รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilities of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
1	3D Additive Direct Ink Writing of Zeolites Material	Zeolite plays an important role for applications in gas adsorption, separation, and catalysis, primarily due to its numerous active sites and distinct porous structure. However, traditional production methods often limit zeolite shaping options, subsequently impacting its gas adsorption efficiency. This research project aims to push the boundaries of zeolite production by investigating the feasibility of producing self-standing zeolite monoliths with goodl shape retention using Direct Ink Writing (DIW). The primary objective is to enhance the overall support loading capacity of zeolite monoliths by maximizing the utilization of their active pores. This goal will be achieved through a combination of structural design, reduction of organic and inorganic binder content, and optimization of processing parameters. The research encompasses three key components: By addressing these research components, we aspire to expand the horizons of zeolite applications and improve their efficiency in various industrial processes, particularly in the realm of gas adsorption, separation, and catalysis.	(1) Learn Direct Ink Printing Process for zeolite material (2)Understand paste rheological behavior and characterization techniques (3)Familiar with post thermal treatment process (4)Hands-on DIW printing, thermal heat treatment and characterization of paste and final parts	1. To conduct DIW experimental work, including feedstock preparation, printing and thermal treatment, etc... 2. To characterize paste properties and gas adsorption 3. To compile and analysis data	Personal (1) Interpersonal skills (2) Willingness to learn (3) Can-do attitude	Project 1. Development of Binder Formulation: •This phase involves formulating novel binders specifically tailored for DIW, aiming to strike the right balance between structural integrity and porosity while minimizing the binder content's impact on zeolite performance. 2.Printing Parameter Studies: •The second aspect of the research focuses on an in-depth exploration of the printing parameters involved in the DIW process. This includes the assessment of variables such as design with different geometries, nozzle size, printing speed, and layer thickness, with the objective of achieving the desired zeolite parts with good shape retention. 3.Optimization of Drying and Sintering Conditions: •In the final stage, the drying and sintering conditions will be fine-tuned to ensure that the zeolite monoliths maintain their structural integrity and maximize the exposure of active sites. This optimization process will be pivotal in realizing the full potential of the zeolite monoliths produced by DIW.	SIMTech	Additive Tech Innovation (ATI)	Su Xia Zhang	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	2
2	3D Printing of Ceramic Materials for Extreme Environment Applications	The project aims to revolutionize the manufacturing of ceramics for use in extreme conditions, such as high-temperature environments, corrosive atmospheres, aerospace, and radiation-related applications. This project combines cutting-edge 3D printing technology with advanced ceramic materials to fabricate highly customized, durable, heat-resistant, and radiation-shielding components for industries where traditional manufacturing methods have proven inadequate.	(1) Understand 3D Printing Process (2) Understand Post-Processing Heat Treatment Processes (3) Understand Microstructural and Elemental Analysis of Ceramic Materials (4) Experimental Planning and Design Skills (5) Hands-On Experience with Additive Manufacturing Technologies (6) Hands-On Experience with Research & Development Work Environment	Project (1) Assist and Involved in 3D Printing Process and Post-Processing (2) Carry Out Experimental Validation (3) Carry Out Feedstock & Sample Preparation (4) Carry Out Material Characterization and Analysis Personal (1) Display Good Team Work (2) Critical Thinking for Problem Solving (3) Willingness to Learn		Project (1) Assist and Involved in 3D Printing Process and Post-Processing (2) Carry Out Experimental Validation (3) Carry Out Feedstock & Sample Preparation (4) Carry Out Material Characterization and Analysis Personal (1) Display Good Team Work (2) Critical Thinking for Problem Solving (3) Willingness to Learn	SIMTech	Additive Tech Innovation (ATI)	Yan Han Liew	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
3	A trimodal AI framework for target discovery	Spatial omic technologies enable high-throughput spatially-resolved measurements of gene and/or protein expression in complex tissues. However, analytical pipelines remain underdeveloped, impeding biological insight and clinical translation. In this project, we will develop methods and algorithms for integration of whole-slide imaging and clinical data with spatial omics data for biomarker discovery.	Student will develop proficiency in processing and analyzing spatial omics data, including quality control, data preprocessing and visualization. Student will also develop proficiency in AI models for clinical imaging analysis, such as vision transformers and graph neural networks.	Student will collaborate with senior scientists to design, develop and train models for integration of spatial omics data with imaging and clinical data. Student will also assist in data preparation and preprocessing. Student will document experiments and findings, and prepare reports and presentations. Student will actively participate in team discussions and attend lab meeting.	Strong programming skills in Python and/or R. Familiarity with machine learning libraries (eg. scikit-learn, PyTorch, DGL) and/or scRNA-seq/spatial omic analysis pipelines, is a plus.	Spatial omic technologies enable high-throughput spatially-resolved measurements of gene and/or protein expression in complex tissues. However, analytical pipelines remain underdeveloped, impeding biological insight and clinical translation. In this project, we will develop methods and algorithms for integration of whole-slide imaging and clinical data with spatial omics data for biomarker discovery.	GIS	Laboratory of Systems Biology and Data Analytics	Grace Yeo	Genome Institute of Singapore, 60 Biopolis Street, Singapore 138672	Computing and Information Sciences	2
4	Accelerated 3D reconstruction with deep learning: development of advanced 3D vision with sparse 2D images	Background Computed Tomography (CT) plays an important role in both medical and industrial applications. For one object, numerous 2D X-ray images are required to be captured for the 3D reconstruction, which is time-consuming and burdens the inspection efficiency. Problem statement Instead of dense 2D X-ray image capturing, this projects targets to accelarate the 3D reconstruction with deep learning. Based on the spatial correlation and network learning capability, the advanced algorithm will be developed to estimate a dense dataset with sparse dataset.	Targeted deliverables 1. Summary and comparison of 3D reconstruction algorithms 2. An accelarated 3D reconstruction algorithm design 3. A computer vision co-authored conference paper	1. Comparison of different 3D reconstruction algorithms and summarize their merits and demerits 2. Build a 3D reconstruction benchmark with our existing 2D X-ray images 3. Design and implement an accelarated 3D reconstruction algorithm 4. Explore the minimum image number for the 3D reconstruction	Focus on deep learning developmemnt based on our dataset. No need to do any X-ray experiments	Refer to roles and responsibilities	SIMTech	Optics and Imaging Systems (OIS)	Dong Chaoyu	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
5	Acousto Microfluidics	The human body comprises various substances, including DNA, proteins, and cells, each with dimensions spanning from nanometers to micrometers. Conventional laboratory equipment, designed for bulk lab-based experiments, falls short when it comes to exploring the properties of these individual entities. IME has pioneered a groundbreaking technology that employs precisely controlled sound waves to capture and manipulate bio-particles from the nanometer to micrometer scale. We invite you to join us in testing this revolutionary device and collaborating on the development of even more advanced iterations. In this project, we aim to create a cutting-edge system for acoustophoretic particle manipulation, achieved by incorporating PiezoMEMS-based acoustic devices into microfluidic channels.	In this project, student will learn two technologies. 1. Acoustic MEMS device: Fundamental, acoustic MEMS device design & characterization 2. Microfluidic: Basic knowledge of microfluidics, acoustophoretic particle manipulation	The student will conduct acoustic MEMS device characterization, microfludic experiments, and analysis.	Knowledge and experience in microelectronics or MEMS	1. MEMS acoustic device characterization (device level) 2. Integration of MEMS acoustic device and microfluidic channels 3. Acousto microfluidic experiments (acoustophoretic particle manipulation)	IME	MEMS	Yui Koh	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
6	Advanced 4D Printing of Magnetic Shape Memory Alloy for Aerospace Application	We are seeking a motivated and innovative student to lead a research project focused on the material and processing development for magnetic shape memory alloys using laser powder bed fusion (LPBF). This project aims to expand the possibilities of LPBF by exploring advanced smart materials with controlable magnetic shape memory effect.	An in-depth understanding of LPBF technology and its applications for shape memory alloys. Expertise in materials science, particularly shape memory alloys. Experience in designing and executing experiments with smart materials. Proficiency in data collection, analysis, and interpretation. Skills in microstructure characterization and functional property evaluation. Effective communication and collaboration within a research team. Presentation and reporting skills to convey research findings.	Literature Review: Conduct an extensive review of existing research and developments in 4D printing of magnetic shape memory alloys. Materials Selection: Collaborate with materials scientists to select appropriate alloying element for additive manufacturing of magnetic shape memory alloy for good printability and functional properties. Experimental Setup: Plan and set up experiments to print parts using the magnetic shape memory alloy powder in an LPBF system. Configure the printer, powder beds, and process parameters. Data Collection: Collect data during the printing process, including process parameters for each powder. Process Optimization: Investigate ways to optimize the printing process with the shape memory alloy, ensuring the high density and excellent shape memory effect of the produced parts. Material Characterization: Evaluate the defects, microstructures, mechanical properties, and shape memory effect of the printed parts. Data Analysis: Analyse the data collected during experiments, identify trends and insights, and use these findings to provide recommendations for further development. Reporting: Document your research findings comprehensively and create presentations and reports for the research team and stakeholders.	Grade Point Average above 4.0 Mechanical / Materials Engineering knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and alloy development. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous.	We are looking for an student who is passionate about pushing the boundaries of additive manufacturing and materials science. As the student, your primary responsibilities include alloy development and processing development for 4D printing of magnetic shape memory alloy. Key responsibilities include conducting experiments, collecting and analyzing data, understanding the process-microstructure-functionality relationship, and reporting your findings to the team.	SIMTech	Additive Tech Innovation (ATI)	Hu Zhiheng	5 Cleantech Loop, #01-01, Singapore 636732	Engineering and Technology	1
7	Advanced Electroless Plating Technology for Metallization of Electronic Grade Ceramics	The market of high-end ceramic-based circuitry has grown rapidly in recent years, which require advanced metallization technology. The application of the high-end ceramic circuitry products includes high power electronics, where both thermal conductivity and electrical insulation are requested with high reliability, e.g. rectifiers for aerospace, electronic packages, heat spreaders and heat sinks (e.g. LED), laser components and heatsink. Conventional technologies to metallize the ceramics include physical vapour deposition (PVD), chemical vapour deposition (CVD), screen printing of metal paste, sintering and brazing, etc. However, all the above methods have limitations in terms of coating coverage and uniformity for the components with deep holes or complex surface due to their line-of-sight process in nature. In addition, the conventional metallization processes are not cost effective. In this project, innovative electroless deposition process is proposed to metallize high-end and hard-to-plate ceramics (AlN, Al2O3 & MgO) with good adhesion and compatible with the high temperature processing such as reflow or laser soldering and/or brazing.	The student will learn literature review, electroless nickel or electroless copper plating, formulation of solution baths for cleaning, conditioning, new activation process as well as coating characterization.	The attached student will go through HSE induction and briefing and ensure safety compliance. Literature review. Plan and conduct the relevant experiments. Compile and present results in written form or oral presentation.	N.A.	1) Literature Review on ceramic metallization process 2) Process optimization and modification 3) Experiment on metallization 4) Coating characterization 5) A final report with detailed process and results"	SIMTech	Surface & Circular Processing (SCP)	Yujie Zhou	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1

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8	Advancing optical wireless technologies for underwater communications	The team's objective is to pioneer optical wireless technologies to enable underwater communication. IHPC team is leading the design and analysis of the optical systems and measurements data, leveraging on computational algorithms and AI/ML techniques. We are collaborating with industry partners, including multinational corporations and government agencies, to ensure seamless technology deployment for rapid and robust underwater optical data transmission.	• Gain experience with computational algorithms to solve design challenges in research • Gain understanding of state-of-the-art optics and material, relevant to applications in sensors, displays, ICs, space • Work in a collaborative environment with cross-domain experts, exposed to other domains' knowledge: e.g., precision manufacturing, robotics • Opportunity to publish and produce intellectual property	• Play a part as an active research team member • Develop computational algorithms to solve design challenges • Pro-actively engage supervisor & colleagues to explore new ideas/solutions • Actively learn new knowledge through literature reviews	> Proficiency in a programming language (e.g. Python) > Prior Experience with AI/ML is a plus	IHPC is looking for enthusiastic and talented students to be part of our team, focused on the development of optical wireless technologies for underwater communications. In this role, students will collaborate with interdisciplinary experts, applying computational algorithms or machine learning tools to innovate and analyze state-of-the-art optical systems tailored for optical communication applications.	IHPC	EP	Jonathan Trisno	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	2
9	Advancing Polyelectrolyte Injectable Hydrogels for Sustained and Modulated Drug-Release	Thermogels are amphiphilic polymers with the ability to form temperature-dependent supramolecular interactions that could lead to gelation. The advantage of a system whereby gelation happens with increasing temperature includes injectability and the potential to encapsulate heat-sensitive drugs and cells. We have designed a versatile synthetic platform that allows the attachment of various chemical groups that would impart a mixture of mechanical and functional properties. By introducing cationic and anionic moieties, we seek to enhance the interactions between gels and drugs, expanding the range of possibilities for sustained and modulated release of drugs (e.g. ampholytic biologics). Students will be involved in materials synthesis, characterization, and in vitro drug release.	Students will learn polymer synthesis and functionalization, spectroscopic characterization (e.g. NMR, FTIR), rheology, polymer self-assembly, and drug release mechanisms.	Synthesize and characterize chemical and mechanical properties of injectable hydrogels. Assist with in vitro drug release experiments. To develop the students' knowledge, he/she student is expected to read widely, comprehend, and summarize the relevant literature.	B.Sc in Chemistry or B.Eng in Materials Engineering	Assist with polymer synthesis and functionalization, rheological characterization, and in vitro drug release experiments.	IMRE	SRI	Rubayn Goh	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
10	Advancing Quantum Control through Deep Reinforcement Learning	Quantum computers offer exponential processing speed compared to classical counterparts, with wide-reaching potential applications. Nevertheless, their susceptibility to errors poses a significant challenge. Research shows that skilful low-level control design can mitigate hardware-induced errors. However, conventional quantum control relies heavily on precise physical models, introducing model bias, particularly in noisy intermediate-scale quantum systems. To overcome these limitations, we utilize deep reinforcement learning (DRL) for robust quantum control, free from the constraints of a specific Hamiltonian model. We enhance our DRL models with meticulously designed agents, refined rewards, and effective exploration-exploitation strategies. Employing a two-stage DRL agent training method reduces time and improves accuracy. In addition, our adoption of online learning empowers the DRL agent to adapt continually to dynamic noise sources. The aim of our DRL-based quantum control method is to achieve higher target state fidelity in less time while displaying increased resilience to noise.	•Proficiency in training DRL agents to produce precise control pulses for high-fidelity quantum gates. •Comprehensive understanding of quantum computing principles. •Proficiency in DRL concepts and techniques. •Hands-on experience in coding and implementing DRL algorithms.	As a research assistant with duties include: 1.Enhancing and fine-tuning the DRL algorithm for optimal performance. 2.Training the DRL agent using either simulated or experimental data. 3.Validating and testing of the DRL agent's functionality.	knowledge in coding (e.g., Python)	1.Grasping the fundamental principles of quantum computing and quantum control. 2.Familiarizing with existing DRL algorithms. 3.Fine-tuning the parameters of the DRL algorithm. 4.Training the DRL agent to perform effectively. 5.Testing the DRL agent.	IHPC	EP	Bai Ping	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
11	AI and Knowledge System for Resource Circularity	Resource circularity, often referred to as the circular economy plays an important role in resource conservation, environment sustainability and economic efficiency. This project focus on AI and Knowledge System for Resource Circularity	1. AI skills 2. Software Skills 3. Concept of Sustainability and Circular Economy	1) Data acquisition for recycling and waste-to-resource conversion technologies 2) Build the multi-modal learning model by using various data type (e.g. waste photo, text data in the literature) for resource circularity.	1. Basic Knowledge on Python Programming 2. Basik Knowledge on Machine Learning	Resource circularity, often referred to as the circular economy plays an important role in resource conservation, environment sustainability and economic efficiency. This project focus on AI and Knowledge System for Resource Circularity. In particular, the main tasks for this project are 1) Data acquisition for recycling and waste-to-resource conversion technologies, including literature data, waste photo and etc. 2) Build the multi-modal learning model by using various data type for resource circularity.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yajuan Sun	Singapore Institute of Manufacturing Technology (SIMTech) @ CTZB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
12	AI approach for cancer spatial immunology study	Pioneering advanced AI methods to address complex cancer challenges through deep learning models and integrating optimal algorithms into a robust workflow. This entails the analysis of diverse advanced spatial omics data	1, They can gain hands-on experience in data analysis, computational modelling, and statistical techniques relevant to biological data. 2. They can develop proficiency in analyzing large-scale biological datasets and interpret the results and draw meaningful conclusions from complex biological data 3. They can enhance their coding skills in Python/R and develop algorithms. 4. They learn how to navigate various bioinformatics databases, resources, and tools. 5. Interns have opportunities to present their research findings	1.Organizing their time well 2.Updating work progress on weekly basis 3.Reading papers to learn about AI approaches for spatial immunology 4.Resourcing for software packages when necessary 5.Maintaining a positive learning attitude	1.Programming skill, deep learning/ image processing skill will be a plus 2.Problem solving skill 3.Fundamental knowledge of biology/ immunology	1.Perform literature review to study the state-of-art deep learning approaches for gene/marker prediction from histological images, or AI methods for multi spatial-omics analysis 2.Implement and evaluate the methods using in-house cancer patient data 3.Optimize and enhance the methods 4.Build an end-to-end workflow by incorporating data loading, cleaning, normalization, AI models, and visualization (this step is optional, depending on the progress of the students)	BII	Biomedical DataHub	LAU Mai Chan	8A Biomedical Grove, Immunos, Level 5, Singapore 138665	Biomedical Sciences	2
13	AI in Genomics	We are a dedicated team of computer scientists focusing on innovative projects that intersect AI and genomics. Our ambition is to pave the way for groundbreaking AI solutions inspired by genomic research. Students who join our team will have the opportunity to delve into areas such as RNA/DNA language modeling, genome assembly using graph neural networks, microbial classification in samples, detection of epigenomic alterations in DNA, and RNA structure prediction (akin to Alphafold's approach to proteins).	Students will gain hands-on experience in: - Conducting data cleaning, wrangling, and exploratory analysis - Designing and implementing machine learning models using PyTorch - Training and optimizing AI models - Visualizing data and creating comprehensive reports	Students are expected to: - Engage in data preparation tasks - Contribute to the development and training of machine learning models - Attend regular lab meetings - Deliver presentations to the lab team - Actively participate in the lab's AI journal club discussions	Mandatory: - A strong drive and motivation - An eagerness to learn through hands-on experience - Foundational programming and machine learning abilities - No prior biology knowledge is necessary Desirable (but not mandatory): - Proficiency in Python - Understanding of probability, statistics, linear algebra, and information theory - Familiarity with PyTorch or similar deep learning frameworks - Basic comprehension of deep learning methodologies	Interns will actively participate in one of the highlighted AI-genomics projects, based on their personal interests. Throughout the internship, they will receive mentorship from both a Ph.D. student/postdoc and the principal investigator. Interns are expected to compile weekly one-page reports detailing their progress. Additionally, they will showcase their findings to a lab subgroup in mid-term and final presentations.	GIS	Laboratory of AI in Genomics	Mile Šikić	60 Biopolis Street, Genome, #03-01, Singapore 138672	Computing and Information Sciences	6
14	AI Prompt Optimisation for Generative Value Chain Manufacturing (DSVC WP1)	Multi-objective optimisation is relevant for many applications in value chain manufacturing, especially those which concern enterprise decision making between multiple parties. However, one of the challenges in developing such AI-based optimisation algorithms is to gather sufficient data to train the algorithms. This is usually high-dimensional data with a known format, where uncertainties and disruptions can arise from multiple non-probabilistic sources. In this project, we will consider an approach to data generation that leverages the recent availability and improved performance of LLM technology. The student will explore prompt optimisation techniques to generate multi-enterprise value chain manufacturing data that can be used to train AI-based multi-objective optimisation algorithms for decision-making applications such as multi-enterprise material positioning and order allocation.	•Be able to understand prompt optimisation and its application to generative AI •Be able to deploy and use LLMs for generative value chain manufacturing AI •Be able to understand and train algorithms for AI-based multi-objective optimisation	The student will explore prompt optimisation techniques to generate multi-enterprise value chain manufacturing data that can be used to train AI-based multi-objective optimisation algorithms for decision-making applications such as multi-enterprise material positioning and order allocation.	1.Engineering, Programming skill (Python, C/C++, Java) 2.Familiar with Pytorch or Tensorflow frameworks and relevant libraries	1.Data annotation, preprocessing 2.Explore and apply prompt optimisation techniques with guidance 3.Train optimisation algorithms for value chain manufacturing on generative dataset	SIMTech	Cyber-Physical Production System (CPPS)	Wei En Joel Tay	Singapore Institute of Manufacturing Technology (SIMTech) @ CTZB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	2
15	AI-Driven Carbon Footprint Estimation and Mitigation for Blockchain Applications	With the increasing adoption of blockchain technologies in various sectors, there is a pressing need to quantify and mitigate the environmental impact. This research intends to create an AI-driven framework to precisely measure and predict the carbon footprint of blockchain applications and to provide actionable mitigation solutions.	1. Understand the fundamentals of blockchain technologies and their environmental implications, especially in terms of carbon footprint. 2. Acquire knowledge on AI-driven methodologies for measuring and predicting the environmental impact of blockchain applications. 3. Develop skills to design and implement mitigation solutions to reduce the carbon footprint of blockchain systems.	1. Participate actively in meetings, discussions, and activities related to blockchain, its environmental impact, and AI-driven solutions. 2. Conduct research to measure, predict, and analyze the carbon footprint of various blockchain applications using AI techniques. 3. Design and test mitigation strategies, leveraging AI, to reduce the environmental impact of blockchain technologies.		1. Engage in meetings and discussions focused on the environmental implications of blockchain and the role of AI in quantifying and mitigating them. 2. Develop AI-driven frameworks to measure and predict the carbon footprint of blockchain applications. 3. Propose and validate actionable AI-based solutions to reduce the carbon footprint of blockchain technologies.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yang Zhao	Singapore Institute of Manufacturing Technology (SIMTech) @ CTZB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
16	AI-driven innovation: Designing next-generation optical sensors	The team is developing novel optical systems to enhanced light collecting ability of sensors. The IHPC team is leading the design and analysis of the optical systems, by building numerical simulations and AI/ML methods. The project will present an exciting challenge to design optical system that will be compatible with 3D printing technology for prototyping. The team will work with industry partners (MNC and government agency) for technology deployment in secure communications and energy harvesting.	• Gain experience with computational modelling or AI to solve design challenges in research. • Gain understanding of state-of-the-art optics, relevant to applications in sensors, displays, ICs, space. • Work in a collaborative environment with cross-domain experts, exposed to other domains' knowledge: e.g., additive manufacturing, nanotechnology. • Opportunity to publish and produce intellectual property.	• Play a part as an active research team member • Develop computational modelling or AI tool to solve design challenges • Pro-actively engage supervisor & colleagues to explore new ideas/solutions • Actively learn new knowledge through literature reviews	> Proficiency in a programming language (e.g. Python) > Prior Experience with AI/ML is preferred.	IHPC is seeking talented and passionate students to join our team, dedicated to developing sensor technologies. As part of this role, students will work with cross-domain scientists to apply AI, machine learning, and numerical simulation methodologies to design and analyze cutting-edge optical systems for applications in communications. Join us in this exciting opportunity to be at the forefront of innovation of sensor technologies and beyond.	IHPC	EP	Jonathan Trisno	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	2

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17	AI-driven olfactory mapping of environmental pollutants	The accurate detection and quantification of odors in the environment are essential for effective pollution control. While a general olfactory map has been developed recently, it is primarily designed for the fragrance industry and does not address the specific needs related to environmental pollutants. Currently, there is a significant gap in the availability of a dedicated olfactory map tailored to identify and trace the sources of these pollutants. In this project, the successful candidate will: 1. Compile a dataset encompassing prevalent environmental pollutants in the region, drawing from reputable scientific literature. 2. Evaluate the accuracy of state-of-the-art machine learning models specific to common environmental pollutants. 3. Fine-tuned these models with transfer learning to exclusively target environmental pollutants, and assess their accuracies. This research endeavor will contribute valuable insights towards the development of a specialized olfactory mapping system for environmental pollutants.	At the end of the project, student will be able to perform routine cheminformatics analysis and machine learning for molecules	1. Data curation via literature search 2. Model evaluation 3. Training machine learning algorithms	Basic Python Programming	1. Data curation via literature search 2. Model evaluation 3. Training machine learning algorithms	ISCE²	Chemical Biotechnology and Biocatalysis (CBB)	Ang Shi Jun	8 Biomedical Grove #07-01 Neuros Building Singapore 138665	Physical Sciences	1
18	AI-enabled Quality of Service (QoS)-Aware Model for Optimal Resource Allocation in Edge based Manufacturing Networks	In today's interconnected manufacturing systems, the efficient allocation of resources and reliable communication are paramount. The discrepancy in real-time state synchronization between manufacturing processes, edge-based distributed systems, and intelligence must be minimized. To address this challenge, this research project focuses on developing a Quality of Service (QoS) aware model to accurately classify and assess the perceived quality of manufacturing network services into application types and different levels to optimize resource allocation. Manufacturing network services to be studied include monitoring and controls, robot operations, video streaming, and real-time analytics. This project also investigates the use of artificial intelligence techniques in the QoS aware model to extract relevant performance features from large manufacturing network services datasets and to model complex patterns of manufacturing network traffic.	• Investigate into techniques to classify complex industrial network performance. • Perform thorough study on standardization of communication descriptors for QoS in manufacturing. • Build suitable deep learning models for the proposed application • Develop automated translation of raw industrial data into application and operation-Based context including application types.	To design and develop deep learning-driven capabilities for intelligent edge computing services in 5G-and-beyond industrial networks.	• Proficient in C, C++ and Python programming • Team player and strong interpersonal and communication (verbal & written) skills. • Strong analytical and problem-solving skills. • Motivated self-starter with a strong enthusiasm to learn. • Results-oriented with a strong sense of ownership in delivering for members and stakeholders. • Prior experience working in data-driven related wireless communications projects is a plus.	Research Engineer	ARTC	Smart Virtual Systems	Cheng Leong (Lin Qianlong) Lim	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Engineering and Technology	1
19	AI-Enhanced Design and Simulation of Photonics Devices	In an era of rapidly advancing technology, the development of photonics devices plays a pivotal role in various domains, including telecommunications, healthcare, sensing, and more. The design and simulation of photonics devices have traditionally been time-consuming and labor-intensive processes, demanding expert knowledge in optical physics and engineering. To expedite and enhance this design process, our project aims to leverage the power of Artificial Intelligence (AI) to revolutionize the creation and optimization of photonics devices.	The learning outcomes for students engaging in a project focused on AI design and simulation of photonics devices can be diverse and comprehensive, catering to various educational levels and objectives. Here are some potential learning outcomes for students: 1. Understanding of the fundamental principles of photonics, including optics, waveguides, and photonic device functionality. 2. Learn how to integrate Artificial Intelligence and machine learning techniques into the design and simulation of photonics devices. 3. Develop problem-solving skills through the application of AI to address complex design and optimization challenges in photonics. 4. Acquire proficiency in using simulation software to model and simulate the behavior of photonics devices, gaining hands-on experience in virtual prototyping. 5. Learn how to balance multiple conflicting design objectives, such as maximizing device performance while minimizing costs, using multi-objective optimization techniques.	Students may take on various roles and responsibilities to contribute effectively to the project's success. 1. Conduct literature reviews to understand the state-of-the-art in photonics and AI. 2. Write code for AI algorithms and models. Implement machine learning and deep learning techniques. 3. Assist in the design and simulation of photonic devices. Analyze and interpret simulation results.	1. Background in engineering, physics, computer science, or a related field. 2. Basic Programming Skills, proficiency in at least one programming language, such as Python, C++, or MATLAB, is essential. Students should have the ability to write, debug, and optimize code. 3. Strong mathematical skills, particularly in areas like linear algebra, calculus, and statistics, are important for understanding and developing AI algorithms. 4. An understanding of the fundamental principles of photonics, optics, and waveguides is beneficial. Prior coursework or training in photonics is advantageous. 5. Knowledge of data analysis techniques and tools for handling and interpreting data is important, especially for students involved in AI development.	The AI Photonics Designer will be responsible for designing and simulating photonics devices using artificial intelligence (AI) and machine learning (ML) techniques. This role involves collaborating with interdisciplinary teams to develop cutting-edge solutions in photonics technology. The AI Photonics Designer will contribute to research, design, simulation, and optimization efforts, with a focus on enhancing device performance through AI-driven methodologies.	IHPC	EP	Lim Soon Thor	1 Fusionopolis Way, #20-10 Connexis North Tower Singapore 138632	Computing & Information Sciences	
20	All-xScxN Devices for mm-Wave and Edge Computing	Data communication is the key technologies in this coming big data era. Specifically, an emerging material with superior ferroelectric and piezoelectric properties, called 'ScAlN' (scandium aluminium nitride), will be systematically investigated by you to facilitate the demonstration of these novel devices. The deposition of ScAlN films will be optimized through multiscale modeling, surface and strain engineering, and machine learning, to achieve high quality ultrathin films with only a few nanometer thickness. On applications, you will be part of a team that aims to break-through the frequency limitation of acoustic filters devices. The filter devices that you will help to develop in this project are aimed at over 20GHz frequency (in the mmWave range for 6G and beyond and aerospace communication). Current acoustic filters can only achieve <6 GHz frequency. With delivery of this project, ScAlN-based filters will become one of the most promising and competitive solutions for the next-generation communication system.	In this project, the students will have access to the advanced microelectronic processes for MEMS devices, and learn the basic microelectronics manufacturing knowledge along with onsite experience in cleanrooms. This experience will benefit the students who would like to seek career opportunities in this microelectronics area. The students will also learn how to perform the electrical testing of the devices and how to further analysis the large amount of data via coding or data process softwares. Along with supervision from senior scientists, the students will also learn basic knowledge about the 5G communication.	The following are the student's responsibilities: 1. To support the device fabrication, including 3D structure drawing, layout drawing, assist communication between different teams, micro-observations of films, process and devices, and so on. 2. To support the electrical characterization of the 5G filter devices. The student will need to operate the testing tool, collect the data and also support the data analysis work.		1. Literatures reading and take training to understand the material, devices and applications. 2. Take training of the softwares, testing tools or clean room protocols. Depending on specific job assigned. 3. Perform the specific process/testing/simulation work under guidance. Depending on specific job assigned. 4. Data analysis under guidance. 5. Assist to prepare slides or reports.	IME	MEMS	Liu Chen	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
21	Algorithm Development for Railway Noise Prediction	Railway noise has been an environmental concern in Singapore. As the transportation network continues to expand and integrate modern rail systems, the impact of railway noise on communities and the environment in Singapore becomes increasingly important to address. This project aims to conduct a comprehensive review of algorithm development methods for railway noise prediction, specifically tailored to the context of Singapore. This study will focus on understanding the algorithms and computational techniques employed in predicting railway noise, as well as provide insights into their applicability in the unique urban landscape of Singapore.	By the end of this project, the student should achieve the following learning outcomes: Research Skills: Improved ability to collect, organize, and synthesize academic literature related to algorithm development for railway noise prediction. Critical Thinking: Enhanced critical thinking skills for evaluating the applicability of algorithms in a specific context, such as Singapore. Technical Skills: Gained proficiency in understanding and analyzing the algorithms used in railway noise prediction. Problem Solving: Developed problem-solving skills for identifying and proposing solutions to reduce railway noise. Communication: Improved communication skills through the preparation of a comprehensive review report and a presentation of key findings and recommendations.	- A comprehensive review report on algorithm development for railway noise prediction in the Singaporean context. - Identification of key algorithmic approaches and their applicability to Singapore. - Recommendations for the development and implementation of noise prediction algorithms tailored to Singapore. - A presentation summarizing the key findings and recommendations.	- Preferably has a basic understanding of noise pollution and its impact on the environment. - Preferably familiar with data analysis and research methodology. - Preferably proficient in conducting literature reviews and summarizing research findings. - Preferably has basic knowledge of python programming.	- To review the existing methods and algorithms for railway noise prediction. - To identify the key factors contributing to railway noise in Singapore. - To compare the pros and cons of various prediction algorithms and computational techniques. - To provide recommendations for the development and implementation of noise prediction algorithms.	IHPC	Engineering Mechanics	Linus Ang	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	1
22	Alloy Design Framework for Crack-free Additive Manufacturing High-Strength Aluminum Alloy Matrix Composites	We are seeking a motivated and innovative student to lead a research project focused on the material development for aluminum alloy matrix composites using laser powder bed fusion (LPBF). This project aims to establish the design framework for LPBF of aluminum alloy matrix composites and identify the optimum compositions of the composite and the possible mechanisms behind the enhanced properties for high strength aluminum alloys.	An in-depth understanding of LPBF technology and its applications for aluminum alloy matrix composites. Expertise in materials science, particularly aluminum alloys or metal matrix composites. Experience in designing and executing experiments with metal matrix composites. Proficiency in data collection, analysis, and interpretation. Skills in microstructure characterization, mechanical property and corrosion resistance evaluation. Effective communication and collaboration within a research team. Presentation and reporting skills to convey research findings.	Literature Review: Conduct an extensive review of existing research and developments in additive manufacturing of aluminum alloy matrix composites. Materials Selection: Collaborate with materials scientists to select appropriate ceramics for LPBF of high strength aluminum alloy for enhanced properties. Experimental Setup: Plan and set up experiments to print parts using the blending powder in an LPBF system. Configure the printer, powder beds, and process parameters. Data Collection: Collect data during the printing process, including process parameters for each composite. Process Optimization: Investigate ways to optimize the printing process with the shape memory alloy, ensuring the crack-free and excellent mechanical properties and corrosion resistance of the produced parts. Material Characterization: Evaluate the defects, microstructures, mechanical properties, and shape memory effect of the printed parts. Data Analysis: Analyse the data collected during experiments, identify trends and insights, and use these findings to provide recommendations for further development. Reporting: Document your research findings comprehensively and create presentations and reports for the research team and stakeholders.	Grade Point Average above 4.0 Mechanical / Materials Engineering knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and alloy development. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous.	We are looking for an student who is passionate about pushing the boundaries of additive manufacturing and materials science. As the student, your primary responsibilities include alloy development and processing development for laser powder bed fusion of aluminum alloy matrix composite. Key responsibilities include conducting experiments, collecting and analyzing data, understanding the composition-process-microstructure-functionality relationship, and reporting your findings to the team.	SIMTech	Additive Tech Innovation (ATI)	Hu Zhiheng	5 Cleantech Loop, #01-01, Singapore 636732	Engineering and Technology	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
23	Applications of Large Language Models in Industrial Symbiosis: A Deep Dive into Sustainable Collaborative Systems	This topic seeks to deeply investigate the transformative potential of large language models (LLMs) in the domain of industrial symbiosis. Industrial symbiosis, a cornerstone of sustainable industrial practices, involves the shared exchange of resources, information, and capabilities among diverse industries, leading to mutual benefits and reduced environmental footprints.	1. Understand the principles and benefits of sustainable industrial practices. 2. Identify the role of technology, especially large language models, in promoting and facilitating industrial symbiosis. 3. Evaluate the potential of LLMs in enhancing collaboration, resource optimization, and sustainable outcomes in diverse industries.	1. Students will be part of the group, and work closely with group members. 2. Analyze data, case studies, and real-world examples to enhance understanding and application of knowledge. 3. Work effectively in teams, respecting diverse perspectives and expertise.	N.A.	As a student in this course, you will delve deep into the transformative potential of large language models (LLMs) in the domain of industrial symbiosis. You will actively engage in understanding, researching, and applying knowledge about the integration of LLMs with sustainable industrial practices.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yang Zhao	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
24	Assist in the development of 3D tumour models to test anti-cancer therpy	Theraputic development often overlook the importance of the tumour microenvironment. This may result in the therapy to be clinically ineffective. Therefore, we develop 3D tumour models that include multicellular tissues to mimic cell-cell and cell-matrix interactions, responsible for complex phenomena like drug resistance and immunesuppression within the tumor microenvironment.	Student will be trained on: 2D cell culture, 3D cell culture, procedures to work in a biological lab, use of a biological safety cabinet, lab maintenance, fluorescent imaging, image analysis, data analysis and statistics. The candidate will learn image analysis and will practise presentation skills during the lab meetings.	The Student will be responsible of maintaining the culture of cells and preparing them to set up the 3D functional assay. The candidate will assist in performing imaging by fluorescent microscopes. The candidate will help in analysing images and data, calculate statistics and prepare presentations. Responsibilities will also include maintaining lab safety and operations.	A knowledge in cell biology and a basic experience working in a biological lab, and with tissue culture would be appreciated. Commitment to work, interest in the project, quick-learning skills, and good communication skills are expected.	The candidate will assist in the development of 3D in vitro models to perform functional assays and compound testing. The candidate will assist in image and data analysis. The candidate will perform literature search and present during the lab meetings.	SIgN	Department of Biomedical Engineering	Giulia Adriani	8A Biomedical Grove, #04-06 Immunos Building, Singapore 138648	Biomedical Sciences	1
25	Automation of AC/DC transfer measurements	To develop and improve an automated solution for AC/DC voltage and current measurements using Labview, and to explore the possibility for instrumentation control using Python	Understanding of AC/DC transfer process, learning how to apply coding to control instruments, and to verify the results of the software.	To develop a working software for automation of AC/DC in Labview, and an initial exploration of instrumental control using Python	Familiarity with electrical circuits, and knowledge in Python or other programming languages.	To develop an automated solution for AC/DC transfer measurements using Labview. To explore instrumental control using Python.	NMC	ETM	Connor Peh	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
26	Automation of data acquisition and processing in gas flow nozzles system	To develop an automated solution for the data acquisition and processing in gas flow nozzles system by using Labview	1) Understand the fundamental working principle of nozzles flow system; 2) Understand the fundamental concept of metrology and calibration; 3) Learn how to maunally operate the nozzles system; 4) Learn how to develop a Labview program to make the data acquisition and processing automated; 5) Learn how to verify the results after automation	To develop a program (e.g. using Labview, Python etc) to automate the data acquisition and processing	1. Background in mechaniacl/electrical engineering or familiarity with instrumentation systems 2. Familiarity with Labview or matlab or other programming languages 3. Good attitude, willing to learn	To develop a Labview, Python etc. program to automate the data acquisition and processing	NMC	MFM	Zeng Yan	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
27	Automation of primary and secondary mass calibration process	To develop an automated solution to make the primary and secondary mass calibration process automated.	1) Understand the fundamental working principle of primary and secondary mass calibration process; 2) Understand the fundamental concept of metrology and calibration; 3) Learn how to maunally operate the primary and secondary mass calibration system; 4) Learn how to develop a Labview program to make the calibration process automated; 5) Learn how to verify the results after automation	To develop a program (e.g. using Labview, Python etc) to automate the primary and secondary mass calibration process	1. Background in mechaniacl/electrical engineering or familiarity with instrumentation systems 2. Familiarity with Labview, python, matlab or other programming languages 3. Good attitude, willing to learn	To develop a Labview, Python etc. program to automate the primary and secondary mass calibration processes	NMC	MFM	Lee Shih Mean	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
28	Automation of the operation of Primary hydraulic Dead Weight Tester	To make operation of the hydraulic deadweight tester automated by the implementation of an automated mass handler (AMH).	1) Understand the fundamental working principle of dead weight tester; 2) Understand the fundamental concept of metrology and calibration; 3) Learn how to maunally operate the dead wight tester; 4) Learn how to design an aumated mass handler (AMH) and the corresponding program to control the system; 5) Learn how to verify the results after automation	To develop an AMH and the corresponding program to aumation the operation process of Primaray hydraulic Dead Weight Tester.	1. Background in mechaniacl/electrical engineering or familiarity with instrumentation systems 2. Familiarity with python or matlab or other programming languages 3. Good attitude, willing to learn	To develop an AMH and the corresponding program to automate the operation process of Primaray hydraulic Dead Weight Tester.	NMC	MFM	Zeng Yan	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
29	Autonomous Supply Chain Optimization	The objective of this project is to harness the power of Generative Artificial Intelligence (Gen-AI) to optimize demand and supply planning processes. By combining advanced AI algorithms and generative models, we aim to enhance accuracy, flexibility, and responsiveness in our supply chain operations.	o□I and Machine Learning Proficiency: A deep understanding of AI and machine learning techniques, particularly generative AI models, and their applications in demand and supply planning. o□Data Analysis and Data Management: Proficiency in data integration, data preprocessing, and data cleaning techniques. Experience in handling large datasets and ensuring data quality. o□emand Forecasting Skills: Advanced skills in demand forecasting, including the use of probabilistic models and handling uncertainty in predictions. o□upply Chain Optimization: Knowledge and experience in optimizing supply chain operations, including production planning, inventory management, and distribution routing. o□n-AI Model Implementation: Practical experience in implementing generative AI models within real-world supply chain systems.	- data preparation and analysis for AI model training. - developing and testing generative AI models. - developing model on demand forecasting and optimization of the supply planning process		- R&D development work - Industry engagement for solution improvement	ARTC	Digital Supply Chain	Shanshan Yang	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Computing and Information Sciences	4
30	Ballistic spin injection in transition metal dichalcogenides	Transition metal dichalcogenides are interesting new materials for Valleytronics due to the presence of spin-valley coupling in the band structure, allowing us to address the valley states using the carrier spin states. However, spin injection is a challenging problem as there is a fundamental impedance mismatch between the ferromagnet and the semiconductor. In this project, the student will explore spin injection using ballistic spins, where the spin polarized current is driven by kinetic energy and is not limited by the impedance mismatch. The student will be involved in device fabrication using advanced lithography techniques and measurements using scanning tunnelling microscopy.	The student will be trained in ultra-high-vacuum (UHV) instrumentation, electrical measurement techniques and 2D semiconductor fabrication. These skillsets and techniques will be directly relevant to the research and semiconductor manufacturing industries in Singapore.	Students will be responsible for fabricating their devices, collecting measurements and analysis of their data.	Physics and Electrical engineering	Students will learn to fabricate their own devices and peform electrical meaurements on these devices. The device measurement be will be understood from semiconductor physics relevant to present day microelectronics.	IMRE	QTE	Calvin Wong	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
31	Beam Acquisition, Tracking and Pointing system for Optical Wireless Communications	Optical wireless communication uses light for high speed, secure data communications between two locations. It can be used for satellite to ground station, or underwater communications. Optical systems are designed to receive signals with high speed and sensitivity. The pointing accuracy of the system used for communications is also critical. Because of the narrow beam width, lasers require accurate pointing accuracy of several - rad, and gimbals or mirror beam steering systems are required.	In this project, students will learn about optical wireless communication technology and electronics and mechanical prototyping. He will also learn about setting up optical systems.	In this project, students will assist in the development of a pointing, acquisition and tracking system for our optical communication system. The student will be assisting in programming of control feedback system and setting up of beam steering components.	Background in Physics, Electrical and Electronic engineering, Knowledge in python programming, FPGA programming will be useful.	The student will be assisting a team of researchers in developing an acquisition, tracking and pointing system for optical wireless communications. The student will help with programming of the feedback control system and testing the tracking of the beam.	IMRE	AOT	Teo Ee Jin	2 Fusionopolis Way, Innovis, S138634	Physical Sciences	2
32	Bioinformatics tools for integrative spatial analysis	The focus of our project is to develop an integrative bioinformatics approach for comprehensive spatial analysis. The primary goal is to facilitate the discovery and understanding of complex biological patterns and relationships within various biological systems through the integration of spatial, histological, and molecular data.	1, They can gain hands-on experience in data analysis, computational modelling, and statistical techniques relevant to biological data. 2. They can develop proficiency in analyzing large-scale biological datasets and interpret the results and draw meaningful conclusions from complex biological data 3. They can enhance their coding skills in Python/R and develop algorithms. 4. They learn how to navigate various bioinformatics databases, resources, and tools. 5. Interns have opportunities to present their research findings.	1.□Collaborate with the project lead and data scientists to understand the goals of the algorithm development. 2.□Contribute to the development of bioinformatics algorithms under the guidance of the project lead or a senior data scientist. 3.□Test the developed algorithms on a subset of data and document the results. 4.□Assist in optimizing the algorithms for efficiency and accuracy. 5.□Assist in the development of user-friendly software tools that implement the project's algorithms. 6.□Participate in the debugging and testing of the software. 7.□Help create documentation and user manuals for the software tools.	1.□Programming skill, image processing skill will be a plus 2.□Problem solving skill 3.□Fundamental knowledge of biology/ immunology	1.□Algorithm Development: Create innovative bioinformatics algorithms that can efficiently integrate and interpret multi-omics data in the spatial context. The focus will be on utilizing machine learning and AI techniques to deal with the complexity of the data. 2.□Tool Development: Develop user-friendly, open-source software tools that implement the developed algorithms. 3.□Case Studies: Apply the developed tools and methodologies on in-house datasets to validate their utility. This will involve collaborations with biology labs, wherein the tools will be used to answer specific biological questions.	SIgN	Immunomonitoring/Computational Immunology	LAU Mai Chan	8A Biomedical Grove, #04-06 Immunos Building, Singapore 138648	Biomedical Sciences	2

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Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilities of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
33	Bridging Generative Design to Final Component: Standardizing the 4D Printing Design Procedure	We seek a aspiring student to join an innovative project at the intersection of generative design, final component creation, and standardization in the realm of 4D printing. This studentship opportunity offers a unique chance to be part of a cutting-edge research endeavor aimed at transforming the way we design, fabricate, and standardize components in the dynamic field of 4D printing.	1. Gain hands-on experience in the latest 4D printing technologies and generative design software. 2. Expertise in design optimization procedure and software for 4D printing 3. Expertise in numerical simulation and finite element analysis of 3D-printed engineering components 4. Contribute to the development of standardized procedures that have the potential to revolutionize the 4D printing industry. 5. Proficiency in data collection, analysis, and interpretation. 6. Effective communication and collaboration within a research team. 7. Presentation and reporting skills to convey research findings.	1. Literature Review: Conduct an extensive review of existing research and developments in the recent advancements in engineering design for 4D printing, with a focus on bridging generative design with industrial design process. 2. Design and optimization: Apply generative design principles to create innovative, 4D-printable components, optimizing performance and manufacturability. Finalize the design by taking industrial and 4D design constraints into consideration. Establish a design platform or protocal to bridge the generative design and final detailed design in a standard manner. 3. Numerical simulation and analysis: Conduct numerical simulations to analyze and validate the performance, structural integrity, and behavior of 4D-printed components designed through generative processes, ensuring their compliance with standard procedures. 4. Data Analysis: Analyze the data collected during experiments, identify trends and insights, and use these to guide recommendations for further development. 5. Reporting: Document your research findings comprehensively and create presentations and reports for the research team and stakeholders.	1. Grade Point Average above 4.0 2. Mechanical Design Engineering knowledge 3. Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. 4. Knowledge in mechanical design and simulation software, such as SolidWorks and Abaqus is preferred but not strictly required. 5. Strong problem-solving skills and attention to detail. 6. A keen interest in advanced manufacturing and materials science. 7. Effective teamwork and communication skills. 8. Knowledge of additive manufacturing processes is advantageous.	We are seeking highly motivated students with backgrounds in engineering, materials science, design, or related fields who are passionate about pushing the boundaries of 4D printing. If you are looking for an opportunity to make a tangible impact on the future of manufacturing and design, we encourage you to apply.	SIMTech	Additive Tech Innovation (ATI)	Jiazhao Huang	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
34	Building an integrated atlas from single-cell epigenomics datasets	Single-cell epigenomic profiling is essential for understanding the role of epigenetic modification in diseases and biological processes. There is an increasing number of publications based on single-cell ChIP-seq and single-cell ATAC-seq. In this project, we will collaborate with Dr. Tim Stuart's lab to collect publicly available datasets and processing them uniformly to create an integrated single-cell epigenomics dataset. Such a dataset will be a valuable resource for knowledge discovery, validation of findings and benchmarking exercises.	Students will learn 1) how to handle and process big data efficiently. 2) how to collaborate with experimental scientists and other bioinformaticians. 3) how to manage their time, deadlines and presentation skills. 4) single-cell epigenomic field and its importance. 5) deepen their coding skills. Additional training in Unix, R and Python will be provided as needed.	Student will be responsible to 1) identify relevant datasets in collaboration with the supervisor and collaborators 2) download the relevant datasets along with the corresponding meta data 3) preprocess all dataset uniformly 4) assess quality of samples and annotate the cell types using a variety of computational tools. 5) document the process and decisions made We can explore additional tasks for well motivated candidates.	Some experience with any coding software, willingness to learn new softwares and interest to collaborate.	Single-cell epigenomic profiling is essential for understanding the role of epigenetic modification in diseases and biological processes. There is an increasing number of publications based on single-cell ChIP-seq and single-cell ATAC-seq. In this project, we will collaborate with Dr. Tim Stuart's lab to collect publicly available datasets and processing them uniformly to create an integrated single-cell epigenomics dataset. Such a dataset will be a valuable resource for knowledge discovery, validation of findings and benchmarking exercises.	GIS	Bioinformatics Consulting & Training Platform	Adaikalavan Ramasamy	60 Biopolis St, Genome Building, 3rd Floor, Singapore, 138672	Biomedical Sciences	1
35	Characterising tryptophan metabolism in the placenta	The placenta serves as the functional interface between mother and child. Tryptophan is an essential nutrient found in the diet and is necessary for healthy growth and development in the womb. Our lab is interested in investigating the factors that alters tryptophan processing in the placenta and whether these changes relate to differences in maternal and child outcomes using the local GUSTO mother-child cohort.	The selected student(s) will gain an appreciation for the study of human potential in the areas of developmental/reproductive biology and intrauterine programming of long-term health, while learning practical laboratory skills in cell/tissue culture, molecular biology (eg. extraction of RNA and protein, qPCR, immunoblotting, ELISAs), safe handling of human tissue samples as well as analytical skills in statistics.	- Follow all lab safety rules - Perform experiments and data processing/analysis as guided by mentor - Regularly read the scientific literature and assist with literature reviews of scientific papers - Attend and participate in lab meetings - Have proof of Hepatitis B antibody titres to work with human tissue samples in the lab	- Undertaking biology subjects at the undergraduate level - Experience with using a micropipette	The selected student(s) will have the opportunity to perform laboratory experiments such as placental cell/tissue culture, extraction of RNA and proteins, qPCR and immunoblotting to determine RNA and protein expression in human placental samples and to analyse the relationship of experimental findings with clinical data such as BMI and age.	SICS	Human Development	Hannah Yong	Singapore Institute for Clinical Sciences, Brenner Centre for Molecular Medicine, 30 Medical Drive, Singapore 117609	Biomedical Sciences	2
36	Chemical Free and Energy Efficient Processes for Wastewater Treatment and Water Circularity	Wastewaters need be properly treated to mitigate pollution to environment and reclaim water sources for reuse. The contaminants in wastewaters may present in various types (soluble, non-soluble, inorganic, organic, microbial, etc.) and at different concentrations (from < 1 mg/L to > 100 g/L). Therefore, a comprehensive process including different technologies (biological, chemical, physical) would be a practical solution to remove these contaminants in the wastewaters. However, there are several limitations in current wastewater treatment technologies. For example, coagulation has sludge disposal problems, biological treatment (both aerobic and anaerobic processes) requires substantial chemical input for pretreatment and conditioning, as well as post-treatment of the sludge. Advanced oxidation processes (AOPs) could provide non-selective oxidation to degrade organic contaminants which are not suitable for biological treatment, but the high cost and potential toxic by-products need be adressed. In this project, we will leverage on the synergistic effect of hybrid wastewater treatment technologies to provide minimal chemical addition, sludge generation and secondary pollution in wastewater treatment, and to achieve water circularity in sustainable manufacturing.	The student will learn analytical tools for water and wastewater characterization, electrochemical advanced oxidation process for organic wastewater treatment, filtration process, as well as other research skills including literature review and data analysis.	The attached student will go through HSE induction and briefing and ensure safety compliance. Literature review. Plan and conduct the relevant experiments. Compile and present results in written form or oral presentation.	N.A.	1) Literature review on wastewater treament related technologies. 2) Perform lab work on water analysis using Total Organic Carbon (TOC), Ion Chromatography (IC), Chemical Oxygen Demand (COD) and other analytical instrument. 3) Performance evalutaion of hybrid wastewater treatment process. 4) Data acquisition and analysis. 6) Report on results and findings.	SIMTech	Surface & Circular Processing (SCP)	Weiyi Wu	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
37	Chiral Magnetic Josephson Junctions for Hybrid Quantum Computing	Chiral magnetic films are known to host topological spin structures called magnetic skyrmions. Hybrid multilayer films comprising chiral magnetic and superconducting layers can be used to develop Josephson junctions, which are used in quantum computing. The combination of chiral magnetism and superconductivity is expected to give rise to new topological particles relevant to unconventional quantum computing applications. This project will involve the design and characterisation of hybrid multilayer films hosting chiral magnetic and superconducting layers. The student will characterise the stacks developed using magnetometry and electrical measurements. Time permitting, the student will be involved in the development and characterization of Josephson junction devices	The project will acquaint students with magnetism,superconductivity, and device physics concepts and train them on device characterization and data analysis. It may also acquaint them with skill sets relevant to the semiconductor and quantum industries.	The student may perform some or all aspects of the following work: 1. Learn the use of electrical and magnetometry techniques to characterize magnetic and superconducting films; 2. Design and characterize hybrid multilayer stacks with magnetic and superconducting components; 3. Analyse the data, and iterate the stack development to enable the development of Josephson junction devices	1. Coursework in electromagnetism and materials physics. 2. Some lab experience in using electrical instruments 3. Optional: experience with data analysis and data curve fitting.	The student may perform some or all aspects of the following work: 1. Learn the use of electrical and magnetometry techniques to characterize magnetic and superconducting films; 2. Design and characterize hybrid multilayer stacks with magnetic and superconducting components; 3. Analyse the data, and iterate the stack development to enable the development of Josephson junction devices	IMRE	ELE	Anjan Soumyanarayanan	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
38	Collaborative Logistics Planning and Optimization	Logistics plays a big role to ensure delivery to customers promptly and efficiently. Logistics operators in supply chains may have their own inventory / route optimization engines that operate in silos that produce sub-optimal decisions, causing delays, increased cost and reduced service levels that could have been avoided if proper coordination/consolidation had been sought. Effective logistics planning is needed to enable collaboration and coordination among logistics service providers to provide quality fulfilment services while ensuring cost and carbon efficiency and challenging operational constraints in inventory, routing, packing, and loading/unloading. The underlying logistics planning algorithms in existing solutions always consider the logistics planning as an optimisation problem and describe it in the form of mathematical programming, which is hard to capture the dynamics and collaboration among players. Furthermore, existing logistics planning solutions always ignore some realistic yet crucial factors such as loading sequence and inventory status. They affect not only the collaboration among the players, but also the eventual logistics cost. Due to the computational hardness, a multi-party logistic planning solution taking into account all above factors is desired yet out of reach so far. In this proposal, we will explore to	The project objective is to develop AI-based learning-to-optimise algorithm for collaborative logistics planning to tackle the dynamics (e.g. the demands, inventory, and fulfilment status), and the coordination among logistics players and other players	(1). Review state-of-the art of the learning-to-optimise algorithm for logistics planning optimisation and identify research gaps in existing methods. (2). Develop new algorithm to address the gaps. (3). Implementing it as software module. (4). Test, validate and benchmarking against existing methods in the literature.	-Good foundation in optimization, machine learning and probability would be useful for this project. - Basic training or knowledge in operations research and software programming	Last mile Logistics refers to the last stage of delivery from warehouse to customer. In recent years, logistics companies are experiencing tremendous growth in customer demands and thus efficient logistics planning becomes very important for daily operations. In this project, the candidate is to develop AI-based learning-to-optimise algorithm for collaborative logistics planning to tackle the dynamics (e.g. the demands, inventory, and fulfilment status), and the coordination among logistics players and other players. The model/algorithm is to be implemented as a software module. The candidate will also perform experiments to validate the solution by real industry data and analyze the experiment results.	SIMTech	Smart Urban Logistics (SUL)	Chi Xu	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	2
39	Color Metrology for Fluorescence Monitoring in Biomedical applications	This is a research project to develop a metrology solution to link the fluorescent signal with standards which are calibrated for spectral intensity and traceable to SI units. This technique will find wide applications in biology, chemistry, environmental science, and materials science.	The student will be able to learn and experience the process of design of experiment, measurement data analysis. The student will also learn the concept of metrology and why it's important in making sure the measurement results are accurate and reliable.	The student will work in optical metrology department with the supervisor in the design, experiment, and data analysis. He/she will also build up the software of color correction by using Python tkinter or other GUI Programming.	Knowledge on light and experience of basic computer programming in Python	Learn about color calibration and develop the setup and software for applications.	NMC	ODM	Zhang Jing	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
40	Comparatice host-virus interplay of novel immune host factors discovery and mechanistics for novel therapies	This project aims to characterise the role and function of novel host factors linked to immune responses hijacking. Several candidate host factors were discovered using a novel in vivo strategy comparing two closely related arthropod-borne viruses. Project will aim to construct tools and use them in vitro and in vivo to mechanistically understand the interplay during viral infection.	Student will have the opportunity to learn basic and advanced molecular biology, cellular culture and tools for genetic engineering of cells and viral reverse genetics. Depending of project stage and internship length, student may have the opportunity to familiarize themselves with in vivo animal work.	The student will learn to work in a lab with proper safety and biosafety standards, design and conduct experiments, learn to analyse data and present their work in a scientific manner.	Studies in a related biology field, strong interest in immunology or virology preferred.	The student will learn to work in a lab with proper safety and biosafety standards, design and conduct experiments, learn to analyse data and present their work in a scientific manner.	ID Labs	Host-Pathogen Interactions lab	Guillaume Carissimo	8A Biomedical Grove, #05-13 Immunos Building, Singapore 138648	Biomedical Sciences	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
41	Computation of dissolved gas transport around bioreactor bubbles	Large bioreactors used for food manufacturing need high bubble flow in the reactor medium to satisfy the oxygen demands of the cells suspended within. However, increasing bubble throughput can aggravate physiological stresses in the cells. We will use numerical simulations to measure and analyse the gradients of dissolved gas concentrations in the vicinity of individual particles transported around bubbles in turbulent flows to determine the time history of dissolved gas availability in bioreactor-relevant conditions. Minimising the variation in these concentrations will help to improve cell viability and growth.	Understand how multi-phase (liquid/gas) fluid dynamics simulations are performed; Learn how to implement post-processing routine and/or solver module in open-source software to measure desired flow quantities; Practise conducting scientific analysis using open-source fluid dynamics software to support reactor design objectives	Perform numerical simulations of bubbles in turbulence; Add tracer particles and use them to determine time history of concentration gradients seen by suspended cells; Perform post-simulation analysis of flow and particle data	Computational/programming skills and interest in fluid dynamics	The student will need to gain familiarity with open-source fluid dynamics software used to simulate bubbles in conditions relevant to bioreactor operation. He/she will then make minor modifications to the software inputs and post-processing utilities to measure the time history of concentration gradients seen by tracer particles. The student will need to analyse these statistics to come to a conclusion on the range and frequency make-up of dissolved gas clusters in the vicinity of suspended cells.	IHPC	Fluid Dynamics	Ronald Chan	1 Fusionopolis Way, #16-16 Connexis	Engineering and Technology	1
42	Computational Analysis of Spatial Multi-omics Data	Spatial transcriptomics is a cutting-edge technology that allows researchers to study the gene expression patterns within tissues in their native spatial context. Many diseases, including cancer, are characterized by significant heterogeneity within tissues. The intern will participate in the development of machine learning algorithms and software tools for quantifying the immune cell phenotypes from tumor tissue images.	The intern will have the opportunity to learn bioinformatics software development process, and prepare for a possible career in this exciting field. He/she will have the opportunity to work in a highly interdisciplinary and stimulating environment, and learn how computational biology can help clinicians to fight cancers.	The candidate will design, program, and test software tools for storing and analyzing molecular profiles and tissue images collected from cancer patients. He/she will also have to perform research on current clustering algorithms, and benchmark the performance of these methods.	The intern must have taken undergraduate-level courses in computational biology/bioinformatics, genomics, and machine learning. He/she must be proficient in R, Bioconductor, Python, and comfortable to work under the Linux environment. Prior knowledge/training in cell biology, image processing, or web programming (HTML and Javascript) are preferred but not required.	The intern will develop novel computational methods and tools for analyzing multiplex tissue images, and spatial transcriptomic and metabolomic data collected from cancer patients.	BII	Cellular Image Informatics Division	Loo Lit Hsin	30 Biopolis Street, #07-01 Matrix, Singapore 138671	Computing and Information Sciences	1
43	Computational analysis of spatial omics data	New technologies in spatial transcriptomics now enable us to collect spatially-resolved measurements of gene expression within a tissue. We are looking for students interested in working with spatial omics data generated using cutting-edge technologies.	Students will learn to work with spatial data generated from the latest spatial omics technologies (such as Xenium, CosMx, Visgen). They will gain expertise in bioinformatics analysis methods and workflows.	Students will work on improving algorithms used in analysing spatial omics data. They will work closely with senior members in the lab who will guide them. Students will be encouraged read, learn, pose questions, and actively pursue their assigned tasks.	Familiarity with Python, deep learning libraries (Pytorch, Tensorflow), along with some existing knowledge of machine learning, deep learning and computer vision.	Optimisation of algorithms used in analysing spatial omics data.	GIS	Laboratory of Systems Biology and Data Analytics	Shyam Prabhakar	60 Biopolis Street, Genome L3, Singapore 138672	Computing and Information Sciences	2
44	Computational design of high entropy perovskite for optoelectronics	Lead halide perovskites nanocrystals have been widely studied and applied to optoelectronic devices such as solar cells, lasers, photodetectors, and light-emitting diodes (LED). Doping perovskite in the metal site enhances its radiative rate and allows possible applications in quantum technologies. However, only <10% of the total Pb content can be substituted before structural instability occurs, with the high Pb toxicity limiting potential commercialization of perovskite devices. High entropy alloys (HEA), first proposed in 2004 as an innovative way to maximize configurational entropy to stabilize multicomponent systems, have demonstrated improved structural stability and functional performances. The ideas have been extended to ceramics, oxides and chalcogenide materials used in structural, catalysis and thermoelectric applications. More recently, multi-component substitution in perovskite and double perovskite have been achieved using a mix of isovalent metals, resulting in higher photoluminescence yield and reduced Pb content. The proposed project aims to accelerate the prediction of stable high-entropy phases of perovskite with the vast compositional space using a combination of first-principles density functional theory (DFT) calculations, surrogate models, and machine learning methods.	The student will learn about the cutting edge research in computational material design, and the utilization of emerging materials as a platform for optoelectronics, quantum and sustainability applications. The student will learn about the tools to carry out these research such as density functional theory, cluster expansion and machine learning techniques.	The student will perform first-principles density functional theory calculations on many perovskite alloy structures. The student is expected to write/modify scripts to automate the workflow for a large number of calculations. The student is expected to extract and interpret the output of these calculations such as total energies, band structures, density of states and wavefunctions. Depending on the project progress, the student can participate in structure design of the high entropy perovskite or double perovskite, using surrogate models such as cluster expansion.	Condensed Matter Physics or related knowledge, basic programming skill on using bash or python are desirable.	Lead halide perovskites nanocrystals have been widely studied and applied to optoelectronic devices such as solar cells, lasers, photodetectors, and light-emitting diodes (LED). Doping perovskite in the metal site enhances its radiative rate and allows possible applications in quantum technologies. However, only <10% of the total Pb content can be substituted before structural instability occurs, with the high Pb toxicity limiting potential commercialization of perovskite devices. High entropy alloys (HEA), first proposed in 2004 as an innovative way to maximize configurational entropy to stabilize multicomponent systems, have demonstrated improved structural stability and functional performances. The ideas have been extended to ceramics, oxides and chalcogenide materials used in structural, catalysis and thermoelectric applications. More recently, multi-component substitution in perovskite and double perovskite have been achieved using a mix of isovalent metals, resulting in higher photoluminescence yield and reduced Pb content. The proposed project aims to accelerate the prediction of stable high-entropy phases of perovskite with the vast compositional space using a combination of first-principles density functional theory (DFT) calculations, surrogate models, and machine learning methods.	IHPC	MSC	Liu Yun	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Physical Sciences	1
45	Computational modelling based Investigation of New age material AlScN for Edge computing and post 5G communications	AlScN system has attracted enormous interest recently as it exhibits enhanced piezoelectric and ferroelectric response. These properties vary with the scandium content in the Al(1-x)ScxN. AlScN is also CMOS fab compatible and hence holds promise towards realization of new age microelectronics devices for communication and edge computing applications. However, these unique properties are reported for large samples, whereas the niche applications demand reducing the dimension to sub 100 nm thin films to be viable and energy efficient in microelectronic devices.	The student would gain insight into thin film growth process deployed in device development and be exposed to programming tools, numerical techniques, visualization tools, parallel programming	The student would be developing new subroutines, modify existing code, running simulations in high performance computing, collect and analyze results, maintain logs, periodically prepare report updates during meetings.	Degree or course work undertaken in Materials science, Mechanics, Physics, engineering science. Motivated towards research and research-oriented tasks. Aptitude in programming, numerical methods required. Basic machine learning knowledge would be desirable.	Evaluation of reported scientific literature in the context of the specific research objective of the project, developing new computational codes, using existing codes to compile and run towards specific research questions, collecting data, post processing of the data to draw conclusions, submit periodic report	IHPC	MSC	Ramanarayan Hariharaputran	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Engineering and Technology	1
46	Computational modelling of antibody-antigen interactions	Monoclonal antibodies have become an increasingly popular therapeutic avenue in the past few decades due to their unique target specificity. For example, in the treatment of cancer, antibodies are designed to neutralize cancer cells by targeting specific tumor antigens, often overexpressed membrane receptors on the surface of such cells. Understanding how antibodies interact with their specific antigens will therefore contribute towards engineering better antibodies that can neutralize cancer cells more efficiently. In this project, molecular modelling and simulations will be used to study antibody-antigen interactions at the molecular level.	The students will learn how to use cutting-edge programs and tools in the areas of computational biology, bioinformatics, and structure-based drug design. They will gain knowledge in principles of structural biology and the chemistry and biophysics of biomolecular systems. This will enable them to elucidate the structure-function relationships of proteins, such as the roles of mutations in protein dynamics and protein-protein binding, enabling the prediction of antibody interactions with therapeutic targets such as cancer antigens.	The student will perform the study as described with supervision from members of the research team. The student will be responsible for doing literature research, searches on bioinformatics servers, setting up simulation systems, and performing subsequent data analysis. Other duties include attending and/or presenting at group meetings, learning how to generate graphs and figures to present data, and writing project reports.	The student must have basic knowledge in protein biochemistry, especially structural biology and intermolecular interactions. Experience using Linux command line environments is an advantage. Other desirable skills include experience using bioinformatics servers such as the Protein DataBank (PDB), performing literature searches, and working with biomolecular visualization programs such as PyMOL or VMD. The student must be willing and enthusiastic to learn the basics of computational structural biology, including molecular dynamics simulations and simple scripting with Python.	The student will do literature searches on monoclonal antibodies currently used in the treatment of cancer. Concurrently, the student will search for relevant structures of antibody-antigen complexes available in the PDB. Using suitable visualization programs and bioinformatics servers, the student will study the specific residues involved in the antibody-antigen interaction and anticipate probable mutations that can improve binding. Selected antibody-antigen complexes will be subject to molecular dynamics simulations, after which the student will perform data analysis to assess protein dynamics, protein-protein interactions, and binding energies.	BII	Biomolecular Structure to Mechanism Division / Multiscale Simulation, Modelling and Design group	Peter J Bond	30 Biopolis Street, #07-01 Matrix, 138671	Biomedical Sciences	1
47	Computational modelling of SARS-CoV-2 variant proteins	The emergence of novel SARS-CoV-2 variants has caused new waves of COVID-19 around the world. Mutations in the spike protein create viruses that are more resistant to neutralizing antibodies including those arising from vaccines. There is an urgent need to understand how these mutations affect virulence. In this project, molecular modelling and simulations will be used to predict the effects of mutations in the spike protein on its interactions with various molecules including antibodies and lipids. The outcome of the project will contribute towards our knowledge of vaccine and drug development targeting COVID-19.	The students will learn how to use cutting-edge programs and tools in the areas of computational biology, bioinformatics, and structure-based drug design. They will gain knowledge in principles of structural biology and the chemistry and biophysics of biomolecular systems. This will enable them to elucidate the structure-function relationships of proteins, such as the roles of mutations in protein dynamics and protein-protein binding, enabling the prediction of antibody interactions with therapeutic targets such as viral proteins.	The student will perform the study as described with supervision from members of the research team. The student will be responsible for doing literature research, searches on bioinformatics servers, setting up simulation systems, and performing subsequent data analysis. Other duties include attending and/or presenting at group meetings, learning how to generate graphs and figures to present data, and writing project reports.	The student must have basic knowledge in protein biochemistry, especially structural biology and intermolecular interactions. Experience using Linux command line environments is an advantage. Other desirable skills include experience using bioinformatics servers such as the Protein DataBank (PDB), performing literature searches, and working with biomolecular visualization programs such as PyMOL or VMD. The student must be willing and enthusiastic to learn the basics of computational structural biology, including molecular dynamics simulations and simple scripting with Python.	The student will do literature and database searches of SARS-CoV-2 variants and identify key mutations in the spike protein. Using suitable programs, the student will model these mutations and anticipate whether they will affect lipid and antibody binding. Selected spike mutants will be subject to molecular dynamics simulations, after which the student will perform data analysis to assess protein dynamics.	BII	Biomolecular Structure to Mechanism Division / Multiscale Simulation, Modelling and Design group	Peter J Bond	30 Biopolis Street, #07-01 Matrix, 138671	Biomedical Sciences	1
48	Computational optimization of synthetic peptides for improved antimicrobial activity.	Synthetic antimicrobial peptides (AMPs) offer a useful source for the development of novel antimicrobial agents. This project aims to characterize the interactions of AMPs with bacterial membranes, to provide novel insights into the influence of peptide sequences on structure, aggregation, and membrane active properties. This will be achieved using computational approaches based on molecular modelling and simulations, and will help to guide collaborative wet lab experiments, towards engineering of AMPs with improved antimicrobial characteristics.	The student will learn how to use multiple cutting-edge programs and tools in structural biology and bioinformatics. They will gain knowledge in basic principles of structural biology and the biophysics of biomolecular systems. This will enable them to elucidate the structure-function relationships of AMPs interacting with bacterial membranes, as well as the roles of their dynamics and influence of mutations upon antimicrobial activity.	The student will perform the study as described with supervision from members of the research team. The student will be responsible for doing literature research, searches on bioinformatics servers, setting up simulation systems, and performing subsequent data analysis. Other duties include attending and/or presenting at group meetings, learning how to generate graphs and figures to present data, and writing project reports.	The student must have basic knowledge in protein biochemistry, especially structural biology and intermolecular interactions. Experience using Linux command line environments is an advantage. Other desirable skills include experience using bioinformatics servers such as the Protein DataBank (PDB), performing literature searches, and working with biomolecular visualization programs such as PyMOL or VMD. The student must be willing and enthusiastic to learn the basics of computational structural biology, including molecular dynamics simulations and simple scripting with Python.	The student will be performing in silico mutations on antimicrobial peptides (AMPs) of specified sequence, and use molecular modelling and simulations to assess their aggregation tendency and propensity to bind bacterial outer membrane. The student will use appropriate analysis / visualization tools to investigate specific residues involved in protein-protein and protein-membrane interaction and mutations that may improve desirable properties.	BII	Biomolecular Structure to Mechanism Division / Multiscale Simulation, Modelling and Design group	Peter J Bond	30 Biopolis Street, #07-01 Matrix, 138671	Biomedical Sciences	2
49	Conformal Skin Patch for Dehydration Monitoring in Dementia Patients	Sweat being a natural expiration is rich in physiological biomarkers. This opens a novel avenue for non-invasive diagnosis and monitoring without painful sample collection such as blood and interstitial fluid (ISF). Recently, wearable electrochemical biosensors (EBs) using sweat analyte are emerging state of the art technology. However, sweat based bioelectronics encounters multiple challenges such as complexity in sweat collection, lifetime of the aptamer cocktail, ambient temperature range and mechanical artefacts due to body movement. Due to the complexity of sweat secretion and collection, the concurrent screening of multiple physiological biomarkers is needed. In this work, a novel sweat based conformal patch (CoP) for continuously monitoring Na+, K+ and pH of sweat is developed.	In this project, student will learn gain exposure in both wet and dry lab and learn about sensor design and fabrication. Also, student will get to conduct data analysis during simulation study.	1. Wet lab work 2. Testing and evaluation of fabricated sensors 3. Data consolidation 4. Data analysis and inference	1. Ongoing degree or knowledge from Electronics/ Electrical/ Biomedical engineering. 2. Previous wet lab experience 3. Experience in setting up experiments	1. Fabrication of sensor electrode 2. Testing and validation of sensors 3. Working with simulation tools to generate prelim data	IME	Medtech	Lim Ruiqi	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
50	Control policy training for multi-robot collaborative manipulation	The project targets to facilitate system setup for multi-robot collaboration with imitation learning, generate control policy from typical demonstrations, refine control policy to correct model errors, and allow flexible adaptation to environmental changes with continuous learning.	1) Fundamentals of robot control 2) System design for multi-robot collaboration 3) Machine learning algorithms for imitation learning and control policy refinement 4) Research skills, the ability to identify research problems, develop and test hypotheses, and communicate research results 5) Problem-solving skills, the ability to identify and solve complex problems 6) Collaboration skills, the ability to work effectively with other team members	1) Collecting demonstration data 2) Implementing and testing methods and algorithms on robots 3) Analyzing and interpreting experimental results 4) Writing and presenting research results	Experience with programming languages such as Python; Basic understanding of machine learning and reinforcement learning; Ability to work independently and as part of a team; Experience with robotics and ROS is a plus.	The student will work under the supervision of a senior researcher and will be responsible for collecting demonstration data, implementing and testing methods and algorithms, analyzing and interpreting experimental results, and working collaboratively with team members.	ARTC	Autonomous Systems & Robotics	Shijun Yan	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Engineering and Technology	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilies of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
S1	Control strategies for manipulation planning and safety in a human-centric robot-human collaborative assembly system	Develop a safety-guaranteed robot-human collaborative system where the robot manipulator can share a small working space with humans to complete a task. The platform MATLAB/Simulink is chosen as the proposed tools perform high-computing solution with a model-based system engineering approach.	to apply a significant range of advanced and specified skills and be able to act autonomously in the planning and implementation of research, to practice proactive, self-critical and self-reflective approaches based on research and to develop professional relationships with others where appropriate.	The student is responsible for undertaking research; undertaking appropriate skills training; maintaining the progress of their work; taking the initiative in raising problems or difficulties; and presenting their research works in conferences and seminars, within the constraints of the ARTC's / A*STAR's regulation.		Carrying out research towards a master's or doctoral degree. Participating in theoretical and/or empirical research in the relevant areas. Publishing results in the appropriate media. Presenting findings at conferences and seminars.	ARTC	Autonomous Systems & Robotics	Shin Horng Chong	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Engineering and Technology	2
S2	Data Analytics Intern for Green Compass	Green Compass™ is an environmental sustainability assessment and strategic roadmapping tool that helps companies to become more environmentally sustainable by better managing their carbon emissions, energy, water, and waste impacts, as well as chart strategic roadmaps for their transformation based on their current environmental sustainability levels. This internship project involves leveraging data analytics and Python coding to analyze environmental sustainability data collected through Green Compass™. The intern will work closely with experienced researchers to transform this data into actionable insights and visually compelling representations. The project aims to contribute to a more sustainable future by helping organizations understand and improve their environmental impact.	The Data Analytics Internship in environmental sustainability through Green Compass™ offers students a unique opportunity to develop proficiency in data analysis and Python coding for research outcomes. Throughout the internship, participants will acquire essential skills in data visualization, problem-solving, and critical thinking, enabling them to extract meaningful insights from complex data sets. They will also gain a deep understanding of environmental sustainability concepts, fostering a commitment to promoting a greener future. This hands-on experience encourages self-driven learning and the development of ethical data handling practices while working collaboratively with experienced researchers. Ultimately, interns will emerge from the program with a valuable skill set, a passion for sustainability, and the ability to contribute meaningfully to global environmental efforts.	As a Data Analytics Intern, you will play a crucial role in our mission to help companies become more environmentally sustainable. You will work closely with our experienced researchers to dive into the data collected through Green Compass™ and transform it into actionable insights. This internship provides an excellent opportunity to gain hands-on experience in data analysis, Python coding, and data visualization, all while contributing to the vital field of environmental sustainability.	Candidates for this internship should be actively enrolled in an undergraduate or master's program within the fields of science, engineering, or quantitative social sciences. Ideally, the candidates have a foundational understanding of data analysis and Python experience, or a willingness to independently learn Python. Familiarity with data manipulation and data visualization is preferred. Strong communication and teamwork skills and a genuine interest in environmental sustainability for businesses will further enhance the candidate's suitability for this role.	Are you passionate about environmental sustainability and eager to harness the power of data analytics to make a positive impact on our planet? We are looking for a highly motivated Data Analytics Intern to join our team and assist in analyzing the wealth of data collected through Green Compass™, an innovative environmental sustainability assessment and strategic roadmapping tool.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yin Jin Lee	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	2
S3	Data-driven modelling for weather nowcasting	Predicting precipitation in the next hour or two, or weather nowcasting, is crucial to effective operations in the aviation and maritime industries. Machine learning tools, such as neural networks, can be utilised to accelerate understanding of convective weather phenomena. We will apply these tools to satellite and radar images and assess their effectiveness in modelling the genesis and transport of weather systems.	Understand how rainfall is measured and predicted; Understand how convolutional neural networks work and how to train them for weather-relevant problems; Practise conducting scientific analysis to assess neural network effectiveness and trends underlying observation data	Train neural networks using observation data to model weather systems; Assess network training effectiveness and identify pertinent trends in observation data	Computational/programming skills and interest in weather forecasting	The student will need to gain familiarity with machine learning software used to implement convolutional neural networks. He/she will apply the software to radar and satellite data for neural network training. The student will then assess the effectiveness of the training process and determine the network's ability to capture key trends.	IHPC	Fluid Dynamics	Ronald Chan	1 Fusionopolis Way, #16-16 Connexis	Engineering and Technology	1
S4	Data-driven models for the mechanics of materials	Processing defects can control the properties of engineering alloys formed through modern methods such as additive manufacturing (AM). Notably, the properties of an AM printed part can depend strongly on its internal distribution of defects. In order to understand how to design robust structures that resist failure, it is important to understand the effects of the statistical distribution of micro- and meso- structures on materials performance. In this project, we will apply a combination of physics based simulation and data science tools to understand deformation in such complex materials	1. Student will learn basic numerical analysis to model the mechanical behavior of inhomogeneous materials 2. Student will learn mechanics concepts such as strength of materials 3. Student will learn statistical analysis and develop skills in tools such as python and Matlab	1. Implement and run python/Matlab codes for random fuse model 2. Implement and run python/Matlab codes for analysis of the model	1. Good knowledge of mechanics and materials properties 2. Experience with programming in python/Matlab and familiarity with statistics/probability theory	1. Literature review 2. Develop a random fuse model to describe the deformation of an inhomogeneous material 3. Apply data science tools to analyze the deformation of the model developed in (2)	IHPC	Engineering Mechanics	Mark Jhon	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	1
S5	Deciphering gene environment interactions using multiplexed functional assays	Precise control in gene regulation is essential for cellular differentiation and lineage specificity during development as well as in response to various environmental cues. The context-dependent interactions between transcriptional regulators and cis-regulatory DNA elements in the genome dictate gene regulation programs in each cell type and tissue. Millions of candidate cis-regulatory elements have recently been annotated based on their unique chromatin features. However, the activity and response of these regulatory elements under various environmental stimuli is largely uncharacterized, providing a significant hurdle to decipher gene environment interaction.	This internship will be involved in the project to perform a large-scale functional characterisation and develop a predictive model to estimate the potential environmental risk factors for individuals. This internship will have the opportunity to carry out the experiments as well as data analysis (depending on student's background and interest).	Assist and carry out assigned experiments	Background in molecular biology and/or strong interest in gene regulation. Team player with strong motivation to achieve the goals.	We are looking for highly motivated students who are passionate about scientific research.	GIS	Laboratory of EpiMetaGenomics	Benson Chen	60 Biopolis Street, Genome, #04-01, Singapore 138672	Biomedical Sciences	1
S6	Deep Reinforcement Learning-assisted Automated Design for Photonics	Traditional methods for designing photonic components are intricate, time-consuming, and demand significant labor. Machine learning has demonstrated that computers possess the capability to scrutinize data and yield valuable insights across various domains. Deep learning, a subset of machine learning, employs artificial neural networks to extract insights from datasets. Reinforcement learning (RL), a subset of deep learning, employs feedback in the form of rewards or scores from an environment to generate enhanced actions. In this project, our objective is to cultivate an RL process that can optimize nanophotonic components, taking into account the imperfections inherent in the fabrication process, and ultimately yield devices with superior performance. We could integrate Large Language Models, such as ChatGPT, into the tool we're developing to improve automation and facilitate knowledge sparking.	Photonics/nanophotonics, nanostructures, light manipulation, optimization algorithms, inverse design, deep learning, deep reinforcement learning, LLMs	Conduct the research honestly and uphold the integrity; keep the working place (IHPC) safe	Students would possess strong background in Math (and Physics), having the interest in coding/AI using MATLAB/Python	1. literature review 2. study a. light-matter interaction b. design of photonics/nanophotonics structures/devices 3. coding a. open source Meep, FlexCompute b. deep NN c. DRL 4. report write-up 5. presentation	IHPC	Electronics & Photonics	Bui Viet Phuong	1 Fusionopolis Way, #16-16 Connexis North, S138632	Engineering and Technology	1
S7	Defining a AUC IC50 threshold for chemotherapy efficacy	In vitro cancer cell screens often report drug efficacy simply as a potency e.g. inhibitory concentraiton 50 (IC50). However, there is no benchmark for what IC50 value can be considered resistant. Using IC50 values from the DepMap, a large cancer cell database, along mouse PK profiles, we aim to come up with a rule to what AUC/IC50 or time/IC50 threshold a drug should ideally have before it is considered a potential efficacious treatment in cancer.	Through this project, the student will learn how to do database curation and management in R, and how to build structural pharmacokinetic models in either NONMEM or monolix. The student will also learn about pharmacotherapy in oncology and pathophysiology of cancer that can affect patient outcomes.	1) compile a database of chemotherapy of interest mouse PK and build model 2) calculate PK indices using PK model and depmap IC50 3) Using PDX database, figure out if for the matching cancer type from depmap, do the drugs that do well in the xenograft models (median tumor shrinkage > 30%) also have higher PK incides to make a rule about how much time/IC50 is ideal.	Basic understanding of pharamcology, PharmD or Bsc Pharmacy are a plus. Basic coding proficiency in R	Curate dataset of mouse PK data, DepMap IC50 and PDX xenograft are response data. Build PK models for the calculation of PK incides.	BII	RDI	Janice Goh	30 Biopolis Street , #07-01 Matrix, Singapore 138671	Biomedical Sciences (BMS)	
S8	Design of 6G reconfigurable intelligent surfaces	Sixth generation (6G) wireless communication networks are needed to provide terabits per second data rates (1000x higher than 4G and 5G) and link latency in sub-millseconds. However, the high frequency of terahertz waves, the 6G carrier waves possess inherently high loss and increased blind spots. Hence, range extension technologies such as re-broadcast solutions (conventional) or novel reflective intelligent surface (RIS) solutions with advanced beam control (IME's approach) are crucial. IME is developing the latter 6G reflective intelligent surfaces using MEMS integrated metasurfaces.	Student 1: The student will learn the fundamentals concepts of electromagnetic metasurface with focus on phase control. The student will design THz metasurface for 2π phase control using CST simulation software. The student will learn inverse design for evaluating the phase distribution of metasurface needed to achieve desired far-field reflection pattern. Student 2: (i) The student will learn the fundamentals of electromagnetic metasurface and MEMS. (ii) The student will learn COMSOL simulation for the design of MEMS switch (iii) The student will learn the CST simulation of MEMS integrated THz metasurface	Student 1: The student will be supporting the design, simulation, and optimization of THZ RIS based on metasurface design concept. The student will be implementing the inverse design code for generating the phase profile for RIS. Student 2: The student will be supporting the simulation and optimization of piezoMEMS reconfigurable terahertz metasurface by co-design MEMS switch and THz metasurface.	Student 1: Basics of electromagnetics Student 2: Experience in MEMS, and /or metasurface or basics of electromagnetics	Student 1: 1) 1-on-1 knowledge sharing sessions and literature study by the student on reconfigurable intelligent surfaces for 6G communications 2) Preliminary simulation using CST software will be taught to the student 3) Student will perform simulations of actual design and optimization by varying the design parameters through CST simulations 4) Automation of metasurface design to generate desired phase profile with inverse design approach 5) Student will prepare report Student 2: 1) 1-on-1 knowledge sharing sessions and literature study by the student on reconfigurable intelligent surfaces for 6G communications 2) Preliminary simulation using CST software will be taught to the student 3) Student will be taught COMSOL software for MEMS modelling. 4) Student will co-design and co-optimize MEMS and THz metasurface to minimize the energy consumption while meeting the functional specifications of RIS. 5) Student will prepare report	IME	MEMS	Prakash Pitchappa	Institute of Microelectronics (IME), 2, Fusionopolis Way, #08-02 Innovis Tower, Singapore 138634	6G communications, MEMS, metasurface, terahertz	

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
59	Design of customizable devices for cutaneous drug delivery and diagnostics	Three-dimensional (3D) printing has been gaining interest for application across various industries. 3D printing enables user customization and production of geometrically-defined and complex constructs, thus enabling personalization of prototypes. In the field of medical technology, 3D printing has been studied for the fabrication of various personalized devices with products in the market such as hearing aids, teeth aligners etc. Herein, we aim to design and fabricate customizable, 3D-printed, skin-interfacing medical devices, such as microneedles, for drug delivery and diagnostic applications. Microneedles are particularly attractive because they are minimally-invasive devices that can be used for the delivery of various therapeutic payloads as well as sensing of bioactive molecules in the skin. Various materials, designs and print parameters will be explored to optimize the efficacy in the performance of these devices on ex vivo skin samples with the goal of developing these devices for in-human clinical application.	1. Understand the unmet clinical needs for cutaneous delivery and diagnostics 2. Familiarity with 3D printing techniques, principles of operations, materials, and their applications across various industries 3. Able to create printable models through the use of computer-aided design (CAD) 4. Critical thinking and decision making in experiments 5. Scientific thinking and communication including literature review and analysis, data presentation and scientific writing	1. Perform experiments, follow SOP and protocols well 2. Comply with mandated health and safety, ethical requirements 3. Provide technical support for other team members	Prior knowledge of CAD design will be advantageous.	You will be contributing to the described project.	A*SRL	Model Development	Kun Liang	8A Biomedical Grove, #06-06, Immunos, Singapore 138648	Engineering and Technology	1
60	Design of reconfigurable intelligent surfaces for 6G communication networks.	6G communications are targeted to provide 100x data rates and 10x speed compared to the current 5G networks. For this requirements, the carrier will be the high frequency terahertz waves (0.1 - 10 THz). However, at such high frequencies, the waves are lossy and hence needs special devices to focus and re-direct the connection links dynamically. At the IME, we develop these advanced wavefront control devices that can provide higher efficiency, lower power consumption, user-defined security and data rates in 6G links.	The student will learn the fundamentals concepts of electromagnetic metasurface with focus on phase control. The student will design THz metasurface for 2pi phase control using CST simulation software. The student will learn inverse design for evaluating the phase distribution of metasurface needed to achieve desired far-field reflection pattern.	The student will be supporting the design, simulation, and optimization of THZ RIS based on metasurface design concept. The student will be studying the influence of variations in MEMS switch on the THZ RIS performance and build an empirical model for estimation.	Basics of electromagnetics	1) 1-on-1 knowledge sharing sessions and literature study by the student on reconfigurable intelligent surfaces for 6G communications 2) Preliminary simulation using CST software will be taught to the student 3) Student will perform simulations of actual design and optimization by varying the design parameters through CST simulations 4) The student will study the impact of MEMS switch variation on the performance of 6G RIS device and develop an empirical model to evaluate the THz RIS peformance. 5) Student will prepare report	IME	MEMS	Prakash Pitchappa	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
61	Design, fabrication and application of large-scale-integrated (LSI) digital microfluidics	A Digital Microfluidics (DMF) technology manipulates liquid droplets into programmed biochemical reactions by controlling the individual droplet. In a large-scale-integrated (LSI) digital microfluidics device, thousands of droplets with picolitre to nanolitre volume perform pre-programmed microfluidic operations (droplet generation, mixing, splitting) which enable complex and autonomous biochemical protocols, such as chemical synthesis, DNA extraction & separation, gene assembly & editing. In this project, the technical challenges related to the design, fabrication and application of LSI digital microfluidics will be investigated, including the microfabrication process, electrowetting control and programming, droplet sensing and routing, microfluidics system integration, etc.	- understand the fundamentals about digital microfluidics and electrowetting - gain the skills in handling and improving the microfabrication process for building up LSI digital microfluidic devices, including the device/material characterization methods - gain experience in digital microfluidics testing and analysis - understand the droplet control and sensing mechanism, be able to program the droplet routing based on the digital microfluidics protocol	Involve in the LSI digital microfluidics development project, contribute to at least one of following tasks - microfabrication process development - digital microfluidics device design and fabrication - digital microfluidics testing and data analysis - electrical control system development and programming - design and develop droplet routing program according to the microfluidics protocol		- accept the designated research project - gain the knowledge and skills through self-learning and on-job training - propose ideas and solutions to the project team - conduct experiments, acquire the data and analyze the results - share the research outcomes in the team through presentation and report writing	SIMTech	Microfluidis & MedTech Devices (MMD)	Zhenfeng Wang	Singapore Institute of Manufacturing Technology (SIMTech) @ CTDB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
62	Designing novel enzymatic tools for food texturization	Alternative Protein-based food products can succeed only if they are tasty, nutritious, safe and most importantly, embraced by consumers. An important parameter that determines consumer satisfaction is food texture. A few plant-based foods have entered the market with the claim of mimicking the taste and juiciness of meat. However, they have failed to match the texture of real meat products. The objective of the project is to develop novel tools for texturization of Alternative Proteins.	Student will learn to use routine methods in cellular and molecular biology Student will be able to perform an objective assessment of data and interpret results. Student will be trained on how to plan and execute an experiment. Student will learn the importance of maintaining a detailed record of experimental observations. Student will be trained to read research papers and enhance their knowledge base and improve their presentation skills.	· Perform research using techniques in genetics, biochemistry, molecular biology, and cell biology. · Help in preparing Media, buffer, plates and reagents for the laboratory. · Process, analyze and report data and in a timely and effective manner · Maintain an accurate and detailed record of experimental details, and present the research work in seminars · Perform all tasks in accordance with relevant laboratory safety guidelines. · Undertake tasks assigned by supervisors as and when appropriate.	A passion for science and experimental research	Student will be a part of a team and actively contribute to the proposed project by designing and performing experiments and interpreting the data	SIFBI	Strain Engineering	Prakash Arumugam	1.Singapore Institute of Food and Biotechnology Innovation, A*STAR, 31 Biopolis Way, Singapore 138869	Biomedical Sciences	1
63	Developing A.oryzae as a food-grade protein production platform	Large-scale production of functional proteins in a cost-effective manner is of outstanding importance. For instance, cellular agriculture has been suggested as a promising solution to global food security issues caused by current animal-centric protein sourcing. However, the media components and growth factors required for cellular agriculture are exorbitantly expensive. Economical production of mammalian growth factors can make cellular agriculture affordable and financially viable. In this project, we will explore the possibility of using the food-grade fungus A. oryzae as a host for producing active mammalian growth factors and other proteins of commercial value.	Student will learn to use routine methods in cellular and molecular biology Student will be able to perform an objective assessment of data and interpret results. Student will be trained on how to plan and execute an experiment. Student will learn the importance of maintaining a detailed record of experimental observations. Student will be trained to read research papers and enhance their knowledge base and improve their presentation skills.	· Perform research using techniques in genetics, biochemistry, molecular biology, and cell biology. · Help in preparing Media, buffer, plates and reagents for the laboratory. · Process, analyze and report data and in a timely and effective manner · Maintain an accurate and detailed record of experimental details, and present the research work in seminars · Perform all tasks in accordance with relevant laboratory safety guidelines. · Undertake tasks assigned by supervisors as and when appropriate.	A passion for science and experimental research	Student will be a part of a team and actively contribute to the proposed project by designing and performing experiments and interpreting the data	SIFBI	Strain Engineering	Prakash Arumugam	1.Singapore Institute of Food and Biotechnology Innovation, A*STAR, 31 Biopolis Way, Singapore 138869	Biomedical Sciences	1
64	Developing an efficient microbial strain for acetate and ethanol assimilation to produce high-value food ingredients	To overcome the challenges in climate change and limited fossil fuel, we aim to develop novel microbes to efficiently utilize the so-called Generation 3 feedstock, such as ethanol and acetate, which can be synthetized from CO2 and H2. We aim to 1) improve the cell growth on the non-conventional C2 feedstock; 2) revalorize them to produce high-value food ingredients, such as carotenoids, vitamins, and omega-3 oil.	1) molecular biology skills; 2) modern synthetic biology; 3) metabolic engineering; 4) cloning and genomic editing such as CRISPR technology; 5) analytical chemistry; 6) fermentation technique	1) cloning and molecular biology work; 2) microbial cell culture; 3) product extraction and analysis; 4) assist microbial fermentation; 5) optimize strain performance.	Knowledge of cloning, molecular biology, biotechnology and microbiology. Quick to grasp new knowledge and skills.	The job aims to select students who are keen to learn applied microbiology, fermentation and synthetic biology.	SIFBI	Strain engineering	Simon Zhang Congqiang	31 Biopolis Way, Level 6 Nanos building Singapore 138669	Engineering and Technology	1
65	Developing circular RNA strategies for RNA vaccines	The recent development of mRNA vaccines has revolutionized our ability to protect against SARS-CoV-2 virus and opened the possibility of vaccinating us broadly from diseases including viral, bacterial infections, and even cancer. The current mRNA vaccine utilizes a linear mRNA that is modified, capped and polyA tailed. This RNA is then packaged with lipid nanoparticles and delivered into human cells through intramuscular injection. While highly effective, current RNA vaccine designs suffer from several drawbacks, including the need for low temperatures for transport and storage, the need for high doses to be injected, development of allergic reactions due to formulation, a lack of target specificity and high cost. As such, much remains to be studied with regards to increasing the stability and translatability of the RNA, the formulation of the nanoparticle and alternative delivery methods. Here, we combine expertise in RNA biochemistry, structural biology, nanoparticle delivery and immunology to develop circular RNA strategies towards SARS-CoV-2. If successful, circular RNA vaccine strategies can also be applied to protection against other diseases.	The student will learn cell culture, molecular biology techniques including western blotting, dot blotting and cloning, as well as high throughput sequencing library preparations to study different aspects of RNA.				GIS	Laboratory of RNA Genomics and Structure	Wan Yue	60 Biopolis Street, Singapore 138672	Biomedical Sciences	2
66	Development of a novel diagnostic tool for antibody responses to vaccines	Substantial variation in antibody responses to vaccines between different people has been observed for multiple vaccines, including COVID-19 mRNA vaccines. However, there is no diagnostic tool to predict antibody response to vaccines. This project aims to build predictive models using machine learning methods and develop a diagnostic tool for clinical use.	Upon completing the project, the student will gain in-depth knowledge about vaccine and immunity. The student will be equipped with wet lab and/or dry lab skills. The student will also learn how scientists collaborate with clinicians to improve human health.	The student will be trained for wet lab or/and dry lab skills. Wet lab) The student will work with the team to learn molecular biology and conduct experiments. or/and Dry lab) The student will learn and use machine learning methods to build predictive models. 3) The student will have a final presentation	Background or experience in immunology, bioinformatics, computer biology, or computer science will be preferable.	The student will work with the team to conduct molecular biology experiments, or/and learn machine learning to build predictive models.	JD Labs	Microbial Immunity Lab	Chen Hsiu-Yi	8A Biomedical Grove, #05-13 Immunos Building, Singapore 138648	Biomedical Sciences	1
67	Development of a self-steering system for time and frequency transfer across a network of clocks	Achieving precise time synchronization across distributed locations is challenging due to clock discrepancies. Synchronization can come in the form of using Proportional–integral–derivative (PID) controllers which can be implemented within a time and frequency self-disciplining system. The focus of this project is the development of a robust PID system to self-discipline a network of clocks. Signals from a network of clocks will be transmitted over optical fibers and compared with a master clock. The PID system will be used to monitor and correct these signals, ensuring that the network of clocks is synchonized to the master.	The student will have: A) a fundamental understanding of PIDs and their applications in clock synchronization. B) apply these knowledge to the development of a multi-network system of clocks for synchronization. C) a fundamental understanding of time and frequency synchronization of clocks across geographical distances. D) a greater appreciation for the need of time keeping, time metrology, and time synchronization. E) understood the importance of reference frequency signals.	A) Study and determine the components required for the development of a PID system. B) Literature survey of the current state-of-the-art methods and determine the optimal approach. B) Make purchases for required components. C) Demonstrate a simple PID system for disciplining of clocks. E) Apply initial demonstration to a network of clocks. F) Developing any software or program code required to run the system. C) Other administrative work.	A) Background in electrical engineering or experimental physics. B) Understanding of Radio frequency and microwave signal transmission. C) Basic knowledge in statistics and statistical analysis. D) Hands-on experience with equipment such as function generators, oscilloscopes and PIDs preferred. E) General knowledge in optics and optical fibers (optional) F) Good, positive, learning attitude. Inquisitive mindset with a	A) Study and determine the components required for the development of a PID system. B) Literature survey of the current state-of-the-art methods and determine the optimal approach. B) Make purchases for required components. C) Demonstrate a simple PID system for disciplining of clocks. E) Apply initial demonstration to a network of clocks. F) Developing any software or program code required to run the system. C) Other administrative work.	NMC	ETM	Tan Yung Chuen	8 Cleantech Loop, #01-20, Singapore 637145	Engineering and Technology	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilies of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
68	Development of AI tool for efficacious pathway optimisation	The production of novel or valuable molecules via the customisation of biological pathways can be substantially enhanced by DNA manipulation technologies. However, evaluating the net effect of pathway modifications on production yield remains a challenge: current black-box AI approaches cannot make grounded or good predictions reliably, whereas pathway modelling requires mechanistic details that are unavailable for most biochemical reactions, limiting its industrial applicability. To complement the weaknesses of each approach, this project focuses the development of an AI tool for the efficacious optimisation of pathways, while allowing for the exploration of underlying mechanisms. Data: Synthetic time-series data of metabolites concentration from simulating the reactions of synthetic pathway. Expected outcomes: Deployable, well-annotated, & neat python codes implementing explainable AI method for pathway optimization (specific guidance will be provided); demonstrated application on Windows server with proper documentation	The student will learn new skills in AI and modeling methods for biological network analysis.	Independent thinking, team playing and research documentation	Good programming skills in Python, R or C++ Good interpersonal skills and creativity Background in biology or molecular biology is a plus	Development and applications of codes and models to study dynamic regulation of complex biological networks. The student will work closely with research advisor. While guidance is provided, student is required to work indepently and creatively.	BII	Analysis/HuPo (Computational Biology & Omics Lab)	Kumar Selvarajoo	31 Biopolis Street, #07-01 Matrix, Singapore 138671	Computing and Information Sciences	1
69	Development of biomimetic scaffolds for skin regeneration and wound healing	3D human skin constructs (HSCs) in vitro have been widely used for many applications. However, current strategies to generate 3D skin models are tedious, labour intensive and suffers from lack of reproducibility. To overcome this issue, 3D skin models can be generated by using additive manufacturing technology. Otherwise known as bioprinting, the semi-automated platform enables the deposition of multiple materials and cells with spatial precision, allowing improved structural and compositional complexity that can further recapitulate native human skin. In this project, we aim to generate biomimetic scaffolds bioinks based on components of the native skin extracellular matrix (ECM) – collagen, elastic, glycosaminoglycans etc. To ensure the bioinks can be used for the generation of bioprinted HSCs, the printability and biocompatibility of the formulations will be investigated	1. Understand the principles of tissue engineering and bioprinting 2. Familiarity with experimental techniques including aseptic preparations, tissue/cell culture, bioprinting and biochemical assays 3. Critical thinking and data analysis 4. Experimental design and troubleshooting 5. Scientific thinking and communication including literature review and analysis, data presentation and scientific writing	1. Perform experiments, follow SOP and protocols well 2. Comply with mandated health and safety, ethical requirements 3. Provide technical support for other team members	Knowledge of skin biology, physiology and ECM will be advantageous.	You will be contributing to the described project.	A*SRL	Model Development	Kun Liang	8A Biomedical Grove, #06-06, Immunos, Singapore 138648	Physical Sciences	1
70	Development of biophotonics platform for MedTech applications	During this internship, the student will get hands-on experience with various optical spectroscopy and imaging systems and how to develop certain new platforms and also on data processing algorithms to cater to the requirement for specific biomedical applications. Students will be working under the guidance of multidisciplinary research scientists in the lab and necessary training will be provided.	Students will gain knowledge on experimental skills in optical spectroscopy technologies, nanophotonics, nanomaterials for biosensing and related data processing, including AI approaches.	After proper training, student will help in routine measurement using Raman/reflectance/fluorescence spectroscopy and also in basic data analysis			A*SRL	Translational Biophotonics Lab	Dinish U.S	31 Biopolis Way, Nanos #07-01 Singapore 138669	Biomedical Sciences	1
71	Development of high power and energy efficient electric drivetrain for electromobility applications	The aim of the research project is to investigate how the power density and efficiency of an high speed electric machine can be enhanced through improved heat dissipation. A computational model of the electric machine will be developed to demonstrate how heat dissipation can be maximized. Through this investigation the optimal cooling conditions that maximizes the power density and efficiency will be determined. The concept device will be evaluated on an experimental set-up simulating a typical drive cycle in an electromobility applications. The outcome of this research will lead to the significant improvement of the power density and efficiency of electric powertrain systems deployed in electric vehicles.	1. Achieve competencies in the usage of computational software tools e.g. COMSOL Multiphysics and perform electromagnetic / thermal analysis of an electrical machines 2. Gain practical skills in the setting up of experiments, design of experimental procedures and usage of instruments to characterize non-isothermal flow 3. Gain understand of the following: a) Operating principles of electrical machines b) Electromagnetic enhancement in electric machines c) Improved heat dissipation in electric machines	1. Design analysis and optimization – electromagnetic and thermal analysis, trade-off analysis and application of optimization techniques 2. Prototyping and experimentation – design of experiments, cooling system implementation, instrumentation and experimental testing	1. Good understanding of electromagnetics, heat transfer and fluid dynamics principles 2. Understanding of FEA and CFD analysis methods 3. Competent with simulation software tools e.g. Ansys, COMSOL	To assist with the design, analysis and characterization of the heat generation and heat dissipation in electrical machines: 1. Perform conjugate heat transfer analysis of the critical components such as the magnetic /rotor / stator assembly: • Modelling and simulating the internal and external flow found in an electric machine • Establish the heat transfer correlations with respect to the design of the device and its operating conditions e.g. rotation speed 2. Setting up and the design of experiments to evaluate the heat dissipation • Measuring the heat dissipation from the device to the coolant or surroundings under the typical operating conditions • Evaluate the effectiveness of the proposed cooling strategy and provide recommendations for design improvements	SIMTech	Adaptive Robotics & Mechatronics (ARM)	Heng Kiat Jonathan Hey	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	2
72	Development of Lab-On-Chip Biomarker Module for Stress Monitoring with Saliva	The project is to develop a Point-of-care diagnostics for wellness testing on microfluidic platform. The scope of the project is to develop & optimize, Lateral flow immunoassay for rapid detection (10-20min) of biomarkers on-chip and protein separation by capillary-based electrophoresis. The idea is to develop an efficient low-cost assay on the disposable chips for rapid diagnosis. The scope involves identifying and optimizing innovation in the detection strategy of the biomolecules. The project involves 1. Development of biosensors for rapid quantification of biomarkers in samples 2. Miniaturization of LFA immunoassay 3. Testing of different protocols and materials to improve the assay sensitivity 4. The workflow would involve investigating, optimizing assays for the biomarker on the bench followed by integration on the chip. The student will be involved in as many aspects of research as he/she can learn. The student will work on a (i) real world problem with a highly interdisciplinary team, (ii) gain experimental skills in immune- & molecular detection assays (iii) independent experiments; statistical data analysis, (iv) can contribute to reviewing the literature for relevant technologies and publishing the research findings in a peer-reviewed journal or filing a TD/patent for the recent discoveries in the technology.	The student will be able to appreciate gold nanoparticles conjugation, ELISA, and lateral flow assay process optimization with hands-on guidance, as well as performing experiments to formulate reagent recipes and improve existing processes to achieve assay robustness. The student will also be given opportunities to practise oral and written scientific communication via literature review, oral presentations and report writing. If he/she is keen to develop additional skill sets, they will have the liberty to learn/contribute to other bio or interdisciplinary skills that are being developed in our labs.	The student should (i) embody safety as number 1 priority through safety briefings and training, (ii) learn and apply lab-work methods and techniques taught to them, eventually able to work independently with some guidance. To enable the student to experience a more representative research experience, he/she would be expected to keep detailed experimental notes, read, and summarize academic papers, draft presentation slides to share research ideas and outcomes, as well as possibly getting involved in another research project for added exposure.	Knowledge in chemistry (for reagent preparation), ELISA (for gold-standard comparison), being inquisitive (show passion in learning new things) and detailed-oriented meticulousness would be very helpful. Having experience in 3D computer-aided drawing (CAD) software knowledge such as SolidWorks or AutoCAD would also be a plus.	The student will (i) perform literature and background research and review, (ii) assist in the daily operations of experiments and reagent and process maintenance and preparation, (iii) keep a daily/weekly record of the learning and experimental outcomes, and (iv) provide a detailed research report and poster by the end of their internship.	SIMTech	Microfluids & MedTech Devices (MMD)	Cong Zhi Chan	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Biomedical Sciences	2
73	Development of process-driven synthetic data generator for omics application	Here, the student will study the statistical distribution of transcriptome-wide gene expressions of a given cell type (e.g. immune cell) and derive a AI or mechanistic model to learn and regenerate the gene expressions for (single gene) mutated condition. The results will be tested on actual mutated transcriptome dataset.	The student will learn new skills in synthetic omics data generation.	Independent thinking, team playing and research documentation	Good programming skills in Python, R or C++ Good interpersonal skills and creativity Background in biology or molecular biology is a plus	Development and applications of codes and models to study dynamic expressions of genes. The student will work closely with research advisor. While guidance is provided, student is required to work indepently and creatively.	BII	Analysis/HuPo (Computational Biology & Omics Lab)	Kumar Selvarajoo	32 Biopolis Street, #07-01 Matrix, Singapore 138671	Computing and Information Sciences	1
74	Development of Selective Laser Sintering (SLS) 3D Printing process for aviation application	Selective Laser Sintering (SLS) is a laser powder bed fusion (L-PBF) process that involves producing a polymeric part using a layer-by-layer approach in a powder bed, by means of thermal fusion of powders using a localized narrow beam of heat source. One of the key advantages of SLS process is the ability to print parts without the need for support structures. The project will be focus on the developmental work of print process using polymeric flame-retardant grade powder in SLS system for aviation application and relevant qualification characterizations.	(1) Understand the polymer laser powder bed fusion (L-PBF) process, its working principle, critical process parameter and its effects on the printed samples' properties (2) Demonstrate the process flow of L-PBF from build job preparation to post-processing of the 3D printed components (3) Understand the advantages of SLS process in manufacturing production such as nesting (4) Recognize the operational safety requirement of SLS printing process	(1) Carry out literature review on the current state of art of SLS printing process and other related polymer additive manufacturing (2) Help in the 3D printing process (3) Involve in the post process work of the 3D printed parts (4) Carry out characterization of the printed parts (5) Analyze of experiment data (6) Display good teamwork and responsibility on the assigned task (7) Self-motivated and willing to learn		The project will be focus on the developmental work of print process using polymeric flame-retardant grade powder in SLS system for aviation application and relevant qualification characterizations.	SIMTech	Additive Tech Innovation (ATI)	Yu Kai Justin Tan	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
75	Development of Simulation Tool to Characterize Light Propagation in Sea Water for Optical Wireless Communication	Recent developments in optical wireless communication (OWC) have revealed the potential and advantages of optical waves over radiofrequency (RF) and acoustic waves, especially in scenarios involving high-speed, medium-range communication from water to air. Optical waves, specifically in the blue-green window (ranging from 450 nm to 550 nm), exhibit acceptable propagation attenuation in both water and air mediums. Moreover, approximately 90% of optical wave energy can penetrate the water surface when the incident angle is small to medium. OWC facilitates high-speed data transmission through laser or light-emitting diode (LED) technology, offering a compact and cost-effective integration. These appealing attributes render OWC a promising solution for optical wireless communication. To model the trajectory and energy loss of photons emitted from a light source in this context, the Monte Carlo method is frequently employed. In this project, we will develop a modified Monte Carlo tool for simulating the anisotropic transport of visible light in turbid seawater, encompassing air-sea and seafloor boundaries. One of the major challenges in implementing this simulation tool is the consideration of wave action at the sea surface. Different frequency, energy, and direction components of waves introduce random	Optical Wireless Communication, Channel Modeling, Monte Carlo Simulation, Scattering, Absorption, Wave action	Conduct the research honestly and uphold the integrity; keep the working place (IHPC) safe	Students would possess strong background in Math (and Physics), having the interest in coding using MATLAB/Python	1. literature review 2. study a. OWC, Channel Characteristic b. Monte Carlo simulation 3. coding 4. report write-up 5. presentation	IHPC	Electronics & Photonics	Bui Viet Phuong	1 Fusionopolis Way, #16-16 Connexis North, S138632	Engineering and Technology	1
76	Development of the cellXpress software	cellXpress is a biologist-friendly image analysis and visualization software tool specifically designed for multiplexed fluorescence (MxF) cellular and tissue images. The intern will participate in the development of the cellXpress software, including graphical user interfaces, image file loader, and 3D data visualization	The intern will have the opportunity to learn software development, advanced programming skills, and data processing methods. He/she will have the opportunity to work in a highly interdisciplinary and stimulating environment, and learn how computational biology can help	The candidate will design, program, and test software tools for processing large tissue images. He/she will also have to perform research on image processing and 3D graphics rendering algorithms, and benchmark the performance of these methods.	The intern must have strong knowledge in image and data processing, algorithms, and know how to perform C++ and Python programming under the Linux environment. Prior knowledge in OpenGL is preferred but not required.	The intern will participate in the development of the cellXpress software, including graphical user interfaces, image file loader, and 3D data visualization.	BII	Cellular Image Informatics Division	Loo Lit Hsin	30 Biopolis Street, #07-01 Matrix, Singapore 138671	Computing and Information Sciences	1
77	Discovery and validation of novel immunotherapy targets for HCC using in vivo CRISPR gene editing of CD8 T cells	The lab's primary research focus is using functional screening approaches to identify candidate targets for downstream immunotherapeutics development. We have recently completed a focused in vivo CRISPR screen for immunosuppressive surface receptors on tumour-specific CD8 cytotoxic T cells that are active in the tumour microenvironment of mice with liver cancer (hepatocellular carcinoma, HCC). In the next phase of the project, we will be validating the screen hits based on demonstrated efficacy and based on uncovering aspects of their biological mechanism of immunosuppression on anti-tumour CD8 T cells	Students will learn: (1) how to design and validate CRISPR gene editing reagents using molecular biology techniques, (2) cell culture and in vitro experimental techniques for primary T cells, and (3) multi-colour flow cytometry. These skills will culminate in the student planning, executing, and analysing data collected from an experiment under my supervision.	Students will be required to: (1) commit to the minimum duration of the internship stipulated to the award, (2) maintain a laboratory notebook recording their learning, experimental protocols, and results, and (3) present their research work and findings in a 20-minute long lab meeting presentation, in addition to university requirements for the internship.	Prospective students should have demonstrated knowledge in molecular biology and cell biology (such has having previously taken the relevant modules in prior semesters). Background knowledge in immunology and biochemistry is helpful but not required.	The student intern's primary job description is to learn from the project supervisor and/or assigned senior lab personnel instructing them to achieve the learning outcomes. The student's secondary job description is to assist the project supervisor with specific procedures under close supervision on an ad hoc basis. The student's tertiary job description will be to perform routine lab maintenance work (e.g. clearing biohazard waste, sending and collecting items for autoclaving etc.) as part of a roster of staff and interns.	SIgN	OR Lab	TAY Rong En	8A Biomedical Grove, #04-06 Immunos Building, Singapore 138648	Biomedical Sciences	1
78	Doped AlN thin films for piezo/ferroelectric applications	Improved piezo-response and ferroelectric properties were observed in ScAlN films. Similar improvements were noticed in other element doped (e.g.; B) AlN films. In this exploratory project effect of foreign elemental doping on the properties of AlN films will be studied. Effect of a third doping element on the ScAlN film properties will also be explored.	1) This project will provide the student an experience on how process optimization is conducted in semiconductor device fabrication. 2) The student will learn how to operate co-sputter deposition tool to form an alloy films, 3) The student will learn how to characterize ferroelectric properties of the deposited films. 3) The student will learn how to interpret metrology data such as I-V curves.	In this role, student will be trianed on a few research tool and will get a chance to design simple DOE, conduct experiments, and analyse data. The student need to learn the PVD tool operation--recipe creation/ modification etc., film measurement/characterization using metrology tools, and data analysis.	Students with Material science/ Physics/ Electrical Engineering background are prefered	Enhancement in piezoelectric properties and discovery of ferroelectric switching in ScAlN thin films attracted immense scientific interest. In this student project effect of different elemental addition on the properties of AlN films will be studied. Effect of an additional third element on the ScAlN film properties also will be explored.	IME	APM	Binni Varghese	4 Fusionopolis Way, Kinesis Tower, Level 11, Singapore 138635	Physical Sciences	1
79	DSVC - WP 2.4 Few-shot product quality and machine condition prediction for reconfigurable manufacturing system	Predictive maintenance (PdM) is a hot trend in advanced manufacturing in recent time thanks to the development of IIoT, emerging technology, and deep learning algorithms. A main challenge of PdM applications is that most of data samples the in industrial practice are under normal or healthy condition while the fault samples are scarce. This affects seriously the accuracy of the built deep learning models due to the biases towards the normal condition as the data have a highly imbalanced ratio among normal and faulty samples. This project aims to solve the issue by developing a few-shot learning-based PdM framework for machines in industrial manufacturing	- Be able to understand IIoT and sensorization - Be able to develop skill sets and knowledge of data analysis and signal processing. - Be able to develop algorithms for PdM	1. Pre-process data collected from experiments 2. Develop algo for PdM under supervision 3. Report the work progress	1. Engineering, Programming skill (Python, Matlab, Go, C/C++). 2. Familiar with Pytorch or Tensorflow frameworks	1. Data collection/experiments 2. Data analysis/data pre-processing 3. Develop a framework-based few-shot learning algorithms under supervisor	SIMTech	Cyber-Physical Production System (CPPS)	Van Tung Tran	Singapore Institute of Manufacturing Technology (SIMTech) @ CTZB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
80	Dynamic Length Measurements in Precision Engineering	This project is to study the dynamic effect of environmental temperature on high-precision length measurement uncertainty by means of experimental testing and data analytics. The work scope includes: (1) experimental tests of length measurement at varying temperatures; (2) data analysis & modeling of the dynamic relationship between thermal expansion and temperature with machine learning; (3) development of the model to minimize temperature-induced uncertainty for length measurements; (4) enhance the capability (measurement and calibration) of current lab instrument; (5) development of in-situ or customized calibration & measurement capability. The outputs of this project will help improve the quality and efficiency of the length measurements	"1. Hands-On Skills: Gain practical experience in experimental testing and data analysis. 2. Data Analysis Proficiency: Develop strong data analysis and machine learning skills. 3. Metrology Knowledge: Learn measurement science principles and metrology. 4. Interdisciplinary Collaboration: Work effectively with experts from diverse fields. 5. Problem-Solving Skills: Enhance critical thinking and troubleshooting abilities. 6. Model Development: Contribute to the creation of a temperature compensation model. 7. Industry Relevance: Understand the practical applications of engineering in enhancing industrial processes."	The student will work with the supervisor and engineers in the length and dimension lab to conduct the experiments and data analytics for this project. The student will also work on the development of machine learning algorithm with coding, as well as customized or in-situ calibration set-up with configurations.	Knowledge of basic physics principles on metrology, like lab measurements; programming coding (like Python or C++); problem solving and thinking.	1. Conduct dimensional measurement and calibration on various instrument; 2. Learn the working principle, operation procedures, and post-processing skill on data; 3. Work on the design, set-up, configuration and optimization based on the project objectives;	NMC	ODM	Xu Dawei	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
81	Dynamic Recyclable Thermosets for Sustainable Plastics	Thermosets are cross-linked polymers with superior strength and durability at the expense of recyclability. Vitrimers, a new class of polymers, possess dynamic covalent cross-links which can rearrange when activated. This stimuli-driven recyclability makes vitrimers highly attractive as sustainable plastics. This project aims to develop vitrimers with good compressive strength and stability to drive the adoption of these circular plastics. The intern will actively participate and work with the team to synthesise vitrimers and optimise their mechanical properties and recyclability.	1. Gain in-depth knowledge of vitrimers, including synthesis and performance characterisation 2. Ability to perform a wide range of lab work and experiments independently, including synthesis and formulation. 3. Gain knowledge and ability to operate molecular and polymer testing equipment and other common characterization tools 4. Independent and critical thinking skills, problem-solving skills, and teamwork are among the many other transferrable skills to be gained.	1. Execute tasks assigned by the supervisor with due diligence. 2. Comply to laboratory safety rules set by the institute.	1. Pursuing undergraduate studies in Bachelor's Degree in Chemistry, Materials Science or any relevant degree. 2. Possess a proactive and positive learning attitude 3. Able to work both independently and in a team	1. Synthesis of molecular cross-linkers 2. Synthesis and modification of cross-linked polymers 3. Characterisation of polymer e.g. mechanical strength, recyclability	IMRE	SOF	Goh Simin Shermin	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	2
82	Economic and Environmental Analysis on Green Ammonia and Methonal Production	Traditional grey ammonia and methanol production heavily rely on fossil fuels, contributing to greenhouse gas emissions and environmental degradation. Green alternatives, generated from renewable sources or sustainable processes, offer a promising solution. The "Economic and Environmental Analysis of Green Ammonia and Methanol Production" project seeks to employ rigorous economic and environmental assessments to determine the viability of green production. Through modelling and simulation over a global setting, it provides valuable insights into cost-effectiveness and will provide a full account for the environmental impacts of green ammonia and methanol production.	This project will expose the student(s) to understand the fundementals of various green ammonia and green methonal production technologies and exposure to modelling and simulation capabilities, techno-economic analysis, and environmental life cycle assessment analysis of such sustainable fuels.	1) Gather information, data, or resources relevant to the project's tasks. 2) Process data and run simulation (with support and supervision) 3) Assist supervisor in overseeing schedules and milestone management as well as preparing slides and reports.	1) Undergrad: Mechanical Engineering, Chemical Engineering or energy related field; H3 RAP: strong interest in Chemistry and Mathematics 2) Interest in modelling and simulation for sustainable fuel production from renewable energy 3) Experience in programming (computational, ideally in Python) and data-driven modelling	The students will be responsible for undertaking in-depth research in modelling and simulation of the various green ammonia and methanol production systems: 1) Conduct literature review to stay up-to-date with the latest trends and innovations in green ammonia and methanol production. 2) Collected databases of cost and life cycle assessment for green ammonia and methanol production process 3) Assist supervisor to build physics or data-driven models for green ammonia and methanol production 4) Assist supervisor to conduct cost-benefit analysis for green ammonia and methanol production and estimate capital and operational costs. 5) Assist supervisor to conduct life cycle assessment studies to quantify the environmental impacts of green ammonia and methanol production. 6) Publish high-quality research papers with research outcomes in Citescore top 10% international journals if applicable	IHPC	Systems Science	LI Xian	1 Fusionopolis Way, #16-16 Connexis, Fusionopolis, Singapore 138632	Engineering and Technology	2

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83	Edge Caching for 5G-and-Beyond Industrial IoT Networks	Enabling wireless communications for industrial Internet-of-Things (IIoT) use cases with strict reliability and latency requirements is an open research challenge due to the harsh indoor and outdoor wireless environments in industrial factories. To enable timely wireless content access for IIoT services, popular content statistics based on the underlying IIoT network traffic are collected. Thereafter, deep learning-based methods are employed to predict popular files that are likely to be requested by end users in IIoT networks. Collectively, such an approach is also known as deep learning-driven edge caching, and it is one of the research areas gaining interest for fifth generation (5G)-and-beyond IIoT networks. Therefore, this project investigates the applications of edge caching and 5G communications as promising technologies that can potentially be used to support ultra-reliable low-latency content access in 5G-and-beyond IIoT networks. Specifically, a edge caching strategies are investigated for 5G-and-beyond IIoT networks. Using non-learning based least frequently used (LFU) and least recently used (LRU) algorithms as benchmarks, edge caching strategies are evaluated based on cache hit rate, latency, and energy efficiency using realistic network traffic model.	•Literature review of IIoT networks and edge caching strategies •Investigate deep learning-based techniques for popular content prediction for IIoT use cases. •Build suitable deep learning model variants, and fine tune for the proposed application. •Train and test with simulated data. •Test the proposed solution with real measurement data from a testbed in ARTC, A*STAR.	To design and develop deep learning-driven capabilities for intelligent edge computing services in 5G-and-beyond industrial networks	•Proficient in C, C++ and Python programming •Team player and strong interpersonal and communication (verbal & written) skills. •Strong analytical and problem-solving skills. •Motivated self-starter with a strong enthusiasm to learn. •Results-oriented with a strong sense of ownership in delivering for members and stakeholders. •Prior experience working in data-driven related wireless communications projects is a plus.	Research Engineer	ARTC	Smart Virtual Systems	Cheng Leong (Lin Qianlong) Lim	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Engineering and Technology	1
84	Effects of the gut microbiome on brain and immune-metabolic function	Gut microbes and their metabolites interact with dietary needs and influence both metabolic and brain function and are a common currency for gut-brain signaling across species. Here we will use the zebrafish model to identify microbes and metabolites that affect feeding, sleep, as well as cardiometabolic and immune function. Promising microbial factors will be further evaluated for their mechanisms of action, including their impact on gut-brain activity and physiology. This study will help establish causal links between gut microbes and brain-body function, and identify novel therapeutic interventions for metabolic or neurobehavioral disorders.	The trainee will become familiar with fundamental laboratory skills (including zebrafish, molecular, and imaging techniques), proper experimental design, data analysis, scientific reading and writing. They will also gain a broad understanding of appetite/nutritional biology, microbiome and neuroscience research.	Accurate monitoring and reporting of experimental results and research findings Zebrafish animal colony management including genotyping and husbandry. Zebrafish brain and behavioural phenotyping experiments; pharmacological screening; microscopy, multi-omics approaches; data analysis and statistics Routine lab techniques: molecular biology (cloning, DNA, RNA extraction), making buffers and reagent preparation. Evaluate and interpret data for oral or written presentations.	Basic lab skills (e.g. pipetting, molecular biology, imaging), basic competence with computers (e.g. Microsoft Office, programming is a plus) Responsible, focused, and willing to learn	1) Literature review / bioinformatics to identify candidate metabolites of human or zebrafish gut microbial origin 2) High-throughput behavioral and image-based screening for effects on zebrafish feeding behavior and metabolic phenotypes 3) In vivo calcium / confocal imaging, metabolic and anatomical phenotyping of the most promising candidates in zebrafish 4) Report writing, scientific presentations, possible follow-up research in other models (e.g. cell culture, rodents)	IMCB	Neurometabolism in Health and Disease	Caroline Lei Wee	61 Biopolis Drive, #08-13 Proteos, Singapore 138673	Biomedical Sciences	2
85	Efficiency in the Era of Foundation Models	This research project focuses on analyzing the efficiency of foundation models. We delve deep into various aspects including the efficiency of the model architectures, the datasets used, and the methods implemented during the training and evaluation phases. By investigating these components, the project aims to identify potential bottlenecks and areas for optimization in deploying foundation models in real-world scenarios.	1. Understand the intricacies and fundamentals of foundation model architectures. 2. Develop a deeper knowledge of dataset efficiency and its impact on model training and output. 3. Gain hands-on experience in evaluating and optimizing training methods. 4. Acquire skills in critically analyzing model evaluation metrics and their real-world implications. 5. Understand the challenges and trade-offs in achieving efficiency in model training and deployment.	1. Conduct literature review on the latest foundation models and their efficiencies. 2. Participate in data collection, preprocessing, and analysis to ensure dataset efficiency. 3. Implement, train, and evaluate different foundation models to benchmark their efficiencies. 4. Document and present findings, insights, and recommendations based on the research. 5. Collaborate with the team to brainstorm and develop strategies to optimize efficiency in future projects.	1. Basic understanding of machine learning and deep learning concepts. 2. Familiarity with common ML/DL frameworks like TensorFlow or PyTorch. 3. Strong analytical and critical thinking skills. 4. Good communication skills for effective documentation and presentation. 5. Previous experience in working with datasets is a plus.	The student will actively participate in a research project focusing on the efficiency of foundation models. They will be involved in literature review, data analysis, model training, and evaluation. The student will collaborate with a team of researchers to uncover insights and provide recommendations on optimizing the efficiency of foundation models in both training and real-world deployment scenarios. The role demands a blend of theoretical knowledge and hands-on application, ensuring a comprehensive learning experience.	IHPC	CFAR	He Yang	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	2
86	Electrical Characterization of Chiral Magnetic Tunnel Junction Devices	Chiral spin textures such as skyrmions and domain walls are promising candidates for next-generation computing technologies. Such applications require electrical detection of spin textures within scalable device geometries. This work will investigate recipes to stabilize and detect chiral spin textures within magnetic tunnel junction devices. The student will use existing setups to perform electrical and magnetic measurements to isolate working devices, and study them to establish signatures of chiral spin textures.	The project will acquaint students with magnetism, spintronics, and device physics concepts and train them on device characterization and data analysis. It may also acquaint them with skill sets relevant to the semiconductor industry.	The student may perform some or all aspects of the following work: 1. Electrical measurements of tunnel junction devices 2. Magnetic characterization of thin films and nanostructures 3. Data analysis using scripting tools 4. Finite element simulations to interpret the data	1. Coursework in electromagnetism and materials physics 2. Some lab experience in using electrical instruments 3. Optional: experience with data analysis and finite element simulations	The student may perform some or all aspects of the following work: 1. Electrical measurements of tunnel junction devices 2. Magnetic characterization of thin films and nanostructures 3. Data analysis using scripting tools 4. Finite element simulations to interpret the data	IMRE	ELE	Anjan Soumyanarayanan	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	1
87	Electrical Transport in Noncollinear Magnets	Chiral spin textures such as skyrmions and domain walls are promising candidates for next-generation computing technologies. Such applications require electrical detection of spin textures within scalable device geometries. The electrical transport properties and their dependence on magnetic fields provides crucial insight into the scattering mechanisms interaction of electronic spins with magnetic textures and their dependence on interfacial properties, all of which are important for magnetic device applications. This work will focus on a systematic exploration of magneto-transport in Hall bar devices consisting of magnetic textures. The student will use existing setups to perform electrical and magnetic measurements to measure their magnetotransport and Hall transport properties.	The project will acquaint students with magnetism, spintronics, and device physics concepts and train them on device characterization and data analysis. It may also acquaint them with skill sets relevant to the semiconductor industry.	The student may perform some or all aspects of the following work: 1. Electrical measurements of chiral multilayer Hall bar devices 2. Magnetic characterization of thin films and nanostructures 3. Data analysis using scripting tools	1. Coursework in electromagnetism and materials physics. 2. Some lab experience in using electrical instruments 3. Optional: experience with data analysis and data curve fitting.	The student may perform some or all aspects of the following work: 1. Electrical measurements of chiral multilayer Hall bar devices 2. Magnetic characterization of thin films and nanostructures 3. Data analysis using scripting tools	IMRE	ELE	Anjan Soumyanarayanan	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
88	Electrifying the Road Ahead: Pioneering High-Performance Variable Flux Motors for Futuristic Electric Vehicles	This project is dedicated to enhancing variable flux actuators, crucial components in cutting-edge electromagnetic systems primarily utilized in electromobility and electric vehicles. The project's objectives encompass motor design, mechanism development, thermal modelling, and control system refinement. Project Objectives: 1)Motor Design: Design, prototype, and optimize variable flux actuators tailored for use in electromobility and electric vehicles. 2)Mechanism Development: Enhance motor mechanisms to ensure superior performance and efficiency in electrified transportation.	1)Advanced Technical Skills: Master CAD, mechanism design skills and ANSYS for designing actuators and contributing to electromechanical system development. 2)Thermal Modelling: Gain expertise in thermal modelling, analysis, and optimization for variable flux actuators. 3)Control System Development: Develop and implement control algorithms for enhanced precision in electromagnetic systems. 4)Experimental Testing: Excel in conducting tests, data analysis, and evaluating actuator performance for continuous improvement.	1)Mechanism Development: •Contribute to the development of motor mechanisms. •Design and refine mechanical components to enhance motor performance. 2)Thermal Management: •Implement thermal management solutions for motors. •Conduct thermal simulations and contribute to temperature optimization. 3)Controls: •Assist in developing and refining motor control systems. •Work on control algorithms and feedback mechanisms for precise operation. 4)Simulation and Data Analysis: •Conduct simulations using software like MATLAB, Simulink, LabVIEW, and C++. •Analyse data to optimize designs and control systems. 5)Documentation and Reporting: •Maintain records of work, including design documents and test data. •Produce technical reports and presentations for project communication.	1)CAD design proficiency, including Solidworks or CREO. 2)Knowledge of manufacturing processes and prototyping techniques. 3)Basic to intermediate simulation skills using software such as MATLAB, Simulink, LabView, and C++. 4)Familiarity with thermal modelling of motors and electromagnetic (EM) simulation tools would be a valuable asset.	Job Description: Student Intern - Variable Flux Actuators Project Position: Student Intern Job Overview: We are seeking a motivated and dynamic student intern to join our team for a challenging and rewarding internship opportunity. As a student intern, you will actively contribute to the design, development, and optimization of Variable Flux Motors, collaborate on mechanism development, assist in implementing thermal management solutions, and contribute to the development of control systems. This role is an excellent opportunity to gain hands-on experience in electromechanical systems while working with a multidisciplinary team of researchers and engineers. Key Responsibilities: •Collaborate on Variable Flux Motor design and optimization using CAD software. •Participate in the development and enhancement of motor mechanisms to improve performance. •Assist in the implementation of thermal management solutions for motors. •Contribute to the development and refinement of motor control systems, including control algorithms.	SIMTech	Adaptive Robotics & Mechatronics (ARM)	Akash Singh	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
89	Electroless Plating for Metallization of High Performance Polymers	Metallization of polymers (or plastics) are widely used in medical instruments, electronics, aerospace, and automotive industry for light-weight and surface properties enhancement such as anti-static, scratch resistance, solvent resistance, and decorative surface. Commercially available plastic plating is mainly performed on ABS/PC based polymers, by following complicated steps such as mechanical roughening, chemical etching, Pd activation and electroless nickel (EN) plating. The current process has disadvantages including use of toxic oxidant (Cr6+) for chemical etching. This project is to develop advanced electroless plating processes for metallization of the high performance and hard-to-plate polymers (such as PEI & PE) with good coating adhesion.	The student will learn literature review, electroless nickel or electroless copper plating, formulation of solution baths for cleaning, conditioning, new activation process as well as coating characterization.	The attached student will go through HSE induction and briefing and ensure safety compliance. Literature review. Plan and conduct the relevant experiments. Compile and present results in written form or oral presentation.	N.A.	1) Literature Review on polymer metallization process 2) Process optimization and modification 3) Experiment on metallization 4) Coating characterization 5) A final report with detailed process and results	SIMTech	Surface & Circular Processing (SCP)	Yujie Zhou	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1

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Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
90	Elucidating the transcriptional response of cancer drug treatment using a spatial multi-omics approach	In this project, we will be setting up a model system for understanding the transcriptional response of estrogen signaling in breast cancer cells. We will apply a spatial omics approach to profile the hormone dependence of breast cancer to gain a better understanding of the disease. In particular, we want to quantify and compare the transient transcriptome and genome of MCF-7 cells in response to E2 treatment and Ethanol control using a microscopy-based approach called MERFISH. From this data, we hope to construct a mechanistic understanding of how estrogen receptor elicit a regulatory response to treatment that ultimately can be exploited to develop improved therapeutics in the clinic. Please visit our labwebsite to learn more: https://khchenlab.github.io/	Intern is expected to learn various practical laboratory skills, including biochemical assays, advanced instrumentation, and data analysis.	Intern is expected to learn from and assist a research fellow or graduate student in conducting experiments. Intern is expected to establish ownership of a small scale project. Intern is encouraged to actively participate in scientific discussions.	Background in any science or engineering field	The intern will be taught how to prepare biological samples for molecular analysis. The intern also learn how to analyze data and derive statistically meaningful biological conclusions.	GIS	Laboratory of Imagenomics	Chen Kok Hao	60 Biopolis Street, Genome, Level 5, Singapore 138672	Biomedical Sciences	2
91	Energy Efficient Ultrasonic Transducer Sensors	Join our internship and step into the captivating world of Piezoelectric Micromachined Ultrasonic Transducer (PMUT) technology. At IME, we're creating ultrasonic transducers smaller than your fingertip using top-notch semiconductor technology! Dive into PMUT physics to craft ultra-efficient sensors, measuring distance, displacement, flow, and pressure. Your mission? Pioneer the driving algorithms that redefine energy optimization, shaping the future of sensor innovation. Apply now and be part of the next big leap in ultrasonic sensor technology!	The student will learn the basics of ultrasonic-based sensors for detecting displacement, flow, pressure etc. At the end of the internship, the student will gain knowledge of the working principles of piezoelectric micromachined ultrasonic transducers and experience in device level testing and system implementation.	The student will support in developing the testbench for device testing and characterization. The student will have hands-on experience with lab equipment, circuit development, and evaluation boards.	Knowledge in electronics or signal processing. Hands on in operating electronic lab equipment and writing Python scripting	1) Conduct electro-acoustic measurements with the ultrasonic transducer sensors fabricated by IME 2) Characterize and develop electro-mechanical equivalent model of the devices for optimising hardware development 3) Develop signal processing algorithms with reduced energy consumption 4) Report and present the findings	IME	MEMS	Daniel Chen	Institute of Microelectronics (IME), 2, Fusionopolis Way, #08-02 Innovis Tower, Singapore 138634	MEMS, electronics, ultrasonics	
92	Energy Efficient Ultrasonic Transducer Sensors	Join our internship and step into the captivating world of Piezoelectric Micromachined Ultrasonic Transducer (PMUT) technology. At IME, we're creating ultrasonic transducers smaller than your fingertip using top-notch semiconductor technology! Dive into PMUT physics to craft ultra-efficient sensors, measuring distance, displacement, flow, and pressure. Your mission? Pioneer the driving algorithms that redefine energy optimization, shaping the future of sensor innovation. Apply now and be part of the next big leap in ultrasonic sensor technology!	The student will learn the basics of ultrasonic-based sensors for detecting displacement, flow, pressure etc. At the end of the internship, the student will gain knowledge of the working principles of piezoelectric micromachined ultrasonic transducers and experience in device level testing and system implementation.	The student will support in developing the testbench for device testing and characterization. The student will have hands-on experience with lab equipment, circuit development, and evaluation boards.	Knowledge in electronics or signal processing. Hands on in operating electronic lab equipment and writing Python scripting	1. Conduct electro-acoustic measurements with the ultrasonic transducer sensors fabricated by IME 2. Characterize and develop electro-mechanical equivalent model of the devices for optimising hardware development 3. Develop signal processing algorithms with reduced energy consumption 4. Report and present the findings	IME	MEMS	Yul Koh	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
93	Engineer a highly robust and high-yield microbial strain to produce vitamin A and E	Astaxanthin (pro-vitamin A) is a naturally occurring pigment famous for its potent antioxidant properties and several health advantages for both humans and animals. Significant progress has been achieved in non-carotenogenic Escherichia coli to produce astaxanthin. It is feasible to further optimize the strain for a higher TRY by modifying the efflux transporters to lessen the physical stress induced by intracellular astaxanthin accumulation. Vitamin E, an essential nutrient in the human diet, is a generic term that refers to α, β, γ, δ-tocopherols and tocotrienols. Its biosynthesis has been demonstrated but the current yield is too low. On top of our astaxanthin strain, we aim to further engineer our E. coli strain to produce high-yield tocotrienols, paving the way for commercialization.	1) molecular biology skills; 2) modern synthetic biology; 3) metabolic engineering; 4) cloning and genomic editing such as CRISPR technology; 5) analytical chemistry; 6) fermentation technique	1) cloning and molecular biology work; 2) microbial cell culture; 3) product extraction and analysis; 4) assist microbial fermentation; 5) optimize strain performance.	Knowledge of cloning, molecular biology, biotechnology and microbiology. Quick to grasp new knowledge and skills.	The job aims to select students who are keen to learn applied microbiology in the production of food ingredients, fermentation and synthetic biology.	SIFBI	Strain engineering	Simon Zhang Congqiang	31 Biopolis Way, Level 6 Nanos building Singapore 138669	Engineering and Technology	2
94	Engineering of amidase for nylon recycling	Candidate amidases will be expressed in a recombinant host. A high-throughput amidase screen will be established to screen candidate enzymes. Top enzymes will be engineered for better expression, stability, and activity.	The student will learn basic molecular biology techniques such as cloning, growing starter cultures, and gel purification. He/she will also learn how to run and analyze enzyme assays.	The student is expected to learn basic molecular biology techniques and setting-up enzymatic assays. He or she is also expected to practice good and safe laboratory practices as well as record keeping.	The student is expected to have attended university-level biochemistry and/or chemistry laboratory classes (hands-on).	The student is expected to perform basic molecular biology techniques and run basic enzymatic assays. He/she is expected to adhere to good and safe laboratory practices as well as record keeping.	ISCE²	Chemical Biotechnology and Biocatalysis (CBB)	Wong Fong Tian	#07-01 Neuros Building	Biomedical Sciences	1
95	Engineering of enzymes for acetate metabolism for production of high-value chemicals.	Enzymes in the pathway that metabolize acetate to form a target chemical will be expressed in a recombinant host. These will be screened for their stability and activity. Once the best enzymes for each type are chosen, these will be assembled in a production host.	The student will learn basic molecular biology techniques such as cloning, growing starter cultures, and gel purification. He/she will also learn how to run and analyze enzyme assays.	The student is expected to learn basic molecular biology techniques and setting-up enzymatic assays. He or she is also expected to practice good and safe laboratory practices as well as record keeping.	The student is expected to have attended university-level biochemistry and/or chemistry laboratory classes (hands-on).	The student is expected to perform basic molecular biology techniques and run basic enzymatic assays. He/she is expected to adhere to good and safe laboratory practices as well as record keeping.	ISCE²	Chemical Biotechnology and Biocatalysis (CBB)	Wong Fong Tian	#07-01 Neuros Building	Biomedical Sciences	1
96	Engineering Robust and Versatile Injectable Hydrogels with Multifunctional Properties	Injectable hydrogels provide a minimally-invasive approach to administering sustained drug depots and regenerative scaffolds. These implants are required to adapt to the mechanical deformation of neighbouring tissues to avoid delamination and structural failure. However, most injectable gels do not have the mechanical resilience to match biological materials. Herein, we have developed a series of novel thermo-responsive injectable hydrogels capable of achieving strains exceeding conventional hydrogels. Students will be involved in materials synthesis and characterization of the temperature-dependent behaviour of these hydrogels.	Students will learn polymer synthesis and functionalization, spectroscopic characterization (e.g. NMR, FTIR), polymer self-assembly, and mechanical testing.	Synthesize and characterize chemical and mechanical properties of injectable hydrogels. To develop the students' knowledge, he/she student is expected to read widely, comprehend, and summarize the relevant literature.	B.Sc in Chemistry or B.Eng in Materials Engineering	Assist with polymer synthesis, polymer functionalization, and temperature-dependent mechanical characterization.	IMRE	SRI	Rubayn Goh	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
97	Enhancing and Tuning Porosity of Nickel Foams via Binder Jet 3D Printing	Nickel foam (NF) is a preferred current collector for electrochemical systems, including energy storage and conversion, due to its superior material properties. Additionally, as a foam, the high porosity offers a high specific surface area, increasing the areal loading of active materials. Binder Jet 3D Printing (BJP) offers an intrinsic advantage in the fabrication of complex porous components, controlling the porosity both via design and process. This project will explore the capabilities of BJP and post-processing heat treatments in manipulating the porosity of NF, as well as analyze the resulting improvement in material properties of the fabricated NF.	(1) Understand Binder Jet 3D Printing Process (2) Understand Post-Processing Heat Treatment Processes (3) Understand Microstructural and Elemental Analysis of Nickel Foam (4) Experimental Planning and Design Skills (5) Hands-On Experience with Additive Manufacturing Technologies (6) Hands-On Experience with Research & Development Work Environment	Project (1) Assist and Involved in 3D Printing Process and Post-Processing (2) Carry Out Experimental Validation (3) Carry Out Feedstock & Sample Preparation (4) Carry Out Material Characterization and Analysis Personal (1) Display Good Team Work (2) Critical Thinking for Problem Solving (3) Willingness to Learn		Project (1) Assist and Involved in 3D Printing Process and Post-Processing (2) Carry Out Experimental Validation (3) Carry Out Feedstock & Sample Preparation (4) Carry Out Material Characterization and Analysis Personal (1) Display Good Team Work (2) Critical Thinking for Problem Solving (3) Willingness to Learn	SIMTech	Additive Tech Innovation (ATI)	Yan Han Liew	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
98	Evaluating role of neurotransmitters in immune cells regulation during CHIKV infection	Neurotransmitters can modulate immune cell functions. Here, the project investigates the role of excitatory glutamate in regulating the activities of peripheral CD4+ T cells and macrophages during chikungunya virus infection. This project will generate critical knowledge on the neuroimmune circuitry during active viral infection leading to the potential identification of novel host-directed therapeutic targets.	At the end of the attachment, student should have obtained valuable experience in planning and executing experiments. Student will also be taught on documenting, analysing and presenting their results. Importantly, this attachment will also allow the student to develop critical thinking and improve on their presentation skills.	Performing experiments, analyses of data obtained, troubleshooting, critical discussion, presenting, reporting and documenting of work done.	Student(s) should show strong interest and have some background on immunology and infectious diseases	Student will be expected to master cell culture, virus production, viral tittering, viral RNA extraction, viral RNA quantification, cell culture infection, gene expression, ELISA and flow cytometry within 1-2 months. Following, student will need to perform the experiments with minimal guidance. Student is also expected to present her work done during lab meetings.	ID Labs	Pathogen Modulation Lab	Lum Fok Moon	8A Biomedical Grove, Immunos #05-13, Singapore 138648	Biomedical Sciences	1
99	Evaluation of age-related biomarkers and their role with disease outcomes.	Ageing biomarkers, including telomere length measurements, mitochondrial dysfunctions and epigenetic clocks have emerged as important tools that can be used to predict for disease outcomes (cancers, cardiovascular disease and others). The study will generate these ageing biomarker data in various datasets, including blood as well as disease relevant tissue samples (for eg. artery tissues) to evaluate their role in disease progressions and outcomes.	Student will become familiar with lab based protocols to determine ageing biomarkers.	Perform DNA quantification and perform lab-based assays to determine methylation marks and qPCR based measurements of telomere length and mitochondrial dysfunction.	Familiarity with qPCR techniques	The study aims to evaluate important ageing biomarkers such as epigenetic age acceleration, telomere length attrition and mitochondrial dysfunctions in various studies to make important links between these ageing biomarkers and disease outcomes.	GIS	Laboratory of Metabolic Disease and Ageing Genomics	Rajkumar Dorajoo	61 Biopolis St, Genome Building, 4th Floor, Singapore, 138672	Biomedical Sciences	1
100	Explainable AI: Revealing the impacts of rare events on financial markets	The impact of rare events on the financial markets are far-reaching and may cause market volatility, losses and risk exposure, global economic impacts. Given the potentially catastrophic consequences of rare events, risk managements, and prudent investment strategies are crucial in mitigating the adverse effects. Explainable AI can play a significant role in measuring the impacts of rare events on financial markets, however the research on understanding impacts of rare events using explainable AI is in its infancy. In this project, we explore and develop explainability in AI algorithms for risk assessment and stress testing of financial markets.	AI explainability, and its applicability to financial markets.	Conduct literature review, both from an AI explainability and AI in finance point of view. Implement and enhance approaches for explainable AI models in financial markets. Collection and curation of financial market data. Analysis of results and benchmarking of methods.	Basic knowledge of machine learning and AI is expected. Programming skills are required, python programming is preferred.	In this project, you will work with the team to: - Conduct literature review, both from an AI explainability and AI in finance point of view. - Implement and enhance approaches for explainable AI models in financial markets. - Collection and curation of financial market data. - Perform analysis of results and benchmarking of methods.	IHPC	CI	Ricardo Shirota Filho	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Computing and Information Sciences	1

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Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilities of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
101	Exploratory investigation of non-coding RNA biomarkers for point-of-care medical device design	Validation of potential biomarkers is essential for the design of clinically translatable epigenomic biosensors. Miniaturization of epigenomic holographic biosensors using microfluidics employing customizable sensing matrix relies on clinically curated biomarker panel. Such biosensors could act as screening tools, prognostic, or diagnostic point of care devices.	The student will be able to assist in profiling non-coding RNA sequences in clinical samples using PCR technique, as well as gain a deeper understanding on the role of micro RNAs as a biomarker for various conditions such as glioblastoma, or aggressive brain tumor. If the student is from a statistics background, he/she would be working on biostatistics for meta analysis. The student will also be given opportunities to practise oral and written scientific communication via literature review, oral presentations and report writing. If he/she is keen to develop additional skill sets, they will have the liberty to learn/contribute to other bio or interdisciplinary skills that are being developed in our labs.	The student should (i) embody safety as number 1 priority through safety briefings and training, (ii) learn and apply lab-work methods and techniques taught to them, eventually able to work independently with some guidance. To enable the student to experience a more representative research experience, he/she would be expected to keep detailed experimental notes, read, and summarize academic papers, draft presentation slides to share research ideas and outcomes, as well as possibly getting involved in another research project for added exposure.	Knowledge in chemistry (for reagent preparation), PCR (for gold-standard comparison), being inquisitive (show passion in learning new things) and detailed-oriented meticulousness would be very helpful. Having experience in 3D computer-aided drawing (CAD) software knowledge such as SolidWorks or AutoCAD would also be a plus, as we would also be exploring customized 3D-printed extracellular matrices	The student will (i) perform literature and background research and review, (ii) assist in the daily operations of experiments and reagent and process maintenance and preparation, (iii) keep a daily/weekly record of the learning and experimental outcomes, and (iv) provide a detailed research report and poster by the end of their internship.	SIMTech	Microfluids & MedTech Devices (MMD)	Cong Zhi Chan	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Biomedical Sciences	2
102	Exploring Drug Interactions within Amphiphilic Hydrogels	Thermogels are amphiphilic polymers with the ability to form temperature-dependent supramolecular interactions that could lead to gelation. The advantage of a system whereby gelation happens with increasing temperature includes injectability and the potential to encapsulate heat-sensitive drugs and cells. By modulating the degree of hydrophobicity, we can tailor the degree of encapsulation and interactions with hydrophobic drugs. Students will be involved in materials synthesis, characterization of drug-hydrogel interactions through material characterization, and in vitro drug release.	Students will learn polymer synthesis and functionalization, spectroscopic characterization (e.g. NMR, FTIR), rheology, polymer self-assembly, physicochemical interactions between drugs and thermogels, and drug release mechanisms.	Synthesize and characterize chemical and mechanical properties of injectable hydrogels. Assist with in vitro drug release experiments. To develop the students' knowledge, he/she student is expected to read widely, comprehend, and summarize the relevant literature.	B.Sc in Chemistry or B.Eng in Materials Engineering	Assist with polymer synthesis and functionalization, rheological characterization, and in vitro drug release experiments.	IMRE	SRI	Rubayn Goh	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
103	Exploring Quantum Algorithms for Biomedical Applications	In this project, students will explore how near-term quantum algorithms can be applied to biomedical applications. The project focuses on leveraging quantum algorithms, including quantum generative adversarial networks (GANs), variational circuits, and QAOA, to address complex biomedical challenges such as molecular docking and the generation of potential new molecules through machine learning techniques. The projectwill be predominantly computational, requiring students to program and simulate quantum algorithms, with the potential of running them on actual quantum hardware.	- Develop an understanding of quantum computation and its potential impact on solving biomedical problems. - Master the implementation of advanced quantum algorithms in the context of biomedical applications. - Enhance programming skills, especially in quantum programming languages and tools that are pivotal in biomedical applications. - Hone analytical skills to interpret complex simulations and contribute to the development of practical quantum algorithms. - Gain hands-on research experience in an interdisciplinary field, blending quantum physics, computer science, and biology. - Foster teamwork and collaborative problem-solving skills within a cutting-edge research environment.	Students will look into quantum algorithms that hold promise for biomedical applications. Students are expected to do quantum software coding, with an emphasis on writing and refining quantum algorithms for simulations that mirror real-world biomedical scenarios, such as molecular docking procedures and the generation of novel molecular structures using quantum machine learning frameworks. Data analysis will be an integral part of the project as students apply quantum algorithms to biomedical data, analyzing results for accuracy, feasibility, and potential innovation in treatments or drug discovery. A continuous commitment to detailed documentation will be essential to ensure reproducibility and to support the peer review process. In addition to technical responsibilities, students are expected to regularly communicate their progress. They must be prepared to document their challenges and milestones in a manner comprehensible to both specialized and non-specialized audiences.	Math Background: Basic understanding of linear algebra. Programming Knowledge: Experience in a high-level programming language, preferably Python, as it is commonly used in quantum programming. Experience in quantum platforms such as Qibo, Qiskit etc is a plus. Quantum Mechanics Basics: (Optional but beneficial) Some exposure to quantum mechanics principles. Experience in basic near-term quantum algorithms is a plus. Critical Thinking: Ability to approach problems systematically and to think critically about computational results. Collaboration: Willingness to work in a team and contribute to all aspects of the project.	Student will contribute to an exploratory project aimed at merging quantum computing algorithms with biomedical applications. Student will be expected to: - Conduct research on quantum algorithms and their potential to tackle biomedical applications such as molecular docking, drug discvery, and so on. - Write, test, and implement code for quantum simulations and potentially quantum hardware. - Analyze and interpret data from quantum simulations/experiments and compare them with classical algorithms and techniques. - Participate in regular team meetings to discuss progress, challenges, and strategies. - Document findings in a clear and concise manner for academic and non-academic audiences. - Present work in both formal and informal settings to a varied audience.	IHPC	MSC	Kong Jian Feng	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Physical Sciences	2
104	Exploring Quantum Machine Learning Algorithms for Classical and Quantum Data	In this project, students will delve into the fundamentals of quantum computing and its applications in processing classical data sets, with a focus on machine learning tasks. Students will work largely with simulated quantum environments and potentially actual quantum hardware to develop and test machine learning algorithms. The project's main goal is the implementation and analysis of quantum algorithms to solve both classical problems, such as recognizing handwritten digits using the MNIST dataset, and quantum problems such as quantum phase classification. This project aims to bridge the gap between classical data analysis methods and quantum computing potential, equipping students with a futuristic skill set that is at the forefront of computational technology.	- Understanding of Quantum Computing: Gain a foundational understanding of quantum mechanics principles as they apply to quantum computing. - Quantum Machine Learning (QML) Knowledge: Learn how quantum algorithms can be applied to ML tasks and understand the advantages and limitations of QML. - Programming Skills: Develop proficiency in quantum programming languages such as the open source package Qibo, and enhance Python skills. - Analytical Skills: Cultivate the ability to analyze and compare the performance of quantum algorithms against classical algorithms on traditional data sets. - Research Experience: Engage in the research process, including problem formulation, experimentation, and discussion of findings. - Team Collaboration: Work effectively as part of a research team, leveraging diverse skills and perspectives to achieve a common goal. Through this project, students will experience firsthand the interdisciplinary nature of quantum machine learning and develop a valuable set of skills across research, programming, analysis, and communication.	Students will engage in a range of responsibilities that collectively contribute to the project's success. They will conduct research on quantum algorithms, machine learning techniques, and their application to noth classical and quantum machine learning problems. Students will be expected to write and debug code capable of running on quantum simulators and potentially on actual quantum hardware. A significant portion of the work will also involve data analysis. Students will manage classical datasets, like the MNIST database of handwritten digits, and prepare them for quantum processing. They will apply the algorithms they have developed to these datasets, analysing the results for accuracy and insights. Comparing these quantum-based outcomes with those from traditional machine learning methods, they will evaluate the effectiveness and efficiency of quantum approaches. Documentation will be a continuous responsibility throughout the project. Students must keep meticulous records of their methods, code, and findings to support reproducibility and peer review. Also, synthesizing and communicating the work done is important, as students may have to prepare and present their research progress and conclusions to various audiences.	Math Background: Basic understanding of linear algebra. Programming Knowledge: Experience in a high-level programming language, preferably Python, as it is commonly used in quantum programming. Experience in quantum platforms such as Qibo, Qiskit etc is a plus. Machine Learning Basics: Familiarity with classical machine learning concepts and algorithms. Quantum Mechanics Basics: (Optional but beneficial) Some exposure to quantum mechanics principles. Critical Thinking: Ability to approach problems systematically and to think critically about computational results. Collaboration: Willingness to work in a team and contribute to all aspects of the project.	Student will contribute to an exploratory project aimed at merging quantum computing algorithms with classical machine learning tasks. Student will be expected to: - Conduct research on quantum algorithms and their potential to revolutionize data processing. - Write, test, and implement code for quantum simulations and potentially quantum hardware, focusing on machine learning applications. - Analyze and interpret data from quantum simulations/experiments and compare them with classical machine learning outcomes. - Participate in regular team meetings to discuss progress, challenges, and strategies. - Document findings in a clear and concise manner for academic and non-academic audiences. - Present work in both formal and informal settings to a varied audience.	IHPC	MSC	Kong Jian Feng	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Physical Sciences	2
105	Fast Adaptive Imitation via Behavior Foundation Models	Imitation learning (IL) aims at producing agents that can imitate any behavior given a few expert demonstrations. IL algorithms achieve impressing results in challenging domains such as autonomous driving, complex robotics tasks, and virtual character animation. Yet existing approaches require many demonstrations and/or running reinforcement learning algorithms for each new imitation task. This project aims to leverage recent RL foundation models to imitate any expert behavior and adapt to novel tasks instantly with just a few demonstrations and no need for RL or finetuning.	The student obtains a opportunity of participating a interesting and challenging research project. The student will gain essential research abilities including idea formulation, algorithm implementation, presentation and paper writing.	• Idea discussion; • Algorithm design and implementation; • Experimental evaluation; • tPaper writing and revising	• Previous research experience is preferred - has published at least one paper in machine learning, reinforcement learning, imitation learning or related topics; • Good coding ability - can implement algorithms using pytorch; • Good presentation ability - can present ideas and write papers in English logically and smoothly.	• Review papers in the research area; • Participating idea discussion; • Formulate ideas and implement algorithms; • Experimentally evaluate the proposed methods and analyze the results; • Summarize the idea and results into a paper.	IHPC	CFAR	Yu Xingrui	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Computing and Information Sciences	1
106	Feature recognition for additive manufacturing workflow	3D printing offers the advantage of reducing lead times in manufacturing. Nevertheless, achieving a final precision product often necessitates post-printing processes such as machining. To optimize the additive manufacturing workflow and minimize processing time, it is essential to identify features in a 3D CAD model that can be automatically recognized as both 3D printable and post-print machinable. By designing for additive manufacturing, minimizing the need for support structures, and leveraging software solutions, manufacturers can streamline the transition from near-net shape 3D prints to highly accurate final products, ensuring efficiency and cost-effectiveness in the production process. This integrated approach harnesses the benefits of 3D printing while maintaining product quality.	The student will be able to implement his Python programming to recognize features from the 3D CAD model for AM workflow. The student is able to determine whether the recognized features are 3D printable, CNC 2D machinable, or both. The student will be able to route the entire AM workflow from a 3D printed near-net shape to the final precision product.	1. Coming to the office/lab on time. 2. Being prepared for office/lab work with all necessary supplies. 3. Taking good care of A*STAR property. 4. Completing all work assignments. 5. Organizing their time well. 6. Respecting themselves and others. 7. Doing literature search and reading on a regular basis. 8. Doing their best.	The candidate is required to have an adequate level of proficiency in CAD skills and Python programming. Prerequisite: GPA 4.0 (Minimal).	1) state-of-art literature survey on feature recognition for AM and post-processing 2) write and test Python programs to recognize a list of planned features 3) write and test programs to generate/recommend optimal manufacturing routes (from near-net shape to final product) based on recognized features.	SIMTech	Additive Tech Innovation (ATI)	Wee Keong Dennis Neo	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
107	Flexible concrete for sustainable infrastructure	The flexible concrete for sustainable infrastructure project aims to revolutionize the way we approach infrastructure construction, ensuring it is not only more durable but also sustainable and adaptable to new challenges.	To equip participants with valuable knowledge and skills of concrete materials that can be applied to future projects and careers in the construction and engineering sectors.	Materials Scientist/Engineer : Research and develop innovative formulations for flexible concrete; Conduct laboratory tests to evaluate material properties such as strength, durability, and flexibility.	Civil Engineering	The Materials Scientist/Engineer is responsible for developing and optimizing the formula for flexible concrete, conducting laboratory tests, and analyzing data.	IMRE	STR	LI Junxia	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
108	Flexible Ion Sensors for Health Monitoring	There has been a surge in research on flexible ion-selective sensors for applications such as human, animal and plant health monitoring. These sensors can detect our bodies' physiological conditions by monitoring sweat ions, such as sodium or chloride for dehydration. In such measurements, sensor accuracy is highly dependent on the stability of the reference electrode. While there have been several reports of flexible reference electrode, most suffer from drift due to leaching of electrode components. This project aims to develop stable reference electrodes through different printing, polymerisation, and electrochemical techniques.	1. Gain a good understanding of how ISEs work, and how ISE performance is measured 2. Independently perform experiments from formulation to fabrication and testing 3. Independently operate electrochemical testing equipment, and other basic chemical characterization tools 4. Independent and critical thinking skills, problem-solving skills, and teamwork are among the many other transferrable skills to be gained.	1. Execute tasks assigned by the supervisor with due diligence. 2. Comply to laboratory safety rules set by the institute.	1. Pursuing undergraduate studies in Bachelor's Degree in Chemistry, Chemical Engineering, Materials Science or any relevant degree. 2. Possess a proactive and positive learning attitude 3. Able to work both independently and in a team	1. Printing of basic electrode 2. Optimisation and characterisation of membrane 3. Calibration and testing of ion-selective electrode	IMRE	SOF	Goh Simin Shermin	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
109	FPGA based frequency synthesizer	Using hardware description language (HDL) to implement a time interval counter on FPGA platform.	Acquire the skills of hardware description language and simulation.	To learn hardware description language and know how to apply it.	Knowledge of basic computer programming in C or Python.	Learn about fpga hardware design and develop the Verilog code to implement specific functions on the hardware.	NMC	ETM	Liaw Chin Yi	8 CleanTech Loop, #01-20, Singapore 637145	Computing and Information Sciences	1
110	Gas/ image sensor towards a sustainable economy	With more and more activities towards a sustainable economy and exploring of new energy, sensors are much needed to identify gas concentrations, gas leakage or for mid-infrared imaging. In this project, we will be developing sensors for such purposes, towards a sustainable economy.	Student will have a better understanding of the working principle of these sensors. After this project, student will be able to appreciate the various software/ analytical tools used. Depending on student's interest, there will be opportunity for design and testing the sensors.	To do literature review related to sensors, understand the landscape for sensors and create benchmark table to compare performance of various sensors available. To conduct testing independently (upon receiving training) and analyze data collected. Learn new skills such as data analysis using ORIGIN software. Hands-on gas testings/ electrical measurements in a dry lab environment. Work with experience scientist and/ or engineers regularly to complete task. Regular meetings and discussion to ensure working on the right track.	NIL	To have a wholesome understanding on mid-infrared detectors and their functionality in gas sensing/ imaging. To be able to conduct various hands-on testing in dry laboratory environment. Willing to do hands-on experiments. To analyze large amount of data using software ORIGIN. To conduct literature review related to sensors (when required). To summarize and present data collected.	IME	P&S	Doris Ng	2 Fusionopolis Way, #08-02 Innovis, Singapore 138634	Engineering and Technology	1

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Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilities of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
111	Generation of complex 3D in vitro human skin models to study chronic wounds	Patients with chronic wounds suffer from painful lesions that do not heal and often become infected. Chronic wounds result in functional impairment, depression, reduce the quality of life of patients, and often lead to serious events such as limb amputations (4 per day in Singapore) and premature death. There is an urgent need to develop a cruelty-free, 'living' human skin-in-a-dish model, that recapitulates different features of chronic wounds. This model will be used to better understand the mechanisms of hard-to-heal wounds, as well as to test new therapeutics against chronic wounds.	The student will be trained in a research and development environment, will acquire practical skills in 2D and 3D cell cultures, molecular biology, immunohistochemistry techniques, and will understand the value of a Cell Biobank. The intern will be exposed to a clean lab environment that follows operational standard procedures (SOPs) and good laboratory practice (GLP) standards. The student will acquire skills that will greatly complement classroom trainings. We intend to cultivate the student's interests in research as a career.	The student will contribute to the development of in vitro 3D human skin models. The student will conduct experiments, analyze the results, and present to the team during lab meeting.	The student should have some experience in cell cultures, molecular and cellular biology, cell-based assays.	You will be contributing in the development of in vitro 3D human skin models, for testing new therapeutics for chronic wounds.	A*SRL	Model Development	Carine Bonnard	11 Mandalay Road, #17-01 Clinical Sciences Building, Singapore 308232	Biomedical Sciences	1
112	Generative AI	The advent of machine learning (ML) has revolutionized and fostered many engineering solutions. However, there are quite several intriguing and demanding aspects of generative AI that are yet to be fully explored. In this project, we endeavor to investigate and propose generative algorithms for inverse design, autonomous clustering, continual learning and time-series analysis.	Substantial outcome from the project will be submitted to high-impact journals/conferences. This internship position provides you with an excellent platform to make the most of research.	You will work with a small team of data scientists/engineers to develop a novel generative model for automatic data processing techniques to improve classification/clustering/forecasting performance. These duties are not limited to, gathering, sampling, processing and analyzing experimental data, developing Python codes of advanced ML and preparing manuscripts, collaborating with other members of the research team and interaction with other staff here at A*STAR	1) Ability to develop prototypes to demonstrate the feasibility of research ideas 2) Good knowledge on machine learning in solving real-world problems 3) Proficient in Python (added skill in PyTorch) 4) Good team player	Implementation of generative AI algorithms for inverse design/autonomous clustering/continual learning/time-series analysis.	I2R	Machine Intellection	Senthilnath Jayavelu	1 Fusionopolis Way, #21-01 Connexis (South Tower), Singapore 138632	Computing & Information Sciences	
113	Generative AI for Enhancing Life Cycle Inventory Datasets: Creating Comprehensive and Consistent Data Landscapes	Life Cycle Assessment (LCA) serves as a pivotal tool in evaluating the environmental impacts of products and processes. However, the accuracy and reliability of LCA results heavily depend on the comprehensiveness and quality of Life Cycle Inventory (LCI) datasets. Given the vast array of products and processes, LCI often encounters gaps. This research intends to employ generative AI models, such as Generative Adversarial Networks (GANs), to synthesize data for these gaps, ensuring a more robust and expansive LCI dataset.	1. Grasp the principles of Life Cycle Assessment (LCA) and the importance of comprehensive Life Cycle Inventory (LCI) datasets. 2. Understand the application and potential of Generative Adversarial Networks (GANs) in enhancing LCI datasets. 3. Evaluate the implications, both ethical and practical, of integrating AI into LCA processes.	1. Actively participate in meetings, discussions, and assignments related to LCA and AI. 2. Research LCI dataset gaps and the functionality of GANs in addressing them. 3. Engage in hands-on AI projects and critically reflect on the ethical dimensions of generated data in LCA.		1. Attend meetings and engage in LCA and AI-related discussions and activities. 2. Undertake research on LCI challenges and the potential solutions offered by GANs. 3. Collaborate on projects and consider the ethical aspects of AI-generated data in environmental assessments.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yang Zhao	Singapore Institute of Manufacturing Technology (SIMTech) @ CTZB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
114	Generative AI for Recommender Systems: A New Frontier in Personalized Content	Recommender systems are essential to our digital lives, providing us with personalized suggestions for products, movies, music, and more. But what if recommender systems could be even better, using the power of generative AI to create new content that is tailored to our individual needs and preferences? In this project, we will explore how to apply generative AI techniques to enhance the performance of recommender systems and produce personalized content on demand. We will develop new algorithms and models that can learn from user data to generate personalized recommendations and content that is both relevant and engaging. This is an emerging research area with the potential to revolutionize the way we interact with the digital world. Our project will help to advance the state-of-the-art in generative AI for recommender systems and personalized content creation.	1). Develop a prototype of recommender system and obain "hands-on" experiences of the generative AI techniques. 2). Submit one top-tier conference/journal paper when the project finishes.	1) Literature review 2) Implement the Generative AI algorithms with python and prompts 3) Prepare a report/paper draft based on the experimental results	python language, basic machine learning knowledge	Read the related papers, conduct experiments and learn to write the academic reports, have weekly discussions	CFAR	CFAR	Victor, Shanshan Feng	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
115	Genome editing enzyme engineering	The project involves computational design of genome editing enzymes (including CRISPR-Cas), protein engineering, high-throughput functional assays of enzyme variants, and high-throughput sequencing library preparation and analysis.	Students will learn the concepts and designs of genome editing experiments, the foundational methodologies of wet lab (including next-generation sequencing, nanopore sequencing, molecular biology, cell culture), and the analysis of sequence data.	Work with mentor to learn the research techniques, contribute to experimental execution, and document research findings.	B.Sc or equivalent.	The project involves computational design of genome editing enzymes (including CRISPR-Cas), protein engineering, high-throughput functional assays of enzyme variants, and high-throughput sequencing library preparation and analysis. Student(s) will learn the concepts and designs of genome editing experiments, the foundational methodologies of wet lab (including next-generation sequencing, nanopore sequencing, molecular biology, cell culture), and the analysis of sequence data. Student(s) will work with mentor to learn the research techniques, contribute to experimental execution, and document research findings.	GIS	Laboratory of Synthetic Biology & Genome Editing Therapeutics	Chew Wei Leong	60 Biopolis Street, Singapore 138672	Biomedical Sciences	1
116	Genome wide in-vivo functional genetic screen to identify novel modulators of Non-Alcoholic Fatty Liver Disease (NAFLD)	With a global prevalence of 25.2%, NAFLD is the leading cause of chronic liver disease. Regarded as the hepatic manifestation of the metabolic syndrome, NAFLD is tightly linked to obesity and type 2 diabetes. It includes a variety of histopathological findings ranging from simple steatosis to steatosis coupled with inflammation and hepatocyte ballooning (non-alcoholic steatohepatitis) to cirrhosis. It is projected to soon become the number one reason for liver transplantations. Despite this, NAFLD continues to be an underdiagnosed disease with no current approved treatment. This is primarily due to lack of understanding of the mechanisms underlying NAFLD development and progression. To address this, we performed a genome-wide in-vivo functional genetic screen in a relevant mouse model for NAFLD to identify novel regulators for the development of new therapeutic approaches. Our study aims to unravel the molecular basis of NAFLD with the hope of developing innovative therapies to address the imminent healthcare burden of this dreaded disease.	The project focuses on employing in-vivo mouse models that resemble and recapitulate the human disease to study NAFLD disease progression. Our preliminary results have identified several shRNAs that confer a negative or positive effect on the regenerative capacity of the hepatocytes. Further approach will be focused on validation of these shRNAs, such as their cell migration and cell proliferation characteristics using various in-vitro assays, followed by selection of the top performing shRNAs for in-vivo validation. In addition, combined transcriptomic and epigenomic approaches will be undertaken to unravel new insights with the aim of identifying targets for therapeutic intervention and treatment of the disease.	Conducting in vitro and in vivo validation experiments, including cloning, stabel cell line generation, wound healing assay, proliferation assay, knockdown efficiency testing, harvesting liver from mice, isolating DNA, RNA, proteins.	Scientific logic thinking, openeness to mouse experiments, basic molecular biology techniques.	The project focuses on employing in-vivo mouse models that resemble and recapitulate the human disease to study NAFLD disease progression. Our preliminary results have identified several shRNAs that confer a negative or positive effect on the regenerative capacity of the hepatocytes. Further approach will be focused on validation of these shRNAs, such as their cell migration and cell proliferation characteristics using various in-vitro assays, followed by selection of the top performing shRNAs for in-vivo validation. In addition, combined transcriptomic and epigenomic approaches will be undertaken to unravel new insights with the aim of identifying targets for therapeutic intervention and treatment of the disease.	GIS	Laboratory of In Vivo Genetics & Gene Therapy	Torsten Wuestefeld	60 Biopolis St, Singapore 138672	Biomedical Sciences	1
117	Geopolymer concrete	The Geopolymer concrete development project aims to advance sustainable construction practices by developing and implementing geopolymer concrete as an eco-friendly alternative to traditional Portland cement-based concrete. Geopolymer concrete is known for its reduced environmental impact, durability, and versatility, making it a promising solution for the construction industry.	Participation in the Geopolymer Concrete Development project not only contributes to the success of the project but also equips students with valuable knowledge and skills that can be applied to their future careers in construction, engineering, and sustainability.	Materials Scientist/Engineer : Research and develop innovative formulations for geopolymer concrete; Conduct laboratory tests to evaluate material properties such as strength and durability.	Civil Engineering	The Materials Scientist/Engineer is responsible for developing and optimizing the formula for geopolymer concrete, conducting laboratory tests, and analyzing data.	IMRE	STR	LI Junxia	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
118	Greenwashing detection using NLP techniques	Greenwashing refers to the practice of companies that produce advertisements, events, or products under the guise of being environmentally friendly, when in fact, the company's products are not environmentally friendly. Natural language processing is a form of artificial intelligence that analyzes human language and is centered on helping machines understand human language. We plan to train a deep learning model (or large language model) to identify pattern in social media posts , articles or news report that are associated with greenwashing. This will involve data analysis, data labelling, and training a model to distinguish between accurate and greenwashing tactics. Required Skills: 1) Experience in Python Programming 2) Experience with tools in python such as pandas, pytorch, matplotlib, openai 3) Passionate about NLP techniques. 4) Passionate about ESG and social good.	Students will learn about NLP techniques applied to Greenwashing	Data extraction, Programming, Model training and testing.	Python programming and NLP basics	Student will be responsible to extract data, write code to find patterns in the data, train a ML/DL model and test it in production environment.	IHPC	CI	Ranjan Satapathy	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
119	Grounded Language Model for Healthcare	Large language models (LLMs) have demonstrated remarkable capabilities in natural language understanding and generation. However, in critical healthcare settings such as Emergency Department (ED) triage, they encounter significant limitations in terms of factual accuracy and a lack of grounding in medical expertise and use-case specific information. This project aims to develop grounded LLMs that have access to factual medical knowledge as well as use-case specific information, which is not available as part of the LLM's trained knowledge. This enhancement will make LLMs more reliable and useful for triaging patients in ERs and similar medical settings.	Learn how to use and develop SOTA LLMs. Learn how to combine LLMs with multimodalities. Submit one paper to the top conferences.	Help to prepare training datasets. Help to reproduce existing baseline methods. Help to train the proposed LLMs and do the experiments.	Familiar with deep learning and NLP. Having research experimence would be a plus.	This project aims to address the limitations existing LLMs by grounding LLM on factual knowledge and use-case specific data modalities, which we believe is crucial for customizing LLMs to a particular organization and medical use case for more precise, meaningful, and contextually appropriate outputs in critical healthcare settings. This grounding empowers LLMs to better understand and reason about health information, leading to more accurate and relevant outputs in real-world healthcare applications. Furthermore, our team plans to develop an AI-powered Emergency Department (ED) triage system as a practical use case for grounded LLMs.	IHPC	CI	Zhou Yang	L15, #20-10 Fusionopolis Way, Connexis, North Tower, 138632	Computing and Information Sciences	1

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilities of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
120	Growth and characterization of non-collinear antiferromagnetic thin films	Chiral antiferromagnetic (AF) thin films with non-collinear spin order have attracted immense interest for the realization of highly scalable and fast switching memory and computing technologies. Mn-based thin films consisting lattices of 120° non-collinear triangular planes of Mn atoms exhibits chirality critical to its unique spin transport properties. This project involves the growth and characterization of chiral Mn-based AF thin films deposited using high temperature physical vapour deposition.	The candidate will begin with relevant literature reviews to acquire fundamental understanding of nanomagnetism and chiral AF thin films. He/She will be trained on thin film deposition and characterization techniques. He will learn to acquire and analyse magnetic hysteresis loops and electrical transport data for the novel AF films.	1) Deposition of AF thin films using high temperature physical vapour deposition 2) Characterization of AF thin films using magnetometry and electrical probe station 3) Perform analysis of magnetometry and electrical data and interpretation of the results	Background on magnetism and experience in materials characterization and data analysis techniques will be preferred. Discipline: Materials Science and Engineering, Electrical and Computer Engineering, Engineering Science, Physics & Applied Physics	The candidate will be involved in the materials design and growth of the AF thin films using high temperature physical vapour deposition. Characterization of the AF thin film properties will be performed using various magnetometry, spectroscopy and electrical techniques. The candidate is expected to analyse the magnetometry and electrical data and interpret the results	IMRE	ELE	Ho Pin	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	1
121	GUI Interface for Time and Frequency Lab	The time and frequency lab of NMC has a number of atomic clocks (Caesium and Hydrogen). The Singapore Standard time (SST) is maintanied by these clocks. An algorithm is developed to merge the signals from these atomic clocks to improve the stability of SST. The student will be involved in developing a Graphic User Interface (GUI) whihc will show the overall performance of the system and will show the flow of the signal from one equipment to the other.	1. Learn about how standard singlas are generated in National labs like NMC in Singapore. 2. Understand the working principle of atomic clocks (Caesium, Hydrogen atomic clocks). 3. Develop at GUI for the system in the lab	1. To conduct relevant literature survey 2. To work in the team of other interns 3. To creat a GUI for the system of the lab	1. Basic knowledge in programming language 2. Basic knowledge in statistics 3. Interest to learn new things and good attitude	1. To conduct relevant literature survey 2. To learn about the working principle of atomic clocks and other components of the lab. 3. To creat a GUI for the system of the lab 4. To work in the team of other interns 5. Other administrative works	NMC	ETM	Shilpa Manandhar	8 Cleantech Loop, #01-20, Singapore 637145	Engineering and Technology	1
122	Hardware based machine learning algorithms for deep learning	Real-time processing is necessary to achieve high throughput for inspection. Typically, dedicated hardware is used to perform real-time processing. This project explores the use of a hybrid set of processors to achieve this goal. Ultimately, we will integrate it with existing deep learning algorithms.	1. Students will be able to write hardware based programming codes. 2. Students will be able to apply and evaluate machine learning algorithm for image processing applications	1. Install the hardware used and configure the hardware for programming. 2. Explore the capabilities of machine learning model used in the simulation.	1. Possess microprocessor programming knowledge, or equivalent 2. Taken at least a semester course on digital signal processing, or equivalent	Refer to roles and responsibilities	SIMTech	Optics and Imaging Systems (OIS)	Seck Hon Luen	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
123	High RF performance GaN HEMT device through Gate metal profile optimization	RF GaN HEMT device gate metal profile is critical, gate contact opening size determine device channel length which correlated with device frequency performance directly. Gate resistance (Rg) directly impacts device max working frequency. Gate metal size and shape also modulates device channel electrical field distribution, hence affects device breakdown and long-term reliability performance. Design and achieve different shape of gate metal profile can optimize/improve GaN HEMT device RF performance significantly. This project will optimize the gate metal profile by process integration change and etch stack change, achieve best HEMT device RF performance.	1. Knowledge about how GaN HEMT device gate metal profile affects device performance 2. Design and simulate different gate metal profile, correlated the impact to device performance 3. How to achieve different gate metal profile through different process methods	1. Participate different gate metal profile design 2. Perform simulation on the impact for various profile design 3. Participate in fabrication process to realize different profile design	1. Knowledge about GaN HEMT device 2. Knowledge about device/process simulation	1. Paper search on related information 2. Work with research engineer/scientist to design/simulation 3. Follow up with research engineer/scientist on process fabrication	IME	NGTC	Xie Han Lin	4 Fusionopolis Way, Singapore 138635, Kinesis Building	Engineering and Technology	1
124	High-Entropy Alloys and Refractory Metals in Powder Bed Additive Manufacturing for Extreme Environments and Fusion Energy	We are seeking a motivated and innovative student to lead a research project focused on the utilization of high-entropy materials and refractory materials in powder bed fusion additive manufacturing (PBF) for applications in extreme environments. This project aims to expand the possibilities of PBF by exploring novel materials capable of withstanding high temperatures, corrosive conditions, and extreme stress.	(1)Gain in-depth understanding of PBF (SLM & EBM) technology and its applications. (2)Expertise in materials science, particularly high-entropy alloys and refractory materials. (3)Experience in designing and executing experiments with advanced materials. (4)Proficiency in data collection, analysis, and interpretation. (5)Working with the supervisor to prepare one journal paper. (6)Establish research capability and writing skills for further studies. (7)Experience real R&D work environments and involve in projects with industry.	Literature Review: Conduct an extensive review of existing research and developments in the field of high-entropy materials and refractory materials, with a focus on their potential in extreme environments. Materials Selection: Collaborate with materials scientists to select appropriate high-entropy alloys and refractory materials for additive manufacturing, considering their suitability for extreme conditions. Experimental Setup: Plan and set up experiments to print parts using high-entropy or refractory materials in PBF systems. Configure the printer, powder beds, and process parameters. Data Collection: Collect data during the printing process, including in-situ monitoring data, process parameters, and any relevant sensor measurements. Material Characterization: Evaluate the physical and mechanical properties of the printed parts, particularly under extreme conditions. This may involve measuring properties such as strength, resistance to heat, and corrosion. Process Optimization: Investigate ways to optimize the printing process with high-entropy and refractory materials, ensuring the highest quality and performance of the produced parts for extreme environments. Data Analysis: Analyze the data collected during experiments, identify trends and insights, and use these findings to provide recommendations for further development.	CGPA > 4.0. Mechanical / Materials Engineering knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and materials science. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous.	We are looking for a student who is passionate about pushing the boundaries of additive manufacturing and materials science. As a student, your primary responsibilities include designing and conducting experiments, collecting and analyzing data, and contributing to advancing PBF technology by exploring high-entropy and refractory materials for extreme environment applications.	SIMTech	Additive Tech Innovation (ATI)	Wang Pan	JTC CleanTech Two Block A, 3 Cleantech Loop, Singapore 637143	Engineering and Technology	1
125	High-performance van der Waals optoelectronic devices	Van der Waals materials and heterostructures have the potential to revolutionize various optoelectronic devices by offering strong light-matter interactions at quantum limits, wide-range tunability, flexibility etc. This project aims to develop high-performance photodetectors that works in a broad range from far infrared to UV by taking advantage of the quantum degree of freedoms in van der Waal heterostructures. The heterostructures will also be engineered for dynamic control of device operation with electrical stimulus.	Experiementally, the students will be able to use the state-of-the-art techniques to fabricate high-quality heterostrucutres and perform optoelectronic device measurements. Intellectually, students will gain understandings of cutting-edge research in optoelectronics.	Fabrication of high-quality van der Waals heterostructures, and optoelectronic characterizations of devices	Background in materials science, or physics, or electronics.	In this project, student will use various methods, such as mechanic exfoliation and electrochemical exfoliation, to produce high-quality 2D materials and their heterostructures. The student will also participate in the characterization of the devices and data analysis	IMRE	AOT	Zhao Meng	2 Fusinopolis Way, Innovis, Singapore 138634	Physical Sciences	1
126	Host determinants of susceptibility to mycobacterial infection	Mycobacteria are able to subvert the host immune response to drive tissue pathology and prevent the efficient clearance of infection by the immune system. This project will study the role of genes and molecular pathways that are hijacked during mycobacterial infection. We will then use genetic tools to manipulate the host immune response to modulate the immune response against infection.	Understanding of in vivo infection biology, live imaging, gene editing, micromanipulation, molecular biology	Experimental wet lab data collection. Animal experimentation.	Interest in infection biology/host-microbe interactions. Ability to work independently once trained. Willingness to seek out work and tenacity to overcome failure.	Full time hands on learning experience using the zebrafish model organism to study infection biology. Project will cover techniques from gene editing at the molecular scale through micromanipulation to live imaging at the whole organism level. Work is suited to an applicant willing to continue project for higher degree study.	ID Labs	Bacterial Pathogenesis Lab	Stefan Oehlers	Level 5, Immunos	Biomedical Sciences	1
127	Immunomodulatory mosquito salivary proteins as a therapeutic approach against arbovirus infection	Mosquito-borne viruses represent a global health risk, affecting millions of people annually. While much research has focused on understanding pathogen biology of mosquito-borne viruses, one area remains understudied: how mosquito saliva modulates immunity in mosquito-borne virus infections. We seek to study this intriguing scientific question by investigating on the hidden mechanisms behind this phenomenon. Our research combines multiple biological concepts and techniques to comprehensively characterise few mosquito salivary proteins to fully understand their impact on host immunity during arbovirus infections. Through careful investigation, this study will reveal which immune pathways and signalling cascades are affected by mosquito saliva, providing insights into its modulatory role during infection. This knowledge will further our understanding of viral pathogenesis as well as how mosquito saliva interacts with host immunity. By investigating mosquito saliva's immune-modulatory properties, this project aims to increase our knowledge about mosquito-borne virus infections and provide invaluable insights in creating effective strategies to combat global health.	Upon successful completion of the research attachment, the student will be able to acquire the necessary skills required in scientific research.	To assist with experimental set up and running; To assist with data analysis; To help with lab day to day operation	1. Life science or biomedical science	Involve in research to answer the following objectives: 1. Characterisation of immunomodulatory effects of mosquito salivary proteins on host immune response. 2. Discovery of vector host interactions critical for mosquito-borne virus infection. This new insight will lead to developing novel tools to circumvent and control mosquito-borne viral infections in humans. 3. Identification of host receptor/pathway that can be a therapeutic target for mosquito-borne viral infections.	ID Labs	Microbial Immunity Lab	Fong Siew Wai	8A Biomedical Grove, #05-13 Immunos Building, Singapore 138648	Biomedical Sciences	1
128	Improving Efficiency of Photon Upconversion	Photon upconversion is a process of converting two or more low-energy photons into a higher-energy photon. Conversion of invisible infrared light into visible-wavelength light is particularly interesting, having potential applications in photodetection, 3D volumetric display, biomaging, and photovoltaics. In this project, we will apply materials engineerig and optical cavities to increase the efficiency of upconversion.	The student will learn basic skills in fabrication and characterization of thin-film optical devices.	The student will work with and learn from a senior PhD student or a scientist. The student will be expected to conduct literature research, help with experiments, and complete a project report.		The student will work with and learn from a senior PhD student or a scientist. The student will be expected to conduct literature research, help with experiments, and complete a project report.	IMRE	AOT	Wu Mengfei	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
129	Integrated quantum photonics with thin-film lithium niobate devices	This project develops integrated photonics devices based on thin-film lithium niobate. Lithium niobate is an emerging, highly versatile material platform with attractive nonlinear optical properties for on-chip quantum photonics. The applications we are developing include photon pair generation, squeezed light, and fast switching. The student will be involved in device fabrication, building of opto-electronic chip testing setups, and thorough characterization of the devices. This work will advance our research efforts in developing integrated quantum nanophotonics platforms.	- In-depth knowledge of integrated photonics devices and nonlinear photonics - Experimental techniques, including device fabrication, lasers and optical setups, chip testing, operation of probe stations - Experience in instrumentation design, building, automation, and testing - Able to plan and execute experiments, document and analyse data, and communicate results - Related engineering skills, e.g. electronics, optics, programming, hardware assembly	- Participate in device fabrication and sample preparation - Opto-electronic characterization of lithium niobate integrated photonics devices - Development of setups and control hardware - Upgrading and automation of test setup to enhance its performance - Analysis of measurement data	Physics or engineering	- Participate in device fabrication and sample preparation - Opto-electronic characterization of lithium niobate integrated photonics devices - Development of setups and control hardware - Upgrading and automation of test setup to enhance its performance - Analysis of measurement data	IMRE	QTE	Victor Leong	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	2

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(A) Project no.	(B) Project Title	(C) Project Description	(D) Learning Outcomes for Students	(E) Roles and Responsibilities of Student	(F) Students' pre-requisites	(G) Job Description for Student	(H) Research Institute of Internship Supervisor	(I) Department of Internship Supervisor	(J) Name of Internship Supervisor	(K) Workplace Address	(L) What is the project's research category?	(M) No. of Students Required
130	Integration Development of Component-based Real-Time Digitalization (CRTD) Platform with Dynamic Value Stream Mapping	This project is to integrate Component-based Real-Time Digitalization (CRTD) Platform with Dynamic Value Stream Mapping (VSM) through provision of the data required by Dynamic VSM as Proof-of-Concept to support Reconfigurable Cyber-Physical Manufacturing System.	•Able to master the useful development tools with the latest approach and concepts •Able to do teamwork in a dynamic environment •Practical skills and working experiences for real industry-oriented project	1. Work as one of development team members 2. Closely work with Tech Lead and team members to solve the problems 3. Short learning curve to pickup the requested knowledge and skills 4. Very clear with project schedule and regularly update task progress to Tech Lead 5. Make sure to deliver the work package based on the project descriptions.	•Development skills using REST API, .NET Web API, WebSocket, or MQTT •Willing to learn the latest development tools with supervision of senior staffs, such as Microservices, DevOps, etc.	1. Work as one of development team members 2. Closely work with Tech Lead and team members to solve the problems 3. Short learning curve to pickup the requested knowledge and skills 4. Very clear with project schedule and regularly update task progress to Tech Lead 5. Make sure to deliver the work package based on the project descriptions.	SIMTech	Cyber-Physical Production System (CPPS)	Yi Zhi Zhao	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
131	Integrative analysis and AI modeling of multimodal datasets of diseases	We work closely with clinicians to explore personalized treatment options for patients of different diseases, including different cancer types and metabolic diseases. We use multi-omic and spatial profiling, and functional screening in patient-derived models. Data of multiple modalities are generated in the process, and we are developing systematic workflows to integrate and analyze the data to enable clinical-decision-making and drive translation research. The Research Data Integration group in BII is developing an end-to-end framework to analyze and integrate complex multimodal datasets to enable clinical-decision-making and drive translation research.	The candidate will have the opportunity to work in a multi-disciplinary team led by a senior Principal Investigator highly experienced in computational biology and biomedical data science and clinician-scientists of various specialization. Eventually, the candidate will receive training in both computational and translational biology. The candidate will gain experience in dealing with highly complex data science challenges in different disease domains.	The intern is expected to work on any of these tasks, depending on field of study and interests. 1) Develop, implement and benchmark executable workflows for multi-omic datasets and image processing of histology images. 2) Organize and analyze in-house and publicly available datasets. 3) Develop visualization tools to visualize results in a meaningful way. 4) Curation of therapies and biomarkers, and patient clinical data.	1) The candidate should have basic programming skills (e.g. Python, R, RStudio, Jupyter Notebook, RShiny, SQL), except for curation tasks. 2) Familiarity with Unix/Linux environment or cloud architecture would be an advantage. 3) Strong analytical and problem-solving skills. 4) Excellent oral and written communication and presentation skills. 5) Able to work independently, and as part of a team.	This project is looking for candidates to develop computational methods, including big-data analytics, AI/ML approaches and visualization platforms, to analyze and integrate the multi-modal data (sequencing, imaging, spatial profiling, treatment response and clinical data) that can deliver translational outcomes to patients. The candidate will work with the PI and computational scientists in the team to execute projects and carry out assigned tasks in a timely and efficient manner. He/She will report her progress on a regular basis.	BII	Biomedical Datahub	Woo Xing Yi	Matrix, Biopolis, L7	Computing and Information Sciences	2
132	Intelligent Robotic Manipulation System with Deep Learning	This project is to develop and research the intelligent robotic systems in areas of advanced robotic manipulation. Intelligent robotic manipulation includes the perception of environment and execute action for achieving specific tasks. For those functions, artificial intelligence and deep learning can play an important role to replace the traditional human-designed feature engineering and embody the agent with self-learning ability to adapt with new environment. The students will evolve in our project to assist in the research phase (deep learning algorithm implementation) and experimental phase of the project.	During this attachment, the students will have the opportunity to participate in and assist the research projects on intelligent robotics and will have hand-on trainings on multiple fields in robot related areas, e.g. Linux/Robot Operating System (ROS) programming, deep learning frameworks (TensorFlow, Pytorch, etc.), computer vision, data-driven optimization, system design, etc.	1. Algorithm Development: Implement and optimize deep learning models using frameworks like TensorFlow and PyTorch for various robotic tasks, such as object recognition, pose estimation, or grasping. 2. Data Collection and Processing: Participate in data collection efforts, which may involve sensor data, images, or videos, and assist in data preprocessing and annotation. 3. Robot Programming: Gain proficiency in Linux and Robot Operating System (ROS) programming to work with robotic hardware and control systems. 5. Computer Vision and Deep Learning: Contribute to computer vision tasks, including image processing, feature extraction, and object tracking, to enhance the robot's perception capabilities.	1, Willing and have passion to explore new areas. 2, Programming experience on any language (C++, Python, Java, C#, etc.) will be preferred.	We are seeking highly motivated and tech-savvy students to join our team as interns in the field of intelligent robotic systems. As an intern, you will have the opportunity to work on cutting-edge projects in advanced robotic manipulation and gain hands-on experience in artificial intelligence, deep learning, and robotics. You will be an integral part of our research and development efforts, contributing to the implementation of deep learning algorithms and conducting experiments to enhance robotic perception and manipulation.	SIMTech	Adaptive Robotics & Mechatronics (ARM)	Haiyue Zhu	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
133	Inter-floor noise control based on metamaterial design	The nuisance caused by inter-floor noise is a common issue to buildings. This is especially important for residents of HDB flats as complaints are keeping received. Hence there is an urgent need to study the mechanisms of Inter-floor noise propagation and provide feasible mitigation solutions. The Inter-floor noise can be generated from both structure-borne noise and air-borne noise, though the structure-borne noise is the dominate one. This project aims to study how metamaterials can be used to mitigate the inter-floor noise. The mechanical/structural metamaterials will be used to reduce impact and the corresponding structure-borne noise can be mitigated; while the acoustic metamaterials will be used to reduce air-borne noise. We hypothesis that metamaterials based designs can achieve significant inter-floor noise reduction.	1. Understand how inter-floor noise generation, propagation, and radiation 2. Explore how advanced design can mitigation noise transmission	1. Literature review on inter-floor noise transmision and mitigation	1. basic knowledge of physics or mechanics 2. design experience	1. Literature review on inter-floor noise 2. literature review on acoustic metamaterials for vibration/noise mitigation	IHPC	Engineering Mechanics	Cui Fangsen	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	1
134	Interpretable Reinforcement Learning	The student supposed to contribute in an interpretable reinforcement learning algorithm development, while validating its performance in different demo examples. The target here is to replace a neural network based function approximator by a symbolic regressor in an actor-critic framework. If the student can generate impactful results, then there is a high chance that the research will get published in a top-tier AI conference.	1) Develop an interpretable reinforcement learning algorithm. 2) Generate sufficient results and performance evaluations to validate the effectiveness. 3) Draft a paper for submitting to a top tier AI conference.	1) Develop few blocks of codes for algorithmic improvement. 2) Test and validate the code on sufficient examples (demos). 3) Generate impactful results and draft a paper.	1) Good knowledge on data analytics/machine learning/data mining, and experiences in solving real-world data science problems. 2) Proficient in Python (added skill in PyTorch, TensorFlow, Keras). 3) Preliminary concepts on Reinforcement Learning	Developing interpretable Reinforcement Learning algorithm and validate its performance on sufficient examples.	I2R	Machine Intellection	Senthilnath Jayavelu	1 Fusionopolis Way, #21-01 Connexis (South Tower), Singapore 138632	Computing & Information Sciences	
135	Investigating crosstalk between immunity and metabolism during bacterial/viral infection.	Recent studies have revealed that metabolic sensors and metabolites (signaling intermediates) are crucial for immune regulatory elements that are key to control microbial infections and the maintenance of immune homeostasis. In this project, we aim to explore the molecular mechanisms underlying host immune-metabolic framework including immune cell signaling pathways, metabolic regulators, host metabolic reprogramming, and immune genes expression during bacterial/viral infections. Some of the experimental techniques and research methods that would be used in executing the proposed work include metabolomics, proteomics, gene cloning, PCR analysis, cell culture, expression and purification of recombinant proteins, single-cell RNA sequencing, flow cytometry, SDS-PAGE, Western blot, etc. These findings would help to device new therapeutic regimens (host-directed therapies) for microbial infections.	From this project student will gain (i) Tissue culture experience, growing human and mouse cells, preparing medium; (ii) Experience with culturing bacteria; (iii) hands on protein biochmistry techniques (Western blot, ELISA, protein quantification, etc.); and (iv) learning of how to infect cells with bacteria and isolation of RNA / DNA.	The student will work in a team; will learn team-work. Data analysis and report writing.	Life Science experience; knowlegde of pathogens and immunity in general;	The job responsibilities are as follows: - Involvement in projects related to metabolic regulation in host cells during inflammation - Perform in vitro and animal experiments. - Perform wet lab experiments using techniques such as molecular biology, immunohistochemical analysis, flowcytometry - Provide laboratory maintenance support	ID Labs	Bacterial Immunopathology Lab	Amit Singhal	#05-13, 8A Biomedical groove, Immunos, SG 138648	Biomedical Sciences	2
136	Investigating Modified-Texture Foods for Dysphagia Patients	This project aims to study the impact of ingredients and processing on the texture and rheology of foods and beverages, particularly in the context of dysphagia meals. Dysphagia is a swallowing disorder that often requires modified-texture foods to ensure safe and enjoyable consumption. Using the International Dysphagia Diet Standardisation Initiative (IDDSI) framework as a guideline, the student will work with benchmark recipes and formulations to manipulate food textures and rheological properties. Through a combination of formulation adjustments and thorough techno-functional characterizations, this project seeks to understand the correlations between ingredient modifications, processing parameters, and final food texture. The ultimate goal is to develop a predictive model for achieving specific dysphagia-friendly textures in food and beverage products.	Gain in-depth knowledge of dysphagia and its dietary requirements. Develop proficiency in food formulation and processing techniques. Acquire skills in techno-functional characterization of food products. Understand the principles of rheology and its impact on food texture. Learn how to use data analysis and statistical tools to identify correlations and make predictions.	Responsible for conducting experiments, data collection, and analysis. Assists in data analysis, statistical modeling, and interpretation. Conducts extensive literature reviews on dysphagia, food science, and relevant research.	A background in food science, nutrition, or a related field. Strong interest in food formulation, rheology, and food texture. Willingness to work with dietary guidelines and recipes. Proficiency in data analysis and statistical tools (beneficial but not mandatory).	Formulating and preparing food and beverage samples based on IDDSI guidelines. Conducting experiments to evaluate the impact of ingredient and processing changes on texture and rheological properties. Collecting and analyzing data using rheological and sensory evaluation methods. Assisting in data interpretation, statistical analysis, and development of predictive models. Documenting findings and contributing to research reports and publications.	SIFBI	SIFBI	Daryl Lee	31 Biopolis Way	Engineering and Technology	1
137	Investigating the role of placental ABC transporters	The placenta serves as the functional interface between mother and child. Placental ATP-binding cassette (ABC) transporters regulate transfer of substances such as nutrients (eg. lipids and folate) and steroid hormones (eg. glucocorticoids and oestrogens) between mother and child. Some of these transporters show gestational-age dependent expression, suggesting they play a critical role in supporting a healthy pregnancy. Our lab is interested in investigating their role in regulating placental lipid metabolism, which is often dysregulated in pregnancy complications such as gestational diabetes.	The selected student(s) will gain an appreciation for the study of human potential in the areas of developmental/reproductive biology and intrauterine programming of long-term health, while learning practical laboratory skills in cell/tissue culture, molecular biology (eg. extraction of RNA and protein, qPCR, immunoblotting, ELISAs), safe handling of human tissue samples, as well as analytical skills in statistics.	- Follow all lab safety rules - Perform experiments and data processing/analysis as guided by mentor - Regularly read the scientific literature and assist with literature reviews of scientific papers - Attend and participate in lab meetings - Have proof of Hepatitis B antibody titres to work with human tissue samples in the lab	- Undertaking biology subjects at the undergraduate level - Experience with using a micropipette	The selected student(s) will have the opportunity to perform laboratory experiments such as placental cell/tissue culture, extraction of RNA, proteins and lipids, qPCR and immunoblotting to determine RNA and protein expression in human placental samples and to analyse the relationship of experimental findings with clinical data such as age and BMI.	SICS	Human Development	Hannah Yong	Singapore Institute for Clinical Sciences, Brenner Centre for Molecular Medicine, 30 Medical Drive, Singapore 117609	Biomedical Sciences	2
138	Investigation of Element Migration and Impurities in Dissimilar Metal Additive Manufacturing	The selected student will be part of a dynamic research team focused on the development and understanding of dissimilar metal additive manufacturing. The project aims to investigate the migration of elements between two different metals during the welding process and identify any impurities that may arise. This research is crucial for understanding element migration between interface of two different metal and ensuring the integrity and longevity of the interface.	1. Gain hands-on experience with advanced welding techniques and equipment. 2. Develop a deep understanding of metallurgical processes during welding, especially in the context of dissimilar metals. 3. Learn to use analytical tools and techniques to study element migration and detect impurities. 4. Collaborate with a team of experienced researchers and contribute to the publication of findings in relevant journals or conferences. 5. Understand the challenges and solutions in the field of dissimilar metal welding and joining.	a) Assist in setting up and conducting welding experiments under the guidance of the research team. b) Collect and analyze samples from welded joints to study element migration and impurities. c) Use analytical tools such as [e.g., Electron Microscopy, X-ray Diffraction, etc.] to study the samples. d) Document findings, prepare reports, and present results to the team. e) Collaborate with team members to brainstorm solutions and optimize welding techniques. f) Stay updated with the latest research and advancements in the field. g) Ensure safety protocols are always followed in the laboratory.	"Grade Point Average above 4.0 Mechanical / Materials Engineering knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and materials science. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous."	The selected student will be part of a dynamic research team focused on the development and understanding of dissimilar metal additive manufacturing. The project aims to investigate the migration of elements between two different metals during the welding process and identify any impurities that may arise. This research is crucial for understanding element migration between interface of two different metal and ensuring the integrity and longevity of the interface.	SIMTech	Additive Tech Innovation (ATI)	Beng Loon Aw	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Physical Sciences	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilities of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
139	Isolation and screening of edible microbes from fermented foods and their potential applications	Fermented foods contain rich microbial resources with various reported benefits. Microbes isolated from fermented foods have various potentials for a wide range of applications, including being used as probiotics, starter cultures and source of health-promoting bioactives. In this project, the overall objective is to isolate microbes from various local food sources and further analyse their beneficial potentials using genotyping and in vitro-based methods. Selected strains with potentially useful properties will be sequenced and bioinformatic analysis will be further performed to map the strains' full potential at genetic level.	Students will learn microbiology and fermentation methods, including various in vitro-based biological assays. Students will also learn how to critically analyse scientific data obtained from experiments and interpret results. Overall, the experimental and analytical skills will be polished through this internship.	• Fulfilling tasks assigned by a supervisor • Learning and performing experiments, analyzing data and interpreting results • Assisting and positively contributing to the team	• Good verbal and non-verbal communication skills • Good organization skills • Attention to detail • Self-motivated, learning attitude	The successful candidate will be involved in microbiology and fermentation related projects for 6 months period. The successful candidate is expected to assist, perform experiments, positively contribute to the team and fulfilling tasks assigned by a supervisor. The student will receive guidance and mentorship from a supervisor, will learn how to conduct scientific experiments, analyze data and interpret results.	SIFBI	Discovery CG	Elvina Parlindungan	31 Biopolis Way Nanos Level 2 Singapore 138669	Biomedical Sciences	1
140	Lamina associated heterochromatin changes in fibrosis	The nuclear periphery is a critical compartment in genome organization and transcriptional regulation. It provides structural constraints and repressive capabilities, playing a fundamental role in these processes. During development, genes not required for a specific cell type are relocated to the nuclear periphery, where they remain silent as heterochromatin. Additionally, proteins at the nuclear periphery mechanically link the nucleus to the cytoskeleton and extracellular matrix, subjecting chromatin in this region (termed LADs for Lamina Associated Domains) to mechanical perturbations. This makes chromatin in the nuclear periphery highly susceptible to misregulation, particularly in diseases like fibrosis. While techniques for mapping LADs in cell culture have been developed, mapping them in tissues is less optimized. This project aims to create and evaluate a novel strategy for mapping LADs in tissues. This method will enable the dissection of in vivo developmental changes in LAD dynamics and how these dynamics are altered in disease states such as fibrosis.	Students will learn basic concepts of nuclear architecture and how it affects genome organization and epigenetic regulation. If time allows (and depending on rate of project progress) learn to carry out some bioinformatic analysis (this is more for ARIA and SIPGA). In general, students will become highly skilled at basic molecular techniques - from conception of an idea to genetic engineering, bacteria culture, protein purification, PCR etc. Students will also become accustomed to aseptic mammalian tissue culture and cellular extraction from (pre)isolated tissues.	1. Work with lab members to execute and troubleshoot experiments 2. Keep detailed and accurate records of experiments, data and analysis to support and protect intellectual property 3. Contribute to lab management	Students should be familiar with basic aspects of genetic engineering pertaining to plasmid cloning, bacteria culture and protein purification. Candidates should have some understanding of molecular biology techniques eg PCR, electrophoresis. For ARIA and SIPGA, practical experience in these areas is preferable. Students should also possess high standards in documentation, good time management and pro-active attitude as well as excellent communication skills allowing conducive teamwork.	The student will help develop and validate a novel biological tool to probe genome organization in normal versus diseases tissues (in this case normal versus fibrotic liver tissues). The student will work closely with team members and collaborators in A*STAR.bThe attachment experience will offer the student a unique opportunity to be directly involved in helping to unravel genomic changes that might underlie/ drive fibrosis progression and/ or hepatocellular carcinoma.	A*SRL	Lee-Wong Lab	Wong Xianrong	8A Biomedical Grove, #06-06 Immunos Building, Singapore 138648	Biomedical Sciences	1
141	Large Language Models for Healthcare	This project leverages cutting-edge large language models (LLM) to transform healthcare. We plan to finetune large language models for different healcare applications, such as health education, healthy lifestyle promotion, diagnosis, drug discovery etc. The intern will be involved in the whole lifecycle LLM development - data collection, cleaning, model training, testing and deployment.	The interns will gain the experiences in the whole lifecycle LLM development - data collection, cleaning, model training, testing and deployment.	data collection, cleaning, model training, testing and deployment	Python programming and deep learning basics	Interns will collect and clean the dataset, code for LLM finetune data, train the model and test its performance.	IHPC	CI	Zhou Jun	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
142	Large Language Models Survey.	This research proposal outlines a plan to conduct an extensive survey on large language models, focusing on three critical dimensions: advanced representation learning, model capabilities, and prompting mechanisms. The primary aim is to synthesize the current state-of-the-art, identify gaps in knowledge, and propose future directions for research and development. By systematically evaluating the existing literature and methodologies, this study aims to provide a holistic understanding of the landscape of large language models and their implications for various domains.	1.Complete a survey draft, providing a comprehensive overview of advanced representation learning in large language models, their capabilities, and the role of prompting. 2. Identification of current challenges, reasoning, robustness, fairness, knowledge gaps, and potential biases in existing models and methodologies.	•Literature search •Algorithm Implementation •Experimental result analysis	•Background in computer science/engineering, computer vision, natural language processing, etc. •Proficient in programming: Pytorch, TensorFlow	•Literature search •Algorithm Implementation •Experimental result analysis	IHPC	CFAR	Yan Ming	1 Fusionopolis Way, #16-16, Connexis North Tower	Computing and Information Sciences	1
143	Large scale foundation model research on global shipping data	Large Language Models (LLM) like ChatGPT attract worldwide interests and become accessible and popular for public use. As a foundation model, ChatGPT makes it feasible to support various applications like support writing script making PPT etc. Similar like natural language, as an intrinsic sequence data, shipping data such as vessels voyage data are type of spatial-temporal sequential data, which has potential to take analogous modelling methodology as done for natural language to build a large model to support a variety of downstream tasks. As of now, there is still lack of such fundamental model based on global shipping data, while its applications are of substantial potential in voyage planning, safety management, estimation of fuel consumption of shipping industry and data generation and simulation for port planning and launching a new shipping route, even help manage the feet etc. This study attempts to build such foundation model, and try and investigate novel approaches to formulate modelling, vectorization and tokenization of large scale shipping data and	1. Understand the spatial-temporal data mining technologies 2. Deep learning method for spatial-temporal data modelling 3. Large model training experience	1. Data preprocessing, vectorization, and tokenization 2. Format the data as input to large model 3. Large foundation model training	1. Knowledge on programming using popular language for deep learning like python 2. Knowledge on data science and statistics 3. Knowledge on NLP	1. Data processing on global shipping data for model training ready 2. Establishing large deep learning model for global shipping data 3. Model training and optimisation to expedite training process	IHPC	Systems Science	Xiao Zhe	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing & Information Sciences (CIS)	
144	Learn from haptic teleoperation	Contact-rich manipulations involve physical interaction between the robot and objects in the environment. Traditional programming methods can be time-consuming and costly. The deployment of robots in factories is hindered by time-consuming and costly setup. The objective of the project is to understand, learn and transfer haptic skills from human users to robots, reduce the effort of programming contact tasks by using haptic teleoperation, and Improve generalization capabilities with machine learning algorithms to adapt to task uncertainty and variability.	1) The fundamentals of haptic sensing and feedback, which includes understanding how haptic sensors work to measure forces, torques, and other tactile cues, and how haptic feedback devices can be used to provide users with similar sensations. 2) The principles of machine learning and reinforcement learning, which will be used to develop robots that can learn haptic skills from human demonstrations, and to generalize these skills to new tasks and environments. 3) Research skills, the ability to identify research problems, develop and test hypotheses, and communicate research results 4) Problem-solving skills, the ability to identify and solve complex problems 5) Collaboration skills, the ability to work effectively with other team members	1) Collecting demonstration data by using haptic teleoperation system 2) Implementing and testing methods and algorithms on robots 3) Analyzing and interpreting experimental results 4) Writing and presenting research results	Experience with programming languages such as Python; Basic understanding of machine learning and reinforcement learning; Ability to work independently and as part of a team; Experience with robotics and ROS is a plus.	The student will work under the supervision of a senior researcher and will be responsible for collecting demonstration data, implementing and testing methods and algorithms, analyzing and interpreting experimental results, and working collaboratively with team members.	ARTC	Autonomous Systems & Robotics	Shijun Yan	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Engineering and Technology	1
145	Low power high selectivity dielectric film etch for GaN HEMT device gate contact opening	RF GaN HEMT device gate metal typically is T shape, bottom dimension is small (100nm range) for short channel length, achieving higher frequency performance. This small gate foot opening normally made by dielectric film dry (RIE) etch process. Etch need a precise etch depth control, also the plasma damage to the below channel layer need to be minimized, to avoid HEMT device performance degradation. Hence a low power (low damage) and high selectivity etch process need to be developed. This project will focus on develop a robust, consistent performance etch recipe specifically for narrow gate foot opening.	1. what is RIE dry etch process 2. what are the key factors affecting RIE dry etch process outcome 3. How to achieve material selective etching by etch recipe condition tuning	1. participate on the etch recipe development 2. prepare/submit sample for X-SEM/TEM analysis	1. knowledge about RIE etch process 2. knowledge about FA analysis	1. paper search/reading to gather related information 2. follow research engineer/scientist to fabricate experiment samples 3. submit and follow up on the sample FA	IME	NGTC	Gao Yuan	4 Fusionopolis Way, Singapore 138635, Kinesis Building	Engineering and Technology	1
146	Machine learning and AI for materials informatics	Materials informatics is an emerging field leveraging data science and AI methods to accelerate the development of new materials, such as lightweight alloys for aerospace applications and nanoparticle catalysts. The student will help to develop machine learning (ML) models to predict the properties of materials. Material properties (e.g., mechanical properties, catalytic activities) are determined by the arrangements of atoms, so the goal is to construct ML models that map atomic arrangements to properties.	The student will obtain first-hand research experience in the emerging field of materials informatics. The student will develop expertise in constructing machine learning models to predict the properties of materials.	The student will work closely with computational materials scientists in A*STAR to develop machine learning models to predict the properties of materials. At the end of the internship, the student will provide documented codes and a report detailing his/her research findings so that the project can be incorporated into A*STAR's in-house platform for accelerated materials development.	Familiarity with Python or a similar programming language, so as to implement standard ML algorithms, such as those in scikit-learn. Familiarity with basic concepts in machine learning is preferred. Background in physical sciences or engineering is preferred, so that the student can better appreciate the datasets and ML models.	The project involves exploratory research. The ML problem is a non-linear regression, but the specific ML methods used will depend on the student's interests and familiarity. The student will be taught sufficient materials science to understand the datasets that we will provide. The focus would be on ML method development and application, including feature engineering. At the end of the internship, the student will provide documented codes and a report detailing his/her research findings so that the project can be incorporated into A*STAR's in-house platform for accelerated materials development.	IHPC	MSC	Leong Zhidong	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	1
147	Machine Learning for Blood Viscosity & Cell Deformation	The complex dynamics of cell motion & deformation are important in many microfluidics and cell biomechanics applications. These dynamics depend on parameters such as fluid viscosity ratio, shear rate and cell membrane properties. The resultant inter-cell interactions impact hydrodynamic diffusion and viscosity. Current numerical models fully resolve each cell which is expensive, or use simplified transport & rheological properties, which can be inaccurate. This project will use machine learning to infer more accurate blood viscosity and cell properties for improved modelling.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow. 2. Student should be able to explain how machine learning models such as neural networks work, and be able to write code to implement said techniques. This should be transferable skills for any future projects the student might be interested in. 3. The student will also learn to run and interpret numerical simulation results (computational fluid dynamics in this project) on a Linux system.	1) Literature review 2) Processing and analysis of numerical simulation results for a single cell and suspension of cells at different shear rates in flow 3) Write and train an ML model to predict deformation for a single cell for different shear rates in flow 4) Write and train an ML model to predict viscosity for a suspension of blood cells at different shear rates in flow	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data analytics/engineering.	1) Literature review 2) Processing and analysis of numerical simulation results for a single cell and suspension of cells at different shear rates in flow 3) Write and train an ML model to predict deformation for a single cell for different shear rates in flow 4) Write and train an ML model to predict viscosity for a suspension of blood cells at different shear rates in flow	IHPC	Fluid Dynamics	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Engineering and Technology	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilities of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
148	Mechano-chemical pre-treatment processes for value extraction from end-of-life products/components	Increasingly products and components are made of multi-material through overmoulding, coating or joining methods (direct or adhesive) so as to fulfill multiple functionalities, such as lightweight, good thermal conductivity or insulation. However, this make it very challenging when these products and components reach their end-of-life and thus, this project aims to pre-treat them without the use of harsh chemicals, enabling them to be segregated into their individual material streams and reach suitable 'r' paths. The process will focus on specific multi-material combinations and they will be characterised so that the process can be design thorugh selection of suitable chemical and agitation mechanism. There will be a need to optimise the process and characterise the effectiveness and efficiency of process.	Through this internship, the intern can expect to learn and improve laboratory techniques such as the use of scientific equipment, and also learn how to apply the knowledge learnt in school into projects and real-life application. Further, the intern is expected to present to project team and supervisor, refining their written and presentation skills.	Attend HSE induction and briefing to ensure that safety is of priority in lab works. Plan and conduct experimental works (process and characterisation) and document observations and findings. Compile and present results in report and presentation format.	N.A.	The scopes of the project comprise of: 1)Literature Review on mechano-chemical processes 2)Process optimisation and modification through pre-process characterisation results (material type and combination, interfacial strength, contaminant type) 3)Characterisation on effectiveness and efficiency of the pre-treatment process 4) Report and presentations on findings and analysis	SIMTech	Surface & Circular Processing (SCP)	Xinying Deng	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
149	Medical Knowledge enhanced Large Language Models	Large language models, like ChatGPT, have shown remarkable capabilities in understanding and generating human language. These models can usually behave well on daily dialog, or question answering scenarios. However, in areas that demand precision, for example, in medical applications, they often exhibit unsatisfactory performance due to a lack of domain-specific knowledge. This project aims to leverage these advanced models to encode medical knowledge from different sources such as medical knowledge base, medical articles, etc.	Gain hands-on experience in working with state-of-the-art large langage models. Deepen your knowledge of machine learning, natural language processing, and the healthcare industry. Work closely with a supportive team of experts who are passionate about AI and healthcare.	Data Collection and Preprocessing, Model Fine-Tuning and Testing	Python programming and fundamental knowledge of Machine Learning (ML) and Natural Language Processing (NLP)	Data Collection and Preprocessing: The student will be involved in collecting medical data from various reliable sources, such as research papers, clinical notes, and textbooks. The task is to preprocess this data to make it suitable for ingestion by the language model. Model Fine-Tuning: The student will work closely with our team to fine-tune existing language models to specially target medical knowledge. This process involves training the model on our curated medical dataset. Collaboration: The student will work closely with researchers and AI engineers to acquire valuable insights and actively participate in the project's advancement.	IHPC	CI	Song Yuting	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
150	Metal additive manufacturing process monitoring with AI	We are seeking a talented and motivated intern to join our research and development team in the field of laser powder bed fusion (LPBF) for additive manufacturing. In this internship, you will work on innovative projects that leverage machine learning techniques to enhance the quality, efficiency, and reliability of LPBF processes. This project offers an excellent opportunity to gain hands-on experience in the intersection of advanced manufacturing and artificial intelligence. The advancement of LPBF has the potential to achieve adoption in various industries such as aerospace, space, oil and gas, automotive, medical and precision engineering	A deep understanding of LPBF technology Proficiency in machine learning, data analysis Hands-on experience in designing and conducting experiments with LPBF equipment. Effective data collection, analysis, and interpretation skills. Collaborative teamwork and communication within a research and engineering team. Presentation and reporting skills to convey research findings.	Process Parameter Optimization: Explore and experiment with process parameter optimization to determine the ideal set of parameters (e.g., laser power, scan speed, layer thickness) that result in improved part quality, mechanical properties, and production efficiency. Part Characterization: Physical part preparation and measurements for characterization of the part in terms of physical properties such as density, hardness, and mechanical strength. Data Collection and Preprocessing: Collect, clean, and preprocess data from LPBF machines, including sensor data, images, and process parameters. This will involve setting up data acquisition systems and ensuring data quality. Feature Engineering: Extract relevant features from the data, such as melt pool characteristics, powder distribution, and layer-wise variations, to create informative input features for machine learning models. Model Development: Develop machine learning models, such as deep neural networks, decision trees, or ensemble methods, to predict various aspects of the LPBF process, such as defects, mechanical properties, and dimensional accuracy.	Grade Point Average above 4.0 Mechanical / Materials Engineering knowledge Programming knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and materials science. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous.	We are seeking a highly motivated and technically skilled person to join our additive manufacturing research and development team. This internship presents an exceptional opportunity for a dedicated student to gain hands-on experience in a cutting-edge field that combines advanced manufacturing with machine learning techniques	SIMTech	Additive Tech Innovation (ATI)	Jyi Sheuan Ten	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
151	Metal Powder Reuse in Laser Powder Bed Additive Manufacturing	We are looking for a dedicated student to join our research team and focus on investigating the feasibility and optimization of reusing metal powders in the laser powder bed additive manufacturing (LPBF) process. This project is essential for sustainable manufacturing and cost-efficiency while maintaining the high quality and performance of additively manufactured parts.	In-depth knowledge of the LPBF process Understanding of metal powders used in LPBF, including their properties and behaviors. Hands-on experience in conducting research and experiments. Proficiency in data collection, analysis, and interpretation. Knowledge of sustainable practices in additive manufacturing Presentation and reporting skills to convey research findings	Literature Review: Conduct a comprehensive review of existing literature and research related to metal powder reuse in LPBF. Experimental Setup: Collaborate with the research team to design and set up experiments for powder reuse. Data Collection: Collect data related to the printing process using reused metal powders. This includes recording process parameters, powder characteristics, and in-situ monitoring data. Characterization: Perform physical and mechanical characterization of the printed parts to assess their quality, including properties like density, porosity, hardness, and mechanical strength. Powder Analysis: Analyze the metal powders before and after each printing cycle to evaluate any changes in their properties and quality. Data Analysis: Analyze the data collected during the experiments, identifying trends and patterns that can inform decisions on the potential for powder reuse. Reporting: Document your findings and observations, and create comprehensive reports and presentations to share your research results.	Grade Point Average above 4.0 Mechanical / Materials Engineering knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and materials science. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous.	We are seeking a motivated and detail-oriented student to support our research efforts in laser powder bed additive manufacturing. Your primary role will be to investigate the feasibility and optimization of metal powder reuse in LPBF, contributing to our goal of sustainable and cost-effective manufacturing practices. Key responsibilities include conducting experiments, collecting and analyzing data, and reporting your findings to the team.	SIMTech	Additive Tech Innovation (ATI)	Jyi Sheuan Ten	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
152	Methods for high-throughput single-cell epigenomic profiling	This project will implement methods for high-throughput epigenomic profiling of single cells. We will use combinatorial indexing approaches to enable the generation of single-cell-resolution data for over 1 million cells per experiment at low cost. We will implement methods for chromatin accessibility and histone postranslational modification profiling. Methods will be optimized using cells grown in culture, as well as human peripheral blood mononuclear cells.	Students will become familiar with the principles behind single-cell epigenomic methods, and become proficient in the experimental molecular workflows needed to generate single-cell DNA sequencing libraries.	Students will be responsible for carrying out optimization experiments to implement new molecular methods for high-throughput single-cell epigenomics. This will include maintaining cell culture systems, isolating nuclei, performing DNA tagmentation, ligation, and PCR amplification reactions. Students will also be responsible for reporting results in one-on-one meetings and at weekly lab meetings, and participating in lab journal clubs.	Experience with molecular biology methods and cell culture.	This project will implement methods for high-throughput epigenomic profiling of single cells. We will use combinatorial indexing approaches to enable the generation of single-cell-resolution data for over 1 million cells per experiment at low cost. We will implement methods for chromatin accessibility and histone postranslational modification profiling. Methods will be optimized using cells grown in culture, as well as human peripheral blood mononuclear cells.	GIS	Laboratory of Genome Function	Tim Stuart	60 Biopolis St, Genome Building, 6th Floor, Singapore 138672	Biomedical Sciences	1
153	Microfluidic optical sensing platform based on the optical bound state in the continuum.	This project aims to build an efficient optical sensor for food safety and environmental monitoring based on the concept of bound state in the continuum and the lab-on-chip microfluidic platform. Bound state in the continuum is an exotic physical phenomenon first introduced in quantum mechanics in 1929 and recently used in various optoelectronic applications due to its exceptional capability in light trapping. The developed optical sensor platform can also be potentially used in various bio- and health applications or integrated into internet-of-thing (i.e., iOT) systems.	The student will learn the physics of optical resonance, especially the new concept of bound state in the continuum. He/she will also learn research skills in device fabrication and optical characterisation. After the attachment, the student will have hands-on experience in microfluidic device fabrication and microspectroscopy.	The role of the student is to fabricate a microfluidic device and integrate resonant nanostructure into that device. He/she will then have to characterise the sensing device with a micro-spectrometer and analyse the data.	Students will need to have a basic understanding of optical physics and material sciences. Thus, undergraduates with majors in Physics, Material Science, and Chemistry will be suitable for this job.	A highly motivated student who has a passion for physical science and medical sensing device development. The job scope will include: Fabrication of microfluidic chip (i.e., design of the chip architecture, 3D printing, moulding using soft-polymeric materials, building a pumping system for the microfluidic chip); Optical characterisation of sensing device (i.e., using microspectrometer); Collect various food samples and analyse them using the sensing device. Analyse the measurement data using Python or Matlab. Writing the scientific finding and report of the project.	IMRE	AOT	Son Tung Ha (Tony)	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
154	Microstructural Engineering for alloy additive manufacturing	Alloy Additive manufacturing(AM) is adapted in manufacturing sector as tool with potential to build components with targeted properties. This involves correlating process conditions and properties through underlying microstructure. Computational modelling of microstructural evolution is a powerful resource for process optimization. Since, current microstructure simulation tools are computationally intense, In this project, accelerated modelling alternatives would be assessed for rapid virtual AM prototyping towards target microstructure	The student would gain insight into additive manufacturing process, phase transformation and be exposed to programming tools, numerical techniques, visualization tools, parallel programming	The student would be developing new subroutines, modify existing code, running simulations in high performance computing, collect and analyze results, maintain logs, periodically prepare report updates during meetings.	Degree or course work undertaken in Materials science, Mechanics, Physics, engineering science. Motivated towards research and research-oriented tasks. Aptitude in programming, numerical methods required. Basic machine learning knowledge would be desirable.	Evaluation of reported scientific literature in the context of the specific research objective of the project, developing new computational codes, using existing codes to compile and run towards specific research questions, collecting data, post processing of the data to draw conclusions, submit periodic report	IHPC	MSC	Ramanarayan Hariharaputran	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Engineering and Technology	1
155	Microstructure prediction of materials processed by additive manufacturing	Additive manufacturing (AM) or "3d printing" has attracted tremendous technological interest given its ability to make complex, non-traditional geometries. However, the AM process results in microstructure that can be quite different with conventional alloy processes. Simulation models are therefore desirable to predict and optimize the microstructure, and hence properties of the printed parts. This project will focus on modelling nucleation (formation) and growth of precipitates from a cellular network of polycrystalline matrix phase during AM. Different mechanisms have been proposed for precipitate nucleation, but the role of grain boundaries with respect to precipitate growth remains unclear.	• Gain an understanding and appreciation of the metallurgical challenges behind metal 3D printing. • Gain knowledge of fundamental nucleation and growth theory and its application to a technologically relevant application. • Opportunity to be part of the team to develop novel models for the 3D printing of metal alloys.	The student will perform computer simulations of precipitate nucleation and growth from a polycrystalline phase in 2D/3D. He/she will be involved in extending current codes to account for nucleation and growth in the presence of grain boundaries and/or diffusion.	Preferably gone through basic materials science course. Prior experience with C++ or Matlab/Octave is desirable though not required. Has a passion to learn.	The student is required to make modifications to an existing code under the guidance of the supervisor. He/she will run numerical simulations, consolidate results and perform statistical analyses.	IHPC	Engineering Mechanics	QUEK Siu Sin Jerry	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilities of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
156	Modelling surface modification through ion bombardment	Ion bombardment, or ion implantation, is a key technique in semiconductor fabrication,for surface treatment by dopant introduction which result in modifying electrical properties, surface activation resulting in enhanced surface reaction improving adhesion and surface modification such as etching and deposition. As semiconductor devices shrink, ion bombardment's precision becomes increasingly critical in maintaining high performance and reliability in the electronics sector. This project aims at gaining insights in underlying physics that goven the ion-surface interaction through atomistic modelling resulting in various surface property modifictions	The student would gain insight into semiconductor fab processes and be exposed to programming tools, numerical techniques, visualization tools, parallel programming	The student would be developing new subroutines, modify existing code, running simulations in high performance computing, collect and analyze results, maintain logs, periodically prepare report updates during meetings.	Degree or course work undertaken in Materials science, Mechanics, Physics, engineering science. Motivated towards research and research-oriented tasks. Aptitude in programming, numerical methods required. Basic machine learning knowledge would be desirable.	Evaluation of reported scientific literature in the context of the specific research objective of the project, developing new computational codes, using existing codes to compile and run towards specific research questions, collecting data, post processing of the data to draw conclusions, submit periodic report	IHPC	MSC	Ramanarayan Hariharaputran	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Engineering and Technology	1
157	Molecular mechanisms of invasion of Plasmodium, the malaria parasite	Malaria is deservedly receiving more attention than in the past. Diverse parasites species can cause this diseases. However, research into many of these species, lags considerably behind that of P. falciparum. A key reason for the research effort disparity between P. falciparum and oth r parasite species is that a robust continuous culture method for *P. falciparum* has been developed in the late 1970s; whereas the continuous culture of species like P. vivax erythrocytic stages still eludes us to this day.This principally due to the fact that P. vivax and other species only invades and grows in reticulocytes, the immature erythrocyte. We have developed of new or improved ex vivo methods and tools to study reticulocyte invasion and immunity.	Learn how to design, perform, and analyse data.	Learn how to design, perform, and analyse data.	Basic knowledge in immunology and biology	The student will learn how to work in the laboratory and interact with colleagues to discuss and present his results	ID Labs	Pathogen Immunobiology lab	Laurent Renia	8A Biomedical Grove, #05-13 Immunos Building, Singapore 138648	Biomedical Sciences	1
158	Mult-cell array of nanogap electrode for impedimetric biosensors	Capacitive biosensors are emerging as a breakthrough technology for early detection of biomarkers of fatal diseases. Nevertheless, theses biosensors possess a shortcoming of electronic thermal noise arising from the electric double layer (EDL). Hence, it masks the critical information of biomolecules of interest for detection. To overcome this, we disclosed a novel multi-cell nanogap electrode array to reduce the impedance of the electric double layer by reducing the gap between the electrodes smaller than the thickness of the EDL and increasing the thickness of the electrode. In this work, we developed a nanogap electrode chip for detection of various proteins and nucleic acids. Also, we will be developing array panel to translate the detection as single chip multi-plexing.	In this project, student will learn gain exposure in both wet and dry lab and learn about sensor design and fabrication. Also, student will get to conduct data analysis during simulation study.	1. Wet lab work 2. Testing and evaluation of fabricated sensors 3. Data consolidation 4. Data analysis and inference	1. Ongoing degree or knowledge from Electronics/ Electrical/ Biomedical engineering. 2. Previous wet lab experience 3. Experience in setting up experiments 4. Previous experience in surface functionalization, antibody and protein hybridization	1. Fabrication of sensor electrode 2. Testing and validation of sensors 3. Working with simulation tools to generate prelim data	IME	Medtech	Musafargani Sikkandhar	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
159	Multi-agent RL for collaborative decision making	Multi-agent reinforcement learning (MARL) is a recent development that enables multiple agents to act cooperatively when they all pursue a common goal, and it relies on decentralized execution. The MARL network learns correlations between multiple agent actions towards maximizing a joint reward. From individual action and observation inputs.	Substantial outcome from the project will be submitted to high impact journals/conferences. This internship position provides you with an excellent platform to make the most of research.	You will work with a small team of data scientists and data engineers to develop the MARL methodology to accelerate high quality decision making. These duties are not limited to, gathering, sampling, processing and setting up simulation environment, developing python codes of MARL in complex simulation environment and preparing manuscripts, collaborating with other members of the research team, interacting with other staff here at A*STAR. This internship position provides you with an excellent platform to make the most of research	1) Ability to develop prototypes to demonstrate the feasibility of research ideas 2) Good knowledge on machine learning (added skill in Reinforcement Learning) in solving real-world problems 3) Proficient in Python (added skill in PyTorch) 4) Team player.	Implementation of multi-agent reinforcement learning on complex simulation environment to exhibit high quality decision making.	I2R	Machine Intellection	Senthilnath Jayavelu	1 Fusionopolis Way, #21-01 Connexis (South Tower), Singapore 138632	Computing & Information Sciences	
160	Multi-material 3D printing of Prothesis and Orthotics	The field of prosthetics and orthotics has been greatly impacted by the introduction of 3D printing technology. Unlike traditional manufacturing methods, 3D printing offers several key advantages including easy customization, a wide range of material selection, low cost, quick processing time from design to prototype, and enhanced functionality. The proposed research aims to develop an optimized methodology with experimental validations by creating filaments and using 3D printing for prosthetic and orthotic applications.	1. Understand the process and method to make customised 3D printing filaments 2. Improve CAD designing skills 3. Improve 3D printing skills	1. Assist in development and 3D printing of custom 3D printing filaments 2. Develop designs for orthotics and prosthesis 3. 3D printing and testing of the 3D printed materials 4. Self-motivated to finish the work scope on time 5. Bi-weekly meeting to update the progress 6. Team-work with other members in the team	1. Experience in Fusion360 CAD software and 3D printing 2. Interested in polymer-related manufacturing technologies (Especially extrusion-based 3D printing) 3. Able to work independently and with a team 4. The candidate is required to have an adequate level of proficiency in CAD skills and basic knowledge in polymers, Prerequisites: GPA 4.0 (Minimal)	1. Assist in development and 3D printing of custom 3D printing filaments 2. Develop designs for orthotics and prosthesis 3. 3D printing and testing of the 3D printed materials	SIMTech	Additive Tech Innovation (ATI)	Muthu Vignesh Vellayappan	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
161	Multi-Material Exploration in Laser Powder Bed Additive Manufacturing	We are seeking a student to join our research team and lead an exciting project focused on the exploration of multi-material capabilities within laser powder bed additive manufacturing (LPBF). This project aims to advance the versatility and functionality of LPBF by investigating the integration of multiple materials in a single build, enabling the creation of complex and innovative components.	Comprehensive understanding of LPBF technology and its applications. Proficiency in materials science and selection for additive manufacturing. Experience in designing and executing multi-material printing experiments. Data collection, analysis, and interpretation. Skills in evaluating multi-material part properties and characteristics. Effective communication and collaboration within a research team. Presentation and reporting skills for sharing research findings.	Literature Review: Conduct a thorough review of existing research and developments in the field of multi-material LPBF. Identify key trends, challenges, and opportunities. Materials Selection: Collaborate with experts in materials science to choose appropriate materials for multi-material experiments, considering compatibility and performance. Experimental Setup: Plan and set up experiments to print multi-material parts using LPBF equipment. Data Collection: Collect data during the printing process, including in-situ monitoring data, process parameters, and any relevant sensor measurements. Characterization: Evaluate the physical and mechanical properties of the printed multi-material parts. Multi-Material Analysis: Analyze the interaction between the different materials used in the printed parts and assess the quality and structural integrity of the components. Process Optimization: Investigate ways to optimize the multi-material printing process, ensuring the highest quality and performance of the produced parts. Data Analysis: Analyze the data collected during experiments, identify trends and insights, and use these to guide recommendations for further	Grade Point Average above 4.0 Mechanical / Materials Engineering knowledge Currently pursuing or recently completed a degree in materials science, mechanical engineering, or a related field. Strong problem-solving skills and attention to detail. A keen interest in advanced manufacturing and materials science. Effective teamwork and communication skills. Knowledge of additive manufacturing processes is advantageous.	We are looking for a dedicated student to lead a dynamic research project that explores the potential of multi-material 3D printing in LPBF. As an student, your primary responsibilities include designing and executing multi-material experiments, collecting and analyzing data, and contributing to the advancement of LPBF technology.	SIMTech	Additive Tech Innovation (ATI)	Jyi Sheuan Ten	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
162	Multimodal Foundation Learning for Medical Data Analysis	Deep learning has shown its superior performance for a few disease detection tasks using medical image. Besides different types of images, other modalities like medical report in text format are also available. In this project, students are expected to work on advanced machine/deep learning algorithms like Multimodal Foundation Learning to utilize different types of medical data for robost detection and prediction tasks.	Working with our AI scientists together to solve real-world problems using cutting-edge AI techniques. At the end of the internship, you can also • Learn a wide variety of machine learning techniques including deep learning techniques • Learn common computer vision techniques and learn how to apply these techniques to design innovative AI applications • Understanding how to improve the performance of exising deep learning models as well	Curate training data, evaluate baseline methods, run experiments	1) Programming skills in Python. 2) Experience in Machine/Deep Learning.	Deep learning has shown its superior performance for a few disease detection tasks using medical image. Besides different types of images, other modalities like medical report in text format are also available. In this project, students are expected to work on advanced machine/deep learning algorithms like Multimodal Foundation Learning to utilize different types of medical data for robost detection and prediction tasks.	IHPC	CI	Xu Xinxing	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
163	Multi-species population genomic from metagenomic samples	Our lab utilizes cutting-edge technologies to investigate microbial populations and their impact on human health. We are currently in search of an enthusiastic student to enhance a tool designed to boost the accuracy of variant calls in metagenomic sequencing data. With this tool, the successful candidate will have the opportunity to tap into our extensive collection of metagenomic sequencing data, exploring previously uncharacterised microbial genetic diversity. The solutions developed during this project will directly benefit ongoing and upcoming microbiome research projects within our lab.	This project offers a unique blend of programming and bioinformatics analysis skills, providing valuable learning experiences for students interested in pursuing careers in data analysis.	Student will be responsible of all bioinformatic analyses with direct support from supervisor and other lab's member.	Analytical and programming skills (python, R, UNIX environment). Candidates with experience in genome sequencing and metagenomic data analysis are preferred	The student will be responsible for developing a new approach to allow species-specific population genomics from metagenomic samples, extending current work previously done within the lab. Using this tool, the student will have the opportunity to explore genomic species diversity using internal and public datasets, adapting well-known population genomic statistics to highlight both the variability of evolutionary mechanisms, and genomic regions and functions under selective pressures.	GIS	Laboratory of Metagenomic Technologies & Microbial Systems	Jean-Sebastien Eric Emmanuel Gounot	60 Biopolis Street, Genome, Singapore 138672	Biomedical Sciences (BMS)	1
164	Muscle Image Analysis	This project involves development of advanced segmentation of fat / muscle compartments from MRI measures. Implementation of deep learning approaches for automation. Correlate various fat / muscle compartments with clinical measures.	The candidate will be able to learn more about various fat compartments and skeletal muscle compartments. Application of deep learning methods for automated quantification. Statistical correlation of fat / muscle compartments with various clinical measures.	1. Perform segmentation of various muscle / fat compartments . 2. Implementation of Deep learning methods for automation 3. Statistical analysis and correlation with clinical measures.	Batchelors / Masters degree in computer engineering / science or biomedical sciences. 1-2 years experience in Python Programming 2. Exposure to image analysis	The student will utilize / modify / develop python programs for automated image analysis. Develop gold standard manual segmentation for training of deep learning models.	SICS	Human Development	Sambasivam Sendhil Velan	30 Medical Drive, Singapore 117609	Biomedical Sciences	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
165	New generation of circular polymeric materials: multi-responsive and reversible reaction manifolds	This student project is working towards the development of novel reaction manifolds based on innovative molecular design for sustainable manufacturing of smart and responsive polymeric materials. Such materials can be programmed to respond to multiple stimuli for tuning chemical and physical properties, and with precise spatiotemporal control. Working with a team of researchers, this student shall contribute towards a chemical platform for advancing the field of sustainable and adaptive materials, with properties including ease of recycling and self-healing.	Students will learn basic synthetic chemistry techniques such as organic synthesis, polymer and materials synthesis. He/she will learn how to design, perform and monitor chemistry experiments, and subsequently purification and data characterization experiments may be performed. Students will be exposed to state-of-the-art instruments in chemicals and materials synthesis.	1. Perform literature review 2. Data analysis, presentation and reporting. 3. Strong willingness to learn, communicates well, team player and independent.	The student is expected to have attended university-level chemistry laboratory classes (hands-on).	The student is expected to perform basic chemistry experiments. He/she is expected to adhere to good and safe laboratory practices, as well as record keeping.	ISCE²	Green Chemistry (GC)	Ken Lee	1 Pesek Road, Jurong Island	Physical Sciences	1
166	New methods for AI-aided generative metamaterials and composites design	The project aims to explore new methods and capabilities in the field of designing metamaterials and/or 3D woven composites, specifically for potential aerospace applications. Metamaterials, with their engineered properties, offer immense potential in various applications such as aerospace, telecommunications, medical devices, and more. 3D woven composites, with their extraordinary performance in impact and damage tolerance, have been increasingly used in nuclear reactors and in aerospace, including jet engines and spacecraft. This project seeks to develop a novel approach that harnesses the power of artificial intelligence to expedite the process of generatively designing metamaterials and/or 3D woven composites with specific, tailored properties. The project will be built upon our prior knowledge in inverse design optimization, deep learning neural networks, architectured materials, 3D woven composites, game theory, and programming. We invite students interested in one of the following topics: AI, design optimization, architectured materials, composites, aerospace engineering, mathematics, and computer science. Training will be provided in these areas to ensure a rewarding learning and development	1. Deep Learning Application: Participants will gain a comprehensive understanding of the application of deep learning methodologies in material design, particularly for generative metamaterials and/or 3D woven composites used in aerospace and other industries. 2. Metamaterials and Composite Materials: Students will develop a strong grasp of the unique properties and applications of metamaterials and/or 3D woven composites, with a focus on their tailored properties and uses in aerospace engineering. 3. AI-Driven Design Optimization: Students will acquire skills in leveraging artificial intelligence, particularly deep learning, to optimize the design process for metamaterials and/or 3D woven composites. This includes understanding how AI expedites the design, leading to tailored and specific material properties. 4. Programming and Computational Skills: Through practical implementation, participants will enhance their programming skills, particularly in the application of coding languages in material design, data processing, and analysis. 5. Critical Thinking, Problem-Solving, and Professional Development for future career development	Students are expected to play a role in developing and extending new methods for architectured material design	Students who are interested in pursuing his career in Science, Physics, Engineering, and/or Mathematics.	1. Actively attend one-to-one trainings at least 3 times a week for the first month. 2. Explore the use of different methods for solving the problems customized based on the students' interests and strength. Sufficient guidence will be provided to ensure the students' efficiency and productivity. 3. Provide a detailed documentation in the form of a professional report. Guidence will be provided.	IHPC	EM	Wang Zhenpei	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Engineering and Technology	1
167	New molecular concepts for diagnostic accessibility	The lab focuses on developing innovation to increase the accessibility of nucleic acid diagnostics by making it faster, cheaper or more workflow-appropriate. The lab has had students develop new LAMP concepts (ANDgate LAMP) and optimize nucleic acid library preparation (for infectious disease sequencing) protocols in the past. The student will be involved in developing or optimizing specific aspect of a nucleic acid diagnostic concept we are working on at the time of attachment.	The student will learn to understand the application use case thoroughly before diving into problem-solving. The student will also learn how to diagnose, troubleshoot and resolve experimental problems in a systemic way.	Running wet lab experiments in a molecular biology laboratory and writing reports.	Molecular Biology / Biochemistry / Medicine / Bioengineering-related degree with a basic understanding of nucleic acid methods e.g. qPCR, cloning, restriction digest, etc.	Running wet lab experiments in a molecular biology laboratory and writing reports for a specific nucleic acid diagnostic concept we will be working on at the time of attachment.	GIS	Laboratory of Diagnostic Accessibility	Seow Yiqi	60 Biopolis Street, Genome, #07-01, Singapore 138672	Biomedical Sciences	2
168	Next Generation Electric Vehicle (NGEV) Simulation	Development of a next generation electric vehicle simulator for use in vehicle electrification scenarios, feasibility studies, policy making.	Students will learn the basic concepts in agent-based simulation, urban complexity, transportation systems, and appy these methods to build simulations to tackle complex issues which cannot be resolved using analytical methods.	Study the basic principles of agent-based simulations, assist in the development of the inhouse simulator, and develop their own models and experiments using the simulator.	Strong background in software programming with a focus on modelling and simulation. Background in transportation research and energy systems is a plus.	Vehicle electrification is a globally disruptive technology trend driven by climate change and competitiveness to conventional engines. However, mass electrification requires significant infrastructure changes, capital investment and national-level strategies to drive the innovation and the market. NGEV is an opportunity for national agencies, transportation operators, and EV companies to experiment and test bed EV deployments. The candidate will be exposed to agent-based modelling, whereby individual vehicles and entities behave and interact autonomously within a virtual environment according to determined behaviours developed in the model. Through the complex interactions between agents, emerging phenomena can be observed.	IHPC	Systems Science	Nasri Bin Othman	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Computing and Information Sciences	1
169	NLP Internship in Sustainability Management	We are excited to offer an internship opportunity for individuals passionate about sustainability and the power of natural language processing (NLP). In today's world, sustainable business practices are of paramount importance. To better understand and improve sustainability management, we are seeking interns to join our project, which combines advanced NLP techniques with sustainability data analysis. This internship offers a unique chance to make a positive impact on the environment by leveraging the power of language and technology.	Proficiency in applying NLP techniques to analyze sustainability text data, enabling the intern to extract valuable insights, trends, and recommendations from a variety of textual sources related to sustainability management.	They will work to transform their analyses, including the information gleaned from sustainability reports, into actionable recommendations, contributing to the development of strategies that promote sustainable business practices. Interns will actively participate in collaborative discussions with the project team, sharing findings from sustainability reports and other sources, and contributing to the effective translation of NLP-derived insights into practical sustainability management recommendations.	Enrollment in or completion of a relevant bachelor's or master's degree program in fields such as computer science, data science, sustainability studies, or a related field. A strong interest in sustainability and environmental issues, with a basic understanding of sustainability management practices and reporting. Effective communication skills, as the intern will be expected to convey findings and insights in a clear and concise manner. A proactive and self-motivated approach to learning and problem-solving, as this internship may involve independent research and analysis. Interest to learn basic understanding of natural language processing (NLP) concepts and tools	As an intern on our "NLP-Powered Sustainability Analytics" project, you will apply your NLP skills to analyze sustainability-related textual data, including sustainability reports. Your responsibilities include extracting insights and trends from this data, translating findings into actionable recommendations, and collaborating with a diverse team of experts. This internship offers a unique opportunity to contribute to sustainable business practices through data-driven analysis and communication.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yin Jin Lee	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
170	Non-Au based low contact resistance ohmic contact formation for GaN HEMT device	Low Rc ohmic contact is very critical to GaN HEMT device RF performance. Traditionally, ohmic contact formation is using Au based metal stack, going through a lift off patterning and high temperature anneal process. Au based process is expensive and limited to lift off patterning process, which affects process yield and performance consistency. This project will try to develop a non-Au based ohmic contact formation process, using dry (RIE) etch method to achieve comparable or better Rc performance with lower anneal temperature	1. What are the key factors affecting GaN HEMT device ohmic contact formation 2. How to do low damage GaN material etch 3. How to measure/characterize ohmic contact Rc 4. How to do DOE (design of experiment) to optimize process condition to achieve the best Rc performance	1. participate on the ohmic contact formation process development 2. measure and characterize Rc performance for fabricated samples 3. participate in DOE design to optimize ohmic contact formation process	1. basic knowledge of semiconductor fabrication process 2. basic knowledge of electrical measurement 3. strong learning capability	1. paper search/reading to gather related knowledge 2. follow research engineer/scientist to develop the new process, fabricate experiment samples 3. learn and perform electrical measurement to characterize ohmic contact Rc performance	IME	NGTC	Xie Han Lin	4 Fusionopolis Way, Singapore 138635, Kinesis Building	Engineering and Technology	1
171	Novel laser scanning strategy for metal 3D printing	The aerospace industry is increasingly exploring 3D printing to reduce lead time and inventory needs. However, 3D printing is relatively slow due to its inherent layer-by-layer processing nature. To increase 3D printing productivity, we propose to simultaneously implement large layer thickness and a dual laser system in the laser powder bed fusion (LPBF) process. Additionally, we will apply a novel laser scanning strategy that can print parts with better surface finish, reduced support structures, and improved part quality.	Student will be able to describe laser powder bed fusion (LPBF) process, working principles and hardware. Student is able to understand the effect of various critical process parameters on the printed sample's properties. Student will be able to elaborate on the current and future advancements of LPBF process. Student will be able to describe advantages and disadvantages of LPBF process. Student will be able to describe possible process related issues. Student can understand the design and file preparation guidelines for LPBF process. Student can understand the importance of support structures. Student will be able to understand the operational safety requirements.	1. Coming to the office/lab on time. 2. Being prepared for office/lab work with all necessary supplies. 3. Taking good care of A*STAR property. 4. Completing all work assignments. 5. Organizing their time well. 6. Respecting themselves and others. 7. Doing literature search and reading on a regular basis. 8. Doing their best.	The candidate is required to have an adequate level of proficiency in CAD skills and basic knowledge in mechanics. Prerequisite: GPA 4.0 (Minimal).	(1) State-of-the-art literature search on laser powder bed fusion (LPBF) process and material systems will be conducted systematically to understand the current researches that are conducted world-wide for such materials and processes. (2) Characterisation of starting powder materials for assessing their suitability for additive manufacturing. (3) 3D modelling and design for additive manufacturing for LPBF process. (4) 3D printing of metal parts using LPBF system. (5) Characterisation of 3D printed parts for the physical, microstructure, and mechanical properties, wherever possible. (6) 3D printing of final net shaped functional components. (7) Preparation of internship technical report	SIMTech	Additive Tech Innovation (ATI)	Chen-nan Sun	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
172	Novel Polymer 3D Printing for Oil and Gas Application	Polymer 3D printing is widely used in various applications due to its ability to produce objects with complex geometries and functionalities. However, there is a limited selection of printable materials for fused filament fabrication (FFF) 3D printing for oil and gas applications. This is because the final products often have poor mechanical and chemical properties. Therefore, the purpose of this research project is to develop a high-performance custom 3D printing filament specifically designed for oil and gas applications.	1. Understand the process and method to make customised 3D printing filaments 2. Improve 3D printing skills 3. Improve material characterisation skills	1. Coming to the office/lab on time. 2. Being prepared for office/lab work with all necessary supplies. 3. Strictly follow the rules and policies of A*STAR 4. Self-motivated to finish the work scope on time 5. Bi-weekly meeting to update the progress 6. Team-work with other members of the team	1. Experience in materials characterisation methods is a plus 2. Interested in polymer-related manufacturing technologies (Especially extrusion-based 3D printing) 3. Able to work independently and with a team 4. The candidate is required to have an adequate level of proficiency in CAD skills and basic knowledge of polymers; prerequisite: GPA 4.0 (Minimal)	1. Assist in producing multi-material 3D printing filaments 2. Optimise 3D printing parameters using the developed hybrid filament 3. Perform basic characterisation of developed filaments and 3D printed materials	SIMTech	Additive Tech Innovation (ATI)	Muthu Vignesh Vellayappan	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
173	Nuclear fusion	There are various experimental, computational, AI, and theoretical projects available. Broadly, the purpose is to understand the physics of fusion plasmas and thus contribute to making fusion power a reality. As this field has gained a lot of interested in recent years, the exact projects available change rapidly. A representative but not exhaustive list can be found here: https://valerian.hall-chen.com/open_positions.html	Learn how to understand complicated physical phenomena and how to communicate data.	Deepen our understanding of fusion science, develop new tools such as software, support other members of the team and external collaborators.	[Experimental project] Familiarity with Python and basic data analysis techniques [Computational project] Familiarity with Python or C++, some knowledge of numerical methods [AI project] Understanding of basic AI principles, techniques, and libraries [Theoretical project] Strong background in physics and mathematics, at least 1 year of time available	We are seeking highly motivated students to join our fusion energy effort. This internship offers a good opportunity for students interested in fusion energy research to gain hands-on experience with computational tools, simulations, and data analysis. The selected interns will work closely with our fusion research team and contribute to cutting-edge research in the field.	IHPC	EP	Valerian Hall-Chen	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Physical Sciences	2

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilies of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
174	Obstacle detection for safe whole-body motion planning of mobile manipulators	Mobile manipulators are equipped with vision-based sensors such as cameras and LiDARs. The project aims to explore state-of-the-art algorithms for obstacle detection and whole-body motion planning to provide detailed information for collision avoidance in dynamic environments.	- Able to use ROS / ROS2 proficiently - Able to evaluate state-of-the-art literature on obstacle avoidance and whole-body motion planning - Develop obstacle avoidance and whole-body motion planning functionalities in ROS / ROS2 - Use simulation tools (e.g. Gazebo) to test and evaluate results - Test and debug code on mobile robots and manipulators	- Evaluate state-of-the-art literature on obstacle avoidance and whole-body motion planning - Propose development methodology on obstacle avoidance and whole-body motion planning - Develop functions based on obstacle avoidance and whole-body motion planning - Test and debug in simulation and actual equipment	- Proficient in Linux, ROS - OpenCV, ROS2 preferred	Student will perform a literature review on obstacle avoidance and whole-body motion planning for mobile manipulators and propose a few approaches to implement these algorithms for collision avoidance in dynamic environments. He/She should be able to set up a simulation environment for testing development. Lastly, the algorithms developed should be tested and debugged on the actual robot for trials in a lab setting.	ARTC	Autonomous Systems & Robotics	Li Zhen Lee	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Engineering and Technology	1
175	Optical coherence tomography for wafer inspection.	Originally developed for ophthalmologists, optical coherence tomography can extend its applications beyond the biomedical field and find utility in modern manufacturing inspection processes. This non-invasive, high-resolution imaging technique ensures product quality and precision. Manufacturers can employ this technology to scrutinize materials, surfaces, and structures with micrometer-level resolution, enabling the detection of imperfections, defects, and irregularities that might be imperceptible to the naked eye. Optical coherence tomography possesses several properties that make it suitable for wafer inspection. In this project, we are exploring the use of optical coherence tomography for defect inspection of wafers. Our aim is to study the properties of the light source that are beneficial for this application.	1. Student will be able to build classical optical instrumentation apparatus 2. Student will be able to have an overview of the industrial needs for inspection of wafer 3. Student will be able to apply machine learning algorithms to defect inspection.	1. Understand and build a classical experimental setup 2. Perform the experiment and summarized the results	1. Enjoy practical problem solving and programming. 2. Taken at least a semester course on digital signal processing, or equivalent.	Refer to roles and responsibilities	SIMTech	Optics and Imaging Systems (OIS)	Seck Hon Luen	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
176	Optimising low frequncy hydrophone calibration system	Hydrophones are underwater microphones and underwater noise pollution measurements is gaining importance due to its effect on marine animals. To ensure that the sensor measurements remain accurate, calibration systems are required to calibrate sensors periodically. NMC has a low frequency hydrophone calibration system. The focus of this project is to evaluate the uncertainties of the hydrophone calibration system and optimise the system for higher accuracy and reliability.	1. Understand the working principles of hydrophones 2. Understand the different sources of uncertainties in physical measurements 3. Fundamental understanding of the concept of calibration 4. Introduction to instrumentation systems 5. Introduction to Design of Experiments 6. Hands on experience to operate a hydrophone calibration system 7. Appreciation of the importance of measurement traceability	1. Literature survey of the working principles of hydrophones 2. Literature survey of the working principles behind hydrophone calibration system 3. Operation of the hydrophone calibration system 4. Finding an optimal configuration for the hydrophone calibration system 5. Propose improvements to the operating procedures 6. Other administrative work	1. Basic knowledge of statistics 2. Background in electrical engineering or familiarity with instrumentation systems 3. Interest to learn, curious mindset, good attitude	1. Literature survey of the working principles of hydrophones 2. Literature survey of the working principles behind hydrophone calibration system 3. Operation of the hydrophone calibration system 4. Finding an optimal configuration for the hydrophone calibration system 5. Propose improvements to the operating procedures 6. Other administrative work	NMC	ACT	Ng Wee Hoe	8 Cleantech Loop, #01-20, Singapore 637145	Engineering and Technology	1
177	Optimization of acetate metabolism for production of high-value chemicals	Various microbial hosts will be tested to determined the best production host to produce a target chemical from acetate. Thereafter, the chosen strain will be engineered for stability and higher production rate of the target chemical. The engineered strain will be used for scale-up fermentation.	The student will learn basic molecular biology techniques such as cloning, growing starter cultures, and gel purification. He/she will also learn how to run and analyze enzyme assays.	The student is expected to learn basic molecular biology techniques and setting-up enzymatic assays. He or she is also expected to practice good and safe laboratory practices as well as record keeping.	The student is expected to have attended university-level biochemistry and/or chemistry laboratory classes (hands-on).	The student is expected to perform basic molecular biology techniques and run basic enzymatic assays. He/she is expected to adhere to good and safe laboratory practices as well as record keeping.	ISCE²	Chemical Biotechnology and Biocatalysis (CBB)	Wong Fong Tian	#07-01 Neuros Building	Biomedical Sciences	1
178	Optimizing ansatz for variational quantum algorithms	This project aims at understanding and optimizing the design of the parameterized Ansatz for solving engineering problems. The general-purpose hardware efficient ansatz is built for current hardware, but it is inefficient for practical applications and is also exposed to scaling problems such as barren plateau.	Understanding and optimizing the design of the parameterized Ansatz for solving engineering problems	Running simulator models and programs	Basic familiarity with the Dirac notation and basic concepts related to quantum computing (Nielsen and Chuang, 2010)	The scope of the project involves constructing and testing Ansaetze specifically designed for solving engineering equations.	IHPC	Fluid Dynamics	Fong Yew LEONG	1 Fusionopolis Way, Connexis, S138632	Computing and Information Sciences	2
179	Optimizing Branched DNA Amplification strategies for FISH experiments in 2D cultures.	The project adapts branched DNA amplification strategies to our in-house FISH encoding probe construct.	At the end of the attachment, students will learn various techniques such as mammalian cell culture, fluorescence in situ hybridization (FISH), fluorescence microscopy and data quantification. They will also learn how to design experiments for assay optimization and development.	Student is required to keep an accurate and detailed experimental log for work relating to this project. Student must ensure that proper PPE is put on while in the lab.	Prior experience with techniques involved highly preferred. Fundamental knowledge of techniques would be good. Attention to detail is desired. Student is also required to have excellent organisation capabilities, and be able to plan experiments ahead of time and execute them.	Students will have to maintain cell lines for experiments, propose and test different parameters for optimization. At the end of the project, a short presentation regarding the work done is expected.	GIS	Laboratory of Single-Cell Spatial Neuromics	Jinyue Liu	60 Biopolis Street, Genome, Singapore 138672	Biomedical Sciences	1
180	Overcome TME-induced T cell exhaustion to augment anti-breast cancer immunity	Tumor microenvironment (TME) is hostile to infiltrating T cells. Infiltrated T cells in the tumor microenvironment will undergo functional disability, loss of stemness and terminal exhaustion. In the breast cancer subtype, tumor hypoxia, persistent antigen activation and other features of tumor microenvironment causes dysfunction and exhaustion of infiltrating T cells, which is the leading reason for failure of immunotherapies in breast cancer treatment. We developed an in vitro co-culture system to model breast cancer microenvironment, which quickly drives T cells to terminal exhaustion. We identified a few gene targets that regulate T cell differentiation and exhaustion. Genetic ablation and pharmacological inhibition of these targets reduced T cell exhaustion and boosted tumor responses to immunotherapies. We are currently validating the potential of these genes as therapeutic targets in mouse models. We are also investigating the mechanism with high throughput sequencing and molecular experiments.	Molecular experimental skills, including western blot and flow cytometry to analyze protein expression, qPCR to analyze mRNA level, Chromatin-immunoprecipitation 2) Processing of cultured cells and tissues for RNA/DNA isolation. Preparation of samples for genomic/transcriptomic sequencing.3) Basic skills for analysis of bioinformatic data, e.g., RNA-seq and ChIP-seq data.	Students will help process cell/tissue samples, extract nucleotides or proteins and run the downstream molecular experiments; Students will help with some data analysis of qPCR, RNA or Chromatin sequecing data; Students will help manage the daily running of the lab	Undergraduate in biomedical/life science	Students will be trained for bio-safety protocols, basic bio-experiment skills as well as biomedical data analysis. Students will work closely with the supervisor to design and perform the biological experiments and help with data analysis and ingestion. Students are encouraged to manage the expeirment schedule independently and communicate with supervisor frequently. Students are also encouraged to do literature research, summarize data, generate and share ideas.	GIS	Laboratory of Precision Cancer Medicine, Yu Qiang's group	Ma Shijun	60 Biopolis St, Singapore 138672, Genome-lvl6	Biomedical Sciences	1
181	Passive device fabrication and characterization for future GaN MMIC design	Monolithic microwave integrated circuit (MMIC) is a type of integrated circuit (IC) device that operates at microwave frequencies (300 MHz to 300 GHz), it normally consists of active GaN HEMT transistor and some passive device such as resistor, capacitor and conductor etc. Design and characterize these passive device in the HEMT device fabrication process will be the starting point to build the MMIC chip in the future. This project will design some basic passive device pattern, fabricate though Fab process, then perform electrical characterization of these test pattern, extract passive device model for future MMIC design.	1. what are the passive devices used in MMIC design 2. how to use layout software to design the passive devices 3. how to characterize the passive devices 4. how to extract passive device model	1. Work with research engineer/scientist on passive device design 2. Follow up on the passive device fabrication 3. Perform electrical measurement for passive devices 4. Work with research engineer/scientist on passive device modeling	1. Basic layout drawing knowledge 2. Basic electrical measurement knowledge 3. Basic modelling concept	1. Layout drawing for passive devices 2. Follow up with research engineer/scientist on the mask making/wafer fabrication 3. Characterization measurement for passive devices 4. Follow up with research engineer/scientist on model extraction	IME	NGTC	Gao Yuan	4 Fusionopolis Way, Singapore 138635, Kinesis Building	Engineering and Technology	1
182	Personalized video generation with diffusion models	Diffusion models have been successfully developed to generate general-themed images and videos. It is highly desirable to generate personalized videos, especially, videos that feature a particular subject (e.g. Keanu Reeves or Blackpink Lisa), which may not be authentically generated with the pretrained diffusion model. We will implement novel diffusion controller modules to condition the generated video frames, so that a desired subject is presented in the videos. This project will be an extension of our in-house personalized method for 2D image generation.	Acquire the basics of diffusion models, especially the techniques for video generation, and how to address common challenges.	Curate training video data, evaluate baseline methods, run experiments	Python programming, github usage, common Linux toolchain.	Diffusion models have been successfully developed to generate general-themed images and videos. It is highly desirable to generate personalized videos, especially, videos that feature a particular subject (e.g. Keanu Reeves or Blackpink Lisa), which may not be authentically generated with the pretrained diffusion model. We will implement novel diffusion controller modules to condition the generated video frames, so that a desired subject is presented in the videos. This project will be an extension of our in-house personalized method for 2D image generation.	IHPC	CI	Li Shaohua	Level 15, Fusionopolis North	Computing and Information Sciences	1
183	Photoresponsive Sustainable Hydrogel Platform for Desalination	This student project is working towards the development of a sustainable 3D network hydrogel platform for efficient solar desalination. The light responsive hydrogels will be fabricated by incorporating spiropyran-containing carbon nanotubes (SP-CNTs) within the porous polyacrylic acid hydrogels. Such a design will enable formation of strong hydrogels that can absorb and release multiple ions, by virtue of the hydrophobic/hydrophilic photoswitching of the spiropyran units. The capture and release of salts can be effectively operated by visible light irradiation, thereby introducing a renewable and economical hydrogel system with high recyclability for the application field of solar-driven water purification.	Students will learn basic synthetic chemistry techniques such as organic synthesis, polymer and materials synthesis. He/she will learn how to design, perform and monitor chemistry experiments, and subsequently purification and data characterization experiments may be performed. Students will be exposed to state-of-the-art instruments in chemicals and materials synthesis.	1. Perform literature review 2. Data analysis, presentation and reporting. 3. Strong willingness to learn, communicates well, team player and independent.	The student is expected to have attended university-level chemistry laboratory classes (hands-on).	The student is expected to perform basic chemistry experiments. He/she is expected to adhere to good and safe laboratory practices, as well as record keeping.	ISCE²	Green Chemistry (GC)	Ken Lee	1 Pesek Road, Jurong Island	Physical Sciences	1
184	Physics-AI Models for Improved Now-casting and Forecasting	Weather prediction in tropical areas like Singapore is complex, and physics-based models like Numerical Weather Prediction and data-driven methods like Generative AI have been applied for fore-casting and now-casting for different time-scales respectively. We seek to develop a Physics-informed ML approach whereby we utilize physics-based model outputs in synergy with data-driven models to produce more accurate, blended outputs that combine the best of both approaches. Models and methods will be tested on Singapore-specific open-source data and on data from other collaborators.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow for processing numerical weather prediction outputs and building data-driven AI models. 2. Student will learn how neural networks work, and be able to edit and run such models based on latest literature. 3. Student will learn basics of generative AI, including the implementation of such models.	1) Literature review 2) Implement and run Python code for data-driven now-casting of weather based on satellite and radar images and latest generative AI methods. 3) Implement and run Python code for processing outputs from numerical weather prediction for these systems and benchmarking of results to literature. 4) Implement and test methods to blend outputs and models from both physics-based models and data-driven AI models to improve predictive performance.	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data science/engineering.	1) Literature review 2) Implement and run Python code for data-driven now-casting of weather based on satellite and radar images and latest generative AI methods. 3) Implement and run Python code for processing outputs from numerical weather prediction for these systems and benchmarking of results to literature. 4) Implement and test methods to blend outputs and models from both physics-based models and data-driven AI models to improve predictive performance.	CFAR	Fluid Dynamics / CFAR	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Physical Sciences	1

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	**Project Title**	**Project Description**	**Learning Outcomes for Students**	**Roles and Responsibilies of Student**	**Students' pre-requisites**	**Job Description for Student**	**Research Institute of Internship Supervisor**	**Department of Internship Supervisor**	**Name of Internship Supervisor**	**Workplace Address**	**What is the project's research category?**	**No. of Students Required**
185	Physics-AI Models for Improved Weather Now-casting and Forecasting	Weather prediction in tropical areas like Singapore is complex, and physics-based models like Numerical Weather Prediction and data-driven methods like Generative AI have been applied for fore-casting and now-casting for different time-scales respectively. We seek to develop a Physics-informed ML approach whereby we utilize physics-based model outputs in synergy with data-driven models to produce more accurate, blended outputs that combine the best of both approaches. Models and methods will be tested on Singapore-specific open-source data and on data from other collaborators.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow for processing numerical weather prediction outputs and building data-driven AI models. 2. Student will learn how neural networks work, and be able to edit and run such models based on latest literature. 3. Student will learn basics of generative AI, including the implementation of such models.	1) Literature review 2) Implement and run Python code for data-driven now-casting of weather based on satellite and radar images and latest generative AI methods. 3) Implement and run Python code for processing outputs from numerical weather prediction for these systems and benchmarking of results to literature. 4) Implement and test methods to blend outputs and models from both physics-based models and data-driven AI models to improve predictive performance.	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data science/engineering.	1) Literature review 2) Implement and run Python code for data-driven now-casting of weather based on satellite and radar images and latest generative AI methods. 3) Implement and run Python code for processing outputs from numerical weather prediction for these systems and benchmarking of results to literature. 4) Implement and test methods to blend outputs and models from both physics-based models and data-driven AI models to improve predictive performance.	IHPC	Fluid Dynamics	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Physical Sciences	1
186	Physics-based deep learning for financial time series forecasting	The Transformer has garnered significant interest in the realm of deep learning, particularly in timeseries forecasting. Nonetheless, the deployment of deep learning models based on Transformers has stirred controversy. A recent study highlighted that using Transformers in specific timeseries scenarios can lead to data loss, rendering the model unsuitable for accurate forecasting. In this project, we conduct a comprehensive examination of cutting-edge Transformer-based models, evaluating their efficacy and accuracy in forecasting financial timeseries. We also delve into the application of physics principles to mitigate information loss.	The successful candidate will be exposed to various AI/ML techniques, including learning about data visualization and analysis. They will also discover how to integrate physics knowledge into AI/ML model to address training data scarcity and to improve modeling accuracy.	The successful candidates will conduct a literature review to understand the problem statement and the research gap. They will develop numerical codes (preferably in Python) for data analysis and data visualization. They will evaluate the performance of several Machine Learning models. In the end, the student will need to submit a short project report indicating the key findings.	The project would be suitable for candidates who have basic knowledge in Thermodynamics and Statistical Physics. Experience in numerical coding and machine learning would be considered a plus for this research project.	We are seeking highly motivated students with a keen interest in AI/ML research, particularly those enthusiastic about addressing critical challenges in the field, such as limited training data, model interpretability, and prediction uncertainty.	IHPC	CI	Joyjit Chattoraj	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Computing and Information Sciences	1
187	Physics-informed learning in fusion turbulence	Understanding the plasma dynamics in confined plasmas is crucial to the successful design of a nuclear fusion reactor, which promises sustainable baseload electricity generation. Machine learning tools, such as neural networks, can be combined with physics constraints and governing equations to accelerate understanding of these complex systems. We will use numerical simulations of reduced plasma systems derived from the gyrokinetic equations to train physics-informed neural networks and assess their effectiveness in modelling such systems.	Understand how plasma simulations are performed; Understand how physics-informed neural networks work and how to train them for fusion-relevant problems; Practise conducting scientific analysis to assess neural network effectiveness and trends underlying simulation data	Design and perform numerical simulations of reduced plasma systems relevant to nuclear fusion reactor operation; Train neural networks using simulation data to model such plasma systems; Assess network training effectiveness and identify pertinent trends in simulation data	Computational/programming skills and interest in plasma dynamics	The student will need to gain familiarity with machine learning software used to implement physics-informed neural networks. He/she will perform simulations of reduced plasma systems to generate data for neural network training. The student will then assess the effectiveness of the training process and determine the network's ability to capture key trends.	IHPC	Fluid Dynamics	Ronald Chan	1 Fusionopolis Way, #16-16 Connexis	Physical Sciences	1
188	Physics-Informed ML for Modelling our World	Many complex phenomena in nature of relevance to science and engineering (e.g. animal skin patterns / urban wind flow) are governed by dynamical systems and seemingly simple differential equations. While useful, identifying the exact parameters that describe these systems from limited data is very difficult, even as simulating these models themselves can be very computationally expensive. Hence, we seek to investigate the effectiveness of physics-informed ML methods as a potentially less computationally expensive and more accurate route to modelling such systems in both a forward meta-modelling setting and an inverse inference setting.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow. 2. Student will learn how neural networks work, and be able to edit such physics-informed models building on prior published work. 3. Student will also learn basics of differential equations and dynamical system modelling, and methods to solve them via numerical simulations.	1) Literature review 2) Numerical simulation of different real-world-inspired ODE/PDE-governed biological, engineering or dynamical systems (e.g. fluid dynamics, weather prediction models, Turing systems) 3) Train a physics-informed neural network for forward prediction of model systems (as in 2) and potential inverse inference of parameters defining these systems and benchmark to literature	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data science, differential equations and numerical methods.	1) Literature review 2) Numerical simulation of different real-world-inspired ODE/PDE-governed biological, engineering or dynamical systems (e.g. fluid dynamics, weather prediction models, Turing systems) 3) Train a physics-informed neural network for forward prediction of model systems (as in 2) and potential inverse inference of parameters defining these systems and benchmark to literature	CFAR	Fluid Dynamics / CFAR	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Engineering and Technology	1
189	Physics-Informed ML via Differentiable Physics Models for Inverse Inference from Limited Sensor Placements	Inverse modelling is of relevance to many industries, including source/contaminant inference across diverse settings such as chemical dispersion in industrial plants, rotting food detection (ethylene gas dispersion) in Agritech, airborne infectious disease transmission in urban scenarios, and defect detection in non-destructive testing. However, the physics is complex while data (typically obtained via sensors) is scarce, and has uncertainty. Hence, this project will focus on using differentiable physics models to develop physics-informed ML methods to solve such inverse problems, and subsequently, to select optimal sensor/data locations for such inverse problems.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow. 2. Student should be able to explain how machine learning models such as neural networks work, and be able to write code to implement said techniques. This should be transferable skills for any future projects the student might be interested in. 3. Student will also learn basics of numerical simulation, including basic finite difference, and be able to modify said models in a differentiable physics framework	1) Literature review 2) Implement and run Python-based numerical simulation of different ODE/PDE-governed engineering systems for inverse modelling 3) Train a neural network for inference of parameters based on simulated data for parametric set of scenarios from (2) 4) Implement algorithm to optimize sensor placements to minimize inversion error given limited sensor budget and prior on potential distribution of scenarios.	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data science and analytics	1) Literature review 2) Implement and run Python-based numerical simulation of different ODE/PDE-governed engineering systems for inverse modelling 3) Train a neural network for inference of parameters based on simulated data for parametric set of scenarios from (2) 4) Implement algorithm to optimize sensor placements to minimize inversion error given limited sensor budget and prior on potential distribution of scenarios.	IHPC	Fluid Dynamics	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Engineering and Technology	1
190	Physics-Informed ML via Differentiable Physics Models for Inverse Problems	Inverse modelling is of relevance to many industries, including source/contaminant inference across diverse settings such as chemical dispersion in industrial plants, rotting food detection (ethylene gas dispersion) in Agritech, airborne infectious disease transmission in urban scenarios, and defect detection in non-destructive testing. However, the physics is complex while data (typically obtained via sensors) is scarce, and has uncertainty. Hence, this project will focus on using differentiable physics models to develop physics-informed ML methods to solve such inverse problems, and subsequently, to select optimal sensor/data locations for such inverse problems.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow. 2. Student should be able to explain how machine learning models such as neural networks work, and be able to write code to implement said techniques. This should be transferable skills for any future projects the student might be interested in. 3. Student will also learn basics of numerical simulation, including basic finite difference, and be able to modify said models in a differentiable physics framework	1) Literature review 2) Implement and run Python-based numerical simulation of different ODE/PDE-governed engineering systems for inverse modelling 3) Train a neural network for inference of parameters based on simulated data for parametric set of scenarios from (2) 4) Implement algorithm to optimize sensor placements to minimize inversion error given limited sensor budget and prior on potential distribution of scenarios.	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data science and analytics	1) Literature review 2) Implement and run Python-based numerical simulation of different ODE/PDE-governed engineering systems for inverse modelling 3) Train a neural network for inference of parameters based on simulated data for parametric set of scenarios from (2) 4) Implement algorithm to optimize sensor placements to minimize inversion error given limited sensor budget and prior on potential distribution of scenarios.	CFAR	Fluid Dynamics / CFAR	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Engineering and Technology	1
191	Plasma Hybrid Process Development for Component Cleaning and Reconditioning	In this project, our goal is to develop a plasma hybrid process, which is specifically designed for cleaning and reconditioning of various product components, enabling their subsequent circular pathways. The technology will possess several key features, including: 1. Deep cleaning of component surfaces: The technology will be capable of effectively cleaning all surface areas of a component, even those with complex geometries, and ensure thorough removal of contaminants. 2. Limited chemical usage and high energy efficiency: To promote sustainability, the technology will employ a minimal amount of chemicals while ensuring high energy efficiency. This approach minimizes environmental impact and conserves resources. 3. Simultaneous surface cleaning and activation: The technology will enable both surface cleaning and activation in a single step. This streamlined process enhances efficiency and reduces the overall time required for reconditioning.	The attached student will learn to improve research methodologies including data collection and intepretation, material characterisation and analysis through hands-on experience with laboratory techniques and equipment, and enhance his/her critical thinking and problem solving skills. Findings will need to be presented routine in wirtten and oral presentation, and the attached student can look to enhance written and oral communication skills for effective scientific communication.	The attached student should go through HSE induction and briefing and ensure safety compliance at all time during duration of attachment. Other than the relevant literature review, the student is expected to plan and conduct the relevant experiements for data gathering and document the observation and findings carefully. Results, discussion and conclusions should be organised, presented clearly in written form or oral presentation.	N.A.	1. Literature review of exisiting and state-of-the-art technologies in Deep cleaning of component surfaces for complex geometries 2. Design of cleaning methods for tight crevices for removal of stubborn contaminants and fabrication of prototypes as necessary 3. Optimisation of cleaning method developed	SIMTech	Surface & Circular Processing (SCP)	Wenjin Yan	Singapore Institute of Manufacturing Technology (SIMTech) @ CTZB 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
192	Predicting printed parts' quality from monitoring data	Current research on quality control of 3D printed parts is mainly from an experimental aspect, therefore, is slow and costly. We will focus on building a relationship between the monitored data and the porosity of printed part. Therefore, design of experiments and their printing, high-resolution X-ray CT, image analysis and detection algorithm, and self-supervised deep learning strategy will be adopted to realize the target. The aim of this project is to finally give a cheap and fast solution for the qualification of printed parts for better industrial adoption.	(1)Understand the powder bed fusion (SLM & EBM) technology. (2)Understand the microstructure characterization for 1 or 2 materials. (3)Master how to do image processing. (4)Master how to use machine learning. (5)Working with the supervisor to prepare one journal paper. (6)Establish research capability and writing skills for further studies. (7)Experience real R&D work environments and involve in projects with industry."	The student will be involved in the 3D printing study. Detailed as follows (1)Must display good teamwork. (2)Carry out a literature review on the current state of art. (3)Help in the 3D printing process. (4)Apply machining learning to analyze the results. (5)Carry out experimental validation. (6)Carry out sample preparation.	CGPA > 4.0.	The student will be involved in the 3D printing study. Detailed as follows (1)Must display good teamwork. (2)Carry out a literature review on the current state of art. (3)Help in the 3D printing process. (4)Apply machining learning to analyze the results. (5)Carry out experimental validation. (6)Carry out sample preparation. In addition, the student may also allow the use high-performance computing resource in the National supercomputing center (NSCC) in Singapore (depending on the student's capacity). The student should intend to explore new knowledge. Experience in metallurgy and/or 3D printing and/or machine learning and/or image processing would be a plus point(s).	SIMTech	Additive Tech Innovation (ATI)	Wang Pan	JTC CleanTech Two Block A, 3 Cleantech Loop, Singapore 637143	Engineering and Technology	1

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilities of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
193	Process development of nanomagnetic particles synthesis and the formation of stable nanofluid	The project scopes are to establish material and process for stable ferrofluid formation and demonstrate a passive cooling system with developed ferrofluid. Ferrofluid is a stable colloidal suspension of nanoscale ferromagnetic or ferrimagnetic particles in a carrier liquid. When preparing a ferrofluid, it is essential to avoid that the particles agglomerate and settle. The current methods to maintain the stability of nanofluids are mainly changing the preparation method or adding surfactants. In the project we will benchmark in-house synthesized Ferromagnetic nano particles with commercial ones by dispersing in different carrier fluids with added surfactants through stability evaluations such as zeta potential method, sedimentation, and spectral absorbance analysis, etc. the established material and process will be used to demonstrate a passive cooling system for thermal management of electric motors	The attached student will learn how to perform literature review, writing of proper lab records, experimental data and report. To perform systematic scientific investigation and studies through hands-on experience with laboratory techniques and equipment and enhance his/her critical thinking and problem-solving skills.	Attend HSE induction and briefing to ensure that safety is of priority in lab works. Plan and conduct experimental works (process and characterisation) and document observations and findings. Compile and present results in report and presentation format.	N.A.	1)Literature Review of state-of-art Fe3O4 nanoparticle synthesis methodologies. 2)Literature review of existing processes for Ferromagnetic nano particles dispersing in different carrier fluids using different surfactants. 3)Perform lab tests to prepare ferrofluids and evaluate their stabilities. 4)Final report detailed process and testing results"	SIMTech	Surface & Circular Processing (SCP)	Min Qian	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
194	Process Interruptions in 4H-SiC Epitaxial Growth for Defect Reduction	Join our internship program to explore the fascinating realm of wide bandgap Silicon Carbide (SiC) technologies. We propose to perform an extensive study at IME on how process disruptions during pre- and post-buffer layer epitaxial growth affect 4H SiC defect reduction. In order to meet the demands of a wide range of semiconductor applications, including high-power and high-temperature electronics, this research aims to improve the quality of epitaxially grown SiC substrates. Shaping the future of high-power electronics innovation, pioneers the driving algorithms that reinvent energy optimization. Apply now to the upcoming significant development in wide bandgap SiC technology.	1. Investigate how process interruptions affect defect density in 4H SiC. We will examine the types of defects formed, including dislocations, stacking faults, and assess their density and distribution. This will provide insights into how interruptions influence defect nucleation and propagation. 2. Identify optimal interruption strategies to reduce defects and enhance epitaxy quality: We will explore various interruption durations, interruption points within the epitaxial growth process, and the effects of temperature during interruptions. By systematically varying these parameters, we aim to optimize the conditions that lead to the lowest defect density. 3. Based on our findings, we will provide specific guidelines for process optimization. These findings will be valuable to researchers and engineers involved in SiC epitaxial growth, enabling them to produce high-quality SiC epitaxy with reduced defects.	1) Involved in the high-quality SiC epitaxy growth 2) Use the epitaxy characterization techniques: Defect characterization using photoluminescence (PL Surface Scan), thickness measurement using FT-IR and doping concentration using Hg-CV measurement. 3) Data Analysis: Analysis of the data collected during the experiments. This analysis will help us to draw valuable conclusions about the relationship between process interruptions and defect formation.	Electronics and/or semiconductor devices physics background	1. Involved in the epitaxy growth using the LPE 108 epitaxy tool. 2. Defect, epitaxy thickness and doping characterization. 3. Analyze the data and write the manuscript/report.	IME	APM	Shiv Kumar	4 Fusionopolis Way, Kinesis Tower, Level 10, Singapore 138635	Engineering and Technology	1
195	Profiling of End-of-Life Components and Processes for Circular Economy	As various products reaches their end of life (EoL), valuable components on scrap from these EoL products offer a potential source of high quality and green materials. With increasing complexity in the material composition use, the market lacks a material profiling framework to characterise the recoverable materials of the various components. In this project, profiling of the EoL components will be performed; the constituent materials of the components and the conditions of sub-components and materials will be examined. We will also be looking to develop a framework, build the knowledge graph and establish the database to assess its conditions, then recommend the suitable "r" route based on availability of the enabling "r" processes (reuse, repair, remanufacture, repurpose, recycle etc). Using specific use cases, the project will investigate for a particular EoL component - what materials it is made of , in a what condition or state is it in, and is suitable for which "r" route for	The attached student will learn to improve research methodologies including data collection and interpretation, material characterisation and analysis through hands-on experience with laboratory techniques and equipment, and enhance his/her critical thinking and problem solving skills. Findings will need to be presented routine in written and oral presentation, and the attached student can look to enhance written and oral communication skills for effective scientific communication.	The attached student should go through HSE induction and briefing and ensure safety compliance at all time during duration of attachment. Other than the relevant literature review, the student is expected to plan and conduct the relevant experiments for data gathering and document the observation and findings carefully. Results, discussion and conclusions should be organised, presented clearly in written form or oral presentation.	Nil	The scopes of the project comprise of: 1)Literature Review of existing assessment framework for the condition of the various stream of (end-of-life) materials. 2)Literature review of existing processes for various R process available for certain sub-component from the composite floorboard and/or airframe 3)Eat pieces of information from the assessment framework and existing processes into a profile map 4)Material characterisation of the samples of EoL components to input these data into the framework / map	SIMTech	Surface & Circular Processing (SCP)	Shuyun Chng	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
196	Protein-protein interaction machine learning model	Developing protein-protein interaction machine learning model	protein-protein interface modeling, machine learning	collect data of protein-protein complexes, explore machine leearning models for data analysis	good at linux, shell scripting, python/perl programming, have experience in machine learning	full time, at least 4 month	BII	BSMD	Hao Fan	30 Biopolis Street, Matrix #07-01, Singapore 138671	Computing and Information Sciences	1
197	Quantum interferometer and its application	The project is related to interferometry of correlated photon pairs often referred as quantum interferometry. This technique is developed for a number of metrology applications, including infrared (IR) spectroscopy, IR imaging and IR polarimetry. Thus, the method of quantum interferometry is extremely promising in environmental control and bio-tissue analysis. Current project will be focused in IR micro-spectroscopy to preform hyperspectral imaging of a specimen in a broadband IR range including mid and far-IR ranges. Using the quantum interferometry technique, we will study various samples (liquids, tissues) and modification of their properties at the IR range over time.	•Gaining knowledge in the quantum mechanics and quantum optics fields; •Obtaining or mastering skills on the experimental work in optics laboratory; •Improvement of scientific writing of scientific presentation skills; •Experience in communication with a multi-disciplinary research team;	The project will involve both experimental and theoretical work on quantum optics. The student will be responsible for his/her own small research project related to quantum optics and nonlinear interferometry. The work will include building experimental setups (using lasers, linear optics, detectors, etc.), acquiring experimental data and analysing of the obtained experimental data. Based on the analysis the student is expected to make primary conclusions and put a summary of the work in a written or presentation forms. The student is also expected to fully comply with the safety requirements while working in the laboratory to keep him/herself and everyone around safe.	•Undergraduate student in Physics, Optical Engineering, Mechanical Engineering, or in related fields; •Knowledge in laser physics, nonlinear optics; •Experience in working with optics laboratory instrumentation; •Experience in simple Python coding for the data analysis; •Proficient with Microsoft Word, Microsoft Excel and Microsoft PowerPoint; •Ability to communicate effectively and clearly with the team,	•Participate in build experimental setup in the laboratory related to quantum optics and nonlinear interferometry together with the team members; •Perform simple automation of the experimental setup by software programming of scientific instruments, such as translation stages, sensors et al; •Participate in experiments on nonlinear optics and interferometry for applications in IR spectroscopy together with the team members;	IMRE	QTE	Anna Paterova	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
198	Quantum nanosensing with diamond NV centers in scanning nanoprobes	This project will be integrated with our ongoing research efforts to perform quantum sensing using specially-designed diamond nanoprobes with nitrogen-vacancy (NV) centres. The NV centers are well-suited for high-precision quantum sensing, especially of magnetic fields. We are developing a quantum nanosensing platform based on these nanoprobes mounted on an atomic force microscope (AFM) platform, aiming to investigate novel sensing modes involving the coupling of the magnetic field to nanomechanical oscillations.	- In-depth knowledge of diamond colour centres and the mechanisms underlying their sensing capabilities - Experimental techniques, including optics, lasers, AFM - Experience in instrumentation design, building, automation, and testing - Able to plan and execute experiments, document and analyse data, and communicate results - Related engineering skills, e.g. electronics, programming, hardware assembly	- Diamond nanoprobe development, including design, assembly, and optical characterization - Upgrading of AFM platform, including the integration of necessary optics, electronics, RF components, software programming, etc required for NV centre investigations - Magnetic field sensing experiments to investigate the coupling of NV centres to nanomechanical oscillations	Physics or engineering	- Diamond nanoprobe development, including design, assembly, and optical characterization - Upgrading of AFM platform, including the integration of necessary optics, electronics, RF components, software programming, etc required for NV centre investigations - Magnetic field sensing experiments to investigate the coupling of NV centres to nanomechanical oscillations	IMRE	QTE	Victor Leong	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
199	Question Answering within Long, Structured Documents	In today's information-rich world, access to accurate and relevant information is vital. However, traditional search engines and document retrieval systems often struggle to provide concise answers from extensive and organized documents such as PDF files. This project addresses that challenge by focusing on the development of Question Answering (QA) system designed specifically for long, structured documents.	Gain hands-on experience in developing advanced Natural Language Processing (NLP) models. Contribute to a project with real-world applications in information retrieval and document analysis. Collaborate with a dedicated team of experts who are passionate about NLP and AI. Learn about the complexities of handling structured data and developing efficient QA systems.	Data Collection and Preprocessing, Model Development, Evaluation and Validation	Python programming and fundamental knowledge of Machine Learning (ML) and Natural Language Processing (NLP)	Data Collection and Processing: The studnet will contribute to the gathering and preprocessing of long, structured documents, such as research papers, and technical manuals. Understanding the unique formatting and content structure of these documents is essential. Model Development: Work alongside our team of experienced researchers and engineers to develop and fine-tune a specialized QA model capable of efficiently extracting accurate answers from these complex documents. Evaluation and Validation: Evaluate the model's performance rigorously, employing real-world documents and questions.	IHPC	CI	Gao Fei	1 Fusionopolis Way, #16-16 Connexis, Singapore 138632	Computing and Information Sciences	1
200	Revealing the Nanoscale Reorganization of Cancer Cell with Advanced Imaging Intelligence	Many cancer cells are found to develop abnormal cellular structures at nanoscale comparing to healthy cells, such as extensive protrusions from the cell membrane and wrinkled nucleus. Despite its significance, our understanding of the mechanisms underlying such nanoscale morphological alteration is still limited. Consequently, new techniques are necessary to provide high-resolution, real-time imaging of this process in 3D.	Development of an intelligent imaging system for cancer cell study	In this project, the student will co-develop an advanced imaging platform to analyse the growth patterns of cells on various types of nanostructures, enhanced by artificial intelligence (AI) algorithms.	None	Refer to roles and responsibilities	SIMTech	Optics and Imaging Systems (OIS)	Tan Piau Siong	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
201	Scalable Optimisation Algorithms with Artificial Intelligence for Rapid Convergence	The practical problems that would benefit from numerical optimisation are often plagued with a wide range of inter-dependent decision variables. As the number of decision variables increase, the dimensionality of a numerical optimisation problem also increases in a manner that affects the difficulty of solving the problem in an exponential manner. Developing algorithms and strategies that can be used for large & complex problem is the critical development effort that allows these algorithms to be practically implemented to give very tangible benefits. The project will take classical optimisation algorithms and enhance them with modern artificial intelligence. An example could be the use of an artificial neural-network to guide search-based algorithms.	The student will develop various technical skillsets which include (but not limited to): scientific programming, optimization algorithms, machine learning, artificial intelligence, and problem formulation. Furthermore, the student will also gain a strong familiarity with the chosen domain of application for the algorithm that he or she will develop, such as logistics.	The student will be working with the Simulations and Optimisation team under the Digital Supply Chain group at the ARTC. The student will be expected to learn the technical skills on the job and also build an understanding of the domains of application. Under the guidance of the team, the student will be designing optimisation algorithms and implementing them in the programming language of their choice. These algorithms should perform to requirements in speed, reliability, and robustness.	Basic programming skills in one of the common languages (Python, C++, Javascript, etc.).	As part of the Simulations and Optimisation team under the Digital Supply Chain group at the ARTC, the student will: - perform scientific programming (implementing optimisation algorithms) - perform data analysis to understand the use cases the student is presented with - perform data engineering for pre- and post-processing of results - formulate numerical optimisation algorithms from real-world problem - study the state-of-the-art methods through literature review and training - design numerical strategies for rapid solution convergence, incorporating artificial intelligence where appropriate and beneficial. - support stakeholder meetings by scoping projects, presenting findings, and giving recommendations	ARTC	Digital Supply Chain	Wen Yao Lee	3 Cleantech Loop, #01/01 CleanTech Two, Singapore 637143	Computing and Information Sciences	2

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
202	Scanning Laser Doppler Vibrometer for vibration measurements	Laser Doppler Vibrometers (LDVs) have been used extensively for high accuracy measurements of vibrations at specific points. As the scanning LDV no longer points perpendicularly to the surface of interest, noise within the signals increase and uncertainties in the measurement increases. This project aims to develop a method that allows one to vary the area of accurate vibration measurements based on different accuracy requirements.	1. Understand the working principles of Laser Doppler Vibrometers 2. Understand the different sources of uncertainties in physical measurements 3. Fundamental understanding of the concept of calibration 4. Introduction to instrumentation systems 5. Introduction to Design of Experiments 6. Hands on experience to operate a laser doppler vibrometer 7. Appreciation of the importance of measurement traceability	1. Literature survey of the working principles of a scanning laser doppler vibrometer 2. Learn the operation of a scanning laser doppler vibrometer 3. Evaluate uncertainties of measurements from a scanning LDV 4. Develop a method to identify and vary the area of measurements based on different accuracy requirements 5. Other administrative work	1. Basic knowledge of statistics and/or experimental physics 2. Background in electrical engineering or familiarity with instrumentation systems 3. Basic knowledge of signal processing 4. Familiarity with python or matlab or other programming languages 3. Interest to learn, curious mindset, good attitude	1. Literature survey of the working principles of a scanning laser doppler vibrometer 2. Learn the operation of a scanning laser doppler vibrometer 3. Evaluate uncertainties of measurements from a scanning LDV 4. Develop a method to identify and vary the area of measurements based on different accuracy requirements 5. Other administrative work	NMC	ACT	Ng Wee Hoe	8 CleanTech Loop, #01-20, Singapore 637145	Engineering and Technology	1
203	Sensors and transducers enabled by smart materials	The project aims at achievements of advanced electromechanical sensor and transducer devices enabled by smart materials, and demonstration of intelligent monitoring systems using the obtained sensors and transducers in combination with data analysis algorithms and artificial intelligence.	The students will have the chance to work in a research and development team with multidisciplinary expertise and experience. They will learn one or two of the skills below, depending on individual background and interests: (1) Preparation and evaluation of smart piezo-materials; (2) Fabrication and testing of electromechanical or ultrasonic sensor and transducer devices; (3) Development of intelligent systems using the obtained sensors and transducers in combination with numerical simulation, signal processing, data analysis algorithms and/or machine learning.	The students will conduct relevant literature study, receive and pass lab trainings from safety to use of facilities, plan and complete the experimental work with guidance of the supervisor and assistances of staff members. The work scope covers one or two items as described above, depending on individual background and interests.	Education on enigineering programme, with attachment time not less than 18 weeks; Passion for science or technical innovations	The research and development job covers literature study, lab trainings from safety to equipment, experimental work on material processing, sensor design, fabrication and testing. The work scope for one student covers one or two items as described, depending on individual background and interests.	IMRE	ELE	Yao Kui	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	1
204	Simulation of fluorescence in X-ray scintillator	X-rays are an interesting part of the electromagnetic spectrum that is used in medical imaging, manufacturing inspection, and attosecond science. In this project, our primary interest lies in simulating the fluorescence resulting from scintillators when exposed to X-ray irradiation. Simulating this fluorescence can enhance our understanding of the factors that influence X-ray imaging. Consequently, we aim to identify the parameters that affect the resolution of X-ray images.	1. Students will be able to perform Python or C/C++ programming on this simulation application. 2. Students will be able to describe the basic principles of X-ray imaging, X-ray generation, and detection. 3. Student will be able to test machine learning toolboxes for this simulation.	1. Complete the simulation and perform experiments to validate the simulation results. 2. Explore the capabilities of machine learning model used in the simulation.	1. Enjoy practical problem solving and programming. 2. Taken a semester course on physics, or equivalent	Refer to roles and responsibilities	SIMTech	Optics and Imaging Systems (OIS)	Seck Hon Luen	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
205	Smart and sustainable materials towards optical function intelligence	We specialize in the development of smart and sustainable materials with a specific emphasis on optical (photonic) properties and functionalities. We focus on materials that are responsive to external stimuli, e.g. temperature and strain. Our interests also extend to sustainable biomass materials. We develop these materials by design to address challenges in emerging energy and information technologies, such as radiative cooling, smart windows, structural colors, and anti-counterfeiting labels. This project provides professional training in materials synthesis, fabrication, and characterization, aiming to push the boundaries of material science and offering undergraduate students an educational and supportive environment for their participation.	• Demonstrate aptitude and mindset for effective scientific research. • Master laboratory techniques and equipment use. • Prioritize safety by following protocols and risk assessments. • Apply critical and creative thinking for troubleshooting and proposing solutions. • Protect the research institute's confidential intellectual property.	• Design novel smart, sustainable, and functional materials. • Prepare and perform experiments. • Collect, analyze and communicate experimental results with mentor.	We are seeking students with a foundation in materials, chemistry, physics (optics), chemical engineering, biomedical engineering, or related fields. We are looking for those who show a keen interest in scientific research, a willingness to learn and contribute productively, and the ability to be independent, mature, organized, proactive, and responsible team players.	Students will be trained to develop the aptitude for planning effective experiments, mastering laboratory techniques, and utilizing advanced equipment. They will gain opportunities to practice critical and creative thinking when troubleshooting and finding solutions for unexpected results. This will provide them with relevant knowledge and skills while emphasizing the importance of ethical decision-making regarding intellectual property confidentiality.	IMRE	SOF	Ke Yujie	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
206	Smart bionic system for biomarker monitoring and on-demand therapeutics	Measuring biomarker concentrations directly inside an organism in real-time could provide a wealth of diagnostic data to transform future healthcare. This project will explore encapsulation of enzymes within a nanoscaffold to obtain a highly stable and biocompatible nanocomposite for optical or electrochemical sensing. A material innovation approach will be developed for nanoscale organization of sensing elements, rendering the wearable bionic sensors with superior operational stability. Additionally, microrobots that carry out programmable actions such as sensing, object manipulation, and enhanced navigation will be incorporated together with the sensor for on-demand therapy to develop the close-looped bionic system.	The student will be exposed to a multidisciplinary research topic, harnessing their research skills in materials science, analytical chemistry, biochemistry and bioengineering. The student will learn about biosensor design, synthesis and characterization of nanomaterials, enzyme kinetics, drug delivery and familiarize with image processing and electrochemistry skills. The student will also learn to apply the research software such as endnote, origin, image J etc as well as improve on their presentation & report writing skills. The overall aim to let the student to familiarize with the entire sensor development process from idea conceptualization to sensor optimization to prototype building.	The student will be involved in synthesis of nanostructures and hydrogels, sensing layer fabrication, sensor optimization and validation, which will be trained by the supervisor. The student will also be responsible for data analysis such as calibration, specificity evaluation, image processing, image analysis and statistical analysis, which will also be taught by the supervisor.	Understanding of basic chemistry is required. Experience in wet chemistry lab with good handling of micro pipettes, knowledge of biochemistry, electrochemistry will be preferred.	1. Conduct literature reviews; 2. Materials synthesis and basic characterizations; 3. Develop and optimize sensors; 4. Data analysis	IMRE	SOF	Zheng Xinting	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	1
207	Smart materials based multifunctional platforms for bioapplications and bioplastics	We develop novel materials based multifunctional and smart platforms for bioreleated applications, such as stimuli-triggered therapeutics delivery, biodegradable and sustainable bioplastics. In therapeutics delivery, external stimuli, such as light, ions, pH, small molecules, chemical/biocatalytic reactions, etc., could be used to trigger the assembly/disassembly of the smart platforms as well as the targeted release of therapeutics. In bioplastics, natural polymers from biomass resources will be developed into novel bioplastics with biodegradability, biosafety, recyclability, water-processability, and the capacity for reforming to contribute to the Singapore Green Plan.	• To demonstrate the right aptitude and mindset in planning and conducting effective scientific research. • To demonstrate the right skills for the required laboratory techniques, use/maintenance of cutting-edge lab equipment. • To exhibit the 'safety first' mindset by complying with lab safety protocols and standard operating procedures, aware of the relevant risk assessments. • To practice critical and creative thinking in trouble shooting and proposing solutions when experimental results produced are less than satisfactory and/or are not as hypothesized. • To protect the interest of research institute by not disclosing confidential intellectual property (IP) of the assigned project.	• Design novel multifunctional materials based smart platforms. • Prepare and perform experiments. • Collect, analyze and communicate experimental results with mentor.	Besides foundational knowledge in material science, chemistry, biology, biomedical engineering, or related field, I am looking for students who demonstrate a keen interest and passion in scientific research, have the willingness to learn and engage scientific research productively, and the ability to be good team players who are independent, matured, organized, proactive, and responsible.	In essence, student will be trained to have the right aptitude in planning effective experiments, right skills in laboratory techniques and use of cutting-edge, sophisticated lab equipment. The student will be exposed to opportunities to practice critical and creative thinking in trouble shooting and coming up with solutions when experimental results are not satisfactory as hypothesized. Gaining knowledge in and exposure to possible scientific research trends would equip students with relevant aptitude, knowledge and skills, and an appreciation of what research work entails and the importance of ethical decision making in relation to the confidentiality issues on intellectual property.	IMRE	SOF	Hu Yuwei	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	2
208	Smart Wearables for Health Monitoring	Electrocardiography (ECG), electromyography (EMG), and electroencephalography (EEG) are some significant human biopotentials for diagnosis and health monitoring. Currently, Ag/AgCl gel electrodes are widely used to measure surface biopotentials, but not suitable for long run of continuous monitoring due to signal degradation and skin irritation. Comfort electrode and smart wearables are needed for long-term biopotential monitoring. In this project, breathable fabric electrodes and smart wearable sensors will be developed to improve the comfort of continuous health measurement.	The student is expected to work with experienced research teams and learn the emerging technology of smart wearables.	To conduct experiments to prepare the materials, fabricate the sensors and test the devices.	Students with Material, Chemical Engineering, Electronics and other relevant Engineering background and research experience are welcome to apply.	Full time attachement	SIMTech	Microfluidis & MedTech Devices (MMD)	Hui Huang	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	1
209	Smart Wearables with Multimodal Sensors for Health Monitoring	Ageing population in developed countries such as Singapore give increasing demands for health monitoring of some key physiological parameters such as electrocardiogram (ECG) and electroencephalogram (EEG) for home based or decentralised care. However, there are some challenges for long-term continuous health monitoring outside laboratory due to short durability of the electrodes and obtrusive sensors uncomfortable to wear. The rapid boom in wearable electronics is driving innovations and potential applications in personal health monitoring, human motion capturing, smart manufacturing, and Internet of Things. Printed electronics pave the way for emerging flexible and wearable devices that people previously may not have thought possible. In this project, we will develop smart wearables with multimodal sensors and our printed electronics to measure the physiological signals for continuous health monitoring. The scopes of works include material and device fabrication, and sensor integration, etc..	The student may contribute to only one, or a few, or all the activities listed above, depending on the available time, his background and skills, and other factors (e.g. collaboration with other parties, time needed for fabrication, etc.)	The student will thus contribute in one or more (if possible, ideally in all) of these areas: 1) Literature Review to understand the state-of-art in flexible and stretchable electronics, their main performance parameters, the key health applications they are used in, and also to determine the possible/necessary parameters that can be monitored using such sensors; 2) Investigate what sensors are commercially available for the parameters desired to be monitored, compare their performance/specs, and finally select the best ones; 3) Purchase the sensors as well as other existing intelligent signal & data processing platforms that can be used for the control and output conditioning of the sensors; 4) Integrate the sensors and other (wearable) devices/sensors in a single platform; 5) Develop mobile apps/software code to acquire, analyze and visualize the data; 6) Assemble the final operational prototype for health monitoring; 7) Conduct subsequent practical testing of the wearable prototype.		Full time	SIMTech	Microfluidis & MedTech Devices (MMD)	Hui Huang	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Engineering and Technology	2
210	Software development of power calibration system	Using Python tkinter or other GUI Programming to develop a power calibration system.	Acquire the skills of power calibration, Python-controlled testing via serials and GPIB, and Python GUI programming.	To built up the software of a power calibration system by using Python tkinter or other GUI Programming.	Knowledge and experience of basic computer programming in Python	Learn about power calibration and develop the software for calibration,based on existing testing programs.	NMC	ETM	Yang Yan	8 CleanTech Loop, #01-20, Singapore 637145	Computing and Information Sciences	1

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
211	Solar-Driven hydrogen perioxide production as next generation hydrogen carrier	This student project is working towards the development of a highly efficient heterostructure photocatalyst for sustainable H2O2 production using renewable and abundant solar energy. The efficiency of a heterostructure photocatalyst is primarily determined by the interfacial charge transfer efficiency. However, current strategies for constructing heterojunctions often lead to suboptimal charge transfer due to random interfacial contacts between the involved photocatalysts. Working with a team of researchers, this student shall contribute towards a facile strategy to optimise the interfacial charge transfer efficiency by assembling the heterojunction on a selective facet, enabling directional and efficient charge transfer. The fabrication of such a high-performing solar-to-chemical system is in alignment with Singapore Green Plan 2030.	Students will learn basic synthetic chemistry techniques such as organic synthesis, polymer and materials synthesis. He/she will learn how to design, perform and monitor chemistry experiments, and subsequently purification and data characterization experiments may be performed. Students will be exposed to state-of-the-art instruments in chemicals and materials synthesis.	1. Perform literature review 2. Data analysis, presentation and reporting. 3. Strong willingness to learn, communicates well, team player and independent.	The student is expected to have attended university-level chemistry laboratory classes (hands-on).	The student is expected to perform basic chemistry experiments. He/she is expected to adhere to good and safe laboratory practices, as well as record keeping.	ISCE²	Green Chemistry (GC)	Ken Lee	1 Pesek Road, Jurong Island	Physical Sciences	1
212	Sparse modelling to identify biomarkers related to breast cancer therapeutic response from multi-omics data	Breast cancer (BC) is a highly heterogeneous tumor type that shows different clinical behavior and responses to same treatment. Clinical management of BC patients remains challenging due to underlying tumor subtypes (eg, LumA, LumB, Her2, Basal) with lack of specific early-stage clinical biomarkers [1]. Thus, there is an urgent need to develop robust strategies to improve diagnosis, prognosis, and treatment for early diagnosis of BC. Recent advances in multi-omics (e.g., genomics, transcriptomics, proteomics) sequencing platforms provide opportunities to study breast cancer at different molecular levels to discover novel biomarkers and identify new therapeutic targets [2, 3]. Several studies have developed machine learning methods to stratify breast cancer subtypes at single-omics level using common risk predictors [4-6]. However, single omics analyses are limited to correlations and primarily reflect reactive processes rather than causal one. Integrating different omics data may provide more biological insights, for example, further improved prediction of the breast cancer subtypes. Many data-driven approaches to multi-omics analysis are aimed at patient stratification, biomarker discovery, pathway analysis and drug discovery [2]. However, multi-omics data are high-dimensional and very noisy, and most existing studies rarely	The student will learn basic cancer biology and data analytics application.	Independent thinking, team playing and research documentation	Good programming skills in Python, R or C++ Good interpersonal skills and creativity Background in biology or molecular biology is a plus	Development and applications of codes and models to study biological omics datasets. The student will work closely with research advisor. While guidance is provided, student is required to work indepently and creatively.	BII	Analysis/HuPo (Computational Biology & Omics Lab)	Kumar Selvarajoo	34 Biopolis Street, #07-01 Matrix, Singapore 138671	Biomedical Sciences	1
213	Spectroscopy of Topological Spin Excitations in Magnetic Films	Magnetic films are recently found to host skyrmions – topologically wound spin arrangements that behave like magnetic particles. As with electrons or photons, the response of skyrmions to electromagnetic fields is determined by characteristic "resonant excitations". The nature of these resonances – typically at GHz frequencies – holds the key to the dynamic behavior of skyrmions in devices. The proposed work will use microwave spectroscopy techniques to characterize resonant excitations in thin magnetic films hosting skyrmions	The project will acquaint students with magnetism, spintronics, and device physics concepts and train them on device characterization and data analysis. It may also acquaint them with skill sets relevant to the semiconductor industry.	The candidate will perform some or all aspects of the following work: 1. Characterize magnetic thin films using microwave spectroscopy and magnetometry techniques 2. Analyze experimental data to deduce the nature of resonant excitations in these films 3. Draw links between textbook quantum physics and observable phenomena in functional materials 4. Compile & communicate scientific results and work within a professional R&D team	1. Coursework in electromagnetism and materials physics 2. Some lab experience in using electrical instruments 3. Optional: experience with data analysis and finite element simulations	The candidate will perform some or all aspects of the following work: 1. Characterize magnetic thin films using microwave spectroscopy and magnetometry techniques 2. Analyze experimental data to deduce the nature of resonant excitations in these films 3. Draw links between textbook quantum physics and observable phenomena in functional materials 4. Compile & communicate scientific results and work within a professional R&D team	IMRE	ELE	Anjan Soumyanarayanan	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
214	Strategies Towards Sustainable AI for Urban Sustainability	Student will read literature on current state-of-the-art methods for assessing carbon emissions from AI model training and AI model inference and strategies for continual learning and training models with less computational cost. They will then apply it to a model urban layout dataset and assess the impact of various methods and algorithms on the carbon emissions incurred when training an AI model for urban planning and sustainability.	1. Student will acquire experience working with widely used general purpose scripting languages such as Python and Tensorflow. 2. Student should be able to explain how machine learning models such as neural networks work, and be able to write code to implement said techniques. This should be transferable skills for any future projects the student might be interested in. 3. The student will also learn to read literature and think more deeply about Greening AI models.	1) Literature review 2) Implement and train different ML model training strategies for a simple model system (e.g. in continual learning and curriculum learning) 3) Assess carbon emissions for different kinds of ML models for this model system	1. Able to read literature and do literature review. 2. Familiar with Python programming. 3. Knowledge of data analytics/engineering.	1) Literature review 2) Implement and train different ML model training strategies for a simple model system (e.g. in continual learning and curriculum learning) 3) Assess carbon emissions for different kinds of ML models for this model system	CFAR	Fluid Dynamics / CFAR	Ooi Chin Chun	1 Fusionopolis Way, Connexis North, Singapore 138632	Computing and Information Sciences	1
215	Sustainable AI: Optimizing Energy Efficiency using Deep Reinforcement Learning	As AI models, especially deep learning architectures, become more complex, their energy consumption and environmental footprint grow significantly. This project seeks to apply deep reinforcement learning to optimize the energy efficiency of AI operations, from training to inference. By using DRL, we intend to dynamically adjust the computational strategies, allocating resources more efficiently, and potentially even modifying model architectures on-the-fly to ensure minimal energy usage without sacrificing performance. The project will not only focus on the direct energy consumption of AI processes but also consider their entire lifecycle to ensure holistic sustainability.	1.Understand the environmental implications of AI, especially deep learning, in terms of energy consumption and overall footprint. 2.Grasp the principles and applications of deep reinforcement learning (DRL) in optimizing AI operations for energy efficiency. 3.Evaluate the sustainability of AI processes by considering both direct energy consumption and the entire lifecycle of AI operations.	1. Engage in meetings, discussions, and hands-on projects related to sustainable AI and DRL. 2. Research and implement DRL techniques to dynamically adjust AI operations, ensuring energy efficiency. 3. Analyze and evaluate the energy consumption and environmental impact of various AI processes, considering their entire lifecycle.		1. Attend meetings and actively participate in discussions focused on the energy efficiency of AI operations. 2. Develop and apply deep reinforcement learning techniques to optimize AI operations for energy sustainability. 3. Conduct holistic evaluations of AI processes, considering both direct energy consumption and broader lifecycle implications.	SIMTech	Sustainability Informatics & Strategy (SIS)	Yang Zhao	Singapore Institute of Manufacturing Technology (SIMTech) @ CT2B 5 Cleantech Loop #01-01 CleanTech Two Block B Singapore 636732	Computing and Information Sciences	1
216	Sustainable catalysis using Cobalt chemistry	Chiral anilines are vital in pharmaceuticals and catalysis. However, current methods for chiral alkylated anilines involve multistep processes or costly asymmetric hydrogenation using precious metals like Iridium and Rhodium. This project seeks to explore earth-abundant, eco-friendly cobalt based hydrogenation as a replacement for noble metals in chiral alkylated aniline synthesis. Working with a team of researchers, this student shall contribute towards the development of chiral-substituted anilines, offering applications across various fields.	Students will learn basic synthetic chemistry techniques such as organic synthesis, polymer and materials synthesis. He/she will learn how to design, perform and monitor chemistry experiments, and subsequently purification and data characterization experiments may be performed. Students will be exposed to state-of-the-art instruments in chemicals and materials synthesis.	1. Perform literature review 2. Data analysis, presentation and reporting. 3. Strong willingness to learn, communicates well, team player and independent.	The student is expected to have attended university-level chemistry laboratory classes (hands-on).	The student is expected to perform basic chemistry experiments. He/she is expected to adhere to good and safe laboratory practices, as well as record keeping.	ISCE²	Green Chemistry (GC)	Ken Lee	1 Pesek Road, Jurong Island	Physical Sciences	1
217	Synergizing chemical and biotechnological techniques for hybrid retrosynthesis	Artificial intelligence (AI) approach combining biosynthetic pathways (fermentation), enzymatic reactions (biocatalysis), and synthetic chemistry into a hybrid retrosynthetic tool. To extend the space of retrosynthetic analysis to yield elegant solutions to access complex molecules sustainably.	The student will learn cheminformatic techniques (e.g. how to process, analyse, and use chemical information), how to modify and design Large Language Model (LLM)-based agent systems, and about interfacing chemical and biotechnological techniques in an interdisciplinary effort.	The student is expected to have a strong willingness to learn, and demonstrate proactive independent learning. They are also expected to work well in a team, and present their findings.	The student is expected to have basic university-level background in chemical retrosythesis. Basic python programming.	The student will benchmark existing computational retrosynthetic tools (biosynthesis, chemical, enzymatic) to identify gaps in capability and support the development of a hybrid retrosynthetic tool optimizing synthesis route to natural product derivatives.	ISCE²	Chemical Biotechnology and Biocatalysis (CBB)	Dillon Tay	8 Biomedical Grove #07-01 Neuros Building Singapore 138665	Physical Sciences	1
218	Tailor design enzymes for natural product biosynthesis	Biosynthesis of natural products has emerged as a competitive alternative to produce chemicals in a green and cost-effective manner. However, one challenge is many pathway enzymes of natural products are unidentified. In this project, we address the challenge by designing artificial pathway(s) to produce natural products. It involves engineering non-specific enzymatic activity towards the desired activity, leveraging on high-throughput assay development and enzyme design. The established workflow enables engineering more efficient biocatalysts for sustainable production of natural products.	The students will be exposed to cross-disciplinary research areas spanning biochemistry, protein engineering, metabolic engineering, and analytical chemistry. He or she will be trained to be proficient in molecular biology techniques such as gene assembly workflows, enzyme purification and characterization etc. Moreover, the intern will be trained to analyze and present scientific data, troubleshoot experiments and hypothesis testing. Teamwork and communication skills will also be sharpened.	•Perform basic lab protocols such as DNA purification, bacterial culture, sample preparation etc. •Learn and apply the techniques of gene assembly and mutagenesis and expose to lab automation. •Innovate to improve lab protocols such as enzyme assays. •Documenting experimental procedures, analyzing the data and updating the team members the consolidated results	Biomedical Engineering, Chemical Engineering, Bioengineering, Chemical & BioMolecular Engineering, Biochemistry, Life sciences	We are seeking a proactive and responsible student, who is willing to embark on the exciting journey of metabolic engineering, synbio and protein engineering. Our team is developing advanced genetic engineering tools to rewire industrial microorganisms' host metabolism to produce high-value secondary metabolites, such as terpenoids and phenolic compounds. In this position, you are expected to learn or practice the enabling techniques (such as PCR, DNA purification, Crispr-Cas9 genome editing etc) and applying them to test scientific hypotheses. In addition, you would gain valuable insights in an application-oriented scientific research laboratory.	SIFBI	Strain Engineering	Chen Xixian	31 Biopolis Way, Nanos level 6,	Engineering and Technology	1
219	Targeting glutamate-signaling as a novel host-directed therapy to combat chikungunya virus infection	Glutamate is one key neurotransmitter that can modulate host immunity, through acting on T cells and macrophages. In this proposal, the immune modulatory role of glutamate will be investigated in chikungunya fever, a highly relevant arboviral disease to Singapore. Interestingly, high levels of blood glutamate were detected in chikungunya virus (CHIKV) infected mice. This proposal will mechanistically study how glutamate influences disease outcome. Success of this project will open new transdisciplinary research paradigms to combat arboviral diseases pathogenesis.	At the end of the attachment, student should have obtained valuable experience in planning and executing experiments. Student will also be taught on documenting, analysing and presenting their results. Importantly, this attachment will also allow the student to develop critical thinking and improve on their presentation skills.	Performing experiments, analyses of data obtained, troubleshooting, critical discussion, presenting, reporting and documenting of work done.	Some knowledge on immunology, neuroimmunology, infectious diseases	Student will be expected to master cell culture, virus production, viral tittering, viral RNA extraction, viral RNA quantification, cell culture infection, gene expression, ELISA and flow cytometry within 1-2 months. Following, student will need to perform the experiments with minimal guidance. Student is also expected to present her work done during lab meetings.	ID Labs	Pathogen Modulation Lab	Lum Fok Moon	8A Biomedical Grove, #05-13 Immunos, Singapore 138648	Biomedical Sciences	
220	Techno-economic and life cycle assessment of carbon utilization and hydrogen processing	This project will evaluate the feasibility of CO2 utilization and hydrogen-related processing in terms of techno-economic and environmental assessment.	Report writing, presentation, TEA and environmental analysis, chemical process modeling, process sytems and engineering	Perform literature review, data collection and analysis, model building, LCA/supply chain network design, data reporting	Chemical or other engineering subjects with good results, interest in sustainability study	Willingness to learn, interest in research work, computer programming skill is a plus	ISCE²	Catalysis & Green Process Engineering (CGPE)	Iskandar Halim	1 Pesek Road, Jurong Island	Engineering and Technology	1

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
221	Technologies to measure the temperature of an air data probe in a wind tunnel	This is a temperature measurment application for aerospace industry. We will use both contact temperature measurement method (optical-fiber temperature sensor) and non-contact temperature measurement method (Infrared thermal imaging) to measure the suface temperature of an air data probe in a wind tunnel environment.	The student will be able to have the chance to learn the following knowleges and skills 1. Basics of an optical fiber sensor 2. Basics of an infrared thermal imaging 3. Wind tunnel experiment 4. Literature rivew and paper writing	The student will work with the project staff on one or more tasks depending on her/his interest 1. Temperature measurement with optical fiber sensor in a wind tunnel 2. Temperature measurement with infrared thermal imaging in a wind tunnel 3. Thermal model development for the air data probe with regards to the environment	#NAME?	1. Temperature measurement testing and data collection 2. Programming for thermal model and simulation studies	NMC	ODM	ZU PENG	9 CleanTech Loop, #01-20, Singapore 637145 and Temasek Laboratories @ NUS	Engineering and Technology	1
222	Transcriptomic Synergy: Improving Short-Read Data with Long-Read Innovations	Long-read sequencing has ushered in a revolutionary era, offering an unprecedented level of accuracy in deciphering the intricate transcriptomic landscapes of various organisms. With the ability to identify novel isoforms, reduce transcript quantification ambiguity, and pinpoint major gene isoforms, it has undoubtedly transformed our understanding of genomics. However, despite these remarkable advancements, long-read data remains relatively scarce in comparison to the vast reservoir of historical short-read sequencing data. Regrettably, short-read data falls short of harnessing the full potential of long-reads. What if we could bridge this technological gap and harness the insights gleaned from long-read sequencing to enhance the value of existing short-read datasets? This exciting endeavor holds the promise of reinvigorating archived data, elevating its isoform-quantification capabilities, and paving the way for a cost-effective means of extending long-read experiments across multiple replicates. Join us in this transformative journey as we unravel the untapped potential of transcriptomic data, revolutionizing the way we explore genomics.	Bioinformatics Skills: Gain proficiency in bioinformatics tools and data analysis using Python and R. Transcriptomics Knowledge: Learn about transcriptomics, including sequencing technologies and gene expression. Data Analysis Expertise: Master data analysis, quality control, and differential expression analysis. Version Control: They may learn to use version control systems like Git to collaborate on code and track changes, ensuring reproducibility and collaboration with other team members. Data Handling: Students will become skilled in working with large datasets, including data cleaning, preprocessing, and transformation, which are important aspects of software engineering for data analysis.	Access large short and long read datasets Develop a method to use long-read annotations for short-read quantification Writing and iterating on unit tests Maintain detailed records of experiments, protocols, and results. Convey research insights to team members and, potentially, to the broader scientific community.	Bioinformatics Skills: Basic knowledge of bioinformatics tools and R is important for data analysis and processing. An elementary understanding of genetics is helpful	Join our team for your internship project, where you'll contribute to a pioneering project aimed at bridging long-read and short-read sequencing technologies. Your role includes data analysis, integration of sequencing methods, data retrieval, experimental support, and project documentation. Collaborate with the research team, enhance your problem-solving skills, and improve your scientific communication. This is an opportunity to learn, grow, and make a real impact in genomics research.	GIS	Laboratory of Computational Transcriptomics	Jonathan Goeke	60 Biopolis Street, Genome, #02-01, Singapore 138672	Computing and Information Sciences	1
223	Transcriptomics Analysis of Lifespan Regulating Drug Response	High-throughput gene expression sequencing and analyses have dominated much of biological research in the last decade. The major challenge here is to tackle the large dataset into a manageable way for novel and key biological inference. There has been much effort in the development of bioinformatic and machine learning tools to interpret the data, especially to identify genes that act differently between any two samples, for example, between normal and disease cells. In this project, we will investigate the transcriptional changes induced by Rapamycin, an FDA-approved drug initially used as an immunosuppressant, and sulforaphane, a natural chemical project; both have shown promising results in extending lifespan or slowing aging process in a diverse range of organisms. The student will use data analytical tools, such as, linear/non-linear correlations, PCA, random forest, t-SNE, SOM and Gene Ontology, to analyze the whole transcriptome response (over 20,000 genes) drug-treated samples. Datasets from worms and mice treated with rapamycin/sulforaphane or a combination of these will be provided. In particular, the student will focus on the role of non-coding RNAs, such as transposons, in aging process. Through the project, the student will learn the principles and usage of data analytic tools and basic aging	The student will learn data analytics and aging biology. Elucidation of novel regulatory genes (coding and non-coding), their sequences, and possible biological pathway enrichment.	Independent thinking, team playing and research documentation	Good programming skills in Python, R or C++ Good interpersonal skills and creativity Background in biology or molecular biology is a plus	Development and applications of codes and models to study dynamic expressions of genes in aging datasets. The student will work closely with research advisor. While guidance is provided, student is required to work indepently and creatively.	BII	Analysis/HuPo (Computational Biology & Omics Lab)	Kumar Selvarajoo	33 Biopolis Street, #07-01 Matrix, Singapore 138671	Physical Sciences	1
224	Ultrasensitive hydrogen sensors with thin film optical coatings	Remote gas sensing, especially hydrogen, is of crucial importance to industries where hydrogen gas is present. Hydrogen is flammable with low ignition energy at concentrations from 4% to 75%. Hydrogen sensors must be able to provide timely response to concentrations significantly lower than the explosive level of 4% to provide adequate warning before an explosion hazard takes place. Furthermore, hydrogen is produced by certain bacteria and hydrogen sensors are used in the food industry and have possible medical applications. In this project, we propose to develop thin film coating based nanophotonic hydrogen sensors to achieve the unmet performance targets set by US Department of Energy. Since the nanostructuring of palladium improves the sensor performance, we introduce a novel method to fabricate scalable palladium nanoporous thin films. This lithography-free nanophotonic cavity exhibits extreme phase singularity at the point-of-darkness due to the presence of an ultrathin absorptive dielectric layer in the cavity. Since the phase-sensitive optical techniques have shown superior sensitivity over traditional spectroscopy-based sensing techniques, we use this extreme phase change to develop ultrasensitive hydrogen sensors.	Gain hands-on research experience in cutting-edge areas of photonics and sensing, Work in a collaborative and intellectually stimulating research environment and	Contribute to the design, fabrication, and characterization of thin film coatings. Perform theoretical analysis and modeling of sensor. Analyze data, interpret results, and contribute to scientific publications	Background in fundamental physics, and mathematics. Programming skills, preferably with experience in languages such as Python, or MATLAB. Excellent written and verbal communication skills in English	Fabrication, characterization, and optimization of Pd-Au nanoporous thin films. Design of thin-film based hydrogen sensor	IMRE	AOT	Sreekanth Kandammathe Valiyaveedu	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1
225	Ultrasensitive photodetectors for nanophotonics devices	This project focuses on developing single-photon avalanche detectors integrated with an on-chip photonics circuit. We work on two types of detectors – 1) avalanche photodetectors that detect photons by rapidly multiplying photogenerated charge carriers via an avalanche effect, and 2) superconducting detectors that detect light when the absorbed photons disrupts its superconducting state. The student will largely be involved in device fabrication, setup building, and thorough characterization of the devices, using the results to improve subsequent devices. These waveguide-based single-photon detectors will be a critical part of our ongoing research efforts to develop an integrated quantum nanophotonics platform.	- In-depth knowledge of photonics devices and single-photon detection - Experimental techniques, including designing and deploying electronics, lasers and optical setups, chip testing, operation of probe stations and cryogenic systems - Experience in instrumentation design, building, automation, and testing - Able to plan and execute experiments, document and analyse data, and communicate results - Related engineering skills, e.g. electronics, optics, programming, hardware assembly	- Participate in device fabrication and sample preparation - Opto-electronic characterization of single-photon avalanche detectors - Development of control electronics and hardware - Upgrading and automation of test setup to enhance its performance - Analysis of measurement data	Physics or engineering	- Participate in device fabrication and sample preparation - Opto-electronic characterization of single-photon avalanche detectors - Development of control electronics and hardware - Upgrading and automation of test setup to enhance its performance - Analysis of measurement data	IMRE	QTE	Victor Leong	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	2
226	Ultrasensitive sensor for on-site wastewater surveillance of viral pathogen.	Infectious pathogens shed from individuals can be carried into wastewater and reflect transmission risks in population. Currently wastewater surveillance relies on laboratory-based analysis. This project aims to develop ultrasensitive nanomaterial-based sensor for on-site wastewater surveillance of viral pathogen.	Students will be trained in material science, biochemistry, bioanalytical chemistry	Design and development of sensors, synthesis of sensing materials, sample treatment, tests, data analysis	biochemistry, engineering	In this project student will be involved in an on-going project. Student will work under supervision to design and develop the sensors and sample treatment needed for detection of viral pathogen from wastewater.	IMRE	SOF	Laura Sutarlie	2 Fusionopolis Way, Innovis, Singapore 138634	Engineering and Technology	1
227	Unraveling the Role of Kupffer Cells in the Progression of NAFLD Using Organoids Derived from NAFLD Patients	This project focuses on understanding the role of Kupffer cells in the spectrum of non-alcoholic fatty liver disease (NAFLD) using advanced patient-derived liver organoids. The project's objectives include establishing and maintaining organoid cultures, isolating and characterizing Kupffer cells, studying their activation and behavior, conducting molecular profiling, and collectively analyzing data.	This position is ideal for individuals interested in molecular biology, immunology, and hepatology. Students will not only contribute to scientific knowledge but also gain valuable skills and experiences that can be applied in their academic and professional pursuits.	This attachment will require students to acquire practical laboratory skills, deepen their intellectual understanding of Kupffer cells and NAFLD disease. Students are required to work with team members and learn to conduct scientific research that ranges from hypothesis formulation to data analysis. Students will have chances to enhance their critical thinking, communication, and collaboration abilities while managing project timelines.	Undergraduates or postgraduates	Student will gain hands-on laboratory expertise, from cell culture to cutting-edge molecular biology techniques. He/she will be able to participate in the scientific process of learning to formulate hypotheses, design experiments, and analyze data. This research fosters critical thinking and problem-solving abilities, equipping students to address complex scientific questions.	GIS	Laboratory of Precision Disease Therapeutics	Lee Mei Chin	60 Biopolis Street, Genome, #07-01, Singapore 138672	Biomedical Sciences	1
228	Upcycling Silicon Waste into Functional Semiconductors for Energy Applications.	As we move into modern technologies era, electronic waste (mainly composed of silicon) have become a pervasive problem. This project aim to not only save the environment by waste scavenging, but also to upcycle and turn them into valuable functional materials (i.e. for thermoelectric cooling, LED, or energy harvesting applications) with an eye towards agricultural technologies and flexible device applications.	By the end of the program, the student will gain industrial relevance skillsets that can be applied to a wide sector of semiconductor/processing industries. In addition, he/she will be gain expertise in both solid state synthesis and electronics properties such as spark plasma sintering (SPS), and ball milling. Lastly, in the era of electronic waste recycling, developing expertise on semiconductor upcycling is both important and timely. The expertise gained allow the flexibility to either go for further study (PhD) or work in industry. 1 co-authored paper can be expected from the work of the student in IMRE.	1. Develop a set of criteria for recyclable silicon waste. 2. Finding and optimizing suitable dopants to tailor the properties for energy related applications (i.e. semiconductor cooling technologies, power harvesting for flexible wearable applications). 3. Demonstrate and analyze the relative performance metric of the upcycled silicon waste compared to pristine silicon based materials.	Basic understanding of materials science, physics, and inorganic chemistry.	As we move into modern technologies era, electronic waste (mainly composed of silicon) have become a pervasive problem. This project aim to not only save the environment by waste scavenging, but also to upcycle and turn them into valuable functional materials (i.e. for thermoelectric cooling, LED, or energy harvesting applications) with an eye towards agricultural technologies and flexible device applications.	IMRE	SOF	Ady Suwardi	2 Fusionopolis Way, Innovis, Singapore 138634	Physical Sciences	1

รายชื่อโครงการวิจัยที่นักศึกษาสามารถเลือกไปปฏิบัติการวิจัย (SIPGA Project List)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Project no.	Project Title	Project Description	Learning Outcomes for Students	Roles and Responsibilies of Student	Students' pre-requisites	Job Description for Student	Research Institute of Internship Supervisor	Department of Internship Supervisor	Name of Internship Supervisor	Workplace Address	What is the project's research category?	No. of Students Required
229	Urban Informatics and Urban Big Data and Analytics	Study of urban science in various social and information systems, ranging from renewable energy, urban mobility, and urban environment.	Students will learn the basic concepts in geoinformation (geographical information science, remote sensing, and GeoAI), and how to build dynamic models to solve geospatial related problems that cannot be easily dealt with using traditional methods.	Study the basic knowledge in computer science, carry out geospatial analysis and simluations, and generate insights.	Background in any of the maths/physics/computing/engineering/geography /social science majors. Knowledge in statistics, programming and data analysis. Knowledge in statistical mechanics and/or deep learning is a plus.	Geographic information system (GIS) is a computer-based tool designed to collect, store, process, analyse, visualise and interpret spatially referenced data. With GIS technology, people can compare the locations of different things in order to discover how they relate to each other. For example, using GIS, a single map could include sites that produce pollution, such as factories, and sites that are sensitive to pollution, such as wetlands and rivers. Such a map would help people determine where water supplies are most at risk. The student will develop comprehensive capability on geospatial analysis and optimization through the integration of computer science, GIS, remote sensing, and GeoAI technologies.	IHPC	Systems Science	Rui Zhu	1 Fusionopolis Way, #16-16, Connexis North Tower, Singapore 138632	Computing and Information Sciences	1
230	Using AI to develop experimental friendly quantum error correcting codes.	The development of hardware-compatible and efficient quantum error-correcting codes is a challenging task. Recently, promising quantum low-density parity-check codes were introduced. However, these codes aren't suitable for experiments because they demand high-weight check operators. In this project, we'll employ AI to streamline the creation of quantum error-correcting codes and refine these codes to pinpoint the most experimentally viable option. This endeavor will edge us closer to the goal of achieving fault-tolerant quantum computing.	The student will get exposure to the state of the art quantum computing and error correction	The student will set-up reinformation learning environment for searching experimental fiendly quantum error correcting codesThe student will set-up reinforcement learning environment for searching experimental friendly quantum error correcting codes.	The student should be aware of basics of maachine learning and quantum computing. They should know how to code in PythonThe student should be aware of basics of machine learning and quantum computing. They should know how to code in Python.	The student will read the recent quantum error correction paper on LDPC codes by IBM team and setup a reinforcement learning library to optimize the codes in the paper.	IHPC	MSC	Bharti Kishor	Connexis, Level 15, Singapore	Physical Sciences	1
231	Using AI to identify pathogen signatures from metagenomic data	Early diagnosis of infections is critical for the successful treatment of hospitalized patients, but the precise detection of causative pathogens remains an open challenge. Compared to current laboratory diagnostic methods, taxonomic classification tools that match sequencing reads with a reference database allow for the rapid identification of pathogens. In this project, we aim to develop deep-learning taxonomic classifiers (e.g., transformers) using long-read sequencing data. We plan to extend previous methods in directions such as representation learning and the detection of novel species.		• Process and perform integrative analysis on metagenomics datasets • Implement, train, tune, and debug deep learning classifiers for taxonomy classification. • Create pipelines for analyzing large biological datasets. • Perform exploratory and statistical analyses to elucidate biological significance from experimental observations. • Study and implement explainable AI techniques for interpreting models prediction.	•Self-motivated individual and willingness to self-learn •Good analytical, statistical and programming skills (Python or like) and ability to work in UNIX environment •Team player and good interpersonal skills		GIS	Laboratory of Metagenomic Technologies & Microbial Systems	Niranjan Nagarajan	Genome Institute of Singapore, 60 Biopolis Street, Singapore 138672	Computing and Information Sciences	2
232	Utilization of microfluidics for discovery of antibody-based therapeutics against viruses and antimicrobial-resistant organisms	This project seeks to identify novel vaccine immunogens for combatting emerging and re-emerging infectious diseases. Droplet microfluidics is capable of enabling high-throughput functional studies of monoclonal antibodies. By analyzing the targets of such protective antibodies, the antigenic targets conferring protective functional activity can be identified. This project will be conducted at the A*STAR ID Labs, within a multidisciplinary lab environment with lab expertise in bioengineering, virus biology, and antibody biology.	Students will learn wet lab skills in virological and/or bacteriological assays, antibody discovery workflow, and biochemical interaction analysis. Students will also learn scientific critical thinking and presentation skills.	Students will be responsible for both wet lab experimentation under the guidance of a full-time staff, as well as experimental record-keeping, data analysis, and presentation of results.	Wet lab skills (cell culture, molecular biology) preferred.	The Antimicrobial Biologics Laboratory in the A*STAR Infectious Diseases Labs is looking for a highly self-motivated individual to join us as a student. Our mission is to develop the next generation of vaccines and biologics-based therapeutics to defend against emerging infectious disease threats to Singapore and to the world. Our lab is focused on novel methods of antibody discovery against difficult targets including complex pathogens and membrane-bound receptors. We utilize such microfluidic technologies and function-based bioassays for discovery of functional monoclonal antibodies, and apply reverse vaccinology to identify critical vaccine epitopes. Solutions developed will be applied to the fields of infectious disease and antimicrobial resistance.	ID Labs	Antimicrobial Biologics Laboratory	Matthew Tay	8A Biomedical Grove, #05-13 Immunos Building, Singapore 138648	Biomedical Sciences	1
233	Video-conditioned Reasoning with Large visual-language models	The aim of this project is to investigate how large visual-language models perform on reasoning. For example, how	1. The ability to read scientific literature and understand how large video-language models are constructed and trained. 2. Understanding the challenges in video-question answering and how they are addressed through video-language models. 3. Building a video-language model for video-question answering.	1. Reading literature about video-question answering and visual-language models. 2. Reproducing the results in existing literature for video-question answering. 3. Discussion and implementation of any new ideas for video-question answering.	Mathematical background such as matrix operations, linear algebra (preferred but not necessary). Basic coding skills in Python.	Large language models such as ChatGPT will become more powerful if we can input images and videos as input along with the questions. Video-language models are a way to answer questions about videos and assistive robots can use these models to predict a person's actions to help them. In this project, we will develop video-language models that answer questions such as what will happen after an event in a video.	IHPC	SCC	Debaditya Roy	16, Connexis North, Fusionopolis One, Singapore 138686	Computing and Information Sciences	1
234	Virtual screening of Traditional Chinese Medicine (TCM) ingredients against disease targets	Virtual screening of Traditional Chinese Medicine (TCM) ingredients against disease targets	Traditional Chinese Medicine (TCM) ingredients, Virtual screening	Verify TCM ingredients, perform virtual screening of TCM ingredients against disease targets	good at linux, shell scripting, python/perl programming	full time, at least 4 month	BII	BSMD	Hao Fan	30 Biopolis Street, Matrix #07-01, Singapore 138671	Computing and Information Sciences	1
235	Interrogating the modulation of retinal cell behaviour by novel biomaterials	Synthetic polymeric hydrogels are a class of biomaterials that are often used in various biomedical applications, such as drug delivery vehicles, because of their tunable and versatile physicochemical properties. Beyond their function as mere physical drug carriers, artificially engineering polymeric materials have recently been shown to influence material-cell interactions, just by tuning their physicochemical properties. This includes the potential to influence cellular behaviour such as apoptosis, proliferation, and migration. However, little is known about the underlying molecular mechanisms governing this cellular phenomenon, nor has it been harnessed for therapeutic applications. The proposed work seeks to interrogate novel hydrogels with different structural and chemical properties, and how these varying factors affect cellular behaviour. The ultimate aim is to be able to make targeted modifications in these hydrogels to elicit a desired therapeutic outcome.	Systematic understanding of relevant knowledge within the scope of their research project. The ability to identify and describe broadly accepted methodologies of science, including the basic tenets of comparative (observational) and experimental approaches. The student eventually will learn to design the experiment, keeping records of the same and to summarize and interpret the data in a scientific and logical manner. Gain specialised expertise in biomaterials and retinal cell biology.	1. Retinal cell culture and maintenance 2. Screening novel hydrogels for biocompatibility of retinal cells 3. Elucidating the behavioural effect of biocompatible hydrogels on cells 4. Correlating the structure-function relationship of biomaterial-cell behaviour	Basic wet lab and molecular biology techniques - pipette handling, aseptic techniques for cell culture, Immunochemistry, western blot.	Good academic record in science, passion for learning and research, strong perseverance, full commitment, meticulous, detail-oriented and independent.	Institute of Molecular and Cell Biology	Innovative Technologies	Su Xinyi	61 Biopolis Drive, #05-15, S1386783	Biomedical Sciences (BMS)	
236	Investigation of retinal stem cell transplants in humanized immune system	There are no effective treatments for end-stage retinal degeneration, where there's profound reduction in the quality of life because of loss of central vision, secondary to an irreversible loss of RPE and photoreceptors cells. Stem cell derived retinal cell replacement is an emerging therapy for retinal degeneration, whereby clinical trials have demonstrated its safety, but not efficacy. The lingering and critical question remains whether we can further augment vision recovery via other adjunct mechanisms such as immuno-modulation of retinal cells. The proposed work seeks to address this unmet clinical need, and if successful, will provide novel ways to augment the outcome of retinal cell therapy.	Systematic understanding of relevant knowledge within the scope of their research project. The ability to identify and describe broadly accepted methodologies of science, including the basic tenets of comparative (observational) and experimental approaches. The student eventually will learn to design the experiment, keeping records of the same and to summarize and interpret the data in a scientific and logical manner. Gain specialised expertise in stem cells, retinal cell biology, and immunology.	1. Stem cell maintenance and differentiation to retinal cell types 2. Molecular characterization of the retinal cells 3. Functional characterization of the retinal cells 4. Evaluating the retinal cell transplant outcome in humanized mice	Basic wet lab and molecular biology techniques - pipette handling, aseptic techniques for cell culture, Immunochemistry, western blot.	Good academic record in science, passion for learning and research, strong perseverance, full commitment, meticulous, detail-oriented and independent.	Institute of Molecular and Cell Biology	Innovative Technologies	Su Xinyi	61 Biopolis Drive, #05-15, S1386783	Biomedical Sciences (BMS)	
237	Modelling retinal degeneration with 3-dimensional retinal organoids	Human pluripotent stem cells with disease specific mutations of inherited retinal diseases will be used to generate and characterize 3D retinal organoids. They share many similar features with the human retinal development. These 3D organoids would be used as a tool to eventually test novel therapeutic modalities against retinal degeneration, with potential for translation to humans.	Systematic understanding of relevant knowledge within the scope of their research project. The ability to identify and describe broadly accepted methodologies of science, including the basic tenets of comparative (observational) and experimental approaches. The student eventually will learn to design the experiment, keeping records of the same and to summarize and interpret the data in a scientific and logical manner. Gain specialised expertise in stem cells, disease modelling, and organoid technology.	1. Stem cell maintenance and differentiation to 3D retinal organoids 2. Immunohistochemical characterization of organoids 3. Measure the gene expression through quantitative PCR 4. Perform stress assays to study differential organoid behaviour	Basic wet lab and molecular biology techniques - pipette handling, aseptic techniques for cell culture, Immunochemistry, western blot.	Good academic record in science, passion for learning and research, strong perseverance, full commitment, meticulous, detail-oriented and independent.	Institute of Molecular and Cell Biology	Innovative Technologies	Su Xinyi	61 Biopolis Drive, #05-15, S1386783	Biomedical Sciences (BMS)	