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Reproductive Physiology

Anatomy & Physiology

Male and female reproductive functions, spermatogenesis, oogenesis, menstrual cycle, fertilisation, pregnancy, lactation and hormonal regulation.

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Functions and hormonal coordination

Reproductive physiology covers gamete production, reproductive hormones, sexual responses, fertilisation, pregnancy, birth and lactation. Male and female terminology in these notes describes common reproductive physiological patterns; individual anatomy and endocrine function vary. Gametes are haploid, carrying 23 chromosomes, while fertilisation restores the diploid chromosome complement. Gonads have both gamete-producing and endocrine functions.

Pulsatile hypothalamic gonadotropin-releasing hormone stimulates anterior-pituitary FSH and LH. Gonadal steroids and inhibin usually provide negative feedback. In ovarian cycles, sustained high estradiol near ovulation can switch to positive feedback and produce an LH surge. The timing, target cells and feedback relationships differ between testicular and ovarian function, even though both use the hypothalamic-pituitary-gonadal axis.

Male functions and spermatogenesis

Spermatogenesis occurs in seminiferous tubules. Spermatogonia provide a renewing cell population; developing spermatocytes undergo meiosis to form haploid spermatids, which differentiate into spermatozoa. Sertoli cells support developing germ cells, contribute to the blood-testis barrier and secrete inhibin. FSH and adequate intratesticular testosterone support this environment. LH stimulates Leydig cells to produce testosterone, which supports reproductive tissues, libido and secondary sexual characteristics.

Sperm acquire further functional maturation in the epididymis and move through ducts during emission and ejaculation. Accessory-gland secretions contribute to semen and support sperm transport. Spermatogenesis requires a suitable testicular temperature, normally below core temperature. Erection predominantly involves parasympathetic and local vascular mechanisms; emission and ejaculation involve coordinated sympathetic and somatic activity. Sperm production and semen production are related but are not identical processes.

Oogenesis and the ovarian-uterine cycle

Stage	Ovarian events	Uterine and hormonal connection
Follicular phase	Follicles develop under gonadotropin support; a dominant follicle emerges	Estradiol supports proliferative endometrial growth
Ovulation	LH surge promotes release of the secondary oocyte	Occurs before the luteal phase; calendar day varies
Luteal phase	Corpus luteum produces progesterone and estradiol	Progesterone supports secretory endometrial changes
Without ongoing pregnancy	Corpus luteum regresses and steroid levels fall	Functional endometrium sheds as menstruation
Early pregnancy	hCG supports corpus-luteum function	Progesterone support continues while placental function develops

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Oogenesis begins before birth. Primary oocytes pause in prophase I, and selected oocytes resume maturation after puberty. The ovulated secondary oocyte pauses in metaphase II; fertilisation normally triggers completion of meiosis II. Unequal division preserves cytoplasm in one large functional gamete and produces polar bodies. Menstrual day one is the first day of bleeding. A 28-day diagram is a teaching model, not a reliable prediction for every cycle.

Fertilisation, implantation and placental exchange

Fertilisation most often occurs in the uterine tube, commonly the ampullary region. Sperm undergo capacitation in the reproductive tract before they can fertilise an oocyte. Acrosomal processes help penetration of surrounding coverings, and changes after sperm-oocyte fusion help prevent entry of additional sperm. The resulting zygote divides while moving toward the uterus, progressing through morula and blastocyst stages.

The blastocyst implants into a receptive endometrium. Trophoblast-derived hCG maintains early corpus-luteum hormone secretion. The placenta develops an extensive exchange interface for gases, nutrients and wastes and becomes an endocrine organ. Maternal and fetal blood normally remain in separate circulations across the placental barrier, although substances and some cells can cross it. The placenta is therefore selective, not an absolute protection from harmful exposures.

Pregnancy, labour and lactation

Progesterone supports the endometrium and reduces uterine excitability during much of pregnancy; estrogens support tissue growth and later uterine responsiveness. Pregnancy increases circulatory and metabolic demands, renal filtration and ventilation. Plasma-volume expansion can lower measured haemoglobin concentration relative to red-cell mass. Physiological adaptation must be distinguished from disease when assessing breathlessness, swelling or fatigue.

Labour involves coordinated myometrial contractions, cervical change and hormonal and local signaling, including prostaglandins and oxytocin. Cervical stretch can increase oxytocin release, reinforcing contractions through positive feedback. After placental delivery, falling estrogen and progesterone allow substantial milk secretion. Prolactin supports milk production; oxytocin causes milk ejection through myoepithelial contraction. Suckling and effective milk removal help sustain lactation. Colostrum provides concentrated protective components, including antibodies.

Nursing applications and examination organization

Take menstrual, reproductive and lactation histories respectfully, using the person's own terminology and relevant anatomy. Record cycle variability, bleeding pattern, pregnancy possibility, pain and functional effects. Severe pain, heavy bleeding, syncope or circulatory deterioration requires prompt assessment and escalation. A positive pregnancy test indicates hCG detection; it does not establish pregnancy location or viability.

For exams, contrast spermatogenesis and oogenesis by onset, meiotic pauses, continuity and functional products. Draw ovarian events, uterine changes and FSH, LH, estradiol and progesterone on one aligned cycle diagram. Keep fertilisation distinct from implantation and explain the transition from corpus-luteum to placental hormonal support. In lactation answers, separate synthesis from ejection and connect the neuroendocrine reflex to nursing observation of feeding and milk transfer.

Quick Revision

- FSH, LH, gonadal steroids and inhibin coordinate reproductive function.
- Sertoli cells support spermatogenesis; Leydig cells produce testosterone.
- Oocytes have prolonged meiotic pauses and unequal divisions.

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- The LH surge triggers ovulatory events.
- Fertilisation, implantation and placental development are separate stages.
- Prolactin supports milk production and oxytocin supports milk ejection.

Important Examination Questions

1. Describe spermatogenesis and its hormonal regulation.
2. Compare spermatogenesis with oogenesis.
3. Explain the menstrual cycle with aligned ovarian, uterine and hormonal changes.
4. Trace fertilisation to implantation and discuss placental functions.
5. Describe pregnancy adaptation, labour feedback and lactation physiology.

References and further reading

Newly written physiology study notes. Read the supporting textbook sections for diagrams, mechanisms and further explanation.

- OpenStax Anatomy and Physiology 2e: Anatomy and Physiology of the Testicular Reproductive System (https://openstax.org/books/anatomy-and-physiology-2e/pages/27-1-anatomy-and-physiology-of-the-testicular-reproductive-system)
- OpenStax Anatomy and Physiology 2e: Anatomy and Physiology of the Ovarian Reproductive System (https://openstax.org/books/anatomy-and-physiology-2e/pages/27-2-anatomy-and-physiology-of-the-ovarian-reproductive-system)
- OpenStax Anatomy and Physiology 2e: Fertilization (https://openstax.org/books/anatomy-and-physiology-2e/pages/28-1-fertilization)
- OpenStax Anatomy and Physiology 2e: Embryonic Development (https://openstax.org/books/anatomy-and-physiology-2e/pages/28-2-embryonic-development)
- OpenStax Anatomy and Physiology 2e: Changes During Pregnancy, Labor, and Birth (https://openstax.org/books/anatomy-and-physiology-2e/pages/28-4-changes-during-pregnancy-labor-and-birth)
- OpenStax Anatomy and Physiology 2e: Lactation (https://openstax.org/books/anatomy-and-physiology-2e/pages/28-6-lactation)

Practice questions

Choose one best answer. The answer key and explanations follow the questions.

1. Which hormone surge triggers ovulatory events?

A. LH
B. ADH
C. Insulin
D. Calcitonin

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2. Which hormone maintains early corpus-luteum function after implantation?

A. TSH

B. hCG

C. Aldosterone

D. Glucagon

3. Which pairing correctly describes lactation?

A. Prolactin-ejection; oxytocin-synthesis

B. FSH-ejection; LH-synthesis

C. Prolactin-production; oxytocin-ejection

D. TSH-production; cortisol-ejection

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Answer key and explanations

1. A - LH

The luteinizing hormone surge supports final oocyte maturation and ovulation.

2. B - hCG

Trophoblast-derived hCG preserves the early corpus luteum and its hormone secretion.

3. C - Prolactin-production; oxytocin-ejection

Milk synthesis and the let-down response are separate hormonal effects.

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