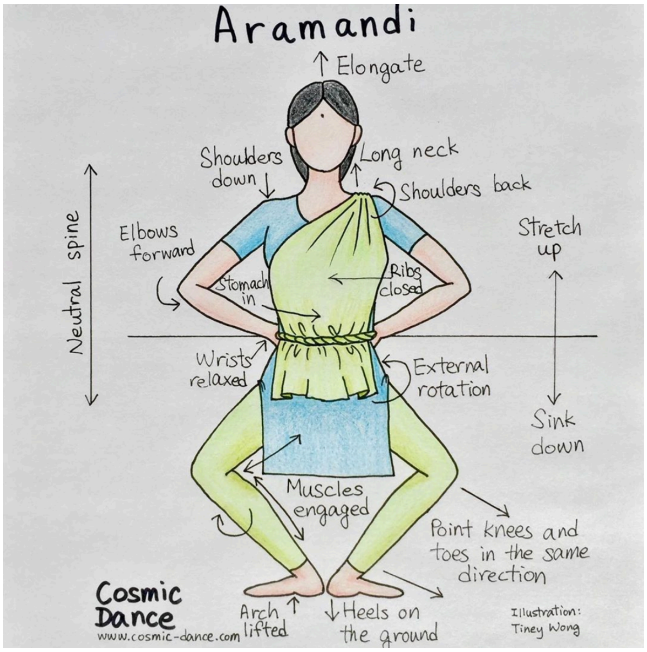
About 2 years ago, I started learning a form of Indian classical dance called Bharatanatyam. Being a Psychologist by profession, I have always been intrigued to know the details about what goes on in my brain while I dance. With the opportunity to do this assignment, I decided to analyse my favourite form dance through the eyes of neurobiology.

In general Bharatanatyam requires the use of the cortico-spinal tract to allow volitional movements, the cerebellum for motor learning and coordination and the basal ganglia to aid in action selection and habituation.

In this project, I am going to talk about three most important and basic characteristics involved in Bharatanatyam and explain them, more specifically, in neurobiological terms.

1. <u>POSTURE</u>

The most basic pose in Bharatanatyam is called *Aramandi,* translated as 'half-sitting'. The entire dance sequence is choreographed around this posture.



The *aramandi* requires me to use:

A) ***The Vermis****:* Sitting in *aramandi* requires perfect midline postural control. As explained by Professor Mason in the lecture on Cerebellar Topography, the vermis is involved in maintaining midline postures, gait and speech.

B) ***Central pattern generators****:* This pose is not as easy because I'm 'top heavy' i.e when my feet are so close together and I'm fighting gravity doubly more than when I stand upright, my balance and posture control take a hit. Through the lecture on CPGs, I realised that as I have a

circuit for maintaining my posture while I'm standing upright, my brain has now reconfigured a circuit to maintain my posture and balance when I take the *aramandi* pose.

2. SYMMETRY

One of the most primary characteristics of Bharatanatyam is the emphasis on symmetry of movement. The steps are very geometrical and linear in nature, which calls for perfection of poses from the trunk, limbs and head, all at once.

To achieve this, I use:

A. *Sensory Reaffrerence:* As illustrated below, my hands have to be diagonally linear and I have to be able to take the pose automatically and quickly while doing a sequence of steps. To do so, my cerebellum needs to process sensory input from my elbow and wrist joints and assess whether I need to contract or relax them more.
B. *Para-vermis:* As explained in Cerebellar Topography, the para-vermis is involved in controlling limb movements. To make my symmetrical dance step happen, I need to move my hands and keep my fingers furled open in a certain way.

3. PERFORMING A DANCE ROUTINE
(*Reference video:* www.youtube.com/watch?v=ffCstktHpZg)

A dance routine is where an amalgamation of steps, facial expressions and a choreographed sequence is involved which requires large amounts of practice before it can become muscle memory! While I learn a 1 minute routine, these are the essentials I need:

A. *Hippocampus:* The hippocampus and medial temporal lobe structures have been implicated in memory formations and motor sequence learning. (Albouy et al, 2013) To be able to effectively perform the routine, I need to pay attention to the steps, encode the sequence in which they occur and execute them effectively. To recall and retain my learnt sequence I need an intact, functioning hippocampus which can store this information in long term-memory.

B. *Basal Ganglia and Chunking*: I noticed that when I forget a step in the routine, I find it easier to just do the step anyway and then proceed further which is not a great idea, obviously, because the song has proceeded and I miss the beat. Because my basal ganglia has been habituated to go through the entire sequence, ignoring the missed step and directly going to the next one takes deliberate thought and action. This needs to happen in a matter of milliseconds so I don't miss the beat. Breaking a habit is very difficult as pointed out in the lecture on Chunking, and it looks like I'm going to take a while to correct this!

As a psychology student, I have studied the brain more in terms of how it plays a role in thought, emotions, and behaviour and how it changes with various mental illnesses and neurological syndromes. Looking at the brain in through the lens of everyday life has given me new insights and sparked my curiosity even more.

With Professor Mason's fantastic lectures, I could break down what goes inside my head while I dance using these complex postures and routines, and now I can say that I have learnt to use neurobiology in my everyday life!

References:

1. Long, J., Feng, Y., Liao, H., Zhou, Q., & Urbin, M. A. (2018). Motor Sequence Learning Is Associated With Hippocampal Subfield Volume in Humans With Medial Temporal Lobe Epilepsy. *Frontiers in human neuroscience*, *12*, 367. https://doi.org/10.3389/fnhum.2018.00367
2. Neurobiology of Everyday Life - Lectures:

A) Automatic Movements - Posture, Postural Control, CPGs.
B) Introduction to Cerebellum - Cerebellar Functions, Cerebellar Topography, Efference Copy and Sensory Reafference.
C) Cerebellar Learning
D) Introduction to Basal Ganglia: Action Selection.
E) Basal Ganglia Function: Operational Learning, Chunking.