Tree-Thinking: An Introduction to Phylogenetic Biology
by David Baum and Stacy Smith
reviewed by Kristy L Halverson

I was very eager to receive my copy of Tree Thinking: An Introduction to Phylogenetic Biology by David Baum and Stacy Smith. I have spent the past six years investigating the ever-growing field of tree thinking and how college students come to make sense of these representations. Until reviewing this text, I had yet to find a valuable text resource that explains tree thinking on a conceptual level appropriate for people new to the subject. This text did not disappoint.

Tree thinking involves understanding the branching pattern produced by evolutionary processes; branching diagrams are used to show how different branches on the tree of life connect and relate. Scientists are able to use these diagrams to illustrate hypothesized evolutionary relationships among taxa by mapping descent from common ancestry. Unfortunately, interpreting and comparing phylogenetic trees can be a complex process, and people that are not familiar with these diagrams often tend to misinterpret the meanings conveyed (for discussion, see Gregory 2008; Halverson and others 2011).

I was pleasantly surprised at how incredibly easy it was to read this text. I could breeze through a chapter or two at a time with very little effort. I appreciated that the authors included helpful and clear definitions of terms associated with tree thinking to help unfamiliar readers understand the language used throughout the text. There were ample visual representations provided throughout the text to aid the written explanations of tree thinking, particularly tree interpretation. The variety of these images was a refreshing alternative to the more monotonous treatment of traditional textbooks.

I would have liked to see more comparisons among historic trees side by side in the text. Still, all of the art in this text is available upon request for teaching purposes, and I can make these comparisons in class. There was not as much emphasis on tree building as on tree reading, but this is a common skew in tree thinking. Additionally, tree thinking is closely tied with evolution, a cross-disciplinary concept, but the text never went into detail on expanding this idea.

This text is supposedly targeted to a large range of audiences, including undergraduates. The introductory chapter and the first half of the text is a nice primer for anyone interested in phylogenetics, but overall I think this text is best suited for faculty, researchers, and graduate students. This text offers much too specific content to be useful as a standalone textbook for most undergraduate courses and would be better suited as a supplemental reference. However, for targeted graduate courses, this text would be an ideal choice.
Upon my initial perusal of the text, I was delighted to find a pretest for assessing student knowledge of tree thinking and end-of-chapter quizzes for each of the eleven chapters. The multiple choice pretest is even available online, so instructors can use it to measure initial student understanding and (if instructors also administer a posttest) learning gains. Unfortunately, upon utilizing this pretest in a classroom situation, I discovered that this feature was not as much of a benefit as I had hoped. I used the text with graduate students enrolled in a phylogenetics course at my university. When I administered the pretest, it took the students much longer than I anticipated to complete it, with most students requiring over thirty minutes. The quiz questions seemed to cover some of the most important aspects of interpreting trees. Yet some of the questions were too long and confusing for students to understand what was actually being asked. For example, several of the multiple choice questions required more than one response to be considered a correct answer (for instance, Question 2 required that students select choice C and D for a correct response) and others offered confusing wording. I found that the included assessments were not the best for measuring tree thinking understanding—I was left to infer for myself why students selected their responses. The authors do not provide any reference to the assessment’s validity or reliability. And there were errors in several of the questions and answer key (for example, the answer to Question 9 should be D, but C is accidentally recorded as the correct response). Still, with a knowledgeable group, working through the problems and assessment provided sparks for intellectual discussion on tree thinking. Students debated and justified rationales for responses and sought to determine accurate interpretations. This led to further use of the text as a valuable reference.

The text also presents multiple problems to work through that address varying aspects of tree thinking. This approach allows the text to provide a stimulating way for readers to challenge their current ideas about phylogenetic trees. Other than the initial pretest, the graduate students found the text easy to use and understand. Several asked to borrow my copy of the text for further use as a reference for their projects. They found this text to be ideal for generic information on tree thinking and a perfect supplement to Joseph Felsenstein’s *Inferring Phylogenies* (2004). As opposed to Felsenstein, a technical, difficult read that is full of details, Baum and Smith provide a straightforward synoptic presentation of phylogenetics.

Overall, I was impressed with the variety in tree representations, the attractive appearance and size of the text, and the welcoming introductory chapter. I have already obtained multiple copies of this text and have assigned readings from it to all of my graduate research assistants. Each copy has survived heavy use and will become an invaluable addition to my lab’s reference library. Understanding tree thinking is a complicated process that becomes much easier when using this text as a reference.

**References**


ABOUT THE AUTHOR

Kristy L Halverson is Assistant Professor in the Department of Biological Sciences at the University of Southern Mississippi. Her research in science education focuses on how students work with and make sense of biological representations, particularly phylogenetic trees.

AUTHOR'S ADDRESS

Kristy L Halverson
Department of Biological Sciences
University of Southern Mississippi
Johnson Science Tower 720
118 College Drive, Box #5018
Hattiesburg MS 39406
Kristy.Halverson@usm.edu