

# LABORATORY EXERCISE #3. Detection of genetically modified food products by gel electrophoresis

## Introduction

PCR products of differing lengths can be separated from each other based on size by an analytical method called gel electrophoresis. In this method charged macromolecules (such as DNA, RNA or proteins) migrate through a porous gel typically made from agarose (polysaccharide polymer derived from sea weed) or polyacrylamide when an electrical current is applied. The DNA sample is loaded into a well within the gel and placed near the anode (negative charge). As DNA has a very high negative charge due to the presence of the ionized phosphate groups on its backbone, it will migrate away from the negative anode toward the positively charged cathode as electrophoresis takes place. During the migration, smaller DNA fragments will pass through the gel pores more easily and thus migrate through the gel faster. Larger DNA molecules take longer to get through the pores and will migrate slower. The separated DNA "bands" or fragments can be visualized within the gel by staining with **ethidium bromide**. This dye intercalates (inserts) itself into the DNA and will fluoresces under ultraviolet light. In other words, DNA fragments will appear as fluorescent bands in the gel when exposed to UV light (Fig 1).

*Concept check: If you compared two DNA fragments, one of 200-base pairs (bp) and the other of 1000 bp, which fragment will appear lower on the gel/have migrated faster?*

*Q: During gel electrophoresis, DNA is separated based on what two properties?*

*A: Size and charge*

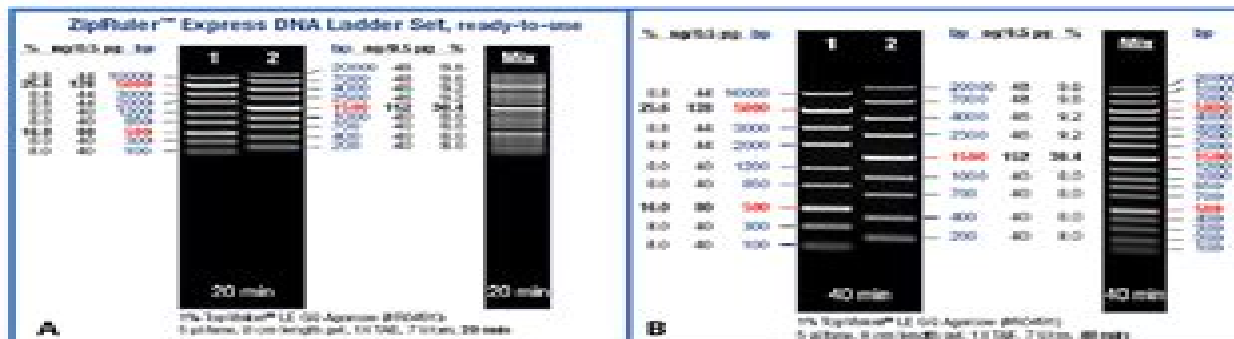


Figure 1. DNA fragments of known size are separated on an agarose gel for 20 min (A) or 40 min (B). By comparing the results, you can see how at 20 min, the DNA fragments are not well separated but by 40 min, the individually sized fragments are well separated and the size is easily determined. Figure adapted from Biogen.

# Gel Electrophoresis Lab Manual

**Steven A. Williams, Barton Elliott  
Slatko, John R. McCarrey**



## **Gel Electrophoresis Lab Manual:**

**Nucleic Acid Electrophoresis** Dietmar Tietz, 2012-12-06 Electrophoresis is a powerful method to analyze nucleic acids DNA RNA Various sophisticated techniques such as capillary electrophoresis pulsed field electrophoresis fingerprinting using RFLP and RAPD DNA sequencing and mobility shift assay are described in detail The required apparatus appropriate use preparation of probes gel staining interpretation of results tricks for troubleshooting manufacturers addresses helpful Internet resources as well as specific applications e g in legal medicine microbiology and agriculture are presented by leading experts

**Laboratory Manual for Biotechnology and Laboratory Science** Lisa A. Seidman, Mary Ellen Kraus, Diana Lietzke Brandner, Jeanette Mowery, 2022-12-23 Provides the basic laboratory skills and knowledge to pursue a career in biotechnology Written by four biotechnology instructors with over 20 years of teaching experience it incorporates instruction exercises and laboratory activities that the authors have been using and perfecting for years These exercises and activities help students understand the fundamentals of working in a biotechnology laboratory Building skills through an organized and systematic presentation of materials procedures and tasks the manual explores overarching themes that relate to all biotechnology workplaces including forensic clinical quality control environmental and other testing laboratories Features Provides clear instructions and step by step exercises to make learning the material easier for students There are Lab Notes for Instructors in the Support Material see tab below Emphasizes fundamental laboratory skills that prepare students for the industry Builds students skills through an organized and systematic presentation of materials procedures and tasks Updates reflect recent innovations and regulatory requirements to ensure students stay up to date Supplies skills suitable for careers in forensic clinical quality control environmental and other testing laboratories

**Pulsed Field Gel Electrophoresis** Bruce Birren, Eric Lai, 2012-12-02 Pulsed Field Gel Electrophoresis A Practical Guide is the first laboratory manual to describe the theory and practice of this technique Based on the authors experience developing pulsed field gel instruments and teaching procedures this book provides everything a researcher or student needs to know in order to understand and carry out pulsed field gel experiments Clear well tested protocols assume only that users have a basic familiarity with molecular biology Thorough coverage of useful data theory and applications ensures that this book is also a lasting resource for more advanced practitioners of pulsed field gels Reviews all types of pulsed field gel electrophoresis Describes all commercially available systems and summarizes advantages and limitations of each Includes step by step protocols for sample preparation and analysis Illustrated with photographs that depict How to run gels What the results should look like What they look like when they go wrong Covers applications to a wide range of organisms Includes bibliography of over 900 publications and cross referenced by topic application and organism

*Laboratory Manual on Biotechnology* P. M. Swamy, 2008 **The Fusarium Laboratory Manual** John F. Leslie, Brett A. Summerell, 2008-02-28 For the first time in over 20 years a comprehensive collection of photographs and descriptions of species in the fungal genus

Fusarium is available This laboratory manual provides an overview of the biology of Fusarium and the techniques involved in the isolation identification and characterization of individual species and the populations in which they occur It is the first time that genetic morphological and molecular approaches have been incorporated into a volume devoted to Fusarium identification The authors include descriptions of species both new and old and provide protocols for genetic morphological and molecular identification techniques The Fusarium Laboratory Manual also includes some of the evolutionary biology and population genetics thinking that has begun to inform the understanding of agriculturally important fungal pathogens In addition to practical how to protocols it also provides guidance in formulating questions and obtaining answers about this very important group of fungi The need for as many different techniques as possible to be used in the identification and characterization process has never been greater These approaches have applications to fungi other than those in the genus Fusarium This volume presents an introduction to the genus Fusarium the toxins these fungi produce and the diseases they can cause The Fusarium Laboratory Manual is a milestone in the study of the genus Fusarium and will help bridge the gap between morphological and phylogenetic taxonomy It will be used by everybody dealing with Fusarium in the Third

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**Basic Laboratory Methods for Biotechnology** Lisa A. Seidman, Cynthia J. Moore, Jeanette Mowery, 2021-12-28 Basic Laboratory Methods for Biotechnology Third Edition is a versatile textbook that provides students with a solid foundation to pursue employment in the biotech industry and can later serve as a practical reference to ensure success at each stage in their career The authors focus on basic principles and methods while skillfully including recent innovations and industry trends throughout Fundamental laboratory skills are emphasized and boxed content provides step by step laboratory method

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Evolve website include the glossary weblinks and content updates New content is added on basic cell biology and etiology of leukocyte neoplasias Updated Molecular Diagnostics chapter keeps you current on techniques being used in the lab Simplified hemostasis material ensures that you can understand this complex and important subject Coverage of morphologic alteration of monocytes macrophages is condensed into a table as the disorders in this grouping are more of a biochemical nature with minimal hematologic evidence

*Laboratory Investigations in Molecular Biology* Steven A. Williams, Barton Elliott Slatko, John R. McCarrey, 2007 Laboratory Investigations in Molecular Biology presents well tested protocols in molecular biology that are commonly used in currently active research labs It is an ideal laboratory manual for college level courses in molecular biology Because of the modular organization of the manual laboratory courses can be assembled that would be ideal for science professionals graduate students undergraduate students and even advanced high school students in AP courses The manual is also intended to be useful as a laboratory bench reference The experiments are designed to guide students through realistic research projects and to provide students with instruction in methods and approaches that can be immediately translated into research projects conducted in modern research laboratories Although these experiments have been conducted and optimized over 20 years of teaching the New England Biolabs Molecular Biology Summer Workshops they are real research projects not canned experiments Based on extensive teaching experience using these protocols the authors have found that conducting these experiments as described in these protocols serves to effectively instruct students and science professions in the basic methods of molecular biology An additional unique feature is that the protocols described in the manual are accompanied by available reagent kits that provide quality tested pre packaged reagents to ensure the successful application of these protocols in a laboratory course setting

*Laboratory Methods in Enzymology: DNA*, 2013-09-02 Methods in Enzymology volumes provide an indispensable tool for the researcher Each volume is carefully written and edited by experts to contain state of the art reviews and step by step protocols In this volume we have brought together a number of core protocols concentrating on DNA complementing the traditional content that is found in past present and future Methods in Enzymology volumes Indispensable tool for the researcher Carefully written and edited by experts to contain step by step protocols In this volume we have brought together a number of core protocols concentrating on DNA

**Experimental Developmental Biology** Laura R. Keller, John Hyde Evans, Thomas C. S. Keller, 1999 This work is designed for use as a lab manual in college level courses in developmental biology or animal development In each exercise students examine gametes and developing embryos of a single species and also perform several experiments to probe its developmental process

General Biology Lab Manual Russell Skavaril, Mary Finnen, Steven Lawton, 1993 This laboratory manual suitable for biology majors or non majors provides a selection of lucid comprehensive experiments that include excellent detail illustration and pedagogy

**Introduction to Biophysical Methods for Protein and Nucleic Acid Research** Jay A. Glasel, Murray P. Deutscher, 1995-11-20 The first of its kind

Introduction to Biophysical Methods for Protein and Nucleic Acid Research serves as a text for the experienced researcher and student requiring an introduction to the field Each chapter presents a description of the physical basis of the method the type of information that may be obtained with the method how data should be analyzed and interpreted and where appropriate practical tips about procedures and equipment Key Features Modern Use of Mass Spectroscopy NMR Spectroscopy Molecular Modeling and Graphics Macintosh and DOS Windows 3 x disks      **Rodak's Hematology - E-Book**

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is no question that the development of rapid molecular techniques for nucleic acid amplification characterization combined with automation and user friendly software has greatly broadened the diagnostic capabilities of the clinical microbiology laboratory. These technical advances in molecular microbiology over the first decade of the 21st Century have profoundly influenced the physical structure of clinical microbiology laboratories as well as their staffing patterns, workflow and turnaround time. These molecular microbiology advances have also resulted in the need for a revised and updated second edition of *Advanced Techniques in Diagnostic Microbiology*. This second edition again provides an updated and comprehensive description of the ongoing evolution of molecular methods for the diagnosis of infectious diseases. In addition, many new chapters have been added, including a chapter on the clinical interpretation and relevance of advanced technique results. The second edition like the first edition includes both a techniques section describing the latest molecular techniques and an applications section describing how these advanced molecular techniques are being used in the clinical setting. Finally, the second edition like the first edition utilizes a diverse team of authors who have compiled chapters that provide the reader with comprehensive and useable information on advanced molecular microbiology techniques.

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