

Introduction and Disclaimer

These mock examination questions span diverse disciplines and are designed for your practice in preparation for the International Research Olympiad (IRO) 2024. Endeavor to answer them to the best of your ability, utilizing this opportunity to enhance your skills and knowledge. For additional practice, it is advisable to engage in extensive reading of various papers; such efforts will contribute to a more comprehensive and nuanced understanding of the subject matter.

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Try your best, and good luck! -International Research Olympiad 2024

Mock Examination Answer Key 6

Bolded answers are correct.

Paper 6: Plant Biochemistry

Question 1

Question: In the exploration of cellulose biosynthesis inhibitors (CBIs) and their multifaceted roles, the paper delves into the intricate balance between fundamental research and applied agricultural practices. The dual role of CBIs, as shown in the paper, involves:

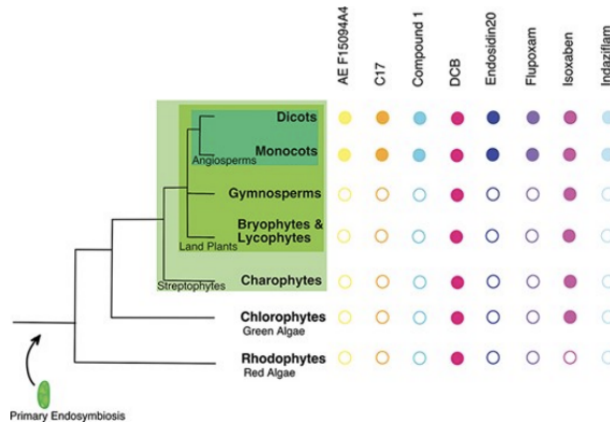
- a.) **Unraveling the complexities of plant growth and development, while simultaneously serving as potent herbicides for weed control.**
 - **This is correct. The paper emphasizes that CBIs are important both for understanding plant biology and for their use in agriculture.**
- b.) Facilitating cellulose biosynthesis to enhance mechanical support in plant cells and promoting sustainable biofuel feedstock.
 - This statement is incorrect as CBIs inhibit, rather than facilitate, cellulose biosynthesis.
- c.) Inhibiting cellulose biosynthesis and promoting textile production.
 - The paper does not link the inhibition of cellulose biosynthesis with the promotion of textile production.
- d.) Accelerating biofuel feedstock development and limiting paper production.
 - The paper does not make a connection between CBIs and the impact on biofuel feedstock development or paper production.

Question 2

Question: The comprehensive overview of plant cell wall structure and cellulose biosynthesis reveals intricate details about the organization, synthesis, and regulation of cellulose. CSCs play a crucial role in cellulose microfibril formation. Which statement accurately describes CSC assembly and function?

- a.) CESAs in Arabidopsis, such as CESA1, CESA3, and one of the CESA6-like clade members, are exclusively responsible for secondary cell wall synthesis.
- This is incorrect; the paper specifies different CESAs are involved in primary and secondary cell wall synthesis.
- b.) CSC movement is primarily influenced by cellulose microfibril alignment, and glucose addition is decoupled from glucan chain translocation.
- This statement is misleading. The paper discusses the coupling of glucose addition and glucan chain translocation.
- c.) **CSCs exhibit 6-fold symmetry, representing six CESA trimers per CSC, and their movement is guided by microtubules for optimal cellulose synthesis.**
- **This is correct. The paper details the structure of CSCs and their relationship with microtubules in guiding cellulose synthesis.**
- d.) The plant-specific regions are not crucial for CSC assembly and interactions with accessory proteins.
- This statement is incorrect; the paper highlights the importance of plant-specific regions in CSC assembly and function.

Question 3



Question: Given the description of the visual representation of the breadth of cellulose biosynthesis inhibitor (CBI) studies across Archaeplastida plants and algae, which statement accurately reflects the information conveyed in the figure?

- a.) A filled circle indicates that CBIs have been tested on all species within the taxon.
- Incorrect. A filled circle does not necessarily imply comprehensive testing on all species within the taxon; it indicates at least one peer-reviewed study has tested the indicated CBI on one species within the taxon.
- b.) An open circle signifies that no CBIs have been developed or tested for the indicated taxon.
- Incorrect. An open circle does not mean that no CBIs have been developed or tested; it signifies that there are no published studies documenting the effects of the CBI within that taxon.
- c.) The exclusion of CBIs tested only on dicots suggests a focus on monocots.
- Incorrect. The figure's exclusion of certain CBIs does not necessarily indicate a focus on monocots but rather a simplification for the visualization.
- d.) **The presence of both filled and open circles conveys variability in the extent of CBI testing across different taxa.**
- **Correct. The combination of filled and open circles indicates that there is variability in the research conducted on CBIs across different taxa, with some groups receiving more attention than others.**

Question 4

Question: Isoxaben exhibits selective activity against various Archaeplastida species, with notable resistance observed in certain grasses. Which statement accurately reflects the factors contributing to isoxaben resistance and its effects on cellulose synthesis?

- a.) Grasses resistant to isoxaben typically display increased isoxaben uptake and metabolism.
- Incorrect. The resistance in grasses does not stem from increased uptake or metabolism of isoxaben.
- b.) **Isoxaben resistance in grasses is associated with a unique cell wall composition.**
- **Correct. The paper suggests that resistance in grasses may be due to their cell wall composition, which includes mixed-linkage glucan in addition to cellulose.**
- c.) Isoxaben-induced effects on primary and secondary cell wall biosynthesis are consistent across different plant species.
- Incorrect. The paper does not claim that the effects of isoxaben are consistent across all plant species; there are variations in sensitivity and response.
- d.) The resistance of Arabidopsis mutants to isoxaben suggests that isoxaben primarily targets CESA1 and CESA3.
- Incorrect. Isoxaben-resistant mutations have been found in CESA3 and CESA6, suggesting that isoxaben may not target CESA1 and CESA3 exclusively.