

# Homeostasis - Key Regulatory Systems Summary

Regulation System	Endocrine System	Nervous System [Sensory/effectors]	Issues & Impacts of imbalance
<b>Glucose regulation</b>	<p><b>Adrenaline</b> (from <b>adrenal gland</b>) = helps convert glycogen to glucose</p> <p><b>*Insulin and glucagon</b> (from <b>pancreas</b>)</p> <p>If glucose is <b>above</b> limit <b>INSULIN</b> causes...</p> <ul style="list-style-type: none"> <li>- glycogenesis (changing glucose to glycogen)</li> <li>- cells to absorb glucose out of blood</li> <li>- inhibition of gluconeogenesis (stops body making glucose)</li> </ul> <p>If glucose is <b>below</b> limit <b>GLUCAGON</b> causes...</p> <ul style="list-style-type: none"> <li>- gluconeogenesis (changing glycogen to glucose)</li> <li>- cells release glucose into the blood</li> <li>- inhibition of glycogenesis (stops body making glycogen out of glucose)</li> </ul>	<p>Brain transmits nerve impulse to adrenal gland to secrete adrenaline</p>	<ul style="list-style-type: none"> <li>• [glucose] too <math>\uparrow</math> = hyperglycaemic <ul style="list-style-type: none"> <li>- excess glucose in urine</li> <li>- more urination and thirst</li> </ul> </li> <li>• [glucose] too <math>\downarrow</math> = hypoglycaemic</li> </ul> <p><b>Diabetes mellitus</b> = reduced insulin production</p> <p><b>Type I</b> - pancreas cells destroyed by the person's immune system! Affects for lifetime. - <i>treat with insulin injection</i></p> <p><b>Type II</b> - body cells resist insulin, which means glucose builds up in blood - <i>treat by diet/lifestyle/medications</i></p>
<b>Thermoregulation</b>	<p><b>Thyroxine</b> (from <b>thyroid gland</b>) - <math>\uparrow</math> production = <math>\uparrow</math> metabolism rate (generates heat)</p> <p><b>Adrenaline</b> (from <b>adrenal gland</b>) - increases heart rate and respiration (generates heat)</p>	<p><b>Sensory thermoreceptors:</b> Skin receptors Hypothalamus receptors</p> <p><b>Effectors:</b> Shiver + sweat Vasodilation/constriction Hair follicle muscles</p>	
<b>Metabolism Regulation</b>	<p><b>TSH</b> (thyroid stimulating hormone) - secreted from <b>pituitary gland</b> - stimulates <b>thyroxine</b> (T4/3) production in <b>thyroid gland</b></p> <p><b>Thyroxine</b> (from <b>thyroid gland</b>) - causes increase in metabolism rates</p> <p><b>Feedback =</b> - <math>\uparrow</math> [thyroxine] inhibits pituitary making more TSH - this leads to less TSH, and so less thyroxine from thyroid gland</p>		<p><b>Hypothyroidism</b> - not enough thyroxine etc. from thyroid gland = can't tolerate cold; poor memory; feel tired</p> <p><b>Hyperthyroidism</b> - excessive production of thyroxine etc. from thyroid gland = can't tolerate heat; rapid heart beat; can't sleep</p>

<p><b>Osmoregulation</b></p> <p>Links to:</p> <ul style="list-style-type: none"> <li>• Blood <b>volume</b></li> <li>• Blood <b>pressure</b></li> </ul>	<p><b>ADH</b> – anti-diuretic hormone (from <b>pituitary gland</b>)</p> <p>Diuretic = causes <u>increase</u> urination (loss of water)  Anti-diuretic = causes <u>decrease</u> urination (keep water)</p>	<p><b>Sensory receptors:</b></p> <p>Hypothalamus (osmoreceptors)  - controls how much ADH is released from glands</p> <p>Baroreceptors (detects blood pressure)  - found in nephron  - if blood pressure ↓ they cause hormones to make blood vessels constrict and thus ↑ blood pressure</p> <p><b>Feedback - High Osmolarity (↓water)</b></p> <ol style="list-style-type: none"> <li>1. Hypothalamus detects</li> <li>2. <b>ADH</b> production increases</li> <li>3. more water exits nephron back into blood</li> <li>4. less urination / water saved / back to normal</li> </ol>	<ul style="list-style-type: none"> <li>• [solutes] too ↑ = enzymes affected;  <u>Causes:</u> dehydration; diarrhoea</li> <li>• [solutes] too ↓ = cells swell; too dilute for some metabolism  <u>Causes:</u> too much water; ADH not secreted properly</li> </ul> <p><b>WHEN water enters blood...</b></p> <ul style="list-style-type: none"> <li>- blood <b>osmolarity</b> decreases</li> <li>- blood <b>volume</b> increases</li> <li>- blood <b>pressure</b> increases</li> </ul> <p><b>Hypotension</b> (low blood pressure)  - light-headedness; dizzy  <u>Causes:</u> dehydration; stress; some meds</p> <p><b>Hypertension</b> (high blood pressure)  - no symptoms but can lead to other complications  <u>Causes:</u> obesity; genetic; smoking; lifestyle</p>
<p><b>Carbon dioxide &amp; pH</b></p> <p><math>\text{CO}_2</math> in blood = <math>\text{H}_2\text{CO}_3 = \text{H}^+ + \text{HCO}_3^-</math></p>	<p><b>Adrenaline</b> &amp; <b>thyroxine</b> both used to increase breathing rates to get rid of excess <math>\text{CO}_2</math></p>	<p><b>Sensory chemoreceptors:</b></p> <ul style="list-style-type: none"> <li>- in the heart</li> <li>- in the medulla (brain stem); detect pH</li> </ul> <p><b>Effectors:</b></p> <ul style="list-style-type: none"> <li>- rib cage muscles, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• ↑ <math>[\text{H}^+]</math> = acidic = breathing rate increases to get rid of excess <math>\text{CO}_2</math></li> <li>• ↓ <math>[\text{H}^+]</math> = basic = respiratory alkalosis due to low <math>\text{CO}_2</math></li> </ul>