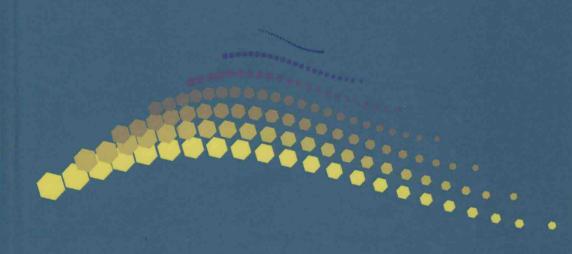
# BIOSCIENCE METHODOLOGIES in PHYSICAL CHEMISTRY

An Engineering and Molecular Approach



Editors Alberto D'Amore, DSc A. K. Haghi, PhD Gennady E. Zaikov, DSc



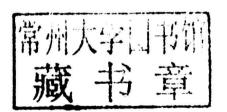


# BIOSCIENCE METHODOLOGIES IN PHYSICAL CHEMISTRY

An Engineering and Molecular Approach

## Edited by

Alberto D'Amore, DSc, A. K. Haghi, PhD, and Gennady E. Zaikov, DSc





3333 Mistwell Crescent Oakville, ON L6L 0A2 Canada

Apple Academic Press Inc. | Apple Academic Press Inc. 9 Spinnaker Way Waretown, NJ 08758 USA

©2014 by Apple Academic Press, Inc. Exclusive worldwide distribution by CRC Press, a member of Taylor & Francis Group

No claim to original U.S. Government works

Printed and bound in Great Britain by TJ International Ltd, Padstow, Cornwall International Standard Book Number-13: 978-1-926895-54-3 (Hardcover)

This book contains information obtained from authentic and highly regarded sources. Reprinted material is quoted with permission and sources are indicated. Copyright for individual articles remains with the authors as indicated. A wide variety of references are listed. Reasonable efforts have been made to publish reliable data and information, but the authors, editors, and the publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors, editors, and the publisher have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged, please write and let us know so we may rectify in any future reprint.

Trademark Notice: Registered trademark of products or corporate names are used only for explanation and identification without intent to infringe.

Library of Congress Control Number: 2013942331

#### Library and Archives Canada Cataloguing in Publication

Bioscience methodologies in physical chemistry: an engineering and molecular approach/ edited by Alberto D'Amore, DSc, A.K. Haghi, PhD, and Gennady E. Zaikov, DSc.

Includes bibliographical references and index.

ISBN 978-1-926895-54-3

1. Chemistry, Physical and theoretical. 2. Life sciences--Methodology. I. D'Amore, Alberto, editor of compilation II. Haghi, A. K., editor of compilation III. Zaikov,

G. E. (Gennadiĭ Efremovich), 1935-, editor of compilation

QD461.B56 2013

541'22

C2013-903441-2

Apple Academic Press also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic format. For information about Apple Academic Press products, visit our website at www.appleacademicpress.com and the CRC Press website at www.crcpress.com

# BIOSCIENCE METHODOLOGIES IN PHYSICAL CHEMISTRY

An Engineering and Molecular Approach



此为试读,需要完整PDF请访问: www.ertongbook.com

# ABOUT THE EDITORS

#### Alberto D'Amore, DSc

Alberto D'Amore, DSc, is currently Associate Professor of Materials Science and Technology at Second University of Naples-SUN in Rome, Italy. He has authored more than one hundred scientific papers published in international journals and books. He is a member of the scientific committees of many international conferences and is on the editorial boards of several international journals. Currently he is the Chairman of the International-Times of Polymers (TOP) and Composites conferences.

#### A. K. Haghi, PhD

A. K. Haghi, PhD, holds a BSc in urban and environmental engineering from the University of North Carolina (USA); a MSc in mechanical engineering from North Carolina A&T State University (USA); a DEA in applied mechanics, acoustics and materials from the Université de Technologie de Compiègne (France); and a PhD in engineering sciences from the Université de Franche-Comté (France). He is the author and editor of 65 books as well as 1000 published papers in various journals and conference proceedings. Dr. Haghi has received several grants, consulted for a number of major corporations, and is a frequent speaker to national and international audiences. Since 1983, he served as a professor at several universities. He is currently Editor-in-Chief of the International Journal of Chemoinformatics and Chemical Engineering and the Polymers Research Journal and on the editorial boards of many international journals. He is also a faculty member of the University of Guilan (Iran) and a member of the Canadian Research and Development Center of Sciences and Cultures (CRDCSC), Montreal, Quebec, Canada.

## Gennady E. Zaikov, DSc

Gennady E. Zaikov, DSc, is Head of the Polymer Division at the N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences,

vi About the Editors

Moscow, Russia, and Professor at Moscow State Academy of Fine Chemical Technology, Russia, as well as Professor at Kazan National Research Technological University, Kazan, Russia. He is also a prolific author, researcher, and lecturer. He has received several awards for his work, including the Russian Federation Scholarship for Outstanding Scientists. He has been a member of many professional organizations and on the editorial boards of many international science journals.

# LIST OF CONTRIBUTORS

#### Anton A. Artamonov

Scientific Company "Flamena", Moscow, Russia

#### Marina I. Artsis

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

#### Levan Asatiani

Ivane Javakhishvili Tbilisi State University I, Ilia Chavchavadze Ave., 0128 Tbilisi, Georgia

#### V. V. Belov

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

E-mail: emal@sky.chph.ras.ru

#### E.V. Belova

Plekhanov Russian University of Economics, Stremyanny per. 36, Moscow 117997, Russia

#### M. Biryukova

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., 119334 Moscow, Russia

#### T. I. Borodina

Joint Institute for High Temperatures Russian Academy of Science, Moscow, Russia

#### A.V. Bychkova

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., Moscow 119334, Russia E-mail: annb0005@yandex.ru

#### Jan Chłopek

Department of Biomaterials, AGH University of Science and Technology, Krakow, Poland

#### J. A. Djamanbaev

Institute of Chemistry and Chemical Technology, Kyrgyz National Academy of Sciences, 720071, Kyrgyzstan, Bishkek, 267 Chui Prospect

E-mail: Djamanbaev-J@mail.ru

#### Alberto D'Amore

The Second Naples University, Dipartimento di Ingegneria Aerospaziale e Meccanica, 19 Via Roma, 8103 1Aversa (CE), Italy

E-mail: Alberto.Damore@unina2.it

#### E. Ya. Davydov

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., 119334 Moscow, Russia

#### Gennady Efremovich Zaikov

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119991, Russia

Tel.: +7 (495) 9397320, E-mail: chembio@chph.ras.ru

#### I. S. Gaponova

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., 119334 Moscow, Russia

#### Eteri Gigineishvili

Ivane Javakhishvili Tbilisi State University I, Ilia Chavchavadze Ave., 0128 Tbilisi, Georgia

#### O. A. Gololobova

Joint Institute for High Temperatures Russian Academy of Science, Moscow, Russia

#### A. K. Haghi

University of Guilan, Rasht P.O.BOX 3756, Guilan, Iran

E-mail: Haghi@Guilan.ac.ir

#### Victor Kablov

Volzhsky Polytechnic Institute (branch of) Volgograd State Technical University, 42-A, Engels St., Volzhsky 404120, Russia

#### V. T. Karpukhin

Joint Institute for High Temperatures Russian Academy of Science, Moscow, Russia E-mail: karp@oivtran.ru

#### G. Kirshenbaum

Brooklyn Polytechnic University, 333 Jay St., Six Metrotech Center, Brooklyn, NYC, NY, USA E-mail: GeraldKirshenbaum@yahoo.com

#### Mikhail A. Klimovich

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow, Russia

#### Dorota Klimecka-Tatar

Institute of Production Engineering, Czestochowa University of Technology, Poland

#### **Dmitry Kondrutsky**

Volzhsky Polytechnic Institute (branch of) Volgograd State Technical University, 42-A, Engels St., Volzhsky 404120, Russia

E-mail: kondrutsky@gmail.com

#### M. Konstantinova

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., 119334 Moscow, Russia

#### Anna Korneva

Institute of Metallurgy and Materials Science, Polish Academy of Sciences, Krakow, Poland Department of Anatomy and Physiology, The Alfred Meissner Graduate School of Dental Engineering and Humanities, Ustron, Poland

#### E. Kostanova

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., 119334 Moscow, Russia

List of Contributors xiii

#### A. L. Kovarski

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., Moscow 119334, Russia

#### G. V. Kozlov

Kabardino-Balkarian State University, KBR, Nal'chik, Chernyshevsky St., 173, 360004, Russia E-mail: I dolbin@mail.ru

#### Mikhail V. Kozlov

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow, Russia

#### Z. G. Kozlova

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

E-mail: yevgeniya-s@inbox.ru, Fax: (495) 137-41-01

#### Wojciech Król

Chair and Department of Microbiology and Immunology in Zabrze, Medical University of Silesia in Katowice, Poland

#### Tomasz Kupka

Unit of Dental Materials Science of Department of Prosthodontics and Dental Materials Science, Medical University of Silesia, Katowice, Poland

#### Nodar Lekishvili

Ivane Javakhishvili Tbilisi State University I, Ilia Chavchavadze Ave., 0128 Tbilisi, Georgia Email: lekino@gmail.com

#### V. B. Leonova

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., Moscow 119334, Russia

#### A. M. Likhter

Astrakhan State University Bld. 20a, Tatischeva St., Astrakhan, 414056 Russian Federation, Russia E-mail: pjulia@pisem.net, Tel.: (8512) 25-17-18

#### V. S. Litvishko

Plekhanov Russian University of Economics, Stremyanny per. 36, Moscow 117997, Russia E-mail: LVS-1@mail.ru

#### A. S. M. Lomakin

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., 119334 Moscow, Russia

#### Piotr Malara

Institute of Engineering Materials and Biomaterials, Silesian University of Technology, 18A Konarskiego St., 44-100 Gliwice, Poland

Clinic for Oral and Maxillofacial Surgery, DENTARIS Medical Centre, 12B Lowiecka St., 41-707 Ruda Slaska, Poland

#### M. M. Malikov

Joint Institute for High Temperatures Russian Academy of Science, Moscow, Russia

#### E. L. Maltseva

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

E-mail: emal@sky.chph.ras.ru

#### E. I. Martirosova

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

E-mail: ms martins@mail.ru

#### A. Matskiv

Sochi Institute of Russian People's Friendship University, 32 Kuibyshev St., Russia

#### Ludmila I. Matienko

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334 Russia

E-mail: matienko@sky.chph.ras.ru

#### Anna Mertas

Chair and Department of Microbiology and Immunology in Zabrze, Medical University of Silesia in Katowice, Poland

#### Viacheslav M. Misin

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Moscow, Russia

#### Larisa A. Mosolova

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334 Russia

#### V. Mottaghitalab

University of Guilan, Rasht P.O. BOX 3756, Guilan, Iran

#### Izabela Orlicka

Department of Anatomy and Physiology, The Alfred Meissner Graduate School of Dental Engineering and Humanities, Ustron, Poland

#### Rajmund Orlicki

Department of Anatomy and Physiology, The Alfred Meissner Graduate School of Dental Engineering and the Humanities in Ustron. Poland

#### N. P. Palmina

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

E-mail: emal@sky.chph.ras.ru

#### P.V. Pantyukhov

Plekhanov Russian University of Economics, Stremyanny per. 36, Moscow 117997, Russia

#### G.B. Pariiskii

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., 119334 Moscow, Russia

#### Grazyna Pawlowska

Department of Chemistry, Czestochowa University of Technology, Poland

#### E. M. Pearce

Brooklyn Polytechnic University, 333 Jay St., Six Metrotech Center, Brooklyn, NYC, NY, USA E-mail: EPearceg@gmail.edu

List of Contributors xv

#### I. G. Plashchina

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

#### U. A. Pleshkova

Astrakhan State University Bld. 20a, Tatischeva St., Astrakhan, 414056 Russian Federation, Russia E-mail: pjulia@pisem.net, Tel.: (8512) 25-17-18

#### T. V. Pokholok

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., 119334 Moscow, Russia

#### S. Razumovskii

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., 119334 Moscow, Russia

#### M. Rosenfeld

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., 119334 Moscow, Russia E-mail: markrosenfeld@rambler.ru, Fax: +7 (495) 137-41-01

#### A. A. Rybalko

Sochi Institute of Russian People's Friendship University, 32 Kuibyshev St., Russia

#### A. E. Rybalko

Sochi Institute of Russian People's Friendship University, 32 Kuibyshev St., Russia

#### A. Shegolihin

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., 119334 Moscow, Russia

#### Lvudmila N. Shishkina

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow, Russia

E-mail: shishkina@sky.chph.ras.ru

#### G. B. Shustov

Kabardino-Balkarian State University, KBR, Nal'chik, Chernyshevsky St., 173, 360004, Russia

#### Vladimir V. Tsetlin

Institute for Biomedical Problems, Russian Academy of Sciences, Moscow, Russia

#### O. N. Sorokina

Federal State Budgetary Institution of Science, N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygina St., Moscow 119334, Russia

#### D. A. Strikanov

Joint Institute for High Temperatures Russian Academy of Science, Moscow, Russia

#### Krzysztof Sztwiertnia

Institute of Metallurgy and Materials Science, Polish Academy of Sciences, Krakow, Poland Department of Anatomy and Physiology, The Alfred Meissner Graduate School of Dental Engineering and Humanities, Ustron, Poland

#### R. R. Usmanova

Ufa State Technical University of Aviation, 12 Karl Marks St., Ufa 450000, Bashkortostan, Russia E-mail: Usmanovarr@mail.ru

xvi List of Contributors

#### G. E. Valyano

Joint Institute for High Temperatures Russian Academy of Science, Moscow, Russia

#### Włodzimierz Więckiewicz

Department of Prosthetic Dentistry, Faculty of Dentistry, Wroclaw Medical University, Wroclaw, Poland

#### Lidiya A. Zimina

N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 4 Kosygin St., Moscow 119334, Russia

#### Olga Zineeva

Volzhsky Polytechnic Institute (branch of) Volgograd State Technical University, 42-A, Engels St., Volzhsky 404120, Russia

#### Magdalena Ziqbka

Department of Ceramics and Refractories, AGH University of Science and Technology, Krakow, Poland

# LIST OF ABBREVIATIONS

AO antioxidants

AOA antioxidant activity
AP acetophenone

APA antiperoxide activity

BAL benzaldehyde

BCS biocybernetical system
BH benzyl hydroperoxide
BSA bovine serum albumin
BSE backscattered electrons

BZA benzyl alcohol
CdTe cadmium telluride
CE cytotoxic effect

CIGS copper indium gallium (di)selenide CTMP chemithermomechanical pulp

DBM dibytyl maleate
DC diene conjugates
DEF diethylferrocene

DLA diffusion-limited aggregation
DMPC dimethyl phenylcarbinol
DPhO 2,5-diphenyl-1,5-oxazole

DSA doxyl-stearic acids

DSSC dye senetesized solar cell
DTA differential thermal analysis
DTA differential-thermal analysis
EMI electromagnetic interference
EPR electron paramagnetic resonance
EPR electron paramagnetic resonance

ESR electron spin resonance
ESR electron spin resonance
EWG electron-withdrawing groups

FA fractal aggregates

FF fill factor

GPi graphitized polyimide

ICP-MS inductively coupled plasma mass spectrometry

IM iod-methylate

IR Infrared KD ketodienes L lecithin

LPO lipid peroxidation MM molecular mass

MNPs magnetic nanoparticles

MNSs magnetically targeted nanosystems

MOF metal-organic frameworks
MPC methylphenylcarbinol
MPP maximum power point

nAg nanoparticles OSCs organic solar cells

P product

P3HT poly(3-hexyl thiophene)

PAni polyaniline PBA perbenzoic acid

PEH phenylethylhydroperoxide PET poly thyleneterphthalate

pFXIII Plasma fibrin-stabilizing factor

PhOH phenol

PL phospholipids

PSM post-synthetic modification

PSU polysulfone PV photovoltaic PVP poly(vinyl py

PVP poly(vinyl pyrrolidone)
ROS reactive oxygen species
ROS reactive oxygen species
SBUs secondary building units
SCE saturated calomel electrode

SE secondary electron SE secondary electrons

SEM scanning electron microscope TGA thermo gravimetric analysis

TSC textile solar cell

# LIST OF SYMBOLS

```
d = dimension of Euclidean space
E = total energy
exp = experimental value
h = dimensionalities of energy
h = hour
h = Planck's constant
H_0 = Gamete acidity
K_m = \text{copolymer constant}
1 = liter
min = minute
n = \text{full earthday number}
pK<sub>a</sub>= basicity parameter
Q = constant insolation
R = atomic radius
r = ionic radius
R_m = \text{radius of the cylindrical chamber}
s = second
t = time
T_{..} = Gordon-Tailor-Wood equation
W = comonomer molar fraction
wk = week
yr = year
c = velocity
```

### **Greek Symbols**

Y = dimensionalities of energy

v = electromagnetic wave frequency

 $\lambda$  = wavelength

 $\eta = intrinsic viscosity$ 

 $\tau$  = estimation of rotational correlation time of labels

 $\xi$  = coefficient of hydraulic resistance