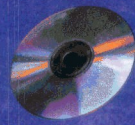


Margit Pavelka
Jürgen Roth

Functional Ultrastructure

Atlas of Tissue Biology and Pathology 2nd Edition



with CD-ROM



SpringerWienNewYork

CONTENTS

THE CELL

Introduction: Structural organisation of a mammalian cell	2
The Nucleus	
Architecture of the cell nucleus	4
Cytochemical detection of ribonucleoproteins	6
Nuclear lamina	6
Detection of sites of DNA replication and of interphase chromosome domains	8
Nucleolus	10
Changes of the nucleolar architecture	12
Detection of sites of RNA synthesis	14
Nuclear pore complexes	16
Nuclear pore complexes: Structural changes as monitored by time-lapse atomic force microscopy	18
Mitosis and cell division	20
Apoptosis	22
Viral inclusions	22
The Cytoplasm: The Secretory System	
Secretory pathway of pancreatic acinar cells	24
Endomembrane system of Dinoflagellates	26
Ribosomes, rough endoplasmic reticulum	28
Nuclear envelope and rough endoplasmic reticulum	30
Annulate lamellae	32
Rough endoplasmic reticulum: Site of protein translocation and initiation of protein <i>N</i> -glycosylation	34
Oligosaccharide trimming, reglucosylation, and protein quality control in the rough endoplasmic reticulum	36
Rough endoplasmic reticulum: Storage site of aggregates of misfolded glycoproteins	38
Russell bodies and aggresomes represent different types of protein inclusion bodies	40
Smooth endoplasmic reticulum	42
Proliferation of the smooth endoplasmic reticulum	44
Pre-Golgi intermediates	46
Pre-Golgi intermediates: Oligosaccharide trimming and protein quality control	48
Golgi apparatus: A main crossroads along secretory pathways	50
Protein secretion visualised by immunoelectron microscopy	52
Protein <i>N</i> -glycosylation: Oligosaccharide trimming in the Golgi apparatus and pre-Golgi intermediates	54
Golgi apparatus: Site of maturation of asparagine-linked oligosaccharides	56
Cell type-related variations in the topography of Golgi apparatus glycosylation reactions	58
Cell type-related differences in oligosaccharide structure	60
Topography of biosynthesis of serine/threonine-linked oligosaccharides	62
Golgi apparatus and TGN – Structural considerations	64
Golgi apparatus and TGN – Secretion and endocytosis	66
Golgi apparatus, TGN and <i>trans</i> Golgi-ER	68
Golgi apparatus, TGN and <i>trans</i> Golgi-ER: Tilt series	70
Structure of the TGN	72
Brefeldin A-induced Golgi apparatus disassembly	74
Brefeldin A-treatment: Tubulation of Golgi apparatus and endosomes	76
Brefeldin A-treatment: Effect on retrograde transport of internalised WGA	78
Brefeldin A-treatment: Transitional ER-elements and pre-Golgi intermediates	80

Heat shock response of the Golgi apparatus	82
Golgi apparatus changes upon ATP-depletion and ATP-replenishment	84
Secretory granules	86
Secretory granule types	88
Goblet cell – Compound exocytosis	90
The Cytoplasm: The Endocytic System	
Receptor-mediated endocytosis via clathrin-coated vesicles and virus endocytosis	92
Endosomes and endocytic pathways	94
Endocytic <i>trans</i> Golgi network and retrograde traffic into the Golgi apparatus	96
Tubular pericentriolar endosomes	98
Langerhans cells and Birbeck granules: Antigen presenting dendritic cells of epidermis	100
Caveolae	102
Fluid phase endocytosis and phagocytosis	104
The Cytoplasm: Lysosomes and Lysosomal Disorders	
Lysosomes	106
Lysosomes: Localisation of acid phosphatase, LAMP and polylectosamine	108
I-cell disease	110
Gaucher's disease	112
Fabry's disease	114
G _{M2} gangliosidosis	116
Farber's disease	118
Wolman's disease	120
Glycogenesis type II	122
Cystinosis	122
The Cytoplasm: Autophagy	
Autophagy: Limited self-digestion	124
Pexophagy: Autophagy of peroxisomes	126
The Cytoplasm: Mitochondria and Structural Abnormalities	
Mitochondria: Crista and tubulus types	128
Abnormalities of mitochondria	130
The Cytoplasm: Peroxisomes and Peroxisomal Disorders	
Peroxisomes: Multitalented organelles	132
Peroxisome biogenesis	134
Peroxisomes: Adaptive changes	136
Peroxisomal disorders	138
The Cytoplasm: Cytosolic Particles	
Glycogen	140
Glycogenesis type I	140
Erythropoietic protoporphyria	142
The Cytoplasm: Cytoskeleton	
Cytocentre, centrosome, and microtubules	144
Effects of microtubule disruption	146
Actin filaments	148
Intermediate filaments	150
Mallory bodies	152

The Plasma Membrane and Cell Surface Specialisations

The plasma membrane	154
Cells in culture	156
Brush cell	158
Glycocalyx (cell coat)	160
Glycocalyx: Cell type specificity and domains	162
Glycocalyx changes in tumours	164

Cell-Cell and Cell-Matrix Contacts and Disorders

Junctional complex	166
Tight junctions and gap junctions	168
Tunneling nanotubes	170
Spot desmosomes	172
Selectin – ligand-mediated cell-cell interaction	174
Cellular interdigitations	176
Basal labyrinth	178
Basement membrane	180
Glomerular basement membrane	182
Alport's syndrome (hereditary nephritis)	182
Descemet's membrane	184
Skin basement membrane and keratinocyte hemidesmosomes: An epithel-connective tissue junctional complex	186
Epidermolysis bullosa simplex	188

PRINCIPLES OF TISSUE ORGANISATION**Secretory Epithelia**

Pancreatic acinus	192
Acinar centre: Acinar and centroacinar cells	194
Pancreatic intercalated duct	196
Submandibular gland	198
Goblet cells – Unicellular glands	200
Parietal cells of stomach: Secretion of acid	202
Intercalated cells of kidney: Important regulators of acid-base balance	204
Endocrine secretion: Insulin-producing beta cells of islets of Langerhans	206
Impaired insulin processing in human insulinoma	208
Cells of the disseminated endocrine system	210
Liver	212
Liver: Hepatocytes, Kupffer cell, cell of Ito	214
Liver epithelium: Bile canaliculi	216
Liver epithelium: Pathway of secretory lipoprotein particles	218
Congenital hepatic fibrosis	220
Choroid plexus ependyma	222

Resorptive Epithelia

Small intestine: Absorptive cells	224
Small intestine: Pathway of lipids	226
Renal proximal tubule: A reabsorption plant	228
Parathyroid hormone response of renal proximal tubules	230

Sensory Epithelia	
Photoreceptor cells of the retina: Signalling of light	232
Photoreceptor cells of the retina: Light-induced apoptosis	234
Olfactory epithelium	236
Stratified Epithelia	
Corneal epithelium	238
Epidermis	240
Differentiation of keratinocytes and formation of the epidermal fluid barrier	242
Respiratory Epithelium and Ciliary Dyskinesia	
The tracheo-bronchial epithelium	244
Ciliary pathology: Immotile cilia syndrome and Kartagener syndrome	246
Alveoli: Gas exchange and host defense	248
Urothelium	
Umbrella cell – Surface specialisations	250
Umbrella cell – Fusiform vesicles	252
Endothelia	
Continuous capillary, Weibel-Palade bodies	254
Hyaline arteriosclerosis	256
Fenestrated capillary	258
Endothelio-pericyte and endothelio-smooth muscle cell interactions	260
Glomerulus and Disorders	
Glomerulus: A specialised device for filtering	262
Pathology of the glomerular filter: Minimal change glomerulopathy and congenital nephrotic syndromes	264
Pathology of the glomerulus: Membranous glomerulonephritis	266
Pathology of the glomerulus: Membranoproliferative glomerulonephritis	268
Pathology of the glomerulus: IgA glomerulopathy (Berger's disease)	270
Pathology of the glomerulus: Chronic allograft glomerulopathy	272
Connective Tissue	
Loose connective tissue	274
Fibroblast, fibrocyte, macrophage	276
Collagen und elastic fibres	278
Eosinophilic granulocyte, plasma cell, macrophage, mast cell	280
Dense connective tissue: Collagen bundles in the cornea	282
Bowman's layer	284
Amyloidosis of kidney	286
Amyloid fibrils: Growth as seen by time-lapse atomic force microscopy	288
Adipose Tissue	
White adipose tissue	290
Brown adipose tissue	292
Cartilage	
Articular cartilage	294

Bone

Osteoblasts and osteocytes	296
Osteoclast	298

Skeletal Muscle and Disorders

Myofibrils and sarcomere	300
Sarcoplasmic reticulum, triad, satellite cell	302
Neuromuscular junction	304
Muscular dystrophies	306
Glycogenesis type II (Pompe)	308

Cardiac Muscle

Myofibrils, intercalated disk	310
-------------------------------	-----

Smooth Muscle

Smooth muscle cells, synapse á distance	312
CADASIL	314

Nerve Tissue and Disorders

Central nervous system: Neuron, glial cells	316
Blood-brain barrier, synapses	318
Structure of the synaptic terminal	320
Unmyelinated nerve fibre	322
Peripheral nerve, connective tissue components	324
Myelinated nerve fibre, myelin	326
Node of Ranvier	328
Axonal degeneration	330
Neuroaxonal dystrophy	332
Neuropathies associated with dysproteinaemias	334
Metachromatic leukodystrophy	336
Neuronal ceroid lipofuscinosis	338

Blood

Red blood cells and cells of the erythroid lineage	340
Neutrophilic granulocyte	342
Eosinophilic granulocyte	344
Basophilic granulocyte	346
Monocyte	348
Lymphocyte	350
Megakaryocyte and thrombocyte	352
Thrombocytes	354

Subject Index