

## Chapter 36

### Evolutionary Aside 36.2--Stems, Stomata, and the Evolution of Cacti

Given the tiny surface area of spines (modified leaves on cacti), how are cacti able to support sufficient gas exchange and transpiration? Although stomata are a leaf trait, stem epidermis of cacti in the subfamilies Cactoideae and Opuntioideae has stomata. These cacti look most like a typical cactus, with highly reduced leaves. Early in the evolution of the cactus family one or more mutations likely arose in the promoter region of genes needed to initiate stomatal development. This is a homeotic mutation, which results in the correct structure being produced in the wrong place on the organism. The mutation(s) allowed for the expression of stomatal genes in stem epidermis. The regulation appears to be quite precise, with higher densities of stomata in the lower epidermis of the modified stems (called cladophylls) than the upper epidermis. Think about the factors that would favor the persistence of this type of mutation in cacti.