

# A Fast and Fun Method for Studying Plant Vascular Tissue

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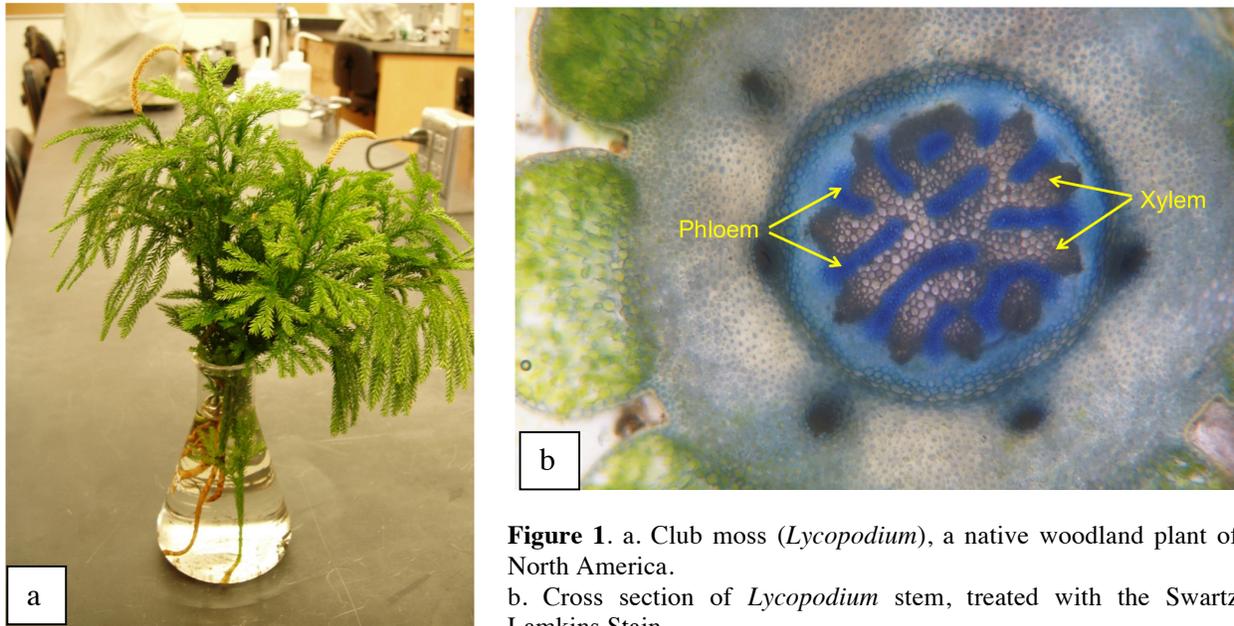
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## Extended Abstract

This lab exercise actively engages students in their studies of plant anatomy. Students use a simple, inexpensive technique for staining the vascular tissue of plant stems, without having to use lengthy or volatile clearing and staining procedures typical of many published techniques. The activity is highly suitable for courses that have limited time and monetary budgets to devote to lab activities; Table 1 lists the required materials and equipment needed to do this activity. The procedure itself is simple and fast: students use one half of a double-edged razor blade to make thin sections of plant stems, transfer them to a microscope slide and immediately cover each section with a drop of a commercially-available, ink-based stain (the Swartz Lamkins Fungal Stain). The stained sections can then be directly examined on a compound microscope after adding a coverslip. Students are able to generate beautifully-stained sections of rarely-seen arrangements of xylem and phloem in simpler plants, for comparison to sections of angiosperm stems from both monocots and eudicots. Students in our introductory biology course work in groups of three or four: they each section one or two different plant stems and also examine the sections made by other students in their group, thereby studying several different types of plant stems during the laboratory period. Examples of plants we have provided to our students include young corn, sunflower and *Coleus* plants, as well as simpler vascular plants such as whisk ferns (*Psilotum*) and club mosses (*Lycopodium*, Figure 1). Instructors may instead choose to have their students collect their own small, herbaceous plants from various campus locations, formulating hypotheses for what the arrangement of the vascular tissues will look like in the collected plants based on preliminary taxonomic classifications. The students can then section and treat the stems with the Swartz Lamkins Stain to test their hypotheses. A flow chart of the procedure, student handout, and a Power Point file, including images of labeled sections of various stained plant stems, is available upon request by e-mailing the author at [jemerson@amherst.edu](mailto:jemerson@amherst.edu).

Table 1. Materials and equipment needs.

Item	Additional notes or vendor and cost (where applicable)
Scissors (2-3 pair)	For cutting plant stems into 1-2 cm length pieces
Dorco ST-300 Platinum Double-Edged Razor Blades	100 blades per box, ~\$7.50 per box from Amazon.com
Dissecting microscope with illumination from above	Helpful, though not required, for making sections of the stems
Toothpicks or small spatulas	For transferring the stem sections to a microscope slide
Glass microscope slides and glass coverslips	1 mm plain and 22 mm square, respectively
Swartz Lamkins Fungal Stain*	Dermatologic Lab and Supply, Inc. (Delasco). Cat.# SL/1, \$14.50 per ½ oz bottle, \$13.25 each if order more than six
Compound microscope with 4X, 10X and 40X objectives	To examine the stained sections
*As the Swartz Lamkins Fungal Stain is considered a medical product, a Statement of Use on school letterhead must be submitted to Delasco for purchase by non-health professionals. Delasco manufactures this stain using the original powdered ink from Parker Pens, which is dissolved in a solution containing a surfactant and potassium hydroxide. It is supplied ready to use, without need of any additional mixing.	



**Figure 1.** a. Club moss (*Lycopodium*), a native woodland plant of North America.  
b. Cross section of *Lycopodium* stem, treated with the Swartz Lamkins Stain.

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I thank Professor Michael Hood in the Biology Department at Amherst College for discovering that the Swartz Lamkins Fungal Stain is also a beautiful stain of plant vascular tissue. In addition, I thank Professor Hood for showing me (and the Biology 181 students) how to make thin sections of plant stems by hand. Finally, I thank the participants of the 2016 ABLE Conference Mini-Workshop, who made their own wonderful, stained sections of a variety of plant stems, including the scapes of day lilies growing on the campus of the University of Houston.

### About the Author

Dr. Julie Emerson is a Biology Lab Coordinator at Amherst College in Amherst, Massachusetts. She has taught a variety of courses in molecular, cellular, developmental and organismal biology at several institutions across the United States. At Amherst, she teaches in the Biology 181 and Biology 191 courses, in which students obtain a comprehensive introduction to many key biological concepts and underlying scientific approaches, methodologies and pedagogical approaches to learning. Dr. Emerson also directed the HHMI-funded Summer Teacher's Workshop for eight summers (from 2005-2012) and currently teaches in the Summer Science Program for incoming first-year students.

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