

# JOURNAL

OF THE

## Tennessee Academy of Science

---

---

VOLUME 91

NUMBERS 3-4

---

---

### CONTENTS

Abstracts of Papers Presented at the 2016 Collegiate Meetings.....	57
Student Presentation Awards at the 2016 Collegiate Division Meetings .....	70
Additions to the Known Vascular Flora of Land Between The Lakes National Recreation Area, Kentucky and Tennessee <i>Edward W. Chester</i> .....	71
Awards Presented by the Tennessee Academy of Science.....	75
Editor's Column .....	76

---

---

December 2016

# Tennessee Academy of Science

## EXECUTIVE COMMITTEE 2016

### President

Dr. Fred Matthews  
Department of Chemistry  
Austin Peay State University  
Clarksville, TN 37044  
Phone: 931-221-7622  
Email: matthewsf@apsu.edu

### Past-President

Dr. Gilbert Pitts  
Department of Biology  
Austin Peay State University  
P.O. Box 4718  
Clarksville, TN 37044  
Phone: 931-221-7777  
Fax: 931-221-6323  
Email: pittsg@tennacadofsci.org

### President-Elect

Dr. Daniel Swartling  
Department of Chemistry  
PO Box 5055  
Tennessee Technological University  
Cookeville, TN 38505  
Phone: 931-372-3431  
Email: dswart@tntech.edu

### Secretary

Teresa L. Fulcher  
Department of Natural and  
Behavioral Sciences  
Pellissippi State Community College  
10915 Hardin Valley Road  
Knoxville, TN 37933  
Phone: 865-539-7048  
Email: tfulcher@pstcc.edu

### Treasurer

Dr. C. Steven Murphree  
Department of Biology  
Belmont University  
1900 Belmont Boulevard  
Nashville, TN 37212-3758  
Phone: 615-460-6221  
Email: steve.murphree@belmont.edu

### Managing Editor

Dr. Rachel Rigsby  
Department of Chemistry  
Belmont University  
1900 Belmont Boulevard  
Nashville, TN 37212-3758  
Phone: 615-460-6425  
Email: rachel.rigsby@belmont.edu

### Assistant Editor

Vacant. Inquiries welcome.

### Department of Education Liaison

Kelly Chastain  
Andrew Johnson Tower,  
12th Floor 710 James Robertson  
Parkway,  
Nashville, TN 37243  
Phone: 615-741-3773  
Email: kelly.a.chastain@tn.gov

### Director, Junior Academy

Dr. Preston MacDougall  
Middle Tennessee State University  
Department of Chemistry  
Box X101  
Murfreesboro, TN 37132  
Phone: 615-898-5265  
FAX: 615-989-5182  
Email: pmacdougall@mtsu.edu

### Director, Collegiate Division

Dr. Fred Matthews  
Department of Chemistry  
Austin Peay State University  
Clarksville, TN 37044  
Phone: 931-221-7622  
Fax: 931-221-6261  
Email: matthewsf@apsu.edu

### Director, Electronic Communications

Dr. Gilbert Pitts  
Department of Biology  
Austin Peay State University  
P.O. Box 4718  
Clarksville, TN 37044  
Phone: 931-221-7777  
Fax: 931-221-6323  
Email: pittsg@apsu.edu

### Director, Visiting Scientist Program

Dr. Daniel Swartling  
Department of Chemistry  
Tennessee Technological University  
Box 5055  
Cookeville, TN 38505  
Phone: 931-372-3431  
Email: dswart@tntech.edu

### Chairperson of Education and Research Annual Meeting Coordinator

Cindi Smith-Walters  
Center for Environmental Education  
Middle Tennessee University  
Box 60  
Murfreesboro, TN 37132  
Phone: 615-898-5449  
Email: cindi.smith-walters@mtsu.edu

### Member-at-Large, 2014-2016:

Dr. J. Brian Robertson  
Department of Biology  
Middle Tennessee State University  
Box 60  
Murfreesboro, TN 37132  
Phone: 615-898-2066  
Email: james.robertson@mtsu.edu

### Member-at-Large, 2015-2017:

Dr. Sandy Mehlhorn  
Department of Agriculture,  
Geosciences and Natural Resources  
University of Tennessee at Martin  
142 Brehm Hall  
Martin, TN 38238  
Phone: 731-881-7253  
Email: smehlhorn@utm.edu

### Member-at-Large, 2016-2018:

Dr. J. Allyn Smith  
Department of Physics and Astronomy  
Austin Peay State University  
Clarksville, TN 37044  
Phone: 931-221-6104  
Email: smithj@apsu.edu

The TENNESSEE ACADEMY OF SCIENCE was founded in 1912 at Nashville, Tennessee. Membership is open to all teachers and professors of science, research workers in science both in educational institutions and industrial establishments, and all others who are interested in some phase of science. Annual dues for various categories of membership follow: student member—\$10; emeritus member—\$10; regular member—\$40; sustaining member—\$50; supporting member—\$100; life member—\$400 (single payment). Applications for membership should be addressed to the Treasurer.

The *Journal of the Tennessee Academy of Science* (ISSN 0040313X) is published by the Tennessee Academy of Science, Department of Biology, Belmont University, 1900 Belmont Boulevard, Nashville, TN 37212-3757, for all members not in arrears for dues. Back issues, if available, are \$10 per copy. Whole sets of back issues on microfilm are available from AMS Press, Inc., 56 E. 13th St., New York, NY 10003. Postage paid at Nashville, TN, and at other mailing offices. Send address change to the following: *Journal of the Tennessee Academy of Science*, c/o Dr. Steven Murphree, Department of Biology, Belmont University, 1900 Belmont Boulevard, Nashville, TN 37212-3757.

This journal is abstracted in *Biological Abstracts*, *Chemical Abstracts*, and the *Zoological Record*, and is indexed by *Science Citation Index* and *Agricola Citations*.