**Question 1: how are human brains compared to brains of neanderthals**

Copilot answer: “Neanderthals actually had **larger brains** than modern humans, but size isn’t everything when it comes to intelligence. The key difference lies in **brain organization**. Neanderthals had **larger visual processing areas**, likely to help them survive in low-light environments. Meanwhile, modern humans developed a gene mutation—**TKTL1**—that allowed for more neurons in the neocortex, the part of the brain responsible for higher cognitive functions. This may have given Homo sapiens an edge in problem-solving and adaptability.

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**Question 2 : describe the neurobiology of the figh{t} tor flight response**

The **fight-or-flight response** is an automatic physiological reaction to perceived threats, governed by the **autonomic nervous system (ANS)** and primarily driven by the **sympathetic nervous system (SNS)**. Here’s a breakdown of its neurobiology:

1. **Perception of Danger** – When the brain detects a potential threat, the **amygdala**, a key region for processing fear, becomes highly active. It sends distress signals to the **hypothalamus**, which acts as the command center for the autonomic response.
2. **Activation of the SNS** – The hypothalamus signals the **adrenal medulla**, prompting it to release **adrenaline (epinephrine)** and **noradrenaline (norepinephrine)** into the bloodstream. This surge increases **heart rate**, **blood pressure**, and **oxygen intake**, preparing the body to take action.
3. **Hormonal Cascade via the HPA Axis** – If the threat persists, the **hypothalamic-pituitary-adrenal (HPA) axis** is engaged. The hypothalamus releases **corticotropin-releasing hormone (CRH)**, which stimulates the **pituitary gland** to release **adrenocorticotropic hormone (ACTH)**. ACTH then triggers the **adrenal cortex** to produce **cortisol**, helping sustain heightened alertness and energy.
4. **Physical Effects** – Blood is redirected from non-essential processes (such as digestion) toward muscles to enhance strength and reaction time. Pupils dilate for better vision, and glucose is released into the bloodstream for extra energy.
5. **Returning to Baseline** – Once the threat is gone, the **parasympathetic nervous system (PNS)** takes over, reducing heart rate and restoring the body to a relaxed state.

This response evolved to help humans and animals survive dangerous situations, but in modern life, it can be triggered by stress rather than physical threats. Chronic activation, especially due to long-term stress, can have negative health effects over time.

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**Question 3: what is the neuroscience of language development**

CoPilot Answer:

Language development is a fascinating process shaped by the brain’s intricate neural networks. Neuroscience research has identified key brain regions involved in language acquisition and processing:

1. **Broca’s Area** – Located in the **left frontal lobe**, this region is crucial for speech production and grammatical processing.
2. **Wernicke’s Area** – Found in the **left temporal lobe**, it plays a major role in understanding spoken and written language.
3. **The Arcuate Fasciculus** – A bundle of nerve fibers connecting Broca’s and Wernicke’s areas, enabling fluent communication between speech production and comprehension.
4. **Subcortical Structures** – The **basal ganglia** and **cerebellum** contribute to language learning by refining speech motor control and cognitive processing.
5. **Neuroplasticity** – The brain’s ability to reorganize itself allows children to acquire language rapidly, and even enables recovery from language impairments after brain injuries.

Recent studies emphasize the **network perspective** of language processing, showing that multiple brain regions work together dynamically. Neuroscientists also explore how early childhood experiences shape language development, influencing cognitive and social abilities2.

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