

Contents

Volume I

Part I The Basics

1 Pre-operatively	3
1 Safety: Safety of Personnel; Safety of the Mice	3
2 Techniques for Controlling the Mouse: Basic Techniques and Variations	5
3 Transfer of Mice: Basic Techniques and Variations	13
4 Injection of Anesthesia: Subcutaneous, Intravenous, Intramuscular and Peritoneal Injections.	18
5 Inhalation of Anesthesia: Safe and Effective, Design and Use of Mouse Anesthesia Mask	19
2 Commonly Used Tools	23
1 Use of Forceps: Use in 15 Different Ways in Mouse Surgery	23
2 Using Scissors: Use of Tip, Blade, and Back	29
3 Use of Syringes: Their Use in Mouse vs Human	33
3 Commonly Used Regional Exposure	41
1 Body Position	41
2 Skull Exposure: Exposure and Bone Thinning Technique	48
3 Sublingual Vein Exposure	52
4 Anterior Neck: Exposure of Subcutaneous Glands, Lymph Nodes, and Muscles	55
5 External Jugular Vein: Anatomy of the Entire Vein and Its Branches.	58
6 Expose the Common Carotid Artery: Its Relationship with the Neck Muscles	62
7 Thoracotomy: Anterior vs Posterior Approach	67
8 Laparotomy: Use of Scissors in Mouse vs Human	73
9 Abdominal Aorta: Design and Use of an Exposure Ring; Appendix: The Design and Use of a Ring Retractor	81
10 Inguinal Region: Anatomy and Surgical Technique	89
11 Skin Preparation	94
12 Skinning Mouse: A Technique for Harvesting Subcutaneous Glands	97
13 Tail-Tearing: Rapid Exposure of Posterior Thoracic and Abdominal Space	100

Part II Collecting Specimen

4 Basic Principles of Specimen Collection	109
1 Basic Principles: An Overview, the Design, and Use of a Dissection Board.	109
5 Harvesting an Organ	111
1 The Brain: Harvest an Intact Brain	111
2 Eye Globe and Optic Nerve: For Pathological Preparation	117

3	Retina: Obtain an Intact Retina in Minutes.	124
4	Conjunctiva: Harvest a Large Area of Conjunctiva	128
5	Tympanic Bulla: Intra-cranial and Extra-cranial Approaches.	134
6	Thyroid and Parathyroid Gland: Surgical Approaches	140
7	Large Blood Vessels: Preserving the Physiologic Shape in Pathological Specimens	145
8	Thymus Gland: Harvest an Intact Gland with Tissue Glue	150
9	Brain and Spinal Cord: Harvest Both Together and Keep Them Intact	158
10	Heart: Harvest Donor vs Sample Organ	170
11	Lungs: Fast Way to Eliminate Air.	180
12	Liver: Harvest an Intact Liver.	186
13	Spleen: Harvest Spleen In Vivo with Minimal Damage	193
14	Pancreas: A Perfusion Technique	198
15	Kidney: Harvest Donor Organ	203
16	Cremaster Muscle: Abdominal Approach, Muscle Anatomy	212
6	Skinning the Mouse: The Tail-Tearing Technique	219
1	Overview: Various Glands Collection by Skinning	219
2	Lacrimal Gland: Extra- and Intraorbital Lacrimal Glands	221
3	Parotid Gland: Distinguish It from the Extra Orbital Lacrimal Gland	224
4	Zymbal's Gland: Exposure Between Skin and Bone	226
5	Submandibular Gland: The Biggest Salivary Gland.	229
6	Collecting Sublingual Gland: Searching Under the Submandibular Gland	234
7	Hibernation Gland: Separate it from White Fat	237
8	Mammary Glands: Separate from Subcutaneous Fat	240
9	Sweat Glands: Exposure from Palmula Only	244
10	Preputial Gland in Male Mouse: A Pair of Subcutaneous Sex Gland.	247
11	Preputial Gland in Female Mouse: Pigmentation Aiding in Identification.	250
12	Harvesting the Vagina and Uteri: Without Laparotomy	254
13	Female Colon and Rectum: Without Laparotomy	260
14	Female Mouse Bladder: Without Laparotomy	263
15	The Bulbourethral Gland: Anterior and Posterior Approaches.	266
16	Seminal Stick: Collecting Sperm in Solid State in the Urethra	268
7	Collecting Blood from Various Sites and Vessels	275
1	Introduction: Proper Selection of a Blood Vessel and Technique.	275
2	Orbital Venous Sinus Blood Collection: An Overview – Six Techniques and Local Anatomy	277
3	Orbital Venous Sinus 1: Capillary Glass Tube	283
4	Orbital Venous Sinus 2: Pipette – Collect Maximal Amount of Blood.	287
5	Orbital Venous Sinus 3: Pipette – Collect a Precise Volume of Blood	289
6	Orbital Venous Sinus 4: Needle Puncture – Blood Collection “Switch”	291
7	Orbital Venous Sinus 5: Transcutaneous Approach with Syringe.	296
8	Orbital Venous Sinus 6: Transconjunctival Syringe – Transconjunctival Syringe	298
9	Facial Blood Vessels: Four Traditional and Two New Techniques.	300
10	Enucleation: Five Ways to Increase the Amount of Blood Collected.	306
11	External Jugular Vein: Using Needle Percutaneous vs Under Direct Visualization	309
12	Cardiopuncture: Collect Blood from the Left or Right Ventricle	313
13	Posterior Vena Cava: Coagulation Study	321
14	Portal Vein: Antegrade vs Retrograde Technique	326
15	Saphenous Arteriovenous: Have Blood Form Droplets Properly	334
16	Lateral Marginal Vein: Distinguish from Small Saphenous Vein	336

17	Dorsal Paw Vein: Front vs Hind Claws	339
18	The Lateral Caudal Vessel: Collecting Multiple Samples with One Puncture . .	343
19	Median Caudal Artery and Vein	346
20	Tail Tip	349
8	Collecting Other Specimens	351
1	Urine 1, Needle Aspiration	351
2	Urine 2, Stress: Special Condition	358
3	Urine 3, Pressing Bladder: Special Condition and Technique	359
4	Urine 4, Catheterization: Male vs Female Mice	361
5	Urine 5, Laboratory Sand	369
6	Cerebrospinal Fluid: Two Techniques	371
7	Bile: Cannulation via Duodenum	379
8	Seminiferous Tubule Perfusion Technique	383
9	Coagulating Gland Imaging: Perfusion and Spreading Technique	386
10	Prostate Gland: Preparation for Observation and Imaging	390
11	Bone Marrow: Get Femur Without Muscle Attached	395
12	Lymph Nodes: Surgical Approach vs Skinning Techniques	400

Part III Drugs Administration

9	Gavage	413
1	Gavage: Technique Based on Applied Anatomy	413
10	Intraperitoneal Injection	425
1	IP-1 Introduction: Different Intraperitoneal Injection Techniques	425
2	IP-2 Routine: A conventional technique	428
3	IP-3 in Mouse with Giant Spleen: Injection Via the Scrotum	433
4	IP-4 in Mouse with a Full Bladder	442
5	IP-5 Control the Entry into the Blood Circulation: Avoid “the First Pass Elimination”	445
11	Various Muscular Injections	447
1	Introduction to Muscular Injections: Intramuscular, Extramuscular, Sub-epimysium	447
2	Extramuscular Injection: Common Misconceptions	451
3	IM-1 Adductor Magnus: For Muscle Electroporation	455
4	IM-2 Anterior Tibialis: A Reliable Low-Volume Intramuscular Injection	459
5	SE-1 Anterior Tibialis: The Preferred Site for Low Volume and Noninvasive	462
6	IM-3 Rectus Femoris: High-Volume Intramuscular Injection	465
7	IM-4 Trapezius: The Preferred Site in Neonatal Mice	470
8	Trapezius: The Preferred Site for High-Volume Injection	473
9	IM-5 Abdominal Muscle: During a Laparotomy	475
10	SE-3 Biceps Femoris: A High-Volume Injection	477
11	IM-6 Uterine: Limited Diffusion Injection	480
12	IM-7 Cervix: Exposure and Injection	482
12	Skin Drug Administration	485
1	An Overview: Various Skin Injections – Mouse vs Human Skin Anatomy . . .	485
2	Subcutaneous Injection: Three Locations in the Trunk	491
3	Subcutaneous Injection: Inguinal Area	497
4	Subcutaneous Injection: Medial and Lateral Auricle	500
5	Intradermal Injection: its definition in mice	505
6	Dermo Muscular Injection: In Upper Lip	510
7	Subdermal Injection: In Upper Eyelid	514

8	Full Cutaneous Injection: Involving Layers from Dermomuscular Layer to Dermis	518
9	Derma-Fascia Injection: Involving All Layers of Skin and Subcutaneous Superficial Fascia.	521
13	Injection in Subcutaneous Gland	527
1	Parotid Gland: Injection	527
2	Mammary Gland: Proper Identification and Depth	531
3	Preputial Gland in Male Mice: Percutaneous vs Under Direct Visualization. ...	534
4	Sweat Gland: Percutaneous Injection in Claw Palm.	540
14	Intravenous Injection	543
1	Introduction: Selection in 23 Different Veins	543
2	Orbital Venous Sinus: An Uncertain Injection	545
3	Sublingual Vein: The Anatomy and Special Equipment.	549
4	External Jugular Vein: Exposure and Different Injection Techniques	551
5	Posterior Vena Cava: Hemostasis	562
6	Portal Vein: Fat Hemostatic Technique.	566
7	Cecum Vein: Alternative to Portal Vein Injection	569
8	Renal Vein: Hemostasis with Rolling Cotton Swab	571
9	Genital Vein in Male Mice: Hemostasis Using Two Cotton Swabs	575
10	Genital Artery and Vein: Proper Names and Injection Technique	578
11	Iliolumbar Vein: Pressure Hemostasis	581
12	Posterior Epigastric Vein: Hemostatic Technique with a Cushion	585
13	Dorsal Penile Vein: Antegrade and Retrograde Injection	588
14	Glans Penis: Alternative to Intravenous Injection in Dorsal Penile Vein	597
15	Femoral Vein: "Bowing" and Transmuscular Injection Techniques.	604
16	Muscular Branch of Femoral Vein: Intravenous Injection Technique	611
17	Cutaneous Branch of Femoral Vein: Intravenous Injection of Drug or Tumor Cells	615
18	Saphenous Vein: "Bowing" Technique	623
19	Dorsal Metatarsal Vein: Intravenous Injection Technique Under Highly Mobile Skin.	627
20	The Lateral Caudal Vein Intravenous Injection: Operation Designed According to Vascular Anatomy	630

Volume II

15	Organ Surface Drug Administration	641
1	Introduction: Minimizing the Physical Injury.	641
2	Eye: Cornea and Conjunctiva	644
3	Subconjunctival Injection: Small, Large Amount.	648
4	Tongue: Submucosal Injection	654
5	Trachea and Lungs: Nasal Drops	657
6	Nasal Cavity	660
7	The Liver: Subserosa Injection	667
8	Spleen: Subserosa Injection	669
9	Kidney: Subserosa Injection	674
10	Kidney-2: Subfibrous Membrane Injection	677
11	Bladder: Subserosa and Submucosa Injection	680
12	Intestine: Sub-mesenteric Injection.	687
13	Ovary: Subserosa Injection	692
14	Testis: Sub-tunica Albuginea Injection	695
15	Coagulating Gland: Intra-fascia Injection.	699
16	Sciatic Nerve: Drug Administration	703

16 Organ Injection	707
1 Brain: Rapid Intracerebral Injection Technique	707
2 Eye Anterior Chamber: Avoid Injury to the Corneal Endothelium and Iris	714
3 Vitreous Body Injection	718
4 Orbit: Retrobulbar Injection Technique	721
5 Lungs: Tumor Cell Implantation	723
6 Liver: Traditional Intrahepatic Injection	727
7 Spleen: Local Injection and the Splenic Vein	730
8 Kidney: Parenchyma and Pelvis Injection	734
9 Seminal Vesicle: Injection Directly	738
10 Uterus: Unilateral Drug Administration	742
11 Spinal Cavity: Lumbar Puncture	745
12 Bone Marrow Cavity: Injecting While Withdrawing the Needle	749
13 Knee Joint Cavity: Challenge in a Small Cavity	753
14 Fascia of Abdominal Aorta: Drug Administration and Hydrodissection	758
15 Femoral Vascular Fascia: Hydrodissection	763
16 Subcutaneous Superficial Fascia Removal	766
17 Cremaster Extramuscular Fascia Removal	770
18 Intrafascial Injection of the Prostate Gland	774
19 Lymph Node: Three Injection Techniques	777
17 Perfusion	785
1 An Introduction to Indirect Administration: Concept and Scope of Application	785
2 Lungs: Through the Trachea	786
3 Liver: Via the Common Bile Duct	790
4 Pancreas: Via the Common Bile Duct	795
5 Bladder: Through the Renal Pelvis	800
6 Bladder-2: Through the Coagulating Gland	803
7 Seminal Vesicle: Through the Urethra with Special Ligation	807
8 Prostate: Through Urethra with Special Ligation	812
9 Coagulating Glands: Through the Urethra	816
10 Transvaginal Intrauterine Perfusion: Through the Vagina with a Large-Head Catheter	818

Part IV Basic Surgical Techniques

18 Preoperative Preparation	825
1 Avoid Hand Tremor: Causes and Prevention of Hand Tremor	825
19 Wound Closure	827
1 Suturing: Instructions and a Practice Device	827
2 Adhesion: Tissue Glue Application	835
3 Clamping: Use of Micro-Clip Specific Technique	838
20 Various Surgical Techniques and Instruments	843
1 Incising: Opening the Lingual Mucosa with a Knife and Needle	843
2 Bite: With a Micro-Rongeur in the Lingual Mucosa	848
3 Excision: Full vs Partial Thickness of the Skin	851
4 Surgical Punch and Electrocautery: In Partial Hepatectomy	859
5 Cutting: With Suture in the Kidney	863
6 Electrocautery: In Vasectomy	867
7 Transection: Removing a Segment of the Sciatic Nerve	871

8	Truncation: Design and Use of a Precision Tail Cutter.	874
21	Organ Intubation	877
1	Anterior Chamber of Eye: Use of Micro-blade and Micro-intubation	877
2	Trachea: A Conventional Technique – Tracheostomy	882
3	Intestines: Use of a Large Head Tube	887
4	Common Bile Duct: Retrograde Intubation	892
Part V Vascular Surgery		
22	Introduction to Vascular Surgery	897
1	Introduction: Characteristics of Different Blood Vessels	897
23	Bleeding and Coagulation	903
1	Venipuncture: With Needle in the Sublingual Vein.	903
2	Slicing: Opening the Sublingual Vein with Combined Needle-Knife Technique	906
3	Fenestration: In the Sublingual Vein with a Spatula Needle	910
4	Transection: A Transection Device for the Caudal Artery and Vein	913
5	Thrombosis: Longitudinal Section in the Saphenous Vein	918
24	Block Blood Flow	923
1	Stenosis: In the Aortic Arch Without Thoracotomy	923
2	Block and Cannulation: In the Common Carotid Artery with Special Cushion Plate	927
3	Suture Ligation: On the Deep Small Lumbar Arteries and Veins	933
4	Tube-Suture Blood Flow Blocker: Block Abdominal Aorta in Narrow Surgery Space	936
5	Electrocoagulation: Different Technique on Different Sized Blood Vessel	941
6	Ligation: The Traditional Way in Femoral Artery	948
7	Elastic Retractor: Temporary Blocking of the Common Carotid Artery	952
8	Traction: Temporary Blocking of the Common Carotid Artery	957
25	Fenestration of Blood Vessels	961
1	Introduction to Vascular Fenestration: Five Techniques	961
2	Biting: With Micro-Rongeur in the Sublingual Vein	963
3	Cutting: Traditional Fenestration Technique in the Posterior Vena Cava	969
4	Pulling: With Suture in the Femoral Vein	973
5	Stitching: With Needle in the Femoral Vein	977
26	Blood Vessels Intubation	979
1	Introduction of Vascular Intubation: Routine and Special Vascular Intubation	979
2	Limited Cerebral Perfusion: From the Aorta	981
3	Microangiography of the Coronary Artery: From the Common Carotid Artery	989
4	Using a Trocar: Common Carotid Artery	992
5	Using a Sharp Tipped Polyethylene Tube: Common Carotid Artery	996
6	Arteriovenous Shunt Intubation: Between the Common Carotid Artery and and External Jugular Vein	1002
7	Trans-muscular Intubation of the External Jugular Vein	1006
8	External Jugular Vein Suture Thrombosis.	1010
9	Intubation in More Movable Vein: Portal Vein	1015
10	Snugly Fit Tube Without Ligation: Posterior Vena Cava	1020
11	Percutaneous Retrograde Intubation: Posterior Vena Cava.	1023

12	Connection After Intubation in a Narrow Space: Femoral Vein	1029
13	Conventional Intubation: Femoral Artery	1033
14	Needle Hook Guide Intubation: Femoral Artery	1037
15	Enlarging Incision Wound: Cutaneous Branch of Femoral Artery	1042
16	Indwelling Needle: Dorsal Penile Vein	1049
17	Indwelling Catheter: Median Caudal Artery	1053
18	Fixation Hoop: Lateral Caudal Vein Intubation	1057

Correction to: Liu’s Principles and Practice of Laboratory Mouse	
Operations: A Surgical Atlas	C1
Index	1059