Lab 22: Prosection lab: Pelvic Skeleton, Pelvic Cavity, and Pelvic Vessels; Perineum

Students:

- **Unlike most lab sessions, which are dissection-based, this session is a "prosection lab."**
- Assemble in 5 groups, each having ~16 members.
- There are 5 learning stations situated around the labs. Pick a station to start at.
- Groups will spend about 25 minutes at each station, rotating around the labs until they have visited all the stations.
- Use the checklists provided to make sure you have identified all the relevant structures.

LAB 22 NAVIGATION

Lab 22, Introduction: Pelvic Skeleton, Pelvic Cavity, and Pelvic Vessels; Perineum

Lab 22, Station 1: Pelvic Skeleton and Ligaments

Lab 22, Station 2: Pelvic Cavity and Anal Triangle of Perineum

Lab 22, Station 3: Female Perineum (Urogenital Triangle)

Lab 22, Station 4: Male Perineum (Urogenital Triangle)

Lab 22, Station 5: Overview: Pelvic Organs and Vessels

Lab 22, Station 1: Pelvic Skeleton and Ligaments

COMPLETE ANATOMY

Hip bone

Pelvic Skeleton (Pelvic Girdle): Two Hip Bones + Sacrum

- [ ] **Hip bone (coxal bone)** = Composed of three fused bones: **Ilium** + **Ischium** + **Pubis**

Features of pelvic skeleton as a whole:

- [ ] **Greater sciatic notch**
- [ ] **Lesser sciatic notch**
- [ ] **Obturator foramen** (covered by a membrane in a living person)
- [ ] **Acetabulum**
- [ ] **Ischiopubic ramus = inferior pubic ramus + ramus of ischium**
- [ ] **Pubic arch**
- [ ] **Pelvic inlet** (superior pelvic aperture)
- [ ] **Pelvic brim**: The bony ridge around the pelvic skeleton that defines the borders of the pelvic inlet
- [ ] **Pelvic outlet** (inferior pelvic aperture)

(tap images to enlarge)

Figure 1. Pelvic skeleton, anterior view.

Figure 2. Pelvic skeleton, superior view.

Figure 4. Hip bone, anterior view.

Figure 5. Hip bone, medial view.

Figure 6. Hip bone, lateral view.

Pubis

- ☐ **Pubic crest**
- ☐ **Pubic tubercle**
- ☐ **Superior pubic ramus**
- ☐ **Inferior pubic ramus**

Ischium

- [ ] Ischial tuberosity
- [ ] Ischial spine
- [ ] Lesser sciatic notch

Ilium

- [ ] Ala ("wing")
- [ ] Iliac crest
- [ ] Iliac fossa
- [ ] Anterior superior iliac spine
- [ ] Anterior inferior iliac spine
- [ ] Posterior superior iliac spine
- [ ] Posterior inferior iliac spine

Sacrum: 5 fused vertebrae

COMPLETE ANATOMY

Sacrum

- [ ] Pelvic surface
  - [ ] Anterior sacral foramina
- [ ] Dorsal surface
  - [ ] Posterior sacral foramina

- ☐ **Sacral canal and Sacral hiatus**
- ☐ **Promontory**
- ☐ **Ala** (left and right)

Coccyx (tail bone): 3 or 4 vertebrae fused into one or two pieces

Figure 7.

Comparison of Male and Female Bony Pelves

Bony Pelvis	Male (♂)	Female (♀)
General structure	Thick and heavy	Thin and light
Greater pelvis (false pelvis)	Deep	Shallow
Lesser pelvis (true pelvis)	Narrow and deep, tapering	Wide and shallow, cylindrical
Pelvic inlet (superior pelvic aperture)	Heart-shaped, narrow	Oval and rounded; wide
Pelvic outlet (inferior pelvic aperture)	Comparatively small	Comparatively large
Pubic arch and subpubic angle	Narrow (<70°)	Wide (>80°)
Obturator foramen	Round	Oval
Acetabulum	Large	Small
Greater sciatic notch	Narrow (~70°); inverted V	Almost 90°

Figure 8.

Ligaments of the Pelvic Skeleton (Study on the Model)

- ☐ **Sacrotuberous ligament**
- ☐ **Greater sciatic foramen (What are its boundaries?)**
- ☐ **Sacrospinous ligament**
- ☐ **Lesser sciatic foramen (What are its boundaries?)**
- ☐ **Anterior and posterior sacroiliac ligaments** (reinforce the sacroiliac joints)
- ☐ **Pubic symphysis** (contains an **interpubic disc** made of cartilage)

COMPLETE ANATOMY

Pelvic ligaments

QUESTION

A "symphysis" is a cartilaginous joint. What type of cartilage is found in a symphysis? Where else have we encountered a symphysis in the body? [Think spine.]

Figure 8. Pelvic skeleton and ligaments.

Figure 9. Midsagittal view of right hemi-pelvis.

CHECKLIST, LAB #22

CHECKLIST ITEMS AT EACH OF THE FIVE STATIONS ARE INDICATED BY CHECKBOXES.

Lab 22, Station 2: Pelvic Cavity and Anal Triangle of Perineum

COMPLETE ANATOMY

Muscles of the pelvic cavity

Pelvic Cavity

The **pelvic cavity** is below the **pelvic brim**, within the confines of the pelvic skeleton. It is continuous with the abdominal cavity above = the abdominal and pelvic cavities communicate via the **pelvic inlet**. The pelvic cavity is closed below by the muscular **pelvic diaphragm**.

Walls of Pelvic Cavity

- ✓ **Anterior = Bone** (pubic bones and pubic symphysis)
- ✓ **Posterior** = Bone (sacrum)
- ✓ **Postero-lateral** = Muscles (**obturator internus** and **piriformis**)
- ✓ **Floor** = Muscle (**pelvic diaphragm**)

QUESTION

Does the pelvic cavity have a roof?

Muscles in the Postero-Lateral Wall

Study the **muscles of the pelvic wall** and the **pelvic diaphragm** on the *models* and *hemisected prosection*.

- ☐ **Piriformis muscle**
  - ☐ Originates from the anterior sacrum
  - ☐ Exits the pelvic cavity through the **greater sciatic foramen**; inserts on the **greater trochanter of the femur**

QUESTION

What is the function of the piriformis?

- ☐ **Obturator internus muscle**
  - ☐ Fan-shaped muscle; has a broad origin from the pelvic surface of the pubic bone and from the obturator membrane. See Figure 11.
  - ☐ Narrows to a tendon that leaves the pelvic cavity through the **lesser sciatic foramen**; Inserts on **greater trochanter of the femur**
  - ☐ Only the upper half of the muscle is visible in the lateral pelvic wall (it is visible above the **tendinous arch of the levator ani muscle**); the lower half is in the lateral wall of the perineum.

QUESTION

What is the function of the obturator internus?

Figure 10.

Figure 11.

Floor of the Pelvic Cavity = Pelvic Diaphragm

Pelvic diaphragm: Has two parts = Levator ani and Coccygeus (see Figures 13 and 14).

- **Levator ani muscle**
  - Three named portions: **Pubococcygeus**, **iliococcygeus**, and **puborectalis**
  - The levator ani is like a hammock in the pelvic floor—it slopes downward from lateral to medial, where its left and right halves meet in the midline.
  - Its lateral bony attachments are to the **spine of the ischium** posteriorly and the **pubic bone** anteriorly.
  - Between these bones, the levator ani attaches along a curved line of pelvic fascia called the **tendinous arch**. The tendinous arch crosses the **obturator internus** muscle.
- **Coccygeus muscle—**stretches from the spine of ischium to the coccyx

✓ The pelvic diaphragm is the floor of the pelvic cavity

✓ The pelvic diaphragm is the roof of the perineum

✓ ***The perineum is therefore outside and below the pelvic cavity.***

Figure 13. Superior view: The pelvic diaphragm is in the floor of the pelvic cavity.

Figure 14. Inferior view of pelvic diaphragm.

QUESTION

What are the functions of the pelvic diaphragm? How does the orientation of the pelvic diaphragm relate to its function? What could happen if the pelvic diaphragm were weak?

The **puborectalis muscle** forms a sling around the **anorectal junction** and its contraction produces the **anorectal (perineal) flexure**. Two consequences:

1. Closure of the anorectal junction aids in fecal continence—preventing defecation.
2. Contraction during defecation regulates the size of the feces passed.

Figure 15.

Anal Triangle

NOTE

The anal triangle is the posterior part of the perineum.

COMPLETE ANATOMY

Anal triangle

REVIEW

The perineum is diamond-shaped. It has two triangles. What are their names?

We will view the anal triangle in a prone donor. It is helpful to have a model of the perineum handy and to place the model in the same position.

Contents of the Anal Triangle

- ☐ **Anal canal and Anus**: The anal canal is the terminal part of the alimentary canal; the anus is its external orifice.
- ☐ **External anal sphincter**: **Is this composed of skeletal or smooth muscle?**
- ☐ **Ischio-anal fossae** (left and right): See Figure 16.

Gilroy, Atlas of Anatomy, 3rd ed., Fig. 19.14 A, Illustrator: Wesker/Voll,
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Figure 16. Anal triangle. The fat pads in the ischio-anal fossae have been removed.

- **Boundaries of the ischio-anal fossae:**
  - ✓ **Roof:** The sloping inferior surface of the pelvic diaphragm
  - ✓ **Floor:** Skin
  - ✓ **Medial:** Anal canal and external anal sphincter
  - ✓ **Lateral:** Obturator internus muscle
  - ✓ **Anterior:** Communicates with the deep perineal pouch in the urogenital triangle
  - ✓ **Posterior:** Gluteus maximus muscle and sacrotuberous ligament
- The ischio-anal fossae contain large fat pads. **What is their function?**
- In the lateral wall of the ischio-anal fossa are the **pudendal nerve** and **internal pudendal vessels**. These traverse the ischio-anal fossa in a fascia-lined tunnel called the **pudendal canal** (Alcock's canal). See Figure 17.

QUESTION

Which spinal nerves give rise to the pudendal nerve?

QUESTION

Where does the internal pudendal artery arise? Where does the internal pudendal vein drain?

Figure 17. The pudendal nerve and internal vessels traverse the ischio-anal fossa within the pudendal canal, in the lateral wall of the fossa.
Coronal section = The ischio-anal fossae (filled with fat) are indicated with **asterisks**.

CHECKLIST, LAB #22

CHECKLIST ITEMS AT EACH OF THE FIVE STATIONS ARE INDICATED BY CHECKBOXES.

Lab 22, Station 3: Female Perineum (Urogenital Triangle)

COMPLETE ANATOMY

Female perineum

QUESTION

What are the boundaries of the perineum? What are its triangles called? (See Figure 18.)

This station covers the female **urogenital (UG) triangle**. The **anal triangle** has a similar construction in both sexes—it is covered at Station 2.

- ✓ The UG triangle contains: (1) the **external genitalia (vulva)** and (2) two fascia-lined spaces: **superficial and deep perineal pouches**.
- ✓ The external genitalia (vulva) are located on the surface of the UG triangle.

Identify these on an undissected donor and models:

- ☐ **Mons pubis**
- ☐ **Labia majora**
- ☐ **Pudendal cleft** (the space between the labia majora)
- ☐ **Labia minora**

  Superiorly, the labia minora split into two parts around the clitoris:

  - ☐ **Prepuce of clitoris** (fusion of labia minora above the clitoris— forms a "hood" over the clitoris)
  - ☐ **Frenulum of clitoris** (fusion of the labia minora below the clitoris)

- ☐ **Frenulum of the labia minora** = the union of the two labia minora inferiorly (clinicians call this the **Fourchette**)
- ☐ **Clitoris: Crura, body and glans** (the body is under the prepuce, the crura are attached to the ischiopubic rami—see Figure 21)
  - ☐ The body of the clitoris contains two erectile bodies = the **corpora cavernosa**. Their distal parts taper down to form the **crura**.
- ☐ **Vestibule** (the cavity between the labia minora)—Within the vestibule are these openings:
  - ☐ **External urethral orifice**
  - ☐ **Vaginal orifice** (aka = **Introitus**)

Figure 21. Parts of clitoris.

Superficial Perineal Pouch

The boundaries of the superficial pouch were covered in the large-group session. It doesn't hurt to review them again:

- ✓ **Floor:** Superficial perineal fascia (Colle's Fascia)
- ✓ **Roof:** Perineal membrane (a robust layer of deep fascia)
- ✓ **Lateral:** Ischiopubic rami
- ✓ **Anterior** (apex of triangle): Pubic symphysis
- ✓ **Posterior** (base of triangle): Line between ischial tuberosities—the fascias of the UG triangle fuse here

Contents of the female superficial perineal pouch (donor and models):

- ☐ **Bulbs of the Vestibule**: Paired, elongated erectile bodies on each side of the vaginal orifice
- ☐ **Greater vestibular (Bartholin's) glands**: Lie on each side of the vestibule at 4:00 and 6:00 positions—their ducts empty into the vestibule adjacent to the vaginal orifice. **What is their function?**
- ☐ **Ischiocavernosus muscles**: Cover the crura of the clitoris
- ☐ **Bulbospongiosus muscles**: Cover the bulbs of the vestibule
- ☐ **Superficial transverse perineal muscles**

NOTE

[Muscles in the UG triangle are not well developed in most cadavers.]

Figure 22. Contents of superficial perineal pouch in female.

- [ ] Although it is on the border between the UG and anal triangles, identify the location of the **perineal body.**

QUESTION

Why is the perineal body a structurally important landmark? It is larger and clinically more important in females.

CHECKLIST, LAB #22

CHECKLIST ITEMS AT EACH OF THE FIVE STATIONS ARE INDICATED BY CHECKBOXES.

Figure 18. Female perineum showing its triangles.

External Genitalia (Vulva)

Figure 19. External genitalia of female.

Figure 20. Location of Bartholin's gland.

Lab 22, Station 4: Male Perineum (Urogenital Triangle)

COMPLETE ANATOMY

Male perineum

This station covers the **male urogenital triangle**. The **anal triangle** has a similar construction in both sexes—it is covered at Station 2.

- ✓ As in the female, the UG triangle contains: (1) the **external genitalia** and (2) two fascia-lined spaces: **superficial and deep perineal pouches**.

Figure 23. Surface anatomy of male perineum.

Male External Genitalia

Identify these structures on the cadaver:

- ☐ **Scrotum and scrotal raphe** (*raphe = seam*; where two halves come together)
- ☐ **Penis** (the penis has three parts: **Root, body, and glans**—the latter two are visible externally)
  - ☐ **Body (shaft)**
  - ☐ **Glans and corona of glans**
  - ☐ **Surfaces of penis: Dorsal and urethral**
  - ☐ **Prepuce (foreskin) of penis** (if present)
  - ☐ **External urethral orifice**

On the dorsal surface of the penis (from lateral to medial):

- ☐ **Dorsal nerves of penis (2)**
- ☐ **Dorsal arteries of penis (2)**
- ☐ **Deep dorsal vein of penis (1)**

NOTE

The clitoris has these structures on its dorsal surface too, but they are smaller and harder to identify.

Figure 24. External genitalia of the male.

Cross Section of Penis

COMPLETE ANATOMY

Cross-section of the penis

Identify the following in a cross-section of the body of the penis:

- ☐ The body of the penis contains three erectile bodies: **Corpora cavernosa (2) and Corpus spongiosum**
- ☐ **Spongy urethra**: Within the corpus spongiosum
- ☐ **Deep arteries of penis**: In the center of the corpora cavernosa. (Note: The corpora cavernosa of the clitoris also contain **deep arteries**.)
- ☐ The erectile bodies have a capsule called the **tunica albuginea**
- ☐ **Deep penile fascia (Buck's fascia)**: Surrounds the erectile bodies and binds them together

Figure 25. Cross section of penis.

Figure 26. Parts of the penis.

Superficial Perineal Pouch

The boundaries of the superficial pouch were covered in the large-group session. It doesn't hurt to review them again:

- ✓ **Floor**: Superficial perineal fascia (Colle's Fascia)
- ✓ **Roof**: Perineal membrane (a robust layer of deep fascia)

- ✓ **Lateral**: Ischiopubic rami
- ✓ **Anterior** (apex of triangle): Pubic symphysis
- ✓ **Posterior** (base of triangle): Line between ischial tuberosities—the fascias of the UG triangle fuse here

Contents of the male superficial perineal pouch (donor and models):

- ☐ **Root of the penis:**
  - ☐ **Crura (2)** (these are the proximal parts of the corpora cavernosa—they attach to the ischiopubic rami)
  - ☐ **Bulb of the penis** (expanded proximal part of the corpus spongiosum—attached to the perineal membrane)
- ☐ **Ischiocavernosus muscles** (cover the crura)
- ☐ **Bulbospongiosus muscles** (two muscles, but they are fused in a midline raphe—they cover the bulb of the penis)
- ☐ **Superficial transverse perineal muscles**

Figure 27. Contents of superficial perineal pouch in male.

QUESTION

What is the male counterpart of the female greater vestibular (Bartholin's) glands? Are these located in the male superficial perineal pouch?"

Figure 28. Contents of superficial perineal pouch in both sexes.

CHECKLIST, LAB #22

CHECKLIST ITEMS AT EACH OF THE FIVE STATIONS ARE INDICATED BY CHECKBOXES.

Lab 22, Station 5: Overview: Pelvic Organs and Vessels

This station is an overview of organs and vessels in the pelvis. This is a review of structures we dissected and studied way back in the previous year!

COMPLETE ANATOMY

Female pelvic organs

COMPLETE ANATOMY

Male pelvic organs

Pelvic Organs

Identify the following organs in the female:

- ☐ **Urinary bladder**
- ☐ **Rectum**
- ☐ **Uterus: Fundus, body, cervix, external os**
- ☐ **Fallopian (uterine) tube: Isthmus, ampulla, infundibulum, fimbriae**
- ☐ **Ovaries**
- ☐ **Broad ligament: Mesometrium, mesos-alpinx, mesovarium**
- ☐ **Round ligament of uterus**
- ☐ **Recto-uterine pouch (pouch of Douglas)**
- ☐ **Vesico-uterine pouch**

Identify the following organs in the male:

- ☐ **Urinary bladder**
- ☐ **Rectum**
- ☐ **Prostate**
- ☐ **Seminal vesicles**
- ☐ **Ductus deferens** (pelvic portion)
  - ☐ Recall that the distal end of each ductus deferens joins the duct of the seminal vesicle to form the **ejaculatory duct**. Where does the ejaculatory duct empty? Where is the origin of the ductus deferens proximally? Trace the pathway of sperm through the male genital duct system.
- ☐ **Male urethra**—has three parts: **Prostatic, intermediate, spongy**
- ☐ **Recto-vesical pouch**

Pelvic Vessels

☐ Identify the **common iliac**, **internal iliac**, and **external iliac arteries**.

QUESTION

What becomes of the external iliac artery distal to the inguinal ligament?

Identify the following branches of the **internal iliac artery**.

NOTE

The branches are highly variable—trace them to their destinations to identify them.

From the posterior division:

- ☐ **Iliolumbar artery**: Ascends over the pelvic brim to the lower lumbar region
- ☐ **Lateral sacral arteries**: Pass into the anterior sacral foramina
- ☐ **Superior gluteal artery**: Exits the pelvic cavity through the greater sciatic foramen ABOVE the piriformis muscle

COMPLETE ANATOMY

Posterior division of internal iliac artery

From the anterior division:

- ☐ **Umbilical artery:**
  Prenatally, the umbilical arteries conduct oxygen-poor blood from the fetus to the placenta for oxygenation and nutrient replenishment. In the fetus, the paired umbilical arteries ascend on the internal abdominal wall to the umbilicus.
  - ☐ The proximal part is called the **patent part** (it transmits blood)—**superior vesical arteries** to the bladder branch from the patent part
  - ☐ The part distal to the superior vesical arteries obliterates after birth. Postnatally, the obliterated part of the umbilical arteries are called the **medial umbilical ligaments**. They can be traced upwards to the umbilicus.
- ☐ **Obturator artery**: Trace it to the obturator canal in the obturator membrane
- ☐ **Inferior gluteal artery**: Exits the greater sciatic foramen BELOW the piriformis muscle
- ☐ **Internal pudendal artery**: Exits the greater sciatic foramen below the piriformis muscle (with the inferior gluteal artery); the major blood supply to the perineum

- [ ] **Uterine artery** (in female): As it approaches the cervix, it crosses over the ureter ("Bridge over Water")
- [ ] **Middle rectal artery**: Often branches from the internal pudendal artery

COMPLETE ANATOMY

Anterior division of internal iliac artery

CHECKLIST, LAB #22

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