Male Reproductive System

A. Functions

1. Spermatogenesis – production of reproductive cells (sperm)

2. Copulation – transfer of sperm to female

3. Production of hormones

B. Structures

1. Scrotum

A) Protective sac around testes

B) Regulate temperature (92oF/33oC)

2. Testes

A) Site of spermatogenesis & hormone production

B) Structures

1) Tunica albuginea – outer cell layer

2) Each testis is subdivided into lobules

3) Each lobule contains 1-4 highly convoluted seminiferous tubules

a) The tubules contain the spermatogonia, which will mature into sperm

b) In between the tubules are interstitial cells, which produce hormones

i) Testosterone & inhibin

4) The tubules converge and unite to form the rete testis

5) The rete testis gives rise to several ducts, which open into the epididymis

3. Epididymis

A) Site of sperm maturation and storage

B) Takes 20 days for sperm to travel through it

C) Can store sperm for several months

4. Vas deferens

A) Conduct and store sperm

B) Move upward in spermatic cord into pelvic cavity

C) Both sides join with ducts of the seminal vesicles to form the ejaculatory duct

which flows into urethra

5. Prostate gland

A) Chestnut shaped

B) Encircles urethra inferior to the bladder

C) Expels thin, milky fluid through a series of ducts

1) Comprises about 33% of semen

2) Slightly alkaline, serves 2 purposes

a) Neutralizes acidic fluid created by the sperm’s metabolism

b) Neutralizes acidic vaginal secretions which would kill the sperm

6. Seminal vesicles

A) Yellowish, finger-shaped structures

B) Slightly inferior and posterior to bladder

C) Produces a component of semen (60%)

1) Slightly alkaline

2) Contains fructose to fuel the sperm

3) Also contains prostaglandins to initiate smooth muscle contractions in female

reproductive tract

7. Bulbourethral glands

A) Pea-sized; empty into the spongy urethra

B) Secrete clear, mucus fluid (smallest component of semen)

1) Alkaline to neutralize acidic urine in urethra

2) Provides some lubrication for intercourse

8. Penis

A) Composed of 3 columns of erectile tissue

1) Corpora cavernosa (2) – lie dorsally

2) Corpus spongiosum – lie ventrally; surrounds urethra

B) Terminates in enlarged portion known as glans penis (covered by prepuce)

1) Location of external urethral orifice

2) Highly innervated with sensory neurons

3) Involved w/ physiological, sexual arousal

9. Urethra

A) Transports semen and urine to the outside of the body

B) 3 divisions

1) Prostatic – passes through prostate

2) Membranous – passes through urogenital diaphragm

3) Spongy – passes through penis

C. Spermatogenesis

1. The seminiferous tubules consist of 2 types of cells

A) Spermatogonia (spermatogenic cells)

1) Give rise to sperm

2) Diploid (46 chromosomes) and undifferentiated

B) Sertoli cells

1) Support, nourish, and regulate spermatogonia

2. Process – starts during embryonic development

A) During development hormones activate a spermatogonium, which undergoes

mitosis

B) One of the daughter cells (Type A) remains undifferentiated and replaces the

parent, the other (Type B) enlarges to become a primary spermatocyte (diploid)

1) The process halts here until puberty

C) At puberty, hormones restart the division (mitosis) of the spermatogonia

D) The primary spermatocyte undergoes meiosis I resulting in 2 secondary

spermatocytes which are haploid (23 chromosomes)

E) The 2 secondary spermatocytes undergo meiosis II, resulting in 4 haploid

spermatids (2 from each secondary spermatocytes)

F) The spermatids will then mature into sperm cells (spermatozoa)

1) The sperm cells collect in the seminiferous tubules, then pass through the rete

testis into the epididymis where they accumulate and mature

3. Sperm Structure

A) Tiny tadpole-shaped cell

B) About 0.06 mm long

C) Has 3 components

1) Head

a) Contains a compact nucleus with the genetic material

b) Acrosome

i) Small protrusion at the anterior end

ii) Contains enzymes that help it penetrate the egg’s membrane

2) Body (Midpiece)

a) Contains protein filaments and mitochondria

3) Tail (Flagella)

a) Allows the sperm to move

b) Gets ATP from mitochondria in the body

D. Erection, Orgasm, & Ejaculation

1. Erection

A) Hardening of a normally flaccid penis allowing its entry into the vagina

B) Results from a filling of the erectile tissue (corpus spongiosum & corpora

cavernosa) with blood

1) Triggered by tactile and/or psychological stimuli resulting in a parasympathetic

reflex

a) Causes a release of nitric oxide from local cells

2) Causes vasodilation of arteries leading to penis

a) No change in the veins leaving the penis

b) As extra blood fills the penis, the veins compress reducing blood flow leaving

the penis

3) Extra blood fills the erectile tissue causing it to expand

4) Parasympathetic input also causes the bulbourethral glands to release their

secretions (pre-ejaculate)

2. Orgasm (a.k.a. climax)

A) Pleasurable feeling of physiological & psychological release

B) Results due to continuation of same stimuli that causes erection

C) Usually accompanies ejaculation

D) Physiological changes include:

1) Increased heart rate (up to 180 bpm), respiration, & BP

2) Heightened emotions

3) Generalized skeletal muscle contraction

E) Followed by a latent period that prevents male from having second orgasm for

minutes to hours

3. Ejaculation

A) The forceful expulsion of semen into the urethra and out of the penis

B) Results from a sympathetic reflex triggered by same stimuli that trigger erection &

orgasm

1) Sympathetic impulses cause contraction of smooth muscle lining of the

accessory glands and ducts forcing secretions into the urethra (emission)

2) Emission triggers skeletal muscle contractions at the base of the penis forcing

semen out of the urethra at a high rate of speed (200 inches/sec)

3) Also causes constriction of internal urethral sphincter to prevent urine from

escaping the bladder

C) Sympathetic impulses over-ride parasympathetic ones causing the penis to return to

its flaccid state

4. Characteristics of semen

A) pH – 7.2 to 7.6

B) Normal discharge – 2-6ml per ejaculation

1) Average = 2.75ml

C) Sperm count is roughly 50 to 130 million/ml

1) Average = 66 million/ml (180 million total)

D) Morphology – <35% are abnormal

E) Motility – 60% exhibit forward motility

F) Survival – can live 24-72 hours after ejaculation into the female

1) Can be stored for 18 hours to 10 days in the male reproductive tract before losing

their ability to fertilize an egg

E. Hormones

1. Testes (interstitial cells)

A) Release testosterone & inhibin

1) Causes secondary sex characteristics

a) Increased hair growth on most of body

i) May slow hair growth on scalp

b) Enlargement of larynx and vocal folds

i) Results in a deeper voice

c) Thickening of the skin

d) Increased muscular development

e) Broadening of the shoulders

f) Narrowing of the waist

g) Thickening and strengthening of the bones

h) Increased release of erythropoietin 🡪 increases RBC count

2) Inhibits release of LH

F. Disorders

1. Testicular cancer (1 in every 20,000 males) – most common cancer in men ages 15 to

35

2. Prostatomegaly – enlargement of the prostate

A) Leads to anuria or inability to achieve an erection

3. Prostatitis – inflammation of the prostate

4. Orchitis – inflammation of the testis

5. Epididymitis – inflammation of the epididymis

6. Impotence – inability to achieve an erection

A) Usually caused by reduced nitric oxide levels or hardening of the arterioles leading

to the penis

1) Nitric oxide release decreases with age

a) Drugs such as Viagra, Levitra, and Cialis work by increasing nitric oxide

levels

2) Can also be reduced by stress, alcohol, and drugs

3) Smoking causes hardening of the arterioles

a) #1 cause in men under 40

B) 50% of men over 40 and 70% of men over 70 experience it to varying degrees

7. Priapism – prolonged and painful erection that can last for hours to days

A) Treatment ranges from simple medications to surgery depending on severity

8. Cryptorchidism – failure of testes to descend into the scrotum

A) #1 precursor for testicular cancer

9. Sexually transmitted diseases – variety of disorders usually caused by a bacteria or

virus

A) Can often lead to reproductive difficulty or dysfunction in males and females

B) Examples include gonorrhea, syphilis, chlamydia, genital warts, genital herpes

10. Sterility – low sperm counts (<20 million/ml)