

# Contents

## Part I     Introductory Topics

<b>1</b>	<b>Introduction to Pathology</b>	3
	Disc Image Legends	15
	Selected References	15
<b>2</b>	<b>Introduction to Forensic Sciences</b>	17
	Overview	17
	Chain of Custody	18
	Admissibility of Tests, Evidence and Testimony	18
	Expert Witness	18
	Forensic Science Disciplines	19
	Forensic Pathology	19
	Forensic Anthropology	19
	Forensic Odontology	19
	Forensic Entomology	20
	Forensic Toxicology	22
	Forensic Psychiatry	22
	Trace Evidence	22
	Firearms and Toolmarks Examiners	24
	Document Examination	25
	Fingerprint Evidence	26
	Serology/DNA	27
	Other Disciplines	29
	Disc Image Legends	32
	Selected References	32
<b>3</b>	<b>Introduction to Forensic Pathology</b>	35
	Overview	35
	Duties of the Forensic Pathologist	36
	Investigation	37
	Autopsy	37
	Verification of Identity	40
	Documentation of Findings	40

Death Certification . . . . .	41
Testifying . . . . .	41
Consultation . . . . .	42
Training and Qualifications of Forensic Pathologists . . . . .	43
Disc Image Legends . . . . .	46
Selected References . . . . .	47
<b>4 Death Investigation . . . . .</b>	<b>49</b>
Introduction . . . . .	49
Death Investigation Systems Within the United States . . . . .	50
Overview . . . . .	50
Jurisdictional Issues . . . . .	51
Coroner Systems . . . . .	51
Medical Examiner Systems . . . . .	52
Mixed Systems . . . . .	53
Duties of Death Investigators . . . . .	53
Overview . . . . .	53
Initial Investigation . . . . .	54
Scene Investigation . . . . .	55
Follow-up Investigation . . . . .	60
Grief Counseling . . . . .	61
Disc Image Legends . . . . .	61
Selected References . . . . .	62
<b>5 Death Certification . . . . .</b>	<b>63</b>
Introduction . . . . .	63
Death Pronouncement . . . . .	66
Cause of Death . . . . .	68
Manner of Death . . . . .	71
Disc Image Legends . . . . .	79
Selected References . . . . .	79
<b>6 Overview of Anatomy and Physiology . . . . .</b>	<b>81</b>
Introduction . . . . .	81
Overview . . . . .	81
Gross Anatomy . . . . .	82
Histology . . . . .	90
Physiology . . . . .	91
Body Regions and Compartments . . . . .	92
Specific Organ Systems . . . . .	92
Integumentary System (Skin) . . . . .	92
Musculoskeletal System . . . . .	94
Nervous System . . . . .	97
Cardiovascular System . . . . .	104
Respiratory System . . . . .	106
Gastrointestinal System . . . . .	108

Hepatobiliary System . . . . .	111
Reticuloendothelial System (Including the Immune System) . . . .	113
Endocrine System . . . . .	116
Genitourinary System . . . . .	120
Special Sensory Structures . . . . .	122
Disc Image Legends . . . . .	124
Selected References . . . . .	126

## **Part II General Topics in Forensic Pathology**

<b>7 The Postmortem Forensic Examination/Autopsy . . . . .</b>	<b>129</b>
Introduction . . . . .	129
Forensic Versus Hospital Autopsies . . . . .	130
Investigation . . . . .	133
External Examination . . . . .	134
Internal Examination . . . . .	137
Ancillary Procedures . . . . .	153
Autopsy Report . . . . .	154
External Examination Only (Without Autopsy) . . . . .	156
After-the-Fact and In-Absentia Cases . . . . .	157
Autopsy Assistants . . . . .	158
Office Accreditation and Forensic Autopsy Standards . . . . .	159
Disc Image Legends . . . . .	159
Selected References . . . . .	161
<b>8 Postmortem Changes and Time of Death . . . . .</b>	<b>163</b>
Introduction . . . . .	163
Early Postmortem Changes . . . . .	163
Livor Mortis . . . . .	163
Rigor Mortis . . . . .	166
Algor Mortis . . . . .	168
Other Early Postmortem Changes . . . . .	168
Decomposition . . . . .	169
Postmortem Injuries . . . . .	177
Time of Death Estimation . . . . .	179
Disc Image Legends . . . . .	182
Selected References . . . . .	184
<b>9 Identification of Human Remains . . . . .</b>	<b>185</b>
Introduction . . . . .	185
Policies for Identification of Bodies . . . . .	188
Common, Non-scientific Methods of Identification . . . . .	188
Hospital Identification . . . . .	188
Visual Identification . . . . .	188
Scientific Methods of Identification . . . . .	190
Fingerprint Identification . . . . .	190

Dental Identification . . . . .	191
Radiologic Identification . . . . .	192
DNA Identification . . . . .	194
Identification Based on Other Unique Features . . . . .	195
Circumstantial Identification . . . . .	198
Unidentified Remains . . . . .	198
Disc Image Legends . . . . .	200
Selected References . . . . .	201

### **Part III Major Causes/Mechanisms of Death**

<b>10 Natural Deaths . . . . .</b>	<b>205</b>
Introduction . . . . .	205
Infectious Disease . . . . .	207
Cardiovascular System . . . . .	208
Congenital Heart Disease . . . . .	209
Congestive Heart Failure (Heart Failure) . . . . .	210
Coronary Artery Atherosclerosis . . . . .	211
Coronary Artery Dissection . . . . .	214
Other Coronary Artery Disorders . . . . .	214
Aortic Aneurysms (Abdominal and Thoracic) . . . . .	215
Cerebrovascular Disease . . . . .	216
Vasculitis . . . . .	217
Fibromuscular Dysplasia . . . . .	217
Myocarditis . . . . .	217
Hypertensive Cardiovascular Disease . . . . .	218
Valve Disorders . . . . .	219
Hypertrophic Cardiomyopathy . . . . .	220
Dilated Cardiomyopathy . . . . .	220
Restrictive Cardiomyopathy . . . . .	222
Deep Venous Thrombosis . . . . .	222
Conduction System Abnormalities . . . . .	222
Neoplastic Heart Disease . . . . .	223
Central Nervous System . . . . .	223
Congenital Anomalies . . . . .	223
Cerebral Palsy . . . . .	223
Infection . . . . .	224
Seizure Disorders . . . . .	225
Dementia . . . . .	226
Cerebrovascular Disease . . . . .	226
Hypertensive Disease . . . . .	226
Spontaneous Intraparenchymal Hemorrhage . . . . .	227
Ruptured Berry Aneurysm . . . . .	227
Ruptured Arteriovenous Malformation (AVM) . . . . .	227
Dural Sinus Thrombosis . . . . .	228
Neoplasia . . . . .	229

Respiratory System . . . . .	229
Congenital Anomalies . . . . .	229
Neonatal Conditions . . . . .	230
Upper Airway Conditions . . . . .	230
Pulmonary Thromboembolism . . . . .	231
Bacterial Pneumonia . . . . .	231
Aspiration Pneumonia . . . . .	232
Viral Pneumonia . . . . .	232
Other Infections (Tuberculosis, Fungi, Parasites) . . . . .	232
Asthma . . . . .	233
Chronic Obstructive Pulmonary Disease (COPD) . . . . .	234
Chronic Lung Disease . . . . .	235
Pulmonary Hypertension . . . . .	235
Neoplasia . . . . .	235
Sarcoidosis . . . . .	235
Gastrointestinal and Hepatobiliary System . . . . .	236
Congenital Anomalies . . . . .	236
Gastritis . . . . .	236
Peptic Ulcer Disease (PUD) . . . . .	236
Cirrhosis/Esophageal Varices . . . . .	237
Mallory–Weiss Tears . . . . .	238
Other GI Abnormalities . . . . .	238
Hemochromatosis . . . . .	239
Pancreatitis . . . . .	240
Reticuloendothelial and Immune Systems . . . . .	240
Autoimmune Disorders . . . . .	241
Leukemia/Lymphoma . . . . .	241
Immunodeficiency . . . . .	242
Endocrine System . . . . .	243
Genitourinary System . . . . .	244
Bones, Joints, and Soft Tissues . . . . .	245
Multisystem and Other Disorders . . . . .	245
Amyloidosis . . . . .	246
Chronic Alcoholism . . . . .	246
Diabetes Mellitus . . . . .	247
Sickle Cell Disease . . . . .	248
Inborn Errors of Metabolism . . . . .	249
Other Genetic Disorders . . . . .	250
Sarcoidosis . . . . .	251
Psychiatric Disease . . . . .	251
Disc Image Legends . . . . .	252
Selected References . . . . .	254
<b>11 Drug-Related and Toxin-Related Deaths . . . . .</b>	<b>257</b>
Introduction . . . . .	257
Investigation of Drug-Related Deaths . . . . .	258

Autopsy Findings in Drug-Related Deaths . . . . .	261
Toxicology Issues . . . . .	263
Death Certification . . . . .	267
Specific Drugs and Toxins . . . . .	269
Ethanol and Related Substances . . . . .	269
Ethanol . . . . .	269
Ethylene Glycol . . . . .	272
Methanol . . . . .	272
Isopropanol . . . . .	273
Amphetamines and Similar Substances . . . . .	273
Other Stimulants . . . . .	274
Barbiturates . . . . .	275
Cocaine . . . . .	275
Opiates and Related Substances . . . . .	277
Morphine . . . . .	279
Heroin . . . . .	279
Methadone . . . . .	280
Fentanyl . . . . .	281
Other Opiates . . . . .	281
Psychoactive Drugs of Abuse (Hallucinogens) . . . . .	282
Marijuana . . . . .	282
Lysergic Acid Diethylamide (LSD) . . . . .	282
Phencyclidine (PCP) . . . . .	283
Mescaline (Peyote) . . . . .	283
Mushrooms (Psilocybin) . . . . .	283
Other Hallucinogens . . . . .	284
Over-the-Counter (OTC) Drugs . . . . .	284
Acetaminophen . . . . .	285
Aspirin (Salicylate) . . . . .	285
Ephedrine/Herbal Ecstasy . . . . .	286
Other Prescription Drugs . . . . .	286
Antidepressants . . . . .	286
Nonbarbiturate Sedative Hypnotic Drugs . . . . .	286
Antipsychotic Drugs . . . . .	287
Anabolic Steroids . . . . .	288
Insulin . . . . .	288
Volatiles and Inhalants . . . . .	289
Nitrous Oxide . . . . .	291
Hydrocarbons . . . . .	291
Helium and Other Simple Asphyxiants . . . . .	293
Heavy Metals . . . . .	294
Arsenic . . . . .	294
Cadmium . . . . .	295
Iron . . . . .	295
Lead . . . . .	295

Mercury . . . . .	295
Other Poisons . . . . .	296
Organophosphates . . . . .	296
Strychnine . . . . .	296
Naturally-Occurring Toxins . . . . .	296
Disc Image Legends . . . . .	297
Selected References . . . . .	299
<b>12 Blunt Force Injury Deaths . . . . .</b>	<b>301</b>
Introduction . . . . .	301
Classification of Blunt Force Injuries . . . . .	302
Abrasions . . . . .	302
Contusions . . . . .	304
Lacerations . . . . .	305
Fractures . . . . .	308
Avulsions . . . . .	310
Blunt Force Head and Neck Trauma . . . . .	311
Skin and Mucosal Injuries . . . . .	312
Subcutaneous Injuries . . . . .	312
Skull and Facial Bone Injuries . . . . .	313
Epidural, Subdural, and Subarachnoid Hemorrhage . . . . .	315
Gross Brain Injuries . . . . .	317
Microscopic Brain Injuries . . . . .	320
Neck, Spinal Cord, and Vertebral Artery Injuries . . . . .	321
Special Topics Related to Blunt Force Injuries . . . . .	322
Mechanisms of Death in Blunt Force Trauma . . . . .	322
Delayed Deaths Related to Blunt Force Injury . . . . .	324
Patterned Injuries . . . . .	325
Clothing Examination . . . . .	327
Specific Subtypes of Blunt Force Injury . . . . .	327
Disc Image Legends . . . . .	332
Selected References . . . . .	334
<b>13 Gunshot Wound Deaths . . . . .</b>	<b>337</b>
Introduction . . . . .	337
Types of Weapons and Ammunition . . . . .	337
Gunshot Wounds . . . . .	343
Entrance Wounds . . . . .	344
Range of Fire . . . . .	346
Exit Wounds . . . . .	351
Graze Wounds . . . . .	351
Caliber . . . . .	352
Miscellaneous Features of Handgun Wounds . . . . .	354
Characteristics of High-Velocity Wounds . . . . .	354
Shotgun Wounds . . . . .	356
Miscellaneous Issues . . . . .	362

Internal Examination . . . . .	362
Mechanism of Injury . . . . .	366
Documentation . . . . .	367
X-Rays . . . . .	368
Clothing Examination . . . . .	368
Gunshot Residue . . . . .	368
Manner of Death Issues . . . . .	369
Special Weapons, Ammunition, and Circumstances . . . . .	370
Disc Image Legends . . . . .	373
Selected References . . . . .	376
<b>14 Sharp Force Injury Deaths . . . . .</b>	<b>379</b>
Introduction . . . . .	379
Stab Wounds . . . . .	381
Incised Wounds . . . . .	385
Chop Wounds . . . . .	388
Special Issues . . . . .	388
Internal Examination . . . . .	388
Mechanism of Injury . . . . .	390
Trace Evidence . . . . .	390
Clothing Examination . . . . .	390
Defensive Wounds . . . . .	391
Hesitation Marks . . . . .	391
Self-Inflicted Wounds/Suicide . . . . .	392
“Self-Injurious Behavior” (“Cutting”) . . . . .	392
Accidental Sharp Force Injuries . . . . .	393
Direction of Incised Wound . . . . .	393
Handedness of Attacker . . . . .	393
X-Rays . . . . .	394
Decomposition . . . . .	395
Postmortem/Perimortem Wounds . . . . .	395
Artifacts . . . . .	397
Disc Image Legends . . . . .	398
Selected References . . . . .	399
<b>15 Asphyxial Deaths . . . . .</b>	<b>401</b>
Introduction . . . . .	401
Suffocation . . . . .	403
Simple Asphyxia (Environmental Asphyxia) . . . . .	403
Smothering (External Airway Obstruction) . . . . .	405
Choking (Internal Airway Obstruction) . . . . .	406
Mechanical Asphyxia (Traumatic Asphyxia) . . . . .	408
Positional Asphyxia . . . . .	410
Combination Forms of Suffocation . . . . .	410
Neck Compression (Strangulation) . . . . .	411
Hanging . . . . .	412



Strangulation . . . . .	415
Ligature Strangulation . . . . .	416
Manual Strangulation . . . . .	417
Non-ligature, Non-manual Neck Compression . . . . .	418
Chemical Asphyxia . . . . .	419
Carbon Monoxide . . . . .	419
Cyanide . . . . .	422
Hydrogen Sulfide . . . . .	423
Other Issues . . . . .	423
Autoerotic Asphyxia . . . . .	423
Choking Game . . . . .	424
Restraint Asphyxia . . . . .	425
Combination Asphyxial Deaths . . . . .	427
Drowning . . . . .	428
Disc Image Legends . . . . .	428
Selected References . . . . .	430
<b>16 Drowning . . . . .</b>	<b>433</b>
Introduction . . . . .	433
Physiology and Mechanism of Death in Drowning . . . . .	434
Scene Investigation . . . . .	435
Autopsy Findings . . . . .	437
Causes of Death Other Than Drowning . . . . .	444
SCUBA Deaths . . . . .	445
Manner of Death . . . . .	446
Disc Image Legends . . . . .	447
Selected References . . . . .	447
<b>17 Electrical Deaths . . . . .</b>	<b>449</b>
Introduction . . . . .	449
Electrocution . . . . .	451
Mechanism of Death in Electrocutions . . . . .	453
Scene Investigation . . . . .	453
Autopsy Findings . . . . .	455
Low Voltage . . . . .	455
High Voltage . . . . .	457
Other Features . . . . .	459
Lightning . . . . .	461
Non-Lethal Electronic Shock Devices . . . . .	464
Death Certification and Manner of Death . . . . .	465
Disc Image Legends . . . . .	465
Selected References . . . . .	466
<b>18 Temperature-Related Deaths . . . . .</b>	<b>469</b>
Introduction . . . . .	469
Hypothermia . . . . .	470

General Features . . . . .	470
Scene Investigation . . . . .	471
Autopsy Findings . . . . .	471
Death Certification . . . . .	475
Hyperthermia . . . . .	475
General Features . . . . .	475
Scene Investigation . . . . .	476
Autopsy Findings . . . . .	477
Death Certification . . . . .	478
Disc Image Legends . . . . .	479
Selected References . . . . .	479
<b>19 Burns and Fire-Related Deaths . . . . .</b>	<b>481</b>
Introduction . . . . .	481
Burn Types . . . . .	484
Dry Burns . . . . .	484
Radiant Burns . . . . .	484
Scald Burns . . . . .	485
Chemical Burns . . . . .	487
Fire-Related Burns . . . . .	488
Fire Deaths . . . . .	489
Questions to Address . . . . .	489
Autopsy . . . . .	492
Mechanism of Death . . . . .	496
Death Certification . . . . .	497
Fire Investigation . . . . .	498
Cremations . . . . .	498
Disc Image Legends . . . . .	499
Selected References . . . . .	500
<b>20 Deaths in Infancy and Childhood . . . . .</b>	<b>501</b>
Introduction . . . . .	501
Discarded Fetuses/Infants and Fetal/Infant Deaths	
in Unattended Births . . . . .	502
Who is the Mother? . . . . .	503
Was the Fetus/Infant Viable? . . . . .	503
Was the Fetus/Infant Live-Born or Stillborn? . . . . .	503
What Was the Cause of Death? . . . . .	505
Birth-Related Infant Deaths . . . . .	506
Infant Deaths . . . . .	508
Natural Death in Childhood . . . . .	513
Accidental Childhood Deaths . . . . .	514
Suicidal Childhood Deaths . . . . .	516
Homicidal Childhood Deaths . . . . .	516
Classification of Childhood Homicides . . . . .	526
Violent Outburst (Angry Impulse) . . . . .	527

Negligence/Neglect . . . . .	527
Sadistic Acts of Punishment . . . . .	528
Munchausen's Syndrome by Proxy . . . . .	529
Unwanted Child . . . . .	529
Unwanted Pregnancy (Neonaticide) . . . . .	529
Spouse Revenge . . . . .	530
Postpartum Mental Disorder . . . . .	530
Acute Psychosis . . . . .	530
Altruism . . . . .	530
Euthanasia (True Mercy Killing) . . . . .	531
Sexual Abuse . . . . .	531
Violent Older Child . . . . .	532
Drug and Alcohol Abuse . . . . .	532
Seizure Disorder . . . . .	532
Innocent Bystander . . . . .	532
Pediatric Autopsy Considerations . . . . .	533
Disc Image Legends . . . . .	535
Selected References . . . . .	537
<b>21 Miscellaneous Topics . . . . .</b>	<b>539</b>
Introduction . . . . .	539
Aircraft Crashes . . . . .	540
Allergic Reactions (Anaphylaxis) . . . . .	542
Animal Attacks . . . . .	544
Artifacts and Mimics . . . . .	544
Emboli . . . . .	546
Pulmonary Thromboemboli . . . . .	547
Systemic Thromboemboli . . . . .	548
Bone Marrow and Fat Emboli . . . . .	548
Amniotic Fluid Emboli . . . . .	548
Gas/Air Emboli . . . . .	549
Bullet and Other Foreign Body Emboli . . . . .	550
Exhumations . . . . .	550
Explosions and Blast Injuries . . . . .	554
High-Profile Cases . . . . .	554
Homicide by Heart Attack . . . . .	555
In-Custody Deaths . . . . .	556
Mass Fatality Incidents . . . . .	560
Multiple Causes of Death . . . . .	561
Nutrition and Hydration Disorders . . . . .	562
Obesity . . . . .	563
Malnutrition and Starvation . . . . .	563
Vitamin Deficiencies . . . . .	564
Anorexia . . . . .	564
Bulimia . . . . .	565

Dehydration . . . . .	565
Overhydration . . . . .	566
Food Poisoning . . . . .	566
Occupational Deaths . . . . .	567
Organ and Tissue Procurement Issues . . . . .	568
Postmortem Chemistry Tests . . . . .	572
Postmortem Cultures . . . . .	574
Pregnancy-Related Maternal Deaths . . . . .	575
Product-Related Deaths . . . . .	578
Radiation . . . . .	578
Ionizing Radiation . . . . .	578
Non-ionizing Radiation . . . . .	580
Sexual Assault . . . . .	580
Terrorist Agents . . . . .	581
Biologic Agents . . . . .	581
Chemical Agents . . . . .	582
Therapy-Related Deaths . . . . .	583
Disc Image Legends . . . . .	586
Selected References . . . . .	588
Aircraft Crashes . . . . .	588
Allergic Reactions (Anaphylaxis) . . . . .	588
Animal Attacks . . . . .	588
Emboli . . . . .	588
Exhumation . . . . .	589
Explosions and Blast Injuries . . . . .	589
High-Profile Cases . . . . .	589
Homicide by Heart Attack . . . . .	589
In-Custody Deaths . . . . .	589
Mass Fatality Incidents . . . . .	589
Nutrition and Hydration Disorders . . . . .	590
Occupational Deaths . . . . .	590
Organ and Tissue Procurement Issues . . . . .	590
Postmortem Chemistry Tests . . . . .	590
Postmortem Cultures . . . . .	590
Pregnancy-Related Maternal Deaths . . . . .	590
Product-Related Deaths . . . . .	591
Radiation . . . . .	591
Terrorist Agents . . . . .	591
Therapy-Related Deaths . . . . .	591
<b>Appendix: Additional Resources and Reference Books . . . . .</b>	<b>593</b>
<b>Index . . . . .</b>	<b>595</b>

Forensic Pathology for Police, Death Investigators,  
Attorneys, and Forensic Scientists

Prahlow, J.A.

2010, XV, 633 p. With online files/update., Hardcover

ISBN: 978-1-58829-975-8

A product of Humana Press