Human Endocrine System:

- Maintains homeostasis by producing and releasing chemical messengers that will affect change(s) throughout the body in response to stimuli.

  What they change or cause to change is called the “target organ” or “target cell”

Things that are chemically controlled include...

- 
- 
- 
- 
- 
- 

The chemical messengers made are called **hormones**. Glands producing them include....

<table>
<thead>
<tr>
<th>Pineal gland</th>
<th>Hypothalamus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pituitary gland</td>
<td>Thyroid</td>
</tr>
<tr>
<td>Parathyroid</td>
<td>Thymus</td>
</tr>
<tr>
<td>Adrenal glands</td>
<td>Pancreas</td>
</tr>
<tr>
<td>Ovaries</td>
<td>Testes</td>
</tr>
</tbody>
</table>
Two Classes of Hormones.....
Steroid and non-steroid hormones

Steroid hormones....
- structure is based on cholesterol
  Ex. “Estradiol” is a steroid hormone based in the molecular structure of cholesterol

- made in smooth endoplasmic reticulum of cells
- secreted directly into the blood for transportation (they are made by endocrine glands)
- hydrophobic (NOT water soluble, they are fat soluble), attaches to a carrier protein (which is hydrophillic)
- gets inside a cell by directly passing through
the fatty material of a cell membrane, attach to a receptor protein inside the cell, and this “switches the cell on”

Non-Steroid hormones...
- made of proteins, not fat
- are water soluble
- don’t have to enter cells to have an effect, they combine with shape specific receptors on the cell’s surface, triggering a series of chemical changes inside to “switch the cell on”

ENDOCRINE GLANDS

“Ductless” glands...put hormones directly into the bloodstream. Have some effect on all organs and tissues.

EXOCRINE GLANDS
Control of Hormones....

Amounts you make depends on metabolism, disease, injuries, stress, age, tumors, genetics, environmental contamination, and food additives.

How much impact they have depends on your blood flow, production rate, the concentrations in the blood, and the hormone’s half life.

Hormonal disorders are treated generally with hormone replacement therapy (HRT), drugs to regulate production, and lifestyle changes (diet, activity level, etc).

The brain’s hypothalamus and pituitary have a special relationship....there is a complex blood vessel network running between the two. The hypothalamus makes “releasing factors” that activate the pituitary, which in turn secretes hormones (tropic hormones) that affect the other glands in the system.
Pituitary gland  
(pg 428)

- makes tropic hormones  
  Ex. TSH (thyroid stimulating hormone) that regulates the thyroid gland  
- called the “master gland”  
- made of two lobes...anterior and posterior pituitary  
- made from mouth palate cells migrating to the brain during dev.

Anterior Pituitary

- 4 tropic hormones  
- 6 endocrine hormones  
- Human growth hormone ( HGH or somatotropin... an exocrine hormone )
HGH / Somatotropin....

- Nonsteroid...controls body development and growth by stimulating calcium uptake, cell division, protein synthesis, and fat metabolism. Half life about 20 hrs. Amount made decreases with age.

- hyposecretion......pituitary dwarfism
  - normal body proportions
  - delayed / no puberty
  - absent / damaged pituitary

  Treated with giving HGH from biotech engineered bacteria.

- Hypersecretion.....
  **gigantism / giantism** if occurring before puberty....abnormally long bones

  **Acromegaly** if after puberty...thickening of bones, disproportionally large hands, feet, jaw
**Prolactin...**

- nonsteroid, also made in small amounts by IS, uterus, brain...also high estrogen levels during late pregnancy help production
- controls mammary gland development in breast tissue, and milk production ( + control ...nerve stimulation during breastfeeding...ex. Milk production in dairy cows)

**Posterior Pituitary**
(neurosecretory cells in hypothalamus... endings in post. Pit., secrete hormones instead of making impulses !)

**Anti-diuretic hormone ( ADH )...**
- increase in blood sodium triggers ADH release...so does massive blood loss...ADH causes vasoconstriction
- production hindered by gland damage, tumors, infections..not enough can cause diabetes...you flush out a lot of water
- too much....fluid retention, conc’d urine, higher blood pressure, twitchy muscles
Oxytocin...

- triggers labor contractions (uterine muscles), which + reinforces production, contractions, birth, and milk release.
- pleasure sensation.....affection / bonding during breastfeeding...
- possibly involved with sex as well
ADH - damage to pituitary inhibits ADH release, tumors, or infections
  hyposecretion - diabetes
insipidus...thirst...lots of dilute urine, treated by administering ADH
hypersecretion....kidneys retain fluids, sodium drops, shakes

A Closer Look at Several Hormones...

**Melatonin** :
- made in the pineal gland, non-steroid,
  - causes sleepiness, levels rise during fall months, may lead to seasonal affective disorder (S.A.D.)...symptoms may include depression and increased sleep
  - light therapy to boost exposure and Vit D levels

**Thyroxine** :
- made by the thyroid gland, non steroid, increases metabolism
- increases the rate of cell respiration and
oxygen demand for increased use of Na/K pumps and increased heat production....

- Levels are controlled, like many other hormones, by an antagonist
- TSH made by the pituitary

3. Adrenaline:

5. Insulin

6. Glucagon