

# Guest Editorial

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Awareness and understanding of research are both increasingly important for medical undergraduates, with the General Medical Council's Outcomes for Graduates stating that medical students in the UK must be able to "*apply scientific method and approaches to medical research*". (1) Critical analysis and interpretation of research is key to applying the evidence-based medicine required for clinical practice. The impact of research on clinical practice is highlighted by NHS England: "*Research is vital in providing the evidence we need to transform services and improve outcomes*". (2) Studies highlight that undergraduate engagement in research helps develop transferable skills such as critical appraisal, (3) together with developing presentations and publications. (4) Furthermore, undertaking a research-oriented programme influences later academic career choice. (5)

However, engagement with research as an undergraduate is not without challenges. A recent systematic review examining global perspectives of medical students towards research showed that students expressed positive attitudes towards research, but identified barriers such as time, lack of mentorship and financial considerations. (6) Whilst intercalation remains a popular choice for many undergraduates, financial considerations and rising graduate entry schemes mean that there is increasing interest in shorter research placements. The reasons for this include to gain a "*taster*" of research and engage with CV enhancing activities such as research presentations and opportunities for publication.

With this in mind, in 2013 we established a summer research internship scheme to provide Keele medical undergraduates much needed opportunities to engage in research. Whilst organisations (e.g. Wellcome Trust and NIHR School for Primary Care) offer short research internships, the lack of funding support for short student projects presented a critical challenge, particularly for a young medical school such as Keele. We gained initial funding in 2013 from INSPIRE- a national scheme funded by the Academy of Medical Sciences and Wellcome Trust, which aims to engage medical undergraduates with research. (7) This enabled us to establish a summer research internship scheme (4-8 weeks) where students identify projects via a specially designed database and undertake their first piece of medical research. The projects are wide ranging-from laboratory, medical humanities and medical education to clinical research (both primary care and hospital based) and can be qualitative or quantitative. Other activities have included the development of the student medical research society, student-researcher networking events, and award of conference bursaries. Successful students present at an Annual Medical School Research Showcase featuring talks from eminent invited speakers, gaining experience of both poster and oral presentations. Critically, gaining external grant support enabled leverage of additional funding from the University, local medical charities such as the North Staffordshire Medical Institute, enabling the scheme to expand whilst ensuring financial sustainability; this is a key consideration in challenging financial times for universities. In 2014, we received funding support from the EPSRC Doctoral Training Centre for Regenerative Medicine, allowing students to undertake projects in collaboration with industrial partners. In 2018, we successfully bid for our third national INSPIRE award.

The scheme overall has been popular and highly successful, with 79 projects

funded to date, including in world leading Brazilian Dengue/Zika research groups. The experience is highly rated by students (Table 1) who emphasised the value of the opportunity to collaborate with academics, gain academic mentoring, learn new techniques and contemplate career opportunities not previously considered.



Figure 1: Student volunteers at the aspire research showcase

- *The studentship experience has been extremely valuable, as well as challenging at times. I have not only learnt a lot about qualitative research but also a lot about myself as a future medical professional.*
- *...the studentship provided me with an opportunity to use lab techniques and equipment that I haven't been able to use up until now.*
- *...the placement provided a valuable insight into a research-based career...*

Table 1: Feedback from students undertaking summer studentships

There have been additional benefits for early career staff researchers in gaining supervision experience working within teams. Key outputs for students have included presentations, regionally and nationally, with several students winning conference prizes and more than ten students publishing their work.

Importantly it has been the start of a research career trajectory for students, with some students going on to intercalate (Case Study 1 & 2) and influencing career choices such as academic foundation posts (Case Study 2) and academic careers long term (Case Study 3).

#### **Case Study 1: Will Woods (Studentship 2018)**

*I gained valuable insight into carrying out research and learnt advanced laboratory skills such as cryosectioning and immunostaining. I presented my data at the Keele ASPIRE conference and was awarded 1st poster prize. The time spent during this project was enjoyable and rewarding as well as providing multiple further research opportunities including a Neuroscience intercalated*

*MPhil position in 2019. The ASPIRE scheme has given me invaluable experience, enabling me to explore and affirm my passion for neurology and skills to further a career in academia and strengthen my portfolio for future job applications.*

**Investigating the feasibility of using the chick embryo as a traumatic spinal cord injury model**

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**Introduction**  
The clinical problem: Spinal cord injury (SCI) is a life-long debilitating condition drastically impacting the lives of patients and their support networks. There are no available treatments which restore function, however SCI costs the UK an estimated £1 billion per annum [1]. Therefore, repairing the spinal cord is a key clinical goal.

**Issues with testing new therapies:** New therapies such as magnetic nanoparticles and therapeutic hydrogels are offering promise in this regard. However, this is hampered by reliance on animal testing which is low throughput, costly and associated with ethical implications.

**The chick embryo as an alternative:** The chick embryo offers advantages for SCI modelling including having all major cell types of the spinal cord arranged in typical cytoarchitecture, cost-effective housing, straightforward manipulation and reduced ethical issues [2].

**Aims**  
This project assesses whether the chick embryo can be used as a SCI model for the screening of nanotherapies.

**Methods**

1. Incubation of fertilised chick eggs at 37.5°C in 45% humidity
2. Chick embryo lesioning at embryonic days (E) 4-7
3. Cryosectioning
4. Immunostaining (Sox-2, GFAP, MBP, TuJ-1, NG-2)
5. Analysis by immunofluorescent microscopy

\*Stages 3-5 were repeated for E11 spinal cords (SC)

**Embryos were successfully sectioned and stained with major neural cell markers**

**A.** TuJ-1 stained neurones in an E5 immediately fixed post lesioning embryonic SC.  
**B.** GFAP marked astrocytes accompanying myelination in an E11 SC developing in a medial to lateral orientation from the central canal.  
**C.** MBP showing laterally developing myelination from the central canal in an E11 SC.  
**D.** Sox-2 shows stem cell activity in a proliferating somite of an immediately fixed post lesioning E5 SC.

**Results**  
E4 and E5 embryonic SCs were cryosectioned successfully. Neural progenitor cells and immature neurons could be reliably detected in the developing SC. In contrast to younger tissue, GFAP and MBP staining was observed in longitudinal sections of an E11 SC although it was difficult to reliably detect individual cells. In the limited period of time for this project, the SCI could not be robustly identified.

**Discussion**  
Initial data shows the injured chick embryo can be processed for immunocytochemistry where major neural cell types (associated with healthy tissue and responses to injury) can be reliably detected within the SC. As key cells (oligodendrocytes and astrocytes) were only detected at late time-points, it needs to be investigated whether trialling the protocols at different embryonic ages can be more relevant to adult human-like SCI.

**Funding**  
• ASPIRE Research Funding  
• British Neuropathological Society (BNS)

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Figure 2: Prize winning poster 2018

**Case Study 2: Beth Seale (Studentship 2015 and 2017)**

*The ASPIRE scheme provided excellent research experience and ultimately inspired me to undertake an intercalated MPhil (due to complete 2019). The rigorous research training undertaken has helped me decide on my future career path, and I am applying to the Academic Foundation Programme and hope to eventually combine clinical work and academia. I do not think I would have taken this path without the opportunities provide to me through the Studentship scheme.*

**Case Study 3: Arani Vivekanatham (Studentship 2013)**

*Undertaking a Keele ASPIRE studentship scheme in my 3rd year of medical school not only allowed me to develop invaluable research skills in a supportive environment, but also gave me an insight into life as a clinical academic early on in my career and led to opportunities (e.g. a poster tour presentation at the British Society of Rheumatology conference, an Arthritis*

*Research UK essay prize and first author publication in a peer review journal), which has been instrumental in helping me to develop a clinical academic career in Rheumatology. I am now an NIHR Academic Clinical Fellow in Rheumatology and believe my successes to date have stemmed from the fantastic opportunities and supervision from the studentship scheme.*

The development of the Keele Summer Internship Scheme, which funds medical undergraduates to undertake a short period of research has been highly successful. In addition, summer Internship Scheme, which funds medical undergraduates to undertake a short period of research. In addition to developing individual research skills via presentations and publications the scheme has had a clear impact on career aspirations and successes in building academic career trajectories, with students going on to do further research via intercalation and academic foundation posts. The long-term impacts of the scheme require further study.

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