

Contents

<i>Preface</i>	<i>page</i> xv
1 Introduction	1
Outline of the metabolic role	1
Biochemical definition	2
Morphology	8
Microperoxisomes, hydrogenosomes and glycosomes	13
Phylogenetic distribution	15
Summary	21
Further reading	22
2 Enzymology	23
Introduction	23
Catalase	23
L- α -Hydroxyacid oxidase	27
D-Amino acid oxidase	29
Urate oxidase	31
β -Oxidation enzymes	32
Acyl-CoA oxidases	33
Enoyl-CoA hydratase and 3-hydroxyacyl-CoA dehydrogenase	35
3-Ketoacyl-CoA thiolase	37
Oxidation of unsaturated fatty acids	38
Palmitoyl-CoA and lignoceroyl-CoA ligase	38
Carnitine octanoyltransferase	39
Isocitrate dehydrogenase	39
Alanine : glyoxylate aminotransferase	41
Glycerol 3-phosphate dehydrogenase	42
Aldehyde dehydrogenase	42

Pipeolic acid oxidase	43
Polyamine oxidase	44
Other peroxisomal enzymes	44
Summary	44
Further reading	46
3 Intraparticulate organization of peroxisomal proteins – methodology and topology	47
Introduction	47
Centrifugal fractionation	47
Use of detergents	50
Electron immunocytochemistry	53
Enzymes of glycerolipid synthesis	55
Perturbations of enzyme localization	58
Peroxisomal enzymes in the cytoplasm	61
The peroxisomal membrane	63
Summary	68
Further reading	70
4 The phenotypic characteristics, genetics and ontogeny of peroxisomal proteins	71
Introduction	71
Catalase – the genetics of turnover and multiplicity	71
Chromosomal mapping of peroxisomal genes	77
Cloning and structural analysis of peroxisomal genes	79
Peroxisomal ontogeny in mammals	84
The involvement of the peroxisome in the ageing process	88
Catalase development in plants	89
Peroxisome–glyoxysome transitions in plants	90
Concluding comments	93
Summary	93
Further reading	95
5 Peroxisomal metabolism – lipids	96
Scope of metabolism	96
β -Oxidation of long chain fatty acids	97
The β -oxidation cycle	99
β -Oxidation of common fatty acids in the peroxisome	101
β -Oxidation of unsaturated fatty acids	101
β -Oxidation of very long chain fatty acids	106

<i>Contents</i>	xi
Branched chain fatty acids	108
Peroxisomal oxidation of dicarboxylic acids	108
Metabolism of bile acids	111
Prostaglandins and related compounds	113
Metabolism of xenobiotics	116
Fatty acid binding proteins	117
Anabolic roles in lipid metabolism	117
Synthesis of ether lipids	118
Synthesis of cholesterol	120
Dolichol metabolism	124
Summary	125
Further reading	126
6 Further metabolic involvements of the peroxisome	127
Introduction	127
The metabolism of amino acids and related compounds	127
Gluconeogenesis	130
Glyoxylate metabolism	131
Glyoxylate adducts	133
Hydroxyacid metabolism	136
Purine metabolism	136
Further oxidations	138
Respiration	138
The subcellular disposal of hydrogen peroxide and superoxide radicals	140
Peroxisomal metabolism in protozoa, yeasts and plants	143
Summary	148
Further reading	149
7 Regulatory factors in peroxisomal metabolism	150
Introduction	150
Energetics	150
Factors influencing peroxisomal metabolism	153
The diversity of metabolism within the peroxisome	155
Regulatory shuttles	157
Metabolic interactions between peroxisomes and other organelles	161
Metabolic flux and its implications in regulation	165
Substrate turnover <i>in vivo</i>	168
Intertissue communication	170

Concluding comments	172
Summary	172
Further reading	173
8 Peroxisomal biogenesis and turnover	174
Overview	174
Biogenesis of individual peroxisomal proteins	177
Catalase	178
Thiolase	179
Topogenic signals	180
Universality of the topogenic signal?	181
Membrane translocation of peroxisomal proteins	183
Biogenesis of peroxisomal membranes	185
Ultrastructural aspects of peroxisomal biogenesis	186
Peroxisome assembly in yeasts and Chinese hamster ovary cells	187
Summarizing model	189
Elements in the turnover of peroxisomal proteins	191
Synthesis and degradation of peroxisomal proteins	193
Organelle turnover	196
Summary	199
Further reading	201
9 Peroxisome proliferators	202
Introduction	202
Induction of peroxisomal enzymes	205
Induction in other cellular compartments	207
Mechanisms of peroxisome proliferation	208
Enzyme activities, membrane permeability and metabolic shifts	209
Substrate overload	212
Receptor mechanisms	213
Commentary on mechanistic models	219
Peroxisome proliferators and carcinogenesis	220
Summary	223
Further reading	224
10 Peroxisomes and human disease	225
Introduction	225
Categories of peroxisomal disorders	225

Cambridge University Press

978-0-521-03683-2 - The Peroxisome: A Vital Organelle

Colin Masters and Denis Crane

Table of Contents

[More information](#)

<i>Contents</i>	xiii
Clinical and biochemical features of peroxisomal disorders	227
Molecular mechanisms of peroxisomal pathology	234
Nature of the molecular defects in the Zellweger syndrome and in other generalized peroxisomal disorders	235
Turnover of peroxisomes	242
Genetic relationships between peroxisomal disorders	242
Summary	244
Further reading	245
11 Concluding comments	246
Recent developments	246
Prospectives in education and science	248
Peroxisomal diseases and community interactions	250
Lorenzo's oil – a journalistic account	252
<i>Bibliography</i>	255
<i>Index</i>	284