



When a population encounters a change in its environment—such as the arrival of a new predator in its current range or the colonization of a new habitat—some individuals will be better equipped to deal with the new conditions than others. Those individuals are more likely to survive, reproduce and pass on their genes, and over time, those genes and the traits they encode come to dominate. The result is that the population has adapted to that new environment or situation. Such evolutionary adaptations are behind much of today’s biodiversity.

Hoekstra has worked to better understand the genetic changes that underlie those adaptations, reconstructing their evolutionary history and understanding their molecular mechanisms. In one key study, she uncovered the sequence of molecular events that led the deer mice that colonized the light-colored Sand Hills of Nebraska to evolve a blonder coat color than mice in the surrounding dark-soil region. Hoekstra identified multiple camouflaging mutations in a single pigment gene, estimated when they occurred and established that these mutations increased chance of survival for mice living in the Sand Hills, which resulted in today’s lighter-colored population. More recently, Hoekstra has applied these innovative methods to the genetic changes that affect natural behaviors. In one study, she focused on two species of burrowing mice—the deer mouse, which makes simple short tunnels, and the closely related oldfield mouse, which makes complex, two-entry tunnels. Hoekstra’s team bred mice, made polyurethane casts of their burrows and sequenced their DNA to find the three genetic regions responsible for tunnel length and a fourth that affects the number of entries, revealing for the first time the genetic basis that lay beneath a complex behavior in natural populations of mammals.