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J. Woodland Hastings

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Harvard University
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13. ABSTRACT *(Maximum 200 words)*

This grant provided travel and subsistence for scientists to attend and report research findings at the 9th International Symposium on Bioluminescence and Chemiluminescence, held at the conference facilities of the Marine Biological Laboratory, Woods Hole, MA from October 4 to 8, 1996. There were 256 persons registered and 169 abstracts submitted, all of which were published in the Journal of Bioluminescence and Chemiluminescence. The program was organized to have no parallel sessions except for one afternoon on education, so all attendees were able to attend all presentations. Evening sessions were devoted to plenary talks with broader coverages.

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GRANT #: N00014-96-1-1103 FINAL REPORT

PRINCIPAL INVESTIGATOR: Dr. J. Woodland Hastings

INSTITUTION: Harvard Univ., Dept Molecular & Cellular Biology

GRANT TITLE: A Symposium on Bioluminescence & Chemiluminescence

REPORTING PERIOD: 15 July 1996- 14 July 1997

AWARD PERIOD: 15 July 1996- 14 July 1997

OBJECTIVE: Provide travel and subsistence for scientists to attend and report research findings at the 9th International Symposium on Bioluminescence and Chemiluminescence.

APPROACH: The program was planned to embrace both basic science and applied research in bioluminescence and chemiluminescence. In addition to support from The Office of Naval Research, which was acknowledged in the program and publication, seven commercial sponsors and fifteen exhibitors contributed to the funding. An international scientific program committee aided by a US planning committee provided advice in all aspects of the organization and session planning. Their names are given in the first page of the meeting program (see Appendix).

The meeting was convened starting on Friday, October 4, 1996 with the final sessions on Tuesday October 8. There were 256 persons registered, of whom about 15 were unable to attend at the last minute, and 169 abstracts submitted, all of which were published in the Journal of Bioluminescence and Chemiluminescence. The program of oral presentations, a copy of which is appended, was organized to have no parallel sessions except for one afternoon on education, so all attendees were able to attend all presentations. Evening sessions were devoted to plenary talks with broader coverages. Two poster sessions (47 and 48 posters) were scheduled with a two day hanging period and a designated time for discussion.

ACCOMPLISHMENTS: The symposium was characterized by attendees, including the several representatives from the Office of Naval Research, as highly informative and very productive in terms of reporting new findings, generating new relationships and stimulating new ideas. Among other things, the crystal structure of GFP was presented for the first time, and a representation of this structure was used as the cover illustration for the volume of papers published from this meeting.

The abstracts were published in two issues of the Journal of Bioluminescence & Chemiluminescence (see Publications, below), covering topics ranging from theoretical chemistry to analytical applications of luminescence. The papers presented were published in a symposium volume edited by Hastings, Kricka and Stanley, which appeared and was distributed to all attendees less than five months after the meeting. The program officer at the Office of Naval Research was provided with a copy of this book.

SIGNIFICANCE:

Basic studies of bio- and chemi-luminescence have provided fundamental insights into chemical mechanisms. They have also facilitated the development of applications of luminescence in numerous diverse uses. In the last decade such developments have been rapid and effective. The use of bioluminescence for analytical specific detection of analytes has been well established and is widely used in biological and medical research.
Luminescence also provides a marker that in many applications can and does replace radioactivity, as in the use of chemiluminescence for DNA sequencing. The most recent and most rapidly developing area is in following gene expression, for which several different luciferases have been employed (bacterial, firefly, coelenterate). The most widely used of such luminescent substances is green fluorescent protein, which occurs as a part of the bioluminescent system of a variety of jellyfish and other coelenterates. Thus studies of basic mechanisms in bioluminescence, as with numerous other areas of research, has led to many advances and applications in numerous other areass.

PUBLICATIONS

Hastings, J. W., Kricka, L. J. and Stanley, P. E. (Editors) (1997) **Bioluminescence and Chemiluminescence: Molecular Reporting with Photons**. Proceedings of the 9th International Symposium. John Wiley & Sons, Chichester 568pp.

Abstracts, 9th International Symposium on Bioluminescence & Chemiluminescence, Marine Biological Laboratory, Woods Hole, MA., 4-8 October, 1996. **J. Biolumin Chemilumin** (1996) **11**: 231-265.

Abstracts, 9th International Symposium on Bioluminescence & Chemiluminescence, Marine Biological Laboratory, Woods Hole, MA., 4-8 October, 1996. **J. Biolumin Chemilumin** (1997) **12**: 21-31.

Appendix:
1) Four pages from the program booklet with listings of plenary lectures and oral research presentations.

9th INTERNATIONAL SYMPOSIUM on BIOLUMINESCENCE & CHEMILUMINESCENCE

Woods Hole MA • October 4-8, 1996

SYMPOSIUM SECRETARIAT: Professor J. Woodland Hastings, Chairman, Karen A. Christians, Secretariat
Harvard University, 16 Divinity Ave., Cambridge, MA 02138

Supported in part by a Grant from:
THE OFFICE OF NAVAL RESEARCH

WE GRATEFULLY ACKNOWLEDGE SPONSOR SUPPORT

International Science Foundation, N.Y. ..... Travel grants
EG & G Berthold, Wilbad, Germany ..... Marlene DeLuca Prize
Dynatech Laboratories, Chantilly, VA ..... Travel grant
Lumigen, Southfield, MI ..... Evening Mixer
MGM Instruments, Hamden, CT ..... Coffee break
Clontech Laboratories, Palo Alto, CA ..... Coffee break
Lab Systems-Denley, Needham Hts. MA ..... Coffee break

COMMERCIAL EXHIBITORS

Exhibit tables (by numbers; see floor plan); mailing addresses are given at the back of the program.

(1) Packard Instrument Company, Inc.
(2) STRATEC Electronic GmbH
(3) Photek Limited
(4) Laboratory Technologies, Inc.
(5) Turner Designs, Inc.
(6) Boehringer Mannheim
(7,8) Wallac Inc., an EG&G Company
(7,8) EG& G Berthold
(9) Tropix, Inc.
(10) BMG LabTechnologies, Inc.
(11) Clontech Laboratories, Inc.
(12) Princeton Instruments, Inc.
(13) MGM Instruments, Inc.
(14) Universal Imaging Corporation
(15) Hamamatsu Photonic Systems

INTERNATIONAL SCIENTIFIC PROGRAM COMMITTEE

LOCAL (US) COMMITTEE

9th INTERNATIONAL SYMPOSIUM on BIOLUMINESCENCE & CHEMILUMINESCENCE

Marine Biological Laboratory • Woods Hole, MA • October 4-8, 1996

Program

Sessions in Lillie auditorium except where noted

Friday PM

Registration Desk open: 3PM to 11PM

(Late arrivals, get key from night watchman)

BUFFET SUPPER: **Swope dining hall 6:00-9:30 PM**

OPENING RECEPTION AND MIXER:

Meigs Room, Swope 9:30-11:00PM

Saturday AM Session 8:45 AM

Introductory remarks: J.W. Hastings, Organizer

Welcome to the MBL: **Dr. John Burris, Director**

- **Chemistry & enzymology of light emitting reactions**
  Co-chairs T. Wilson (US) and Y. Kishi (US)
- Mechanisms in chemiluminescence & bioluminescence: some unfinished business. (25 min) F. McCapra (UK))
- Low temperature photooxygenation of a coelenterate luciferin analog, synthesis and proof of 1,2-dioxetanone as luminescence intermediate. (20 min) M. Isobe (Japan)
- Chemiluminescence of Davis' oxaziridine in the presence of strong bases. (20 min) M.N. Stojanovic and Y. Kishi (US)
- On the mechanism of the peroxyoxalate reaction: synthesis and chemiluminescence characteristics of an intermediate. (20 min) W.J. Baader (Brazil)

COFFEE BREAK 10:30-11:00

SPONSORED BY **MGM Instruments, Hamden, CT**

- Stability and reactivity of oxygenated luciferase-flavin intermediates. (20 min) S.-C. Tu (US)
- Mechanism of excited state production in bacterial bioluminescence. (20 min) S. Ghisla (Germany)
- The interaction of fluorescent antenna proteins with bacterial luciferase reaction intermediates. (20 min) J. Lee (US)
- Flavin reductase P: structural basis for the production of reduced flavin. (20 min) K.L. Krause (US)

LUNCH 12:30-1:30 PM **Swope Dining Hall**

Saturday PM Session 2PM

- **Quorum sensing & regulatory elements controlling bacterial bioluminescence**
  Co-chairs : E.P. Greenberg (US) and A. Eberhard (US)
- Intercellular signalling in marine *Vibrio.* (25 min) B.L. Bassler (US)
- The *Vibrio fischeri LuxR-LuxI* system, a model for quorum sensing in Gram-negative bacteria. (20 min) E.P. Greenberg (US)
- H-NS protein represses transcription of cloned *lux* system of *V. fischeri* and other luminous bacteria. (20 min) S. Ulitzur (Israel)
- The glucose-effect on bacterial bioluminescence seems to be partially due to inhibition of autoinducer synthase by protein $EIIA^{Glc}$. (15 min) U.K. Winkler (Germany)
- Insect pathogenic *Xenorhabdus nematophilus* may have an autoinducer regulatory system similar to *Vibrio harveyi.* (15 min) E.A. Meighen (Canada)
- Genetic study of chaperonin-bacterial luciferase interaction. (15 min) A.P. Escher (US)

Society Business Meeting: 4PM

Agenda items: Adoption of constitution and by laws

Election of Officers and Councilors

Selection of organizer and site for meeting in 1998

Saturday Posters and exhibits: open all day

Swope lobby & lounge, Floors 1 and 2:

(Posters' organizer: **Anatol Eberhard**)

OPEN BAR: 5:00 PM

DINNER: **Swope dining hall 6:00-7:30 PM**

Saturday Evening Session 8PM

- **Symbioses of luminous bacteria with higher organisms**
  Co-chairs: K. Nealson and E. Widder
- The *Euprymna scolopes/Vibrio fischeri* symbiosis.
  The squid says: Margaret McFall-Ngai (US)
  The bacterium responds: Edward Ruby (US)

MIXER: Meigs Room, Swope 9:30-11:00PM

SPONSORED BY **Lumigen, Inc. Southfield, MI**

Sunday AM Session 9 AM

- Firefly luminescence and applications
  Chair: L. Kricka (US) and K. Wood (US)
- Chaperone DnaK and ATP participate in the in vivo folding of firefly luciferase synthesized by *E. coli* cells. (30 min) N.N. Ugarova (Russia)
- Structure of the catalytic site of firefly luciferase and bioluminescence color. (20 min) L. Brovko (Russia)
- Chemical modification of firefly luciferase (20 min) F. Leach (US)
- HIS-433 as a key residue for the color difference in firefly luciferase, Hotaria parvula. (20 min) H. Ueda (Japan)

COFFEE: 10:30-11:00
SPONSORED BY **Clontech Laboratories, Palo Alto, CA**

- Genetically engineered firefly luciferase as a label in immunoassays and gene probe assays. (20 min) D.J. Squirrell (UK)
- Biotinylation of firefly luciferase *in vivo:* purification and immobilization of bifunctional recombinant luciferase. (20 min) C.Y. Wang (US)
- Co-reporter technology integrating firefly and *Renilla* luciferase assays. (20 min) B.A. Sherf (US)

LUNCH: 12:30-1:30 PM Swope Dining Hall

Sunday PM Concurrent Sessions

Session A: Lillie Auditorium 2PM

Luminescence in medicine & disease, clinical chemistry & microbiology, Chairs: P. Stanley (UK) and D.J. O'Kane (US)

- Introductory Remarks: Clinical untility of bioluminescence and chemiluminescence: basic research translated into clinical practice. (10 min) D.J. O'Kane (US)
- Application of fluorescence, bioluminescence, and chemiluminescence technologies to antibacterial drug susceptibility testing. (15 min) R. Cooksey (US)
- Native chemiluminescence of neutrophils from synovial fluid of patients with rheumatoid arthritis. (15 min) J. Arnhold (Germany)
- Chemiluminescence imaging as a bioanalytical tool (15 min) A. Roda (Italy)
- Lumigen™ APS: new substrates for the chemiluminescent detection of phosphatase enzymes (15 min) H. Akhavan-Tafti (US)
- Evaluation of the bioluminescence-enhanced zona binding assay. (15 min) W. Miska (Germany)
- The use of adenylate kinase for the detection and identification of low numbers of micro-organisms. (15 min) M.J. Murphy (UK)

Concurrent Session B: Whitman Lecture Hall 2PM

Luminescence in Science Education

Co-chairs: S. Albrecht (Germany) and J.D. Andrade (US)

- Transformation experiment using bioluminescence genes of *Vibrio fischeri* as a teaching tool. (15 min) J. Slock (US)
- Dr. Darwin's curiosity shop and the sparkling science curiosity road show. (15 min) A.K. Campbell (UK)
- Bacterial bioluminescence in ecological education (15 min) V.A. Kratasyuk (Russia)
- Real Scientist: an educational kit using bioluminescent bacteria and CD-ROM. (15 min) P.E. Andreotti (US)
- A bioluminescence/chemiluminescence bibliographic database for research and education. (15 min) D.J. O'Kane (US)
- Applying bioluminescence to science education. (15 min) J.D. Andrade (US)

Society Business Meeting, second session: 4PM

Sunday Posters and exhibits: open all day, Swope lobby & lounge, Floors 1 and 2: (Posters' organizer: **J.-F. Rees**)

OPEN BAR: 5:00 PM
DINNER: **Swope dining hall 6:00-7:30 PM**

Sunday Evening Session 8PM

- **Aequorin and calcium imaging**
  Co-chairs: A. Szalay (US) and O. Shimomura (US)
- Introductory remarks: Luciferase imaging in transformed cells and organisms. (10 min) A. Szalay (US)
- As time glows by: sleuthing the circadian clock mechanism with luminescent reporters (30 min) C.H. Johnson (US)
- Aequorin and calcium imaging (20 min) R. Créton (US)
- Imaging recombinant aequorin, kinases and ATP in defined compartments of living cells. (20 min) A. Campbell (UK)

MIXER: **Meigs Room, Swope 9:30-11:00PM**

Monday AM Session 9AM

- Coelenterate luminescence, green fluorescent protein & applications Chairs: D. Prasher (US) and W. Ward (US)
- Introductory remarks (10 min) W. Ward (US)
- Recent advances in the use of green fluorescent protein as a genetic reporter. (30 min) P.A. Kitts (US)
- Quantitative imaging of green fluorescent protein. (20 min) D.W. Piston (US)
- GFP as a marker of a nuclear pore complex protein. (20 min) E. Hallberg (Sweden)

COFFEE: 10:30-11:00
SPONSORED BY **Lab Systems-Denley, Needham Heights, MA**

- The molecular structure of green fluorescent protein. (20 min) G.N. Phillips (US)
- Monitoring biofilm induced persistence of Mycobacterium in drinking water systems using GFP fluorescence. D. White (US)
- Characterization and applications of GFP mutants with enhanced fluorescence. (20 min) B. Cormack (US)
- Optimization of GFP as a marker for detection of bacterial environmental samples. (20 min) J.K. Jansson (Sweden)

LUNCH: 12:30-1:30 PM Swope Dining Hall

Monday PM Session 2PM

- **Luminescent reporter genes in cell biology and analytical applications**
  Chair: I. Bronstein & G. Sayler
- Bioluminescent bioreporters for toxicant detection, and bioavailability and biodegradation assessment (20 min) G.S. Sayler (US)
- Measurement of bioluminescence in single bacterial cells: application to biofilm research (20 min). R.J. Palmer (US)
- Chemiluminescence imaging as a bioanalytical tool. (15 min) P. Pasini (Italy)

BREAK

- Combined luminescent assays for multiple enzymes. (20 min) I. Bronstein (US)
- Applications of luminous oxidative stress biosensors: understanding disinfectants mode of action (15 min) S. Belkin (Israel)
- Chemiluminescence determination of catalase at physiological H_2O_2 concentrations. (15 min) S. Mueller (Germany)
- Real-time sequence-based DNA analyses using bioluminescences (15 min) P. Nyrén (Sweden)
- Bioluminescent multienzymic toxicity tests: methods, problems and advantages. (15 min) V. Kratasyuk (Russia)

Monday Posters and exhibits: open all day
Swope lobby & lounge, Floors 1 and 2:
(Posters' organizer: S.-C. (David) Tu)

OPEN BAR: 5:00 PM

Monday Evening Banquet 7-9PM Swope Dining Hall

Master of Ceremonies: Woody Hastings

Guest of Honor: Eric Schram

Presentation of the Marlene De Luca Prize:
Anthony Campbell and Fritz Berthold

After dinner address:
Reflections on light. Kenneth Nealson

Tuesday AM Session 8:30 AM
Oceanic bioluminescence: physiology, functions and evolution
Chair: J.-M. Bassot (France) and J. Case (US)

- Bioluminescent signals and systems: variety is the spice of light. (30 min) P. J. Herring (UK)
- The microscopical structure of the bioluminescence system in the medusa *Periphylla periphylla.* (20 min) P.R. Flood (Norway)
- Bioluminescent responses of the scyphozoan *Periphylla periphylla* from a Norwegian fjord. (video) (20 min) P.J. Herring (UK)
- *In situ* video recordings of bioluminescent displays in the Gulf of Maine. (20 min) E.A. Widder (US)
- *Pholas dactylus*, the remarkable mollusc. (video) (20 min) J. Knight (UK)

COFFEE: 10:00-10:30

- The dark side of marine bioluminescence: a novel non-luminescent function for coelenterazine. (20 min) J.-F. Rees (Belgium)
- The bioluminescent field of the Atlantic Ocean. (20 min) R. Williams (UK)
- The estimation of plankton biomass distribution in the layer of 0-100 meters by bioluminescent field parameters. (20 min) J.A. Rudjakov (Russia)
- The bioluminescence field as an indicator of the spatial structure of the planktonic community of the Mediterranean Sea basin. YuN. Tokarev (Ukraine)

Bag lunches provided for all participants
PM Trip on MBL collecting boat 2PM
($25; by sign up only)