**Anatomy and Physiology of the Endocrine System**

in relation to

Emergency and Urgent care needs

[[1]](#footnote-1)

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**Welcome** to the Anatomy and Physiology (A&P) of the endocrine system work book, which has been designed to help you understand more about the endocrine system and how this is reflected in clinical presentations you will encounter.

You can use the work book as a stand alone resource and follow the activities through to the end of session test at the end. It is suggested that three hours are allocated to complete the work book, though students are encouraged to work through at their own pace.

There are a variety of tasks and activities throughout the work book, indicated by the following symbols:

Written  Discussion 

Reading  Thinking 

Online  Assessment 

At the same time there are notable important pieces of information indicated by the highlighted orange boxes:

**Important Information**

Resources required:

Access to the internet (via a smartphone or tablet is adequate)

Core textbook: Martini, F., Bledsoe, B.E., Bartholomew, E.F. and Ober, W.C. (2008). *Anatomy and physiology for emergency care. 2nd Ed.* USA: Pearson

Tips for activity completion and learning are given in the highlighted yellow boxes:

**Tips**

**Contents:**

* Welcome and instructions to using work book
* Learning Objectives
* Introduction to the Endocrine System
* Glands of the Endocrine System
* Hormones of the Endocrine System
* Interaction of glands and hormones
* Negative feedback loop
* Endocrine System disorders
* Relating to practice
* Formative Assessment
* Evaluation

**Learning Objectives**

On completion of the work book you should be able to:

* Identify and describe the location of the glands of the endocrine system
* Explain the function of glands in relation to regulation
* Discuss the location, hormones and functions of the following endocrine glands and tissues:
	+ pituitary gland
	+ thyroid gland
	+ parathyroid glands
	+ adrenal glands
	+ pancreas
	+ testes & ovaries
* Explain how hormones interact to produce coordinated physiological responses
* Describe and explain the negative feedback loop in relation to hormone regulation
* Compare the similarities between the nervous and endocrine systems
* Identify common endocrine disorders that will be encountered in practice
* Explain the relationship between signs and symptoms of disorders to A&P

 Please make a note of any additional learning objectives you have:

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**The Endocrine System**

The endocrine system works along with the nervous system to regulate the functions of the human body to maintain homeostasis. It consists of glands (that have no direct anatomical links) which secrete hormones.

**HOMEOSTASIS** is a term that describes a stable internal body environment

**EFFECTORS** cause responses that alter conditions

**RECEPTORS** provide information about internal stimuli

Endocrine glands help regulate metabolism, control chemical reactions, transport substances, regulate water and electrolyte balances and aid in reproduction, growth and development.

Glands secrete hormones that diffuse from the interstitial fluid into the bloodstream carrying messenger molecules throughout the body.

There are different groups of hormones and low concentrations of hormones can still stimulate target cell changes with chemical signals binding to receptor molecules.

 Consider the similarities and differences between the endocrine system and the nervous system (you will be able to add to this table once you have completed some of the activities further on in the work book)

|  |  |
| --- | --- |
| **Endocrine System** | **Nervous System** |
|  |  |
|  |  |
|  |  |
|  |  |

**Refer to your core text book to aide with table completion**

**Glands of the Endocrine System**

 Draw the glands of the endocrine system onto the body outline

[[2]](#footnote-2)

(See page 7 for answers)

**There are 9 different glands to add to the diagram:**

**Testes (male, 2), Ovaries (female, 2), Pancreas (1), Thyroid (1), Parathyroid glands (4), Adrenal glands(2), Pituitary gland, Thymus gland, Pineal Body (1)**

**Function of Glands of the Endocrine system**

 List any endocrine disorders you know about

(Don’t worry if you can’t think of many we will add to this list by the end of the work book)

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The main functions of glands are:

**Secretion**

**Regulation**

[[3]](#footnote-3)

**Hormones of the Endocrine system**

**There are more than 50 different hormones**

Hormones are chemical messengers that are released in one tissue, transported in the bloodstream and reach target cells in other tissues.

Hormones can be divided into 3 groups: Amino acids, Peptide derivatives, Lipid derivatives



|  |  |  |
| --- | --- | --- |
| **Type** | **Derived Form** | **Examples** |
| Steroids | Cholesterol | Aldosterone, cortisol, oestrogen, testosterone |
| Amines | Amino acids | Epinephrine, norepinephrine |
| Glycoproteins | Carbohydrates & Proteins | Follicle-stimulating hormone (FSH), lutenizing hormone (LH), thyroid-stimulating hormone (TSH) |
| Peptides | Amino acids | Antidiuretic hormone (ADH), oxytocin (OT), thyrotropin-releasing hormone (TRH) |
| Proteins | Amino acids | Growth hormone (GH), parathyroid hormone (PTH), prolactin (PRL) |

**The secretion and distribution of hormones**

Hormone release occurs with abundant capillaries, they quickly enter the bloodstream or distribution and circulate freely attaching to transport proteins.

Hormones are broken down by liver or kidney cells.

Endocrine activity is controlled by negative feedback mechanisms.

Access and watch the video link below. This is a 12 minute long video which explains the endocrine system and hormones in brief**.**

  **http://youtu.be/WVrlHH14q3o**

Great Glands - your endocrine system

 Can you complete any more of the table on page 5?

 Think about the following questions, the answers of which are in the video link.

1. What acts as a liaison between the endocrine and nervous systems?
2. How do cells receive hormones?
3. Which group of hormones are water soluble?
4. What size is the pituitary gland?
5. What is the function of the pancreas?
6. What is the method of communication within the endocrine system called?

**Watch the video link as many times as you need**

**Negative Feedback Loop**

 In systems controlled by negative feedback the effector response decreases or negates the effect of the original stimulus restoring homeostasis. We can relate this to a central heating system to aide comprehension:

The thermostat (detector) is sensitive to changes, which is connected to the

Boiler control unit (control centre) which controls the

Boiler (effector) which

Regulates temperature by raising or lowering levels

**Stimulus**

**Detector**

**Control**

**Effector**

**Negative feedback regulation of secretion of hormones**

**Negative feedback loop for secretion of thyroxine (T4) and triiodothyronine (T3)**

Stimulation

Releasing hormones

Lowered blood levels of target gland hormones

Use of hormones

Raised blood levels of target gland hormones

Inhibition

**Target Gland**

**Pituitary Gland**

**Hypothalamus**

**Hormone levels drop / raise**

 Fill in the algorithm for thyroid gland secretion

Raised blood levels of T3 and T4

Use of hormones

Lowered blood levels of target gland hormones

Thyroid stimulating hormone (TSH)

Thyroid releasing hormone (THR)

**Exercise, stress, malnutrition, sleep**

Thyroxine (T4)

Triiodothyronine (T3)

Inhibition

**Gland and hormone stimulation**

The pituitary gland and the hypothalamus act as a unit regulating the activity of most of the other endocrine glands. The pituitary gland consists of 3 distinct pasts, the *anterior pituitary,* the *posterior pituitary* and the *intermediate lobe* (which has no known function in humans).

[[4]](#footnote-4) [[5]](#footnote-5)

Both the anterior and posterior pituitary glands influence secretion and release of other hormones by secreting releasing and inhibiting hormones that activate target glands.

Oxytocin

Posterior Pituitary Gland

Anti-diuretic hormone (ADH)

**Note the glands are highlighted in different colours to the hormones**

**Specific Gland Secretion**

Fill in the boxes to describe hormone function

Anterior Pituitary Gland

Thyroid Stimulating Hormone (TSH)

Growth Hormone (GH) released by Growth Hormone Releasing Hormone (GHRH)

Adrenocorticotropic Hormone (ACTH)

Thyroxine

Triiodothyronine

Thyroid

Adrenal Glands

Epinephrine

Glucocorticoids eg. Cortisone, corticosterone and cortisone

Calcitonin

Aldosterone

Pancreas

Somatostatin

Glucagon

Insulin

*Tells the body to absorb glucose*

*Gets converted to glycogen for storage*

**Sex Gland Secretion**

Lutenising hormone releasing hormone (LHRH)

Anterior Pituitary Gland

Gonaotrophins (in response to gonadotrophon releasing hormone)

* Follicle Stimulating hormone
* Lutenising hormone

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Ovaries

Testes

Androgens eg. testosterone

Oestrogens

Progestins

**Refer to your core text book to aide with table completion**

**Diseases of the Endocrine System**



 Link the diseases to the hormones to the glands

**Diseases Hormones Glands**

Giantism

Thyroid

Ovaries

Polycystic Ovaries

Graves Disease

Growth hormone

Thyroxine

Addisons

Adrenal Insufficiency

Diabetes

Cushings Disease

Pancreas

Cortisol

Pituitary Gland

Dwarfism

Pituitary Gland Disorders

Insulin

(See answers on page 20)

**Diseases of the Endocrine System**

 Discuss some of the diseases of the endocrine system you have encountered in practice with your peers:

* What symptoms did patients display?
* Were patients aware of their condition?
* Which gland was there an abnormality with?
* Which hormone was there too much or too little of?
* What was the cause of the malfunction?

**Causes of Endocrine disorders include:**

**Infection**

**Genetics**

**Injury**

**Tumours / Growths**



Contribute to the online discussion board on the integrated learning environment which has been set up to discuss cases in practice.

Please be mindful of patient anonymity and remain professional at all times.







 **Assessment**

 Answer the following questions (See answers are on page 20)

|  |  |  |
| --- | --- | --- |
|  | Questions | Answers |
| 1 | Describe where the thyroid gland is located. |  |
| 2 | Where is the pituitary gland situated? |  |
| 3 | What are the primary functions of glands? |  |
| 4 | What is the primary function of the pituitary gland? |  |
| 5 | What are the four parts of the negative feedback loop? |  |
| 6 | How does the body know to absorb glucose? |  |
| 7 | Give two differences between the nervous system and the endocrine system. |  |
| 8 | Give two similarities between the nervous system and the endocrine system. |  |
| 9 | What are the symptoms of hyperthyroid disease? |  |
| 10 | Which hormones are related to Addisons disease? |  |

**Evaluation and feedback on the educational workbook**

Your opinion and comments are important to use to improve further editions of this workbook and other workbooks. Please answer the questions below in an email and send to sarah.cross3@northampton.ac.uk.

Many Thanks.

1. Was the booklet easy to use?
2. Did the workbook contain all the information you required?
3. Were you able to access the resources suggested?
4. Was the content valid?
5. What was your score out of 10 on the test?
6. How would you improve the workbook?
7. What was your favourite part in the workbook?

 **Answers!**

Insulin

Cortisol

Thyroid

Ovaries

Pancreas

Growth hormone

Giantism

Dwarfism

Addisons

Cushings Disease

Pituitary Gland Disorders

Pituitary Gland

Polycystic Ovaries

Graves Disease

Adrenal Insufficiency

Diabetes

Thyroxine

|  | Questions | *Answers* |
| --- | --- | --- |
| 1 | Describe where the thyroid gland is located | *In the neck in front of the larynx and trachea* |
| 2 | Where is the pituitary gland situated? | *Below the hypothalamus in the brain* |
| 3 | What are the primary functions of glands? | *Secretion and regulation* |
| 4 | What is the primary function of the pituitary gland? | *To influence secretion of hormones from other glands by releasing hormones* |
| 5 | What are the four parts of the negative feedback loop? | *Stimulus, Detector, Control, Effector* |
| 6 | How does the body know to absorb glucose? | *A negative feedback loop communicates glucose levels are too high, so the pancreas releases insulin which informs cells in the body to absorb glucose* |
| 7 | Give two differences between the nervous system and the endocrine system. | *NVS is quicker and has short acting effects**ECS uses hormones and NVS uses Neurotransmitters* |
| 8 | Give two similarities between the nervous system and the endocrine system. | *Negative feedback communication system**Purpose of regulation* |
| 9 | What are the symptoms of hyperthyroid disease? | *Unexplained weight loss, tachycardia, sweating, anxiety, gouter* |
| 10 | Which hormones are related to Addisons disease? | *Cortisol and Aldosterone* |

**Acknowledgement**

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