

## PROJECT DETAILS

Project Title:

**Optimization of Bone Temperature During Drilling.**

Project Summary:

Bone drilling is indispensable in orthopaedic fixation, yet excessive heat at the drill–bone interface can induce thermal osteonecrosis, compromising screw anchorage and implant longevity. Foundational studies indicate irreversible damage around 47–50 °C when exposure is sustained ( $\approx 1$  min), underscoring the need for thermally safe drilling protocols (*Augustin et al., 2008; Rugova & Abboud, 2024*).

This project integrates in vitro experiments, 3D finite element modelling (FEM), and AI-driven prediction and optimization (ANFIS + artificial immune system, AIS) to identify parameter sets—covering drill geometry, speed, feed-rate, and irrigation—that minimize peak cortical bone temperature while maintaining procedural efficacy (*Chen et al., 2024; Safari et al., 2021*). The outcome will be validated thermal guidelines and an open methodological framework appropriate for clinical translation.

Preferred Applicant Skillset:

- Basic knowledge of machining and drilling processes.
- Mechanical/biomedical engineering fundamentals (heat transfer, materials, biomechanics).
- Finite Element Analysis (ANSYS or Abaqus).
- Experimental lab skills (drilling rigs, thermocouples, IR thermography, DAQ systems).
- Programming in MATLAB and/or Python.
- Familiarity with machine learning/optimization methods (e.g., ANFIS).
- Strong data analysis and scientific writing abilities.
- Awareness of orthopaedic/dental drilling and biosafety.

Internship Opportunity:

There is a possibility of the candidate spending a few weeks in the United Kingdom and using the facilities available at the University of Portsmouth (UoP). We have a strong research collaboration with Dr Khaled Giasin from UoP who will facilitate this internship.

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