

# Module Overview

*Organisms—From Macro to Micro* gives students the opportunity for hands-on study of organisms from most of the taxonomic groups scientists currently recognize as kingdoms. While the module addresses 16 representative organisms, it focuses on the life cycles and processes of two organisms in particular—Wisconsin Fast Plants™ and the cabbage white butterfly.

Students discover that the life cycle of these two interesting organisms are linked in important ways. They find that neither can survive without the other. Students also learn that humans are organisms—members of the kingdom Animalia. They discover that humans undergo many of the same life processes as do smaller organisms, which makes the module that much more relevant.

Students of all ages, but particularly those of middle school age, have a natural curiosity about living things and how they function. *Organisms—From Macro to Micro* taps this curiosity by first helping students clarify what they already know about organisms, then having them perform a series of engaging, hands-on, thought-provoking activities that will enable them to expand their knowledge.

*Organisms—From Macro to Micro* is divided into three parts: The Beginning, Continuing the Cycle, and Completing the Cycle.

## **PART 1 THE BEGINNING**

Part 1 consists of six lessons that set the stage for the entire module. Lesson 1 is a preassessment. It gives students an opportunity to share what they already know about organisms as well as to demonstrate their skill level at making observations. Students begin filling out their organism photo cards, which they will revisit and revise throughout the module. After

reading a selection about taxonomy, they use a list of Latin and Greek terms to assign genus and species names to the 16 organisms on the photo cards.

Lesson 2 serves as an introduction to the compound light microscope and an interesting insect called the WOWBug™. Students learn and hone their microscope skills while performing authentic scientific tasks—preparing slides of a live organism, observing the organism through the microscope under different magnifications, drawing the organism while following a specific set of guidelines, and peer-evaluating drawings of other group members. The “form and function” theme, inherent throughout the module, is introduced subtly in this lesson.

In Lesson 3, students work with an organism called *Lumbriculus variegatus*, a relative of the common earthworm. Following the “macro to micro” theme, *Lumbriculus*, more commonly known as the California blackworm, affords students a relatively large specimen to observe. While students can easily observe various blackworm behaviors without magnification, they continue to work on their microscope skills as they determine the pulse rate of the blackworm. Students observe the most common method of reproduction of the blackworm—asexual through fragmentation.

Students set up a pond in a 16-oz plastic cup in Lesson 4. They make macro- and microscopic observations of both the solid and liquid parts of the pond. They place five *Lemna* (duckweed) fronds in their ponds. (In Lesson 12, when they revisit their ponds to observe any changes that have occurred, they determine the average daily increase in the number of *Lemna* fronds when they perform a final count.)

In Lesson 5, students set up growing systems with Wisconsin Fast Plants seeds. They will

follow the progress of these plants, from seed to seed, and to sprouts once more, over a period of about 40 days. They cross-pollinate their Fast Plants, and when the resulting seeds mature, students harvest them and set them up for germination. They also observe the germination of corn seeds (monocots) and bean seeds (dicots) and their development into young plants.

In Lesson 6, students begin to follow the development of cabbage white butterflies from eggs to adults. They conduct three inquiries over several weeks to discover more about this organism and how its life cycle is intertwined with that of Wisconsin Fast Plants.

Lesson 7 acquaints students with several different types of cells—algal, plant, and animal—and their components. Students hypothesize about how the structures of the various cells and their organelles are suited to their functions.

## PART 2 CONTINUING THE CYCLE

Lesson 8 finds students participating in a simulation of the steps of cell division, using pipe cleaners and a set of student sheets. They prepare a model of those steps and compare cell division in plant and animal cells.

In Lesson 9, students read an introductory passage contrasting asexual and sexual reproduction. This sets the stage for an inquiry in which students dissect a flower to observe its male and female reproductive structures. They use cotton swabs to cross-pollinate their Wisconsin Fast Plants. They also record information about the pigmentation of their plants—a characteristic whose importance will become apparent in a later lesson.

In Lesson 10, students use their Wisconsin Fast Plants growing systems to investigate an

important process in plants called transpiration. In the process, they also learn about photosynthesis.

In Lesson 11, students observe and draw four protists—*amoeba*, *euglena*, *paramecium*, and *volvox*. They identify and label the protists' organelles and their methods of movement. In Lesson 12, students revisit the ponds they constructed in Lesson 4 and document changes they observe, including the average daily increase in the number of *Lemna* fronds.

## PART 3 COMPLETING THE CYCLE

Lesson 13 is the Anchor Activity, a group research project on which students continue to work for the remainder of the module. In this activity, students research the structure and function of various parts of a vertebrate and identify and describe the components of its habitat. They present their findings to the class using a method approved by the teacher.

In Lessons 14 and 15, students investigate the Fungi kingdom. They compare the rate of mold formation on freshly baked and brand-name breads and follow the progress of a fungal garden over several weeks. They design an inquiry in which they explore substances that affect yeast activity.

In Lessons 16 and 17, students work with two tiny, freshwater organisms—*Daphnia* and *Hydra*. They explore the effects of cola and alcohol solutions on *Daphnia* and, using the remaining *Daphnia* and blackworm fragments for food, they observe *Hydra*'s feeding habits.

In Lesson 18, students harvest their Wisconsin Fast Plants seeds and set up 36 of them for germination in a petri dish. They observe the germinated sprouts in Lesson 19 to find that the purple-pigmented parents have yielded a three:one ratio of purple-pigmented to

green sprouts. From there, students engage in several follow-up inquiries to learn more about genetics in both plants and animals.

In Lesson 20, the first part of a final assessment, students use the information on their organism photo cards, which they have revised and updated during the module, to construct a graphical, dichotomous key. From the graphical key, they produce a written key. Appendix I provides Part 2 of this assessment, which consists of a set of selected-response items.

Appendices D through F include detailed instructions for the preparation of various items of equipment that are used in the module. Appendix G is the assessment for Part 1 of the module—Lessons 1–7. Appendix H is the assessment for Lessons 8–13. Lesson 20 and Appendix I provide the final assessment for the module.

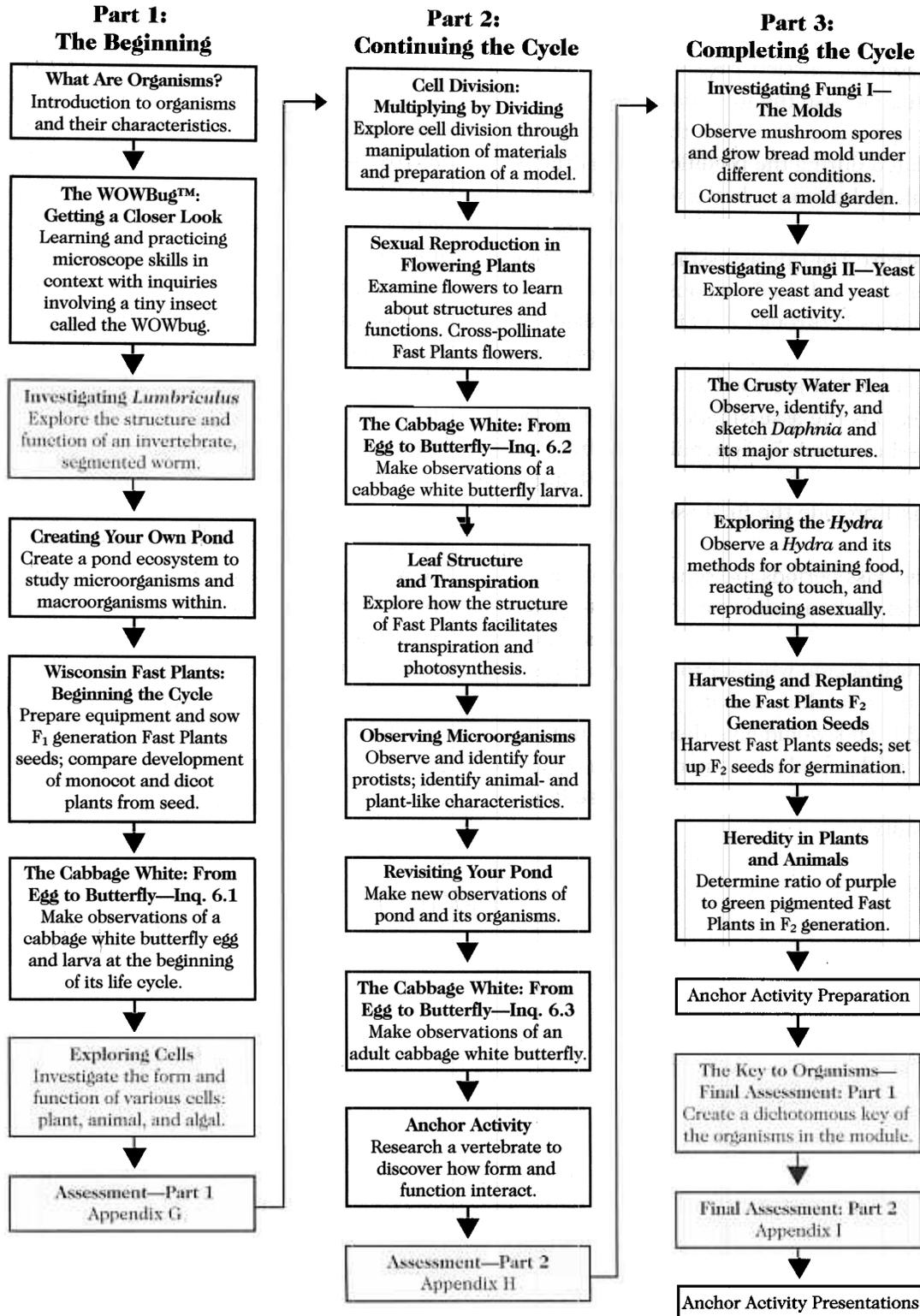
Several class periods are scheduled at the conclusion of the module for students to practice and present their Anchor Activities. The teacher will decide whether to have students present their Anchor Activity projects prior to Lesson 20. This would give them more time to prepare for the final assessment, which includes Lesson 20 and a set of selected response items in Appendix I.

*Organisms—From Macro to Micro* addresses the skills and concepts deemed appropriate for grades 5–8 by the National Science Education Standards. Through this module, students become more acquainted with a variety of living organisms—including themselves.

One of the major strengths of this module is that it raises questions that invite further investigation. While suggestions for further study and inquiry are explored through reading selections and extensions, the NSRC encourages teachers to allow students time for further exploration, either individually or in groups.

Suggestions for the integration of technology are included—specifically, the use of the Internet for research and the application of probeware and computer technology where appropriate and economically feasible. Included throughout the module are suggestions to visit the NSRC Web site, where students and teachers will find links to Internet sites that will reinforce and enhance the concepts addressed in the lessons. A separate probeware and computer technology guide is available through Carolina Biological Supply Company.

## Conceptual Sequence for *Organisms—From Macro to Micro*



## Module Structure

*Organisms—From Macro to Micro* includes a Teacher’s Guide, a Student Guide, and a master Materials List.

### TEACHER’S GUIDE

The Teacher’s Guide for *Organisms—From Macro to Micro* is organized into 20 lessons and nine appendices. The lessons vary in duration. The shortest can be completed in one 45-minute class period, and the longest takes three to five such periods. Most lessons may be taught back to back to accommodate block scheduling or in 45-minute class periods. Block scheduling requires less time for materials management and allows more time for class discussion and extension work. For lessons that are more than 45 minutes long, suggestions for appropriate breaking points are made.

The Inquiry and Homework sections of the Teacher’s Guide are written for 45-minute classes. Those with longer classes will need to read the lessons ahead of time and make the necessary adjustments.

This module is inquiry based. An inquiry usually consists of a combination of the following components: a brainstorming or preassessment session, an explanation of the procedure by the teacher, one or more hands-on laboratory inquiries by the students, and follow-up designed to determine whether students have grasped the concepts and skills addressed in the lesson along with ways to apply what they have learned to new situations. The Teacher’s Guide contains general information on teaching the module, including materials, materials management, and assessment. It also contains information about the Anchor Activity, an ongoing assignment that students begin during Lesson 13 and continue to work on throughout the

module. They present their Anchor Activity to the class just before the final assessment in Lesson 20.

The following components appear in each lesson of the Teacher’s Guide:

### Lesson Number and Title

**Inquiries** The number of inquiries in the lesson.

**Periods** The duration of the lesson. (One class period is assumed to be 45 minutes.)

**Overview** A brief introduction that sets the context for the lesson. It provides the thread between previous and upcoming lessons and briefly outlines what students will do in the lesson.

**Concepts** A list of the major concepts covered by the lesson. Many of the concepts address the National Science Education Standards.

**Student Objectives** A list of what students are expected to accomplish in the lesson.

**Background** Information for the teacher that relates to the content of the lesson. It includes detailed information about the topic and is intended to provide teachers who are unfamiliar with a lesson’s content a foundation for answering student questions and facilitating inquiry. It may also contain information about common student misconceptions that relate to the content of the lesson and brief explanations of the reading selections in the lesson.

**Materials** Materials are listed under a variety of subheadings that are dependent on the lesson:

**For Each Student, For Each Pair of Students, For Each Group of 4 Students, and For the Teacher.**

**Preparation** Explains things the teacher must do prior to the lesson. Preparation may include photocopying student sheets, preparing transparencies or newsprint, preparing solutions from solutes provided with the kit, assembling lab equipment, or setting up audiovisual equipment. It is assumed that the teacher will refill chemical containers and replace other consumables when necessary.

### Name of Inquiry

**Procedure** A step-by-step guide for facilitating the inquiry. Provides a carefully planned route through the lesson and complements the procedure in the Student Guide. Each procedure contains instructions on how to introduce and conduct the inquiries within the lesson.

**Reflections** This section contains instructions about how to provide closure for the lesson.

**Homework** This section describes suggestions for independent student study related to either the current or upcoming lesson. Many of the homework assignments are tied to the reading selections. Additional homework can be assigned from the Extensions.

**Extensions** These are activities designed to extend the students' experience of the topic not only into other fields of science but also into other content areas. They provide the opportunity to work cooperatively with teachers from other content areas to ensure a more integrated curriculum.

**Assessment** Describes the concepts and skills upon which the student should be assessed

based primarily on the objectives of the lesson. Teachers may decide point values that are in line with their regular grading schemes. Scoring rubrics are included where appropriate.

**Preparation for Lesson** Appears only when items to be included in an inquiry have to be prepared by the teacher at least one day in advance. Teachers should check materials requirements at least one day before the lesson is to be taught. More information about materials can be found later in the Module Overview.

**Student Sheets** Masters of one or more student sheets accompany each lesson in the Teacher's Guide. Teachers must photocopy these before each lesson. Students use these sheets to record and interpret their data. Many questions appear only on the student sheets. Students are often referred to these questions in the Procedure section of the Student Guide.

**Inquiry Masters** These are sheets provided for the teacher to use. They consist of keys of the types of answers students may give for an inquiry, transparency masters, and scoring rubrics.

**Appendices** There are nine appendices in the module. Appendices D through F provide extensive information and directions for preparation of the materials and equipment needed for the module. Appendices G through H consist of three assessments, once for each section of the module. Appendices G and H also contain a performance assessment and a set of selected response items. Appendix I is a set of selected response items to be used in conjunction with Lesson 20 as a final assessment for the module.

**STUDENT GUIDE**

The Student Guide has two main components: lessons and reading selections. The Student Guide is not intended to be a stand-alone textbook. It provides instructions and some guiding questions relating to the inquiries and materials. It also includes both background and enrichment reading selections designed to be used in the context of a lesson.

The lessons in the Student Guide correspond to those in the Teacher's Guide and include the following parts:

**Lesson Number and Title**

**Introduction** Places the concepts addressed in the lesson in context with those that have preceded it and with the students' own experiences. It also provides a brief preview of the lesson. Some introductions include background information or contain short reading selections to pique the students' interest.

**Objectives for This Lesson** Outlines what the students are expected to accomplish by the end of the lesson. To maintain the constructivist approach, the objectives are often not worded the same as those in the Teacher's Guide.

**Materials** Specifies the size of the group in which the students will be working as well as the materials that they will require.

**Getting Started** This gives students an opportunity to "focus" on the concept being introduced in the lesson. In most cases, they first brainstorm what they already know about the topic.

**Inquiry Name** The name of the inquiry tells students what they will be exploring.

**Procedure** Provides instructions for the students. It includes step-by-step instructions that students follow to complete the inquiry, or to "explore" the concepts of the lesson more fully.

**Reflecting on What You've Done** In this section, students reflect on what they have learned in the lesson and begin to apply what they have learned to new situations. Extensions listed after each lesson in the Teacher's Guide provide opportunities for students to relate what they have learned to different fields of study.

**Reading Selections** All lessons have one or more reading selections. The reading selections provide background information that helps explain the concepts addressed in the lesson and introduce additional concepts from other areas of the National Science Education Standards. Many of the reading selections show how the concepts addressed in the lessons extend to everyday life. They are also intended to increase student awareness of the history of science and technology as it relates to the module.