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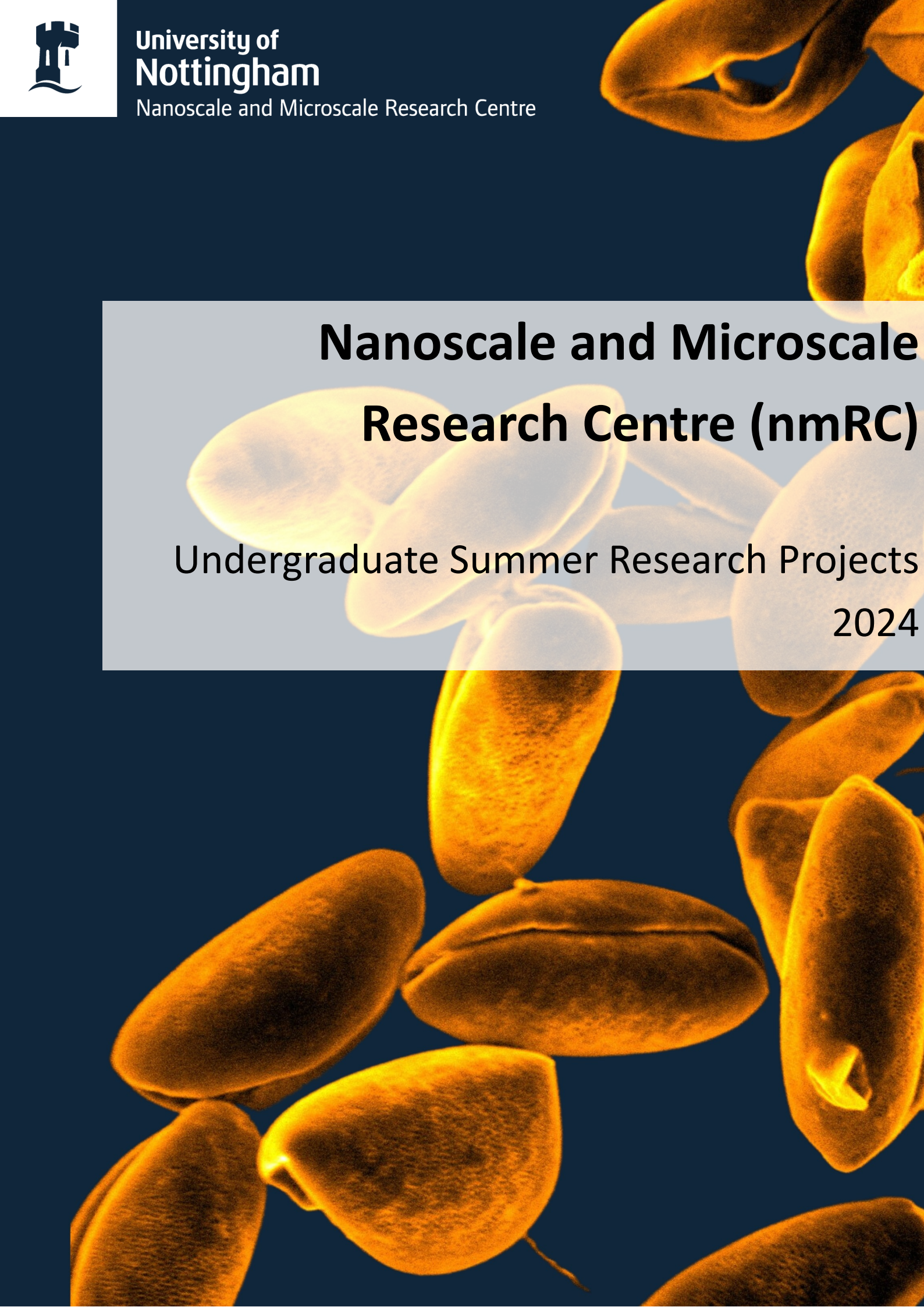
Nanoscale and Microscale Research Centre



# Nanoscale and Microscale Research Centre (nmRC)

## Undergraduate Summer Research Projects 2024

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# UNDERGRADUATE SUMMER RESEARCH PROJECTS 2024

The Nanoscale & Microscale Research Centre (nmRC) is delighted to announce three funded summer research projects are now available to University of Nottingham Undergraduate students. These studentships will last for **six to eight weeks** between **July and August 2024** and are a great opportunity for those interested in developing a career in research and / or keen for experience in a world leading analytical facility.

The projects are open to **second** and **third** year (if moving into a fourth year / masters equivalent) students from any discipline around UoN. Students who's student status will be lost in the summer (i.e. currently completing their final year) are unfortunately ineligible.

Selected students will get hands-on experience within an acclaimed research environment (www.nottingham.ac.uk/nmrc) using a range of cutting edge experimental techniques, academic methods, communication media and fundamental laboratory skillsets to contribute to real and current scientific projects. The research projects available are designed to offer an opportunity to view, experience and contribute to the University's research and knowledge exchange activities. Guided learning will be blended with both general and technically specific training in laboratory practice in addition to opportunities to engage with our research community and visit a broad range of our facilities.

Please read the introductory details to the projects that follows for more specific details.

## Funding:

The studentships will be undertaken for between six to eight weeks with £285.00 being paid to each student per week (£1,710-£2,280 in total). Standard length is six weeks but an adjustment up to eight may be considered on a case by case basis as appropriate. Projects will also possess an experimental budget to enable use of relevant facilities.

## Eligibility and Timing:

This opportunity is open to **second and third (where moving into a 4th year or Masters equivalent )** year University of Nottingham **Undergraduate** students who are interested in developing a career in or around research. Candidates must be averaging a **2.1 or above**. The placements will take place between **July and September 2024**. Initial applications will be reviewed on closing, with shortlisted candidates invited to interview.

## How to apply:

1. **Please complete the application form via the following link:**

   **https://forms.office.com/e/Kzncm8JqNF**

2. **Please e-mail a copy of your CV to nmrcenquiries@nottingham.ac.uk**

## Closing Date:

**Monday 10th June.**

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# PROJECT 1:

# "SURF'S UP!" COMMUNICATING SURFACE SCIENCE TO AN EXTERNAL AUDIENCE


## Dr Luke Norman, Dr Anna Kotowska, Dr Graham Rance, Dr James Kerfoot



**Knowledge Exchange (KE)** is a two-way dialogue between a University and an external partner to realise benefits e.g. societal, economic etc. That dialogue must often be tailored for a variety of audiences including the broader scientific community, commercial entities and the wider public. Many considerations are needed to target a particular audience correctly, including the language used, level of explanation, and engagement media selected. These could include brochures, interactive displays, and videos.

This project will highlight the various **surface science techniques** and facilities that we offer at the nmRC to a range of different audiences by creating a **portfolio of engagement resources**. Surface characterisation techniques are important in many industries such as; catalysis, electronics, and environmental science in order to understand the properties (structure and composition), and performance of materials. Key techniques include: **Raman spectroscopy, secondary ion mass spectrometry (SIMS), atomic force microscopy (AFM), and X-ray photoelectron spectroscopy (XPS)**. Different types of samples (representing multiple areas of research and development) will be evaluated in order to compare and contrast the pros, cons, and capabilities for each technique.

The overall aim is to produce a brochure for surface science at the nmRC that will incorporate the use of **interactive elements** such as **linked datasets, infographics, and videos**. The target audience is primarily commercial entities who may be interested in accessing our services but we would also like elements to be repurposed towards a public audience too.

**The student undertaking the work will have opportunities to:**

⇒ Develop an understanding of knowledge exchange.

⇒ Develop science communication skills and gain awareness of variations on engagement media.

⇒ Enhance their use and awareness of digital learning and communication skills.

⇒ Acquire understanding and hands-on experience of Raman spectroscopy and atomic force microscopy techniques.

⇒ Acquire understanding of secondary ion mass spectrometry, and X-ray photoelectron spectroscopy.

⇒ Produce a brochure for use by the nmRC as part of its KE activities.

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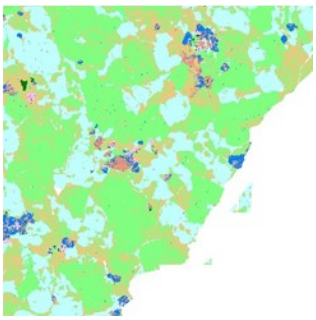
# PROJECT 2:

# "SPECTROCKSCOPY": STUDYING ROCK COMPOSITIONS USING ELECTRON MICROSCOPY IN-SITU TECHNIQUES


## Lorelei Robertson[1], Dr Nigel Neate[1], Martin Roe[1], Dr Magret Damaschke[2]

1. Nanoscale & Microscale Research Centre (nmRC)
2. British Geological Survey, Keyworth





**Electron Microscopy** and its associated analysis techniques are powerful tools that can be used to inform us about the structure and chemistry of materials. These techniques can be particularly useful for **Geological and Natural Environment** disciplines e.g. to understand the mineral composition of the rock and ground below us. Such data can be vital to help inform decisions about subsurface energy storage and the development of geothermal systems.

This project will be a collaboration with the British Geological Survey (BGS) on their UKGEOS underground observatory Cheshire project (https://www.ukgeos.ac.uk/), working on samples taken from borehole cores that have been scanned using X-ray fluorescence (XRF). The BGS data has shown changes in the core chemistry around an aquifer transition zone. Using **Scanning Electron Microscopy (SEM)** and its analytical techniques, the structure and chemistry of sub samples from this transition region will be analysed on the microscale to better understand the compositional and chemical changes in this transition zone. The data will be analysed and processed, to advance the learnings from the larger scale **XRF** data.

This project focuses on geological data analysis and processing. While any geological knowledge from a candidate would be favourable, it is not necessary, as training will be provided during the project.

**The student undertaking the work will have opportunities to:**

⇒ Collaborate with the British Geological Survey (BGS) a world leading geological survey and global geoscience organisation.

⇒ Opportunity to visit BGS Core scanning facility and wider BGS assets.

⇒ An introduction to various Scanning Electron Microscopy techniques, including instrument training.

⇒ Training on geological sample preparation.

⇒ Training on basic geological sample characterisation and identification.

⇒ Training in data processing and data analysis.

⇒ Development of presenting to a scientific audience skill.

⇒ Contribution to a UKGEOS project.

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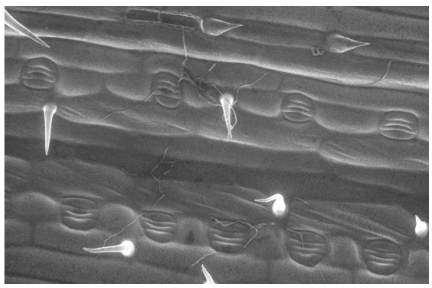
# PROJECT 3:

# VEGI TALES: AN INVESTIGATION OF STRUCTURAL CHANGES IN FROZEN AND WILTED VEGETABLES USING CORRELATIVE IMAGING TECHNIQUES


## Nicola Weston[1], Jordan Kirby[1], Dr Julie Watts[1], Dr Gleb Yakubov[2], Dr Chris Parmenter[1]

1. Nanoscale & Microscale Research Centre (nmRC)
2. School of Biosciences



This project aims to investigate ultrastructural changes in vegetables following wilting or freezing, as these processes result in significantly reduced palatability, and impact negatively on diet quality especially for lower socioeconomic groups. It will develop and optimise a method to prepare fresh, frozen/frozen thawed, and wilted carrots for a variety of correlative imaging techniques e.g. confocal, environmental scanning electron microscopy (ESEM) with elemental mapping, cryogenic-SEM, and potentially Raman spectroscopy of localised areas of interest identified.

The optimisation of parameters to freeze and cut thin sections of vegetables in order to yield a flat surface for better imaging and elemental mapping will be conducted. The latter will be utilised as a method of investigating subcellular plant structures thus identifying smaller and more localised areas for potential Raman investigation. This project will also explore the design and development of new cryostat (cold sectioning tool) holders to ease the transfer of cut samples from the cryostat to the ESEM. In addition, a comparison of cryo-planed tissue block faces imaged in the ESEM at -20 $^{o}$C with standard freeze fracture methods in the cryo-SEM will be undertaken.

Developing methods to prepare plant and food samples for SEM will be useful for future work in this field. The main output will be to produce a method document for nmRC users or to produce a short publication / applications note for the food & materials science community.

**The student undertaking the work will have opportunities to:**

⇒ Develop an understanding & gain experience of various soft matter, hydrated sample preparation methods.

⇒ Acquire understanding and hands-on experience of a range of electron and light microscopy techniques.

⇒ Develop presentation skills.

⇒ Increase understanding of experimental design & method development.

⇒ Gain experience of working in a team & collaborating.

⇒ Produce a methods document or applications note for use by the nmRC and food scientists.