

Tyrosine

The water-soluble compounds epinephrine (*adrenaline*) and norepinephrine (*noradrenaline*) are catecholamines. They are synthesized from tyrosine.

Secretion of these hormones is stimulated by acetylcholine release from preganglionic sympathetic fibers innervating the **adrenal medulla**. Common stimuli for secretion of adrenomedullary hormones include exercise, hypoglycemia, hemorrhage, and emotional distress. Following release into blood, these hormones bind adrenergic receptors on target cells, where the hormones induce essentially the same effects as direct sympathetic nervous stimulation.

Outside the nervous system, norepinephrine and its methylated derivative epinephrine **act as regulators** of carbohydrate and lipid metabolism. Norepinephrine and epinephrine increase the degradation of triacylglycerol and glycogen as well as increase the output of the heart (*specifically, epinephrine*) and blood pressure. These effects are part of a coordinated response to prepare the individual for emergencies and are often called the “fight or flight” reactions.

Norepinephrine can be released in 2 ways:

- By the adrenal medulla **into the bloodstream** (*as discussed above*)
- **Directly onto an organ** by a postganglionic sympathetic (*adrenergic*) neuron that stores norepinephrine

Important: The effects are **more widespread** when norepinephrine is released into the bloodstream by the adrenal medulla **as opposed** to directly onto an organ by a postganglionic sympathetic neuron.

Note: Pheochromocytoma is a tumor of the adrenal medulla with signs and symptoms caused by excessive catecholamines (*epinephrine & norepinephrine*) including tachycardia, hypertension, anxiety, and sweating and is usually associated with excessive excretion of 3-methoxy-4-hydroxymandelic acid (*VMA*).