

## Chapter 30

### Evolutionary Aside 30.1--Common Origins of Stomatal Regulatory Mechanisms

More than 410 MYA stomatal pores first appeared on the sporophytes of moss plants. A recent investigation shows that the mechanism for opening and closing the guard cells of the stomata arose before the divergence of the ferns. The same mechanism that is used by moss and the other seedless plants is also at work in the seed plants. Most likely, there was a single evolutionary origin for this critical innovation that balances gas and water exchange in land plants.

The origins of the stomatal closing mechanisms correlate with the evolution of the abscissic acid (ABA)-signaling pathway in moss. ABA is a plant hormone that is involved in desiccation tolerance.

Both the moss *Physcomitrella* and the flowering plant *Arabidopsis* have a gene called *OPEN STOMATA 1 (OST1)* that encodes a protein kinase-signaling protein that is ABA-regulated. The sequence of both genes is quite similar. When the *Physcomitrella OST1* is inserted into an *Arabidopsis* mutant lacking its own *OST1*, the transgenic plant has functional stomatal opening. Likewise, an *Arabidopsis OST1* gene can substitute for the *Physcomitrella OST1* gene. Although these two plants last shared a common ancestor over 400 MYA, they both appear to use the same, highly conserved mechanism to open and close guard cells. This result underscores the critical importance of stomata in the evolution of the land plants.