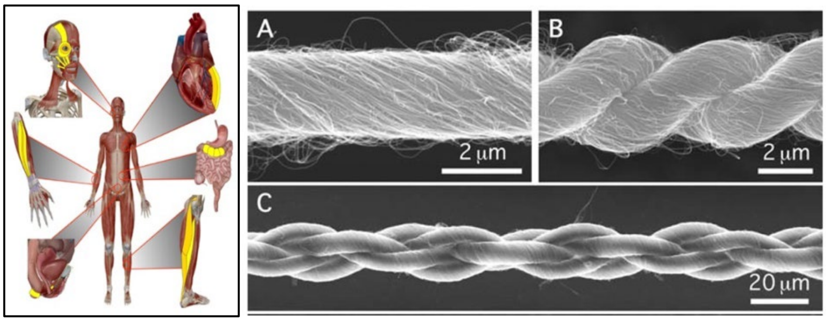
Empower – Artificial Muscles From Polymeric Architectures

About the project or challenge area: Muscles help us move, enable us to interact with objects and the environment, and regulate critical internal functions. Unfortunately, they are susceptible to damage due to disease, ageing and trauma and are a central factor in diverse serious healthcare conditions including sarcopenia (age-related loss of muscle mass and function, stroke, muscular dystrophy, multiple sclerosis, soft-tissue cancers, venous ulceration, diabetes, degenerative myopathy and incontinence). There are over 10.8 million people living with disability in the UK today. Nearly 6.5 million have mobility impairments, with the largest causes being age-related frailty and stroke (there are over 1.2 million stroke survivors in the UK). There is, therefore, significant demand for new treatments of muscle dysfunction, which will have significant global impact of the quality of life of many millions, with implantable medical devices steadily increasing for orthopaedic and diagnostic applications. In this project the aim is to explore the use of safe organic conducting materials, electrospun into fibers and yarns to form Twisted Electroactive Actuators (TEAs). The long-term goal for the development of TEAs will be to explore their use as implantable soft artificial actuators, to address the issues highlighted above.



Why choose this opportunity? The initial focus of your project will be on the preparation of electrospun electroactive polymer fibers which will provide an excellent platform to learn about the design of functional materials and their practical applications in the actuation process, meet the team and get acquainted with the laboratory. The secondary focus will be on the characterisation of the mechanical, electrical conductivity and biocompatiblity properties of spun and twisted fibers, giving you exposure to biocompatibility testing and consequent design, modification and optimization of materials properties. The final focus will be exploring the actuating properties of these novel TEAs, giving you experience in the Bristol Robotics Laboratory, as well as soft matter robotics in general. You will develop and increase your expertise in applied materials chemistry, whilst becoming familiar with the fundamentals of robotics, actuation and biocompatibility. Furthermore, this project will require your collaboration with other members across other research groups and Universities (both home and international), thus improving your teamwork and networking skills. You will also develop a range of transferable skills, including presentation, scientific writing, and project and time management. Finally, you will be interacting with students from all over the world learning from their culture and skills, adding to your professional and personal development.

Full training will be provided for all aspects of this project. You will be embedded in the large, international and dynamic Faul Research Group, who will provide support. You will also participate in the larger ongoing **emPOWER** project (working with clinicians, engineers, bioengineers and chemists). In addition, you will be assigned a student mentor for the duration of your project, who will provide extra support and help you to identify any additional training needs or opportunities.

About you: Ideally you will already have skills and knowledge in electrospinning, polymer chemistry, soft matter actuators, biocompatibility testing, teamwork and time management.

Bench fees: A bench fee of £10,000 is required.

How to apply: Applications are accepted throughout the Academic Year, and you should complete the online application form for Chemistry (MSc by Research).

Supervisor: Your supervisor for this project will be Charl Faul, Professor Chemistry in the School of Chemistry. Please see faulresearchgroup.com and @FaulResearch for further details. You can contact him at +44 (0) 117 954 6321 or email charl.faul@bristol.ac.uk

Find out more about your prospective research program: These articles explain the general background of twisted electroactive actuators:

Zhang et al, Science 306, 1358 – 1361 (2004)
Lima et al, Science 338, 928 – 932 (2012)
Chu et al., Science 371, 494–498 (2021)