

Molecular Bases of the Mind for Living in Society

Miho Murayama, PhD

Director, Wildlife Research Center, Kyoto University

What roles do genes play in the shaping of *kokoro* (mind, psyche, or consciousness)? If genes form the basis of *kokoro*, can we attribute some of the individual differences in *kokoro* to genetics?

All organisms have their own set of DNA whose base sequences differ from species to species and from individual to individual. By analyzing these sequences, we can identify species, assess diversity in a community, and determine parentage and kinship. These days, DNA analysis is also used in studies of personality traits related to social behavior, and I am exploring the genes that may be responsible for individual differences in personality and *kokoro*.

One of my findings concerns the dopamine receptor D4 (DRD4) gene, which is associated with novelty-seeking traits. My team discovered that the gene has numerous genotypes, differing from species to species. Comparing simians and prosimians, humans' close and distant primate relatives, respectively, we found that a genotype linked to traits associated with novelty-seeking occurs more frequently among simians. Meanwhile, analyses of the serotonin transporter (5-HTT) gene have revealed that the closer a species is to humans, the more likely it has a genotype associated with anxiety-related traits. These genotypes, then, may be regarded as a driving force behind the evolution of our own species, which is characterized by both novelty-seeking and anxiousness.

Are there, then, any genes that are responsible for intra-species personality differences? To find out, we analyzed chimpanzees' personality traits as determined by their caretakers, in relation to the primates' individual genetics. Results showed an association between chimpanzee conscientiousness and genotypes of their vasopressin receptor gene. In chimpanzees, we also examined tryptophan hydroxylase 2 (TPH2), an enzyme necessary for serotonin biosynthesis. What we found is that a single nucleotide polymorphism causing a glutamine-to-arginine substitution at the C-terminus of TPH2 is associated with increased serotonin synthesis and neuroticism. These findings seem to indicate that genes do contribute to individual differences in *kokoro*.

Furthermore, recent research has found associations between the oxytocin receptor gene (OXTR) and individual differences in social behavior. These findings have generated renewed interest in the gene as a new focus of evolutionary studies of such behaviors. I expect that these and future discoveries about the biological and molecular bases of animals' kokoro will help deepen our understanding humans as social beings.