Male Sexual Response: Erection

- Enlargement and stiffening of the penis from engorgement of erectile tissue with blood
- During sexual arousal, a PNS reflex promotes the release of nitric oxide
- Nitric oxide causes erectile tissue to fill with blood
- Expansion of the corpora cavernosa:
  - Compresses their drainage veins
  - Retards blood outflow and maintains engorgement
- The corpus spongiosum functions in keeping the urethra open during ejaculation

Male Sexual Response

- Erection is initiated by sexual stimuli including:
  - Touch and mechanical stimulation of the penis
  - Erotic sights, sounds, and smells
- Erection can be induced or inhibited solely by emotional or higher mental activity
- Impotence – inability to attain erection
Ejaculation

• The propulsion of semen from the male duct system
• At ejaculation, sympathetic nerves serving the genital organs cause:
  – Reproductive ducts and accessory organs to contract and empty their contents
  – The bladder sphincter muscle to constrict, preventing the expulsion of urine
  – Bulbospongiosus muscles to undergo a rapid series of contractions
  – Propulsion of semen from the urethra

Female Sexual Response

• The clitoris, vaginal mucosa, and breasts engorge with blood
• Activity of vestibular glands lubricates the vestibule and facilitates entry of the penis
• Orgasm – accompanied by muscle tension, increase in pulse rate and blood pressure, and rhythmic contractions of the uterus
• Females do not have a refractory period after orgasm and can experience multiple orgasms in a single sexual experience
• Orgasm is not essential for conception

From Egg to Embryo

• Pregnancy – events that occur from fertilization until the infant is born
• Conceptus – the developing offspring
• Gestation period – from the last menstrual period until birth
• Preembryo – conceptus from fertilization until it is two weeks old
• Embryo – conceptus during the third through the eighth week
• Fetus – conceptus from the ninth week through birth
Relative Size of Human Conceptus

Accomplishing Fertilization

- The oocyte is viable for 12 to 24 hours
- Sperm is viable 24 to 72 hours
- For fertilization to occur, coitus must occur no more than:
  - Three days before ovulation
  - 24 hours after ovulation
- Fertilization – when a sperm fuses with an egg to form a zygote

Sperm Transport and Capacitation

- Fates of ejaculated sperm
  - Leak out of the vagina immediately after deposition
  - Destroyed by the acidic vaginal environment
  - Fail to make it through the cervix
  - Dispersed in the uterine cavity or destroyed by phagocytic leukocytes
  - Reach the uterine tubes
- Sperm must undergo capacitation before they can penetrate the oocyte
Acrosomal Reaction and Sperm Penetration

• An ovulated oocyte is encapsulated by:
  – The corona radiata and zona pellucida
  – Extracellular matrix
• Sperm binds to the zona pellucida and undergoes the acrosomal reaction
  – Enzymes are released near the oocyte
  – Hundreds of acrosomes release their enzymes to digest the zona pellucida

• Once a sperm makes contact with the oocyte’s membrane:
  – Beta protein finds and binds to receptors on the oocyte membrane
  – Alpha protein causes it to insert into the membrane
Blocks to Polyspermy

- Only one sperm is allowed to penetrate the oocyte
- Two mechanisms ensure monospermy
  - Fast block to polyspermy – membrane depolarization prevents sperm from fusing with the oocyte membrane
  - Slow block to polyspermy – zonal inhibiting proteins (ZIPs):
    - Destroy sperm receptors
    - Cause sperm already bound to receptors to detach

Completion of Meiosis II and Fertilization

- Upon entry of sperm, the secondary oocyte:
  - Completes meiosis II
  - Casts out the second polar body
- The ovum nucleus swells, and the two nuclei approach each other
- When fully swollen, the two nuclei are called pronuclei
- Fertilization – when the pronuclei come together

Events Immediately Following Sperm Penetration

Figure 28.3
Preembryonic Development

- The first cleavage produces two daughter cells called blastomeres
- Morula – the 16 or more cell stage (72 hours old)
- By the fourth or fifth day the preembryo consists of 100 or so cells (blastocyst)

Preembryonic Development

- Blastocyst – a fluid-filled hollow sphere composed of:
  - A single layer of trophoblasts
  - An inner cell mass
- Trophoblasts take part in placenta formation
- The inner cell mass becomes the embryonic disc

Cleavage: From Zygote to Blastocyst

- Fertilization
- Ovulation
- Uterus
- Uterine tube
- Ovary
- Zygote (fertilized egg)
- 4-cell stage
- Morula
- Early blastocyst
- Implanting blastocyst
- Blastocyst cavity
- Inner cell mass
- Trophoblast
Implantation

• Begins six to seven days after ovulation when the trophoblasts adhere to a properly prepared endometrium
• The trophoblasts then proliferate and form two distinct layers
  – Cytotrophoblast – cells of the inner layer that retain their cell boundaries
  – Syncytiotrophoblast – cells in the outer layer that lose their plasma membranes and invade the endometrium

Implantation

• The implanted blastocyst is covered over by endometrial cells
• Implantation is completed by the fourteenth day after ovulation

Implantation of the Blastocyst

Figure 28.5a
Implantation

- Viability of the corpus luteum is maintained by human chorionic gonadotropin (hCG) secreted by the trophoblasts
- hCG prompts the corpus luteum to continue to secrete progesterone and estrogen
- Chorion – developed from trophoblasts after implantation, continues this hormonal stimulus
- Between the second and third month, the placenta:
  - Assumes the role of progesterone and estrogen production
  - Is providing nutrients and removing wastes