ALLOZYME ELECTROPHORESIS

A Handbook for Animal Systematics and Population Studies

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GENERAL INTRODUCTION

Since the advent of starch gel electrophoresis in 1959, the technique of electrophoresis has been increasingly used to provide useful information in a wide range of biological and medical situations. One major area has been its use as a tool for genetic analysis, using enzymatic proteins as markers of variation in the underlying genes (i.e. allozyme electrophoresis). Such genetic markers are useful for the identification of individuals, population structure analysis, the delineation of species boundaries and phylogenetic reconstruction. The purpose of this book is to address these aspects in a single, convenient handbook for all those intending to use electrophoresis as a tool to answer practical questions in population structure analysis, systematics or specimen identification.

Ferguson (1980) provides useful background information in these areas, but does not give the necessary practical details. The book by Harris and Hopkinson (1976), on the other hand, gives a detailed account of the practical procedures for conducting allozyme electrophoresis, but is directed towards work on humans. Both these books make excellent companion references for this handbook.

Whilst much of this book refers to zoological applications, the principles behind the technique and most of the methodology are applicable to virtually all life forms.

In times of budgeting restraint, considerations of cost in terms of money and, more especially, of time, are of paramount importance. A continuing theme throughout the book is that of maximum return for minimum cost. In electrophoretic work, collecting the samples in the field may be much more expensive than the electrophoresis itself. Therefore particular emphasis is placed upon project planning from the economic point of view without compromising the aims of the project.

Any electrophoretic analysis of population structure, species complexes, or phylogeny goes through three phases; project planning, electrophoresis of the samples, and data analysis. The book includes separate parts dealing with each of these three phases.

Part I considers background concepts. The book assumes no specialized knowledge of either genetics or biochemistry. However, some background knowledge is essential to economical and sensible sampling strategies, to

the process of electrophoresis and to the biological interpretation of the data obtained.

Part II covers the practical aspects of data collection, from the viewpoints of both taking and handling the samples for electrophoresis, and of running, staining and interpreting gels.

Part III discusses the analysis of data with methods and examples being given for the treatment of both population data and systematic data.

Part IV consists of a single chapter which briefly reviews other practical applications of allozyme electrophoresis, such as the identity of cell cultures, checking the 'purity' of inbred strains of laboratory animals, the identification of larval forms, and species identification in mixed fish catches.

A number of support media are suitable for allozyme electrophoresis. We have found that cellulose acetate is a very versatile medium and the easiest to use. Therefore the methods section of this book refers mainly to that medium (and in particular to the 'Cellogel' brand). However, we stress that all of Parts I, III and IV and much of Part II are independent of the support medium used. Therefore the book should prove useful to anyone using allozyme electrophoresis, whatever the support medium.

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