NEUROPLASTICITY AND ANATTA

While talking recently with one of my students it became clearer to me that the dynamically functioning interactions between the highly complex networks of neurons in the brain can be useful for cultivating a more contemporary understanding of *anatta* (ah-nah-tah*), the absence of an enduring/autonomous self.*

Until the onset of Buddhist studies and practices in the West in the latter half of the 20th century, Eastern Buddhist traditions approached understanding anatta based on reacting to the Hindu concept *atta* (ah-tah), which describes the self as an emanation of Brahman (brah-mahn), a primary god in Hinduism. In Hinduism, the self arises like a wave in the ocean of Brahman, then falls out of form at the end of a birth cycle, to be reborn according to the person’s adherence to the ethical and religious standards of the emerging caste system.

The Buddha altered this perceptual understanding, describing a person’s self-experience as interdependent with everything else in the universe, regardless of class. Ethical and religious standards are organized around the Noble Eightfold Path rather than caste norms--rebirth depended upon a person’s ability to adhere to the principles and practices found within the path rather than ones’ class status.

My research into what the Buddha taught suggests that when he was asked rebirth related questions, his response would be focusing on what the cause of dukkha is and the ways of eliminating dukkha as it arises, with the ultimate goal of total relief from dukkha, direct experience of Nirvana. His responses didn’t confirm or deny rebirth but suggested that focusing on these concepts is a distraction from realizing the transitory and interdependent nature of subjective experience.

The transitory channeling of energy through the brain operates through *neuroplasticity*, which was a transformative discovery in the field of neuroscience in the 1950’s. Here is what I discovered when using ChatGPT to describe neuroplasticity:

Neuroplasticity is the brain’s ability to **change its structure and function in response to experience, learning, or injury**. It’s the biological foundation for how we acquire new skills, form memories, recover from brain damage, and adapt to changing environments.

Here are the main aspects:

**Types of Neuroplasticity**

1. **Structural plasticity** – Physical changes in the brain’s anatomy, such as:
   * Growth of new synapses (synaptogenesis)
   * Strengthening or weakening of existing synapses (synaptic pruning)
   * Formation of new neurons (neurogenesis, especially in the hippocampus)
2. **Functional plasticity** – The brain’s ability to shift functions from damaged areas to healthy ones. For example, after a stroke, other regions may compensate for lost abilities.

**Mechanisms**

* **Hebbian learning:** “Neurons that fire together, wire together.” Repeated activity strengthens neural connections.
* **Long-term potentiation (LTP):** Sustained increase in synaptic strength from repeated stimulation (basis of learning and memory).
* **Long-term depression (LTD):** Decrease in synaptic strength, helping refine neural networks.

**Factors That Enhance Neuroplasticity**

* **Learning & practice** (new languages, music, complex skills)
* **Physical exercise** (increases BDNF – brain-derived neurotrophic factor)
* **Mindfulness & meditation** (shown to thicken cortical regions)
* **Healthy sleep** (critical for synaptic pruning and memory consolidation)
* **Novel experiences & enriched environments**

Every time the various neural pathways repeatedly interact to provide a moment of consciousness, the connections between the neurons becomes stronger and easier to initiate, described as LTP, and this is how our self-identity is formed and reinforced. Neuroplasticity is inherent in the operation of this process—when mindful investigation reveals an emerging self-state, and renunciation (the shift of energy away from the LTP pattern and back to breath awareness), the “signal strength” of the hindrance is weakened (the synaptic pruning), while the neural networks associated with mindfulness of breathing are strengthened (synaptogenesis).

This process is an act of nature—neuroplasticity and LTP operate within the brain of all sentient beings without the existence of an enduring/autonomous self. The “three poisons”—greed, hatred and ignorance—create the inherently flawed belief that there is an enduring/autonomous self that must be defended or gratified in order to exist. Consciousness inherently exists as a process that involves integrating the neural networks, but the product of that process, the ego, is fabricated based on previous experience, the actions of karma.

Having explained the process of neuroplasticity, I now want to describe some of the various neural networks established for neuroscientific researchers, and their interdependent functions that can be investigated while meditating:

Default Mode Network (DMN): This elaborate system of neuronal interconnection is associated with self-referential rumination—the selfing story.

Central Executive Network (CEN): This system functions to either activate or deactivate the various interactive neural networks.

Salience Network (SN): This system functions to detect emerging neural functions as to their relevance and emotional potency. It operates as an alerting system—friend or foe/ food or poison?

Task Positive Network (TPN): This system functions to initiate action, both cognitive and behavioral.

These networks are interconnected and mutually influential in producing self-consciousness, even though they normally operate outside of conscious awareness. One of the core functions of mindfulness is to cultivate intentional awareness of these networks as they operate.

Contemporary research systems such as functional Magnetic Resonance Imaging (fMRI) provide ways to study the complex interactions between such systems, supportive of Buddhist doctrine regarding craving and clinging and other important understandings on the path toward Awakening.

For example, we can mindfully investigate the flow of the “selfing story” as the impersonal neuronal activity of the Default Mode Network (DMN), the wandering “monkey mind” that we all experience. I find this understanding of how these neural patterns operate to be more effective for depersonalizing what is happening in consciousness—there’s no “teller of the story”, but instead the transfer of electrochemical energy through a variety of identifiable neural networks that are interacting with other identifiable co-occurring neural networks.

The neural pathways that are operating during the mental process we call craving overlap and interact with the neural pathways involved in the DMN. Buddhist doctrine includes the concept *vossagga* (voh-sah-gah), interpreted as *renunciation*, which operates through interactions of the DMN and the Central Executive Network (CEN). The CEN operates to either continue the process that is emerging into consciousness or activates renunciation, which “switches channels”, shifting the flow of action away from the daydreaming and back to the breath. This switching process is intentional, monitored by the neural networks associated with mindfulness and is activated by another identifiable neural system in the brain, the Task Positive Network (TPN).

Research studies provide evidence that regular mindfulness meditation practice has a beneficial effect on the DMN, either by “switching channels”, or by creating an emotional distancing from the DMN storyline. I experience it as reducing the volume of the selfing story, almost as if it is in another room, somewhat muted, and easier to ignore because a quiet mind is a more enjoyable experience.

These deeply interactive systems are always humming along whether we are conscious of their operation or not, and it seems to me that the introspective and self-disciplinary capabilities that we develop with regular meditation practice, contemplated as the interactions between the networks, confirms the concept of *anatta* (ah-nah-tah), *the absence of an enduring/autonomous self*.

During future talks, I intend to describe how the functions of various Buddhist concepts can be understood from the perspective of impersonal interactions among different regions of the brain. Hopefully this research will be helpful to increase our understanding of the Three Characteristics, Anicca (The transitory nature of interactions between the neuronal systems), Dukkha (The subjective experience of distress and confusion that results from craving and clinging), and Anatta (The impersonal nature of neuronal activity)