Year 12 HL

IB BIOLOGY

6.6 Hormones, Homeostasis and Reproduction

Name:

Teacher: Mr Trent

Topic 6.6 Hormones, Homeostasis and Reproduction

Essential idea: Hormones are used when signals need to be widely distributed

Understandings:

- Insulin and glucagon are secreted by β and α cells of the pancreas respectively to control blood glucose concentration.
- Thyroxin is secreted by the thyroid gland to regulate the metabolic rate and help control body temperature.
- Leptin is secreted by cells in adipose tissue and acts on the hypothalamus of the brain to inhibit appetite.
- Melatonin is secreted by the pineal gland to control circadian rhythms.
- A gene on the Y chromosome causes embryonic gonads to develop as testes and secrete testosterone.
- Testosterone causes pre-natal development of male genitalia and both sperm production and development of male secondary sexual characteristics during puberty.
- Estrogen and progesterone cause pre-natal development of female reproductive organs and female secondary sexual characteristics during puberty.
- The menstrual cycle is controlled by negative and positive feedback mechanisms involving ovarian and pituitary hormones.

Applications and Skills:

- Application: Causes and treatment of Type I and Type II diabetes.
- Application: Testing of leptin on patients with clinical obesity and reasons for the failure to control the disease.
- Application: Causes of jet lag and use of melatonin to alleviate it.
- Application: The use in IVF of drugs to suspend the normal secretion of hormones, followed by the use of artificial doses of hormones to induce superovulation and establish a pregnancy.
- Application: William Harvey's investigation of sexual reproduction in deer.
- Skill: Annotate diagrams of the male and female reproductive system to show names of structures and their functions.

Key Terms

Try the Quizlet activity here: https://quizlet.com/_8qe7w8?x=1jqt&i=28b19k

Positive and Negative Feedback

Type of feedback	Negative	Positive
Definition and explanation		
Example 1		
Example 2		

Create a **5 minute** (maximum 8 minutes) presentation on the tasks below. You may choose **to record or present live** and include or not include your face in the presentation.

Task	Description	Grade/Comment
1	State what hormones are and how they work	
2	Select a hormone from the list and find as much information about the hormone and its effect in the body ● What is the hormone (s)? ● Where is it produced? ● What are the target cells? ● What does it cause/trigger? ● When does this occur? ● Why does this occur? ● What would happen if it did not occur/happens to often? ● What can the hormone be used for artificially? ● Facts about your chosen hormone.	
3	What is homeostasis and what in the body is controlled by homeostasis?	
4	Create a kahoot, quizlet or word wall.	

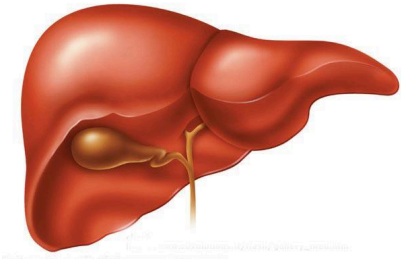
1	**Insulin and glucagon** are secreted by β and α cells of the pancreas respectively to control blood glucose concentration.	**Causes and treatment of Type I and Type II diabetes.**
2	**Thyroxin** is secreted by the thyroid gland to regulate the metabolic rate and help control body temperature. **Leptin** is secreted by cells in adipose tissue and acts on the hypothalamus of the brain to inhibit appetite.	What are the consequences of **over and underactive thyroids?** **Testing of leptin** on patients with clinical obesity and reasons for the failure to control the disease
3	**Melatonin** is secreted by the pineal gland to control circadian rhythms.	Causes **of jet lag** and use of melatonin to alleviate it.
4	**Testosterone** causes pre-natal development of male genitalia and both sperm production and development of male secondary sexual characteristics during puberty. A gene on the Y chromosome causes embryonic gonads to develop as testes and secrete testosterone.	**William Harvey's investigation** of sexual reproduction in deer. William Harvey failed to solve the mystery of sexual reproduction because effective microscopes were not available when he was working, so fusion of gametes and subsequent embryo development remained undiscovered
5	**Estrogen and progesterone** cause pre-natal development of female reproductive organs and female secondary sexual characteristics during puberty.	The **menstrual cycle** is controlled by negative and positive feedback mechanisms involving ovarian and pituitary hormones.

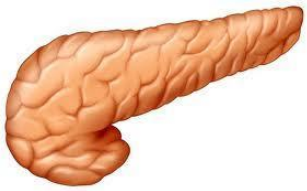
Hormone Examples

Hormone	Details	Other information (what can go wrong/medical uses)
Leptin	Secreted from: Target organ: Function:	What is the mice experiment?
Thyroxin	Secreted from: Target organ: Function:	
Melatonin	Secreted from: Target organ: Function:	How is melatonin used to regulate sleep and avoid jetlag?
Insulin	Secreted from: Target organ: Function:	
Glucagon	Secreted from: Target organ: Function:	

6.6 U1 Insulin and glucagon are secreted by β and α cells of the pancreas respectively to control blood glucose concentration.
6.6 A1 Causes and treatment of Type I and Type II diabetes.

Glucose Regulation





Put these sentences into order:

A. This reduces blood glucose, which causes the pancreas to stop secreting insulin.
B. Glucagon causes the liver to break down some of its glycogen store to glucose, which diffuses into the blood.
C. This is detected by the pancreas, which secretes insulin from its b cells in response.
D. This increases blood glucose, which causes the pancreas to stop producing glucagon.
E. Insulin causes glucose to be taken up by the liver and converted to glycogen.
F. If the glucose level falls too far, the pancreas detects this and releases glucagon from its a cells.
G. After a meal, glucose is absorbed from the gut into the hepatic portal vein, increasing the blood glucose concentration.

Explain the shape of the graph. Use the terms **set point, negative feedback, stimulates, high blood sugar, low blood sugar, glycogen, glucose.**

Diabetes

Complete the table:

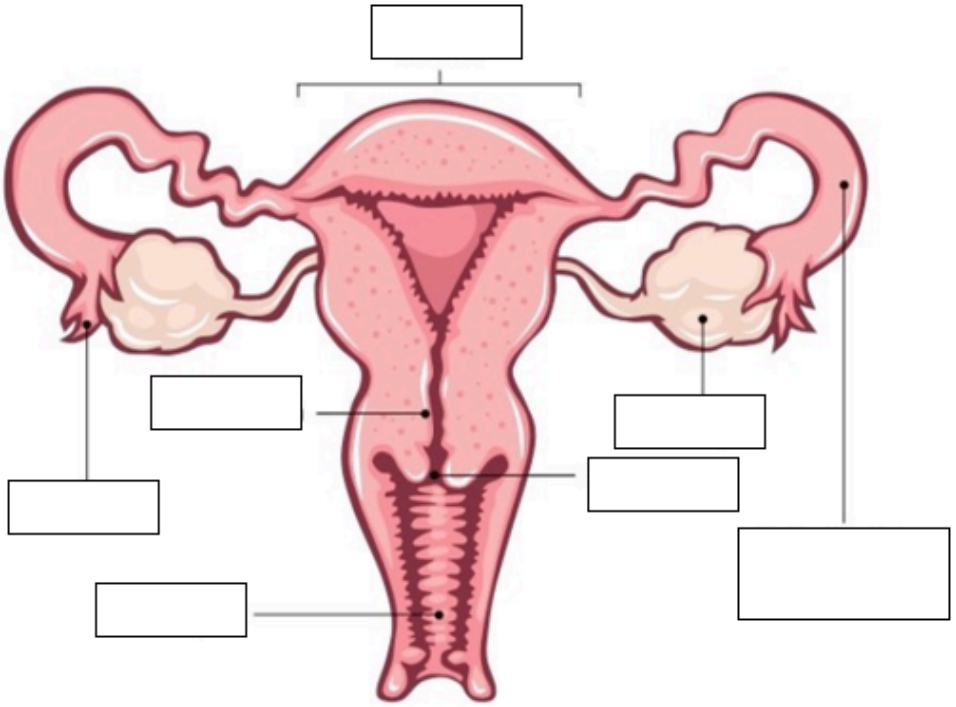
Type	**1**	**2**
Description		
Cause		
Symptoms		
Treatment		

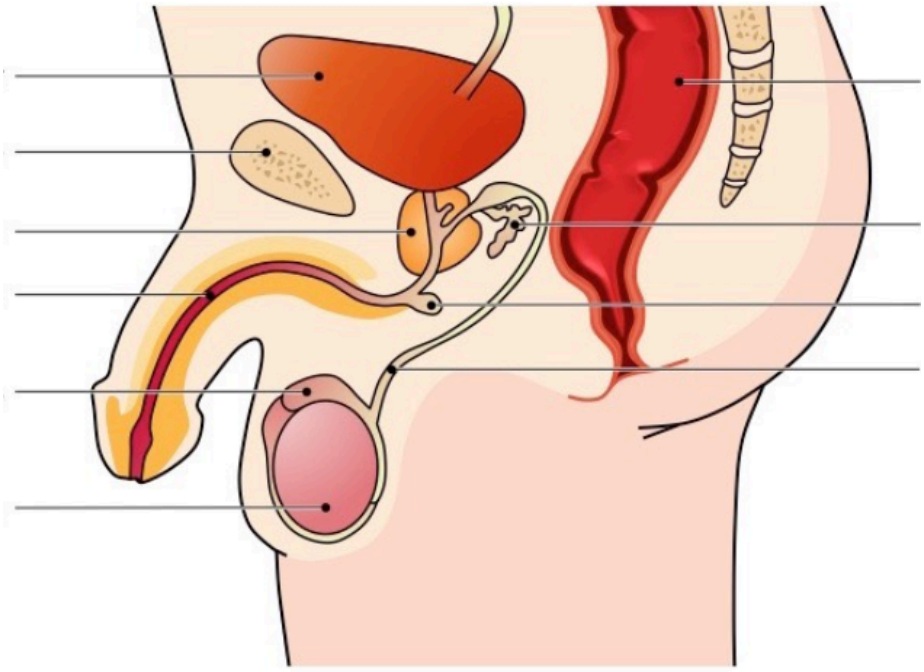
6.6 U2 Thyroxin is secreted by the thyroid gland to regulate the metabolic rate and help control body temperature.
6.6 A2 Testing of leptin on patients with clinical obesity and reasons for the failure to control the disease.

Male and Female Reproductive System

6.6 A4 The use in IVF of drugs to suspend the normal secretion of hormones, followed by the use of artificial doses of hormones to induce superovulation and establish a pregnancy.
6.6S1 Annotate diagrams of the male and female reproductive system to show names of structures and their functions.

Label the diagrams:





Match structure to function:

Female Reproductive System

Ureter	Stores urine
Urethra	Carries urine from the kidneys to the bladder
Vagina	The neck of the uterus
Bladder	Collects the egg released from the ovary and carries it to the uterus
Fallopian Tube (oviduct)	Contains ova and produces the female hormones oestrogen and progesterone
Uterus (womb)	Receives the penis during intercourse and is the way out for the baby during birth
Cervix	Carries urine out of the body
Ovary	Where the foetus (baby) develops

Male Reproductive System

Sperm duct	Add seminal fluid to make semen
Penis	Where sperm are stored before release
Testes	Carries semen from the testes to the penis
Scrotum	Where the sperm is made and the male hormone testosterone
Ureter	Protects and holds the testes outside the body
Urethra	Becomes erect for penetration
Epididymis	Carries urine from the kidneys to the bladder
Glands	Carries sperm from the testes to the urethra

- Skill: Annotate diagrams of the male and female reproductive system to show names of structures and their functions.

Hormones in the Menstrual Cycle

Complete the table:

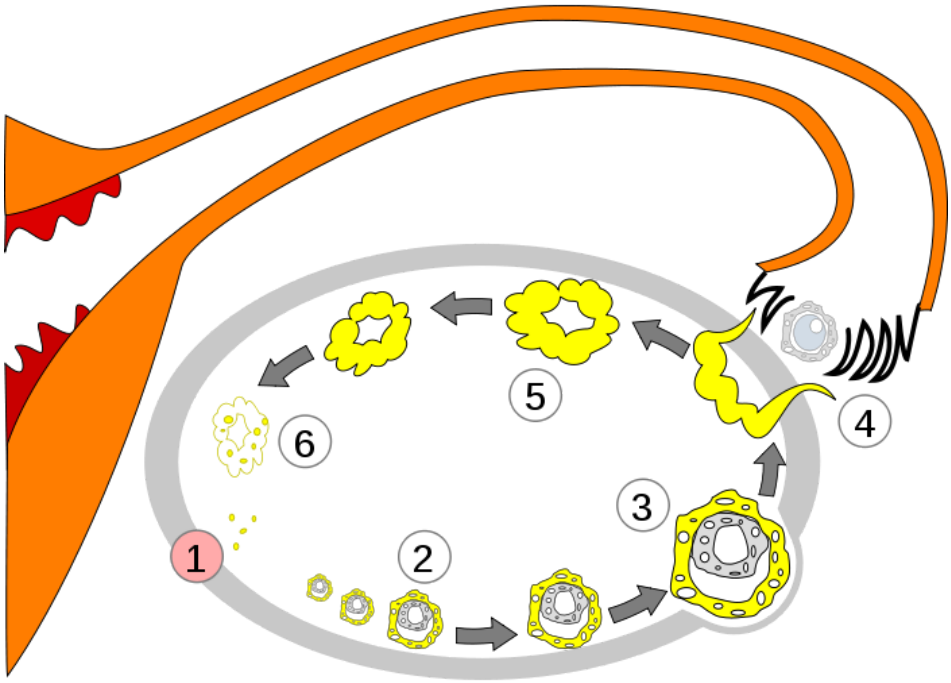
Name of hormone	Where it is made	Role in menstrual cycle
	Anterior Pituitary 	
	Ovaries 	
	Anterior Pituitary 	
	Ovaries 	

On the axes below:

- Using different colours add lines to the graph to show how the levels of FSH, LH, oestrogen and progesterone change during the cycle.
- Label the follicular and luteal phases.
- Identify when ovulation occurs.
- Show how the lining of the uterus changes.

Explain what happens during the menstrual cycle using a graph:

Identify stages 1 to 6:



Testosterone

List some functions of testosterone in males.

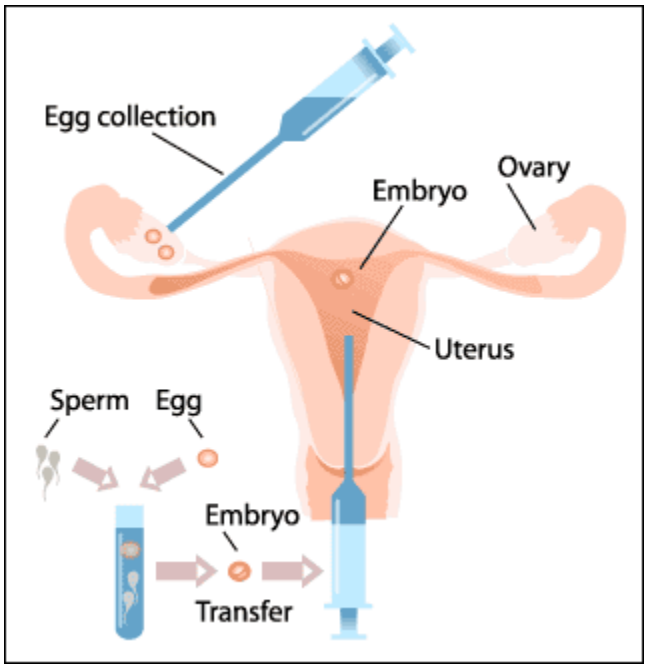
Where is testosterone produced?

What group of biological molecules do the steroid hormones (including testosterone) belong to? What component of cell membranes has a similar structure?

In vitro fertilization (IVF)

Watch this video: http://www.youtube.com/watch?v=GeigYib39Rs

Use the diagram to outline the main stages in the IVF procedure:



Read this article http://www.webmd.com/infertility-and-reproduction/guide/in-vitro-fertilization and then answer the questions:

Identify some reasons why a couple might choose to use IVF:

What hormone is used and why?

How many oocytes are typically removed?

What does “in vitro” mean?

How long do embryos typically develop out of uterus before being implanted?

How is the embryo inserted into the uterus?

How many embryos are typically inserted? Why?

What are the options for leftover embryos?

What is the typical success rate of IVF treatments?

Ethical issues associated with IVF

Read the article “The Ethics of In Vitro Fertilization” here:http://pedsinreview.aappublications.org/content/20/8/e28.full.pdf+html

Identify some pro’s and con’s of the IVF process and outline them in the table below:

Pro’s	**Con’s**

Watch these brilliant videos by Professor Robert Winston

Try IVF at home with sea urchins!http://www.youtube.com/watch?v=zmh8Xj5o-p0

And an interesting talk on how unlikely it is that we get pregnant at

all:http://www.youtube.com/watch?v=54h8wLkND_Y

Application: William Harvey's investigation of sexual reproduction in deer.

Past Paper Questions

1. What are causes of type I and type II diabetes?

	Type I	Type II
A.	autoimmune disease leading to reduced insulin secretion	decreased responsiveness of the body to insulin
B.	decreased responsiveness of the body to insulin	autoimmune disease leading to reduced insulin secretion
C.	increased responsiveness of the body to insulin	autoimmune disease leading to increased insulin secretion
D.	autoimmune disease leading to increased insulin secretion	increased responsiveness of the body to insulin

(Total 1 mark)

2. What will be happening in a person after eight hours of sleep?

A. β cells in the pancreas will be producing insulin.

B. Glucose will be converted into glucagon.

C. α cells in the pancreas will be producing glucagon.

D. Glycogen is being produced and stored in the liver and muscle cells.

(Total 1 mark)

3. What is a role of the hypothalamus in homeostasis?

A. Monitoring body temperature

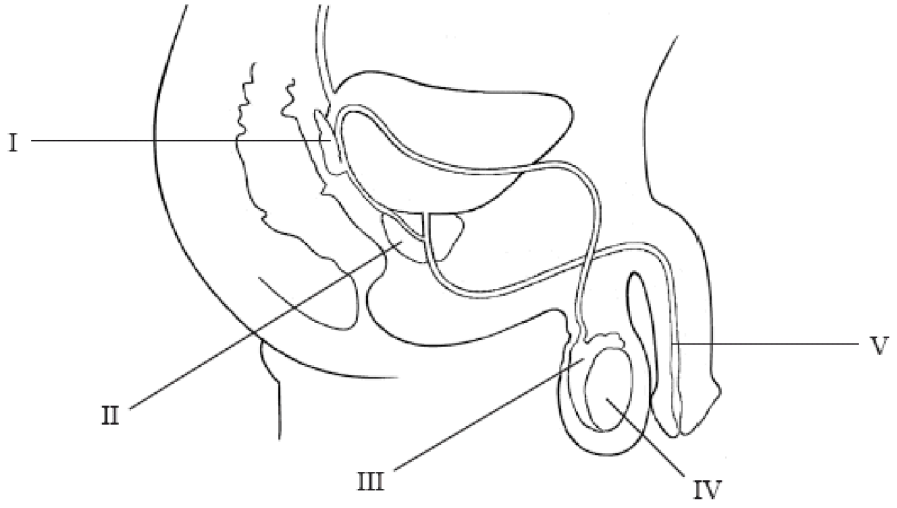
B. Monitoring blood glucose concentration

C. Secretion of glucagon

D. Secretion of sweat

(Total 1 mark)

4. The diagram below shows the male reproductive system.



Which are the epididymis and the seminal vesicle in the diagram?

	Epididymis	Seminal vesicle
A.	IV	I
B.	III	II
C.	I	V
D.	III	I

(Total 1 mark)

5. How is *in vitro* fertilization different from natural fertilization in humans?

A. *In vitro* fertilization involves artificial injection of sperm into the uterus

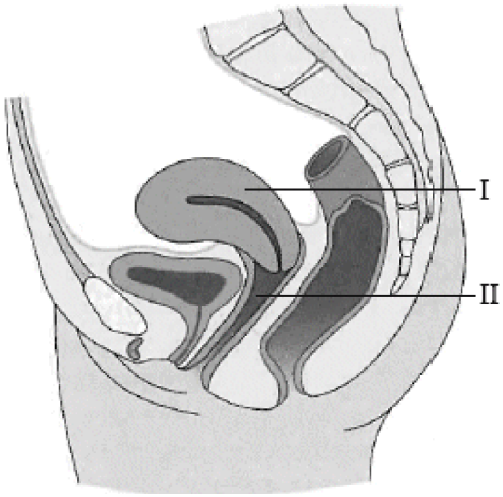
B. *In vitro* fertilization only involves one parent

C. *In vitro* fertilization happens outside the body

D. *In vitro* fertilization uses stem cells instead of eggs

(Total 1 mark)

6. The following diagram shows the human female reproductive system as seen from the side.



[This article was published in Jones, R and Lopez, K. 2006. *Human Reproductive Biology*. Third Edition. Academic Press. P. 52. Copyright Elsevier 2006.]

What are the names of the organs labelled I and II?

	I	II
A.	uterus	vagina
B.	bladder	ovary
C.	urethra	oviduct
D.	clitoris	cervix

(Total 1 mark)

7. What is the consequence of insufficient secretion of FSH in women?

A. Embryo implantation fails because the uterus lining is too thin.

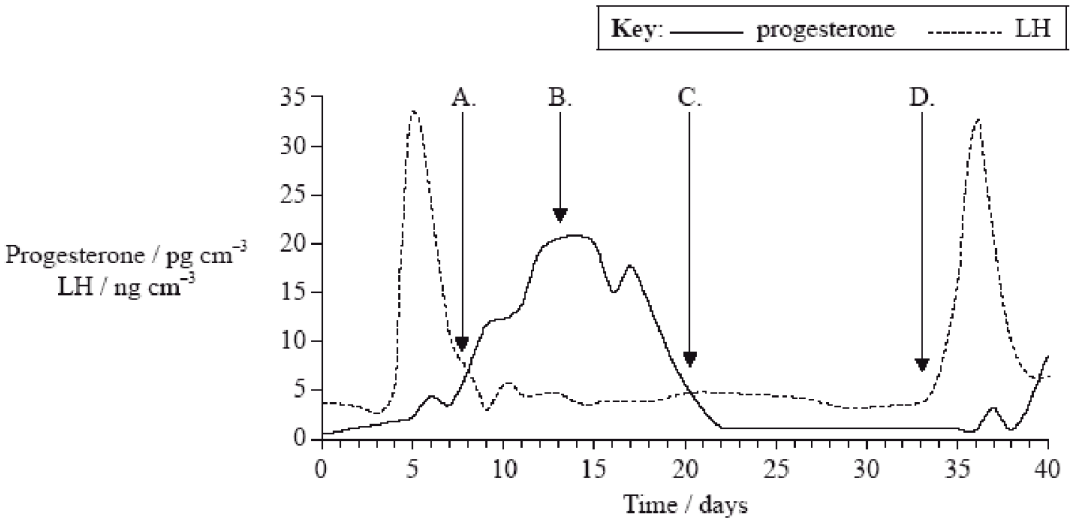
B. Mature eggs (oocytes) are not produced.

C. Menstruation starts before embryo implantation occurs.

D. Progesterone secretion is inhibited.

(Total 1 mark)

8. The hormones progesterone and LH were measured in a woman's blood over 40 days. When did her menstrual bleed start?



(Total 1 mark)

9. List **two** roles of testosterone in males.

1. .....

2. .....

(Total 1 mark)

10. Outline the role of hormones in the menstrual cycle.

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..... **(Total 6 marks)**

1. A

[1]

2. C

[1]

3. A

[1]

4. D

[1]

5. C

[1]

6. A

[1]

7. B

[1]

8. C

[1]

9. *Award **[1]** for two of the following*
pre-natal development of male genitalia;
development of male secondary sexual characteristics / name of specific characteristic;
sperm production / development of male primary sexual characteristic;
maintenance of sex drive; 1 max

10. FSH promotes development of a new follicle;
also leads to the production of estrogen;
estrogen brings about repair and growth of uterine lining;
estrogen causes negative feedback of FSH;
estrogen brings about LH production;
LH stimulates follicle growth;
LH triggers ovulation;
estrogen contributes to the proliferative phase of the uterine cycle / triggers LH surge;

progesterone contributes to the secretory phase of the uterine cycle/ maintains uterus lining;
lowered level of progesterone (due to degeneration of corpus luteum) leads to menstruation;
6 max