

DNA AMPLIFICATION

CURRENT TECHNOLOGIES AND APPLICATIONS

Edited by:

Vadim V. Demidov
Boston University, USA

and

Natalia E. Broude
Boston University, USA

Inspired by and dedicated to the golden jubilee of the double helix and complementarity principle, which underlie all methods of DNA amplification presented in this book.

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Contributors

Michael Adler*

Chimera biotec GmbH
Emil-Figge Str. 76a
44227 Dortmund
Germany

Luis Blanco

Instituto de Biología Molecular
“Eladio Viñuela” (CSIC)
Centro de Biología Molecular
“Severo Ochoa” (CSIC-UAM)
Universidad Autónoma
Cantoblanco, 28049 Madrid
Spain

Natalia E. Broude*

Center for Advanced Biotechnology
Boston University
36 Cummington Street
Boston, MA 02215
U.S.A.

Weiguo Cao*

South Carolina Experimental Station
Clemson University
51 New Cherry Street
Clemson, SC 29634
U.S.A.

Connie Chang

Cornell University Medical College
New York, NY 10021
U.S.A.

Cecile Colpaert

Winship Cancer Institute
Emory University
1365 Clifton Road NE
Atlanta, GA 30322
U.S.A.

Hirock D. Datta

Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

Vadim V. Demidov*

Center for Advanced Biotechnology
Boston University
36 Cummington Street
Boston, MA 02215
U.S.A.

John C. Detter*

US DOE Joint Genome Institute
2800 Mitchell Drive
Walnut Creek, CA 94598
U.S.A.

Richard S. Dondero

Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

Konstantin Ebralidse

Beth Israel Deaconess Medical Center
and Harvard Medical School
Boston, MA 02115
U.S.A.

Michael Egholm

Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

A. Errami

Department of Clinical Genetics
Free University of Amsterdam
v.d. Boechorststraat 7
1081BT Amsterdam
Netherlands

Richard Finkers

Plant Research International
WUR, Wageningen
Netherlands
Current address:
Laboratory of Plant Breeding
WUR, Wageningen
Netherlands

Manohar R. Furtado*
Applied Biosystems
850 Lincoln Centre Drive
Foster City, CA 94404
U.S.A.

Christian Harwanegg
VBC-GENOMICS
Bioscience Research GmbH
1030 Vienna
Austria

Tobin J. Hellyer*
BD Diagnostic Systems
54 Loveton Circle
Sparks, MD 21152
U.S.A.

Sjaak van Heusden
Plant Research International
WUR, Wageningen
Netherlands

Seiyu Hosono
Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

Martin Huber
VBC-GENOMICS
Bioscience Research GmbH
1030 Vienna
Austria

Hidetoshi Kanda
Eiken Chemical Co., Ltd.
1381-3 Shimoishigami
Ohtawara, Tochigi 324-0036
Japan

Konstantin Khrapko*
Beth Israel Deaconess Medical Center
and Harvard Medical School
Boston, MA 02115
U.S.A.

Stephen F. Kingsmore
Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

Sergei A. Kozyavkin
Fidelity Systems, Inc.
7961 Cessna Avenue
Gaithersburg, MD 20879
U.S.A.

Yevgenya Kraysberg
Beth Israel Deaconess Medical Center
and Harvard Medical School
Boston, MA 02115
U.S.A.

Andrew M. Kuhn
BD Diagnostic Systems
54 Loveton Circle
Sparks, MD 21152
U.S.A.

Heiko Kuhn
Center for Advanced Biotechnology
Boston University
36 Cummington Street
Boston, MA 02215
U.S.A.

Roger S. Lasken*
Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

José M. Lázaro
Instituto de Biología Molecular
“Eladio Viñuela” (CSIC)
Centro de Biología Molecular
“Severo Ochoa” (CSIC-UAM)
Universidad Autónoma
Cantoblanco, 28049 Madrid
Spain

Kenneth J. Livak
Applied Biosystems
850 Lincoln Centre Drive
Foster City, CA 94404
U.S.A.

Yasuyoshi Mori
Eiken Chemical Co., Ltd.
1381-3 Shimoishigami
Ohtawara, Tochigi 324-0036
Japan

Aki Morikawa
Winship Cancer Institute
Emory University
1365 Clifton Road NE
Atlanta, GA 30322
U.S.A.

Manfred W. Mueller
VBC-GENOMICS
Bioscience Research GmbH
1030 Vienna
Austria

Michael C. Mullenix*
Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

James G. Nadeau
BD Diagnostic Systems
54 Loveton Circle
Sparks, MD 21152
U.S.A.

Kentaro Nagamine
Eiken Chemical Co., Ltd.
1381-3 Shimoishigami
Ohtawara, Tochigi 324-0036
Japan

Ekaterina Nekhaeva
Beth Israel Deaconess Medical
Center
and Harvard Medical School
Boston, MA 02115
U.S.A.
PerkinElmer Life and Analytical Sciences
Boston, MA 02118
U.S.A.

John R. Nelson
Amersham Biosciences
800 Centennial Avenue
PO Box 1327
Piscataway, NJ 08855
U.S.A.

Christof M. Niemeyer
Universität Dortmund
Fachbereich Chemie
Biologisch-Chemische
Mikrostrukturtechnik
Otto-Hahn-Str. 6
D-44227 Dortmund
Germany

Tsugunori Notomi*
Eiken Chemical Co., Ltd.
1381-3 Shimoishigami
Ohtawara, Tochigi 324-0036
Japan

A.O.H. Nygren
Department of Clinical Genetics
Free University of Amsterdam
v.d. Boechorststraat 7
1081BT Amsterdam
Netherlands

Andrey R. Pavlov
Fidelity Systems, Inc.
7961 Cessna Avenue
Gaithersburg, MD 20879
U.S.A.

Nadejda V. Pavlova
Fidelity Systems, Inc.
7961 Cessna Avenue
Gaithersburg, MD 20879
U.S.A.

Lorah T. Perlee
Molecular Staging, Inc.
300 George Street
New Haven, CT 06511
U.S.A.

Olga V. Petrauskene
Applied Biosystems
850 Lincoln Centre Drive
Foster City, CA 94404
U.S.A.

Xiaoquan Qi*
Sainsbury Laboratory
Norwich Research Park
Colney, Norwich NR4 7UH
U.K.

Paul M. Richardson
US DOE Joint Genome Institute
2800 Mitchell Drive
Walnut Creek, CA 94598
U.S.A.

Margarita Salas*
Instituto de Biología Molecular
“Eladio Viñuela” (CSIC)
Centro de Biología Molecular
“Severo Ochoa” (CSIC-UAM)
Universidad Autónoma
Cantoblanco, 28049 Madrid
Spain

Wolfgang M. Schmidt*
VBC-GENOMICS
Bioscience Research GmbH
1030 Vienna
Austria

J. P. Schouten*
MRC-Holland
Hudsonstraat 68
1057SN Amsterdam
Netherlands

Alexei I. Slesarev*
Fidelity Systems, Inc.
7961 Cessna Avenue
Gaithersburg, MD 20879
U.S.A.

Keith Thornton
BD Diagnostic Systems
54 Loveton Circle
Sparks, MD 21152
U.S.A.

Miguel de Vega
Instituto de Biología Molecular
“Eladio Viñuela” (CSIC)
Centro de Biología Molecular
“Severo Ochoa” (CSIC-UAM)
Universidad Autónoma
Cantoblanco, 28049 Madrid
Spain

Sha-Sha Wang
BD Diagnostic Systems
54 Loveton Circle
Sparks, MD 21152
U.S.A.

Tanisha Williams
Winship Cancer Institute
Emory University
1365 Clifton Road NE
Atlanta, GA 30322
U.S.A.

David M. Wolfe
BD Diagnostic Systems
54 Loveton Circle
Sparks, MD 21152
U.S.A.

Diansheng Zhong
Winship Cancer Institute
Emory University
1365 Clifton Road NE
Atlanta, GA 30322
U.S.A.

Wei Zhou*
Winship Cancer Institute
Emory University
1365 Clifton Road NE
Atlanta, GA 30322
U.S.A.

* Corresponding author

Preface

DNA amplification is the cornerstone of modern biotechnology and it is also a key procedure in numerous basic studies involving DNA molecules. All methods for DNA amplification have rested on the concept of DNA strand complementarity discovered by James Watson and Francis Crick fifty years ago. To an equal extent, these methods became possible with the discovery of DNA polymerases first identified by Arthur Kornberg soon after the Watson-Crick discovery and DNA ligases discovered in 1967 by Martin Gellert, Charles Richardson, Jerard Hurwitz, Robert Lehman and others. Using these enzymes (and later their thermostable variants), a variety of isothermal and temperature-cycling amplification techniques have been developed starting in late 1980s. Among these techniques, Kari Mullis' polymerase chain reaction (PCR) was the first one and it is still the most popular amplification method. Yet, some alternatives to PCR have also successfully invaded the area. The emergence of such methodologies significantly widened the range of approaches for DNA amplification and dramatically changed the abilities of basic and applied researchers in various fields of life sciences. It will not be an exaggeration to say that now no research related to DNA can be performed without the employment of DNA amplification procedures.

Despite the importance of this topic we found to our surprise that only a few books were published that deal with the subject. Moreover, these books cover mostly PCR-based techniques and/or describe the use of PCR and other DNA amplification approaches for specific goals, such as clinical analysis, environmental microbiology, forensics, etc. This information shortage was a major motivation for us to compile a book on a wider range of methods for DNA amplification with emphasis on their diverse applications. Besides, almost twenty years after PCR was invented, we now are witnessing a new stage in the craft of DNA amplification thanks to the introduction of real-time PCR, several powerful non-PCR DNA amplification techniques and microarray technologies. In an attempt to represent the current state-of-the-art our book covers both well-established and newly-developed protocols with promising potential.

Although the book goes far beyond PCR by presenting a number of isothermal assays along with the ligation-based thermocycling approaches, PCR remains, despite some limitations, the dominant diagnostic technique for target DNA amplification and analysis, and recently this primary method has been systematically improved in many ways. That is why a significant part of our book is devoted to new PCR developments. A separate section

is devoted to a group of enzymes, both natural and engineered, which are employed for DNA amplification and related purposes. We also present here the use of DNA amplification in the detection of non-DNA analytes. Note that we do not consider *per se* the methods for the detection of amplicons obtained by one way or another except for those few that establish a new potent amplification approach, as in the case of real-time PCR or real-time strand displacement amplification (SDA).

We hope that our book will serve as a practical tool and reference source for a broad audience of academic researchers and industry biotechnologists who rely in their work on DNA amplification techniques. We are very grateful to all the contributors and to the publisher who made this book possible.

Vadim V. Demidov and Natalia E. Broude

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