

## **Italian Society of Chemistry**

Division of Organic Chemistry Division of Medicinal Chemistry Division of Mass Spectrometry

# TARGETS IN HETEROCYCLIC SYSTEMS

## **Chemistry and Properties**

Volume 21 (2017)

Reviews and Accounts on Heterocyclic Chemistry https://www.soc.chim.it/en/libri\_collane/ths\_catalogo

#### **Editors**

Prof. Orazio A. Attanasi

University of Urbino "Carlo Bo", Urbino, Italy

Prof. Pedro Merino

University of Zaragoza, Zaragoza, Spain

Prof. Domenico Spinelli

University of Bologna, Bologna, Italy

Published by:

## Società Chimica Italiana

Viale Liegi, 48 00198 Roma Italy

## Copyright © 2016 Società Chimica Italiana

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means (electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise) without permission in writing from the publishers. A person may photocopy an article for personal use.

Volume 1 (1997)	First edition 1997	ISBN 88-86208-24-3	
	Second edition 1999	ISBN 88-86208-24-3	
Volume 2 (1998)	First edition 1999	ISBN 88-86208-11-1	
Volume 3 (1999)	First edition 2000	ISBN 88-86208-13-8	
Volume 4 (2000)	First edition 2001	ISBN 88-86208-16-2	
Volume 5 (2001)	First edition 2002	ISBN 88-86208-19-7	
Volume 6 (2002)	First edition 2003	ISBN 88-86208-23-5	
Volume 7 (2003)	First edition 2004	ISBN 88-86208-28-6	ISSN 1724-9449
Volume 8 (2004)	First edition 2005	ISBN 88-86208-29-4	ISSN 1724-9449
Volume 9 (2005)	First edition 2006	ISBN 88-86208-31-6	ISSN 1724-9449
Volume 10 (2006)	First edition 2007	ISBN 978-88-86208-51-2	ISSN 1724-9449
Volume 11 (2007)	First edition 2008	ISBN 978-88-86208-52-9	ISSN 1724-9449
Volume 12 (2008)	First edition 2009	ISBN 978-88-86208-56-7	ISSN 1724-9449
Volume 13 (2009)	First edition 2010	ISBN 978-88-86208-62-8	ISSN 1724-9449
Volume 14 (2010)	First edition 2011	ISBN 978-88-86208-67-3	ISSN 1724-9449
Volume 15 (2011)	First edition 2012	ISBN 978-88-86208-70-3	ISSN 1724-9449
Volume 16 (2012)	First edition 2013	ISBN 978-88-86208-72-7	ISSN 1724-9449
Volume 17 (2013)	First edition 2014	ISBN 978-88-86208-75-8	ISSN 1724-9449
Volume 18 (2014)	First edition 2015	ISBN 978-88-86208-98-7	ISSN 1724-9449
Volume 19 (2015)	First edition 2016	ISBN 978-88-86208-77-2	ISSN 1724-9449
Volume 20 (2016)	First edition 2017	ISBN 978-88-86208-90-1	ISSN 1724-9449
Volume 21 (2017)	First edition 2018	ISBN 978-88-86208-87-1	ISSN 1724-9449

Printed and bound in Italy by: Arti Grafiche Editoriali s.r.l. Via della Stazione, 41 61029 Urbino (PU) Italy March 2018

## **Editorial Advisory Board Members**

Sylvain Achelle, University of Rennes 1, Lannion, France

Mauro F. A. Adamo, Royal College of Surgeons, Dublin, Ireland

Jan Bergman, Karolinska Institute, Huddinge, Sweden

Robert K. Boeckman Jr., University of Rochester, Rochester, USA

Helio G. Bonacorso, Federal University of Santa Maria, Santa Maria, Brazil

**Donatella Caruso**, *University of Milano*, *Milano*, *Italy* 

José A. S. Cavaleiro, University of Aveiro, Aveiro, Portugal

Jia-Rong Chen, Central China Normal University, Wuhan, P.R. China

Marco A. Ciufolini, University of British Columbia, Vancouver, Canada

Janine Cossy, ESPCI, Paris, France

Gabriele Costantino, University of Parma, Parma, Italy

Wim Dehaen, KU Leuven, Leuven, Belgium

Dieter Enders, RWTH, Aachen, Germany

Gianluca M. Farinola, University of Bari "Aldo Moro", Bari, Italy

Athina Geronikaki, Aristotle University of Thessaloniki, Thessaloniki, Greece

Armin Geyer, Philip's University of Marburg, Marburg, Germany

Leon Ghosez, Catholic University of Louvain, Louvain la Neuve, Belgium

Gianluca Giorgi, University of Siena, Siena, Italy

Jason B. Harper, University of New South Wales, Sydney, Australia

Laurence M. Harwood, University of Reading, Reading, UK

Tomas Hudlicky, Brock University, St. Catharines, Canada

Hiriyakkanavar Ila, JNCASR, Bangalore, India

Victor G. Kartsev, InterBioScreen Ltd, Moscow, Russia

Stefan F. Kirsch, Bergisches University of Wuppertal, Wuppertal, Germany

Martin Kotora, Charles University in Prague, Praha, Czech Republic

Steven V. Ley, University of Cambridge, Cambridge, UK

Mieczsław Mąkosza, Polish Academy of Sciences, Warsaw, Poland

**Péter Mátyus**, Semmelweis University, Budapest, Hungary

Thomas J. J. Müller, Heinrich Heine University of Düsseldorf, Düsseldorf, Germany

Carmen Nájera, University of Alicante, Alicante, Spain

Nagatoshi Nishiwaki, Kochi University of Technology, Kochi, Japan

Teresa M. V. D. Pinho e Melo, University of Coimbra, Coimbra, Portugal

Hans-Ulrich Reißig, Freie Universität Berlin, Berlin, Germany

Roberto A. Rossi, National University of Córdoba, Córdoba, Argentina

Branko Stanovnik, University of Ljubljana, Ljubljana, Slovenia

Peter Szolcsányi, Slovak University of Technology, Bratislava, Slovakia

Richard J. K. Taylor, University of York, York, UK

Eric J. Thomas, University of Manchester, Manchester, UK

Boris A. Trofimov, Favorsky Irkutsk Institute of Chemistry, Irkutsk, Russia

Wen-Jing Xiao. Central China Normal University, Wuhan, P.R. China

Miguel Yus, University of Alicante, Alicante, Spain

**Preface** 

Heterocyclic derivatives are important in organic chemistry as products (including natural) and/or useful tools in the construction of more complicated molecular entities. Their utilization in polymeric, medicinal and agricultural chemistry is widely documented. Dyestuff, electronic, and tanning structures, as well as life molecules frequently involve heterocyclic rings that play an important role in several chemical and biochemical processes.

Volume 21 (2017) keeps the international standard of TARGETS IN HETEROCYCLIC SYSTEMS - Chemistry and Properties (THS) series and contains eighteen chapters, covering the synthesis, reactivity, and activity (including medicinal) of different heterorings. In this book, authors from Belgium, Czech Republic, France, Germany, Italy, Popular Republic of China, Russian Federation, Spain, United Kingdom, and Vietnam are present.

As yet, THS Volumes 1-21 published 283 reviews by 786 authors from 36 different countries for a total of about 8.500 pages.

Comprehensive Reviews reporting the overall state of the art on wide fields as well as personal Accounts highlighting significative advances by research groups dealing with their specific themes have been solicited from leading Authors. The submission of articles having the above-mentioned aims and concerning highly specialistic topics is strongly urged. The publication of Chapters in THS is free of charge. Firstly a brief layout of the contribution proposed, and then the subsequent manuscript, may be forwarded either to a Member of the Editorial Board or to one of the Editors.

The Authors, who contributed most competently to the realization of this Volume, and the Referees, who cooperated unselfishly (often with great patience) spending valuable attention and time in the review of the manuscripts, are gratefully acknowledged.

> Orazio A. Attanasi, Pedro Merino, Domenico Spinelli Editors