10.4: Applications of Molecular Markers

Several characteristics of molecular markers make them useful to geneticists. First, because of the way DNA polymorphisms arise and are retained, they are frequent throughout the genome. Second, because they are phenotypically neutral, it is relatively easy to find markers that differ between two individuals. Third, their neutrality also makes it possible to study hundreds of loci without worrying about gene interactions or other influences that make it difficult to infer genotype from phenotype. Lastly, unlike visible traits such as eye color or petal color, the phenotype of a molecular marker can be detected in any tissue or developmental stage, and the same type of assay can be used to score molecular phenotypes at millions of different loci. Thus, the neutrality, high density, high degree of polymorphism, co-dominance, and ease of detection of molecular markers has lead to their wide adoption in many areas of research.

It is worth emphasizing again that DNA polymorphisms are a natural part of most genomes. Geneticists discover these polymorphisms in various ways, including comparison of random DNA sequence fragments from several individuals in a population. Once molecular markers have been identified, they can be used in many ways, including:

10.4.1 DNA fingerprinting

By comparing the allelic genotypes at multiple molecular marker loci, it is possible to determine the likelihood of similarity between two DNA samples. If markers differ, then clearly the DNA is from different sources. If they don't differ, then one can estimate the unlikelihood of them coming from different sources – eg they are from the same source. For example, a forensic scientist can demonstrate that a blood sample found on a weapon came from a particular suspect. Similarly, that leaves in the back of a suspect's pick-up truck came from a particular tree at a crime scene. DNA fingerprinting is also useful in paternity testing (Figure 10.4) and in commercial applications such as verification of species of origin of certain foods and herbal products.
Figure 10.4: Paternity testing. Given the molecular phenotype of the child (C) and mother (M), only one of the possible fathers (#2) has alleles that are consistent with the child’s phenotype. (Original-Deyholos-CC:AN)

Contributors and Attributions

- Dr. Todd Nickle and Isabelle Barrette-Ng (Mount Royal University) The content on this page is licensed under CC SA 3.0 licensing guidelines.