The Neuroscience of Stuttering

Genetic Factors

Mutations in genes GNPTAB, GNPTG, NAGPA and AP4E1 can disrupt lysosomal function, affecting brain cells involved in speech.

- These mutations impair how cellular waste cleared and procesed, potentially harming astrocytes that support neural connectivity.

Brain Networks

The brain's 'speech network" includes motor areas, auditory processing regions, and basal ganglia.

- Reduced white matter connectivity linking these regions
- Inefficient coordination between motor and auditory circuits
- An imbalanced speech network may lead to struggling with timing, sequencing and smooth motor control.

Timing & Coordination

Fluent speech requires precise muscle movements controled by brain circuits involving basal ganglia.

- Stuttering may reflect difficulty timing and sequencing rapid, complex muscle.
- Basal ganglia dysfunction can disrupt internal speech timing and motor planning.

Overactive Monitoring

- Overly aware of their speech errors.
- Excessive self-monitoring can disrupt natura speech flow.
- Increased activity may create a cycle of frustration and avoidant behaviors.

Neurofluency INITIATIVE

White Matter Differences

Children and adults who stutter often show reduced connectivity in this region.

EEG Studies

Irregular brain activity patterns during speech reflect challenges with motor funation and speech timing.

- Unstable motor phonemic representations
- Reduced suppression of auditory cortex during speech.

Neuroplasticity

With practice, the brain can form new, more efficient connections for fluent speech.