

# PROGRESS IN PHOTOBIOLOGY

Proceedings of the  
VI. International Congress on Photobiology

Bochum, 21. - 25. 8. 1972

Editor

GÜNTHER O. SCHENCK

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**Editor**

**GÜNTHER O. SCHENCK**

**on behalf of the Organizing Committee**

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DER VI. INTERNATIONALE PHOTOBIOLOGIE-KONGRESS BOCHUM 1972  
STEHT UNTER DER SCHIRMHERRSCHAFT DES HERRN BUNDESPRÄSIDENTEN

D.Dr.Dr. Gustav W. Heinemann

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## ACKNOWLEDGEMENTS

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We owe special thanks to the Ruhr-Universität Bochum and to the Gesellschaft der Freunde der Ruhr-Universität Bochum, the Deutsche Forschungsgemeinschaft and the Stifterverband für die deutsche Wissenschaft e.V. Our sincere thanks are due to the many nameless helpers behind the scene who contributed to the success of the congress as well as to those mentioned in the course of the Proceedings.

The printing of the Proceedings has been made possible by the above-mentioned financial support and by the help of the printing facilities of the Institut für Strahlenchemie im Max-Planck-Institut für Kohlenforschung.

## Preface

Photobiology is concerned with areas in which science is applied on the grandest scale, agriculture and energy resources for example, and with one of the most fundamental questions of natural philosophy, the origins of life. It is an important factor in many environmental problems, and in areas of medicine such as dermatology and vision. In spite of this diversity of application it is a science soundly based on fundamental principles which, although derived from other disciplines, have been established and extended to photobiology relatively recently - particularly over the last two decades.

The International Congress on Photobiology is held only once every four years and this, together with the fact that photobiology is one of the most rapidly developing subjects, ensures that the papers contain much that is new, and that each Conference is able to report significant progress. The interdisciplinary nature of the subject of photobiology is another reason why these Congresses are so valuable and why this report of the Sixth International Congress, held in Bochum in 1972, will be valuable not only to all who call themselves photobiologists but to the far greater number of physicists, chemists and biologists whose work has led them into one of the many areas where light and living matter interact.

The President of the 6th Congress, Professor G.O.Schenck, who was largely responsible for the organisation of the meeting, has also served as editor of this volume of the Proceedings and the Comité International de Photobiologie, and indeed all photochemists are greatly indebted to him for his indispensable contribution to the success of the Congress and for making the Proceedings available to us all.

Sir George Porter  
President, C.I.P.



The present Proceedings of the VI. International Congress on Photobiology are a documentation of the scientific and other activities of the congress. They reflect "Progress in Photobiology" to the state of the art in 1972. The Proceedings are essentially based on 45 full papers of invited speakers and 326 abstracts, most of them containing references to the pertaining literature. A good coverage of the actual literature (ending 1972) was obtained providing easy access to photobiological documentation. It is our hope that this book may serve as an interdisciplinary source-book of photobiology for those already interested in the field as well as for the newcomer from any neighbouring discipline.

Our special thanks are due to all authors of invited papers who kindly completed and delivered their full manuscripts after the oral presentation at the congress. In the first place we have to thank M. Calvin for providing his scientific opening address entitled "Solar radiation and life" and to E.J. Bowen, R. Latarjet and G. Porter for their public evening lectures and the dinner talk. This outstanding group of authors set the standards and attracted others to follow:

Of Section I: F. Wilkinson and J. Jousset-Dubien; of Section II: C.S. Foote, H. Berg, M. Koizumi, H. Tsubomura, J.D. Spikes, N.J. Turro, N.K. Krinsky, L. Musajo, A. Kornhauser and L. Santamaria; of Section III: K.C. Smith and R.S. Cole; of Section IV: P. Schopfer, W. Shropshire, Jr. and W. Haupt; of Section V: W. Kreutz, L. Packer, B. Kok, W. Junge, B. Rumberg and A.R. Crofts; of Section VI: H. Glubrecht, P.M. Rentzepis, W. Waide-lich, R. Rigler, P.H. Bartels and V. Zanker; of Section VII: M.A. Pathak, J.H. Epstein, B.E. Johnson, J.C. van der Leun, I.A. Magnus, H. Ippen, K. Schwarz, L.C. Harber, E.G. Jung and G.H. Findlay; of Section VIII: E. Raschke, R. Reiter and R. Schulze.

There is a complete documentation of the opening ceremony including the presentation of the Finsen-Prize medals to Th. Förster, R. Hill and R. Latarjet. Th. Förster died May 20, 1974 on the way to his institute. Photobiology has lost a great scientist whose studies contributed much to the present understanding of the primary events in photobiology. As a vice-president of the photobiology congress he served as organizer of the plenary symposium "Photochemistry and photobiology" of Section I. Th. Förster's outstanding work and variety of contributions are cited in the Finsen-laudatio written in his honor by E.J. Bowen.

During the unsettled financial situation in the planning state of the congress it was decided to refrain from any proceedings of the congress. Later, when the Book of Abstracts came into press we hoped to print at least a full coverage of the opening ceremony and the public evening lectures including the dinner talk. At the beginning of the congress week, however, thanks to industrial financial support it turned out that a low-priced edition of congress proceedings was feasible provided that it could be produced in a similar way as earlier the Book of Abstracts. Congress participants showed a strong interest in such proceedings by answering our questionnaire.

The purpose of the Proceedings of a congress may be seen either as a mere edition of the scientific papers presented at the meeting. Or, in a wider sense, it may be considered as the attempt of a more or less complete documentation of the congress reflecting all its various activities. The present version is a compromise between the two views. In order to lower the overall printing costs we had to apply the same photo-offset printing technique (and where possible as in the part of contributed papers the same printing plates) as used earlier in the production of the Book of Abstracts. Here four type-written manuscript pages had been reduced in size to one page size of this book. The texts turned out to be still readable to the average reader and the Book of Abstracts found a friendly acceptance, as demonstrated by those who bought second copies. In fact nobody can be happy with the small size of the texts but it seems acceptable as a compromise. All papers have the same numbers as earlier in the Book of Abstracts and in the program. References in the contents, program and author index mean the number of the paper and not the page numbers.

We would be glad to take care of a second printing with a less reduced size of text if the necessary money could be spent on that. We have to ask the authors and readers for their kind understanding and patience.

As a hard consequence of the late decision on the proceedings we had to ask for manuscripts of invited papers only in the course of and after the congress. This certainly caused some trouble to the majority of our friendly authors and, quite understandably, a number of our invited speakers was unable to complete manuscripts for our purpose. To all we owe our apologies. We also ask for a kind understanding for the delay in the editing of the proceedings. After manuscripts had been promised we had to wait for many more months than expected and our timing ran completely out of phase.

The preceding international photobiology congress in Germany was held in Wiesbaden in 1936 under the title "3. Internationaler Kongress für Lichtforschung" under W. Friedrich as president. It is worthwhile to compare the "Kongressbericht" that means the proceedings of this congress which was organized during the period of the Comité International de la Lumière, the precursor of the Comité International de Photobiologie. Unfortunately, the Wiesbaden proceedings cannot easily be traced in libraries. There is indeed a full coverage documentation of the congress in this report. There are 100 scientific (97 in the program) papers and to a large extent verbatim reported discussions. The scientific part was printed on 680 pages. There are, however, 80 more pages essentially on documentation of the congress organization, statutes, program, ladies program, exhibition and list of apparatus demonstrated, organization of the Comité International de la Lumière, its various commissions and national committees, report of the secretary general of the C.I.L., Professor Rosselet to the congress and a special report by W.W. Coblenz on page xxxv on "Intensity requirements of ultraviolet lamps for acceptance by the American Medical Association". According to the statutes of the congress the authors agreed with the publication of the papers in the journal "Strahlentherapie" if the editor of the periodical decides to publish (p. xii). Unfortunately, however, only 42 of the 100 papers contained in the Wiesbaden proceedings have been published in Strahlentherapie 61 (1938) 403-715. No hints were given to the papers omitted, for example the important contributions by W.W. Coblenz (see also W.W. Coblenz [Washington], Physical methods of lightdosimetry, Wiesbaden proceedings p. 91-109). The same is true for a paper by R. Latarjet on "Une nouvelle méthode physique de dosimétrie de la lumière", Wiesbaden congress report p. 115-120. Reference is only made in Strahlentherapie to the official "Kongressbericht" containing the whole of the papers and discussions but no detailed bibliographic data can be found.

From the fate of the Wiesbaden proceedings we learned that full coverage in documentation is desirable, easy bibliographic retrieval and a broad distribution among the scientific community is necessary.

Most of the Wiesbaden proceedings were printed in German. German, English, and French had been accepted as congress languages. One of the most drastic decisions we had to make in the early state of planning of the Bochum congress was on congress language. We decided to accept English as the only official congress language. Everybody, however, might present his paper in his own tongue provided an English abstract is available. By renouncing a simultaneous translation service we were able to avoid a financial burden which would have been intolerable for our budget. Our decision was essentially intended to serve the economy of information exchange. Finally, it turned out completely justified by the fact that contributions from English speaking countries amount to by far the highest percentage: 166 out of 390, that is 42.6%. Here, the U.S.A. are in the leading position with 130 contributions = 34.3% followed by the U.K. with 32 contributions (8.2%). The Organizing Committee of the congress is proud that scientists from the Federal Republic of Germany have provided 51 (20.7%) contributions. Since no other language shows a higher than 6% representation with regard to the origin of papers we may conclude that the decision on language was a fair one which really serves the scientific purpose of the congress. In this con-



text it is interesting to learn that the Wiesbaden congress was attended by 6 participants from the U.S.A. with 3 papers presented and by 12 participants from Great Britain with one paper presented.

The change of national contributions to the two congresses in 1936 and 1972 indicates an international shift of activity in various fields of research.

For an analysis of this type it was useful to find the list of participants (326) included in the Wiesbaden proceedings. Unfortunately, our 1972 list of participants cannot be included because space doesn't permit it. Instead the Comité International de Photobiologie decided to prepare a new (Second Edition) International Directory of Photobiologists which will be distributed by the Secretary-General of the C.I.P., Dr. David O. Hall. It contains about 2300 addresses from 52 countries. Copies will be kept at least at various places listed below.

For several reasons we had not limited the submission of contributed papers to the 1972 congress. As a result we obtained an approximate activity profile of present photobiological research. This shows that Section V, Photosynthesis, received by far the highest number of contributed papers, 86 out of 261, that is 33%. It's interesting that all contributions from Israel belong to Section V, Photosynthesis, whereas those from Italy essentially belong to Section II, Photobiochemistry, photodynamic action. The fact that different nations may focus on different scientific goals supports the demand for large international and interdisciplinary congresses on photobiology to be held from time to time as sponsored by the C.I.P. and its possible future successors. The change of scientific emphasis became especially clear by the comparison of the Wiesbaden proceedings with the Bochum congress. I have already pointed to this fact in my official speech.

Similarly after 36 more years the proceedings of the VI. International Congress on Photobiology may be helpful to analyze the changing world of photobiology. The essential variables involved may be scientific, environmental and sociological as well. The selection of documentation presented here may then perhaps appear rather naive. Perhaps more emphasis should have been laid on critical remarks from students who disliked the international conference as a typically capitalistic project or on questions from the press who expected a photobiologist to be a photographer taking pictures of butterflies.

In the course of the congress it turned out that it was right to ask the participants in advance for cooperation and tolerance and for kind understanding that we had to compromise in so many respects. It began with our own mistake. A large poster in the congress hall showing the congress emblem was intended to serve as decoration for the opening ceremony. A misspelling told the surprised audience that this was an international "Lady Photobiologists Congress" as translated from the Latin "Congressus Internationalis Photobiologae" instead of "Congressus Internationalis Photobiologiae" (International Congress on Photobiology). This of course stimulated all the Latin conscious scientists to smile and was the beginning of a scientifically most healthy attitude: keep your sense of humor and don't take anything too seriously including yourself. Already before the beginning of the opening ceremony the president had to learn that an immediate repair was technically impossible. So he quieted himself knowing that a special congress postmark with the correct Latin spelling was available in the congress mail office. Immediately after the opening ceremony, two scientists of international reputation demonstrated their knowledge of Latin and showed that their gifts could be spent on poetry as well:

Attending Congressus in Bochum  
We found many languages spochum  
The French, German and Dutch,  
English, Slavic and such  
Were perfect, but Latin was brochum.

C. S. Foote

"Never simple, and seldom pure"  
Truth is often most obscure  
That is why we took the lure  
To meet our colleagues in the Ruhr.

The programme was heavy, the subject was light.  
Our lectures told us exactly what's right.  
The sunshine was dim, but the science was bright,  
And we basked in a general Gemütlichkeit.

The Committee we thank for a most pleasant stay  
At this Sixth Congressus Photobiologiae  
(Or so it was spelt in this curious way)  
We all have enjoyed it, so Hip, Hip, Hooray.

E. J. Bowen

After the opening ceremony the Organizing Committee, honorary guests and representatives from each country were invited to a formal lunch by the Lord Mayor of the City of Bochum, represented by H. Kuhnert. All participants enjoyed gratefully the warm hospitality and the exchange of friendly speeches.

During the congress we were able to use the "Haus der Freunde" by courtesy of the Gesellschaft der Freunde der Ruhr-Universität Bochum and their president Dr. H. Kost. It served for the offices of the presidents of the C.I.P. and of the congress. Its Gemütlichkeit provided a friendly atmosphere for all gatherings at this place. On Sunday afternoon, August 20, we had a meeting of the Board of the C.I.P., then of the Executive Committee of the C.I.P. Sunday night was reserved for a business meeting of the Editorial Advisory Board of Photochemistry and Photobiology. On Monday night a press conference was held. A reception by the president of the congress on behalf of the supporting industry and friends was organized on Tuesday night for the invited speakers, the Organizing Committee and the helping staff of the university. Many friends from the neighbouring industry and institutes joined in. After the welcome and thanks to all whom it concerned by the president, Sir George Porter addressed B. Rajewsky as the president of the German National Committee. He expressed his special thanks for Rajewsky's long lasting contributions to the C.I.P. and his unique responsibility and merits in bringing the congress to Germany and creating the Organizing Committee. Many participants from abroad who planned to attend the beer party at Schlegel's brewery had to leave earlier but felt a bit uneasy expecting another unknown way on the campus. Many who tried to find their way out of the university after the welcome evening on Sunday night or hoped to attend the chamber music on Monday night (three Sonatas Viola da Gamba by J.S.Bach by invitation of the Musikisches Zentrum der Universität) were lost on the campus. Th. Förster, therefore, decided to release his poem of consolation immediately. It was accepted with great applause.

The new university at the Ruhr  
Will flourish, of this I am sure.  
But I frankly must say  
That to find there one's way  
Orientational help is quite poor.

Th. Förster

On Wednesday, August 23, afternoon, an excursion to the Rhine followed by a boat trip down the river to Bonn was scheduled for all participants. It was great fun, no rain, many pictures taken. H. Langer's laboratory band provided excellent musical entertaining. On Thursday, August 24, social evening with dinner at the Stadtpark-Restaurant Bochum. Sir George Porter presented his highly appreciated dinner talk (see 04). The ladies provided a charming atmosphere and R. Latarjet honored the ladies in a witty speech. Dancing with Müller's jazzband was great.

On Thursday, August 24, the General Assembly of the C.I.P. met in the Haus der Freunde. Then the last meeting at this friendly house took place on Saturday noon as an informal gathering of the participants of the symposium "Photochemistry and the origin of life".

After a busy week as documented by the scientific program the official part of the congress came to the point where we could say with relief "all's well that ends well"! On Friday, August 25, we met for the closing evening at the Kammerspiele of the Bochum municipal theater. The Yves Joly puppet theater, Paris, surprised the audience by its excellent and most imagi-

native performance and drove all of us to high spirits. During the intermission German sparkling wine was served as a refreshment and further stimulant. After meeting again in the theater G.O. Schenck expressed his gratitude to all who had worked hard for the success of the congress, welcomed the participants of the joint meeting of the dermatological association and those of the continuing symposia and finished by declaring himself past-president. Then Sir George Porter expressed his thanks to G.O. Schenck and his co-workers of the congress, announced that the General Assembly of the C.I.P. had elected R.B. Setlow as president of the C.I.P. and that it was decided to convene the VII. International Congress on Photobiology in Italy in 1976. Finally he declared the VI. International Congress on Photobiology as closed. The puppet theater then continued with its second part and, believe it or not, the closing evening became one of the most joyful events to remember.

G.O. Schenck

#### Publications of Joint Meetings

##### Special Symposium

"Photochemistry and the Origin of Life", in Space Life Sciences 4 (1973) 434-515

##### Joint Meeting of the Northrhine-Westphalian Dermatologist Association

"Photo-Dermatoses and Porphyrins", in H. Ippen und G. Goerz, Photodermatosen und Porphyrinen, (Copyright H. Ippen), Düsseldorf 1974. Inquiries: Prof. Dr. H. Ippen, Hautklinik der Universität, D-3400 Göttingen

##### Special Symposium

"Biochemistry and Physiology of Visual Pigments", in H. Langer, Biochemistry and Physiology of Visual Pigments, Berlin-Heidelberg-New York: Springer 1973

#### ARCHIVAL CENTER FOR RADIATION BIOLOGY Alexander Hollaender, Director

The University of Tennessee has developed in its Research Library at Knoxville, Tennessee (USA), an international center for archival material related to radiation biology including photobiology. The emphasis is on relevant manuscripts, research notes and data, scientific society proceedings, scientific correspondence, bibliographies, and rare specialized journals in all languages from scientists in all countries. Although the emphasis in this depository is upon manuscript materials, the library also will include significant published books and journals, as well as photographs and photoduplicated material. All of these materials are being catalogued by librarians at the University and will be available for use by scholars and advanced students interested in the history and philosophy of science.

Dr. Alexander Hollaender, Honorary President of the C.I.P., is Senior Research Adviser of the Biology Division of the Oak Ridge National Laboratory and Professor of Biomedical Sciences. The Executive Committee of the C.I.P. gladly acknowledges his suggestions and new endeavor. All photobiologists concerned are kindly requested to contribute and to ask for more information at the Archival Center for Radiation Biology.

#### COMITÉ INTERNATIONAL DE PHOTOBIOLOGIE

The Comité International de Photobiologie (C.I.P.) is a Commission of the International Union of Biological Sciences. The aim of C.I.P. is to stimulate scientific research concerning the physics, chemistry and climatology of non-ionizing radiation (visible, ultra-violet and infra-red) in relation to their biological effects and their applications in biology and medicine. The material presented in these Proceedings of the VIth International Photobiology Congress illustrate well the interdisciplinary nature of photobiology, the enormously wide field to which photobiological studies relate and also their importance to mankind.

C.I.P. sponsors the International Photobiology Congresses, which are held quadrennially. The VIIth Congress is planned for Italy in 1976, and will probably take place in, or near Rome.

C.I.P. also sponsors other International Meetings. The next, an International Symposium entitled 'New Trends in Photobiology', will be held in Rio de Janeiro, Brazil from 15 - 20 July, 1973. This meeting is organized by the Instituto de Biofisica, Universidade Federal de Rio de Janeiro, under the patronage of the Academia Brasileira de Ciências, the Conselho Nacional de Pesquisas and the Comissão Nacional de Energia Nuclear of Brazil. The general theme of the Symposium will be the basic biochemistry and biology of ultra-violet irradiation of cellular systems and their component molecules. There will also be lectures concerning solar energy conversion by photosynthetic organisms and the subtle role of light as a factor in the environment.

A list of the Board of C.I.P. is given below. New Officers were elected at the VIth International Photobiology Congress in 1972 and will serve until the next Congress in 1976.

Board of C.I.P. 1972 - 1976		
President	R.B. Setlow	Oak Ridge, USA
Secretary-General	D.O. Hall	King's College, 68 Half Moon Lane, London SE24 9JF, U.K.
Treasurer	A. Wiskemann	Hamburg, Germany
Vice-Presidents	A. Castellani	Italy
	I. Honjo	Japan
	G.O. Schenck	Germany
	Daphne Vince-Prue	U.K.

On the occasion of the VIth Photobiology Congress, C.I.P. elected as Honorary Members, Professor Sir George Porter (U.K.) the retiring President of C.I.P., and Professor R. Schulze of Germany.

The Finsen Medals, given in memory of Niels Finsen, were awarded to Th. Förster (Germany), R. Hill (U.K.), and R. Latarjet (France).

Sixteen countries are at present officially affiliated to C.I.P. These are: Austria, Czechoslovakia, Finland, France, Germany, Hungary, India, Israel, Italy, Japan, Netherlands, Poland, South Africa, Sweden, Switzerland, United Kingdom, U.S.A. There are also individual members of C.I.P. and in addition contact is maintained with other countries which have, at present, no official links with C.I.P. In all, C.I.P. is in contact with photobiologists in about 30 countries.

D. Vince

The C.I.P. deeply regrets to announce the death of Prof. Dr. Rudolf Schulze, Hamburg, July 16, 1974. Photobiology has lost an outstanding scientist. R. Schulze, Honorary Member of the C.I.P. since 1972 was an active member of the C.I.P. (formerly Comité International de la Lumière) since 1936. He was President of the Deutsche Gesellschaft für Lichtforschung since 1965 and First Executive Vice-President of the VI. International Congress on Photobiology. His contributions to photobiology will be cited in an obituary with a list of publications appearing in "Strahlentherapie".

The first purpose of the book of abstracts is to serve the participants during the congress. The second is that it may be used later on as an interdisciplinary source-book of photobiology. Asking for references to the pertaining literature was an experiment suggested by the scientific committee and not all authors of abstracts have been able to meet our demands. Nevertheless a good coverage of the actual literature has been obtained providing easy access to photobiological documentation. Unfortunately, we have been unable to prepare a subject index, as planned originally, since a major portion of the abstracts has been received too late after the dead-line. A few abstracts which have been received after completion of the author index have been included in an addendum (beginning with number 411) with its own author index.

The present book also contains the abstracts of the special symposia, which will be published in extenso elsewhere as indicated below. The book of abstracts does not reflect, however, some of the major scientific events of the congress, which may be mentioned here for the purpose of documentation. At the opening ceremony, on Monday, August 21, 1972, there will be in addition to welcomes and speeches by G. Porter and G.O.Schenck three citations of Finsen-Prize winners 1972, which will be followed by the scientific opening address by M. Calvin on "Solar radiation and human life". Two public evening lectures on "Comparative radiation biology - Ionizing versus non-ionizing radiation" by R. Latarjet and "Vision in man" by W.A.H. Rushton will be presented and last not least the dinner talk on "Relevance of science" by G. Porter. It is hoped that these proceedings can be printed soon after the congress and be distributed to the participants of the congress later. If any of the abstracts will be published as full paper we would be pleased to receive reprints marked with the corresponding abstract number for the purpose of documentation.

For technical reasons all the titles have been rewritten by my secretary, Miss I. Heuer, whose careful help during the preparation of the congress and especially of the abstracts is gratefully acknowledged. With the enthusiastic help from the Reproduktionsteilung of the Abteilung Strahlenchemie, Max-Planck-Institut für Kohlenforschung, Mülheim a.d. Ruhr, we have tried to produce the book of abstracts with no loss of information at lowest possible cost. Manuscripts of varying qualities from black to grey print had to be photographed with the skill and tricks of Mr. Kapeller in order to provide nearly the same black offset-print in a still readable size. I wish to express my sincere thanks to Dr. H. J. Kuhn, the head of the Reproduktionsteilung and his staff for a wonderful cooperation. Some mistakes which we had discovered and removed have been replaced by others, occasionally also in the numbering on the wrong side of the abstracts. In paper no. 010 the unreadable address means "Columbia University, USA". We regret that in some cases we have been unable to withdraw an abstract which was already printed when the author had to cancel his participation of the congress. Abstract no. 31 has been replaced by no. 417 in the addendum. The careful reader may discover more mistakes. Since nobody is perfect, nothing can be made perfect at low cost. Please make the best of it and accept all my apologies.

G.O.Sch.

PS 1973:

Two evening lectures have been held: "The development of chemical ideas of light" by E.J. Bowen and "Comparative radiation biology: Ionizing versus non-ionizing radiations" by R. Latarjet. "Vision in man" by W.A.H. Rushton had to be cancelled.

## Welcome to the VI. International Congress on Photobiology

I cordially welcome the participants of the VI. International Congress on Photobiology to the Federal State of Northrhine-Westphalia. I sincerely hope that the Congress will come to good and auspicious results in the field of increasingly important interdisciplinary research. I take great pleasure in the fact that the Congress on Photobiology, held in Germany for the first time after 36 years, takes place in the State of Northrhine-Westphalia.

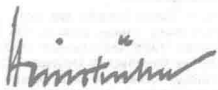
The idea of this Congress and of its joint meetings and symposia clearly indicates how important the collaboration among different disciplines, among physicians and biologists, physicists, chemists and engineers has become on the international level for the understanding of the extremely complex problems we are facing today. The relevance of the various roles of light on life, the main subject of this congress, goes far beyond the narrow frame of a merely technical meeting. It has an effect on general questions such as environmental protection, the strengthening of the world nutritional basis, traffic safety, and the improvement of the quality of life on this planet.

I consider it to be essential that this Congress conveys to the participants and to an interested public the newest results of a very complex field which in some parts may still be regarded as a "terra incognita". Thus the Congress is a sort of a "novelty fair of international photobiology".

For the Prime Minister of this Federal State, it is a special pleasure to find this Congress in Bochum - one of the most important towns of the Ruhr area. I appreciate this as an estimation of the scientific importance of this region which is especially fostered by our university policy.

I hope that the participants of this Congress, besides their scientific work, will be able by visits and excursions, to gain an impression of the often underestimated dynamics and of the special charm of this region.

To the Congress, to its organizers and all those who take part, a cordial "Glückauf"!



Prime Minister  
of the Federal State of Northrhine-Westphalia

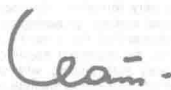
## Welcome

On behalf of the city of Bochum I welcome all participants of the VI. International Congress on Photobiology which is being held here from August 21 to August 25, 1972.

This meeting takes place one week before the Olympic Games in Munich. Here in Bochum prominent scientists interested in the biological effects of light having gathered from all over the world will contribute to the welfare of mankind through the exchange of experience and information.

I wish to express my thanks to the sponsors of this important international congress for having chosen Bochum for their meeting. Your choice is an honor for our city as well as for the Ruhr-University.

I wish you all success in your endeavour and a pleasant stay at Bochum.



Claus,  
Lord Mayor of the City of Bochum

## Welcome

The „Deutsche Gesellschaft für Lichtforschung“ has been founded in 1928 on the initiative of the röntgenologist Hans Meyer and of the physicist Walter Friedrich, who served as president from 1928 till 1948. The new society was aimed to be the union of all interested in the exploration and understanding of biological actions of light and ultraviolet radiations. Thus the Gesellschaft für Lichtforschung offered the opportunity of cooperation and communication to scientists of most diverse disciplines, such as physicians, biologists, physicists, chemists and engineers.

In the twenties and early thirties German photobiology had found worldwide recognition. Thus the III. International Congress on Light Research, sponsored by the Comité International de la Lumière has been held in Wiesbaden in 1936, organized by the Deutsche Gesellschaft für Lichtforschung. Those who attended this congress certainly remember an unforgettable meeting. After 1950 the C.I.L. has been substituted by the Comité International de Photobiologie and the congresses are now named more adequately „International Congress on Photobiology“. Therefore the VI. International Congress on Photobiology, Bochum 1972, is a true successor of the Wiesbaden 1936 meeting. Our society is proud to participate in the organization of the present congress after 36 years.

The Deutsche Gesellschaft für Lichtforschung and the German National Committee in the C.I.P. are connected by their statutes. The president of the latter committee, B. Rajewsky, has served as president of our society from 1948 till 1965 and has strengthened its scientific activity after the war.

It's my privilege to welcome all the participants of the VI. International Congress on Photobiology. I sincerely hope that this congress will stimulate and intensify the friendly and creative cooperation between all interested in photobiology.



Prof. Dr. Dr. h. c. Rudolf Schulze  
President of the Deutsche Gesellschaft  
für Lichtforschung in the F.R.G.

## A few words from the President of the Congress

A cordial welcome to all participants from all countries! The members of the organizing committee of the congress and many kind helpers try their best to make your stay in Bochum enjoyable and ensure fruitful scientific meetings. The success of the international scientific community, however, depends on mutual cooperation and tolerance. Therefore, your cooperation is needed to bring the congress to real success.

At the last congress in Hanover (USA) in 1968, the C.I.P. accepted the invitation by the German National Committee to convene the VI. International Congress on Photobiology in the Federal Republic of Germany. This congress now takes place in Bochum at the invitation of the Ruhr-University-Bochum. After Hanover, the German National Committee in the C.I.P. met several times under B. Rajewsky until the Committee of the Congress was elected and finally took over full responsibility. Also under German law a registered society was founded for the purpose of the congress. The principal outline of the Bochum Congress was accepted at the Evian 1970 meeting of the C.I.P. Later the idea of a joint meeting with the Northrhine-Westphalian dermatologists has been substantiated. In addition, the scientific gravitational field of the congress attracted three interesting satellites, the special symposia. On behalf of the organizing committee, I also cordially welcome the organizers and participants of the joint meetings and special symposia.

The scientific committee of the congress decided to honor three distinguished retired scientists for their outstanding contributions to photobiology by electing them as honorary presidents of the congress: Boris Rajewsky, Günter Scheibe and Josef J. Weiss. We hoped to have all three among us.

It was also planned to introduce our honorary presidents to our younger colleagues by biographical sketches in our program book. We are now deeply sorry that our youngest honorary president, Prof. Weiss, who while working in Mülheim/Ruhr intended to be most active himself at the congress, has suffered a most tragic and premature death. We have lost an unforgettable scientist and friend. G. Scholes, his long-time scholar and friend has now kindly written his obituary. We also thank A. Schraub and H. Dörr for the biographic sketches of B. Rajewsky and G. Scheibe, respectively.

During the preparations for the congress we have learned much about the need to compromise. Although our governmental agencies in Bonn and Düsseldorf have provided substantial financial support to our congress and in spite of private donations from the beginning we have not been able to meet the needs of all who applied for our travel grant funds. Unfortunately, many who planned to participate had to cancel for lack of sufficient travel subsistence from their own agencies.

Many contributed papers contain important new results. Unfortunately, we have to compromise on a very short time for these oral communications in order to permit all speakers to present their respective results. We are invited to use the lecture halls and other facilities of one of the most modern and unique universities of the Federal Republic of Germany. For the sake of this excellent opportunity we have to compromise again: neither can we offer high mountains nor alpine lakes nor fashionable high life in luxury hotels. For compensation, however, Prof. Langer's local committee has organized some other attractions for you which, I trust, you will find enjoyable. From the roof of the university you may see the Ruhr, the river which gave the name to one of the most densely populated industrial regions of Germany. You may be surprised finding one of the cleanest rivers in Europe, free from industrial and municipal water pollution, serving essentially as supply of drinking water. Take your time and make with our advice more discoveries in the scenic industrial and cultural environment of Bochum.

Rephrasing a word I found in a well-known old New York hotel I concentrate my best wishes for pleasure, scientific progress and new friendship into the motto for this week:

„As you are coming to the congress, whatever be your goal,  
look upon the doughnut and not upon the hole!“



Prof. Dr. Günther O. Schenck  
President of the VI. International  
Congress on Photobiology

Preceding international congresses on photobiology, sponsored by the C. I. P., have been held in Hanover (1968), Oxford (1964), Kopenhagen (Finsen Memorial 1960), Turin (1957), Amsterdam (1954). International congresses and conferences sponsored by the C. I. L. have been held in Paris (1951), Wiesbaden (1936), Kopenhagen (1932), Paris (1929) after a founding conference on light research in Lausanne (1928), from which the C. I. L. originated. The international congresses on photobiology in Amsterdam and Turin showed C. I. P.- and C. I. L.-numbers I, (IV.) and II, (V.), respectively. Thus the very beginning in Lausanne is from zero and Paris (1951) does not appear on the scale.



## B. Rajewsky, Honorary President

Boris Rajewsky, born 1893 in Tschigirin/Ukraine studied physics and mathematics at the University of Kiev, where he graduated with a thesis on "The dispersion of electric waves in dielectric liquids". In 1923 F. Dessauer offered him the opportunity to work at the "Institut für physikalische Grundlagen der Medizin" in Frankfurt a. M., which had been founded a few years earlier. Based on a series of outstanding contributions to the Institute's research program, i. e., the broadening of the basis of X-ray therapy and X-ray diagnosis, he took his doctor's degree in science at the university of Frankfurt.

Still engaged in his studies of ionizing radiations, and stimulated by the then new basic results of K. W. Hauser and W. Vahle Rajewsky realized the importance of photobiology. His studies on the behaviour of highly purified protein solutions after exposure to X-ray and U.V.-irradiation led him to recognize similarities in the mechanisms of protein coagulation and in the development of erythema. Rajewsky has been honored for these studies by receiving the *venia legendi* in 1929.

During the following years Rajewsky dedicated himself to the extension of his research field and to what he named "biophysics". He sustained his dedication to photobiology in spite of other burdens that nearly took all his time: the struggle for saving the institute after the expulsion of his well-respected teacher, F. Dessauer, by the Nazis, and the organization of the newly founded Kaiser-Wilhelm-Institut für Biophysik (now Max-Planck-Institute) after his honorable appointment as scientific member and director. During and after the war he had to overcome many extraordinary shortcomings and difficulties in order to keep research still going. Several times he became dean of his faculty and twice he served as rector of Frankfurt university after the war. Simultaneously he was active in many committees, mostly in leading positions.

In this short exposition it is impossible to outline in full detail Rajewsky's merits with regard to photobiology. Always inspiring his research students and co-workers, he participated spiritually in all publications of his institute, even when he refused to be named as co-author. Many of his former research students and co-workers are now full professors.

In the above-mentioned studies on proteins Rajewsky was confronted with problems of U.V.-dosimetry. Trying to answer (by the way with a positive result) the question of the existence of some radiation emitted during certain biochemical reactions *in vivo*, as presumed by A. Gurevich, he succeeded in constructing a "Lichtzähler" (light-counter) which was called after him, showing an up to that time unattained sensitivity. With regard to the process of vision it followed (1944) a study on "Disturbance of vision by U.V.-light", and at the same time it was shown in a further study that the human eye is still able to notice light of 890 nm, though with a sensitivity of only 2 % of that of 820 nm.

Realizing clearly that studies of photobiological effects require high light irradiance with sufficient spectral purity, Rajewsky laid special stress on the construction of large monochromators, which for the first time made possible a series of novel investigations by his co-workers and himself, such as the determination of the spectral monochromatic U.V.-irradiation, comparing studies of U.V.-irradiated skins, irradiation effects on the structure of proteins, the determination of the action spectrum of U.V. effects of lysine decarboxylase-induction in b. cadaveris, above all, detailed studies of U.V.- and heat-erythema, and studies of their discrimination and of direct pigmentation, and finally the proof that primary formation of organic substances in the primitive atmosphere can be induced also by U.V.-radiation.

Beside this promotion of scientific research in photobiology Rajewsky has earned great merit in organizing this scientific field on an international and national level. For many years he was active in the executive committee of C.I.P. and finally was elected an honorary member of the C.I.P. It was especially Rajewsky who succeeded in reestablishing the contacts between his German colleagues soon after the end of the war. In Marburg (1949), he gave new activity to the German committee in the C.I.L. (later C.I.P.), which became complemented by new elections and Rajewsky was elected president, which office he has been keeping to the present date. A large number of German scientists have already participated in the IV. C.I.L.-Congress Paris in 1951. By Rajewsky's initiative the "Deutsche Gesellschaft für Lichtforschung" obtained new impulses after the war and at the meeting in Bad Homburg in 1952 Rajewsky was elected its president. The new activity of the society was also successful in increasing the number of its members. In 1965 Rajewsky rendered his office to R. Schulze, Hamburg. Since 1950 Rajewsky also participated in the organization of the most stimulating Hanauer U.V.-Tagungen which have been made possible by the generous support from the Original "Höhen-sonne" Quarzlampengesellschaft Hanau.

Boris Rajewsky, who is still healthy and active, will soon celebrate his 80. birthday. He holds five honorary doctor degrees, he is honorary member of various societies in his own and in foreign countries and has received numerous decorations, among them the Bundesverdienstkreuz mit Stern.

A. Schraub

## Günter Scheibe, Honorary President

The contributions of Günter Scheibe to general photochemistry have been extraordinary fruitful in the field of photobiology.

Günter Scheibe was born in München in 1893 and studied chemistry in Erlangen where he did his Ph. D. with O. Fischer on "Quinocyanines". After habilitation in 1922 he soon became a. o. professor in Erlangen and in 1930 head of the department of physical chemistry. In 1928 he worked with James Franck as a guest in Göttingen. In 1932 he followed a call to the Technische Hochschule München and has been active there up to his retirement in 1961.

The scientific work of Günter Scheibe is dominated by the question on the energetics of organic molecules. Already in his Ph. D. thesis he applied the method of absorption spectroscopy, a technique which he methodically developed. Together with G. Herzberg he investigated and assigned the U. V. spectra of methyl halogenides. He discovered the charge transfer spectra of the halogenide ions and correlated these with their redox potentials.

His main interest, however, were cyanine dyes, which he liked to synthesize himself with great enthusiasm. Among them he recognized models for a large number of phenomena which are of basic importance in photobiology. The "reversible polymers" of the pseudo-isocyanine (1936) have been proved to be especially suited for the studies of intermolecular forces which lead to new ordered structures with new energetic behaviour. This has been established by fluorescence quenching, sensitization of photoreactions in solution and in the solid state, shown to be of importance for the deeper understanding of photography and photoconductivity.

In monomer dyes he discovered properties of photochemical relevance such as the relationship between excitation energy and basicity, or the polarization of transition moments and their coupling with vibrations. His studies on reversible cis-trans-isomerizations were relevant to the photochemistry of vision and the work on the influence of the environment of an excited molecule on its energy levels and electron distributions has had a general impact on photochemistry. His contributions to other fields, e. g., emission spectral analysis, are manifold and can not be enumerated here.

The scientific work of Günter Scheibe has been given wide attention and he has received many honors such as the honorary degree of the University München (1963) and Erlangen (1966), and the award of the Liebig Medal by the Gesellschaft Deutscher Chemiker (1964), and the Bayerischer Verdienstorden. He is a member of the Bayerische Akademie der Wissenschaften and of the Deutsche Akademie der Naturforscher.

H. Dörr

## J. J. Weiss (1905 – 1972), Honorary President

Professor J. J. Weiss, died on April 9th, 1972, at his home in Newcastle upon Tyne, England. His passing has meant the loss of an outstanding contributor and an extraordinary personality. His pioneering work in photochemistry and radiation chemistry and the application of the physicochemical ideas which emerged to photo- and radiation biology, are milestones in the development of these important fields. Such accomplishments were possible as a result of his deep understanding of the physical sciences, particularly chemistry, and his ability to apply the concepts in a much wider context.

Joseph Joshua Weiss was born in Austria in 1905. After obtaining his doctorate at the Technische Hochschule in Vienna, he entered the Textile Institute at Sorau in 1928 as head of the chemistry department. However, his interest in the mechanism of chemical reactions in solution, particularly the role of free radicals, prompted him to leave Sorau after only two years to take up an appointment as an assistant to Professor Fritz Haber at the Kaiser-Wilhelm-Institut für Physikalische und Elektrochemie in Berlin. Although the period spent with Haber was quite short, it was a very formative one, moulding much of his subsequent scientific career and also providing an opportunity to establish personal contact with many of the great figures in the physical and mathematical sciences. An important paper resulting from this association with Haber was that dealing with the hydrogen peroxide/ferrous-ion system in which the intermediate involvement of free radicals was proposed. Weiss accompanied Haber to Cambridge in 1933, and, on the latter's death soon afterwards, moved to University College, London, where he carried out research and obtained a Ph. D. degree. It was in the 30's that Weiss published many of his ideas on electron-transfer processes in the mechanisms of photochemical and thermal reactions in solution; such processes were postulated to occur in the quenching of fluorescence in dye-photosensitized reactions, in chemiluminescence and in systems containing aromatic molecules and polycyclic hydrocarbons.

Weiss's long association with Newcastle upon Tyne started in 1937 with his appointment to a Demonstratorship at King's College, University of Durham (now the University of Newcastle upon Tyne). In 1942 he married Frances Sonia Lawson whom he met whilst still a medical student in Newcastle, and this helped to cement his ties to Britain. It was at this stage that Weiss began his researches into the chemical effects of ionizing radiations, particularly in solutions. In 1944, he put forward the view that chemical effects in aqueous solutions could be accounted for by reactions of H-atoms and OH-radicals, this free-radical theory being elaborated in a large number of systems, including solutions of substances of biological interest. The implications to radiobiology were pointed out, thus allowing a more chemically-based approach in this important area. His interest in the radiobiological aspects continued through the years, and more latterly he had been concerned with the consequences of radiation damage on DNA templates on *in-vitro* RNA synthesis and DNA replication.

Weiss was at the forefront in the discovery of the hydrated electron produced both photochemically and by ionizing radiations, being particularly intrigued by the exact physical state of this entity. His activity across a broad scientific domain led to international recognition, and to his promotion, in 1956, to Professor of Radiation Chemistry at the University of Newcastle upon Tyne. Honours included the conferment of an honorary degree by the Technical University of Berlin (1968), the award of the Marie Curie Medal of the Institut du Radium (1970), and to the establishment of the Weiss Medal by the Association for Radiation Research (1972).

After his official retirement from his Chair at Newcastle in 1970, Professor Weiss continued his scientific activities; this was very characteristic, given his life-long dedication to science. At the time of his death, one of the research programmes which he was conducting involved laser flash photolysis of aqueous dye solutions. This was being carried out at the Abteilung Strahlenchemie, Max-Planck-Institut für Kohlenforschung, Mülheim-Ruhr, where he was appointed Guest Scientist in 1971.

Professor Weiss will be remembered by those who knew him for his warmth and generosity, and for his stimulating approach to science. By the scientific community at large he will be remembered for his creative contributions to the fields of photo- and radiation chemistry.

G. Scholes

## Invitation

You are invited to participate in the Sixth International Congress on Photobiology at the Ruhr-University, City of Bochum, during the week beginning Monday, August 21, 1972. The invitation to convene the Sixth Congress in the Federal Republic of Germany (FRG) was extended by the German National Committee in the C.I.P. on behalf of the photobiologists of the Federal Republic. It was accepted by the Comité International de Photobiologie meeting at Hanover in 1968. The preceding Congresses have been held at Amsterdam (1954), Torino (1957), Copenhagen (1960), Oxford (1964), and Hanover (1968).

The aim of the Congress is the interdisciplinary stimulation of scientific research into the physics, chemistry and climatology of non-ionizing (ultra-violet, visible and infra-red) radiation in relation to its biological effects and the effects of the application of such radiation in biology and medicine. Particular emphasis will be placed on receptor problems and basic questions of molecular photobiology. A meeting of the North-Rhine Westphalian Dermatologists and three special symposia will also take place in connection with the congress.

Participation is open to all who are interested in photobiology.

**Registration for Contributed Papers** Contributed papers will be accepted in connection with Sections II-VIII including Symposia 2-12. In order to permit discussion, there is a time limit of 5 minutes for each presentation. Registration should be made on the enclosed form (form C) which should be filled out and sent to the Secretary General to arrive by March 31, 1972.

**Abstracts** An abstract will be required for every paper, film or demonstration submitted to the Congress. Each Active Participant may submit one abstract. Abstracts should include references to the pertinent literature. If available program time makes it necessary, the Program Committee reserves the right to have any paper read by title only. To facilitate reproduction by photo-offset, abstracts must be submitted on the enclosed standard form (form D). They will appear exactly as submitted on the form. Abstracts which are technically incomplete or which arrive late cannot be accepted.

The abstracts may be submitted separately from the Registration Form, but must be received before June 1, 1972 by Professor Schenck's office. Abstracts will be distributed to registrants at the Congress.

Contributed papers will not be published by the Congress; authors are free to publish these papers in journals of their choice. It is suggested that suitable papers may be submitted to the Editor of the International Journal PHOTO-CHEMISTRY and PHOTOBIOLOGY.

Attention Dr. K. C. Smith

Department of Radiology

Stanford University

STANFORD, Calif. 94305 / USA

**Congress Language** The congress language is English. Papers may be presented in any language; translation services will not, however, be available.

**Illustrations** Dispositive slides are acceptable in the following standard size: 2" x 2" (5 x 5 cm). Epiliascopic illustrations are not available. Film projectors are available if requested on the form for submission of contributed papers.

**Dermatologists Conference** In connection with the Congress a meeting of the North-Rhine Westphalian Dermatologists will take place on August 25-26, 1972. The theme will be "Photophysiology and Photopathology" with photographic demonstrations of typical cases.

Inquiries: Prof. Dr. H. Ippen  
Hautklinik der Medizinischen Akademie  
4000 Düsseldorf 1  
Moorenstraße 5

## Special Symposia

"Phototactic Movements"  
August 25-26, 1972

Inquiries: Prof. Dr. W. Haupt  
Botanisches Institut der Universität  
8520 Erlangen, Schloßgarten 4

"Photochemistry and the Origin of Life"  
August 26, 1972

Inquiries: Prof. C. Ponnamperna  
Laboratories of Chemical Evolution  
University of Maryland, Dept. of Chemistry  
College Park, Md. 20742, U. S. A.

"Biochemistry and Physiology of Visual Pigments"  
August 27-30, 1972

Inquiries: Prof. Dr. H. Langer  
Institut für Tierphysiologie der Universität  
4630 Bochum-Querenburg  
Postfach 2148

## Tentative Scientific Program

The scientific program is subdivided into eight sections (I-VIII). Within this framework 12 symposia will be held on specific subjects. The symposia will be opened by the organizers and will begin with an introductory lecture followed by lectures from other invited speakers.

M. Calvin will present the scientific opening address (O.) at the opening session on Monday, August 21, 1972. There will be two public evening lectures (A. and B.) on Monday and Tuesday and a dinner talk (C.) on Thursday by the president of the CIP.

All scientific meetings will be held under one roof in the lecture halls of the Ruhr-University Bochum. The plenary symposium on "General Photochemistry and Photobiology" will begin on Monday, August 21, 1972 at 14.00 hours.

- |   |                         |
|---|-------------------------|
| O. Solar Radiation and Human Life   | M. Calvin (U.S.A.)      |
| A. Vision in Man  | W. A. H. Rushton (U.K.) |
| B. Comparative Radiation Biology:<br>Ionizing versus non ionizing Radiation | R. Latarjet (France)    |
| C. Relevance of Science   | G. Porter (U.K.)        |

## General Information

**Registration** The final registration forms for participants are enclosed with this Second Circular (form A + B). There are two types of participants:

1. **Active participants** may take part in all scientific meetings, discussions and receptions; may register for contributed papers and will receive the abstract booklet.
2. **Accompanying persons** can take part in excursions and the social program but not attend the scientific meetings.

### Registration should be sent in by March 31, 1972

For active participants the congress fee is	DM 120,-
For accompanying persons each	DM 80,-
After March 31 the fee	
For active participants will be	DM 150,-
For accompanying persons each	DM 100,-

Cheques for the congress fees should be made out in Deutsche Mark to Wagons-Lits/Cook. DM-Cheques and remittances for accommodation and/or additional and social programs should be sent to Reisebüro Wagons-Lits/Cook

Account no. 93/5007  
Deutsche Bank AG.  
Frankfurt (M.)

and should note: VI. Internationaler Photobiologie-Kongress.

Later registrations can be accepted in writing up to August 1, 1972. After this date registrations can be made at the congress office in Bochum which will open on August 20, 1972, at 10 a.m. The congress fee will not be refunded after August 1, 1972. Cancellations arriving after this date cannot be accepted. Participants already registered will receive the program and abstracts by post.

**How to get there** Bochum is situated in the middle of the Ruhr and can be reached easily by all types of transportation.

The nearest airports are Düsseldorf (30 km) and Cologne (45 km). Information stands will be set up at the airports to furnish arriving members with details about the onward journey and hotel. Similarly an information stand will be found on Bochum station. Those arriving by car will receive a plan of the city with their confirmation. Details will be given in the final program.

**Accommodation and meals** For participants, hotels in Bochum, Essen and Dortmund will be available as well as rooms in student hostels near the campus. (without food).

Room reservations should be made through the travel agency Wagons-Lits/Cook (form A). Please send in registration to arrive by March 31, 1972.

Participants and accompanying persons can obtain à la carte meals at the Mensa and several cafeterias on the university campus. Those who stay in student hostels can also have their breakfast here.

**Shuttle bus** A free shuttle-bus service will ensure an effortless journey between accommodation and university.

**Bank and Post Office** The Westphalia Bank will open a bureau de change alongside the congress information stand. Post office and telephone facilities will also be available.

**Travel agency and air tickets** The travel agency responsible for travel arrangements and accommodation will have a counter in the congress office where all tickets (rail, bus etc.) can be bought.

Lufthansa will have an office to deal with air tickets.

**Travel grants** The organizing committee will consider the possibility of offering financial assistance towards participation in the congress. Applications and any queries should be addressed to Prof. A. Wiskemann, Univ-Hautklinik, 2 Hamburg 20, Martinstrasse 52.

**Exhibition** An industrial exhibition on the different floors of the Bochum university has been organized in connection with the congress. Firms from different countries will exhibit medicines, apparatus and equipment related to the fields of photobiology and medicine.



## Scientific Program

(The numbers preceding the author's name correspond with the numbers in the Book of Abstracts.)

Monday, Aug. 21, 1972 14:00 - 17:45 Lecture Hall 20

### Section I: General Photochemistry

Organizers: Th. Förster, A. Weller

Symposium 1: General Photochemistry and Photobiology

Chairman: E. J. Bowen (UK)

001 F. Wilkinson (UK)

Elementary photochemical processes and primary products  
(Introductory Lecture)

002 H. Kuhn (FRG)

Energy migration and photochemistry in monomolecular layers

Break (30 min.)

003 J. Elsingher (USA)

Some aspects of energy transfer in biological molecules

004 J. Jousset-Dubien (France)

Biphotonic processes

Monday, Aug. 21, 1972 19:00 Lecture Hall 20

E. J. Bowen (UK)

The Development of Chemical Ideas of Light

Tuesday, Aug. 22, 1972 9:00 - 12:45 Lecture Hall 40

### Section IV: Photobiology of Higher Systems

Organizers: H. Mohr, W. Reichardt

Symposium 5: Photobiology of Higher Systems I

Chairmen: W. L. Butler (USA)  
N. N.

020 W. R. Briggs (USA)

Phytochrome I: Molecular properties and photochemistry  
(Introductory Lecture)

021 P. Schopfer (FRG)

Phytochrome II: Properties and function in vivo

Break (30 min.)

022 A. Kropf (USA)

Vision I: Elementary photochemical processes and photochemistry of visual pigments

023 R. A. Cone (USA)

Vision II: Rhodopsin, receptor potentials, and visual excitation

Tuesday, Aug. 22, 1972 9:00 - 12:45 Lecture Hall 50

### Section VII: Photobiology in Medicine

Organizer: A. Wiskemann

Symposium 10: Biochemical and Structural Effects of Light on the Skin

Chairman: F. Daniels (USA)

043 F. Daniels (USA)

Biochemical and structural effects of light on the skin  
(Introductory Lecture)

044 M. A. Pathak

Biochemical changes in epidermal nucleic acids following UV-irradiation  
Break (30 min.)

045 J. H. Epstein (USA)

DNA synthesis and cell proliferation in the epidermis following UV-irradiation

046 B. E. Johnson (UK)

Lysosomal damage by UV-irradiation of the skin

047 J. C. Van Der Laan (Netherlands)

Instrumental observation near the erythral threshold

Tuesday, Aug. 22, 1972

9:00 - 12:40

Lecture Hall

### Section III: Photobiology of Lower Systems (Bacteria, Phages)

Organizer: A. Wacker

Contributed Papers

Chairmen: L. R. Caidas (Brazil)

K. C. Smith (USA)

105 W. Köhnlein, F. Mönkehaus (FRG)

Photodamage in hybrid BU-DNA after long wavelength UV (313 nm) and its correlation to biological activity

106 F. Mönkehaus, W. Köhnlein (FRG)

Intramolecular energy transfer in BU-DNA after UV-irradiation: Single and double strand breakage rates

107 M. B. Lion, W. Köhnlein (Israel, FRG)

Effect of DNA conformation on the UV damage in 5-bromouracil substituted DNA of T3 coliphage

108 W. S. Dennis, F. Hutchinson (USA)

Repair of single-strand breaks induced by ultraviolet light in *E. coli* DNA containing bromouracil

109 I. Johansen, E. Sæberg (Norway)

Enzymic incisions in superinfecting bacteriophage  $\lambda$  DNA molecules in lysogenic strains of *E. coli* after ultraviolet

110 S. Igall, G. L. Gaze (Hungary)

Comparison of lethal and mutagenic photosensitization by near ultraviolet (365 nm) irradiation plus different peroxalens in *Escherichia coli* strains with different repair capacities

111 R. M. Tyrrell (USA)

The biological significance and repair susceptibility of pyrimidine dimers induced in bacterial DNA by 365 nm radiation

112 H. D. Mennigmann (FRG)

Killing, reactivation, and mutation induction in *E. coli* by light of  $\lambda > 300$  nm in the presence and absence of acetophenone

113 A. J. Forage, T. Alper (UK)

Effects of DNA-bound acriflavine on UV-induction of reversions in auxotrophic *Escherichia coli* B<sub>1</sub>WP<sub>6</sub>hcr<sup>+</sup> and hcr<sup>+</sup>

114 R. B. Webb, M. S. Brown (USA)

Acriflavine sensitization and liquid-holding recovery after exposure of *Escherichia coli* to near ultraviolet and visible radiation

Break (20 min.)

115 J. C. Sutherland, B. M. Sutherland (USA)

Photoreactivating enzyme: Physical studies of a far-UV absorbing component

116 B. M. Sutherland, M. J. Chamberlin, J. C. Sutherland (USA)

Properties of the photoreactivating enzyme from *E. coli*

117 S. H. Moss, R. M. Tyrrell, D. J. G. Davies (UK)

The inter-relationship of photoreactivation with excision and recombination repair in UV-irradiated *Escherichia coli*

118 A. P. M. Eker (Netherlands)

DNA-photoreactivating enzyme from *Streptomyces griseus*

119 W. Stoedckenius (USA)

Isolation of a presumed photoreceptor from *Halobacterium halobium*

120 M. Chessin (USA)

Mechanism of photoreactivation of plant viruses

121 J. Kiefer (FRG)

Respiration and fermentation in UV-irradiated diploid yeast

122 B. Laske, J. Kiefer (FRG)

Protein synthesis in UV-irradiated diploid yeast

123 E. Schneider, J. Kiefer (FRG)

Changed UV-sensitivity of yeast cells due to pre-exposure with ionizing radiation

124 I. Wienhard, J. Kiefer (FRG)

Effect of cycloheximide on liquid holding recovery in diploid yeast

Tuesday, Aug. 22, 1972

9:00 - 12:40

Lecture Hall 60

### Section V: Photosynthesis

Organizer: H. T. Witt

Contributed Papers: Chlorophyll Reactions in vitro and in vivo

Chairman: A. A. Krasnovsky (USSR)

225 G. Tollin, J. R. Harbour (USA)

Chlorophyll-quinone photochemistry in solution as a model for photochemical energy conversion

226 V. B. Evstigneev, V. S. Chudar (USSR)

On the mechanism of acid-base equilibrium alterations in a medium during chlorophyll and other pigments photoreactions

227 J. R. Norris, J. J. Katz, R. A. Uphaus (USA)

Electron spin resonance in carbon-13 chlorophyll systems and features of the photosynthetic reaction center

228 T. Kihara (USA)

Effect of deuterium substitution on the decay rate of light-induced EPR signal of hydrated chlorophyll

229 B. A. Kiselev (USSR)

Electrochemical study of chlorophyll A reduction

230 F. Van Nostrand, N. E. Geacintov, J. F. Becker (USA)

The in vivo orientation of chlorophyll

231 A. Faludi-Daniel, F. Joó (Hungary)

Circular dichroism of chlorophyll in granal and agranal chloroplasts

232 A. Kahn (Denmark)

Formation of protochlorophyll holochrome

233 O. F. Nielsen (Denmark)

Photoconversion of protochlorophyll holochrome

234 C. A. Reibel (USA)

Protochlorophyll and chlorophyll synthesis and accumulation during chloroplast differentiation in vitro

Break (20 min.)

- Section V: Photosynthesis**  
 Organizer: H. T. Witt  
 Contributed Papers: Photosystem I and II  
 Chairman: R. K. Clayton (USA)
- 235 A. Yu. Borisov, M. D. Il'ina (USSR)  
 Quantum yield of reaction center photooxidation in subchloroplast particles enriched with photosystem I
- 236 J. S. C. Wessels (Netherlands)  
 Isolation and properties of small particles with photosystem-II activity
- 237 B. L. Epel, J. Neumann (Israel)  
 Oxidation of ascorbate by superoxide formation mediated by electron transport to low potential acceptors
- 238 J. W. M. Visser, W. L. Butler (Netherlands)  
 Primary photochemical reactions of photosystem II at low temperature
- 239 H. Senger, B. Frickel-Faulstich, N. I. Bhanop (FRG)  
 Variable effectiveness of inhibitors on photosystem II during the life cycle of algae
- 240 G. Oquist (Sweden)  
 Distribution of chlorophyll between the two photosystems in *Anacystis nidulans* grown in different light intensities
- 241 J. S. Brown (USA)  
 Photosystems I and II in fractions of synchronously grown *Chlamydomonas*
- 242 K. N. Timofeev, A. B. Rubin (USSR)  
 Connection between photoinduced paramagnetism and primary processes of photosynthesis in green plants
- 243 S. M. Klein, L. P. Vernon (USA)  
 Protein composition of photosystem I and photosystem II of spinach chloroplasts
- 244 M. Coumans, R. J. Strasser, R. Bronchart (Belgium)  
 Photosystem II activity and grana formation in flashed bean leaves

Tuesday, Aug. 22, 1972 9:00 - 10:00 Lecture Hall 100

- Section VI: Modern Experimental Methods**  
 Organizer: H. Glubrecht  
 Contributed Papers  
 Chairman: R. Rigler (Sweden)
- 319 D. M. Napoli, M. A. Mahaney, L. J. Heidt (USA)  
 Uranyl oxalate actinometer photolysis study
- 316 D. E. W. Ernst (FRG)  
 Three dimensional analysis and deblurring in quantitative microscopy
- 418 G. Moreno, C. Salet (France)  
 Laser micro-irradiation of cell mitochondria
- 317 V. Zanker, D. Benicke, E. Cmiel (FRG)  
 Determination of triplet-triplet spectra and intersystem crossing probability
- 315 H.-W. Tiffe (FRG)  
 Dependence of the fluorescent intensity from the incident light measured at T. pollen
- 318 G. Georgiev (Bulgaria)  
 Photometer for objective photobiological characteristic of the radiations with respect to their photosynthetic efficiency

Tuesday, Aug. 22, 1972 14:00 - 17:45 Lecture Hall 40

- Section II: Photobiochemistry, Photodynamic Action**  
 Organizers: G. O. Schenck, A. Wacker  
 Symposium 2: Molecular Mechanisms of Photodynamic Action Involving Molecular Oxygen  
 Chairmen: H. Berg (GDR), C. S. Foote (USA), L. Santamaria (Italy)
- 005 C. S. Foote (USA)  
 Photoreactions with molecular oxygen (Introductory Lecture)
- 006 H. Berg, F. A. Gollmick (GDR)  
 Photodynamic mechanisms and redox potentials of excited sensitizers
- 007 M. Koizumi, Y. Usui (Japan)  
 Photooxidative bleaching of some dyes with oxygen via D-O and D-D mechanisms  
 Break (30 min.)
- 008 H. Tsubomura (Japan)  
 Spectroscopic and photo-chemical properties of O<sub>2</sub>-charge transfer complexes
- 009 J. D. Spikes (USA)  
 Photodynamic oxidation not involving singlet oxygen

Tuesday, Aug. 22, 1972 14:00 - 17:40 Lecture H

- Section IV: Photobiology of Higher Systems**  
 Organizers: H. Mohr, W. Reichardt  
 Contributed Papers: Physiology of Phytochrome  
 Chairman: W. Shropshire (USA)
- 155 S. C. Cundiff, L. H. Pratt (USA)  
 Immunochemical characterization of phytochrome
- 156 P. H. Quail, E. Schäfer, D. Marmé (FRG)  
 De novo synthesis of phytochrome
- 157 E. Schäfer, W. Schmidt, P. Quail, D. Marmé (FRG)  
 Spectroscopy of phytochrome in turbid materials
- 158 B. Frankland (UK)  
 Kinetics of phytochrome decay in seedling tissue
- 159 D. Porath, Y. Ben-Shaul (Israel)  
 Spectrophotometric survey of phytochrome in *Spirodela* spp.
- 160 R. E. Kendrick, C. J. P. Spruit (Netherlands)  
 Phytochrome intermediates in-vivo
- 161 R. L. Weintraub, V. R. Lawson (USA)  
 Mechanism of phytochrome-mediated effects of light on cell growth
- 162 H. Oelze-Karow, H. Mohr (FRG)  
 Repression of lipoxigenase synthesis in plant tissue through a threshold mechanism (cotyledons of mustard seedlings)
- 163 R. L. Satter, P. B. Applewhite, A. W. Galston (USA)  
 Joint rhythmic and phytochrome action in control of leaf movements and potassium flux
- 164 H. Frick, H. Mohr (FRG)  
 On the physiological equivalence of phytochrome in green and etiolated *Lemna minor*  
 Break (20 min.)

**Contributed Papers: Physiology of Phytochrome**  
 Chairman: M. J. Kasperbauer (USA)

- 165 H. Drumm, H. Mohr (FRG)  
 Induction of ascorbate oxidase by phytochrome
- 166 R. Carff (FRG)  
 Glyceraldehyde-3-phosphate dehydrogenases and glyoxylate reductase: Their regulation under continuous red and far-red light in the cotyledons of *Sinapis alba* L.
- 167 E. Wellmann (FRG)  
 Ultraviolet light-dependent flavonoid synthesis in parsley
- 168 G. Engelma (Netherlands)  
 A possible role of manganese ions in the photoinduction of phenylalanine ammonia-lyase
- 169 M. Nešković, R. Konjević (Yugoslavia)  
 The effect of phytochrome on endogenous gibberellins and some macro-molecular compounds in peas
- 170 M. J. Kasperbauer (USA)  
 Influence of end-of-day phytochrome manipulation on growth and development of *Nicotiana tabacum*
- 171 R. El Dab, H. Fredericq, J. De Greef (Belgium)  
 Interactions between photoperiod and terminal irradiations in seed germination
- 172 J. A. De Greef, R. Caubergs, J.-P. Verbelen (Belgium)  
 Photomorphogenic expressions in plant development by interorgan correlations
- 173 E. Bellini (Italy)  
 Phytochrome and far red effects on radish seedlings
- 174 A. Erez, A. Kadman-Zahavi (Israel)  
 The effect of high energy irradiation on some enzyme systems and ethylene production in peach spines
- 175 L. B. Rubin, O. V. Eremeyeva, G. Y. Frik, U. E. Shvinka (USSR)  
 Evidence for the existence of phytochrome system of regulation in microorganisms

Tuesday, Aug. 22, 1972 14:00 - 17:40 Lecture Hall 100

**Section IV: Photobiology of Higher Systems**  
 Organizers: H. Mohr, W. Reichardt  
 Contributed Papers: Miscellaneous in Vision  
 Chairman: N. N.

- 202 A. Knowles (UK)  
 The dye-sensitized isomerization of 11-cis-retinal in bovine rhodopsin
- 203 C. D. B. Bridges (USA)  
 Action of light on the visual pigments of amphibian larvae
- 204 H. Suzuki (Japan)  
 Theory of the optical property of retinal in visual pigments
- 205 T. H. Goldsmith, M. S. Bruno (USA)  
 Visual pigments of crabs
- 206 T. R. C. Sisson (USA)  
 Effect of visible light and oxygen on the retina
- 207 V. V. Subbarao, M. L. Gupta (India)  
 Effect of light and dark exposure on the enzymatic and amino-acid levels in the retina
- 208 B. D. Drujan, M. A. Ali (Venezuela, Canada)  
 ATP metabolism in light and dark adapted retinæ
- 209 G. Svastichin, K. H. Ruddock (Venezuela)  
 Metabolic and electrical properties of rod and cone photoreceptors  
 Break (20 min.)
- 210 W. T. Mason, R. S. Fager, E. W. Abrahamson (USA)  
 The structural response of vertebrate photoreceptor membranes to light
- 211 M. Carapancea (Romania)  
 Photobiological detection of general fatigue phenomenon, by graphic indication of localized functional modifications of the potential photoreceptors
- 212 C. C. Krischer (FRG)  
 Interpretation of characteristic time parameters of photoreceptor-potentials of the barnacle
- 213 A. M. Granda, T. Ohisuka (Japan)  
 Temporal characteristics of horizontal cells in turtle retina
- 214 K. H. Ruddock, G. Svastichin (UK, Venezuela)  
 Linear receptor intensity transfer function and subsequent non-linear processing
- 215 F. J. Verheijen (Netherlands)  
 The effect of a photodetector's angle of acceptance upon the weighted radiance distribution, and upon an organism's direction of orientation
- 216 M. Pašić, Z. Damjanović, Lj. De Safaria (Yugoslavia)  
 The effect of repeated photostimulation on the spontaneous activity of neurons in the visceral ganglia of *Aplysia depilans*
- 217 J. M. Fox (FRG)  
 Selective blocking of the sodium conductivity of isolated sensory and motor nerve fibres by ultraviolet radiation
- 218 A. J. Dewar, H. W. Reading (UK)  
 RNA and protein metabolism in the visual cortex of normal rats and rats with retinal degeneration

Tuesday, Aug. 22, 1972 14:00 - 18:00 Lecture Hall 60

**Section V: Photosynthesis**  
 Organizer: H. T. Witt  
 Contributed Papers: Electron Transfer  
 Chairman: W. L. Butler (Netherlands)

- 292 D. Arnon (USA)  
 Some new aspects of enhancement in photosynthesis
- 245 E. Bamberger, H. Rottenberg, M. Avron (Israel)  
 The relation between the internal pH and electron transport in chloroplasts
- 246 S. G. Reeves, D. O. Hall (UK)  
 Site of ferricyanide reduction (photosystem II activity) in stroma and grana lamellae of different chloroplasts
- 247 A. F. Esser (USA)  
 EPR signal II in chloroplasts
- 248 T. Hiyama (USA)  
 Secondary reactions of photosystem I: Interactions of P700 and P430 with plastocyanin and cytochromes
- 249 A. Teller, M. C. W. Evans, A. V. Lord (UK)  
 Evidence for bound ferredoxin as primary electron acceptor in photosynthetic electron transport in higher plants and blue green algae
- 250 G. A. Hauska (FRG)  
 Plastocyanin content and reactivity in chloroplast preparations
- 251 P. C. Brandon (Netherlands)  
 BBMD-catalyzed electron transport from photosystem II directly to oxygen
- 252 R. J. Strasser (Belgium)  
 Light induction of the ability to produce oxygen in higher plants grown under a flash regime

- 253 A. Kononenko, E. Lukashov, P. Venediktov, A. Rubin (USSR)  
Photosynthetic electron-transfer and coupled processes in  
*Ectothiorhodospira shaposhnikovii*
- 254 W. P. Williams (UK)  
Electron transport chain interaction in *Chlorella pyrenoidosa*  
Break (20 min.)
- Contributed Papers: Cytochromes  
Chairman: S. Malkin (Israel)
- 255 G. Ben-Hayyim (Israel)  
Photooxidation and photoreduction of cytochrome  $b_{559}$  in chloroplasts
- 256 J. Amesz, M. P. J. Pulles, J. W. M. Visser (Netherlands)  
The function of cytochromes  $b$  and  $f$  in cyclic and non-cyclic photo-  
synthetic electron transport
- 257 A. Vermeglio, P. Mathis (France)  
Spectroscopic study of cytochrome  $b_{559}$  and  $C_{520}$  in spinach chloroplasts
- 258 W. Haehele (FRG)  
New aspects on the reaction of cytochrome  $F$  and chlorophyll  $A$
- 259 B. R. Silberstein, L. N. M. Duysens (Netherlands)  
Kinetics of cytochromes  $C_{422}$  and  $C_{423.5}$  and  $P_{680}$  in the electron trans-  
port chain in *Chromatium*
- Contributed Papers: Photosynthetic Bacteria  
Chairman: G. Jacobi (FRG)
- 260 P. Reinach, S. S. Brody (USA)  
Chemistry of bacteriochlorophyll in monomolecular films at an air-water  
interface
- 261 L. Slooten (Netherlands)  
Identification of an electron acceptor in reaction center preparations from  
photosynthetic bacteria
- 262 N. N. Drozdova, A. A. Krasnovsky (USSR)  
Reactions of excited bacteriochlorophyll with electron acceptors
- 263 E. H. Evans, A. R. Crofts (UK)  
In situ thermodynamic characterisation of cytochromes of  
*Rhodospseudomonas capsulata*
- 264 R. J. Cogdell, J. B. Jackson, A. R. Crofts (UK)  
The effects of redox potential on rapid  $H^+$  changes in chromatophores  
from *Chromatium* and *Rhodospseudomonas viridis*
- 265 R. K. Clayton (USA)  
Analysis of photosynthetic membrane proteins of bacteria
- 266 K. Knobloch (FRG)  
Chromatophore independent reduction of pyridinucleotide in the purple  
bacterium *Rhodospseudomonas palustris*

Tuesday, Aug. 22, 1972 14:00 - 17:45 Lecture Hall 70

Section VII: Photobiology in Medicine  
Organizer: A. Wiskemann  
Contributed Papers: Normal Skin Reactions  
Chairman: T. B. Fitzpatrick (USA)

- 325 B. E. Johnson, J. Herd, L. Mackenzie (UK)  
Ultraviolet radiation erythema action spectrum; variation with change in  
1/2 bandwidth of monochromatic radiation
- 326 J. H. Anglin, R. M. Sayre, W. H. Batten (USA)  
Application of total diffuse reflectance to the study of ultraviolet irradi-  
ation of skin: A new approach to the evaluation of radiation effects
- 327 F. Stenbäck (USA)  
Morphological characteristics of UV-irradiated epidermis: Effect of wave-  
length, dose, species and chemicals
- 328 G. Eweri, K. Böttcher, A. Wiskemann (FRG)  
DNA staining in human epidermis cells irradiated by 1.254 and 302 nm
- 329 W. Nikesch, A. Norman (USA)  
Studies of ultraviolet radiation damage in human leukocytes with a  
fluorescent probe
- 330 E. Zimmermann, M. A. Pathak (USA)  
In vivo effect of ultraviolet light ( $\lambda_{\text{max}} > 290$  nm) on epidermal chromatin  
Break (20 min.)
- 331 S. Cohen, G. Gabor, C. Lachmann (Israel)  
Absorption and emission spectra of a covalently bounded purine-pyrimi-  
dine base pair
- 332 K. Klimek, P. Ševčíková, M. Vlášková (CSSR)  
UV sensitive subclones induced in and selected from HeLa S3 cells
- 333 R. Chatterjee, A. Chakraborty, D. Roy (India)  
Photoreactivation of u.v. irradiated carcinoma cells in mice
- 334 G. Kahn (USA)  
UV protective effects of 5-fluorouracil and thymidine
- 335 J. F. Lucey, J. R. Hewitt, R. M. Klein (USA)  
Phototherapy of hyperbilirubinemia in the Gunn rat

Tuesday, Aug. 22, 1972 19:00 Lecture Hall 20

R. Latarjet (France)  
Comparative Radiation Biology: Ionizing versus non ionizing Radiation

Wednesday, Aug. 23, 1972 8:30 - 12:45 Lecture Hall 40

Section V: Photosynthesis  
Organizer: H. T. Witt  
Symposium 7: Structure and Electron Transfer  
Chairman: M. Calvin (USA)  
R. Hill (UK)

- M. Calvin (USA)  
Introductory remarks
- 028 K. Mühlethaler (Switzerland)  
Structure of thylakoids by electron microscopy
- 029 W. Kreutz (FRG)  
On the correlation between the lipid-phase characteristics and "water  
splitting" in the photosynthetic membrane
- 030 L. Packer (USA)  
Structural changes in chloroplast membranes  
Break (30 min.)
- 031 B. Kok (USA)  
Light reactions and electron transfer
- 032 P. Joliot (France)  
Cleavage of  $H_2O$

Wednesday, Aug. 23, 1972 9:00 - 12:45 Lecture Hall 50

Section III: Photobiology of Lower Systems (Bacteria, Phages)  
Organizer: A. Wacker  
Symposium 4: Molecular Mechanisms in Photobiology of Bacteria and  
Phages  
Chairman: R. B. Setlow (USA)

- 015 A. Wacker (FRG)  
Photobiological consequences of thymine photodimerization  
(Introductory Lecture)
- 017 K. C. Smith (USA)  
Photoaddition of proteins and other molecules to nucleic acids  
Break (30 min.)
- 018 C. S. Rupert (USA)  
Kinetics of enzymatic photoreactivation
- 019 R. B. Setlow (USA)  
Repair of photochemical damage to DNA: Its generality
- 151 R. S. Cole (USA)  
Psoralen cross-links in DNA: Formation, consequences and repair

Thursday, Aug. 24, 1972 9:00 - 12:45 Lecture Hall 40

Section II: Photochemistry, Photodynamic Action  
Organizer: G. O. Schenck, A. Wacker  
Symposium 3: Molecular Mechanisms of Photodynamic Action  
with and without Molecular Oxygen  
Chairman: M. Musajo (Italy)  
N. J. Turro (USA)

- 010 N. J. Turro (USA)  
Photosensitization and oxetane formation  
(Introductory Lecture)
- 011 N. I. Krinsky (USA)  
The protective functions of carotenoid pigments against aerobic photo-  
sensitivity
- 012 L. Musajo, G. Rodighiero (Italy)  
Photoreactions of furocoumarins with nucleic acids  
Break (30 min.)
- 013 A. Kornhauser (Yugoslavia)  
Photosensitization of cyclodimerization of pyrimidines
- 014 L. Santamaría (Italy)  
Photodynamic action and skin cancer

Thursday, Aug. 24, 1972 9:00 - 12:45 Lecture Hall 50

Section VI: Modern Experimental Methods  
Organizer: H. Glübrecht  
Symposium 9: Pulse Photobiology and Quantitative Microscopy  
Chairman: G. Porter (UK)

- 038 H. Glübrecht (FRG)  
Light sources, optics and detection methods in photobiology  
(Introductory Lecture)
- 039 P. M. Rentzepis (USA)  
Picosecond spectroscopy  
Break (30 min.)
- 040 W. Waidelich (FRG)  
Laser techniques in photobiology
- 041 R. Rigler (Sweden)  
Fluorescence microspectrophotometry and its application in biology
- 042 P. H. Bartels (USA)  
Computer analysis of cell response

Thursday, Aug. 24, 1972 8:30 - 12:40 Lecture Hall 60

Section V: Photosynthesis  
Organizer: H. T. Witt  
Contributed Papers: Light Emission, Potential Changes  
Chairman: D. O. Hall (UK)

- 267 P. K. Mohanty, B. Zilinskas-Braun, Govindjee (USA)  
Quenching of chlorophyll fluorescence yield by phenazine methosulfate  
in chloroplasts
- 268 N. V. Karapetyan, A. Avazov, V. V. Kimov, A. A. Krasnovsky (USSR)  
Reactivation of variable fluorescence of chloroplasts by plastoquinone
- 269 G. S. Singhal, P. K. Mohanty, Govindjee (India, USA)  
Effect of temperature on the absorption and fluorescence spectra of algal  
suspensions
- 270 H. Hardt, S. Malkin (Israel)  
Oscillations of the triggered luminescences of chloroplasts
- 271 D. N. Matorin, P. S. Venediktov, A. B. Rubin (USSR)  
Study of the delayed light emission of photosynthesizing organisms
- 272 S. Lurie, W. Bartsch (USA)  
Thermoluminescence of chloroplasts: Identification of two peaks with  
energy storage sites in reaction center II
- 273 B. R. Valtuys, J. Amesz (Netherlands)  
The relation between delayed luminescence and the redox level of the  
electron acceptors of photosystem 2
- 274 J. Barber (UK)  
Stimulation of millisecond delayed light emission from chloroplasts by  
ion gradients
- 275 G. Throm (FRG)  
Correlation between the light dependent potential change and redox  
changes
- 276 Z. Gromet-Ehrman, M. Leiser (Israel)  
Interconversion of the membrane potential and the pH gradient and  
their relation to energy conservation in the chromatophores
- 277 L. N. M. Duysens, T. E. Van Der Schatte Olivier, G. A. Don Hean  
(Netherlands)  
Light-induced quenching of the yield of chlorophyll  $a_2$  fluorescence, with  
microsecond backreaction stimulated by oxygen
- 278 J. W. T. Fiolet (Netherlands)  
Effects of tetraphenylboron (TPB) on energy linked functions in spinach  
chloroplasts
- 279 A. Ilani, D. S. Berns (Israel, USA)  
Electron tunnelling through membrane-water interface  
Break (20 min.)