Research Theme: **Biomedical Engineering; Chinese Medicine**

MSc Research Project Title: Develop a Microneedle Acupuncture for Pain Management

Principal Investigator/Supervisor: Mingxiao Yang

Co-supervisor/ Collaborator(s) (if any):

Project Description

a) Background:

Acupuncture is a safe, evidence-based modality for managing a wide range of pain conditions. However, despite practitioners' proficiency, minor adverse events such as mild pain, bruising, and superficial bleeding occur in approximately 5–10% of patients in real-world practice. Although these side effects are typically benign, they can significantly impact patient experience and reduce the acceptance and accessibility of acupuncture, particularly among individuals with needle phobia, hematological risks, or immune compromise. Thus, there is an unmet clinical need to develop a safer, less invasive, and patient-friendly acupuncture delivery system. Microneedles, an emerging technology at the intersection of materials science and biomedical engineering, offer a promising solution. Dissolving microneedles are capable of penetrating the superficial layers of skin without significant pain or tissue trauma and can be engineered to deliver therapeutic agents directly into local tissues in a controlled manner. This project aims to 1) Design and develop a novel acupuncture device using dissolving microneedle arrays to mimic traditional acupuncture stimulation while minimizing adverse events, and 2) Incorporate controlled drug delivery (e.g., analgesic peptides, anti-inflammatory compounds) into the microneedle system to enhance therapeutic effects for chronic pain management.

b) Proposed work:

- Develop a prototype of a dissolving microneedle-based novel acupuncture device combining controlled drug delivery for pain relief
- Examine the stability, safety, applicability, and preliminary effect of the microneedle acupuncture in an animal model of chronic pain

c) Preferred skills: Bioengineering; Chinese Medicine (Acupuncture); Pain Physiology; Animal Study. Computational modeling of drug release kinetics or finite element modeling of microneedle-tissue interactions.

Supervisor contact:

If you have questions regarding this project, please email the Principal Investigator:

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SBS contact and how to apply:

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Please apply at the following:

Application portal:

https://venus.wis.ntu.edu.sg/GOAL/OnlineApplicationModule/frmOnlineApplication.ASPX