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| **Project Details:** | |
| **Host Institution:** | Dublin City University |
| **Location:** | Glasnevin, Dublin 9, Ireland |
| **College/Company:** | National Centre for Sensor Research |
| **School/Unit:** | Mechanical and Manufacturing Engineering |
| **Website:** | www.ncsr.ie |

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| **Project Title:** |

Convective PCR on a Lab-on-a-Disc

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| **Brief Project Description:** |

Currently, a project student in my team is developing a laboratory instrument to conduct convective PCR on a Lab-on-a-Disc. Lab-on-a-Disc is the automation of common biological diagnostics tests, such as ELISA assays, Immunoassays, and Nucleic Acid tests (i.e. PCR and LAMP tests such as those used for point-of-care diagnostic testing). Here, the microfluidic chips shaped like CDs / DVDs are manufactured and the centrifugal force is used to move liquids from the centre to the edge of the disc.

At point-of-care it is very difficulty to implement PCR DNA amplification (used to tests such as COVID-19 diagnostics) because PCR requires rapid heating and cooling of samples. This often requires use of large heating elements and TEM (Peltier) coolers which are power-hungry and so not suited for use in small automated laboratory instruments. Convective PCR offers a potential solution where natural convection is used to move PCR reagent about a chamber and so rapid heating / cooling is not required. Some work has previously been conducted on convective PCR on a Lab-on-a-Disc but the field is relatively new. This project will continuing development of our convective PCR laboratory instrument and then conducting biological experiments (particularly relating chambers sizes and ‘relative centrifugal force’ to speed at which PCR takes place.

My lab is multidisciplinary so this project is suitable for students from all branches of engineering, and from physics, biology (particularly molecular biologists) and chemistry. The references below link to some of my lab’s work on Lab-on-a-Disc systems and supporting instrumentation. Note many of these links have videos demonstrating how the Lab-on-a-Disc works. There is also a link to a review of convective PCR.

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| **References:** |

<https://doi.org/10.1039/C4LC00380B>

<https://doi.org/10.1039/C4RA14887H>

<https://doi.org/10.1371/journal.pone.0155545>

<https://doi.org/10.1016/j.bios.2018.03.012>

<https://doi.org/10.3390/bios11030073>

Convective PCR Review: <https://doi.org/10.1016/j.aca.2020.01.069>

<https://scholar.google.com/citations?user=T3TNAB0AAAAJ&amp;hl=en&amp;oi=ao>

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| **Project Dates:** |

Not specified

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| **Candidate Requirements:** |

Not specified