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, oeastrogen.
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

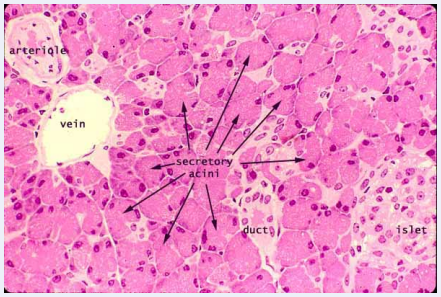
Exocrine and endocrine gland.

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, corticoseron. 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 isulin

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.

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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.
Chemor-eceptors	CO_2 level detected in aorta, carotid and medulla.
Barore-ceptors	Regulates blood pressure, detected in aorta, vena cava, carotid.

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