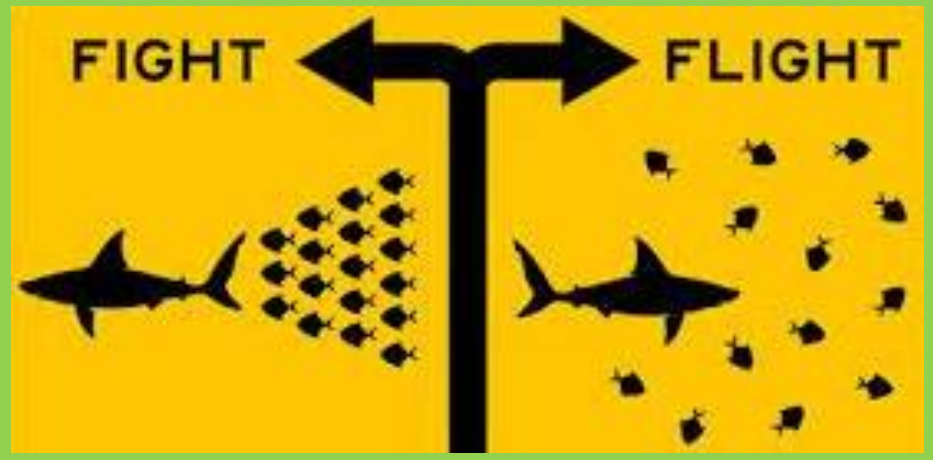
Sympathetic Adrenal Medullary System (SAM)

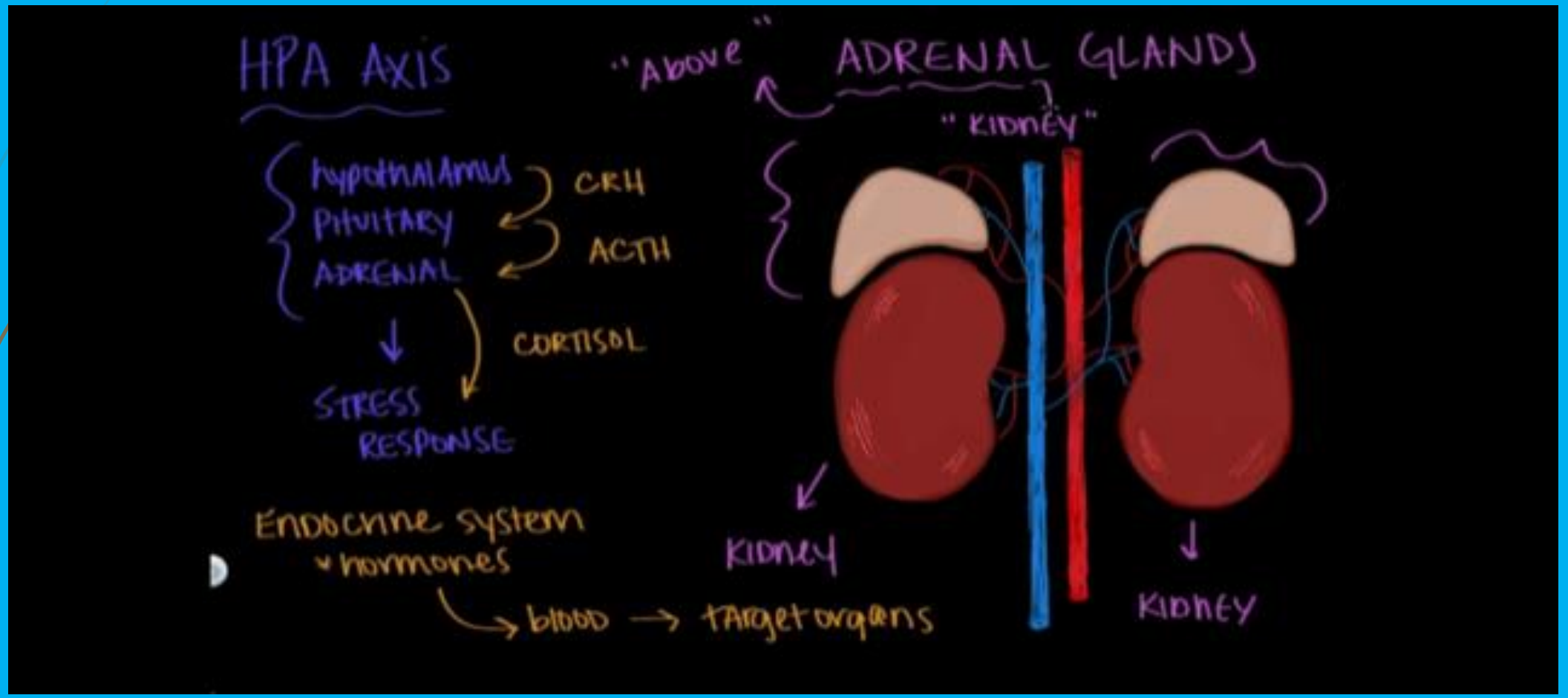


Jeffrey E. Hansen, Ph.D.
Center for Connected Living, LLC

"Trauma has a way of overwhelming us. When we are threatened, our first response is fight, flight, or freeze."

— Kenny Weiss

The SAM System is distinct from the HPA System. The HPA activates for longer term stress with the primary steroid hormone being Cortisol while the SAM system activates the release of epinephrin and norepinephrine aka adrenalin and noradrenalin. These hormones are released from the adrenal glands which sit on top of the kidneys.



SAM – Sympathetic-Adrenal-Medullary System

While the adrenal glands are often pointed to as responsible for handling the normal stress response, they may instead be target organs of two intersecting systems. The hypothalamus-pituitary-adrenal (HPA) axis is the endocrine response to stressors producing adrenocorticotropic hormone (ACTH) from the pituitary gland with measurable changes in levels of plasma cortisol and salivary cortisol as produced in the adrenal cortex.

The sympathetic-adrenal-medullary system produces epinephrine and norepinephrine and measurable changes in heart rate are seen. It is important not to oversimplify this relationship as HPA responses habituate to repeated stress exposure. In effect, the body responds better and better to the same stressor.

The adrenal medulla is actually a glandular extension of the sympathetic division of the autonomic nervous system. When the sympathetic division is activated in response to stress or a threat, the medulla **releases two substances, epinephrine, and norepinephrine, into the blood stream**.

The Stress Hormones

Adrenaline (epinephrine) and noradrenaline (norepinephrine): These hormones are known as the “fight or flight” hormones and are called catecholamines. Adrenaline and noradrenaline are capable of increasing your heart rate and force of heart contractions, increasing blood flow to your muscles and brain and assisting in glucose metabolism. They also control the squeezing of your blood vessels (vasoconstriction), which helps maintain blood pressure. Your adrenal glands often release these hormones, like other adrenal hormones, when you’re in physically and emotionally stressful situations.

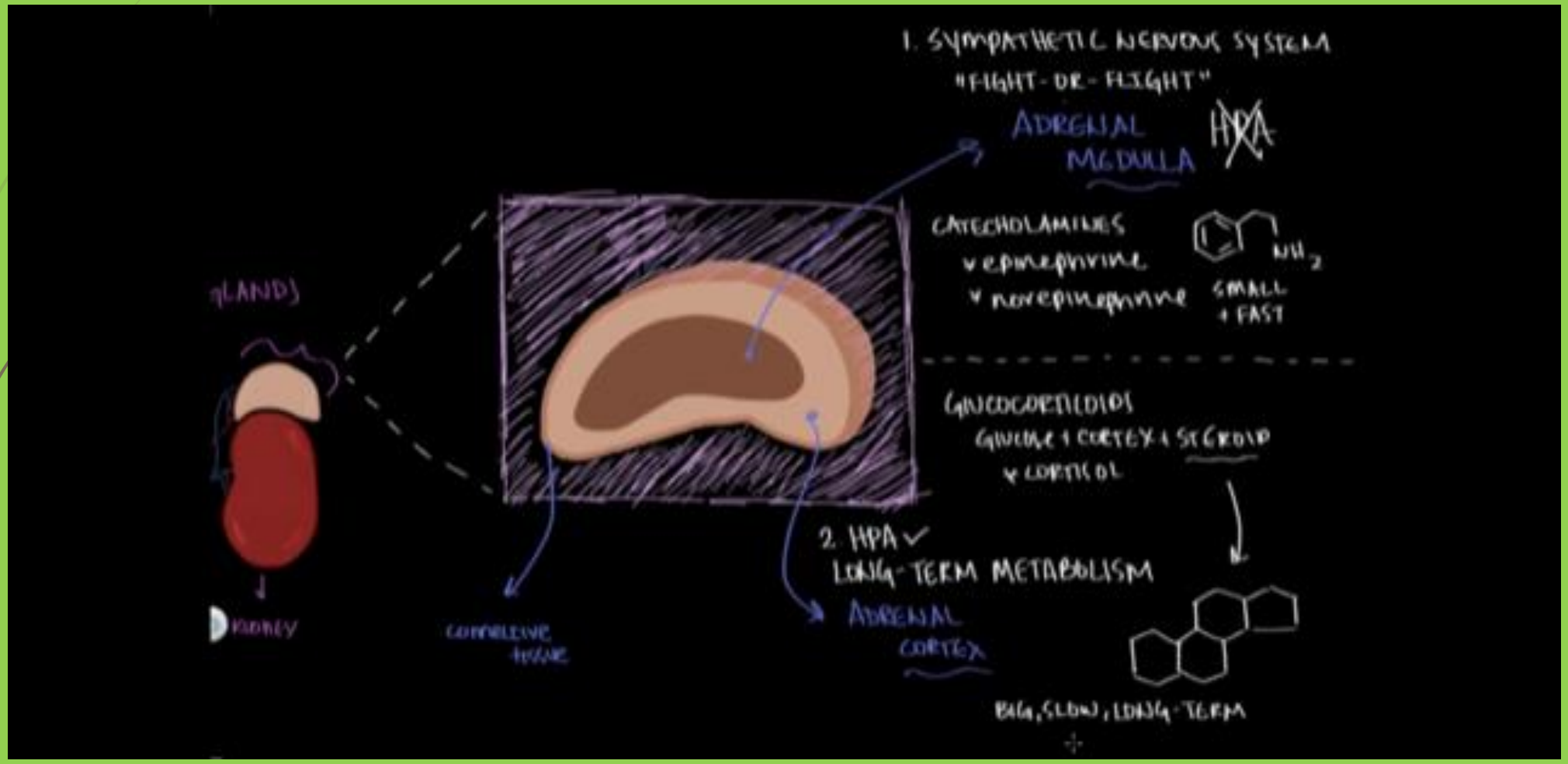
These hormones can be categorized into two broad groups:

Catecholamines: Catecholamines are a group of similar substances that your body releases into your blood in response to physical or emotional stress. The primary catecholamines are dopamine, adrenaline and noradrenaline. The adrenal medulla, the inner part of your adrenal glands, produces and releases the catecholamines adrenaline and noradrenaline.

Steroid hormones: Steroid hormones help control metabolism, inflammation, immune system functions, salt and water balance, development of sexual characteristics and the ability to withstand injury and illness. The adrenal cortex, the outer region of your adrenal glands, produce and release glucocorticoids, mineralocorticoids and adrenal androgens, which are all types of steroid hormones.

Anatomy of the adrenal gland

The inside is the medulla(SAM system) which releases adrenalin and noradrenalin for immediate mobilization to stress and the outside is the cortex (HPA system) which releases cortisol for longer term mobilization to stress.



Summary of the SAM and HPA systems

Click the link below for an excellent video on the SAM/HPA systems by honors student Jessica Tung
https://www.youtube.com/watch?v=JOttLFspwoE&ab_channel=NickPollock