Research Statement

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WHERE MY WORK MEETS THIS LABORATORY

Your description names structure–property relationships in molecular solids, porous materials and pharmaceuticals. My doctorate lived in the intersection of those three, approached from the pharmaceutical side rather than the spectroscopic one.

DOCTORAL WORK

At the Shanghai Institute of Materia Medica, Chinese Academy of Sciences, I designed a **mesoporous polydopamine-based Pickering emulsion** — a system in which solid particles stabilise an oil–water interface, and in which the porous solid does the carrying. Its performance was decided almost entirely by structure: pore architecture and accessible surface area determined loading capacity; interfacial coverage determined colloidal stability; and surface chemistry determined release kinetics.

The problem was that the two payloads had opposite requirements. Shikonin, a naphthoquinone, and JQ1, a BET bromodomain inhibitor, differ in solubility and in the release profile each needs, yet both had to occupy one particle and arrive together in a fixed ratio. Resolving that meant systematic control of composition, drug ratio, loading and encapsulation efficiency, particle size and polydispersity, surface charge, stability across storage conditions, and release in physiologically relevant media — characterised by transmission and scanning electron microscopy, dynamic light scattering and zeta potential, HPLC and UV-visible spectroscopy.

The biological outcome — suppression of primary tumour growth and lung metastasis in triple-negative breast cancer models, through simultaneous blockade of epithelial–mesenchymal transition and vasculogenic mimicry — is published in *Acta Pharmacologica Sinica* 46(12):3314-3326, **joint first author, equal contribution formally recorded**.

I have also published reviews on **additive manufacturing in nanoparticulate drug delivery** and on **3D printing for oral dosage materials**, both of which are materials-processing papers concerned with how manufacture determines final structure.

WHAT I WOULD CONTRIBUTE, AND WHAT I WOULD LEARN

Contribute: experience of porous and composite materials whose function is defined by structure; routine characterisation by electron microscopy, light scattering and chromatographic assay; and — unusually for a materials laboratory — the ability to take a characterised material through cell work and into an animal study, including ethics approval, biodistribution and histopathology. Where a structure–property question ends in a pharmaceutical claim, I can close that loop in-house.

Learn: solid-state NMR in full. I have no experience of magic-angle spinning, multinuclear or two-dimensional methods, NMR crystallography, or DFT prediction of NMR parameters. I would be starting from the beginning, and I would rather write that plainly than imply a familiarity I do not have. My evidence for being able to do so is that every analytical method listed above was learned from nothing during my doctorate.

A QUESTION I WOULD WANT TO PURSUE

Mesoporous carriers are characterised almost entirely by ensemble methods — nitrogen adsorption, electron microscopy, light scattering — which describe the population but say little about the local environment of the molecule inside the pore. Whether the payload is amorphous, ordered, or interacting with the pore wall determines its stability and its release, and it is precisely the kind of question solid-state NMR answers and pharmaceutics currently guesses at. That intersection is why I am writing to a materials NMR laboratory rather than to another delivery group.

RECORD

Seven peer-reviewed publications, 324 citations, h-index 3 (Google Scholar, July 2026); three as first or joint first author. One filed Indian patent (No. 202421042057). Doctoral research funded throughout by the ANSO Young Talent and Belt and Road Government Fellowships.