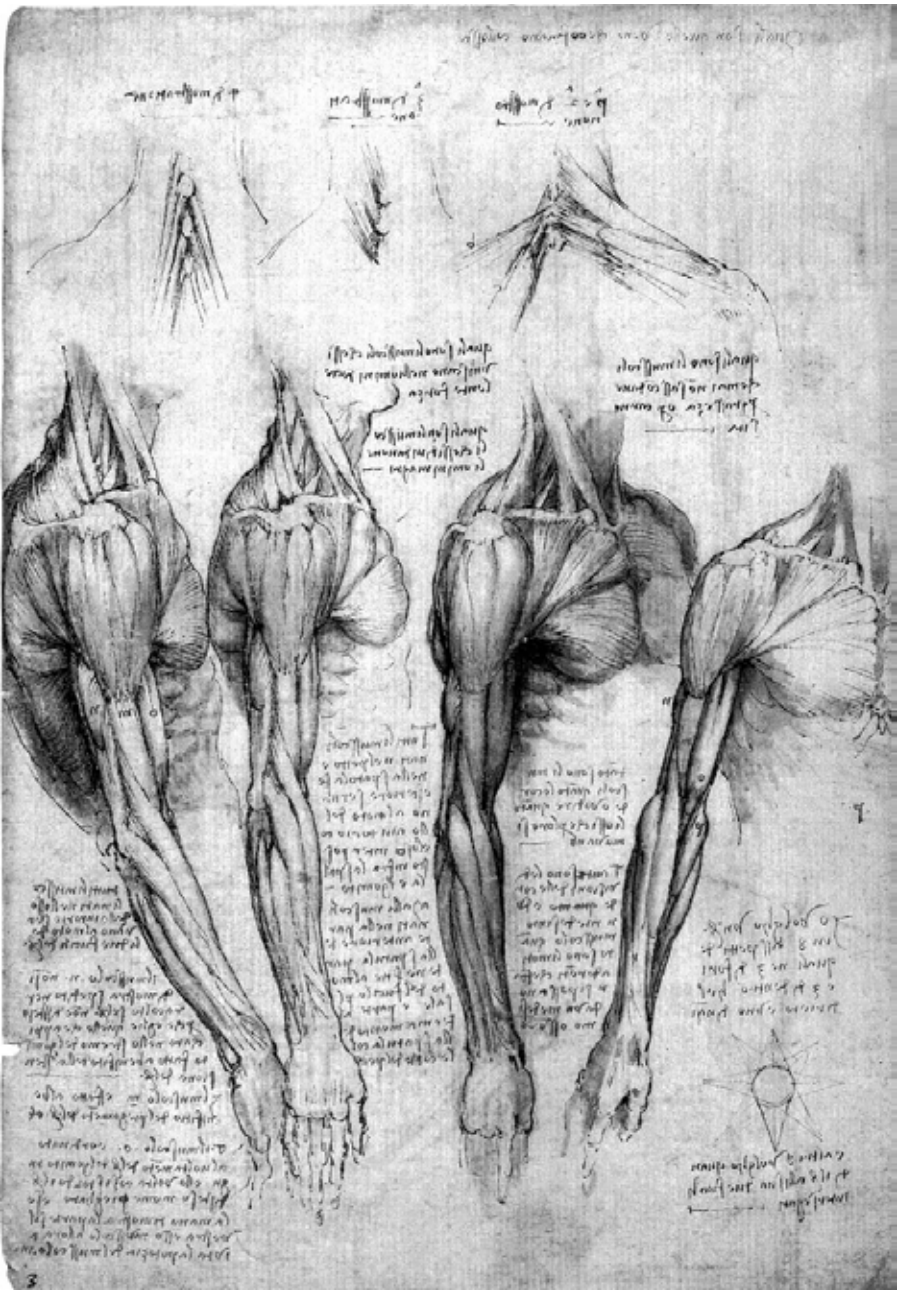
How to make new discoveries in (human) anatomy

OR

Can we develop predictive guidelines to help us make new anatomical discoveries?

Matt Wedel

Western University of Health Sciences, Pomona, California




足太陽膀胱經之圖

2013

Journal of Anatomy

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Anatomy of the anterolateral ligament of the knee

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Abstract

In 1879, the French surgeon Segond described the existence of a 'pearly, resistant, fibrous band' at the anterolateral aspect of the human knee, attached to the eponymous Segond fracture. To date, the enigma surrounding this anatomical structure is reflected in ligament', 'capsulo-osseous layer of the iliotibial band description has yet been provided. In this study, the hereafter termed anterolateral ligament (ALL), was in femoral and tibial attachment of the ALL, its course and studied both qualitatively and quantitatively. In all but a well-defined ligamentous structure, clearly distinguish the ALL was situated at the prominence of the latera the lateral collateral ligament, although connecting fib showed an oblique course to the anterolateral aspec lateral meniscus, thus enveloping the inferior later anterolateral tibia was grossly located midway betwe definitely separate from the iliotibial band (ITB). The A the anterolateral aspect of the human knee with cons detailed anatomical characterization of the ALL, this st existence of a ligamentous structure connecting the fe anatomic location, the ALL is hypothesized to control i phenomenon, although further studies are needed to ir

Key words: anatomy; anterior cruciate ligament; antero

Introduction

In 1879, years before the discovery of X-rays, Dr. Paul Segond described a remarkably constant avulsion fracture pattern at the anterolateral proximal tibia as a result of forced internal rotation at the knee (Segond, 1879). This eponymous Segond fracture was reported to occur in the tibial region 'above and behind the tubercle of Gerdy'. At this anatomical location, he furthermore designated the existence of 'a pearly, resistant, fibrous band which invariably

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OPEN

Structure and Distribution of an Unrecognized Interstitium in Human Tissues

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Petros C. Benias[1,2], Rebecca G. Wells[3,4], Bridget Sackey-Aboagye[3], Heather Klavan[3], Jason Reidy[3], Darren Buonocore[3], Mark Carr-Locke[1,5] & Neil D. Theise[1,3,6]

Confocal laser endomicroscopy (pCLE at a depth of 60–70 μm during endosc injection demonstrated a reticular pa anatomical correlate. Freezing biops demonstrating that it is part of the su space, draining to lymph nodes and s These bundles are intermittently line markers and vimentin, although ther matrix proteins of the bundles and th tissues that are subject to intermitte entire gastrointestinal tract and urin tissues, and fascia. These anatomic st and mechanical functioning of many histology of a previously unrecognize between tissues, a novel expansion o

The interstitial space is the primary so anatomy and composition of the interst tion, and structure of larger inter- and ticularly important in reference to "th interstitial fluid flow and volume, whi

Advances in *in vivo* microscopy offe tures in humans. Lymphatic vessels in *in vivo* multiphoton microscopy imagi Endomicroscopy (pCLE) is an *in vivo* m structures during endoscopy, generally that, in the extrahepatic bile ducts and subepithelial "reticular pattern" (Fig. 1A

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2019

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Case Reports and Series

Cutaneous Branch of the Obturator Nerve Extending to the Medial Ankle and Foot: A Report of Two Cadaveric Cases

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[5] Resident, Einstein Healthcare Network, Philadelphia, PA
[6] Resident, University of Missouri School of Medicine, Kansas City, MO
[7] Resident, Mercy Health, Muskegon, MI
[8] Professor, Department of Podiatric Medicine, Surgery, and Biomechanics, and Associate Dean of Clinical Education and Graduate Placement, Western University of Health Sciences College of Podiatric Medicine, Pomona, CA
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ARTICLE INFO

Level of Clinical Evidence: 4

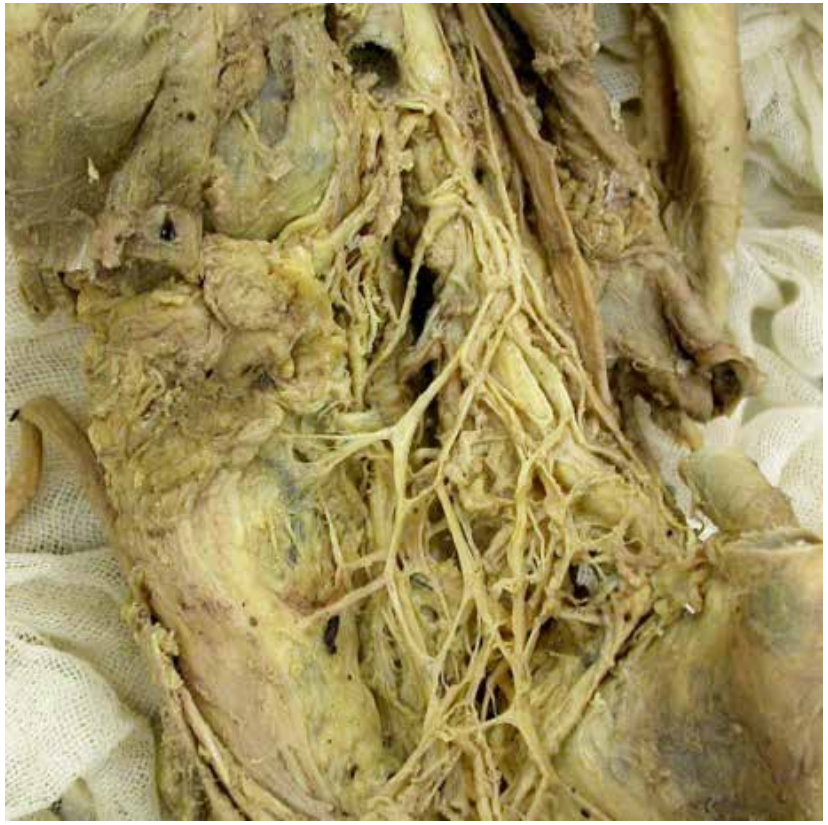
Key Words:

ABSTRACT

The area of skin supplied by the cutaneous branch of the obturator nerve (CBO) is highly variable. Although most introductory anatomy texts describe the CBO as innervating only a portion of the medial thigh, there are numer-

Why, after centuries of careful study, are we still making new discoveries in human anatomy?

- Humans are complex; lots of stuff to find
- Not everything that gets found gets published



Filters to the publication of new discoveries

Palaeontology

- What gets fossilized
- What gets discovered
- What gets collected
- What gets prepared
- What gets published

Filters to the publication of new discoveries

Palaeontology

- What gets fossilized
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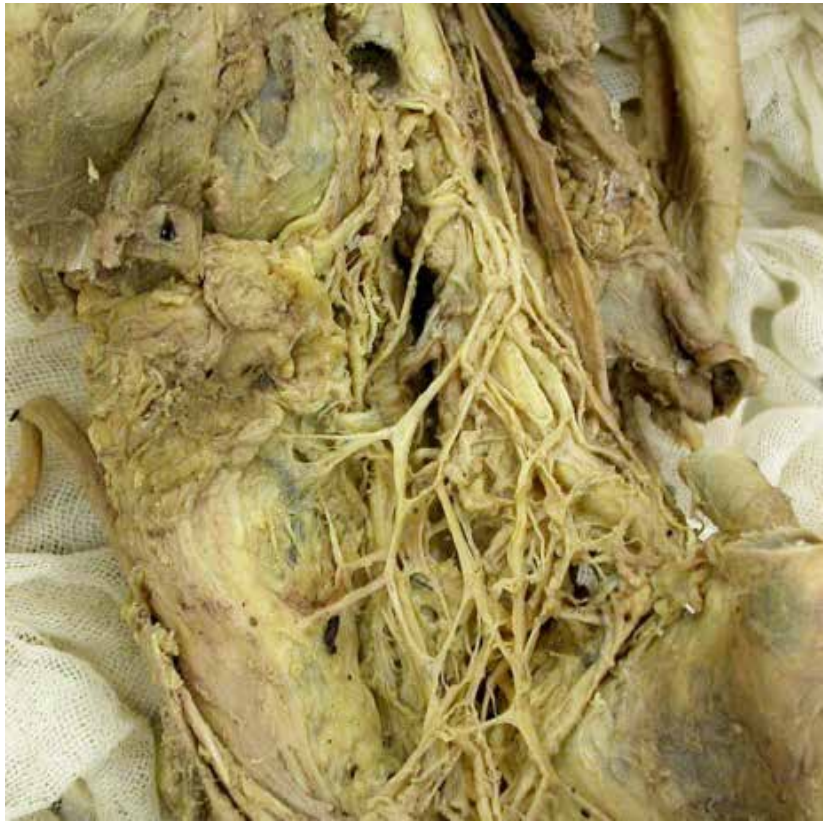
- What gets prepared
- What gets published

Human anatomy

- What gets preserved
- What gets noticed
- What gets recognized as possibly important
- What gets published

Why, after centuries of careful study, are we still making new discoveries in human anatomy?

- Humans are complex; lots of stuff to find
- Not everything that gets found gets published



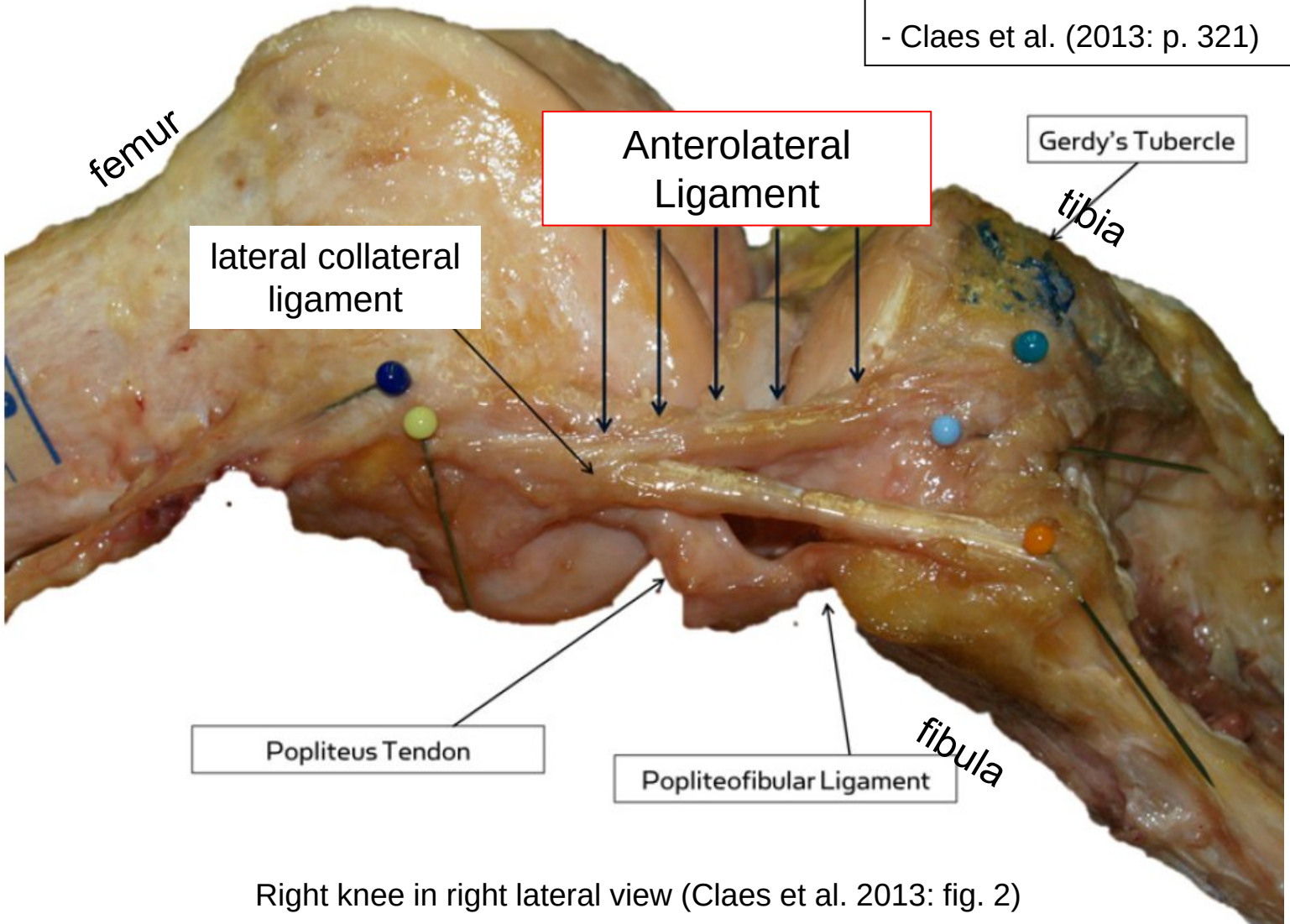
Case Study 1:

Anterolateral ligament of the knee

A new knee ligament described this decade! (sorta)

”In 1879, years before the discovery of X-rays, Dr. Paul Segond described…‘a pearly, resistant, fibrous band which invariably showed extreme amounts of tension during forced internal rotation (of the knee)’.”

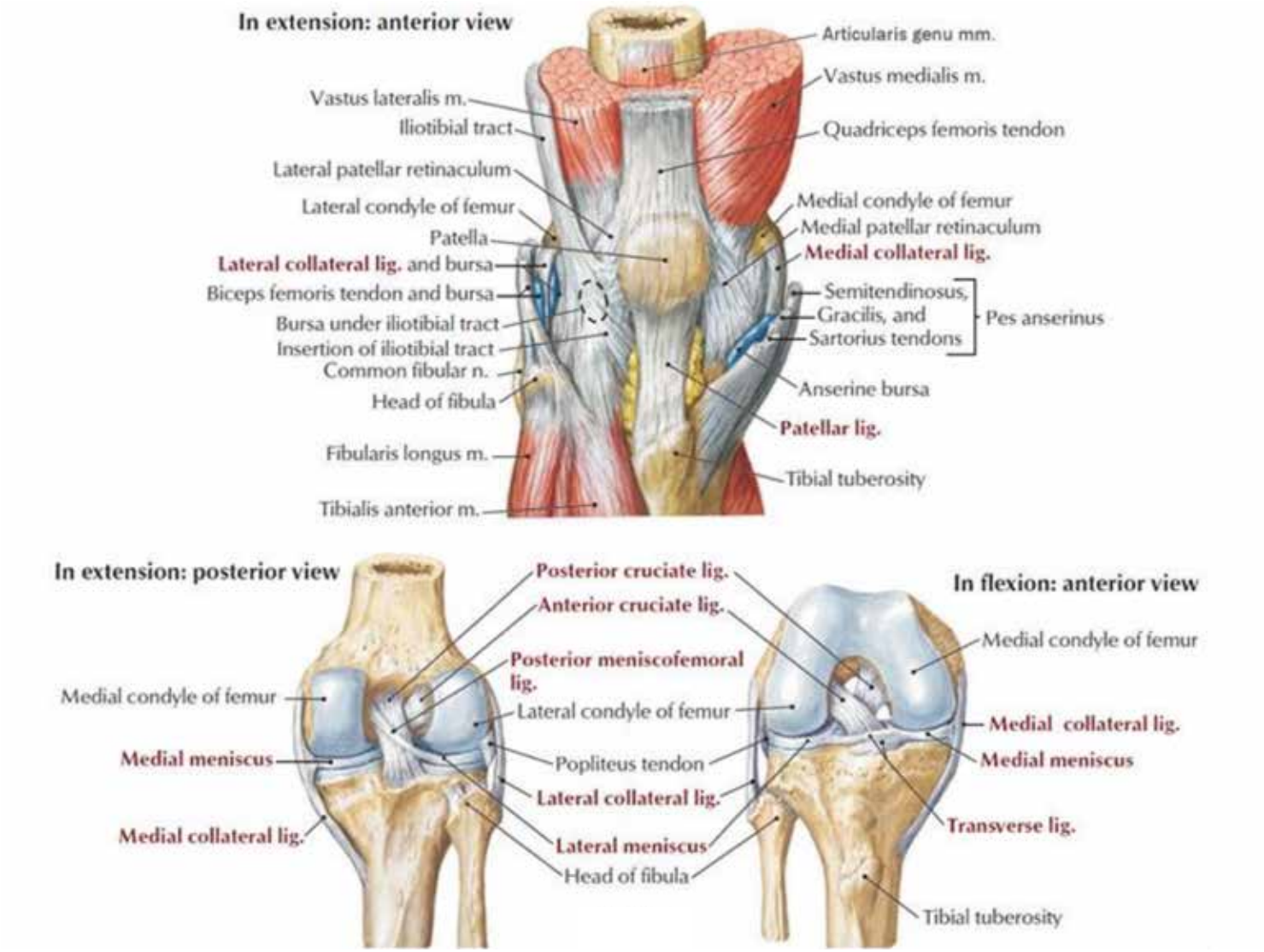
- Claes et al. (2013: p. 321)

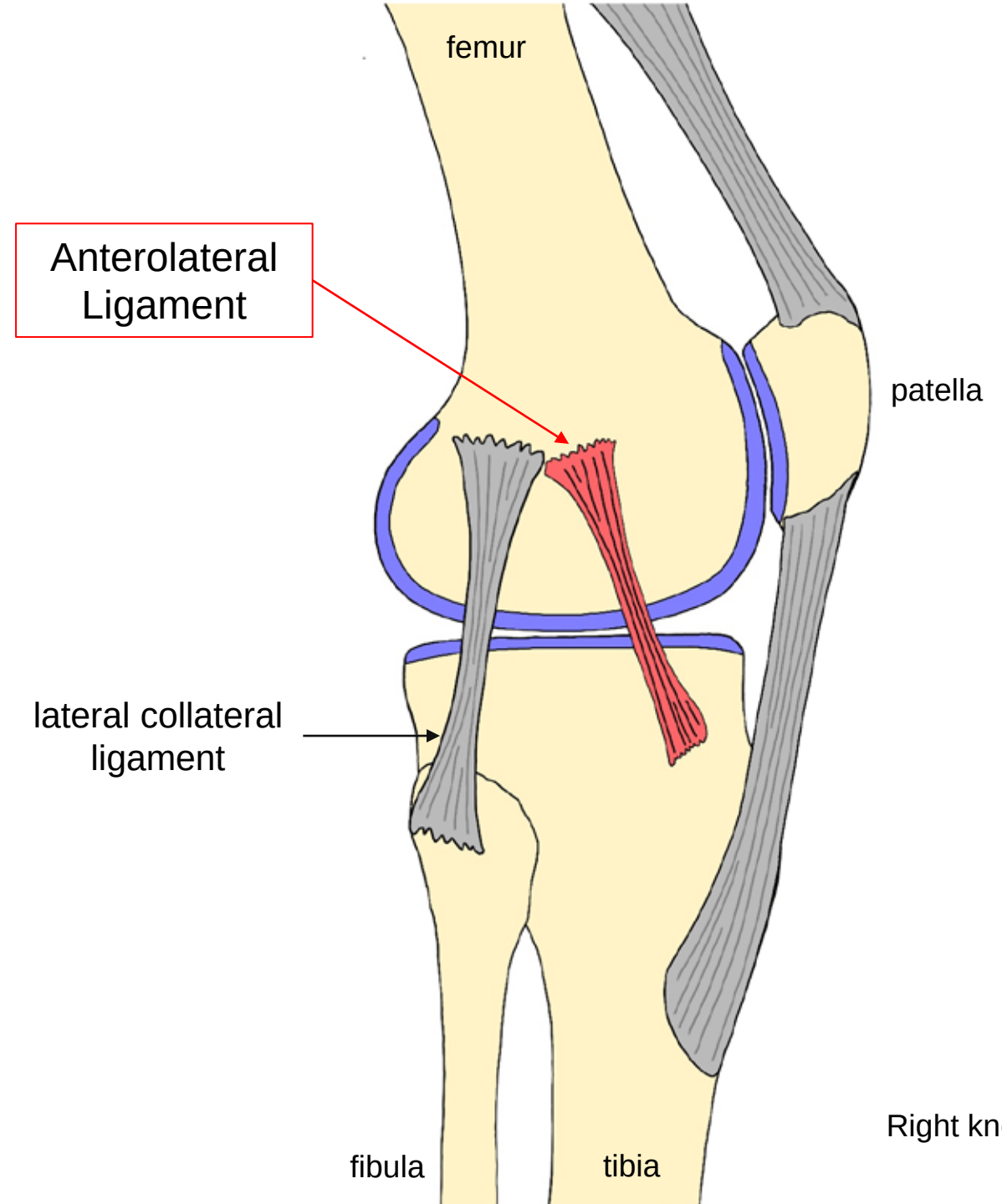


Right knee in right lateral view (Claes et al. 2013: fig. 2)

Endoscopic knee surgery

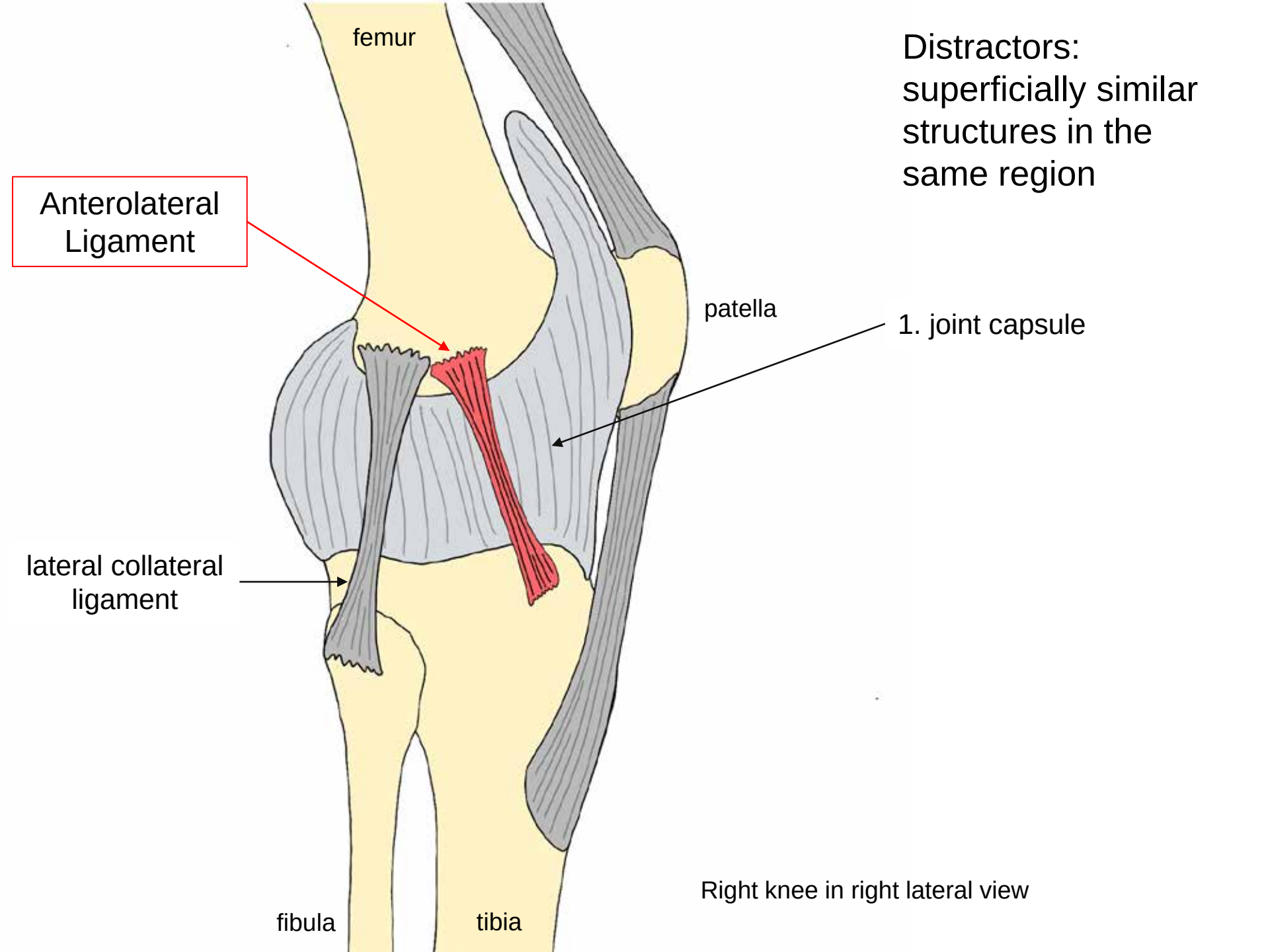
Med student view





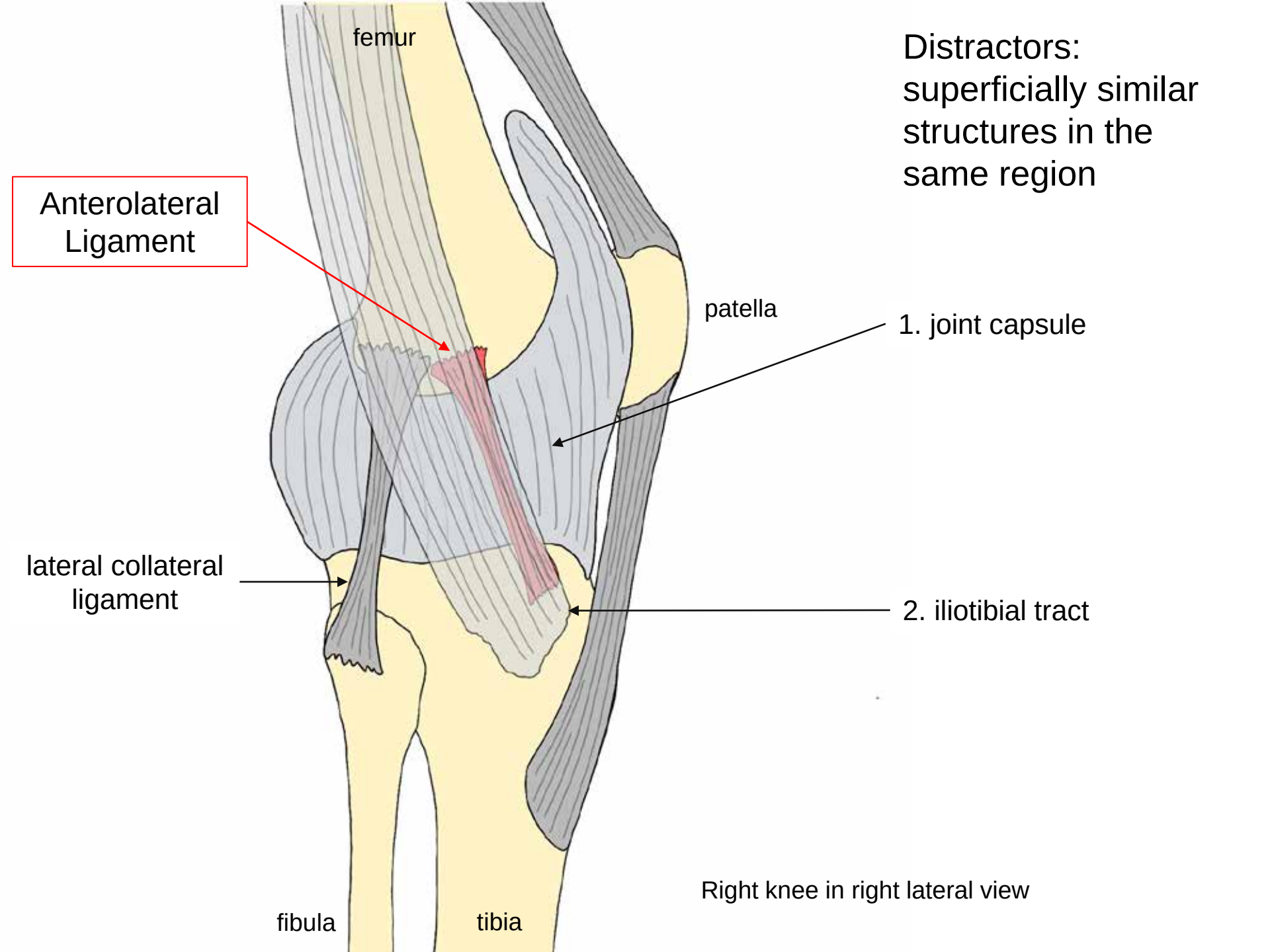
Distractors: superficially similar structures in the same region

Right knee in right lateral view



Distractors: superficially similar structures in the same region

Right knee in right lateral view

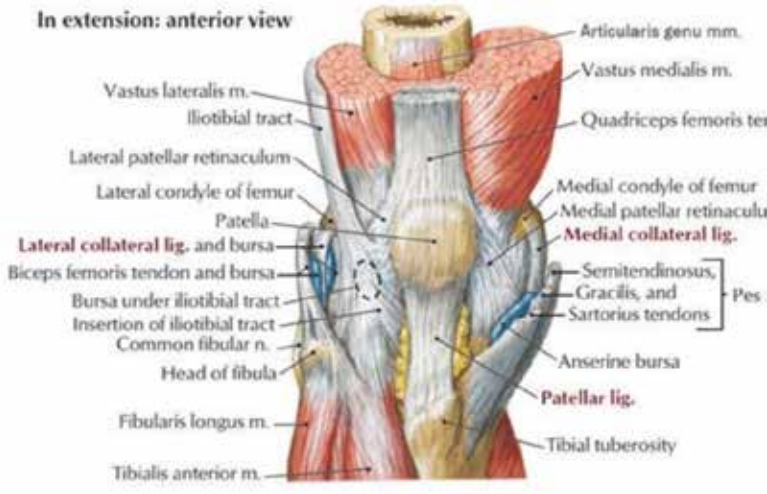


Distractors: superficially similar structures in the same region

Right knee in right lateral view

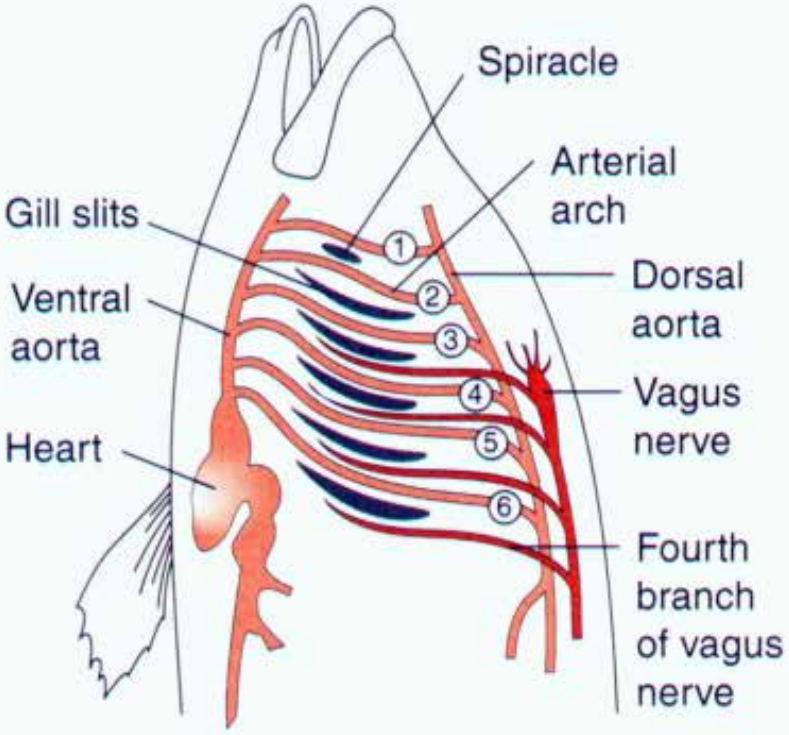
Why wasn’t the anterolateral ligament of the knee recognized sooner?

- Anatomically complex region
- Rarely dissected completely
- Known distractors in the same area

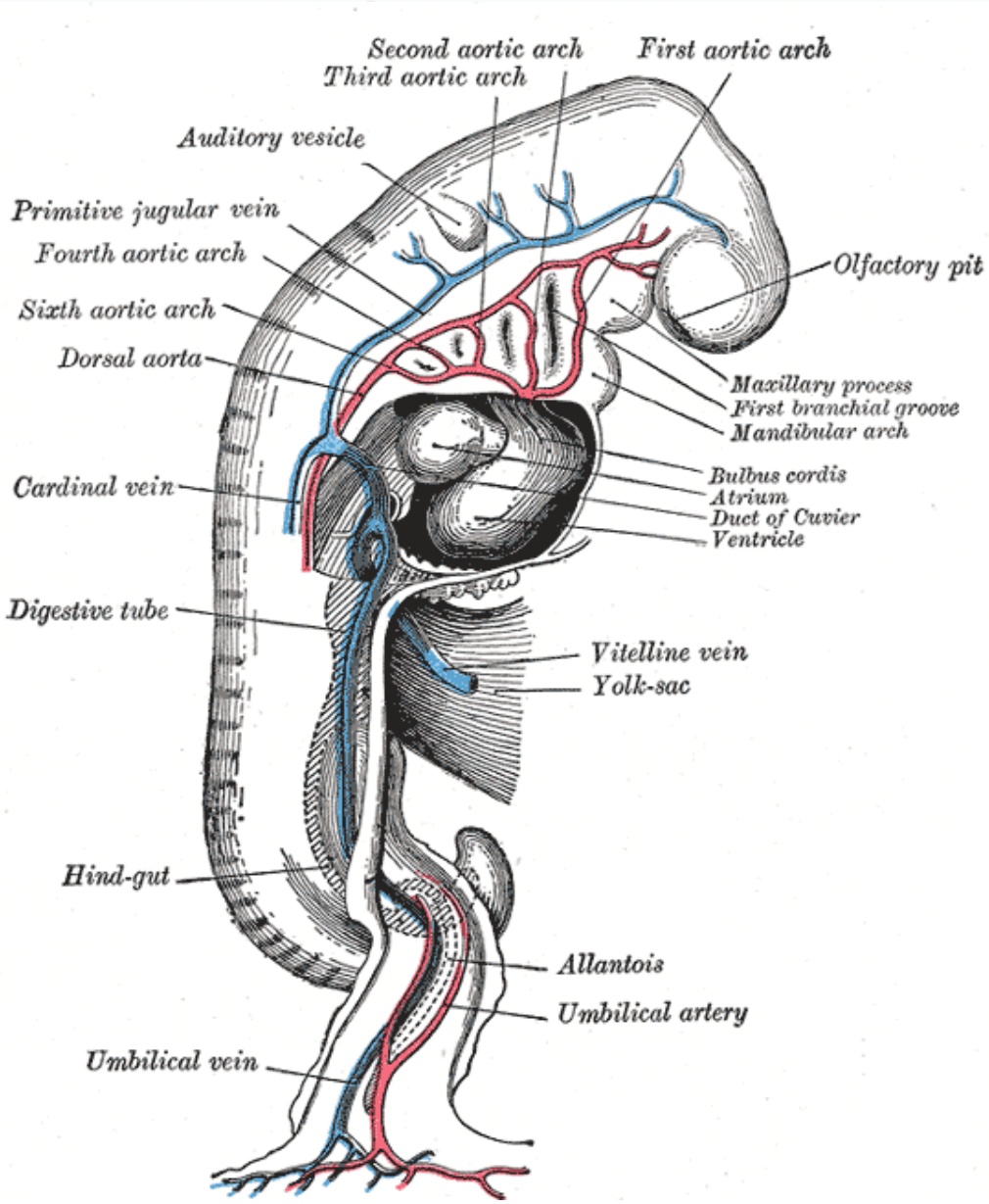


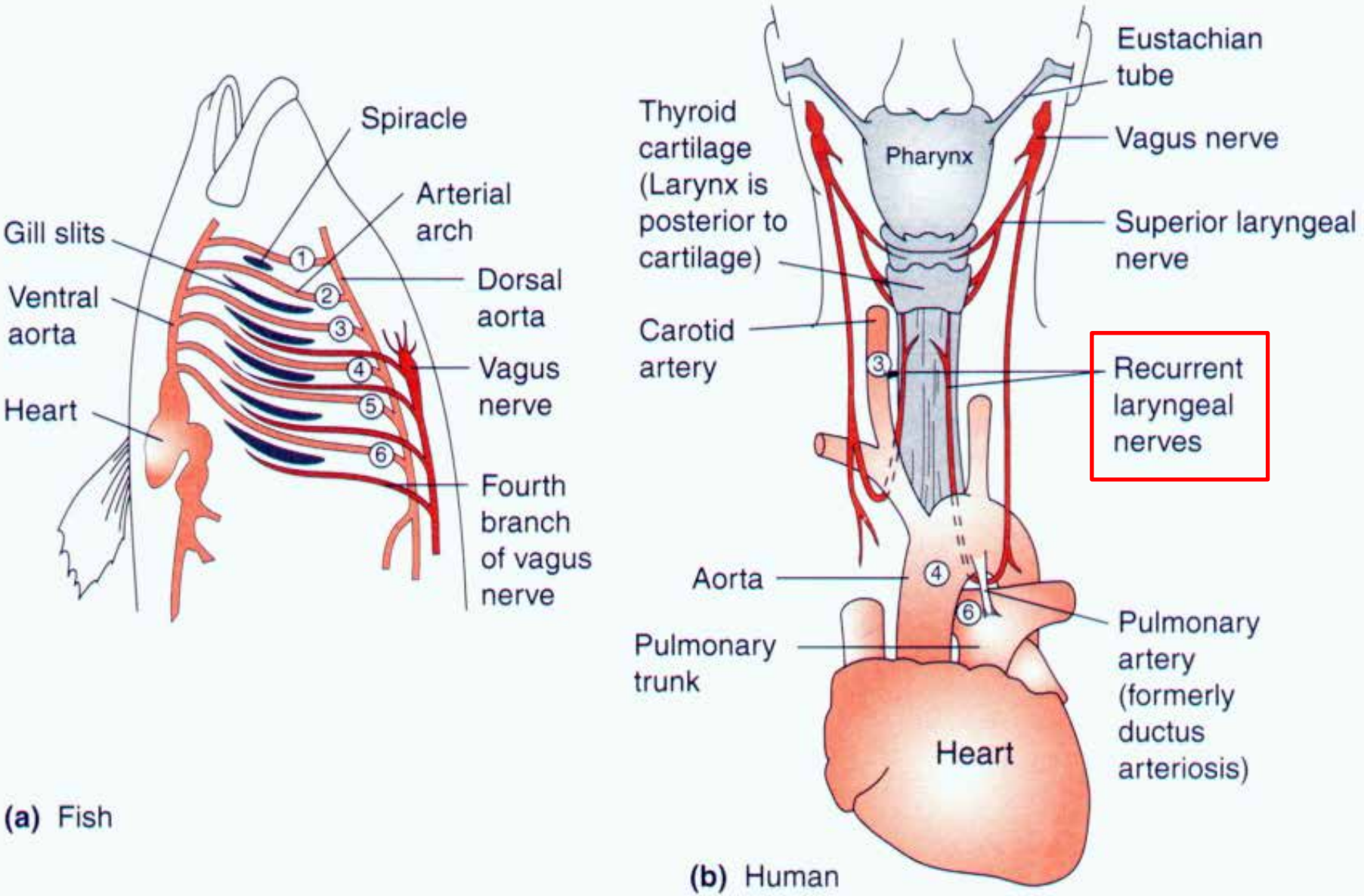
Case Study 2:

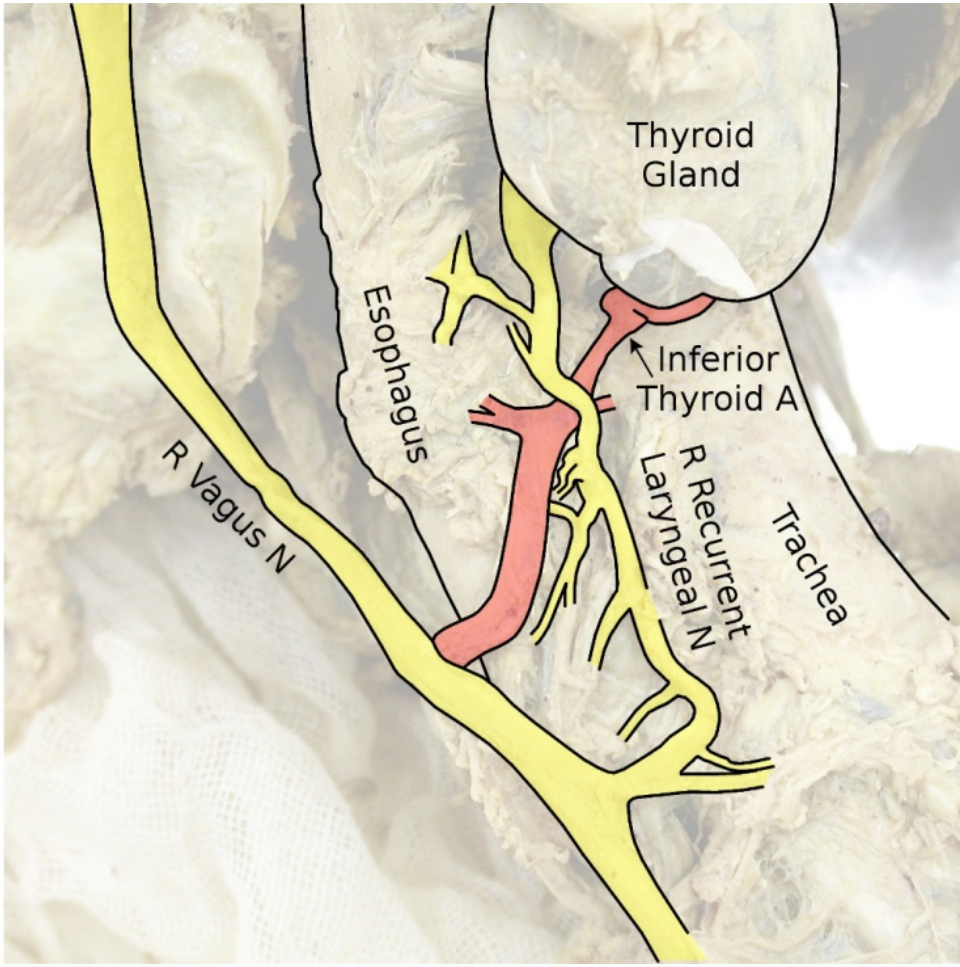
Pararecurrent nerve
(recurrent pharyngeal nerve)


Spiracle
Arterial arch
Gill slits
Dorsal aorta
Ventral aorta
Vagus nerve
Heart
Fourth branch of vagus nerve
1
2
3
4
5
6

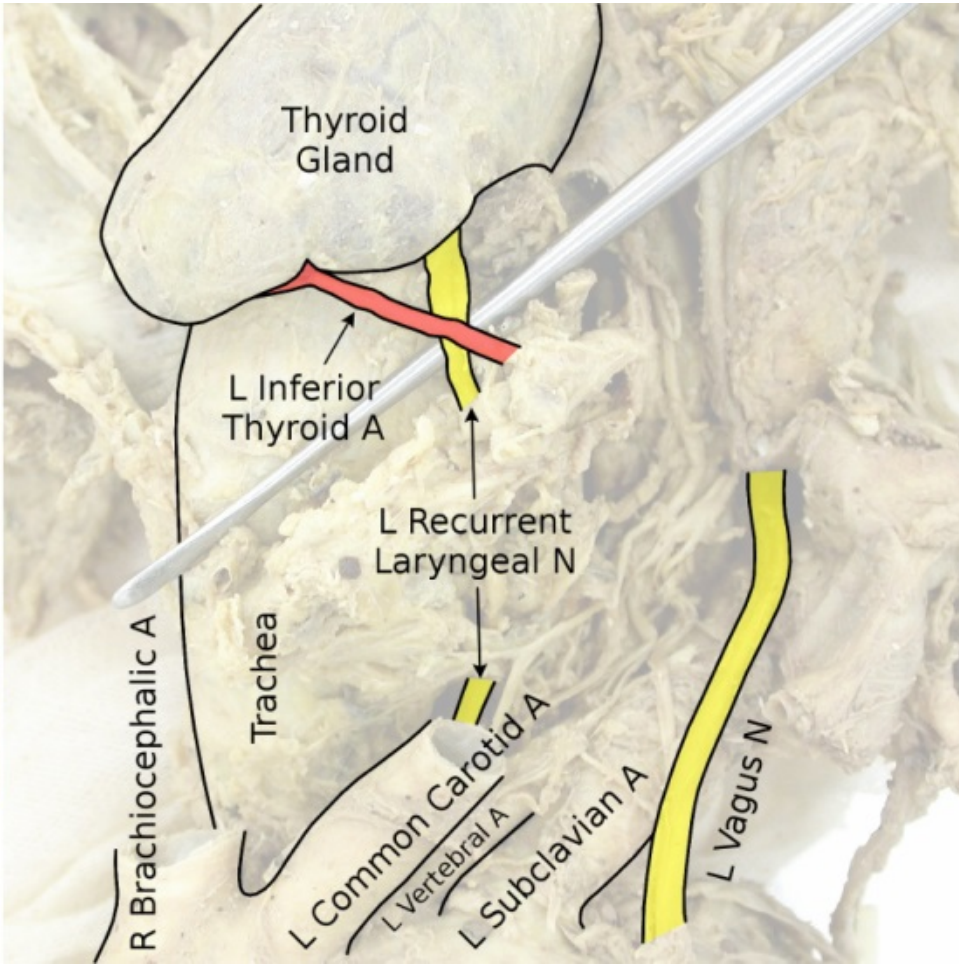
(a) Fish


Second aortic arch
First aortic arch
Third aortic arch
Auditory vesicle
Primitive jugular vein
Fourth aortic arch
Olfactory pit
Sixth aortic arch
Dorsal aorta
Maxillary process
First branchial groove
Mandibular arch
Bulbus cordis
Cardinal vein
Atrium
Duct of Cuvier
Ventricle
Digestive tube
Vitelline vein
Yolk-sac
Hind-gut
Allantois
Umbilical artery
Umbilical vein

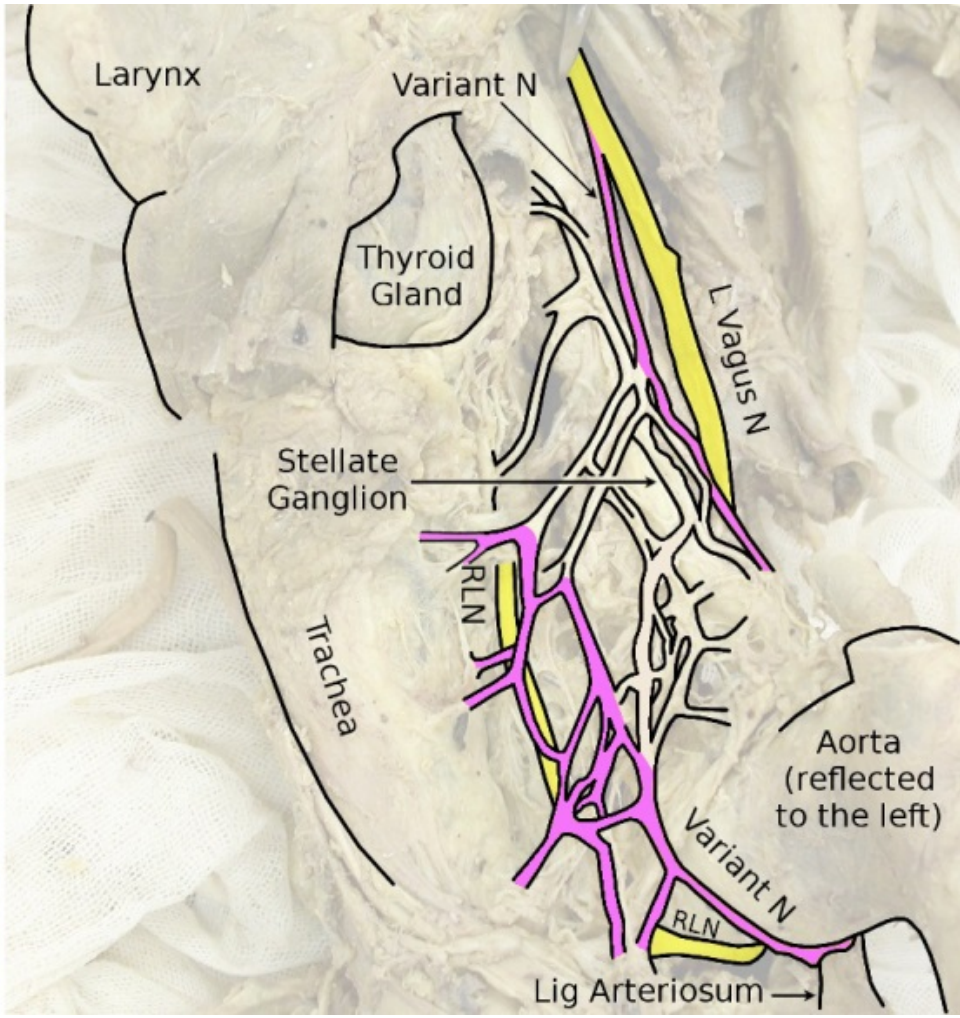

Spiracle
Arterial arch
Gill slits
Dorsal aorta
Ventral aorta
Vagus nerve
Heart
Fourth branch of vagus nerve
(a) Fish
Eustachian tube
Thyroid cartilage (Larynx is posterior to cartilage)
Pharynx
Vagus nerve
Superior laryngeal nerve
Carotid artery
Recurrent laryngeal nerves
Aorta
Pulmonary trunk
Pulmonary artery (formerly ductus arteriosis)
Heart
(b) Human



Neck viscera in right lateral view

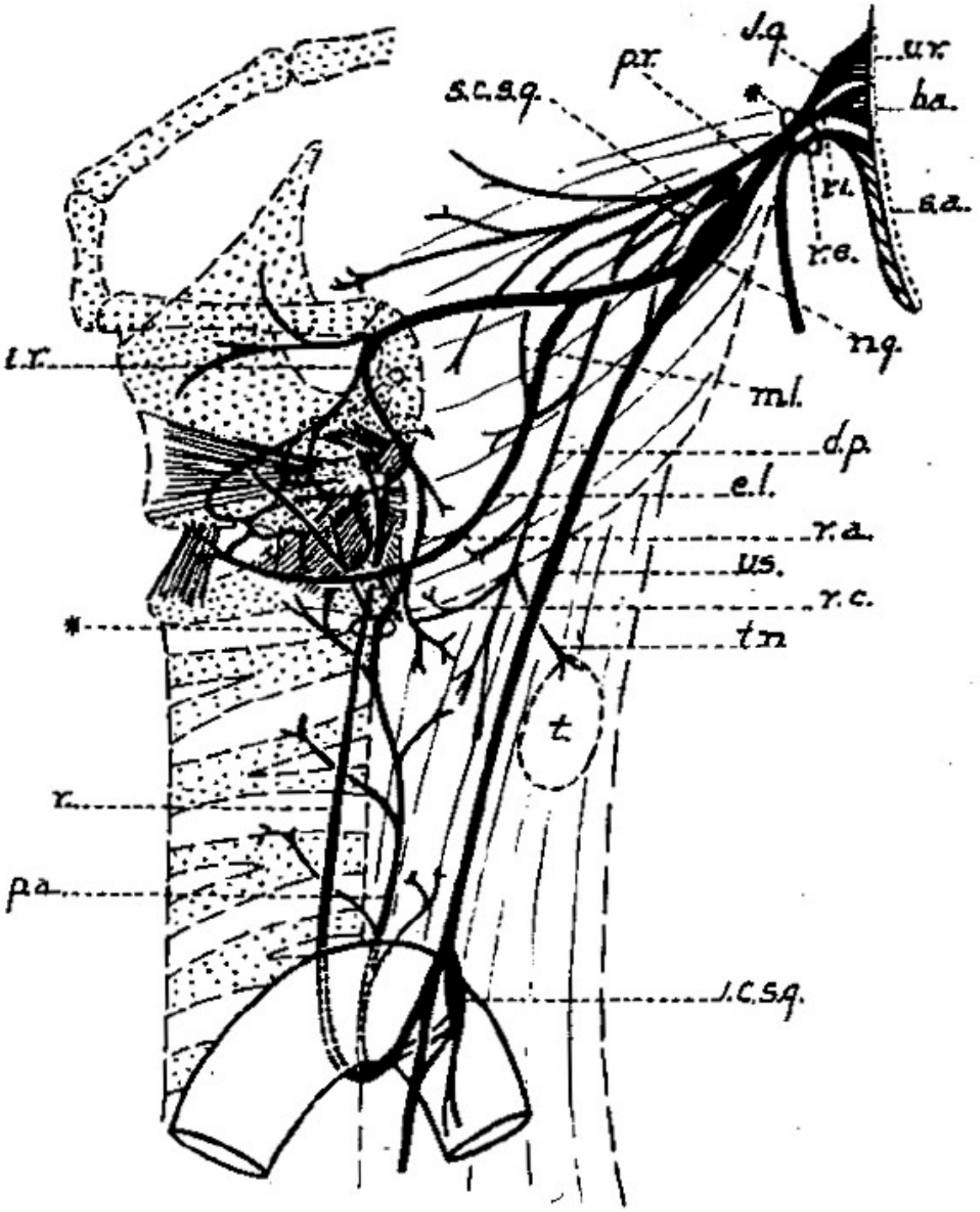


Neck viscera in left lateral view

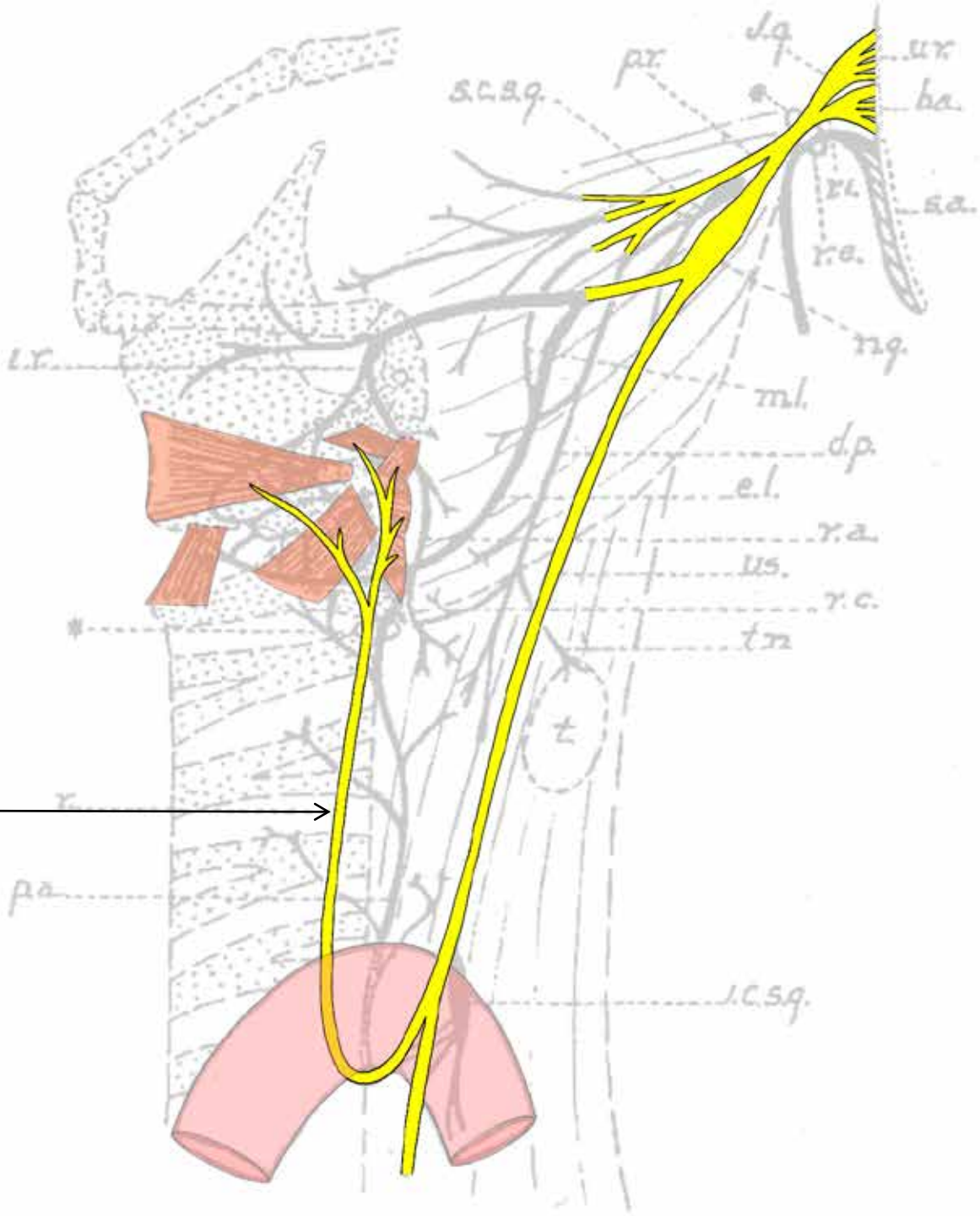


Neck viscera in left lateral view

Innervation of the larynx and trachea in a dog, modified from Lemere (1932: fig. 1)

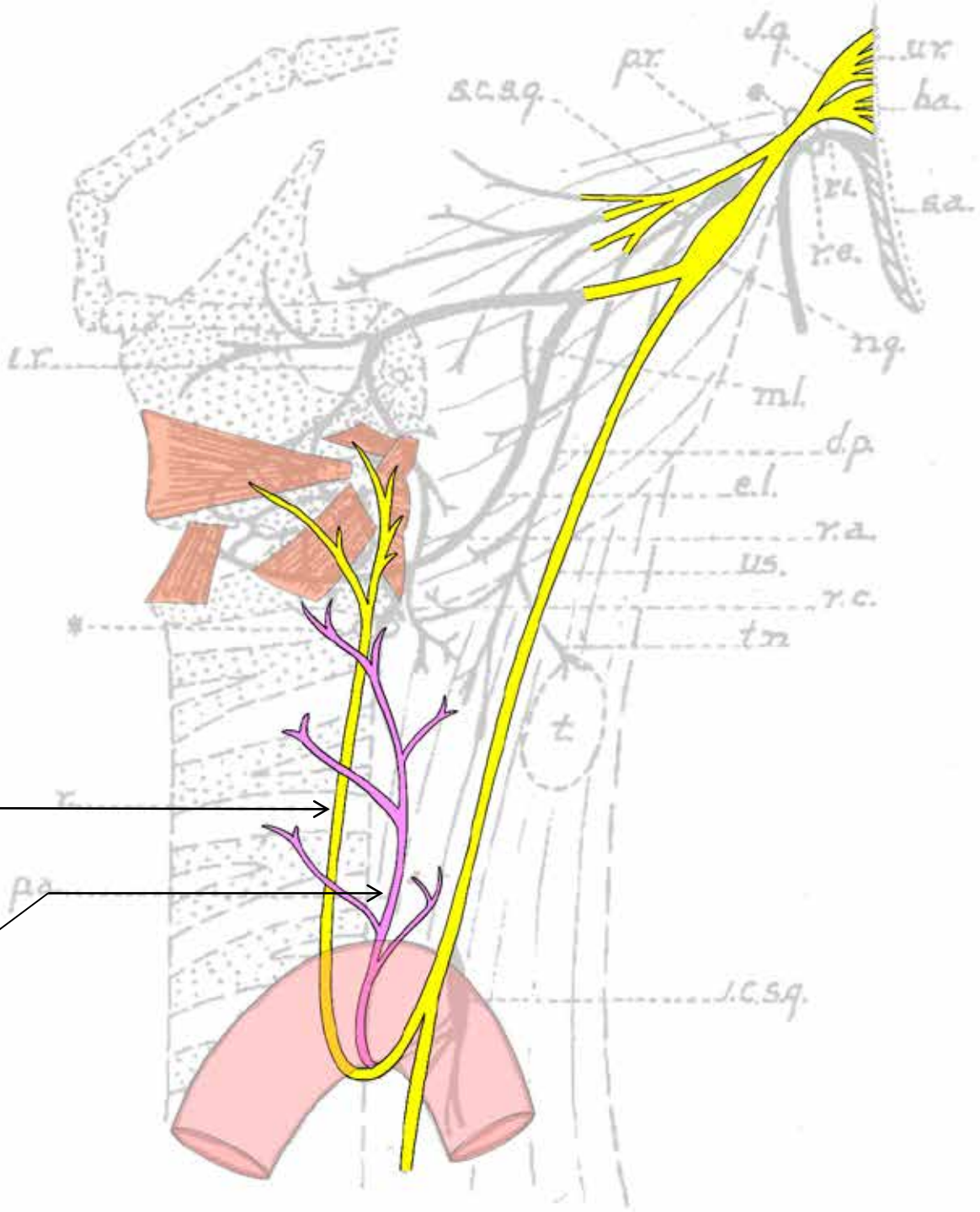


Innervation of the larynx and trachea in a dog, modified from Lemere (1932: fig. 1)



recurrent laryngeal N (to larynx only)

Innervation of the larynx and trachea in a dog, modified from Lemere (1932: fig. 1)

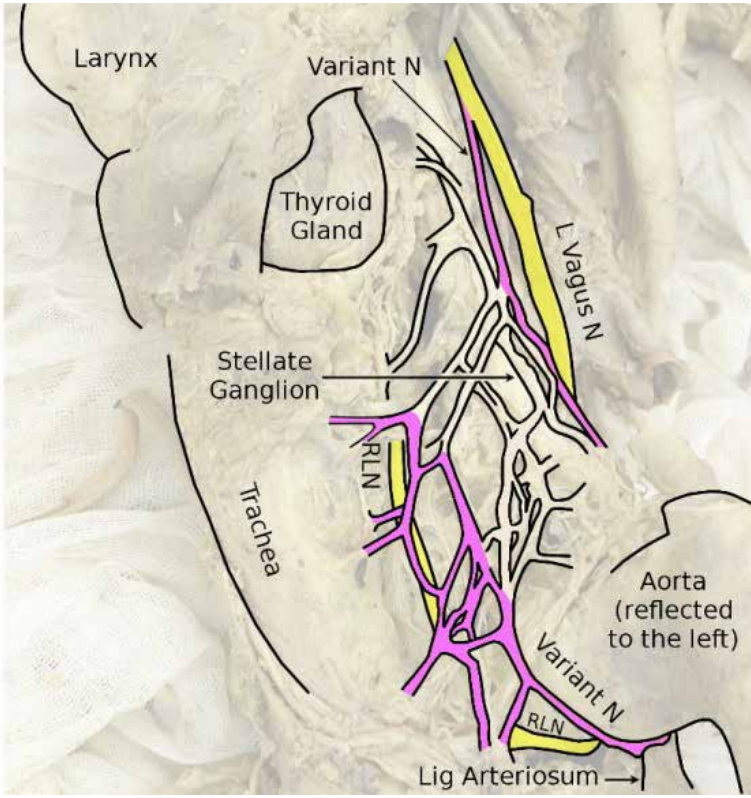


recurrent laryngeal N
(to larynx only)

pararecurrent N
(to esophagus/trachea)

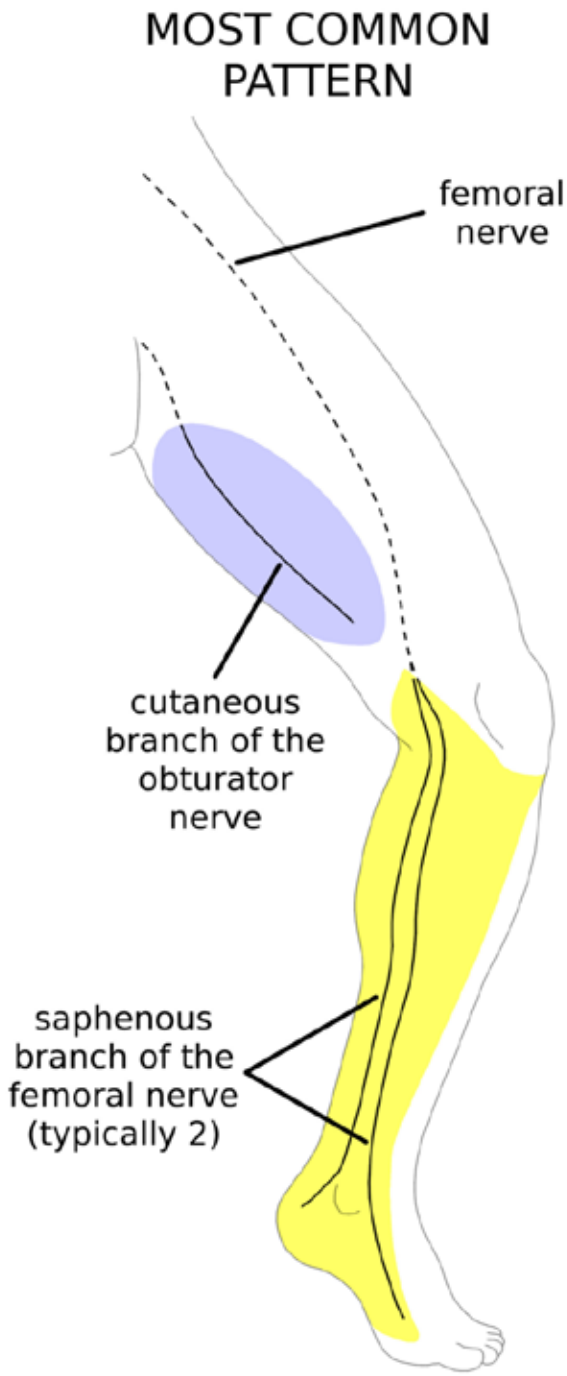
Why wasn’t the pararecurrent nerve in humans recognized sooner?

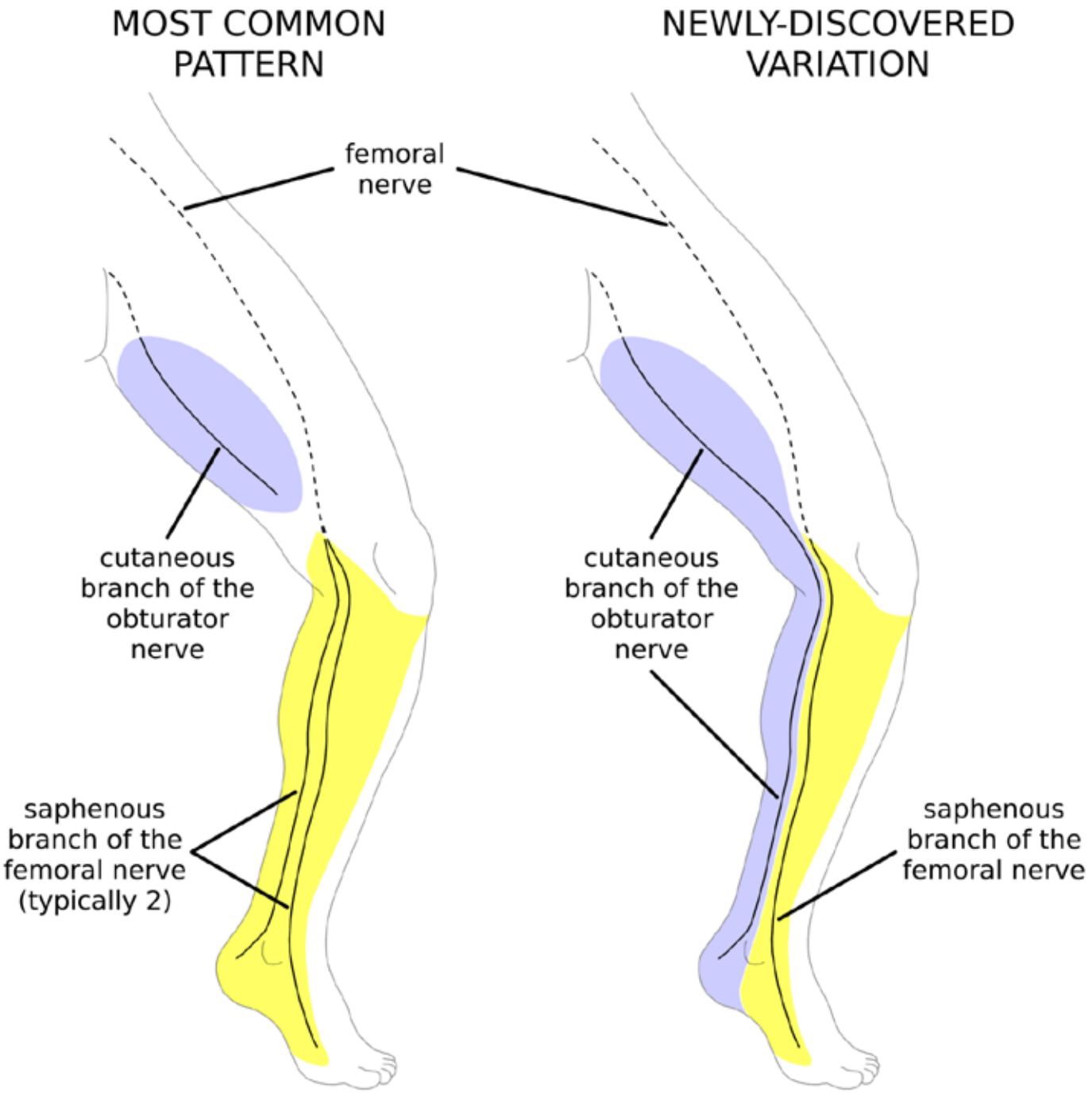
- Anatomically complex region
- Rarely dissected completely
- Known distractors in the same area



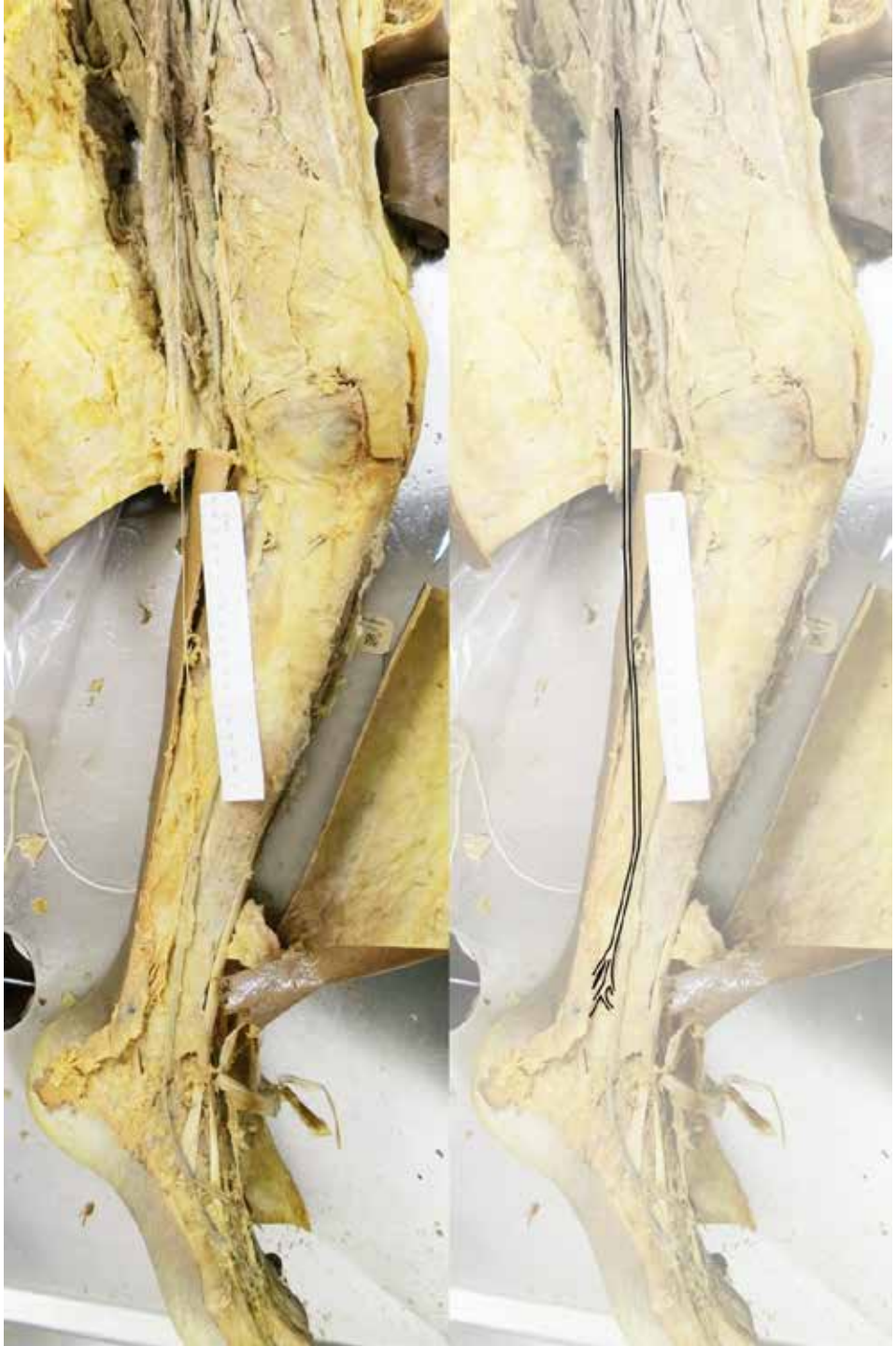
Case Study 3:

Long cutaneous branch of the obturator nerve

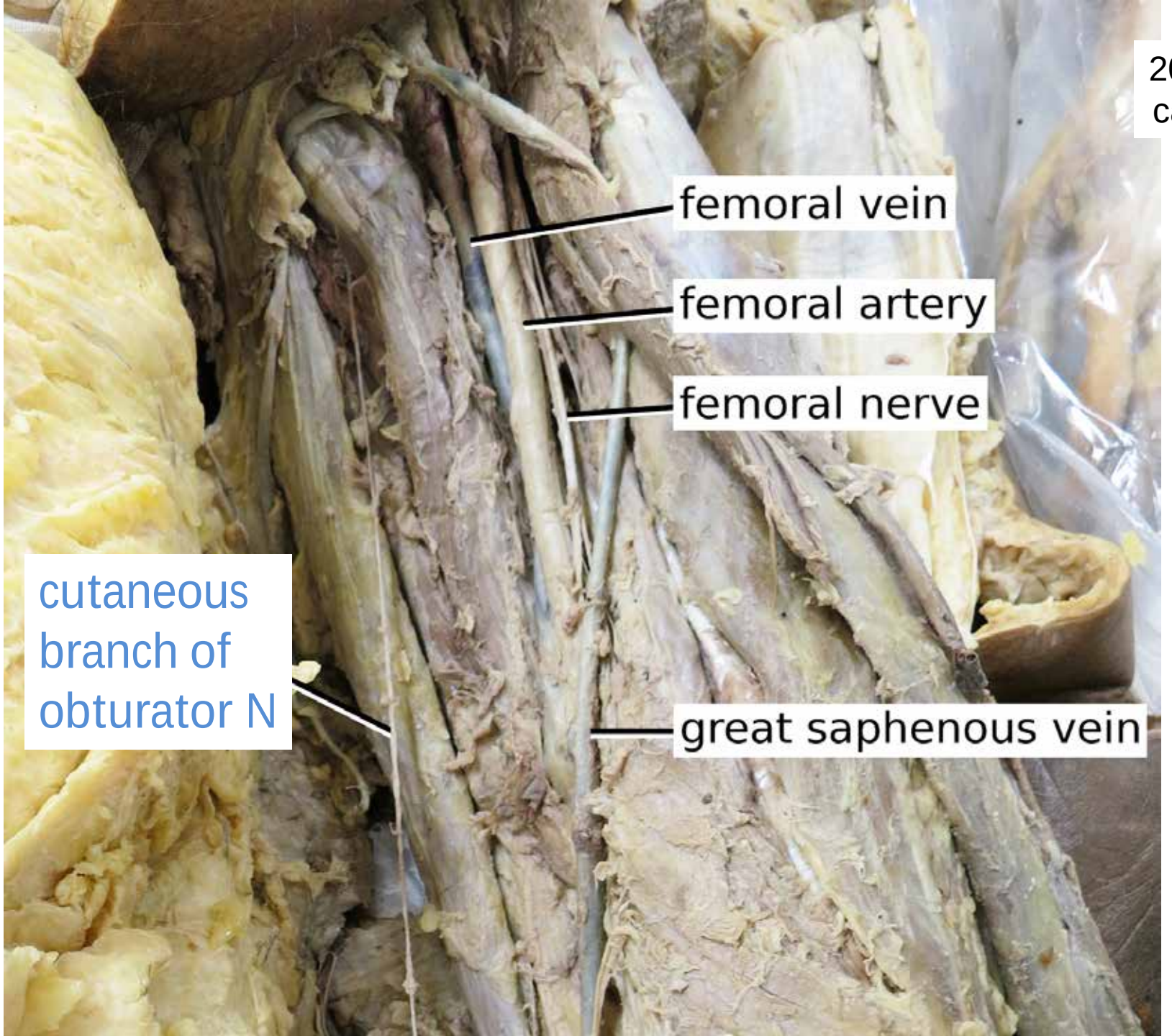

MOST COMMON PATTERN
femoral nerve
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve (typically 2)


MOST COMMON PATTERN
NEWLY-DISCOVERED VARIATION
femoral nerve
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve (typically 2)
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve

2013
case



Left lower limb in
anteromedial view

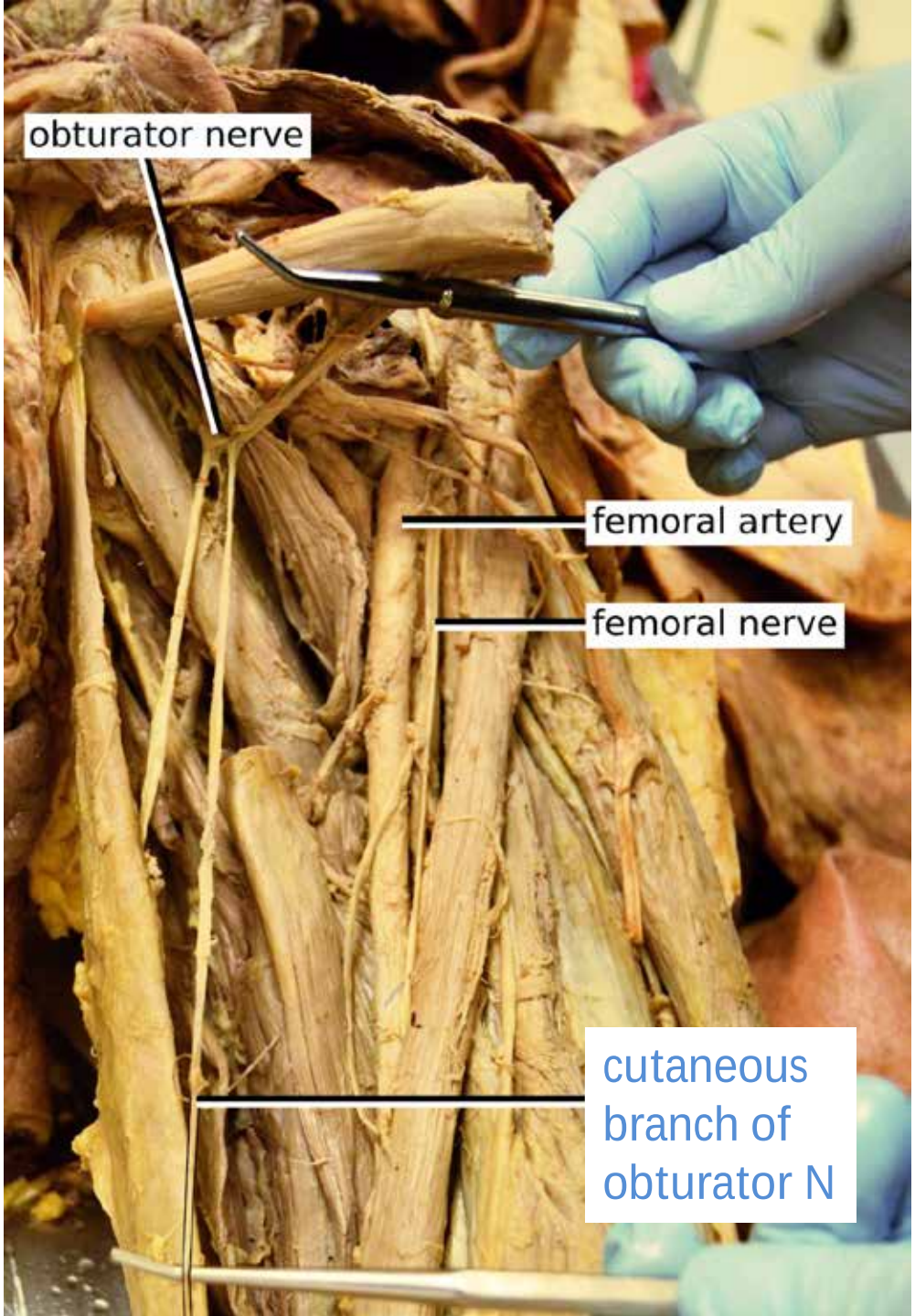

femoral vein
femoral artery
femoral nerve
cutaneous branch of obturator N
great saphenous vein

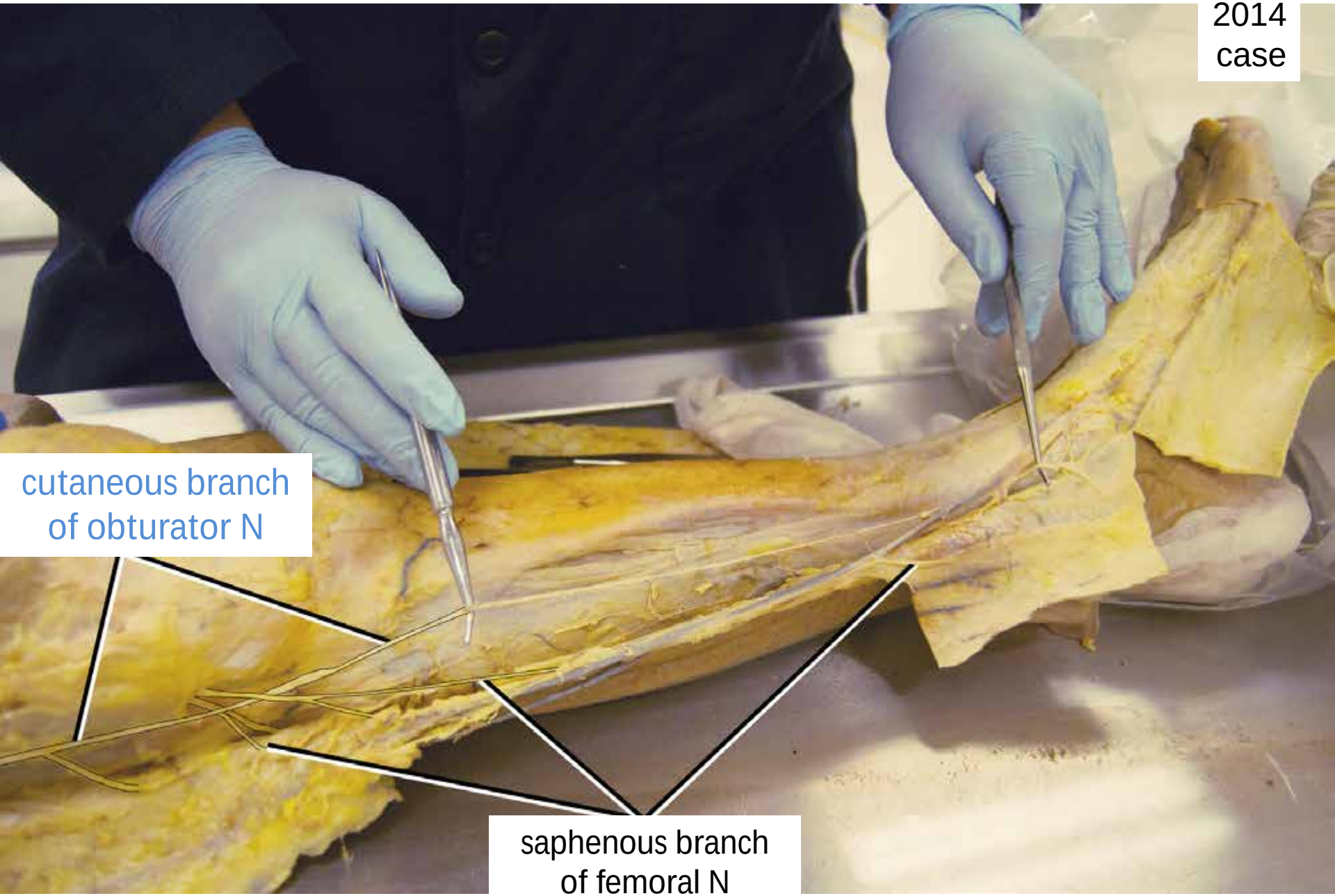
2013 case

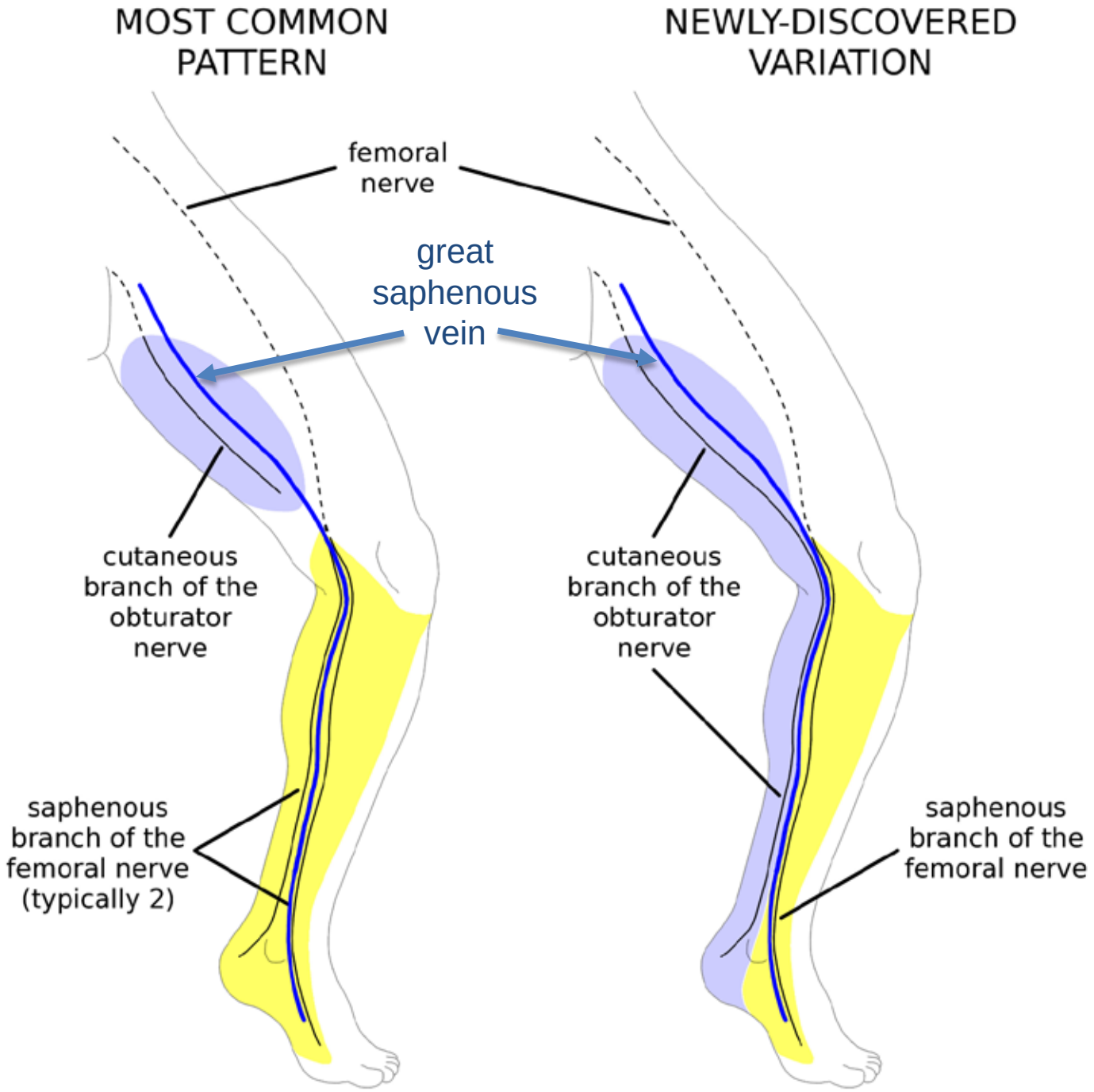
2014
case

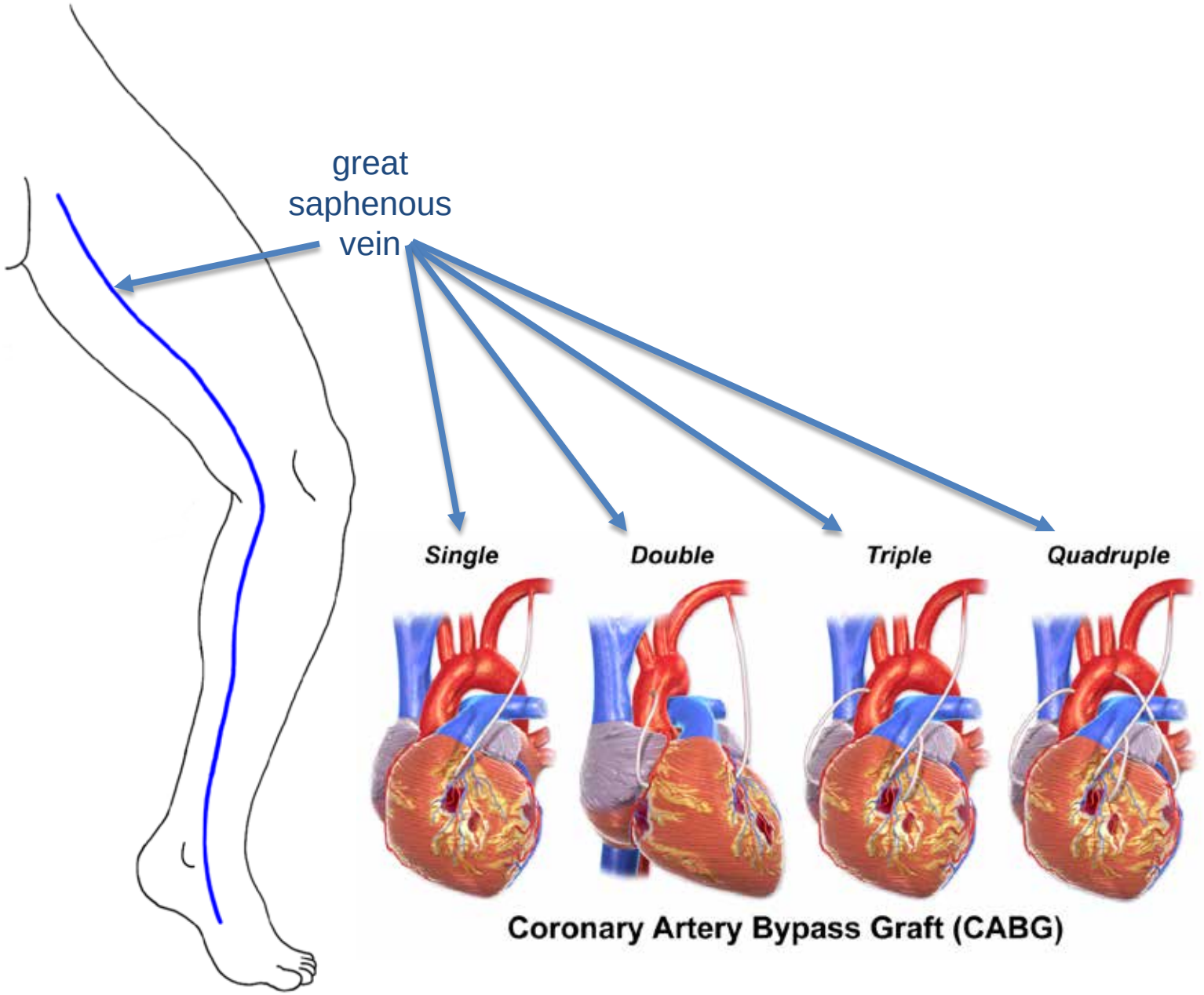
Left lower limb in
anteromedial view

2014
case

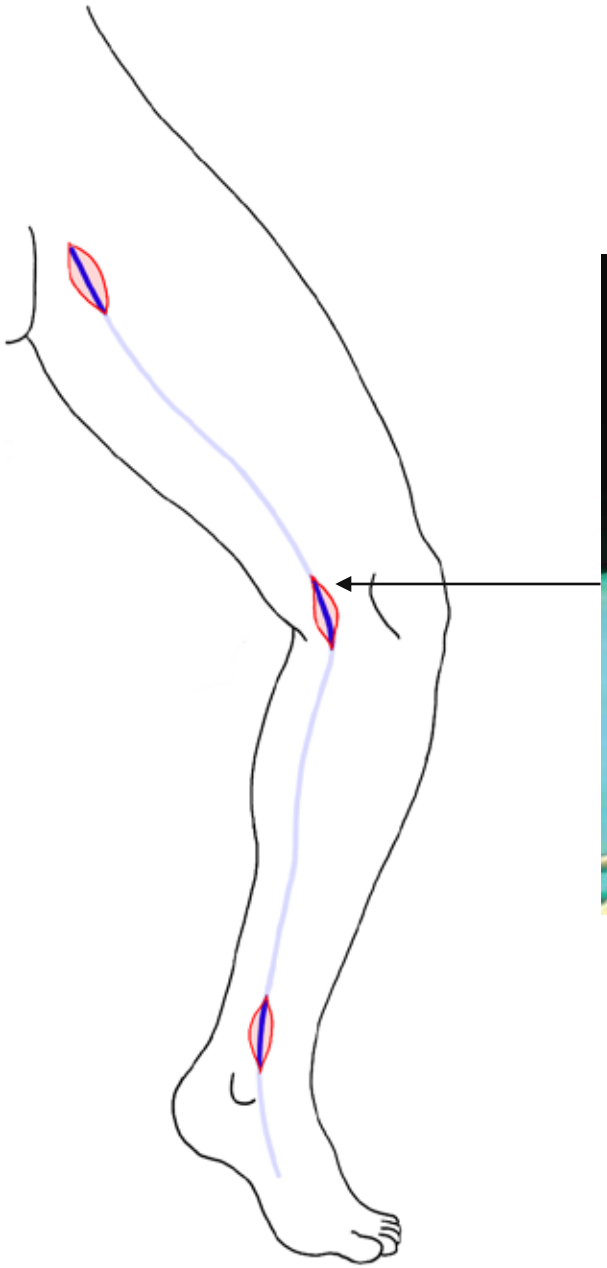

obturator nerve
femoral artery
femoral nerve
cutaneous branch of obturator N


2014
case
cutaneous branch
of obturator N
saphenous branch
of femoral N

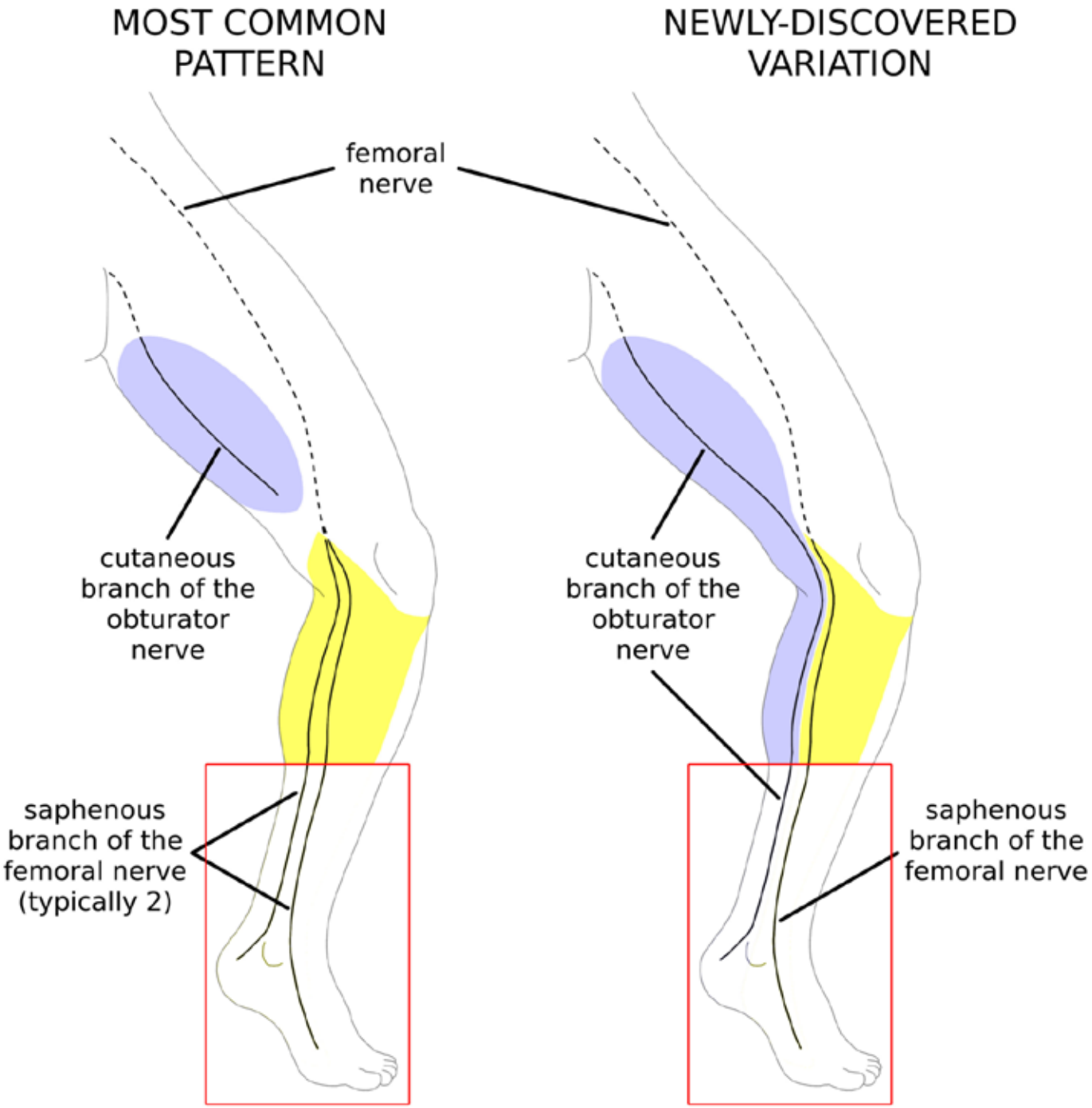

MOST COMMON PATTERN
NEWLY-DISCOVERED VARIATION
femoral nerve
great saphenous vein
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve (typically 2)
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve


great
saphenous
vein
Single
Double
Triple
Quadruple
Coronary Artery Bypass Graft (CABG)

Endoscopic vein harvesting

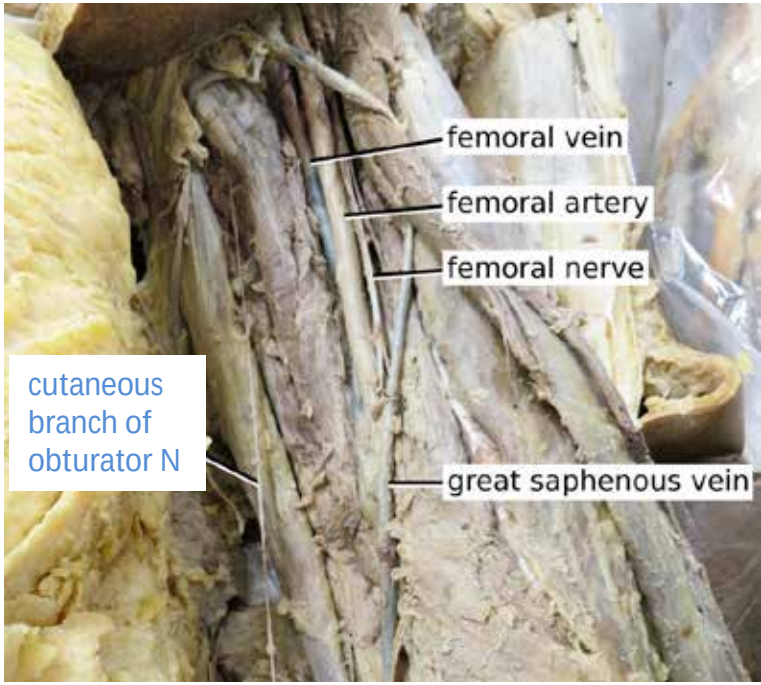


Elalfy et al. (2015: fig. 2)


MOST COMMON PATTERN
NEWLY-DISCOVERED VARIATION
femoral nerve
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve (typically 2)
cutaneous branch of the obturator nerve
saphenous branch of the femoral nerve

Why wasn’t the long obturator nerve recognized sooner?

- Challenging, fragile structure
- Rarely dissected completely
- Known distractors in the same area



Places to look for new discoveries in (human) anatomy

- Complex regions that are rarely dissected fully
  - joints, distal tendon insertions, nerve plexes
- Recent evolutionary changes from close relatives
  - e.g., pararecurrent nerve
- Opportunities for “replaced” structures
  - blood vessels, nerves (especially cutaneous nerves)

These principles probably work at least as well for non-human organisms as they work for humans!

Places to look for new discoveries in (human) anatomy

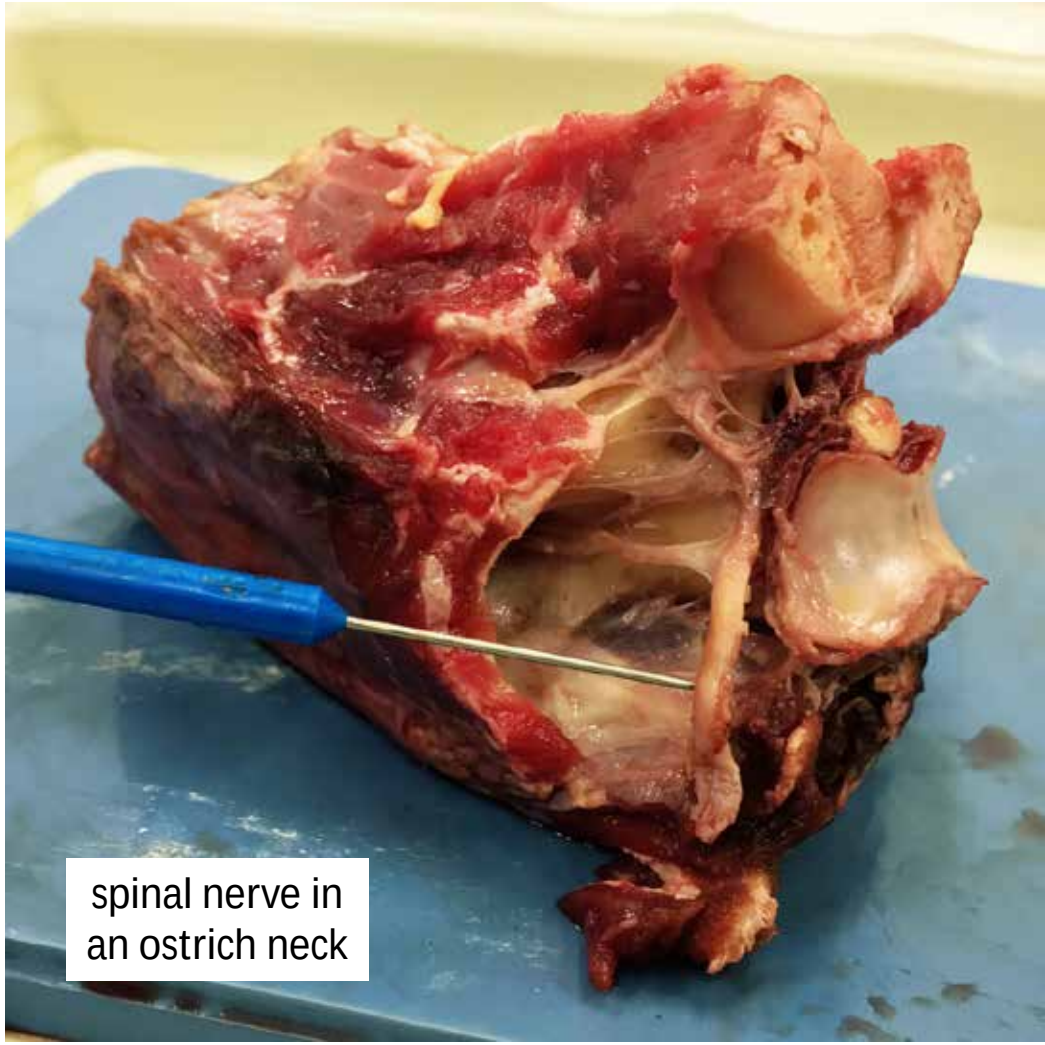
- Talk to surgeons (or other morphologists), ask them what they've seen that they didn't expect
- Get to know the literature and look where no-one else is looking

Alamosaurus sanjuanensis
BIBE 45885
Caudal neural arch
height 99mm

Astrophocaudia slaughteri
SMU 61732
Caudal 14
height 198mm

“I am firmly convinced that the best book in medicine is the book of Nature, as writ large in the bodies of men. You remember the answer of the immortal Hunter, when asked what books the student should read in anatomy – he opened the door of the dissecting-room and pointed to the tables.”

— Sir William Osler, 1901



spinal nerve in an ostrich neck

Acknowledgments

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- Niña McCoy, WesternU Willed Body Donation Program
- WesternU Institutional Review Board