AD NUMBER

AD488239

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Critical Technology; SEP 1966. Other requests shall be referred to Commanding Officer, Edgewood Arsenal, Attn: SMUEA-TSTI-T, Edgewood Arsenal, MD 21010.

AUTHORITY

USAEA ltr, 22 Dec 1971

EDGEWOOD ARSENAL SPECIAL PUBLICATION

EASP 100-4

PHOTOCHEMISTRY OF HETEROCYCLIC COMPOUNDS

A Literature Survey

by

Edward J. Poziomek

September 1966

Task 1C622401A10204

Physical Research Laboratory
Research Laboratories
US ARMY EDGEWOOD ARSENAL
EDGEWOOD ARSENAL, MARYLAND 21010

FOREWORD

This work was conducted under the Mutual Educational and Cultural Exchange Act of 1961, Public Law 87-256. It is being published under Task 1C622401A10204, Detection and Warning Investigations (U).

The survey was made during September 1965, while the author was on a leave of absence.

DIGEST

The literature on the photochemistry of heterocyclic compounds was surveyed with a particular interest in pyridine chemistry.

This listing of references was compiled as a result of searching volumes 41 to 61 of Chemical Abstracts under the headings light, photochemistry, and pyridine. References to earlier work may be found in The Action of Ultraviolet Rays by C. Ellis and A. A. Wells (Reinhold Publishing Corp., New York, New York, 1941).

A complete survey of the photochemistry of heterocyclic compounds requires searching under each heterocyclic-ring heading. This presents a challenge that could not be met. Additional references may be found, however, in Präparative Organische Photochemie by A. Schönberg [Springer-Verlag, Berlin-Wilmersdorf (West), Germany, 1958] and in the Advances in Photochemistry series (Interscience Publishers, Inc., New York, New York, 1963).

CONTENTS

THE PHOTOCHEMISTRY OF HETEROCYCLIC COMPOUNDS
A Literature Survey

I. INTRODUCTION.

The US Army is interested in photochemistry for use in the fields of detection, stability of reagents, and synthesis, to mention a few. This listing of references provides a convenient source of citations for researchers faced with problems in photochemistry. References are listed alphabetically by author, and keywords are listed beside each reference as well as in an alphabetical index. The title following the author's name is either a paraphrased journal article title or, in instances where the article was not entirely about the photochemistry of heterocyclics, an indication of that part of heterocyclic photochemistry with which the article dealt.

II. REFERENCE LIST.

Rhodopsin

1. Adams, R. G. Flash Photolysis of Rhodopsin in Solution. Dissertation Abstr. 20, 2782 (1960). [Chem. Abstr. 54, 11662b.]

Nicotinamide
Histidine

2. Alechinsky, A., and Reuse, J. Nicotinamide in Relation to Histidine Irradiation by Light. Compt. Rend. Soc. Biol. 140, 1224 (1946). [Chem. Abstr. 42, 626b.]

Diazirine

3. Amrich, M. J., and Bell, J. A. Photoisomerization of Diazirine. J. Am. Chem. Soc. 83, 292 (1964).

Methylene blue
Thiourea

4. Angelescu, E., and Cornea, F. Methylene Blue Reaction With Thiourea in Light. Analele Univ. "C. I. Parhon" Ser. Stiint. Nat. 9, No. 26, 123 (1960). [Chem. Abstr. 59, 1452c.]

Pyridones

5. Ayer, W. A., Hayatsu, R., de Mayo, P., Reid, S. T., and Stothers, J. B. Photodimers of Pyridones. Tetrahedron Letters, No. 18, 648 (1961).

Ferrocyanide-2, 2'-bipyridine
Ferrocyanide-1, 10-phenanthroline

6. Balzani, V., Carassiti, V., and Looe, R. S. Substitution Reactions in the Ferrocyanide-2, 2'-bipyridine, and Ferrocyanide-1, 10-phenanthroline Systems. Ann. Chim. (Rome) 54, 103 (1964). [Chem. Abstr. 61, 10220h.]

2, 2'-Bipyridine and o-phenanthroline tetracyanoferrate complexes

7. Balzani, V., Carassiti, V., and Moggi, L. Light Induced Decomposition of Tetracyanoferrate Complexes of Bipyridine and o-Phenanthroline. Ann. Chim. (Rome) 54, 251 (1964). [Chem. Abstr. 61, 5120f.]

2, 4-Dimethylthiazole
Yeast

8. Barnabei, O., and Brighenti, L. 2, 4-Dimethylthiazole Action on Yeast and Light. Boll. Soc. Ital. Biol. Sper. 30, 461 (1954). [Chem. Abstr. 49, 1872d.]

Photography
Pyridine sensitizer
Picoline sensitizer

9. Belgian Patent 557, 657 (to Kodak Soc. Anon.). Photographic Emulsions Supersensitized by Pyridine or Picoline. June 15, 1957. [Chem. Abstr. 54, 153a.]

Benzotriazoles

10. Belgian Patent 628, 131 (to Societa Generale per l'Industria Meneraria e Chimica). Light Stabilizer, Benzotriazole Hydroxy Derivatives. August 7, 1963. [Chem. Abstr. 60, 14688b.]

Malononitrile derivatives
Phenyl-(2-thienylmethylene)-malononitrile

11. Belgian Patent 633, 103. Heterocyclic Compounds Resistant to Light. Phenyl-(2-thienylmethylene)malononitrile. October 21, 1963. [Chem. Abstr. 61, 8279i.]

Methyl and phenyl pyridyl glycols
Pyridyl glycols
Ketones
Pyridyl ketones

12. Bencze, W. L., Burckhardt, C. A., and Yost, W. L. Photochemical Preparation, Rearrangement, and Dehydration of Symmetrical Methyl and Phenyl Pyridyl Glycols. J. Org. Chem. 27, 2865 (1962).

Dihydropyridine

13. Berson, J. A., and Brown, E. Irradiation of Dihydropyridines. J. Am. Chem. Soc. 77, 450 (1955).

3-Indoleacetic acid
Tryptophan

14. Berthelot, A., and Amoureux, G. 3-Indoleacetic Acid From Tryptophan by Action of Light. Compt. Rend. 206, 699 (1938). [Chem. Abstr. 32, 4161[6].]

3-Indoleacetic acid Tryptophan	15.	Berthelot, A., Amoureux, G., and Deberque, S. 3-Indoleacetic Acid From Tryptophan by Action of Ultraviolet Light. Compt. Rend. Soc. Biol. 131, 1234 (1939). [Chem. Abstr. 34, 4245.]
Pyrimidines	16.	Beukers, R., and Berends, W. Effect of Paramagnetic Substances on the Conversion of Some Pyrimidine Derivatives by Ultraviolet Radiation. Biochim. Biophys. Acta 38, 573 (1960). [Chem. Abstr. 54, 16499d.]
Pyrethrin	17.	Blackith, R. E. Pyrethrin Decomposition by Light. J. Sci. Food Agr. 3, 219 (1952). [Chem. Abstr. 47, 3509eh.]
Rhodopsin	18.	Bliss, A. F. Rhodopsin Transformation to Yellow Lipids in Light. J. Biol. Chem. 172, 165 (1948). [Chem. Abstr. 42, 3002f.]
Thiopyronine Methylene blue	19.	Boehme, H., and Wacker, A. Mutagenic Activity of Thiopyronine and Methylene Blue in Combination With Visible Light. Biochem. Biophys. Res. Commun. 12, 137 (1963). [Chem. Abstr. 60, 11095f.]
Carbazole Diphenylamine	20.	Bowen, E. J., and Eland, J. H. D. Carbazole Formation From Diphenylamine in Presence of Light. Proc. Chem. Soc., 202 (1963). [Chem. Abstr. 59, 9493a.]
3-Indoleacetic acid	21.	Brauner, L. 3-Indoleacetic Acid Decomposition. Naturwissenschaften 40, 23 (1953). [Chem. Abstr. 47, 12000g.]
3-Indoleacetic acid	22.	Brauner, L. 3-Indoleacetic Acid Decomposition by Light. Z. Botan. 41, 291 (1953). [Chem. Abstr. 48, 5296a.]
3-Indoleacetic acid	23.	Brauner, L. 3-Indoleacetic Acid Decomposition by Light. Z. Botan. 42, 83 (1954). [Chem. Abstr. 48, 6842h.]
Visual pigments Rhodopsin	24.	Bridges, C. D. B. Flash Photolysis of Visual Pigments. I. Pigments Present in Frog-Rhodopsin Solutions After Flash Irradiation. Biochem. J. 79, 128 (1961). [Chem. Abstr. 55, 22396h.]

Visual pigments Rhodopsin

25. Bridges, C. D. B. Production of Thermally Stable Photosensitive Pigments in Flash Irradiated Solutions of Frog Rhodopsin. Biochem. J. 79, 135 (1961). [Chem. Abstr. 55, 22397a.]

Quinoline-N-oxide

26. Buchardt, O. Photochemical Rearrangement of Quinoline-N-oxide. Acta Chem. Scand. 17, 1461 (1963).

Carbostyril N-Methylcarbostyril

27. Buchardt, O. Structure of the Photodimers of Carbostyril and N-Methylcarbostyril. Acta Chem. Scand. 18, 1389 (1964).

Quinoline-N-oxides

28. Buchardt, O., Becher, J., and Lohse, C. Photorearrangement of Methyl Substituted Quinoline-N-oxides. Acta Chem. Scand. 19, 1120 (1965).

Pyridine

29. Cantieni, R. Effect of Light on Pyridine Mixtures With Sugars, Monohydric Alcohols and Acetone. Helv. Chim. Acta 18, 1420 (1935). [Chem. Abstr. 30, 16623.]

Dipyridyl Silver dipyridyls

30. Carassiti, V., Condorelli, G., and Costanzo, L. L. Photochemistry of Silver Dipyridyls. Ann. Chim. (Rome) 54, 303 (1964). [Chem. Abstr. 61, 5120f.]

DPN (diphosphopyridine nucleotide) ATP (adenosine triphosphate)

31. Carter, C. E. Effect of Light on Adenosine Triphosphate and Diphosphopyridine Nucleotide. J. Am. Chem. Soc. 72, 1835 (1950).

1-Aza-3, 5, 7-trimethylcyclohepta-4, 6-dien-2-one

32. Chapman, O. L., and Hoganson, E. D. Photoisomerization of 1-Aza-3, 5, 7-trimethylcyclohepta-4, 6-dien-2-one. J. Am. Chem. Soc. 86, 498 (1964).

Uracil

33. Conrad, W. E. Uracil Decomposition by Light. Radiation Res. 1, 523 (1954). [Chem. Abstr. 49, 4412e.]

2-Pyrone N-Methyl-2-pyridone

34. Corey, E. J., and Streith, J. Internal Photoaddition Reactions of 2-Pyrone and N-Methyl-2-pyridone. J. Am. Chem. Soc. 86, 950 (1964).

2, 2'-Benzothiazyl disulfide	35.	Cutforth, H. G., and Selwood, P. W. Effect of Light on 2, 2'-Benzothiazyl Disulfide. J. Am. Chem. Soc. 70, 278 (1948). [Chem. Abstr. 42, 2485a.]
Iridium and rhodium pyridine derivatives	36.	Delépine, M. Action of Light on Aqueous Solutions of trans-Pyridine Derivatives of Iridium and Rhodium. Compt. Rend. 240, 2468 (1955).
Iridium and rhodium pyridine derivatives	37.	Delépine, M. Effect of Light on Aqueous Solutions of cis-Dipyridine-tetrachloro Derivatives of Iridium and Rhodium. Compt. Rend. 242, 27 (1956). [Chem. Abstr. 50, 9883i.]
Quinine hydrochloride	38.	Delperdange, G. R. Quinine Hydrochloride Sensitivity to Light, Effects of Crystal Form. Rev. Paludisme Méd. Trop. 6, 103 (1948). [Chem. Abstr. 43, 2839c.]
Tryptophan	39.	Deschreider, A. R., and Renard, M. Tryptophan Decomposition by Light. Bull. Inst. Agron. Sta. Rech. Gembloux 23, 269 (1955). [Chem. Abstr. 50, 3904f.]
Tryptophan	40.	Deschreider, A. R., and Renard, M. Tryptophan Irradiated by Light. Spectrum of. Bull. Inst. Agron. Sta. Rech. Gembloux 23, 151 (1955). [Chem. Abstr. 49, 15482e.]
Spirans Methylene blue Xanthylidineanthrone Dinitrobenzylpyridine	41.	Dessauer, R., and Paris, J. P. Photochromism of 2-(2', 3'-Dinitrobenzyl)pyridine, Xanthylidineanthrone, Spirans, and Methylene Blue. Advances in Photochemistry. Vol 1, p 275. Interscience Publishers, Inc., New York, New York. 1963.
Serotonin 5-Hydroxytryptophan	42.	Doepfner, W., and Celetti, A. The Formation of Serotonin From 5-Hydroxytryptophan With Ultraviolet Irradiation. Experientia 14, 376 (1958). [Chem. Abstr. 53, 14015e.]
Pyoverdine Pseudomonada pigment	43.	Elliott, R. P. Pyoverdine Decomposition by Light. Appl. Microbiol. 6, 241 (1958). [Chem. Abstr. 52, 18654d.]

Photochemistry Heterocyclics (early work)	44.	Ellis, C., and Wells, A. A. The Chemical Action of Ultraviolet Rays. Reinhold Publishing Corp., New York, New York. 1941.
Pyridine	45.	Feigl, F., and Anger, V. Photopyridine Reaction. J. Prakt. Chem. 139, 180 (1934). [Chem. Abstr. 28, 2334^5.]
Pyridine	46.	Fialkovskaya, O. V., and Terenin, A. N. Pyridine Adsorbed on Silica Gels Irradiated by Light. Izv. Akad. Nauk SSSR Otd. Khim. Nauk, 226 (1951). [Chem. Abstr. 45, 9374g.]
Histamine Histidine	47.	Flemming, K. Mechanism of Histamine Formation in Histidine Solution Irradiated With Ultraviolet Light. Arch. Exptl. Pathol. Pharmakol. 236, 27 (1959). [Chem. Abstr. 53, 10350d.]
Triazines	48.	Freeman, H. C., and Le Fèvre, R. J. W. 1, 3-Diphenyltriazine Decomposition by Light. J. Chem. Soc., 2932 (1952). [Chem. Abstr. 46, 10903e.]
Diazirine	49.	Frey, H. M., and Stevens, I. D. R. Photolysis of Diazirine. Proc. Chem. Soc. 79, (1962).
Pyridine Pyridines	50.	Freytag, H. Action of Ultraviolet Light on Pyridine Derivatives. Chem. Ber. 69B, 32 (1936). [Chem. Abstr. 30, 2966^6.]
Pyridine Pyridines	51.	Freytag, H. Photochemistry of Pyridine and Its Derivatives. Phot. Korr. 73, 17, 37, 57 (1937). [Chem. Abstr. 32, 9839^3.]
Pyridine	52.	Freytag, H. Pyridine Decomposition by Light (Analytical Principles). Z. Anal. Chem. 152, 86 (1956). [Chem. Abstr. 51, 3372b.]
Histamine Histidine Imidazole	53.	Fujiwara, T., Takano, H., Morokuma, T., and Yamada, M. Decomposition by Light of Histamine, Histidine and Imidazole Derivatives. Nagasaki Igakkai Zasshi 24, 726 (1954). [Chem. Abstr. 49, 2538i.]

Riboflavine	54.	Fukamachi, C., and Sakurai, Y. Photolytic Formation of 6, 7-Dimethylflavin-9-acetic Acid From Riboflavine. Shokuryo Kenkyusho Kenkyu Hokoku,No. 10, 207 (1955). [Chem. Abstr. 53, 14111c.]
Thiophenes	55.	German Patent 955, 379 (to Kalle and Co. Akt. -Ges.). Light-Sensitive Material for Reproduction. (Nitrated Thiophene Derivatives). January 3, 1957. [Chem. Abstr. 54, 12848f.]
Acridine Acridan	56.	Giurgea, M., Mihai, G., Topa, V., and Musa, M. Photochemical Reactions in Solutions of Acridine and Acridan. J. Chim. Phys. 61, 619 (1964). [Chem. Abstr. 61, 5483h.]
Pyrethrum	57.	Glynne Jones, G. D. Pyrethrum Decomposition by Light. Ann. Appl. Biol. 48, 352 (1960). [Chem. Abstr. 55, 2145h.]
Ethylene oxide	58.	Gomer, R., and Noyes, W. A., Jr. Photochemical Decomposition of Ethylene Oxide. J. Am. Chem. Soc. 72, 101 (1950).
Indole	59.	Hantsu, S. Photolysis of Indole. Nagasaki Igakkai Zasshi 35, 65 (1960). [Chem. Abstr. 54, 18035b.]
Rhodopsin	60.	Hara, R., and Takagi, M. Effect of Illumination on the Electrical Conductance of Rhodopsin at Low Temperature. Dobutsugaku Zasshi 69, 255 (1960). [Chem. Abstr. 55, 20030c.]
Nitrobenzyl-pyridines	61.	Hardwick, R., and Mosher, H. S. γ-2, 4-Dinitrobenzyl-pyridine Reactions in Presence of Light. J. Chem. Phys. 36, 1402 (1962). [Chem. Abstr. 57, 4222b.]
2-Picoline-N-oxide	62.	Hata, N. 2-Picoline-N-oxide Decomposition by Light. Bull. Chem. Soc. Japan 34, 1440 (1961). [Chem. Abstr. 56, 4286b.]
3-Picoline-N-oxide	63.	Hata, N. 3-Picoline-N-oxide Decomposition by Light. Bull. Chem. Soc. Japan 34, 1444 (1961). [Chem. Abstr. 56, 4286e.]

Pyridine-N-oxide	64.	Hata, N., and Tanaka, I. Pyridine-N-oxide Derivatives Irradiated by Light. J. Chem. Phys. 36, 2076 (1962). [Chem. Abstr. 57, 5888f.]
Formazans	65.	Hausser, I., Jerchel, D., and Kuhn, R. Rearrangement of Formazans by Light. Chem. Ber. 82, 515 (1949). [Chem. Abstr. 44, 3927h.]
Tetrazolium compounds Triphenyltetrazolium chloride Formazans Triphenylformazan	66.	Hausser, K. H. Decomposition of Triphenyltetrazolium Chloride and Triphenylformazan. Naturwissenschaften 36, 313 (1949). [Chem. Abstr. 44, 5713e.]
Pyridylacrylic acid	67.	Henze, M. Attempted Polymerization of Pyridyl Acrylic Acid. Chem. Ber. 70B, 1273 (1937). [Chem. Abstr. 31, 5800^3.]
Riboflavine	68.	Hioki, H., and Sakurai, Y. On the Inhibition of Riboflavine Photolysis With Apple Juice. Bitamin (Kyoto) 8, 380 (1955). [Chem. Abstr. 51, 18027abd.]
Riboflavine	69.	Hioki, H., and Sakurai, Y. On the Photolytic Formation of 6, 7-Dimethylflavine-9-acetic Acid From Riboflavine. Bitamin (Kyoto) 7, 1014 (1954). [Chem. Abstr. 51, 18026gi.]
Vitamin B_2 Riboflavine	70.	Hioki, H., and Sakurai, Y. Vitamin B_2 Photolysis. V. The Photolytic Formation of 6, 7-Dimethylflavine-9-acetic Acid Ester From Riboflavine. Bitamin (Kyoto) 7, 939 (1954). [Chem. Abstr. 51, 18026gi.]
Riboflavine	71.	Hioki, H., and Sakurai, Y. Why Fructose Inhibits the Photolysis of Riboflavine in Alkaline Solution. Bitamin (Kyoto) 9, 221 (1955). [Chem. Abstr. 51, 18027abd.]
Riboflavine	72.	Holmstroon, B., and Oster, G. Riboflavine as an Electron Donor in Photochemical Reactions. J. Am. Chem. Soc. 83, 1867 (1961). [Chem. Abstr. 55, 19429e.]

Ferric salts 2, 2'-Bipyridine	73.	Ignatieff, V. Effect of Light on Reduction of Ferric Ion by Citrate and 2, 2'-Bipyridine. J. Soc. Chem. Ind. 56, 407 (1937). [Chem. Abstr. 32, 13769.]
Imidazole	74.	Inoue, M., Takano, N., and Morokuma, T. Imidazole Acetic Acid Decomposition by Light. Nagasaki Igakkai Zasshi 29, 549 (1954). [Chem. Abstr. 48, 13759b.]
Phenothiazine Sulfonamide	75.	Ippen, H. Effect of Light on Phenothiazine and Sulfonamide Derivatives. Proc. Intern. Congr. Photobiol., 3rd, Copenhagen 1960, 509-514 (Pub. 1961). (German). [Chem. Abstr. 60, 6054e.]
Riboflavine	76.	Ishiguro, I., Kato, Y., and Suguira, M. The Mechanism of Riboflavine Photolysis and Its Stability. Gifu Yakka Daigaku Kiyo 8, 49 (1958). [Chem. Abstr. 53, 10321i.]
4-Azidopyridine	77.	Itai, T., and Kamisja, S. 4-Azidopyridine Related Compounds Cleavage by Light. Chem. Pharm. Bull. (Tokyo) 9, 87 (1961). [Chem. Abstr. 55, 27338c.]
1, 2-Benziso-thiazolin-3-one-1, 1-dioxide	78.	Italian Patent 652, 828 (to Montecatini).. Stabilizer for Olefin Polymers; 1, 2-Benzisothiazolin-3- one-1, 1-dioxide. February 23, 1963. [Chem. Abstr. 60, 9437h.]
Acridine 9-Methylacridine	79.	Ivanoff, Nina. Action of Ultraviolet and γ-Radiation on Solutions of Acridine. III. Quantum Yield for the Reaction of Acridine and 9-Methylacridine With Carbon Tetrachloride. J. Chim. Phys. 55, 768 (1958). [Chem. Abstr. 53, 19534h.]
Acridine	80.	Ivanoff, Nina, and Walch, France. Action of Ultraviolet Light on Solutions of Acridine (Halogenated Solvents). J. Chim. Phys. 56, 574 (1959). [Chem. Abstr. 51, 16112fi.]
Tetrazolium compounds	81.	Jambor, B. Reactions of Tetrazolium Compounds in the Presence of Light. Pharmazie 13, 277, 282, 411, 414 (1958). [Chem. Abstr. 53, 4264f.]

Benzotriazole derivatives	82.	Japanese Patent 2476 (to Osaka Seika Industry Co., Ltd.). Light Stabilizer, 2-(2-Hydroxy-5-methyphenol)-benzotriazole. May 23, 1962. [Chem. Abstr. 60, 10890b.]
Hydroxypyrimidines	83.	Japanese Patent 5647 (to Shin Fujisawa). Photosensitive Material (Hydroxypyrimidine Derivatives). June 29, 1959. [Chem. Abstr. 53, 21309f.]
Thymine dimers Dinucleotides	84.	Johns, H. E., Rapaport, S. A., and Delbruck, M. Photochemistry of Thymine Dimers. J. Mol. Biol. 4, 104 (1962). [Chem. Abstr. 57, 2549e.]
4,4'-Bipyridine Viologens	85.	Johnson, C. S., Jr., and Gutowsky, H. S. Decomposition of Benzyl, Ethyl and Methyl Viologens and 4,4'-Bipyridine. J. Chem. Phys. 39, 58 (1963). [Chem. Abstr. 59, 2315c.]
Triazines	86.	Jordan, L. S., Day, B. E., and Clerx, W. A. Photodecomposition of Triazines. Weeds 12, 6 (1964). [Chem. Abstr. 60, 11302g.]
Pyrimidines	87.	Kalab, D. Application of Oscillographic Polarography in Photochemistry. I. Pyrimidines. Chem. Zvesti 18, 435 (1964). [Chem. Abstr. 61, 11515d.]
Quinoxalines Dihydroxyquinoxaline	88.	Kawai, S., Tanaka, S., and Ichikawa, K. Synthesis of 2,3-Dimethyl-5,8-dihydroxyquinoxaline and the Influence of Light Upon Catalytic Hydrogenation. J. Chem. Soc. Japan Pure Chem. Sect. 75, 40 (1954). [Chem. Abstr. 49, 10314h.]
Thiamine	89.	Kawasaki, C., and Daira, I. Decomposition of Thiamine Derivatives by Ultraviolet Irradiation. Bitamin (Kyoto) 26, 462 (1962). [Chem. Abstr. 61, 16350g.]
Acridine	90.	Kellmann, A. Kinetics of the Photochemical Reaction of Acridine in Alcohol. J. Chim. Phys. 56, 574 (1959). [Chem. Abstr. 53, 21088c.]
Acridine	91.	Kellmann, A. Mechanism of the Photochemical Reactions of Acridine in Hydrogen Solvents. J. Chim. Phys. 57, 1 (1960). [Chem. Abstr. 54, 12743g.]

Acridine 9-Methylacridine	92.	Kellmann, A. Photodimerization of Acridine and of 9-Methylacridine. J. Chim. Phys. 54, 468 (1957). [Chem. Abstr. 51, 16112fi.]
Malachite green	93.	Kemula, W., and Gra Bowska, A. Malachite Green Leucocyanide Decomposition by Light. Roczniki Chem. 34, 1445 (1960). [Chem. Abstr. 55, 12010e.]
Oxadiazoline	94.	Kirmse, W. Photoreactions of an Oxadiazoline. Chem. Ber. 93, 2357 (1960). [Chem. Abstr. 55, 2623c.]
Purines	95.	Kland, M. J., and Johnson, L. A. Kinetic Study of the Ultraviolet Decomposition of Biochemical Derivatives of Nucleic Acid. (Purines). J. Am. Chem. Soc. 79, 6187 (1957). [Chem. Abstr. 52, 4718h.]
Methylene blue	96.	Koizumi, M., and Obata, H. Formation of Stable Semiquinone of Methylene Blue by Irradiation With Visible Light. Bull. Chem. Soc. Japan 31, 823 (1958). [Chem. Abstr. 53, 14717a.]
Riboflavine	97.	Kravchina, L. N., and Koltunova, V. I. Effect of Illumination on Solutions of Crystalline Riboflavine. Tr. Vses. Nauchn. Issled. Vitamin. Inst. 5, 73 (1954). [Chem. Abstr. 51, 7158f.]
Quinine	98.	Kyker, G. C., McEven, M. M., and Cortatzer, W. E. Quinine Decomposition by Light. Arch. Biochem. Biophys. 12, 191 (1947). [Chem. Abstr. 41, 3866c.]
Triazines	99.	Le Fèvre, R. J. W., and Liddiroel, T. H. Effect of Light on 1-Aryl-3, 3-dimethyltriazines. J. Chem. Soc., 2743 (1951).
Pyridine	100.	Letsinger, R. L., and Ramsay, O. B. Pyridine Reaction With m- and p-Nitrophenyl Disodium Phosphate in Light. J. Am. Chem. Soc. 86, 1447 (1964). [Chem. Abstr. 60, 14347b.]
Thiamine Pyridoxine	101.	Lhuissier, M., and Biette, E. Effect of Light on Pyridoxine and Thiamine in Milk in Storage. Ann. Technol. Agr. 11, No. 1, 63 (1962). [Chem. Abstr. 57, 5071i.]

Triprolidine	102.	Loewenthal, L. J. A. Triprolidine Hydrochloride in the Prevention of Some Solar Dermatoses. Brit. J. Dermatol. 75, 254 (1963). [Chem. Abstr. 60, 2232e.]
Piperidine 1-Chloro-piperidine	103.	Lukes, R., and Ferles, M. Reaction of 1-Chloro-4-ethyl- and 1-Chloro-4-methyl-4-ethylpiperidine With Sulfuric Acid in Light. Chem. Listy 49, 510-518 (1955). [Chem. Abstr. 49, 10290d.]
Oxetane 2, 2'-Dimethyloxetane	104.	Margerum, J. D., Pitts, J. N., Jr., Rutgers, J. G., and Searles, S. Photochemical and Free Radical Decomposition of Oxetane and 2, 2'-Dimethyloxetane. J. Am. Chem. Soc. 81, 1549 (1959).
Tryptophan	105.	Matsuda, G. Tryptophan Decomposition by Light. Nagasaki Igakkai Zasshi 28, 438, 811, 814, 817 (1953). [Chem. Abstr. 48, 6842d.]
Vitamins Riboflavine Thiamine	106.	Maurer, H. J., and Dittmeyer, R. The Action of Ionizing Radiation on Vitamins (Thiamine and Riboflavine). Strahlentherapie 102, 531 (1957). [Chem. Abstr. 51, 12998d.]
Pyrone 4, 6-Dimethyl-2-pyrone	107.	de Mayo, P. Irradiation of 4, 6-Dimethyl-2-pyrone. Advances in Organic Chemistry. Vol II, p 394. Interscience Publishers, Inc., New York, New York. 1960.
3-Indoleacetic acid	108.	Mayr, H. H. 3-Indoleacetic Acid Decomposition by Light. Planta 46, 512 (1956). [Chem. Abstr. 50, 7922g.]
Dipyridinium bromide 1, 1'-Ethylene-2, 2'-dipyridinium bromide	109.	Mees, G. C. Effect of Light on Weed Control by 1, 1'-Ethylene-2, 2'-dipyridinium Bromide. Ann. Appl. Biol. 48, 601 (1960). [Chem. Abstr. 55, 14798h.]
Tryptophan	110.	Melchior, G. H. Tryptophan Decomposition by Light. Planta 50, 262 (1957). [Chem. Abstr. 52, 5501c.]

Insecticides	111.	Mistric, W. J., and Martin, D. F. Insecticide Toxicity in Relation to Sunlight. J. Econ. Entomol. 49, 757 (1956). [Chem. Abstr. 51, 6070e.]
Pyrimidines HCN	112.	Moore, A. M. Ultraviolet Irradiation of Pyrimidine Derivatives. Effect of HCN. Can. J. Chem. 37, 1281 (1959). [Chem. Abstr. 53, 21094d.]
Pyrimidines Uracil	113.	Moore, A. M. Ultraviolet Irradiation of Pyrimidine Derivatives. Synthesis of the Reversible Photolysis of Uracil. Can. J. Chem. 36, 281 (1958). [Chem. Abstr. 52, 6949d.]
Pyrimidine	114.	Moore, A. M., and Thomson, C. H. Pyrimidine Decomposition by Light. Can. J. Chem. 35, 163 (1957). [Chem. Abstr. 51, 9331d.]
Pyrimidines	115.	Moore, A. M., and Thomson, C. H. Pyrimidine Derivatives, Reaction in Light. Science 122, 594 (1955). [Chem. Abstr. 50, 4646f.]
Pyridoxal phosphate	116.	Morrison, A. J., and Long, R. F. Photolysis of Pyridoxal Phosphate. J. Chem. Soc., 211 (1958). [Chem. Abstr. 52, 11035h.]
Chlorpromazine Promethazine	117.	Nakagawa, T., Kubota, T., and Miyazaki, H. Chlorpromazine and Promethazine Irradiation by Light. Ann. Rept. Shionogi Ris. Lab. 7, 19 (1957). [Chem. Abstr. 51, 15279i.]
Chlorpromazine	118.	Napolitano, L., and Maffei, R. Allergy From Chlorpromazine. Policlinico (Rome) Sez. Prat. 64, 257 (1957). [Chem. Abstr. 51, 12322b.]
α-Pyridylferrocene	119.	Nesmeyanov, A. N., Sazonova, V. A., Gerasimenko, A. V., and Sazonova, N. S. Decomposition of Salts of α-Pyridylferrocene. Dokl. Akad. Nauk SSSR 149, 1354 (1963). [Chem. Abstr. 59, 3460h.]
Tetrazolium salts	120.	Nickerson, W. J., and Meckel, J. R. Effect of Light in Tetrazolium-Salt Reduction. Proc. Natl. Acad. Sci. U. S. 39, 901 (1953). [Chem. Abstr. 48, 8293f.]

Riboflavine Methionine	121.	Nickerson, W. J., and Strauss, G. Illumination of Air Free Riboflavine Solution in the Presence of Methionine. J. Am. Chem. Soc. 82, 5007 (1960).
Methylene blue	122.	Obata, H., Kogasaka, K., and Koisumi, M. Photochemical Reactions Between Methylene Blue and Various Amines in the Presence of Oxygen. Bull. Chem. Soc. Japan 32, 125 (1959). [Chem. Abstr. 54, 16130b.]
Methylene blue	123.	Obata, H., and Koisumi, M. Photochemical Reactions Between Methylene Blue and Tri-, Di-, and Monomethyl Amine. I. Bull. Chem. Soc. Japan 32, 125 (1959). [Chem. Abstr. 54, 16130b.]
8-Quinuclidinol Metal chelates	124.	Ohnesarge, W. E., and Rogers, L. B. Fluorescence of Some Metal Chelate Compounds of 8-Quinuclidinol. Effect of Ultraviolet Irradiation. Spectrochim. Acta 41 (1958). [Chem. Abstr. 53, 13775h.]
Picrylpyridinium chloride	125.	Okon, K., and Waclawek, W. Picrylpyridinium Chloride, Decomposition by Light. Biul. Wojakowej Akad. Techn. 10, No. 111-112, 105 (1961). [Chem. Abstr. 56, 15070b.]
Pyridine nucleotide	126.	Oyama, T., and Miyachi, S. Pyridine Nucleotide Formation in Light. Biochim. Biophys. Acta 34, 202 (1959). [Chem. Abstr. 53, 19037i.]
Pyrethrin	127.	Page, A. B., and Blackith, R. E. Pyrethrin Decomposition by Light. Pyrethrum Post 2,No. 1, 18 (1950). [Chem. Abstr. 44, 8587g.]
Azepin-2-one derivatives	128.	Paquette, L. A. The Photoisomerization of 1, 3-Dihydro-3, 5, 7-trimethyl-2H-azepin-2-one. J. Am. Chem. Soc. 86, 500 (1964).
2-Pyridones	129.	Paquette, L. A., and Slomp, G. Photodimerization of Substituted 2-Pyridones. J. Am. Chem. Soc. 85, 765 (1963).
Dipyridylethylenes	130.	Purkampus, H. H., and Senger, P. Decomposition of trans-1, 2-Dipyridylethylenes. Ber. Bunsenges. Physik. Chem. 67, 876 (1963). [Chem. Abstr. 60, 6382h.]

Riboflavine	131.	Povolotskaya, K. L., and Zaitseva, N. I. Destruction of Riboflavine Under the Influence of Visible Light. Tr. Vses. Nauchn. Issled. Vitamin. Inst. 5, 145 (1954). [Chem. Abstr. 51, 7653c.]
Pyrimidines	132.	Prusoff, W. H. Pyrimidine Derivatives Irradiated by Light-Cell Sensitization. Biochim. Biophys. Acta 58, 588 (1962). [Chem. Abstr. 57, 7584b.]
Indigo dyes	133.	Pummerer, R., and Marondel, G. Optical Evidence of the Reversible Formation of cis- Indigo Dyes by Means of Irradiation. Ann. 602, 228 (1957). [Chem. Abstr. 51, 10236f.]
3-Indoleacetic acid	134.	Ray, P., and Curry, G. M. Photodestruction of Indole-3-acetic Acid. Nature 181, 895 (1958). [Chem. Abstr. 52, 15266.]
Pyrimidines Benzo[a]pyrene Uracil Thymines Cytosines Guanine	135.	Rice, J. M. Photochemical Addition of Benzo[a]pyrene to Pyrimidine Derivatives (Uracil, Thymine, Cytosine, 5-Methylcytosine, Guanine, and 6-Azathymine). J. Am. Chem. Soc. 86, 1444 (1964).
Pyrimidine Uracil Thymine	136.	Rorsch, A., Beukers, R., Ijlstra, J., and Berends, W. The Effect of Ultraviolet Light on Some Components of the Nucleic Acids. I. Uracil, Thymine. Rec. Trav. Chim. 77, 423 (1958). [Chem. Abstr. 52, 15610i.]
Pyrimidinecarboxylic acids	137.	Rutter, H. A., Jr., Gustafson, L. O., and Batt, W. G. Pyrimidinecarboxylic Acids Irradiated by Light. J. Franklin Inst. 260, 329 (1955). [Chem. Abstr. 50, 3904e.]
Phenothiazine sensitizers	138.	Santamaria, L., Prino, G., and Neri, M. Photosensitizing Action of Some Phenothiazine Derivatives. Boll. Chim. Farm. 98, 67 (1959). [Chem. Abstr 53, 16386i.]
Pyrimidine Toxopyrimidine	139.	Saseki, T., and Kinoshita, T. Effect of Light on Toxopyrimidine. Bitamin (Kyoto) 4, 420 (1951). [Chem. Abstr. 46, 10218b.]

Metal complexes	140.	Schäfer, H. L. Effect of Light on Transition Metal Complexes. Acta Chim. Acad. Sci. Hung. 18, 375 (1959). [Chem. Abstr. 53, 21355b.]
Photochemistry Heterocyclics (additional references)	141.	Schönberg, A. Präparative Organische Photochemie. Springer-Verlag, Berlin-Wilmersdorf (West), Germany. 1958.
TPN (triphosphopyridine nucleotide)	142.	Seraydarian, M. W. Triphosphopyridine Nucleotide Response to Light. Am. J. Physiol. 181, 291 (1955). [Chem. Abstr. 50, 13567i.]
DPN (diphosphopyridine nucleotide)	143.	Seraydarian, M. W., Cohen, A. I., and Sable, H. Z. Diphosphopyridine Nucleotide Inactivation by Light. Am. J. Physiol. 177, 150 (1954). [Chem. Abstr. 48, 8293e.]
Trypsin	144.	Setlow, R. B., and Doyle, B. Trypsin Inactivation by Light. Arch. Biochem. Biophys. 48, 441 (1954). [Chem. Abstr. 48, 5906f.]
1, 3-Dimethyluracil	145.	Shih-Yi Wang. First Step in the Ultraviolet Irradiation of 1, 3-Dimethyluracil. J. Am. Chem. Soc. 80, 6196 (1958). [Chem. Abstr. 53, 21088c.]
Pyrimidines	146.	Shih-Yi Wang. Photochemical Reactions in Frozen Solutions of Pyrimidines. Nature 190, 690 (1961). [Chem. Abstr. 55, 23013f.]
1, 3-Dimethyluracil	147.	Shih-Yi Wang. The Ultraviolet Irradiation of the First Product From 1, 3-Dimethyluracil. J. Am. Chem. Soc. 80, 6199 (1958). [Chem. Abstr. 53, 21088c.]
1, 3-Dimethylthymine	148.	Shih-Yi Wang. Ultraviolet Irradiation of 1, 3-Dimethylthymine. Nature 184, 59 (1959). [Chem. Abstr. 54, 2897f.]
1, 3-Dimethyluracil	149.	Shih-Yi Wang, Apicella, M., and Stone, B. R. 1, 3-Dimethyluracil Decomposition by Light. J. Am. Chem. Soc. 78, 4180 (1956). [Chem. Abstr. 50, 15242d.]

Pyrimidines Oligonucleotides Polynucleotides	150.	Shugar, D., and Wierzchowski, K. Photochemistry of Pyrimidine Residues in Oligonucleotides and Single and Double Stranded Polynucleotides. Proc. Intern. Congr. Photobiol., 3rd, Copenhagen 1960, 609 (Pub. 1961). [Chem. Abstr. 58, 14350.]
Pyrimidines Nucleic acids	151.	Shugar, D., and Wierzchowski, K. Reversible Photolysis of Pyrimidine Derivatives Including Triols With Nucleic Acids. Biochim. Biophys. Acta 23, 657 (1957). [Chem. Abstr. 51, 9331e.]
Pyrethrin	152.	Siddiqui, R. H., and Maqrood Ali, S. Stability of Pyrethrin in Light. Pakistan J. Sci. Res. 4, 20 (1952). [Chem. Abstr. 47, 8961c.]
o-Quinone diazides Pyrroles	153.	Süs, O. Light Reaction of o-Quinone Diazides. Photosynthesis of Cyclopentadiene and Pyrrole Derivatives. Z. Wiss. Phot. Photophysik Photochem. 50, 476 (1955). [Chem. Abstr. 50, 8355d.]
N-Methyl-2-pyridone	154.	Slomp, G., MacKellar, F. A., and Paquette, L. A. Photodimer of N-Methyl-2-pyridone. J. Am. Chem. Soc. 83, 4473 (1961).
Tryptophan	155.	Spies, J. R., and Chanbers, D. C. Photochemistry of Tryptophan, p-Dimethylaminebenzaldehyde and Their Condensation Products. J. Am. Chem. Soc. 70, 1682 (1948). [Chem. Abstr. 42, 6706b.]
Furaldehyde semicarbazone	156.	Sprosa, B. Decomposition of 5-Nitro-2-furaldehyde Semicarbazone by Light. Farm. Revy 52, 501, 517 (1953). [Chem. Abstr. 47, 12002e.]
Riboflavine	157.	Strauss, G., and Nickerson, W. J. Photochemical Cleavage of Water by Riboflavine. Role of Activators. J. Am. Chem. Soc. 83, 3187 (1961).
DPN (diphosphopyridine nucleotide)	158.	Strehler, B. L. Luminescence in Cell-Free Extracts of Luminous Bacteria and Its Activation by DPN (Diphosphopyridine Nucleotide). J. Am. Chem. Soc. 75, 1264 (1953). [Chem. Abstr. 47, 5480g.]

Molybdenum carbonylpyridine compounds	159.	Strohmeier, W., and Gerlach, K. The Photochemical Preparation of Molybdenum Pentacarbonylpyridine and Molybdenum Tetracarbonyldipyridine. Chem. Ber. 93, 2087 (1960). [Chem. Abstr. 55, 3586d.]
Rhodopsin	160.	Takagi, M., and Sekoguti, Y. Effect of Illumination on the Ultraviolet Absorption Spectrum of Rhodopsin. Biochim. Biophys. Acta 49, 589 (1961). [Chem. Abstr. 55, 26068c.]
Pyrethrin	161.	Takei, S., Wakazono, K., and Hiraoka, K. The Change in Pyrethrin Caused by Light and Heat. J. Agr. Chem. Soc. Japan 17, 419 (1941). [Chem. Abstr. 45, 3982g.]
Alkyl and aryl pyridines 2-Methyl-5-ethylpyridine	162.	Tarkington, T. W., and Whitt, C. D. Belgian Patent 614,030 (to Chemstrand Corporation). Alkyl and Aryl Pyridine Light Stabilizers Toward Acrylonitrile Polymer Discoloration. August 16, 1962. [Chem. Abstr. 58, 1581g.]
Pyrazoles	163.	Tasnura, H. Pyrazole Fungicides and Light. Bull. Natl. Inst. Agr. Sci., Ser. C., No. 5, 1-14 (1955). [Chem. Abstr. 51, 5344c.]
2-Aminopyridines 2-Pyridones	164.	Taylor, E. C., and Kan, R. O. Photochemical Dimerization of 2-Aminopyridines and 2-Pyridones. J. Am. Chem. Soc. 85, 776 (1963).
2-Aminopyridines 2-Pyridones	165.	Taylor, E. C., Kan, R. O., and Paudler, W. W. Photolysis of 2-Aminopyridines and 2-Pyridones. J. Am. Chem. Soc. 83, 4484 (1961). [Chem. Abstr. 57, 776e.]
2-Pyridones	166.	Taylor, E. C., and Paudler, W. W. Photodimerization of Pyridones. Tetrahedron Letters, No. 25, 1 (1960).
Histidine	167.	Tomohiro, Y. Histidine Decomposition by Light. Nagasaki Igakkai Zasshi 28, 1117 (1953). [Chem. Abstr. 48, 6042g.]
Phenazine	168.	Toromanoff, E. Molecular Association in the Phenazine Series in Relation to Photochemical Reactions. Ann. Chim. (Paris) 1, 115 (1956). [Chem. Abstr. 52, 9151h.]

Flavines	169.	Vehara, K., Muramaku, I., and Makita, M. Light Activation of Flavine Compounds. Bitamin (Kyoto) 13, 261 (1957). [Chem. Abstr. 54, 3542i.]
Pyrimidine	170.	Wacker, A. Dimerization of Pyrimidine by Light. J. Chim. Phys. 58, 1041 (1961). [Chem. Abstr. 56, 11983e.]
Pyrimidines Pyrimidine ribosides Ribosides	171.	Wacker, A., Dellweg, H., and Lodemann, E. Effect of Light on Pyrimidines and Pyrimidine Ribosides. Angew. Chem. 73, 64 (1961). [Chem. Abstr. 55, 15573a.]
Pyrimidines Ribosides	172.	Wacker, A., Trager, L., and Weinblum, D. Effect of Light on Ribosides and Pyrimidines. Angew. Chem. 73, 65 (1961). [Chem. Abstr. 55, 15573a.]
Rhodopsin	173.	Wald, G. Rhodopsin System and Light. The Photochemical Basis of Rod Vision. J. Opt. Soc. Am. 41, 949 (1951). [Chem. Abstr. 46, 3139g.]
Rhodopsin	174.	Wald, G., and Brown, P. K. Sulfhydryl Group-Role in Bleaching and Synthesis of Rhodopsin. J. Gen. Physiol. 35, 797 (1952). [Chem. Abstr. 46, 7145h.]
Tetrazolium compounds	175.	Weygand, F., and Frank, I. Tetrazolium Compounds-Decomposition in Light. (2, 3, 5-Triphenyltetrazolium Chloride). Z. Naturforsch. 3b, 377 (1948). [Chem. Abstr. 43, 5313f.]
Pyrimidine 4-Amino-pyrimidines	176.	Wierzchowski, K., and Shugar, D. Decomposition of 4-Aminopyrimidines. Proc. Intern. Congr. Photobiol., 3rd, Copenhagen 1960, 606 (Pub. 1961). [Chem. Abstr. 58, 9783h.]
Polymers Pyridinium salts	177.	Williams, J. L. R., and Borden, D. G. Photoreactive Polymers, 2-(Arylvinyl)-N-vinylpyridinium Arene Sulfonate Polymers. Makromol. Chem. 73, 203 (1964). [Chem. Abstr. 61, 737h.]
Aminopterin	178.	Williams, J. N., Jr. Decomposition by Light of Aminopterin and Folic Acid. J. Biol. Chem. 187, 47 (1950). [Chem. Abstr. 45, 3879d.]

Thiazine dyes	179.	Wotherspoon, N., and Oster, G. Light Induced Spectral Shift of the Thiazine Dyes in the Bound State (Polyacrylic Acid). J. Am. Chem. Soc. 79, 3992 (1957). [Chem. Abstr. 52, 98c.]
Rhodopsin	180.	Wulff, V. J., Adams, R. G., Linschitz, H., and Abrahamson, E. W. Effect of Flash Illumination on Rhodopsin in Solution. Ann. N. Y. Acad. Sci. 74, Art. 2, 281 (1958). [Chem. Abstr. 53, 6311b.]
Methylene blue	181.	Yoshida, Z., and Kazama, K. Methylene Blue Decomposition by Light. Kogyo Kagaku Zasshi 59, 1418 (1956). [Chem. Abstr. 53, 2821i.]
Methylene blue	182.	Yoshida, Z., and Kazama, K. Photosensitized Reduction of Benzophenone by Methylene Blue. Kogyo Kagaku Zasshi 60, 195 (1956). [Chem. Abstr. 53, 2822b.]
Rhodopsin	183.	Yoshizawa, T., and Kito, Y. Rhodopsin Illuminated at Low Temperatures. Ann. Rept. Sci. Works Fac. Sci. Osaka Univ. 6, 27 (1958). [Chem. Abstr. 53, 7783g.]
Pyridine	184.	You Sun Kin and Yong Ja Park. Reaction of Pyridine With Organic Halides in Ultraviolet Light. Ta Han Hua Hsueh Hui-Chih 6, 148 (1962). [Chem. Abstr. 60, 2476b.]
Methylene blue	185.	Yushina, V. V., and Nikolaev, L. A. Methylene Blue Reaction With Amines in Light. Zh. Fiz. Khim. 37, 2277 (1963). [Chem. Abstr. 60, 4279a.]
Acridine	186.	Zanker, V., Cnobloch, H., and Mader, F. Ultraviolet Spectroscopical and Photochemical Behavior of Acridine. Proc. Intern. Symp. Mol. Struct. Spectry. (Tokyo) B 302/14 (1962). [Chem. Abstr. 61, 207g.]
Acridine dyes Fluorescein dyes	187.	Zanker, V., and Peter, W. Acridine and Fluorescein Dyes. Z. Physik. Chem. (Frankfurt)26, 159 (1960). [Chem. Abstr. 55, 7007b.]
Dypnone oxide	188.	Zimmerman, H. E. Photolysis of trans-Dypnone Oxide Advances in Photochemistry. Vol 1, p 199. Interscience Publishers, Inc., New York, New York. 1963.

III. KEYWORD INDEX.

DISTRIBUTION LIST 13

Copies	
1	Central Files, Bldg 3330
9	Research Laboratories, Bldg 3330 Chief, PP&A Ofc Chief, Clin Res Dept Chief, Def Res Dept Chief, Med Res Dept Chief, Phys Res Lab - 1 cy for author Chief, Toxicology Dept
3	Director, Defense Development & Engineering Labs, Bldg 3330 Chief, Physical Protection Lab Chief, Detection & Warning Lab
1	Director, Weapons Development & Engineering Labs, Bldg 3330
1	Technical Support Directorate, Building 1570, ATTN: Chief, Field Evaluation Division
10	Technical Information Division Library, Building 3330
2	Technical Support Directorate, Building 1570, ATTN: Chief, Engineering Documents Division
1	Technical Support Directorate, Building 1570, ATTN: Chief, Publications Section
8	Technical Support Directorate, Building 1570, Chief, Technical Reporting Section, ATTN: Mrs. E. P. Skaunick
1	Chief, Chemical - Biological Briefing Team, Edgewood Arsenal, Maryland
2	Chief, FSTC Field Office, Edgewood Arsenal, Maryland 21010
1	Commanding Officer, US Army Technical Escort Unit, Edgewood Arsenal, Maryland 21010
1	Officer-in-Charge, Toxic Aid Station, Building 3132, Edgewood Arsenal, Maryland 21010
1	Patent Advisor, Office of Counsel, Building 4405, Edgewood Arsenal, Maryland 21010
1	USA CDC CBRA Liaison Office, Building 5101, Edgewood Arsenal, Maryland 21010
1	U.S. Naval Unit, Edgewood Arsenal, Maryland 21010
6	Australian Army Staff, ATTN: Lt Col Thomas Toukin, 1735 Eye Street, N.W., Washington, D.C. 20006
6	Canadian Liaison Officer (CBR), Building 5101, Edgewood Arsenal, Maryland 21010
6	Dr. D.F. Downing, BDSW(R&D), M/TW, British Embassy, 3100 Massachusetts Avenue, N.W., Washington, D.C. 20008
20	Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314
1	Office, Chief of R&D, Department of the Army, ATTN: CB Branch, Rm 3C367, The Pentagon, Washington, D.C. 29310
1	Headquarters, Department of the Army, OACSFOR, ATTN: FOR CH SR, The Pentagon, Washington, D.C. 20310
1	Headquarters, USAF (AFRSTA), The Pentagon, Washington, D.C. 20330
1	CBR and Nuclear Operations Directorate, OACSFOR, Department of the Army, ATTN: Mr. N.E. Sills, Washington, D.C. 20310

DISTRIBUTION LIST 13 (Contd)

Copies

1	Commanding General, US Army Materiel Command, ATTN: AMCAD-S, Washington, D.C. 20315
1	The Surgeon General, Department of the Army, ATTN: MEDPS-P, Washington, D. C. 20315
1	US Army Medical Research and Development Command, ATTN: MRDDH-SR, Main Navy Building, Washington, D.C. 20315
1	Commanding General, U.S. Army Materiel Command, ATTN: AMCRD-DB, Washington, D.C. 20315
1	Commanding General, U.S. Army Materiel Command, ATTN: Chemistry & Materials Branch, Research Division, Washington, D.C. 20315
1	Commanding General, Supply and Maintenance Command, ATTN: AMSSM-SO-A, Washington, D.C. 20315
1	Commanding General, US Army Supply and Maintenance Command, ATTN: AMSSM-MDA, Washington, D.C. 20315
4	PHS Liaison Officer, Fort Detrick, Frederick, Maryland 21701
1	Commanding General, U.S. Army Test and Evaluation Command, ATTN: AMSTE-NB, Aberdeen Proving Ground, Maryland 21005
2	Redstone Scientific Information Center, ATTN: Chief, Document Section, U.S. Army Missile Command, Redstone Arsenal, Alabama 35809
1	Surgeon, U.S. Army Rocky Mountain Arsenal, Denver, Colorado 80240
2	Commanding Officer, Dugway Proving Ground, ATTN: STEDP-MS-TI, Dugway, Utah 84022
2	Senior Standardization Representative, US Army Standardization Group, UK, ATTN: CBR Representative, Box 65, FPO, New York 09510
1	President, US Army Infantry Board, ATTN: STRBC-TR, Fort Benning, Georgia 31905
1	Commanding Officer, U.S. Army Arctic Test Center, ATTN: STEAC-TA, APO Seattle 98733
2	Commanding General, Deseret Test Center, ATTN: Technical Library, Fort Douglas, Utah 84113
1	Services & Support Group, Provisional, ATTN: Mr. H. David Boston, Headquarters Command, USAF, P.O. Box 50, Bolling Air Force Base, Washington, D.C. 20332
1	Commanding Officer, U.S. Army Frankford Arsenal, ATTN: C2500 - Library, Philadelphia, Pennsylvania 19137
1	Commanding Officer, U.S. Army Limited War Laboratory, ATTN: CRD-AM-7A (V. J. DiPaola), Aberdeen Proving Ground, Maryland 21005
1	Commanding General, U.S. Army Munitions Command, ATTN: AMSMU-QA, Dover, New Jersey 07801
1	Commanding General, US Army Munitions Command, ATTN: AMSMU-RE-N, Dover, New Jersey 07801
1	Commanding General, U.S. Army Munitions Command, ATTN: AMSMU-SS-SC, Dover, New Jersey 07801
1	U.S. Army Infantry School, Bde & Bn Op Dept., Cbt Spt Gp, ATTN: Chmn, CBR Committee, Fort Benning, Georgia 31905
1	Commandant, U.S. Army Chemical Center and School, ATTN: AJMCL-A, Fort McClellan, Alabama 36201

DISTRIBUTION LIST 13 (Contd)

Copies

2	Commandant, U.S. Army Artillery & Missile School, ATTN: AFFSIAS-PL-FH, Fort Sill, Oklahoma 73503
1	Commandant, U.S. Army War College, ATTN: Library, Carlisle Barracks, Pennsylvania 17013
1	Commandant, U.S. Army CBR Weapons Orientation Course, Dugway Proving Ground, Dugway, Utah 84022
1	Commandant, Medical Field Service School, ATTN: CDCO, Fort Sam Houston, Texas 78234
1	Commanding Officer, US Army Combat Development Command Special Warfare and Civil Affairs Group, Fort Belvoir, Virginia 22060
1	Commanding Officer, USA CDC Ordnance Agency, ATTN: CDCOA-A (Library), Aberdeen Proving Ground, Maryland 21005
1	Commanding Officer, USA CDC Medical Service Agency, Fort Sam Houston, Texas 78234
1	Commanding Officer, USA CDC CBR Agency, Fort McClellan, Alabama 36201
1	Commanding Officer, US Army CDC Engineer Agency, Fort Belvoir, Virginia 22060
1	Commanding Officer, USACDC Armor Agency, Fort Knox, Kentucky 40121
1	Commanding Officer, US Army CDC Infantry Agency, Fort Benning, Georgia 31905
2	Commanding General, Hqs, USA CDC, ATTN: CDCMR-U, Fort Belvoir, Virginia 22060
1	Commanding General, USACDCCOSG, ATTN: CSSG-DM, Fort Lee, Virginia 23801
1	Commanding General, USA CDC Experimentation Command, ATTN: CDEC-AG, Fort Ord, California 93941
1	USACDC Liaison Office, Hq, USA MUCOM, Dover, New Jersey 07801
2	Commanding General, USA CDC Combined Arms Group, Fort Leavenworth, Kansas 66027
1	Project Officer, Biological Countermeasures, Code 443, Office of Naval Research, Room 0423, Main Navy Building, Washington, D.C. 20360
1	NBC Warfare Defense Branch, Preventive Medicine Division, Bureau of Medicine and Surgery, Navy Department, Washington, D.C. 20390
2	Chief, Bureau of Yards and Docks, ATTN: (Code 42.330) Navy Department, Washington, D.C. 20390
1	Officer-in-Charge, Naval Biological Laboratory, Naval Supply Center, Oakland, California 94625
1	Director, Research Division, Bureau of Medicine and Surgery, Department of the Navy, Potomac Annex, Washington, D.C. 20390
1	Director, U.S. Naval Research Laboratory, ATTN: Army Liaison Officer, Code 1031, Washington, D.C. 20390
1	Biological Sciences Division (Code 440), Office of Naval Research, 17th & Constitution Ave., N.W., Washington, D.C. 20360
1	U.S. Naval Applied Science Laboratory, ATTN: Code 944, Naval Base, Brooklyn, New York 11251
1	Commander (Code 753), U.S. Naval Ordnance Test Station, ATTN: Technical Library, China Lake, California 93555

DISTRIBUTION LIST 13 (Contd)

Copies

1	Commander, ATTN: Code 8031, U.S. Naval Ordnance Test Station, China Lake, California 93555
1	Army Chemical Liaison Office, U.S. Naval Explosive Ordnance Disposal Facility, Indian Head, Maryland 20640
1	Commanding Officer, U.S. Naval School, Explosive Ordnance Disposal, Indian Head, Maryland 20640
1	Commander, U.S. Naval Weapons Laboratory, ATTN: Code WMB, Dahlgren, Virginia 22448
1	Commanding Officer, Nuclear Weapons Training Center, Atlantic, Norfolk, Virginia 23511
1	Commanding Officer & Director, U.S. Naval Radiological Defense Laboratory, ATTN: 222A, San Francisco, California 94135
1	Chief of Naval Operations, ATTN: (OP-342), Navy Department, Washington, D.C. 20301
1	Commanding Officer, Nuclear Weapons Training Center, Pacific, ATTN: Code 50, US Naval Air Station, North Island, San Diego, California 92135
1	Commander, Training Command, U.S. Pacific Fleet, ATTN: Strike Warfare Officer, San Diego, California 92147
2	Officer-in-Charge, Scientific and Technical Intelligence Center, U.S. Naval Observatory, Building 52, Washington, D.C. 20390
1	Cmdr, Naval Ord Sys Comm (ORD-0462C), Dept of Navy, Wash., D.C. 20360
1	Chief, Bureau of Naval Weapons, Code RMMO-3, Washington, D.C. 20360
1	Commanding Officer & Director (Code L31), U.S. Naval Civil Engineering Laboratory, Port Hueneme, California 93041
1	Headquarters, USAF (AFXPDC/Lt. Col. Halstead), Washington, D.C. 20330
1	Headquarters, USAF, ATTN: (AFMSPAA), T-8, Washington, D.C. 20333
1	Director, Air University Library, ATTN: AUL3T-8879, Maxwell AFB, Alabama 36112
1	AFOC(PCSPS-12), Eglin AFB, Florida 32542
2	Chief, Foreign Technology Division, ATTN: TDEWA, Wright-Patterson AFB, Ohio 45433
1	Headquarters, USAF, ATTN: AFRDDA, Washington, D.C. 20301
1	Commanding Officer, USAF School of Aerospace Medicine (SMSDL), ATTN: Documents Librarian, Brooks AFB, Texas 78235
1	Commanding Officer, 2705th Airmunitions Wing, ATTN: OOAMA (OOYICTB), Hill AFB, Utah 84001
2	Commander, Technical Training Center (TSOP), Lowry AFB, Colorado 80232
1	Headquarters, ATTN: AFSC (SCBB), Andrews AFB, Maryland 20331
1	Office of the Deputy for Research and Development, Headquarters Aerospace Medical Division, Brooks Air Force Base, Texas 78235
2	Air Force Armament Laboratory (ATCR), Eglin AFB, Florida 32542
1	USAF School of Aerospace Medicine, ATTN: Maj. Irving Davis (SMBS), Brooks AFB, Texas 78235
1	Lt Col Paul V. Bartlett, Hq, USAF (AFCOAL), Washington, D.C. 20330

DISTRIBUTION LIST 13 (Contd)

Copies

1	Hq AFETR (ETXH), ATTN: Col W. B. Lee, Patrick AFB, Florida 32925
1	Headquarters, ETD/ETTW, Bolling AFB, Washington, D.C. 20332
5	Commanding General, Fleet Marine Force, Atlantic, Norfolk, Virginia 23511
2	Commanding General, Fleet Marine Force, Pacific, ATTN: G-4 Ordnance Section, c/o FPO, San Francisco, California 96602
1	Headquarters, U.S. Marine Corps Representative, USA-[illegible], Dover, New Jersey 07801
1	Research Analysis Corporation, ATTN: Library, McLean, Virginia 22101
1	Remote Area Conflict Information Center, Battelle Memorial Institute, 505 King Avenue, Columbus, Ohio 43201
1	Central Intelligence Agency, ATTN: BSD/OSD/DD/S&T, Washington, D.C. 20505
1	Rand Corporation, 1700 Main Street, ATTN: Library, Santa Monica, California 90406
1	Institute for Cooperative Research, University of Pennsylvania, ATTN: Librarian, 3634 Walnut Street, Philadelphia, Pennsylvania 19104
1	University of Pennsylvania, P.O. Box 1067, Library, Eglin AFB, Florida 32542
1	ONR Resident Representative, University of Michigan, Box 622, Ann Arbor, Michigan 48107
1	Stanford Research Institute, ATTN: G-037 External Reports for: Ilia Poppoff, Menlo Park, California 94025
1	Commanding Officer, U.S. Naval Schools Command, ATTN: NSCD Technical Library, San Francisco, California 94130

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
US Army Edgewood Arsenal,
Edgewood Arsenal, Maryland 21010 -
Defensive Research Department

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP
N/A

3. REPORT TITLE
PHOTOCHEMISTRY OF HETEROCYCLIC COMPOUNDS
A Literature Survey

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
This survey was made during September 1965.

5. AUTHOR(S) (Last name, first name, initial)
Pozicznek, Edward J.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
September 1966	37	

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. Task No. 1C622401A10204	EASP 100-4
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N/A
d.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Commanding Officer, US Army Edgewood Arsenal, ATTN: SMUEA-TSTI-T, Edgewood Arsenal, Maryland 21010.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Detection and warning investigations	N/A

13. ABSTRACT (U) The literature on the photochemistry of heterocyclic compounds was surveyed with a particular interest in pyridine chemistry. This listing of references was compiled as a result of searching volumes 41 to 61 of Chemical Abstracts under the headings light, photochemistry, and pyridine.

14. KEYWORDS

Literature survey	Irradiation
Heterocyclic compounds	Stability
Photochemistry	Decomposition
Pyridines	Ultraviolet light
Detection	Photosensitivity
Synthesis	Photochromism
Reaction mechanisms	Illumination
Photography	Luminescence
Light	Fluorescence
Photolysis	Sensitizers