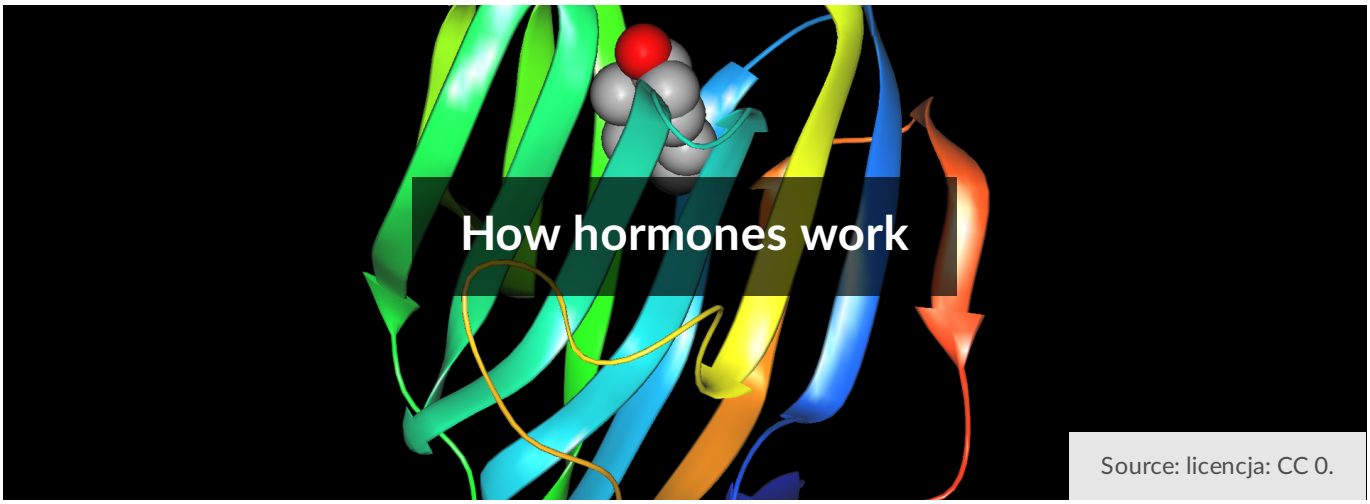
How hormones work

- How hormones work
- Lesson plan (English)
- Lesson plan (Polish)



Source: licencja: CC 0.

Link to lesson

> **Before you start you should know**
>
> - hormones regulate life processes of the body;
> - hormones stimulate only target cells which have specific receptors;
> - one hormone can stimulate many different organs and one organ can be stimulated by many different hormones.

> **You will learn**
>
> - to give examples of life processes regulated by hormones;
> - to explain the antagonism in how insulin and glucagon work;
> - to describe the results of too much and too little of growth hormone, thyroxine and insulin;
> - to describe the influence of medicine and hormones on your body.

Nagranie dostępne na portalu epodreczniki.pl

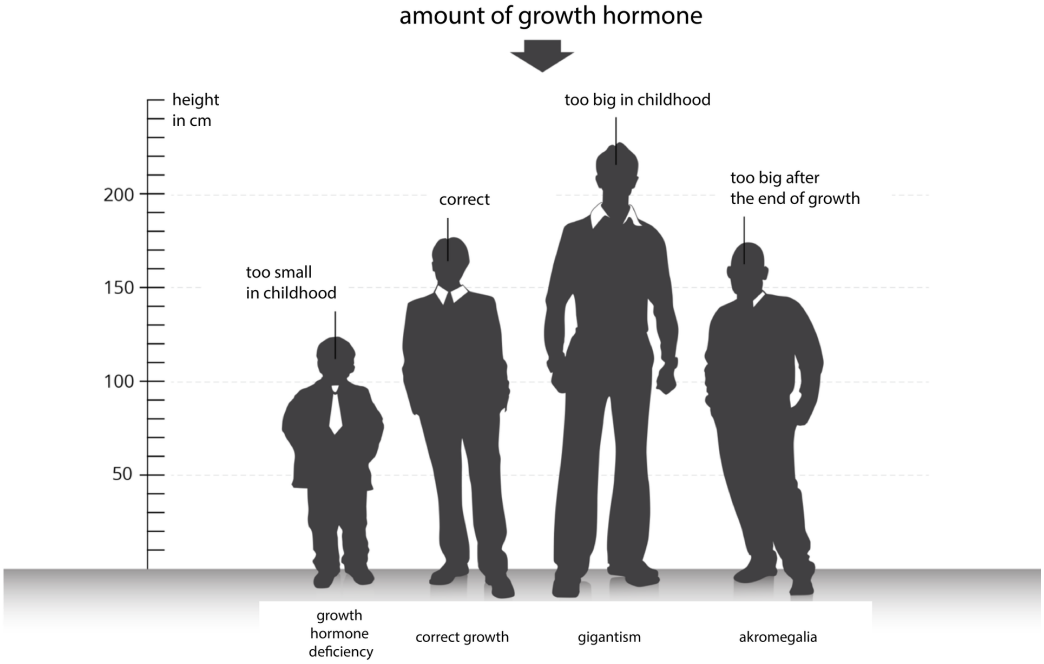
Nagranie dźwiękowe dotyczące działania hormonów

Hormones of metamorphosis

Changes in our body in subsequent developmental stages happen mainly because of the hormones secreted by 3 endocrine glands: pituitary gland, testicles and ovaries. Pituitary gland produces growth hormone, which speeds up the digestion of spare fats and glycogen, increases the absorption of calcium and phosphates needed for building bones, and stimulates cells to multiply. Its work causes a child's silhouette to become more slender, and the body to become taller. Growth hormone deficiency in childhood, caused by decreased pituitary function, leads to dwarfism. A child suffering from this condition will be no taller than 140-150 cm in adult years. The condition may be prevented when the patient is given

growth hormone. Too much of the growth hormone, caused by the increase in pituitary gland functioning, may lead to gigantism. Kids with this problem grow faster than their peers and very often they are over 205 cm when they are adults.

Acromegaly is a hormonal disorder that develops when your pituitary gland produces too much growth hormone during adulthood. When this happens, bones increase in size, including those of hands, feet and face. If excess growth hormone is produced during childhood the result is gigantism.



Dwarfism and gigantism

Source: Tomorrow Sp. z o.o., licencja: CC BY 3.0.

Growth hormone, together with sex hormones produced by gonads – testosterone (produced mainly in testicles) and estrogens (produced mainly in ovaries) contributes to our body's development in puberty. Gonads stay dormant until we enter puberty, when their secretion increases. Higher levels of sex hormones causes the development of sex organs and shapes the characteristic silhouette of our body.

Hormones that control metabolism

Thyroxine secreted by the thyroid has partial influence on our development and growth. It speeds up metabolism, increases the pace of burning fat in tissues, raises sugar level in blood and body temperature. Thyroxine deficiency can lead to suppression of growth and mental development, low metabolism, whereas too much of thyroxine leads to weakening of the body, heart problems, nervousness, increased appetite and hot flashes.

Diagram of interaction between the nervous and hormonal systems on the example of cold reaction

Insulin and glucagon are responsible for processes of transforming sugars. The hormones work in an antagonistic way and are secreted by the cells of the pancreas. They maintain correct level of glucose in our blood, which should be around 70-110 mg in 100 ml of blood on an empty stomach. Insulin lowers the sugar level in blood, whereas glucagon is responsible for raising it. The amount of insulin depends on the level of glucose – the higher the level, the more insulin is produced. Lack of insulin leads to diabetes. This disease can damage the kidneys, cardiovascular system and even cause sight loss. Treatment of diabetes is based on a special diet focused on regular meals, limiting sweets and using insulin and other drugs that lower the level of blood in the body.

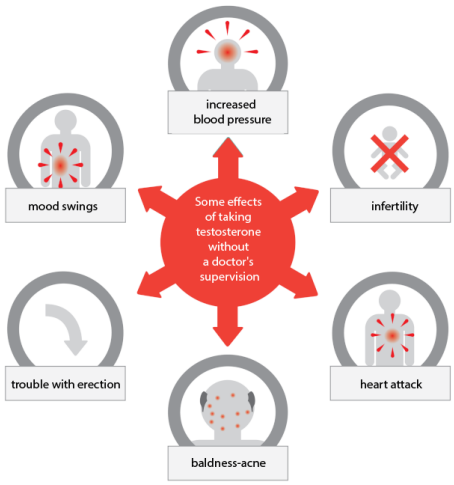
Hormone of fight and flight

Adrenaline is one of the hormones produced by adrenal glands. It is usually produced in small amounts. Its amount increases very quickly when we are stressed and when there are factors that disturb the homestasis of our organism. For example, in life threatening situations, this hormone initiates a number of processes that mobilize the organism and that allow us to fight or flight. Under the influence of adrenaline, the amount of blood that reaches the heart, muscles, brain and skin is increased. At the same time, the blood vessel of the abdomen become narrower, e.g. the vessels that are around the intestine. This limits digestion. Because of adrenaline, the frequency and strength of heart contractions is increased, same with blood pressure. We take quicker breaths, glucose level in blood increases. Muscle cells receive a lot of fuel and oxygen, thanks to which they are able to make a lot of effort, in extreme situations this effort is described as superhuman.

The influence of medicine and hormones on our body

Lowered amount of hormones in blood may cause various diseases. In order to alleviate the results of decreased amount of hormones or force a gland to work, we use hormone-based drugs. E.g. in order to restore the homestasis in our body caused by decreased functioning of the ovaries and estrogen deficiency during menopause, the hormone replacement therapy is used. This means that the patients receive physiological amounts of estrogen in order to replenish its deficiency.

Some hormones have strong anti-inflammatory and stimulating properties. **Cortisol** is given in acute allergic reactions, whereas adrenaline – in heart problems. Hormonal medicine used in motor system diseases are anabolic steroid, e.g. **testosterone** used as a medicine that stimulates muscular development. Taking hormonal medicine is connected with serious side effects, which is why the medicine should be taken under doctor's supervision.



Selected consequences of taking testosterone
Source: Dariusz Adryan, licencja: CC BY 3.0.

> **Exercise 1**
>
> Match the name of the hormone with the gland that produces it.
>
> adrenal gland, testicles, thyroid, pancreas

testosterone	
adrenaline	
glucagon and insuline	
thyroxine	

Summary

- Correct development of the body depends on hormone levels.
- Adrenaline is responsible for initiating processes that mobilize the organism, either to fight or to flight.
- Insulin and glucagon work antagonistically, regulating the sugar level in the blood.

Keywords

homeostasis, insulin, glucagon

Glossary

adrenaline

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka adrenaline

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adrenalina – hormon wydzielany przez nadnercza, odpowiedzialny za mobilizację organizmu w sytuacji stresowej

diabetes

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka diabetes

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cukrzyca – przewlekła choroba metaboliczna związana z niedoborem lub brakiem insuliny we krwi

glucagon

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka glucagon

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glukagon – hormon wydzielany przez komórki wewnątrzwydzielnicze trzustki; podwyższa poziom glukozy we krwi

estrogens

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka estrogens

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estrogeny – hormony wydzielane głównie przez jajniki; odpowiadają za wytworzenie żeńskich cech płciowych

growth hormone

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Nagranie dźwiękowe słówka growth hormone

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hormon wzrostu – hormon wydzielany przez przysadkę mózgową; odpowiada za wzrost i rozwój organizmu

insulin

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka insulin

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insulina – hormon wydzielany przez komórki wewnątrzwydzielnicze trzustki; obniża poziom glukozy we krwi

testosterone

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka testosterone

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testosteron – hormon wydzielany głównie przez jądra, odpowiedzialny za wytworzenie męskich cech płciowych

thyroxine

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka thyroxine

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tyroksyna – hormon wydzielany przez tarczycę; kontroluje procesy przemiany materii oraz wzrost i rozwój organizmu

Lesson plan (English)

Topic: How hormones work?

Author: Elżbieta Szedzianis

Target group

7th grade students of an eight-year elementary school

Core curriculum

11. Endocrine system. Student:

2) explains the antagonistic effects of insulin and glucagon;

3) explains why one should not take medicine containing hormones without consulting a doctor.

IV. Homeostatsis. Student:

1) analyzes the cooperation between specific organ systems in maintaining certain parameters of internal environment at a certain level (temperature, glucose level in the blood, amount of water in our bodies).

Lesson aim

The students give examples of hormonal regulation and explain the idea of homeostasis.

Key Success Criteria

- you will explain how the process of regulating sugar levels in blood takes place and why this process is so important;
- you will describe how the nervous system and the endocrine system work together;
- you will define the term “homeostatsis”';
- you will explain how dangerous is taking hormonal medicine without consulting a doctor first.

Key competences

- communicating in the mother tongue;
- communicating in a foreign language;
- Mathematical competence and basic competences in science and technology;
- digital competence;
- learning to learn;
- Social and civic competences.

Methods/forms of work:

Work with text, work with film, workshop method, discussion.

Individual work.

Teaching measures:

- abstract;
- interactive whiteboard or traditional blackboard;
- tablets/computers;
- sheets of white A4 paper for every student;
- coloring markers.

Lesson plan overview (Process)

Introduction

1. The teacher asks the students to describe the process of digestion and absorption of sugars, and then explains why a person who fainted in hunger can be given a sugary drink.
2. The teacher writes the topic of the lesson, key success criteria and presents the proposed course of the class.

Realization

1. The teacher asks the students to read the fragment titled “Hormones that control metabolism” and draw a schematic drawing of how insulinand glucagon work based on the text they have just read.
2. Volunteers present and explain their schematic drawings.
3. He then shows them a film titled “Antagonistic nature of glucagon and insulin”. The students analyze the changes in the levels of glucose, insulin and glucagon in our bodies. They define the notion of antagonism and homeostasis.
4. The teacher tells the students to complete the jigsaw puzzle “How nervous system and endocrine system work together on the example of reaction to cold“. He asks them to explain how
   the nervous system and the endocrine system maintain homeostasis in the body.
5. The teacher explains that pharmaceutical doping in sports is very often based on taking hormones and other substances that speed up the metabolism. He encourages the students to participate
   in a discussion on doping in sports.
6. The students analyze and talk about an illustration “Some effects of taking testosterone”.

Summary

1. Students complete interactive exercises.

2. The teacher asks the students to select one success criterion and show the skill they gained during this class on an excellent level.

Homework

Write a short note about the symptoms accompanying acromegaly. You can find additional ones, e.g. www.mayoclinic.org.

The following terms and recordings will be used during this lesson

Terms

> **adrenaline**
>
> Nagranie dostępne na portalu epodreczniki.pl
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> Nagranie dźwiękowe słówka adrenaline
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> ---
>
> **adrenalina** – hormon wydzielany przez nadnercza, odpowiedzialny za mobilizację organizmu w sytuacji stresowej

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> **glucagon**
>
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> **estrogens**

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Nagranie dźwiękowe słówka estrogens

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estrogeny – hormony wydzielane głównie przez jajniki; odpowiadają za wytworzenie żeńskich cech płciowych

growth hormone

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insulin

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testosterone

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe słówka testosterone

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thyroxine

Nagranie dostępne na portalu epodreczniki.pl

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Texts and recordings

Nagranie dostępne na portalu epodreczniki.pl

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- Correct development of the body depends on hormone levels.
- Adrenaline is responsible for initiating processes that mobilize the organism, either to fight or to flight.
- Insulin and glucagon work antagonistically, regulating the sugar level in the blood.

Lesson plan (Polish)

Temat: Jak działają hormony?

Autor: Elżbieta Szedzianis

Adresat

Uczeń klasy VII szkoły podstawowej

Podstawa programowa

11. Układ dokrewny. Uczeń:

2) przedstawia antagonistyczne działanie insuliny i glukagonu;

3) wyjaśnia, dlaczego nie należy bez konsultacji z lekarzem przyjmować preparatów i leków hormonalnych.

IV. Homeostaza. Uczeń:

1. analizuje współdziałanie poszczególnych układów narządów w utrzymaniu niektórych parametrów środowiska wewnętrznego na określonym poziomie (temperatura, poziom glukozy we krwi, ilość wody w organizmie).

Cel lekcji

Uczniowie podają przykłady regulacji hormonalnej i wyjaśniają pojęcie homeostazy.

Kryteria sukcesu

- wyjaśnisz, jak przebiega w organizmie proces regulowania poziomu cukru we krwi i dlaczego jest on bardzo ważny;
- opiszesz współdziałanie układu nerwowego i hormonalnego;
- zdefiniujesz termin „homeostaza”;
- wyjaśnisz, jakie szkody może przynieść samowolne zażywanie preparatów i leków hormonalnych.

Kompetencje kluczowe

- porozumiewanie się w języku ojczystym;
- porozumiewanie się w językach obcych;
- kompetencje matematyczne i podstawowe kompetencje naukowo-techniczne;
- kompetencje informatyczne;
- umiejętność uczenia się;
- kompetencje społeczne i obywatelskie.

Metody/formy pracy

Praca z tekstem, praca z filmem, metoda warsztatowa, dyskusja.

Praca indywidualna.

Środki dydaktyczne

- abstrakt;
- tablica interaktywna lub tradycyjna;
- tablety/komputery;
- białe kartki A4 dla każdego ucznia;
- kolorowe pisaki.

Fazy lekcji

Wstępna

1. Nauczyciel prosi uczniów, żeby opisali proces trawienia i wchłaniania cukrów, a następnie wyjaśnili, dlaczego osobie, która zasłabła z głodu, można podać słodki napój.
2. Nauczyciel zapisuje na tablicy temat lekcji i kryteria sukcesu oraz omawia przebieg zajęć.

Realizacyjna

1. Nauczyciel prosi uczniów, żeby przeczytali fragment pt. „Hormony kontrolujące przemianę materii" i na jego podstawie narysowali schemat przedstawiający działanie insuliny
   i glukagonu.
2. Ochotnicy prezentują i omawiają swoje schematy.
3. Nauczyciel wyświetla film pt. „Antagonizm działania glukagonu i insuliny". Uczniowie analizują zmiany zawartości glukozy, insuliny i glukagonu w organizmie. Definiują pojęcia antagonizmu działania oraz homeostazy.
4. Nauczyciel poleca uczniom, aby ułożyli elementy układanki „Współdziałanie układu nerwowego i hormonalnego na przykładzie reakcji na zimno". Prosi o wyjaśnienie sposobu,
   w jaki układ nerwowy i hormonalny utrzymują homeostazę w organizmie.
5. Nauczyciel wyjaśnia, że doping farmakologiczny w sporcie polega często na zażywaniu hormonów i innych substancji przyspieszających metabolizm. Zachęca uczniów do udziału
   w dyskusji na temat dopingu w sporcie.
6. Uczniowie oglądają i omawiają ilustrację „Niektóre skutki przyjmowania testosteronu".

Podsumowująca

1. Uczniowie wykonują ćwiczenie interaktywne.

2. Nauczyciel prosi uczniów, żeby wybrali jedno kryterium sukcesu i wykazali się umiejętnością, którą opanowali na lekcji w znakomitym stopniu.

Zadanie domowe

Napisz krótką notatkę dotyczącą objawów towarzyszących akromegali. Dodatkowe możesz znaleźć np. www.mayoclinic.org.

W tej lekcji zostaną użyte m.in. następujące pojęcia oraz nagrania

Pojęcia

adrenaline

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Nagranie dźwiękowe słówka adrenaline

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adrenalina – hormon wydzielany przez nadnercza, odpowiedzialny za mobilizację organizmu w sytuacji stresowej

diabetes

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Teksty i nagrania

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Insulin and glucagon are responsible for processes of transforming sugars. The hormones work in an antagonistic way and are secreted by the cells of the pancreas. They maintain

correct level of glucose in our blood, which should be around 70-110 mg in 100 ml of blood on an empty stomach. Insulin lowers the sugar level in blood, whereas glucagon is responsible for raising it. The amount of insulin depends on the level of glucose – the higher the level, the more insulin is produced. Lack of insulin leads to diabetes. This disease can damage the kidneys, cardiovascular system and even cause sight loss. Treatment of diabetes is based on a special diet focused on regular meals, limiting sweets and using insulin and other drugs that lower the level of blood in the body.

Adrenaline is one of the hormones produced by adrenal glands. It is usually produced in small amounts. Its amount increases very quickly when we are stressed and when there are factors that disturb the homestasis of our organism. For example, in life threatening situations, this hormone initiates a number of processes that mobilize the organism and that allow us to fight or flight. Under the influence of adrenaline, the amount of blood that reaches the heart, muscles, brain and skin is increased. At the same time, the blood vessel of the abdomen become narrower, e.g. the vessels that are around the intestine. This limits digestion. Because of adrenaline, the frequency and strength of heart contractions is increased, same with blood pressure. We take quicker breaths, glucose level in blood increases. Muscle cells receive a lot of fuel and oxygen, thanks to which they are able to make a lot of effort, in extreme situations this effort is described as superhuman.

Lowered amount of hormones in blood may cause various diseases. In order to alleviate the results of decreased amount of hormones or force a gland to work, we use hormone-based drugs. E.g. in order to restore the homestasis in our body caused by decreased functioning of the ovaries and estrogen deficiency during menopause, the hormone replacement therapy is used. This means that the patients receive physiological amounts of estrogen in order to replenish its deficiency.

Some hormones have strong anti-inflammatory and stimulating properties. **Cortisol** is given in acute allergic reactions, whereas adrenaline – in heart problems. Hormonal medicine used in motor system diseases are anabolic steroid, e.g. **testosterone** used as a medicine that stimulates muscular development. Taking hormonal medicine is connected with serious side effects, which is why the medicine should be taken under doctor's supervision.

- Correct development of the body depends on hormone levels.
- Adrenaline is responsible for initiating processes that mobilize the organism, either to fight or to flight.
- Insulin and glucagon work antagonistically, regulating the sugar level in the blood.