“Seeing” the nanoscale structure of soft materials

**CURRICUL VITAE**

***Dr Khay Fong***



# Short CV

Since 2023, Dr Fong is a Senior Lecturer & EMCR in the School of Chemistry at Monash University. As Course Coordinator for the Masters of Green Chemistry and Sustainable Technology, she is training the next generation of scientists in sustainable approaches, ensuring future innovations prioritise environmental stewardship alongside functionality. Dr Fong started her academic career in 2019 as a Lecturer in the Discipline of Chemistry, University of Newcastle. Between this and the award of her PhD (Pharmacy, Monash University 2013), she held postdoctoral fellowships at ETH Zurich, Monash University and the Adolphe Merkle Institute at the University of Fribourg.

Her research has developed both analytical and computational tools to investigate and control the bio-nano interface to create on-demand lipidic nanomedicines and diagnostic tools for enhanced treatment outcomes. Beyond drug delivery, she leads projects related to environmental microplastics, developing innovations in analytical chemistry to highlight the impact of microplastics on marine and human health. Notably, Dr Fong demonstrates an excellent capability in exploiting advanced analytical technologies into innovative solutions for complex physicochemical and environmental challenges.

Dr Fong is currently supervising 7 PhD and 1 Masters students. Her mentorship has launched successful careers, with supervised postdoc and PhD researchers now thriving in academia (3) and industry (1). As course coordinator for the Masters of Green Chemistry, she has strategically expanded industry partnerships with industry, creating innovative pathways for students to apply sustainable chemistry principles in real-world contexts.

Since 2019, CI Fong has been a Director of AusCRS, the Australian chapter of the Controlled Release Society and is the current VP. CI Fong regularly reviews ARC Grants and proposals for ANSTO. She is currently on the Program Advisory Committee for the SAXS/BSX at the Australian Synchrotron. She is a regular peer reviewer for J Colloid Interface Sci, J. Control Release, Pharmaceutics, Drug Deliv Transl Res amongst others. She has been a co-guest editor for special issues on lipidic drug delivery and oral drug delivery in Pharmaceutics (2022) and Frontiers in Drug Delivery (2021).

CI Fong has participated in many engagement activities including as a presenter at “An Evening with 500 Queer Scientists” as part of World Pride, Sydney (2023), highlighting her passion for enabling EDI activities. She has been interviewed by SBS World News (2024) and ABC Radio National (2022) for her research in microplastics.

# Bibliometric data

Dr Fong has 31 publications (>1700 citations) published in the leading journals (Q1) for pharmaceutical science, physical chemistry and environmental science. She has established an extensive global research network, collaborating with 74 researchers across 11 countries, where her cutting-edge expertise in nanoscale characterisation has proven instrumental in advancing fundamental understanding of novel materials.

In the microplastics space, CI Fong works closely with Pacific scientists (Scientific Research Organisation of Samoa, Samoa’s Ministry of Natural Resources and Environment) and Non-Government Organisations in Australia (AUSMAP, Port Phillip Ecocentre) and abroad (Sail and Explore Association) to empower their advocacy with data, demonstrating her ability to bridge the gaps between scientific disciplines and community.

Her work has commercial outcomes on stimuli responsive nanomaterials for drug delivery (WO2011/050388A1, 30/10/2009). More recently, CI Fong uses fundamental physical chemistry phenomena at the oil/water interface to solve industry questions. This was key to unlocking a proprietary suppository product from Noxopharm (2020-22, $272k)); where her research improved the company’s IP submission (2022). She is currently a scientific consultant for Samsara Eco, using her expertise in colloid and interface science to improve their enzymatic reactions to turn plastic waste into monomers.

# Selection of the 10 most relevant publications and/or patents

1. Fong W-K, Hanley TL, Boyd BJ. J. Control Release 2009; Stimuli responsive liquid crystals provide ‘ondemand’ drug delivery in vitro and in vivo. 135(3):218-26.

This study kickstarted our research into how to manipulate lipidic mesophases for on-demand drug delivery. Described as ‘pioneering’ by peers in the field (Langmuir 2011, 27, 9, 5296–5303) and sparked many international projects into responsive lipidic materials for drug delivery.

1. Fong, W.-K., Hanley, T.L., Thierry, B., Hawley, A., Boyd, B.J. & Landersdorfer, C.B. 2016, 'External manipulation of nanostructure in photoresponsive lipid depot matrix to control and predict drug release in vivo', Journal of Controlled Release, vol. 228, pp. 67-73

We used NIR-activated lipid nanostructures enable to precise, on-demand drug release in vivo, optimising drug concentration profiles.

1. Caukwell J, Assenza S, Hassan K, Neilan BA, Clulow A, Salvati Manni L, Fong W-K. J. Colloid Interface Sci., (2025), Lipidic drug delivery systems are responsive to the human microbiome. 293-302, 677.

We utilised dynamic synchrotron SAXS to reveal bacterial enzymatic activity transforms nanomaterial structures, dynamically altering drug delivery mechanisms.

1. Salvati Manni L, Duss M, Assenza S, Boyd BJ, Landau EM and Fong WKǂ, J. Colloid Interface Sci., 2020, Enzymatic hydrolysis of monoacylglycerols and their cyclopropanated derivatives: Molecular structure and nanostructure determine the rate of digestion. 588, 767–775.

Dynamic SAXS shows that tuning lipid structures affects self-assembly and digestion rates, key for developing oral drug/nutrient delivery nanosystems.

1. Etter M, Dellenbach DC, Petri-Fink A, Rothen-Rutishauser B, Landau EMǂ, Fong W-Kǂ. J. Colloid Interface Sci 2020, Understanding the assembly of amphiphilic additives in bulk and dispersed non-lamellar lipid-based matrices: phosphorylation, H-bonding and ionisation. 562, 502-510.

Precisely designed phosphoesters manipulate lipidic cubic phase nanostructures, enabling advanced drug delivery systems by controlling channel size, molecular positioning, and pH-dependent changes investigated via 31P NMR and SAXS.

1. Fong W-K, Moore TL, Balog S, Vanhecke D, Rodriguez-Lorenzo L, Rothen-Rutishauser B, Lattuada M and Petri-Fink\*. Nanoparticle Behaviour in Complex Media: Methods for Characterizing Physicochemical Properties, Evaluating Protein Corona Formation, and Implications for Biological Studies. In: Gehr P and Zellner R (editors) Biological Responses to Nanoscale Particles: Springer, 2019. p. 101-150. https://link.springer.com/chapter/10.1007/978-3-030-12461-8\_5 .

Book chapter summarising innovative interdisciplinary analytical techniques used to reveal the dynamic transformations of nanoparticles at the bio-nano interface.

1. Salvati Manni Lǂ, Fong W-Kǂ, Mezzenga Rǂ. Lipid-based mesophases as matrices for nanoscale reactions. Nanoscale Horiz. 2020, 5, 6, 914-927. https://doi.org/10.1039/D0NH00079E.

In this review, we show that lipid mesophases have a unique architecture that enables enzyme hosting, catalysis, and synthesis of complex materials in organized nanoscale environments.

1. Carbery M, Herb F, Reynes J, Pham CK, Fong W-K, Lehner R. How small is the big problem? Small microplastics <300 μm abundant in marine surface waters of the Great Barrier Reef Marine Park, Marine Pollution Bulletin, 2022, 184, 114179.

This citizen-science study was the first to demonstrate that the number of microplastics 50-300 μm outnumbers microplastics >300 μm by up to 120x.

1. Fong, Wye-Khay, Herb, Frithjof & Boley, Mario 2024, 'Machine Learning Microplastic Characterisation Surpasses Human Performance and Uncovers Labelling Errors in Public FTIR Data', doi:10.21203/rs.3.rs-5081019/v1

We used an efficient <2GB ANN to streamline the analysis of environmental microplastics. This is currently under review in J Haz Mat.

1. Contreras-Pereda N, Rodríguez-San-Miguel D, Franco C, Sevim S, Vale JP, Solano E, Fong W-K, Del Giudice A, Galantini L, Pfattner R, Pané S, Mayor TS, Ruiz-Molina D and Puigmartí-Luis J; Synthesis of 2D porous crystalline materials in simulated microgravity. Adv. Mater., 2021, 33, 2101777. https://doi.org/10.1002/adma.202101777

International collaboration utilising microfluidic devices simulate microgravity on Earth, enabling unprecedented control of 2D MOF growth.