An understanding of a plant as a living system is the foundation of becoming a successful grower. Knowing how plants work, observing their development, and responding appropriately to their needs is the alpha and omega of good gardening.
Photosynthesis:
The process of converting energy in sunlight into chemical forms of energy that can be used by biological systems in order to grow and develop.

Above Ground: Leaves, Transpiration and Photosynthesis

A plant’s leaves contain millions of tiny light converters called chloroplasts. These microscopic bio-factories convert light energy into a form of chemical energy that is then used to power other essential plant processes. During the daytime a plant absorbs carbon dioxide from the atmosphere (the carbon is used as a building block to create more plant matter) and emits oxygen as a by-product. This process reverses at night (plants absorb oxygen and emit carbon dioxide.) These gas exchanges occur through tiny holes in the leaf surface called “stomata.”

Stomata are also the site of transpiration. This is the process where a plant loses water to the surrounding atmosphere—like evaporation. Stomata open and close to regulate how much moisture is given up to the atmosphere. If conditions are hot and dry the stomata will close to protect the plant—this, in turn, has a direct effect on gaseous exchange and, thus, the amount of carbon available to the plant in order to grow and develop.

Below Ground: Roots, Water, Oxygen, and Nutrients

It’s a very different picture under the ground. In the absence of light, and insulated from the drying effect of the air, roots seek out moisture. Dissolved in this moisture are essential minerals which the plant uses as food. In soil, a complex array of microorganisms work to break down organic matter into inorganic (or ionic) forms that can be absorbed through the root hairs. In hydroponics, nutrients are supplied in ready-to-use ionic form so no microbiology is required. Mineral-rich moisture is transported throughout the plant via a network of channels called the vascular system.