Environmental factors influence the expression of the genotype in an organism. (4.C.2)

a. **Environmental factors** influence many traits both directly and indirectly.

   - Flower color based on soil pH

   ![Image](http://www2.ekol.slu.se/)

   **The effect of environment on phenotype**: Hydrangea flowers of the same genetic variety range in color from blue—visible to pink, with the shade and intensity of color depending on the acidity and aluminum content of the soil. (Pink: no aluminum, pH 6.0-6.4, Blue: aluminum present in soil, pH 5.0). At acidic pHs aluminum becomes more available and is found at a higher concentration in the sepals than at more alkaline pHs. When aluminum is available it will change the anthocyanins (flower pigments) from pink to blue.

Environmental factors influence the expression of the genotype in an organism. (4.C.2)

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   - Effect of adding lactose to a Lac+ bacterial culture

   ![Image](http://www2.ekol.slu.se/)

   **The effect of environment on phenotype**: The Lac operon is an operon required to the transport and metabolism of lactose in Escherichia coli. It consists of three adjacent structure genes lacA, lacC, and lacY, and will only be activated in the present of lactose. MacConkey agar is a culture medium designed to grow bacteria and differentiate them for lactose fermentation, acting as a visual pH indicator. Lac+ bacteria will produce acid, which lowers the pH of the agar (below 6.8) causing the appearance of red/pink colonies. Non-lactose fermenting bacteria cannot utilize lactose and will use peptone instead. This forms ammonia, which raises the pH of the agar, and leads to the formation of white/colorless colonies.

Environmental factors influence the expression of the genotype in an organism. (4.C.2)

b. An organism’s adaptation to the local environment reflects a **flexible response** of its genome.

   - Darker fur in cooler regions of the body in certain mammal species

   ![Image](http://www2.ekol.slu.se/)

   **Environment and Phenotype: Himalayan Rabbits**- A Himalayan rabbit normally has black hair only on its long ears, nose, tail, and lower leg limbs. For one experiment, a patch of a rabbit's white fur was plucked clean, and an ice packet was secured over the hairless patch. Where the colder temperature had been maintained, the hairs that grew back were black. Himalayan rabbits are homozygous for the allele of a gene that codes for tyrosinase, an enzyme required to produce melanin. The allele specifies a heat-sensitive version of the enzyme, which is able to function only when the air temperature is below about 33°C. When cells that give rise to hairs grow under warmer conditions, they cannot produce melanin and their hairs appear light. This happens in body regions that are massive enough to conserve a fair amount of metabolic heat. Ears and other slender extremities are cooler because they ten to lose metabolic heat more rapidly.
Environmental factors influence the expression of the genotype in an organism. (4.C.2)

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- Alterations in timing of flowering due to climate changes

Plants are Flowering Early - Dozens of flowering plants have gradually begun blooming earlier as average temperatures rise. Currently this just means that certain parts of the country could see longer growing seasons, but if the trend continues some plants might not be able to flower at all because they will not have enough of a cooling during the winter months to flower in the "spring".

Climate Changes Causes Plants to Flower Historically Early:

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Bozeman Biology: Genotype Expression (7:00 min.)
http://www.bozemanscience.com/053-genotype-expression

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