

2018 CSC - CSIRO: Project Opportunity Form

Antimicrobial coatings for improved biomedical devices

CSIRO supervisor full name:	Helmut Thissen
CSIRO supervisor contact details:	helmut.thissen@csiro.au , +61-3-95452191
Supervisor CSIRO details:	Dr. Helmut Thissen CSIRO Manufacturing Bayview Avenue Clayton VIC 3168 Australia
PhD or Scholar Program:	Both
Project title:	Antimicrobial coatings for improved biomedical devices
Research area:	Polymer and surface chemistry, with a focus on advanced coatings for the prevention of biomedical device related infections
Project opportunity:	<p>Expected deliverables</p> <ul style="list-style-type: none"> • Development of advanced antimicrobial polymer coatings that display antimicrobial activity • Demonstration of biocompatibility and antimicrobial activity of coatings <i>in vitro</i> in biofilm and cell culture experiments <p>Required tasks and activities</p> <ul style="list-style-type: none"> • Synthesis and characterization of bioactive monomers and polymers • Deposition of polymer coatings and their characterization using techniques such as SEM, XPS, AFM, microscopy etc. • Preparation of journal papers and presentations
Skill required from student:	The student is required to have skills in organic chemistry, polymer chemistry, biomaterials and ideally surface analysis. English language skills are also required.
Developmental outcomes for student:	Experience of an exciting environment in an internationally recognised laboratory. New skills ranging from organic and polymer synthesis to coating deposition and surface analysis. <i>In vitro</i> testing of samples in cell culture and biofilm assays. Publication of results in peer reviewed journals. Presentation of results at national or international conferences.
Any additional comments (optional):	The visitor will work in a highly interdisciplinary work environment, in a team that features student, postdoctoral fellows and experienced researchers from all over the planet. In addition to enhancing scientific and language skills, the visitor will have the opportunity to network with international opinion leaders in the field of biomaterials and biomedical devices.

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New strategies for the prevention of biofouling

CSIRO supervisor full name:	Helmut Thissen
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Supervisor CSIRO details:	Dr. Helmut Thissen CSIRO Manufacturing Bayview Avenue Clayton VIC 3168 Australia
PhD or Scholar Program:	Both
Project title:	New strategies for the prevention of biofouling
Research area:	Polymer and surface chemistry, with a focus on advanced coatings for the prevention of biofouling
Project opportunity:	<p>Expected deliverables</p> <ul style="list-style-type: none"> • Development of advanced polymer coatings that provide ultra-low fouling properties on a range of materials • Demonstration of biocompatibility and performance of coatings <i>in vitro</i> <p>Required tasks and activities</p> <ul style="list-style-type: none"> • Synthesis and characterization of novel monomers and polymers • Deposition of polymer coatings; characterization using techniques such as SEM, XPS, AFM, etc.; application of high throughput screening and modelling approaches • In vitro screening of biointerfacial interactions • Preparation of journal papers and presentations
Skill required from student:	The visitor is required to have skills in organic chemistry, polymer chemistry, biointerfaces and ideally surface analysis. English language skills are also required.
Developmental outcomes for student:	Experience an exciting environment in an internationally recognised laboratory. New skills ranging from organic and polymer synthesis to coating deposition and surface analysis, from protein and biofilm assays to high throughput screening and modelling. Publication of results in peer reviewed journals. Presentation of results at national or international conferences.
Any additional comments (optional):	The visitor will work in a highly interdisciplinary as well as international work environment. In addition to enhancing scientific and language skills, the visitor will have the opportunity to establish a network with leading international researchers in the field of biomaterials and biointerface science.

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Nanotopography based control of cellular responses

CSIRO supervisor full name:	Helmut Thissen
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Supervisor CSIRO details:	Dr. Helmut Thissen CSIRO Manufacturing Bayview Avenue Clayton VIC 3168 Australia
PhD or Scholar Program:	Both
Project title:	Nanotopography based control of cellular responses
Research area:	Nanofabrication, surface science, stem cell biology with the aim to develop new and improved biomedical devices
Project opportunity:	<p>Expected deliverables</p> <ul style="list-style-type: none"> • Development of nanostructured surfaces that display highly spatially controlled cues to cells • Demonstration of improved cellular responses, such as stem cell expansion or the differentiation of stem cells into defined lineages <p>Required tasks and activities</p> <ul style="list-style-type: none"> • Nanofabrication and analysis of large scale surface coatings with high spatial resolution • Deposition of nanostructured surface coatings. Surface analysis using SEM, XPS, AFM, confocal microscopy, etc. • High throughput stem cell culture assays • Preparation of journal papers and presentations
Skill required from student:	The student is required to have skills in materials science, surface analysis and ideally cell biology. English language skills are also required.
Developmental outcomes for student:	Experience of an exciting environment in an internationally recognised laboratory. New skills ranging from nanofabrication to material synthesis, from coating deposition to surface analysis and from <i>in vitro</i> stem cell culture assays to high throughput testing. Publication of results in peer reviewed journals. Presentation of results at national or international conferences.
Any additional comments (optional):	The visitor will work in a highly interdisciplinary as well as international work environment. In addition to enhancing scientific and language skills, the visitor will have the opportunity to establish a network with leading international researchers in the field of biomaterials and biomedical devices.

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Non-fouling biomedical surfaces

Details:	
CSIRO supervisor full name:	Pete Cass
CSIRO supervisor contact details:	Pete.Cass@CSIRO.au +61395452428 cas165
Supervisor CSIRO details:	Manufacturing, Biomedical Manufacturing, Biomedical Synthetic chemistry
PhD or Scholar Program:	PhD and scholar programs
Project title:	Nonfouling biomedical surfaces promoted by self-assembling polyampholytes
Research area:	Our research area is predominantly focussed on preparing biomedical polymers for the healthcare applications. This includes functional polymer designs, surface chemistry of implants and drug delivery applications.
Project opportunity:	<p>Protein adsorption is the initial event in the cascading sequence of a foreign body response towards an implant in vivo. Protein adsorption and the subsequent opsonisation influences cellular recognition and immune responses subsequently leading to clearance or encapsulation of a foreign body.</p> <p>The objective of this project is to prepare polymeric surface coatings to improve the biocompatibility of implants. We aim to achieve this by coating implants with carefully designed and optimised polyampholytes which help to repel protein adsorption, prevent protein denaturing, without any immune or cytotoxic responses.</p> <p>The project will involve polymer synthesis, quantification of adsorbed self-assembled polymer, characterisation of the topography of these surfaces and to qualify and quantify protein adsorption. We also welcome partnering with Chinese academics with capability to expand the scope of this work to animal studies for evaluating the potential of these materials for human applications.</p>
Skill required from student:	<p>The student will be suitably skilled in the fields of</p> <ul style="list-style-type: none"> - Polymer chemistry or - Organic chemistry with materials experience <p>Students with complimentary knowledge of biology or biochemistry will be preferred.</p> <p>Furthermore, students will need to have good communication skills in English to be considered.</p>
Developmental outcomes for student:	Students will be welcomed into a multidisciplinary scientific environment with 'state of the art' equipment. Students will develop experience in controlled radical polymerisation techniques such as RAFT and expand their knowledge in the field of biomaterials. Instruments such as NMR, SEM, XPS and AFM will be used for materials characterisation. Protein chemistry techniques such as SDS-PAGE and mass spectroscopy will be used

	to evaluate proteins. Students will also gain further experience in scientific writing and presenting in English.
Any additional comments (optional):	CSIRO Manufacturing have a large Chinese community (staff and visitors) which helps to culturally support visitors

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Cell-penetrating peptide/glycopolymer hybrid materials for gene delivery

CSIRO supervisor full name:	Xiaojuan Hao, Ravin Narain (DVS)
CSIRO supervisor contact details:	Xiaojuan.hao@csiro.au , 61 3 95452614, hao003
Supervisor CSIRO details:	Manufacturing, Bio Medical Manufacturing, Biomedical Synthetic Chemistry
PhD or Scholar Program:	both
Project title:	Cell-penetrating peptide/glycopolymer hybrid materials for gene delivery
Research area:	Well defined glycopolymers will be prepared via RAFT, which will couple with cell-penetrating peptide for targeted gene therapy.
Project opportunity:	<p>Expected deliverable</p> <ul style="list-style-type: none"> Preparation of well-defined glycopolymers, short cell-penetrating peptides (CPPs), and the coupling of glycopolymers and CPPs <p>Required tasks and activities</p> <ul style="list-style-type: none"> Living free radical polymerisation (RAFT) of water soluble and biocompatible sugar monomers with controlled molecular size and narrow polydispersity Preparation of short cell-penetrating peptides using CSIRO facilities Characterisation of hybrid materials (various techniques, i.e. NMR, GPC, etc.) Evaluation of hybrid materials in vitro and in vivo (partially) Writing journal papers
Skill required from student:	The student is required to have skills related to organic chemistry, polymer chemistry, chemical engineering, and/or biomaterials. English language skills are also required.
Developmental outcomes for student:	Development and full characterization of novel biomaterials; biological and biocompatible testing towards their potential bio-applications; publications of results in peer reviewed journal and presentations of outcomes at national/international conferences.
Any additional comments (optional):	The student will gain experience in multidiscipline R&D environment. He/she will increase knowledge in synthesis and characterisation of materials both chemically and biologically along with devices fabrication. In addition, He/she will improve skills of writing reports, publications, and presentations. Moreover, he/she will get to experience a foreign culture and gain valuable English language experience.

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Temperature responsive hydrogels for cell cryopreservation, prepared by RAFT polymerisation

CSIRO supervisor full name:	Xiaojuan Hao, Ravin Narain (DVS)
CSIRO supervisor contact details:	Xiaojuan.hao@csiro.au , 61 3 95452614, hao003
Supervisor CSIRO details:	Manufacturing, Bio Medical Manufacturing, Biomedical Synthetic Chemistry
PhD or Scholar Program:	both
Project title:	Temperature responsive hydrogels for cell cryopreservation, prepared by RAFT polymerisation
Research area:	Well defined block polymers will be prepared via RAFT, which can form hydrogels for cell preservation at a low temperature.
Project opportunity:	<p>Expected deliverable</p> <ul style="list-style-type: none"> Development of novel polymer structures that can self-assemble into flower-like hydrogels for efficient cell preservation <p>Required tasks and activities</p> <ul style="list-style-type: none"> Living free radical polymerisation (RAFT) of various water soluble and biocompatible monomers with controlled molecular size and narrow polydispersity Preparation of thermal responsive hydrogels Characterisation of polymer materials (various techniques, i.e. NMR, GPC, SEM etc.) Evaluation of hybrid materials in vitro and in vivo (partially) Writing journal papers
Skill required from student:	The student is required to have skills related to organic chemistry, polymer chemistry, chemical engineering, and/or biomaterials. English language skills are also required.
Developmental outcomes for student:	Development and full characterization of novel biomaterials; biological and biocompatible testing towards their potential bio-applications; publications of results in peer reviewed journal and presentations of outcomes at national/international conferences.
Any additional comments (optional):	The student will gain experience in multidiscipline R&D environment. He/she will increase knowledge in synthesis and characterisation of materials both chemically and biologically along with devices fabrication. In addition, He/she will improve skills of writing reports, publications, and presentations. Moreover, he/she will get to experience a foreign culture and gain valuable English language experience.

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Preparation of aqueous-dispersible fullerenes by RAFT process for cancer treatment

CSIRO supervisor full name:	Xiaojuan Hao
CSIRO supervisor contact details:	Xiaojuan.hao@csiro.au , 61 3 95452614, hao003
Supervisor CSIRO details:	Manufacturing, Bio Medical Manufacturing, Biomedical Synthetic Chemistry
PhD or Scholar Program:	both
Project title:	Preparation of aqueous-dispersible fullerenes by RAFT process for cancer treatment
Research area:	Fullerene nanotechnology, RAFT polymerisation to prepare water-soluble polymers, modification of fullerenes using RAFT polymers, biological applications of polymer-fullerene hybrid nanomaterials
Project opportunity:	<p>Expected deliverable</p> <ul style="list-style-type: none"> Development of novel hybrid biomaterials with dual function of imaging and treatment for solid tumors <p>Required tasks and activities</p> <ul style="list-style-type: none"> Living free radical polymerisation (RAFT) of various water soluble and biocompatible monomers with controlled molecular size and narrow polydispersity Development of new approaches for preparation of aqueous dispersible fullerene nanoparticles Characterisation of hybrid materials (various techniques, i.e. thermal analysis, infrared analysis, imaging etc.) Evaluation of hybrid materials in vitro and in vivo (partially) Writing journal papers
Skill required from student:	The student is required to have skills related to organic chemistry, polymer chemistry, chemical engineering, and/or biomaterials. English language skills are also required.
Developmental outcomes for student:	Development and full characterization of novel biomaterials; biological and biocompatible testing towards their potential bio-applications; publications of results in peer reviewed journal and presentations of outcomes at national/international conferences.
Any additional comments (optional):	The student will gain experience in multidiscipline R&D environment. He/she will increase knowledge in synthesis and characterisation of materials both chemically and biologically along with devices fabrication. In addition, He/she will improve skills of writing reports, publications, and presentations. Moreover, he/she will get to experience a foreign culture and gain valuable English language experience.

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Functional nanoparticles for biomedical applications

CSIRO supervisor full name:	Xiaojuan Hao and Hong Yin
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Supervisor CSIRO details:	CSIRO Manufacturing; Program: Biomedical Manufacturing Team: Biomaterial Interface Chemistry and Program: HPMI - High Performance Metal Industries Team: Nanomaterials & Surface Design
PhD or Scholar Program:	Both PhD and visiting Scholar
Project title:	Functional nanoparticles for biomedical applications
Research area:	Functional nanoparticles, such as magnetic nanoparticles, semiconductor quantum dots, graphene oxide etc. used in bio-imaging, sensing and drug delivery
Project opportunity:	Functional nanoparticles with cores composed of inorganic materials such as noble, magnetic metals, their alloys and oxides, and semiconductors have great potentials for application in many biomedical areas, from bio-imaging to sensing. These nanoparticles must be well designed and controllably synthesised to deliver desired results with minimum cytotoxicity. These criteria can be met by careful tailoring of the ligand shell, allowing stabilisation, specific targeting, and recognition of biochemical species. The project will focus on novel biofunctionalisation of inorganic metal, semiconductor, and magnetic nanoparticles for biomedical applications.
Skill required from student:	<ol style="list-style-type: none"> 1. Demonstrated capability to carry out research work independently including literature search, concept development, experimental work planning and implementation. 2. Good knowledge in chemistry or biomedical materials, a degree in chemistry or material science will be desirable. 3. Good knowledge and skills on composite fabrication and characterization methods. 4. Good communication and writing skills and capable to prepare oral presentation and written report, articles. 5. Good interpersonal skills and a team player, hardworking and willing to strive for excellence.
Developmental outcomes for student:	<ul style="list-style-type: none"> • Research experience in CSIRO, Australia's national science agency and one of the world's largest and most diverse research agencies • Collaboration with CSIRO teams with strong international reputation in the field of materials science and engineering • Ability to work in multi-disciplinary research teams and access to the world class facilities in CSIRO.

	<ul style="list-style-type: none">• Enhanced English skills in materials science and materials engineering• Networking with researchers in CSIRO and in the Australia scientific community• Opportunity to work on a topic that could lead to publications in top journals.
Any additional comments (optional):	Either PhD student or visiting scholar is welcome, more than one is welcome, too.

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Structure and function of protein molecules

CSIRO supervisor full name:	Bin Ren
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Supervisor CSIRO details:	Manufacturing Flagship, Biomedical Manufacturing program, Protein Science group, Protein Engineering team
PhD or Scholar Program:	both PhD and Scholar
Project title:	Structure and function of protein molecules
Research area:	We study the structure-function relationship of bio-macromolecules using molecular biology and biophysics methods, focusing on structure guided molecular design.
Project opportunity:	Functional and structural studies will be carried out on industrial enzymes that catalyse the hydrolysis of polyphenolic compounds from plants. These enzymes have long been widely used in food, beverage, pharmaceutical and chemical industries. Such studies will help us understand the basis of substrate specificity and guide molecular modification for application purposes. The visitor will have the opportunity to be involved in both basic and applied researches, in the disciplines of biophysics, molecular biology, and protein chemistry. Training of these techniques, including X-ray crystallography will be provided. Research publications are expected.
Skill required from student:	The visitor is required to have a strong background in general laboratory techniques and a good understanding of protein biochemistry and molecular biology, including protein expression, purification and characterisation of recombinant proteins. Biophysical and crystallographic techniques will be applied in this research and some prior knowledge will be a plus but not a must.
Developmental outcomes for student:	<ul style="list-style-type: none"> - CSIRO Parkville site runs Australia's largest and most advanced protein expression and protein crystallography facilities and the visitor would work within both of these facilities. - develop skills in prokaryotic protein expression. - develop skills in the use of laboratory automation for molecular biology, protein expression and protein purification. - develop skills in purification and analysis of recombinant proteins using chromatography, electrophoresis, mass spectrometry, differential scanning fluorimetry and dynamic light scattering. - develop skills in crystallisation of proteins using robotics and nano-drop technology. - develop skill in structural determination using high throughput protein crystallography. - develop skills for the design of experiments, interpretation of scientific results and writing of publications - develop English language and scientific presentation skills for the effective communication of research data

Any additional comments (optional):	We welcome visitors with background of biochemistry, molecular biology, biophysics, or biomedical research. They are encouraged to discuss how their research projects may benefit from the interaction, and to initiate new projects for long-term collaboration in the future.
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