

➤ ENVIRONMENTAL EFFECTS AND GENE EXPRESSION:

145

8> Inheritance Pattern

$R' = \text{white}$
 $R = \text{red}$

Parents

Gametes

Offspring

1 red : 2 roan : 1 white

Codominance
The phenomenon in which heterozygote expresses the phenotypes of both homozygote is called Codominance. In the ABO blood types, the I^A , I^B heterozygote expresses both alleles.

ENVIRONMENTAL EFFECTS AND GENE EXPRESSION

Mutations and the various mechanisms of genetic recombination cause genetic variation. These variations make natural selection possible. And natural selection acts over many generations. It can increase the proportion of mutants in a bacterial population. These mutants are adapted to some new environmental condition. They can resist specific antibiotic. All variations are produced by environment. Thus environment greatly affects the gene expression. For example: *E. coli* bacterium lives in the changing environment of a human gut. It depends in its host for nutrients.

(a) Sometimes, its host does not provide it tryptophan amino acid. This amino acid is necessary for its survival. Therefore, the bacteria activate its genes of tryptophan synthesis. It stimulates the metabolic pathway to make its own tryptophan from another compound.

(b) Later, if the human host eats a tryptophan-rich meal, the cell stops producing tryptophan for itself. It saves the cell from wasting its resources to produce a substance. This substance is now available in the surroundings solution. Thus

it stops the expression of genes of tryptophan. It shows that the environment directly affect the expression of tryptophan gene.

Control of metabolism: Metabolic control occurs at two levels

1. Cells can vary the numbers of specific enzymes. Thus the cell can regulate the expression of a gene of that enzyme.
2. Second, cells can vary the activities of enzymes already present. It is more immediate control. It depends on the sensitivity of many enzymes. These enzymes can increase or decrease their catalytic activity.

For example, end product inhibits the activity of the first enzyme of the tryptophan synthesis pathway. Thus, if tryptophan accumulates in a cell, it shuts down its own synthesis. It is a feedback inhibition. It allows a cell to adapt to short-term fluctuations in levels of a substance it needs. If the environment continues to provide all the tryptophan the cell needs, then regulation of gene expression also comes into play. The cell stops making enzymes of the tryptophan pathway. This control of enzyme occurs at transcription level. The synthesis of messenger RNA coding for these enzymes is stopped. Thus many genes of the bacterial genome are switched on or off by changes in the metabolic status of the cell. It is the basic mechanism for this control of gene expression.

DEFINITIONS AND KEY POINTS

TERMS	DEFINITIONS
Mendel's law of segregation	The law of Mendel states that "the allele of gene present on the homologous chromosomes segregates during meiosis in such a way that each gamete get one allele not both".
Reciprocal crosses	The cross with same characteristics but a reversal of the sexes of the individuals is called reciprocal cross.
Law of independent assortment	"When alleles of more than one trait are followed together in cross, the alleles of these traits assort independently to each other during gamete formation."
kilocalorie	A kilocalorie (Kcal) is the amount of heat necessary to raise 1 kg of water 1° C and is equal to 1,000 calories.
Multiple allele	The presence of more than two alleles in a single gene in different combination is called multiple alleles.
Incomplete dominance	The interaction between two alleles that are expressed more or less equally, and the heterozygote is different from their homozygote is called incomplete dominance.
Codominance	The phenomenon in which heterozygote expresses the phenotypes of both homozygote is called Codominance.