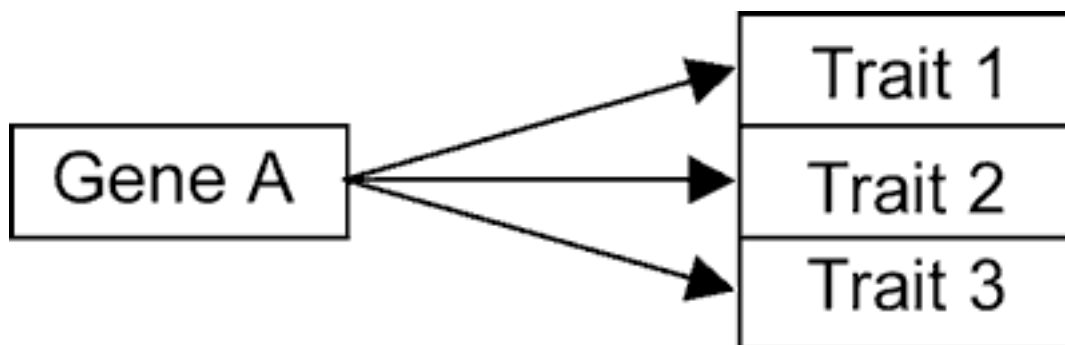


Pleiotropy and Multiple Loci

In reality, the inheritance of many traits is not simple, due to the lack of independence among genes and among traits within individuals. The terms describing the interactions among traits and loci are often confusing and for that reason some of them will be reviewed here.

The simplest of the phenomena being considered here is **pleiotropy**. Pleiotropy exists when one locus (gene) influences more than one trait within a given individual. Pleiotropy could be diagrammed as follows:

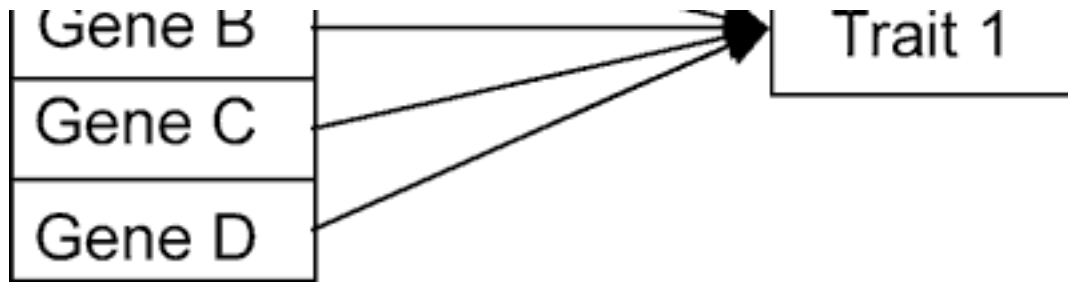


Pleiotropy: A given gene affects more than one trait.

Examples of pleiotropy abound; in fact, probably every gene is pleiotropic to some extent. Some instances of pleiotropy are not surprising. For example, mice that are bred for larger body size also produce litters with more pups. It is not hard to understand how this can occur, since larger bodies have more room for young inside and can supply more nutrients to the young. On the other hand, pleiotropy can produce unexpected effects. In humans, some of the genes that affect eye color can also influence the overall height of the individual involved.

More confusing are the situations in which more than one gene affects a given trait. These are called multiple loci or multiple gene effects. Once again, probably most traits are affected by more than one gene, and in fact many traits are controlled by dozens, hundreds, or even thousands of genes to some extent. This situation could be diagrammed as follows:





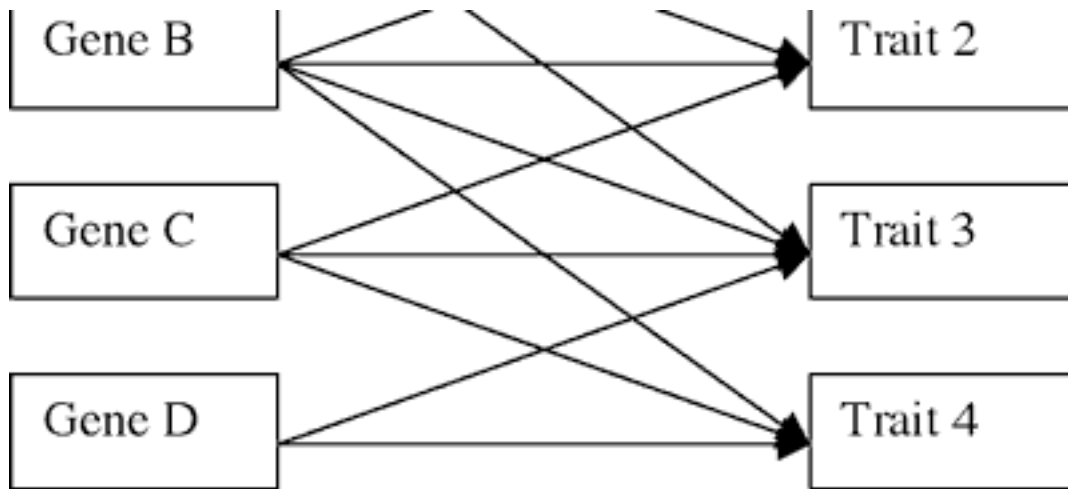
Multiple Loci: More than one gene affects a particular trait.

Sometimes the effect of each locus influencing a particular trait is different, and unusual outcomes can result. These are described under such terms as collaboration and complementation.

Unfortunately, different biologists use these words differently. To the Mendelian geneticist, the word **epistasis** refers to a particular kind of effect wherein one locus can inhibit or mask the expression of a second locus. To the evolutionary biologist, all interactions among loci that do not have the simplicity of the columbine example are referred to as epistasis. Thus, the epistasis of the Mendelian geneticist is only an example of the epistasis of the evolutionary biologist. For your understanding of the material in Unit 6, it is not necessary for you to be able to distinguish between the terms collaboration, complementation, and epistasis, but rather to understand that when more than one locus affects a trait, the outcome can't always be predicted. Thus, in dihybrid crosses, proportions of the different phenotypes among the offspring may not fit simple Mendelian expectations if there are any interactions among the two loci involved. Specific instances of epistasis (in the sense of the evolutionary biologist) are described in some of your genetic problems and can be understood on a case by case basis.

It should be clear to you by now that although many traits can be described using simple Mendelian principles, the genetics of the inheritance of most traits is more complex. Since most traits are influenced by multiple loci and since most loci are pleiotropic, the following diagram summarizes the true complexity of inheritance:





Pleiotropy and Multiple Loci: In real organisms, many genes affect each trait, and each gene influences many traits.

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