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# Acquisition of Laser Scanning Confocal Microscope for Biological and Materials Research

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**Final Report for Period:** 08/1999 - 07/2002**Submitted on:** 11/01/2002**Principal Investigator:** Shaler, Stephen M.**Award ID:** 9977643**Organization:** University of Maine**Title:**

Acquisition of Laser Scanning Confocal Microscope for Biological and Materials Research

**Project Participants****Senior Personnel****Name:** Shaler, Stephen**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Tyler, Seth**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Brawley, Susan**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Kim, Carol**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Millard, Paul**Worked for more than 160 Hours:** Yes**Contribution to Project:****Post-doc****Name:** Hooge, Matthew**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Applies confocal microscopy in study of phylogenetics of lower worms

**Graduate Student****Name:** Pfistermueller, Regina**Worked for more than 160 Hours:** No**Contribution to Project:**

Applied microscopy in thesis research

**Name:** Hooge, Matthew**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Used confocal microscopy for major part of dissertation research on comparative morphology of Acoela (Platyhelminthes)

**Undergraduate Student****Technician, Programmer**

**Name:** Crouse, Justin

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Coordinates use of the microscope among engineering staff and visiting scientists

**Name:** Edwards, Kelly

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Coordinates use of microscope among biologists

**Other Participant**

**Name:** Sorensen, Martin

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Collaborator on projects dealing with comparative microscopy of musculature and jaw structures in Gnathifera

**Name:** Funch, Peter

**Worked for more than 160 Hours:** No

**Contribution to Project:**

collaborates in research on Cycliophora

**Research Experience for Undergraduates**

**Organizational Partners**

**Other Collaborators or Contacts**

This grant involved the purchase and set-up of a laser scanning confocal microscope facility. Additionally, training of users (graduate students, staff, and faculty) with the University community was involved.

**Activities and Findings**

**Research and Education Activities:**

This is an instrument grant. The major activities have included the selection and the installation of the instrument, training of students, staff, and faculty on campus in the use of the instrument.

**Findings:**

The instrument has found use in both biological and materials science applications. The materials science applications have included both 3-D structure and component distribution as well as surface structure measurements. Expanded use of the instrument is occurring with time.

**Training and Development:**

This instrument grant has resulted in the training of over 15 individuals on the use of the Leica TCS-SP2 Laser Scanning Confocal Microscope. This instrument has been used in a variety of research projects ranging from muscular structure of worms to surface analysis of rubber printing rolls. Experience in the role of fluorescent probes for separation of different composite material constituents has also been gained. Additional experience in image processing tasks such as roughness, image segmentation procedures, and volumetric rendering has been incorporated into many of the research activities.

**Outreach Activities:**

The instrument has been featured in over 100 tours of the building in which it is housed over the past two years. Specific tours of microscopy by middle school biology and science classes incorporate the LSCM, along with EM facilities on campus.

### Journal Publications

- Muszynski, L., F. Wang, and S.M. Shaler, "Short term creep tests on phenol-resorcinol formaldehyde (PRF) resin undergoing moisture content changes", *Wood and Fiber Science*, p. 612, vol. 34, (2002). Published,
- Tyler S, Hooge MD, "Musculature of *Gnathostomula armata* Riedl 1971 and its ecological significance.", *PSZN Marine Ecology*, p. 71, vol. 21, (2001). Published,
- Hooge MD, "Evolution of body-wall musculature in the Platyhelminthes (Acoela, Catenulida, Rhabditophora).", *J Morphol*, p. 171, vol. 249, (2001). Published,
- Pfistermüller R, Tyler S, "Correlation of fluorescence and electron microscopy of F-actin-containing sensory cells in the epidermis of *Convoluta pulchra* (Platyhelminthes: Acoela).", *Acta Zoologica*, p. 15, vol. 83, (2001). Published,
- Hooge M, Tyler S, "Interstitial acoels (Platyhelminthes, Acoela) from Bermuda.", *Proc. Biol. Soc. Wash.*, p. 414, vol. 114, (2001). Published,
- Hooge MD, Haye P, Tyler S, Litvaitis MK, Kornfield I, "Molecular systematics of the Acoela (Platyhelminthes) and its concordance with morphology.", *Molecular Phylogeny and Evolution*, p. 333, vol. 24, (2002). Published,
- Hooge MD, Tyler S, "Acoels (Platyhelminthes, Acoela) from the Atlantic coast of North America.", *Meiofauna Marina*, p. , vol. , (2002). Accepted,
- Sørensen MV, Funch P, Hooge M, Tyler S, "Musculature of *Notholca acuminata* (Rotifera: Ploima: Brachionidae) revealed by confocal scanning laser microscopy.", *Invertebrate Biology*, p. , vol. , (2003). Accepted,
- Tyler S, "Epithelium--the primary building block for metazoan complexity", *Journal of Integrative and Comparative Biology.*, p. , vol. , (2003). Submitted,
- Hooge MD, Tyler S, "Acoels (Platyhelminthes, Acoela) from the central coast of California.", *Zootaxa*, p. , vol. , (2003). Submitted,
- Gschwentner R, Tyler S, Hooge MD, Rieger RM, "Unique patterns of body-wall musculature in the Acoela: The ventral musculature of *Convolutiloba longifissura*.", *Invertebrate Biology*, p. , vol. , (2003). Submitted,

### Books or Other One-time Publications

- Shaler, S.M., and J.E. Crouse, "Microscopy of Extruded Materials", (2001). Center Publication, Published  
Bibliography: AEWRC Research Report Number 01-04. 16 pp
- Shaler, S.M.  
J. Crouse, "Calendering Effect on Surface Structure of Paper Using Laser Scanning Confocal Microscopy", (2002). Center Publication, Published  
Bibliography: Research Report Number AEWRC 02-03 University of Maine
- Shaler, S.M.  
J. Crouse, "Surface Structure of Industrial Samples: Jeld-Wen", (2002). Center Report, Published  
Bibliography: Research Report Number AEWRC 02-11 University of Maine
- Shaler, S.M.  
J. Crouse, "Surface Structure of Paper Samples Using Laser Scanning Confocal Microscopy - No. 2", (2002). Center Report, Published  
Bibliography: Research Report Number AEWRC 02-16 University of Maine

Shaler, S.M.

J. Crouse, "Surface Structure of Paper Samples Using Laser Scanning Confocal Microscopy", (2002). Center Publication, Published Bibliography: Research Report Number AEW C 02-01

Tyler S, "The early worm--origins and relationships of the lower flatworms.", (2001). chapter in book, Published

Editor(s): Littlewood, D.T.J. and R. Bray

Collection: Interrelationships of the Platyhelminthes.

Bibliography: Taylor & Francis, London. pp 3-12.

### Web/Internet Site

### Other Specific Products

### Contributions

#### **Contributions within Discipline:**

The Laser Scanning Confocal Microscope purchased on this grant is set up as a multi-user facility representing a variety of disciplines. In the area of wood-based composite materials the instrument has been used as a tool on a variety of research projects ranging from paper coating structure, resin distribution on wood fibers, surface structure of rubber, and the distribution of inorganic additives within the wood plastic polymer composites.

Its use in biological disciplines has included comparative morphology of musculature, sensory organs, and nervous systems as well as physiology and functional morphology of invertebrates, fungi, and algae. Novel application of fluorescence images of musculature from confocal microscopy has contributed significantly to new understanding of phylogenetic relationships of lower worms.

#### **Contributions to Other Disciplines:**

Since this is a multi-user instrument, the other disciplines discussion was presented in the previous section.

#### **Contributions to Human Resource Development:**

Human resource development in science, engineering, and technology has occurred through the training of 7 graduate students on the use of the instrument, which has formed a portion of their thesis work. Additionally, the grant has supporting the training of 26 students, staff, and faculty at the University in the area of fluorescent staining of materials. This was accomplished through three two-day workshops conducted on the campus by Drs. Carol Kim and Paul Millard. Training of both graduate and undergraduate students in biological sciences on applications of confocal microscopy has been conducted through a microscopy course conducted each spring semester, a course that will continue to be offered indefinitely, and through a course in application of fluorescence techniques in general offered in fall semester 2001. A dedicated confocal-microscopy course is being developed for graduate credit. All those who go through these courses and continue with confocal applications also receive individual training in tutorial sessions before commencing with independent research using the microscope.

#### **Contributions to Resources for Research and Education:**

This instrument is the only Laser Scanning Confocal Microscope within the University of Maine System. As such, it has contributed to the institutional capabilities and has been part of 10 proposals submitted by faculty on campus within the last 3 years. The instrument has also been used for research and materials characterization for industrial clients who are part of an Industrial Research Consortium (Paper Surface Science Program) at the University of Maine.

#### **Contributions Beyond Science and Engineering:**

The instrument is routinely featured in tours on campus including middle school biology classes. For the past three years, approximately 30 K-12 Teachers and 250 K-12 students saw demonstrations of the confocal microscope as part of a GK-12 National Science Foundation grant on which Dr. Susan Brawley is an investigator. Demonstrations and tours of the facility are also offered to various classes on the UMaine campus as well as to faculty and administrators to acquaint them with the capabilities and potential uses of the system in research and education.

### Categories for which nothing is reported:

Organizational Partners

Any Web/Internet Site

Any Product