

# Proteins and Enzymes

by Tracey Kuit

## Experiment Overview

Proteins are extremely important biological molecules, both structurally (e.g. your fingernails are made of the protein keratin, whilst collagen is a very important protein in connective tissue) and functionally as enzymes catalyzing biological reactions. In part A of this prac, students determine the **amount** of protein in a sample, by effectively measuring the peptide bonds (as each amino acid has a peptide bond connecting it with the next) using a Biuret spectrophotometric assay. Students generate a **standard curve**, an extremely important tool in biochemistry.

In the second part of the prac, students do a hypothetical experiment on enzymes. Enzymes are protein molecules which act as **catalysts** of biochemical reactions. Enzymes act by binding the substrate (substance which reacts) and providing a pathway for the reaction, making the conversion from substrate to product faster. Without enzymes, biochemical reactions would take hours or days to proceed. During an enzymatic reaction, substrate is converted to product, but the enzyme is released **unchanged**, ready to **repeat** the process with other substrate molecules (*catalysis* - to change without changing).

## Learning Experience

This experiment covers some of the most fundamental principles of introductory biochemistry and focuses on proteins and enzymes. In the first part of the experiment students undertake an assay to determine protein content and through this experiment students learn to use a basic biochemical tool, the spectrophotometer. Additionally, the second part of this practical highlights the important role of enzymes in biological reactions. Namely, the students visualise the effect enzymes have in speeding up chemical reactions, using various amounts of the enzyme. Students also learn the important skill of graphing and utilisation of a standard curve. Students are also required to complete some basic biochemistry calculations.

## Aims and Objectives

By the end of this practical, students should be able to:

- Conduct** a protein assay, **using** a spectrophotometer
- Make** a standard curve and use it to **quantitate** the amount of protein in a sample
- Do a **hypothetical** experiment on enzyme activity and **analyse and present** the results

## Level of Experiment

This experiment is aimed at first year biology students.

## Keyword Descriptions of the Experiment

### Domain

proteins, enzymes

### Specific Descriptors

standard curve, protein assay, catalysts, biuret, amylase, absorbance

## Course Context

This experiment is targeted at 1<sup>st</sup> year biology students and these students will have been given lectures on proteins and their various levels of structure. Lectures will have also covered the roles of proteins in biological systems and namely their role as biological catalysts. Lectures will have highlighted enzyme substrate interactions. Introductory metabolism lectures will have also covered this in greater detail.

## Prerequisite Knowledge and Skills

**Students are also required to do some pre-reading:**

**Reading BEFORE the lab (from Practical Skills in Biology):**

- Methods of determining the amount of protein...
- Chapter 59 Basic Spectroscopy pp 366 - 369

**Background reading (from Knox, *et al.*, 3<sup>rd</sup> Edn):**

- Chapter 1 section on Proteins pp 36 - 43
- Chapter 2 section on Enzymes pp 53 - 57

## Time Required to Complete

**Prior to Lab:** 1 hour (pre-lab reading and answering of questions)

**In Laboratory:** 3 hours

**After Laboratory:** 2 hours (completion of all graphs and all questions)

## Experiment History

This experiment has been a staple of a first year biology subject at UoW for at least 5 years. In the past students collected the salivary amylase sample and generated their own data for part B of the practical. Due to OH&S concerns and class limitations students are now given the raw data to complete this part of the practical.