Research Statement

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THE PROBLEM I WORK ON

Potent epigenetic inhibitors do not usually fail because they are weak. They fail because they cannot be delivered.

BET bromodomain inhibitors are the clearest example. JQ1 silences MYC-driven transcriptional programmes at nanomolar concentrations in culture, and yet its translation has been limited by poor aqueous solubility, a short half-life, and a therapeutic window narrowed by exposure of healthy tissue. The same pattern recurs across the class. The chemistry is not the limiting step; the pharmaceutics is.

My work sits at that boundary. I design carriers that hold a poorly soluble, rapidly cleared compound long enough, and release it in the right place, for the biology to matter.

WHAT I ESTABLISHED DURING MY DOCTORATE

At the Shanghai Institute of Materia Medica, Chinese Academy of Sciences, I developed a **mesoporous polydopamine-based Pickering emulsion** that co-delivers two agents with fundamentally incompatible formulation requirements: shikonin, a naphthoquinone natural product that inhibits PKM2 and suppresses tumour glycolysis, and **JQ1**, a BET bromodomain inhibitor.

Co-delivery in a single particle was the point, not a convenience. Two agents administered separately reach a given tumour cell at different times and in different ratios; a single carrier holds the ratio fixed to the point of release.

The result in triple-negative breast cancer models was suppression of both primary tumour growth and lung metastasis. Mechanistically the combination induced **apoptosis**, blocked **epithelial–mesenchymal transition** — the programme by which carcinoma cells acquire the motility to leave the primary site — and blocked **vasculogenic mimicry**, in which tumour cells form their own perfusion channels and so escape therapies aimed at normal blood-vessel formation. Closing three escape routes at once is what produced the anti-metastatic effect. Published in *Acta Pharmacologica Sinica* 46(12):3314-3326, **joint first author, equal contribution formally recorded**.

I then extended the platform into a **thermosensitive hydrogel** intended for placement at the resection site, addressing the post-surgical window in which residual disease seeds recurrence and where systemic dosing is poorly suited.

WHAT I WOULD PROPOSE HERE

Carrier design for the group's inhibitor series. Systematic optimisation of loading, encapsulation efficiency, size distribution, surface charge, colloidal stability and release profile — treated as coupled variables against a defined target product profile rather than optimised one at a time.

Establishing that delivery actually happened. A formulation result is not a delivery result. Cellular uptake, intracellular localisation by confocal microscopy, target engagement by Western blot and RT-qPCR, and biodistribution in vivo — so that a negative efficacy result can be attributed to the compound rather than to the carrier.

The in vivo package. Study design and ethics approval, dosing and route selection, tumour and body-weight monitoring, terminal tissue collection, histopathology and organ-toxicity readouts. I have run this end to end, independently.

Two directions I would want to develop: whether **local and sustained delivery** widens the therapeutic window for epigenetic inhibitors whose systemic toxicity is dose-limiting; and whether the **immune consequences** of epigenetic inhibition can be exploited by controlling where and when the drug appears, which follows from my first-author review on nanocarrier modulation of the tumour immune microenvironment.

WHAT I DO NOT BRING

I am a formulation scientist, not a synthetic chemist. I do not perform multi-step organic synthesis, route optimisation or structural elucidation by NMR. If the group's synthesis capability is already in place, I complement it; if the post is fundamentally a synthesis post, I am the wrong applicant and would rather that be clear at the outset. I have also not worked on delivery across the blood–brain barrier, so the neurological arm would be something I learn rather than lead.

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 (App. No. 202421042057) on a transdermal delivery system, taken from formulation concept through in vitro efficacy and in vivo safety evidence to filing. Doctoral research funded throughout by the ANSO Young Talent Fellowship and the Belt and Road Government Fellowship.