

Course: BSCI 330 – Cell Biology and Physiology
Integrating a topic of sustainability into the curriculum

June M Kwak

Cellular Signaling and Fresh Water Scarcity
--- *Environmental problem, Sustainability, Global climate change*

Around 190 students from a variety of colleges on campus enroll in the BSC1330 class that I teach. In this course, I focus on the biochemical, cell biological, molecular biological, genetic, and physiological mechanisms underlying cell function. A considerable amount of time is spent regarding cellular signaling pathways, and I emphasize that the necessity of understanding cellular signaling networks in order to treat human diseases and to address environmental problems.

One of the signal transduction cascades I cover in the course leads to cellular response to drought in plants, which is mainly mediated by the phytohormone abscisic acid (ABA). Drought is a major environmental problem that causes a severe reduction in agricultural production. Fresh water scarcity is also one of the century's major global problems. As global temperatures rise, we will encounter increased variability in the amounts and distribution of precipitation, increased water demand, and enhanced susceptibility to drought. This will result in profound impacts on global fresh water resources, 65% of which are used for agriculture.

Plants lose over 95% of their water via transpiration through stomatal pores on the leaf surface. Guard cells on the leaf surface form stomatal pores and regulate pore size, controlling water loss and CO₂ uptake. Under drought conditions, ABA rapidly triggers stomatal closure, which is crucial to the plant's ability to survive drought.

I will incorporate a special lecture into BSCI330 regarding the serious fresh water scarcity situation we are currently facing and how it negatively affects agriculture, economy, environment, and human life. In fact, 14,000 people die every day just because they do not have access to clean fresh water. I will discuss with students how studying cell biology and signal transduction can address, at least in part, these global problems. More specifically, we will discuss how we can improve drought tolerance and more sustainable water use of plants based on the knowledge we learn in the course. In addition, we will discuss what we have to do in our daily lives in order to be part of the effort of sustaining the sacred resource, fresh water.