

PCR Troubleshooting and Optimization

The Essential Guide



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The polymerase chain reaction (PCR) is a fundamental tool in scientific research and clinical testing. Real-time PCR, combining both amplification and detection in one instrument, is a rapid and accurate method for nucleic acid detection and quantification. Although PCR is a very powerful technique, the results achieved are valid only if the appropriate controls have been employed. In addition, proper optimization of PCR conditions is required for the generation of specific, repeatable, reproducible and sensitive data.

This book discusses the strategies for preparing effective controls and standards for PCR, when they should be employed and how to interpret the information they provide. It highlights the significance of optimization for efficiency, precision and sensitivity of PCR methodology and provides essential guidance on how to troubleshoot inefficient reactions. Experts in PCR describe design and optimization techniques, discuss the use of appropriate controls, explain the significance of standard curves and explore the principles and strategies required for effective troubleshooting. Authors highlight the importance of sample preparation and quality, primer design, controlling inhibitors, avoiding amplicon and environmental contamination, optimizing reagent quality and concentration, and modifying the thermal cycling protocol for optimal sensitivity and specificity. In addition, specific chapters discuss the history of PCR, the choice of instrumentation, the applications of PCR in metagenomics, high resolution melting analysis, the MIQE guidelines, and PCR at the microliter scale.

The strategies, tips and advice contained in this concise volume enable the scientist to optimize and effectively troubleshoot a wide range of techniques including PCR, reverse transcriptase PCR, real-time PCR and quantitative PCR. An essential book for anyone using PCR technology.

Chapter 1. Magic in Solution: An Introduction and Brief History of PCR. *Carl T. Withwer and Jared S. Farrar*

Chapter 2. Difficult Templates and Inhibitors of PCR. *Jack M. Gallup*

Chapter 3. Significance of Controls and Standard Curves in PCR. *Ian Kavanagh, Gwyn Jones and Saima Naveed Nayab*

Chapter 4. Obtaining Maximum PCR Sensitivity and Specificity. *Cameron N. Gundry and Matthew D. Poulson*

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Chapter 7. qPCR Data Analysis: Unlocking the Secret to Successful Results. *Jan Hellemans and Jo Vandecasteele*

Chapter 8. The MIQE Guidelines Unleashed. *Gregory L. Shipley*

Chapter 9. PCR Applications for Epigenetics Research. *Gavin Meredith, Miro Dudas, Mark Landers, Vasiliki Anest, Jonathan Wang, Cailu Chen, Peter Jozsi and Christopher Adams*

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