

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.

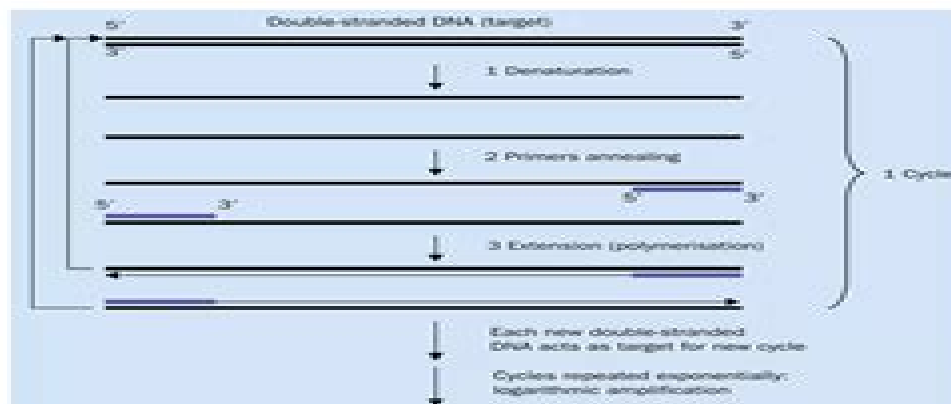


Figure 1. Schematic of PCR. The PCR reaction takes place in a thermocycler. Each PCR cycle consists of three major steps: (1) denaturation of template DNA into single-stranded DNA; (2) primers annealing to their complementary target sequences; and (3) extension of primers via DNA polymerisation to generate 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.

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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

Yechiel Becker, Gholamreza Darai



Pcr Based Diagnostics In Infectious Diseases:

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-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 **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 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 **Emerging Infectious Diseases** ,2016 *Large Animal Internal Medicine - E-Book* Bradford P.

Smith,2014-04-01 *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 NEW Extensively updated content from expert authors clarifies the latest research and clinical findings on pain the nervous system toxicology BVD malignant catarrhal fever bluetongue and strong ions NEW Vaccines and vaccination protocols keep you up to date with the information you need to prevent newly emerging diseases in large animals NEW Expanded coverage of the veterinarian s role in animal welfare equine abdominal ultrasound DNA genetic and PCR testing and colostrum supplements and replacers supplies you with the most current large animal internal medicine information NEW Current information on foreign animal diseases

dangerous to large animals in the US including coverage of rinderpest keeps you aware of diseases that can be transmitted from other countries Perspectives in Translational Research in Life Sciences and Biomedicine Ena Ray

Banerjee,2017-10-17 This book is a collation of translational research outcomes in the area of life research which was formerly used mainly for academic pursuits The studies described focus on innovative interdisciplinary approaches to unraveling problems in life sciences and biomedicine using biodiversity exploration and green technology The techniques and models presented offer a ready reckoner for researchers in academic institutions and industry and also provide valuable insights into fundamental research The book discusses topics such as tissue engineering to create lineage specific cells for tissue specific regeneration how combination cultures of commensalistic bacteria can help boost immunity development of functional food from natural products from plant animal and microbial sources in the nutraceuticals domain as well as synthesis and mechanisms in nanomedicine and nanoscaffolds in biomedicine The studies and discourses described touch upon topics that explore biodiversity for the development of disease models toxicity studies developmental studies and harvesting of bioactive compounds for alternative income generation and poverty alleviation and as a result bring about economic and ecologic sustainability This multidimensional and multidisciplinary book focuses on tissue specific targeting by nanodrugs development of bioengineering formats for cell based nutraceutical based functional food based and antibody based green therapy designed tackle multifaceted diseases and syndromes **Infectious Diseases of the Dog and Cat**

Jane E. Sykes,Craig E. Greene,2011-11-15 Expanded coverage of zoonoses zoonotic potential and precautions helps you effectively monitor and treat zoonotic infections Fully updated drug formulary reflects the most current pharmacokinetics indications contraindications handling and administration guidelines and dosage recommendations available Updated content throughout the text details current diagnostic testing regimens and therapeutic and preventive considerations for all pathogens you re likely to encounter in the clinical setting Special focus on disease incidence and susceptibility in traveling animals helps you alert animal owners to potential risks associated with pet travel **Pathology of Infectious Diseases**

Daniel H. Connor,1997 The role of classic and modern molecular methods in assessing disease aetiology is documented in this text and the pathology of infectious diseases is explained in simple practical terms The text emphasizes the history pathology prevention and treatment of disease and explores changes in human demographics behaviours technology industry economics land use and travel examining the effects of these on public health **Biotechnology in Healthcare, Volume 2**

Debmalya Barh,2022-08-14 Biotechnology in Healthcare presents up to date knowledge on the emerging field of biotechnology as applied to the healthcare industry Biotechnology has revolutionized healthcare in the last two decades by developing and introducing novel diagnostics therapeutics and preventive measures whether it is noncommunicable or communicable disease primary or secondary care or public health it has shown its immense potential to provide a solution to the healthcare providers physicians and allied health care professionals The second volume Applications and Initiatives

contains 19 chapters focused on the applications of biotechnology related to public healthcare hospital management oncology neurodegenerative and infectious diseases regenerative medicine IVF clinical trials precision food FMGCs PPCPs pharmaceuticals and smart technologies to monitor pandemic Further this volume also presents government initiatives and entrepreneurship challenges in healthcare biotechnology sector This is a valuable resource for students biotechnologists bioinformaticians clinicians and members of biomedical and healthcare fields who need to understand more about the promising developments of the emerging field of biotechnology in healthcare Describes various applications of novel biotechnology approaches in healthcare Presents applications of biotechnology in primary and secondary healthcare and in public health Discusses government initiatives challenges and opportunities and entrepreneurship development in the area of healthcare biotechnology

PCR: Protocols for Diagnosis of Human and Animal Virus Diseases Yechiel Becker,Gholamreza Darai,1995-09-26 Today the diagnosis of human and animal pathogenic viruses would be unthinkable without the polymerase chain reaction PCR The short styled protocols in this volume elucidate this important technique and its application in the laboratory including a discussion of recent advances in PCR technology The enclosed diskette enables the user to work with interesting sequences on his own computer *Spezielle Pathologische Anatomie: Tropical pathology.*

Contributors: T. G. Ashworth [et al Wilhelm Doerr,Erwin Uehlinger,1966 **The Annals of Otolaryngology, Rhinology & Laryngology**,1995 **The Journal of Infectious Diseases**,1994-10 **Annual Book of ASTM Standards** ASTM International,American Society for Testing and Materials,2004 **Annual Book of ASTM Standards** American Society for Testing and Materials,2007 **Ullmann's Biotechnology and Biochemical Engineering, 2 Volume Set**

Wiley-VCH,2007-07-23 The one stop resource for all those involved in the biochemical and biotechnological industries Based on the latest online edition of Ullmann s Encyclopedia of Industrial Chemistry containing articles never seen before in print this ready reference meets the need for a detailed survey of the biochemical fundamentals and techniques as well as their applications in biochemical engineering and biobased production *Dermatopathology: Third Edition* Raymond Barnhill,A. Neil Crowson,Cynthia Magro,Michael Piepkorn,2010-01-27 The definitive survey of diagnostic dermatopathology now extensively revised with expanded full color art Includes Online Image Bank containing all the images in the book A Doody s Core Title for 2011 4 STAR DOODY S REVIEW This is an excellent textbook of dermatopathology in a highly competitive field Doody s Review Service For virtually every kind of skin lesion this skill sharpening resource has everything you need to successfully perform differential diagnosis at the microscopic level Dermatopathology features a systematic algorithmic approach that cuts through the complexity of the discipline s traditional disease oriented focus providing a ready to use diagnostic tool that puts the entire world of dermatopathology into perspective Filled with hundreds of color photomicrographs the book features a clear five part organization and 37 detailed chapters each reflecting the scientifically rigorous up to date insights of authors who are acknowledged experts in the field The book s vast scope encompasses all skin

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