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Four homeostatic variables in humans

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Negative feedback

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Insulin: source, stimulus, effect

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Glucagon: source, stimulus, effect

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How do pancreatic hormones reach target cells?

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Physiological basis of type 1 diabetes

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Physiological basis of type 2 diabetes

Body temperature, blood pH, blood glucose concentration, blood osmotic concentration.

Maintenance of the internal environment of an organism: variables kept within preset limits despite fluctuations in the external environment.

β cells of pancreatic islets; high blood glucose; liver and muscle cells absorb glucose and convert it to glycogen.

A change from the set point triggers a response that reverses it, from above or below, returning the variable to the set point.

Secreted directly into blood capillaries and transported in the blood to cells with the matching receptors.

α cells of pancreatic islets; low blood glucose; liver cells break glycogen to glucose and release it into the blood.

Target cells become resistant to insulin.
Risk factors: obesity, inactivity, diet, age, genetics.

Autoimmune destruction of β cells, so little or no insulin is secreted. Treated with insulin injections.

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How can type 2 diabetes be prevented?

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Roles of the hypothalamus and pituitary in thermoregulation

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Effect of thyroxine on body temperature

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Uncoupled respiration in brown adipose tissue

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Vasodilation versus vasoconstriction

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Responses to overheating

Hypothalamus compares temperature with the set point and controls effectors; via the pituitary (TSH) it increases thyroxine secretion when cold.

Healthy diet low in sugars and fat, regular exercise and keeping a healthy body mass.

Protons leak back across the inner mitochondrial membrane, so energy is released as heat instead of making ATP.

Raises the basal metabolic rate, so cells generate more heat.

Vasodilation of skin arterioles and sweating (evaporation removes heat); behaviour such as seeking shade.

Vasodilation: skin arterioles widen, more blood near surface, more heat lost.
Vasoconstriction: arterioles narrow, less heat lost.