Pelvis and Contents

Reproductive Organs and System
Bony Pelvis

- 2 Pelvic = Coxal = Innominate bones fused together
- Each Pelvic bone
  - Ilium
  - Ischium
  - Pubis
  - 3 parts join to form acetabulum
- Sacrum and Coccyx help create pelvis and form pelvic cavity
- Function
  - attaches lower limb to axial skeleton
  - supports viscera
  - transmits weight of upper body

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Use lab work to learn bony landmarks of pelvis
Contents of Pelvic Cavity

- **True Pelvis**
  - below pelvic brim
  - space contains
    - part colon
    - rectum
    - bladder
    - uterus/ovaries (females)

- **False Pelvis**
  - iliac blades
  - above pelvic brim
  - contains abdominal organs
  - attachment for muscles + ligaments to body wall

- **Pelvic Diaphragm** = levator ani + coccygeus m
### Sexual Dimorphism in Pelvis

<table>
<thead>
<tr>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cavity is broad, shallow</td>
<td>- Cavity is narrow, deep</td>
</tr>
<tr>
<td>- Pelvic inlet oval + outlet round</td>
<td>- Smaller inlet + outlet</td>
</tr>
<tr>
<td>- Bones are lighter, thinner</td>
<td>- Bones heavier, thicker</td>
</tr>
<tr>
<td>- Pubic angle larger</td>
<td>- Pubic angle more acute</td>
</tr>
<tr>
<td>- Coccyx more flexible, straighter</td>
<td>- Coccyx less flexible, more curved</td>
</tr>
<tr>
<td>- Ischial tuberosities shorter, more everted</td>
<td>- Ischial tuberosities longer, face more medially</td>
</tr>
</tbody>
</table>
Sexual Dimorphism in Pelvis

Male pelvis

Female pelvis

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Perineum

- Diamond-shaped area between
  - Pubic symphysis (anteriorly)
  - Coccyx (posteriorly)
  - Ischial tuberosities (laterally)
- Males contain
  - Scrotum, root of penis, anus
- Females contain
  - External genitalia, anus
Development of Reproductive Organs

- **Gonadal ridge**: Forms in embryo at 5 weeks
  Gives rise to gonads
  Male gonads = testis  Female gonads = ovaries
- Male and Female ducts are both present in early embryo, but only one set develops!
- **Wolffian ducts (Mesonephric):** form male ducts
  - vas deferens, epididymis
- **Mullerian ducts (Paramesonephric):** form female ducts
  - uterus, oviduct, vagina
External genitalia develops from same structures

- **Embryonic structure**
  - Male: Genital tubercle
  - Female: Labial major

- Labioscrotal swelling
  - Male: Scrotum
  - Female: Labia major

- Urethral folds
  - Male: Penile Urethra
  - Female: Labia minor

- Genital tubercle
  - Male: Penis
  - Female: Clitoris

Indifferent
Approximately 5 weeks
Male Development

• Male fetus
  – Testes descend partially at 3 months, finish at 7 months into scrotum
  – Vaginal Process: outpocketing of peritoneum forms tunica vaginalis
  – Gubernaculum: fibrous cord; attaches bottom of scrotum to testes
  – Testes Descent: partly due to shortening of gubernaculum, final descent due to testosterone and maybe increase in intra-abdominal pressure
Female Development

- Ovaries descend into pelvis
- **Vaginal process**: outpocketing of peritoneum guides descent
- **Gubernaculum**: guides descent of ovaries; attached to labia major
  - caudal portion = round ligament of uterus
  - cranial portion = ovarian ligament
Puberty: period where reproductive organs grow and can reproduce

- **Females = around 11**
  - breasts enlarge
  - increase subcutaneous fat in hips and breasts
  - hair in pubic and axillary region
  - oily skin
  - menstruation (1-2 years later)

- **Males = around 13**
  - scrotum + testes enlarge
  - enlargement of larynx
  - increase in body size, musculature
  - hair in facial, pubic, axillary regions
  - oily skin
Reproductive System

Genitalia = sex organs
Primary = ovaries, testes
Secondary = glands, ducts, external genitalia

Female

Male

pg 5
Male Reproductive System

- **Primary Sex Organs**
  - testes

- **Accessory Sex Organs**
  - **External Genitalia**
    - penis
    - scrotum
  - **Ducts**
    - Efferent ductules (epididymis)
    - vas deferens
    - ejaculatory duct
    - urethra
  - **Glands**
    - seminal vesicle
    - prostate
    - bulbourethral
Male Reproductive Anatomy

- **Scrotum**
  - sac of skin + superficial fascia
  - contains testes

- **Associated Muscles**
  - **Dartos**: inside skin of scrotum
    - wrinkles skin = warm
  - **Cremaster**: extends into scrotum from spermatic cord
    - Fibers from internal oblique
    - elevates testes = warm
    - lower testes = cool

- **Tunica vaginalis**: light sac
  - covering each testis

- **Tunica albuginea**: fibrous
  - deep to tunica vaginalis
  - divides testes into lobules

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Male Reproductive Anatomy:
Testes

- Seminiferous Tubules
  - make-up testes
  - location of spermatogenesis
  - Divided into lobules
- Tubulus Rectus
  - convergence of seminiferous tubules
- Rete Testis
  - network of branching tubes
  - leads to epididymis

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Male Reproductive Anatomy:

- **Epididymis**
  - Contains efferent ductules: tube from rete testis to duct of epididymis
  - gain ability to swim here
  - smooth muscle layer = ejaculation
  - epithelial layer lined w/stereocilia
    - resorb excess testicular fluid
    - transfer nutrients to sperm in lumen

- **Vas Deferens**
  - tube from duct of epididymis to ejaculatory duct
  - Vasectomy - cut vas deferens, close off end

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Cell Division

• Mitosis: cell division with chromosome duplication and division $\rightarrow$ 2 daughter cells = parent
  – Have **Diploid** = $2n$ number of chromosomes
  – Occurs in body (somatic) cells

• Meiosis = Reduction Division: cell division resulting in cells having half the number of chromosomes as parent
  – Have **Haploid** = $n$ number of chromosomes
  – Occurs in sex cells
Spermatogenesis: production of sperm

• Stem cells = Spermatogonia (2n)
• Undergo Mitosis
  – Type A spermatogonia = precursor cells (2n)
  – Type B spermatogonia = primary spermatocytes (2n)
• Primary spermatocytes undergo Meiosis I
  → 2 secondary spermatocytes (n)
• 2 Secondary spermatocytes (n) undergo Meiosis II
  → 4 spermatids (n)
• Spermiogenesis: maturation of spermatids into spermatozoa (sperm)
  – Head (acrosome), midpiece, tail
• Controlled by FSH (pituitary gl.), Testosterone (testes)
Within Seminiferous Tubules

- **Sustenacular (Sertoli) cells**: surround spermatogonia in lumen of seminiferous tubules
  - Provide nutrients to spermatogenic cells
  - Move cells toward tubule lumen
  - Secrete testicular fluid
  - Phagocytize cytoplasm shed by developing spermatids
  - Secrete Androgen-binding protein (concentrates testosterone)
  - Secrete **Inhibin**: hormone slows rate of sperm production

- **Blood-testis barrier**: sustenacular cells bound together by tight junctions to prevent escape of membrane antigens from sperm into blood

- **Myoid Cells**: layer around seminiferous tubules of smooth muscle

- **Interstitial (Leydig) Cells**: in loose CT between seminiferous tubules secrete androgens (male sex hormones)
Spermatogenesis: production of sperm
Spermatic Cord

Collective name for structures associated with the scrotum

- Passes through inguinal canal

- Includes
  - Vas Deferens
  - Testicular Arteries + Veins
  - Lymphatic vessels
  - Cremaster muscle fibers
  - Nerves

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Accessory Glands

• **Seminal vesicle** (paired)
  - posterior surface of bladder
  - contracts during ejaculation
  - empties into vas deferens
  - Functions
    - nourish sperm
    - stimulate uterine contractions
    - suppress immune response
    - enhance sperm motility
    - clot ejaculated semen once in vagina, then liquefy sperm to allow swim

• **Prostate**
  - inferior to bladder, anterior to rectum
  - encircles first part of urethra
  - contracts during ejaculation
  - Functions: clot, liquefy, motility
Accessory Glands

- Bulbourethral (paired)
  - inferior to prostate
  - within urogenital diaphragm
  - empties into spongy urethra
  - Function: produce mucous
    - neutralize urine in urethra
    - lubricate semen for passage
Penis

- Male external genitalia
- Function: delivers sperm into the female reproductive tract
- Anatomy
  - root = attached end
    - crura-anchored to pubic arch, covered by ischiocavernosus muscle
    - bulb-secured to urogenital diaphragm
  - shaft/body = free, not attached
  - glans penis = enlarged tip
  - prepuce = loose cuff around glans
  - spongy urethra = tube within penis

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Penis (continued)

• Erectile bodies
  – 3 long strips of erectile tissue around the spongy urethra
  – thick tube covered by dense CT and filled with smooth muscle, CT + vascular spaces
  – Corpus spongiosum
    • distally = glans penis
    • proximally = bulb of penis
    • midventral erectile body
  – Corpora cavernosa
    • proximally = root/crura of penis, covered by ischiocavernosus m.
    • paired, dorsal erectile bodies
    • make up most of mass

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Penis (continued)

• Arterial Supply = branches of Internal Pudendal (branch of internal iliac)

• Innervation = branches of Pudendal (from sacral plexus) provide sensory
  – Parasympathetic: engorgement of blood in erectile bodies = erection
  – Sympathetic: contraction of smooth muscle in ducts and glands and bulbospongiosum m = ejaculation
  – Above Autonomic from inferior hypogastric plexus
Female Reproductive System

- **Primary Sex Organs**
  - Ovaries = gonads

- **Accessory Sex Organs**
  - External Genitalia = vulva
    - Labia major + minor
    - Mons pubis
    - Clitoris
  - Ducts
    - Uterine tube = oviducts
    - Vagina
  - Glands
    - Greater vestibular gland
Female Reproductive Anatomy

- **Ovaries (paired)**
  - produce and store ova (eggs)
  - Produce estrogen
  - Tunica albuginea - surrounds each ovary
  - Germinal epithelium-external to tunica albuginea (= mesothelium)

- **Arterial Supply**
  - Ovarian & branches of uterine a.

- **Ligaments**
  - Ovarian ligament
    - connects ovaries to uterine wall (medial)
  - Suspensory ligament
    - connects ovaries to pelvic wall (lateral)
  - Broad ligament
    - supports uterus, oviducts
  - Round Ligament (part of broad)
    - Attaches uterus to labia majorum
Oogenesis: production of eggs (ova)

- **Stem cells = oogonia** undergo Mitosis
  - all of female’s oogonia produced while fetus
- Oogonia begin Meiosis I are called **primary oocytes** (2n)
- Meiosis I is stalled before birth
- During ovulation, Meiosis I completed and Meiosis II begins
- Once Meiosis II begins, primary oocytes now called **secondary oocytes** (n)
- Meiosis II is completed when sperm penetrates egg
- When Meiosis II is completed, secondary oocyte is now called **ovum** (egg)
- Meiosis II results in 1 ovum and 3 polar bodies (degenerate)
Oogenesis

**Meiotic Events**

**Before birth**
- Oogonium (stem cell)
- Mitosis
- Primary oocyte
- Growth
- Primary oocyte (arrested early in meiosis I) present at birth (ovary inactive)

**Childhood**
- Each month from puberty to menopause
- Primary oocyte (still arrested in meiosis I)

**Meiosis I** (completed by one primary oocyte each month)
- First polar body
- Secondary oocyte (arrested in meiosis II)
- Ovulation
- Sperm

**Meiosis II of polar body** (may or may not occur)
- Polar bodies (all polar bodies degenerate)
- Second polar body
- Meiosis II completed (only if sperm penetration occurs)
- Ovum

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• **Uterine Tubes = Oviducts = Fallopian Tubes**
  – from near ovaries to uterus
  – Run lateral (ovary) to medial (uterus)
  – **Infundibulum**: lateral, funnel-shaped portion
    • **Fimbriae** on edges
  – **Ampulla**: expanded portion medial to infundibulum
    • Usual site for fertilization
  – **Isthmus**: narrow medial portion
  – Visceral Peritoneum, Smooth Muscle, Ciliated Epithelium

• **Movement of Ova in Oviduct**
  – receives oocyte after ovulation
  – peristaltic waves
  – cilia lining tube
  – contains cells to nourish ova

• **Ectopic pregnancy**: implantation of zygote outside of uterus
Female Reproductive Anatomy
Female Reproductive Anatomy

• Uterus
  – 3 Layers
    • perimetrium
    • myometrium
    • endometrium
  – Anatomy
    • fundus
    • body
    • isthmus
    • cervix
  – Location
    • anterior to rectum
    • posterior to bladder

Vagina
  – Inferior to uterus
  – External adventitia
  – Muscularis
  – Mucosal rugae
  – vaginal orifice

• Hymen: extension of mucosa = incomplete wall
Female External Genitalia

- **Mons pubis**: fatty pad over pubic symphysis
- **Labia major**: fatty skin folds
- **Labia minor**: smaller, hairless folds inside labia major
  - Fourchette = junction of labia minora
  - Central tendon = perineal body
  - **Vestibule**: created by labia minor; opening for urethra and vagina
- **Clitoris**: superior to vestibule
  - crura, prepuce, corpus cavernosum
  - NO corpus spongiosum
- **Bulbs of Vestibule**: erectile tissue surrounding vaginal orifice
- **Greater vestibular glands**: either side of vaginal opening; secrete mucus
Female Reproductive Anatomy

• Innervation: branches of Pudendal nerve (hypogastric plexus & pelvic splanchnic nerves)

• Arterial Supply:
  – Uterine arteries (from internal iliac) + arcuate branches of = uterus
  – Ovarian arteries (from abdominal aorta) + ovarian branches of uterine arteries = ovaries
Fertilization: sperm meets egg

**Path of sperm:**
- Seminiferous tubules → tubulus rectus → rete testis → efferent ductules → duct of epididymis → vas deferens → urethra → female’s vagina → uterus → oviduct

**Path of egg:**
- ovary → peritoneal cavity → infundibulum (oviduct) → oviduct

**The meeting:**
- Sperm + egg meet in uterine tube → sperm penetrates egg = fertilization
- Zygote → uterus for implantation in uterine wall
Last Quiz = Pelvic Cavity & Reproductive Structures

- DUE Wednesday, 12/15 in my mailbox by 1:00 pm
- You are to create and hand in:
  1) An anatomy quiz
     - It must have 15 questions
     - It must be typed
     - Any format (other than essay)
     - It should **NOT** be filled in
  2) An Answer Key
     - It should match the quiz
     - It should have the correct answers
- You will lose points if you do not follow these instructions!