

Index

- Action spectra**
carotenoid protection of *S. lutea*, 203
cataract formation, 151
erythema, 135
growth delay, 196
inactivation
of transforming DNA, 218
of tryptophanase, 196
inhibition
of leucine transport, 196
of RNA synthesis, 196
of succinate transport, 196
lethality
bacteria, 172
bacteriophage, 222
low vs. high fluence rates, 235
mutagenesis (bacteria), 228
photokeratitis, 135, 140, 141
Aflatoxin (fluorescence), 13
Aging (human lens changes), 148
Amino acids
photochemical adducts to nucleic acid,
70
singlet-oxygen effects, 91
Analogues (nucleic acid), 60
Aphakic eye (sensitivity to UV radiation),
160
Apurinic endonuclease
bacteria, 305ff.
mammalian cells, 278ff., 309ff.
xeroderma pigmentosum, 310
Ataxia telangiectasia
enzymatic deficiencies, 311
sensitivity to X-rays, 311
ATP (Raman spectrum), 5
Bacteria
apurinic endonuclease, 305ff.
azapurines, 63
azapyrimidines, 63
Bacteria (cont'd)
biological effects of base analogues, 65
DNA-protein cross-linking, 70
endonuclease II, 305ff.
furocoumarins, 72
halogeno derivatives of uracil, 60, 70
mutagenesis (near-UV), 226ff.
photodynamic inactivation, 95
UV irradiation effects, 46, 59
Bacteriophage (near-UV)
action spectrum for lethality, 222
mechanisms of inactivation, 223
Bacteriorhodopsin (Raman spectrum), 4
Base analogues (photochemistry)
alkyl derivatives of uracil, 62
azapurines, 63
azapyrimidines, 63
biological effects of photoproducts of.
65ff.
5-bromouracil, 60
5-fluorouracil, 62
5-iodouracil, 61
Bergapten (structure and photochemistry),
72
Biological effects
DNA single-strand breaks, 211
furocoumarins, 73
lasers, 16ff.
membrane, transport and metabolic
damage, 214
near-UV radiation, 169ff.
nucleic acid-protein cross-links, 71
photodynamic action, 91, 94
photohydrates, 53
photoproducts of base analogues, 65
pyrimidine dimers, 46, 206
UV radiation on the human eye, 133ff.
Blepharisma (photosensitivity), 217
5-Bromouracil
biological effects, 65

- 5-Bromouracil (*cont'd*)
 nucleic acid–protein cross-links, 70
 photochemistry, 60, 70
 Brunescant cataract (UV-induced), 150
- β -Carotene (protection against phototoxicity),
 243
- Carotenoids (protection against)
 near-UV inactivation, 201
 phototoxicity, 243
- Cataracts
 action spectrum, 151
 brunescant (humans), 150
 chemical model, 153
 furocoumarins, 159
 guinea pigs, 151
 photosensitization-induced, 159
 rabbits, 151
 UV radiation-induced, 150
- Chlorophyll
 flash photolysis, 8
 fluorescence, 13
- Chromosome anomalies (laser-induced), 19,
 24
- Classification of DNA damage, 274
- Coenzyme Q (flash photolysis), 9
- Conjunctiva (*see* Photokeratitis)
- Cornea (*see* Photokeratitis)
- Crystallins
 fluorescence, 149
 Raman spectra, 4
- Cysteine (photoreactions)
 in lens proteins, 157
 with nucleic acids, 70
- Cytochrome a_3 (flash photolysis), 9
- Cytochrome oxidation
 flash photolysis, 7, 9
 Raman spectroscopy, 5
- Cytofluorimetry (lasers), 21
- Cytosine (photohydrate), 47
- Deamination of DNA bases, 303
- Depurination, 303
- Depyrimidination, 304
- DNA
 alkyl derivatives of uracil, 62
 amino acid adducts, 70
 base analogues, 60
 classification of DNA damage, 274
 cross-links, 280
 cytofluorimetry, 21
- DNA (*cont'd*)
 deamination of bases, 303
 fluorescence, 58
 fluorescence labeling, 83
 furocoumarins, 72, 280
 halogeno derivatives of uracil, 60, 70
 laser-induced thymine dimers, 21
 minor bases, 58
 photoalkylation, 57, 70, 72
 photochemistry, 39ff.
 photodynamic effects, 87
 photohydrates, 51
 photosensitization, 77
 purine adducts, 57
 pyrimidine adducts, 57, 70, 72
 pyrimidine dimers, 41
 Raman spectrum, 6
 spore photoproduct, 57
 UV laser effects on, 20
- DNA ligases (role in repair), 296
- DNA polymerases (role in excision repair),
 294
- DNases III and IV (rabbit), 287
- Elemental analysis (microprobe-emission
 spectroscopy), 11
- Endonucleases (repair), 275ff., 305ff., 309
- Endonuclease II of *E. coli*, 305ff.
- Enzymology of DNA repair, 263ff.
- Erythema
 action spectrum, 135
 synergism by mid-UV and near-UV, 240
- Excision repair
 bacteria, 169ff.
 enzymology, 274ff.
 mammalian cells, 274ff.
- Excitation energy migration (nucleic acids),
 85
- Eye (human)
 light transmission characteristics, 134
 photokeratitis, 137ff.
 UV radiation effects on, 133ff.
- Fish (photoreactivation in), 265
- Flash photolysis
 chlorophyll, 8
 coenzyme Q, 9
 cytochrome a_3 , 9
 cytochrome oxidation, 7, 9
 flavins, 10
 hemoglobin, 9

- Flash photolysis (*cont'd*)
 photosystem-2, 8
 rhodopsin, 10
 ubiquinone, 9
- Flavins (flash photolysis), 10
- Fluorescence
 cytofluorimetry, 21
 energy migration in nucleic acids, 85
 labeling of chromosomes, 83
 laser-induced
 aflatoxin, 13
 chlorophyll, 13
 HCl, 13
 sodium, 13
 lens (human), 146
 5-methylcytosine, 58
- Franconi's anemia (repair deficiency), 292
- Furocoumarins
 cataract formation, 159
 DNA cross-links, 280
 effects on the lens of the eye, 159
 photobiological effects, 73, 159
 photochemical reactions with nucleic acids, 72ff.
 structures, 72
 treatment of psoriasis, 76, 243
 treatment of vitiligo, 242
- Gamma-ray (*see* X-ray)
- N*-Glycosidases, 305, 307
- Gramicidin A' (Raman spectrum), 7
- Guinea pigs (UV-induced cataracts), 151
- HCl (fluorescence), 13
- Hemoglobin (flash photolysis), 9
- Hemoproteins (Raman spectrum), 5
- Herpes simplex (photochemotherapy), 243
- Histidine (photoreactions in lens proteins), 156
- Histochemistry (photokeratitis), 143
- Hyperbilirubinemia (phototherapy), 242
- Insulin (Raman spectrum), 6
- Isotope enrichment (laser-induced), 15
- Jaundice (phototherapy), 242
- Lasers
 argon ion laser, 13, 15
 biological effects, 16
 chromosome anomalies, 19, 24
- Lasers (*cont'd*)
 CO₂ laser, 18
 cytofluorimetry, 21
 dye laser, 15
 effects on eyes, 152
 flash photolysis, 7
 fluorescence, 11
 helium–neon laser, 26
 hydrogen fluoride laser, 14
 isotope enrichment, 15
 light scattering, 30
 neodymium glass laser, 8
 neodymium YAG laser, 14, 92
 nitrogen laser, 13
 partial cell irradiation, 23
 photochemistry, 14
 photosensitization, 19
 Raman spectroscopy, 3
 ruby laser, 7
 surgery, 17
- Lens
 cataracts, 150
 crystallins, 149
 fluorescence, 146ff.
 normal pigmentation, 146
 photosensitized damage, 158
 pigmentary changes with aging, 148
 UV damage to epithelium, 158
 UV radiation-induced cataract, 150ff.
- Lethality (near UV-induced)
 action spectra, 172
 bacteriophage, 223
 damage to repair systems, 190
 exponential-phase vs. stationary-phase cells, 181
 mammalian cells, 205
 oxygen dependence, 177
 partially dehydrated cells, 204
 protection against, 192, 201, 221
 repair of lethal damage, 177
 role
 of DNA single-strand breaks, 211
 of membrane, transport, and metabolic damage, 214
 of pyrimidine dimers, 206
 transforming DNA, 223
- Leukocytes (photoreactivating enzyme), 265
- Light scattering (lasers), 30
- Luminescence (laser-induced)
 inorganic phosphor compounds, 14
 (*see also* Fluorescence)

- Mammalian cells**
 ataxia telangiectasia, 311
 DNA ligases, 296
 DNA polymerases, 294
 endonucleases, 275, 305ff., 309
 excision repair enzymes, 274ff.
 Franconi's anemia, 292
 near-UV lethality, 205
 photoreactivating enzyme, 264
 repair of monoadduct damage to DNA
 alkylation damage, 301
 ionizing radiation damage, 301
 unscheduled DNA synthesis, 275, 293
 xeroderma pigmentosum, 265, 275
- 8-Methoxypsoralen**
 DNA cross-links, 280, 293
 structure and photochemistry, 72
 treatment of psoriasis, 76
- 5-Methylcytosine (fluorescence), 58**
- Microbeam irradiations (laser), 23**
- Microprobe-emission spectroscopy, 11**
- Minor bases (photochemistry)**
 pseudouridine, 59
 4-thiouridine, 59
- Mutagenesis (near UV-induced)**
 action spectrum, 228
 broad-spectrum irradiation, 230
 comparison of high and low fluence rates, 235
 continuous cultures, 226
 high fluence rates, 230
 low fluence rates, 226
 monochromatic radiation, 231
 partially dehydrated cells, 234
 photoreactivation, 233
- Near-UV radiation**
 bacteria, 169ff.
 bacteriophage, 222ff.
 chromophores for DNA damage and repair inhibition, 215
 damage
 to membranes, 194
 to transport and metabolic systems, 195
 DNA single-strand breaks (or alkali-labile bonds), 188
 exponential-phase vs. stationary-phase cells, 181
 inactivation of phage production capacity, 197
 lethality, 169ff.
- Near-UV radiation (*cont'd*)**
 mammalian cells, 205
 medical aspects, 241ff.
 mutagenesis, 226ff.
 oxygen dependence of lethality, 177
 photoprotection, 192
 photosensitizing effects of natural pigments, 217
 pyrimidine dimers, 185
 repair of lethal damage, 177
 synergism, 193, 194, 235ff., 241
 thymine glycols, 188
 transforming DNA, 218
- Nucleic acid-protein cross links, 70**
- Oxygen dependence of near-UV lethality, 177, 221**
- Partial cell irradiation (laser), 23**
- Photoalkylation**
 purines, 57
 pyrimidines, 57, 70, 72
- Photocarcinogenicity, 91**
- Photochemistry**
 amino acids, 70
 furocoumarins, 72ff.
 isotope enrichment, 15
 laser-induced, 14ff.
 minor bases, 58
 natural purines and pyrimidines, 41
 nucleic acids, 39ff.
 photodynamic action, 87
 photosensitization (nucleic acids), 77
 proteins, 70
 purine and pyrimidine analogues, 60
 singlet-oxygen, 91
 thymine dimers (laser-induced), 21
- Photodynamic action**
 biological effects, 94
 damage to nucleic acids, 93
 mutagenesis, 234
 near-UV inactivation, 177, 221
 photodynamic agents (table), 95
 radical photoreactions, 87
 singlet oxygen, 91
- Photohydrates**
 biological effects, 53
 formation, 47
 nucleophilic solvent-addition reactions, 52
 reversal, 51

- Photohydrates (*cont'd*)
 single- vs. double-stranded DNA (RNA), 54
- Photokeratitis
 action spectra, 135, 140, 141
 chemical model for, 138
 histochemistry, 143
 repair of, 144
 symptoms, 137
- Photoprotection, 192
- Photoreactivation
 E. coli B *phr*, 186
 fish, 265
 inactivation of enzyme by near-UV irradiation, 190
 leukocytes (enzyme), 265
 mutagenesis, 233
 of 254-nm inactivation, 209ff.
 of 365-nm inactivation, 206ff.
 problems in enzyme assays, 269
 transforming DNA, 220
 xeroderma pigmentosum fibroblasts (enzyme), 266
- Photosensitization
 induction of cataracts, 159
 labeling of chromosomes, 83
 lasers, 19
 nucleic acids
 dyes, 79
 ketones, 71, 77
 of natural pigments, 217
 photodynamic action, 87ff.
 protection against, 201, 243
 splitting of pyrimidine dimers, 86
- Photosystem-2 (flash photolysis), 8
- Phototherapy
 herpes simplex, 243
 hyperbilirubinemia (jaundice), 242
 orthodontics, 242
 psoriasis, 243
 vitiligo, 242
- Phototoxicity and protection against it, 243
- Postreplication repair, 169ff.
- Proteins
 photochemical cross-links with nucleic acids, 70
 photodynamic effects on, 94
- Pseudouridine (photochemistry), 59
- Psoralen (photochemical reactions with nucleic acids), 72
- Psoriasis (photochemotherapy), 76, 243
- Purines
 photoalkylation, 57
 photodynamic effects, 93
 photosensitization, 93
 singlet-oxygen effects, 92
- Pyrimidine (photoalkylation), 57, 70, 72
- Pyrimidine adducts, 55
- Pyrimidine dimers
 adducts, 55
 biologic effects of, 46
 cyclobutane type, 41
 effects on dimerization
 heavy atoms, 46
 organic solvents, 44
 pH, 46
 relative humidity, 45
 temperature, 45
 excising nucleases, 286, 289
 interstrand, 55
 isomeric forms, 42
 mechanisms for dimerization, 43
 noncyclobutane type, 55
 produced by near-UV radiation, 185
 short-wavelength reversal, 41
 single- vs. double-stranded DNA (RNA), 54
- Rabbits (UV-induced cataracts), 151
- Radical photoreactions, 87
- Raman spectroscopy
 ATP, 5
 bacteriorhodopsin, 4
 crystallin, 4
 cytochrome oxidase, 5
 DNA, 6
 gramicidin A', 7
 hemoproteins, 5
 insulin, 6
 retinaldehyde, 4
 rhodopsin, 4
 ribosomal RNA, 6
 snake venoms, 7
 valinomycin, 7
 vitamin A, 4
- Recombination repair, 169ff.
- Repair (DNA)
 damage to repair systems, 190
 excision, 274ff.
 Franconi's anemia, 292
 inhibitors of, 183
 mammalian cells, 263ff.

- Repair (DNA) (*cont'd*)
 photoprotection, 192
 photoreactivation (*see* Photoreactivation)
 role
 of DNA ligases, 296
 of DNA polymerases, 294
 sensitivity
 of exponential-phase cells, 181
 of repair-deficient strains, 177
 of stationary-phase cells, 181
 unscheduled DNA synthesis, 275, 293
- Resonance enhancement, 3
- Retina
 newborn, 148
 UV radiation effects, 160
- Retinaldehyde (Raman spectrum), 4
- Rhodopsin
 flash photolysis, 10
 Raman spectrum, 4
- Ribosomal RNA (Raman spectrum), 6
- RNA
 action spectrum for synthesis inhibition, 196
 azapurine photochemistry, 63
 azapyrimidine photochemistry, 63
 5-fluorouracil photochemistry, 62
 furocoumarins, 72
 photodimerization, 41, 57, 59
 photodynamic action, 95
 photohydration, 47ff.
 pseudouridine photochemistry, 59
 4-thiouracil photochemistry, 59
 tRNA (photoinactivation), 55, 59
 viruses, 53, 62, 95
- Short-wavelength reversal of pyrimidine dimers, 41
- Singlet oxygen
 photocarcinogenicity, 91
 photodynamic action, 91
- Skin cancer
 induction, 241
 xeroderma pigmentosum, 265
- Snake venoms (Raman spectra), 7
- Sodium (fluorescence), 13
- Spore photoproduct, 57
- Synergism
 cell lethality, 236
 erythema, 240
 far-UV and X-rays, 193, 238
- Synergism (*cont'd*)
 near-UV
 and far-UV, 194, 238
 and heat, 238
 and X-rays, 193, 238
 skin cancer, 241
 transforming DNA, 235
- 4-Thiouridine (photochemistry), 59
- Thymine
 amino acid adducts, 70
 dimers (cyclobutane type), 41ff.
 glycols (near-UV), 188
 interstrand dimers, 55
 laser-induced dimers, 21
 monoadducts with psoralen, 75
 photohydrate, 51
 pyrimidine adducts, 57, 70, 72
 spore photoproduct, 57
- Transforming DNA (near-UV radiation)
 action spectrum for inactivation, 218
 mechanisms of inactivation, 223
 oxygen dependence of inactivation, 221
 protection of, 221
- Tryptophan
 biological effects of near-UV photoproducts, 197, 198ff.
 photoreactions in lens proteins, 153
- Tyrosine (photoreactions in lens proteins), 156
- Ubiquinone (flash photolysis), 9
- Unscheduled DNA synthesis, 275, 293
- Uracil
 alkyl derivatives (photochemistry), 62
 amino acid adducts, 70
 dimers (cyclobutane type), 41ff.
 halogeno derivatives (photochemistry), 60, 70
 photohydrates, 47
- UV radiation effects
 human eye, 133ff.
 mammalian cells, 263ff.
 near-UV effects, 169ff.
 nucleic acids, 39ff.
- Valinomycin (Raman spectrum), 7
- Viruses (*see also* Bacteriophage)
 5-bromouracil sensitization, 67
 5-fluorouracil sensitization, 62
 furocoumarins, 72

Viruses (*cont'd*)

- herpes simplex (photochemotherapy),
243

- photodynamic inactivation, 93, 95

- pyrimidine photohydrates, 53

- Vision (Raman spectra of visual pigments),
3

- Vitamin A (Raman spectrum), 4

- Vitiligo (photochemotherapy), 242

- Xanthotoxin (structure and photochemistry),
72

Xeroderma pigmentosum

- apurinic endonuclease, 310

- endonucleases, 275, 310

- enzyme deficiencies, 291

Xeroderma pigmentosum (*cont'd*)

- photoreactivating enzyme, 266

- role of DNA damage to carcinogenesis, 265

- variant group, 268

X-ray

- ataxia telangiectasia, 311

- DNA single-strand breaks, 197

- endonuclease for irradiated DNA, 280

- inactivation

 - of *E. coli*, 221

 - of *S. lutea*, 201

- repair of DNA damage, 301

- sensitization by 365-nm radiation, 193,
213

- synergism with 254-nm radiation, 193

- transforming DNA, 225