QUICK FIX

Using Pipe Cleaners to Bring the Tree of Life to Life

KRISTY L. HALVERSON

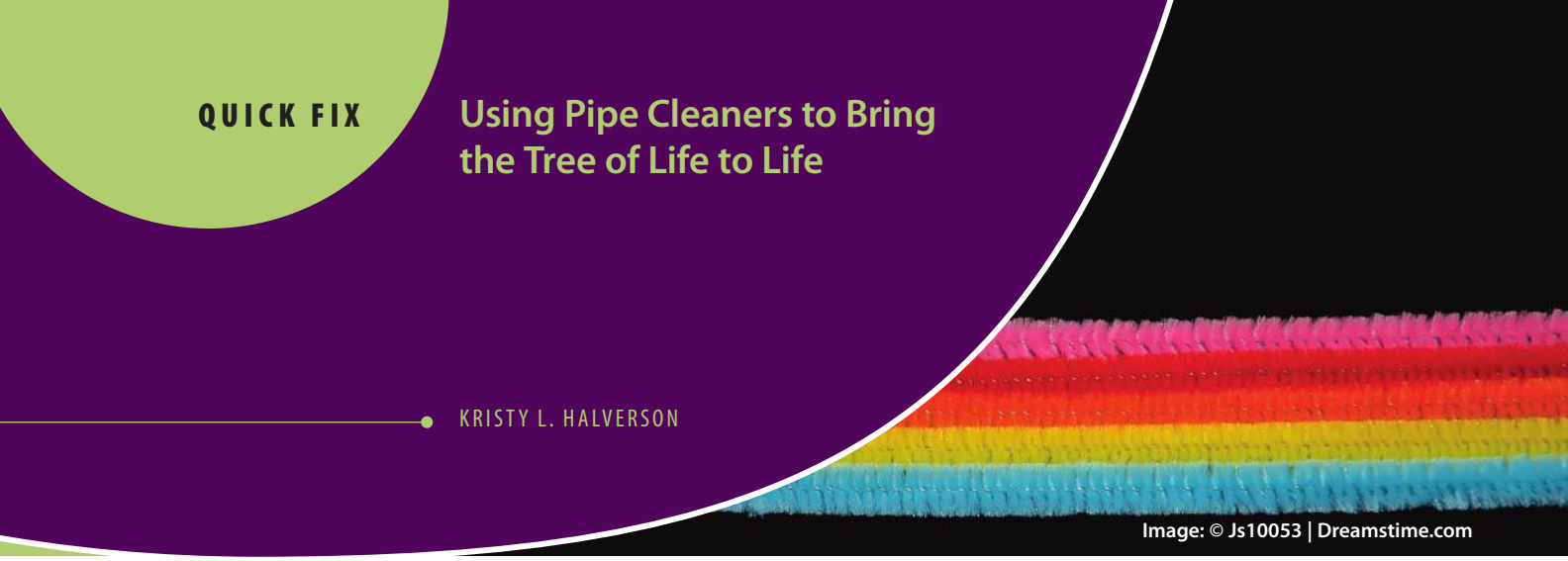

Image: © Js10053 | Dreamstime.com

Abstract

Phylogenetic trees, such as the "Tree of Life," are commonly found in biology textbooks and are often used in teaching. Because students often struggle to understand these diagrams, I developed a simple, inexpensive classroom model. Made of pipe cleaners, it is easily manipulated to rotate branches, compare topologies, map complete lineages, identify informative phylogenetic features, and examine the effects of superficial structural changes.

Key Words: *Biology; cladogram; evolution; phylogenetics; tree thinking.*

Many students, teachers, and even some scientists struggle to make sense of phylogenetic trees (Baum et al., 2005), which are commonly used in both textbooks and classroom instruction. Rather than ignore student struggles, it is time to address the challenge of "tree thinking" by developing ways to help students learn how to read these diagrams. I created a manipulative model that pushes students to explore phylogenetic trees and think more deeply about evolutionary relationships. This simple, inexpensive pipe-cleaner model gives students a 3D experience of what is typically represented in two dimensions. Students manipulate the tree to rotate branches, compare topologies, map complete lineages, identify informative phylogenetic features, and examine the effects of superficial structural changes. For example, when this model was used in a college biology course, one student said that "the pipe cleaners allow us to see how manipulating the tree by twisting and straightening does nothing to the tree's meaning, just its appearance." Another student had struggled with how two rotated trees could illustrate the same relationships. She stated, "I had trouble imagining the 'rotation' of the branches in my head, and this provided a physical rotation that I could see."

I created a manipulative model that pushes students to…think more deeply about evolutionary relationships.

You will need five pipe cleaners of different colors for each tree. Here, I use pink, purple, green, blue, and orange to represent each element of a single tree or lineage. There are four steps to building the model. (1) Gather the five pipe cleaners together so that they are flush at each end. (2) Twist them together at one end, using about 2 inches of the bundle. (3) Take the other end of the pink pipe cleaner and wrap it around the others once. Then twist the remaining pipe cleaners together for another 1.5 to 2 inches. Repeat this step with the remaining pipe cleaners until they have all been isolated in the following order: pink, purple, green, blue, orange. (4) Bend the pipe cleaners 90° at each point of intersection and another 90° at each halfway point (see Figure 1).

This model works well in addressing the challenge of tree thinking because (1) it uses color to help identify complete lineages; (2) it is bendable, so that it can be transformed into multiple styles of trees; (3) to alter relationships, students must deconstruct and rebuild the model – much like a real tree; (4) students can use additional pipe cleaners to incorporate additional species and information; and (5) the model can be modified easily by using a hole punch to add taxa to the tips to provide a more concrete learning tool. This model has been used at high school and postsecondary levels to help students read trees, build them, and understand what they represent.

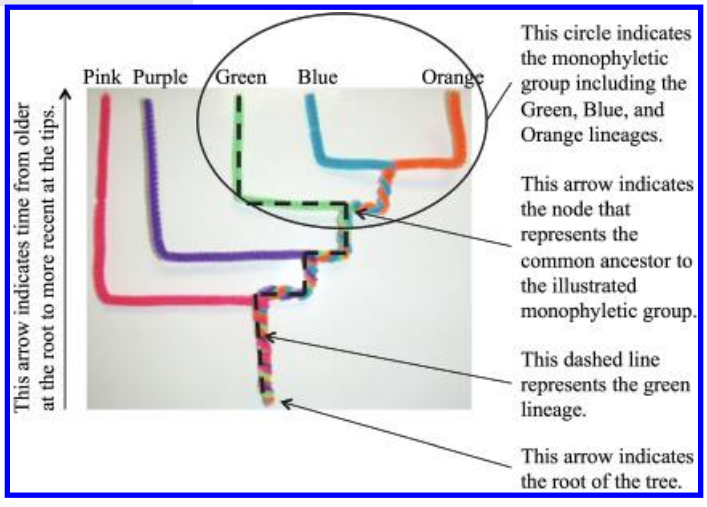

Figure 1. Sample pipe-cleaner phylogenetic tree with the "green" lineage identified.

The American Biology Teacher, Vol. 72, No. 4, pages 223–224. ISSN 0002-7685, electronic ISSN 1938–4211.
DOI: 10.1525/abt.2010.72.4.4

References

Baum, D.A., Smith, S.D. & Donovan, S.S.S. (2005). The tree-thinking challenge. *Science*, *310*, 979–980.

KRISTY L. HALVERSON is Assistant Professor of Biological Sciences at the University of Southern Mississippi, 118 College Dr. #5018, Hattiesburg, MS 39406; e-mail: kristy.halverson@usm.edu.