Can Neonatal Behavior and Genotype Predict Adult Sensory Processing Function?

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INTRODUCTION

Background:
Sensory processing disorder (SPD) is a regulatory disorder characterized by atypical patterns of responses to non-noxious stimuli.

Certain genetic polymorphisms may impact brain development and influence an individual’s response to their environment.

Purpose: To identify genetic and early behavioral markers that predict sensory hyper-responsivity later in life. The goal is to identify early markers of SPD in a nonhuman primate model.

METHODS

Subjects: 47 rhesus macaques, 29 females and 18 males

Assessments:
The Schneider Neonatal Assessment for Primates (SNAP) was administered on postnatal days 3, 8, 15, 23, including the following clusters:

- Orientation: visual orientation, visual following, duration of looking, and attention span. High scores indicate optimal orientation.
- Temperament: irritability, inconsolability, struggle during test, and predominant state. High scores indicate high irritability.
- Sensory Sensitivity: rotation test, protective extension, vocalizations, galant reflex, calming self, head posture prone, and tactile response. High scores indicate hyper-responsivity to tactile stimuli and sub-optimal vestibular responses.

Sensory Processing Scale for Monkeys (SPS-M) was administered when subjects were between 5-7 years old. The SPS-M is a test of responsivity to three tactile stimuli (6 trials each for feather, cotton ball, brush) applied to the face/neck area. Two scores were calculated:
1. Magnitude: average withdrawal score across 18 trials. High scores indicate hyper-responsivity to tactile stimuli.
2. Habituation: the subject’s ability to inhibit their response to repeated stimuli. High scores indicate habituation and low scores indicate sensitization.

RESULTS

Genotype:
Both 5-HTTLPR and OPRM-1 gene polymorphisms contribute to developmental outcomes. Carriers of the protective alleles (C/C and C/G, respectively) tend to thrive in most environments, while carriers of the plasticity alleles (s/s and G/G, respectively) are more responsive to both adverse and positive environments.

5-HTTLPR - The short 5-HTTLPR serotonin transporter allele is associated with reduced serotonin function, increased stress reactivity, depression, and anxiety in humans and rhesus macaques under adverse environmental conditions.

OPRM-1 - The G allele of the mu-opioid receptor OPRM-1 is associated with increased aggression, increased stress activity, and reduced social interaction in humans and rhesus macaques.

CONCLUSIONS

The neonatal Sensory Sensitivity cluster is a reliable predictor of sensory responsiveness in adulthood in nonhuman primates. This thread of continuity may make it possible to identify vulnerability for sensory processing disorder early in life.

Subjects with the plasticity alleles (s and G) show a relationship between neonatal irritability temperament and sensory hyper-responsiveness. This pattern of responsivity suggests that genetic vulnerability may underlie this relationship between function related to emotionality.

Subjects with the protective alleles (C and C/C) display positive correlations between neonatal orientation and adult habituation, showing continuity in indicators of cognitive-related processing.

FUTURE RESEARCH

Future research with children should investigate the impact of genotype, particularly plasticity alleles such as 5-HTTLPR and G OPRM-1 on the development of SPD, and how the interaction of genotype and environment could identify young children at greatest risk for sensory processing problems. Emerging research shows that these children may be most responsive to early intervention.

SELECTED REFERENCES


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