

Research Statement

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RESEARCH FOCUS

My work is about what a delivery system does to a bioactive after it leaves the formulation bench — how composition and structure determine where the compound goes, how long it survives, and whether enough of it arrives to matter. I approach that as a physico-chemical question first and a biological one second, because the biology cannot be interpreted until the formulation is under control.

DOCTORAL AND MASTER'S PROGRAMMES

A polymeric carrier for two incompatible actives. At the Shanghai Institute of Materia Medica I designed a mesoporous polydopamine-based Pickering emulsion carrying shikonin and the BET bromodomain inhibitor JQ1 in a single particle. The two differ in solubility and in the release profile each requires, so the formulation had to hold a fixed ratio to the point of release. Optimisation covered composition, drug ratio, loading, encapsulation efficiency, size distribution, surface charge, stability across storage conditions and release in physiologically relevant media.

In triple-negative breast cancer models the system suppressed primary tumour growth and lung metastasis, through **apoptosis** combined with blockade of **epithelial–mesenchymal transition** and **vasculogenic mimicry**. Published in *Acta Pharmacologica Sinica* 46(12):3314-3326, **joint first author, equal contribution formally recorded**. I later formulated it into a thermosensitive hydrogel for local post-surgical delivery.

A transdermal product taken to filing. My Master's work produced a transdermal patch carrying a *Curcuma longa* flavonoid fraction for acne, evaluated for physicochemical properties, sustained release, **antimicrobial activity**, skin permeation and in vivo safety. It produced a first-author paper in the *Journal of Pharmaceutical Innovation* and a filed Indian patent (No. 202421042057).

WHAT I WOULD PROPOSE

1. Formulation as the variable that decides antimicrobial performance. For a topical or locally delivered antimicrobial, the minimum inhibitory concentration in a plate says little about what happens at the site. Building the physico-chemical characterisation that predicts local concentration over time — rather than assuming it — is directly useful to an antimicrobial programme and is work I have done before on a smaller scale.

2. Sustained local delivery of bioactives. My hydrogel work targets the case where systemic exposure is undesirable and the therapeutic window is narrow. The same logic applies well beyond oncology, including to animal-health settings where dosing frequency is a practical constraint rather than a clinical one.

3. Manufacturability as a design input. I have published reviews on additive manufacturing in nanoparticulate delivery and on 3D printing for oral dosage materials. A formulation that cannot be made reproducibly is not a product, and that constraint belongs at the start of a project rather than at the end.

CAPABILITY AND LIMITS

Capability: formulation design and optimisation across polymeric carriers, Pickering emulsions, thermosensitive hydrogels and transdermal systems; characterisation by DLS, zeta potential, TEM, SEM, HPLC, UV–Vis and fluorescence spectroscopy; stability and release profiling; cell-based assays and mechanistic molecular biology; complete murine in vivo studies run independently; and the assembly of an evidence package to the standard a patent filing requires.

Limits: no veterinary or animal-health formulation experience, no biopharmaceutical engineering, and no GMP manufacture or scale-up. These are application areas and process skills rather than new science, but they are absent from my record and I would rather state that.

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. Doctorate funded throughout by the ANSO Young Talent and Belt and Road Government Fellowships.