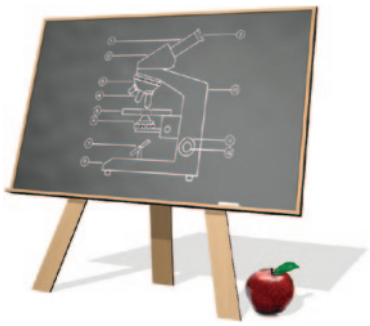
# Project MICRO: Science Excitement in Middle Schools



**Caroline Schooley**
Retired; Project MICRO Co-Coordinator, MSA; 45301 Caspar Point Road, Box 117, Caspar, CA 95420

schooley@mcn.org

## Introduction

*MICRO*, an acronym for Microscopy In Curriculum—Research Outreach, is the outreach program for middle schools sponsored by the Microscopy Society of America (MSA). Middle schools are the battleground for minds of young people because this is an important time for students to make decisions about whether to take science classes in high school. Unfortunately, the majority of middle school teachers are not adequately prepared to teach science; therefore, additional exposure to science may encourage students' interest.

## Goal of Project MICRO's Outreach Program

Project MICRO's goal is to reach *all* students, not just the few that may someday use microscopes in their adult careers. Project MICRO does not teach microscopy; rather, it teaches observation. Microscopes are arguably the best way to reduce a child's fear of science and to create enthusiasm and an "I can do this" attitude. Observation of the microworld introduces science as a useful way of thinking, opening the door for future interests and opportunities. A 20× inspection/dissection scope is a "tool of science" that children can recognize, and using one excites them all.

## Project MICRO's 20-Year History

Several large professional societies developed pre-college outreach programs in the early 1990s. Most were summer research fellowship programs for high school teachers, their educational effectiveness was limited to the participating teachers and their classrooms, and the cost per teacher was high. When the original grants expired, new funding sources were hard to find. The MSA began its outreach in 1992 and benefited from the experience of its predecessors. Early contact with the Lawrence Hall of Science (LHS) was fortunate. The LHS is one of the leaders in science education, and their teaching materials are used in a third of U.S. schools (see the LHS GEMS website: http://lhsgems.org/index.html). The LHS principal teacher's manual series is titled *Great Explorations in Math and Science* (GEMS), and they offered MSA the opportunity to sponsor the development of a new manual entitled *Microscopic Explorations* [1, 2]. The fundraising required to support the development of this new manual took several years. That delay, however, was actually a blessing because during the same time frame teacher demand for GEMS workshops resulted in the creation of a national training network, solving the problem of how to sustain Project MICRO into the future. A highly skilled category of teacher-trainer, the "GEMS Associate," was soon established. Currently, there are hundreds of them, all over the United States (and in several other countries). The GEMS Associates help MSA's local societies organize programs; and, in areas that are not served by participating local societies, they invite individual microscopist-volunteers to attend GEMS workshops and help them find a teacher to work with. The growth of this support structure has greatly reduced the need for independently funded implementations of the Project MICRO concept.

Funding the production of *Microscopic Explorations* was a major task because the total cost was $88,000. MSA President Michael Isaacson was extremely helpful with fundraising for this new microscopy manual. Funds were eventually provided by several outside sources: NSF; the Chevron Research, Hertz, Hewlett Packard, and Glaxo Wellcome Foundations; and the Cornell University Materials Science Center.

*Microscopic Explorations* was finally published in 1998, just before the Atlanta M&M meeting. It promptly received several good reviews and has been widely used since that time. Through LHS's extensive publicity, it has become an unusually successful teacher's manual. The policy of LHS is to do relatively small printings but reprint frequently. The current sale price is $23 (retail), which covers the cost of the next printing. There have been three reprints with revisions, and sales now total an impressive 13,000 copies. Unfortunately, the sales rate lately has slowed for all LHS manuals, including *Microscopic Explorations* sales, which were less than 200/year for 2009–2011. It appears that science education nationally has been curtailed to make way for the teach-to-the-test response to the No Child Left Behind act. However, there are signs that science education again will become a priority.

## Benefits of GEMS Collaboration

In order to increase student interest in science, an outreach program must publicize its existence, train teachers, and train volunteers. The GEMS program does all of this for Project MICRO. *Microscopic Explorations* gets extensive publicity (and general acceptance of its quality by teachers and school districts) as part of the GEMS series. In the many locations where microscopists are not available as classroom volunteers, GEMS Associates, GEMS Sites (two or more Associates with supplies and extra training), and GEMS Centers (three or more Associates with more expertise and structure) promote *Microscopic Explorations* as part of their ongoing workshop programs. Volunteers can learn effective methods by attending GEMS workshops or working with GEMS-trained teachers. See the GEMS website for full information (http://lhsgems.org/index.html).

## Local Affiliate Society Programs

Project MICRO began in the early 1990s, when the MSA local affiliate society (LAS) network was strong. Local societies in New England, Minnesota, North Carolina, and Arizona (plus Cornell University) all began programs. North Carolina and Arizona

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eventually lost critical funding, but New England, Minnesota, and Cornell continue to this day. The Minnesota LAS switched from classroom presentation to science museum events, New England continues with traditional classroom activities, and Cornell's program has merged with a larger departmental program. The New England Society for Microscopy circulates supplies kits in their area: one is now in Bar Harbor, Maine; one is in Burlington, Vermont; and three others are circulated to schools on request.

## A Model Program

The outstanding Project MICRO program is in Burlington, Vermont, sponsored by the Microscopy Imaging Center at the University of Vermont Medical School (Figure 1). Janet Schwarz, the technologist who manages the program, reports that from 1999–2011: 78 schools were visited (5–8 per year); 174 teachers were involved; 517 parents and other volunteers participated; and, most important, 5,308 students were brought to science! Though Janet has had occasional help from others at the Imaging Center, she has been the primary volunteer. She estimates that she has put 1,000 volunteer hours into school visits over the last 12 years. That is an amazing total, but a little arithmetic translates it into a manageable 8-9 hours per month during the school year. She has been able to do this because the Center has allowed her to work flexible hours. She has always done her normal workload after the school visits, and all of those visits have been on personal time. This amounts to a major educational impact at no cost to her department, in either salary or work done. One person can make a difference [3]!

## The Internet

It is hard to remember life before the web, but that was when Project MICRO began. Project MICRO now has a web site (http://www.microscopy.org/education/projectMICRO) that has been designed to be as self-contained as possible: most basic questions can be answered by its content. Search engines and other websites link it. Usage varies, but the site receives an average of about 20 visits per day. We will never know how many of those site visitors use its advice or the exercises in *Microscopic Explorations* in their own classroom or at home. The website includes a searchable database of children's books about microscopy, the microworld, and now, nanotechnology. The book collection started early, when we needed to know whether the effort to produce *Microscopic Explorations* was justified. The collection itself is a popular feature

**Figure 1:** Vermont students working on a *Microscopic Explorations* exercise.

**Figure 2:** Attendees at the Project MICRO workshop during the 2010 M&M meeting in Portland, OR.

in Project MICRO's area within the MSA Megabooth at the annual M&M meetings.

## MSA Meeting Workshops

A Project MICRO workshop at an M&M meeting provides a half-day training session that presents the exercises contained in *Microscopic Explorations* as they might be used in a classroom. Attendees role-play students and actually perform the exercises. Local teachers, meeting registrants, and registrant spouses attend. Meeting workshops can serve two purposes: recruiting meeting attendees for school outreach and providing local teachers with usable classroom skills (Figure 2). Because the M&M meeting is held in the summertime, recruiting teachers to participate in sessions at the meeting is a daunting task. Good local workshop organizers are essential, and Project MICRO has had a hard time finding them. Nevertheless, it has been possible to hold workshops at many M&M meetings: Kansas City, Portland (twice), Long Beach, San Antonio, and Honolulu. There will be a Project MICRO workshop at the July M&M 2012 meeting in Phoenix, and all interested meeting attendees (including spouses!) will be welcome.

## You Can Become a Project MICRO Volunteer

The National Academy of Sciences has compiled a list of reasons to become involved in science education; it is on an excellent website (http://www.nas.edu/rise/roles1.htm). If you have an NSF grant, for example, you have a particularly good reason to get involved because there is now a requirement that grant recipients do some sort of community outreach [4], and Project MICRO can help accomplish that.

## References

[1] S Brady and C Willard, *Microscopic Explorations*, Lawrence Hall of Science, University of California, Berkeley, 1998, 1999, 2003, and 2007.

[2] L Bergman and C Schooley, *Cell Biology Education* 2 (2003) 1–4.

[3] J Schwarz. Please contact Janet Schwarz directly for details about the Vermont program: janet.schwarz@uvm.edu.

[4] NSF grant outreach requirements: L Marvis, *Science* 334(6053) (2011) 169–71.

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