

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

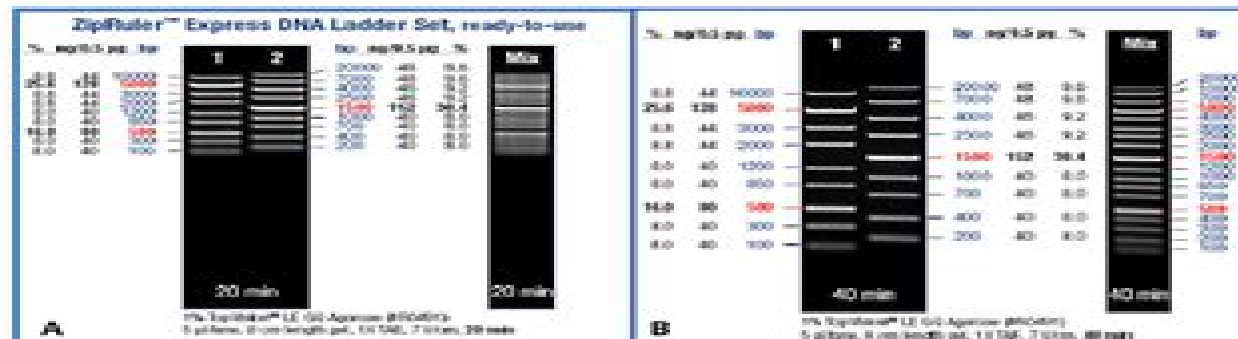


Figure 1. DNA fragments of known size are separated on an agarose gel for 20 min (A) or 40 min (B). By comparing the results, you can see how at 20 min, the DNA fragments are not well separated but by 40 min, the individually sized fragments are well separated and the size is easily determined. Figure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

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JS Bruner



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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 Millennium W F O Marasas Medical Research Council South Africa Recombinant DNA Laboratory Manual, Revised Edition Judith W.

Zyskind, Sanford I. Bernstein, 2012-12-02 The latest edition of this introductory benchtop manual is up to date affordable and easy to follow This text is perfect for your two quarter or one semester course in Recombinant DNA Techniques and is specifically designed to lead your student or technician who is a newcomer to molecular biology from the basic skills of growing and maintaining bacterial colonies through plasmid DNA isolation cloning DNA sequencing and hybrid detection Comb bound three column large 9 1 4 x 7 1 2 format Exercises contain explanatory material and margin notes that pinpoint critical steps and important concepts Necessary reagents and equipment are presented in a checklist at the beginning of each protocol Techniques for bacteria are complemented with those for *Drosophila* Each experiment has been tested in the laboratory by students for five years Features a complete chapter on computers in the molecular biology laboratory Presents helpful appendixes on safety in the laboratory frequently used ancillary techniques and recipes for buffers media and strains

Genetics Manual G. P. Radei, 1998 Radei has created an outstanding compendium of genetics Arranged as a dictionary the book is almost an encyclopedic collection of terms concepts The author has managed to define terms with appropriate mixtures of depth detail for the researcher along with clarity useful for the nonexpert Choice 1998 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 instructions for

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Basic Methods for the Biochemical Lab Martin

Holtzhauer,2006-09-13 This book presents proven lab procedures and practical hints for research in analytical and preparative biochemistry and offers convenient key data in numerous tables Coverage includes quantitative methods electrophoresis chromatographic protocols immunochemical protocols centrifugation and radioactivity In additional chapters tables offer quick access to a broad array of useful information including SI units conversion factors detergent protein and nucleotide data and the basic principles of statistics and enzyme and receptor kinetics are reviewed This first English language edition of a successful German language manual is a valuable resource for students and working professionals in biochemistry biotechnology and biomedical laboratories

Hematology - E-Book Bernadette F. Rodak,Elaine M.

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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 Elaine M. Keohane, Catherine N. Otto, Jeanine M. Walenga, 2019-02-22 Selected for Doody's Core Titles 2024 in Laboratory Technology Make sure you are thoroughly prepared to work in a clinical lab Rodak's Hematology Clinical Principles and Applications 6th Edition uses hundreds of full color photomicrographs to help you understand the essentials of hematology This new edition shows how to accurately identify cells simplifies hemostasis and thrombosis concepts and covers normal hematopoiesis through diseases of erythroid myeloid lymphoid and megakaryocytic origins Easy to follow and understand this book also covers key topics including working in a hematology lab complementary testing areas such as flow cytometry cytogenetics and molecular diagnostics the parts and functions of the cell and laboratory testing of blood cells and body fluid cells UPDATED nearly 700 full color illustrations and photomicrographs make it easier for you to visualize hematology concepts and show what you'll encounter in the lab with images appearing near their mentions in the text to minimize flipping pages back and forth UPDATED content throughout text reflects latest information on hematology Instructions for lab procedures include sources of possible errors along with comments Hematology instruments are described compared and contrasted Case studies in each chapter provide opportunities to apply hematology concepts to real life scenarios Hematology hemostasis reference ranges are listed on the inside front and back covers for quick reference A bulleted summary makes it easy for you to review the important points in every chapter Learning objectives begin each chapter and indicate what you should achieve with review questions appearing at the end A glossary of key terms makes it easy to find and learn definitions NEW Additional content on cell structure and receptors helps you learn to identify these organisms NEW New chapter on Introduction to Hematology Malignancies provides and overview of diagnostic technology and techniques used in the lab

Forestry Research West, 1983 Handbook Of Unconventional Computing (In 2 Volumes) Andrew Adamatzky, 2021-08-18 Did you know that computation can be implemented with cytoskeleton networks chemical reactions liquid marbles plants polymers and dozens of other living and inanimate substrates Do you know what is reversible computing or a DNA microscopy Are you aware that randomness aids computation Would you like to make logical circuits from enzymatic reactions Have you ever tried to implement digital logic with Minecraft Do you know that eroding sandstones can compute too This volume reviews most of the key attempts in coming up with an alternative way of computation In doing so the authors show that we do not need computers to compute and we do not need computation to infer It invites readers to rethink the computer and computing and appeals to computer scientists mathematicians physicists and philosophers The

topics are presented in a lively and easily accessible manner and make for ideal supplementary reading across a broad range of subjects Related Link s **Handbook of Aggregation-Induced Emission, Volume 3** Youhong Tang,Ben Zhong Tang,2022-04-06 The third volume of the ultimate reference on the science and applications of aggregation induced emission The Handbook of Aggregation Induced Emission explores foundational and advanced topics in aggregation induced emission as well as cutting edge developments in the field celebrating twenty years of progress and achievement in this important and interdisciplinary field The three volumes combine to offer readers a comprehensive and insightful interpretation accessible to both new and experienced researchers working on aggregation induced emission In Volume 3 Emerging Applications the editors address the applications of AIEgens in several fields including bio imaging fluorescent molecular switches electrochromic materials regenerative medicine detection of organic volatile contaminants hydrogels and organogels Topics covered include AIE active emitters and their applications in OLEDs and circularly polarized luminescence of aggregation induced emission materials AIE polymer films for optical sensing and energy harvesting aggregation induced electrochemiluminescence and mechanoluminescence materials with aggregation induced emission Dynamic super resolution fluorescence imaging based on photoswitchable fluorescent spiropyran Visualization of polymer microstructures Self assembly of micelle and vesicles New strategies for biosensing and cell imaging Perfect for academic researchers working on aggregation induced emission this set of volumes is also ideal for professionals and students in the fields of photophysics photochemistry materials science optoelectronic materials synthetic organic chemistry macromolecular chemistry polymer science and biological sciences Advanced Techniques in Diagnostic Microbiology Yi-Wei Tang,Charles W. Stratton,2012-09-13 In the United States hospitals annually report over 5 million cases of infectious disease related illnesses clinical microbiology laboratories in these hospitals are engaged in detecting and identifying the pathogenic microorganisms in clinical specimens collected from these patients with suspected infections Clearly the timely and accurate detection identification of these microbial pathogens is critical for patient treatment decisions and outcomes for millions of patients each year Despite an appreciation that the outcome of an infectious disease related illness is directly related to the time required to detect and identify a microbial pathogen clinical microbiology laboratories in the United States as well as worldwide have long been hampered by traditional culture based assays which may require prolonged incubation time for slowly growing microorganisms such as Mycobacterium tuberculosis Moreover traditional culture based assays often require multiple steps with additional time needed for discernment of species and or detection of antimicrobial resistance Finally these traditional slow multistep culture based assays are labor intensive and required skilled clinical microbiologists at the bench Over the past several decades advanced molecular techniques in diagnostic microbiology quietly have been revolutionizing the practice of clinical microbiology in the hospital setting Indeed molecular diagnostic testing in general and nucleic acid based amplification methods in particular have been heralded as diagnostic tools for the new millennium There

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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