

Endocrine glands

Endocrine glands release hormones in the blood.

Exocrine glands release hormones via ducts.

Gland Produces:

Pituitary gland In brain - ADH, gonadotrophins, growth hormones.

Thyroid In throat - thyroxine.

Adrenal gland Above kidneys - adrenaline.

Testes Testosterone

Ovaries Progesterone, oestrogen.

Pancreas Between kidneys - insulin, glucagon.

Thymus gland In thorax - thymosin

Pineal gland In brain - melatonin

Steroid and non-steroid hormones

Steroid hormones e.g. oestrogen

Steroids = lipid-soluble and can therefore go through the membrane of the target cell.

The hormone binds to a receptor in the nucleus.

The hormone-receptor complex binds to DNA and acts as a transcription factor.

mRNA produced for gene to create protein.

Non-steroid hormones e.g. adrenaline

Soluble in water - cannot go through the membrane.

Hormone acts as primary messenger, binds to receptor on cell membrane surface.

Receptor changes enzyme shape to catalyse formation of cAMP (secondary messenger) from ATP.

Secondary messenger starts a cascade reaction which affects cellular function (for adrenaline, triggers glycogen breakdown).

The pancreas

Exocrine and endocrine gland.

Exocrine Amylases
Proteases
Lipases

Endocrine Insulin
Glucagon

Histology

α cells Produce and secrete glucagon.

β cells Produce and secrete insulin.

Islets of Langerhan Contain both types of cells.

Adrenal cortex *Glucocorticoids* - e.g. cortisol, corticosterone.

Release controlled by hypothalamus

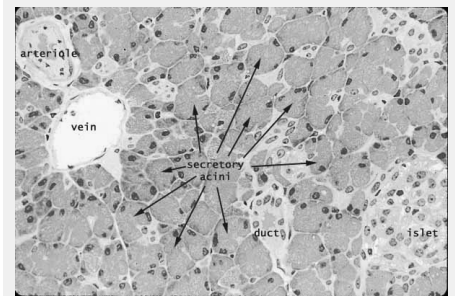
Mineralcorticoids - e.g. aldosterone (blood pressure and salt levels).
Release controlled by kidney signals.

Androgens - Small amounts of sex hormones.

Adrenal medulla (fight or flight resp.) *Adrenaline* - Inc. blood glucose and heart rate.

Noradrenaline - Works alongside adrenaline, increases heart rate, widens pupils.

Pancreas histology



Controlling blood glucose

Lowering blood glucose Insulin released from beta cells.

Glucose converted to glycogen.

Respiration.

Increasing blood glucose Glucagon released (alpha cells).
Causes glycogenolysis - breaks down glycogen into glucose

Glycogenesis - Make new glucose from other molecules.

Diet.

Secreting insulin

Glucose outside beta cell diffuses in through glucose transport protein.

Glucose allows mitochondria to respire more and produce more ATP.

ATP closes K_{ATP} channels.

No movement of K^+ makes it build up, depolarising the membrane (-30mV).

Voltage-gated Ca^{2+} ion channels open, Ca^{2+} diffuses in.

Ca^{2+} binds to vesicles containing insulin which binds to the - exocytosis and insulin is released.

Types of diabetes

Type 1 No insulin produced by beta cells.

No cure, childhood symptoms develop early.

Insulin injection as treatment.

Type 2 Can't effectively use insulin
- Body cells don't respond / beta cells don't produce enough.

Caused by diet / exercise.

Can regulate person's carb intake through diet and drugs.

Newer diabetes treatments

Medically produced insulin Genetically modified bacteria produce human insulin.

Stem cells Create new beta cells.

Controlling heart rate

Medulla oblongata Sends impulses to:
- Accelerator nerve to inc. heart rate.
- Vagus nerve to dec. heart rate.

Chemoreceptors CO₂ level detected in aorta, carotid and medulla.

Baroreceptors Regulates blood pressure, detected in aorta, vena cava, carotid.



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