Experiments with hollow microneedles – insertion, fluid extraction

Laboratory Name: Stoeber Lab
Faculty Supervisor: Prof. Boris Stoeber
Graduate Student Mentor: Pranav Shrestha

General Area of Research

Tissue biomechanics, fracture mechanics, microfluidics, fluid/solid mechanics

The Project

Hollow microneedles are biomedical microdevices that target the skin for applications such as drug delivery and bio-sensing (e.g. blood and/or interstitial fluid extraction). Due to their small size (around a millimeter in length and 1/10 of a millimeter in diameter), hollow microneedles improve patient compliance and are less invasive than the conventional hypodermic needles. The mechanics of dynamic microneedle insertion into skin needs to be investigated for optimizing the use of microneedles for injection of drugs (such as vaccines) and for extraction of blood or interstitial fluid. This study aims to experimentally investigate 1) the insertion mechanics of hollow microneedles into artificial skin models; and 2) fluid extraction through hollow microneedles for bio-sensing applications. The findings from such a study can help improve or create new minimally-invasive techniques for drug delivery and bio-sensing.

Tasks to be performed by the student

- Conduct experiments with hollow microneedles using existing experimental setup for insertion /extraction
- Analyze and process sensor/actuator data
- Design and 3D print (or machine) any required modifications to the experimental setup for testing new samples
- Conduct literature review to relate experimental findings to theoretical models

Facilities and team

The experiments will be conducted in AMPEL 146, Advanced Materials Process Engineering Laboratory. The student will work closely with Prof. Boris Stoeber's graduate student, Pranav Shrestha (email: pranav.shrestha@alumni.ubc.ca).

Supervision Received

The student will be assisted on a regular basis by the graduate student mentor, and will receive guidance from Prof. Stoeber. The student will be provided with initial references for literature review, and will be trained on using the experimental setup and measurement techniques. The student will get access to the lab in AMPEL and a student office space in Kaiser, which is shared by members of the Stoeber Lab and other research groups.