Contents

1	Fundamentals S. Silbernagi and F. Lang	2
•	Cell Growth and Cell Adaptation ··· 2 Abnormalities of Intracellular Signal Transmission ··· 6 Signal Transduction ··· 10 Necrotic Cell Death ··· 12 Apoptotic Cell Death ··· 14 Development of Tumor Cells ··· 16 Effects of Tumors ··· 18 Aging and Life Expectancy ··· 20	
2	Temperature, Energy S. Silbernagl	24
-	Fever ··· 24 Hyperthermia, Heat Injuries ··· 26 Hypothermia, Cold Injury ··· 28 Obesity, Eating Disorders ··· 30	
3	Blood S. Silbernagl	32
	Overview ··· 32 Erythrocytes ··· 34 Erythropoiesis, Anemia ··· 34 Erythrocyte Turnover: Abnormalities, Compensation, and Diagnosis ··· Megaloblastic Anemia Due to Abnormalities in DNA Synthesis ··· 38 Anemias Due to Disorders of Hemoglobin Synthesis ··· 40 Iron Deficiency Anemia ··· 42 Hemolytic Anemias ··· 44 Immune Defense ··· 46 Inflammation ··· 52 Hypersensitivity Reactions (Allergies) ··· 56 Autoimmune Diseases ··· 60 Immune Defects ··· 62 Hemostasis and Its Disorders ··· 64	36
4	Respiration, Acid–Base Balance F. Lang	70
	Overview 70 Ventilation, Perfusion 72 Diffusion Abnormalities 74 Distribution Abnormalities 76 Restrictive Lung Disease 78 Obstructive Lung Disease 80 Pulmonary Emphysema 82 Pulmonary Edema 84	



Pathophysiology of Breathing Regulation ... 86 Acute Respiratory Distress Syndrome ... 88 Hvpoxia ... 90 Hyperoxia, Oxidative Stress ... 92 Development of Alkalosis ... 94 Development of Acidosis ... 96 Effects of Acidosis and Alkalosis ... 98 Kidney, Salt and Water Balance F. Lang 100 Overview ... 100 Abnormalities of Renal Excretion ... 102 Pathophysiology of Renal Transport Processes ... 104 Abnormalities of Urinary Concentration ... 108 Polycystic Kidney Disease ... 110 Abnormalities of Glomerular Function ... 112 Disorders of Glomerular Permselectivity, Nephrotic Syndrome --- 114 Interstitial Nephritis ... 116 Acute Renal Failure ... 118 Chronic Renal Failure ... 120 Renal Hypertension ... 124 Kidney Disease in Pregnancy ... 126 Hepatorenal Syndrome ... 128 Urolithiasis ... 130 Disorders of Water and Salt Balance ... 132 Abnormalities of Potassium Balance ... 134 Abnormalities of Magnesium Balance ... 136 Abnormalities of Calcium Balance ... 138 Abnormalities of Phosphate Balance ... 140 Pathophysiology of Bone ... 142 Stomach, Intestines, Liver S. Silbernagl 146 Function of the Gastrointestinal Tract ... 146 Esophagus -- 148 Nausea and Vomiting ... 152 Gastritis ... 154 Ulcer --- 156 Disorders after Stomach Surgery ... 160 Diarrhea ··· 162 Maldigestion and Malabsorption ... 164 Constipation and (Pseudo-)Obstruction --- 168 Chronic Inflammatory Bowel Disease ... 170 Acute Pancreatitis ... 172 Chronic Pancreatitis ... 174 Cystic Fibrosis ... 176 Gallstone Disease (Cholelithiasis) -- 178

VH

5

6

laundice (Icterus) ... 182 Cholestasis ... 182 Portal Hypertension ... 184 Fibrosis and Cirrhosis of the Liver ... 186 Liver Failure ... 188 190 Heart and Circulation S. Silbernagi Overview ... 190 Phases of Cardiac Action (Cardiac Cycle) ... 192 Origin and Spread of Excitation in the Heart ... 194 The Electrocardiogram (ECG) ... 198 Abnormalities of Cardiac Rhythm ... 200 Mitral Stenosis ... 208 Mitral Regurgitation ... 210 Aortic Stenosis ... 212 Aortic Regurgitation ... 214 Defects of the Tricuspid and Pulmonary Valves ... 216 Circulatory Shunts ... 216 Arterial Blood Pressure and Its Measurement ... 220 Hypertension ... 222 Pulmonary Hypertension ... 228 Coronary Circulation ... 230 Coronary Heart Disease ... 232 Mvocardial Infarction ... 234 Heart Failure ... 238 Pericardial Diseases ... 244 Circulatory Shock ... 246 Edemas --- 250 Atherosclerosis ... 252 Metabolic Syndrome ... 256 Nonatherosclerotic Vascular Diseases ... 258 Venous Disease ... 258 Metabolism S. Silbernagl 260 8 Overview ... 260 Amino Acids ... 260 Disorders of Carbohydrate Metabolism ... 262 Lipidoses ... 262 Abnormalities of Lipoprotein Metabolism ... 264 Gout -- 268 Iron Metabolism, Hemochromatosis ... 270 Copper Metabolism, Wilson's Disease ... 272 α₁-Antitrypsin Deficiency ... 272 Dysproteinemias ... 274 Heme Synthesis, Porphyrias ... 276

7

VIII

, Hormon	es F.	Lang
----------	-------	------

General Pathophysiology of Hormones ... 278 Abnormalities of Endocrinal Regulatory Circuit ... 280 The Antidiuretic Hormone ... 282 Prolactin ... 282 Somatotropin ... 284 Adrenocortical Hormones: Enzyme Defects in Formation ... 286 Adrenocorticoid Hormones: Causes of Abnormal Release ... 288 Excess Adrenocorticoid Hormones: Cushing's Disease ... 290 Deficiency of Adrenocorticoid Hormones: Addison's Disease ... 292 Causes and Effects of Androgen Excess and Deficiency ... 294 Release of Female Sex Hormones ... 296 Effects of Female Sex Hormones ... 298 Intersexuality ... 300 Causes of Hypothyroidism, Hyperthyroidism, and Goiter ... 302 Effects and Symptoms of Hyperthyroidism ... 304 Effects and Symptoms of Hypothyroidism ... 306 Causes of Diabetes Mellitus ... 308 Acute Effects of Insulin Deficiency (Diabetes Mellitus) ... 310 Late Complications of Prolonged Hyperglycemia (Diabetes Mellitus) ... 312 Hyperinsulinism, Hypoglycemia ... 314 Histamine, Bradykinin, and Serotonin ... 316

Neuromuscular and Sensory Systems F. Lang

320

Overview --- 320

10

Eicosanoids ... 318

Pathophysiology of Nerve Cells ... 322

Demyelination ... 324

Disorders of Neuromuscular Transmission --- 326

Diseases of the Motor Unit and Muscles ... 328

Lesions of the Descending Motor Tracts ... 332

Diseases of the Basal Ganglia ··· 334

Lesions of the Cerebellum ... 338

Abnormalities of the Sensory System ... 340

Pain ... 342

Diseases of the Optical Apparatus of the Eye $\,\cdots\,$ 344

Diseases of the Retina ... 346

Visual Pathway and Processing of Visual Information ... 348

Hearing Impairment ... 350

Vestibular System, Nystagmus ... 352

Olfaction, Taste ... 352

Disorders of the Autonomic Nervous System ... 354

Lesions of the Hypothalamus ... 356

ŧΧ

The Electroencephalogram (EEG) ··· 358
Epilepsy 360
Sleep Disorders ··· 362
Consciousness ··· 364
Aphasias ··· 366
Disorders of Memory 368
Alzheimer's Disease, Dementia ··· 370
Depression ··· 372
Schizophrenia ··· 374
Dependence, Addiction ··· 376
Cerebrospinal Fluid, Blood-Brain Barrier 378
Cerebrospinal Fluid Pressure, Cerebral Edema 380
Disorders of Cerebral Blood Flow, Stroke ··· 382

Further Reading	384
Index	387