

**APPENDIX A: SUMMARY OF COGNITIVE STYLES RESEARCH REVIEWED
BY RIDING AND CHEEMA (1991)**

Holistic – Analytic Style Dimension		
Style labels	Theorist	Basic description
Field dependence (FD) – independence (FI)	Witkin (1962)	Field Dependence (FD) - rely on external frames of reference, prefer group interaction, like structure. Field Independence (FI) – rely on internal frames of reference, prefer to work on individual tasks, like to impose their own structure.
Impulsivity – Reflectivity	Kagan (1964)	Impulsive style characterised by quick responses to request to undertake task, whereas the reflective style will deliberate over the issue before providing a response.
Convergent - Divergent thinkers	Guilford (early 1950's)	Convergent thinkers deal best with problems which require the ability to generate one correct answer, while divergent thinkers are perform well when required to generate several equally acceptable answers.
Levellers - Sharpeners	Holzman & Klein (1954)	Focuses primarily on how a visual task is perceived. Levellers tend to perceive a task very simply and assimilate new events with previously stored ones, while sharpeners perceive a task in a complex and differentiated fashion, with little assimilation.
Holists - serialists	Pask (1972)	Holists will scan large amounts of data and look for patterns, while serialists will examine less data and use a step-by-step approach when completing a task.
Verbaliser-Imager Style Dimension		
Style Label	Theorist	Basic description
Abstract – concrete	Harvey (1961)	Preferred level and capacity of abstraction.
Verbaliser - visualiser	Paivio (1971), Riding and Taylor (1976), Riding and Calvey (1981)	Visualisers better than verbalisers in the recall of high imagery material. Will use either verbal or visual strategies to represent knowledge and thinking.

APPENDIX B: LETTER REQUESTING PERMISSION TO CONDUCT THE STUDY AND LETTER PROVIDING THIS CONSENT

12 September 2005

Head of Department: Department of Physiology
 Faculty of Health Sciences
 Basic Medical Sciences Building – 9-8
 University of Pretoria
 0002

Dear Prof van Papendorp

PERMISSION TO CONDUCT PhD RESEARCH USING PHYSIOLOGY AS CONTEXT AND CONTENT

I am currently registered as a PhD student in the Faculty of Education at the University of Pretoria. My research proposal outlines a study which aims to investigate the relationship between cognitive load and cognitive styles when using animations as learning resources within a specific content domain. I attach an executive summary of my proposal. I successfully defended my proposal on the 22 April 2005.

My work in the field of multimedia development over the last five years has primarily been in the health sciences education field. This is a field which makes extensive use of multimedia learning resources. As such I would like to use the context of health sciences education in general, and physiology education in particular for my research. It is also my aim to base this research in a setting which is as authentic as possible – in other words, to take content which must be studied by all students who take physiology as part of their curriculum. Many research studies in this field use content which is not part of the student's normal curriculum. There is a need for research which uses more authentic learning experiences.

I therefore request permission to develop multimedia content which covers various sections of the physiology of the renal system, and to use the students at UP who take physiology as a subject as participants in the study. On completion of the study all content developed will be given to the University of Pretoria.

There will be two phases in this research. The detail about the times and particular student groups are outlined on the table below.

Phase	Student group	No of participants	Time frame	Duration of experiment
Pilot study	Students doing Physiology which is not part of the MBChB program	80 – 120	February 2006	2 sessions First – 20 – 30min Second – 1.5 - 2 hours
Larger study	MBChB students – during	400 - 500	April / May 2006	2 sessions

	Other students in the Faculty of Health Sciences		Whenever it fits into their curriculum	First – 20 – 30min Second – 1.5 - 2 hours
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I will therefore require approximately 2 hours of time from each student who participates in the study. These sessions will be conducted in the computer laboratories on with the Hatfield campus or the Prinshof campus. Participation will be voluntary. I furthermore request permission to approach the lecturers in your department who teach the physiology of the renal system to serve as the content experts who will guide the development. I will continue with the necessary application and ethical review with the appropriate committees should you give me permission to undertake this study.

Yours sincerely

Anne Strehler

Student No: 77006799

APPENDIX C: PERMISSION FROM SMITH (2007) TO USE DATA FROM HER STUDY

P O Box 74000
Lynnwood Ridge
0040
20 February 2008

Department of Statistics
University of Pretoria
Pretoria

Dr M v. d. Linde

I, M E Smith, hereby grant Anne Strehler permission to use any of the datasets from the research project DPG9077 - OD425993 - T06028 as required.

Regards

M E Smith

Student nr 72224089

APPENDIX D: PRE TEST / POSTTEST: COMPUTER-BASED TEST

Knowledge questions

Section 2 | Pre-test

Pre-test

There are 9 questions in this test. Please try and answer all the questions. The questions will be scored, and the mark displayed at the end.

Instructions on how to answer each question are provided on the screen.

Click on the **START** button to begin. There is a time limit of 10 min for completing the test.

You **CANNOT** go back to a previous question.

Start


Image cropped for illustrative purposes

Section 2 | Pre-test

Pre-test

Question 1: Which area of the brain is most directly involved in the reflex control of the autonomic system?


Select the answer in the drop-down list.

Click on the  button to continue.

Correct answer / Score = 1

Image cropped for illustrative purposes

Time remaining:

Click here when you are finished 

Section 2 | Pre-test

Pre-test

Question 2: Which organs are innervated **mainly** by the sympathetic system?

Select the answer(s) by clicking on the check box next to the option

- Salivary glands
- Stomach glands **Correct answer / Score = 1**
- Sweat glands
- Blood vessels of the skin **Correct answer / Score = 1**
- Pancreas glands

Image cropped for illustrative purposes

Time remaining: 00:09:41

[Click here when you are finished](#) ▶

Section 2 | Pre-test

Pre-test

Question 3: Click on the label and drag it to its place on the diagram.

Labels in correct places
Score = 6

Time remaining: 00:09:18

[Click here when you are finished](#) ▶

Section 2 | Pre-test

Pre-test

Question 4: Which group of receptors are stimulated when the bladder is full?

Select the answer in the drop-down list.

Correct answer / Score = 1

Baroreceptors
Stretch receptors
Volume receptors

Image cropped for illustrative purposes

Time remaining: 00:09:01

[Click here when you are finished](#) ▶

Section 2 | Pre-test

Pre-test

Question 5: Parasympathetic ganglia are located...

Select the answer from the drop down list

Correct answer / Score = 1

in a chain parallel to the spinal cord.
in the dorsal roots of spinal nerves.
next to or within the organs innervated.
in the brain.

Image cropped for illustrative purposes

Time remaining: 00:08:44

[Click here when you are finished](#) ▶

Section 2 | Pre-test

Pre-test

Question 6:
This diagram illustrates

Correct answer / Score = 1

Select the answer in the drop-down list.

Time remaining: 00:08:29

Click here when you are finished

Section 2 | Pre-test

Pre-test

Question 7: Which neurotransmitters are released by the neurons at the synapses in this diagram?

Type on your answer in each field. Use the abbreviations provided in the legend. Use the TAB key to move from one field to the other

Legend

- Ach - Acetylcholine
- Nor - Noradrenaline
- Dop - Dopamine
- NO - Nitrogen Oxide

Time remaining: 00:08:11

Click here when you are finished

Section 2 | Pre-test

Pre-test

Question 8: What effect does increased sympathetic stimulation have on the following organs?

Select the answer from the drop-down list next to each organ

Heart **Correct answer / Score = 1**
 Decreases heart rate

Pupils **Correct answer / Score = 1**
 Constrict

Bladder **Correct answer / Score = 1**
 Wall contracts - bladder empties

Salivary glands **Correct answer / Score = 1**
 No effect whatsoever
 Secretes large amount of watery enzyme-rich saliva

Time remaining: 00:07:57

[Click here when you are finished](#) ▶

Section 2 | Pre-test

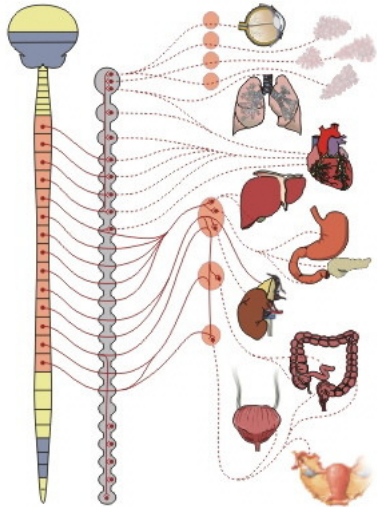
Pre-test

Question 9:

This diagram illustrates the **Correct answer / Score = 1**

Select the answer in the drop-down list.

Click on the button to continue



Time remaining: 00:07:02

[Click here when you are finished](#) ▶

Section 2 | Pre-test

Pre-test results

Your score for this pre-test: 11 / 22

You are now going to work through the content of the lesson. You will be assessed again at the end of the lesson. You may go back to previous screens as often as you like in order to master the content. Take your time. You may use the paper provided to make notes - these will be collected before the next assessment.



Click on the  button at the bottom of the screen to continue

Image cropped for illustrative purposes



The Autonomic Nervous System | Menu


Post-test results


Your score for the post-test was: 12 / 22

This is not your final score. The two open-ended questions must still be assessed. I will send the results to your lecturer, if you are interested in knowing what your final score was.

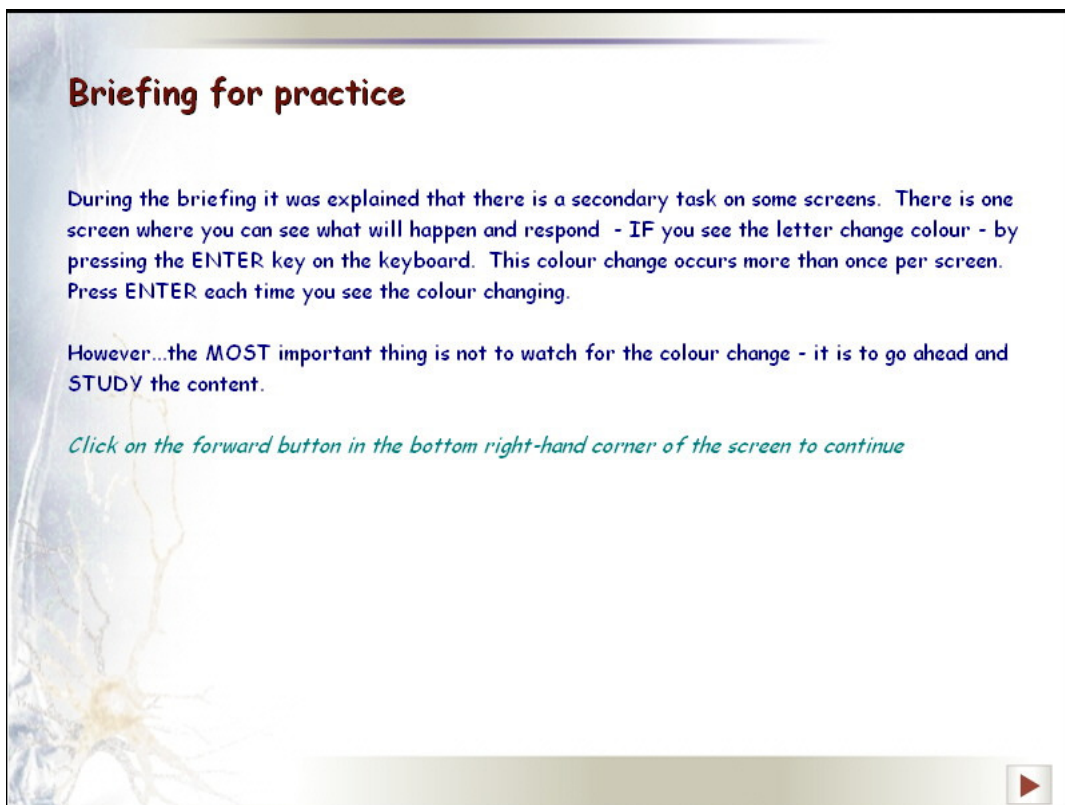
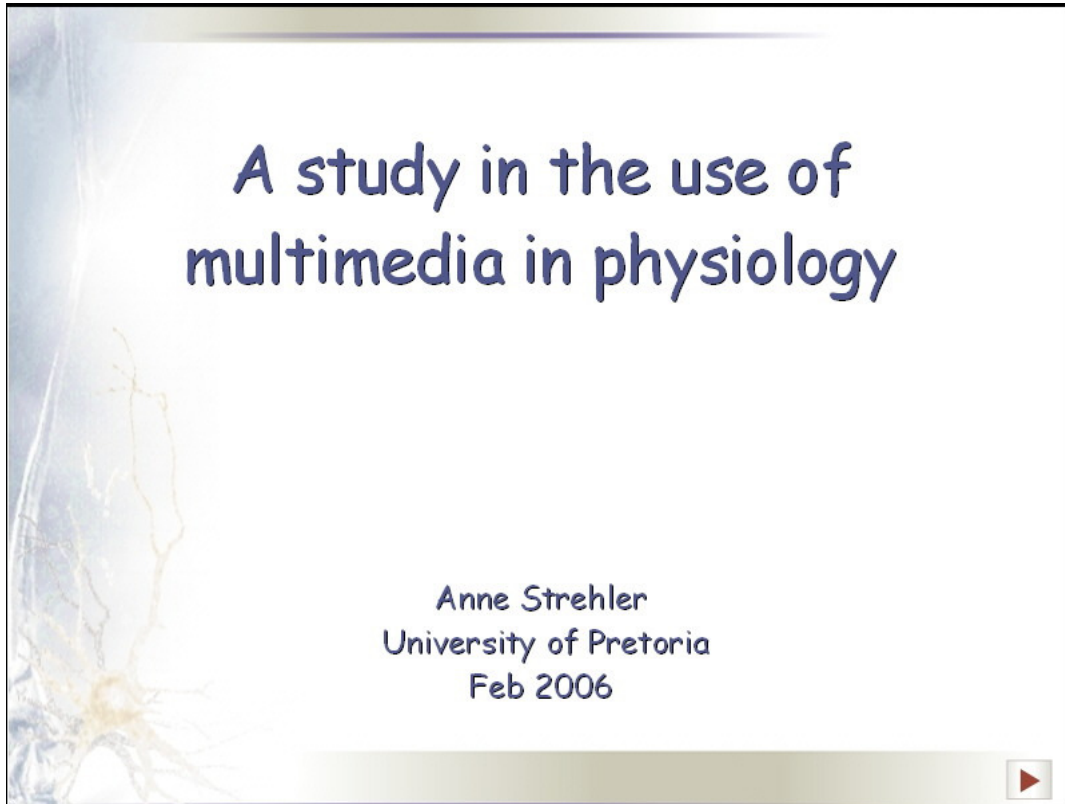
Did this score come close to your estimation at the start of the post-test?

There are another four screens to work through. You need to answer a series of questions about your experience today. Please read the question and the options carefully before your attempt to answer.

Click on the  button at the bottom of the screen to continue



APPENDIX F: TITLE SCREEN AND PRACTICE SESSION SCREEN

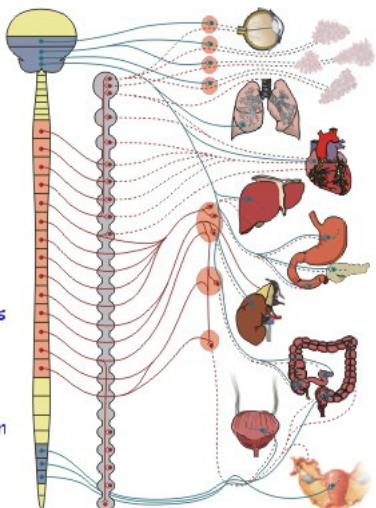


Practice screen

This system was described by Gaskell and Langley around the end of the 19th - beginning of the 20th century. At first it was thought that the autonomic nervous system functioned independently of the central nervous system, but this is not the case.

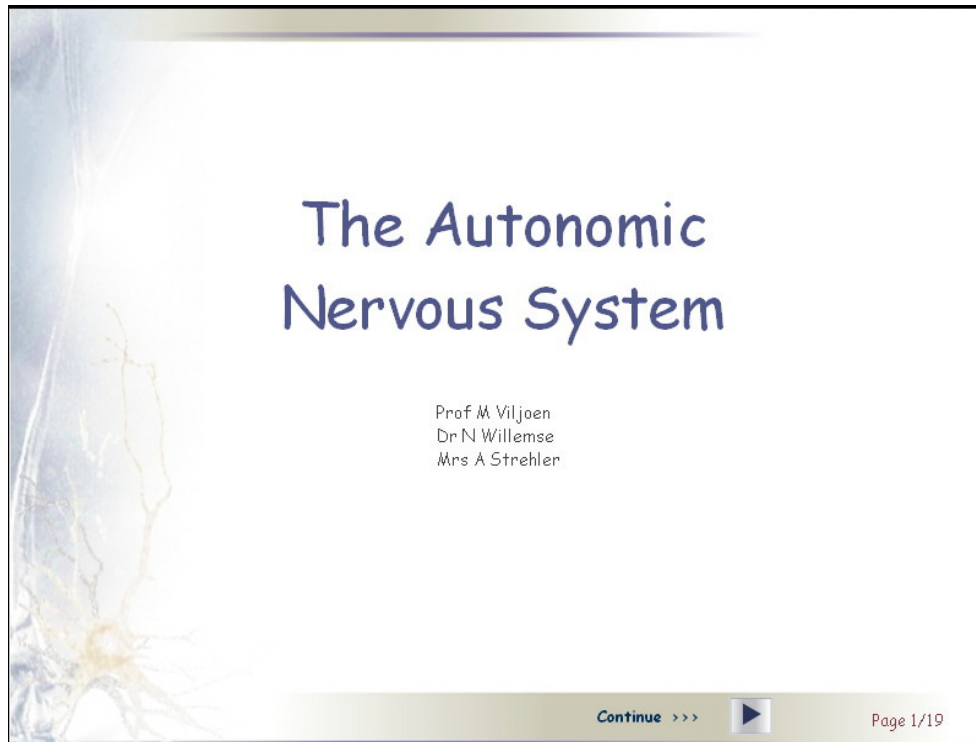
The ANS is regulated by the central nervous system (CNS), especially the hypothalamus. We also know that cognitive and emotive processes from the higher brain centra also influence the ANS. The ANS plays an important role in homeostasis.

The autonomic nervous system is often seen only as an efferent or motor system, but there are afferent or sensory pathways and inflows to the central nervous structures, which are involved in the regulation of the efferent or motor function. We will now look at both these pathways in more detail in the next few screens.

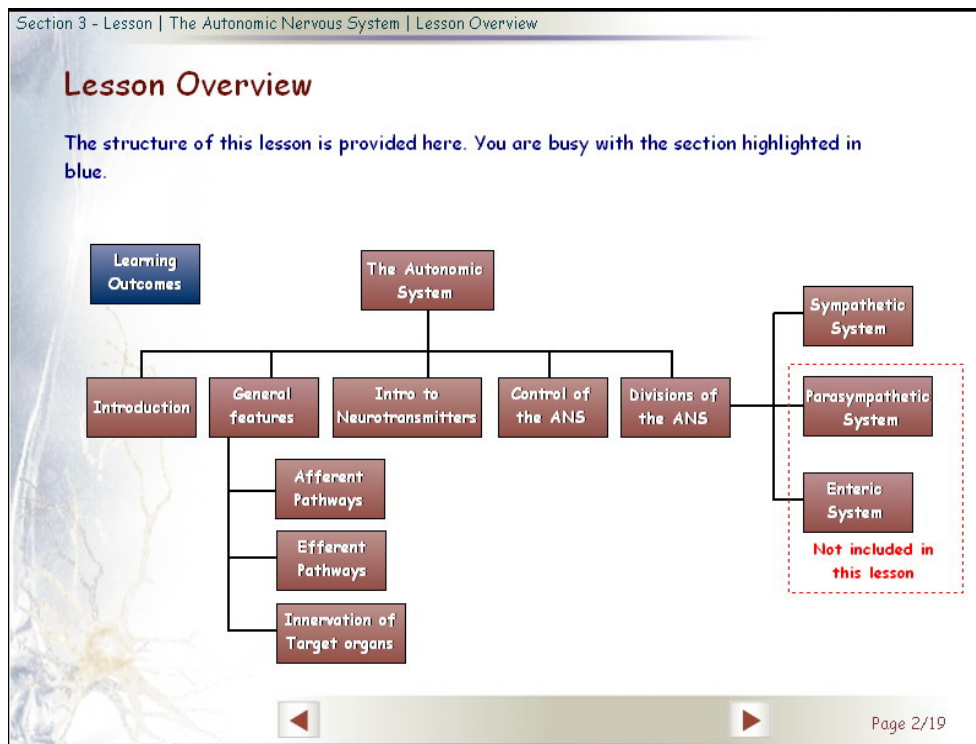


The diagram illustrates the autonomic nervous system (ANS) and its connection to the central nervous system (CNS). On the left, the brain and spinal cord are shown. The brain is divided into the cerebrum (top) and the brainstem (middle). The spinal cord is shown as a vertical column of segments. On the right, various organs are depicted, including the lungs, heart, liver, stomach, intestines, and bladder. Lines represent the pathways of the ANS, showing how signals from the brain and spinal cord reach these organs. The pathways are color-coded: blue for sympathetic (fight or flight) and red for parasympathetic (rest and digest). A green letter 'A' is visible in the bottom right corner of the screen.

APPENDIX G: MULTIMEDIA INTERVENTION: SCREENS COMMON TO BOTH FORMATS



Animation version: Screen 1/19 and Static images & text version: Screen 1/23




Animation version: Screen 2/19 and Static images & text version: Screen 2/23



Section 3 - Lesson | The Autonomic Nervous System | Learning Outcomes

Learning outcomes

The learning outcomes for this lesson are to:

- Describe the structure of the Autonomic Nervous System, using basic illustrations.
- Understand the control of the Autonomic Nervous System.
- Compare the structure and function of the Sympathetic and Parasympathetic divisions.
- Describe the function of the Sympathetic Nervous System.
- Describe how the function of the Autonomic reflexes can apply to patient care management for selected problems.

Click on the  button to continue

 Site Map  Page 3/19

Animation version: Screen 3/19 and Static images & text version: Screen 3/23

Section 3 - Lesson | The Autonomic Nervous System | Introduction

Introduction

Click on the underlined text



The Autonomic Nervous System (ANS) is involved in maintaining homeostasis of the internal environment of the body through the regulation and modification of the following activities.

- All involuntary muscle tissue.
- The secretory activity of all exocrine glands.
- Some endocrine glands.
- Some adipose tissue.

Examples of this type of tissue include the heart muscle, smooth muscle fibers.

The **TWO** main functions of the system are to:

- Regulate the activity of the visceral organs and glandular structure responsible for the basic (vegetative) bodily processes - during rest and digest.
- Respond to a stressor - also known as the typical 'fight or flight' response.

 Site Map  **A** Page 4/19

Animation version: Screen 4/19 and Static images & text version: Screen 4/23

Section 3 - Lesson | The Autonomic Nervous System | Introduction

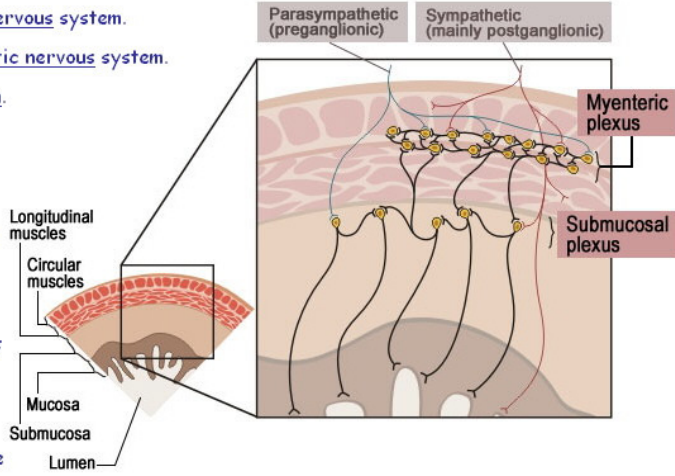
Click on the underlined text and watch the image

The ANS has three parts, the

- The sympathetic nervous system.
- The parasympathetic nervous system.
- The enteric system.

Many of the systems regulated by the ANS receive both excitatory and inhibitory signals from sympathetic and parasympathetic divisions. This provides fine control of the regulated system.

We will look at each of these in turn.



The Enteric Nervous System

Site Map Page 5/19

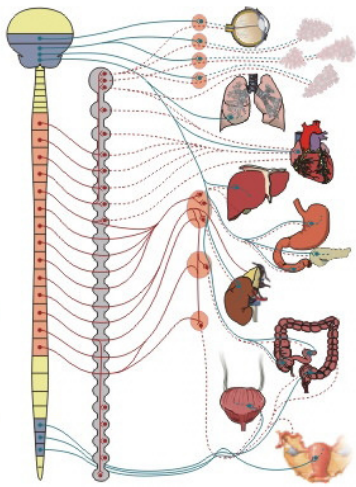
Animation version: Screen 5/19 and Static images & text version: Screen 5/23

Section 3 - Lesson | The Autonomic Nervous System | Introduction

This system was described by Gaskell and Langley around the end of the 19th - beginning of the 20th century. At first it was thought that the autonomic nervous system functioned independently of the central nervous system, but this is not the case.

The ANS is regulated by the central nervous system (CNS), especially the hypothalamus. We also know that cognitive and emotive processes from the higher brain centra also influence the ANS. The ANS plays an important role in homeostasis.

The autonomic nervous system is often seen only as an efferent or motor system, but there are afferent or sensory pathways and inflows to the central nervous structures, which are involved in the regulation of the efferent or motor function. We will now look at both these pathways in more detail in the next few screens.



Site Map Page 6/19

Animation version: Screen 6/19 and Static images & text version: Screen 6/23

Section 3 - Lesson | The Autonomic Nervous System | Afferent pathways

Afferent pathways

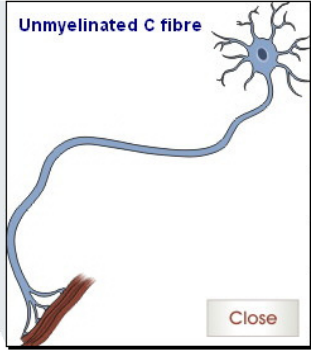
Click on the underlined text

These autonomic fibres are unmyelinated C fibres. Stimulation is both internal and external.

Internal stimulation

The fibres originate in receptors that provide functions in the visceral organs. These receptor groups have further categorisation. This is summarised in the table below.

Pressure changes	Baroreceptors
	Stretch receptors
	Volume receptors
Chemical changes	Chemoreceptors
	Osmoreceptors



Unmyelinated C fibre

Each

Close

Navigation: Site Map, Page 7/19

Animation version: Screen 7/19 and Static images & text version: Screen 7/23

Section 3 - Lesson | The Autonomic Nervous System | Afferent pathways

Activity: Afferent pathways

Match the example with the type of receptor. Drag the example to the correct place in the table. Click on the Check Answer button to mark your effort

Pressure changes	Baroreceptors	Stimulated when the bowel is full
	Stretch receptors	Decrease in O ₂ saturation of blood
	Volume receptors	Changes in electrolyte balance
Chemical changes	Chemo-receptors	
	Osmo-receptors	

An increase in blood pressure

A full bladder

Check Answer

Navigation: Site Map, Page 8/19

Animation version: Screen 8/19 and Static images & text version: Screen 8/23

Section 3 - Lesson | The Autonomic Nervous System | Afferent pathways

External stimulation

- Changes in the external environment can also stimulate the afferent pathways - temperature changes, extreme climates and environments e.g. underwater pressure during diving.
- Psychological stressors.

The afferent pathway is illustrated here (using blue).

Labels in diagram: Dorsal root ganglion, Sympathetic ganglion, Afferent sympathetic fibre, Preganglionic neuron, Postganglionic neuron, Target organ.

Site Map Page 9/19

Animation version: Screen 9/19 and Static images & text version: Screen 9/23

Section 3 - Lesson | The Autonomic Nervous System | Efferent pathways

Efferent pathways

Click on the underlined text

The functional unit of the **efferent division** of the autonomic nervous system is a two-neuron motor pathway, which consists of a preganglionic neuron and a postganglionic neuron. The preganglionic fibers are typically myelinated B fibres, whereas the postganglionic fibers are unmyelinated C fibres.

Labels in diagram: Preganglionic neuron, Postganglionic neuron, Vascular smooth muscle.

Myelinated C fibre

Close

Map Page 10/19

Animation version: Screen 10/19 and Static images & text version: Screen 10/23

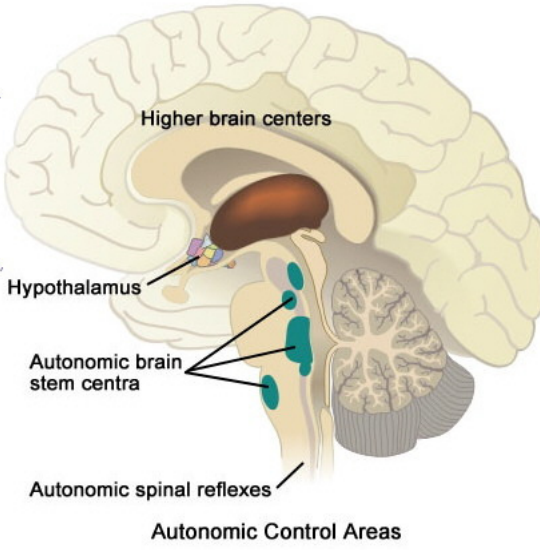
Section 3 - Lesson | The Autonomic Nervous System | Control

Control of the ANS

Click on the underlined text

The activity of the sympathetic nervous system is controlled by:

- autonomic spinal reflexes - first level of control,
- autonomic centra in the brain stem - second level of control,
- the autonomic nuclei of the hypothalamus - third level of control - and
- by higher brain centra.



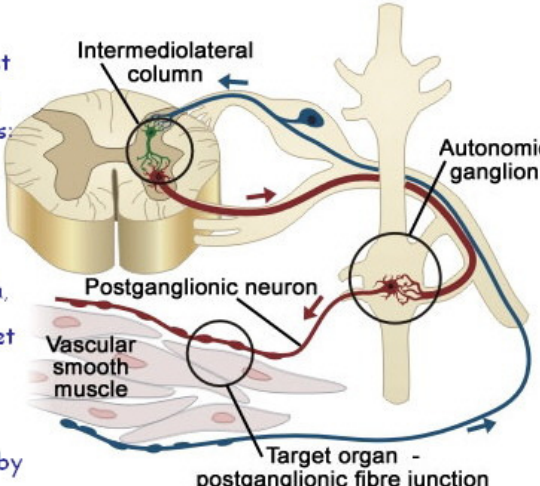
Page 15/19

Animation version: Screen 15/19 and Static images & text version: Screen 22/23

First level of control

Autonomic spinal reflexes represent the first level of control of sympathetic activity. The control centres involved at this level includes:

- the preganglionic sympathetic nuclei in the intermediolateral grey matter,
- the autonomic ganglia in the paravertebral and prevertebral ganglia,
- and even the junction between the target organ and postganglionic fibre.



The first level of control can be influenced by the second level of control.

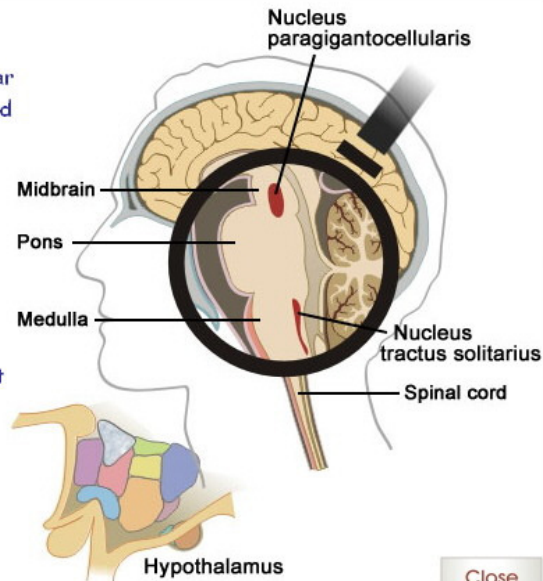
Close

Second level of control

The second level of control, is the reticular formation in the brain stem and spinal cord that include the

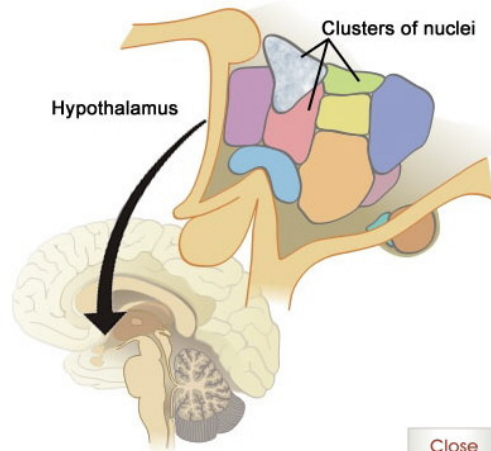
- nucleus tractus solitarius, and the
- nucleus paragigantocellularis.

These autonomic centra of the midbrain, pons, medulla and spinal cord are in turn under the influence of the third level, that is, the hypothalamus.



Third level of control

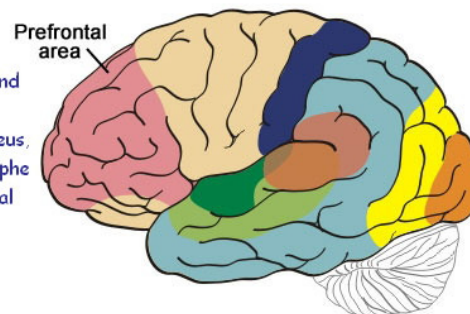
The autonomic nuclei of the hypothalamus represents the third level of control. The hypothalamus can in a sense be seen as the head autonomic ganglion and consists of clusters of nuclei that control endocrine and autonomic nervous system function. The hypothalamus can, however, be influenced by the higher brain centra.



Control by higher brain

Higher brain centres can influence autonomic control by the hypothalamus and brain stem through descending tracts associated with the paraventricular nucleus, the central noradrenergic system, the raphe nuclei and others. Cognitive and emotional events can in this way alter sympathetic activity and chronic stress can through conditions of sustained sympathetic stimulation even shorten the life time of humans and animals.

The degree to which external and cortico-limbic inputs activate the sympathetic system is largely determined by the individual's perception of the situation, which is often a function of previous experience and conditioning.



Section 3 - Lesson | The Autonomic Nervous System | Innervation of the Target Organs

Innervation of the target organs Still under construction - the link for the GIT, Eyes and Lungs is active

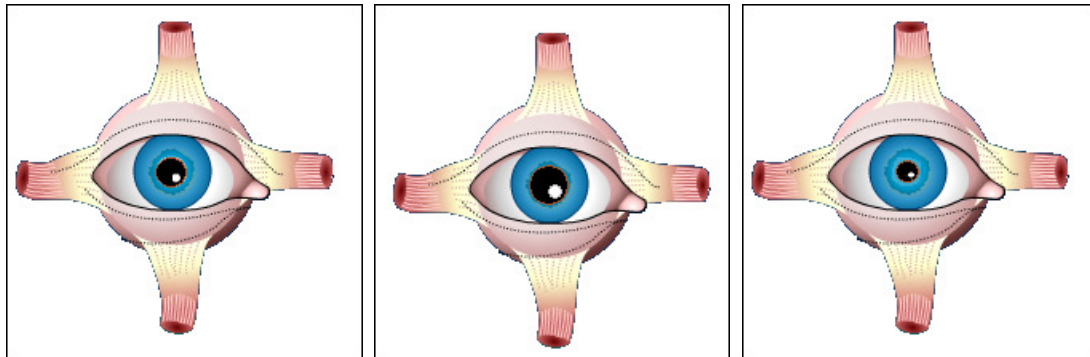
Click on the organ, then click on either the SNS or the PNS button below

Sympathetic Innervation | Parasympathetic Innervation | Reset

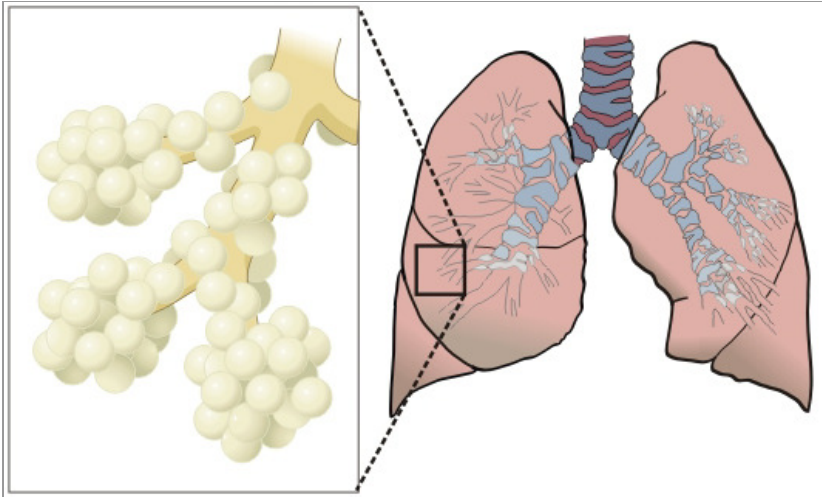
GIT Lungs Eyes Heart Bladder

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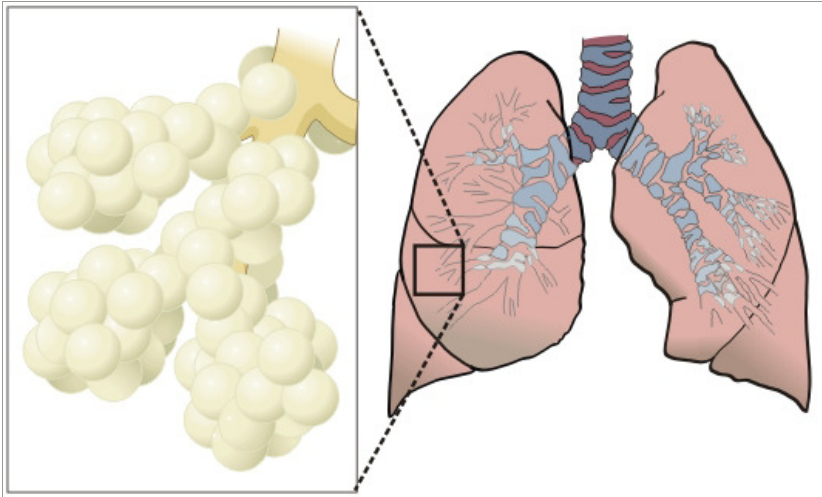
Animation version: Screen 17/19 and Static images & text version: Screen xx/23 – opening view



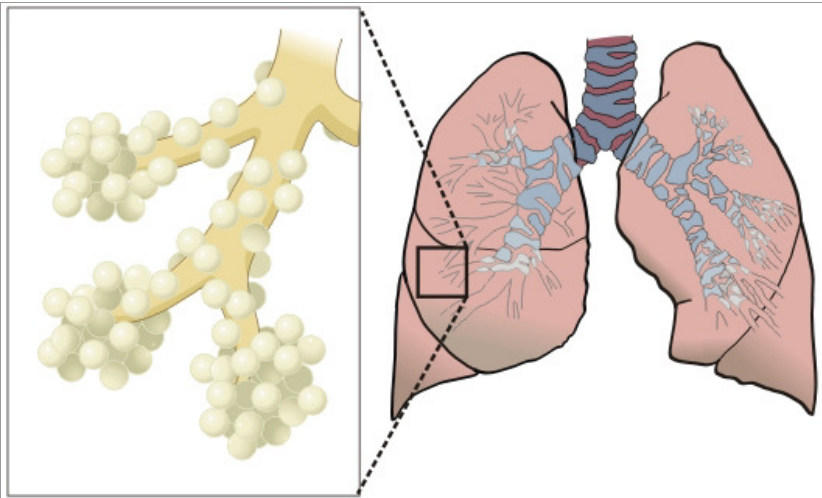
Three views of the innervation of the eye



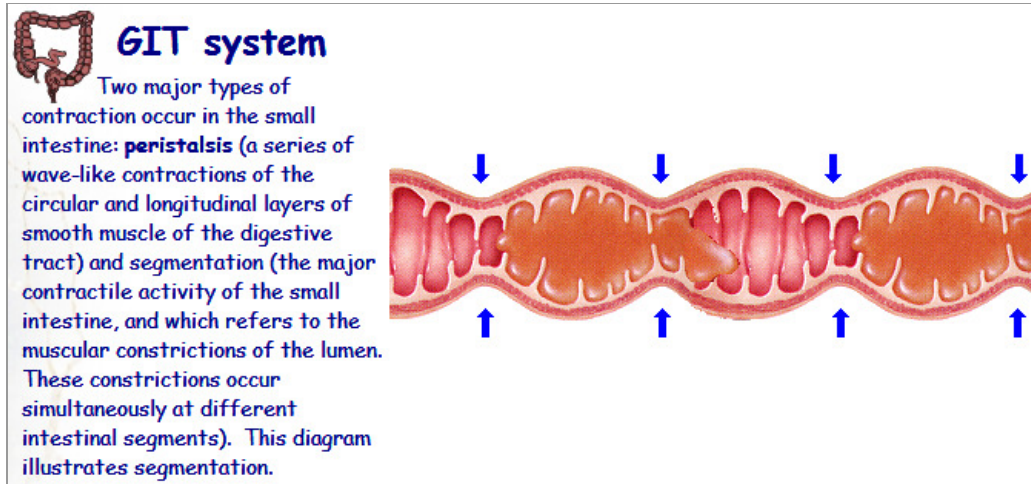
First view of the lung



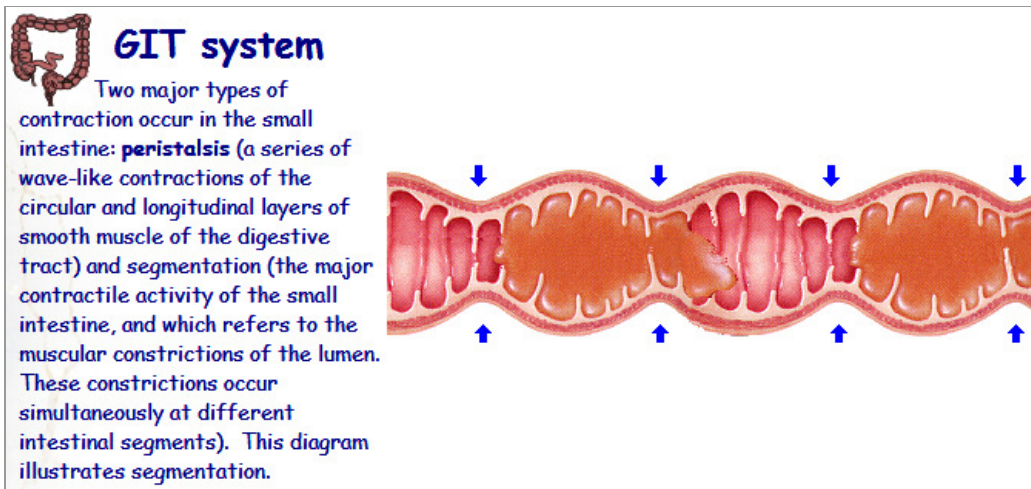
Innervation by the Sympathetic Nervous System



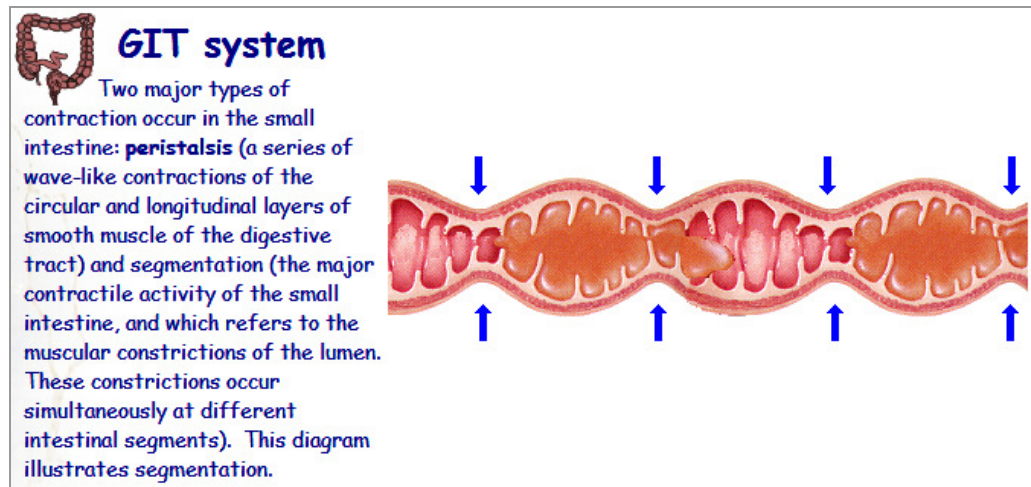
Innervation by the Parasympathetic Nervous System



First view of the GIT system



Innervation by the Sympathetic Nervous System



Innervation by the Parasympathetic Nervous System

APPENDIX H: MULTIMEDIA INTERVENTION: DIFFERENT STRATEGIES TO DISPLAY SAME CONTENT

Animation version – Screen 13

Section 3 - Lesson | The Autonomic Nervous System | Divergence and Convergence

Divergence and convergence

There are two phenomena in the sympathetic nervous system, known respectively as:

- Divergence
- Convergence

Click on each concept for an illustrated explanation

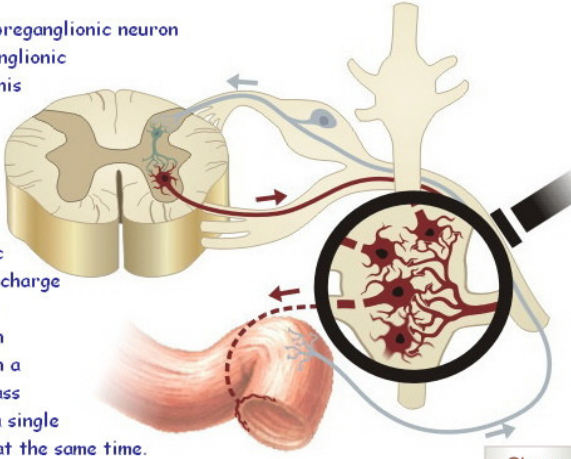
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◀ Site Map ▶ **A** Page 13/19

Divergence

This is the phenomenon where a single preganglionic neuron synapses with an average of ten postganglionic neurons in the sympathetic ganglion. This **SIMULTANEOUSLY** activates more organ systems. Divergence occurs primarily in the sympathetic nervous system (SNS).

This mass activation of the sympathetic nervous system - the so-called mass discharge or 'fight-or-flight' response - plays an important role in stress responses when there is a need to coordinate changes in a broad range of systems. Because of mass activation the SNS can (activation as a single unit) affect all of its effector organs at the same time.

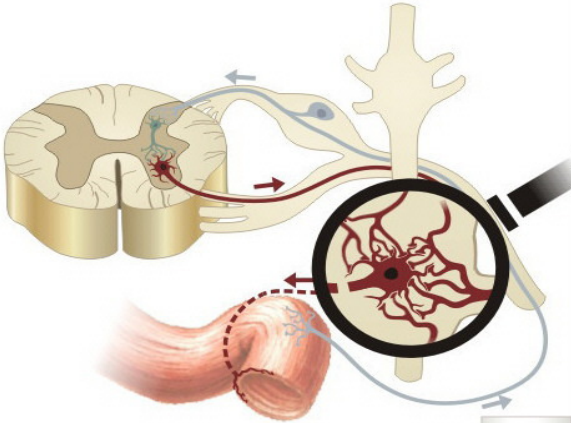


Close

Convergence

This is the phenomenon where many preganglionic neurons converge on one postganglionic cell body in the sympathetic ganglion.

Convergence allows for modulation and integration of control.



Close

Static images & text version – Screen 20

Section 3 - Lesson | The Autonomic Nervous System | Divergence and Convergence

Divergence and convergence

There are two phenomena in the sympathetic nervous system, known respectively as:

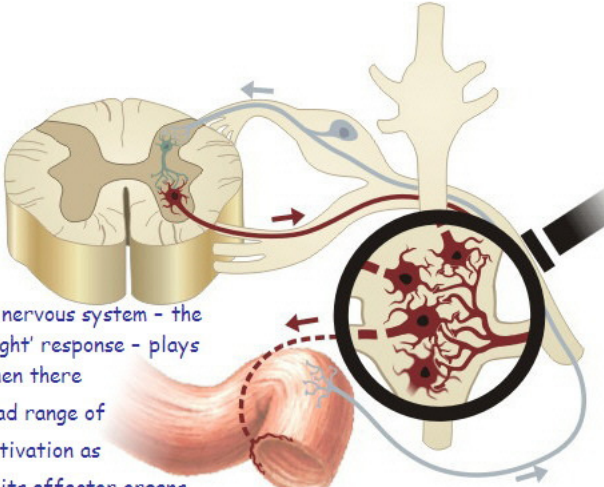
- Divergence
- Convergence

<<<< Click on each concept for an illustrated explanation

Divergence

This is the phenomenon where a single preganglionic neuron synapses with an average of ten postganglionic neurons in the sympathetic ganglion. This **SIMULTANEOUSLY** activates more organ systems. Divergence occurs primarily in the SNS.

This mass activation of the sympathetic nervous system - the so-called mass discharge or 'fight-or-flight' response - plays an important role in stress responses when there is a need to coordinate changes in a broad range of systems. Because of mass activation (activation as a single unit) the SNS can affect all of its effector organs at the same time.



◀ Site Map ▶ **A** Page 20/23

Section 3 - Lesson | The Autonomic Nervous System | Divergence and Convergence

Divergence and convergence

There are two phenomena in the sympathetic nervous system, known respectively as:

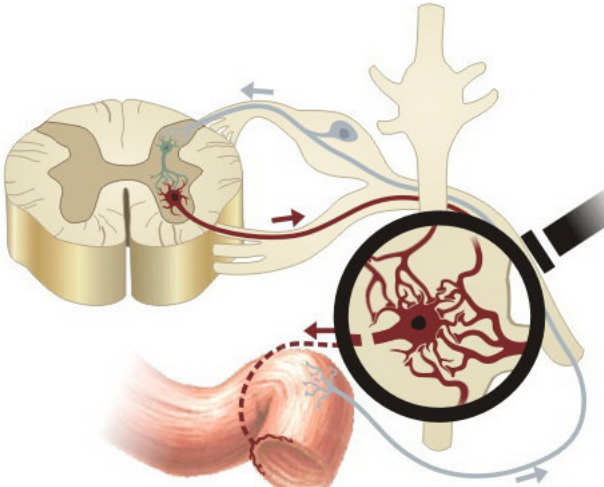
- Divergence
- Convergence

<<<< Click on each concept for an illustrated explanation

Convergence

This is the phenomenon where many preganglionic neurons converge on one postganglionic cell body in the sympathetic ganglion.

Convergence allows for modulation and integration of control.



◀ Site Map ▶ **A** Page 20/23

APPENDIX I: MULTIMEDIA: ANIMATION VERSUS STATIC IMAGES

Animation version: Screen 12 (Animation)

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System

Structure of the system This is a narrated animation - listen using the earphones

Click on the button to play the animation [Site Map](#) **A** Page 12/19

Static images & text version: Screens 12 – 16

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

This section will take you through a step-by-step, illustrated explanation of the structure of the sympathetic nervous system. There are a total of 7 screens. You need to work through all 7 screens, and return to this screen to continue.

The content, displayed schematically here, is explained in three sections:

- The origins of the efferent fibres
- The ganglia and synaptic connections
- The effector organs

Follow the instructions on the screen. Explore the content on your own as well. Rolling the mouse over the images will often display more information.

Click on the white text below to get to the different sections. When you have completed a section you will see the word 'Completed' under the relevant section. Once all are complete you can use the forward button to move on in the lesson

```

graph LR
    A[Origins] --> B[Synapses & ganglia]
    B --> C[Effector organs]
  
```

[Site Map](#) Page 12/23

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

You are studying the section highlighted in blue

The preganglionic neurons originate from the autonomic centres located in the pars intermedia of the grey matter of the thoracic and upper two lumbar segments of the spinal cord.

Roll mouse over this area of the spinal cord T1 - T12 for more detail

Page 13/23

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

You are studying the section highlighted in blue

The preganglionic neurons originate from the autonomic centres located in the pars intermedia of the grey matter of the thoracic and upper two lumbar segments of the spinal cord.

Roll mouse over this area of the spinal cord T1 - T12 for more detail

Intermediolateral column

Spinal cord

Page 13/23

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

Origins →
 Synapses & ganglia →
 Effector organs

You are studying the section highlighted in blue

The preganglionic neurons which originate from the CNS terminate in autonomic ganglia where they form synaptic connections with neurons in the ganglia. These autonomic ganglia are located in three areas - illustrated here in the diagram and on the next screen.

Roll mouse over the diagram for more detail

Paravertebral chain ganglia

▶ Page 14/23

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

Origins →
 Synapses & ganglia →
 Effector organs

You are studying the section highlighted in blue

The preganglionic neurons which originate from the CNS terminate in autonomic ganglia where they form synaptic connections with neurons in the ganglia. These autonomic ganglia are located in three areas - illustrated here in the diagram and on the next screen.

Roll mouse over the diagram for more detail

2

The preganglionic fibres supplying the digestive tract do **not** relay in the sympathetic chain but pass right through and synapse in collateral ganglia in nerve plexuses on the arteries supplying the intestines. There are three large ganglia:

- Celiac ganglion
- Superior mesenteric ganglion
- Inferior mesenteric ganglion

Paravertebral chain ganglia

▶ Page 14/23

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

Origins →
 Synapses & ganglia →
 Effector organs

You are studying the section highlighted in blue

The preganglionic neurons which originate from the CNS terminate in autonomic ganglia where they form synaptic connections with neurons in the ganglia. These autonomic ganglia are located in three areas - illustrated here in the diagram and on the next screen.

Roll mouse over the diagram for more detail

1

The **sympathetic ganglia**. These are **two** paravertebral or sympathetic chains, one on each side of the spinal cord. Each chain consists of about **22 ganglia**. Most of the preganglionic fibres terminate in neurons within the ganglia, but some may pass up or down the chain before establishing synaptic connections.

Paravertebral chain ganglia

▶ Page 14/23

Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

Origins →
 Synapses & ganglia →
 Effector organs

You are studying the section highlighted in blue

In this example.....

T12

When it enters the region of the chain of autonomic ganglia it passes downwards in this chain.....

Reset
▶

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Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

A

You are studying the section highlighted in blue

The preganglionic fibres (illustrated in green) leave the spinal cord and pass directly to the **medulla of the adrenal gland**, which can be likened to a modified sympathetic ganglion. This is the third area where there is a synaptic connection. The cells of the adrenal medulla (illustrated in the magnified area) are innervated by the preganglionic sympathetic fibers.

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Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

This section will take you through a step-by-step, illustrated explanation of the structure of the sympathetic nervous system. There are a total of 7 screens. You need to work through all 7 screens, and return to this screen to continue.

The content, displayed schematically here, is explained in three sections:

- The origins of the efferent fibres
- The ganglia and synaptic connections
- The effector organs

Follow the instructions on the screen. Explore the content on your own as well. Rolling the mouse over the images will often display more information.

Click on the white text below to get to the different sections. When you have completed a section you will see the word 'Completed' under the relevant section. Once all are complete you can use the forward button to move on in the lesson

Site Map

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APPENDIX J: MULTIMEDIA INTERVENTION: WHOLE VIEW VERSUS PARTS VIEW

Animation version – Screen 18

Section 3 - Lesson | The Autonomic Nervous System | Innervation of the Target Organs

Summary of the Autonomic Nerve Supply and effects on visceral organs

A. Organs with dual supply		
Organ	Sympathetic effects	Parasympathetic effects
Iris	Pupil dilation	Pupil constriction
Bronchioles	Dilation	Constriction
Heart	Rate ↑	Rate ↓
Digestive system	Motility ↓	Motility ↑
Sphincters of digestive tract	Contraction	Relaxation
Urinary bladder	Relaxation of wall → filling	Contraction of wall → emptying
B. Organs with mainly sympathetic supply		
Organ	Absence of sympathetic activity	Increased sympathetic activity
Blood vessels of skin	Vasodilation	Vasoconstriction
Sweat glands	None	Secretion
C. Organs with mainly parasympathetic supply		
Salivary glands	Secretion of large amounts of watery enzyme-rich saliva. (Stimulation of sympathetic fibres produce small amounts of a thick, viscous secretion)	
Stomach glands	Secretion of enzyme-rich gastric juice	
Pancreas glands	Secretion of enzyme-rich pancreatic juices	
Sex organs	Vasodilation in erectile tissue → erection	

◀ Site Map ▶ Page 18/19

All information presented in one table

Static images & text version – Screen 19

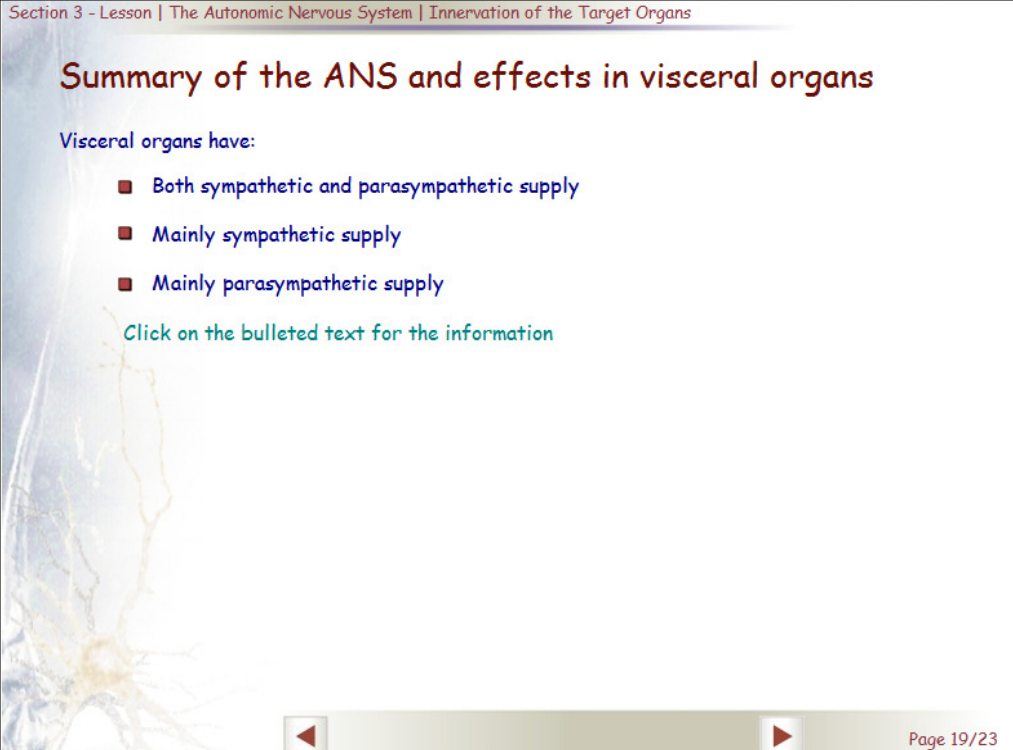
Section 3 - Lesson | The Autonomic Nervous System | Innervation of the Target Organs

Summary of the ANS and effects in visceral organs

Visceral organs have:

- Both sympathetic and parasympathetic supply
- Mainly sympathetic supply
- Mainly parasympathetic supply

Click on the bulleted text for the information



Page 19/23

Information accessed by clicking on bulleted text

Section 3 - Lesson | The Autonomic Nervous System | Innervation of the Target Organs

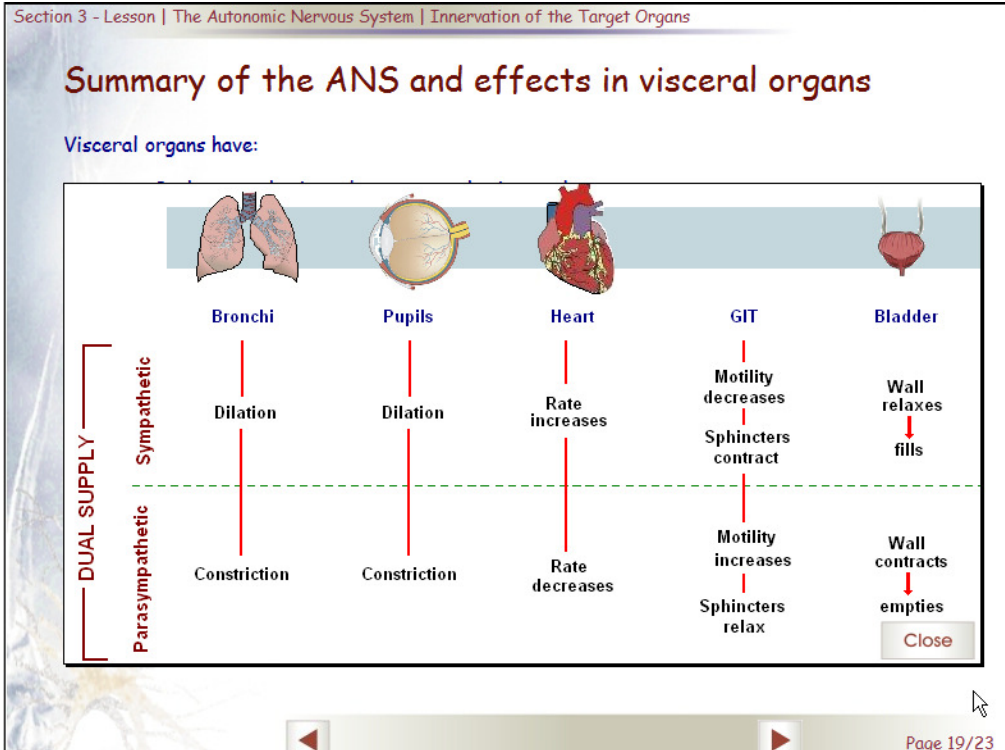
Summary of the ANS and effects in visceral organs

Visceral organs have:

	Bronchi	Pupils	Heart	GIT	Bladder
Sympathetic	Dilation	Dilation	Rate increases	Motility decreases Sphincters contract	Wall relaxes fills
Parasympathetic	Constriction	Constriction	Rate decreases	Motility increases Sphincters relax	Wall contracts empties

DUAL SUPPLY

Close



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Information provided in smaller chunks with text and visual material

Section 3 - Lesson | The Autonomic Nervous System | Innervation of the Target Organs

Summary of the ANS and effects in visceral organs

Visceral organs have:

- Both sympathetic and parasympathetic supply
- Mainly sympathetic
- Mainly parasympathetic

Click on the diagram to see the effects of sympathetic and parasympathetic activity on visceral organs.

	Blood vessels	Sweat glands
MAINLY Sympathetic Absence of sympathetic activity	Vasodilate	No secretion
MAINLY Sympathetic Increased sympathetic activity	Vasoconstrict	Secretion

Close

Page 19/23

Second pop-up for screen 19

Section 3 - Lesson | The Autonomic Nervous System | Innervation of the Target Organs

Summary of the ANS and effects in visceral organs

Visceral organs have:

- Both sympathetic and parasympathetic supply
- Mainly sympathetic
- Mainly parasympathetic

Click on the diagram to see the effects of sympathetic and parasympathetic activity on visceral organs.

	Salivary glands	Stomach glands	Pancreas	Sex organs
MAINLY Parasympathetic	Secrete large amounts of watery enzyme-rich saliva	Secretion of enzyme-rich gastric juice	Secretion of enzyme-rich pancreatic juices	Vasodilation in erectile tissue Erection
MAINLY Parasympathetic	Stimulation of sympathetic fibres produces small amounts of a thick, viscous secretion			

Close

Page 19/23

Third pop-up for screen 19

APPENDIX K: A SUMMARY OF THE MULTIMEDIA AND THE INTEGRATION OF THE RESEARCH INSTRUMENTS


Instrument	Section in multimedia	Appendix	It will measure...	Development	No of times administered	Source	Alignment with research sub-question / Purpose of this instrument
Cognitive Style Analysis (CSA)	Not included	Not included	Cognitive style	Existing instrument	Once	License to use CSA purchased from Learning & Training Technology, UK	What are the cognitive styles of the participants taking part in the study? What is the relationship between cognitive style and cognitive load when learning with multimedia?
Practice secondary task	1	Appendix G		Self-developed	Once – at beginning of multimedia	Not applicable	This was included to expose the participants to the direct measurement technique for measuring cognitive load. This was an attempt to control the potential extraneous cognitive load caused by this secondary task.
Demographic questionnaire	2	Appendix M	Demographic profile of sample	Self-developed	Once	Not applicable	Provides data for other potential covariates.
Self-report rating scale	2	Appendix N	Self-rating of Verbaliser-Imager dimension of cognitive style	Modified an existing instrument	Once	Adaptation of Mayer's instrument (Mayer & Massa, 2003)	What are the cognitive styles of the participants taking part in the study? The data collected will be used to determine the correlation between self-report measures of the style dimension and the measure obtained using Riding's Cognitive Style Analysis.

Instrument	Section in multimedia	Appendix	It will measure...	Development	No of times administered	Source	Alignment with research sub-question / Purpose of this instrument
Pretest	3	Appendix E	Prior knowledge of learning outcomes. First step in assessing extent of the learning gain.	Self-developed	Once	Physiology textbooks Validated by subject matter experts for content validity	How do participants with different cognitive styles perform when using the same content with different cognitive load?
Self-rating questionnaire	4	See Figure 3.3 on page 137	Self-report rating of mental load	Embedded at selected points in the program. Existing instrument	Version 1 Five (5) times Version 2 Six (6) times	Developed by Paas (1994)	What is the correlation between the participant's self-report of cognitive load and the direct measure of the cognitive load of the content?
Direct measurement technique	4	See Figure 3.9 and 3.10 on page 162	Cognitive load	Instrument embedded at selected points in multimedia program. Protocol modified for Smith's study (2007). Basic principles not changed.	Version 1 Eleven (11) times. Version 2 Thirteen (13) times.	Method described by Brünken, Plass & Leutner (2003).	Which presentation format was instructionally more efficient? To what extent do the presentation formats influence cognitive load? What is the relationship between cognitive style and cognitive load when learning with multimedia?
Posttest - Section 1	5	Appendix F	Knowledge and achievement of learning outcomes.	Self-developed	Once	Same test as pretest	How do participants with different cognitive styles perform when using the same content with different cognitive load?
Posttest - Section 2	Not included in multimedia		Test ability to apply knowledge.	Self-developed - pencil and paper test	Once	Validated by subject matter experts for content validity	Which presentation format was instructionally more efficient?

APPENDIX L: ELECTRONIC QUESTIONNAIRE TO COLLECT DEMOGRAPHIC DATA

Section 1 | Questionnaire - Personal Data

I need some personal information

Please complete all the fields and click on the  button when you are finished. Use the TAB key to move from field to field. Select the most appropriate options from the drop-down lists.

Personal information

Age (enter only the number e.g.24) :

Gender:

Which cultural group best describes you?:
(Select the option from the drop down list)

Information about your course


What programme are you registered for (e.g. MBChB):

What is your year of study?(enter only the number e.g. 3) :

Page 1/4

Section 1 | Questionnaire - Personal Data

I need some personal information

Please complete all the fields and click on the  button when you are finished. Use the TAB key to move from field to field. Select the most appropriate options from the drop-down lists.

Information about the lesson

Have you previously studied the physiology of the Autonomic Nervous System? (Y for Yes, N for No)

Rate your own knowledge and understanding of the physiology of the Autonomic Nervous System

I think I know & understand
(select the best option from the drop-down list)

Information about your language skills:

English is my:
(select the best option from the drop down list)

 language.

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APPENDIX M: ALLOCATION OF GROUPS FOR THE MAIN STUDY

	Animation version 10:30 – 12:30		Static images & text version 12:30 – 14:30	
Session 1	HWS Lab Lesson 1 Group 1 Sample size: n = 17	HWS Lab Lesson 2 Group 16 Sample size: n = 17	HWS Lab Lesson 3 Group 6 Sample size: n = 17	HWS Lab Lesson 4 Group 9 Sample size: n = 16
	BMW Lab Lesson 1 Group 2 Sample size: n = 16	BMW Lab Lesson 2 Group 15 Sample size: n = 16	BMW Lab Lesson 3 Group 5 Sample size: n = 16	BMW Lab Lesson 4 Group 10 Sample size: n = 16
Session 2	HWS Lab Lesson 1 Group 3 Sample size: n = 16	HWS Lab Lesson 2 Group 14 Sample size: n = 16	HWS Lab Lesson 3 Group 7 Sample size: n = 16	HWS Lab Lesson 4 Group 12 Sample size: n = 16
	BMW Lab Lesson 1 Group 4 Sample size: n = 16	BMW Lab Lesson 2 Group 13 Sample size: n = 17	BMW Lab Lesson 3 Group 8 Sample size: n = 16	BMW Lab Lesson 4 Group 11 Sample size: n = 17

**APPENDIX N: EXAMPLE OF DATA FOR A SINGLE PARTICIPANT - WRITTEN
OUT TO AN .INI FILE**

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[Accessed Lesson Time]

Time=10:59:46

[Exited Lesson Time]

Time=11:54:57

[XXXXXXXX] - Student number removed to protect identity of participant

02/27/06

Student No V1=**XXXXXXXX - Student number removed to protect identity of participant**

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Version V2=1

[Demographic Data3]

Age V3=18

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Gender V4=2

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Culture V5=3

[Course Detail 1]

Programme V6=MBCHB

[Course Detail 2]

Year of study V7=2

[Lesson Detail]

Prior Know V8=0

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\14 \15 \16 \17 \16 \17 \18 \19 \18 \19 \end lesson \final surv \exit

APPENDIX O: STUDENT HANDOUT - PARTICIPATION IN THE STUDY

Letter of consent

The relationship between cognitive load, cognitive style and multimedia learning

A study in the use of multimedia in physiology

Dear Participant

You are invited to participate in a research project aimed at exploring the role which cognitive load and cognitive style play in the successful achievement of learning outcomes when using animations as multimedia learning resources within the higher education sector. The study will also investigate the interrelationship between cognitive load, which is influenced by both the nature of the content and the specific design strategies used, and the cognitive style of the person using the multimedia.

Your participation in this research project is voluntary and confidential. You will not be asked to reveal any information that will allow your identity to be established by persons reading the results of the study. At this stage no follow-up interviews are planned. Attached to this letter is a document explaining your role in this research process. It includes the information provided to you during the briefing. The results from this study will be used to improve existing / extend the range of design guidelines for developing multimedia which makes extensive use of animation and images. The results will also inform designers of the extent to which the design should accommodate different cognitive styles.

If you are willing to participate in this study, please sign this letter as a declaration of your consent, i.e. that you participate in this project willingly and that you understand that you may withdraw from the research project at any time. Participation in this phase of the project does not obligate you to participate in follow up individual interviews, however, should you decide to participate in follow-up interviews your participation is still voluntary and you may withdraw at any time. Under no circumstances will the identity of interview participants be made known to the Faculty of Health Sciences or your individual lecturers. The research is done in fulfillment of the requirements for a doctoral degree in the department of Teaching and Training Studies, University of Pretoria.

Participant's signature: Date:

Student No:

Researcher's signature: Date:

Yours sincerely

Anne Strehler

Accessing the work

Open Windows Explorer

Cognitive styles analysis

- ◆ There is a folder on the C: drive – C:/CSA.
- ◆ There are two files in this folder.
- ◆ Click on the file CSA.EXE.
- ◆ Read the instructions carefully.

Before you close the program – call the research assistant to write down your scores

Opening the Lesson

- ◆ There is a folder on the C: drive – C:/Lesson1 OR C:/Lesson2 OR C:/Lesson2 OR C:/Lesson2.
- ◆ There are several files in this folder.
- ◆ Click on the file Lesson1.exe OR Lesson2.exe OR Lesson3.exe OR Lesson4.exe.
- ◆ The program will take a few seconds to open – please be patient.
- ◆ Start as soon as it is open.
- ◆ Read the instructions carefully.

Participation in the study – What the researcher expects from you

1. You have already been assigned to a particular session and the number of the lesson you must do. The way research participants are assigned is VERY important and affects the validity of the data.
2. Please do NOT swop with anyone.
3. Write your student number on each page of the handout.
4. Read all instructions carefully – everything you need to know is displayed ON THE SCREEN.
5. Do BOTH the Cognitive Styles Analysis and the lesson.
6. Please take this session seriously.
7. Answer EVERY question on every screen – including the ones embedded in between the content of the lesson.
8. Work individually – once the session starts PLEASE do NOT confer with your peers or talk to each other.
9. If you need help – ASK.
10. If the program bombs out – log in again – it is bookmarked and you can continue where you left off.
11. STUDY the content on the screen – this is a STUDY session – some of the content is not going to be repeated in your Block 3.
12. Follow ALL the links.

Results of Cognitive Style Analysis

Student Number

.....

WA Ratio

.....

VI Ratio

.....

Scribble page

Use this page to make any notes / mind maps etc while you study the content in the multimedia

Student No:

.....

APPENDIX P: RIDING’S COGNITIVE STYLES ANALYSIS

The CSA provides a score for each dimension in the cognitive style model. The ratios for each style dimension typically range from 0.4 through to 4.0 with a central value around 1.0. But for descriptive convenience, the dimensions may be divided into groupings and given labels (Riding, 2005a).

Riding clearly states:

Since each dimension is a continuum, the labels are used only for descriptive convenience, and are not meant to imply that there are style ‘types’ in any absolute sense. There is no requirement to use the same cut-off points as those given by the CSA, as long as the cut-offs are clearly reported in the research report.

Riding (2005a, page 7).

The cut-off points suggested by Riding (2005a) for the ratios on each dimension are given below.

WHOLIST-ANALYTIC Dimension	>1.35	Analytic Verbaliser	Analytic Bimodal	Analytic Imager
	>1.02 and <=1.35	Intermediate Verbaliser	Intermediate Bimodal	Intermediate Imager
	<=1.02	Wholist Verbaliser	Wholist Bimodal	Wholist Imager
		<=0.98	>0.98 and <=1.09	>1.09
	VERBALISER-IMAGER Dimension			

There are researchers who divide the style only into two categories with the following ranges: Wholists <0.99 and Analytics >1.00; Verbalisers < 0.93 and Imagers > 1.00 (Riding, Glass & Douglas, 1993).