Project Details	
Project Code	NMH27Ca Sumner
Title	Chronic pain, sensory hypersensitivity and neurodiversity: why are they linked?
Research Theme	Neuroscience & Mental Health
Project Type	Dry lab
Summary	Chronic pain conditions such as fibromyalgia, dysmenorrhea and back pain affect millions of people and severely disrupt daily life. An interesting but poorly understood feature of these chronic pain conditions is their association with heightened aversion to everyday sensory input, such as bright lights, loud sounds, touch, or strong smells. Chronic pain also has higher prevalence in neurodivergent people (e.g. autistic, ADHD) than would be expected. A theory potentially explaining these links is 'central sensitisation', but mechanistic understanding is currently very limited. This PhD will investigate the nature of central sensitisation and test potential mechanisms that may contribute to it.
Description	Chronic pain affects many millions of people worldwide. It is more common in women than men. Less well known, it is more common in people who identify as neurodivergent. The reasons for this are currently mysterious. Around 15% of the general population experience 'sensory hypersensitivity', heightened sensitivity to everyday sensory input, such as bright lights, loud sounds, certain textures, or strong smells. These sensory experiences can limit participation in work or education, reduce wellbeing and cause distress. Sensory hypersensitivity is especially common in autism (being part of the diagnostic criteria), and also correlates robustly with dyslexia and ADHD for example. Likewise, sensory hypersensitivity is common in people experiencing various types of chronic pain, including fibromyalgia, dysmenorrhea, migraine and back pain. This overlap between chronic pain, neurodiversity and sensory hypersensitivity is not understood. Nor have the research fields and clinical specialties come together to ask whether treatments and intervention approaches for pain might be applied for aversive sensory hypersensitivity, and vice versa. One theory evoked to explain this overlap is 'central sensitisation', a process where the central nervous system becomes more responsive to incoming sensory and pain signals. This mechanism was first described in the spinal cord where it upregulates pain signals. A similar idea has been extended as a more generalized theory (with less supporting evidence) to explain non-pain sensory sensitivities (with possible mechanisms in sensory cortices, or thalamus, for example). It remains unclear whether this more general theoretical framework (henceforth 'generalized central sensitization') is an appropriate extension of the known spinal cord mechanism, and what the mechanisms of this general theory are that could explain why some people with chronic pain should have co-morbid non-pain sensory hypersensitivies, and why prevalence is also associated with neurodiversity. Key Research Questions:

	- What is the nature of the association between pain and other sensory sensitivities, and what mechanisms might explain it? This PhD offers an exciting opportunity to investigate the mysterious relationship between chronic pain and sensory hypersensitivity and inspire future strategies for supporting sensory wellbeing and personalised pain support. Specific objectives Objective 1: To better understand the relationships between chronic pain conditions and sensory hypersensitivity, both for people who do or do not identify as neurodivergent. Within this aim are several lines of enquiry that can be guided by student interest: A: does sensory hypersensitivity fully explain (mediate) the association between pain and neurodiversity? (questionnaires and mediation modelling) B: Since pain intensity changes across the day, between days and across monthly cycles, does sensitivity to sound, lights or touch change in sync with these fluctuations? This would suggest some shared mechanisms (questionnaires and standardized testing). C: Which types of sensory sensitivity are most associated with each chronic pain condition, with standardized measures of pain, and with indicators of central sensitization? This would build on our recent clarification of the difference subtypes of sensory sensitivity (questionnaires and standardized testing). Objective 2: Do pain and sensory sensitivity directly influence each other? Often, people find that visual or auditory stimuli can reduce pain sensations through distraction. But a generalized central sensitization theory would assume the opposite should occur once central sensitization is established – that stimulation in one sense exacerbates aversive experiences in another sense. Again, the exact questions and methodology can be directed by student interest. Techniques will be psychophysical. Objective 3: To test the proposed mechanism of generalized central sensitization as a change in excitation/inhibition balance in key brain regions. Leveraging CUBRIC's world class imaging facilities and experience, this will use state of the art neuroimaging techniques known to reflect the balance of excitation and inhibition in neural circuits. This objective could also harness intra-individual differences in sensory experience over time - a feature of both chronic pain and non-pain hypersensitivities. We may also utilise microneurographic recordings of single pain fibre activity. The successful student will develop strong foundations in pain measurement, sensory psychology, sensory neurobiology, neuroimaging and co-production with people with lived experience. They will receive comprehensive training across both quantitative and qualitative approaches, building confidence in advanced analytical and methodological techniques. No specific skills are required in advance - just curiosity, motivation, and an interest in developing both theoretical understanding and practical research skills (including a willingness to learn new statistical methods). They will enter a vibrant and supportive environment, working alongside students and researchers engaged in related and complementary topics.

	The student will benefit from the rich research ecosystem spanning Cardiff and Bristol, including the GW4 Biopsychosocial Pain network, CUBRIC (brain imaging and neuroscience), the Wales Autism Research Centre, Women's Health Research Wales, the Cardiff Dizzy Lab, and the Bristol Anaesthetics, Pain and Critical Care research group. This multidisciplinary setting offers exceptional opportunities to learn from experts across fields, collaborate on cutting-edge research, and become part of an engaged, welcoming academic community.
Can be completed part time?	Yes
Supervisory Team	
Lead Supervisor	
Name	Professor Petroc Sumner
Affiliation	Cardiff
College/Faculty	BLS
Department/School	Psychology
Email Address	sumnerp@cardiff.ac.uk
Co-Supervisor 1	
Name	Dr George Tackley
Affiliation	Cardiff
College/Faculty	BLS
Department/School	Medicine
Co-Supervisor 2	
Name	Dr Jim Dunham
Affiliation	Bristol
College/Faculty	LS
Department/School	School of Psychology and Neuroscience
Co-Supervisor 3	
Name	
Affiliation	
College/Faculty	
Department/School	