Inquiry approaches to teaching college biology are becoming recognized as important in articulating the learning paradigm and pedagogy initiated in the pre-collegiate years with introductory post-secondary science teaching (Leonard, 2000; McIntosh, 2000; SCST, 1998). This investigation into plant nutrition is written as a guided inquiry (Colburn, 2000; Minstrell & van Zee, 2000) learning cycle and can be adapted across several grade levels from middle school life science to introductory college biology classes. This experience with plant nutrition “uncookbooks” (Leonard 1991) the traditional study using tomato plants in hydroponic or sand cultures, reorients it to inquiry, and increases its flexibility to span middle school science through introductory college biology. The methods and materials are doable, even in minimally equipped biology classrooms and laboratories, largely because of the use of Wisconsin Fast Plants, fluorescent light, and purchased prepared stock solutions of elemental nutrients. The level of sophistication of the laboratory and the depth of the content can be adjusted to the student audience.

The study of plant nutrition is as important as the study of human nutrition but historically of less interest to adolescents and young adults in secondary and post-secondary biology classes. Similarities to human nutrition can be explored in plants by withholding or supplying excessive single elements in order to observe the effects, much like deficiency diseases led to the discovery of necessary vitamins and minerals for human nutrition. Asking questions such as “What happens if a human does not have enough iron in his or her diet?” and “What happens to a plant if it does not have enough iron?” poses both relevant and scientific issues.

This lesson is designed as guided inquiry (Colburn, 2000), but can be modified with an imposed experimental design (structured inquiry) or posed as an open-ended question (open inquiry). It is presented as a learning cycle following a similar format to those published by Lawson in this journal (Lawson, 1996; Lawson, 2000). The specific approach utilized is a three-part learning cycle (Exploration, Concept Development, and Application), but is easily adapted to the 5 E’s (Engagement, Exploration, Explanation, Elaboration, and Evaluation) (Biological Sciences Curriculum Study [BSCS], 1993).

After a focus question or motivational strategy is provided, the first phase of a learning cycle allows students to mentally explore ideas through brainstorming to identify what they currently know and to ask questions. During Exploration the experiment is designed and data is collected, summarized, and initially analyzed. At this point ideas are shared with peers leading into Concept Development. This phase requires teacher facilitation in asking questions that direct thinking without dictating ideas or providing answers. A skilled teacher can listen and redirect questions such that students ultimately answer their own questions. After concepts are formed and necessary biological terminology is provided, the students are set to use their new ideas in the Application. This phase of the