2022 UG Summer Studentship Programme - Project List

Project Reference No.	SoCoBio DTP partner	Faculty School Department	Supervisor	Start Date	End Date	Project Title	BBSRC Theme	Project Overview
2022_01	NIAB EMR	Crop Science and Production Systems	Eleftheria Stavridou	03/07/2022	07/08/2022	Phenotyping the growth and nutritional quality of African eggplant cultivars under climate change	Bioscience for sustainable agriculture and food;	Climate change and a growing population push us to reinvent our current food systems to ensure their sustainability, accessibility and quality. The African eggplant is one of many indigenous vegetables from Africa that are being under-researched and under-used despite offering high nutrition and adaptability to extreme climates. This project will focus on understanding the responses of the African eggplant grown under stress to use it at its full potential. The activities that the trainee will carry out includes: 1) Assist on setting up experiments 2) Assist in coordinating field trials and collecting samples from field and glasshouse 3) Carry out plant physiological measurements, i.e. photosynthesis rate, stem water potential, chlorophyll fluorescence, etc. 4) Undertake measurements of plant water relations, i.e. wet readings, download logger data, etc. 5) Undertake sample preparation for chemical analysis, i.e. lyophilise and grind samples 6) Carry out laboratory analysis on secondary compounds of plants, i.e. antioxidants, phenols, flavonoids, etc. 7) Manage data sets, including data input and analysis These data will be relevant to companies and farmers working with the African eggplant by providing key information on their use. You will be able to develop your analytical skills throughout the project by analysing the different types of data, using Excel or R. You will gain experience in both fieldwork and lab work using various pieces of equipment such as the MultiSpeq, LiCor and spectrophotometer. While working on your project, you will be part of a dynamic team and will have the possibility to exchange with people with a wide range of expertise. At the end of the project, there will be the possibility of writing a report or giving a presentation to be informally reviewed and help improve your writing/presenting skills. Start/End dates can be modified. Feel free to contact me for a chat!
2022_02	NIAB EMR	Crop Science and Production System	Eleftheria Stavridou	04/07/2022	14/08/2022	Understanding Nutritional Variability in Local Crops for UK Food System Health and Sustainability	Bioscience for sustainable agriculture and food;	The purpose of food systems is not only to provide enough food to feed a population, but also to provide food of sufficient quality to meet the nutritional requirements of a healthy population. Current assessments of the UK's supply of essential micronutrients highlight a substantial reliance on imported fruit and veg to secure recommended population intakes, leaving UK micronutrient security increasingly vulnerable to shifting trade deals and global climate shocks. Increasing domestic production of essential micronutrients by changing the way we select and grow local fruit and veg will be an important aspect of improving both the resilience, and sustainability of the UK food system. Micronutrient content in fruit and veg is known to vary by a range of factors including genetic variation, environmental conditions and agronomic practices. Genetics alone has been shown to account for as much as 3x variation in strawberry vitamin C content, for example. Improving our understanding of the sources and extent of nutritional variation in local fruit and veg will enable us to leverage existing variation to breed more nutritious varieties and to develop complementary, nutrition smart growing practices. The placement project will investigate phenotypic variability in a diverse strawberry mapping population at NIAB EMR. The student will work as part of a diverse team to generate data that will inform future work aiming to improve strawberry nutritional quality, as well as support ongoing genome-wide association studies of strawberry quality traits. The student will gain experience in... Setting up and coordinating both field and lab-based experiments Collecting samples from field, polytunnel and glasshouse experiments Utilising dataloggers and manual sensors to monitor plant health and physiological characteristics Lyophilisation of strawberry samples in preparation for chemical analysis Utilising spectrophotometric analysis to measure strawberry nutritional content Effectively managing and analysing their collected data using R
2022_03	NIAB EMR	Genetics, Genomics and Breeding	Dr Suzanne Litthaeur	04/07/2022	15/08/2022	Raspberry root rot: investigating the effect of Phytophthora species on UK raspberry cultivars	Bioscience for sustainable agriculture and food;	The project will investigate raspberry host susceptibility to a panel of Phytophthora spp. isolates. Phytophthora spp. are oomycete plant pathogens, several species are known to cause extensive root and stem damage in raspberry plants. The species typically noted to be most prevalent and virulent in raspberry is Phytophthora rubi, however, observations from previous studies and extensive surveying of the UK raspberry industry has intimated that more than one species may be the cause of the disease. The project will investigate the effect of a panel of Phytophthora species on raspberry through whole-plant pathogenicity screening. Through whole-plant testing, we aim to determine if different Phytophthora species exhibit different pathogenicity and if pathogenicity varies with raspberry cultivar. The trial will give further insight into the disease characteristics and symptoms of a panel of Phytophthora species on raspberry, improving in-field diagnostics and plant clinic work. Additionally, Phytophthora species isolated from strawberry will be used to assess if some species can infect multiple hosts. Following the trial, the student will assist with direct isolation of the pathogens from infected material to fulfil Koch postulates and add to the UK Phytophthora isolate bank. The results of this project will improve our understanding of the plant-pathogen interactions between emerging Phytophthora species and raspberry. The student will work with the supervisor to record disease symptoms, re-isolate the pathogen from infected plants and compile reports. The student will gain experience in disease reporting, plant pathogen identification, and traditional and molecular pathogen diagnostic techniques. The project will improve the student's transferable skills in time management, report writing, data input and aseptic technique.

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2022_04	NIAB EMR	Genetics, Genomics and Breeding	Dr Suzanne Litthauer	04/07/2022	15/08/2022	Tools for better fruit breeding: phenotyping strawberries to map important traits	Bioscience for sustainable agriculture and food;	NIAB EMR is a major horticultural research organisation in the UK with a mission to deliver knowledge, products, and services to the horticulture industry. Part of this mission involves developing and implementing genetic and genomic tools for effective and efficient breeding of new varieties. DNA-based methods are increasingly implemented in the breeding and selection of strawberries. While a wealth of genotypic information is available for strawberry breeding material, phenotypic data is required to identify genetic variation associated with specific traits. The aim of this project is to collect and analyse phenotypic data for use in a Genome Wide Association Study (GWAS) in a genetically diverse strawberry population. This will be achieved by measuring and assessing commercially-relevant visual, textural, and organoleptic traits (including yield, fruit size and quality, shape, firmness, and sugar content), as well as resistance to pathogens such as Botrytis cinerea. Results from this project will contribute towards identifying loci associated with these important traits, which in turn paves the way for future research into the underlying mechanisms, and identification of possible targets to improve yields and efficiency. The student will gain experience in performing strawberry fruit quality and yield assessments, assays to assess resistance to pathogens, and general plant husbandry. In addition, the student will develop a range of general research skills, including accurate data collection, thorough record-keeping, and time management. All work will be carried out on site at NIAB EMR in East Malling, Kent.
2022_05	NIAB EMR	Genetics, Genomics and Breeding	Cindayniah Godfrey/Felicidad Fernandez Fernandez	11/07/2022	26/08/2022	Rootstock breeding for woolly apple aphid resistance	Bioscience for sustainable agriculture and food;	Traditional apple rootstock breeding takes upwards of 25 years from initial breeding to commercial introduction and requires the integration of multiple desirable characteristics for example dwarfing, vigour, and resistance to pests and disease. The woolly apple aphid (Eriosoma lanigerum) is able to feed on both the scion and the rootstock but is difficult to detect when feeding belowground. There are four reported woolly apple aphid resistance genes and this project aims to improve understanding of the mechanism(s) of resistance conferred by these genes and developing molecular breeding tools. The project will include glasshouse/polytunnel work phenotyping apple families for woolly apple aphid resistance which will be combined with genotyping data to create a genetic map for the gene(s) of interest.
2022_06	UKent	Biosciences	Giuseppe Silvestri	25/07/2022	02/09/2022	Investigating births from unfertilised eggs (virgin birth) in the barn owl (Tyto alba)	Understanding the Rules of Life;	In very rare cases, an unfertilised egg completes development and produces a live hatchling. This phenomenon, known as “parthenogenesis” or “virgin birth”, has been previously described in captive birds but few reports exist which are limited to chicken, turkey, or quail. In very recent times, evidence of parthenogenesis has also been discovered by studying preserved condor DNA samples. Birds born following parthenogenesis suffer from reduced lifespan and fertility so that being able to assess this phenomenon appears important for evaluating potential problems with their breeding for conservation or display. Anecdotal evidence suggests parthenogenesis may be present in other birds, but the difficulty of correctly identifying sexes, potential interactions with wild birds, and the ability of the females to store sperm for extended periods make proving this arduous. Recently, Dorset Falconry Park has reported the birth of an owlet from a securely housed, virgin barn owl but no methodology is in place to prove this was a parthenogenesis case. This project aims at developing a DNA test able to prove parentage in the barn owl. If successful, this would be the first study to report the occurrence of parthenogenesis in the barn owl as well as the first to demonstrate virgin birth in a currently living raptor. Owl DNA samples will be collected non-invasively from all the barn owls at Dorset Falconry Park (n=5). Additional samples (n=10, approximatively) will be obtained from barn owls housed at different aviaries in the UK and/or archived samples. DNA fingerprinting analysis will be conducted by PCR, testing up to 14 genetic markers (short tandem repeats, STR) per bird. Another PCR test would be used to determine the sex chromosome constitution of each bird. The DNA profiles of all birds in study will be compared to determine to a high confidence degree if the target owl was indeed born following a parthenogenetic event.
2022_07	UKent	Biosciences	Helen Cockerton	04/07/2022	12/08/2022	Boosting plant disease resistance through RNA hairpin introduction	Bioscience for sustainable agriculture and food;Understanding the Rules of Life;	Plant pathogens can cause extensive damage to crops, and if left untreated, epidemics can lead to complete crop destruction. New biotechnologies such as Host Induced Gene Silencing (HIGS) can be used to provide an environmentally friendly strategy for disease control. Here we ask whether off-target RNA hair pins can boost baseline plant immunity or whether targeted hair pins are required to generate disease resistant plants. Published work has shown that exogenous application of random siRNA can create disease resistant plants through the upregulation of pathogen triggered immunity. Preliminary data suggests that “internally generated” siRNA produced through the introduction of a hairpin can also upregulate a plants base line immunity, irrespective of the hair pin target. Here we will study whether the introduction of an off-target RNAi hairpin can generate disease resistant plants. Over the course of the placement a summer student will transform the model plant Arabidopsis thaliana to contain premade constructs. Four transformation lines will be produced, these will target 1) a control gene that is not present in the plant or the pathogen 2) a pathogenicity gene present in a fungal pathogen 3) a transcription factor present in a fungal pathogen 4) an empty hairpin vector. The student will also conduct disease assays on pre-existing A. thaliana HIGS lines to assess disease resistance status to both Botrytis cinerea and Verticillium dahliae. This placement will generate resources to study the impact of “off-target” HIGS on a plants base line immunity. Ultimately, the project will shed light on whether there is a secondary mechanism of resistance created by the use of RNA hairpins to reveal an underexploited mechanism of disease resistance.

Biotechnology and Biological Sciences Research Council

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SoCoBio DTP

Project Reference No.	SoCoBio DTP partner	Faculty School Department	Supervisor	Start Date	End Date	Project Title	BBSRC Theme	Project Overview
2022_08	UKent	School of Biosciences	Campbell Gourlay	04/07/2022	29/08/2022	Investigating metabolic dysfunction as a driver of Motor Neuron Disease	Bioscience for an integrated understanding of health;	Amyotrophic lateral sclerosis, also known as motor neuron disease (MND) is a devastating and incurable disease. Significant research efforts have increased our understanding of the cellular dysfunction that underpins ALS pathology, but we have much to learn. Recent findings suggest that metabolic defects play an important role in the onset and progression of ALS, offering the tantalising prospect of new avenues to therapy. The project will make use of our recently developed yeast model of ALS to investigate how mutations in Superoxide Dismutase 1 (SOD1) that are associated with motor neuron disease leads to metabolic dysregulation in eukaryotic cells. You will receive training in genetic engineering, assays to monitor cell health, high resolution live cell imaging and flow cytometry. The outcomes of this research will increase in our understanding of the metabolic dysfunction and cytotoxicity associated with SOD1 mutation that may underpin ALS.
2022_09	UKent	Biosciences, NATS	Marina Ezcurra	04/07/2022	12/08/2022	The microbiome-muscle connection - how gut microbes improve muscle function	Understanding the Rules of Life;	The gut microbiome affects many important functions including gut health, immunity and cognition. Recent studies in humans and mice suggest gut microbes also alter muscle function and performance, raising the exciting possibility that the microbiome can be targeted to improve muscle function and health. The Ezcurra lab has developed a model system to study host- microbiome interactions using the model organism C. elegans and a simplified experimental microbiome. Using this system we found that the microbiome affects muscle function and protects against age-related motility decline by altering immune responses, mitochondrial networks and lipid metabolism. The focus of our research is to determine the exact mechanisms by which host-microbiome affect muscle function. In this project the student will determine microbiome effects on muscle strength and muscle morphology in the model organism C. elegans using behavioural assays and imaging techniques. The project will provide the student with training and experience in microbiological, genetic and imaging approaches. The student will be supervised and trained by the PI and lab members (postdoc and PhD students) and participate in lab meetings, journal clubs and other team activities. OBJECTIVES Objective 1: Basic training in microbiological and C. elegans methods. Methods: Media preparation, cultivation of bacterial strains and C. elegans, handling of C. elegans, epifluorescence microscopy. Weeks 1-2 Objective 2: Muscle strength assays measuring motility using pluronic gel burrowing assays. Weeks 3-4 Objective 3: Quantifying microbiome effects on muscle morphology using transgenic reporters of muscle sarcomeres and epifluorescence microscopy. Weeks 5-6 Objective 4: Data analysis using Excel, ImageJ, GraphPad and statistical methods. Writing of a short scientific report presenting project and results (feedback from supervisor will be provided). Week 6
2022_10	UKent	Bioscience	Simon Moore	04/07/2022	12/08/2022	The biosynthesis of duocarmycin - a future anti-malarial drug?	Understanding the Rules of Life;Bioscience for an integrated understanding of health;	This project concerns the enigmatic biosynthesis of duocarmycin, a DNA binding secondary metabolite, produced by some Streptomyces bacteria. Recent evidence has shown the broad potential of duocarmycin for treating breast cancer and malaria, since it has high specificity for AT rich DNA sequences. Duocarmycin has developed a mesmerising biosynthetic pathway - gleaned from aromatic amino acid biogenesis - to build indole rings from L-tyrosine. This is unusual since most indole containing natural products begin from L-tryptophan, rather than L-tyrosine. Intriguingly, the enzymes involved in this pathway remain uncharacterised. This project primarily aims to characterise the early stage enzymes involved in indole biosynthesis. This includes three enzymes with homology to L-tryptophan synthase (DuoA), 3-dehydroquinate synthase (DuoB) and L-tyrosine decarboxylase (DuoD). We propose DuoA, DuoB and DuoD make a duocarmycin precursor. We aim to show how duocarmycin has developed this unique chemical logic. Preliminary data: We have isolated a novel duocarmycin biosynthetic pathway from Streptomyces corchorusii. The pathway is active and produces a range of duocarmycin intermediates. In addition, we have isolated high yields of soluble protein for DuoA, DuoB and DuoD. The student will follow-up on these preliminary studies and will learn a selection of biochemistry techniques. The major objectives of the proposal are: Objective 1 - Enzymology A)Purify the DuoB, DuoA and DuoD enzymes (soluble and produced in E. coli) B)Perform SDS-PAGE and biochemical analysis of co-purified cofactors (e.g., DuoA/DuoJ co-purify with flavin cofactors but require HPLC-MS verification) C)Perform enzyme assays D)Liquid chromatography-mass spectrometry (LC-MS) analysis of enzyme reactions Outcome - Establish protein purification and show potential activity of the enzymes Objective 2 - Microbiology

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2022_11	UKent	Biosciences	Dr. Anastasios Tsaousis	04/07/2022	12/08/2022	Understanding the effects of regenerative agriculture on the prevalence of methanogens in the soil and animals' gut	Bioscience for sustainable agriculture and food;	There are approximately 9.3 million hectares of farmland in England and through a move to regenerative farming practices agriculture can sequester a significant amount of the CO2e emitted annually in England, helping to achieve agriculture's net zero goal by 2040. Healthier soils are more climate resilient, can hold more water; for example a single teaspoon of healthy soil sustains more organisms than there are humans on earth. Soils with higher organic carbon levels are more productive, require less fertilizer, improve plant and animal health, and reduce flooding. To investigate the role and effect of soil in farming, the aim of this project is to integrate a set of multidisciplinary approaches to evaluate the success of range of regenerative management practices that will be incorporated in a farm setting. As such, we will be joining forces with Re-Generation Earth, that has already established a living laboratory in a farm. This infrastructure combines agroforestry and biochar to the introduction of grazing livestock into a crop rotation. The student will investigate the effect of all these settings on the biology and biochemistry of certain microorganisms (methanogens and symbionts) that are present in the soil and animals' gut, while also investigating the gas emissions from the soil. The student will have access to the farm facilities at the Re-Generation earth establishment, but also will be working in the Tsaousis Lab (Biosciences) and Rob Barker's (SPS) laboratories at the University of Kent. Consequently, the student will investigate the soil's (micro)biology behind its gas emissions, while alternating the configuration of farming and agriculture in general. This project will provide a small piece within the larger puzzle where we intend to display how regenerative agriculture can contribute to England's net zero goal.
2022_12	UKent	School of Biosciences, Division of Natural Sciences	Mark Shepherd	06/06/2022	18/07/2022	Drug repurposing approaches to target the cytochrome bd complex of MRSA	Bioscience for an integrated understanding of health;Understanding the Rules of Life;	Rationale: Antimicrobial resistance remains, 'one of the most urgent health threats of our time', accelerated by indiscriminate antimicrobial use during the COVID pandemic. Hence, new approaches to combat infection are urgently needed. The overarching goal of this project is to repurpose existing drugs and to identify novel inhibitors to target bacterial protein complexes that are important during infection. The protein complex of interest is the cytochrome bd complex, which is found in a broad range of bacterial pathogens and is not present in humans, making this an excellent choice of drug target. Pathogens currently under study in the host lab are multidrug-resistant E. coli, MSRA and Mycobacterial species. Approaches and project plan: The Shepherd lab has developed a computational pipeline for in silico drug screening and has identified hundreds of compounds (from thousands of molecules in a number of libraries) that are likely to target cytochrome bd. Additionally, the host lab has a variety of key mutant strains that are required for drug efficacy assays, which include oxygen electrode measurements, viability assays, and a recently-developed high-throughput fluorescence technique to measure oxygen consumption. This particular Summer project will focus on targeting the cytochrome bd complex from MRSA. The student will employ in silico screening approaches to identify drug candidates and experimentally quantify compound efficacy using the aforementioned suite of techniques. Objectives: - Provide training in in silico drug screening and identify potential drugs that may bind cytochrome bd from MRSA. - Provide training in membrane isolation and oxygen electrode assays, and assay selected drugs for efficacy against cytochrome bd. - Provide training in growth/viability assays, and measure the impact of selected drugs against MRSA cells.
2022_13	UPort	Faculty of Science and Health/School of Pharmacy and Biomedical Sciences/Centre for Enzyme Innovation	Samuel Robson	01/08/2022	09/09/2022	Screening Environmental Microbes for PET Degradation Capabilities	Bioscience for renewable resources and clean growth;	Description: Accumulation of plastics in the environment is one of the major global challenges facing us today. Natural enzymes, such as those produced by micro-organisms such as bacteria, may hold the key to breaking down plastics, with the potential to be deployed on an industrial scale. The Centre for Enzyme Innovation (CEI) at the University of Portsmouth aims to identify and exploit such enzymes from the environment. They have developed a biobank of environmental samples collected from a range of sources with potential for plastic-degrading enzymes to be present (waste sites, recycling plants, fuel tanks, sea sponges, etc.). In this project, the selected candidate will first select bacterial isolates of interest from the CEI biobank, culture these isolates, and perform DNA extraction in order to carry out PCR screening for known PET-degrading genes. Any isolates indicating a positive result from this PCR screening will then undergo confirmatory tests using microbiological techniques developed within the CEI (i.e. screening using Coomassie blue staining of M9 agar and 5% PEG), as well as a novel technique developed by Charnock et al (2021). Potential candidates from this screening project will undergo whole genome sequencing, providing the successful candidate with experience of Nanopore sequencing, bioinformatics analysis, and data exploration (e.g. de novo genome assembly, gene annotation). Objectives: 1) Identify potential PET-degrading isolates based on PCR screening. 2) Optimise PET-degrading assay from Charnock et al. 3) Confirm PET-degrading potential using a range of assays. 4) Perform whole genome sequencing of candidate isolates using Nanopore sequencing. References: Charnock C (2021). A simple and novel method for the production of polyethylene terephthalate containing agar plates for the growth and detection of bacteria able to hydrolyze this plastic. Journal Of Microbiological Methods, 185, 106222. doi: 10.1016/j.mimet.2021.106222.

University of Southampton · University of Portsmouth · University of Sussex · NIAB EMR · University of Kent

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2022_14	UPort	Science and Health/Pharmacy and Biomedical Sciences	David Rusling (and Franklin Nobrega)	01/08/2022	09/09/2022	RNA-DNA triplex formation by bacteriophages	Understanding the Rules of Life;	It is well-established that single-stranded RNA can bind within the major groove of duplex DNA by triple-helix formation, and there is growing evidence that non-coding RNAs regulate the expression of genomic DNA in this manner (Greifenstein, 2021). It therefore seems plausible that RNA-DNA hybrids take part in regulating other DNA transactions in vivo, for example preventing DNA degradation by endonucleases. We postulate that RNA-DNA hybrids might be exploited by bacteriophages as a means to protect their genome from degradation by bacterial immune system, such as CRISPR-Cas systems (Vlot, 2018). This project will exploit a simple combinatorial assay to isolate and identify interactions between isolated phage RNAs and DNA. The assay is based on a modified REPSA assay and consists of three steps: RNA binding to a DNA pool, non-specific cleavage of unbound DNA by a Type IIS restriction endonuclease, and amplification of uncleaved DNA by PCR (Van Dyke, 2007). The RNA bound DNA is then enriched, cloned and sequenced. The enriched RNA-DNA sequences will be investigated for their ability to protect the underlying DNA from digestion by Cas9, Cas12 and Cas13 nucleases using an EMSA-based restriction assay. The student will be supervised by Dr Rusling (triplex formation, Portsmouth) and Dr Nobrega (CRISPR-Cas, Southampton) and gain experience in assay design, gel electrophoresis, PCR, simple cloning and the manipulation and purification of nucleic acids. Greifenstein et al. RNA:DNA triple helices: from peculiar structures to pervasive chromatin regulators. Essays Biochem. 2021, 65: 73. Vlot et al. Bacteriophage DNA glucosylation impairs target DNA binding by type I and II but not by type V CRISPR–Cas effector complexes. Nucleic Acids Res. 2018; 46 873–885. Van Dyke et al. REPSA: general combinatorial approach for identifying preferred ligand-DNA binding sequences. Methods. 2007, 42: 118.
2022_15	USoton	Medicine/Human Development and Health/Nutrition	Dr Caroline Childs	11/07/2022	19/08/2022	The effect of dietary Taxifolin or Ergothioneine upon immune biomarkers in healthy volunteers	Understanding the Rules of Life;Bioscience for an integrated understanding of health;	The complexities of the immune system make measuring the impact of dietary interventions upon its function challenging. An individual's diet provides the energy required to mount a strong and protective immune response, the building blocks required for synthesis of immune mediators such as antibodies and cytokines, and can also indirectly affect immune function via changes in the gut microbiome. Though current dietary guidelines advise the consumption of 5 portions of fruits and vegetables per day, recent surveys reveal that fewer than 30% of adults achieve this. Antioxidants found within fruits and vegetables are understood to be one of the important aspects by which our diet can influence health. Adults aged 50-65 were provided with 8-week dietary supplement with 250mg Taxifolin or 80mg Ergothioneine. Taxifolin is a naturally occurring polyphenol found in apples, onions and other fruits and bark extracts. Ergothioneine is an amino acid found in mushrooms, oats and some bean varieties. We hypothesise that Taxifolin/DHQ and/or Ergothioneine will alter immune function via their established antioxidant effects, and that the effects observed will vary among older adults relative to their degree of immunosenescence. This student project will examine the effects of supplementation upon biobanked samples, which may include markers of immune age, immune function, antioxidant status or upon the metabolome. The student will work as part of an established research team and supported to learn laboratory methods, conduct sample analysis, and undertake data analysis. This project period will include opportunities to gain experience in a range of techniques used in nutrition science including flow cytometry, ELISA, cell culture and mass spectroscopy.
2022_16	USoton	Faculty of Medicine / School of Human Development and Health	Jonathan Swann	01/07/2022	30/09/2022	Role of the microbiota-gut-brain axis in cognitive decline	Bioscience for an integrated understanding of health;	Cognition is a mental process for gaining knowledge and understanding of the world around us, and it usually gets worse with age. This deterioration often coincides with structural and functional changes in the brain. While healthy lifestyles can reduce the rate of age-associated cognitive decline, obesity has been implicated in its acceleration. This is important as obesity rates continue to rise in the UK, peaking in adults aged 45-54 years (36% obese) and remain high in older groups (33.5%, 55-74 years). A vast population of microorganisms are present in the human gut, collectively referred to as the gut microbiota. We, and others have shown that these microorganisms are able to produce chemicals in the gut that can modify processes occurring in the brain with implications for cognition and overall well-being. Importantly, the types of microbes present in the gut and their overall activities change with age and obesity, and we now have preliminary data suggesting that the intestinal microbiota and their chemical output is related to normal age-related cognitive decline. To further investigate this, we will measure the chemicals produced by the gut microbiota in humans of different ages and body mass index (BMI; a measure of obesity) and explore relationships between these signals and brain structure and function. Using different analytical chemistry techniques, we will measure microbial-related molecules in blood and stool samples collected from over 1,000 people (aged 50-98 years). These participants have had their brain structure and function measured as well as the microorganisms present in their stools (reflective of their gut microbiota). This data will allow us to identify microbial metabolites that are associated with brain function, the microorganisms responsible for their synthesis, and the influence of age and obesity on their production and effects.
2022_17	USoton	FELS / Psychology	Valerie Brandt	04/07/2022	08/08/2022	Understanding what drives tics in patients with Tourette syndrome - the psychological side	Bioscience for an integrated understanding of health;	I am currently collecting data on the urge to tic in Tourette patients and how behavioral therapy changes that urge to tic and the tic frequency. The project will include inputting questionnaire data, organizing data and running simple, descriptive statistical analyses. The project may also include watching patient videos and coding tics.

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2022_18	USoton	Medicine/Human Development and Health/Nutrition	Dr Caroline Childs	01/07/2022	30/09/2022	A study of dietary Taxifolin and Ergothioneine upon oxidative stress in healthy older volunteers	Bioscience for an integrated understanding of health;	Antioxidants found within fruits and vegetables are understood to be one of the important aspects by which our diet can influence health. Taxifolin is a naturally occurring polyphenol found in apples, onions and other fruits and bark extracts. Ergothioneine is an amino acid found in mushrooms, oats and some bean varieties. Healthy older volunteers (age 50-65yr) have been provided with dietary supplements for 8 weeks, in a parallel placebo-controlled study which started in November 2021 (REC number: 21/LO/0504, NCT05190432) and available biobanked samples include immune cells, urine, plasma/serum and faecal samples. This project will examine the effect of these dietary supplements upon markers of oxidative stress. Outcomes to be assessed will include plasma lipid peroxide concentrations, and urinary and plasma isoprostane concentrations. These will be assessed by ELISA using commercially available kits, under the supervision of experienced researchers. Samples are collected at baseline, after 4 weeks of supplementation, after 8 weeks of supplementation, and 3 months after supplementation ended. Data will be explored for relationships between any change in status and participant characteristics, such as age, gender, BMI or background diet. In addition to the work undertaken by the student, they will have opportunities to observe other research taking place within the study team, which will include cell culture, flow cytometry, Luminex and metabolomics. The student will join a vibrant nutrition research team, supported by postdoctoral and PhD researchers in the laboratory, and able to attend regular meetings and seminars of the Nutrition Research group and to participate in online or in-person public outreach events such as the New Forest Show. The work undertaken by this student will be of high value to this research project, and it is probable that the student will be included in conference abstracts and/or publications arising from their contributions to the laboratory analysis.
2022_19	USoton	FELS/Health Sciences & Biological Sciences	Sandra Wilks	01/06/2022	12/08/2022	Can green tea enhance the antimicrobial activity of antibiotics on planktonic and biofilm bacteria	Bioscience for an integrated understanding of health;Bioscience for sustainable agriculture and food;	Biofilms, structured communities of bacteria forming on a surface and surrounded in a self-produced matrix of extra-polymeric substances (EPS), exhibit a higher tolerance to antibiotics, leading to chronic infections and the appearance of multi-drug resistant strains. Recent work has demonstrated how certain natural products, such as honey and various plant extracts, can exhibit high levels of antimicrobial activity. One such product is green tea which is widely used across Asia for its health benefits. While the search for new antibiotics continues, the need for improved treatments is urgently required. In this study, we will look at whether combining green tea with antibiotics can improve their efficacy against biofilms, as well as planktonic bacteria. To do this, biofilms of two Gram positive (Staphylococcus aureus and Streptococcus pneumoniae) and two Gram negative (Escherichia coli and Pseudomonas aeruginosa) bacterial species will be tested using MBEC plates to determine the minimum biofilm inhibition and eradication concentrations and compared with planktonic samples. The main objectives are: •Determine the minimum inhibitory concentration (MIC) values for green tea and appropriate (species-specific) antibiotic in planktonic cultures. •Using MIC values and a checkerboard assay, show whether a combined effect of green tea plus antibiotic has no effect or is antagonistic or synergistic. •Repeat using biofilm cultures grown on MBEC plates. Main techniques: This project will involve development of standard microbiological culture techniques, maintenance of cultures, completion of MIC, MBEC and MBIC assays as well as the use of spectroscopic approaches in the checkerboard assay. Outcome: Determine whether the use of green tea can enhance antibiotic activity on a range of bacteria including biofilms, providing proof of concept data for further investigation.
2022_20	USoton	FELS/Biological Sciences	Mark Chapman	03/07/2022	14/08/2022	Environmental effects on tomato fruit quality and quantity	Understanding the Rules of Life;Bioscience for sustainable agriculture and food;	The environment affects how plants grow and survive. For example, more nutrients in the soil can allow greater vegetative growth and yield. In facing a changing climate, we are going to need to grow more food under more variable and extreme conditions and potentially on poorer quality soils. Little is known about the effect of the environment on the quality of the product, most studies so far focus solely on yield. In our study we are growing tomatoes and their wild progenitors under multiple soil nutrient environments to determine how this affects the plants in terms of biomass and fruit production. The role of the student undertaking this project will be to evaluate the fruits for sugar and vitamin content to determine whether greater yield also means better and more healthy tomatoes, or whether more fruit are produced at the expense of the fruit quality. Determining whether different tomato varieties or the wild progenitors are differently affected by the environment will have important repercussions for planning strategies to mitigate food insecurity.

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Project Reference No.	SoCoBio DTP partner	Faculty School Department	Supervisor	Start Date	End Date	Project Title	BBSRC Theme	Project Overview
2022_21	USoton	Faculty of Natural and Environmental Sciences	Jessica Teeling	04/07/2022	12/08/2022	Can we use cabbage-derived chemicals to promote healthy ageing?	Bioscience for an integrated understanding of health;	People in England live longer than ever before, but not always in good health. Many older people live with multiple long-term conditions, resulting in substantial risk of age-related disease and care needs. Many age-related neurological conditions are multi-factorial and include neurodegeneration, neurotransmitter abnormalities especially cholinergic dysfunction, formation of amyloid plaques, the hyperphosphorylation of Tau protein and inflammation. Yet existing approved therapies primarily provide a single mode of action. Thus, to promote healthy ageing, there is a clear need for develop novel interventions with multiple modes of actions. The involvement of the gut microbiome and inflammation in age-related conditions has been the subject of much recent interest and eating a vegetable-rich diet, has shown promising effects in experimental models of ageing. Cruciferous vegetables, like broccoli, bokchoy, and cabbage, have high levels of hydrogen-sulphate (H2S) releasing chemicals. These chemicals include sulforaphane and brassinin, known for their antioxidant, anti-inflammatory and antimicrobial properties, but the effect of these H2S-releasing compounds on microglia and neuroinflammation remains unknown. In this summer project we wish to compare the anti-inflammatory properties of sulforaphane and brassinin, and compare their effects to a newly developed dithiocarbamate derivative of sulphoraphane, which enhanced capacity to generate H2S. The student will screen our target compounds (sulforaphane, sulforaphane dithiocarbamate and brassinin) for anti-oxidant and anti-inflammatory activity and cell viability against LPS- activated human microglia (HMC3 cell line). Levels of inflammatory mediators will be analysed using qPCR and commercially available immune assays. This summer project will provide proof-of-concept data that H2S-releasing compounds derived from cruciferous vegetables have potent anti-inflammatory properties. This project will help us to better understand healthy ageing and how dysregulation can lead to increased risk of developing certain types of dementia. This project may lead to development of SoCoBio DTP studentship application for the 2022-2023 round.
2022_22	USusx	School of Life Sciences/ Neuroscience	Majid Hafezparast	04/07/2022	12/08/2022	The role of TDP-43 in aberrant alternative translation in motor neuron disease/amyotrophic lateral sclerosis (ALS)	Understanding the Rules of Life;	Amyotrophic lateral sclerosis (ALS) is the most common form of motor neurone disease. It is a debilitating and fatal degenerative disorder of motor neurones in the brain and spinal cord, which is manifested by progressive muscle weakness, wasting and paralysis. The gene encoding Tar DNA binding protein 43 (TDP-43) is one of several genes that has been shown to undergo mutations which cause ALS. The exact mechanism by which faulty TDP-43 leads to ALS is not understood. Hafezparast's laboratory have evidence that mutant TDP-43 impairs 'alternative translation' of a protein known as peripherin. Peirpherin is a structural protein and part of the internal skeleton of neurones, contributing to the maintenance and shape of our neurones. It is likely that aberrant alternative translation of genes such as those coding for peripherin by defective TDP-43 is a contributory factor in ALS. This project aims to evaluate and characterise a versatile cellular model for ALS, in which the molecular mechanisms of the role of TDP-43 in alternative translation of peripherin could be interrogated. This model system will provide a paradigm for understanding the basic biology of ALS.
2022_23	USusx	Neuroscience	Louise Serpell	01/07/2022	19/08/2022	Exploring the polymorphic structures of tau	Understanding the Rules of Life;	Tau is a natively unfolded protein well known for its relationship to protein misfolding in Alzheimer's disease and other neurodegenerative disorders. The stabilisation of microtubules is most well characterised function but it also plays additional functions in the nucleus. Furthermore, recent studies have shown that tau is able to participate in liquid-liquid phase separation. In Neurodegenerative Diseases known as Tauopathies, tau self-assembles and adopts amyloid fibrils composed of cross-beta structure. Intriguingly, each type of tauopathy has a particular polymorphic fold within the fibrils and these form the rungs of the beta-sheet ladder. Overall, tau is a fascinating protein with potential to form many different structures. This project will aim to examine the different structural polymorphs that are formed by tau under varying conditions. By subtly altering the assembly conditions, we aim to explore potential different structures. Our own recent work has revealed that a truncated form of tau is able to self-assemble to form paired helical filaments that mimic those extracted from Alzheimer's disease brain and we will utilise this protein for these studies. Objectives: 1) to characterise the structures of filaments formed by truncated tau under varied conditions of temperature, salts, buffers and pH using electron microscopy (Sussex) and Atomic force microscopy (Kent) 2) to examine the assembly kinetics under varied conditions using fluorescence assays. This work will reveal the potential of truncated tau to form different polymorphs and establish the influence of assembly conditions on the morphology of the filaments. This is important since different diseases are related to different polymorphs. Our work will provide important details regarding the contribution of environmental conditions for the generation of filaments from tau.

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Project Reference No.	SoCoBio DTP partner	Faculty School Department	Supervisor	Start Date	End Date	Project Title	BBSRC Theme	Project Overview
2022_24	USusx	EBE, Life Sciences	Dr Beth Nicholls	04/07/2022	12/08/2022	Can bees taste pollen with their feet?	Bioscience for sustainable agriculture and food;	Background: Bees visit flowers to collect pollen and nectar as a source of food, and in the process provide a vitally important pollination service to wildflowers and food crops. Bees are known to use sugar concentration and nectar volume to guide their flower choices during nectar collection, but how bees evaluate pollen rewards is not currently understood. This is because unlike nectar, bees typically don't eat pollen themselves at the flower, but instead carry it back to the nest on their bodies to be consumed by larvae and young bees. This raises the question of whether foraging bees can taste differences in the nutritional quality of pollen, and if so, which sensory organs do they use to do this? Bees have taste receptors on their antennae, mouthparts and tarsi (feet/legs), but taste perception is generally not well understood in bees, or indeed many insect species. The least well studied taste organs are the tarsi, however since bees' legs make lots of contacts with pollen during collection and grooming, the tarsi may play an important role in pollen evaluation. Project aim: Use taste assays to test the ability of bumblebees to taste pollen nutritional compounds (amino acids and fatty acids) with their tarsi (feet). Nature of work: Experiments will take place in the Nicholls lab at the University of Sussex between July-August (exact dates flexible). You will learn how to collect bees from colonies, prepare test solutions, conduct taste assays and condition learning behaviour in bees. You will receive all the training necessary to carry out this project. Ideally you will have an interest in animal behaviour, and be comfortable learning how to handle live insects. If you have a bee allergy this project may not be suitable as there is a very small risk of being stung during experiments.