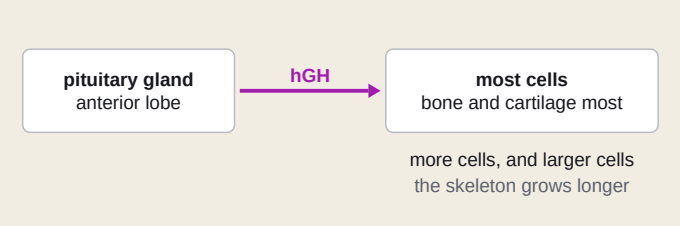
A11 · Growth and metabolism: hGH, thyroxine and blood calcium · Completed notes

Goals: State what hGH does, and what happens when there is too little or too much. State what thyroxine does, and compare hyperthyroidism with hypothyroidism. Trace the loop of TSH and thyroxine. Explain how a lack of iodine causes a goitre. Predict hormone levels when one part of a loop fails. Explain how PTH and calcitonin control blood calcium.

These are the completed notes. The blanks are filled in and each question is worked.

Slide 1 of 6 · hGH: the hormone for growth

In lesson A10, the anterior lobe of the pituitary gland released hGH, TSH and ACTH. Today you follow two of them: hGH first, then TSH.



Amount of hGH	Result
too little, in childhood	dwarfism
too much, in childhood	gigantism
too much, in an adult	acromegaly: hands, feet and face grow

Key ideas

hGH is released by the anterior lobe of the pituitary gland.

It makes cells divide and grow larger. **Bone** cells and cartilage cells respond most.

Too little hGH in childhood causes **dwarfism**.

Too much hGH in childhood causes **gigantism**.

Example

A child's pituitary gland releases too much hGH. Name the condition that results.

1. The bones grow too long.
2. The condition is gigantism.

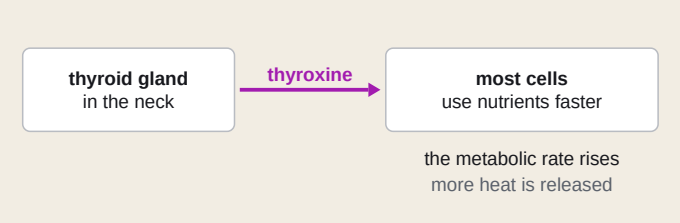
Try it

State the gland that releases hGH and the main effect of hGH.

1. The anterior lobe of the pituitary gland releases it.
2. It makes bones and other tissues grow.

Slide 2 of 6 · Thyroxine and metabolism

On the last slide, hGH controlled growth. The thyroid gland releases a hormone that controls how fast your cells use food.



	Too much thyroxine	Too little thyroxine
Name	hyperthyroidism	hypothyroidism
Metabolism	fast	slow
Body mass	falls	rises
The person feels	warm and nervous	cold and tired

Key ideas

The thyroid gland releases **thyroxine**.

Thyroxine raises the **metabolic rate**.

Too much thyroxine is **hyperthyroidism**. Too little is **hypothyroidism**.

Example

A person feels cold and tired and gains body mass. State if thyroxine is high or low, and name the condition.

1. Metabolism is slow.
2. Thyroxine is low.
3. The condition is hypothyroidism.

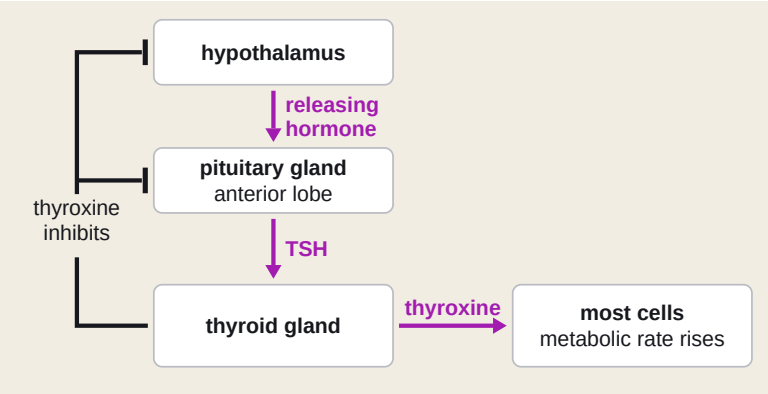
Try it

A person loses body mass and feels warm and nervous. State if thyroxine is high or low, and name the condition.

1. Metabolism is fast.
2. Thyroxine is high.
3. The condition is hyperthyroidism.

Slide 3 of 6 · TSH and the thyroxine loop

On the last slide, thyroxine raised the metabolic rate. The thyroid gland does not decide by itself how much thyroxine to release.



Key ideas

The hypothalamus sends a **releasing hormone** to the pituitary gland.

The pituitary gland releases **TSH**.

TSH makes the thyroid gland release **thyroxine**.

Thyroxine **inhibits** the hypothalamus and the pituitary gland.

Example

Thyroxine in the blood rises above normal. Predict what happens to TSH.

1. Thyroxine inhibits the hypothalamus and the pituitary gland.
2. The pituitary gland releases less TSH.

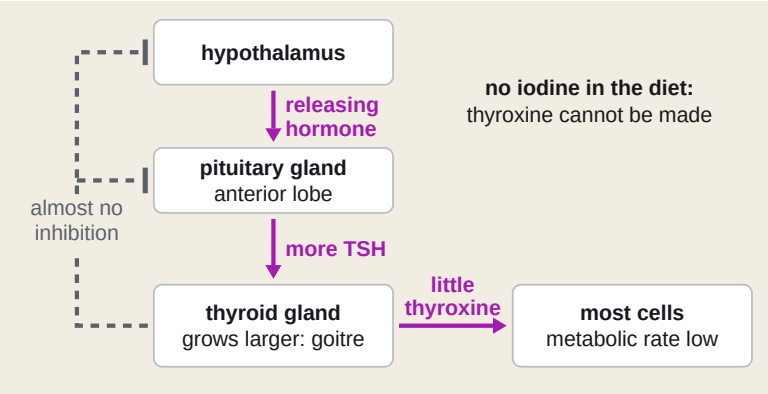
Try it

List the three glands in the thyroxine loop, in order.

1. The hypothalamus.
2. The pituitary gland.
3. The thyroid gland.

Slide 4 of 6 · Goitre: when the loop breaks

On the last slide, thyroxine inhibited the pituitary gland and kept TSH in check. Here is what happens when thyroxine cannot be made.



Key ideas

The thyroid gland needs **iodine** to make thyroxine.

With no iodine, little thyroxine is made. So **more TSH** is released.

The thyroid gland grows larger. This is a **goitre**.

Example

In a person with a goitre from lack of iodine, state if TSH is high or low. Explain.

1. Little thyroxine is made.
2. Almost nothing inhibits the pituitary gland.
3. So TSH is high.

Try it

Explain why iodine is added to table salt.

1. The thyroid gland needs iodine to make thyroxine.
2. Iodine in the diet prevents goitre.

Slide 5 of 6 · Method: predict hormone levels when a loop breaks

Goitre is one way a loop can break. Questions give many others. These four steps work for all of them.

1. **Write** the loop as a chain, from the first gland to the last hormone.
2. **Find** the part that has failed.
3. **State** that the hormone after the break falls.
4. **State** that inhibition is lost, so hormones before the break rise.



Check: low after the break, high before it.

Used again in: lessons A12 to A14

Key ideas

Step 1: write the loop as a **chain**. Step 2: find the part that has **failed**.

Step 3: the hormone after the break **falls**.

Step 4: inhibition is lost, so hormones before the break **rise**.

Example

Use the four steps. A thyroid gland is removed. Predict the levels of thyroxine and TSH.

1. Chain: hypothalamus, pituitary gland (TSH), thyroid gland (thyroxine).
2. The thyroid gland has failed.
3. Thyroxine comes after the break, so it falls.
4. Nothing inhibits the pituitary gland, so TSH rises.

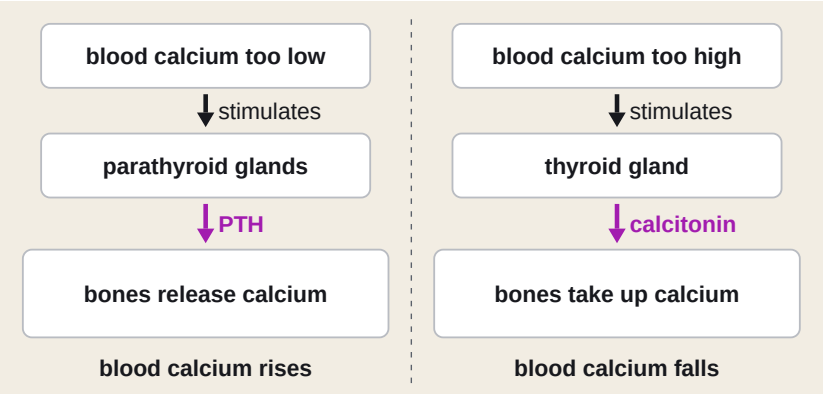
Try it

Use the four steps. The cells that make TSH are destroyed. Predict the levels of TSH and thyroxine.

1. Chain: hypothalamus, pituitary gland (TSH), thyroid gland (thyroxine).
2. The pituitary gland has failed.
3. TSH falls. Thyroxine comes after it, so it falls too.

Slide 6 of 6 · Blood calcium: PTH and calcitonin

So far each loop had one final hormone. Blood calcium is controlled by two hormones that pull in opposite directions.



Key ideas

When blood calcium is too low, the parathyroid glands release **PTH**.

PTH makes bones **release** calcium. Blood calcium rises.

When blood calcium is too high, the thyroid gland releases **calcitonin**.

Two hormones with opposite effects are **antagonistic hormones**.

Example

Name the hormone released when blood calcium is too high. State what it does.

1. The thyroid gland releases calcitonin.
2. Bones take up calcium, so blood calcium falls.

Try it

Name three places where PTH acts to raise blood calcium.

1. The bones.
2. The kidneys.
3. The intestines.