

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

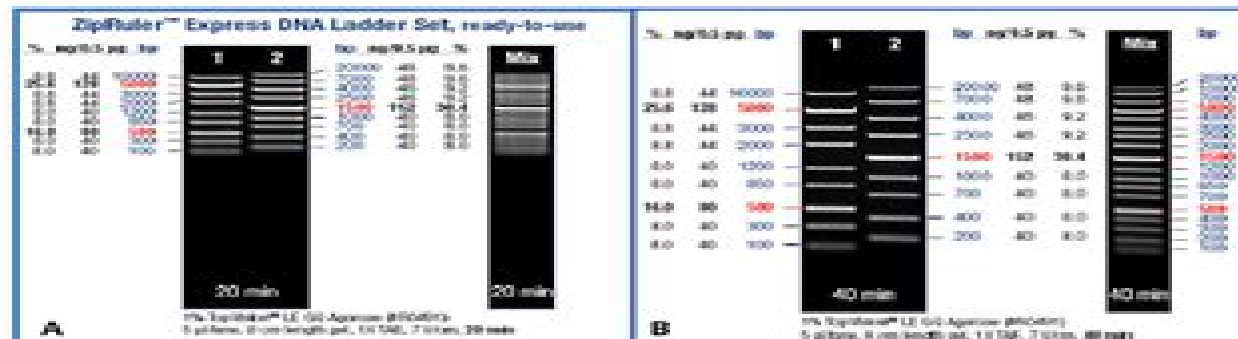


Figure 1. DNA fragments of known size are separated on an agarose gel for 20 min (A) or 40 min (B). By comparing the results, you can see how at 20 min, the DNA fragments are not well separated but by 40 min, the individually sized fragments are well separated and the size is easily determined. Figure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

Gel Electrophoresis Lab Manual Answers

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Barch, Helen J. Lawce**



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Laboratory Manual For Genetic Engineering VENNISON, S. JOHN, 2009-01-01 This systematically designed laboratory manual elucidates a number of techniques which help the students carry out various experiments in the field of genetic engineering The book explains the methods for the isolation of DNA and RNA as well as electrophoresis techniques for DNA RNA and proteins It discusses DNA manipulation by restriction digestion and construction of recombinant DNA by ligation Besides the book focuses on various methodologies for DNA transformation and molecular hybridization While discussing all these techniques the book puts emphasis on important techniques such as DNA isolation from Gram positive bacteria including Bacillus sp the slot lysis electrophoresis technique which is useful in DNA profile analysis of both Gram negative and positive bacteria plasmid transduction in Bacillus sp and the conjugal transfer of plasmid DNA in cyanobacteria Bacillus and Agrobacterium tumefaciens This book is intended for the undergraduate and postgraduate students of biotechnology for their laboratory courses in genetic engineering Besides it will be useful for the students specializing in genetic engineering molecular biology and molecular microbiology **KEY FEATURES** Includes about 60 different experiments Contains several figures to reinforce the understanding of the techniques discussed Gives useful information about preparation of stock solutions DNA protein conversions restriction enzymes and their recognition sequences and so on in Appendices

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

Lab Manual Biology Class 12 Rajesh Kumar, Lab Manual

BIOCHEMISTRY LABORATORY MANUAL PALLAB BASU, 2016-01-01 *The AGT Cytogenetics Laboratory Manual* Marilyn S. Arsham, Margaret J. Barch, Helen J. Lawce, 2017-04-24 Cytogenetics is the study of chromosome morphology structure pathology function and behavior The field has evolved to embrace molecular cytogenetic changes now termed cytogenomics Cytogeneticists utilize an assortment of procedures to investigate the full complement of

chromosomes and or a targeted region within a specific chromosome in metaphase or interphase Tools include routine analysis of G banded chromosomes specialized stains that address specific chromosomal structures and molecular probes such as fluorescence in situ hybridization FISH and chromosome microarray analysis which employ a variety of methods to highlight a region as small as a single specific genetic sequence under investigation The AGT Cytogenetics Laboratory Manual Fourth Edition offers a comprehensive description of the diagnostic tests offered by the clinical laboratory and explains the science behind them One of the most valuable assets is its rich compilation of laboratory tested protocols currently being used in leading laboratories along with practical advice for nearly every area of interest to cytogeneticists In addition to covering essential topics that have been the backbone of cytogenetics for over 60 years such as the basic components of a cell use of a microscope human tissue processing for cytogenetic analysis prenatal constitutional and neoplastic laboratory safety and the mechanisms behind chromosome rearrangement and aneuploidy this edition introduces new and expanded chapters by experts in the field Some of these new topics include a unique collection of chromosome heteromorphisms clinical examples of genomic imprinting an example driven overview of chromosomal microarray mathematics specifically geared for the cytogeneticist usage of ISCN s cytogenetic language to describe chromosome changes tips for laboratory management examples of laboratory information systems a collection of internet and library resources and a special chapter on animal chromosomes for the research and zoo cytogeneticist The range of topics is thus broad yet comprehensive offering the student a resource that teaches the procedures performed in the cytogenetics laboratory environment and the laboratory professional with a peer reviewed reference that explores the basis of each of these procedures This makes it a useful resource for researchers clinicians and lab professionals as well as students in a university or medical school setting *Lab Manual Biology Hard Bound Class 12* Rajesh Kumar, Lab Manual

Laboratory Manual on Biotechnology P. M. Swamy, 2008 Biochemistry Laboratory Manual For Undergraduates Timea Gerczei Fernandez, Scott Pattison, 2015-03-11 Biochemistry laboratory manual for undergraduates an inquiry based approach by Gerczei and Pattison is the first textbook on the market that uses a highly relevant model antibiotic resistance to teach seminal topics of biochemistry and molecular biology while incorporating the blossoming field of bioinformatics The novelty of this manual is the incorporation of a student driven real real life research project into the undergraduate curriculum Since students test their own mutant design even the most experienced students remain engaged with the process while the less experienced ones get their first taste of biochemistry research Inclusion of a research project does not entail a limitation this manual includes all classic biochemistry techniques such as HPLC or enzyme kinetics and is complete with numerous problem sets relating to each topic 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

Miller Levine Biology 1e Lab Manual a (Average Advanced) Student Edition 2002c Prentice Hall Direct Education Staff,2001-04 One program that ensures success for all students

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

Analytical Chemistry Abhay Nanda Srivastva,2021-09-08 Analytical insight of materials provides a lucid pathway for further opportunities in the development of high potential modified materials The analytical assessment also enhances the probability of finding suitable materials for various applications This book presents the latest advancements and applications of analytical chemistry in a systematic manner It is an anthology of scientific findings and views of researchers from various research centers across the globe on emerging topics of instrumentation energy environment biotechnology and synthetic enhancement analysis techniques related to analytical chemistry The volume contains twelve chapters containing discussion analogies and graphics for a better understanding of the presented concepts

Biochemistry Laboratory Manual Mr. Rohit Manglik,2024-07-30 Hands on manual with detailed protocols and experiments for conducting fundamental and advanced biochemistry lab work

Laboratory Manual of Microbiology, Biochemistry and Molecular Biology J. Saxena,M. Baunthiyal,I. Ravi,2015-05-01 Though many practical books are available in the market but this Laboratory Manual of Microbiology Biochemistry and Molecular Biology is an unique combination of protocols that covers maximum about 80% of the practicals of various Indian universities for UG and PG courses in Bioscience Biotechnology Microbiology Biochemistry and Biochemical Engineering

Challenges and Potential Solutions in Gluten Free Product Development Navneet Singh

Deora,Aastha Deswal,Madhuresh Dwivedi,2021-12-04 This work provides researchers with a thorough overview of all aspects

related to the development of gluten free food products In summarizing and offering critical reviews of published works and focusing on current advances and technologies in gluten free product development this book covers all of the important subjects related to this increasingly important aspect of the food industry Important case studies in gluten free breadmaking and alternative proteins are presented making this a rich and singular source for food manufacturers and scientists seeking practical knowledge on the challenges and solutions involved in the development of gluten free foods Challenges and Potential Solutions in Gluten Free Product Development covers the latest advances and strategies for gluten free diets including the important nutritional factors involved Traditional and alternative approaches for the development of gluten free dough including starch applications and microbial fermentations are extensively covered Alternative proteins including those from vegetables cereals legumes and eggs are presented Novel approaches for gluten free breadmaking such as aeration strategies prebiotics hydrocolloids and nutritional enhancements are also covered in depth With further chapters dedicated to regulatory aspects gluten detection methods and the global market this book presents full and up to date coverage of the development and manufacture of gluten free products

Human Molecular Biology Laboratory Manual Stefan Surzycki, 2008-04-15 Human Molecular Biology Laboratory Manual offers a hands on state of the art introduction to modern molecular biology techniques as applied to human genome analysis In eight unique experiments simple step by step instructions guide students through the basic principles of molecular biology and the latest laboratory techniques This laboratory manual s distinctive focus on human molecular biology provides students with the opportunity to analyze and study their own genes while gaining real laboratory experience A Background section highlighting the theoretical principles for each experiment Safety Precautions Technical Tips Expected Results Simple icons indicating tube orientation in centrifuge Experiment Flow Charts Spiral bound for easy lab use [Prentice Hall Miller Levine Biology Laboratory Manual a for Students Second Edition 2004](#) Kenneth Raymond Miller, Joseph S. Levine, Prentice-Hall Staff, 2003-02 Authors Kenneth Miller and Joseph Levine continue to set the standard for clear accessible writing and up to date content that engages student interest Prentice Hall Biology utilizes a student friendly approach that provides a powerful framework for connecting the key concepts a biology Students explore concepts through engaging narrative frequent use of analogies familiar examples and clear and instructional graphics Whether using the text alone or in tandem with exceptional ancillaries and technology teachers can meet the needs of every student at every learning level

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book will serve as a practical reference manual for any life science researcher Written by a combination of distinguished investigators and outstanding faculty Current Protocols Essential Laboratory Techniques 2e is the cornerstone on which the beginning scientist can develop the skills for a successful research career *Comprehensive Laboratory Manual of Life Sciences* Mamta Baunthiyal,Indu Ravi,Jyoti Saxena,2019-12-19 The present book *Comprehensive Laboratory Manual of Life Science* deals with practical trends in modern biological sciences It furnishes protocols on recent advances in biotechnological methods and aims to cover three most important aspects of this interdisciplinary stream such as Microbiology Biochemistry and Molecular biology The book contains four sections 1 Introduction emphasizes on good laboratory practices and etiquettes for beginners the do s and don ts of working in a laboratory concepts and terminology etc 2 Instruments Principle and Precautions explores commonly used equipments employed in different experiments 3 Experiments is further divided into three parts Microbiology with more than 70 experiments Biochemistry with 62 and Molecular Biology having around 32 detailed protocols accorded to make the readers proficient in the paramount disciplines of Bio Sciences and Biotechnology 4 Appendix at the end a rather comprehensive section that concludes the book This book is designed to meet the practical requirements of undergraduate and post graduate students of Life Science Biotechnology Microbiology Biochemistry and Biochemical Engineering by providing worked out solution to the most commonly practiced experiments prescribed by majority of Indian Universities The latest technological developments in the book will be appealing to the researchers and scientists

Biophysical Approaches Edward D. Korn,2013-04-17 The short period since the publication of Volume 1 of *Methods in Membrane Biology* has been a time of momentous progress Calorimetry electron spin and nuclear magnetic resonance X ray diffraction and freeze cleavage electron microscopy reinforced by biochemical analyses and enzymatic studies have led to universal acceptance of a generalized membrane model All membrane biologists would agree that a major element of all biological membranes is a bilayer of phospholipids which in some instances also contains other lipids notably sterols and glycolipids The fatty acid composition of the lipids of most membranes is such that the lipids are above their transition temperatures in their normal environment so that the bilayer is fluid The microviscosity of the fatty acyl groups decreases progressively down the chain so that at the hydrocarbon interior of the bilayer the lipid phase has a viscosity approximating that of olive oil at room temperature As a consequence of this membrane fluidity a phospholipid molecule is very mobile within the plane of the membrane moving a distance of about 1.2 μm in 1 s but the movement of a phospholipid molecule from one side of the membrane bilayer to the other flip flop is very slow The lipid bilayer is an essentially inert and rather impermeable structure as shown by many studies with model systems Proteins of course provide the catalytic components of the membranes as well as playing a significant structural role

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