To children with Williams syndrome, people are much more comprehensible than inanimate objects. Despite myriad health problems, generally low IQs and high levels of anxiety, they are extremely gregarious and irresistibly drawn to strangers, and they insist on making eye contact. This strange mix of mental peaks and valleys allows Ursula Bellugi and her collaborators to untangle the connections between genes, brain function and prosocial behavior.

In 2011, Bellugi and her collaborators, including Salk professors Fred Gage and Terrence Sejnowski and Salk adjunct professor Julie Korenberg, were awarded a renewal of an NIH program project grant to link the unusual prosocial behavior typified by the condition to its underlying neurobiological and molecular genetic basis. The researchers work in such disparate fields as social cognition, molecular genetics, stem cell biology, neuronal architecture and neuroimaging and are tackling the disorder from several directions.

Williams syndrome is caused by the absence of a tiny set of genes on one copy of chromosome 7, presenting a strong relationship between genes and altered behaviors. Virtually everyone with Williams syndrome is missing the same genes, but some rare individuals retain one or more genes that most people with the condition have lost, providing clues to the function of those genes and gene networks.

Bellugi and her colleagues are charting how these genetic aberrations may lead to the unusual cognitive and social behaviors characteristic of Williams syndrome. This includes using imaging technologies to visualize how the gene deletions alter brain activity, mapping the neural circuits affected by the disorder, and using stem cell reprogramming techniques to study the cellular aspects of the syndrome in the laboratory with neurons derived from patients’ skin cells. Recently, her team reported that the system that regulates two hormones associated with emotions, oxytocin and vasopressin, appears to be altered in people with Williams syndrome. This link between genes, hormones and behavior is an unprecedented opportunity to study how genes influence social behaviors and their role in Williams and other mental disorders, such as autism and anxiety. Understanding Williams syndrome also may provide fundamental insights into the genetic mechanisms and neural circuits responsible for human social behavior.

For more information, please visit www.salk.edu/faculty/bellugi