

Autonomic Nervous System

ANS Definition responsible for controlling bodily functions that are largely involuntary, or automatic, in a nature.

What functions ANS do

Autonomic Nervous System

Functions of ANS Control of BP, and other CVS functions, digestion, elimination, and thermoregulation.

Anatomy of the ANS: * Two areas: Sympathetic and Parasympathetic

Parasympathetic or Cranio-sacral Composed of neurons originating in the midbrain, brainstem, and sacral region of the spinal cord.

Enteric nervous system Third ANS division -Comprised of GI tract that controls various aspects of GI function. IT has both Sympathetic and parasympathetic components.

Sympathetic nervous system thoracolumbar- Arises from thoracic and upper lumbar regions of the spinal cord.

Sympathetic organization

Preganglionic Fibres Short-myelinated-type B

Postganglionic fibres Long-unmyelinated-type C

PreGanglionic Arise from:Intermediolateral gray columns of the thoracic and upper lumbar spinal cord , Leave Spinal Cord: via ventral root of the spinal nerve, End in: sympathetic ganglion

Sympathetic organization (cont)

Sympathetic ganglia Located in three areas:1)Chain ganglia/Paravertebral: both side of vertebral Column 2) Unpaired prevertebral ganglia: anterior to aorta 3) Terminal ganglia: in the tissue that is innervated - bladder and rectum

Ratio of preganglionic to postganglionic fibres 1:15 to 1:20

Route of Sympathetic PreGanglionic Fibre-arise-end in sympathetic ganglia-meet post ganglion or more ganglion - leaves to the effector tissue that it supplies (heart, sweat gland etc)

Parasympathetic Organization

Preganglion Origin: Midbrain-brainstem (cranial portion) or Sacral region of Spinal cord

Cranial Portion Exit: CNS via cranial nerves- 3,7,9,10

Vagus nerve - cranial nerve 10 comprises of 75% of the efferent component of entire parasympathetic division

Function of Sympathetic and Parasympathetic

Organ innervated by both systems physiological antagonism typically exists between these two divisions - both divisions innervate the tissue, one division increases function and the other decreases activity.

Function of Sympathetic and Parasympathetic (cont)

Function Sympathetic: to mobilize body energy and Parasympathetic: tends to conserve and store the energy.

Sympathetic Discharge Cause: increased cardiac output, decreased visceral blood flow(leave more blood available for skeletal muscle), increased cellular metabolism, several other physiological changes that facilitate vigorous activity.

Parasympathetic Discharge opposite effect. Slows down heart rate, bring changes that encourage inactivity. Increase intestinal digestion, absorption, an activity that stores energy for future needs.

Adrenal Medula

Function Synthesizes and secretes (20%)norepinephrine and (80%) epinephrine directly into blood stream.

Epinephrine (EPI) Increases Cardiac function and cellular metabolism Because higher affinity for certain receptors: Epi more readily binds to beta subtype of adrenergic receptors.

Where they release In stress situation: Release directly into blood stream to reach everywhere

Autonomic Integration and Control

Autonomic reflexes	Homeostatic control of BP, Thermoregulation, GI function
Reflexes are based on strategies	Peripheral sensor- Monitors the change in a particular system- information goes to CNS- integration of information- adjustment is made in the autonomic discharge in specific tissue/organ- alter activity to return physiological function back to normal level
Baro receptors location	neck and large arteries of thorax
Thermo receptors location	skin, viscera, hypothalamus
Hypothalamus function	Control of - body temperature, water balance, energy metabolism
Higher involvement of the ANS	cortex, limbic system, brainstem

Neurotransmitters

Acetylcholine (Ach) and Norepinephrine (NorEpi)	Important Neurotransmitters of ANS
Ach	Synapse 1: Between Pre-post ganglionic neurons-Sympathetic division
Ach	Synapse 2: Synapse 1: Between Pre-post ganglionic neurons-Parasympathetic division
Ach	Synapse 4: Parasympathetic-Postganglionic - Effector cell synapse

Neurotransmitters (cont)

NorEpi	Synapse 3: Sympathetic postganglionic neuron - effector cell
Cholinergic Neurons	Preganglionic and Parasympathetic postganglionic neurons - because Ach
Adrenergic Neurons	Most sympathetic postganglionic neurons
Exception	Some sympathetic postganglionic use -Ach, as neurotransmitter. - innervate in sweat glands and certain blood vessels in face, neck, and lower extremities.

Other Neurotransmitters / Contraneurotransmitters

Purinerbic substances	Adenosine and Adenosine Triphosphate : possible transmission in the GI tract, CVS, other organs
Peptides	Neuropeptide Y, Vasoactive intestinal polypeptide, Calcitonin gene related peptide, orexin, cholecystokinin, and angiotensin II, --- Control of the organs and systems
Nitric Oxide	to regulate peripheral autonomic responses and CNS autonomic activity.

Autonomic Receptors

Cholinergic	Located at : acetylcholine synapses,
Adrenergic	Located at: norepinephrine synapses

ACH---> Cholinergic Receptor ---> 1) Muscarinic 2) Nicotinic

Norepinephrine NE---> Adrenergic Receptor ---> 1) Alpha -> alpha1, alpha2 and, 2) Beta -> beta-1, beta-2

Cholinergic receptors

Nicotinic	Located: Junction between preganglionic and postganglionic neurons in both sympathetic and parasympathetic pathways
Nicotinic	Effects: both divisions of ANS
Type 1 Nicotinic	Means: Located at ANS (Nn)
Type 2 Nicotinic	Means: Located at skeletal neuromuscular junction (Nm)
Muscarinic	Located: all of the synapses between cholinergic postganglionic neurons and the terminal effector cell, including all the parasympathetic terminal synapses and the sympathetic postganglionic cholinergic fibers that supply sweat glands and some specialized blood vessels.
Subtypes of Muscarinic	M1, M2, M3, M4, M5 : Based on their characteristics (chemical and structural)
M1, M4, M5	CNS
M2	heart
M3	bladder detrusor muscle and to control pancreatic insulin release, and other peripheral metabolic responses

Adrenergic Receptors (Alpha)

Alpha 1	Located at: Smooth muscle- in various tissues throughout the body
Subtypes of Alpha 1	Alpha 1A, Alpha 1B, Alpha 1D
Alpha 2 or Autoreceptors	Located at: Presynaptic terminal of certain adrenergic synapses



Adrenergic Receptors (Alpha) (cont)

Alpha 2 work decrease the release of norepinephrine and other chemicals. : overall serve as negative feedback that limits the amount of neurotransmitter released from the presynaptic terminal.

Alpha 2 Stimulation Cause: Decreased neurotransmitter release and diminished stimulation of the interneurons that influence the alpha motor neurons.

Alpha 2 Stimulants Agonists - tizanidine, -- decrease neuronal excitability in the spinal cord and so, decrease muscle hyperexcitability in spasticity conditions.

Subtypes of alpha 2 Alpha-2A, alpha- 2B, alpha-2C

Adrenergic Receptors (Beta)

Beta1 heart and kidneys

Beta 2 located: smooth muscle of certain vasculatures, the bronchioles, the gallbladder, and the uterus

Beta 2 functional role in some tissues. Located at: Adipose tissue



By **Hiral OT** (Hiral)
cheatography.com/hiral/

Published 5th October, 2016.
Last updated 5th October, 2016.
Page 3 of 3.

Sponsored by **Readable.com**
Measure your website readability!
<https://readable.com>