

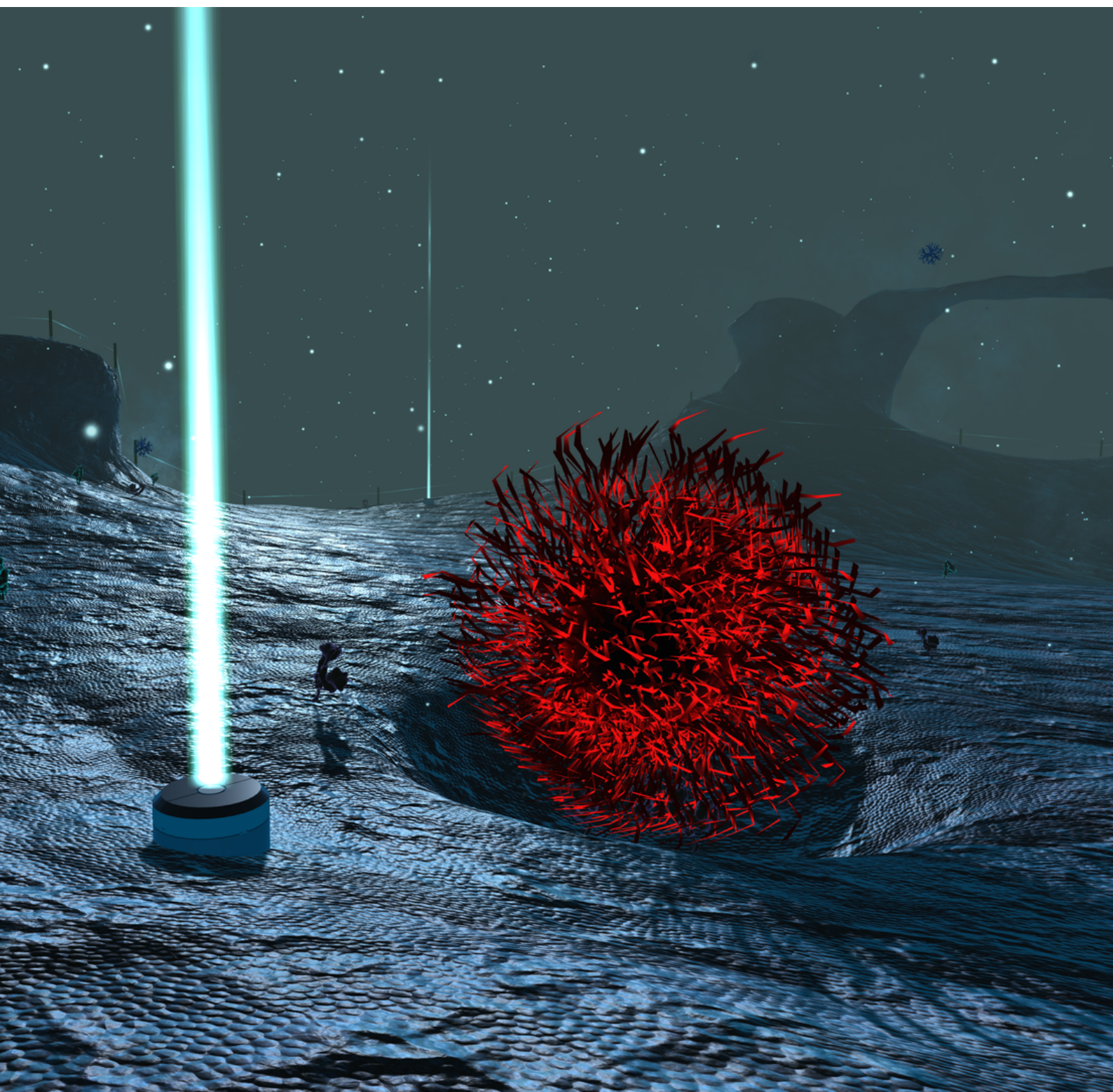


AUSTRALIAN CENTRE FOR
NANOMEDICINE



Australia's
Global
University

Annual Report 2017



Cover: A nanoparticle (red) being absorbed by the surface of a cancer cell.

Image: A/Prof John McGhee, John Bailey (UNSW Art & Design)

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Directors' Report

The Australian Centre for NanoMedicine (ACN) was established in mid-2011 as a national innovator in NanoMedicine, bringing together a diverse team of leading researchers in Medicine, Science and Engineering to deliver the next generation of health innovations, and is dedicated to providing new solutions for therapeutics and diagnostics enabled by nanotechnology.

The key science that underpins all the activities of the Centre is to fully understand and exploit the unique properties of nanomaterials for various applications (eg. nanosensors for cell imaging and therapeutics for treating cancer). The Centre's strategic vision is to create teams focused on particular diseases using Team ACN's skills in drug delivery, diagnostics and imaging.

To succeed in this, it requires an integrated team of researchers coming from diverse backgrounds and we have assembled a remarkable team of highly distinguished scientists and engineers covering nanotechnology, polymer science, cancer biology, chemical engineering, microfluidics, chemistry, sensors and imaging, social science and experimental arts (3D imaging) from five UNSW faculties: Medicine, Science, Engineering, Arts & Social Sciences, and Art and Design.

Towards end of 2017 the Centre's Management Team re-examined the Centre's vision and priorities in response to a changing UNSW landscape and new grant funding environment. Management has since developed a new strategic plan to harness our full potential. The new strategic focus moving forward will focus on the following three themes:

People/ Talent

Our people and their commitment to excellence are our strength. To retain, attract and develop emerging and leading researchers is our Strategic focus. We have recruited 5 new members in 2017, including Prof Liming Dai, UNSW SHARP hire; Dr Kris Kilian and Dr Kang Liang, both UNSW Scientia Fellows; Dr Iman Roohanie, NHMRC ECF Fellow; and Dr Robert Chapman, ARC DECRA Fellow.

The Centre seeks to develop emerging leaders and retain talents through workshops and Seed Funding and providing postdoc and PhDs the opportunity to host workshops, visitors and chair Nanomed Conference sessions.

Research Focus/ Engagement

The Centre aims to transform from bottom-up driven to end-user industry & clinician driven. To achieve this goal, we've introduced a Clinical Challenges Session and Industry Session at our annual Nanomed Conference. These sessions have already achieved pleasing results and led to collaborations and linkages, incl. Justin and Maria's ARC Linkage Project with Inventia on 3D printing (see Research section for details).

The Centre has actively engaged with Translational Cancer Research Network (TCRN) NSW and is working towards becoming a member of TCRN. A TCRN/ACN Clinical workshop was held on Friday 17 Nov 2017 where our Centre Directors pitched to a broader clinical audience on big picture Nanomedicine and potential. Maria gave an overview of the ACN and capabilities, Cyrille gave a talk on "Nanomedicine for antimicrobial use" and Justin talked about "The potential of nanosensors and diagnosis for clinical use".

Profile

ACN has gone from strength to strength from its inception in 2011. We strive to continue to strengthen our high profile through a number of initiatives, including: becoming part of Translational Cancer Research Centres NSW and addressing the disease problems, producing high quality publications and hosting the annual International Nanomedicine Conference, attracting and retaining high quality researchers.

These and several other key achievements during 2017 are summarised in the body of this annual report. These achievements contributed to making 2017 an extremely successful year for the Centre. We look forward to similar progress in 2018 and in subsequent years.



Justin Gooding
Centre Co-Director



Maria Kavallaris
Centre Co-Director



Cyrille Boyer
Centre Co-Director

ACN 2017 Summary

Our People

33 PostDocs and
Research Associates and
4 Associated Members

80 Honours and PhD
Students including 4
Scientia PhDs

21 Members incl 11 Self-
Funded Research Fellows, 1
SHARP Appointment and 2
Scientia Fellows

1 University Medalist
and 14 PhD
Completions/
Submissions in 2017

16 Administration and
Technical Staff

Research Output

150 Journal Publications plus
10 Conference Proceedings
in 2017

ACN members and students
worked on 13
interdisciplinary research
projects in 2017

Over \$11.5M new funding to
fund projects commencing in
2017

ACN hosted 8th International
NanoMedicine Conference
3-5 July 2017 where many
ACN researchers presented
their research

35 Plenary, Keynote and
Invited talks by Team ACN in
2017 at major international
conferences, incl 12 overseas
and 15 with financial support

49 seminars, oral
presentations and poster
presentations by team ACN
at universities, symposiums
and meetings in 2017

26 memberships on Editorial
Boards in 2017

Team ACN actively
collaborated with 56
organisations in 2017
including 36 overseas
organisations

24 visitors (including 20
international) visited ACN in
2017 to discuss research
collaboration

2017 major awards incl. Justin Gooding's Eureka Prize in
Mentoring and Katsumi Niki Prize in
Bioelectrochemistry, Maria Kavallaris' Premier's Science
and Engineering Award for Leadership in Innovation in
NSW

Team ACN garnered over 90 media
articles (including TV & Radio) both
in Australia and overseas in 2017

Governance, Our People and Visitors



Associated Faculties and Schools

The Australian Centre for NanoMedicine is a unique Centre in that it draws members from several faculties, schools, institutes and centres across UNSW.

Presiding Faculty	-	Faculty of Engineering
Associate Faculties	-	Faculty of Science
		Faculty of Medicine
		Faculty of Art and Design
		Faculty of Arts and Social Sciences
Host School	-	School of Chemical Engineering
Associate Schools	-	School of Chemistry
		School of Medical Sciences
		School of Humanities and Languages
		School of Women’s and Children’s Health
		Graduate School of Biomedical Engineering
		School of Materials Science and Engineering
		School of Mechanical and Manufacturing Engineering
Associate Institutes	-	Children’s Cancer Institute



Steering Committee

The Steering Committee provides support, guidance and oversight on strategy and stakeholder engagement as well as monitoring progress towards the delivery of key performance indicators and other objectives. The ACN Steering Committee is chaired by Professor Mark Hoffman (Presiding Dean) and is comprised of members from the associate Faculties of Science and Medicine. The 2017 Steering Committee meetings are noted below.

Steering Committee Members		May 1	Jul 31	Nov 14
	Professor Mark Hoffman (Chairman) Dean of Engineering, UNSW	•	•	•
	Professor Emma Johnston Dean of Science, UNSW (from July 2017)		•	
	Professor Rodney Phillips Dean of Medicine, UNSW			• (Mark Ainsworth deputised for Rodney Phillips)
	Professor Peter Lovibond Deputy Dean of Science, UNSW	•		•
	Scientia Professor Ian Dawes School of Biotechnology and Biomolecular Sciences, UNSW	•	•	•
	Scientia Professor Justin Gooding ACN Co-Director School of Chemistry, UNSW	•		•
	Professor Maria Kavallaris ACN Co-Director Children's Cancer Institute	•	•	•
	Professor Cyrille Boyer ACN Co-Director School of Chemical Engineering, UNSW	•	•	•
	Kimberly Edmunds Centre Manager Australian Centre for NanoMedicine	•	•	•

Centre Directors



Scientia Professor J. Justin Gooding

Editor-in-Chief, ACS Sensors
ARC Australian Laureate Fellow
School of Chemistry, UNSW Sydney

Scientia Professor Justin Gooding is currently an ARC Australian Laureate Fellow, the co-director of the Australian Centre for NanoMedicine and the co-director of the New South Wales Smart Sensing Network. He is a Fellow of the Australian Academy of Science and the International Society of Electrochemistry. He is also editor-in-chief of the journal ACS Sensors. He has won many awards including a 2004 NSW Young Tall Poppy award, the 2009 Eureka Prize for Scientific Research, the 2013 NSW Science and Engineering Award for Emerging Research, the 2016 Faraday Medal of the Royal Society of Chemistry and the 2016 Biosensors and Bioelectronics Award. He leads a research team of over 40 researchers interested in sensors for medical diagnostics, nanomedicine, 3D printing of cells for biomedical research and biomaterials.



Professor Maria Kavallaris FAHMS

Head, Tumour Biology & Targeting Program
Children's Cancer Institute

Professor Maria Kavallaris, Founding Director, Australian Centre for NanoMedicine, UNSW, and Program Head, Children's Cancer Institute Australia. She holds a prestigious NHMRC Principal Research Fellowship and is an internationally recognized leader in cancer biology, therapeutics and cancer nanomedicine. Her research has led to clinical collaborations and industry linkages that is maximising translation of her research. She is a Fellow of the Australian Academy of Health and Medical Sciences. Professor Kavallaris has received numerous national and international awards and prizes including an Australian Museum Eureka Award, AIPS Young Tall Poppy Award, 2015 AFR/Westpac 100 Women of Influence Award, recognized in the 2015 Knowledge 100 Australian Innovators and the 2017 Premier's Science and Engineering Award for Leadership in Innovation in NSW.



Professor Cyrille Boyer PhD

School of Chemical Engineering, UNSW Sydney

Professor Cyrille Boyer is the Co-Director of Australian Centre for NanoMedicine. He received many awards including the 2012 SCOPUS Young Researcher of the Year Award, the 2015 Prime Minister's Science Prize, the 2016 LeFevre Memorial Prize, ARC-APD and ARC-Future Fellowship in 2010 and 2012 respectively, and was nominated as one of the inaugural Knowledge Nation 100 in 2015. Cyrille's research has gained international recognition, winning the prestigious ACS Biomacromolecules/ Macromolecules Award and Journal of Polymer Science Innovation Award in 2016. Cyrille's research interests mainly cover the use of photoredox catalysts to perform living radical polymerization and functional polymers for therapeutic applications (for example, polymers with anti-microbial properties). He holds 6 international patents and has published over 200 research articles including 24 highly cited papers according to ESI Web of Science.

ACN Members



Prof Liming Dai
Engineering
SHARP Hire



Dr Kris Kilian
Science
Scientia Fellow



Dr Kang Liang
Engineering
Scientia Fellow



Dr Iman Roohani
Science
NHMRC ECR Fellow



Dr Rob Chapman
Science
ARC DECRA Fellow



Scientia Prof Kat Gaus
Medicine
NHMRC Senior
Research Fellow



Prof Richard Tilley
Science



Prof Pall Thordarson
Science



Prof Naresh Kumar
Science



A/Prof Phoebe Phillips
Medicine



A/Prof John McGhee
Art & Design



A/Prof Matthew Kearns
Arts & Social Sci
ARC Future Fellow



Dr Joshua McCarroll
Medicine
Cancer Inst CDF Fellow



Dr Damia Mawad
Science



Dr Alex Donald
Science



Dr Orazio Vittorio
Medicine
Cancer Inst CDF Fellow



Dr Jason Xu
Engineering
ARC Future Fellow



Dr Sophia Gu
Engineering
NHMRC ECF Fellow



Dr Adam Martin
Science
NHMRC-ARC Dementia
Research Fellow



Dr Alex Soeriyadi
Science
NHMRC ECF Fellow



Dr Edgar Wong
Engineering
VC Postdoc

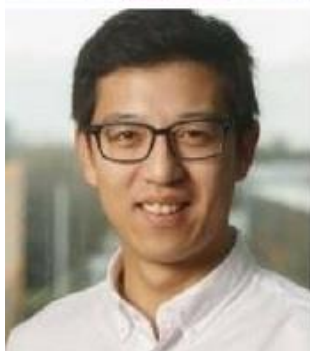
2017 New Members



Professor Liming Dai is a fractional UNSW SHARP (Strategic Hires and Retention Pathways) appoint to School of Chemical Engineering in July 2017 and joined ACN the same month. Professor Dai comes from the Department of Macromolecular Science and Engineering at Case Western Reserve University in the US and has an outstanding CV with over 30,000 citations. Prof Dai would be a great asset to ACN.



Dr Kristopher Kilian is a Scientia Fellow with a joint appointment to School of Chemistry and School of Materials Science and Engineering. He worked for Merck Research Labs in the Methods Development group from 2000-2004 before travelling to Sydney to do his PhD with Justin Gooding at UNSW. In 2007, he joined the Milan Mrksich lab at the University of Chicago as a NIH postdoctoral fellow. Kris joined the University of Illinois at Urbana-Champaign in 2011. Kris is a 2008 recipient of the NIH Ruth L. Kirchstein National Research Service Award, a 2014 Kavli Fellow of the 19th German-American Frontiers of Science, a 2015 recipient of the National Science Foundation's CAREER award, and a 2017 Young Innovator of Cellular and Molecular Bioengineering from the Biomedical Engineering Society (BMES).



Dr Kang Liang is a Scientia Fellow with a joint appointment to School of Chemical Engineering and The Graduate School of Biomedical Engineering. Kang joined ACN in August 2017. Kang is also an Honorary Fellow at The University of Melbourne and Monash University. In 2015, Dr Kang Liang developed a new technique for fingerprinting by creating an ultraviolet light to recapture fingerprints at crime scenes by making them "glow"; he also developed a new technology in the same year that can protect proteins in drugs and vaccinations from heat, bacteria and other hostile environments by applying the concept of a sea urchin's shell. Dr Liang is an awardee of Victoria Fellowship in Physical Sciences in 2017.



Dr Iman Roohani is a NHMRC ECF Fellow and joined the Gooding Group at School of Chemistry and ACN in mid-2017. Iman received his PhD in 2014 from USyd. His PhD discovery is now being commercialised by Allegra Orthopaedics. Allegra was awarded \$1.6M from the NSW Government Medical Devices Fund in 2015 to bring this technology to market. Iman has received many honours and awards through his career. Since joining ACN, Iman has received 2 major NHMRC Project Grants including one as Sole CI, A Targeted Delivery System for Treatment of Bone Metastasis, \$243,607.



Dr Robert Chapman is an ARC DECRA fellow at the School of Chemistry. He joined ACN in August 2017. Robert completed his PhD in Chemistry at the University of Sydney in 2013. He subsequently worked as a research associate in the lab of Prof. Molly Stevens at Imperial College London (2013-15) on the development of nanomaterial based biosensors and scaffolds for tissue engineering, before returning to UNSW in 2016. Robert uses enzymes to design multivalent polymer-peptide conjugates for protein binding applications and to design novel biosensors for the detection of disease. He has expertise in well controlled polymerisation techniques, the self-assembly of polymer and peptide based nanomaterials, and in nanoparticle based biosensing.

Associate Members

Professor Martina Stenzel
A/Pro Shelli McAlpine
Dr May Lim
Dr Renee Whan

Research Fellows

Dr Elizabeth Hinde **
Dr S R C Vivekchand (VC)
Dr Enrico Klotzsch (VC)**
Dr Yuanhui Zheng (VC)**
Dr Hongxu Lu (DECRA)
Dr. Padmavathy Bakthavathsalam
(Trust-India Fellow)
Dr. Yuhua Xue (VC)
Dr Vinicius Goncalves*

Post Docs

Dr Christopher Fife*
Dr Georgia Miller*
Dr Chin (Ken) Wong*
Dr Fabio Lisi*
Dr Jonathan Wojciechowski*
Dr Ernesto Moles*
Dr Jonathan Yeow*
Dr Amelia Parker**
Dr Parisa Sowti**
Dr James Webb**
Dr Roya Tavallaie**
Dr Declan Kuch
Dr Friederike Mansfeld
Dr Lakmali Atapattu
Dr Sela Pouha
Dr Wee Siang Teo
Dr Marion Le Grand
Dr Andrew McGrath
Dr Robert Utama
Dr Stephen Parker
Dr Wenqian Wang
Dr Ying Yang
Dr Alistair Laos
Dr Thibault Tabarin
Dr Tania Benedetti

PhD & Honours Students

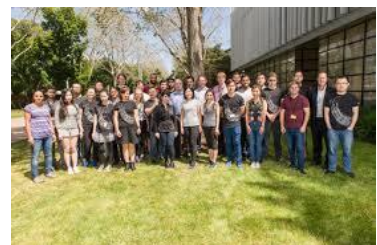
Mr Simone Bonaccorsi*#
Mr Cong Vu*#
Ms Munkhshur (Shuree) Myekhlai*#
Mr Agus Poerwoprajitno*#
Ms Gervase Ng*
Mr Sihao Xu*
Mr Peter Judzewitsch*
Mr Chenyu Wu*
Ms Alicia Cheng*
Ms Yiping Wang*
Mr Ahmed Mustafa*
Ms Panthipa Suwannakot*
Mr Ali Alinezhadcham*
Mr Timothy Snailham*
Miss Yingying Chu*
Mr Zixuan Huang*
Mr Hsiang-Sheng Chen*
Ms Jianxin Lily Lian*
Ms Sharmin Maitry*
Ms Wenxian Tang*
Ms Zerong Ma*
Ms Florida Voli*
Ms Tara McDonnell*
Ms Mahdie Mollazade**
Mr Chin (Ken) Wong**
Mr Jonathan Wojciechowski**
Mr Md. Musfizur Hassan**
Ms Georgia Miller**
Mr Saimon Silva**
Mr Fei Han**
Mr Yosef Arman**
Ms Leila Zarei**
Mr Vincent Tan**
Ms Ranjana Piya**
Mr Siva Shanmugam**
Ms Khanh Nguyen**
Mr Jonathan Yeow**
Ms Aria Ahmed-Cox**
Mr Michael Lawler**
Mr Alexander Rashleigh**
Ms Holly McEwen**
Mr Alexander Kross
Ms Joanna Kwiatek
Mr Alex (Yuanqing) Ma
Mr Jason Tran
Ms Lucy Gloag
Mr Cameron Kelly
Dr David Chang

Mr Walter Muskovic
Ms Helen Forgham
Mr Abu Sadat Md. Sayem Rahman
Mr Bijan Po
Mr Lachlan Carter
Mr Manish Sriram
Mr Mehran Bolourian Kashi
Mr Peter O'Mara
Mr Sanjun Fan
Mr Yanfang Wu
Ms Duyen Nguyen
Ms Fida'a Alshawawreh
Ms Kelly Zong
Ms Manchen Zhao
Ms Mohadesseh Kahram
Ms Raheleh Pardekhorrarn
Mr Abbas Darestani Farahani
Mr Eric Du
Ms Genevieve Duche
Ms Kristel Tjandra
Ms Susan Tan
Mr Nik Nik Mohd Adnan
Ms Sri Augustina
Mr Ali Bagheri
Mr Nat Corrigan
Mr Xiankan He
Mr Kenward Jung
Ms Susan Oliver
Mr Zhenbang Cao
Mr Shashidhar Nizalapur
Mr Ming Han Eugene Yee
Mr Kumar Bishwajit

***Joined in 2017**

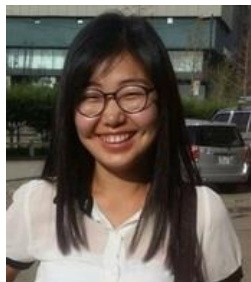
****Submitted /Left in 2017**

Scientia PhD



Above: Gooding Group & Kavallaris Lab

Meet our Scientia PhDs



Munkhshur Myekhlai received her bachelor degree in Chemical Engineering and master degree in Science of Nanoengineering from the National University of Mongolia (Mongolia). Her recent research concerns the synthesis of magnetic metallic nanoparticles and in particular cobalt and Au nanoheterostructures in the electrocatalysts. She has expertise in the metallurgy, 2D nanomaterials, and electrochemistry. Her current PhD project title is: Cobalt and Au nanoparticles for electrocatalysts.



Simone Bonaccorsi holds a BS in Electronic Engineering from Politecnico of Turin (Italy), MS in Nanotechnology, joint degree between Politecnico of Turin (Italy), EPFL (École polytechnique fédérale de Lausanne, Switzerland) and Grenoble INP Phelma (France). His background spans applications in engineering, nanotechnology, biology, immunology, genomics and bio-nanotechnology. He has worked in different technology and biotechnology-related industries as well as research institutes worldwide such as Riken (Tokyo, Japan) and Ludwig Cancer Research (Lausanne, Switzerland). He has also worked in Harvard-MIT Health Science and Technology, Imperial College London.



T Cong's research is mainly focusing on the synthesis mesoporous silica nanorods, and then compare the cellular uptake of nanorods to the traditional nanospheres while the surface chemistry and diameter are kept similar to understand the role of shape on uptake pathway. Surface chemistry and size of mesoporous silica nanoparticles have been extensively studied, but the impact of shape has been little understood with near exclusive use of spherical shape. Despite this relative limited volume of papers, mesoporous silica nanorods have been shown to give significant improvement in drug delivery.



Agus R. Poerwoprajitno received B.Eng. degree from Diponegoro University in 2014 and M.Sc. degree from National Taiwan University of Science and Technology in 2015. He then worked as a research assistant in Institute of Chemistry, Academia Sinica. His previous research experience focused on mechanistic study of hydrogen production by iron thiolate catalyst. He joined in Prof. Tilley's group as Scientia Ph.D. student in July 2017. Currently, his research interest includes synthesis of nanoparticle for energy-related applications. In March 2018, he works as visiting doctoral student at the Center for Integrated Nanotechnologies (CINT), Sandia National Laboratories, USA.

Centre Administration

Kimberly Edmunds
Centre Manager

Mr Campbell Strong
Researcher (From 2017)

Mr. James Wilmot
Research Assistant (From Jan 17)

Dr Joshua Peterson
Research Officer (To Dec 2017)

Ms Rose-Marie Olsson
Senior Research Assistant

Dr Robert Healey
Research Assistant (From Feb-17)

Mr Eh Hau Pan
Lab Manager

Ms Kathleen Kimpton
Senior Research Assistant

Ms Victoria Gernedl
Research Trainee

Dr Andrew Lilja
Researcher (From 2017)

Mrs Sona Samuels
Research Assistant

Ms Jesu Schlogl (To July 17)
Ms Claudia Demech (Jul- Oct 17)
Ms Samantha Ellis (From Oct 17)

Mr John Bailey
Researcher

Ms Efremova Varvara
Research Assistant

EA to Prof Kavallaris

Visitors to the ACN

The ACN has hosted a diverse range of visitors from academia and industry within Australia and around the world during 2017. Our visitors have presented seminars and met with research staff and students to investigate potential collaboration opportunities.

Prof Hiroaki Kitagawa
Department of Applied Life
Sciences
Gifu Univeristy
Japan

Prof Barbara Prainsack
Global Health & Social
Medicine
King's College London
UK

Prof Eric Anslyn
Distinguished Professor in
Chemistry
University of Texas at Austin
USA

Prof Emma Kowal
ARC Future Fellow
Deakin University
Australia

Prof Jenny Reardon
Director, Science & Justice
Research Center
University of California
Santa Cruz, USA

Prof Wolfgang Schuhmann
Chemistry Department
Bochum University
Germany

Prof Daohan Ge
Distinguished Professor
Jiangsu University
China

Prof Wolfgang Parak
Head of Biofunctional
Nanomaterials
Philipps University of Marburg
Germany

Prof Helen Rizos
Head of Biomedical Sciences
Faculty of Medicine and Health
Sciences
Macquarie University
Australia

Prof Bradley Smith
Director, Notre Dame
Integrated Imaging Facility
Norte Dame University
USA

Prof Andrew Webster
Sociology Department
University of York
UK

A/Prof Jann Grimm
Memorial Sloan Kettering
Cancer Center
USA

A/Prof Albert Folch
Bioengineering
University of Washington
USA

A/Prof Krishna K Darodaran
Supramolecular Chemistry
Group
University of Iceland
Iceland

A/Prof Lisa Butler
ARC Future Fellow
University of Adelaide
Australia

Dr Robert Ramsey
Group Leader
Gastrointestinal Cancer
Program
Peter McCallum Cancer Centre
Australia

Dr Johannes Reynisson
Faculty of Science
University of Auckland
New Zealand

Ms Saskia Peters
Practicum
Delft University of Technology
The Netherlands

Mr Sander J Wezenberg
Practicum
University of Groningen
The Netherlands

Dr Sherry Y Wu
University of Texas M.D.
Anderson Cancer Center
(MDACC)
USA

Prof Benjamin G Davis
Chemistry Department
Oxford University
UK

Mr William Whitehouse
Practicum
Imperial College London
UK

Ms Anna Wang
PhD Candidate
Harvard University
USA

Dr Andrew Surman
Chemistry Department
University of Glasgow
UK



A great talk by our international visitor **A/Prof Jan Grimm from MSKCC in NYC** on 13 Nov: “When particles meet...”

Biomedical Futures: Social Scientists engaging with big questions about science

National Science Week provided an opportunity for Dr. Declan Kuch, Dr. Georgia Miller and A/Prof Matthew Kearnes to engage with laboratory scientists, researchers and policy-makers around their research into the construction and implications of precision and targeting in biomedicine. Their work involves both ethnographic research of the science in the making and the broader policy landscape. These overlaps between science and policy have become increasingly visible in the push to engage publics in the making of various biobanks, such as the ‘All of US’ initiative.

Professor Jenny Reardon (UCSC) made an outstanding keynote lecture Just Biomedical Research based on her most recent book *The Postgenomic Condition*. Drawing inspiration from Arendt’s original formulation of human condition, Professor Reardon powerfully argued that simplistic narratives that genomic science - and precision medicine - will produce new cures and miracle drugs obscure harder questions about not only the meaning of genomic data but also how and by whom decisions about who lives and dies should be made.



(Photo Above: A/Prof Matthew Kearnes welcoming panel members. **Prof Jenny Reardon** from UCSC, 4th from left)

Research Highlights



Concept illustration of multiuser virtual reality visualisation of nanoparticle distribution in vivo.
Image: A/Prof John McGhee, Dr Andrew Lilja (UNSW Art & Design)

2017 Grant Funding

ACN members' total research funding for projects commencing in 2017 is approx. \$11.5 million. Below is a list of 2017 new funding highlights.

ARC Discovery Project DP170102727, Katharina Gaus , et al. DNA nanotechnology for controlled antigen presentation to T cells. (2017-2019). \$485,500	pancreatic cancer. (2017-2018). \$100,000	2019). \$150,000
ARC Discovery Project DP170103599, Katharina Gaus , et al. Statistical analyses for spatial organisation in T cell signalling networks. (2017-2019). \$398,500	Cancer Australia Priority-driven Collaborative Grant APP1126738, Phoebe Phillips, Joshua McCarroll , et al. Therapeutically Targeting a Solute Carrier Transporter in the Stroma of Pancreatic Cancer. (2017-2020). \$511,000	Department of Industry, Innovation & Science, Innovation Connections Contracts, Pall Thordarson . (2017-). \$50,000
ARC Linkage Project LP170100623, Justin Gooding, Maria Kavallaris , et al. Bioinks for the 3D printing of cells made from off-the-shelf components. (2017-2019). \$416,287	Cancer Australia Priority-driven Collaborative Grant APP1126736, Phoebe Phillips, Joshua McCarroll , et al., Reprogramming the tumour microenvironment with the use of nanomedicines for the treatment of pancreatic cancer. (2017-2020). \$500,000	Industry funding, Inventia, Maria Kavallaris . (2017-). \$150,000
ARC Linkage Infrastructure, Equipment and Facilities LE170100087, Richard Tilley , et al. Plasma-focused ion beam for nanoscale characterisation of materials. (2017). \$1,100,000	Cancer Council NSW, Katharina Gaus , et al. T cell receptor (TCR) signaling in adoptive T cell therapy against B cell lymphoma. (2017-2019). \$450,000	Lleaf Pty Ltd, ARC Linkage Partner Contribution, Pall Thordarson . (2017-). \$37,500
ARC Industrial Transformation Training Centres Scheme IC170100020, Pall Thordarson, Richard Tilley , et al. ARC Training Centre for the Chemical Industries. (2017-2021). \$3,279,502	Cancer Institute NSW Research Equipment Grant REG171128, Maria Kavallaris . Ultra-fast, high resolution, low-dose microcomputed tomography for cancer and vascular imaging in small animals. (2017-) \$383,100	NHMRC Principal Research Fellowship APP1119152, Maria Kavallaris . Precision nanomedicine-based cancer therapeutics. (2017-2021). \$763,845
Avner Pancreatic Cancer Foundation Innovation Grant, Phoebe Phillips, Joshua McCarroll , et al. Therapeutically targeting a solute carrier transporter in the stroma of	CINSW Career Development Fellowship, Orazio Vittorio . An anticancer chemically-modified natural compound targeting copper in neuroblastoma. (2017-	NHMRC Project Grants APP1129609, Katharina Gaus . Regulation of the signalling efficiency of the T cell antigen receptor. (2017-2019). \$456,557
		Ovarian Cancer Foundation, Maria Kavallaris . Re-activating anti-tumour immunity by targeting N-MYC-Let7 axis in ovarian cancer. (2017-). \$126,000
		Public section grant, NSW State Government for the New South Wales Smart Sensing Network, Justin Gooding (2017-). \$1,700,000
		Tianjin Sungene Biotech Co Ltd, ARC Linkage Partner Contribution, Pall Thordarson . (2017). \$50,000

Tour de Cure Established Research Grant, **Phoebe Phillips, Joshua McCarroll**, et al. Nanomedicine-based treatment to inhibit pancreatic cancer growth and metastases. (2017-2018). \$200,000

Tour de Cure Pioneering Cancer Research Grant, **Phoebe Phillips**,

Joshua McCarroll, et al. Targeting muty-homolog to reduce pancreatic tumour chemoresistance and metastatic spread. (2017-2018). \$80,000

Tour de Cure Pioneering Cancer Research, **Maria Kavallaris**. Precision nanomedicine for the

treatment of neuroblastoma. (2017-2018). \$80,000

UNSW-Tsinghua Collaborative Research Fund, **Zi (Sophia) Gu, Cyrille Boyer, Maria Kavallaris**. Engineering a biodegradable nanorobot for advanced therapies and diagnosis. (2017-2018). \$15,000



(Left: **Dr Sophia Gu** with Tsinghua Seed Fund collaborators.

Right: **A/Prof Phoebe Phillips** winner of Avner Pancreatic Cancer Grant)

Interdisciplinary Projects Currently Carried out at the Centre

Title of interdisciplinary projects	Disciplines represented
Isolating, interrogating and bioengineering single circulating cells	Chemistry, cell biology
JTCC: Visualising bio-imaging and data in 3D Virtual Reality (VR)	Chemistry, Medical research, Biology, Data Science
Nano challenges and opportunities in cancer	Chemistry, cell biology, cancer biology
Sensors and diagnostic for managing bloodstream infections	Chemistry and Cell Biology
Social dimension of bio-nano interactions	Chemistry and Social Sciences
MiRNA Detection	Chemistry, cell biology, cancer biology
Opendatafit	Chemistry, Medical research, Biology, Data Science
Gels as 3D cell culture materials	Chemistry, Medicine, Cell Biology, Biomedical Engineering
Folding of quaternary proteins	Chemistry, Biophysics
Aesthetics and drug delivery	Chemistry and Social Sciences
Faceted polymersomes for drug delivery	Chemistry, Medicine, Cell Biology
3D printing of cells	Cell biology, polymer chemistry, mechanical and electrical engineering
Surfaces for cell capture and release	Chemistry, cell biology, cancer biology

2017 Newly Funded Projects

Precision Nanomedicine-Based Cancer Therapeutics

M Kavallaris (NHMRC Senior Research Fellowship)

Cancer remains a significant clinical problem and causes considerable morbidity and mortality in society. Prof Maria Kavallaris is an international leader in cancer biology, therapy and the development of less toxic therapies for cancer using nanotechnology. Her vision is to build a leading program of applied research to develop treatments for aggressive disease that will reduce the impact and improve the outcomes for cancer patients.

Regulation of the Signalling Efficiency of the T Cell Antigen Receptor

K Gaus (NHMRC Project Grants)

An immune response starts with activation of the T cell antigen receptor (TCR). How T cell receptor signalling begins, however, is not well understood. We have developed a novel imaging approach that allows us to directly observe what happens after an antigen binds to the receptor. The research will provide mechanistic insights into how T cells sense and discriminate antigens. This knowledge will aid the development of cancer immunotherapies and vaccines.

Bioinks for the 3D Printing of Cells Made from Off-the-shelf Components

J Gooding, M Kavallaris, et al. (ARC Linkage Projects)

This project aims to develop a

simple method for creating complex, multiple-cell-type three-dimensional (3D) cell cultures for in-vitro cell based assays. Using 3D printing technology, this project will develop a versatile polymer system, made from entirely commercially available components, that gels upon printing and has functionality to assist cells in adhering, growing and migrating. The 3D printing of multiple cell types will provide biological scientists with more realistic in-vitro cell assays to those found in-vivo. Applications of the research are in cell biology, studying diseases and developing new drugs.

DNA Nanotechnology for Controlled Antigen Presentation to T Cells

K Gaus, et al. (ARC Discovery Project)

The project aims to present individual antigens to T cells and to image T cell receptor signalling with single molecule microscopy. Combining DNA origami nanotechnology with single molecule imaging should reveal the sensitivity of T cell signalling. A DNA force sensor will determine whether mechanical forces contribute to antigen discrimination. The project will use the nanotechnology strategy to identify antigen-specific T cells in tissue. The project is expected to advance understanding of T cell biology, and contribute to DNA nanotechnology and super-resolution microscopy whilst providing fundamental insights into antigen recognition by T cells and ultimately derive clinically relevant practical applications.

Statistical Analyses for Spatial Organisation in T Cell Signalling Networks

K Gaus, et al. (ARC Discovery Project)

This project aims to reveal how nanoscale spatial organisation encodes plasticity in the T cell signalling network, and how T cells exploit this plasticity to regulate sensitivity to antigens. In adoptive immunity, T cells respond appropriately to any given antigen, but how they make decisions is unclear. This project will define how nanoscale spatial organisation of signalling molecules shapes signalling strength and plasticity in the T cell antigen receptor (TCR) network; and infer rules linking spatial organisation and signalling activities in intact T cells. Contextualising the TCR signalling network is expected to reveal the origin and use of network plasticity for T cell decision-making. Such information could be invaluable for the design of vaccines and immune-modulating drugs.

Plasma-Focused Ion Beam for Nanoscale Characterisation of Materials

R Tilley, et al. (ARC Linkage Grant)

This project aims to enable research programmes in functional materials to characterise materials using xenon-plasma focused ion beam (FIB) instrumentation. The plasma FIB, with its fast milling speeds across large areas, will enable new three-dimensional imaging experiments and types of

transmission electron microscopy samples. This will have applications in engineering, photovoltaics and environmental geosciences, which all need to analyse materials on a nanometre scale.

Metabolically Reprogramming the Stroma to Starve Pancreatic Tumours

R Phillips, J McCarroll, etc.
(Cancer Australia grant)

This new project funded by the NHMRC will develop a novel cutting-edge gene therapy and gene therapy delivery vehicle (nanomedicine) to metabolically starve pancreatic tumours by tackling stromal cells in the tumour microenvironment. This project involves a multidisciplinary collaboration with chemists at the Australian Centre for NanoMedicine, biologists from UNSW Sydney/Sydney University/Cancer Research UK

Beatson Institute (Glasgow, Scotland) and a clinical oncologist from Prince of Wales Hospital/UNSW.

Therapeutically Targeting a Solute Carrier Transporter in the Stroma of Pancreatic Cancer

P Phillips, J McCarroll, etc. (Avner Pancreatic Cancer Foundation innovation grant)

Pancreatic cancer (PC) claims five Australian lives daily, with little improvement in patient survival in 40 years. Targeting PC cells alone has failed. Pancreatic tumours are surrounded by extensive scar tissue, which inhibits drug delivery and increases tumour growth. Our novel nanomedicine may be a therapy to breakdown this scar.

Magnetic Layered Double Hydroxide Nanoparticles as Dual-mode Magnetic Resonance Imaging Contrast Agent

Z Gu, M Kavallaris, C Boyer, et al.
(Tsinghua Seed Fund)

Magnetic resonance imaging (MRI) is currently one of the most powerful non-invasive molecular imaging techniques for cancer diagnosis by providing anatomical images of tissues and organs with excellent spatial resolutions. The diagnostic capabilities of MR imaging can be greatly improved by introducing exogenous contrast agents (T1 or T2 weighted contrast agents) to enhance target tissue contrast through altering the relaxation time of nearby water protons. Dual-mode MR imaging has been explored to address the issues on single-mode MR imaging by combining T1 and T2 weighted contrast agent into one nanoplatform. The project aims to develop a new dual-mode MRI contrast agent with high selectivity, superb relaxivity and desirable biocompatibility. The project is a collaborative project with Tsinghua University, China.



(Photo: Dr Vittorio takes visitors on a tour of the lab and explains his research)

High Impact Papers

Highlighting Outstanding Work from Authors in Australia

In honor of The Royal Australian Chemical Institute Centenary Congress

Selected publications by Professors **JUSTIN GOODING** and **CYRILLE BOYER** have been named among top 100 papers in Australia by the Royal Australian Chemical Institute Centenary Congress.



ANALYTICAL CHEMISTRY

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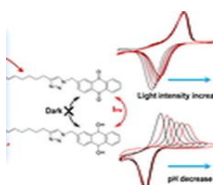
Paper-Based Sensor for Monitoring Sun Exposure

Parisa S. Khiabani, Alexander H. Soeriyadi, Peter J. Reece, and **J. Justin Gooding**

ACS Sens., 2016, 1 (6), pp 775–780



PHYSICAL CHEMISTRY



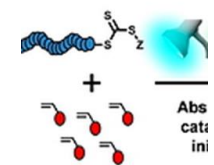
Light Activated Electrochemistry: Light Intensity and pH Dependence on Electrochemical Performance of Anthraquinone Derivatized Silicon

Ying Yang, Simone Ciampi, Moinul H. Choudhury, and **J. Justin Gooding**

J. Phys. Chem. C, 2016, 120 (5), pp 2874–2882



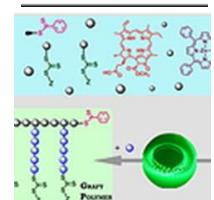
POLYMER SCIENCE



Visible Light-Mediated Polymerization-Induced Self-Assembly in the Absence of External Catalyst or Initiator

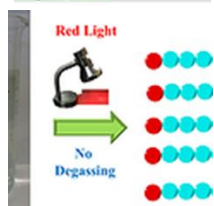
Jonathan Yeow, Odilia R. Sugita, and **Cyrille Boyer**

ACS Macro Lett., 2016, 5 (5), pp 558–564



Selective Photoactivation: From a Single Unit Monomer Insertion Reaction to Controlled Polymer Architectures

Jiangtao Xu, Sivaprakash Shanmugam, Changkui Fu, Kondo-Francois Aguey-Zinsou, and **Cyrille Boyer**; J. Am. Chem. Soc., 2016, 138 (9), pp 3094–3106



Aqueous RAFT Photopolymerization with Oxygen Tolerance

Sivaprakash Shanmugam, Jiangtao Xu, and **Cyrille Boyer**

Macromolecules, 2016, 49 (24), pp 9345–9357

Selected Articles with Impact Factors >10

Hinde E; Thammasiraphop K; Duong HT T; **Yeow J**; Karagoz B; **Boyer C**; **Gooding JJ**; **Gaus K**, 2017, 'Pair correlation microscopy reveals the role of nanoparticle shape in intracellular transport and site of drug release', *Nature Nanotechnology*, vol. 12, pp. 81 – 89 (IF=38.9)

Von Krbek LK S; Schalley CA; **Thordarson P**, 2017, 'Assessing cooperativity in supramolecular systems', *Chemical Society Reviews*, vol. 46, pp. 2622 – 2637 (IF=38.6)

Doonan, C.; Ricco, R.; **Liang, K.**; Bradshaw, D.; Falcato, P. "Metal-organic Frameworks at the Bio-interface: Synthetic Strategies and Applications." *Accounts of Chemical Research* 2017,

50, 1423 (IF = 20.268)

S.J. Lam, **E.H.H. Wong**, **C. Boyer**, G.G. Qiao (2017) Antimicrobial polymeric nanoparticles, *Progress in Polymer Science*, DOI: 10.1016/j.progpolymsci.2017.07.007. (IF = 28.0)

Wong CK; **Mason AF**; Stenzel MH; **Thordarson P**, 2017, 'Formation of non-spherical polymersomes driven by hydrophobic directional aromatic perylene interactions', *Nature Communications*, vol. 8 (IF=12.1)

Laos AJ; Dean JC; Toa ZS D; Wilk KE; Scholes GD; Curmi PM G; **Thordarson P**, 2017, 'Cooperative Subunit Refolding of a Light-Harvesting Protein through a Self-Chaperone Mechanism.', *Angew*

Chem Int Ed Engl, vol. 56, pp. 8384 – 8388 (IF=12)

Liang, K.; Richardson, J. J.; Doonan, C.; Ju, Y.; Cui, J.; Caruso, F.; Mulet, X.; Falcato, P. "Enzyme-coated metal-organic framework shell for synthetically adaptive cell survival" *Angewandte Chemie International Edition* 2017, 56, 8510. (IF = 11.994)

Xu J; Fu C; **Shanmugam S**; Hawker CJ; Moad G; **Boyer C**, 2017, 'Synthesis of Discrete Oligomers by Sequential PET-RAFT Single-Unit Monomer Insertion', *Angewandte Chemie International Edition*, vol. 56, pp. 8376 – 8383 (IF= 11.5)

Rational Design of Single-Chain Polymeric Nanoparticles That Kill Planktonic and Biofilm Bacteria

Thuy-Khanh Nguyen,[†] Shu Jie Lam,[§] Kitty K. K. Ho,[#] Naresh Kumar,[#] Greg G. Qiao,[§] Suhelen Egan,[‡] Cyrille Boyer,^{*†} and Edgar H. H. Wong^{*†§}

[†]Centre for Advanced Macromolecular Design (CAMD) and Australian Centre for NanoMedicine (ACN), School of Chemical Engineering, UNSW Australia, Sydney, NSW 2052, Australia

[§]Department of Chemical and Biomolecular Engineering, The University of Melbourne, Parkville, VIC 3010, Australia

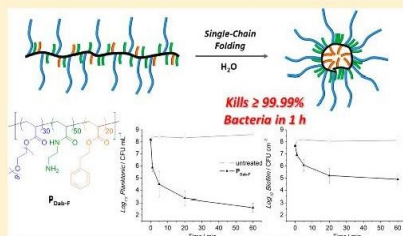
[#]School of Chemistry, UNSW Australia, Sydney, NSW 2052, Australia

[‡]Centre for Marine Bio-Innovation, School of Biological, Earth and Environmental Sciences, UNSW Australia, Sydney, NSW 2052, Australia

Supporting Information

ABSTRACT: Infections caused by multidrug-resistant bacteria are on the rise and, therefore, new antimicrobial agents are required to prevent the onset of a postantibiotic era. In this study, we develop new antimicrobial compounds in the form of single-chain polymeric nanoparticles (SCPNS) that exhibit excellent antimicrobial activity against Gram-negative bacteria (e.g., *Pseudomonas aeruginosa*) at micromolar concentrations (e.g., 1.4 μ M) and remarkably kill $\geq 99.99\%$ of both planktonic cells and biofilm within an hour. Linear random copolymers, which comprise oligoethylene glycol (OEG), hydrophobic, and amine groups, undergo self-folding in aqueous systems due to intramolecular hydrophobic interactions to yield these SCPNs. By systematically varying the hydrophobicity of the polymer, we can tune the extent of cell membrane wall disruption, which in turn governs the antimicrobial activity and rate of resistance acquisition in bacteria. We also show that the incorporation of OEG groups into the polymer design is essential in preventing complexation with proteins in biological medium, thereby maintaining the antimicrobial efficacy of the compound even in *in vivo* mimicking conditions. In comparison to the last-resort antibiotic colistin, our lead agents have a higher therapeutic index (by ca. 2–3 times) and hence better biocompatibility. We believe that the SCPNs developed here have potential for clinical applications and the information pertaining to their structure–activity relationship will be valuable toward the general design of synthetic antimicrobial (macro)molecules.

KEYWORDS: single-chain polymeric nanoparticles, self-folding, RAFT polymerization, antibiotics, biofilm



Assessing cooperativity in supramolecular systems

Larissa K. S. von Krbek,[†] Christoph A. Schalley,^{*§} and Pall Thordarson^{*‡}

[†] Author affiliations

^{*} Corresponding authors

[†] Institut für Chemie und Biochemie, Freie Universität Berlin, Takustraße 3, 14195 Berlin, Germany

E-mail: christoph@schalley-lab.de

Fax: +49 30 838 4 52639

Tel: +49 30 838 52639

[‡] School of Chemistry, The Australian Centre for Nanomedicine and the ARC Centre of Excellence in Convergent Bio-Nano Science and Technology, University of New South Wales, Australia

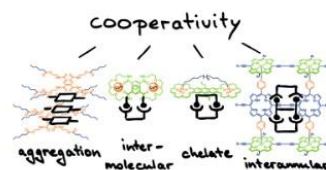
E-mail: p.thordarson@unsw.edu.au

Fax: +61 2 9385 6141

Tel: +61 2 9385 4478

Abstract

This tutorial review summarises different aspects of cooperativity in supramolecular complexes. We propose a systematic categorisation of cooperativity into cooperative aggregation, intermolecular (allosteric) cooperativity, intramolecular (chela) cooperativity and interannular cooperativity and discuss approaches to quantify them thermodynamically using cooperativity factors. A brief summary of methods to determine the necessary thermodynamic data is given with emphasis on isothermal titration calorimetry (ITC), a method still underrepresented in supramolecular chemistry, which however offers some advantages over others. Finally, a discussion of very few selected examples, which highlight different aspects to illustrate why such an analysis is useful, rounds up this review.



This article is part of the themed collection: [Supramolecular chemistry anniversary](#)

Engagement & Activities



ACN Directors Prof Justin Gooding, Maria Kavallaris, Cyrille Boyer and Conference co-Chair Prof Richard Tilley with NSW Minister for Health and Minister for Medical Research, the Hon. Brad Hazzard MP

Awards, Honours and Achievements



Professor Justin Gooding was awarded the prestigious UNSW Enterprise Award for Engagement for his Sun Patch, Sun Exposure Sensor in Nov 2017. The invention uses innovative technologies to create cheap, printable and easy-to-use sun exposure sensor stickers, which indicate to the wearer when they should seek shade or apply more sunscreen. By using off-the-shelf components and existing technologies, the invention has the potential to be widely deployed, maximising the benefit to society.

(Photo: NSW Minister for Innovation and Better Regulation Matt Kean with Enterprise Award for Engagement winner Professor Justin Gooding)

Professor Justin Gooding was awarded the Katsumi Niki Prize for Bioelectrochemistry of the International Society of Electrochemistry, for his creative and truly innovative contributions in areas of bioelectrochemistry such as peptide-based electrodes, DNA biosensors, "wiring" of enzymes to electrodes, antifouling coatings, disposable electrodes with low detection limits of hyphenated methods for detecting cell response to therapeutics. The prize is awarded every two years to a scientist who has made an important contribution to the field of bioelectrochemistry.



Professor Maria Kavallaris, of the Children's Cancer Institute, won the award for Leadership in Innovation in New South Wales.

She is an internationally recognised authority in cancer biology research and nanomedicine therapeutics. She has made seminal contributions to the understanding of both the actions of anti-cancer agents and how resistance is developed against them.

(Photo: Prof Maria Kavallaris receives her 2017 NSW Premier's Prize for Science and Engineering from NSW Premier)

Professor Cyrille Boyer has received numerous national and international awards, including from the National High-end Foreign Experts Recruitment Project by the P.R. of China. Cyrille was appointed Honorary Professor at Beijing University of Chemical Technology in 2017.

Cyrille is a leader in his field of polymer chemistry, with a focus on pioneering practical, industry-relevant solutions to globally important problems.



Dr Alex Donald has been recognised as an Emerging Investigator in the field of mass spectrometry research in April 2017 issue of the Journal of the American Society of Mass Spectrometry – the official society journal, and the leading specialty journal in mass spectrometry research. Donald's research was also selected for the cover of the April issue, which features high quality and interdisciplinary research communications contributed by the 14 researchers identified as rising stars in this field. This is the first year that an Australian-based researcher has been selected as an Emerging Investigator by the Journal of the American Society of Mass Spectrometry.



Ms Aria Ahmed-Cox completed her honours at the Kavallaris lab in 2017. She was awarded a 1st class honours and a University medal. She has since received a prestigious UNSW Scientia PhD scholarship to study with Maria Kavallaris and A/Prof John McGhee.

Her project is entitled “Cancer Nanomedicine: Visualisation and Efficacy of Nanoparticle Delivery”. The aim of Aria’s project, which will bring together expertise from multiple disciplines including Medicine, Engineering, Chemistry and Art & Design, is to optimise nanoparticles as drug transporters to deliver drugs directly to cancer cells, without harming normal cells.

Aria will work with A/Prof John McGhee to create an interactive virtual reality 3D model of her nanoparticles entering cancer cells. This is possible thanks to an ongoing collaboration between Prof Kavallaris and A/Prof McGhee.

Third year PhD student **Manish Sriram** from Justin Gooding’s group, was selected to represent UNSW at the Global Fellows Program in Germany on “Cities of the Future” during the European summer (from 17–21 July). This is a new initiative of Global Alliance of Technological Universities to help students from all disciplines develop the professional, research and collaborative skills needed to develop solutions for the challenges facing cities of the future. During this summer school, the students will meet with the Mayor of Burghausen and city planners to pitch their ideas for improving the management of issues, including infrastructure and healthcare, of expanding urban populations.



Ms Helen Forgham is a PhD student jointly supervised by Prof Maria Kavallaris and Dr Joshua McCarroll. Helen won the Tow Award in Nov 2017. The prize includes \$1000 Award, Inscribed medal and hardbound set of volumes including past prizewinning entries plus Travel Grant: Up to \$3000 will be available for travel to an international conference occurring outside of Australia, and up to \$2000 for a conference (international, national, or local) occurring within Australia. Congratulations, Helen!

(Photo: Helen Forgham receiving the Tow Award)

PhD student **Morphy Dumlao** takes home the prize for best student talk from the 26th Australian and New Zealand Society for Mass Spectrometry (ANZSMS) Conference held at Flinders University, Adelaide, 16 – 20 July.

Dumlao presented his winning talk entitled “Solid-phase microextraction dielectric barrier discharge ionisation for mass spectrometry” at the biennial conference, which brings together local and international researchers working with mass spectrometry.

(Photo: Morphy Dumlao with supervisor Alex Donald)



Ms Susan Oliver won the prize for Best Presentation at UNSW Engineering Postgraduate Research Symposium held 26-29 September 2017.

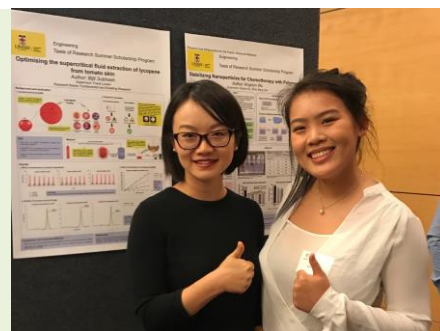
Susan commenced her PhD in March 2015 working with Professor Boyer. Her work involves developing new methods of using natural polymers to stabilise and deliver therapeutic molecules

(photo: Susan Oliver (right) receiving the prize for Best Presentation)

Ms Angelyn Wu is a Taste of Research (ToR) student under Dr Zi (Sophia) Gu's supervision. Angelyn won the first prize in the Faculty ToR Showcase.

Angelyn is currently a 3rd year Chemical Engineer. Her ToR project was focused on Researching polymer coatings in order to stabilize nanoparticles for bio-applications.

(Photo: Angelyn Wu (right) with supervisor Dr Sophia Gu)



Scientia Professor Justin Gooding

- UNSW Innovation Enterprise Award for Engagement
- Bertram Dillon Steel Lectureship from University of Queensland School of Chemistry
- Australian Museum Eureka Prize for Outstanding Mentor of Young Researchers
- Katsumi Niki Prize in Bioelectrochemistry from the International Society of Electrochemistry
- Special Commendation, Australian Council for Graduate Research Award for Excellence in Promoting Industry Engagement in Graduate Research

Professor Maria Kavallaris

- NSW Premier's Science and Engineering Award for Leadership in Innovation 23rd October
- Invited Judge, 2017 Australian Museum Eureka Awards
- 2017 Fellowship Selection Committee, Australian Academy of Health and Medical Sciences
- Member, NHMRC Research Committee
- Chair, NHMRC Population Health Panel
- Chair, NHMRC Project Grant Panel

Professor Cyrille Boyer

- Visiting professor appointment at Beijing Chemical Technology University
- Eureka Prize finalist for Scientific Research

Professor Pall Thordarson

- Fellow of the Royal Australian Chemical Institute
- Fellow of the Royal Society of Chemistry UK

A/Prof Phoebe Phillips

- Dean's Award for Research Excellence
- Invited member of NHMRC Assigners Academy for Project Grants 2018
- Promoted to Deputy Director of the Adult Cancer Program, Lowy Cancer Research Centre, UNSW Sydney

Dr Jason Xu

- Listed as "Emerging Investigator" by Polymer Chemistry and Chemical Communications
- Visiting Academic to Nagoya University (NU) under the Japanese Global COE program

Dr Sophia Gu

- Monash Engineering Women's Leadership Award

Dr Damia Mawad

- Best Lecture prize for her invited talk, "A sutureless conductive patch for enhancing the cardiac electric signal", in the Laser Florence 2017, 29th International Congress Laser Medicine, 9-11 Nov2017

Ms Raheleh Pardehkorram

(PhD student, Gooding group)

- Small Award for Best oral presentation by a PhD student at 8th International Nanomedicine Conference, 3-5 Jul 2017

Mr Jonathan Wojciechowski

(PhD student, Thordarson Group)

- Poster prize, 8th International Nanomedicine Conference, 3-5 Jul 2017

Ms Susan Tan

(PhD student, Thordarson group)

- Poster prize, 8th International Nanomedicine Conference, 3-5 Jul 2017

Ms Anouschka Akerman

(PhD student, Phillips group)

- Champion-Ma-Playoust Memorial Award for best oral presentation at ASMR national conference

Editors of Journals

Scientia Professor Justin Gooding

- Editor-in-Chief, ACS Sensors
- Member of the editorial board (Handling) of the American Scientific Publishers *Journal of Chemical and Biological Interfaces* 2013-present
- Member of the editorial board of the Elsevier journal *Electrochemistry Communications* 2003-present
- Member of the editorial board of the Humana Press journal *Nanobiotechnology* 2005-present
- Member of the editorial board of the Wiley journal, *Electroanalysis* 2006-present
- Member of the editorial board of the Elsevier journal *Sensors and Actuators B* 2008-present
- Member of the advisory editorial board of the Royal Society of Chemistry journal, *Chemical Sciences* 2010-present
- Member of the editorial board of the MDPI journal *Biosensors* 2010-present
- Member of the editorial board of the Wiley-VCH journal, *ChemElectroChem* 2013-present

- Member of the editorial advisory board of the ACS journal, *Bioconjugate Chemistry* 2014-present
- Member of the editorial board of the Wiley-VCH journal, *Chemistry – A European Journal* 2014-present
- Member of the editorial board of the MDPI journal, *Nanomaterials* 2015-present

Professor Maria Kavallaris

- Editorial Board Member Nanomedicine NBM

Scientia Prof Katharina Gaus

- Biophysical Journal 2013-present
- PLoS ONE 2011-present
- Biochemical Journal 2004-present

A/Prof Matthew Kearnes

- Member of the editorial board of Science, Technology and Society (Sage)

Professor Cyrille Boyer

- Associate Editor for RSC Advances 2015-Aug 2017
- Guest Editor for Macromolecular Rapid Communication
- Guest Editor for International Journal of Polymer Sciences
- Member of the editorial board of *Biomacromolecules* 2017-present
- Member of the editorial board of *Macromolecular Rapid Communication* 2017-present
- Member of the editorial board of *Macromolecular Physics Chemistry* 2017-present
- Member of the editorial board of *Polymer Chemistry* 2017-present
- Member of the editorial board of *Polymer International* 2017-present

Professor Pall Thordarson

- Associate Editor of Australian Journal of Chemistry



8th International Nanomedicine Conference: **Mr Jonathan Wojciechowski** & **Ms Susan Tan**, PhD students from Thordarson Group, received the Mark Wainwright Analytical Centre and ACS Journals poster prizes. **Ms Raheleh Pardehkhorrām**, PhD student from Gooding group received the Small Award for best oral presentation by a PhD student.

Eureka!



ACN Co-Director Scientia Professor Justin Gooding has won the prestigious Eureka Prize for Outstanding Mentor to Young Researchers

- Professor Katharina Gaus is 2017 Eureka Prize Finalist for Scientific Research
- The Boyer Laboratory are 2017 Eureka Prize Finalist for Scientific Research
- Professor Justin Gooding, Dr Parisa Khiabani and Dr Alexander Soeriyadi are 2017 Eureka Prize Finalist for Innovative Use of Technology



Media

The ACN researchers are dedicated to reaching out beyond the scientific community and have engaged in various television, radio, newspaper, magazine and online interviews; and contributed to newspaper articles and online blogs to promote the Centre and its research. The following list provides a glimpse of the Centre's extensive media engagement.

P.S. Khiabani, A.H. Soeriyadi, P.J. Reece, J.J. Gooding, A Paper Based Sensor for Monitor Sun Exposure, *ACS Sensors* 1 775-780 (2016).

Continuing on from the huge media interest generated from the above named paper published in 2016, there are further numerous media reports in 2017 featured in:

- The Age
- WA Today
- Canberra Times
- Brisbane Times
- Warrnambool Standard
- Hills News
- The Border Mail
- Central Western Daily
- Bussleton Times
- The Advocate
- Newcastle Herald
- Wagga Wagga Daily
- Redland City Bulletin
- Bendigo Advertiser
- Southern Weekly
- Northern Daily Leader
- The Area News
- Blayney Chronicle
- Great Lakes Advocate and 47 other local papers

Selected media coverage:

- 7News, Sun-sensing 'smart' paper promises new shield against Aussie sun, 1/2/2017
- SMH, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017
- ABC News, ABC AM interview with Justin about the UV patch, 1/2/2017

- ABC Radio News, New stick-on patches indicate when it's time to get out of the sun, 1/2/2017
- World News Network, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017
- Brisbane Times, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017
- NSS Smart Sensing Network, Sydney scientists invent skin patch that can prevent sunburn, 31/01/2017
- Western Advocate, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017
- Lithgow Mercury, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017
- Daily Liberal, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017

- Mudgee Guardian, Sydney scientists invent skin patch that can prevent sunburn, 1/2/2017
- ABC News, Smart sun sensor lets you know when you're cooked, 29/08/2017
- National Geographic, New Sticker Will Let You Know When You're Cooked, 31/08/2017

- UNSW Newsroom, A wearable sunburn sensor!, 2/11/2017

Justin Gooding Eureka Prize
Selected media coverage

- UNSW Newsroom, 2017 Eureka Prize finalist for Outstanding Mentor of Young Researchers, 28/07/2017
- UNSW Newsroom, Eureka Prizes for outstanding science mentor and world-first trials, 31/08/2017
- ABC News, Eureka Prize winners show off Australian-grown science ingenuity, 31/08/2017
- Business Insider, 2017 Eureka Prizes, 30/08/2017
- Open Gov, NSW Smart Sensing Network launched to develop portable, smart sensors for health, environment, 28/10/2017
- Australian Academy of Science, Academy Fellow wins Eureka Prize for mentoring young researchers, 7/9/2017



Maria Kavallaris



- *ABC Radio News*, Meet three scientists finding cures for childhood cancer at the Children's Cancer Institute, 31/03/2017
- *The Conversation*, Explainer: what is nanomedicine and how can it improve childhood cancer treatment? 23/05/2017
- *UNSW Newsroom*, UNSW researchers win Premier's Awards, 22/10/2017
- *Domain News*, House that love built snapped up for \$700000, all going to ..., 22/10/2017
- *Online News 9 Honey*, House sale makes \$700k for children's cancer charity, 23/10/2017
- *Online News Children's Cancer Institute*, Childhood cancer leader's star on the rise at NSW Premier's Science and Engineering Prize, 23/10/2017
- *SBS TV*, The life-long effects for childhood cancer survivors, 23/10/2017
- *SBS*, Australian professor wins prestigious prize for effects of childhood cancer, 24/10/2017
- *Wentworth Courier*, Professor's honour for helping children, Page 31, 25/10/2017

- *oKosmos* - Greek language newspaper, Title is in Greek
 - Page 5, 17/10/2017
 - Page 5, 24/10/2017
 - Page 2, 25/10/2017
 - Pages 1&9, 27/10/2017
- *Children's Cancer Institute Online News*, Our science stars shine, 25/10/2017

Cyrille Boyer



- *Ingenuity*, Molecular Warfare, Page 30, 29/5/2017
- *Ingenuity*, Polymath of Polymers, Page 31, 29/5/2017
- *Science meets Business*, Molecular warfare, 24/8/2017
- *UNSW Newsroom*, Boyer Laboratory - finalist, Eureka Prize for Scientific Research, 28/7/2017
- *UNSW Newsroom*, Green polymers and instructive clouds: new Professors look ahead, 1/11/2017

John McGhee (& Maria Kavallaris)



- *UNSW Newsroom*, Virtual reality allows multiple scientists to 'walk' through cancer cells, 19/12/2017
- *ABC News*, Virtual reality lets scientists walk around inside cancer cells, set to revolutionise medicine, 19/12/2017
- *ABC News*, ABC interviews A/Prof John McGhee about the potential of VR to revolutionise health education, 19/12/2017
- *ABC Perth Radio News*, University of New South Wales is combining 3D Gaming technology, 19/12/2017
- *Adelaide News*, Researchers from the University of New South Wales have created a futuristic way of scanning and identifying cancer cells, 19/12/2017
- *ABC TV*, 3D gaming technology could revolutionise cancer treatment, 19/12/2017
- *ABC TV*, Researchers from the University of New South Wales have created a futuristic way of scanning and identifying cancer cells, 19/12/2017
- *UNSW TV*, Multi-user VR opens new worlds for medical research, 11/12/2017
- *Lab Online*, VR allows scientists to 'walk' together through cancer cells, 20/12/2017
- *Science Daily*, Virtual reality allows you to look inside your body and could help improve drug delivery, 21/11/2017

Phoebe Phillips



- *NHMRC in Focus*, Cancer research breakthrough reduces pancreatic tumour growth, 24/1/2017
- *Laboratory Equipment Magazine*, The Promise of Nanomedicine, 13/11/2017
- *Last Post magazine*, Promising ways to tackle the most deadly cancer, Issue 14, 2017

Orazio Vittorio



- *The Sydney Morning Herald*, NSW government funds search for new cures for childhood cancer, 15/02/2017
- *SBS News*, Scientists on track to find less toxic treatments for childhood cancer, 10/08/2017
- *SBS Italy News*, Dr Orazio Vittorio's challenge to cancer, 16/08/2017

Matthew Kearnes, Declan Kuch, Robert Utama & Palli Thordarson



- *Radio ABC*, The man in a dress: who were the real luddites? 17/8/17

INGENUITY



Molecular warfare

Bacterial biofilms are a major problem in medicine: tough, toxic and nearly indestructible, they form on tissues and prosthetics and can resist antibiotics. But Cyrille Boyer thinks he's found a way to beat them.

STORY Alla Katsanidou PORTRAIT Quentin Jones



W E OFTEN PICTURE disease-causing bacteria as an invading army of individual cells. But in fact, these pathogens find strength in numbers, glomming onto each other and coating the surfaces around them in near-indestructible protective sheets called biofilms.

These biofilms pose an enormous problem in medicine. They can form directly on lungs, wounds or other living

tissue, and can contaminate medical devices such as catheters, prosthetic joints and other implants. Food production, water treatment, and other industrial facilities can also fall victim to their powers. Many types of biofilms resist antibiotics, and the bacteria they're built from churn out toxins that make their human hosts sick. Yet, no good way exists to destroy them.

Cyrille Boyer, a polymer chemist and Co-Director of the Australian Centre

for Nanomedicine at UNSW in collaboration with Dr Nicolas Barraud, believes that a nanomaterial he designed – a polymer-coated iron oxide particle that heats up when a magnetic field is applied – can provide a solution. In December 2015, he and his colleagues reported in *Nature's* open access journal *Scientific Reports* that using these nanoparticles to raise the temperature of a biofilm by just a few degrees caused it to break apart.

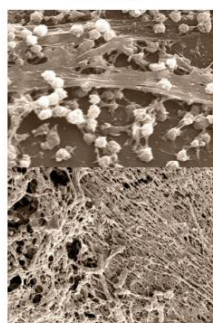
Solo swimming bacteria are much more susceptible to antibiotics, Boyer explains, so the researchers could then send in another type of particle to deliver medicine that kills off the bugs. They are now planning on testing the particles in live mice and discussing a potential partnership with a company interested in taking the method into clinical development.

Polymer chemist Eva Harth from Vanderbilt University in Tennessee, describes it as an out-of-the-box strategy to treat a long-intractable problem.

"This paper shows that a polymer construct can be much more effective than a traditional drug," she says. "There's an enormous need for new technologies for breaking up biofilms," says Rodney Dolan, Director of the Biofilms Laboratory at the US Centers for Disease Control and Prevention. "It's a very creative, very interesting approach, particularly combining particles with magnetic fields to localise and control the effect."

BOYER IS A master of materials, and his specialty is controlling the effects of the nanoparticles and polymers he creates. "In my team, we are looking at how to make smarter nanoparticles, where the nanoparticle acts in response to an external signal," he says. In 2015, Boyer was awarded the Australian Prime Minister's Prizes for Science and the Macdonald Prize for Physical Scientist of the Year for his

Left: Cyrille Boyer of UNSW's School of Chemical Engineering. Below: Biofilm of *Staphylococcus aureus* (or 'golden staph') on a catheter. bloodstream infections with this bacteria kill 20 to 35% of patients within a year.



work using light to catalyse the assembly of polymers with distinct properties. Although the biofilm-heating technique doesn't employ light, it's right in line with Boyer's vision of building 'smart' particles whose behaviour can be controlled for therapeutic purposes. Boyer created his iron oxide particles in response to a discovery made by microbiologist Nicolas Barraud at the Institut Pasteur in Paris, France. The two met by chance, when Barraud, then based at UNSW, was attending a conference out of town. He popped in on a talk Boyer was giving about polymers that release nitric oxide. "It was a serendipitous meeting," he says. "We realised we were working at the same university, a few buildings across."

Barraud was studying the basic properties of biofilm formation and dispersal, and had recently discovered that nitric oxide could break up biofilms. Back in Sydney, he asked Boyer if he could try the polymers described in the talk. Boyer was happy to comply, and the approach worked relatively well, according to both researchers. They published a couple of papers, filed a patent, and are still pursuing the project – but the drawback was that nitric oxide is a gas, which makes it difficult to spatially and temporally control its release.

Barraud had also discovered that giving biofilms a tiny temperature boost made the bacteria move and slide, ultimately disbanding them, but he couldn't work out how to apply the discovery. Then one day, over a beer, Boyer mentioned that he could create particles that induce local heating. "I've worked with chemists before," Barraud says, "and usually as soon as you get into the lab you run into problems. But with Cyrille's polymer, it was very straightforward," he says.

That's because in this project and others, Boyer focuses on identifying simple, well-worked-out polymerisation methods that can be used in specific applications. "Very precise materials that are easy to make – that's the key," says Harth. "It's smart, easy, and elegant – that's what he's after."

PROF CYRILLE BOYER, Deputy Director, Australian Centre for Nanomedicine, UNSW Sydney
+61 2 9385 5268 | cboyer@unsw.edu.au

POLYMATH OF POLYMERS

AT A RECENT conference, someone snapped a photo of Cyrille Boyer standing outside a building, and reflected in the window behind him. Colleagues joke that the photo answers a burning question many have about the young materials scientist: "Nobody really knows when he does all the research he does," says Eva Harth, who met Boyer when he invited her to participate in a conference several years ago. "Maybe there are two Cyrilles?"

As a polymer chemist, Boyer decided to feed his concurrent interest in biology by seeking out biological applications for the molecules he was learning to build. He tackled his first biologically-inspired project less than a decade ago, working with Tom Davis at Monash University in Melbourne, Australia, to grow polymers from simple proteins. Since then, he has published more than 150 research papers and filed seven international patents. "He's incredibly fast and creative," says Harth.

"I have no idea where this guy gets his energy from – it's just incredible to watch." Over the past five years or so, research at the intersection of polymer chemistry and nanomedicine has exploded, as scientists discover new ways of generating and manipulating materials. By all accounts, Boyer is at the leading edge in this creative wave. In particular, a light-induced polymerisation technique he discovered a few years ago, is now well known and widely used. "It's giving the entire field enormous stimulus," says Harth.

These new approaches for generating nanomaterials equip researchers with the tools to design innovative ways of fighting infections, delivering drugs, and otherwise interfering with disease mechanisms. "This type of technology is a big advantage, because you can control more accurately where in the body you're acting," says Boyer.

But his vision goes even further. Ultimately, Boyer hopes to create even 'smarter materials' that don't need any type of external stimulus but simply respond to the signals available within the body – a detector that senses a drop in glucose levels, for example, coupled with a delivery system that rectifies the deficit. "It's a natural evolution toward such an integrated system," he says.

8th International Nanomedicine Conference

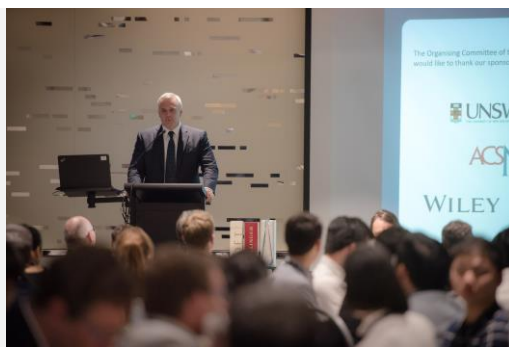
The 8th International Nanomedicine Conference was hosted by the ACN and chaired by Centre Co-Director Professor Maria Kavallaris, and Professors Richard Tilley and Nico Voelcker. The Conference took place at the Crowne Plaza, Coogee Beach from 3-5 July 2017. This is a key event in the nanomedicine research community and was attended by biologists, clinicians, chemists, material chemists and engineers from around the world.

The conference welcomed over 200 delegates from 17 countries. 5 plenary speakers, 11 keynote and 21 invited speakers led discussions in 8 conference theme areas. This year we had the great honour of welcoming NSW Minister for Health and Minister for Medical Research, the Hon. Brad Hazzard MP who officially opened the conference. Monday night saw the annual conference dinner where the Guest of Honour UNSW Dean of Engineering Professor Mark Hoffman delivered a short speech and shared his insights on nanomedicine.

48 ACN members, post-doctoral researchers, and PhD students attended the conference and presented their research including 10 oral presentations and 13 posters. Congratulations go to 3 of our PhD students who won the conference prizes: Mrs Raheleh Pardehkorram received the Small prize for Best PhD oral presentation; Mrs Susan Tan and Mr Jonathan Wojciechowski won the Mark Wainwright Analytical Centre and ACS Journals poster prizes. Special thanks go to our conference Support Committee team leaders Dr Robert Utama, Mr Manish Sriram, Dr Adam Martin and Dr Josh Peterson and our wonderful team of volunteers who helped make the event successful.



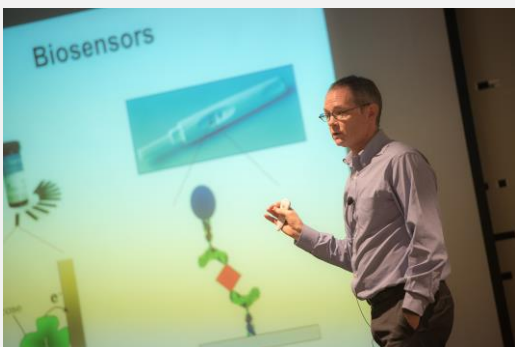
NSW Health Minister Brad Hazzard attended and officially opened the 8th International Nanomedicine Conference.



UNSW Dean of Engineering Professor Mark Hoffman was Guest of Honour at Conference Dinner.



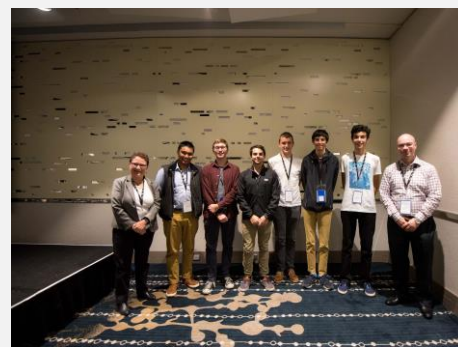
Conference co-Chairs Profs Maria Kavallaris and Richard Tilley welcoming delegates.



Scientia Professor Justin Gooding delivering a Plenary talk "Cell based diagnostic devices to explore therapeutic action".



Professor Justin Gooding thanking **NSW Health Minister Brad Hazzard** for his support of the Conference.



Students from St. Aloysius' College participated in poster judging session.

NanoMedicine Elevator Pitches

An elevator pitch is a succinct, persuasive speech to get your ideas and concepts across. The purpose of this event is to increase dialogue and encourage cross disciplinary research collaboration within ACN.

As part of our ongoing drive to develop emerging leaders and retain talents through workshops and providing postdoc and PhDs the opportunity to plan and host workshops, we launched the NanoMedicine Elevator Pitches event. Dr Adam Martin was actively involved in organizing and chairing this event. Adam is an NHMRC-ARC Dementia Research Development Fellow and joined the ACN in 2016. Members from 7 groups pitched their research to a panel of experts. Topics range from “Antimicrobial polymeric nanomaterials”, “Tumour-targeting peptide-drug conjugates” to “Is biomedicine a Ponzi scheme?”



Photos:

Above left: Packed room of audience

Bottom left: Panel Deliberations. The quality of presentations intensified deliberations

Above Right: **CBNS Director Prof Tom Davis** presenting **Dr Orazio Vittorio** with Directors' Award for his presentation entitled: *Targeting copper in neuroblastoma by using nano-modified natural compounds*

Bottom Right: **ACN Co-Director Prof Maria Kavallaris** presenting **Dr Rob Utama** with People's Choice Award for his presentation entitled: *High throughput 3D cell culture at the push of a button*

Panel Discussion with ECRs

Drawing from the wealth of talent within ACN members, the ACN also organized a unique panel discussion, entitled: An ECR's Perspective on Obtaining Your First Fellowship. Six of our fully funded ECR fellows participated in the panel discussion. Dr Adam Martin put in great effort in the planning of this event. Dr Declan Kuch chaired the discussion.

The panel discussion is a great addition to our regular seminars. It once again gives our ECRs, postdocs and PhDs the opportunity to plan and chair panel discussion and seminar sessions, which all fits well into our top most strategic priority People/Talent.



Seminar by Matt Faria

FRIDAY 3RD NOVEMBER 2017, 3PM
ROOM 320, CHEM SCI (F10)



Title: Quantifying nanoparticle performance: a combined dosimetric and kinetic approach

ABSTRACT: Nanoengineering holds tremendous promise for the treatment and diagnosis of disease. One of its most compelling potential uses is in the design of materials that exhibit "stealth" (i.e. reduced association to cells) and/or "targeting" (i.e. increased association to particular cells). However, partially due to the range of physicochemical properties nanomaterials exhibit, in vitro quantification of bio-nano interactions has unique challenges when compared to traditional small-molecule drugs or materials in bulk. In this talk, I will present an approach to quantifying the performance of nanoengineered materials by accounting for dosage effects and extracting particle-cell association kinetics from commonly performed in vitro experiments. While the techniques discussed are computationally focused, slides full of equations will be kept to a minimum. I will conclude with a brief presentation of a

SHORT BIO: Matt Faria is a PhD student at the University of Melbourne, where his advisors are Frank Caruso of the NIMS (Nanostructured Interfaces and Materials Science) group and Edmund Crampin of the Systems Biology Lab. His experience and educational background has focused on computer science, mathematics, biology, and software engineering. His research focus has been on developing and improving methods to quantify the interactions of

Panel Discussion

FRIDAY 3RD NOVEMBER 2017,
3:30PM, ROOM 320, CHEM SCI (F10)

An ECR's Perspective on Obtaining Your First Fellowship

	Dr Robert Chapman ARC DECRA Fellow		Dr Adam Martin NH&MRC-ARC Dev Fellow
	Dr Jason Xu ARC Future Fellow		Dr Sophia Gu NH&MRC ECF Fellow
	Dr Orazio Vittorio Cancer Inst ECF Fellow		Dr Alex Soeniyadi NH&MRC ECF Fellow

Seed Funding

ACN launched the seed funding program as a strategic initiative in 2015. The purpose of the program is to provide seed funding to ACN members to pursue research that can lead to future grant applications. One of the key requirements is that projects must involve collaboration between ACN members across two or more different groups.

The seed funding program has helped ECRs and students manage their own projects on a small scale and generate some results that they can use for their own grant applications in the future. It helped them forge new collaborations within ACN and put people with differing backgrounds in the same room to talk about how to tackle new problems together. A few papers have been generated with data produced from the seed funding projects, including one published in *Angewandte Chemie* as a VIP (very important paper); and data generated from another project was used in the successful application for an ARC discovery project.



Selected Seed Funding Report

Applicants: Damia Mawad, Phoebe Phillips, Joshua McCarroll

Supervisor: Damia Mawad

Project: An implantable sutureless patch for drug delivery

1. Have you achieved the proposed outcome? Please describe the actual outcome of the project. (What went well? Where do I go from here?)

The main outcome of the project was the development of a patch with degradable profiles without altering the chemical composition of its components. The project aim was to develop an implantable patch that can be adhered to pancreatic tissue using photoadhesion and deliver therapeutic drugs such as siRNA locally to the tumour. The patch is based on a medium molecular weight chitosan with a very slow degradation profile (> 3 months). As will be discussed in question (2), the delivery of the siRNA loaded within the non-degradable patch was hindered. To overcome this limitation, we have designed a chitosan based patch containing water soluble chitosan oligomers to speed up the degradation rates. As shown in Figure 1, by varying the wt% content of the water soluble oligomer from 0 to 30%, the passive degradation was accelerated from 7 to 60% over 1 week. In summary, we have enhanced the degradation profiles of the chitosan patch using the same polymeric backbones but shorter molecular weight. Keeping the chemical composition of the patch ensures that its photoadhesion properties are not affected.

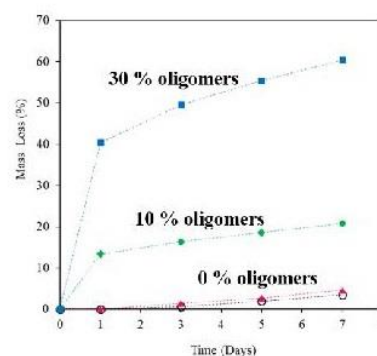


Fig. 1: % Mass loss of chitosan patches prepared with water soluble chitosan oligomers added in the patch at different wt%.

2. Have you encountered any problems that stopped you from achieving your goals? (What could you have done differently? Who/what could have helped you in achieving your goals?)

As a first step, we have investigated the *in vitro* release kinetics of siRNA loaded in the non-degradable patch at different concentrations (50, 100 and 200 nM). As shown in Figure 2, the release profiles reached equilibrium shortly after incubation suggesting that the amount of siRNA delivered is mostly a burst release. Interestingly, release of higher amounts of siRNA was achieved from the patches loaded with lower concentrations. This can be attributed to the size and charge of the siRNA. Higher amounts of siRNA might have physically prohibited other siRNA chains from diffusing out, as well as more crosslinking with the positively charged backbone of chitosan. As a control, we loaded the patch with phenol red which is negatively charged but of smaller size than siRNA. 100% release of phenol red was achieved within 5 minutes. This data suggests that the size of the drug is an important factor. To resolve this issue, we have developed patches with faster degradation rates. This approach will allow the patch to lose polymers and consequently minimise the physical entrapment of the siRNA.

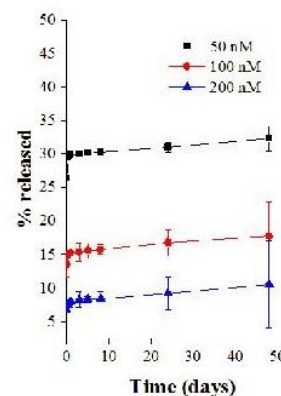


Fig. 2: % Release profiles of siRNA from the non-degradable patch.

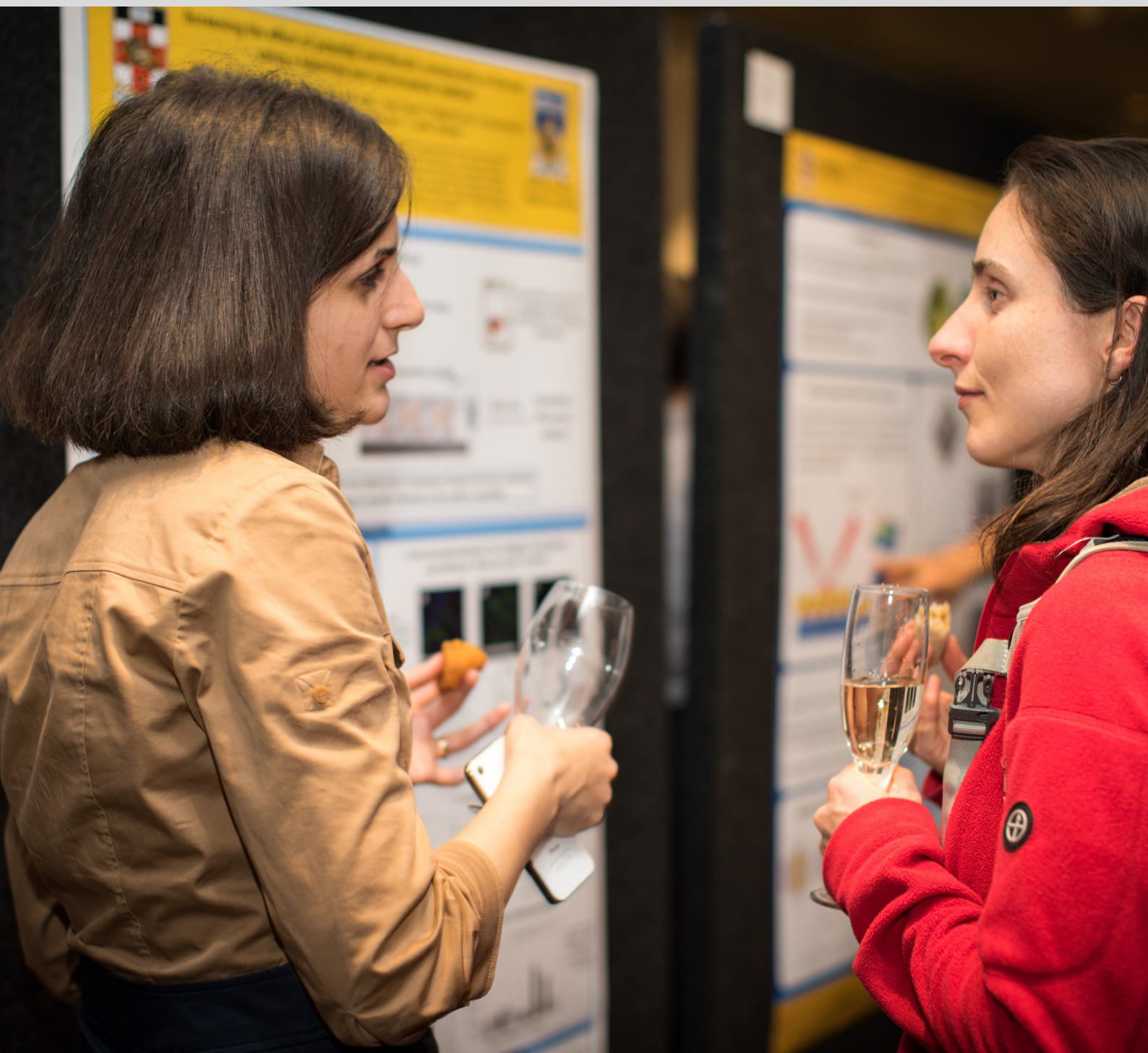
3. Any other comments

Having developed a fabrication approach to tailor the degradation of the patch, ongoing work is focused on assessing the drug delivery mechanism. We have a full time master by research student dedicated for this project.

Collaborating Organisations

Australian National University, Australia	University, Bangladesh	Carl Gustav Carus, Germany
Griffith University, Australia	Federal University of Maranhão, Brazil	Philipps Universität Marburg, Germany
Macquarie University, Australia	University of Campinas, Brazil	University of Leipzig, Germany
University of Sydney, Australia	University of Alberta, Canada	University of Calabria, Italy
Victor Chang Cardiac Research Institute, Australia	University of British Columbia, Canada	Hebron University, Palestine
Deakin University, Australia	Linyi University, China	CIC Biomagune, Spain
Monash University, Australia	Qingdao University, China	University of Zaragoza, Spain
University of Melbourne, Australia	Central China Normal University, China	University of Warwick, United Kingdom
CSIRO Manufacturing, Australia	University of Aix-Marseille, France	University of British Columbia, Canada
Curtin University, Australia	Institut für Chemie und Biochemie, Germany	Tianjin Sungene Biotech Co Ltd, China
Royal Perth Hospital, Australia	University of Bremen, Germany	Freie Universität Berlin, Germany
University of Western Australia, Australia	Institute of Radiopharmaceutical Cancer Research, Germany	University of Iceland, Iceland
Queensland University of Technology, Australia	Technische Universität Dresden and Helmholtz-Zentrum Dresden-Rossendorf, Germany	Gifu University, Japan
University of Queensland Diamantina Institute, Australia	Leibniz Institute of Solid State and Material Research Dresden, Germany	Victoria University of Wellington, New Zealand
ANSTO, Australia	University Hospital Erlangen, Germany	The University of Auckland, New Zealand
Australian Synchrotron, Australia	German Cancer Consortium (DKTK) Dresden and German Cancer Research Center (DKFZ), Germany	Delft University of Technology, The Netherlands
RR Medsciences Pty Ltd, Australia		Imperial College, UK
Lleaf Pty Ltd, Australia		University of Manchester, UK
Ettason Pty Ltd, Australia		Princeton University, USA
Daffodil International		Harvard University, USA

Presentations & Publications



Presentations

The Centre puts great value on the knowledge shared and gained at conferences both local and international. The following is a list of selected talks, seminars and poster presentations in 2017.

Plenary/ Keynote Presentations – Conferences and Symposia

J.J. Gooding, “Nanotechnology and Biosensors: From Detecting Small Molecules and Drugs to the Monitoring of the Activity of Whole Cells”, E3-Nano: International School and Workshop on Nanotechnology, Brisbane, Australia, 26-29 Sep 2017. **(Financially supported)**

J.J. Gooding, M. Parviz, S. G. Parker, R. Utama, E. Hinde, Y. Yang, L. Atapattu, S. Ciampi, M. Kavallaris, K. Gaus, “Cell based diagnostic devices to explore therapeutic action”, 2017 International Conference on BioNano Innovation, Brisbane, Australia. 24-27 Sep 2017. **(Financially supported)**

J.J. Gooding, M. Parviz, S.G. Parker, R. Utama, E. Hinde, Y. Yang, L. Atapattu, S. Ciampi, M. Kavallaris, K. Gaus, Cell based diagnostic devices to explore therapeutic action, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017. **(Financially supported)**

M. Kavallaris, “New Drugs-New Thinking: Potential of Nanotechnology to Advance Cancer Drug Delivery”, Menzies Health Institute Queensland, Griffith University, 16 Jun 2017.

(Financially supported)

M. Kavallaris, “Nanoparticle delivery for cancer therapy: Design, uptake and efficacy”, 2017 International Conference on Bio-Nano Innovation, Brisbane, 24 -27 Sep 2017.

P. Thordarson, “Peptide gels for 3D cell cultures”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

M. Kearnes, “The Challenge of Responsible Research and Innovation: Nanomedicine and Beyond”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

Invited Talks – Conferences and Symposia

J.J. Gooding, S.G. Parker, Y. Yang, M.B. Kashi, V.R. Gonçalves, S. Ciampi, Light activated electrochemistry for the capture, electrochemical interrogation and release of single cells, Pittcon 2017, Chicago, USA, 5-9 Mar 2017. **(Financially supported)**

Y.H. Zheng, K. Chuah, Y.F. Wu, X. Lu, X.Y. Cheng, P. Nicovich, K. Gaus, **J.J. Gooding**, Towards Single Molecule Sensors, Pittcon 2017, Chicago, USA, 5-9 Mar 2017. **(Financially supported)**

J.J. Gooding, R. Tavallaie, S.M. Silva, K. Chuah, Y.F. Wu, E. Murago, D.B. Hibbert, R.D. Tilley, *Magnetic Nanoparticles as Dispersible Electrodes*, Mátrafüred, Hungary 11-15 Jun 2017. **(Financially supported)**

S.G. Parker, Y. Yang, S. Ciampi, **J.J. Gooding**, Light Activated Electrochemistry for the Capture, Electrochemical Interrogation and Release of Rare Cells, 9th International Conference on Materials for Advanced Technologies, Singapore 18-23 Jun 2017. **(Financially supported)**

M. Kavallaris, “Cancer nanomedicine: drug delivery and beyond to solid tumours” The Lorne Cancer Conference, Melbourne, 9-11 Feb 2017. **(Financially supported)**

M. Kavallaris, “Nanotechnology for Cancer Therapy”, 34th Combined Health Science Conference, Centenary Institute, Royal Prince Alfred Hospital, Camperdown, Australia, 20-21 Nov 2017.

C. Boyer, J. Xu, “Design of functional polymer using visible light”, RACI National Conference, Melbourne, Jul 2017.

C. Boyer, “Precision polymer synthesis using visible light”, ACS Conference, Washington, USA, 19-24 Aug 2017.

K. Gaus, “Super-resolution and single molecule science”, The 28th

New Zealand Conference on Microscopy, Auckland, New Zealand, 31 Jan - 3 Feb 2017.

K. Gaus, "Single Molecule Membrane Protein Dynamics" Biophysical Society 61st Annual Meeting, New Orleans, Louisiana, USA, 11-15 Feb 2017.

K. Gaus, "T cell receptor clustering – a mechanism of signal transduction", 2017 Hunter Cell Biology Meeting, Lovedale, NSW, Australia, 3-7 Apr 2017.

K. Gaus, "T Cell Receptor Clustering – A Mechanism of Signal Transduction", Molecular Membrane Biology Gordon Research Conference, Proctor Academy, USA, 16-21 Jul 2017.

O. Vittorio, M. B. Brandl, G. Cirillo, K. Kimpton, E. M. H. Yee, N. Kumar, M. Kavallaris. Nano-modified natural therapeutic agents to target copper homeostasis in Neuroblastoma. Nanotech France 2017, Paris, France, 28 - 30 Jun 2017. **(Financially supported)**

O. Vittorio, "Targeting copper homeostasis as a therapeutic strategy for neuroblastoma". The Cancer Institute NSW Fellows' Forum 7 Sep 2017. **(Financially supported)**

O. Vittorio, "Being a young scientist in Australia: a job or a lifestyle?", ASMR NSW Early Career Development Day 19 Sep 2017. **(Financially supported)**

G. Cirillo and **O. Vittorio**, "Nanotechnology in cancer therapy: where we are up to". Italian Orthopaedic research society: Focus on Nanotechnology,

Pisa, Italy, 1-2 Dec 2017. **(Financially supported)**

O. Vittorio, M. Kavallaris. "In vivo ^{64}Cu CuCl₂ PET imaging reveals activity of copper-targeting anticancer drug". Cancer Nanotheranostics, University of Sydney, 6 Dec 2017. **(Financially supported)**

J. McCarroll, "Development of gene-silencing nanomedicines for the treatment of cancer", Imaging to Innovate UNSW Sydney, Jul 2017.

K. Liang, "Synthetic biomineralization of metal-organic frameworks" Collaborative Conference on Materials Research (CCMR), Jeju, Korea, Jun 2017.

K. Liang, "Synthetic biomineralization of metal-organic frameworks" Layer-by-layer (LbL) 2017 Conference, Seoul National University, Seoul, Korea, Jun 2017.

K. Liang, "Metal-Organic Frameworks at the Surface of Living Cells" Australian X-ray Analytical Association conference (AXAA2017), Melbourne, Feb 2017.

P. Phillips, "Therapeutically targeting the stroma of pancreatic cancer", Avner Pancreatic Cancer Foundation Symposia, Sydney, Australia, 16 Nov 2017.

P. Phillips, PANEL: Q & A – World Pancreatic Cancer Day: What does the future look like? Avner Pancreatic Cancer Foundation Symposia, Sydney, Australia, 16 Nov 2017.

P. Phillips, "Importance of

community engagement for philanthropy: A researcher's perspective", Avner Pancreatic Cancer Foundation Symposia, Sydney, Australia, 16 Nov 2017.

P. Phillips, "Therapies personalised to the stroma in pancreatic cancer", Australian Gastroenterology Week (AGW), Gold Coast, Australia, 20-22 Aug 2017.

P. Phillips, "Nanomedicine as a therapy to target 'undruggable' genes in pancreatic cancer", Australian Gastroenterology Week (AGW), Gold Coast, Australia, 20-22 Aug 2017.

P. Phillips, "Novel Therapeutic Targets in Pancreatic Cancer", Adult Cancer Program Seminar Series, Lowy Cancer Research Centre, UNSW Sydney, 2017.

P. Phillips, "Modulating Pancreatic Tumours using RNAi based Nanomedicines", US-Australian Emerging Cancer Biomedical Technologies Workshop held at Virginia Tech Research Center in Arlington, Virginia, USA, Jun 2017.

Public Lectures, Seminars – Universities and Societies

J.J. Gooding, "Sensing our World: From glucose sensors to counting single molecules and cells" Public Lecture: Royal Society of New South Wales Liversidge Lecture, UNSW, 11 May 2017.

J.J. Gooding, "Transforming

materials in new measurement devices using well-defined surface chemistry”, Science at the Shine Dome 2017, Australian Academy of Science, Canberra, Australia, 23-25 May 2017.

J.J. Gooding, “Single Entity Sensors: From Detecting Many to Detecting One to Detecting Many”, Intelligent Polymer Research Centre, University of Wollongong, 2 Jun 2017.

J.J. Gooding, “Single Entity Sensors: From Detecting Many to Detecting One to Detecting Many”, Public Lecture: University of Queensland Bertram Dillon Steele Lecture, 18 Sep 2017.

M. Kavallaris, Keynote Speaker, “Twists and Turns on the Path of a Cancer Researcher”, Cure Cancer Australia ECR Meeting, Melanoma Institute, Sydney, 16 May 2017.

M. Kavallaris, Special Guest Speaker at OEEGA Ladies’ Committee Dinner Dance on 29 Apr 2017 to raise funds for Children’s Cancer Institute.

M. Kavallaris, “Cancer Biology to Nanomedicine-based Therapeutics”, Kidson Lecture, QIMR Berghofer Medical Research Institute, Queensland, 6 Jun 2017.

C. Boyer, “Functional Polymers for Bioapplications”, Queensland University of Technology (QUT), Brisbane, 9 Jun 2017.

C. Boyer, “Precision Polymer Synthesis for Advanced Applications”, Hefei University of Technology, 4 Dec 2017.

C. Boyer, “Precision Polymer Synthesis for Advanced

Applications”, University of Science and Technology of China, 5 Dec 2017.

C. Boyer, “Living radical polymerisation”, University of South Australia, 14 Feb 2017.

C. Boyer, “Light regulated polymerization for the synthesis of well-defined nanoparticles”, Case Western University, USA, 2017

K. Gaus, “What can single molecule localization microscopy (SMLM) do for you?” Walter+Eliza Hall – Institute of Medical Research, Australia, 27 Mar 2017.

K. Gaus, “T cell receptor clustering - a mechanism of signal”, Hudson Seminar Series, School of Clinical Sciences at Monash Health, Australia, 27 Apr 2017.

K. Gaus, “T Cell Receptor Clustering – a mechanism of signal transduction”, School Colloquia Series, Faculty of Science, UNSW, 26 Sep 2017.

K. Gaus, “EMBL in Australia”, Garvan Institute of Medical Research, Australia, 9 Jun 2017.

O. Vittorio, “Targeting copper metabolism by flavonoids: promising strategy for cancer treatment”, School of Pharmacy, the University of Calabria, 21 Jun 2017. **(Financially supported)**

O. Vittorio, A. Parmar, G. Pascali, M. Kavallaris. “[⁶⁴Cu]CuCl₂ PET imaging for the evaluation of anticancer activity of Dextran-Catechin conjugate as a novel treatment for neuroblastoma”. UNSW imaging workgroup/ symposium talks, 5 Jun 2017.

J. Xu, “Photo-induced Living Polymerization for Green Polymer Synthesis”, Monash University, Melbourne, Australia, 18 Nov 2017.

P. Phillips, “Novel Therapeutic Targets in Pancreatic Cancer”, Adult Cancer Program Seminar Series, Lowy Cancer Research Centre, UNSW, 2017.

P. Phillips, “The Future of Pancreatic Cancer treatment: A Pre-clinical View from the Laboratory”, Translational Cancer Research Network (TCRN; Cancer Institute NSW) Seminar Series and Prince of Wales Hospital, Nov 2017.

P. Phillips, “Scaling the Pancreatic Cancer Mountain – Trust and Teamwork”, Bridging the Gap Seminar Series, Translational Cancer Research Network, UNSW, 2017.

P. Phillips, “Chemoresistance in Pancreatic Cancer using a Novel Nanoparticle-siRNA Approach”, Anderson Stuart Research Seminar Series, University of Sydney, 2017.

P. Phillips, “Tackling Pancreatic Cancer using Nanomedicine”, Nanoclinic Conference: Translational Cancer Research Network (TCRN), UNSW Sydney, 2017.

P. Phillips, “The New NHMRC Grant Structure – An Insider’s View”, Shifting Funding Landscape in Australia; UNSW Sydney Symposia, 2017.

Other Oral Presentations

Y. Yang, S.G. Parker, S. Ciampi, J.J. Gooding, "Light Activated Electrochemistry for Single Cell Isolation and Analysis", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

R. Utama, L. Atapattu, A. O'Mahony, J. Ribeiro, M. Kavallaris, J.J. Gooding, "High Throughput Production of Multicellular Spheroid Assays Using 3D Bioprinting", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

M. Sriram, S. R. C. Vivekchand, P. R. Nicovich, R. D. Tilley, J.J. Gooding, "Digital biosensors for enhanced disease detection", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

R. Pardehkhorrām, Y.H. Zheng, P. Bakthavathsalam, R.D. Tilley, N.A. Lee, J.J. Gooding, "Immuno-Gold Nanorods Composite for Food Safety Monitoring", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

L. Zarei, M.H. Choudhury, R. Tavalalaie, V.R. Gonçalves, S. Ciampi, S.G. Parker, J.J. Gooding, "Fabrication of High-Density DNA Microelectrode Arrays Using Light Activated Electrochemistry", Pittcon 2017, Chicago, USA, 5-9 Mar 2017.

R. Piya, J.J. Gooding, P.J. Reece, A.H. Soeriyadi, "Cell Based Biosensing on Micropatterned

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S.M. Silva, R. Tavalalaie, D.B. Hibbert, J.J. Gooding, "DNA Surface Hybridization: Electrochemical Investigation", Pittcon 2017, Chicago, USA, 5-9 Mar 2017.

A. Martin, "Establishing neural networks in peptide hydrogels", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

G. Duche, "Assessing the social aspect of a novel drug delivery system used for topical application in aesthetic therapy. A story of collaboration between science and social science", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

Poster Presentations

A. Parker, W. Teo, J. McCarroll, M. Kavallaris. "Structural Domains of betaIII-Tubulin Regulate Multiple Stress Responses and Influence Cell Growth and Survival in Glucose-Deprived Non-Small Cell Lung Cancer". 2017 AACR Annual Meeting.

W. Teo, T. Dewart, T. Failes, G. Arndt, **J. McCarroll**, **M. Kavallaris**. "High throughput kinase inhibitor screen reveals novel inhibitor combinations acting in synergy with TUBB3/ β III-tubulin suppression in non-small cell lung cancer". 2017 AACR Annual Meeting.

A. Ahmed-Cox, "Targeting copper homeostasis in glioblastoma using a chemically modified polyphenol", Lorne Cancer Conference, Melbourne, 9-11 Feb, 2017.

Y.F. Wu, K. Chuah, P.J. Reece, A.P. Micolich, J.J. Gooding, "Single-Molecule Detection of Proteins Based On Solid-State Nanopore Array Combined With Magnetic Nanoparticles As Capturing Vehicles", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

A.J. McGrath, A.M. Henning, S. Cheong, J.J. Gooding, R.D. Tilley, "Seed-mediated synthesis of iron nanoparticles for biomedical imaging", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

A.D. Farahani, "The Role of Aromatic Interactions in Self-Assembled Gels: Fluorinated Aromatic Capping Groups", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

E. Du, "Self-assembled peptide hydrogels as fully defined 3D cell matrices", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

G. Duche, "Encapsulating self-assembled peptide hydrogels in liposomes for drug delivery and aesthetic therapy", 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

M. Lawler, "Peroxide Responsive Bio-mimetic gels as sensors for oxidative cellular stress", 8th International Nanomedicine

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F. Mansfeld, “An anti-GD2-doxorubicin Conjugate for Treatment of Neuroblastoma”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

H. McEwen, “Designing Tunable Transfection Agents Using Self-Assembling Short Peptides”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

A. Rashleigh, “Fluorescently Labelled Peptides That Bind to the Complement 5A Receptor”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

S. Tan, “Using Fluorescent Probes to Elucidate Sweet Taste Receptor Function”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

K. Tjandra, “Tumour-Targeting Peptide for Cancer Therapy”, 8th International Nanomedicine

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C.K. Wong, “One polymer, multiple polymersome shapes and sizes - but which has better cellular uptake properties and tumour penetration ability?”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.

J. Wojciechowski, “Chemically Programmed Supramolecular Hydrogels”, 8th International Nanomedicine Conference, Sydney, Australia, 3-5 Jul 2017.



The 2017 International Nanomedicine Conference was held at the beautiful Coojee beach, an inspiring environment that inspires greater science!

Publications

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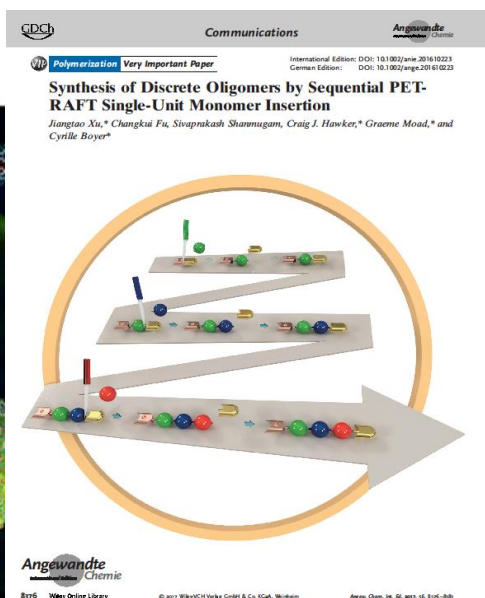
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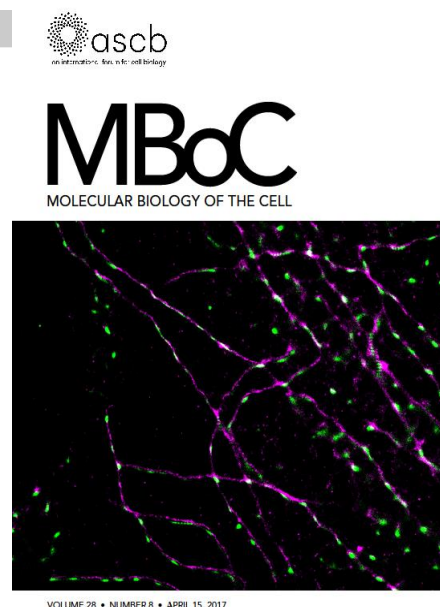
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Financial Report



AUSTRALIAN CENTRE FOR
NANOMEDICINE

Australian Centre for NanoMedicine
Chemical Sciences Building (F10)
UNSW SYDNEY
UNSW SYDNEY NSW 2052 AUSTRALIA
T: +61 (2) 9385 6031
E: acn@unsw.edu.au

www.acn.unsw.edu.au
www.oznanomed.org