

Precision sensors for biomagnetic and neurological monitoring

Institution	The University of Queensland
Project details	This internship will focus on the development and characterization of precision magnetic sensors designed for biomedical measurement modalities, including magnetoencephalography (MEG), magnetomyography (MMG), and magnetic resonance imaging (MRI). Ultra-sensitive optomechanical magnetic sensors offer the potential to revolutionize non-invasive neural and muscular monitoring by enabling room-temperature, unshielded measurements, in contrast to the cryogenic or heavily shielded systems required by current technologies. The project will investigate the performance of magnetometers based on optomechanical and piezomagnetic elements, focusing on key parameters such as sensitivity and frequency response to biomagnetic fields. Interns will work closely with a team of researchers to measure sensor responses to weak magnetic signals representative of neural and muscular activity, identify dominant environmental noise sources relevant to biomagnetic measurements (e.g., electromagnetic interference, instrumentation noise), and explore improved device designs, shielding, and signal-processing strategies to enhance sensor performance. Practical tasks will include assembling and testing sensor prototypes, performing basic signal acquisition and analysis, and evaluating key performance metrics such as magnetic field sensitivity, noise floors, and temporal-frequency signal components. The internship will provide hands-on experience with techniques directly relevant to translating sensor technologies from the lab to biomedical applications. Expected Aims and Outcomes • Gain practical experience in designing and testing optomechanical magnetometers. • Quantify sensor performance relative to biomagnetic field strengths typical of MEG and MRI signals. • Characterize relevant signal features and noise sources and explore methods to improve sensor performance. • Develop a preliminary roadmap for integrating these sensors into biomedical measurement systems.
Who can apply	Undergraduate students in their 3rd or 4th year, ideally with a background in physics, biomedical engineering, or electrical engineering. Experience with optics, electronics and signal processing, will be advantageous.
Contact / Project supervisors	Dr Benjamin Carey - benjamin.carey@uq.edu.au