PCR amplification from student's own DNA

by Dr Michelle Coulson

Experiment Overview

The technique of Polymerase Chain Reaction (PCR) has revolutionised biology and biomedical science research and medical diagnosis and testing. PCR is applied in forensics to allow identification of individuals. This involves regions of the human genome that are highly variable, such as minisatellite loci. This experiment involves students purifying a sample of their own genomic DNA, and using PCR to amplify a specific minisatellite loci, D1S80. The PCR products are viewed by gel electrophoresis, and different alleles at minisatellite loci produce different length PCR products. Students analyse their own genotype and the results of some of their classmates, within the limitations of agarose gel electrophoresis.

Learning Experience

This experiment covers the theory and technique of PCR presented in the context of human DNA variation. By collecting a biological sample and purifying their own DNA, the theory and practical aspects are made relevant to each individual student.

Aims and Objectives

The aims are to introduce PCR theory, reinforce micropipetting and other basic molecular biology techniques, give experience in agarose gel electrophoresis, and exposure to minisatellites as a specific type of DNA variation.

Level of Experiment

Second year science students doing any biology based in molecular biology techniques.

Keyword Descriptions of the Experiment

Domain
molecular biology, genetics
Specific Descriptors
PCR, polymerase chain reaction, human variation, D1S80, minisatellite, agarose gel electrophoresis

Course Context

This experiment is done in isolation from lecture material, and thus is designed to have a detailed introduction presentation that introduces PCR theory as well as the specific details of D1S80, the locus to be amplified.

Prerequisite Knowledge and Skills

Some prior experience in basic molecular biology laboratory work is assumed, especially micropipetting (Gilson pipettes). Students are assumed to have already completed first year biology (or equivalent), so they are already familiar with DNA and DNA replication, and genetic terms including genotype, homozygous, heterozygous (though this can be avoided depending on how students are expected to interpret results).

Time Required to Complete

Prior to Lab: 0
In Laboratory: two sessions of two hours each
After Laboratory: 0 (assessment write-up only)

Experiment History

This experiment could be extended to use polyacrylamide gel electrophoresis instead of agarose (to give better resolution of PCR products), and/or amplifying additional loci (to more accurately represent the idea of DNA fingerprinting/identification).