

Final Report Summary
Investigation of Novel Optical Methods of Undertaking
Polymerase Chain Reactions (PCR)

PHOTONASE



Photonase Ltd

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Under the TTOM scheme the Institute of Photonics at Strathclyde University has been working with Photonase, an SME based in Dundee, to explore options for novel optical methods of undertaking Polymerase Chain Reactions (PCR). The project built upon an initial idea from Photonase and used the Institute's expertise and experience in Biophotonics to undertake several pilot experiments.

A significant limitation on the uptake of genomic based testing and screening for health care is the time required to multiply up the DNA to a level at which it can be reliably detected in assays. This project aimed to tackle this issue by undertaking a preliminary evaluation of a novel way of reducing the cycle time for DNA replication. The technique also applies to real time reverse transcriptase PCR ("RT2 PCR"). In order to evaluate DNA the initial small sample needs to be copied, or replicated, until sufficient material has been produced for the DNA to be run in various assay systems. Generally a copying cycle needs to be run between 25 and 30 times. The exact form of the cycle depends on the length of the DNA strand to be replicated but all the current methods involve repeated temperature cycling between around 95 and 55 Celsius. Crucial to the process in either conventional or RT2 PCR is the stability and repeatability of each step.

Currently many instruments use either a thermo-electrically heated & cooled metal block or a hot & cold air system to produce the required temperature cycle but these methods are both limited by the use of indirect heat transfer. Various electrical and micro-fluidic methods have also been proposed but at present the repeatability of such methods are in doubt.

In this project a novel laser based method of direct sample heating was explored to validate a model developed prior to the commencement of the practical work. Initially a series of accurate absorption measurements were made covering a broad spectral bandwidth. Based upon these measurements a series of practical direct laser heating tests were undertaken. Only a few micro-litres of sample were present illustrating the level of the challenge presented in measuring the temperature and subsequent control of the heating cycle.

Using the results from these initial studies a series of PCR runs were then undertaken using direct laser heating method and after some limited optimisation a significant yield of the required DNA sequence was produced. This demonstrates that the direct laser heating technique is viable.

A patent has been filed on the direct laser heating method by Photonase and work is now underway to fully optimise all aspects of the process. Direct laser heating shows great promise for PCR in general and fast RT2 PCR in particular.

The project illustrates the way that a TTOM project can use well equipped University laboratories to undertake initial studies of a practical nature with the aim of demonstrating to future investors that a novel method may be suitable for full development funding.

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