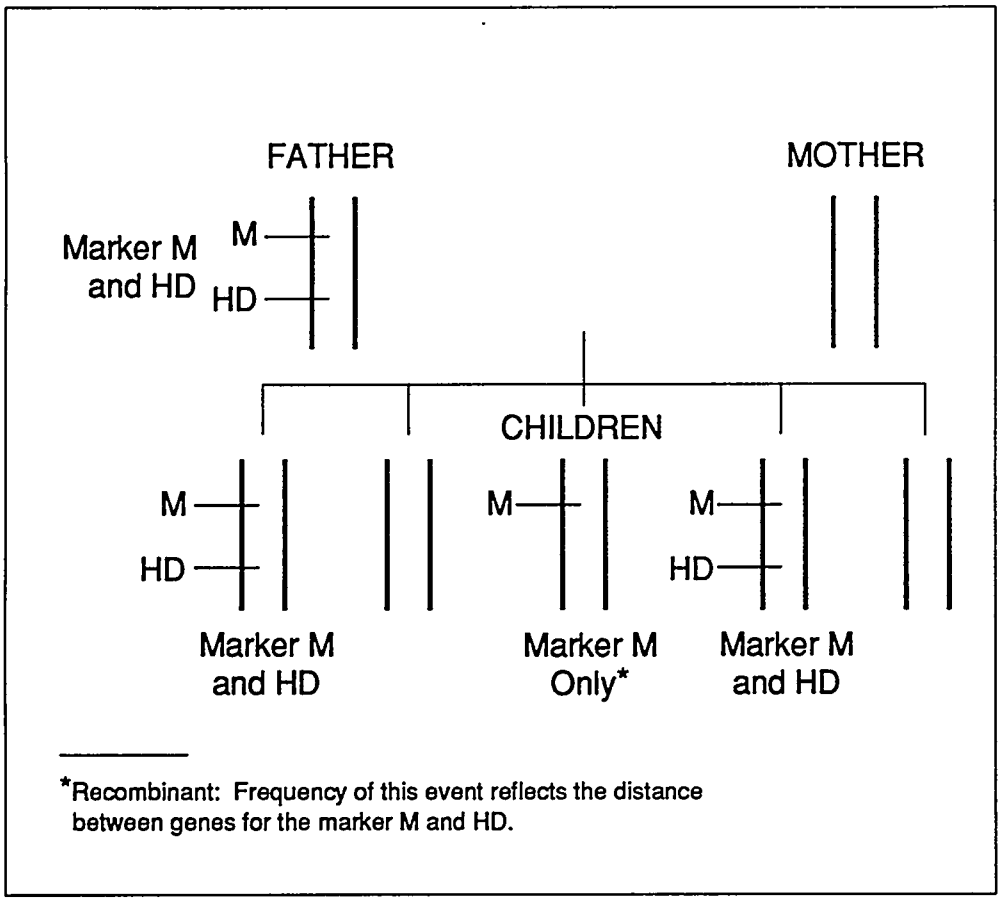

Fig. 8. Constructing a Genetic Linkage Map. *Genetic linkage maps of each chromosome are made by determining how frequently two markers are passed together from parent to child. Because genetic material is sometimes exchanged during the production of sperm and egg cells, groups of traits (or markers) originally together on one chromosome may not be inherited together. Closely linked markers are less likely to be separated by spontaneous chromosome rearrangements. In this diagram, the vertical lines represent chromo-some 4 pairs for each individual in a family. The father has two traits that can be detected in any child who inherits them: a short known DNA sequence used as a genetic marker (M) and Huntington's disease (HD). The fact that one child received only a single trait (M) from that particular chromosome indicates that the father's genetic material recombined during the process of sperm production. The frequency of this event helps determine the distance between the two DNA sequences on a genetic map.*

chromosomal components. Assessing the frequency of marker sites remaining together after radiation-induced DNA fragmentation can establish the order and distance between the markers. Because only a single copy of a chromosome is required for analysis, even nonpolymorphic markers are useful in radiation hybrid mapping. [In meiotic mapping (described above), two copies of a chromosome must be distinguished from each other by polymorphic markers.]

Physical Maps

Different types of physical maps vary in their degree of resolution. The lowest-resolution physical map is the chromosomal (sometimes called cytogenetic) map, which is based on the distinctive banding patterns observed by light microscopy of stained chromosomes. A complementary DNA (cDNA) map shows the locations of expressed DNA regions (exons) on the chromosomal map. The more detailed cosmid contig map depicts the order of overlapping DNA fragments spanning the genome. A macrorestriction map describes the order and distance between enzyme cutting (cleavage) sites. The highest-resolution physical map is the complete elucidation of the DNA base-pair sequence of each chromosome in the human genome. Physical maps are described in greater detail below.