What Causes CP?

The most basic way to describe what is going on with cerebral palsy is that there is damage to or developmental problems in these tracts of cells that are supposed to communicate with one another. When development is disrupted and cells don't migrate where they are supposed to, or when there is damage or lesions to different areas, these paths of communication are interrupted and impulses can’t be passed on properly. This then affects the signals that the muscles receive, leading to motor impairments.

Subtypes of Cerebral Palsy

The overall syndrome of cerebral palsy has three main classifications. These subtypes include spastic cerebral palsy, choreoathetotic cerebral palsy, and ataxic cerebral palsy. Each of these is a result of damage to a different area of the brain.

- **Spastic** – This type of cerebral palsy is caused by damage to the cortical motor system. This is referring to the gray matter that makes up the entire outside portions of the brain called the cortex, specifically the areas seen in image “A” below that affect motor movements.
- **Choreoathetotic** – This type of cerebral palsy is caused by damage to the basal ganglia. This is referring to areas of gray matter deep within the brain, seen in image “B” below.
- **Ataxic** – This type of cerebral palsy is caused by damage to the cerebellum or cerebellar nuclei. This is referring to the structure of the brain called the cerebellum and the cell bodies associated with that structure, seen in image “C” below.

Ataxic Cerebral Palsy

Ataxic cerebral palsy is the least common of the three subtypes and is characterized by gait instability and poor control over balance as well as posture. These symptoms often recur when there is damage to the cerebellum or the cerebellar nuclei.

Imaging studies have determined that lesions to the cerebellum are the cause of this form of cerebral palsy. The cerebellum contains tracts involved in responsiveness to balance changes. When these are interrupted, individuals are unable to maintain stability and balance.

Clinical Application of Studies of Motor Tracts

The exact cause of cerebral palsy is not completely understood, which is seen in the fact that there are multiple hypotheses as to what causes each type. Studies are being done to try to determine more accurately the tracts that are affected and lead to each of the symptoms. Knowing this would allow for better treatment options and coping techniques. Even now there are methods being studied that have promising outcomes.

Studies creating intentional lesions to structures in the brain that contain gray matter, where the cell bodies of the neurons are located, are showing improvement in motor function. This treatment technique is used in Parkinson’s as well to reduce symptoms. Because cerebral palsy generally includes very complex causes and affected pathways, it is more difficult to target a single area that this would be effective on.

The fact that motor pathways are affected is definite, but determining exactly which ones cause which symptoms is something that is still being studied. With improving technology and a growing interest in the pathophysiology of cerebral palsy, new treatment options are likely to surface in the near future.
A reflex is the stretch reflex of a muscle. The stretch reflex is a protective mechanism that helps maintain posture and control movement. When a muscle is stretched, the stretch receptors in the muscle send a signal to the spinal cord, which then triggers a response. This response can be either a flexion or an extension of the muscle, depending on the type of reflex.

**Choreoathetotic Cerebral Palsy**

Choreoathetotic cerebral palsy is a condition that affects the muscles and can result in involuntary movements. These movements are often characterized by jerky, writhing motions, which can be seen in the arms, legs, or trunk. The condition is caused by a developmental error that affects the way the brain and spinal cord work together. This error can affect the way the brain and spinal cord work together, which can lead to problems with movement and coordination.

**Spastic Cerebral Palsy**

Spastic cerebral palsy is a condition that affects the muscles and can result in stiff, rigid movements. These movements are often characterized by a lack of control and difficulty with fine motor tasks. The condition is caused by a developmental error that affects the way the brain and spinal cord work together. This error can affect the way the brain and spinal cord work together, which can lead to problems with movement and coordination.

There are several different ideas of what exactly leads to chorea and athetosis in muscles.

1. **Improper timing of muscle activation.** In this case it was found that the order in which muscles are supposed to contract to cause a movement are out of order. In order to cause a smooth motion, a muscle or several muscles must be activated in a certain order. In choreoathetotic cerebral palsy, this order is not followed correctly.

2. **Antagonist and agonist muscles are both stimulated.** The main muscle that is contracted to cause a motion is called the agonist muscle. During a motion, the muscle that is on the opposite side of the joint relaxes, allowing for the agonist to cause a smooth motion. The muscle that relaxes is known as the antagonist muscle. In choreoathetotic cerebral palsy, it was found that both the agonist muscle and the antagonist muscle are stimulated, so an individual has to fight against his/her own muscle in order to cause a movement. This is due to the neuron that is stimulating the muscle, in the pathways described under "The Cells," sending the impulses to the incorrect location.

3. **Relaxation of the antagonist causes the movement, not the contraction of the agonist.** If was also found that, in some cases, the movements that are being produced are caused by the relaxation of the antagonist, rather than the contraction of the agonist. In a typical muscle contraction, all muscles are relaxed until an individual decides to contract the agonist and cause a movement. In choreoathetotic cerebral palsy, the muscles are contracted to start, and relaxing the antagonist is what causes the movement. This causes the inability to have the same level of conscious control over motor movements.

4. **Cortical motor system did not develop properly and the crossing-over does not occur as expected.** This means that during development, the cells did not move to where they were supposed to be located. This is specific to the mirror movements that are typical of spastic cerebral palsy. Where there are supposed to be right-handed responses, the impulse is instead sent to the left-sided muscles. This is due to a developmental error.