TBL Goals Overview

- Use the TBL framework to deliver a series of lessons which addressed standards tied to plant physiology and response.
- Use individual readiness assessment score, team assessment score, lab report, and post-test as the summative assessment pieces for the TBL.
- Use open-ended and relevant application questions to facilitate discussion.
- Use laboratory skills and techniques to reinforce ways of knowing.
- Develop a TBL cycle which will reinforce previously addressed standards without feeling like ‘Review’.
- Have students take ownership over analytical skills, critical thinking, and motivation to address real problems facing our changing world as it relates to assessable content.

TBL Cycle Overview

Background and Readiness

Students read two background articles, and then use those articles, along with prior knowledge, to complete the iRAT and tRAT components in class.

Application Exercise

Students utilize background knowledge to try and come up with solutions to real-life application problems that include varying solutions which could be applicable.

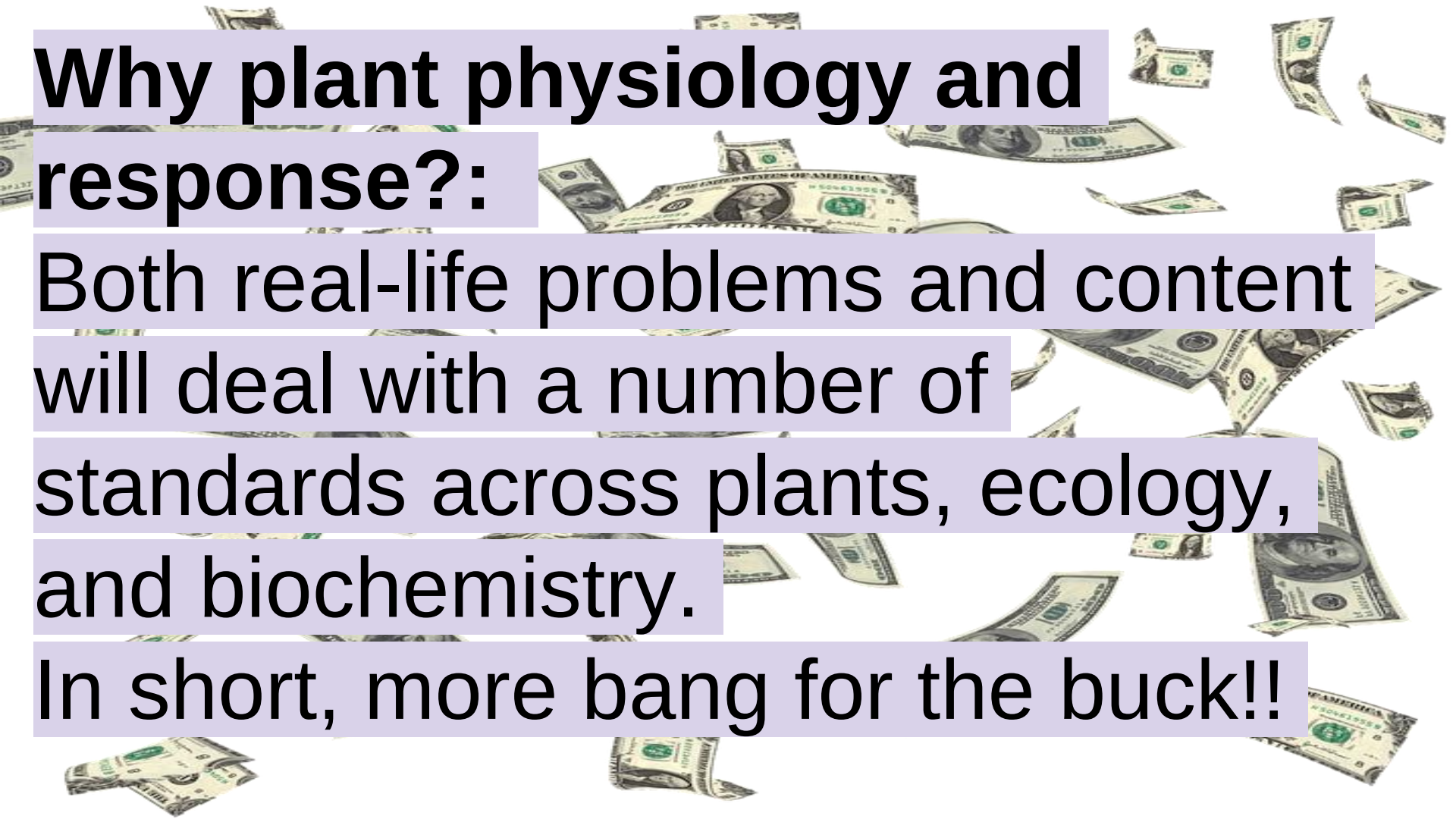
Students share results simultaneously to fuel discussion

Lab Practical and Post-Test

Students complete a lab exercise with a simulated ELISA panel.

The lab ties directly into issues raised within the application questions.

A more standardized post-test is given on the covered material.



Why plant physiology and response?:

Both real-life problems and content will deal with a number of standards across plants, ecology, and biochemistry.

In short, more bang for the buck!!

Reading Material:

Key part of plants' rapid response system revealed

International collaboration puts molecular face on enzyme family that allows plants to adjust quickly to herbivore attack or changes in growing conditions

SCIENCE

A Race to Save the Orange by Altering Its DNA

By AMY HARMON JULY 27, 2013

CLEWISTON, Fla. — The call Ricke Kress and every other citrus grower in Florida dreaded came while he was driving.

Fig. 1. Map of Crete depicting the morphology of the island and the major agricultural areas (A: Falassarna; B: Chania; C: Heraklion; D: Messara valley; E: Ierapetra).

Both Olive and Citrus trees are grown in the same regions on Crete, and it seems that they both follow the same general responses for increased CO^2, however, the citrus crops appear to respond differently. Their stomatal density seem to lower with increased CO^2 levels, but their stomatal aperture grow larger, and stay open for a longer duration during the day to facilitate gas exchange. Farmers are worried that this might increase opportunities for plant fungal infections, which would only lessen productivity further. What would be your recommendation for growers who are concerned about fungal infections in the Citrus crops in growing areas A (Falassarna) and B (Chania)?

A.) Farmers in these regions should invest in engineering solutions to help remove excess water from rainfall away from the tree groves because moist, damp conditions will encourage fungal growth.
B.) Farmers should consider planting additonal rotational crops in these areas to encourage insect activity and soil bacteria which could mitigate fungal spread.
C.) Farmers should move their Citrus crops to growing regions on the island with less precipitation (D, *Messara Valley*) or (E, *Ierepetra*) to proactively prevent the economic impact of Citrus fungal infections.
D.) Farmers should invest heavily in fungicidal sprays in regions A and B to proactively protect the Citrus trees.

Students make connections with the material through outside reading and set-up for application exercise

Read both articles	• Individual Readiness Assessment Test (6 questions) • Team Readiness Assessment Test (6 questions)
Application Exercise	• Students spend most of a class period to discuss and share out simultaneously (3 questions)
Lab Investigation	• Students complete “dummy” ELISA test for plant pathogen from Crete tree crops.
Post-Test	• Formal assessment (only one right answer) on material covered throughout the unit.

Resources to help get it there!

https://www.apsnet.org/edcenter/instcomm/TeachingArticles/Citruskiller/Pages/default.aspx

https://www.nytimes.com/2013/07/28/science/a-race-to-save-the-orange-by-altering-its-dna.html?pagewanted=all&_r=0

10.8 grade level reading score

https://source.wustl.edu/2012/06/key-part-of-plants-rapid-response-system-revealed/

11.9 grade level reading score

https://s3.amazonaws.com/academia.edu.documents/41481257/Global_Change_Effects_on_Crop_Photosynth20160123-27101-1c1go38.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1530219508&Signature=kax5GbneWAO8tDUHAAkOWNrzPGw%3D&response-content-disposition=inline%3B%20filename%3DGlobal_change_effects_on_crop_photosynth.pdf

https://idus.us.es/xmlui/bitstream/handle/11441/38732/Problem-Based%20Learning%20in%20Plant%20Biology.pdf?sequence=1