Teaching Tools in Plant Biology

ideas to grow on

THE PLANT CELL

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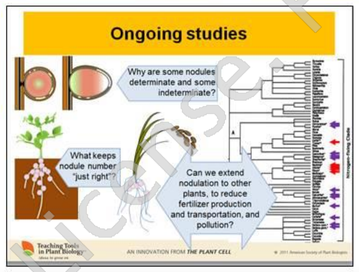
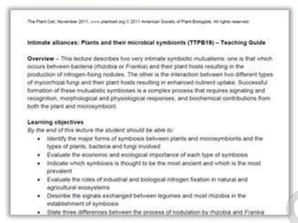
What are Teaching Tools in Plant Biology?

PowerPoint slides, **Lecture Notes**, and **Teaching Guides** for undergraduate teaching

- Customizable
- Peer-reviewed
- Current and up-to-date
- Free to subscribers to ASPB journals





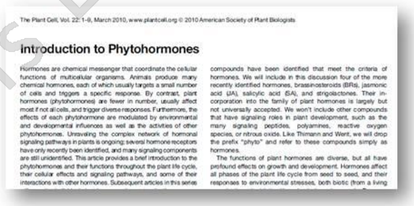
Intimate alliances: Plants and their microbial symbionts (TTPB19) – Teaching Guide

Overview – This lecture describes two very intimate symbiotic mutualisms: one is that which occurs between bacteria (rhizobia or *Frankia*) and their plant hosts resulting in the production of nitrogen-fixing nodules. The other is the interaction between two different types of mycorrhizal fungi and their plant hosts resulting in enhanced nutrient uptake. Successful formation of these mutualistic symbioses is a complex process that requires signaling and recognition, morphological and physiological responses, and biochemical contributions from both the plant and microsymbiont.

Learning objectives

By the end of this lecture the student should be able to:

- Identify the major forms of symbiosis between plants and microsymbionts and the types of plants, bacteria and fungi involved
- Evaluate the economic and ecological importance of each type of symbiosis
- Indicate which symbiosis is thought to be the most ancient and which is the most prevalent
- Evaluate the roles of industrial and biological nitrogen fixation in natural and agricultural ecosystems
- Describe the signals exchanged between legumes and most rhizobia in the establishment of symbiosis
- State three differences between the process of nodulation by rhizobia and *Frankia*



The Plant Cell, Vol. 22: 1–9, March 2010, www.plantcell.org © 2010 American Society of Plant Biologists

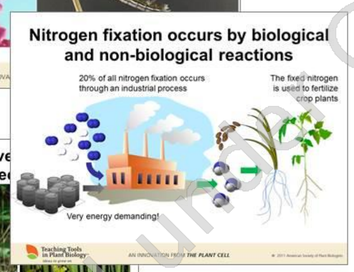
Introduction to Phytohormones

Hormones are chemical messenger that coordinate the cellular functions of multicellular organisms. Animals produce many chemical hormones, each of which usually targets a small number of cells and triggers a specific response. By contrast, plant hormones (phytohormones) are fewer in number, usually affect most if not all cells, and trigger diverse responses. Furthermore, the effects of each phytohormone are modulated by environmental and developmental influences as well as the activities of other phytohormones. Unraveling the complex network of hormonal signaling pathways in plants is ongoing; several hormone receptors have only recently been identified, and many signaling components are still unidentified. This article provides a brief introduction to the phytohormones and their functions throughout the plant life cycle, their cellular effects and signaling pathways, and some of their interactions with other hormones. Subsequent articles in this series

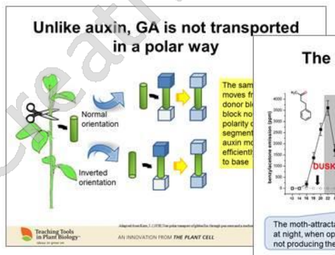
compounds have been identified that meet the criteria of hormones. We will include in this discussion four of the more recently identified hormones, brassinosteroids (BRs), jasmonic acid (JA), salicylic acid (SA), and strigolactones. Their incorporation into the family of plant hormones is largely but not universally accepted. We won't include other compounds that have signaling roles in plant development, such as the many signaling peptides, polyamines, reactive oxygen species, or nitrous oxide. Like Thimann and Went, we will drop the prefix "phyto" and refer to these compounds simply as hormones.

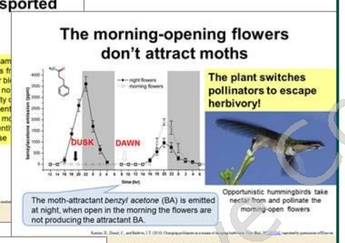
The functions of plant hormones are diverse, but all have profound effects on growth and development. Hormones affect all phases of the plant life cycle from seed to seed, and their responses to environmental stresses, both biotic (from a living

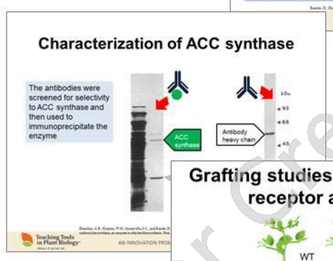
Slides are image-centric

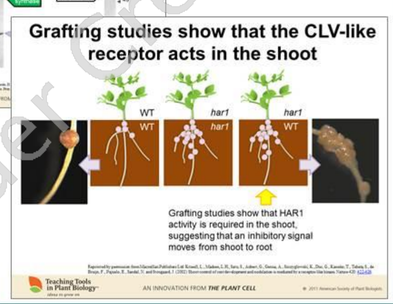


Key experiments are explained and linked

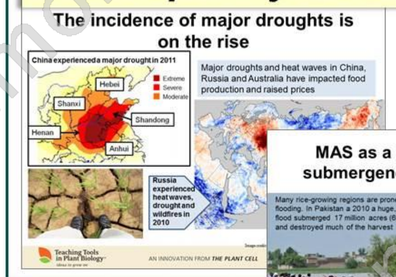


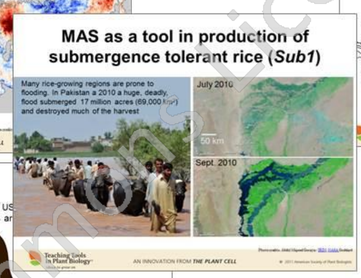


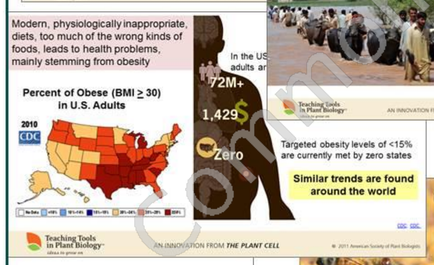




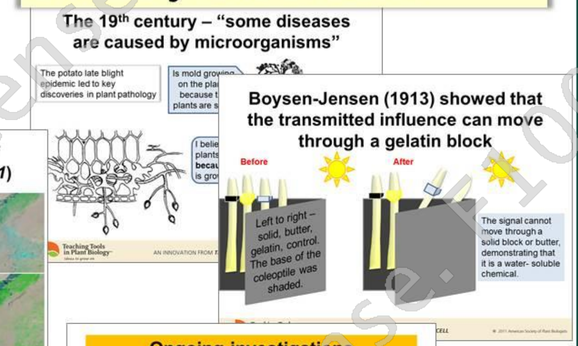
Plant science is put in a contemporary context

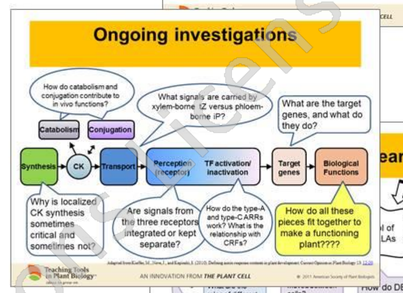


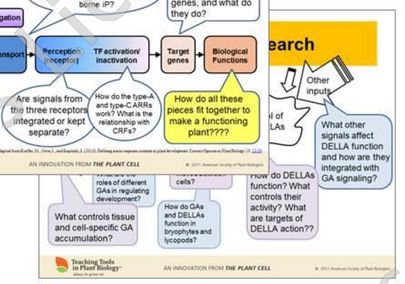




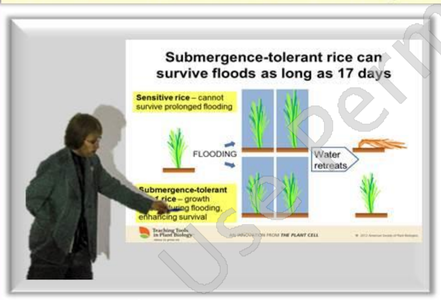
Science is a process, with a history and a future







How can I use Teaching Tools?

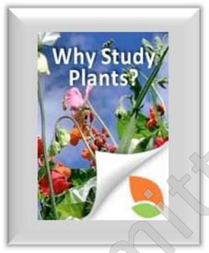


You can incorporate materials into your lectures, or use them as a starting point to write a new lecture

You can read them for a quick review, or assign them to students

You can adapt them into posters for a public exhibition

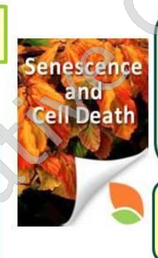
You and your students can use them as a starting point for class discussions and inquiry-based learning approaches, using suggestions from the Teaching Guides



You can use them in a public lecture

Topics (so far)

Plant Hormones
- Auxin
- Cytokinins
- Gibberellins
- Brassinosteroids
- Ethylene
- ABA
- Salicylates
- Jasmonates
- Strigolactones

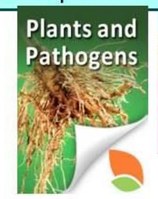


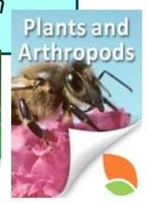
Leaf Development
- Phyllotaxy
- Patterning and Polarity
- Senesce

- Epigenetics
- Small RNA

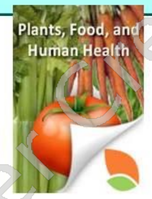
Plants are Not Alone

Plants and…
- Arthropods
- Symbionts
- Pathogens
- *Agrobacterium*
- Other plants





Plants and People
- Plants, Food and Human health
- Medicinal plants



General audience
- Why study plants?
- Genetic improvements in agriculture

Plant Physiology *(in progress)*
- Water uptake and transport
- Mineral nutrition
- Light harvesting and photophosphorylation
- Carbon fixing and carbon concentrating
- Phloem and intercellular transport
- Cell walls
- Biofuels
- Organelles and protein trafficking
- Abiotic stress responses