

How does the endocrine system  
help maintain homeostasis ?



# General Facts about endocrine glands

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- # Endocrine glands produce chemical hormones that help maintain homeostasis and regulate reproduction and development.
  - # Hormones are produced in one part of the body and affect targets elsewhere.
  - # Hormones are transported in the blood.
  - # Minute amounts have significant influence on target cells.
  - # Hormones may be steroids, peptides, or modified amino acids.
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# Hypothalamus

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- # Hypothalamus (brain) and pituitary work together to control many metabolic activities.
  - # Neurosecretory cells in the hypothalamus communicate with the pituitary gland.
  - # Neurosecretory cells are structured like neurons but release hormones into the blood instead of neurotransmitters across synapses.
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# Pituitary Gland

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- ✦ Posterior Pituitary – two hormones, ADH (antidiuretic hormone) and oxytocin, are produced in neurosecretory cells in the hypothalamus are stored in the posterior pituitary. They are released as needed.
  - ✦ ADH targets the kidney and increases the reabsorption of water
  - ✦ Oxytocin targets the mammary glands and stimulates the release of milk. Oxytocin made in the uterus seems to have an affect on uterine contractions.
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# Pituitary Gland

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- # Anterior pituitary is sometimes referred to as the “master gland” because it produces *tropic hormones*.
  - # Tropic hormones target other endocrine glands. Thus, the pituitary has a direct control over other endocrine glands.
  - # Neurosecretory cells produce *releasing hormones* which travel to the anterior pituitary through the blood.
  - # Releasing hormones stimulate the release of tropic hormones by the anterior pituitary.
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# How is blood sugar concentration controlled by antagonistic hormones ?

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- # The pancreas contains tissues called the “Islets of Langerhans” .
  - # The Islets of Langerhans is made up of two types of cells: alpha cells & beta cells.
  - # Beta cells produce the insulin hormone. Under insulin’s influence, liver and muscle cells convert glucose to glycogen for storage. Adipose cells (connective tissue) convert glucose into fat. Thus the blood sugar level drops.
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# How is blood sugar concentration controlled by antagonistic hormones ?

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- # Alpha cells secrete glucagon. Glucagon stimulates the liver to release glucose. This glucose is the product of glycogen hydrolysis and the conversion of amino acids and fatty acids into glucose.
  - # Thus, glucagon and insulin are antagonistic. One decreases blood sugar (insulin) and the other increases blood sugar (glucagon).
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# How do antagonistic hormones control blood calcium concentrations ?

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- # Parathyroid hormone from the parathyroid glands increases  $\text{Ca}^{+2}$  ion concentration in the blood by stimulating  $\text{Ca}^{+2}$  ion reabsorption in the kidney and  $\text{Ca}^{+2}$  ion release from the bones.
  - # Calcitonin, a hormone produced in the thyroid gland, has the opposite effect on the bones and kidneys.
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# How do hormones trigger activities in target cells ?

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- # 1) The hormone, usually a steroid, diffuses through the plasma membrane, through the cytoplasm, and into the nucleus.
  - # The hormone binds to a receptor protein in the nucleus.
  - # The receptor protein activates a portion of the DNA that turns on specific genes.
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# How do hormones trigger activities in target cells ?

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- # 2) The hormone (usually a peptide) binds to a receptor protein on the plasma membrane of the cell.
  - # The receptor protein, in turn, stimulates the production of one of the following second messengers - cyclic AMP or inositol triphosphate.
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# How do hormones trigger activities in target cells ?

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- # Cyclic AMP (cAMP) is produced from membrane phospholipids. It triggers enzymes to generate cellular changes.
  - # Inositol triphosphate ( $IP_3$ ) is produced from membrane phospholipids. It triggers the release of  $Ca^{+2}$  ions from the ER, which, in turn, activates enzymes to generate cellular changes.
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