



THE OHIO STATE UNIVERSITY

The William G. Lowrie Department of Chemical and Biomolecular
Engineering Graduate Program Cordially invites you to attend a seminar on
**Nanotechnologies for Isolating and Characterizing Extracellular
Nanocarriers of Biomarkers**

Hsueh-Chia Chang

Bayer Professor of Chemical and Biomolecular Engineering

University of Notre Dame

Thursday, October 26th, 11:30 AM

130 Koffolt Lab, CBEC 151 W Woodruff Ave, Reception at 11:00 AM - CBEC Lobby

Bio

Hsueh-Chia (Chia) Chang received his BS from Caltech in 1976 and his PhD from Princeton in 1980, all in Chemical Engineering. He currently holds the Bayer Corporation Chair at the Chemical Engineering department of University of Notre Dame.

He is known for his fundamental work on interfacial dynamics and electrokinetics, as well as his inventions of diagnostic devices. He holds 18 issued patents, with 10 more pending. Eight have been licensed to four startups and he serves as the CTO and Board member of one (Aopia Biosciences) that he cofounded. In 2006, he founded a new journal, Biomicrofluidics and served as its chief editor for 12 years.

More than 35 of his 65 PhD and postdoc students have embarked on academic careers in all engineering and science disciplines over 5 continents (15 in the US). They include 1 chancellor, 3 endowed chairs, 3 deans, 4 chairs and 5 NSF Career Awardees.

He wrote the seminal book on Electrokinetics (Cambridge University Press, 2009) and published more than 300 papers, which have garnered more than 18,000 citations and reached an h-index of 77 (Google Scholar statistics) in 2023. He has delivered more than 200 invited seminars throughout the world, including 3 named lectures. His awards include the American Physical Society Frenkiel Award, the American Electrophoresis Society Lifetime Achievement Award, the Indiana 1st Source Bank Commercialization Award. He is a fellow of APS and National Academy of Inventors.

Abstract

We review a suite of nanotechnologies from our lab for the isolation and characterization of extracellular nanocarriers of biomarkers in cell culture media and physiological fluids. These nanocarriers are exosomes, lipoproteins, ribonucleoproteins and supermeres that are secreted by diseased cells and carry potential protein and nucleic acid biomarkers for cancer, cardiovascular, neurodegenerative and even mental diseases. The technologies include size-based ultrafiltration membranes with conic nanopores to eliminate protein fouling, bipolar membranes that can actuate a pH gradient by splitting water to allow rapid and continuous isoelectric separation of nanocarriers, electrokinetic nanoporous membrane sensors that can quantify nanocarriers with specific colocalized surface proteins, magnetic Janus particles that can determine the activity of enzymes on the nanocarriers etc. The goal is to determine the existence, location and stage of different diseases of even asymptomatic patients. We seek clinical collaborators that can advance these technologies into viable early screening or therapy management diagnostic tests.

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Kumar, S., Maniya, N., Wang, C., Senapati, S. and Chang, H.-C., "Quantifying PON1 on HDL with Nanoparticle-Gated Electrokinetic Membrane Sensor for accurate cardiovascular risk assessment", *Nature Comm*, 14:557(2023).

Sharma, H., Yadav, V., D'Souza-Schorey, C., Go, D., Senapati, S. and Chang, H.-C., "A Scalable High-Throughput Isoelectric Fractionation Platform for extracellular nanocarriers: comprehensive and bias-free isolation of ribonucleoproteins from plasma, urine, and saliva", *ACS Nano*, 17 (10): 9388-9404(2023).

Zhang, Y., Kim, G., Zhu, Y., Wang, C., Zhu, R., Lu, X., Chang, H.-C., Wang, Y., "Chiral Graphene Quantum Dot enhanced drug loading into small extracellular vesicles", *ACS Nano*, 17(11):10191-10205(2023).