Proceedings of the 14th International Symposium on

BIOLUMINESCENCE AND CHEMILUMINESCENCE

Chemistry, Biology and Applications

edited by
Aladar A Szalay
Philip J Hill
Larry J Kricka
Philip E Stanley

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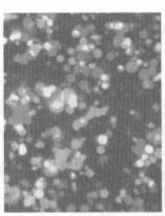

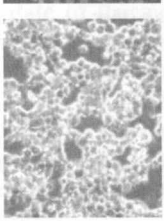

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PREFACE

These are the Proceedings of the 14th Symposium on Bioluminescence and Chemiluminescence held at Paradise Point Resort & Spa from October 15-19, 2006. This series of symposia started in Brussels in 1978, and a list of the other Proceedings volumes appears at the end of this Preface. As in previous symposia, participants came from far and wide and in all 18 countries were represented.

The Organizing Secretariat was fortunate to have the continued association with the International Society for Bioluminescence & Chemiluminescence. The organizers are thankful for the kind support of the society. We also thank John Wiley & Sons for publishing the regular abstracts in the journal *Luminescence* Vol. 21(5) 2006.

Editorial Note

This volume was compiled without peer review from camera-ready manuscripts of lectures and posters presented at the Symposium. The Editors have, in the interest of rapid publication, made only minor stylistic changes. They take no responsibility for scientific or priority matters.

The Editors: AA Szalay, PJ Hill, LJ Kricka, PE Stanley

THE MARLENE DELUCA PRIZE

The Marlene DeLuca prizes were again generously given by Dr Fritz Berthold, together with Berthold Technologies. Dr. Berthold has provided these prizes at each symposium since the 1988 Symposium in Florence. The prize can be awarded to symposium participants under the age of 35 at the day before the starting date of the symposium. The prize is given in memory of Dr. Marlene DeLuca who made major contributions to the science of bioluminescence (*see* Stanley PE. Dedication to Marlene DeLuca: *J Biolumin Chemilumin* 4;1989:7-11 (includes list of her papers). Similarly to previous years' selections, the President of the International Society, Professor Aladar A Szalay (University of Würzburg, Würzburg, Germany), assembled a five-member selection committee from the society to choose the three candidates based on their presentations.

The 2006 prize winners were:

Yoriko Ando (University of Tokyo, Chiba, Japan) *Quantitative luminescence, yield spectra of firefly bioluminescence*

Jenny Krönström (Department of Zoophysiology, Göteborg University, Göteborg, Sweden) *Do muscular sphincters control oxygen supply to photocytes in Northern Krill,* Meganyctiphanes norvegica*?*

Kazuki Niwa (National Institute of Advanced Industrial Science and Technology, Osaka, Japan) *Biosynthesis of firefly D-luciferin*

INTERNATIONAL SOCIETY FOR BIOLUMINESCENCE AND CHEMILUMINESCENCE

SYMPOSIUM ORGANIZING COMMITTEE

ACKNOWLEDGEMENTS

We wish to express our sincere appreciation to the following for their generous support of this symposium and to the ISBC for the loan of deposit for the conference venue.

SPONSORS/EXHIBITORS

Genelux Corporation; Promega Corporation; American Gene Therapy, Inc.; Applied Biosytems; Berthold Detection Systems GmbH; Berthold Technologies GmbH & Co. KG; Kodak Molecular Imaging Systems; Teledyne Benthos, Inc.; Turner BioSystems; Xenogen Corporation.

NEXT SYMPOSIUM

The 15th International Symposium on Bioluminescence and Chemiluminescence is proposed to be held in 2008 in China. Dr. Xiaolin Yang (People's Hospital of Peking University, Beijing, China, xiaolin.yang@yuande.com) volunteered to organize the symposium as symposium chairman. Details of the organization of the 15th BL&CL Symposium will be posted on the society website, http://www.isbc.unibo.it.

PROCEEDINGS OF PREVIOUS SYMPOSIUMS

13th 2004 Yokohama, Japan

Bioluminescence & Chemiluminescence: Progress and Perspectives. Editors: Tsuji A, Matsumoto M, Maeda M, Kricka LJ, Stanley PE. Singapore: World Scientific 2002. pp. 520. ISBN 981-238-156-2.

12th 2002 Cambridge, UK

Bioluminescence & Chemiluminescence: Progress & Current Applications. Editors: Stanley PE, Kricka LJ. Singapore: World Scientific 2002. pp. 520. ISBN 981-238-156-2.

11th 2000 Monterey, CA, USA

Proceedings of the 11th International Symposium on Bioluminescence & Chemiluminescence. Editors: Case JF, Herring PJ, Robison BH, Haddock SHD, Kricka LJ, Stanley PE. Singapore: World Scientific 2001. pp. 517. ISBN 981-02-4679-X.

10th 1998 Bologna, Italy

Bioluminescence and Chemiluminescence: Perspectives for the 21st Century. Editors: Roda A, Pazzagli M, Kricka LJ, Stanley PE. Chichester: Wiley 1999. pp. 628. ISBN: 0-471-98733-6.

9th 1996 Woods Hole, MA, USA

Bioluminescence and Chemiluminescence: Molecular Reporting with Photons.

Editors: Hastings JW, Kricka LJ, Stanley PE. Chichester: Wiley 1997. pp. 568. ISBN: 0-471-97502-8.

8th 1994 Cambridge, UK

Bioluminescence and Chemiluminescence: Fundamentals and Applied Aspects. Editors: Campbell AK, Kricka LJ, Stanley PE. Chichester: Wiley 1994. pp. 672. ISBN: 0-471-95548-5.

7th 1993 Banff, Canada

Bioluminescence and Chemiluminescence: Status Report. Editors: Szalay AA, Kricka LJ, Stanley PE. Chichester: Wiley. 1993, pp. 548. ISBN: 0-471-94164-6.

6th 1990 Cambridge, UK

Bioluminescence and Chemiluminescence: Current Status. Editors: Stanley PE, Kricka LJ. Chichester: Wiley 1991. pp. 570. ISBN: 0-471-92993-X.

5th 1988 Florence, Italy

Bioluminescence and Chemiluminescence: Studies and Applications in Biology and Medicine. Editors: Pazzagli M, Cadenas E, Kricka LJ, Roda A, Stanley PE. Chichester: Wiley 1989. pp. 646. (published as volume 4, issue 1 of the *Journal of Bioluminescence and Chemiluminescence*, 1989). ISBN: 0-471-92264-1.

4th 1986 Freiburg, Germany

Bioluminescence and Chemiluminescence: New Perspectives. Editors: Schölmerich J, Andreesen R, Kapp A, Ernst M, Woods WG. Chichester: Wiley 1987. pp. 600. ISBN: 0-471-91470-3.

3rd 1984 Birmingham, UK

Analytical Applications of Bioluminescence and Chemiluminescence. Editors: Kricka LJ, Stanley PE, Thorpe GHG, Whitehead TP. London: Academic Press 1984. pp. 602. ISBN: 0-12-426290-2.

2nd 1980 San Diego, CA, USA

Bioluminescence and Chemiluminescence: Basic Chemistry and Analytical Applications. Editors: DeLuca MA, McElroy WD. New York: Academic Press 1981. pp.782. ISBN: 0-12-208820-4.

1st 1978 Brussels, Belgium

International Symposium on Analytical Applications of Bioluminescence and Chemiluminescence. Proceedings 1978. Editors: Schram E, Stanley PE. Westlake Village, CA: State Printing & Publishing, Inc., 1979, pp. 696. (Privately published).

INTRODUCTION

On behalf of the Organizing Committee of 14th International Symposium on Bioluminescence & Chemiluminescence (IS BL and CL), held October 15-19, 2006, I would like to thank the International Society of Bioluminescence and Chemiluminescence (ISBC) for their trust and support to host this beautiful event. The symposium brought experts from different areas of the world to Paradise Point Resort & Spa in San Diego, California. The first symposium was held in 1978 in Brussels, Belgium, and has subsequently been held every two years in Europe, America or Asia. After unforeseen complications in Europe, we were pleased to be able to create an opportunity for scientists interested in bioluminescence and chemiluminescence to meet and exchange new ideas in the magnificent city of San Diego, which is considered the center of biomedical science and industry in the southwestern United States.

After opening remarks from the President of the Symposium, Dr. Keith Wood from Promega Corporation delivered the keynote address entitled "Switchable luciferases: the third wave of bioluminescence technology." The Science and Technology Advance Lecture, titled "Subcellular imaging *In vivo:* The new cell biology," was presented by Dr. Robert M. Hoffman, from Anti-Cancer, Inc., and the University of California, San Diego. We were fortunate to have oral and poster presentations given by scientists from 18 countries, as well as active participation from industrial exhibitors. Like previous symposia, the sessions included luciferases, instrumentation, bioluminescent and chemiluminescent assays, multicolor assays, optical imaging, physiology, biochemistry, detection of biological light emission in bioluminescent oceans, as well as its utility in space exploration.

The participants very much enjoyed the lovely gala dinner overlooking Mission Bay and a harp concert by artist Alfredo Rolando Ortiz. The highlight of the festive dinner was the Marlene DeLuca Prize award ceremony, which has become a tradition for honoring outstanding scientific achievements. The President and Dr. Fritz Berthold handed over the prizes to three young scientists under the age of 35: Dr. Yoriko Ando (University of Tokyo, Chiba, Japan), Dr. Jenny Krönström (Department of Zoophysiology, Göteborg University, Göteborg, Sweden) and Dr. Kazuki Niwa (National Institute of Advanced Industrial Science and Technology, Osaka, Japan). In addition to the very capable young awardees, it was refreshing to see the active participation of many young men and women from different scientific disciplines. I predict that this new generation of young scientists, if nurtured, will soon become a well-recognized, innovative scientific force in the footsteps of the greatest pioneers in the BL/CL sciences, many of whom were unfortunately unable to attend the symposium in San Diego, in 2006.

In 1986, exactly 20 years ago, at the 4th International Symposium on Bioluminescence & Chemiluminescence, convened in Freiburg, Germany, I presented, for the first time, visualization of nitrogenase activation in live root nodules (bacterium-caused plant tumors) infected by stably transformed (genomic insertion), *nif* promoter luxAB gene containing Rhizobia. The visualization experiments occurred two years prior to the symposium in my laboratory at Cornell

University (Ithaca, New York) by low light imaging using the Hamamatsu Argus 100 dual microchannel plate camera.

Since that time, numerous publications on imaging of live organisms have appeared from our and other laboratories using many different cells, tissues and organisms with luciferases alone, with fluorescent proteins alone or with separate luciferase and fluorescence protein combinations, as well as with luciferase-fluorescence protein fusion derivatives.

In addition to excellent presentations in the fundamental science session of the 14th International Symposium, the highlight of the symposium was a whole body live imaging session using light-emitting bacteria or viruses as vectors for detection of tumors and metastases. These unexpected findings presented by myself in Yokohama (13th International Symposium on Bioluminescence & Chemiluminescence) are now confirmed by participants from several laboratories, four of whom gave fascinating presentations during the optical imaging session. This optical imaging research may one day lead to the monitoring of tumor detection, progression and therapy in man. The combined scientific contributions of the bioluminescence/chemiluminescence research community to live imaging by light-emitting vectors is beginning to exceed the *in vitro* assay or diagnostic field and is slowly expanding its utilization into live animal (veterinary) applications and even into human clinical trials.

The ability to monitor host-pathogen interactions in live animals based on low light imaging, especially in tumors and metastases, will set new horizons for understanding the role of the host immune system in eradication of tumors and, thus, reaches far beyond the capability of cell culture infection assays. These developments in imaging over the past 20 years demonstrate once again the need for longterm support from funding agencies such as the National Institutes of Health, especially in novel and innovative research.

The organizers and I are grateful to all the generous donors for their support. A special thanks is owed to the management of Genelux Corporation, which contributed the majority of the outside financial support, and all my competent and friendly staff who aided the participants of the 14th International Symposium without pay. Lastly, I would like to thank Dr. Phil Hill, all of my colleagues in the ISBC, the chairpersons and organizers and the graduate students for their selflessness, unconditional and generous help. Without them, none of this would have happened in San Diego.

Cordially,
Aladar A. Szalay, PhD
The President of 14th International Symposium on Bioluminescence and Chemiluminescence

CONTENTS