CHAPTER 32

Homeostasis and Endocrine Signaling

**Anatomy:** study of an organism’s structures

**Physiology:** study of the functions of an organism’s structures
Levels of Structural Organization

- **Tissues** – a cooperative unit of many very similar cells that perform a specific function
  - Epithelial
  - Connective
  - Muscle
  - Nervous
Epithelial tissue occurs in sheets of closely packed cells that covers the body & lines internal organs.

- Simple - single layer
- Stratified - multiple layers
- Squamous - floor tile
- Cuboidal - dice
- Columnar - bricks

Mucous membrane – smooth, moist epithelium that lines digestive tract & air tubes leading to lungs (secretes slimy soln that lubricates & keeps a surface moist)
Simple Squamous
Simple Cuboidal
Simple Columnar

Sectional view of large intestine (600 ×)
Stratified Squamous

Sectional view of vagina (185x)
Stratified Cubodial
Stratified Columnar

Sectional view of the duct of the submandibular salivary gland (375 x)
Connective tissue consists of a sparse population of cells scattered through a nonliving substance called matrix.

3 types of fibers w/in tissue:

1. **Collagenous** – strength w/flexibility, nonelastic, made of collagen

2. **Elastic** – easily stretched, snap back to position, made of elastin

3. **Reticular** – very thin & branched, tightly woven, made of collagen
6 Major Types

1. **Loose connective tissue** – binding & packaging material, holding other organs & tissues in place

2. **Adipose tissue** – contains fat, pads, insulates body, stores fuel molecules
3. **Fibrous connective tissue** – has a matrix of densely packed parallel bundles of collagen

- **tendons** – join muscles to bone
- **ligaments** – join bones to bones at joints
4. **Cartilage** – flexible & strong support material
5. **Bone** – mineralized that is very rigid (but not brittle unless lack of Calcium)
6. **Blood** – liquid matrix known as plasma
Muscle tissue – bundles of long, excitable cells called muscle fibers that are capable of contraction

- **Skeletal muscle** – attached to bones (striated, voluntary)
Cardiac muscle – forms the walls of heart (striated, involuntary)
Smooth muscle – found in walls of digestive tract, bladder, & other internal organs (involuntary)
Nervous tissue forms the communication system that transmits information as nerve signals.

- Neurons – functional units of nervous tissue
- Support tissues – nourish & insulate (glial cells)
Organs

- Made up of different tissues organized for a specific function
  - mesenteries are membranes that suspend many organs
- 2 body cavities that house the organs
  - diaphragm - sheet of muscle that separates the 2 cavities
Body Cavities

- **Thoracic Cavity** - upper cavity
- **Abdominal Cavity** - lower cavity

![Diagram of body cavities](image-url)
Organ Systems

• Consists of several organs working toward the same function

• 12 organ systems in human body:
12 Organ Systems

1. Digestive
2. Respiratory
3. Circulatory
4. Lymphatic
5. Immune
6. Excretory
7. Reproductive
8. Endocrine
9. Nervous
10. Muscular
11. Skeletal
12. Integumentary
Exchange w/Environment
(Internal Environment)

• Interstitial fluid - bathes the cells
• direct exchange does not occur between blood and cells that make up tissues and organs
• blood - body cells- blood
Regulation

- Internal environment of an animal always fluctuates slightly
  - in response to external conditions
  - homeostasis - ability to maintain a constant environment
Humans maintain homeostasis based on negative feedback: a change in internal or external environment causes processes to reverse that change. Similar to a thermostat, it controls things like temp., pH, [salt].
positive feedback – amplifies a mechanism already functioning
ex: childbirth

- Both types rely on a set point, stimulus, response, & normal range.

acclimatization – adjusting to change (not adaptation), temporarily
Endotherms – usually regulators (internal to deal w/external)

Ectotherms – usually conformers
Regulation of Body Temperature

- **Ectotherm** – warms itself mainly by absorbing heat from its surroundings
- **Endotherm** – derives most of its body heat from its own metabolism
Heat Production & Transfer

• **Conduction** – direct transfer of thermal motion between molecules of the environment & the body’s surface (hot to cold, never cold to hot)

• **Convection** – transfer of heat by movement of air/liquid past a body surface
• **Radiation** – emission (release) of electromagnetic energy
Evaporative Cooling – loss of heat from the surface of a liquid that is transforming into a gas.
Thermoregulation

- Depends on heat production by the animal, as well as heat gain & loss
- Endotherms & ectotherms can change the rate of heat production
Changing Rate of Heat Production

- Regulating heat gain & loss by conduction, convection, radiation, or evaporative cooling
- Hormonal changes may raise metabolic rate
- Shivering also increases metabolic heat production
Blood flow to the skin affects heat loss - **vasoconstriction** – causes less blood flow to skin, minimizing heat loss - **vasodilation** – increases rate of heat loss.
Hypothalamus in brain is body’s thermostat.
-this region of the brain has 2 thermoregulatory areas
* heating center controls vasoconstriction & shivering
* cooling center controls vasodilation & sweating
I.  Nature of Chemical Regulation

A. Hormones

1. A hormone is a regulatory chemical that travels in the blood from its production site & affects certain other sites in the body, often at a distance.

Con. 32.2
TEEN HORMONES
a. Hormones are made & secreted mainly by organs called endocrine glands.

b. The endocrine cells *secrete* the molecules of hormones directly into the circulatory system & the molecules travel in the blood to *target cells.*
2. Collectively, all hormone-secreting cells constitute the endocrine system.
B. Neurotransmitters

1. The endocrine system often works w/the nervous system.
2. The nervous system sends electrical signals via nerve cells.
3. Neurotransmitters are chemical messengers that carry info from one nerve cell to another. p.648
Seven Processes in Neurotransmitter Action

1. Neurotransmitter molecules are synthesized from precursors under the influence of enzymes.
2. Neurotransmitter molecules are stored in vesicles.
3. Neurotransmitter molecules that leak from their vesicles are destroyed by enzymes.
4. Action potentials cause vesicles to fuse with the presynaptic membrane and release their neurotransmitter molecules into the synapse.
5. Released neurotransmitter molecules bind with autoreceptors and inhibit subsequent neurotransmitter release.
6. Released neurotransmitter molecules bind to postsynaptic receptors.
7. Released neurotransmitter molecules are deactivated either by reuptake or enzymatic degradation.
II. Vertebrate Endocrine System

A. Overview p. 650

1. The vertebrate endocrine system consists of more than a dozen glands, secreting more than 50 hormones.

a. Some hormones have a very narrow range of targets & effects.

b. Some have numerous effects on targets throughout the body.
The Female Endocrine System and its Hormone Secreting Glands and Organs

The Male Endocrine System and its Hormone Secreting Glands and Organs
2. Among the least understood vertebrate endocrine organs is the pineal gland.
   a. specific action of melatonin is not yet known (thought to play a role in body rhythms: when to sleep, when to eat)
   b. secretes melatonin
3. Another misunderstood gland is the thymus.

a. secretes several important hormones including a peptide that stimulates the production of T cells

b. thymus shrinks during puberty
B. The Hypothalamus

1. Plays a role in integrating the endocrine & nervous system
   a. It is the master control center
   b. Its signals control the pituitary gland, which secretes hormones that influence numerous body functions
2. Pituitary gland is located at the base of the hypothalamus & consists of 2 distinct regions:

- Posterior
- Anterior
Posterior Lobe – an extension of the hypothalamus & stores and secretes hormones made in hypothalamus

Posterior Lobe Hormones

1) Oxytocin – stimulates contraction of uterine muscles & mammalian gland cells for birth & nursing

2) Antidiuretic Hormone (ADH) – promotes retention of water in kidneys
Oxytocin - delivers milk

Acts on muscles surrounding milk cells, releasing milk

Oxytocin released by thinking about baby and stimulation of breast

Baby suckling stimulates breast
Anterior Lobe – produces its own hormones, which influence a broad range of body activities

1) Thyroid-stimulating Hormone (TSH) – stimulates thyroid to secrete hormones

2) Adrenocorticotropic Hormone (ACTH) – stimulates adrenal cortex to secrete glucocorticoids
3) Follicle Stimulating Hormone (FSH) – stimulates production of egg & sperm

4) Luteinizing Hormone (LH) – stimulates ovulation & sperm production

5) Growth Hormone (GH) – stimulates growth (skeletal); ↑GH causes gigantism; ↓GH causes dwarfism
6) Prolactin (PRL) – stimulates milk production

7) Endorphins – body’s natural painkillers, like the drug morphine, so called “runner’s high”
3. Thyroid gland is located just under voicebox.

a. Triiodothyronine ($T_3$) & Thyroxine ($T_4$) – stimulate and maintain metabolic processes (increases $O_2$ consumption & heat production, regulates metabolism)
Thyroid Hormones

3-monoiodothyrosine  3,5-diodothyrosine

T4 precursors

Thyroxine

Triiodothyronine
The hypothalamus and the pituitary in the brain control the normal secretion of thyroid hormones which in turn controls metabolism.
3 Problems w/the Thyroid

1) Hyperthyroidism – “too much” increases heat production, sweating, weight loss (metabolism), high BP
2) Hypothyroidism – too little decreases skeletal growth & development, causes mental retardation.
3) Goiter – dietary deficiency of iodine causes hypothyroidism that increases thyroid size due to inadequate feedback system

\[ T_3 \text{ & } T_4 \]
b. Calcitonin – lowers blood Ca levels; inhibits release of calcium from bone

4. Parathyroid glands are embedded in the surface of the thyroid

- Parathyroid Hormone (PTH): raises Ca levels in blood; releases Ca from bone, kidneys, & intestine
* Note: Calcitonin & PTH are antagonistic hormones – maintains appropriate levels (nerve signals, blood clotting, transport across CM) by having opposite effects.
5. Pancreas is located beneath the stomach

a. Insulin – lowers blood glucose levels (produced by islet cells in pancreas)

b. Glucagon – stimulates glycogen breakdown in the liver (when blood sugar is low)
Islets of Humor

by Theresa Garnero

\[ \sqrt{16} = \]
\[ 15 \div 12 = \]
\[ a + b = \quad \]
\[ b^2 + c^2 = \]

I figured it out. Diabetes is such a pain in the pan-cre-as!
c. Diabetes – body cells unable to absorb glucose from blood; not enough insulin or cells do not respond

- needed fuel will come from body’s supply of fats & protein, excess glucose comes out in urine
FIGURE 18-22 Histology of the pancreas. (a) Photomicrograph at a magnification of 600×. (Copyright © 1983 by Michael H. Ross. Used by permission.) (b) Diagram. Of the nearly almost one million islets in the pancreas, most are located in the tail of the pancreas.

- **Exocrine acinus**
- **Pancreatic islet** (islet of Langerhans)
- **Alpha cell** (secretes glucagon)
- **Beta cell** (secretes insulin)
- **Delta cell** (secretes growth hormone-inhibiting hormone)
Leaks cloud or block vision
Abnormal new blood vessels
Dosage instructions are entered into the pump's small computer and the appropriate amount of insulin is then injected into the body in a calculated, controlled manner.
d. Hypoglycemia – too much insulin when sugar is eaten; so sugar levels drop very low
6. Adrenal glands sit on top of kidneys & have 2 regions (--the cortex & medulla)
a. Adrenal Medulla – central part

1) Epinephrine – increase blood sugar, constrict blood vessels in skin (adrenaline)

2) Norepinephrine – increase heart rate & force contraction of heart, constrict blood vessels (noradrenaline)
b. Adrenal Cortex – outer portion (steroids)

1) Mineralcorticoids – affects salt & water balance in kidneys

2) Glucocorticoids – (pain relief) reinforce effects of glucagon, promote synthesis of glucose from proteins & fats, fuel and reduce swelling
Adrenal Cortex

- Capsule
- Zona glomerulosa
- Zona fasciculata
- Zona reticularis

Adrenal Medulla
7. Gonads or sex glands secrete sex hormones in addition to producing gametes.

a. Testes – male gonads: produce androgens

-testosterone: stimulates development & maintenance of male reproductive system; makes embryo male sex characteristics
The production of testosterone by the testis is controlled by the pituitary gland.

Testosterone causes beard and body hair growth, promotes the growth of the prostate gland, contributes to male sexuality and causes bone and muscle growth.

Testosterone stimulates cells in the testis to produce sperm.
b. Ovaries – female gonads: produce estrogens & progestins

1) Estrogen – stimulates uterine lining growth; development & maintenance of female secondary sex characteristics

2) Progesterone – promotes continued uterine lining growth
CHAPTER 38.4 – 38.6 – Sensory, Mechano & Visual Receptors
Sensory Reception

- **Sensation** - awareness of sensory stimuli (chemicals, light, muscle tension, sounds, electricity, cold, heat, touch)

  - sensory info reaches our CNS in the form of action potentials

  - sensations result when brain integrates new info
• **perception** - meaningful interpretation or conscious understanding of sensory data
  - integrates new info w/other sensations & memories
Conversion of Stimuli

• **Sensory transduction** - stimulus detection means that a cell converts one type of signal into an electrical signal.

--What is this electrical signal called? **action potential**

- the conversion produces electrical signals called **receptor potentials** (electrical signals can be weak or strong) *fig 38.16*
- action potentials are transmitted to CNS for processing

How is it transmitted? sensory neurons

- brain distinguishes different types of stimuli: so for every stimulus, there is an action potential

- strength of stimulus alters the rate of action potential transmission (the stronger the stimulus, the more action potentials)
• Sensory neurons become less sensitive when stimulated repeatedly - known as sensory adaptation (like wearing braces, eating chocolate then drinking a coke)

- sensory adaptation keeps normal background stimuli at bay
5 TYPES OF RECEPTOR CELLS
For different kinds of sensations, different kinds of receptor cells. Rod and cone cells of the eye's retina are specialized to respond to the electromagnetic radiation of light. The ear's receptor neurons are topped by hair bundles that move in response to the vibrations of sound. Olfactory neurons at the back of the nose respond to odorant chemicals that bind to them. Taste receptor cells on the tongue and back of the mouth respond to chemical substances that bind to them. Meissner's corpuscles are specialized for rapid response to touch, while free nerve endings bring sensations of pain.
5 TYPES OF RECEPTORS

1. Pain Receptors - sense dangerous stimuli
- make us aware of injury or disease
- have pain receptors in all parts of the body except brain (heart defers pain)
- pain dendrites are naked as well as hair dendrites
Nociceptors: to hurt

- Prostaglandins increase pain sensation
- Aspirin stops synthesis of prostaglandins
2. **Thermoreceptors** - in skin to detect heat & cold
   - others monitor temp. of blood
   - hypothalamus

3. **Mechanoreceptors** - respond to various forms of mechanical energy such as touch and pressure, stretching of muscles, motion, sound
   - receptors that detect light touch & strong pressure
- stretch receptors monitor position of body parts
- hair cells (such as ear for sound, head & arm for air) detect sound waves & other forms of movement in air & water
- skin contains 3 different receptors: pain, thermo, mechano
4. **Chemoreceptors** - respond to chemicals in external environment or body fluids
- include sensory receptors in nose & taste buds
- osmoregulators in brain detect changes in total solute [ ] of blood ([ ] of alcohol)

What part of the body detects this [ ] difference?
5. **Electromagnetic Receptors** - respond to electricity, magnetism, & light

- most common type of these receptors is called photoreceptors (including our eyes); these detect visible light
Parts of the Eye

- Ciliary body
- Extrinsic eye muscle
- Choroid
- Retina
- Fovea
- Path of Light
- Iris
- Pupil
- Lens
- Cornea
- Blood vessels
- Optic nerve

Sherwood Figure 6-9

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• Sclera - tough, whitish layer of connective tissue that covers the eye
  - surrounds the choroid (thin pigmented layer)
  - if at the front of the eye, it is transparent & lets light in (cornea)
• **Conjunctiva** - thin mucous membrane that keeps the eye moist; lines the inside of the eyelids & covers the front of the eyeball, except the cornea
  - pink eye, nondescriptive conjunctivitis

• **Iris** - choroid at the front of the eye (gives the eye color)
  - absorbs light rays & prevents them from reflecting within the eyeball & blurring vision
- muscles of the iris regulate the size of the pupil
- pupil lets the light into the interior of the eye

• Light then passes through a disk-like lens, which is held in position by ligaments.
• Lens focuses images into the retina, a layer just inside the choroid

- **photoreceptors** on the retina transduce energy & then action potentials pass via sensory neurons in the optic nerve to the visual centers in the brain

- **fovea**: photoreceptors that are highly concentrated at the retina’s center of focus
- no photoreceptors in the optic nerve, so the place where the optic nerve passes through the back of the eye is called the **blind spot**

- although transparent, the lens is composed of hundreds of cells arranged in layers like an onion
2 chambers make up the bulk of the eye: Vitreous & Aqueous Humors

- Large chamber behind the lens is filled with jelly-like substance
- Much smaller chamber in front of lens is full of liquid similar to blood plasma
- Fluid circulates through this chamber
- Blockage of the ducts that drain this chamber can lead to glaucoma
- Humors help maintain the shape of the eyeball
Focusing

- Muscles attached to choroid control shape of the lens
- when eye focuses on a nearby object, muscles contract
  - this constricts the area around the lens & makes the ligaments that suspend the lens slacken
- lens becomes thicker & rounder
- when eye focuses on a distant object, muscles will relax & the lens flattens

*This process is called accommodation.*
• Visual acuity – ability to read fine details (tested w/letters on a special chart)
Most common visual problems:

*nearsighted* - cannot focus well on distant objects

(Focal point occurs before the retinal wall.)
(Near objects focused,... objects further away are blurry.)
*farsighted - cannot focus at short distances*

(Focal point occurs beyond retina.)
*astigmatism* - blurred vision where light rays do not focus at any one point on the retina (usually caused by a misshaped cornea)
Normal vision

Same scene viewed by a person with diabetic retinopathy

Same scene as viewed by a person with glaucoma
The retina prior to focal laser treatment

The retina immediately after focal laser treatment
Photoreceptors

- Photoreceptor cells on retina are called **rods** & **cones**
1. **Rods**
   - rods are very sensitive to light & enable us to see in dim light at night (shades of gray, movement)
   - found at edges of retina (about 125 million in humans)
- completely absent from center of focus (fovea)

- best night vision is achieved by looking at things out of “the corner of your eye”
2. Cones

- Cones are stimulated by bright light (distinguishes color, visual acuity)

- Found densest in center of visual field (about 6 million in humans)

- 3 types of cones distinguish 3 predominant wavelengths (primary colors)

- Groups of cones then distinguish tints

- Best vision is looking directly at the object
• rods & cones contain light absorbing visual pigments
  - rods = rhodopsin: (absorbs dim light)
  - cones = photopsin: (absorbs bright, colored light)

- Sensory Transduction in the Eye
  p. 788 Fig. 38.26
• Rods & cones are stimulus transducers to produce our vision.

• Process of vision involves 3 different reactions:
  - Eye must form a light image on retina.
  - Image is converted into signals of action potentials via optic nerve.
  - Brain must interpret those sensations to create sight.
Hearing & Balance
The Human Ear

• **Outer ear** - consists of a flap-like pinna & the auditory canal
  - these structures collect sound waves & channel them to the **eardrum**
  - eardrum transmits sound waves to middle ear

*p. 783*
The surface anatomy of the auricle of the ear.

- Helix
- Triangular fossa
- Antihelix
- Concha
- Tragus
- External auditory meatus
- Antitragus
- Lobule
Middle ear picks up sound waves from eardrum: 3 little bones are set into motion

- **malleus**: hammer
- **incus**: anvil
- **stapes**: stirrup

- Bones vibrate & transmit sound into inner ear through the **oval window** (membrane covered hole in skull) by producing pressure waves in fluid
• Eustachian tube conducts air between middle ear & back of throat, equalizing pressure

• Inner ear consists of several channels of fluid wrapped in a spiral & encased in bones of skull
INNER EAR, ...
-cochlea: long coiled tube that contains the actual hearing organ
-organ of Corti: long, thin spiral within middle of cochlea which is the actual hearing organ
- semicircular canals: organ for balance & equilibrium
Process of Hearing

- Sound waves at different pressures vibrate eardrum
- Middle ear bones are set in motion
- Bones amplify (about 20x) & transmit sound to fluid of cochlea through oval window
- Cochlea transduces sound waves into action potentials
Movement of hair cells of the organ of Corti against the overlying shelf of tissue triggers nerve signals to the brain.
- Louder sounds cause greater movement & more action potentials (sustained loud noises cause damage to hair cells)

- Sounds of different pitches stimulate hair cells in different parts of the cochlea (which ever is stimulated sends the action potentials)

p. 784 Fig. 38.21
- humans hear 20-20,000 Hz
(1 Hertz = 1 vibration per second)
- dogs up to 40,000 Hz
- bats up to 100,000 Hz
Balance

- We have 2 sets of balance or equilibrium receptors (1 on each side)
- Each set lies next to the cochlea in 5 fluid spaces
  - 3 semicircular canals
  - 2 chambers (utricle & saccule)
- All equilibrium structures operate on the same principle - bending of hairs on the hair cells
• Semicircular canals detect changes in the head’s rate of rotation or angular movement (motion: pitch, yaw, roll)
• Clusters of hair cells in the utricle & saccule detect position of ear with respect to gravity
• Conflicting signals from inner ear & eyes may cause motion sickness

• p. 785
Taste

- Also known as gustation
- Taste receptors (chemoreceptors) are organized into taste buds on our tongue that detect chemicals (through contact)
- 5 types: sweet, sour, salty, bitter, umani (meat)
- Taste buds respond to specific shapes of molecules
Is this true...p. 782

[Diagram of the tongue with labels for bitter, sour, salt, and sweet regions, and a close-up view of a taste bud, sensory nerve fiber, surface of tongue, taste pore, taste receptor cell, and supporting cell.]

Sherwood Figure 6-42
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Smell

Also known as olfaction

- airborne molecules are trapped in mucus
- chemoreceptors in upper portion of the nasal cavity detect airborne molecules & bind w/ receptors
- able to distinguish about 50 general types of odor
- olfaction is tied to limbic system, which is why it’s especially useful at recalling emotions & memories
Con. 32.3-32.4
Osmoregulation & Excretion
Components of Vertebrate Excretory System

• Excretory system plays a central role in homeostasis, forming & excreting urine while regulating the amount of water & salt in the body fluids
• Two kidneys are the main processing centers
  - About 1100 – 2000 liters of blood pass through kidney capillaries each day
-as blood moves through, tubules of the kidneys extract a fluid called **filtrate**: composed of valuable solutes (Na+, K+, glucose, amino acids)
- Kidneys refine filtrate, concentrating the waste product (urea) & return most of the water & solutes back to the blood.

- Blood enters kidneys for filtering through renal artery & filtered blood exits through renal vein.
• Waste fluid (urine) exits kidney through a duct called the ureter.
• Ureter leads to the urinary bladder, which will empty periodically.
The bladder

Urine trickles down the ureters from the kidneys to the bladder. The bladder has elastic, flexible walls, which allow it to expand as it fills and then contract to expel urine when you urinate. Valves (not shown here) between the ureters and bladder are thought to prevent urine from flowing back up into the ureters.
During pregnancy the uterus puts pressure on the bladder resulting in the need for frequent urination.
• From the bladder, urine is released through a tube known as the urethra.
Structure of a Nephron

- Consists of urine forming tubule & its associated blood supply
- **Bowman’s Capsule** – end of the nephron tubule where filtrate enters from the blood (cup-shaped receptacle)
• Bowman’s capsule surrounds a ball of capillaries called the glomerulus.

• Filtrate enters the specialized regions of the tubule:
  - proximal tubule
  - loop of Henle
  - distal tubule
  - collecting duct
Capillaries converge as they leave the Bowman’s Capsule.
- they redivide forming a 2nd capillary network around the tubule
- this allows blood to pass through 2 capillary beds before returning to the heart
Function of the Nephron

• Nephrons control the composition of blood by means of 4 processes:
  1. filtration
  2. reabsorption
  3. secretion
  4. excretion
Filtration

Water & virtually all other molecules small enough to be forced through the capillary wall enter the nephron tubule from the glomerulus.

- blood cannot pass through the capillary wall
- filtrate is a mixture of salts, wastes, glucose, aa, vitamins, etc.
Reabsorption

- Water & valuable solutes are reclaimed from the filtrate & returned to the blood
- Proximal tube & Loop of Henle
Secretion

• Certain substances are removed from the blood & added to the filtrate
  - excess K⁺ & H⁺ ions are added into filtrate
  - this also eliminates certain drugs & toxic substances from the blood

• Loop of Henle & distal tubule
Excretion

- Urine is formed & passes from the kidneys to the outside via collecting duct, ureters, urinary bladder, & urethra
Nephrons are oriented perpendicular to the kidney surface - their capsules & tubules are located in the outer portion of the kidney (cortex) - loops of Henle extend downward into the inner zone of the kidney (medulla)
Regulation of the Kidneys

- **Osmoregulation** – depends on control of water & salt reabsorption in kidneys
- **Sensory cells** – located in brain & monitor salt & water balance in body fluids (hormones respond to any imbalances)
Pituitary gland releases antidiuretic hormone (ADH)
- it increases water permeability in the collecting ducts
- produces a more concentrated urine (very yellow)
Absence of ADH causes large volumes of diluted urine to be released -caused by caffeine or alcohol -produces a condition called **diuresis** (pale yellow to clear)
If kidneys are damaged, **dialysis** can be used in their place.

- **Dialysis** performs the function of the nephrons
- Removes wastes & maintains solute concentration
Problems associated with excretory system.

3. Bladder Infections

**Possible signs of a bladder infection**
- A burning sensation when you urinate
- Feeling like you need to urinate more often than usual
- Feeling the urge to urinate but not being able to
- Leaking a little urine
- Urine that smells bad
- Cloudy, dark or bloody urine

△ Terminal dribbling  △ An urgent need to urinate  △ Weak urinary stream
Homeostatic Function of the Liver (Assisting the Kidney)

- Liver helps kidneys by making urea from ammonia
- Breaks down toxic chemicals, such as drugs & alcohol
- It will modify substances from digestion before blood reaches the kidneys
Regulating Glucose Levels

• Liver converts glucose to glycogen
• Glycogen is stored in liver for later use