JUNIOR RESEARCH ASSOCIATE SCHEME

2024

LAUNCH EVENT

FIND OUT MORE ABOUT
THE JRA SCHEME
ON OUR WEBPAGES

SCAN ME

Welcome to the JRA 2024 Launch

Jeremy Niven
Dean of the Sussex Researcher School

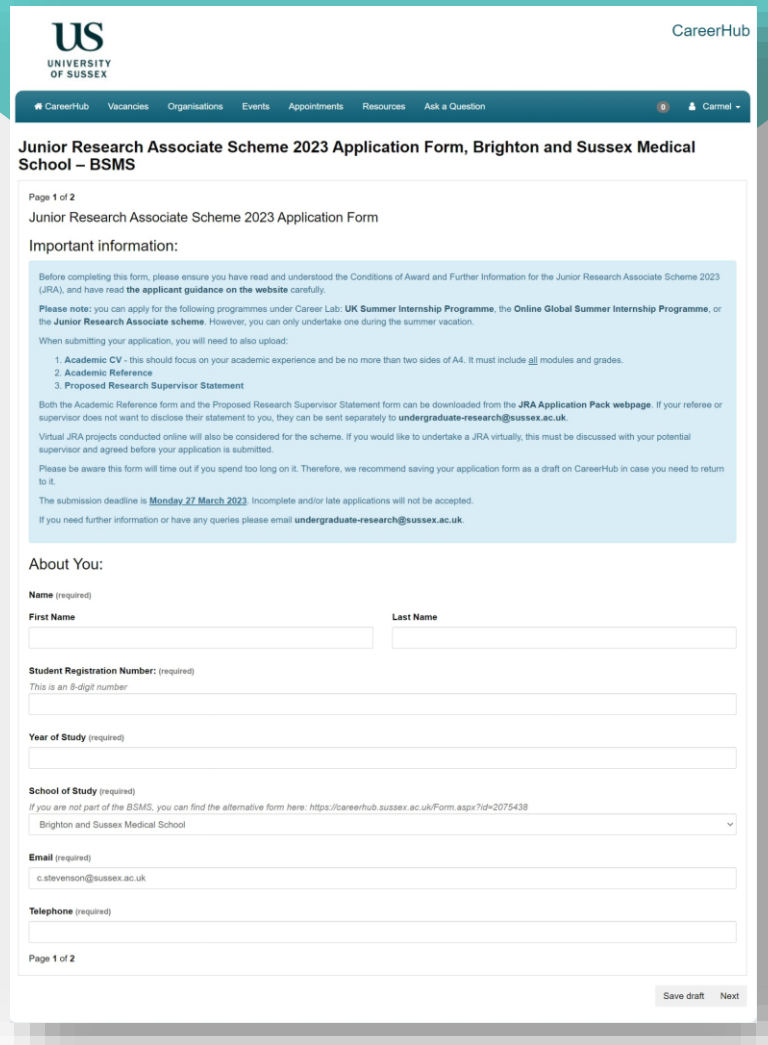
The JRA Application Process

Maddie Talbot

Senior Coordinator

2024 Applications open – Wednesday 14th February

The online application form can be found on our webpages, in the 'Applying for the JRA' section.



Step 1: Check your eligibility

- You must be an undergraduate student at the University of Sussex
- You must be in their middle year of study (i.e. have completed one year of study and not to be in their final year)
- You must have a good academic track record, noting any barriers to achievement
- You must have a genuine interest in pursuing postgraduate study

Step 2: Find a Supervisor

You might decide to either join a pre-existing research project or propose your own research project. Either way, you will need to identify an academic willing to act as your supervisor for eight weeks.

To join an existing research project, you should approach faculty in your department to learn what research projects are currently underway on campus and whether you are able to join any of these as a JRA.

If you want propose your own project, you should look for academics who have research interests similar to your own.

How you approach your potential supervisor will depend on your previous relationship with them, as well as on the type of research you wish to undertake. This is an important part of the JRA process, and something you should think about carefully.

Further guidance and support can be found on the Sussex Undergraduate Research pages

Step 3: Prepare your application

Research Proposal & Summary

Once you have identified your supervisor and your research question, it is time to write your research proposal and summary. This should be no longer than **1,500** words for the proposal and **150** words for the summary and should be checked by your potential supervisor.

When you have finished your proposal, be sure to proofread it before submitting it on the online application form via CareerHub.

Supervisor Statement

This form is to be completed by the individual who will act as the main supervisor on the JRA proposed research project. Once completed it should be submitted by the student via the online application form.

It is your responsibility to ensure that your supervisor completes this form by the application deadline. If your supervisor is submitting their forms to us directly, then please let us know.

Academic Reference

This form should provide the JRA awarding panel with an honest indication of your academic performance while at Sussex. This form should therefore be completed by a faculty member who knows you well enough to answer the questions.

Once completed it should be submitted by the student via the online application form. If your referee is submitting their forms to us directly, then please let us know.

Current CV

This is a copy of your **current academic CV**, to be no more than two A4 pages in length, focusing on academic experience and including all modules and grades.

Be sure to proofread it before submitting it on the online application form via CareerHub.

Widening Participation Statement

We want the JRA scheme to benefit all students who are enthusiastic about a future in research, we particularly want to make it accessible to students who might not otherwise be exposed to research or consider a research career.

This may include, but is not limited to, specific ethnic minority groups, students with a disability, mature students, care experienced students, estranged students and those with caring responsibilities (including student parents), forced migrant students, students from Gypsy, Roma and Traveler communities, students from military service families, First Generation Scholars, LGBTQ+ students, and commuter students.

The Widening Participation Statement is entirely optional, but if you feel it applies to you then please fill it in. It will be considered by assessors when your application is reviewed.

Applicant's preparedness for research

Organisational skills

ability to organise, and manage themselves and their time, will manage a research project competently

Presentation and communication skills

ability to present and organise information, communicate it to a range of audiences

Problem-solving

ability to overcome obstacles, identify problems and offer solutions or a plan of action

Potential

the applicant's potential to complete the project successfully, fostering further academic research

Quality and impact of research proposal

Originality

the proposal demonstrates originality, identifies a gap in knowledge, and constitutes an original piece of research

Structure of research project

to what degree the project is well organised, with clear aims, scope, timeline and outcomes

Impact of research

Does the research have the potential to benefit everyone -the student, supervisor, department, School

Knowledge of existing body of research

to what degree the research proposal displays knowledge of the existing literature in this field

Demystifying Scientific Research

Ivor Simpson

Senior Lecturer in Artificial Intelligence

Previous JRA Supervisor

Questions about Research

- Scientific research seems like a mystery from the outside.
- What do people do all day? Do they work by themselves? How do they keep up? What happens when they get stuck? Where do their ideas come from? How do interdisciplinary projects work.
- The JRA gives you an opportunity to experience research:
  - The scientific process, with its challenges and new opportunities.
  - Working on independent projects and collaborating with others.
  - The importance of communication.

UNIVERSITY OF SUSSEX

The Application

- Writing a research proposal may seem daunting.
- It's an excellent opportunity to practice articulating complex ideas.
  - Similar to future application for research, masters, PhD
- Need to identify an area and supervisor that match your interests.
  - It needs to work for both sides!
- Identify a specific research challenge and your intended solution
  - Make sure you explain why it's important.
- Trickiest bits:
  - You don't have all the background knowledge.
  - Research is not without risk!

UNIVERSITY OF SUSSEX

The Project

- Establish lines of communication: I meet at least once a week, but would also have occasional troubleshooting deep dives.
  - I like to have a presentation and discussion of progress half-way.
- Be independent – it's your research project!
- Plans might change as you make progress: unknown unknowns
- Connect with the research group (reading groups, seminars)
  - Talk to the team, learn how they work through problems.

UNIVERSITY OF SUSSEX

Mae Schreiner (CS&AI): Machine Learning for Neurodegenerative Disease

- I advertised a project on the general topic.
- We discussed several challenges& directions.
- She was particularly interested in understanding sample bias in datasets.
- She did some reading & wrote a proposal.
- Mae's FYP tackled understanding sources of uncertainty in disease modelling.
- Now doing an MSc in Computational Biology and applying for PhDs.

UNIVERSITY OF SUSSEX

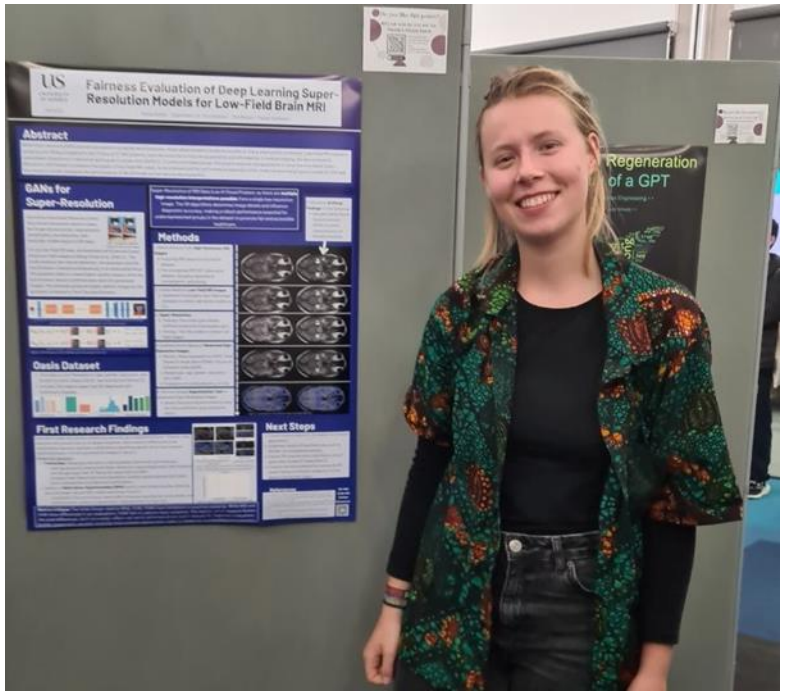
Rehan Zuberi (CS&AI): Cell Image Analysis

- Rehan knew I researched biological imaging
- He was particularly excited by the prospect of interdisciplinary research, working with a biologist (Prof. Hochegger in Life Sci) and me.
- Challenges from LifeSci; solutions from CS.
- Proposal drew from both supervisors input.
- Completed his FYP on efficient cell tracking.
- Now doing an MSc in Computational Biology and applying for PhDs

UNIVERSITY OF SUSSEX

Paula Seidler (CS&AI): Fairness in Brain MRI Analysis

- Paula was interested in computer vision and fairness.
- She wanted to learn about a new area: brain MRI analysis.
- We discussed challenges related to a new research projects on low-cost MRI, and Paula did some research and proposed this project.
- FYP is on interpretable computer vision.
- She is applying for Masters and PhDs in this area.



UNIVERSITY OF SUSSEX

Fairness Evaluation of Deep Learning Super-Resolution Models for Low-Field Brain MRI

UNIVERSITY OF SUSSEX

JRA 2023

Paula Seidler - Supervisor: Dr. Ivor Simpson - Phd Mentor: Pranav Indrakanti

Abstract

While high-resolution (HR) scanners are advancing rapidly technologically, these advancements remain accessible to only a small portion of society. Low-Field MRI scanners, weighing just 250kg compared to the 13 tons of 3T MRI systems, have the potential to improve accessibility and affordability of medical imaging, but also come with unavoidable reductions in resolution and signal-to-noise ratio (SNR) [1]. To overcome these issues, this project explores the application of deep learning based Super-Resolution (SR) Models to enhance the quality of low-field MRI scans. As an unbiased and fair performance especially within underrepresented groups is crucial for this task, the project critically evaluates the performance of the SR model across various demographics.

GANs for Super-Resolution

Generative Adversarial Networks (GANs) have shown impressive results in tasks like image reconstruction, segmentation, classification, and detection, with especially notable results in SR tasks.

Fig. 1: Example of ESRGAN results on real world images

For our low-field SR task, we implement an Enhanced Super-Resolution GAN based on Wang Xintao et al, 2018 [4]. The model employs two neural networks—the generator and the discriminator—trained simultaneously in an adversarial setup. The generator aims to create higher-quality images, while the discriminator learns to differentiate real from generated images. This interplay produces highly realistic images as the generator is trained to "fool" the discriminator.

(a) Generator: Convolutional Neural Network (CNN) generating SR images from LR inputs by minimizing perceptual and content loss while attempting to "fool" the discriminator.

$$D_{Ra}(x_r, x_f) = \sigma(C(\text{[image]}) - \mathbb{E}[C(\text{[image]})]) \rightarrow 1$$ More realistic than fake data?

$$D_{Ra}(x_f, x_r) = \sigma(C(\text{[image]}) - \mathbb{E}[C(\text{[image]})]) \rightarrow 0$$ Less realistic than real data?

(b) Discriminator: Classifier distinguishing between real and generated images.

Figure 2: The architecture of the ESRGAN used in this project (from [4])

Oasis Dataset

- 416 subjects with Metadata for age, gender, education, and Social Economic Status (SES) - see distribution below [3].
- Includes 100 subjects aged over 60 diagnosed with Alzheimer's disease.

SES Histogram | Gender Histogram | Age Histogram | Education Histogram

Super-Resolution of MRI Data is an *Ill-Posed Problem*, as there are **multiple high-resolution interpretations possible** from a single low-resolution image. The SR algorithms determine image details and influence diagnostic accuracy, making a robust performance essential for underrepresented groups in the dataset to promote fair and accessible healthcare.

Methods

1. Obtain Ground Truth **High-Resolution MRI Images**
   - Acquiring MRI data from the OASIS dataset.
   - Pre-processing MRI Nifti data using NiBabel, including registration, normalization, and slicing.
2. Create Realistic **Low-Field MRI Images**
   - Implement a stochastic low-field image simulator to mimic real-world conditions [2].
3. Introduce **Artificial Findings** to One Subgroup
   - Simulate White Matter Hyperintensities (WMH) to mimic characteristics of Multiple Sclerosis.
4. **Super-Resolution**
   - Training: Fine-tune a pre-trained ESRGAN model with training data pairs.
   - Testing: Test the model on unseen low-field images.
5. Evaluate Performance of **Generated High-Resolution Images**
   - Metrics: Mean Squared Error (MSE), Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index (SSIM).
   - Metagroups: age, gender, education, SES, WMH.
   - Evaluation of crucial areas (e.g. in red).
6. Perform Simple **Segmentation Task** on Generated High-Resolution Images
   - Assess the practical performance using the Dice coefficient as an evaluative metric.

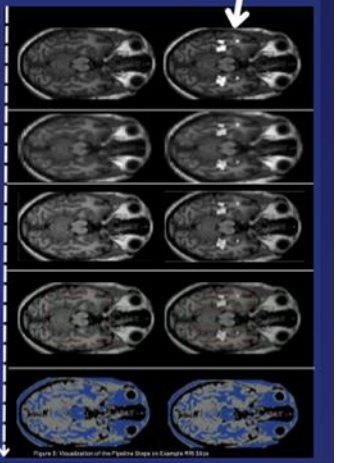


Figure 3: Visualization of the Pipeline Steps on Example MRI Slice

First Research Findings

Generated images demonstrate detailed and generally good visual performance. However, their alignment with ground truth is not always consistent, which results in differences in the segmentation task and could lead to difficulties in identifying specific structures (compare segmented areas of HR with generated SR images in Figure 4).

Metagroup Evaluation:

- **Training Bias**: Metagroups dominant in training dataset show better performances:
  - Older age groups (correlating with higher Alzheimer's cases) display better performances with the age group "over 70" having the lowest MSE and SSIM.
  - Education level 1 (below high school graduation, smallest sample size) and SES 5 (with only 20 samples) demonstrate poorer performance.
- Addition of **White Matter Hyperintensities (WMH)** results in performance decline, affecting the entire image, not just WMH-added regions (see Figure 5).
  - Compared to the control group, adding WMH introduces inaccuracies, wrong details, and shifted contrast, leading to segmentation challenges (refer to Figure 4b).

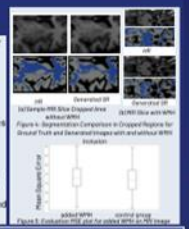


Figure 4: Segmentation Comparison in Cropped Regions for Ground Truth and Generated Images with and without WMH Inclusion

Figure 5: Evaluation MSE plot for added WMH on MRI image

Metrics Critique: The initial chosen metrics (MSE, SSIM, PSNR) have limitations in practical scenarios. While MSE and SSIM show differences in our evaluations, PSNR fails to capture many variations. The metrics, which measure factors like pixel differences, don't accurately reflect real-world performance and aren't relevant for diagnostic evaluations. Further assessment, possibly involving more complex segmentation tasks, is needed for a comprehensive evaluation.

Next Steps

- Extend implementation to 3D images for practical applicability.
- Implement various SR architectures, such as SRCNN, for comparative analysis.
- Explore MR reconstruction techniques using k-space data instead of image data [5].
- Enhance fairness evaluation by testing the SR model trained on different subsets to further assess training bias impact.

References

[1] Low-field MRI: Clinical promise and challenges', Arnold, T.C. et al., 2022
[2] 'Low-field magnetic resonance image enhancement via stochastic image quality transfer', Lin, H. et al., 2021
[3] 'Open Access Series of Imaging Studies (OASIS): cross-sectional MRI data in young, middle aged, nondemented, and demented older adults', Marcus, D.S. et al., 2007
[4] 'ESRGAN: Enhanced super-resolution generative adversarial networks', Wang, X. et al., 2018
[5] 'A review on deep learning MRI reconstruction without fully sampled k-

Git-Hub Code and Further Resources

UNIVERSITY OF SUSSEX

Ethical Reviews

Alice Saryazdi

Senior Research Ethics and Integrity Officer

Applying for Ethics Review

Tim Parkinson
Alice Saryazdi SCI-TEC
Carol Cooley – SSARTS
Alice Ashford –BSMS
Kate Gannon - AWERB
Senior Research Ethics and Integrity Officers

https://canvas.sussex.ac.uk/enroll/BR8W38

UNIVERSITY OF SUSSEX

Three things…

- If your research involves the collection of data from human and or animal participants (including social media data) then your research will need to have been through ethics review.

- The ethics review process will make your research better.

- Separate your personal life from your research work.

UNIVERSITY OF SUSSEX

Do you need ethics approval for your research project?

Question	Y/N
1. a) Will the research project involve human participants, with or without their knowledge or consent at the time? (This includes yourself if you are the main subject of the research). b) Will the research project involve animals?	
2. Is the research project likely to expose any person, whether or not a participant, to physical or psychological harm?	
3. Will you have access to personal information and/ or data that allows you to identify individuals or to confidential corporate or company information?	
4. Does the research project present a significant risk to the environment or society?	
5. Are there any ethical issues raised by this research project that require further ethical review?	

Why we ‘do’ ethics

- **Historical reasons** - Nuremberg Code (1947), Helsinki Declaration (1964), Human Tissue Act (2008)
- **You are a professional researcher!** – we want you to learn from this experience – funding/publishing in journals
- **Wellbeing and safety – you and your participants**
- **Compliance** – insurance, data (GDPR), Health and Safety (OTSSRA).

wellcome

NON SOLUS
ELSEVIER

UNIVERSITY OF SUSSEX

NIHR | National Institute for Health Research

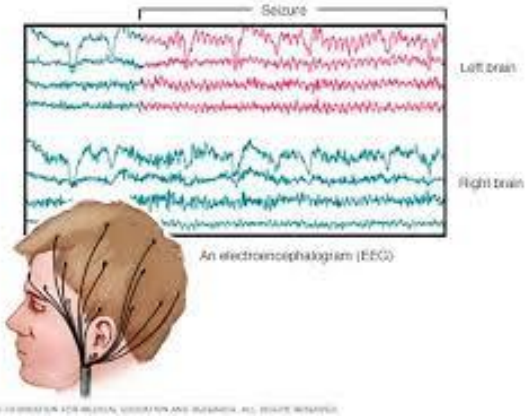
WILEY

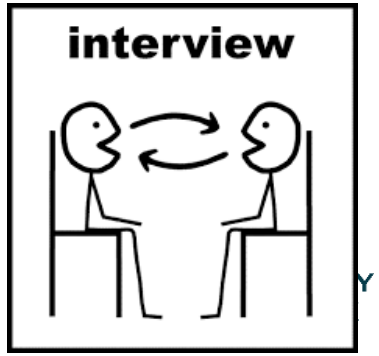
Key principles of ethical research with human participants

- The research participants' welfare
- Vulnerable groups
- Equitable distribution of benefits and burdens
- Informed consent (opt out / deception)
- Confidentiality and privacy
- Data protection
- The researcher's welfare

UNIVERSITY OF SUSSEX

Research involving human participants





Ethics review at Sussex

School Research Ethics Officer (SREO)

SSARTS C-REC

SCITEC C-REC

Research Sponsorship Sub-Committee

Research involving the NHS, patients, their tissue, data, staff or facilities.

BSMS RGEC

AWERB

all research involving animals

UNIVERSITY OF SUSSEX

Ethics review at Sussex

School Research Ethics Officer (SREO)

SSARTS C-REC

SCITEC C-REC

How it works…

1 – Submit your application on Sussex Direct

2 – Your supervisor either approves the application for review or sends it back to you for amendments.

3 – If approved by your supervisor you don't yet have approval to start your research and must wait till you hear from the SREO or C-REC.

4 – The application gets sent to a School Research Ethics Officer (UG and PGT applications) or a C-REC (UG and PGT high risk applications and all PhD and Staff Research

UNIVERSITY OF SUSSEX

Ethics review at Sussex

School Research Ethics Officer (SREO)

SSARTS C-REC

SCITEC C-REC

How long does it take?

It all depends on the complexity of your application!

SREO reviewed applications should take 2-3 weeks to review but sometimes longer depending on the time of year.

SCI-TEC applications get sent for review when received.

SSARTS applications have a deadline of the 20th of each month (except August).

If you haven't heard back within 3/4 weeks, email either the SREO, Alice (SCI-TEC) or Carol (SS Arts) and they can check for you.

UNIVERSITY OF SUSSEX

Ethics review at Sussex

School Research Ethics Officer (SREO)

SSARTS C-REC

SCITEC C-REC

Then what happens?

- Most applications come back with at least some amendments for you to make.
- Make the amendments as detailed in the response and submit your application to your supervisor. Your supervisor will then send your application for review.
- Always include a PDF that details how you have addressed the points raised in a response and what changes you have made.
- Your resubmitted application will be sent for review as soon as it is received and you should hear back within a fortnight. (SS Arts deadline does not apply).

UNIVERSITY OF SUSSEX

Ethics review at Sussex

School Research Ethics Officer (SREO)

SSARTS C-REC

SCITEC C-REC

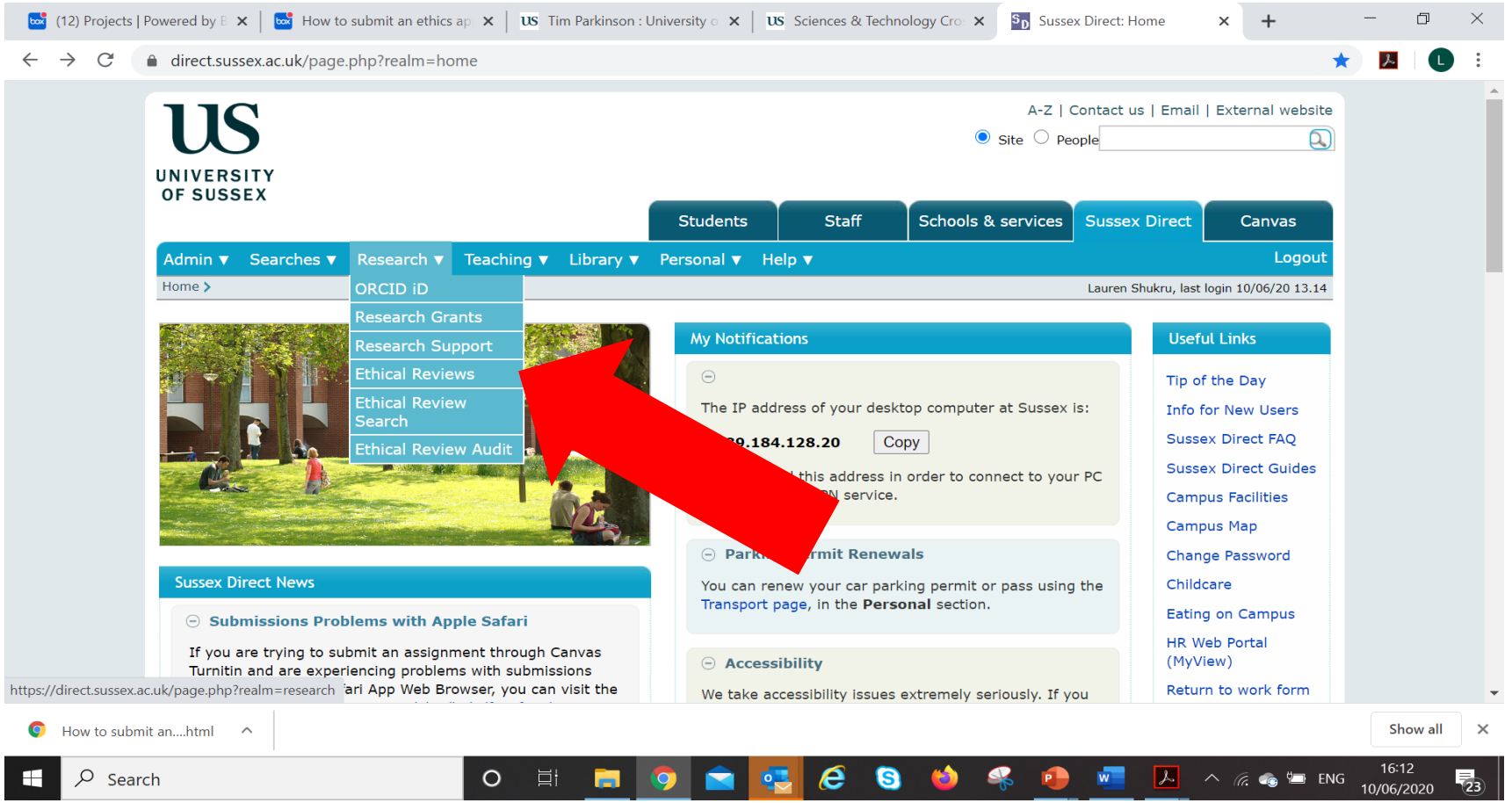
Then what happens?

- **Approved** – Your application is approved and you can start your research
- **Conditional Approval** – Your application is approved on the proviso you make some changes first. You do not need to re-submit your application with these changes made.
- **Application rejected**

If your research needs to change then you have to submit an amendment and wait for that to be approved before starting any new protocol.

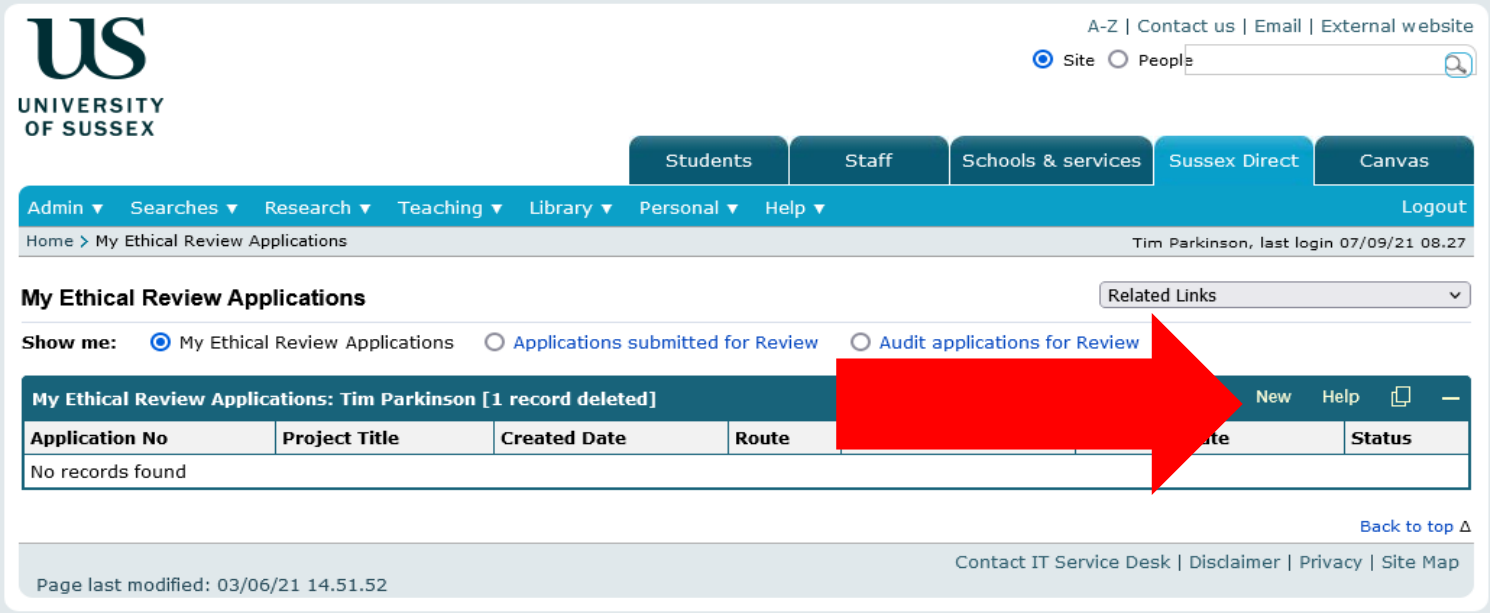
UNIVERSITY OF SUSSEX

On-line application on Sussex Direct



UNIVERSITY OF SUSSEX

On-line application on Sussex Direct



UNIVERSITY OF SUSSEX

On-line application process

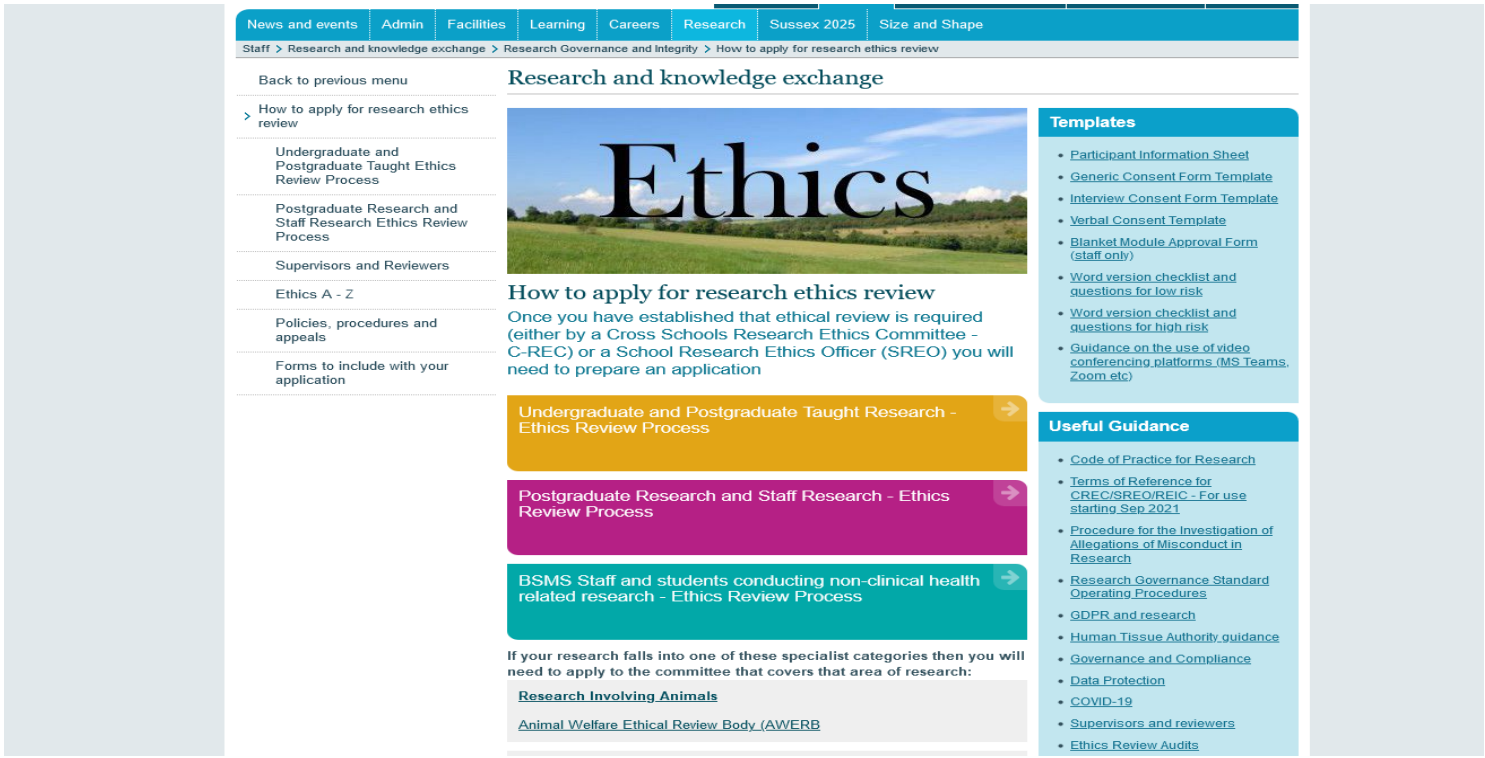
- The application starts with a title and project description, section: use this to tell the reviewer the **‘what/why/how’**
- Once this is complete you’ll see a **checklist** on the ethics form. This helps to decide if your application is **high** or **low** risk.
- High risk doesn’t mean you, your research or the people you are researching are more ‘risky’ but rather that we need some more information from you before you can start.

UNIVERSITY OF SUSSEX

» Checklist	
A1. Will your study involve participants who are currently or potentially vulnerable or unable to give informed consent or in a dependent position (e.g. people under 18, people with learning difficulties, over-researched groups or people in care facilities)?	No
A2. Will participants be required to take part in the study without their consent or knowledge at the time (e.g. covert observation of people in non-public places), and / or will deception of any sort be used? Please refer to the British Psychological Society *Code of Ethics and Conduct* (or similar guidelines) for further information.	No
A3. Unless specifically and clearly consented (e.g. a media release form), will it be possible, through a research output, to identify participants in any way? (This does not include taking email details for participant prize draws or identifying participants from signed consent forms or holding identity encryption spreadsheets that are stored securely separate from the research data).	No
A4. Might the study induce psychological stress or anxiety, or produce humiliation or cause harm or negative consequences beyond the risks likely to be encountered in the everyday life of the participants?	No
A5. Is there a risk that the research topic might lead to disclosures from the participant concerning their beliefs, involvement in illegal actions or any other activities that may represent a threat to themselves or others?	No
A6. Will the study involve collecting any ***personal special category information**** in a form that could allow the participant/ participants to be identified? [* identifiers relating to race, ethnic origin, politics, religion, trade union membership, philosophical beliefs, genetics, biometrics, health, sex life or sexual orientation]	No
A7. Will any drugs, placebos or other substances (such as food substances or vitamins) be administered as part of this study and will any invasive or potentially harmful procedures of any kind will be used?	No
A8. Will your project involve working with any substances and / or equipment which may be considered hazardous?	No
A9. Will your study involve the taking and/or storage of human tissue that falls under the Human Tissue Act (HTA)? http://www.sussex.ac.uk/staff/research/governance/erp_overview/humantissue	No
» Risk Assessment	
A10. If you have answered *Yes* to ANY of the above questions, your application may be considered as HIGH risk. If, however you wish to make a case that your application should be considered as LOW risk please enter the reasons here. Researchers should note that SREOs or C-RECs may decide NOT to agree with the case that you have made.	

Ethics website

(put ‘Sussex ethics’ into google)



UNIVERSITY OF SUSSEX

Website resources to help you complete the on-line form

A - Z

- Ethics A - Z

- Supervisors and reviewers

User Guide for on-line ethical review system

Online Interviews – Always use UoS platforms

- Always use your UoS versions of MS Teams or Zoom and make sure you log in with your UoS email and password
- Make sure you include the privacy policy of the platform on your Participant Information Sheet
- UoS MS Teams best for sensitive data – records and uploads to your UoS OneDrive

UNIVERSITY OF SUSSEX

Qualtrics anonymous surveys

- UoS Qualtrics is a great way for you to collect anonymous data from participants
- Creates anonymous share-able link which you can distribute online (if using social media then you need to create new accounts with your UoS email)
- Think creatively with it! For example, you can ask participants to upload images

UNIVERSITY OF SUSSEX

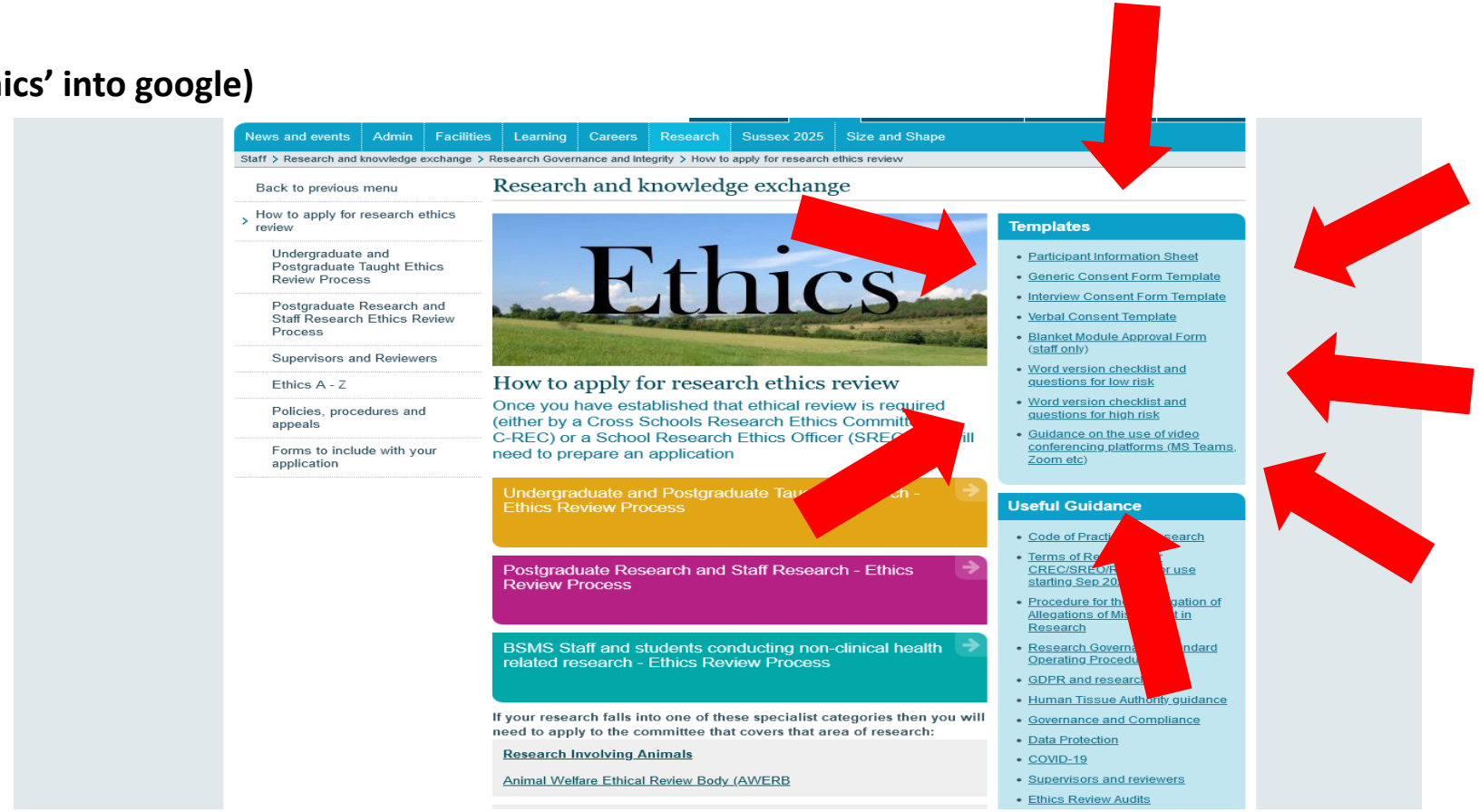
Social Media & Research

- **Using Social Media for research is complex – we can't assume consent**
- **People have a right to re-invent themselves online – doesn't mean we can use what they say**
- **You can never use personal social media accounts – too risky**
- **You can't use WhatsApp, Signal or Telegram for research purposes.**
- **If you are thinking of using large amounts of data – we need to talk!**
- **Chat GPT or similar platforms need to be stated to participants from the outset**

UNIVERSITY OF SUSSEX

What other documents do I need?

(put ‘Sussex ethics’ into google)



UNIVERSITY OF SUSSEX

What other documents do I need?

- **Participant Information Sheet**

This sheet gives your participants all the information they need about you and your research. You should tell them:

- Who you are
- What you are doing
- Why you are doing it
- How you will look after them
- What you will do with their data
- How they can withdraw from the research and up to what point
- Who they contact if they have any questions/concerns

Use the template! You can adapt it to fit your research

UNIVERSITY OF SUSSEX

What other documents do I need?

- **Consent Form**

This form allows your participants to make an informed choice about taking part in the research and what information you collect from them.

- Adapt the template to your research
- Delete/add information as required
- Keep the tick boxes!

UNIVERSITY OF SUSSEX

JRA Skills Programme

Chris Brown

Academic skills and writing instructor

Purpose

1. Review academic skills that may support your research.

1. Discuss research progress and troubleshoot with fellow JRAs.

1. Prepare to make the most of your project (academic posters, presentations, future research opportunities etc).

UNIVERSITY OF SUSSEX

Skills Sessions

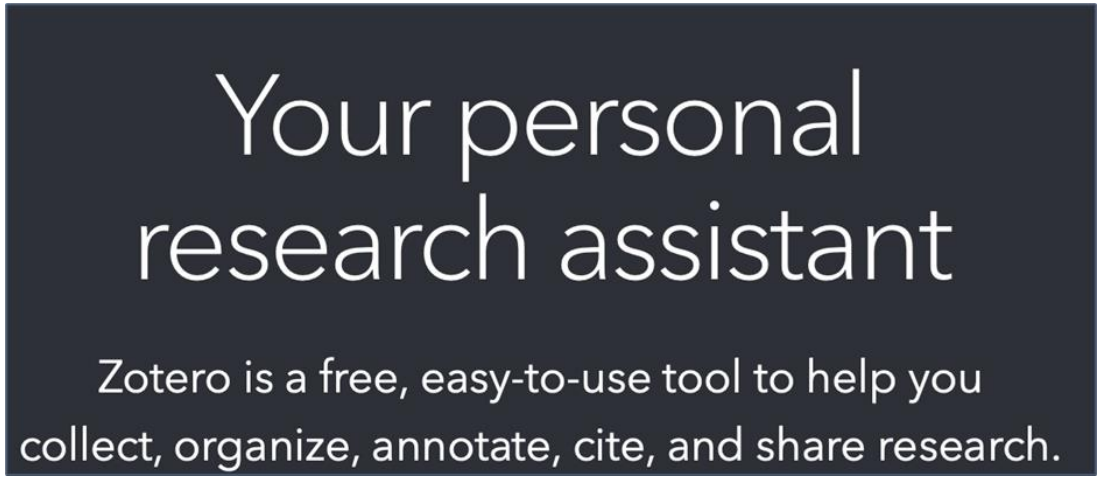
- Introductory Audiocast: Making the most of your JRA Summer
- Strategy: Planning and Structuring your JRA Project
- Critical Thinking, Note-Making and Active Reading
- Academic Writing and Editing
- Academic Posters
- Delivering Presentations

- Weekly in-person and online 1v1, pair, or small group office hours.

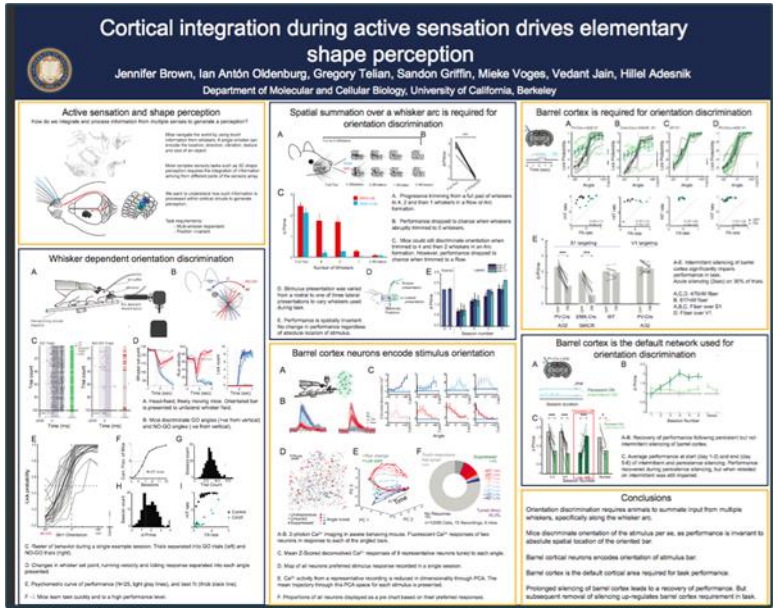
UNIVERSITY OF SUSSEX

Example Resources & Skills

- Consider using tools such as Zotero to manage your reading and notes



- Review previous JRA posters and posters from your subject area



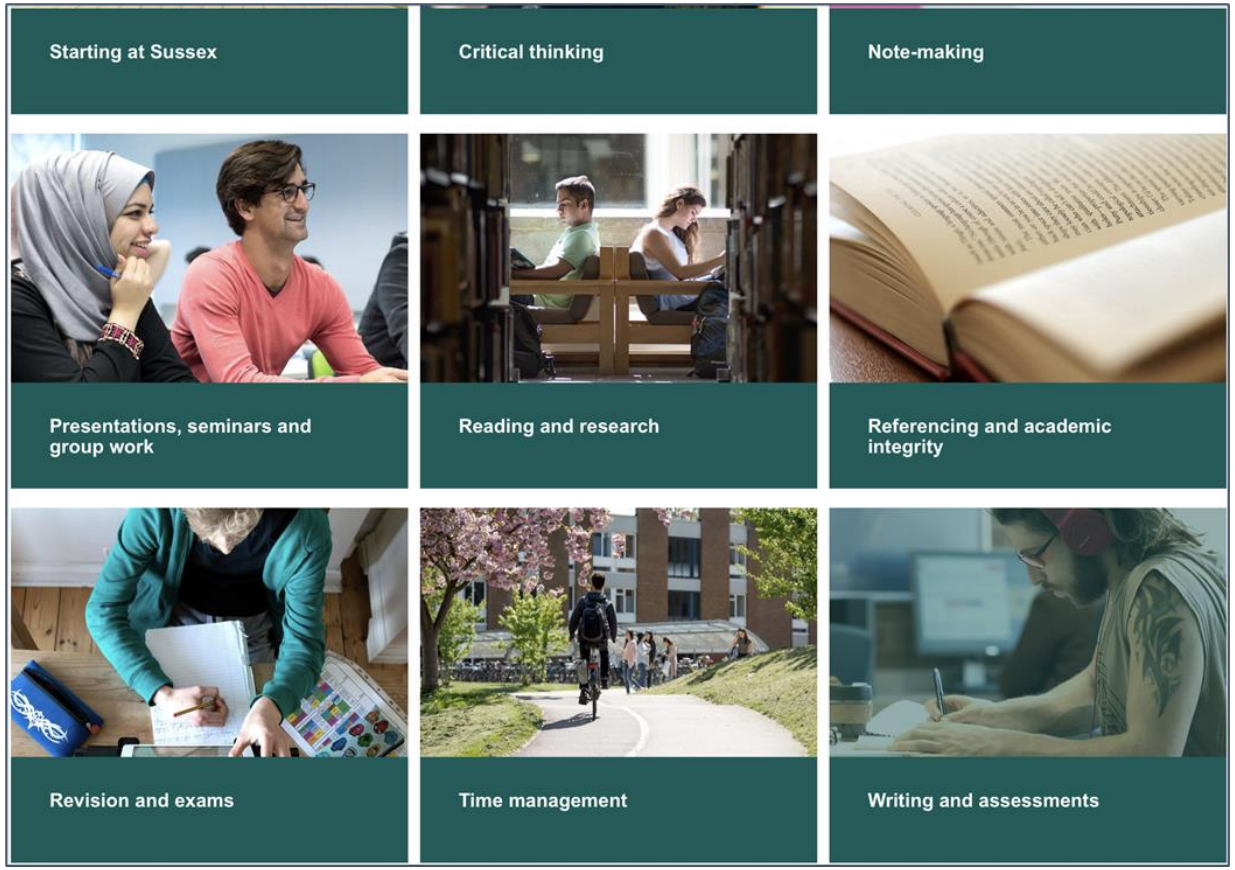
UNIVERSITY OF SUSSEX

Resources

- JRA Canvas site with slides, recordings, materials and posters

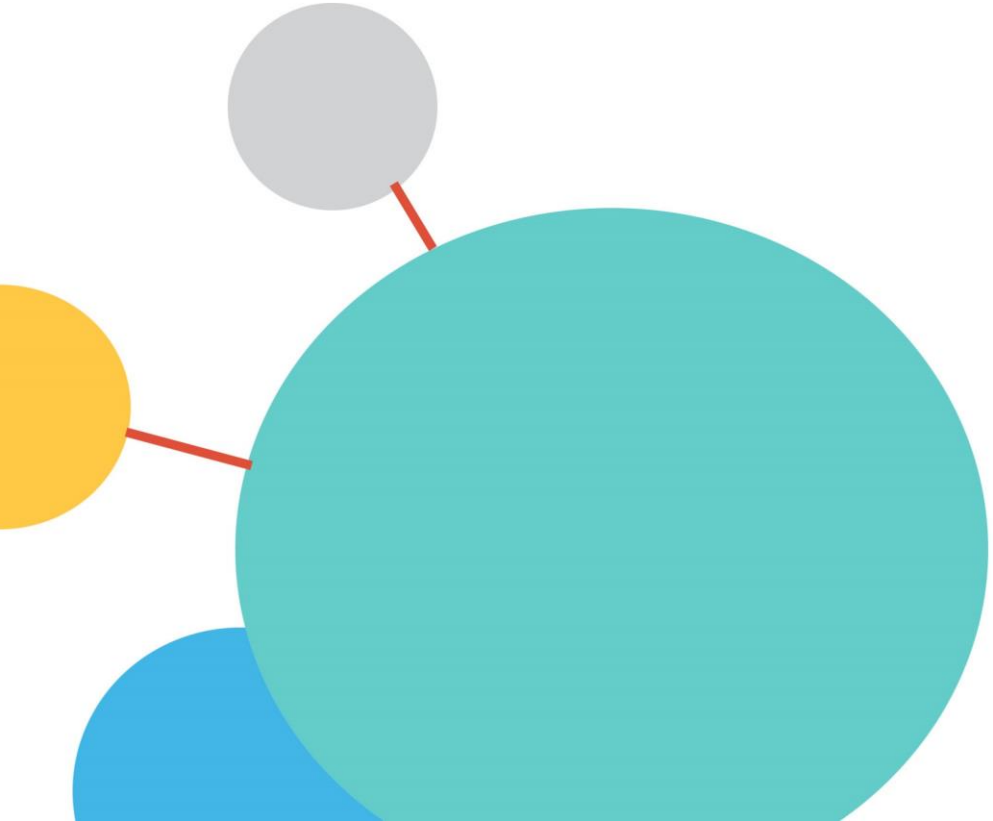
- Skills Hub: https://www.sussex.ac.uk/skills-hub/

- Library: https://guides.lib.sussex.ac.uk/zotero



UNIVERSITY OF SUSSEX

Throughout the JRA



Maddie Talbot

Senior Coordinator

Financial Support

Each JRA will receive a bursary of **£3,500**, paid in two installments, to allow them to work full-time on their research.

As a JRA, you will receive your first payment in the first week of the scheme. The second payment will be processed in the fifth week, once your supervisor has completed a short report confirming that you are fulfilling your obligations and that your research project is progressing accordingly.

Please note that attending the training sessions is also a condition of receiving your bursary.

Alongside the bursary, each JRA is granted a **£200** expenses allowance. This money can be used to cover any costs directly supporting your research, so please see our webpage on claiming your expenses for more information.

Social Events

Research Tours

Scenic Walks

Coffee Catch Ups

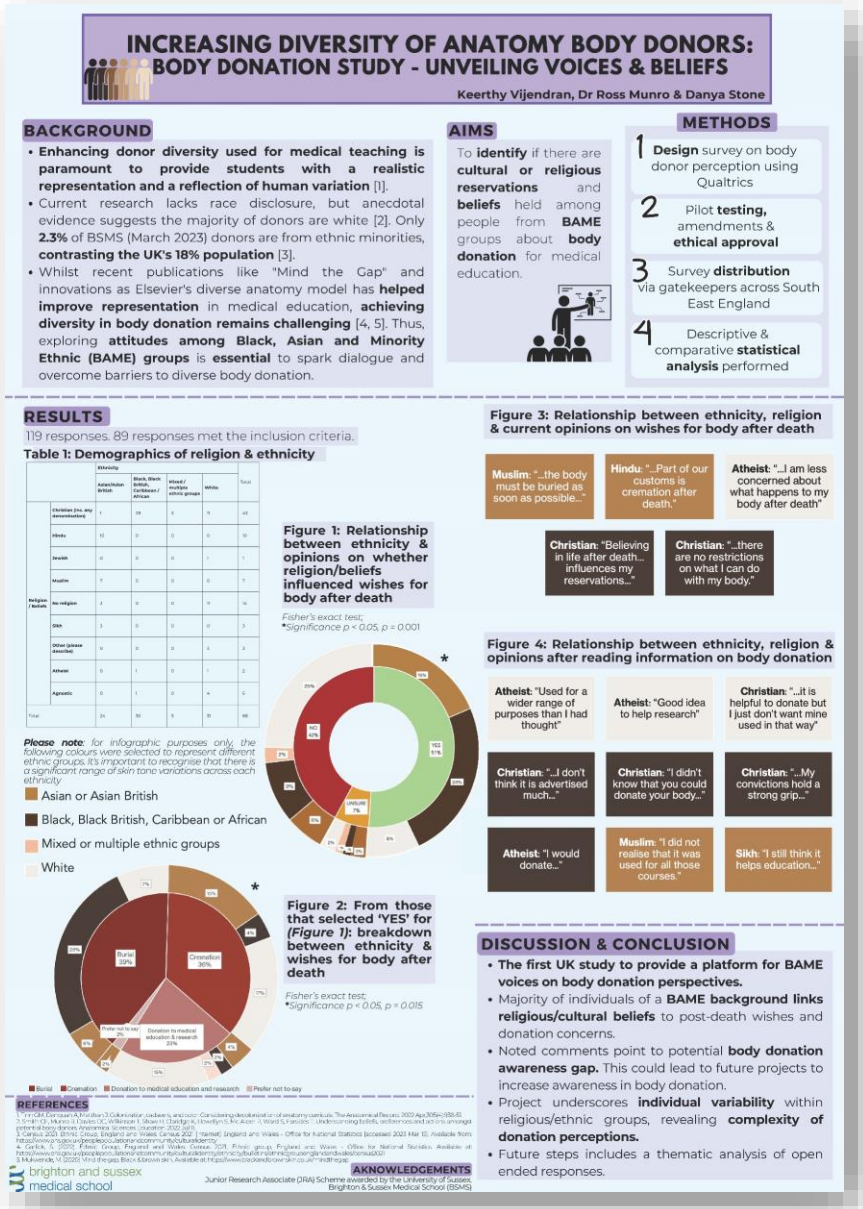
Crafting Sessions

Evening Socials

End of Summer Celebration

We are always open to suggestions for social event ideas and encourage JRAs to arrange their own socials

Academic Posters and the Poster Exhibition



All JRAs are required to submit an A1 academic poster as a condition of the scheme. As many JRAs have never designed an academic poster before, there are specific training sessions on how to create a research poster.

Every year there is a Poster Exhibition in the autumn term where JRAs display their academic posters. It is a chance to celebrate the completion of your project and to talk about your research to a wider audience.

Taking your Research further

For many of our undergraduates, the legacy of their research project extends well beyond their original eight weeks as a JRA.

Several students continue to develop the ideas they formed as a JRA in the final years of their undergraduate degree, and often into their postgraduate degrees.

Many forge lasting relationships with their academic supervisors, and therefore some subsequently choose to undertake PhDs, working alongside their former JRA supervisors.

Many JRA projects have been presented at academic conferences such as the British Conference for Undergraduate Research.

BCUR BRITISH CONFERENCE OF UNDERGRADUATE RESEARCH

British Conference for Undergraduate Research, is an annual conference bringing together the very best junior researchers from across the country.

All JRAs are given the opportunity to present their work at BCUR, either by giving a presentation or by presenting a poster. If you do choose to attend BCUR, we will cover the application fee and offer you support and assistance to ensure your trip is a success.

Each university can nominate **two students** to represent them at PiP. Sussex's nominated students are drawn from our JRA scheme: the creators of our **top two undergraduate research posters**, as selected by a panel of academics, will represent Sussex at Westminster.

Any Questions?

You can also email us with any queries you may have at:
undergraduate-research@sussex.ac.uk

SCAN ME

Or Scan the QR code to check out our ‘Applying for the JRA’ Webpages