RABBIT ANATOMY

RABBIT ANATOMY:

A BRIEF PHOTOGRAPHIC ATLAS AND DISSECTION GUIDE

PART II: CARDIOVASCULAR SYSTEM

SOMA MUKHOPADHYAY AND LISA RUGGIERO WAGNER

Disclaimer:

This Photographic Atlas is developed under a grant received from Affordable Learning Georgia (ALG) Textbook Transformation Grant.
This work is an extension of the SoTL Fellowship of Soma Mukhopadhyay from Augusta University
This Atlas is developed primarily to meet Student Learning Objectives at Augusta University, so every details of Rabbit Anatomy is not presented.

DEDICATION

I would like to dedicate this work to my son, Nilabhra, for all his support and encouragement.

- Soma

I would like to dedicate this work to my dear husband and sons, Tony, Tyler and Jesse for their loving support and encouragement.

- Lisa

AUGUSTA UNIVERSITY

RABBIT ANATOMY:
A BRIEF PHOTOGRAPHIC ATLAS AND DISSECTION GUIDE

First Edition

PUBLICATION: DECEMBER 2019

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Acknowledgements:
The authors would like to acknowledge their colleagues at Augusta University for their input in the review process toward the development of this atlas.

Dr Richard Griner
Dr Deborah Richardson
Dr Faith Wiley
Dr Christina Wilson
Dr Debra Saul

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AUTHOR BIOGRAPHIES

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Soma Mukhopadhyay

Dr Soma Mukhopadhyay is a professor by profession, scientist by training and educator by passion. In her free time she is an elocutionist, singer, poet, writer, script writer, theater actor and producer.

Born in Kolkata (also known as Calcutta), India, Soma started her career as a professor in the United States after finishing her BS and MS in Zoology from University of Calcutta and Ph.D. in Nuclear Medicine from Indian Institute of Chemical Biology and Jadavpur University at Kolkata, India. Her Ph.D. research was in the area of structure and functional relationship on mammalian renal system; objective was to develop an efficient imaging agent (radiopharmaceutical) for diagnostic purpose. She was also part of a pilot clinical study to monitor the efficiency of the radiopharmaceuticals in the human system. During her Post-Doctoral endeavor, she undertook studies to identify and characterize pathways involved in arterial contractility following drug-receptor interaction. She also completed a Professional Certification Program in Biotechnology from University of Cincinnati.

Dr. Mukhopadhyay has been teaching for almost 25 years. She has received four teaching awards and was nominated for three others. Soma received Indian Council of Medical Research's Fellowship for doing her Ph.D. research. Later she received a Fellowship under National Library of Medicine for a Biomedical Informatics program. Soma has been selected for Scholarship of Teaching and Learning Fellowship at Augusta University and a Fellowship from Howard Hughes Medical Institute for pedagogical research under their Faculty Mentoring Network. For decades Dr.Mukhopadhyay has been involved with pedagogical research and for last few years she is working with and guiding undergraduate students in a number of research projects.

Dr Mukhopadhyay's current research focus includes study of molecular genetics of human evolution and significance of the interaction between the Homo neanderthalensis, Denisovans and the Homo sapiens and development of interactive courses on Anatomy, Physiology and Evolution. Academically she is passionate about Art and Anatomy and History of Medicine. Soma has a Degree in Music and got her Diploma in Science Journalism from Calcutta University. She was a radio artist at Kolkata and performed in Pennsylvania Public Radio. Her short stories, poetry, and news communications have been and continue to be published in newspapers and magazines in India and abroad. She is a co-author of a book, "Ekatmo" (One Soul), a Literary Collection of three generations. She writes in both Bengali and English. Her passions include painting, photography, recitation, drama, music and literature.

AUTHOR BIOGRAPHIES

Biological Sciences
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Lisa Ruggiero Wagner

Lisa began her teaching career while she was still in graduate school at Temple University in Philadelphia, Pennsylvania. Lisa took her degree in Microbiology from the Pennsylvania State University and, after raising her sons with her husband in State College, Pennsylvania, decided to pursue agraduate degree with an interdisciplinary approach to health, diseaseand health disparities. Her research focused on upstream disease causation mechanismsof multi-drug resistant (MDR)and extremely drug resistant tuberculosis (XDR-TB). She also holds a Graduate Certification for Teaching in Higher Education from Temple University. This graduate work was focused on excellence in teaching and learning and evidence-based teaching. Inspired by students' capacity for learning, Lisa has been facilitating and encouraging curiosity and inquiry in the lecture hall and lab as a lecturer in Anatomy & Physiology as well as in Biology at Temple University (Philadelphia), Augusta University and Clemson University since 2008. She lives for the learner's "AHA Moment"!

In her off-campus life, Lisa has a wonderful husband and two amazing adult sons. Hiking, cooking and Yoga for fun. Oh...she will always be a Nittany Lion, but she is learning what it is like to be a Clemson Tiger!

LEARNING OBJECTIVES

RABBIT CARDIOVASCULAR SYSTEM

STUDENT LEARNING OBJECTIVES

ARTERIES

Superior to Diaphragm

Aorta
- *Aortic Arch*
- *Descending Thoracic Aorta*

Brachiocephalic
- *Common Carotid (Right & Left)*
  - *Internal Carotid (R & L)*
  - *External Carotid (R & L)*
  - *Facial (R & L)*
  - *Lingual (R & L)*

Subclavian (R & L)
- *Internal Thoracic/Internal Mammary (R & L)*
- *Vertebral (R & L)*
- *Thyrocervical trunk*
- *Thoracoacromial (R & L)*

Axillary (R & L)
- *Lateral Thoracic (R & L)*
- *Subscapular (R & L)*

Brachial (R & L)

Inferior to Diaphragm

Descending (Abdominal) Aorta
- *Celiac Trunk*
- *Superior Mesenteric*
- *Adrenolumbar (R & L)*
  (Note: splits and serves adrenal gland and lumbar region separately)
- *Renal (R & L)*
- *Inferior Mesenteric*
- *Gonadal (Ovarian or Testicular (R & L))*
- *Common Iliac (R & L)*
  - *External Iliac (R & L)*
  - *Internal Iliac (R & L)*
- *Lumbar (R & L)*
- *Caudal*
- *Femoral (R & L)*
  - *Deep Femoral (R & L)*
- *Saphenous (R & L)*
- *Popliteal (R & L)*

LEARNING OBJECTIVES

RABBIT CARDIOVASCULAR SYSTEM

VEINS

Superior to Diaphragm

- *Superior Vena Cava (Precava) (R & L)*
- *Internal Jugular (R & L)*
- *External Jugular (R & L)*
- *Transverse Jugular*
- *Facial (R & L)*
- *Subclavian (R & L)*
- *Brachiocephalic (R & L)*
- *Internal Thoracic / Internal Mammary (R & L)*
- *Axillary (R & L)*
- *Brachial (R & L)*
- *Cephalic*
- *Azygous*

Inferior to Diaphragm

- *Inferior Vena Cava (Postcava)*
- *Hepatic*
- *Renal (R & L)*
- *Adrenolumbar (R & L)*
- *Gonadal (Ovarian or Testicular) (R & L)*
- *Inferior Mesenteric*
- *Iliolumbar (R & L)*
- *Common Iliac (R & L)*
  - *External Iliac (R & L)*
  - *Internal Iliac(R/L)*
- *Femoral (R & L)*
- *Deep Femoral (R & L)*
- *Caudal (R & L)*
- *Popliteal (R & L)*
- *Great Saphenous (R & L)*

Hepatic Portal Vein: receives from

- *Gastrosplenic*
- *Superior mesenteric*
- *Inferior mesenteric*
- *Gastric*
- *Pancreaticoduodenal*

DISSECTION GUIDE

DISSECTION INCISION GUIDE FOR THE BLOOD VESSELS OF THE RABBIT

Opening the Ventral Body Cavity

1. *Open stitches on the ventral midline*
2. *Insert index finger into abdominal cavity superficially and move superiorly to locate the diaphragm.*

NOTE: KEEP ALL INCISIONS SUPERFICIAL to prevent damage to interior structures and organs.

- **INCISION #1:** *Extend midline incision superiorly toward the diaphragm being careful NOT to cut the diaphragm.*
- **INCISION #2:** *Make a transverse incision along the inferior margin of the diaphragm (Lateral left & right).*
- **INCISION #3:** *Move superiorly ABOVE the diaphragm (about 1/8-1/4 of an inch above INCISION #2) and make ANOTHER transverse incision just ABOVE the SUPERIOR margin of the diaphragm (Lateral left & right). THIS SHOULD CREATE A "BELT" AT THE DIAPHRAGM.*
- **INCISION #4:***Insert the scissor blade into the tissue at the sternal mid-line (above the Diaphragm, at the top of the "BELT") and cut through the sternum while continuing the midline superior incision up to the mandible. It could be difficult to cut through the sternum. ONLY if necessary, the incision can be made to the IMMEDIATE left of sternum through the cartilage instead of the sternum.*
- **INCISION #5:** *The exact location of this transverse incision will depend on your specimen. Generally: Locate the superior margin of the pectoralis major muscle group and make a transverse incision along the muscle laterally in each direction left and right.*
- **INCISION #6:** *Extend the midline incision 'below the diaphragm 'belt' to the pelvic region.*
- **INCISION #7:** *Make a lateral left and lateral right incision from the inferior most point of the midline incision. Be cautious not remain superficial to not damage internal structures* with these (2) incisions ESPECIALLY in male rabbits.*

NOTE: *In male rabbits, be careful to avoid cutting the spermatic cords.*

- *Access to the subclavian and axillary vessels is obtained from the antecubital region toward the shoulder. Incisions must be shallow (epitrochlearis should be reflected already which can provide easier access for the incisions).*

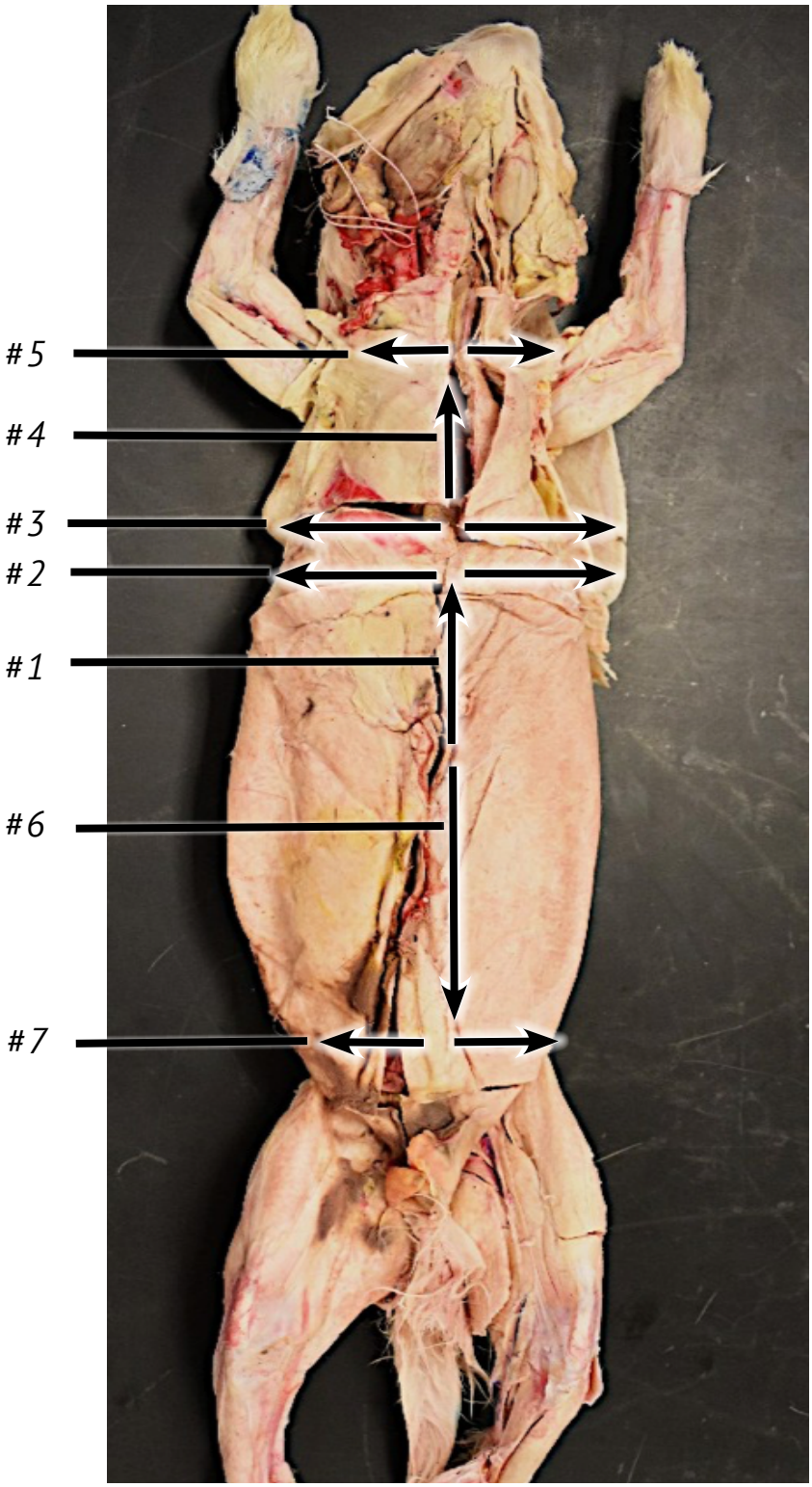
Note:
Many chest vessels are named based on the tissue they go to. If they are torn before reaching their target, (chest wall, subscapularis) you will be unable to name them.

Identifying some of the basic organs in the thoracic and abdominal cavities will aid in tracing blood supply through the rabbit.

- *In the thoracic cavity, identify the heart, lungs, and thymus.*
- *In the abdominal cavity, identify the greater omentum, diaphragm, liver, stomach, spleen, small intestine, large intestine.*

DISSECTION GUIDE

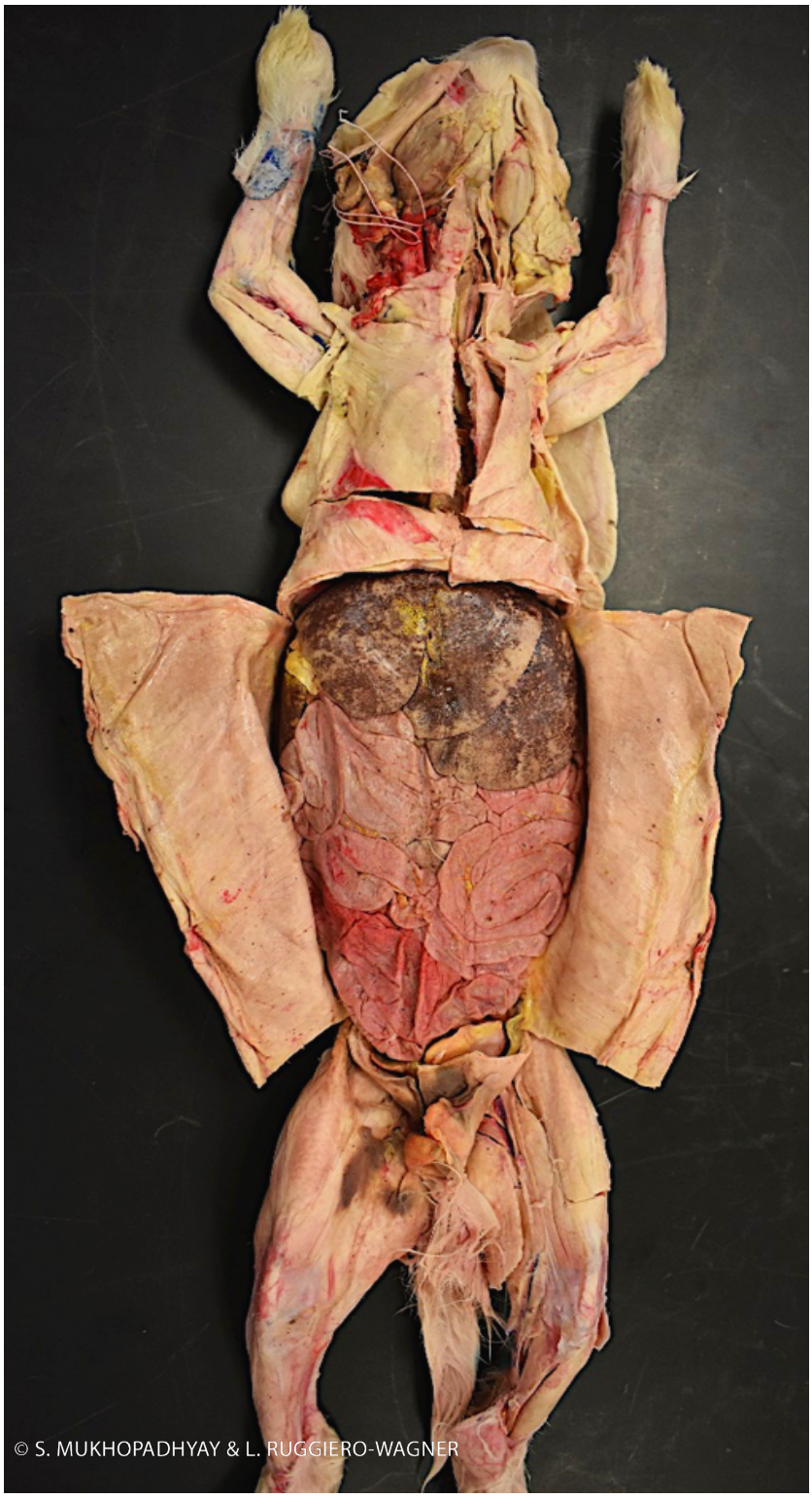
DISSECTION INCISION GUIDE FOR THE BLOOD VESSELS OF THE RABBIT



Dissection Guide 2A– Incisions (Circulatory System)

DISSECTION GUIDE

DISSECTION INCISION GUIDE FOR THE BLOOD VESSELS OF THE RABBIT



Dissection Guide 2B– Incisions (Circulatory System)

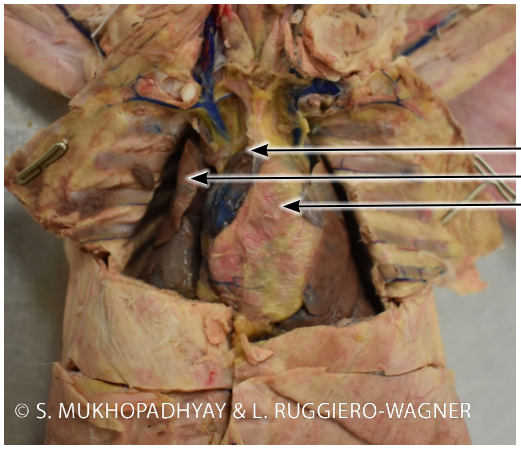
DISSECTION GUIDE

DISSECTION GUIDE: MAJOR ORGANS OF THE THORACIC CAVITY

A. Thymus Gland over the heart:

I. Remove the thymus gland carefully to find the full view of heart and blood vessels.

B. Heart within Pericardium:



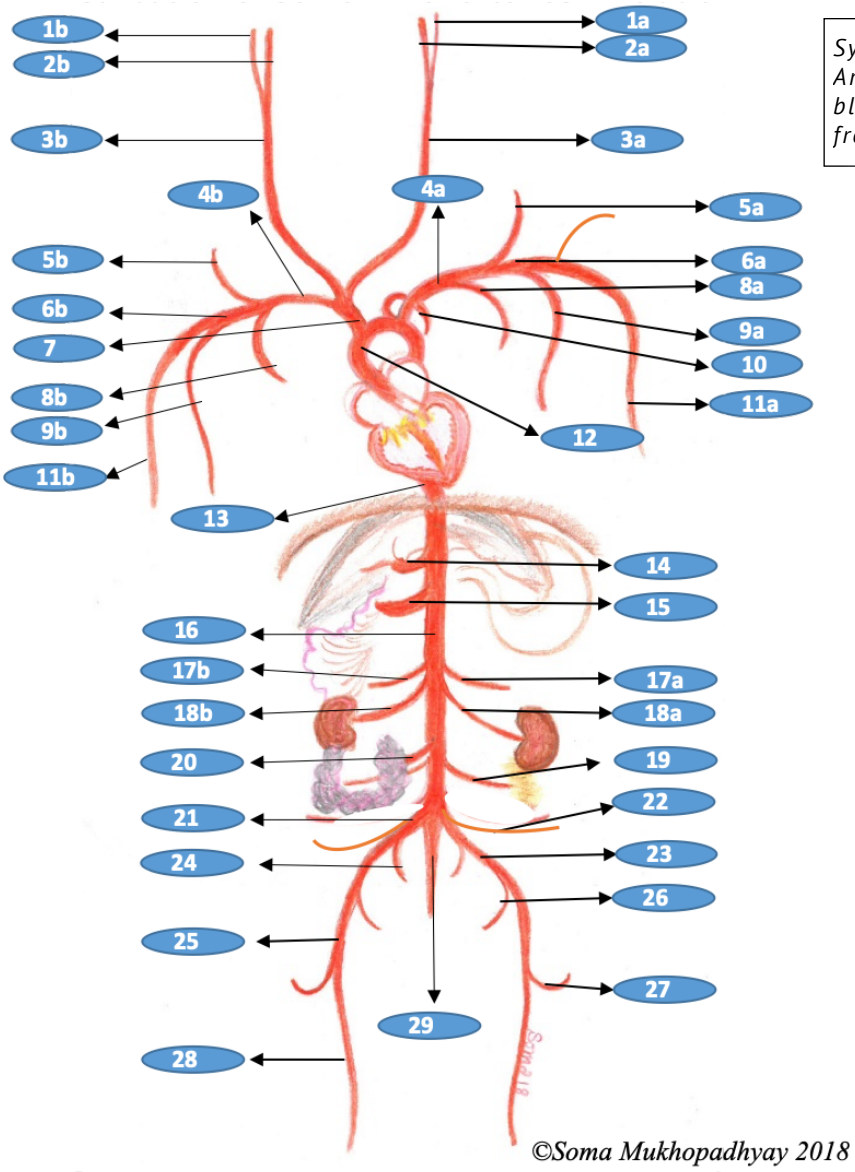
II. Remove the transparent pericardium with extra care to find the full view of heart and blood vessels.

Note: After dissection, spray the rabbit with preservative solution and then bag it. Throw away skin, fat and other body parts (if any) in the biohazard continer. Clean the tools and the tables with disinfectant solution.

Incisions #3, 4, and 5 from above guides, provide access to the thoracic cavity and the following views.

MAP OF THE ARTERIES

DISTRIBUTION OF MAJOR ARTERIES IN RABBIT



Systemic Arteries: take blood away from heart

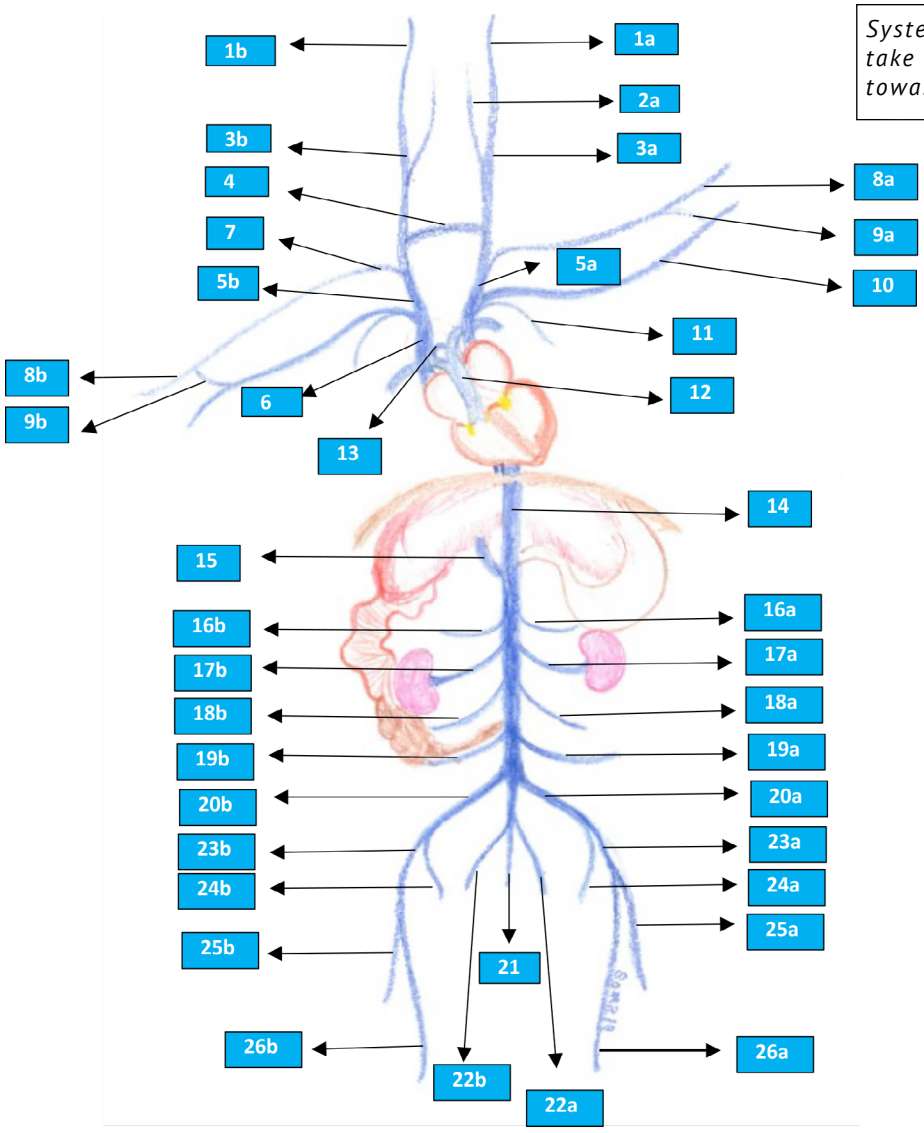
1b. Right Internal Carotid Artery
2b. Right External Carotid Artery
3b. Right Common Carotid Artery
4b. Right Subclavian Artery
5b. Right Thyrocervical Artery
6b. Right Axillary Artery
7. Brachiocephalic Trunk
8b. Right Internal Thoracic/Mammary Artery
9b. Left Lateral Thoracic Artery
11b. Left Brachial Artery
13. Descending Aorta (Thoracic)
16. Descending Aorta (Abdominal)
17b. Right Adrenolumbar Artery
18b. Right Renal Artery
20. Inferior Mesenteric Artery
21. Right Common Iliac Artery
24. Right Internal Iliac Artery
25. Right Femoral Artery
28. Right Saphenous artery
29. Caudal Artery

1a. Left Internal Carotid Artery
2a. Left External Carotid Artery
3a. Left Common Carotid Artery
4a. Left Subclavian Artery
5a. Left Thyrocervical Artery
6a. Left Axillary Artery
8a. Left Internal Thoracic/Mammary Artery
9a. Left Lateral Thoracic Artery
10. Vertebral Artery
11a. Left Brachial Artery
12. Arch of Aorta
14. Celiac Trunk
15. Superior Mesenteric Artery
17a. Left Adrenolumbar Artery
18a. Left Renal Artery
19. Left Gonadal Artery
22. Left Iliolumbar Artery
23. Left External Iliac Artery
26. Left Deep Femoral Artery
27. Left Popliteal Artery

MAP OF THE VEINS

DISTRIBUTION OF MAJOR VEINS IN RABBIT

Systemic Veins: take blood towards heart



1b. Left Facial Vein
3b. Left External Jugular Vein
4. Transverse Jugular Vein
5b. Right Superior Vena Cava
6. Right Brachiocephalic Vein
7. Right Subscapular Vein
8b. Right Cephalic Vein
9b. Right Cubital Vein
13. Azygous Vein
15. Hepatic Portal Vein
16b. Left Adrenolumbar Vein
17b. Right Renal Vein
18b. Right Gonadal Vein
19b. Right Iliolumbar Vein
20b. Right External Iliac Vein
22b. Right Internal Iliac Vein
23b. Right Femoral Vein
24b. Right Deep Femoral Vein
25b. Right Popliteal Vein
26b. Right Great Saphenous Vein

1a. Left Facial Vein
2a. Left Internal Jugular vein
3a. Left External Jugular Vein
5a. Left Superior vena Cava
8a. Left Cephalic Vein
9a. Left Cubital Vein
10. Left Brachial Vein
11. Left Internal Thoracic/Mammary
12. Pulmonary Artery
14. Inferior (Caudal) Vena Cava
16a. Left Adrenolumbar Vein
17a. Left Renal Vein
18a. Left Gonadal Vein
19a. Left Iliolumbar Vein
20a. Left External Iliac Vein
21. Caudal Vein
22a. Left Internal Iliac vein
23a. Left Femoral Vein
24a. Left Deep Femoral Vein
25a. Left Popliteal Vein
26a. Left Great Saphenous Vein

ARTERIES AND VEINS

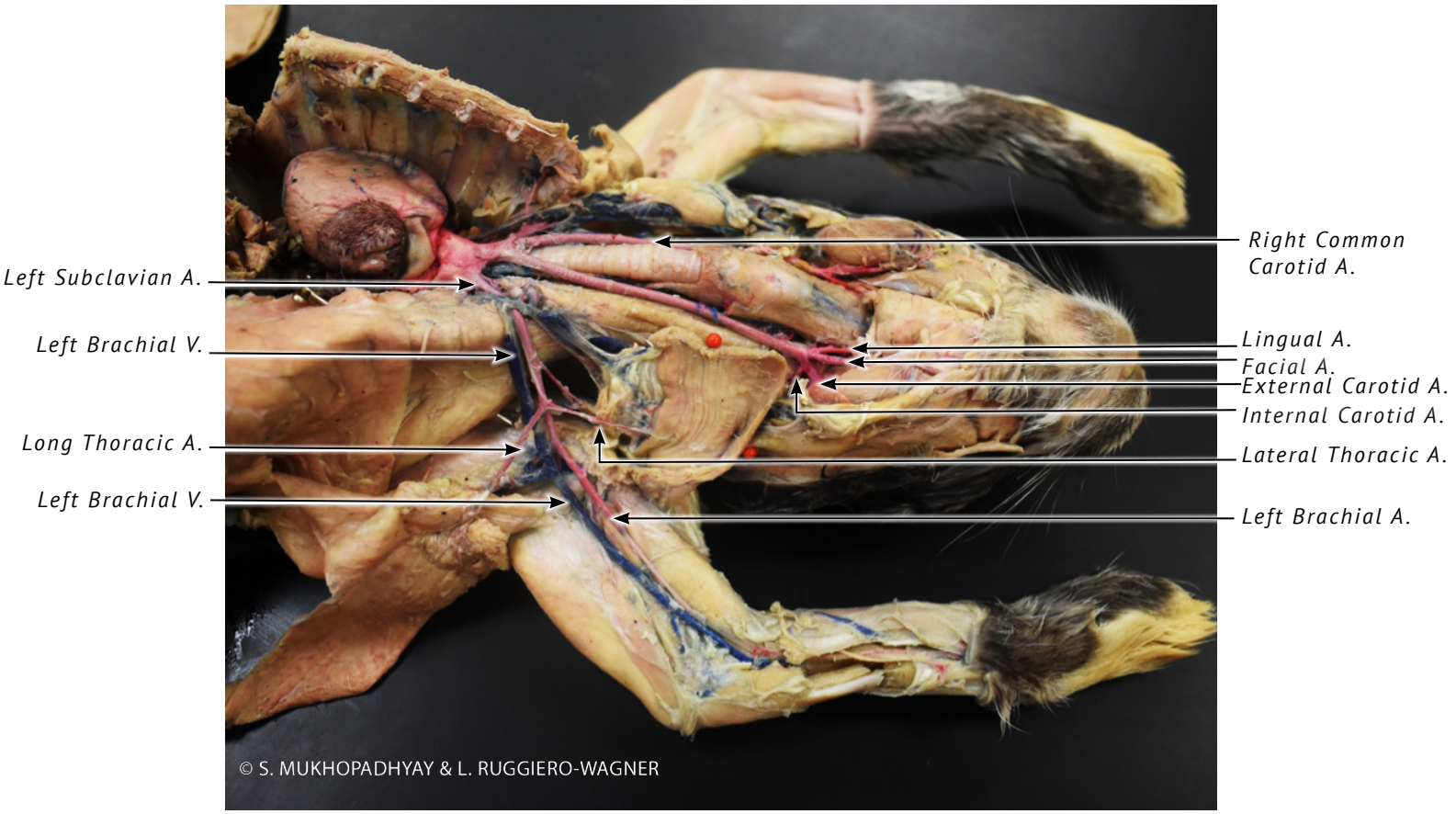


Figure 8 Head Neck Axillary Overview

LABELS OFF LABELS ON

BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES SUPERIOR TO THE DIAPHRAGM

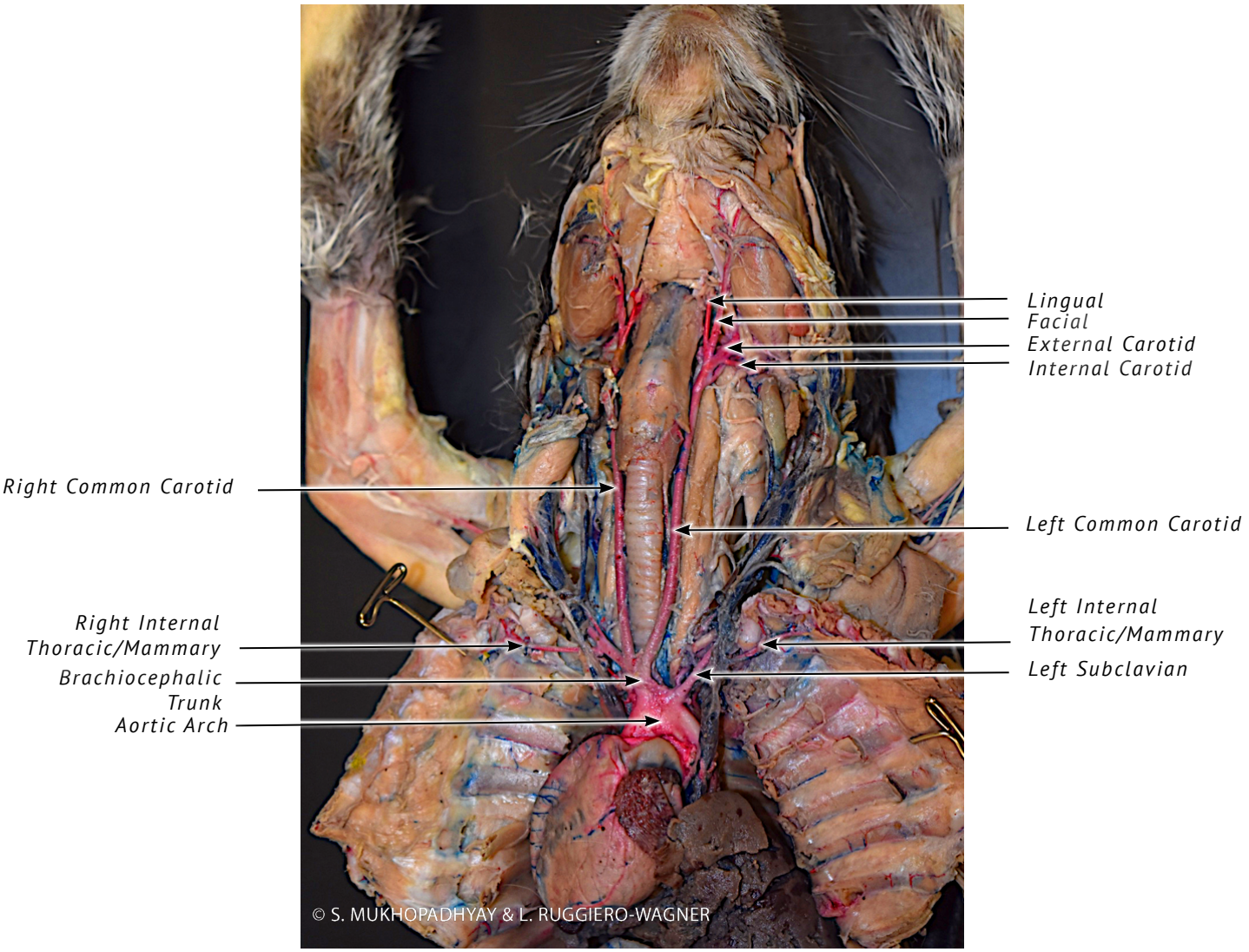


Figure 8a: Arteries Superior to the diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES SUPERIOR TO THE DIAPHRAGM

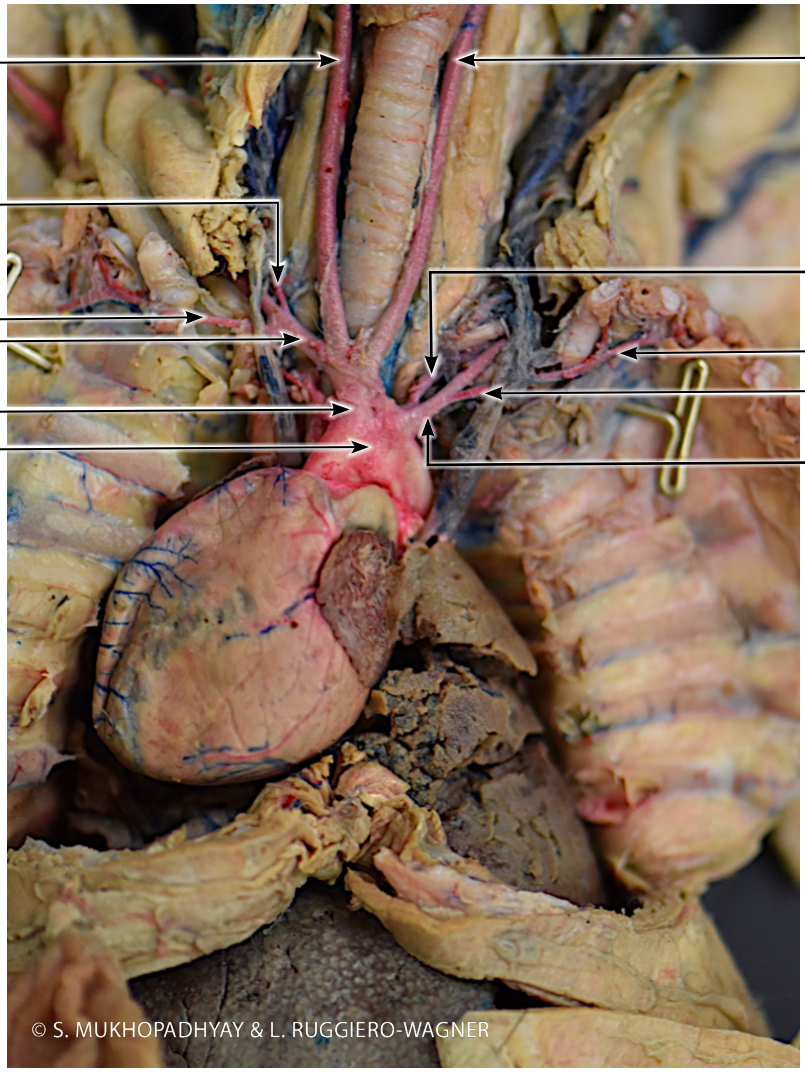

Figure 8b: Arteries Superior to the diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES SUPERIOR TO THE DIAPHRAGM

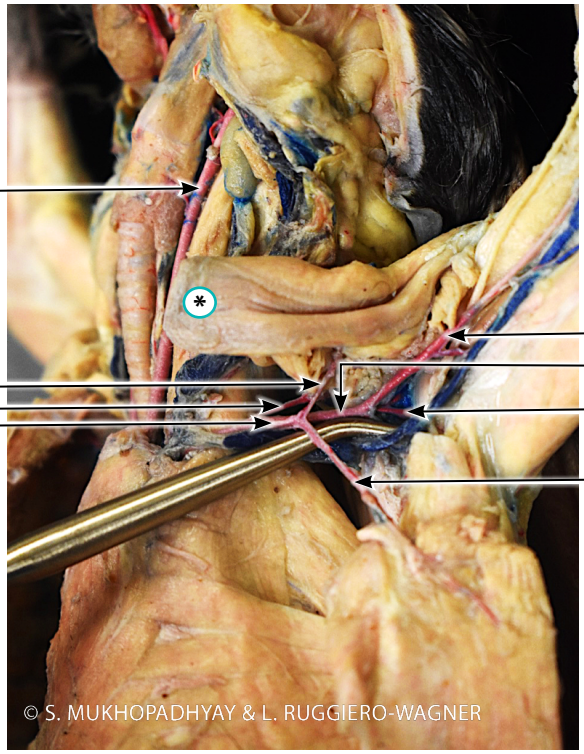

Figure 8c Arteries Superior to the diaphragm
(Pectoral, thoracic and brachial region-Left side)

Dissection Guide

1. * *Pectoralis Major Muscle reflected.*
2. *Branching Pathway:*

Subclavian → *Axillary* → *Brachial*

LABELS OFF LABELS ON

BACK TO STUDENT LEARNING OBJECTIVES

VEINS SUPERIOR TO THE DIAPHRAGM

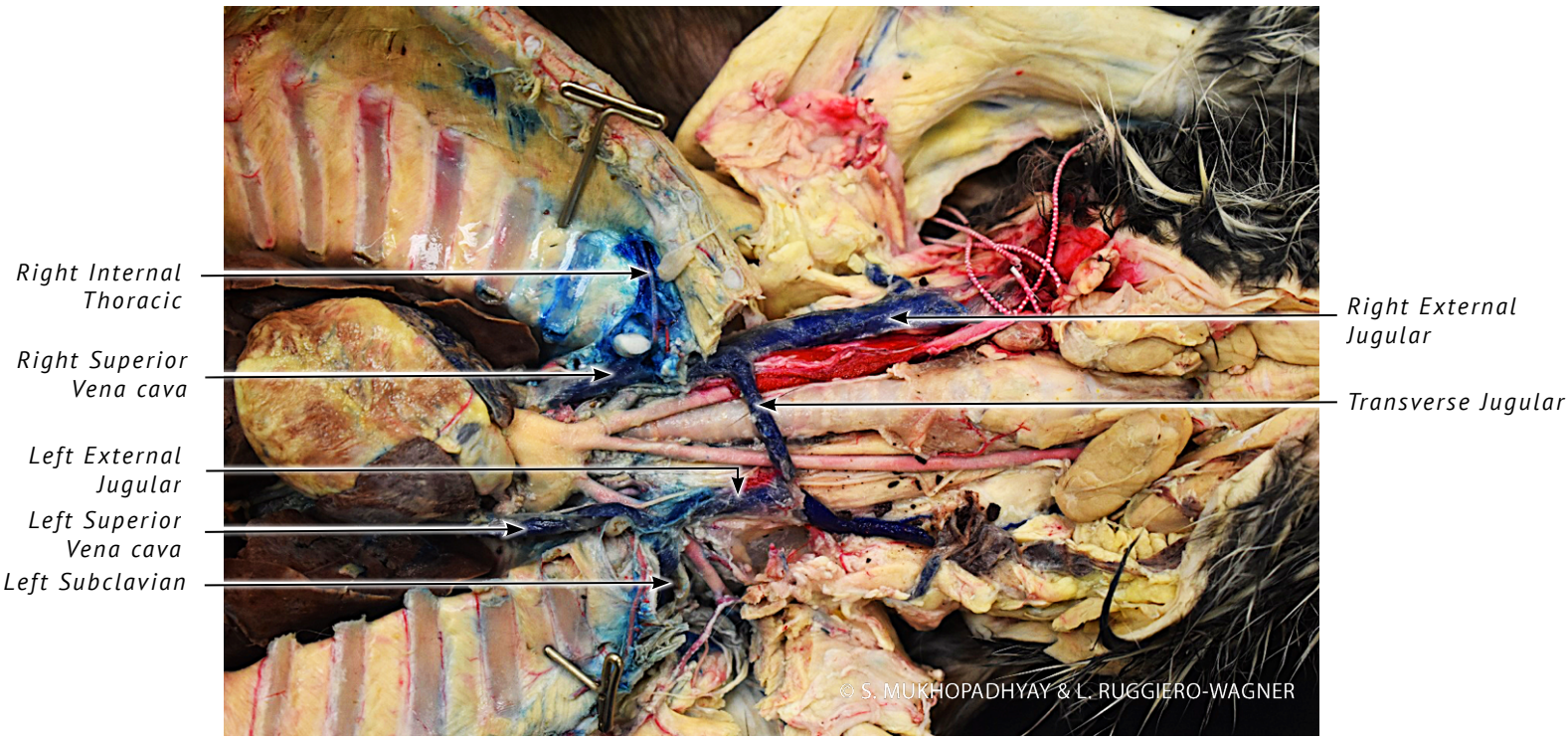

Figure 8d Veins Superior to Diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES INFERIOR TO THE DIAPHRAGM

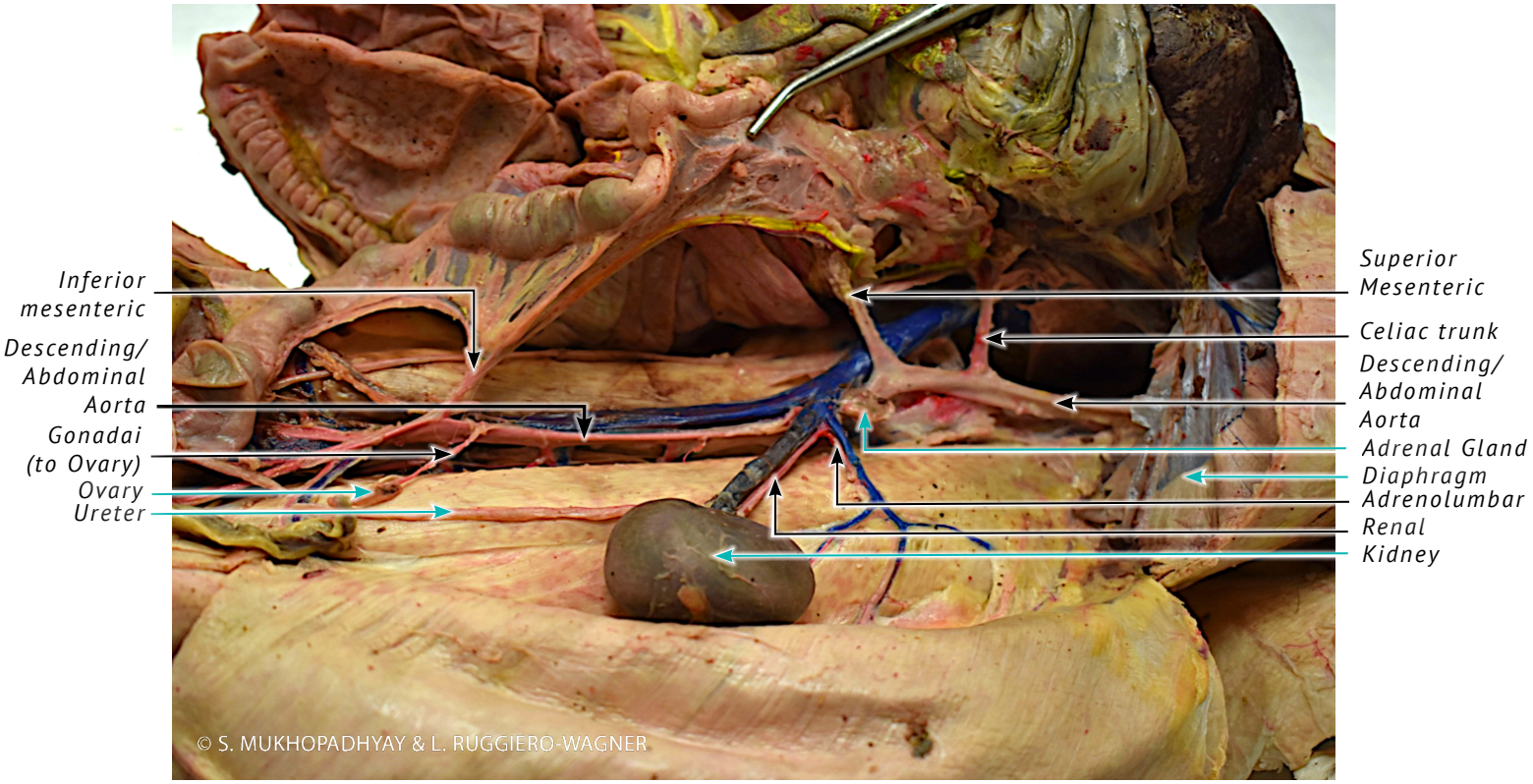

Figure 9a: Arteries inferior to the diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

VEINS INFERIOR TO THE DIAPHRAGM

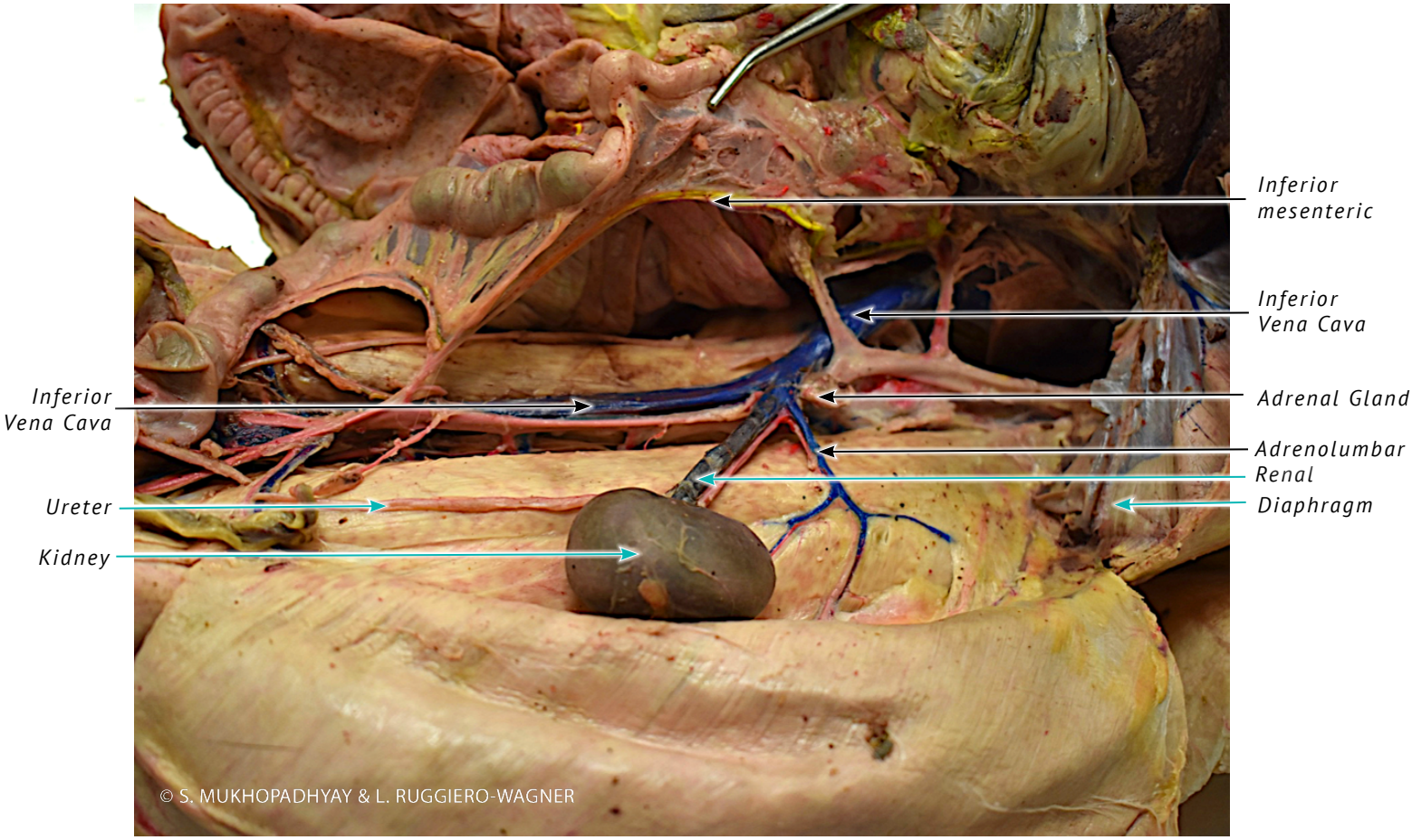

Figure 9b: Veins Inferior to Diaphragm

LABELS OFF LABELS ON

BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES INFERIOR TO THE DIAPHRAGM

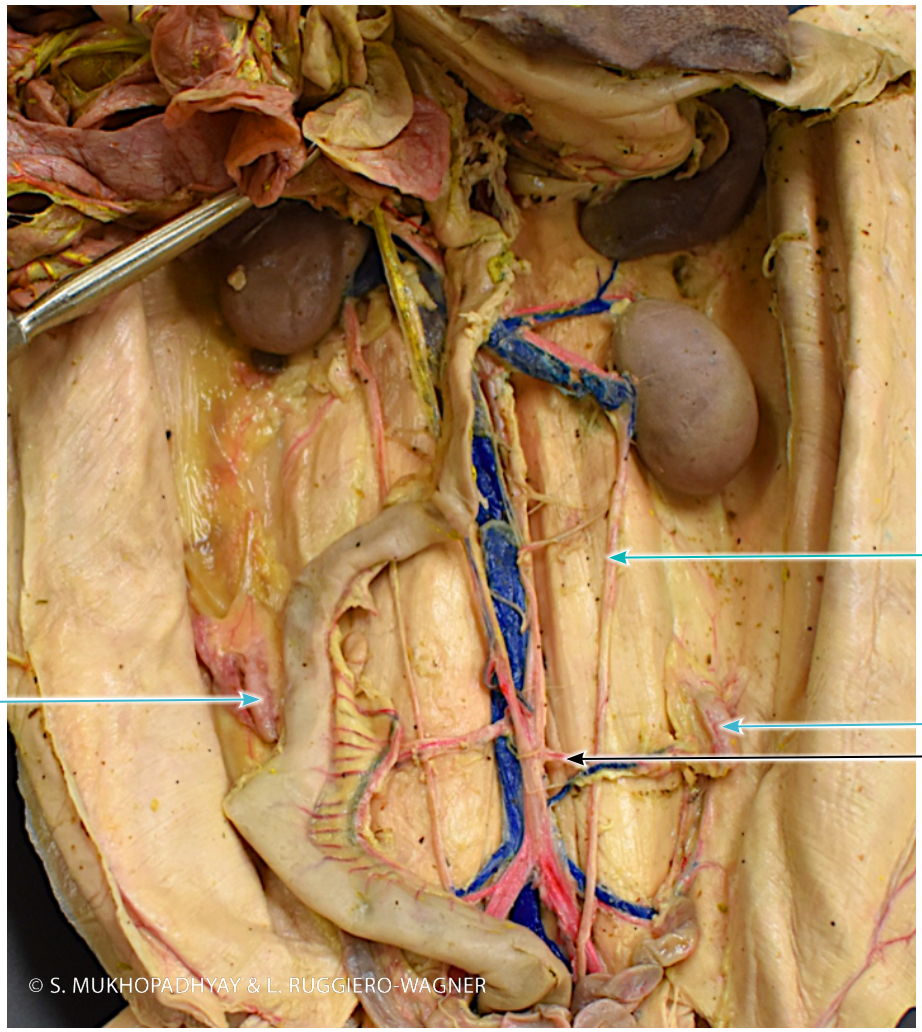

Figure 9c FEMALE: Arteries inferior to the diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES INFERIOR TO THE DIAPHRAGM

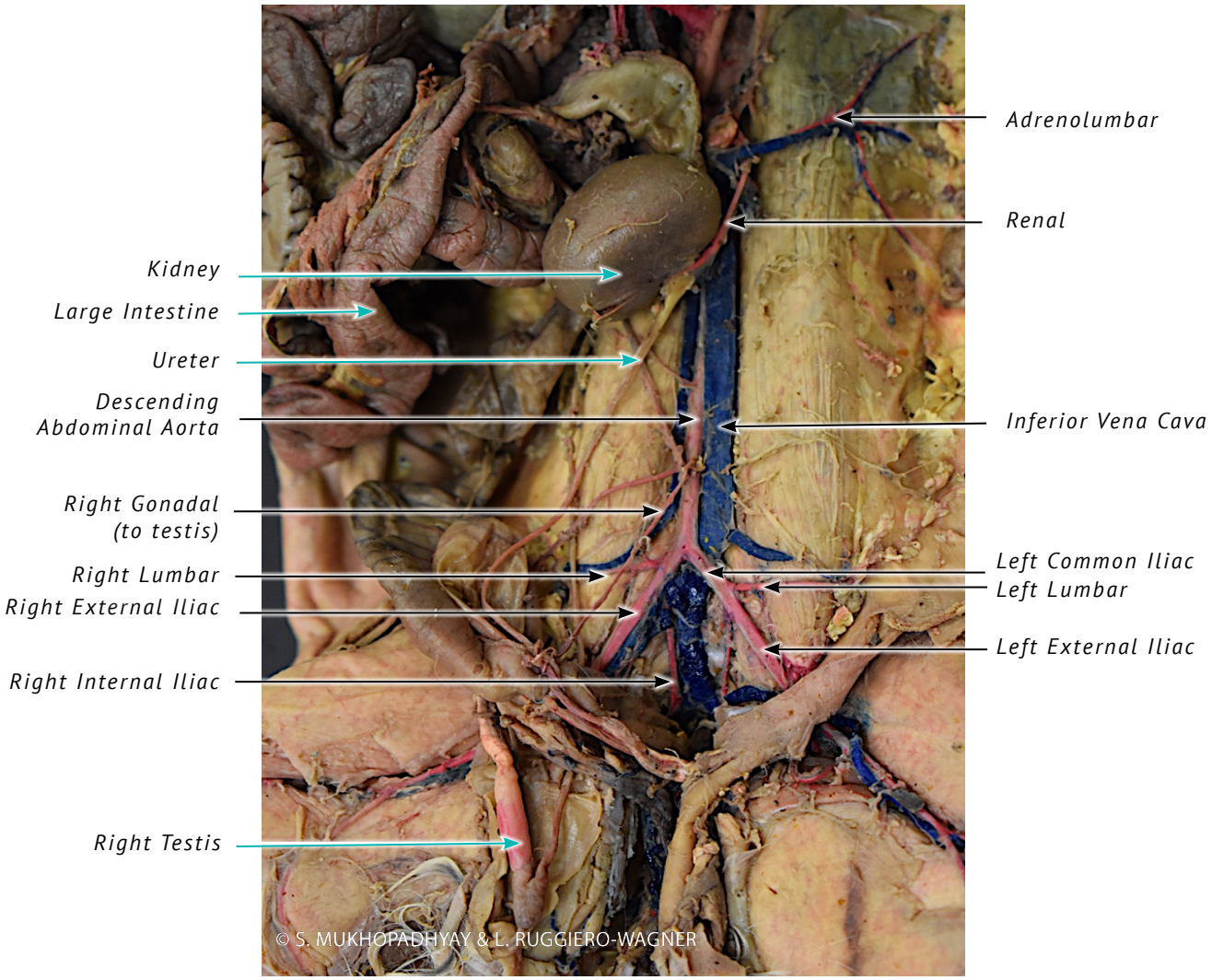

Figure 9d: Arteries inferior to the diaphragm (special focus: Internal Iliacs)

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BACK TO STUDENT LEARNING OBJECTIVES

VEINS INFERIOR TO THE DIAPHRAGM

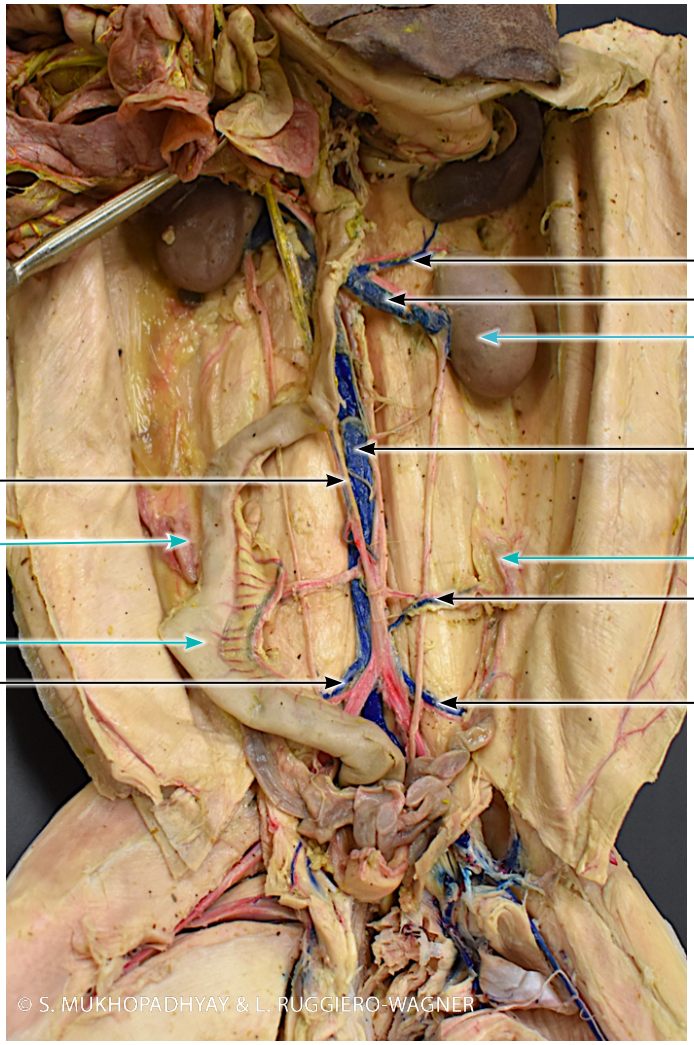

Figure 9e FEMALE: Veins inferior to the diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES INFERIOR TO THE DIAPHRAGM

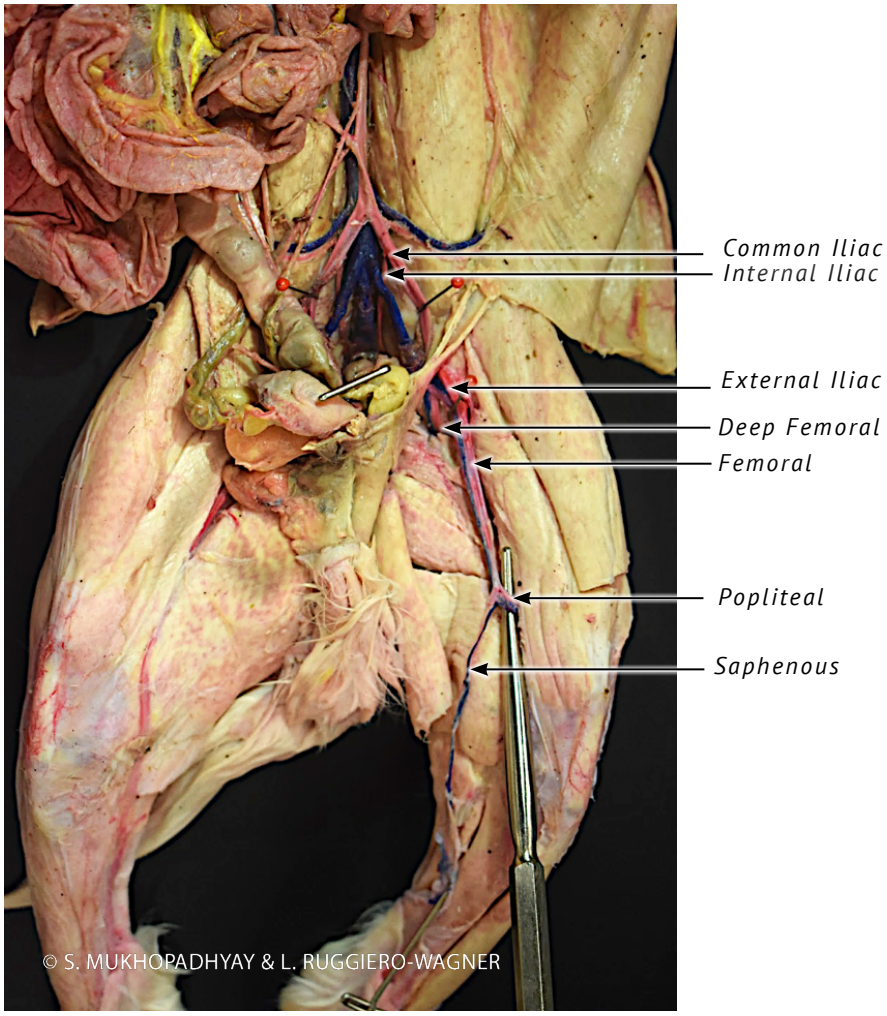

Figure 9f Arteries Inferior to Diaphragm Pelvic and Leg

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BACK TO STUDENT LEARNING OBJECTIVES

ARTERIES AND VEINS INFERIOR TO THE DIAPHRAGM

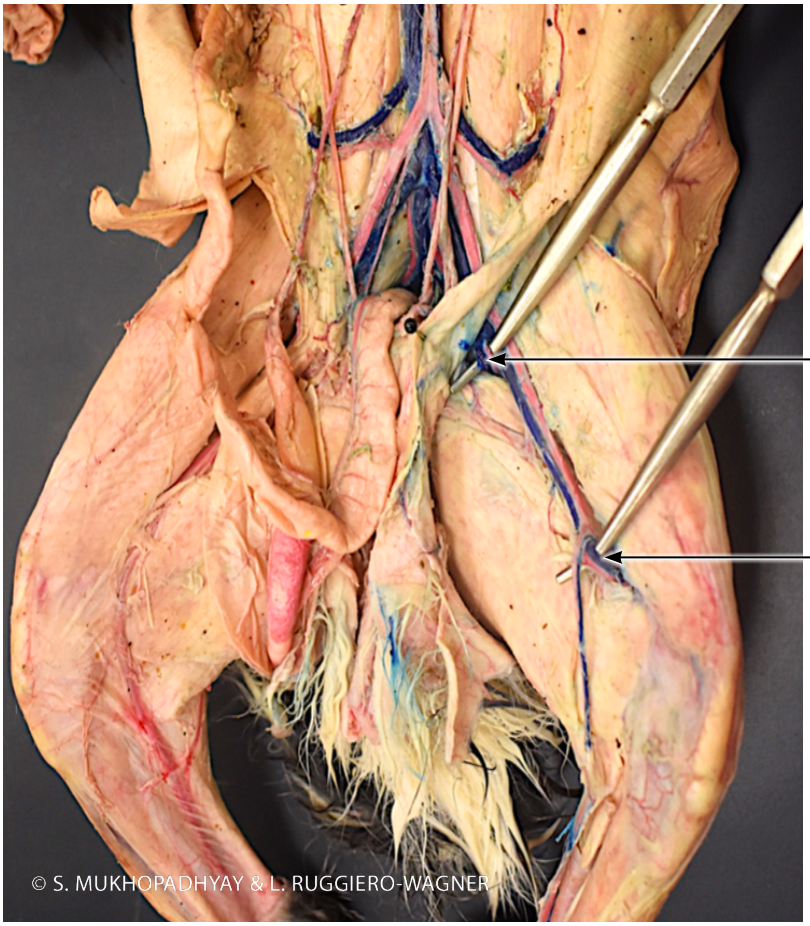

Figure 9g Arteries and Veins inferior to the diaphragm

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BACK TO STUDENT LEARNING OBJECTIVES

VEINS INFERIOR TO THE DIAPHRAGM

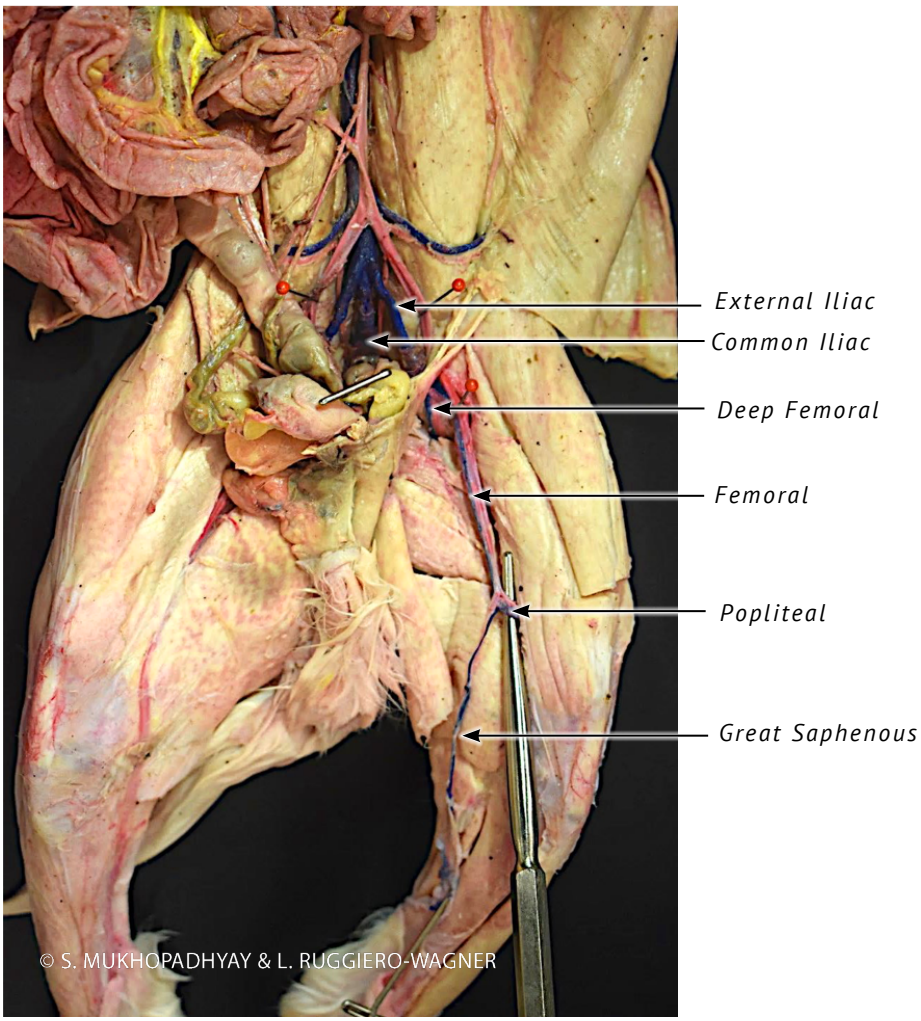

Figure 9h Veins Inferior to Diaphragm Pelvic and Leg

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BACK TO STUDENT LEARNING OBJECTIVES

VEINS INFERIOR TO THE DIAPHRAGM

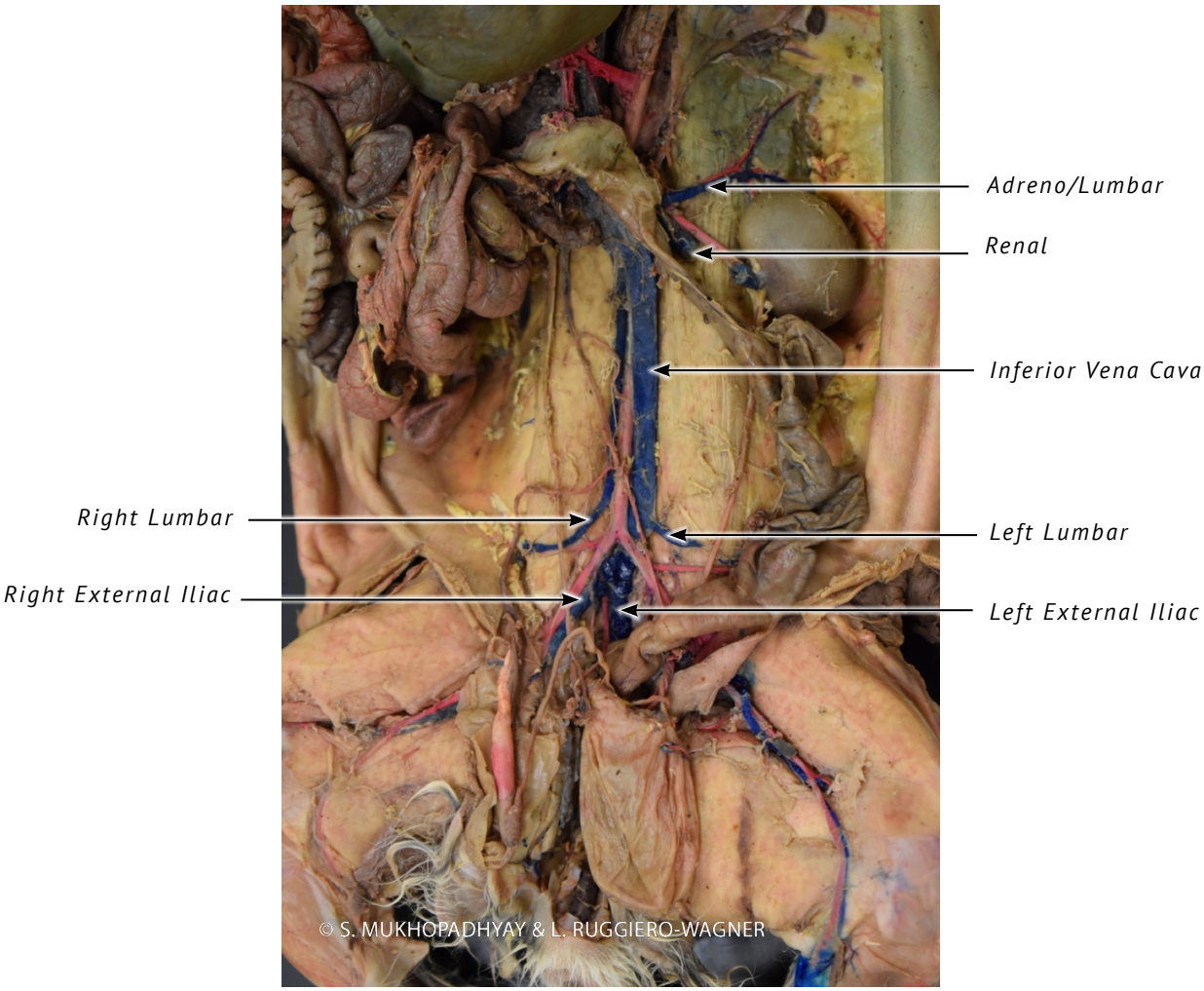

Figure 9i: Veins inferior to the diaphragm

LABELS OFF LABELS ON

BACK TO STUDENT LEARNING OBJECTIVES

VEINS INFERIOR TO THE DIAPHRAGM

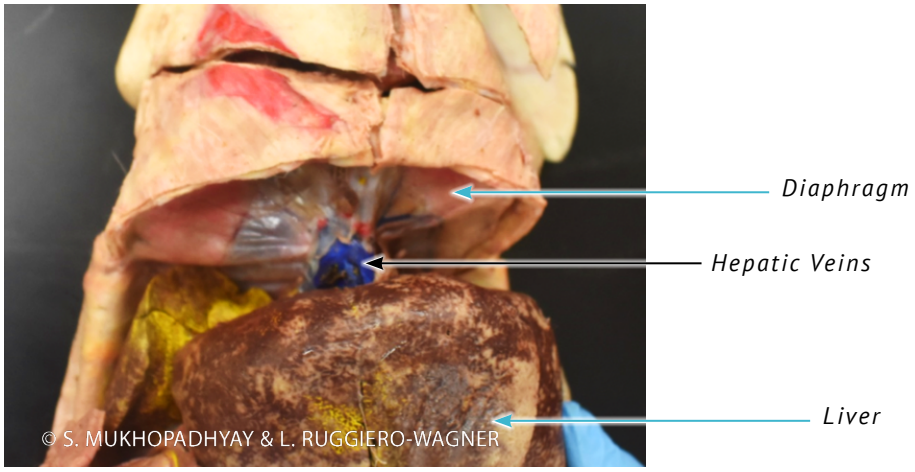

Figure 10a Hepatic Vein

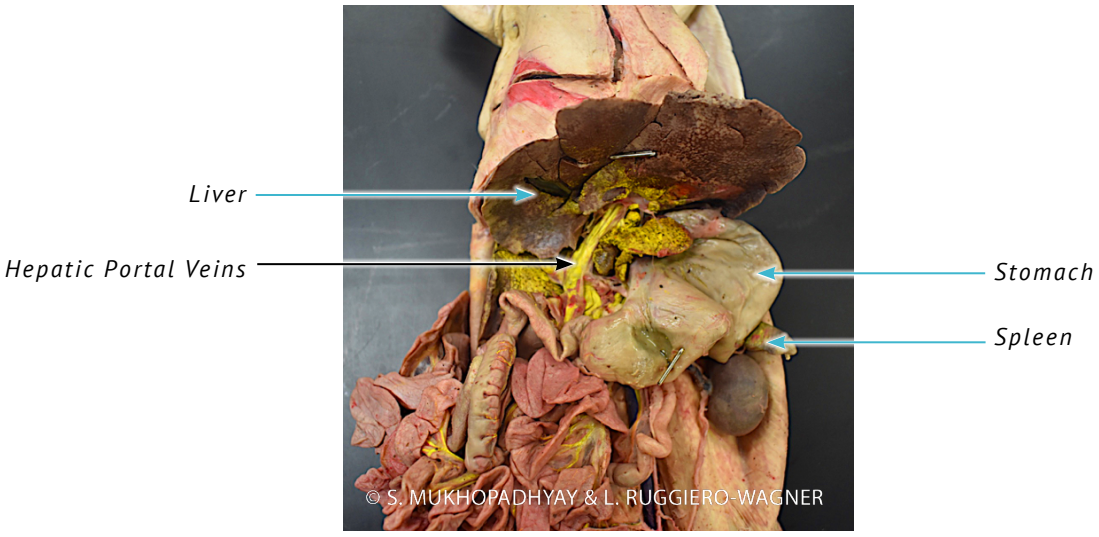

Figure 10b Hepatic Portal Vein

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BACK TO STUDENT LEARNING OBJECTIVES

VEINS INFERIOR TO THE DIAPHRAGM

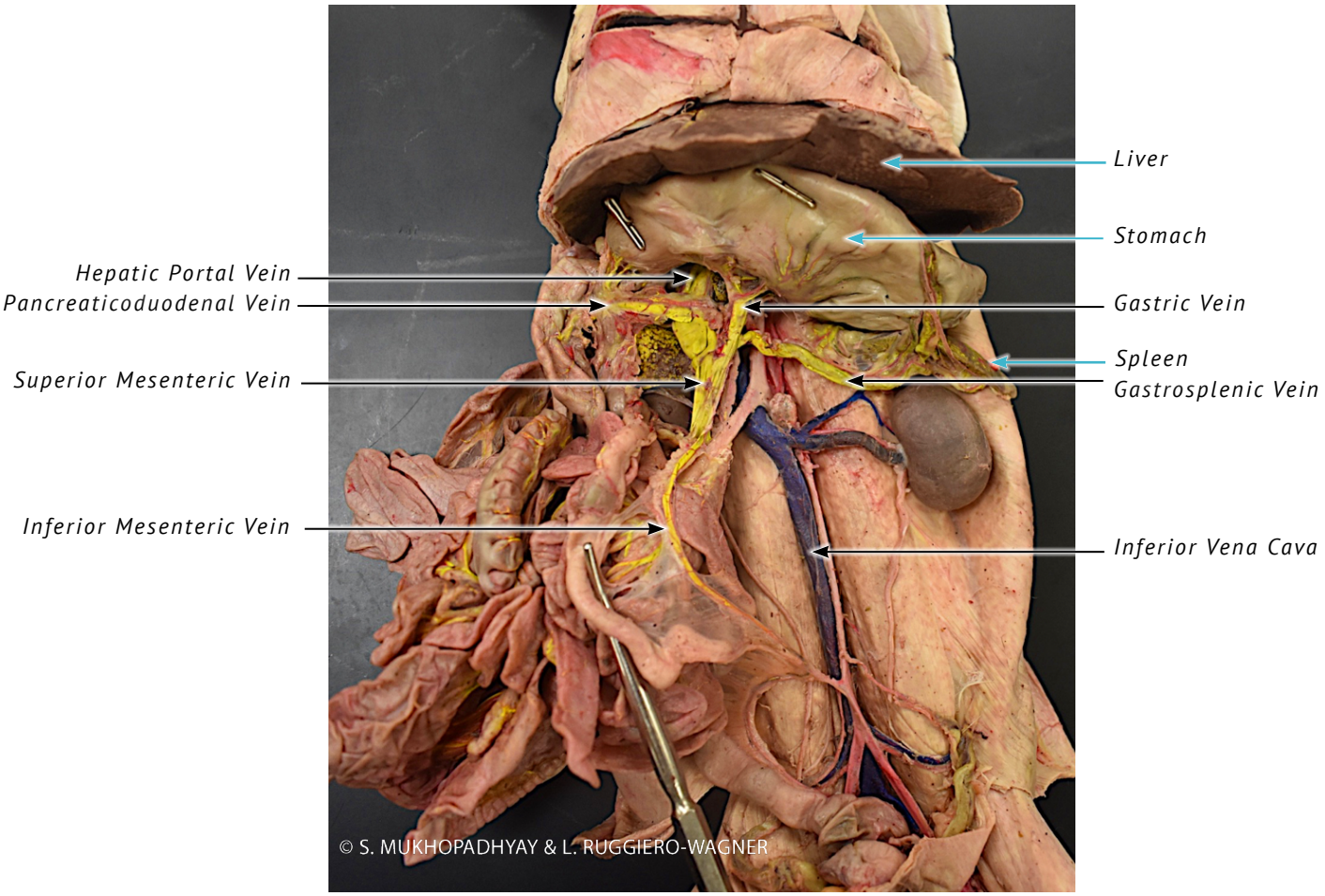

Figure 10c Hepatic Portal System

LABELS OFF LABELS ON

BACK TO STUDENT LEARNING OBJECTIVES