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Rabbit Anatomy: A Brief Photographic Atlas and Dissection Guide - Part II: Cardiovascular System

Soma Mukhopadhyay
Augusta University

Lisa Ruggiero Wagner
Clemson University, lrwagne@clemson.edu

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RABBIT

ANATOMY:

A BRIEF PHOTOGRAPHIC ATLAS AND DISSECTION GUIDE

PART II: CARDIOVASCULAR SYSTEM

SOMA MUKHOPADHYAY AND LISA RUGGIERO WAGNER

SECOND EDITION



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Disclaimer:

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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.

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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

RABBIT ANATOMY:
A BRIEF PHOTOGRAPHIC ATLAS AND DISSECTION
GUIDE
Second Edition

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AUTHORS:

SOMA MUKHOPADHYAY
College of Science and Mathematics
Department of Biological Sciences
AUGUSTA UNIVERSITY
smukhopadhyay@augusta.edu

LISA RUGGIERO WAGNER
College of Science
Department of Biological Sciences
CLEMSON UNIVERSITY
lrwagne@clemson.edu

DEVELOPMENT:

CENTER FOR INSTRUCTIONAL INNOVATION
www.augusta.edu/innovation

LYNSEY EKEMA, MSMI, CMI

JEFF MASTROMONICO, MED

ALL PHOTOGRAPHS BY SOMA MUKHOPADHYAY

COVER DESIGN: SOMA MUKHOPADHYAY AND LYNSEY EKEMA

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- VEINS SUPERIOR TO THE DIAPHRAGM
- VEINS INFERIOR TO THE DIAPHRAGM



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.



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 a graduate degree with an interdisciplinary approach to health, disease and health disparities. Her research focused on upstream disease causation mechanisms of 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!

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)*

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*
- *lumbar (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 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).*

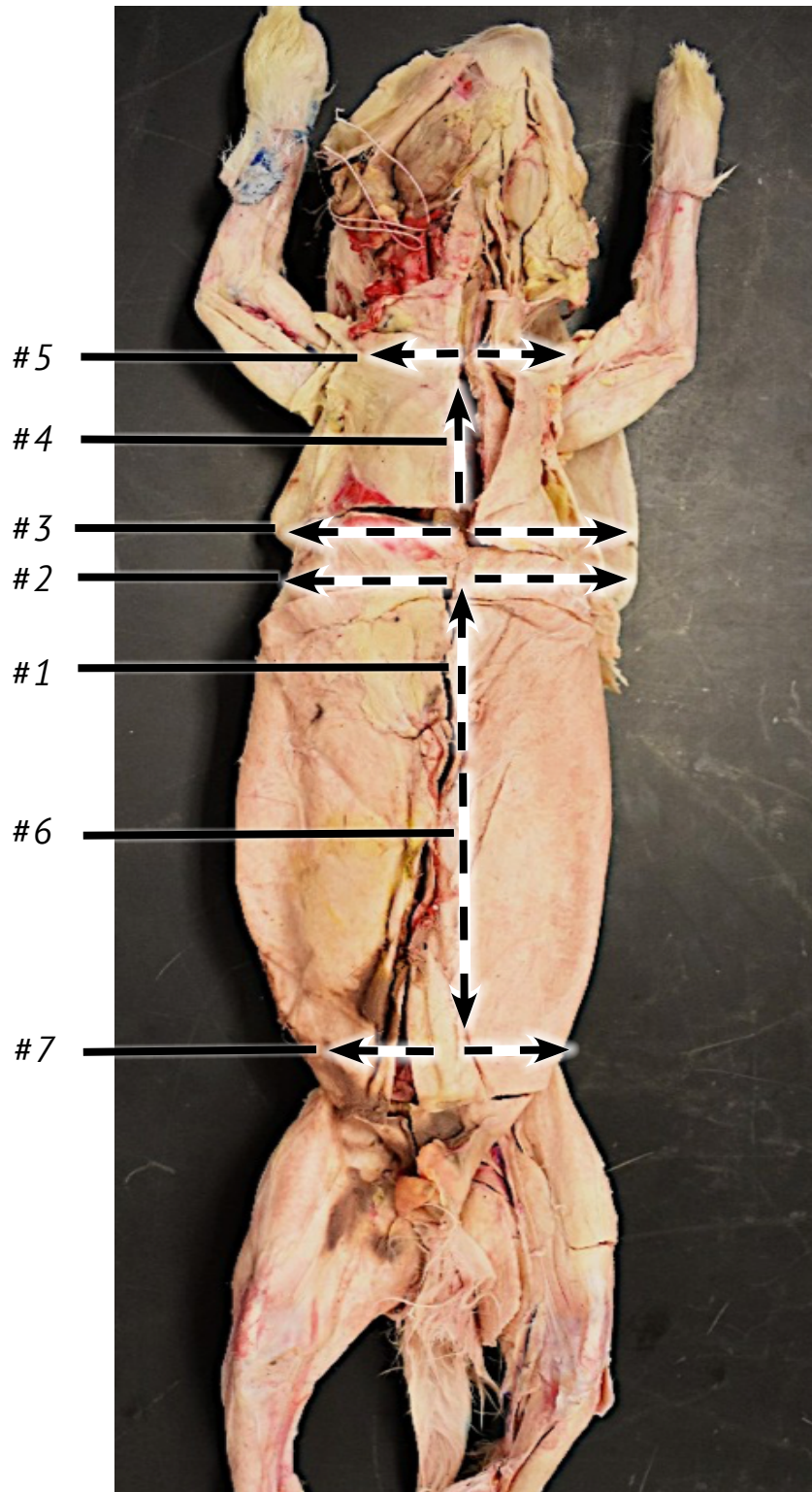
Note:

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.

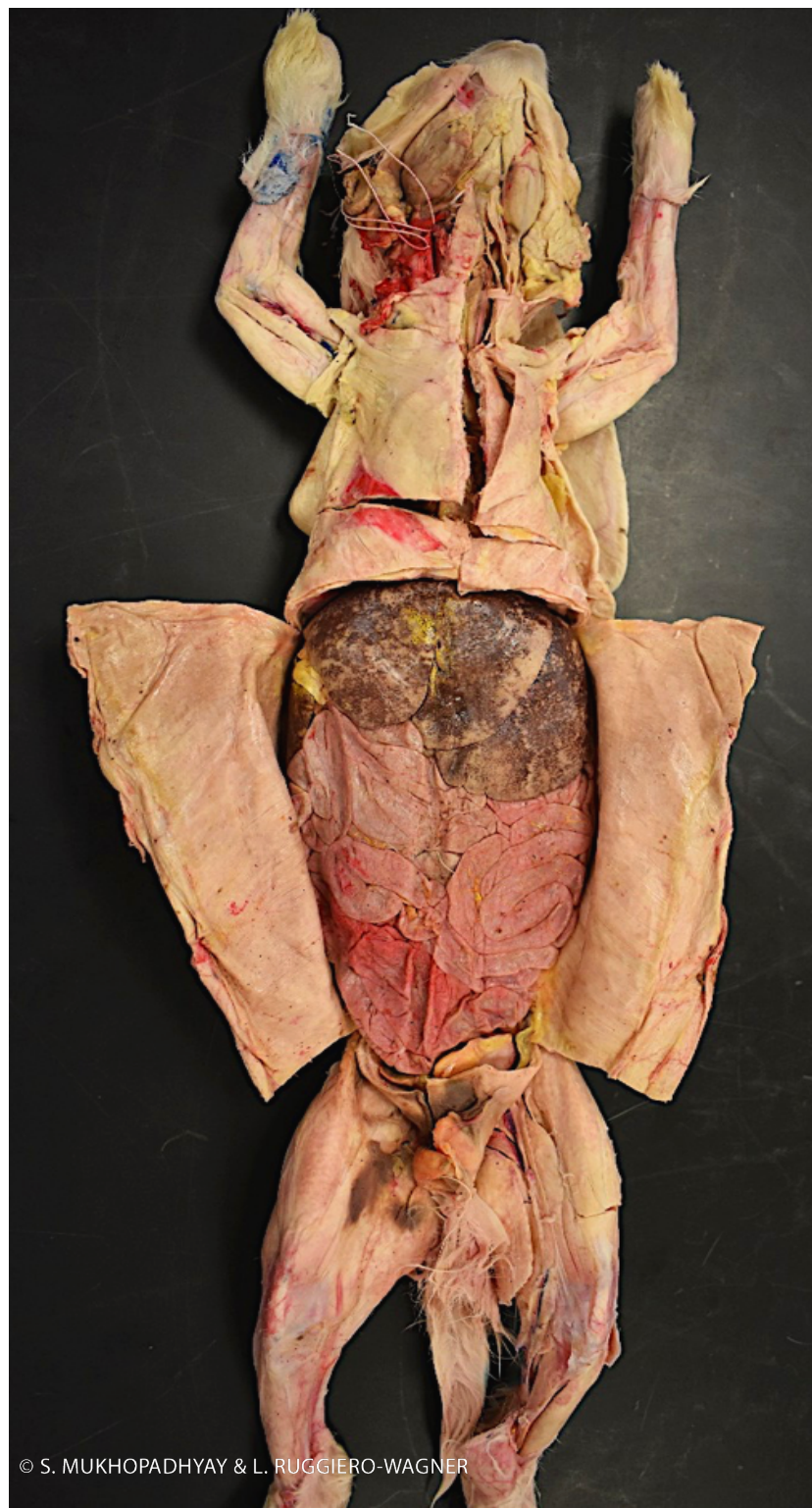
- *In the thoracic cavity, identify the heart, lungs, and thymus.*
- *In the abdominal cavity, identify the greater omentum, diaphragm, liver, stomach, spleen, small intestine, large intestine.*

DISSECTION INCISION GUIDE FOR
THE BLOOD VESSELS OF THE RABBIT



Dissection Guide 2A- Incisions (Circulatory System)

DISSECTION INCISION GUIDE FOR THE
BLOOD VESSELS OF THE RABBIT



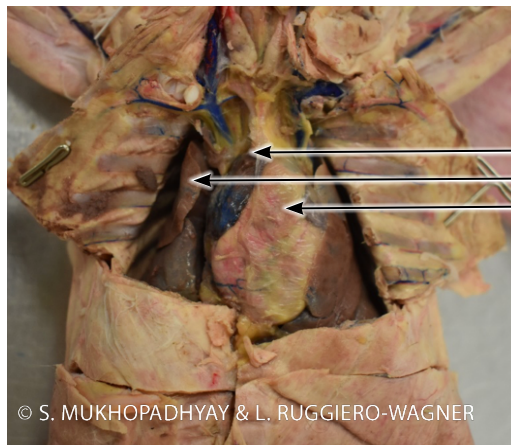
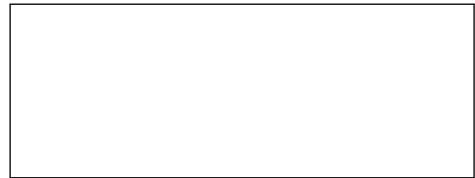
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Dissection Guide 2B- Incisions (Circulatory System)

DISSECTION GUIDE: MAJOR ORGANS OF THE THORACIC CAVITY



Heart



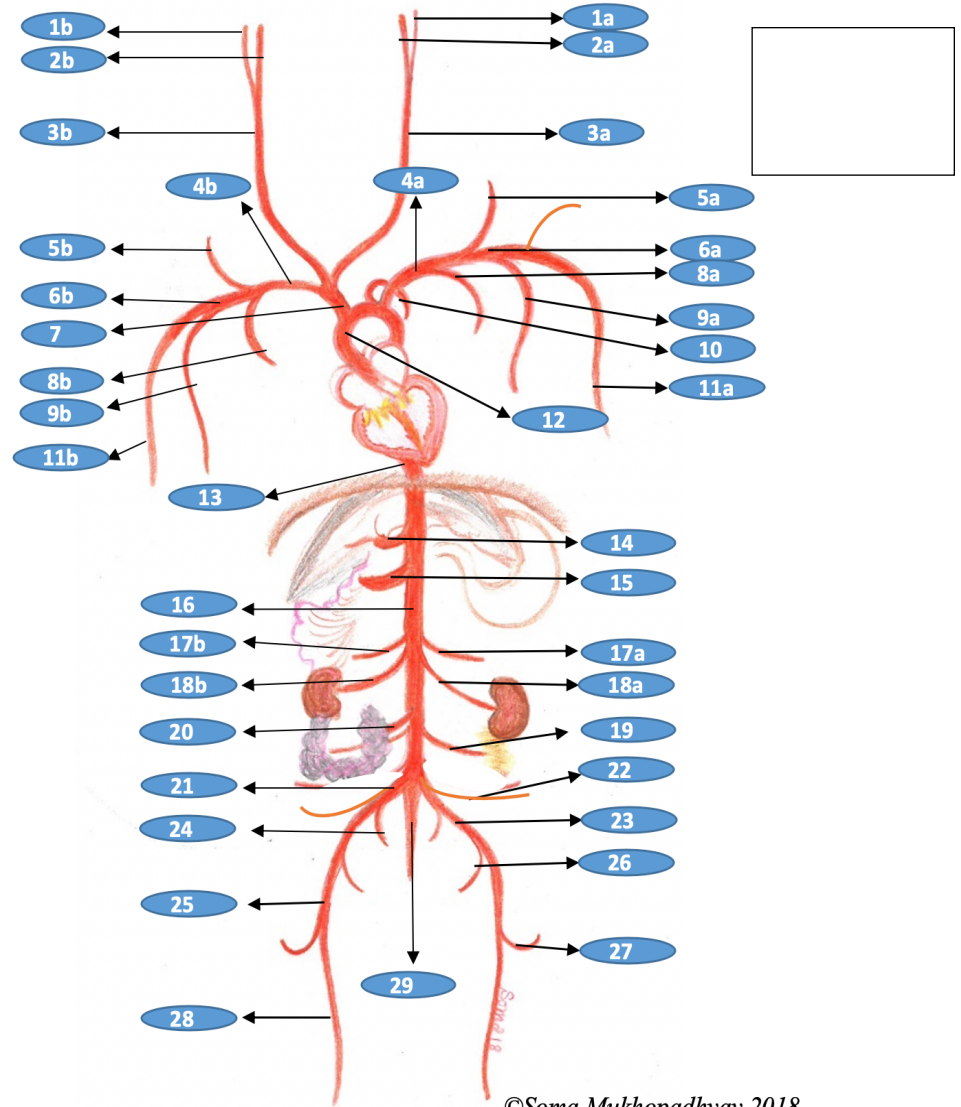
Lung
Heart



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 container. 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.

DISTRIBUTION OF MAJOR ARTERIES IN RABBIT

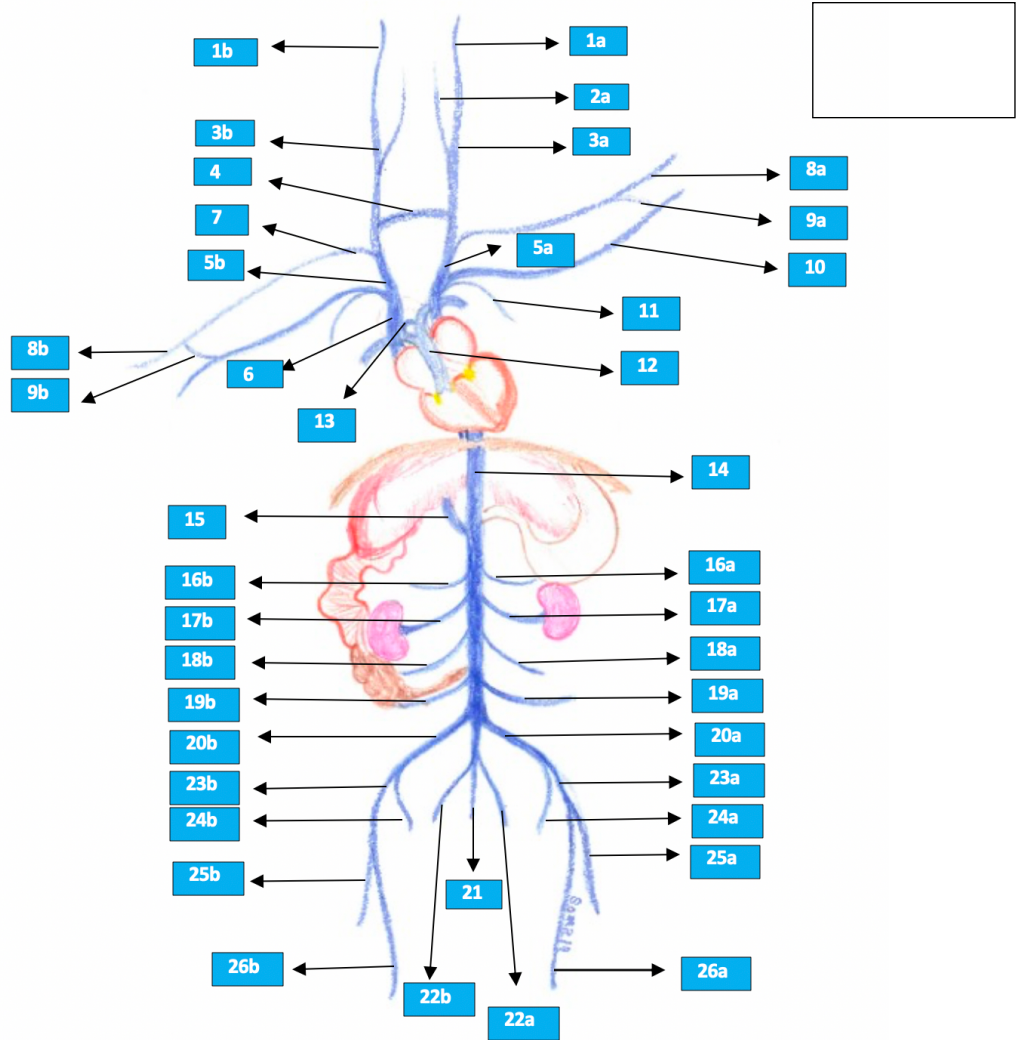


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- 1b. Right Internal Carotid Artery
- 2b. Right External Carotid Artery
- 3b. Right Common Carotid Artery
- 4b. Right Subclavian Artery
- 5b. Right Thyrocervical Artery
- 6b. Right Axillary Artery
- 7. Brachiocephalic Trunk
- 8b. Right Internal Thoracic/Mammary Artery
- 9b. Right Lateral Thoracic Artery
- 11b. Right 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

DISTRIBUTION OF MAJOR VEINS IN RABBIT



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- 1b. Right Facial Vein
- 3b. Right 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. Right 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

RABBIT ANATOMY

RABBIT VESSELS

ARTERIES AND VEINS

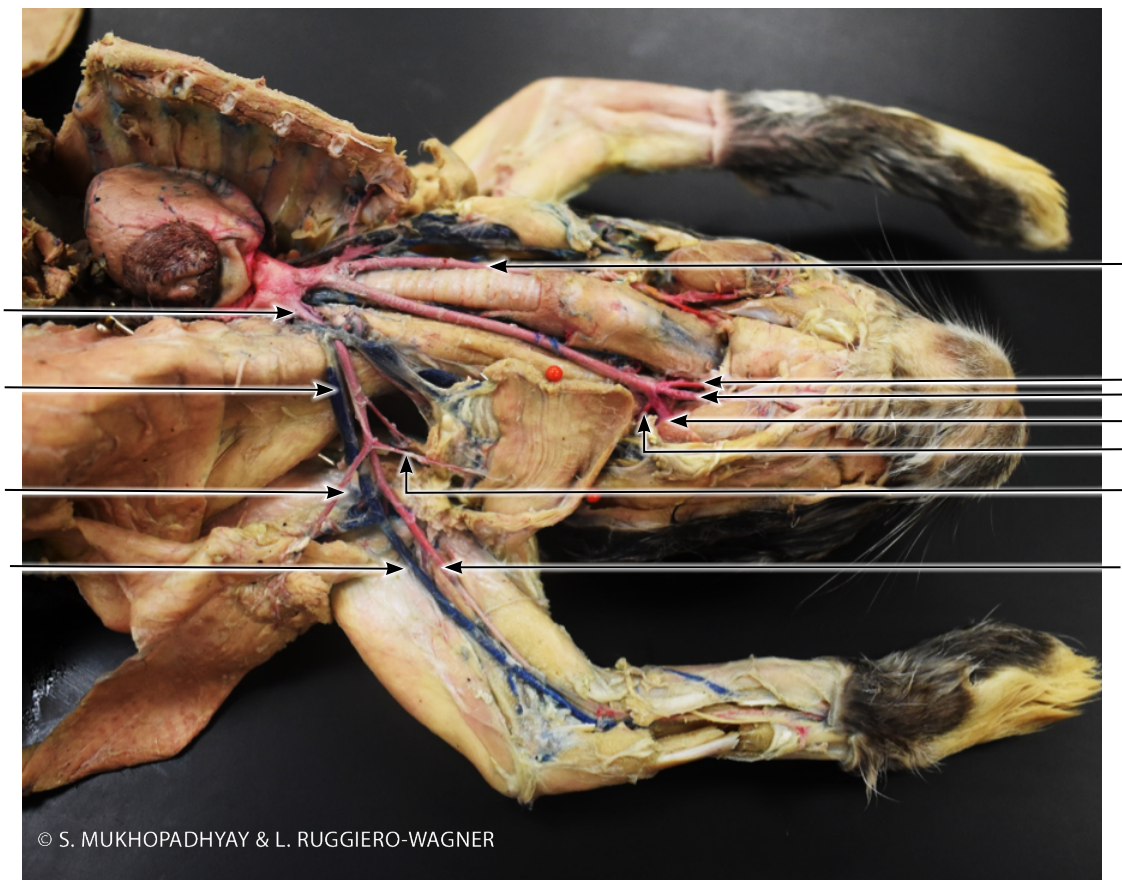


Figure 8 Head Neck Axillary Overview



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES SUPERIOR TO THE DIAPHRAGM

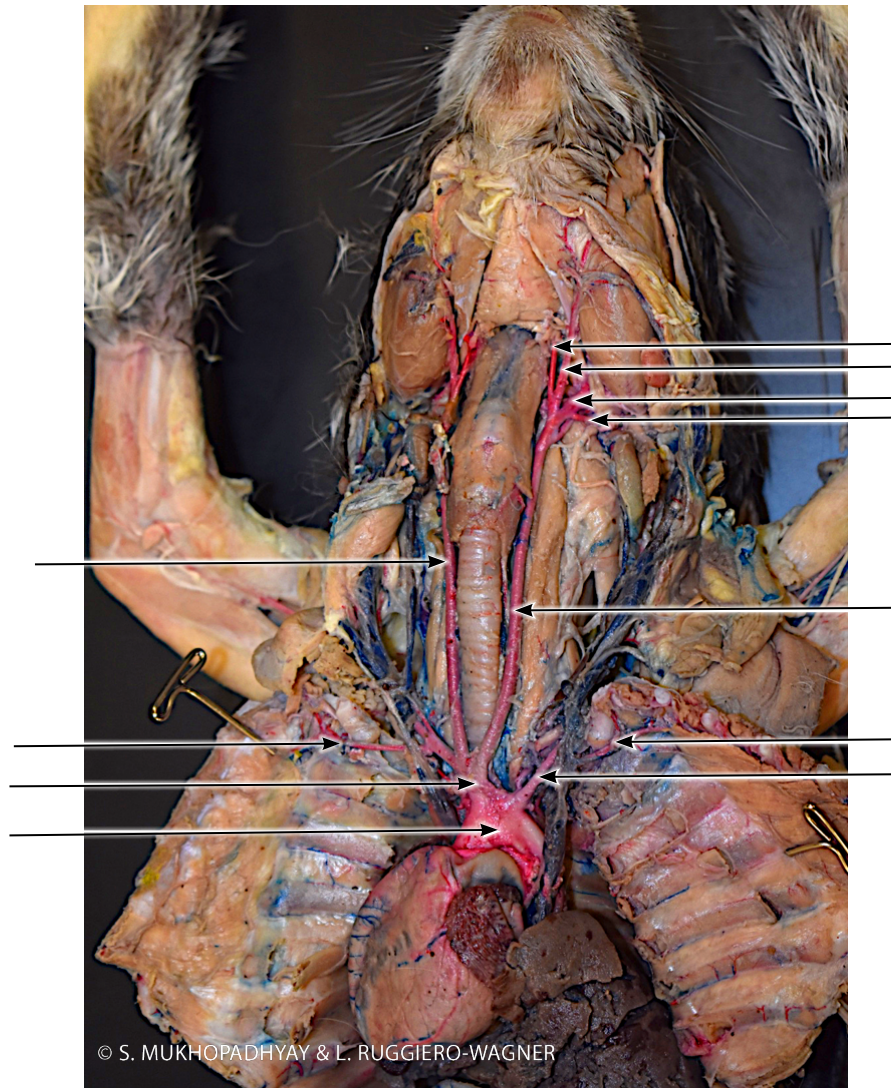


Figure 8a: Arteries Superior to the diaphragm



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES SUPERIOR TO THE DIAPHRAGM

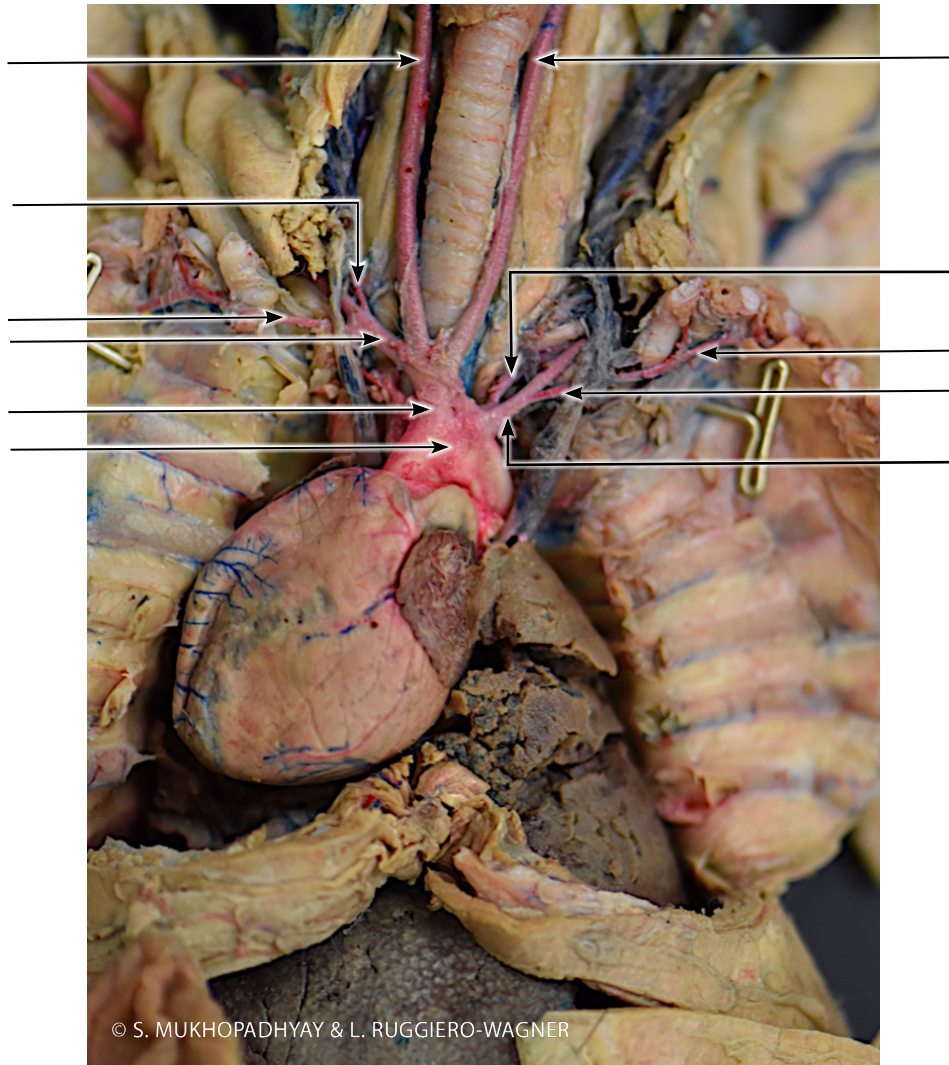


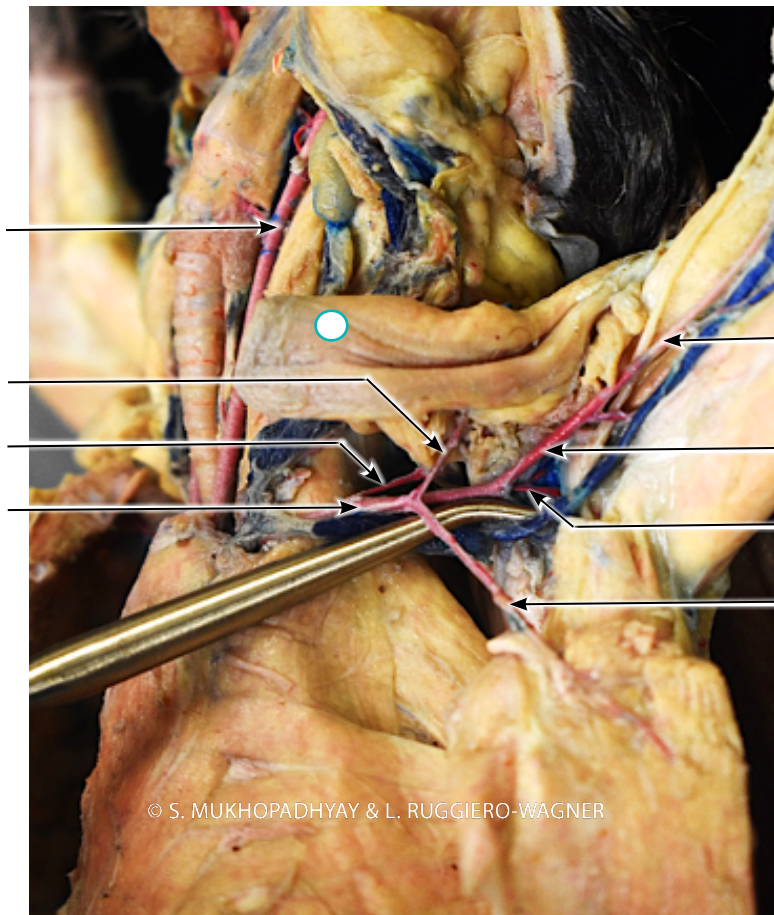
Figure 8b: Arteries Superior to the diaphragm



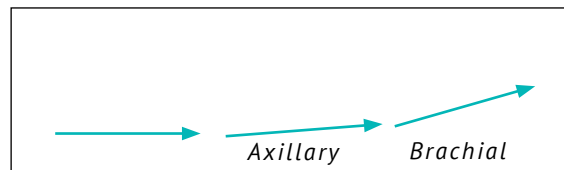
RABBIT ANATOMY

RABBIT VESSELS

ARTERIES SUPERIOR TO THE DIAPHRAGM



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



RABBIT ANATOMY

RABBIT VESSELS

VEINS SUPERIOR TO THE DIAPHRAGM

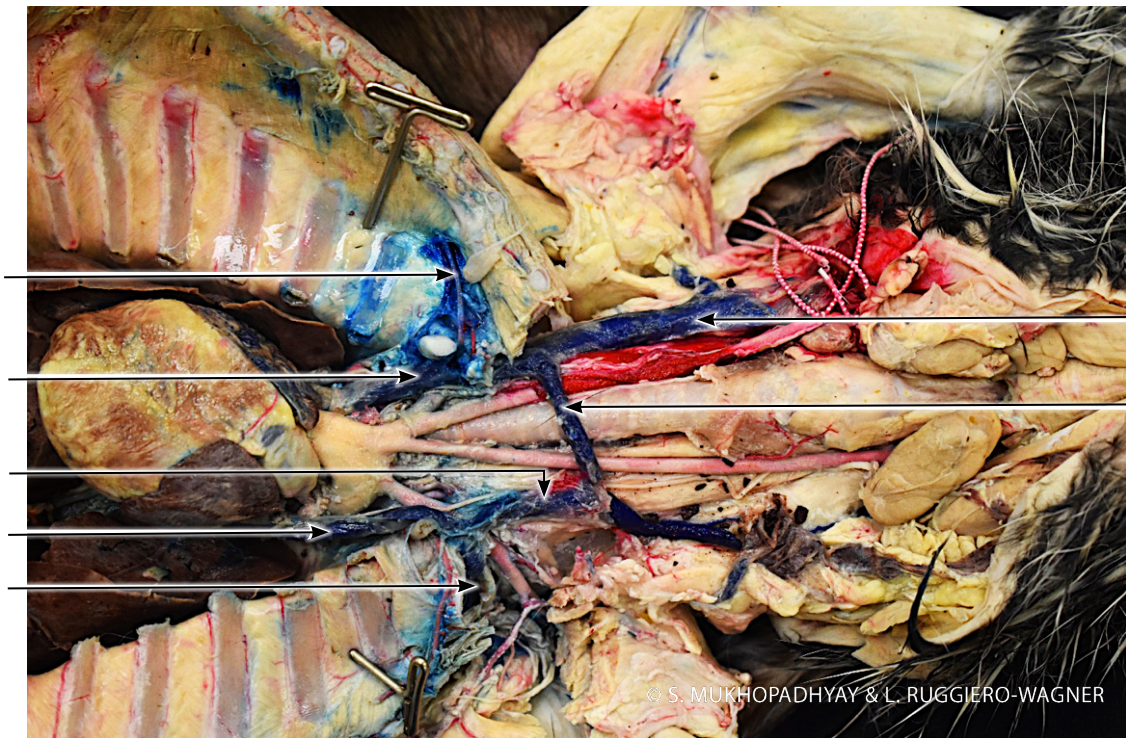


Figure 8d Veins Superior to Diaphragm

RABBIT ANATOMY

RABBIT VESSELS

VEINS SUPERIOR TO THE DIAPHRAGM

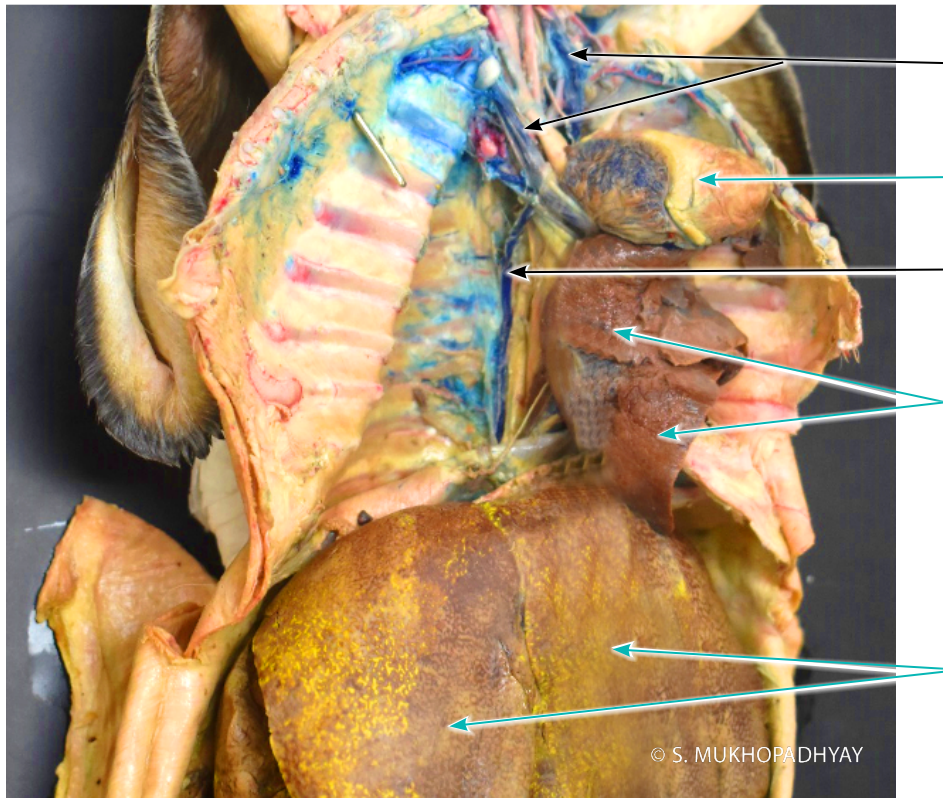


Figure 8e Veins Superior to Diaphragm



Dissection guide:
Azygous vein runs lateral to the right side of vertebral column in the posterior thoracic cavity. Reflect lungs and heart completely towards the left side to find the vein.



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES INFERIOR TO THE DIAPHRAGM

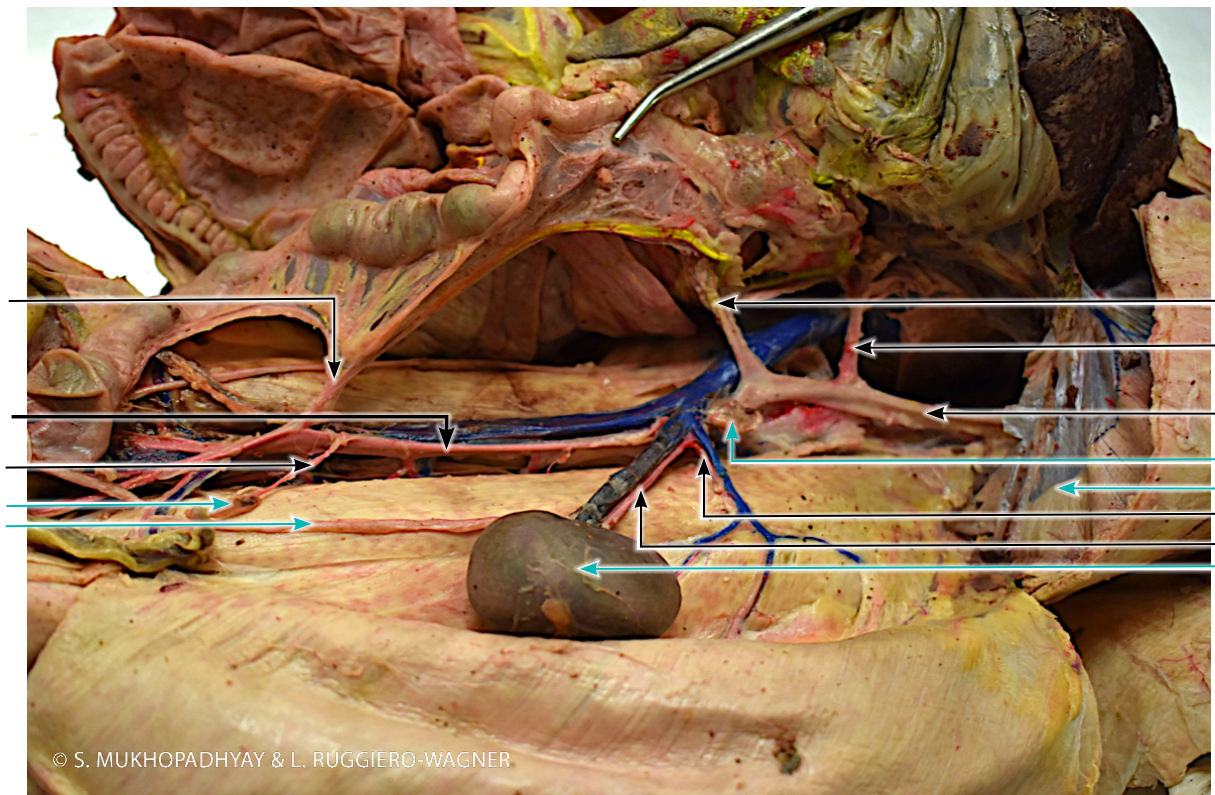


Figure 9a: Arteries inferior to the diaphragm



RABBIT ANATOMY

RABBIT VESSELS

VEINS INFERIOR TO THE DIAPHRAGM

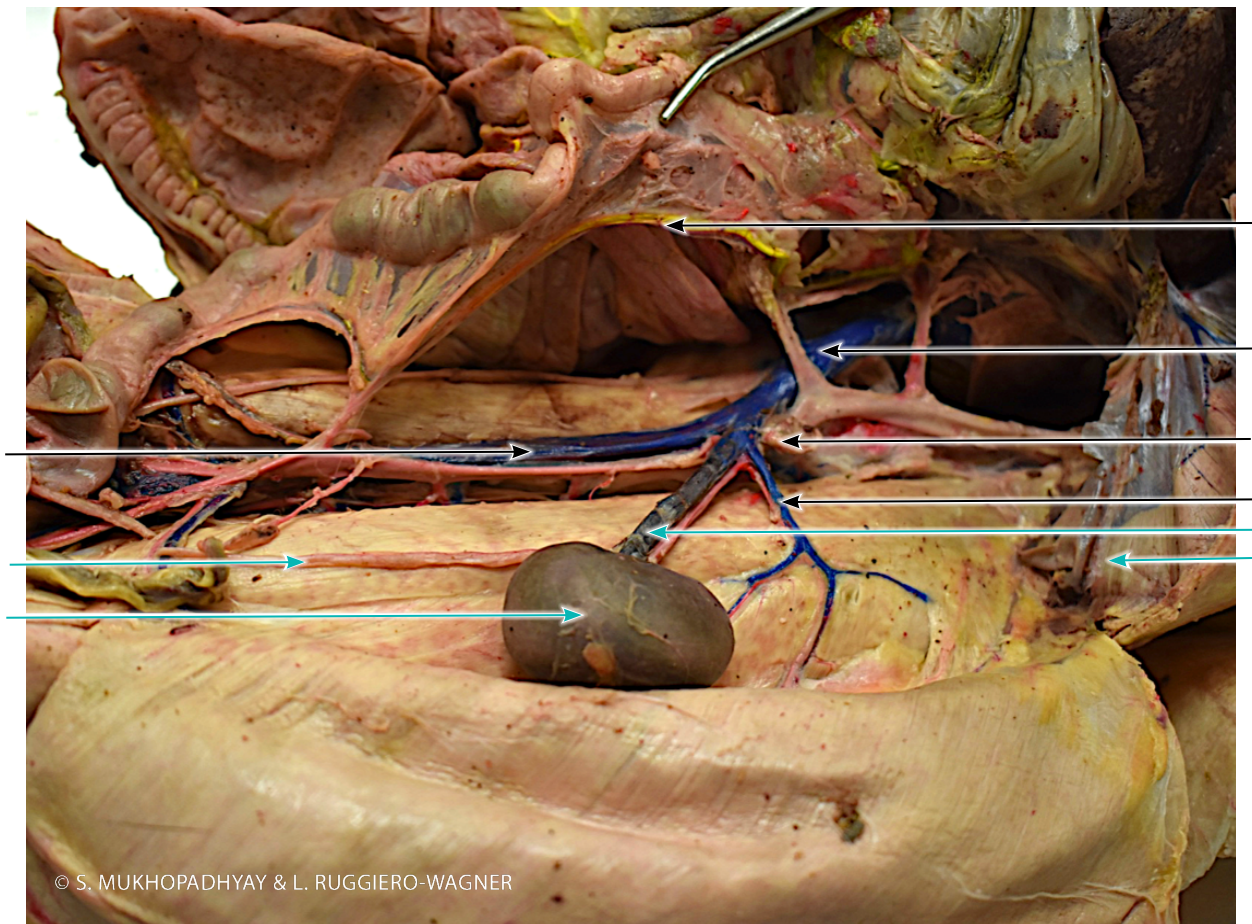


Figure 9b: Veins Inferior to Diaphragm



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES INFERIOR TO THE DIAPHRAGM

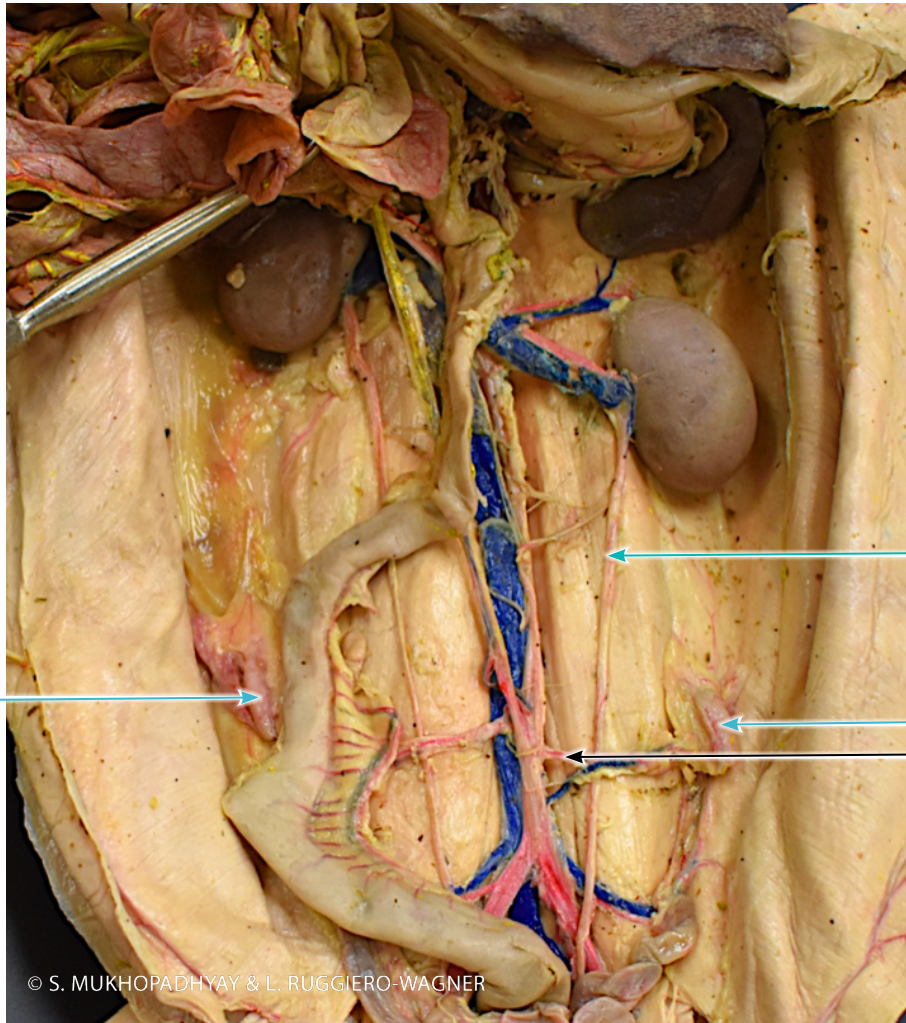


Figure 9c FEMALE: Arteries inferior to the diaphragm



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES INFERIOR TO THE DIAPHRAGM

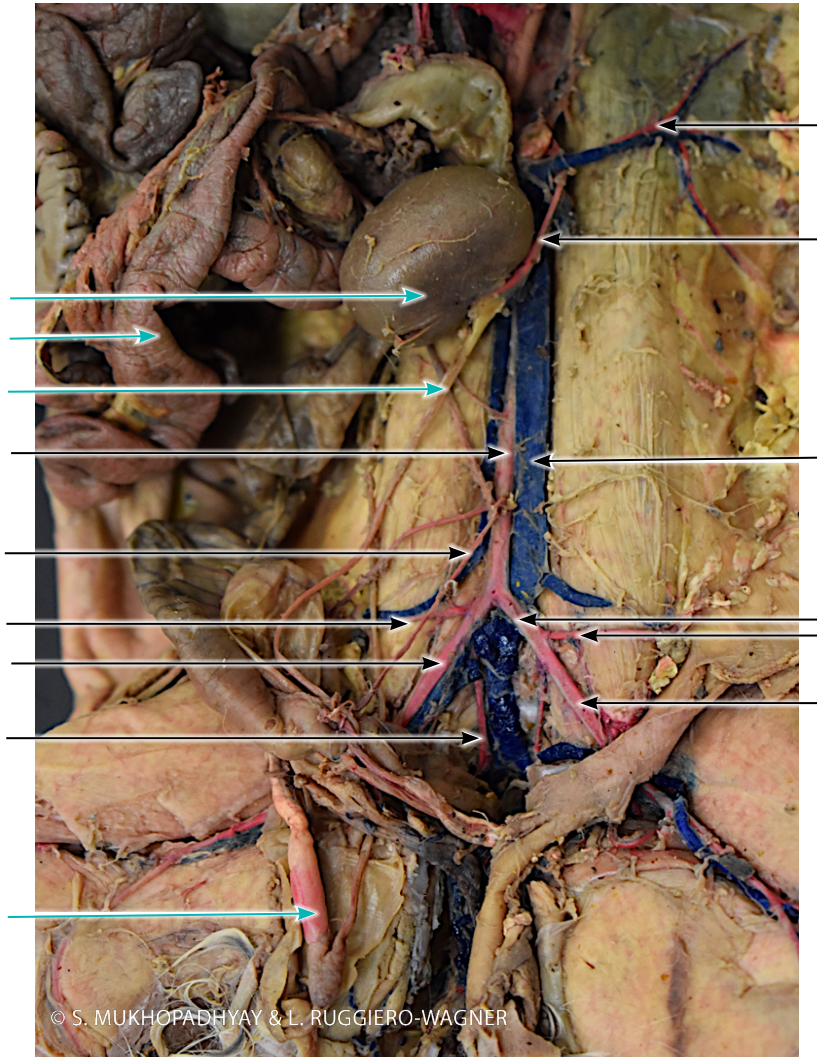


Figure 9d: Arteries inferior to the diaphragm (special focus: Internal Iliacs)



RABBIT ANATOMY

RABBIT VESSELS

VEINS INFERIOR TO THE DIAPHRAGM

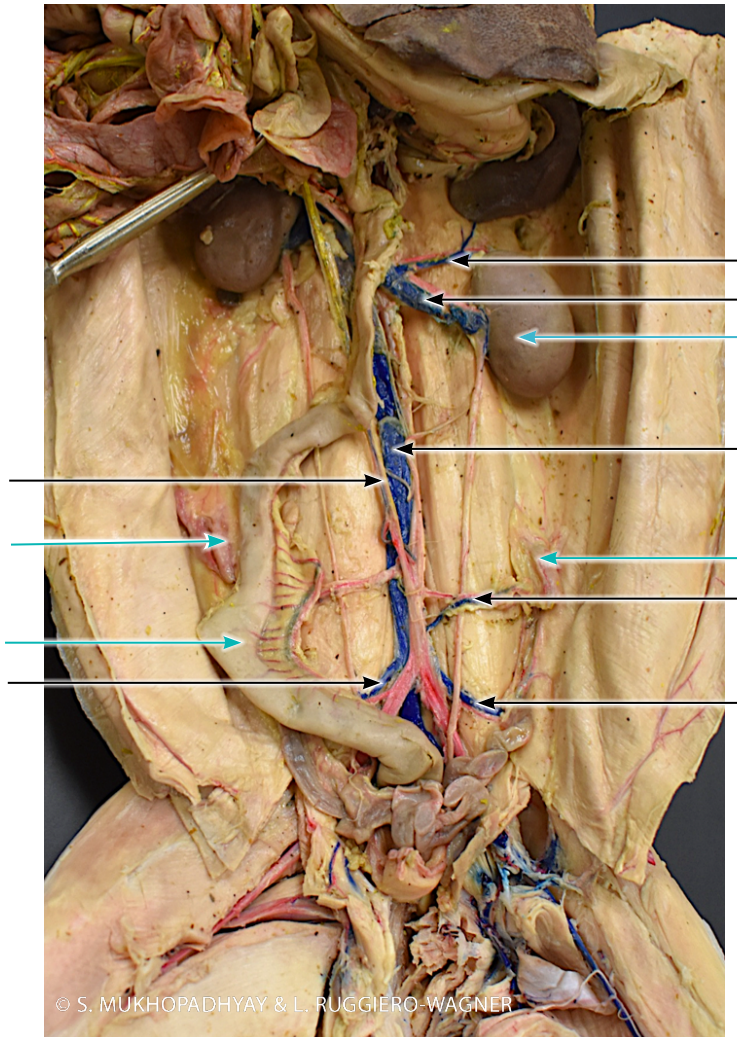


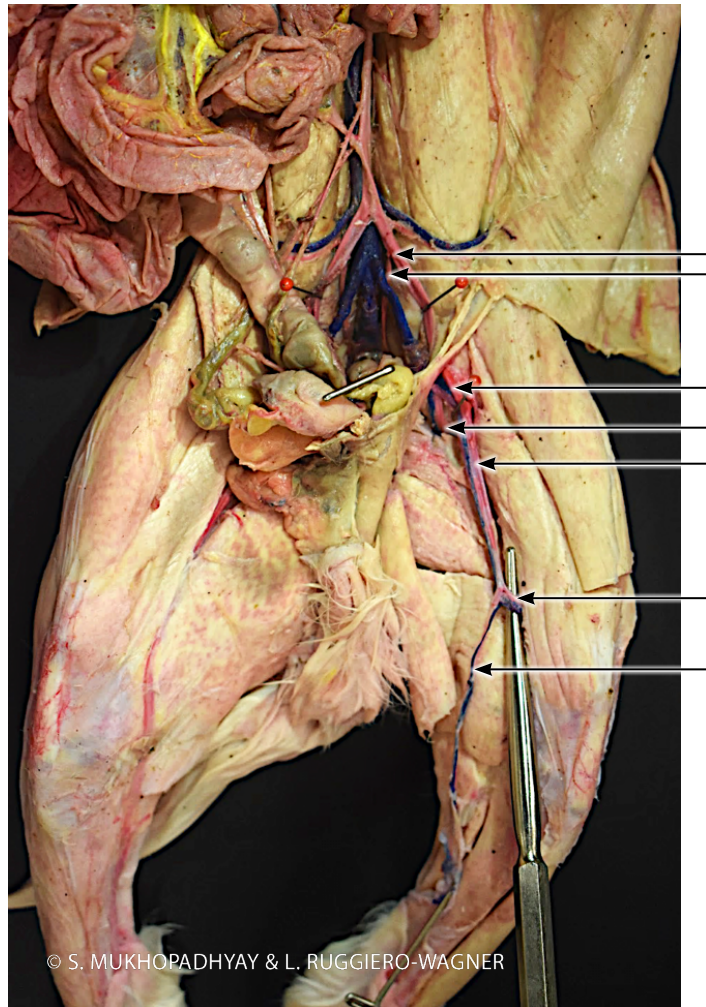
Figure 9e FEMALE: Veins inferior to the diaphragm



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES INFERIOR TO THE DIAPHRAGM



*Figure 9f Arteries Inferior to Diaphragm
Pelvic and Leg*



RABBIT ANATOMY

RABBIT VESSELS

ARTERIES AND VEINS INFERIOR TO THE DIAPHRAGM

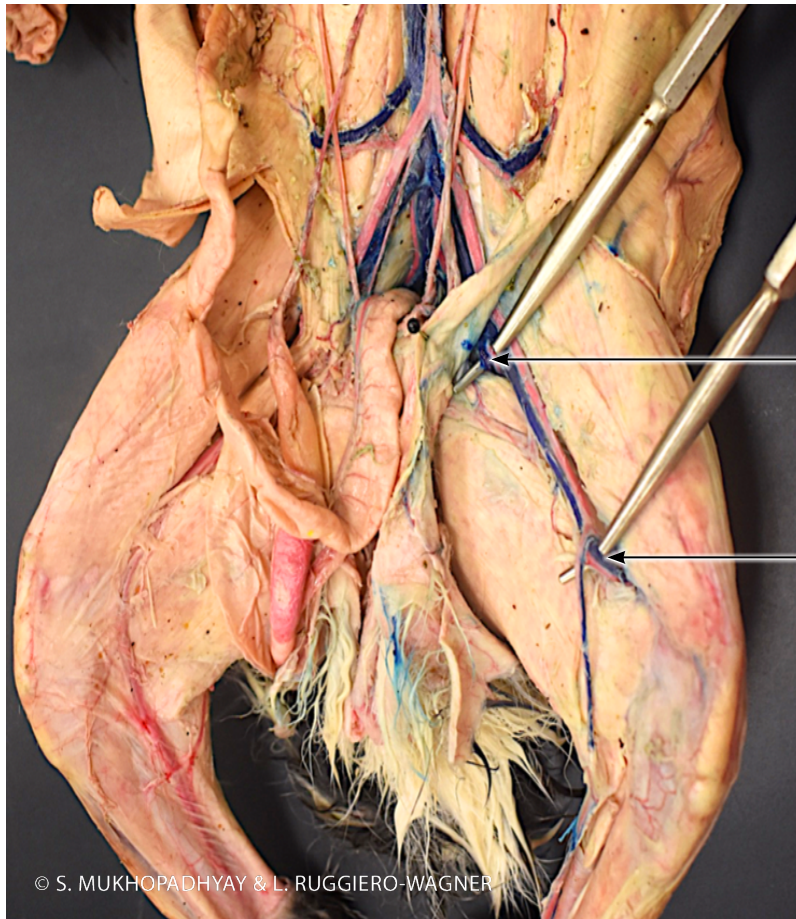


Figure 9g Arteries and Veins inferior to the diaphragm



VEINS INFERIOR TO THE DIAPHRAGM

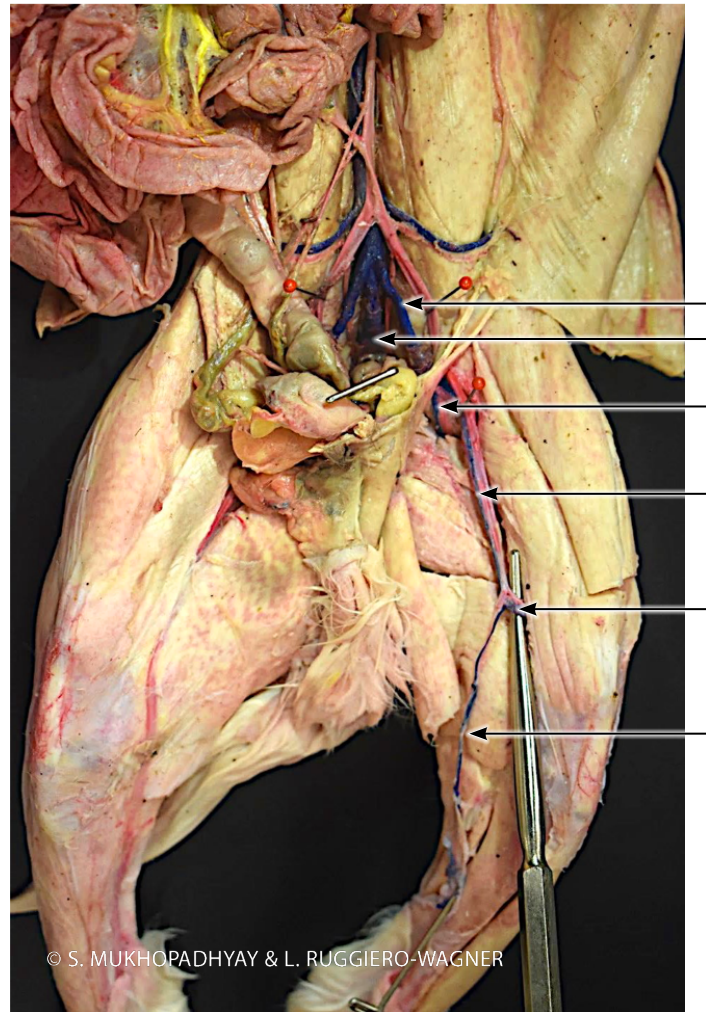


Figure 9h Veins Inferior to Diaphragm Pelvic and Leg



RABBIT ANATOMY

RABBIT VESSELS

VEINS INFERIOR TO THE DIAPHRAGM

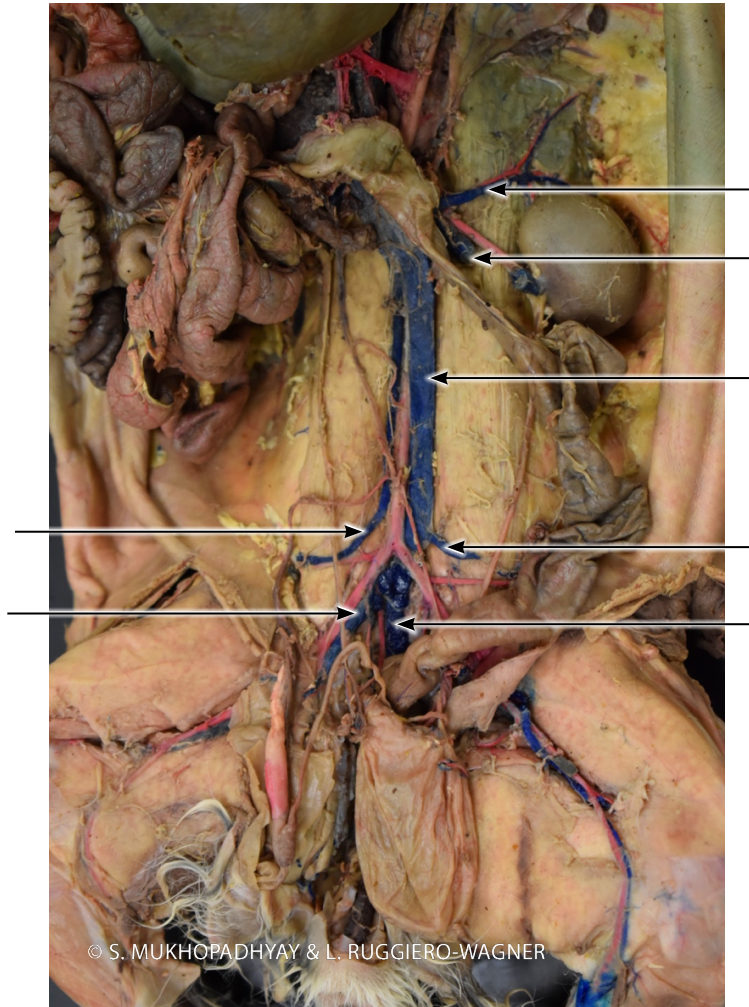


Figure 9i: Veins inferior to the diaphragm



RABBIT ANATOMY

RABBIT VESSELS

VEINS INFERIOR TO THE DIAPHRAGM

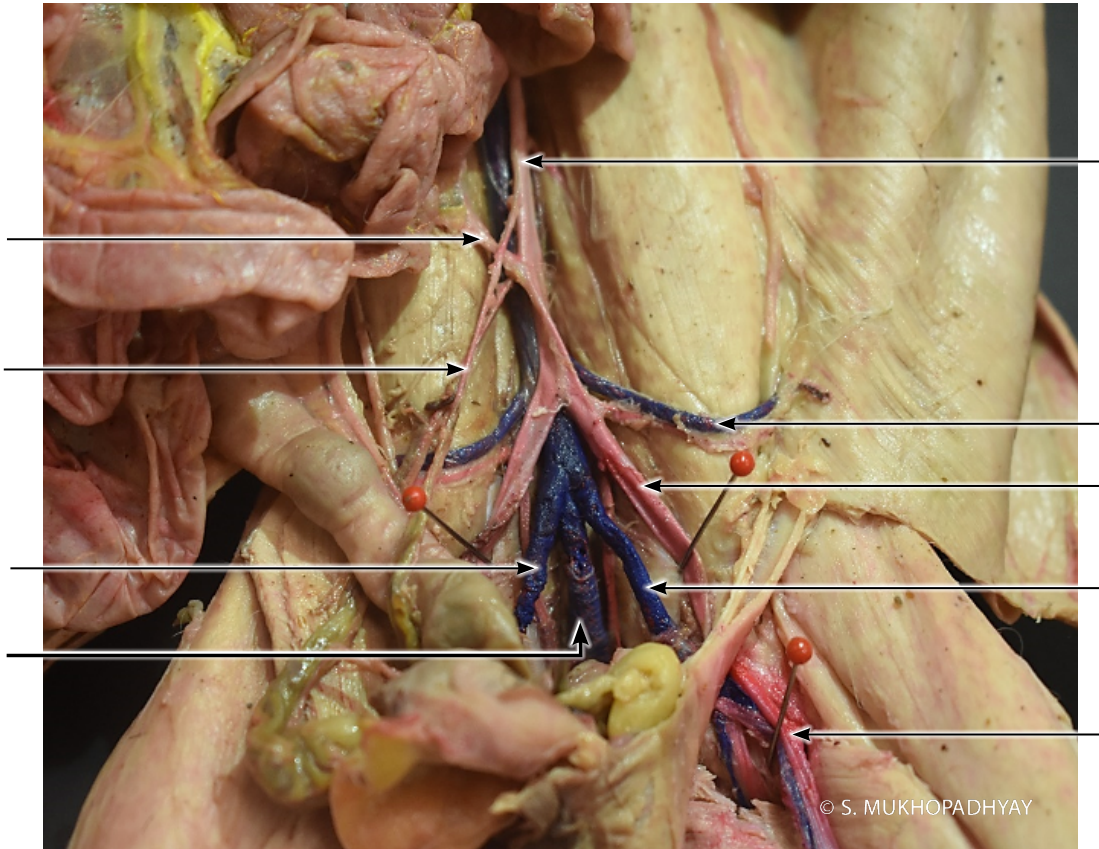
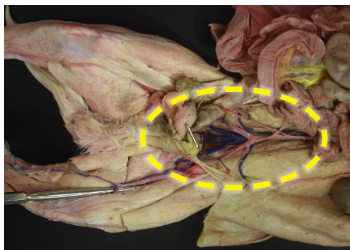


Figure 9j Arteries and Veins - special focus on iliacs



RABBIT ANATOMY

RABBIT VESSELS

VEINS INFERIOR TO THE DIAPHRAGM

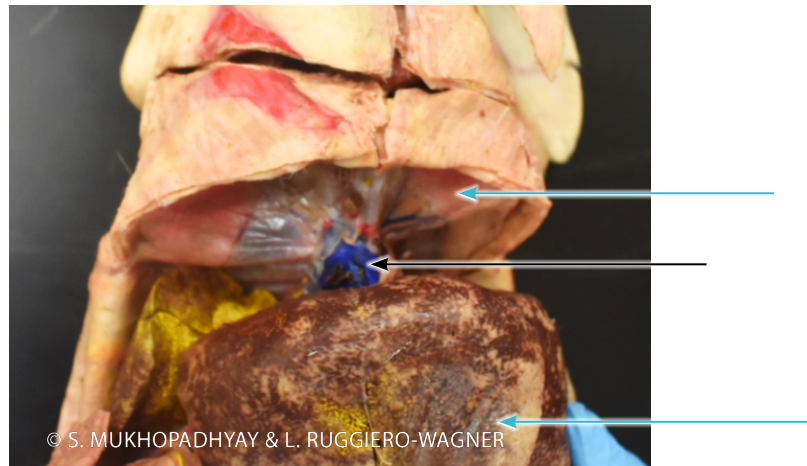


Figure 10a Hepatic Vein



Figure 10b Hepatic Portal Vein

RABBIT ANATOMY

RABBIT VESSELS

VEINS INFERIOR TO THE DIAPHRAGM



Figure 10c Hepatic Portal System



NOTES

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