

Human Performance & Limitations - Module B — The Living Machine

The Brain & Nervous System

Chapter 4 — The pilot's control computer: the brain, and the central, peripheral and autonomic nervous systems that carry every command and reflex.

BOOK

Human Performance & Limitations

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EXAM

DGCA CPL / ATPL — HPL

CHAPTER

4 of 26 · Module B

In this chapter

1. [The Brain & the Nervous System \(CNS · PNS · ANS\)](#).



Plate 4.0 — The control computer. Every decision, reflex and command in the cockpit begins here.

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The Brain & the Nervous System

The brain is the master controller of your body — every input you receive in flight (visual, vestibular, proprioceptive, auditory) is processed here, and every output (control inputs, R/T calls, decisions) originates here. The nervous system is the wiring that connects the brain to every organ and muscle.

7.1 The Brain

DEFINITION

The brain controls all bodily functions. It performs an incredible number of tasks, every one of which is potentially flight-critical.

What the brain does — exam list

- It controls **body temperature, blood pressure, heart rate and breathing**.
- It accepts information about the world around you from your various **senses** — seeing, hearing, smelling, tasting and touching.
- It handles your **physical movement** when walking, talking, standing or sitting.
- It lets you **think, dream, reason and experience emotions**.
- The brain controls **decision-making and speech**. Through the brain we experience **consciousness, vision, hearing, taste, smell, thought and memory**.

WHY THIS MATTERS IN THE COCKPIT

Every one of these functions is **oxygen-dependent**. The brain consumes about **20 % of the body's oxygen** despite being only ~2 % of body mass. Even mild hypoxia degrades judgement, decision-making and speech long before the pilot is consciously aware of it. (*Detailed in §10 Hypoxia — Part 3.*)

7.2 The Nervous System — Three Main Parts

The Nervous System is divided into **three main parts**:

DIVISIONS OF THE NERVOUS SYSTEM

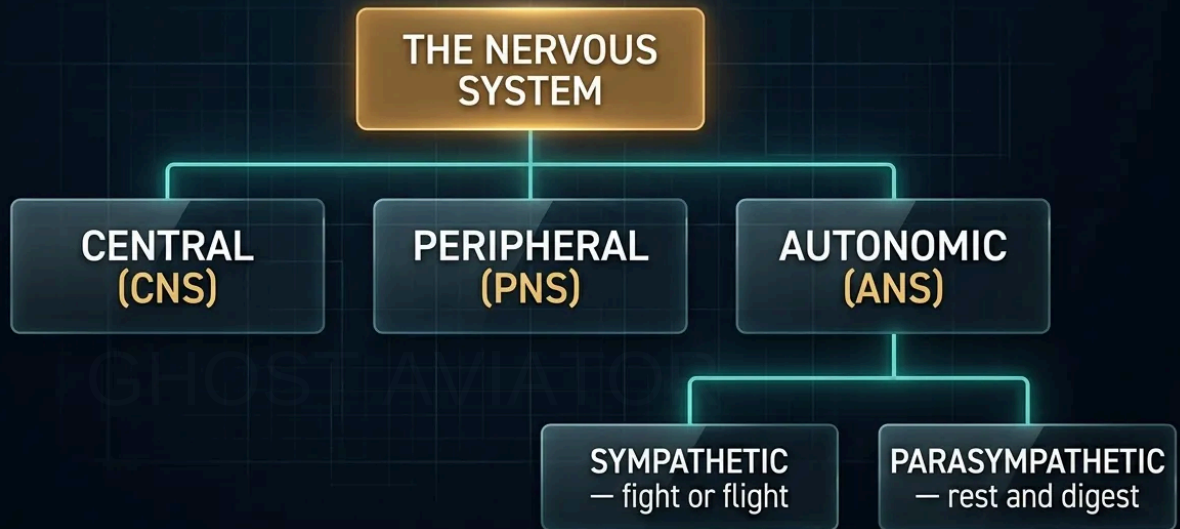


Figure 4.2 — The three divisions of the nervous system, with the autonomic split into sympathetic and parasympathetic.

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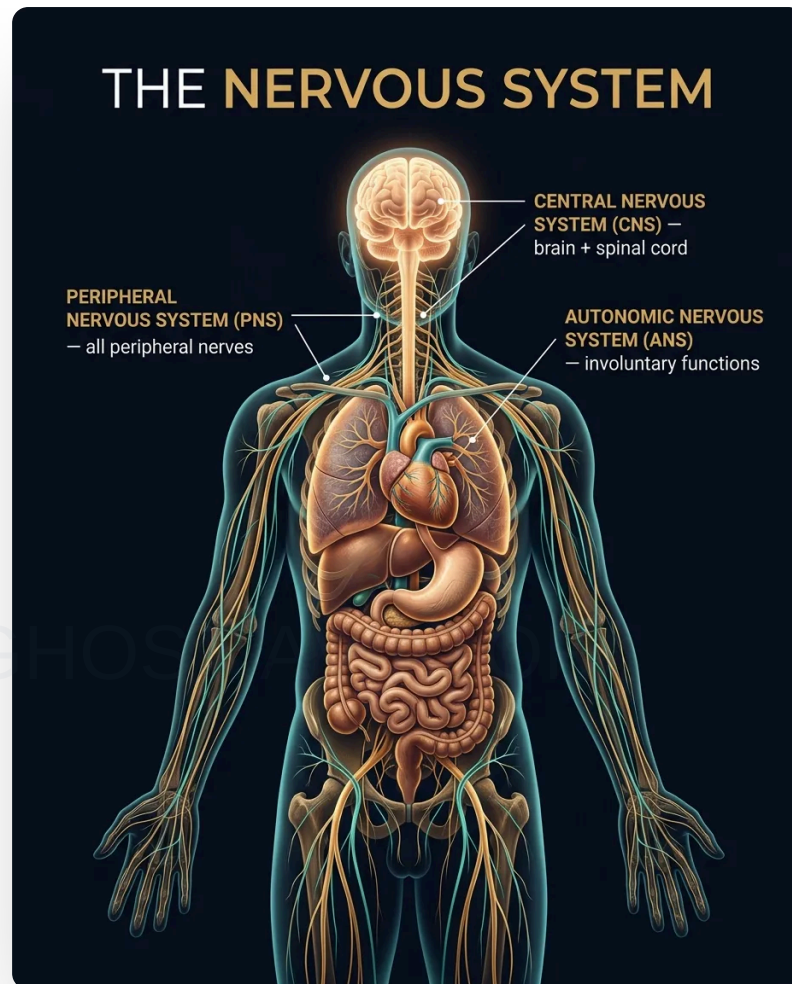


Figure 4.1 — The nervous system: the central (CNS), peripheral (PNS) and autonomic (ANS) divisions.

The Central Nervous System (CNS)

DEFINITION

The central nervous system consists of the **brain and the spinal cord**. The brain, spinal cord and peripheral nerves make up a **complex, integrated information-processing and control system known as Central Nervous System**. In tandem, they regulate **all the conscious and unconscious facets of your life**.

- The scientific study of the brain and nervous system is called **neuroscience** or **neurobiology**.
- The **brain** functions to **receive nerve impulses from the spinal cord and cranial nerves**.
- The **spinal cord** contains the nerves that **carry messages between the brain and the body**.

The Peripheral Nervous System (PNS)

FUNCTION

The peripheral nervous system includes **all peripheral nerves**. It **connects the central nervous system to the organs and muscles** of the body and regulates **all purposeful and reflex actions**. The peripheral nervous system controls organs and muscles like **skin, eye, blood vessels, heart and stomach**.

The Autonomic Nervous System (ANS)

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DEFINITION

The organs (the "**viscera**") of our body — such as the **heart, stomach and intestines** — are regulated by a part of the nervous system called the **Autonomic Nervous System (ANS)**. The ANS is **part of the peripheral nervous system**, and it controls many organs and muscles within the body.

KEY CHARACTERISTIC — IT WORKS WITHOUT YOU KNOWING

In most situations, we are **unaware of the workings of the ANS** because it functions in an **involuntary, reflexive manner**. For example, we do not notice when blood vessels change size or when our heart beats faster.

The Autonomic Nervous System exercises its functions **independently of the Central Nervous System** to the extent that it controls parts of the body without having to think about it.

What the ANS controls — full DGCA list

SENSORY Eye	CARDIAC Heart	RESPIRATORY Breathing
THERMOREGULATION Temperature	VASCULAR Blood Pressure	DIGESTIVE Stomach & Intestines
EXCRETORY Urinary Output & Bladder	COOLING Sweating & Glands	STRESS RESPONSE Fight-or-Flight Reaction

FLIGHT-RELEVANCE — THE "FIGHT OR FLIGHT" REFLEX

The ANS controls the **fight-or-flight response or reaction to stress**. In a sudden emergency — engine failure, severe turbulence, near-miss — the ANS dumps adrenaline into your bloodstream automatically. Heart rate, breathing rate, BP and sweating all spike **without your conscious permission**. *This is why a well-trained pilot's drilled checklist beats raw reaction: the conscious brain must override an autonomic surge.*

Three divisions of the Nervous System — quick comparison

Division	What it Contains	What it Controls	Conscious / Involuntary
Central NS	Brain + Spinal Cord	Receives, processes & commands all activity	Both
Peripheral NS	All peripheral nerves	Skin, eye, blood vessels, heart, stomach & muscle action	Both — voluntary & reflex
Autonomic NS	Sub-system of PNS	Eye · Heart · Breathing · Temp · BP · GI · Bladder · Sweat · Stress	Involuntary only

✦ END OF CHAPTER 4 ✦

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