



PROF. WOJCIECH CHRZANOWSKI

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Nationality: Australian

"Professor Wojciech Chrzanowski is a nanobiomedical engineer who translates nanoscale science to human applications and transforms medical treatments and disease diagnosis."

CURRENT APPOINTMENTS

2021 – present	Professor of Nanomedicine, Faculty of Medicine and Health, The University of Sydney (0.8 full-time equivalent)
2019 – present	President of High-Intensity Focused Ultrasound Biomedical Association Inc.
2015 – present	Vice President of the Asian Federation for Pharmaceutical Sciences
2010 – present	Founder and Director of the Nano-Bio-Engineering Group and the Nano-Bio-Characterisation Facility, Sydney Pharmacy School, The University of Sydney

PREVIOUS APPOINTMENTS

2016 – 2021	Deputy Director at The University of Sydney Nano Institute (0.2 full-time equivalent)
2015	Research Fellow in Medicine, Harvard Medical School Harvard University
2008 – 2009	Research Assistant, School of Mechanical Engineering, University of Glasgow, EU Framework Program 6 Project Grant
2006 – 2008	Marie Curie Research Fellow, Eastman Dental Institute, Division of Biomaterials and Tissue Engineering, University College London
2003 – 2006	Research Assistant/Lecturer,.

ACADEMIC QUALIFICATIONS

2006 – 2014	Doctorate of Science in Biomedical Engineering, Polish Academy of Science, Nałęcz Institute of Biocybernetics and Biomedical Engineering, Poland
2013	Graduate Certificate in Educational Studies, The University of Sydney
2000 – 2003	Doctor of Philosophy in Biomedical Engineering, The Silesian University of Technology, Poland
1995 – 2000	Master of Science in Biomedical Engineering, The Silesian University of Technology, Poland.

GRANTS

Since 2006 I have obtained \$14. 8M in competitive grant funding including: EU Horizon2020 (2×), Australian Research Council Linkage Projects (3×), NHMRC equipment grants (6×), Sydney Catalyst Grant (2×), Medical Advances Without Animals Research Grant (3×), and Harmonia Project Grant, National Science Centre Poland (1×). I was also awarded \$850k amount in internal competitive funding including a Sydney Outstanding Academic Researcher (SOAR) Prize (\$150k), Sydney Nano Grand Challenge Projects (2×), Sydney Nano Kickstarter Grants (2×) and \$160k in partnership and travel grants.

FELLOWSHIPS

Japanese Society for Promotion of Science Invitational Fellowships – Chubu University (2014), Tokyo University (2012)

Marie Curie Intra-European Fellowship (2006), University College London – European Union Framework Program 7

AWARDS

2021	Highly Commended Finalist, Australia Research Awards, Category Frontier
2020	Winner of the Biomedical Shark Tank Competition – Institute for Biomedical Materials and Devices, University of Technology, Sydney
2019	Barry Inglis Medal for Innovation in Nanometrology – National Measurement Institute
2019	Sydney Nano Institute's Publication Award in the field Nanotoxicology

2019	Award for being Outstanding Reviewer for <i>Nanoscale Horizons</i> – Royal Society of Chemistry
2018	Winner of the Big Idea Award Competition – Sydney Local Health District
2018	Vice Chancellor's Award for Excellence (Outstanding Teaching and Research) – The University of Sydney
2018	2 nd Most Influential Scientific Discovery – The University of Sydney
2018	Outstanding Research Paper Award – Royal Society of Chemistry
2018, 2016	Supervisor of the Year Award – Sydney University Postgraduate Research Association
2017	Deputy Vice Chancellor Research Award for Reduction in the Use of Animals in Research (Magnetically bioprinted three-dimensional scaffold-free liver model for nanotoxicity studies) – The University of Sydney
2015	Endeavor Executive Award in the field of Nanotoxicology – The Department of Industry, Innovation, Science, Research and Tertiary Education of the Australian Government
2014, 2014	Recipient of Australian Institute Nuclear Science and Engineering Research Awards in the field of Biomedical Engineering

PUBLICATIONS

- 218 peer-reviewed publications, 3 books, 6 book chapters and inventor of 6 patents; ORCID: <https://orcid.org/0000-0001-8050-8821>
- H-index: **41**; i10-index: 115. My h-index doubled in the last 5 years.
- Field Weighted Citation from the last 3 years is 5.29 – 4.1x the Australian average and 5.2x the global average for the field of Medical and Health Sciences.
- 48% of my papers have been published in journals classified in the top 10% (Scientific Journal Rankings – SJR) in the field: **Nature Biotechnology** 2021 – 2nd in Biotechnology, **ACS Nano** 2021 – 1st in Nanotechnology, **Analytical Chemistry** 2019, 2016 – 1st in Analytical Chemistry, 7th Most Influential Journal Across the Board according to Innovation Index; **Nature Protocols** 2019 – in the top 1% of journals in biochemistry; **Advanced Functional Materials** 2014 – 2nd in Biomaterials; **Biomaterials** 2017, 2016, 2014 – 4th in Biomaterials.
- I am the first or senior author on over 69% of my publications.

SEMINARS

- 65 invited seminar/conference/workshop presentations in total, 46 of which were international.
- 23 invited conference presentations in the last 5 years.

OUTREACH

- International TV, Radio, and newspaper interviews viewed over 700M times, e.g., The Guardian, Project, Ch9 News (Exclusive), Ch7 News, ABC News, ABC Radio National, Sydney Morning Herald, The Age, Engineers Australia).
- VIVID Sydney 2014 – I exhibited my work at the Australian Museum of Contemporary Arts.

SERVICE TO THE DISCIPLINE

- *Editor in Chief* – Artificial Cells, Nanomedicine and Biotechnology.
- *Associate Editor* – Nanomaterials, Journal of Tissue Engineering.

CURRENT INDUSTRY COLLABORATIONS/ENGAGEMENT

BiomeCentric (AUS), MedLab Clinical (AUS), Aspect Biosystems (Canada), Probiotics Australia (AUS), Nano Medical Technologies (AUS), Kinaltec (AUS), TheraKii (AUS), IZON (NZ), BCAL (AUS), SynThera (India).

Selected Grants

Title			
Funding agency / number	CI(s)	Amount funded	Years
Title: Integrated Assessment and Advanced Characterization of Neuro-Nanotoxicity			
Horizon 2020 Framework Programme, Call: HE-01-35	Ernesto Alfaro-Moreno, Wojciech Chrzanowski,	A\$ 5 210,000	2022-2025

Gianni Ciofani, James Baker, Sean Kelly, Alberto Katsumiti, Isabel Rodríguez, Adrián García, plus five industry partners.

This program establishes the world's first integrated approach for the neuro-nanotoxicity assessment that understands the interconnected in vivo-in vitro relationship holistically.

Title: EV-Phage Biobots			
CDIP Fund	Wojciech Chrzanowski, Hien Duong	A\$ 69,000	2022-2023

This program pioneers the development of multifunctional biologicals that simultaneously eradicate bacteria and heal wounds.

Title: Shaping Innovative Products for Sustainable Tissue Engineering Strategies – SHIFT			
Horizon 2020 Framework Programme, Call: H2020-MSCA-RISE-2020	Antonella Motta, Rui Reis, Alicia El Haj, Anthony Weiss, Wojciech Chrzanowski, Gilson Khang, Natalia Nalves, Rui L. Reis, Sorada Kanokpanont, Turmunkh Gerelchuluun	A\$ 1 540,000	2021-2024

This program focuses on the development of new strategies for hard and soft tissue regeneration and wound healing.

Title: Breathe Easy - Development of the next generation treatment for chronic obstructive pulmonary disease COPD using a COPD-on-chip model that replaces the use of animal models in lung disease and lung injury research including COVID-19,			
Medical Advances Without Animals (MAWA)/Research Grant	Wojciech Chrzanowski, Thanh Phan	A\$ 25,000	2020-2021

This program aims to develop new models mimicking lung pathophysiology for testing new formulation to treat COPD.

Title: nanoJECT - light-thrusted needleless injections for pain-free cannabinoids delivery			
Office of Global Engagement/Partnership Collaboration Awards	Chrzanowski W, Oh K, Divakarla S, Hyeonwoo L (International partner: Yonsei University)	A\$ 35,000	2019-2020

This program focuses on the development of optic fibre based devices for pain free and needles injections of drugs.

Title: HIFU n - Nanotechnology-Enhanced High Intensity Focused Ultrasound as the New Generation of Cancer Therapy: advancing HIFU towards mainstream, non-invasive cancer therapy			
Sydney Catalyst	Wojciech Chrzanowski	A\$ 45,000	2019-2020

This program develops nano enhanced ultrasound system for cancer therapy.

Title: Skin- and skin injury-on-chip-microfluidic platform for Nano toxicity, drug discovery, and precision biology to replace the traditional use of animals in biomedical research and testing			
Medical Advances Without Animals (MAWA)/Research Grant	Chrzanowski W, Divakarla S,	A\$ 25,000	2019-2020

This program develops new models of skin and skin injury for testing toxicity of nanoparticles and drugs.

Title: Sense-and-Dispense - breaking barriers in cancer pain treatment using iontophoretic tattoo-like cannabinoids delivery systems

Office of Global Engagement/Partnership Collaboration Awards	Chrzanowski W, Zhao N, Divakarla S, Vitetta L, Liu J, Chen S, Hall S (International partner: Chinese University of Hong Kong)	A\$ 35,000	2018-2020
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This program develops ultrasound-based system for transdermal delivery of therapeutics which continuous monitoring of drug concentration in the blood stream.

Title: Big Idea 2018

Sydney Local Health District/Research Support	Wojciech Chrzanowski, Sally Yunsun Kim	A\$ 45,000	2018-2020
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This program develops new aerosol device for pulmonary delivery of extracellular vesicles.

Title: CannaPatch - microneedle delivery platform for cannabinoids for cancer patients

NSW Industry and Community Engagement SEED Program BOOST 2018	Wojciech Chrzanowski	A\$ 75,000	2018-2020
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This program focuses develops microneedle patch for transdermal devilry of cannabinoids.

Title: Novel nano-composite particles for controlled-release drugs via inhalation

Australian Research Council (ARC)/Linkage Projects (LP)	Chan H, Cipolla D, Chrzanowski W	A\$456,000	2018-2021
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This program develops innovative nanoparticles which encapsulate single drug crustal and allow for sustained delivery of the drug.

Title: Nanosafety - safety of nanoparticles and their impact on health and environment

CDIP Industry & Community Seed Fund 2017	Elizabeth New, Wojciech Chrzanowski	A\$50,000	2018-2019
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This program established single nanoparticles characterisation capability for testing nanotoxicity.

Title: Delivery of anti-inflammatory extracellular vesicles via aerosolisation for treatment of inflammatory lung diseases

Office of Global Engagement/Partnership Collaboration Awards	Wojciech Chrzanowski, Marca Wauben	A\$30,000	2018-2019
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This program developed new approaches for characterisation of single extracellular vesicles and was validated using vesicles derived from milk, human milk and stem cells.

Title: BEAM - Biomedical Engineering - EU Australian cooperation at master level

ICI-ECP Programme European Commission EACEA and Australian Government, Department of Education	Claudio Migliaresi Rui L. Reis Thomas Groth Dietmar W. Hutmacher Wojciech Chrzanowski Anthony Weiss	197,500 Euro + \$325,000 = A\$610,000.00	2014-2017
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Title: Design clean technologies for the synthesis and purification of biohybrid polymers			
ARC LP LP120200489	Fariba Dehghani, Wojciech CHRZANOWSKI	\$336,000	2013-2016
Title: Engineering of intelligent inhalable therapeutics with the capacity for guided accumulation and triggered release of active pharmacological ingredient using external electromagnetic field			
National Science Centre (Poland), Project Grant Harmonia	Elzbieta Pamula Wojciech Chrzanowski Marek Langner	\$310,000	2014-2017
Title: 'Firefighters' for smoke inhalation injury			
DVC-R Compact Grant	Wojciech Chrzanowski Kim Chan Yiwei Wang Sally Kim	\$25,000	2016
Title: 3D cell explorer – quantitative 3D stain-free, high-resolution imaging of cells and tissues			
NHMRC Equipment Grant	Wojciech Chrzanowski Nicholas King 1Anthony Weiss Jackob George Alan Body	\$39,500	2016
Title: ElastoSensTMBio2 – non-destructive & contactless biophysical tests of soft biomaterials and cell cultures			
University of Sydney Equipment Grant	Fariba Dehghani Wojciech Chrzanowski Geraldine O'Neil Robyn McConchie	\$55,000	2016
Title: NanoSafety – new generation of 3D scaffold-free tissue models for high throughput nanotoxicity and drug delivery studies			
DVC Research/AINST Accelerator Scheme	Wojciech Chrzanowski Nicholas King Iqbal Ramzan Brian Hawkett Dipesh Khanal	\$94,500	2015
Title: Cancer invasion and metastasis: how actin networks control cell movement in 3 dimensional environments			
SPARC-Cancer	Geraldine O'Neill Matteo Biro Fariba Dehghani Wojciech Chrzanowski	\$124,000	2015
Title: Focus on Nano-Antibiofilm-Interfaces - Current Approaches to Examine and Combat Infections Associated with Biomedical Devices			
The São Paulo Research Foundation (FAPESP). SPRINT – São Paulo Researchers in International Collaboration FAPESP grant: 2015/50311-8	Carlos Eduardo Vergani (UNESP) Wojciech Chrzanowski (USyd)	\$19,500	2015

Title: Kicking, scorching and cooling cells to guide their fate – understanding effects of vibrations and temperatures on a single cell responses using novel micorfluidic devices			
JSPS Invitational Fellowship	Wojciech Chrzanowski	\$21,000	2014
Title: Externally activated drug eluting implants/devices			
DVC Research Bridging Support Grant	Wojciech Chrzanowski	\$20,000	2014
Title: Nanoparticle drug Carriers for Externally Triggered and Targeted Chemotherapy			
Sydney Catalyst Pilot Funding	David McKenzie Natalia Suchowerska Wojciech Chrzanowski Joanne Toohey Lisa Horwath	\$50,000	2014
Title: Cell-based therapy for pulmonary injury			
USyd Faculty of Pharmacy, Innovation Challenge Award Grant	Wojciech Chrzanowski Kim Chan Sally Kim	\$30,000	2014
Title: Multifunctional surface for implantable devices			
AINSE research award Australian Institute of Nuclear Science and Engineering (AINSE)	Wojciech Chrzanowski	\$58,000	2013
Title: nanoIR - nanoscale bioimaging with continuous mapping of chemical and physical properties			
NHMRC Equipment Grant	Wojciech Chrzanowski, Filip Braet Marcela Bilek Kim Chan Sebastian Perrier Geraldine O'Neil Alaina Ammit Fariba Dehghani	\$196,151	2013
Title: Naturally good - fibres and particles of natural origin as a new biomaterials for regenerative medicine and drug delivery			
<i>Australian Government Department of Education and Training Endeavour Executive Award</i>	Wojciech Chrzanowski	\$31,000	2013
Title: Scanning Ion Conductance Microscopy			
The Ramaciotti Establishment and Equipment Grants Ramaciotti Foundation	Iqbal Ramzan Wojciech Chrzanowski	\$75,000	2012
Title: Talking to cells - biointerface as a key parameter in communication with cells			
DVC International/IPDF Grant	Wojciech Chrzanowski David Brown Fariba Dehghani Hae-Won Kim	\$16,000	2012

Title: Molecular force probe for nanoscale bioimaging – MFP-3D-BIO			
NHMRC Equipment Grant	Wojciech Chrzanowski Filip Braet Marcela Bilek Kim Chan Sebastian Perrier Paul Young Daniela Traini Alexey Kondyurin	\$197,555	2012
Title: Bioimprinted implant surfaces with multifunctional properties			
Australia-Korea Early Career S&T Researchers Program The Australian Academy of Science	Wojciech Chrzanowski Hae-Won Kim	\$4,800	2011
Title: ‘Braille’ for cells – functional surfaces that enhance implant integration			
JSPS Invitational Fellowship	Wojciech Chrzanowski Tadashi Kokubo	\$18,900	2011
Title: qNano – scanning ion occlusion spectroscopy (SIOS)			
NHMRC Equipment Grant	Wojciech Chrzanowski Mary Bebawy Kim Chan Ramin Rohanizadeh Brian Hawkett	\$16,000	2011
Title: The Instron testing material instrument			
NHMRC Equipment Grant	Fariba Dehghani Tony Weiss Marcela Bilek Hala Zreiqat Colin Dunstan Wojciech Chrzanowski Ramin Rohanizadeh	\$64,000	2011

PUBLICATIONS

- Calder, D.; Fathi, A.; Oveissi, F.; Maleknia, S.; Abrams, T.; Wang, Y.; Maitz, J.; Tsai, K. H.-Y.; Maitz, P.; Chrzanowski, W., **Thermoresponsive and Injectable Hydrogel for Tissue Agnostic Regeneration**. *Advanced Healthcare Materials* **2022**, 11 (23).
- Divakarla, S. K.; Das, T.; Chatterjee, C.; Ionescu, M.; Pastuovic, Z.; Jang, J.-H.; Al-Khoury, H.; Loppnow, H.; Yamaguchi, S.; Groth, T., **Antimicrobial and Anti-inflammatory Gallium-Defensin Surface Coatings for Implantable Devices**. *ACS Applied Materials & Interfaces* **2022**, 14 (7), 9685-9696.
- Limantoro, C.; Das, T.; He, M.; Dirin, D.; Manos, J.; Kovalenko, M. V.; Chrzanowski, W., **Synthesis of Antimicrobial Gallium Nanoparticles Using the Hot Injection Method**. *ACS Materials Au* **2023**.
- Phan, T. H.; Shi, H.; Denes, C. E.; Cole, A. J.; Wang, Y.; Cheng, Y. Y.; Hesselson, D.; Roelofs, S. H.; Neely, G. G.; Jang, J.-H., **Advanced pathophysiology mimicking lung models for accelerated drug discovery**. *Biomaterials Research* **2023**, 27 (1), 35.
- Tsai, K. H.; Shi, H.; Parungao, R. J.; Naficy, S.; Ding, X.; Ding, X.; Hew, J. J.; Wang, X.; Chrzanowski, W.; Lavery, G. G., **Skin 11 β -hydroxysteroid dehydrogenase type 1 enzyme expression regulates burn wound healing and can be targeted to modify scar characteristics**.

Burns & Trauma **2023**, *11*. Pokrajac L, Abbas A, Chrzanowski W, Dias G, Eggleton B, Maguire S, Maine E, Malloy TF, Nathwani J, Nazar L: **Nanotechnology for a Sustainable Future: Addressing Global Challenges with the International Network4Sustainable Nanotechnology**. *UCLA School of Law, Public Law Research Paper* 2022(22-03):15.

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7. Divakarla SK, Das T, Chatterjee C, Ionescu M, Pastuovic Z, Jang J-H, Al-Khoury H, Loppnow H, Yamaguchi S, Groth T: **Antimicrobial and Anti-inflammatory Gallium–Defensin Surface Coatings for Implantable Devices**. *ACS Applied Materials & Interfaces* 2022, **14**(7):9685-9696.
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9. Wang H, Zhang C, Yu J, Song Y, Liu S, Chrzanowski W, Cai W: **Voxel-wise cross-volume representation learning for 3d neuron reconstruction**. In: *International Workshop on Machine Learning in Medical Imaging: 2021*: Springer; 2021: 248-257.
10. Tong A, Sorrell TC, Black AJ, Caillaud C, Chrzanowski W, Li E, Martinez-Martin D, McEwan A, Wang R, Motion A: **Research priorities for COVID-19 sensor technology**. *Nature Biotechnology* 2021, **39**(2):144-147.
11. Pokrajac L, Abbas A, Chrzanowski W, Dias GM, Eggleton BJ, Maguire S, Maine E, Malloy T, Nathwani J, Nazar L: **Nanotechnology for a sustainable future: Addressing global challenges with the international network4sustainable nanotechnology**. In.: ACS Publications; 2021.
12. Phan TH, Divakarla SK, Yeo JH, Lei Q, Tharkar P, Pansani TN, Leslie KG, Tong M, Coleman VA, Jämting Å: **New Multiscale Characterization Methodology for Effective Determination of Isolation–Structure–Function Relationship of Extracellular Vesicles**. *Frontiers in bioengineering and biotechnology* 2021, **9**:669537.
13. Park SH, Phan TH, Kim JE, Chrzanowski W: **Physicochemical Characterisation of Extracellular Vesicles**. In: *Extracellular Vesicles*. edn.; 2021: 45-75.
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15. Hunt NJ, Lockwood GP, Kang SW, Westwood LJ, Limantoro C, Chrzanowski W, McCourt PA, Kuncic Z, Le Couteur DG, Cogger VC: **Quantum dot nanomedicine formulations dramatically improve pharmacological properties and alter uptake pathways of metformin and nicotinamide mononucleotide in aging mice**. *ACS nano* 2021, **15**(3):4710-4727.
16. Chrzanowski W, Lim CT, Kim SY: **Extracellular Vesicles: Applications to Regenerative Medicine, Therapeutics and Diagnostics**, vol. 9: Royal Society of Chemistry; 2021.
17. Chen Y, Song Y, Zhang C, Zhang F, O'Donnell L, Chrzanowski W, Cai W: **CellTrack R-CNN: A novel end-to-end deep neural network for cell segmentation and tracking in microscopy images**. In: *2021 IEEE 18th International Symposium on Biomedical Imaging (ISBI): 2021*: IEEE; 2021: 779-782.
18. Zhang B, Zhu M, Li Z, Lung PS, Chrzanowski W, Kwok CT, Lu J, Li Q: **Cellular fate of deformable needle-shaped PLGA-PEG fibers**. *Acta Biomaterialia* 2020, **112**:182-189.
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42. Farajikhah S, Rukhlenko ID, Stefani A, Large M, Chrzanowski W, Fleming S: **Thermally drawn polycaprolactone fibres with customised cross sections.** In: *AOS Australian Conference on Optical Fibre Technology (ACOFT) and Australian Conference on Optics, Lasers, and Spectroscopy (ACOLS) 2019*: 2019: SPIE; 2019: 201-202.
43. Dodballapur V, Song Y, Huang H, Chen M, Chrzanowski W, Cai W: **Mask-driven mitosis detection in histopathology images.** In: *2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019)*: 2019: IEEE; 2019: 1855-1859.
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REACH AND SIGNIFICANCE OF THE RESEARCH

My research program on nanomedicine has led to knowledge and health impact on the safety and efficacy of nanoparticles for medical applications. This has driven my development of (i) innovative high-content and high-throughput nanoparticle assessment methods & tools, and (ii) advanced therapeutic formulations, resulting in clinical & commercial outcomes.

My research program has established human pathophysiology-mimicking models and innovative methodologies for the multiscale determination of nanoparticles' interactions with biological systems, thus their safety and efficacy [e.g. *Biomaterials Research* 2023; *Frontiers in Bioengineering and Biotechnology* 2021; *International Journal of Nanotechnology* 2017].

The use of my models led to the 2016 Vice Chancellor's Award for Reduction in Use of Animals, and the 2022 Annual Bioprocessing Network Conference award for the development of non-animal strategy for the quality control of biologics. I also established an international consortium (iCare) and led the submission of a successful EU H2020 grant (\$5M; CI: iCare: Integrated Assessment and Advanced Characterization of Neuro-Nanotoxicity; HE-01-35, 2022). My work on alternative models to animals led to establishing NSW Centre for Organoid Innovation (CI). My work on human-mimicking models provided also key evidence presented during in NSW Inquiry into Alternatives to Animal Research

(2022), and was pivotal to the USyd participation in developing a strategy and roadmap for Australia: 'Non-animal models for preclinical development' (led by CSIRO) of which I am the USyd lead.

The assessment methods & tools I established were/are essential to establish innovative, safe and affordable nano-based formulations (aka nanomedicines) for different indications, e.g. gene therapy for macular degeneration (CI: Macular Disease Foundation Australia Research Grant G212978; AI: NHMRC Ideas 2020950); nano-Q10 formulation to treat metabolic disease (AI: NHMRC Ideas 2013621), and nano-cannabinoid formulation delivery using a microneedle patch (CI: Commercial Development and Industry Partnership Fund & NSW BOOST Program 2018).

In contrast to conventional approaches to nanomedicines design that sparingly consider the social, legal and sustainability aspects of new technologies, my approach comprehends the interconnected nanoparticle-cell-organ-patient-society relationship holistically (ACS Nano 2021; Nature Biotechnology 2021) and has had the following knowledge and health impacts:

KNOWLEDGE IMPACT

- 156 (218 GS) publications, 7360 citations, FWCI of 3.34 (5.29, last 3 years) in Biomedical and Clinical Sciences
- 21 prizes/awards since 2011 (6 international, 15 national); e.g. Highly Commended Finalist Research Australia Awards, category Frontier
- \$14.8M from grants since 2010, including 3x ARC Linkage grants, 3x EU (FP7/H2020)
- Reduction in use of experimental animals – 3R Vice-Chancellor Award 2017, 3x research grants (\$80k) from Medical Advances Without Animals and Ethical Australia
- Protocols for determining the pharmacokinetics of nanoparticles at the single-cell level
- Current industry collaborations: BiomeCentric, Probiotics Australia, nanoMT, MedLab Clinical, ExoPharm, BCAL Diagnostics, Therakii, IZON, SynThera, CYTIVA.
- Adviser to WHO in preparation of a 2020 handbook on nanoparticle safety testing.

HEALTH IMPACT

- Development of the human lung models to reduce animal in research and boost success in clinical trials <https://www.theguardian.com/science/2023/apr/11/australian-scientists-grow-replica-human-lungs-and-call-for-end-to-animal-testing>
- Demonstration that TiO₂ nanoparticles in food are harmful, leading to media with >300M views and contributing to EU banning these nanoparticles in food, <http://www.abc.net.au/news/2017-12-12/associate-professor-wojciech-chrzanowski-nanoparticles-food/9249038>, <https://www.sbs.com.au/news/health-concerns-over-nanomaterials-spark-call-for-safety-body>
- Demonstration that NanaBis™ from MedLab Clinical (https://www.medlab.co/science/scientific_advisory_board), a novel medication for chronic pain, is unstable. This led directly to changes in the manufacturing, dosing, delivery device, and formulation of NanaBis™; Phase II NCT04808531 in 360 participants.
- Demonstration that nano360, an anti-viral agent, is ineffective against viruses and has likely harmful biological effects, contributing to the company (nanoMT) withdrawing their application to the TGA.

KNOWLEDGE IMPACT

It is estimated that globally more than 10000 groups work on nanoparticles, my program is the only one which integrated nanoparticle-cell-organ-patient-society relationship holistically and translated from the laboratory through to routine applications. My program established:

A. Methods for determining: (i) the composition of single nanoparticles (engineered and natural such as EVs), and (ii) pharmacokinetics of nanoparticles at single cell level. The former outcome – previously considered impossible – was achieved by innovative combination of nanoscale infrared spectroscopy,

atomic force microscopy and nanoindentation (resolution <10 nm). The later was achieved by correlative nanoimaging using holotomography and confocal microscopy (resolution <100 nm)

B. Multi-organ-like systems that mimic human pathophysiology. These consist of 'mini organs' cultured using patent-derived cells and established using PhysioMimics™ system (CN Bio), which emulates dynamic conditions of human body. I was the first to integrate lung mini organs with the PhysioMimics™ system. This system is currently used by FDA and AstraZeneca.

C. Integration of legal framework and safe-sustainable-by-design as well as responsible innovation principles in the research program [ACS Nano, Cell science]

This integrated system (A+B+C) enables my research program to guide a design of advanced drug delivery system (e.g. NanoBis), nano-diagnostics (breast cancer screening test, research collaboration with BCAL) and new biologicals for lung injury (research contract Therakii Biotherapeutics LTD).

HEALTH IMPACT

For the ban of synthesized/engineered nanoparticles from food in EU, I claim partial responsibility (<https://www.abc.net.au/radio/programs/am/scientists-call-for-national-body-to-regulate-nanoparticles/9248522>). The >300M media hits and over 20 media interviews about my research program's paper showing harmful effects of a common food nanoadditive (TiO₂), on gut microbiota and overall health happened 18 months prior to the ban in EU. Leading to this ban I was an invited speaker and invited panel chair at Food Toxicology Conference in Singapore (January 2021), where I debated and discussed with representatives from the FDA, EU and Singapore the health impact and sustainability of nanoparticles.

Without the outcomes from my research program, the withdrawal of nano360 from a TGA application for its widespread use as an anti-viral spray for domestic and public applications would likely not have been made. My research program conducted the multifaceted testing of efficacy and safety and showed that this formulation is unsafe for humans and environment.

My research program's approach to characterising the interaction of single nanoparticles with single biomolecule, cells, organ-like structures and multi-organ-like systems was uniquely responsible for identifying the stable and safe formulation of NanaBis™ by MedLab Clinical being used in the above-listed Phase II RCT.