for various applications, e.g. as filler materials, for biomedical applications or optical applications. In our projects, we synthesize novel polymer particles from biocompatible polymers to achieve various structures in aqueous environment, e.g. capsules or hydrogel particles. The particles will be used to encapsulate biomacromolecules (proteins or enzymes) as well as small molecules (dyes or drugs) or as reaction environment (nano reactor). With the specific design of our polymers we can introduce additional properties like degradability, stimuli-response or targeted delivery, which will be tailored according to envisioned application. In the end, we target to utilize the particles in biomedical applications for example drug-delivery or enzyme therapy.
Psychology

Convenor: Dr Jude Stevenson

Overview:

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Requirements of entry:

Eligible students must have ideally completed 2nd year of the Undergraduate Degree, majoring in Psychology. Students having completed their first year of Undergraduate studies may be considered for entry, this will be at the course convenors discretion.

Research project titles and descriptions:

1. **Psychology of behaviour change: Healthy and sustainable food choices.**

   This project will develop tools to promote food choices that benefit people and planet health. We will examine how people cognitively represent plant-based foods, and how these representations can be shifted to increase desire for such foods. Working on this project will develop skills in literature review, experiment design, running an online or field study, understanding qualitative and quantitative data, and presenting results to varied audiences.

2. **Exploring adolescent wellbeing in the #sleepyteens research project**

   This project involves working with survey data from thousands of Scottish adolescents in the national #sleepyteens research project, which includes measures of wellbeing, sleep and social media experiences. Students will be supported to review and present current research literature in this field. Students will develop skills in data wrangling and reproducible data analysis.