

PCR-based diagnostics for infectious diseases: uses, limitations, and future applications in acute-care settings

Samuel Yang and Richard E Rothman

Molecular diagnostics are revolutionising the clinical practice of infectious disease. Their effects will be significant in acute-care settings where timely and accurate diagnostic tools are critical for patient treatment decisions and outcomes. PCR is the most well-developed molecular technique up to now, and has a wide range of already fulfilled, and potential, clinical applications, including specific or broad-spectrum pathogen detection, evaluation of emerging novel infections, surveillance, early detection of bioterror agents, and antimicrobial resistance profiling. PCR-based methods may also be cost effective relative to traditional testing procedures. Further advancement of technology is needed to improve automation, optimise detection sensitivity and specificity, and expand the capacity to detect multiple targets simultaneously (multiplexing). This review provides an up-to-date look at the general principles, diagnostic value, and limitations of the most current PCR-based platforms as they evolve from bench to bedside.

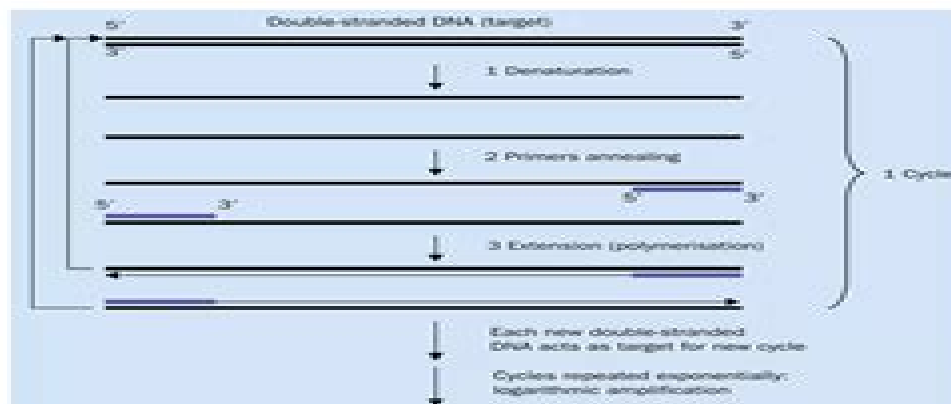


Figure 1. Schematic of PCR. The PCR reaction takes place in a thermocycler. Each PCR cycle consists of three major steps: (1) denaturation of template DNA into single-stranded DNA; (2) primers annealing to their complementary target sequences; and (3) extension of primers via DNA polymerisation to generate new copy of the target DNA. At the end of each cycle the newly synthesised DNA act as new targets for the next cycle. Subsequently, by repeating the cycle multiple times, logarithmic amplification of the target DNA occurs.

Lancet Infect Dis 2004; **4**: 337–48

Pathogen identification: scope of the problem

In the USA, hospitals report well over 5 million cases of recognised infectious-disease-related illnesses annually.¹ Significantly greater numbers remain unrecognised, both in the inpatient and community settings, resulting in substantial morbidity and mortality.² Critical and timely intervention for infectious disease relies on rapid and accurate detection of the pathogen in the acute-care setting and beyond.³ The recent anthrax-related bioterrorist events and the outbreak of severe acute respiratory syndrome (SARS) further underscore the importance of rapid diagnostics for early, informed decision-making related to patient triage, infection control, treatment, and vaccination with life-and-death consequences for patients, health providers, and the public.^{4–6} Unfortunately, despite the recognition that outcomes from infectious illnesses are directly associated with time to pathogen identification, conventional hospital laboratories remain cumbered by traditional, slow multistep culture-based assays, which

preclude application of diagnostic test results in the acute and critical-care settings. Other limitations of the conventional laboratory include extremely prolonged assay times for fastidious pathogens (up to several weeks); requirements for additional testing and wait times for characterising detected pathogens (ie, discernment of species, strain, virulence factors, and antimicrobial resistance); diminished test sensitivity for patients who have received antibiotics; and inability to culture certain pathogens in disease states associated with microbial infection.^{1,7}

The failure of either clinical judgement or diagnostic technology to provide quick and accurate data for identifying the pathogen infecting patients leads most clinicians to adopt a conservative management approach. Empiric intravenous antibiotic therapy (most common in

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Pcr Based Diagnostics In Infectious Diseases

Richard M. Rosenfeld



Pcr Based Diagnostics In Infectious Diseases:

PCR-based Diagnostics in Infectious Disease Garth D. Ehrlich, Steven J. Greenberg, 1994 Designed as both a comprehensive reference and a practical laboratory guide the book is divided into three major interrelated sections Section 1 the Clinical PCR Laboratory is an introduction to PCR technology and the establishment of an effective lab Section 2 PCR in Clinical Diagnostics describes the role of PCR in diagnosing specific diseases from the Epstein Barr virus through sexually transmitted diseases and Section 3 PCR Based Protocols explains the use of PCR technology in detecting specific organisms

Clinical metagenomics-based diagnostics for infectious diseases Sathyavathi Sundararaju, Arun Prasath Lakshmanan, Pushpanathan Muthurulan, Jeyaprakash Rajendhran, 2024-08-20 Clinical metagenomics is an emerging method in the diagnosis of infectious diseases that uses next generation sequencing NGS technology to identify the etiologic agents to allow for more effective and targeted treatment of infectious diseases Conventional diagnostic methods are mainly based on basic morphologic phenotypic and genotypic analyses which can be insensitive and or time consuming Metagenomic NGS mNGS can be performed with only a small amount of nucleic acid from the specimen and not only can the pathogen be identified and characterized but also its antimicrobial susceptibility can be inferred Although tremendous advancements were made in the speed throughput and cost of NGS in recent years the application of clinical metagenomics in routine diagnosis of infectious diseases is not yet practical because of its much higher cost compared to conventional microbiological tests complex laboratory workflows and computational challenges *Molecular diagnostics for infectious diseases: Novel approaches, clinical applications and future challenges* Xiaogang Xu, Chao Zhuo, Bing Gu, Kamal El Bissati, 2023-03-31

PCR Technology Tania Nolan, Stephen A. Bustin, 2013-06-13 PCR's simplicity as a molecular technique is in some ways responsible for the huge amount of innovation that surrounds it as researchers continually think of new ways to tweak adapt and re formulate concepts and applications PCR Technology Current Innovations Third Edition is a collection of novel methods insights and points of view that **Greene's Infectious Diseases of the Dog and Cat - E-Book** Jane E. Sykes, 2022-06-24 Selected for Doody's Core Titles 2024 with Essential Purchase designation in Veterinary Medicine Greene's Infectious Diseases of the Dog and Cat 5th Edition provides a comprehensive clinically useful reference on the management of infectious diseases caused by viruses bacteria including rickettsiae chlamydiae mycoplasmas and spirochetes fungi algae protozoa parasites and other atypical agents Each section guides the reader through diagnostic testing for specific infectious diseases from specimen collection to laboratory submission to interpretation of results to appropriate treatment measures Full color illustrations and hundreds of tables provide convenient access to diagnostic and therapeutic recommendations along with the appropriate drug dosages for effective treatment and prevention A fully searchable enhanced eBook version is included with print purchase allowing access to all of the text and figures on a variety of digital devices More than 150 internationally recognized experts contribute chapters on topics in their field of specialty Clear and logical organization of

chapters provides a solid basis for an approach to diseases caused by specific pathogens with the first part of the book including sections on diagnostic approaches treatments including recommended antimicrobial drug doses and prevention Specific pathogens are addressed in the second part of the book using a structured approach that includes etiology epidemiology relevance to wildlife animal hosts role of the environment clinical and laboratory findings treatment prevention and public health implications Case examples illustrate principles and highlight how the material can be applied More than 800 clinical images maps life cycles and photomicrographs assist with accurate understanding of epidemiology pathogenesis diagnosis of disease and disease prevention Visually appealing maps and life cycle drawings enhance your comprehension and retention of the material Convenient drug dosage tables in each chapter provide complete prescribing information chapters on antimicrobial drugs in the first part of the book summarize pharmacokinetics indications contraindications handling and administration guidelines and dosage recommendations are made for antivirals antibacterials antifungals antiprotozoals and antiparasitic drugs The book emphasizes approaches to optimize antimicrobial stewardship Clinical Problems section helps you understand what infectious diseases should be considered in animals seen with clinical signs relating to different organ systems Suggested readings and references are listed in each chapter facilitating further research and study Fully searchable enhanced eBook version is included with print purchase allowing access to all of the text and figures on a variety of digital devices

Diagnostic Advances in Precision Medicine and Drug Development

Emmanuel Kwaku Ofori, Seth Kwabena Amponsah, Yashwant V. Pathak, 2025-06-18 To arrive at the most appropriate decision regarding patient management an essential step for medical practitioners is to determine a correct and accurate diagnosis of the patient's condition In recent years there have been significant technological efforts in chemistry biochemistry laboratory science and biotechnology toward improving disease diagnosis and management in patients Further drug developers have utilized some of these novel diagnostic methods during preclinical and clinical trials that have led to creating efficiencies in their development processes This book provides an overview of diagnostic procedures that aid in precision medicine and the drug development process Presents innovative methodologies for diagnostic testing that will be beneficial to biomedical science researchers and health professionals Discusses recent significant technological advancement toward improving disease diagnosis Describes recent developments in spectroscopic and chromatographic methods that will be of interest to pharma companies and scientists in chemistry biochemistry and pharmacology Gives an overview of the integration of artificial intelligence in digital health that will be beneficial to biotechnologists bioengineers health professionals and people in regulatory agencies Is suitable globally for graduate and postgraduate students studying laboratory medicine

Laboratory Techniques for Fish Disease Diagnosis Basanta Kumar Das, Vikash Kumar, 2025-04-30 This book covers various aspects of fish health disease identification and laboratory procedures Each section of the book is detailed and includes practical information step by step procedures and relevant illustrations and diagrams The recent updates on fish

disease diagnosis have been incorporated to address new techniques and technologies in the field Fish disease diagnosis is primarily based on the color and characteristics in the image to target the infected area It is an indispensable part of modern aquaculture and rapid and real time diagnosis is an essential part of the early and precise treatment of the diseases As farmed fishes are affected by viruses bacteria parasites metal pollution and fishing damage accurate disease diagnosis is crucial for effective management interventions It often requires a combination of clinical expertise advanced technology and collaboration among healthcare professionals This book is a comprehensive guide for students researchers and professionals involved in fish disease diagnosis **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

Interpretation of Equine Laboratory Diagnostics Nicola Pusterla, Jill Higgins, 2017-10-05 Interpretation of Equine Laboratory Diagnostics offers a comprehensive approach to equine laboratory diagnostics including hematology clinical chemistry serology body fluid analysis microbiology clinical parasitology endocrinology immunology and molecular diagnostics Offers a practical resource for the accurate interpretation of laboratory results with examples showing real world applications Covers hematology clinical chemistry serology body fluid analysis microbiology clinical parasitology endocrinology immunology and molecular diagnostics Introduces the underlying principles of laboratory diagnostics Provides clinically oriented guidance on performing and interpreting laboratory tests Presents a complete reference to established and new diagnostic procedures

Chlamydia pneumoniae L. Allegra, F. Blasi, 2012-12-06 Chlamydia pneumoniae is now recognized as an important human pathogen Chlamydia pneumoniae is involved in 5% 15% of community acquired pneumonias and recent data indicate its relevance in severe pneumonia and as a respiratory pathogen in immunocompromised subjects A causal role for Chlamydia pneumoniae in the initiation exacerbations and promotion of asthma has been suggested Approximately 5% of chronic bronchitis exacerbations have been attributed to Chlamydia pneumoniae infections and chronic infection may facilitate access of other pathogens to the lower respiratory tract Another field of potential great social impact is the possible involvement of Chlamydia pneumoniae in the pathogenesis of atherosclerosis and related cardiovascular diseases This book presents the current state of the art knowledge on Chlamydia pneumoniae infection and highlights future lines of research

Molecular Diagnostics for Viral Diseases Aditya Arya, **Interventions in Infectious Disease Emergencies, An Issue of Medical Clinics** Nancy M. Khardori, 2012-11-28 This important issue of Medical Clinics provides essential updates in heart failure The following topics are covered epidemiology pathophysiology and general approach for heart failure symptoms signs diagnostic studies and prognostic significance of systolic versus diastolic heart failure the appropriate use of biomarkers oral versus intravenous diuretic therapy guideline based therapy including RAAS blockade beta blockade and aldosterone antagonist appropriate use of AICD and biventricular pacing role of ventricular assist device pathophysiological consideration and management approaches in acute decompensated heart failure pathophysiology and current approaches to cardiorenal syndrome heart failure with other comorbidities including diabetes obesity anemia and cancer heart failure and atrial fibrillation and the role of disease management strategies in heart failure

Advances and Perspectives of Infections Caused by Staphylococcus aureus, 2025-01-29 Staphylococcus aureus is one of the main pathogenic microorganisms of humans Many studies have been carried out on this bacterium worldwide due to its importance for human and animal health In this book we have published several chapters in order to contribute to the knowledge and study of this important microorganism in which aspects related to its pathogenic factors its capacity to form biofilms its detection and its

presence in a pediatric population are reviewed A final chapter depicts what awaits us in the study of this microorganism We invite you to explore the world of Staphylococcus aureus and hope that this book will be of great use to you in studying this challenging microorganism

Antibiotic Policies: Fighting Resistance Ian M. Gould, Jos W.M. van der Meer, 2007-09-12 This volume examines many of the crucial issues of resistance in a clinical context with an emphasis on MRSA surely the greatest challenge to our antibiotic and infection control policies that modern health care systems have ever seen Other chapters explore the psychology of prescribing modern management techniques as an adjunct to antibiotic policies and the less obvious downsides of antibiotic use

Viruses, Genetic Exchange, and the Tree of Life Arshan Nasir, Gustavo Caetano-Anollés, Jean-Michel Claverie, 2020-01-23

Nucleic Acids as Molecular Diagnostics Andreas Keller, Eckart Meese, 2015-01-12 By integrating technology supporting infrastructure and efficient application the all in one guide presents molecular diagnostics as an essential component of modern personalized clinical practice It considers all important aspects from the hardware and software needed to recent improvements in blood and non blood based biomarker tests Chapters on ethical challenges and a look at current trends and the latest innovations are also included Bridging the gap between industry and academia this is a highly useful resource for practitioners as well as for developers of modern DNA and RNA based molecular diagnostics

Textbook-Atlas of Intestinal Infections in AIDS Daniele Dionisio, 2012-12-06 This book represents an international collaborative work focused on the current challenges of AIDS related intestinal infections in the worldwide scenario The unique problems of developing countries the epidemiological and immunological aspects the risks for immunodeficient travellers and the reservoirs and ways of transmission from animal to man are all equally considered as are the diagnostic advances and the changing patterns of prophylaxis and treatment Moreover the etiological and clinical aspects and the histologic and electron microscopic features of biopsy samples are reported Furthermore notes on intestinal parasitoses in the past centuries with emphasis on disadvantaged people and worldwide trends and perspectives are also included as a link between the past and the future This volume is expected to fill a gap in the medical literature provide the latest information on therapeutic advances provide an exhaustive series of light and electron microscopy micrographs and illustrations contribute to the educational programs in developing countries and gain international approval as a reference book for problems arising in clinical and laboratory practice and as a text book for medical and graduate students

[Large Animal Internal Medicine - E-Book](#) Bradford P. Smith, 2008-06-02 [Large Animal Internal Medicine](#) 4th Edition features a problem based approach with discussions of over 150 clinical signs This is the first internal medicine reference that enables you to efficiently diagnose horses cattle sheep and goats based on clinical observation and laboratory and diagnostic testing With this user friendly format you can find essential information about specific diseases and reach a diagnosis by simply identifying the signs A unique problem based approach with discussions of over 150 clinical signs and manifestations helps you quickly reach a diagnosis based on observations and laboratory tests Causes of Presenting Signs boxes provide easy

access to complete lists of common less common and uncommon diseases associated with manifestations or signs of disease Complete lists of diseases associated with a given lab abnormality in Causes of Abnormal Laboratory Values boxes help you easily interpret abnormalities in clinical chemistry hematology blood proteins and clotting tests An expert team of over 180 authors contributing information in their areas of expertise ensures you are using the most accurate and up to date information available Color plates accompanying Diseases of the Eye and Diseases of the Alimentary Tract enable you to visually recognize the clinical appearance of ophthalmologic conditions and alimentary tract disorders for quick and easy diagnosis and treatment Six all new chapters provide in depth coverage of diagnostic testing critical care and fluid therapy biosecurity and infection control and genetic disorders

Integration of Omics Approaches and Systems Biology for Clinical Applications Antonia Vlahou,Fulvio Magni,Harald Mischak,Jerome Zoidakis,2018-01-24 Introduces readers to the state of the art of omics platforms and all aspects of omics approaches for clinical applications This book presents different high throughput omics platforms used to analyze tissue plasma and urine The reader is introduced to state of the art analytical approaches sample preparation and instrumentation related to proteomics peptidomics transcriptomics and metabolomics In addition the book highlights innovative approaches using bioinformatics urine miRNAs and MALDI tissue imaging in the context of clinical applications Particular emphasis is put on integration of data generated from these different platforms in order to uncover the molecular landscape of diseases The relevance of each approach to the clinical setting is explained and future applications for patient monitoring or treatment are discussed Integration of omics Approaches and Systems Biology for Clinical Applications presents an overview of state of the art omics techniques These methods are employed in order to obtain the comprehensive molecular profile of biological specimens In addition computational tools are used for organizing and integrating these multi source data towards developing molecular models that reflect the pathophysiology of diseases Investigation of chronic kidney disease CKD and bladder cancer are used as test cases These represent multi factorial highly heterogeneous diseases and are among the most significant health issues in developed countries with a rapidly aging population The book presents novel insights on CKD and bladder cancer obtained by omics data integration as an example of the application of systems biology in the clinical setting Describes a range of state of the art omics analytical platforms Covers all aspects of the systems biology approach from sample preparation to data integration and bioinformatics analysis Contains specific examples of omics methods applied in the investigation of human diseases Chronic Kidney Disease Bladder Cancer Integration of omics Approaches and Systems Biology for Clinical Applications will appeal to a wide spectrum of scientists including biologists biotechnologists biochemists biophysicists and bioinformaticians working on the different molecular platforms It is also an excellent text for students interested in these fields

Evidence-based Otitis Media Richard M. Rosenfeld,2003 Evidence Based Otitis Media offers one stop shopping for the best current evidence to guide management decisions at the individual organizational and societal levels This text details the importance of evidence based data in

interpreting the ever enlarging body of literature on otitis media The editors have assembled an impressive group of experts on all aspects of otitis media and addressed comprehensively many issues related to methodology clinical management and consequences of this disease The eight chapters comprising the methodology section provide the necessary background and detail to allow physicians and other health professionals to understand and appreciate the value of evidence based medicine Updates include the incorporation of new original research systemic reviews and evidence reports to existing chapters New chapter topics include evidence based medicine professional evidence reports molecular and translational research complementary and alternative medicine bacteriologic efficacy of antimicrobials vaccine prevention international management perspectives meta analysis of speech and language sequelae suppurative complications host susceptibility to sequelae and judicious use of systemic and topical antimicrobials FEATURES Maturation of evidence based medicine as a foundation for clinical care is reflected throughout the text Extensive evidence tables summarize study characteristics and quantitative outcomes for clinically relevant endpoints Internationally distinguished contributors selected based on both their clinical expertise and their ability to write for an evidence based text

Pcr Based Diagnostics In Infectious Diseases: Bestsellers in 2023 The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous compelling novels captivating the hearts of readers worldwide. Lets delve into the realm of bestselling books, exploring the fascinating narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover's "It Ends with Us" This poignant tale of love, loss, and resilience has gripped readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can prevail. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This intriguing historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Pcr Based Diagnostics In Infectious Diseases : Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of compelling stories waiting to be discovered. The novel begins with Richard Pape, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a brilliant and suspenseful novel that will keep you wondering until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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