AFFIDAVIT OF FREDERICK W. SPIEGEL

COMES NOW Frederick W. Spiegel, being duly deposed and sworn, and states on his oath or affirmation all as follows:

1. My name is Frederick W. Spiegel.

2. I am the same Frederick W. Spiegel who gave a declaration in support of the motion for post-conviction relief in *Randeep Singh Mann v. United States*, No. 4:14-CV-00614-BSM, now pending before the United States District Court for the Eastern District of Arkansas, the Hon. Brian S. Miller, Chief Judge. This declaration appears in the Court's public electronic file in *United States v. Randeep Singh Mann*, No. 4:09-CR-99-BSM as Doc. No. 395 at 81-92 (PCR/Habeas Exhibit 2). A true and correct copy of this declaration, as it is electronically filed in the same post-conviction relief action, is attached to this affidavit, incorporated in it, and marked as "Spiegel Affidavit Exhibit A".

3. In support of the traverse in the foregoing post-conviction relief action, I submitted an affidavit. That affidavit appears in the Court's public electronic file in *United States v. Randeep Singh Mann*, No. 4:09-CR-99-BSM as Doc. No. 491-02 (PCR/Habeas Exhibit 103). A true and correct copy of that affidavit as on file in the same post-conviction relief action is attached to this affidavit, incorporated in it, and marked as "Spiegel Affidavit Exhibit B".

4. The curriculum vitae attached to the declaration (Spiegel Affidavit Exhibit A) was superseded by the curriculum vitae attached to the affidavit (Spiegel Affidavit Exhibit B). Since the completion of the curriculum vitae attached to Exhibit B, there have been some additional accomplishments. Among them, the University of Arkansas has named me a Distinguished Professor of Biological Sciences. I developed the proposal for a new course, Biology for Majors, and will teach the inaugural offering in

Fall 2016. I have two new academic journal articles published, three completed and under review, and two more in preparation. In 2015 I was honored with the William H. Weston Award for Excellence in Teaching of the Mycological Society of America. To report these and other ongoing professional activities, I have prepared a new curriculum vitae, a true and correct copy of which I attach to this affidavit, incorporate in it, and have marked it as "Spiegel Affidavit Exhibit C".

5. If I were to appear as a live witness at any trial or hearing during the week of August 22, 2016, in *United States v. One Intercord Corp. Model USAS-12 12 Gauge Shotgun, Serial Number A0002089SA*, No. 4:14-CV-134-BSM, or *One Assortment of 93 NFA-Regulated Weapons*, No. 4:14-CV-423-BSM, or both of these actions, my testimony would be in conformity with the declaration (Spiegel Affidavit Exhibit A) and affidavit (Spiegel Affidavit Exhibit B) that I have submitted as exhibits to this affidavit.

Further, the affiant saith naught.

I swear or affirm that the foregoing is true and correct.

FREDERICK W. SPIEGEL

STATE OF ARKANSAS)
) SS.
COUNTY OF Washington)

Subscribed and sworn to before me, a Notary Public, this 18th day of August 2016.

NOTARY PUBLIC

My commission expires on 7/2/2022.

E BECKY HARRIS
Arkansas - Washington County
Notary Public - Comm# 12388811
My Commission Expires Jul 2, 2022

DECLARATION

COMES NOW the declarant, Frederick W. Spiegel, PH.D., and as authorized by 28 U.S.C. § 1746, states and declares under penalty of perjury all as follows:

1. My name is Frederick W. Spiegel.

2. I reside in Washington County, Arkansas.

3. I am of legal age and of sound mind and body.

4. I graduated from Drew University, Madison, New Jersey, in 1974, with a B.A. degree and majors in botany and anthropology.

5. I earned a PH. D. in Botany from the University of North Carolina–Chapel Hill in 1978, with concentrations in botany and mycology.

6. I was a post-doctoral fellow at Princeton University from 1978-1980 working on developmental biology of mycological organisms.

7. Mycology is the branch of botany that studies fungi, and involves the decomposition of leaves and other flora in or on the earth, which is one of the principal functions of fungi.

8. I have held the following faculty positions teaching biology, botany, and mycology:

   a. 1980-1982 — Visiting Assistant Professor, Department of Botany, Miami University, Oxford, Ohio

   b. 1982-1988 — Assistant Professor, Department of Botany and Microbiology, University of Arkansas–Fayetteville

   c. 1988-1990 — Associate Professor, Department of Botany and Microbiology, University of Arkansas–Fayetteville

   d. 1990-present — Associate Professor, Department of Biological Sciences, University of Arkansas–Fayetteville

9. During the past ten years, I have published approximately thirty-six works (with the exact number depending on the date of publications within the calendar year 2004). I have listed my publications in the accompanying Spiegel Declaration Exhibit A.

10. I have not offered expert testimony in last four years.

11. In March 2014, I was approached to serve as a consulting expert in a post-conviction relief or habeas corpus action to be filed in federal district court on behalf of Dr. Randeep Singh Mann. In this capacity I am being compensated for my professional time in studying the biological evidence in this case at my standard consulting rate of $200 per hour.

12. I have been provided the following materials specifically relating to Dr. Mann's case:

a. Jason Smith still photographs taken on March 3, 2009, in a clearing off a cul-de-sac at the end of Galaxy Lane, in London, Arkansas, subsequently admitted as Government Exhibits 98-A through 98-I at Dr. Mann's criminal trial

b. ATF still photographs taken on March 4, 2009, in a clearing off a cul-de-sac at the end of Galaxy Lane, in London, Arkansas

c. Video clips dated February 17, 2010, on the menu and created March 22, 2010, according to the directory on the disk containing them, depicting the same clearing as well as other , sites on Milky Way Lane and Galaxy Lane, in London, Arkansas, subsequently admitted as Government Exhibit 101-C at Dr. Mann's criminal trial

d. Transcripts of the testimony of Deputy Sheriff Jason Smith, Katherine Barton-Scanlon, Mark Rinke, Ryan Kimbell, and Wayne Henry at Dr. Mann's criminal trial

e. Photographs of the creation of holes at the same clearing in March 2014 that would have in fact accommodated an ammunition canister that Mark Rinke testified that he found in a clearing off a cul-de-sac at the end of Galaxy Lane, in London, Arkansas, on March 3, 2009; the placement of ammunition canisters of the same or similar size to the one introduced at Dr. Mann's criminal trial as Government Exhibit 99-A; placement of the canisters in these holes; and removal of the canisters, together with declarations explaining the process and certifying the accuracy of the pictures

f. Photographs of the weathering of holes of a size consistent with placement of Government Exhibit 99-A consistently with Mr. Rinke's testimony, and showing this weathering and the accumulation of biological data in and around the holes at

various points in time, from two days to six days to 91 days, together with affidavits explaining the process and certifying the accuracy of the pictures

g. Weather data from weathersource.com for both National Weather Service stations in the Russellville, Arkansas, area for January-March 2009 and from the Dardanelle weather station for January 1 through March 9, 2014, and precipitation records for 2009-2014 from March 15 through April 16;

h. Aerial maps from Google Maps showing the location of the clearing off the cul-de-sac relative to Lake Dardanelle, Arkansas One, Dr. Mann's home, and the home closest to the clearing at the end of the cul-de-sac at the end of Galaxy Lane, in London, Arkansas; and

i. Data on the time of sunset and sunrise in March 2009 in London, Arkansas, from www.SunriseSunset.com

13. The hole in Government Exhibits 98-A, 98-B, 98-C, 98-H & 98-I appears to have been open to the elements for some time prior to when these images were taken. It does not look like the hole was freshly opened and emptied of a large rectangular canister within the last few hours. It is clearly weathered, more than would be consistent with exposure of the interior of the hole to the elements if it had been dug during the previous few months and then opened in the previous few hours.

14. The leaves that appear in the hole pictured in the Jason Smith photographs appear to have settled into the hole after it was opened. From the degree of their decomposition, the leaves in and around the hole appear to have fallen the previous autumn and winter. There appears to be no discontinuity among the leaves around the area of the hole photographed by Jason Smith. If the canister had been in the hole for a very long time, the leaves would have been more flattened and fragmented, and they would have be scattered with small bits of soil. Compare the hole photographed by Jason Smith with the known holes before the test canisters were put into them on March 13, 2014, and immediately after the canisters were removed on March 15, 2014. Also, look at the leaves that were in the known holes in June, 2014. Though covered with mud, many of these leaves are intact and unflattened.

15. The leaves in the hole photographed by Jason Smith have kept their shape reasonably well, *i.e.*, there is not much decomposition of them, nor are they flattened as if they had been under a heavy object and under the surface of the earth for any length of time, even as little as two days based upon the condition of the leaves in the known holes immediately after the test canisters were removed from them on March 15, 2014.

16. Some of the leaves in the hole appear just flattened and fragmented enough to have been under the weight of the canister for a brief period of well less than two days.

17. The leaves in the hole in Government Exhibits 98-A though 98-C, Exhibits 98-H & 98-I, and 101-C are substantially less flattened and fragmented—and less likely to have been under the canister—than the leaves in the bottoms of the 2014 holes of known depths for only two days in which weighted canisters had actually been placed in the earth as Mr. Rinke testified that he saw Government Exhibit 99-A.

18. In ATF Galaxy Lane pictures, "40mm rounds scene 012.jpg" shows an ATF ruler next to a piece of the duct tape that Messrs. Rinke and Kimbell testified they saw on the canister. Assuming the truth of the markings on the ATF ruler, and that the size of neither it nor the duct tape has been distorted in the ATF picture, the piece of duct tape in this picture is approximately 14 cm. long and 4.5 to 5 cm. wide. Thus, the duct tape is about two inches wide.

19. In the first of the Jason Smith still photographs of the Galaxy Lane scene, later introduced at trial as "Government Exhibit 98-C", there is a leaf with three points, resembling a turkey foot, that is no less than one-third of the way into the hole. It is from a Southern Red Oak tree (*Quecus falcata*, also known as Turkey Foot Oak). It is no more than four inches wide from lobe tip to lobe tip upon comparison with the duct tape in the image. That is in the normal size range for a leaf of that species. Based on the width of this leaf, the hole could be not more than one foot deep, and not necessarily even one foot deep.

20. For the foregoing reasons, it is my opinion, to a reasonable degree of scientific certainty, that the hole pictured in Government Exhibits 98-A, 98-B, 98-C, 98-H & 98-I, and in Government Exhibit 101-C (part two), was not a freshly dug hole nor a freshly opened hole, but had been created by some means and left open for at least several weeks before these pictures were taken. It would take that amount of time for the layer of leaves in that hole to have blown in and be continuous with the leaves in the surrounding ground litter.

21. I was not contacted about Dr. Mann's case until 2014. If I had been consulted in 2009 or 2010, and presented with the same or substantially the same data, the opinions I would have expressed would have been the same as I have expressed in this document. I would have been available to give evidence then as I have now.

Further, the declarant saith naught.

I declare under penalty of perjury that the foregoing is true and correct.

Executed: 14 October, 2016

FREDERICK W. SPIEGEL
Professor
Department of Biological Sciences
SCEN 601
1 University of Arkansas–Fayetteville
Fayetteville, Arkansas 72701

Frederick W. Spiegel

Department of Biological Sciences, SCEN 601
1 University of Arkansas
Fayetteville, AR 72701
Phone: 479-575-4248
Email: fspiegel@uark.edu

(a) Professional Preparation

Drew University, Madison, NJ — Botany and Anthropology — BA, 1974

University of North Carolina, Chapel Hill, NC -- Botany — PhD, 1978

Princeton University, Princeton, NJ (postdoc) — Biology — 1978-1980

(b) Appointments

1982-present: Assistant Professor (1982-88), Associate Professor (1988-2005), Professor (2005-present), Department of Biological Sciences (Botany and Microbiology, 1982-1990), University of Arkansas, Fayetteville

1980-1982: Visiting Assistant Professor, Department of Botany, Miami University

1978-1980: NIH Postdoctoral Fellow, Department of Biology, Princeton University

(c) **Publications**

Spiegel, FW, LL Shadwick, G Ndiritu, MW Brown, M Aguilar, and JDL Shadwick. 2015 (anticipated). Protosteloid Amoebozoa (Protosteliids, Protosporangiida, Cavostellida, Schizoplasmodiida, Froactoviteliida, and sporcarpic members of Vanellida, Centramoebida, and Pellitida). In: JM Archibald, AGB Simpson, and C. Slamovits, eds. Handbook of the Protists (Second Edition of the Handbook of Protoctista by Margulis et al.) Springer Reference Works (e-book) Manscript with the editors.

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AFFIDAVIT OF FREDERICK W. SPIEGEL

COMES NOW Frederick W. Spiegel, being duly deposed and sworn, and states on his oath or affirmation all as follows:

1. My name is Frederick W. Spiegel.

2. I am the same Frederick W. Spiegel who gave a declaration in support of the motion for post-conviction relief in *Mann v. United States*, No. 4:14-CV-00614-BSM, now pending before the United States District Court for the Eastern District of Arkansas, the Hon. Brian S. Miller, Chief Judge.

3. Since my previous declaration in October, 2014, I have had two book chapters submitted to the publishers. I have received the William H. Weston Award from the Mycological Society of America for Excellence in Teaching. I have served out my term as President of the International Society of Protistologists and am now Past-President. I have developed and taught a new online version of BIOL 1543/1541L. I have had one more Ph.D. student complete his degree. Along with a colleague at Mississippi State University and two international colleagues, I have been awarded a grant from the National Science Foundation. An updated curriculum vitae is submitted herewith, incorporated herein, and marked as "Spiegel Affidavit Exhibit A."

4. I have reviewed the response to show cause from the U.S. Attorney's Office in Little Rock (Doc. No. 483) insofar as it relates to the declaration by me and the subject of the age and depth of the space on the surface of the ground where two city workers claim to have found an ammunition canister.

5. In reply to the respondent's attorneys' criticisms in the points from my declaration filed with the pending motion, I would first observe that I have collected leaf litter from forests in North America for forty years in order to gather substrates for the

fungi and protists (a/k/a protozoa) that I study. I know very well the structure of leaves in the litter.

6. The most freshly fallen leaves will be the most complete in structure, and the leaves that have been in the litter for some time will be more broken down and decomposed by the action of invertebrates, fungi, and bacteria. Those leaves closest to the bottom of the litter, and, therefore, closest to the surface of the soil itself, will be quite fragmented. There will be a gradient of breakdown from the top of the litter to the bottom of the litter. In the process of removing leaf litter from the soil, this gradient will be disrupted such that decomposed, either fragmented leaves will be mixed with more complete leaves or the gradient will be completely inverted.

7. Neither of these scenarios applies to the leaves that can be seen in the hole in Government Exhibits 98-A, 98-C, and 98-H, marked versions of which I present between paragraphs 15 and 16 of this affidavit as Figures 1, 2, and 3 respectively. Instead of being mixed with more complete leaves or in inverted-gradient positions, the leaves in the hole are continuous with the layers of leaves on the side of the hole (left side) that has not been disturbed by the presence of the black trash bag and ammunition canister shown in 98-A and 98-C. (The canister and bag have been removed in 98-H.)

8. If the leaves in the hole had been blown in between the time the city workers testified they opened the hole and the time a deputy sheriff testified that he took the pictures, the blown-in leaves would consist primarily of dried leaves from the surface of the litter. This is not what happened here: fragmented, decomposed leaves can be seen in the spaces between relatively complete leaves that form the top layer.

9. If the leaves had been swept or kicked into the hole while it was being opened, highly decomposed leaves and less decomposed leaves would be mixed together. But this is not what the evidence shows.

10. Therefore, my botanical education and experience in the analysis of leaves in North America leads me to interpret the nature of the leaf litter in the hole in Government Exhibits 98-A, 98-C, and 98-H as a layer of leaf litter that has attained a normal structure which would take at least many weeks or months to develop.

11. Second, when it has not rained recently, leaf litter will dry out, such that the leaves in its upper surface will be much drier than those underneath. There is no indication that moister leaves have been moved to the surface of the leaves in the hole in Government Exhibits 98-A, 98-C, and 98-H. Again, this distribution of leaves presents no evidence of recent disturbance.

12. Third, if the leaves in the hole in Government Exhibits 98-A, 98-C, and 98-H had been buried in the hole along with the ammunition canister, they would have been flattened, and they would have appeared to be moist with water absorbed from the soil making up the sides and bottom of the hole. This is not how they present. The Government Exhibits show leaves near the upper surface of the litter as being just as dry as all the leaves on the surrounding ground, indicating that they were not in the hole. Also, the professional observer would expect leaves buried in the hole to be smeared with soil from the side of the hole. But they are not.

13. Fourth, the first three considerations indicate to me that this hole had been open to the elements for at least many weeks, and had not been opened less than a few hours.

14. The response to my declaration asserts that it was impossible for me to draw an accurate conclusion about the depth of the hole. That is incorrect. I pointed out that there was a *Quercus falcata* leaf (marked with a yellow asterisk in the figures from Government Exhibits 98-A, 98-C, and 98-H) that could not be more than about 10 cm. (or 4 in.) in width in the hole. I could calculate this be using the known width of the duct tape visible in 98-C. In 98-C, a close-up of the hole, the bottom of the hole is visible (red X), though the top edge of the hole is not. The top is visible in 98-A and 98-H, especially in the latter because the bag and ammunition canister had been removed. The approximate space that had contained the black plastic bag and canister is marked The *Quercus falcata* leaf is also visible (yellow asterisk). The three pictures are taken from approximately the same orientation.

15. Compare the two pieces of duct tape on the bag from 98-A and 98-C and the position of the dead branch on the ground in the foreground of 98-A and 98-H. By combining estimation of the distance from the top of the hole to the *Quercus falcata* leaf from 98-A and 98-H with the distance from the bottom of the leaf in 98-C, it follows as a matter of logic or plane geometry that the hole (assuming a *maximum* leaf width of 4 in.) is no more than 3 leaf-widths deep.

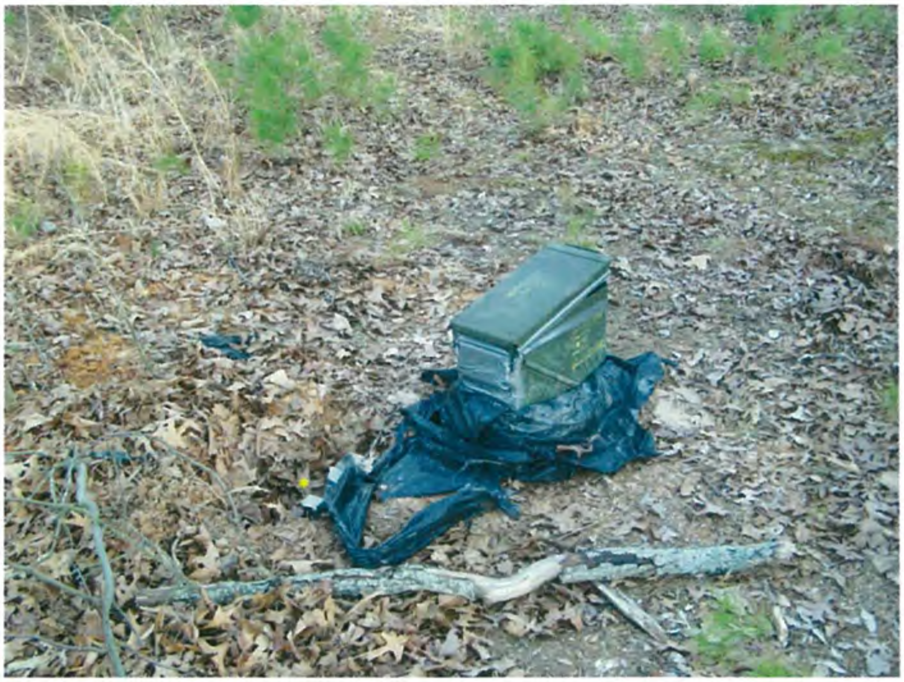

Figure 1. Image from Exhbit 98-A showing *Quercus falcata* leaf (yellow asterisk).

Figure 2. Image from Exhibit 98-C showing *Q. falcata* leaf (yellow asterisk) and bottom of hole (red X).

Figure 3. Image from Exhibit 98-H showing *Q. falcata* leaf (yellow asterisk) and approximate space that was taken up by the black plastic bag and the ammunition canister in Exhibit 98-A.

16. Because (1) the leaf litter in the hole in Government Exhibits 98-A, 98-C, and 98-H as a layer that has attained a normal structure which would take at least many weeks or months to develop, (2) the uniform moisture levels of the leaves indicates a lack of recent disturbance, and (3) the leaves in the bottom of the hole had not been flattened or smeared with dirt, it is my opinion, to a reasonable degree of scientific certainty, that this hole had been open to the elements for at least many weeks, and had not been opened less than a few hours. In addition, based on my ability to identify the *Quercus falcata* leaf and my knowledge of the ranges of sizes of leaves of this species, combined with my knowledge of applied mathematics, it is my opinion, to a reasonable degree of scientific certainty, that the hole in Government Exhibits 98-A, 98-C, and 98-H is no more than 12 inches deep.

Further, the affiant saith naught.

I swear or affirm that the foregoing is true and correct.

FREDERICK W. SPIEGEL

STATE OF ARKANSAS)
) SS.
COUNTY OF Washington)

Subscribed and sworn to before me, a Notary Public, this 29th day of November 2015.

NOTARY PUBLIC

My commission expires on 7/2/2022.

E BECKY HARRIS
Arkansas - Washington County
Notary Public - Comm# 12388811
My Commission Expires Jul 2, 2022

Curriculum Vitae

Frederick W. Spiegel
Professor of Biological Sciences

Department of Biological Sciences
SCEN 601
1 University of Arkansas, Fayetteville AR 72701

Telephone: (479) 575-4248
FAX: (479) 575-4010
E-mail: fspiegel@uark.edu

Education:

Shore Regonal High School, West Long Branch, NJ, 1974. Named to Shore Regional High School Distinguished Alumni Hall of Fame, April, 2002.
Drew University, Madison, NJ, B.A. in Botany and Anthropology with Honors in Anthropology and CIBA/Geigy Award as Outstanding Botany Major,1974
University of North Carolina, Chapel Hill, NC, Ph.D. in Botany (Mycology), 1978
Princeton University, Princeton, NJ, NIH Postdoctoral Fellow (Developmental Biology of Cellular Slime Molds), 1978-80

Doctoral and Postdoctoral Advisors:

Ph.D. Advisor: Lindsay S. Olive (deceased), University of North Carolina, Chapel Hill.
Postdoctoral Advisor: Edward C. Cox (retired), Princeton University.

Professional History:

Chair (1 July, 2008-30 June, 2012), Vice-chair (1991-1993 and 2001-2004), Professor (2005-present) Associate Professor (1988-2005), Assistant Professor (1982-88), Department of Biological Sciences (Botany and Microbiology prior to 1990), University of Arkansas, Fayetteville, AR.
Member of the Cell and Molecular Biology Program Faculty
Member of Environmental Dynamics Program Faculty
Member of Honors College Faculty.
Visiting Assistant Professor (1980-82), Department of Botany, Miami University, Oxford, OH

Selected Educational Activities:

- **Courses Taught:** General Biology, Concepts in Biological Science, Principles of Biology, Plant Biology (General Botany), Cell Biology, General Genetics, Survey of the Plant Kingdom, Mycology, Protistology, Comparative Botany, Advanced Methods in Microscopy.
- I chaired the College *ad hoc* committee that designed the BS in Biology (1990) and the Department *ad hoc* committee that designed Principles of Biology (1996), and I am presently a member of a Department committee to develop a majors' for freshmen entering our BA and BS majors in Biology. The Department has decided that a freshman course focused on preparing students for our core of Cell Biology, General Genetics, Evolutionary Biology, and General Ecology is preferable to the broad survey in our Principles of Biology course.
- I have developed, along with my graduate assistant, Geoffrey Zahn, and the design team of the UofA Global Campus, the first fully online version of Principles of Biology, including laboratories on this campus. I am offering it for the first time this spring of 2015.
- I was Coordinator of BIOL 1543, Principles of Biology from 2001-2003. This activity entailed coordinating a team of faculty to teach our basic freshman course in biology at

UAF. Over 1200 students are enrolled per year. I was responsible for all grading, handling student issues, maintaining the course web site. I also was ultimately responsible for oversight of the graduate teaching assistants. When I took over this position, the course was in turmoil since it had been changed from a number of individually taught sections to a set of large, coordinated team taught sections. The initial coordinator made a weak effort at making the changes work and failed to take advantage of various technological aids that can help a large, team taught course succeed. I added in-class, computer aided quizzes, a course web site through WebCT, and numbers of WebCT based practice quizzes to aid students in developing their learning skills. I also added regular meetings of the teaching teams to make sure we all knew what was expected of each other. The semester before I began coordinating the course, the rigor of the course was low and yet the mean grade was barely above 60%. By the time I moved out of the coordinator's role, the rigor was much higher and the average was in the mid 70s.

- I developed BIOL 4724, Protistology in 1997. This course is offered to graduate and advanced undergraduates in fall semesters of odd numbered years. This course has developed into a study of the comparative biology and phylogeny of eukaryotes other than embryophytes, metazoans, zygomycetes, and Dikarya. Many organisms that have classically been considered "mycological property," e.g., oomycetes, hyphochytridiomycetes, mycetozoans, s.l., chytridiomycetes, rozellids (including microsporidians), labyrinthulids, etc. are covered in the course. I team taught it with JD Silberman in 2007, 2009, and 2011.
- I developed BIOL 4404/5404, Comparative Botany. This course for advanced undergraduates and graduate students concentrates on the phylogeny and morphology of the organisms classically considered to be plants with major emphasis on Cyanobacteria and the Red Algae, Green Algae/Embryophyte clade. I taught it for the first time in fall, 2007. It is mycology related because it includes the host organisms for pathogenic, commensal, and mutualistic fungi.
- I have developed a large collection of photographic images of protists, plants, and fungi for my courses. Many of these have been available as auction items at MSA meetings.
- I have conducted portions of workshops on the collection and identification of protosteloid amoebae at the Mycological Society of America meetings in San Juan (1998) and Great Smoky Mountains National Park (2004), at the Third International Congress on the Systematics and Ecology of Myxomycetes in Beltsville, MD (1999), at the Ernst Moritz Arndt Universität, Greifswald, Germany (2004), and at the Royal Botanical Gardens, Madrid, Spain (2005).
- To aid in identification of protosteloid amoebae, I developed Spiegel, FW, JD Shadwick, LA Lindley, MW Brown, and G Ndiritu. 2007. *A beginners guide to identifying the protostelids*. To aid biologists in bringing slime molds into culture, I developed Spiegel FW, Haskins EF, Cavender JC, Landolt JC, Lindley-Settlemyre LA*, Edwards SM, Ndiritu* G, Shadwick JD. 2005. *A beginner's guide to isolating and culturing eumycetozoans*. Both are available inpdf format on the Eumycetozoan Project website: http://slimemold.uark.edu/IsoHandbook.pdf.
- I am the Chair of the SRC for the Northwest Arkansas Regional Science and Engineering Fair.
- In 2012, I was a participant in a workshop sponsored by McGraw-Hill at Lake Tahoe covering technology advancements for the teaching of biology.
- In 2011 and 2014, I was a participant in workshops on protistology held at the University of Neuchatel, Switzerland, covering various aspects of the biology of mycetozoans, *s.l.*

Research Interests:

- Systematics and phylogeny of Amoebozoa, the supergroup that includes protosteloid amoebae, myxomycetes, and dictyostelids. As a CoPI with PI Matthew Brown, my former PhD student who is now an assistant professor at Mississippi State, we are about to begin a project to be funded by NSF on the phylogenomics and comparative development of Amoebozoa. We wish to elucidate the major macroevolutionary patterns in the group. One of the hypotheses we will be testing using comparative and developmental transriptomics is whether the most recent common ancestor of amoebozoans fruited like a protosteloid amoeba. Should this hypothesis be supported, it would suggest strongly that the amoebozoans had a terrestrial origin.
- I have also become interested in encouraging those studying eukaryote phylogeny to consider the hypotheses that the last common ancestor of extant eukaryotes was a terrestrial organism and that eukaryotes may have evolved in terrestrial habitats.
- Systematics and biogeography of the amoebozoan slime molds in the groups known as protosteloid amoebae, dictyostelid cellular slime molds, and myxomycetes. Our most recent projects are NSF funded grants to study the worldwide distribution of the slime molds and to train new taxonomists in the revisionary systematics of the group. The former has been publicized in *The New Yorker*, on the NPR program *Living on Earth*, and in statewide newspapers in Arkansas.
- Research Travels include: Hawaiian Islands (1998, 99, 2000, 04, 05, late 06 early 07, 09), New Zealand (2004, 05), Argentina (2005), Spain (2005), Germany (2004, 05), China (Spring 2007)
- Web dissemination of mycetozoan reseach: The Eumycetozoan Project (http://slimemold.uark.edu). This site provides material to professional biologists and amateurs interested in the biology of protostelids, dicytostelid cellular slime molds, and myxomycetes.
- Modern documentation of protist morphology. Many taxa of protists are very poorly illustrated, and it is not clear in many cases what the organisms associated with taxonomic names look like. We have excellent light microscopy facilities and access to many protists, and we are making an effort, whenever possible, to document protist taxa with good light micrographs.
- Classification of eukaryotes (Adl et al. 2005, 2012; Schnittler et al. 2012).

Publications (* - Graduate Students former and present):

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Spiegel, FW, LL Shadwick*, G Ndiritu*, MW Brown*, M Aguilar*, and JDL Shadwick*. 2015 (anticipated). Protosteloid Amoeboazoa (Protosteliids, Protosporangiida, Cavostellida, Schizoplasmodiida, Fractoviteliida, and sporcarpic members of Vanellida, Centramoebida, and Pellitida). In: JM Archibald, AGB Simpson, and C. Slamovits, eds. Handbook of the Protists (Second Edition of the Handbook of Protoctista by Margulis et al.) Springer Reference Works (e-book). Manuscript with the editors.

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Spiegel, FW and J Feldman. 1988. The trophic cells of *Clastostelium recurvatum*, a third member of the myxomycete-like protostelids. Mycologia 80:525-535.

Spiegel, FW, J. Feldman, and WE Bennett. 1986. Ultrastructure and development of the amoebo-flagellate cells of the protostelid *Protosporangium articulatum*. Protoplasma 132:115-128.

Spiegel, FW and J Feldman. 1986. Mitosis in the protostelid *Ceratiomyxella tahitiensis* (Eumycetozoa). Can. J. Bot. 64:932-942.

Spiegel, FW and J Feldman. 1985. Obligate amoebae of the protostelids: significance for the concept of Eumycetozoa. BioSystems 18:377-386.

Best, SC* and **FW Spiegel**. 1984. Protostelids and other simple slime molds of Hueston Woods State Park. In: Hueston Woods State Park and Nature Preserve, Proceedings of Symposium, April 16-18, 1982. (G.E. Willeke, ed.). Miami University, Oxford, OH. 116-121.

Spiegel, FW 1984. *Protostelium nocturnum*, a new, minute, ballistosporous protostelid. Mycologia 76:443-447.

Spiegel, F.W. 1982. Mitosis in the protostelid *Planoprotostelium aurantium*. Protoplasma 113:178-188.

Spiegel, FW 1982. The ultrastructure of the trophic cells of the protostelid *Planoprotostelium aurantium*. Protoplasma 113:165-177.

Spiegel, FW 1981. Phylogenetic significance of the flagellar apparatus of *Ceratiomyxa fruticulosa*. J. Elisha Mitchell Sci. Soc. 97:183-189.

Spiegel, FW 1981. Phylogenetic significance of the flagellar apparatus in protostelids (Eumycetozoa). BioSystems 14:491-499.

Spiegel, FW and EC Cox. 1980. A one-dimensional pattern in the cellular slime mould *Polysphondylium pallidum*. Nature (London) 286:806-807.

Spiegel, FW, LS Olive, and RM Brown, Jr. 1979. Roles of actin during sporocarp culmination in the simple mycetozoan *Planoprotostelium aurantium*. Proc. Natl. Acad. Sci. USA 76:2335-2339.

Spiegel, FW and LS Olive. 1978. New evidence for the validity of *Copromyxa protea*. Mycologia 70:843-847.

Manuscripts in Preparation:

Schnittler, M, JD Shadwick*, J Tesmer, and **FW Spiegel**. Myxomycete and protostelid biota of Oman. To be submitted to Biogeography. Title tentative.

Zahn, G*, JD Shadwick*, DE Hemmes, and **FW Spiegel**. The protostelids of the Hawaiian Islands. To be submitted to J. Eukaryotic Microbiology.

Shadwick, JD*, **FW Spiegel**, LA Shadwick*, and JD Silberman. The morphological and genetic diversity of *Protostelium mycophaga*. To be submitted to J. Eukaryotic Microbiol.

Shadwick, LA* and **FW Spiegel**. *Luapeleamoeba*, n. g., a genus of protosteloid amoebae in Centramoebida. To be submitted to J. Eukaryotic Microbiol.

Tice, AK*, JD Silberman, and **FW Spiegel**. *Sorodiplophrys stercoria*: a case of sorocarpic multicellularity in Stramenopila. To be submitted to Protist or J. Eukaryotic Microbiol. Title tentative.

Tice, AK*, JD Silberman, MW Brown*, and **FW Spiegel**. Evidence for the validity of the genus *Pocheina* (Excavata, Heterolobosea). To be submitted to Protist or J. Eukaryotic Microbiol.

Spiegel, FW. Was LECA a Landlubber? To be submitted to Current Biology of Bioessays.

Swanson, AR, DE Hemmes, and **FW Spiegel**. Dictyostelid slime molds associated with a small Hawaiian *kipuka*. To be submitted to Biogeography or J. Eukaryotic Microbiol.

Research Funding (* with former graduate students):

NSF Systematics. PI: BSR83-07376, Comparative study of the flagellate protostelids (Eumycetozoa). 1983-1986. $85,000.

NSF Systematics. PI: BSR86-00639, Comparative study of the flagellate protostelids (Eumycetozoa) – nonflagellate states. 1986-1989.

NSF Systematics. PI: BSR89-00190, Comparative study of the protostelids (Eumycetozoa) – nonflagellate species. 1989-1992 with no cost extension to May, 1993. $159,000.

USDA Collaborating Investigator in USDA funded Center for Alternative Pest Control. USDA89-34195-4378. Project: Mating between different strains of *Colletotrichum gloeosporioides* with D.O. TeBeest and C.R. Cisar. 1989-1993. approx. $50,000.

NSF Equipment Grant. CoPD (PI: Walter Bottje): BIR94-13897, Development of a cell isolation and characterization center. 1994. $244,790.

National Geographic Society PI: #6372-98. Simple slime molds of Hawaii.1998-2000. $6714.

NSF PI (Co-PIs, Stephenson, Cavender, Lado, Schnittler): DEB03-16284. PBI: Global Biodiversity of Eumycetozoans. 2003-2010. $2,075,523.

NSF PI (Co-PIs, Stephenson, Cavender, Moncalvo) DEB03-29102. PEET: A revisionary study of the Eumycetozoans. 2003-2010, $500,000.

*****NSF CoPI (PI MW Brown) DEB1456054, Examining the macroevolutionary trajectories in Amoebozoa, a major lineage of eukaryotes. 2015-2018. Pending formal notification of funding. $825,009.

Service and Administrative Experience (*Mycology related)

University:

Member, Task Force on Improving Science, Mathematics, and Engineering Education in Arkansas -1990-1991
Member, Emergency Preparedness Committee - 1986-1989
Member, Parking and Transit Committee – 1992-1995
Member, Science and Engineering Building Users' Committee (to help develop plans for the renovation of SCEN) – 1992-1994
Member, Catastrophic Leave Committee – 1995-1998
Member *ad hoc* Committee to Revise Catastrophic Leave Policy - 2000
Member, Research Council – 1996-1999, Vice Chair - 1997/98, Chair-1998/99
Member, University Core Curriculum Committee – 2001-2004, 2007-2008
Member, Toxic Substances Committee – 2002–2009
Member, EM Users' Committee – 2002–present
Member, Research and Sponsored Programs Advisory Committee -2006-2009
Member, Faculty Senate – 2006-2008
Member, Campus Council – 2007-2008
Member, Environment Dynamics Program Executive Committee – 2008-2012
Member, Graduate Council – 2013-present

College:

Chair, Committee to Develop BS Major in Biology – 1990
Member, Faculty Development Committee – 1990-1991
Member, Search Committee for Chair of Department of Biological Sciences - 1991
Member, Premedical Advisory Committee – 1996–2005, 2006-2008
Member, Academic Programs Committee – 2004–2005, 2006-present, Vice Chair – 2004-2005, 2006-2007, 2013-2014, Chair 2007-2008, 2014-present.
Member, College Cabinet – 2004-2008, 2013-present, Vice Chair – 2006-2007, Chair – 2007-2008, 2013-present.
Department Representative at several recruiting functions – 1991–present

Department: (selected activities):

Vice-Chair – 1991-1994
Coordinator of General Biology – 1994-1995
Faculty Supervisor of Freshman Biology Labs – 1996-1997
Curriculum Committee, *ex officio* Member - 1991-1994, Member - 1997-2005;

Chair - 2001-2002, 2004-2005
Member, Graduate Studies Committee – 1992-1995, 1997-1998
Undergraduate Advising for Orientation – 1991-1998, 2001-2004
Member, Personnel Committee – 1994-1997, 2000
Chair, *Ad hoc* Committee to develop Principles of Biology – 1995-1996
Member, Search Committee for Biology Educator - 1996-1997
Member, *Ad hoc* Committee on Advising – 1997-1999
Member, *Ad hoc* Committee on the format of Principles of Biology – 1999-2000
Member, Search Committee for COOP Assistant Leader, Fisheries - 1999
Coordinator of Principles of Biology – mid fall 2000-2003: responsible for organizing course, maintaining web site, keeping records, oversight of TA prep, handling student concerns.
Vice-Chair for Academics – July 2001-July 2004: responsible for course and room assignments, interaction with undergraduate students, TA assignment, summer advising, standing in for chair when necessary.
Member, Search Committee for Evo-Devo position – 2002-2004, Chair 2003-2004
Member, Advising Committee – 2003-2005
Chair, Awards Committee – 2003-2004, 2006-2008
Chair – July 2008 -2012
Chair, Undergraduate Studies Committee, 2012-present.

Professional Organizations:

Arkansas Academy of Science
Judge, Graduate Student Papers – 1989
Program Chair – 1991 Annual Meeting
International Society for Evolutionary Protistology
Symposium Co-organizer – 1987
Associate Editor, Special Issue of BioSystems – 1990
Mycological Society of America
Member, Sustaining Membership Committee -1984-1986
Chair, Endowment Committee – 1988-1991
Member, Endowment Committee – 1998-2000, 2004-2007
Member, Program Committee – 2007-2009
Judge, Graduate Student Presentations at Annual Meeting – 1986, 1989
Symposium Organizer – 1984, 1990
Associate Editor, *Mycologia*, 1994-1995
Developed and coorganized with Don Hemmes the Photo Show Component of the Annual Auction - 1995-2001
Assisted Don Hemmes with Annual Auction – 1998-2005
3rd International Congress for the Systematics and Ecology of Myxomycetes
Member Organizing Committee for 1999 Congress in Beltsville, MD

Phi Kappa Phi
President elect UAF Chapter - 1993-1994
President UAF Chapter – 1994-1999
Sigma Xi
President elect UAF Chapter – 1993-1994
President – 1994-1995

Northwest Arkansas Regional Science and Engineering Fair
Chair, SRC Committee – 1996-present (missed 2004 Fair because of collecting trip)
5th International Congress for the Systematics and Ecology of Myxomycetes
Member, Scientific Advisory Board for Congress in Tlaxcala, Mexico
President-elect (2013-2014), President (2014-present) Intenational Society of Protisologists

Service to State or Nation:

State:

Advised junior high teacher, Dawna Stewart, on summer project in Arkansas STRIVE program with Ralph Henry – 2002
Ex officio Nonvoting Member, Arkansas Game and Fish Commission – 2008-present

National and International:

Member, NSF Systematics Panel, 1988-1992
Member, NSF Systematics, Special Panel on Monographic Systematics – 1994, Developed guidelines for Partnerships for Enhancing Expertise in Taxonomy (PEET)
Member, NSF Systematics, PEET Panel – 1999, 2005
Member, NSF Living Stock Collections Panel – 2004
Member, NSF Biotic Surveys and Inventories/Planetary Biodiversity Inventories Panel - 2008
Member, NSF Genealogy of Life Panel - 2014
Member, ORAU/NSF Graduate Fellowships Panel in Biology – 1996-1998
Member, Special Committee on the Nomenclature of Fungi with a Pleomorphic Life Cycle of the International Committee of Botanical Nomenclature. 2006-2011.
Member, International Commission on the Taxonomy of Fungi. 2006-2011.
Reviewer: *Mycologia, Canadian Journal of Botany, Canadian Journal of Microbiology, Nova Hedwigia, Journal of Protozoology/Journal of Eukaryotic Microbiology, Progress in Protistology, European Journal of Protistology, Journal of the American Microscopical Society, Protist, Proceedings of the Royal Society B, PLoS ONE, Science, Molecular Biology and Evolution, Molecular Phylogenetics and Evolution, Soil Biology and Biochemistry, Biologia*, McGraw-Hill, W.C. Brown, Pearson, Macmillan, NSF, Oak Ridge Associated Universities, *Journal of Biological Control*
Consultant, Eukaryote Tree of Life Project, Laura Katz, PI, 2007

Other Professional Service and Awards:

Guided Mushroom Walks for the University Museum several years between 1983 and 1999.
Identified fungi for area hospitals in potential poisoning cases many years between 1982 and present.
Identified fungi for local industries many years between 1982 and present.

Named to Shore Regional High School Distinguished Alumni Hall of Fame, April, 2002.

Memberships in Professional Societies:

American Association for the Advancement of Science (no longer active)
Arkansas Academy of Science (no longer active)
Beta Beta Beta
Botanical Society of America (no longer active)
International Society for Evolutionary Protistology
International Society of Protistologists
Mycological Society of America
Phi Kappa Phi
Sigma Xi

Outside Interests:

Nature photography, fishing (especially fly fishing), fly tying, natural history photography, cooking (especially Chinese cooking).

Curriculum Vitae
Frederick W. Spiegel
Distinguished Professor of Biological Sciences

Department of Biological Sciences
SCEN 601
1 University of Arkansas, Fayetteville AR 72701

Telephone: (479) 575-4248
FAX: (479) 575-4010
E-mail: fspiegel@uark.edu

Education:

Shore Regonal High School, West Long Branch, NJ, 1974. Named to Shore Regional High School Distinguished Alumni Hall of Fame, April, 2002.
Drew University, Madison, NJ, B.A. in Botany and Anthropology with Honors in Anthropology and CIBA/Geigy Award as Outstanding Botany Major,1974
University of North Carolina, Chapel Hill, NC, Ph.D. in Botany (Mycology), 1978
Princeton University, Princeton, NJ, NIH Postdoctoral Fellow (Developmental Biology of Cellular Slime Molds), 1978-80

Doctoral and Postdoctoral Advisors:

Ph.D. Advisor: Lindsay S. Olive (deceased), University of North Carolina, Chapel Hill.
Postdoctoral Advisor: Edward C. Cox (retired), Princeton University.

Professional History:

Chair (1 July, 2008-30 June, 2012), Vice-chair (1991-1993 and 2001-2004), Distinguished Professor (1 July, 2016-present), Professor (2005-present) Associate Professor (1988-2005), Assistant Professor (1982-88), Department of Biological Sciences (Botany and Microbiology prior to 1990), University of Arkansas, Fayetteville, AR.
Member of the Cell and Molecular Biology Program Faculty
Member of Environmental Dynamics Program Faculty
Member of Honors College Faculty.
Visiting Assistant Professor (1980-82), Department of Botany, Miami University, Oxford, OH

Selected Educational Activities:

- **Courses Taught:** Biology for Majors, General Biology, Concepts in Biological Science, Principles of Biology, Plant Biology (General Botany), Cell Biology, General Genetics, Survey of the Plant Kingdom, Mycology, Protistology, Comparative Botany, Advanced Methods in Microscopy.
- I chaired the College *ad hoc* committee that designed the BS in Biology (1990) and the Department *ad hoc* committee that designed Principles of Biology (1996), and I am presently a member of a Department committee to develop a majors' for freshmen entering our BA and BS majors in Biology. The Department has decided that a freshman course focused on preparing students for our core of Cell Biology, General Genetics, Evolutionary Biology, and General Ecology is preferable to the broad survey in our Principles of Biology course.

- I developed the proposal for a new course, BIOL 1584, Biology for Majors, and I will teach the inaugural offering in Fall, 2016.
- I have developed, along with my graduate assistant, Geoffrey Zahn, and the design team of the UofA Global Campus, the first fully online version of Principles of Biology, including laboratories on this campus. I am offering it for the first time this spring of 2015.
- I was Coordinator of BIOL 1543, Principles of Biology from 2001-2003. This activity entailed coordinating a team of faculty to teach our basic freshman course in biology at UAF. Over 1200 students are enrolled per year. I was responsible for all grading, handling student issues, maintaining the course web site. I also was ultimately responsible for oversight of the graduate teaching assistants. When I took over this position, the course was in turmoil since it had been changed from a number of individually taught sections to a set of large, coordinated team taught sections. The initial coordinator made a weak effort at making the changes work and failed to take advantage of various technological aids that can help a large, team taught course succeed. I added in-class, computer aided quizzes, a course web site through WebCT, and numbers of WebCT based practice quizzes to aid students in developing their learning skills. I also added regular meetings of the teaching teams to make sure we all knew what was expected of each other. The semester before I began coordinating the course, the rigor of the course was low and yet the mean grade was barely above 60%. By the time I moved out of the coordinator's role, the rigor was much higher and the average was in the mid 70s.
- I developed BIOL 4724, Protistology in 1997. This course is offered to graduate and advanced undergraduates in fall semesters of odd numbered years. This course has developed into a study of the comparative biology and phylogeny of eukaryotes other than embryophytes, metazoans, zygomycetes, and Dikarya. Many organisms that have classically been considered "mycological property," e.g., oomycetes, hyphochytridiomycetes, mycetozoans, s.l., chytridiomycetes, rozellids (including microsporidians), labyrinthulids, etc. are covered in the course. I team taught it with JD Silberman in 2007, 2009, and 2011.
- I developed BIOL 4404/5404, Comparative Botany. This course for advanced undergraduates and graduate students concentrates on the phylogeny and morphology of the organisms classically considered to be plants with major emphasis on Cyanobacteria and the Red Algae, Green Algae/Embryophyte clade. I taught it for the first time in fall, 2007. It is mycology related because it includes the host organisms for pathogenic, commensal, and mutualistic fungi.
- I have developed a large collection of photographic images of protists, plants, and fungi for my courses. Many of these have been available as auction items at MSA meetings.
- I have conducted portions of workshops on the collection and identification of protosteloid amoebae at the Mycological Society of America meetings in San Juan (1998) and Great Smoky Mountains National Park (2004), at the Third International Congress on the Systematics and Ecology of Myxomycetes in Beltsville, MD (1999), at the Ernst Moritz Arndt Universität, Greifswald, Germany (2004), and at the Royal Botanical Gardens, Madrid, Spain (2005).
- To aid in identification of protosteloid amoebae, I developed Spiegel, FW, JD Shadwick, LA Lindley, MW Brown, and G Ndiritu. 2007. *A beginners guide to identifying the protostelids*. To aid biologists in bringing slime molds into culture, I developed Spiegel

FW, Haskins EF, Cavender JC, Landolt JC, Lindley-Settlemyre LA*, Edwards SM, Ndiritu* G, Shadwick JD. 2005. *A beginner's guide to isolating and culturing eumycetozoans*. Both are available inpdf format on the Eumycetozoan Project website: http://slimemold.uark.edu/IsoHandbook.pdf.

- I am the Chair of the SRC for the Northwest Arkansas Regional Science and Engineering Fair.
- In 2012, I was a participant in a workshop sponsored by McGraw-Hill at Lake Tahoe covering technology advancements for the teaching of biology.
- In 2011 and 2014, I was a participant in workshops on protistology held at the University of Neuchatel, Switzerland, covering various aspects of the biology of mycetozoans, *s.l.*

Research Interests:

- Systematics and phylogeny of Amoebozoa, the supergroup that includes protosteloid amoebae, myxomycetes, and dictyostelids. As a CoPI with PI Matthew Brown, my former PhD student who is now an assistant professor at Mississippi State, we are about to begin a project to be funded by NSF on the phylogenomics and comparative development of Amoebozoa. We wish to elucidate the major macroevolutionary patterns in the group. One of the hypotheses we will be testing using comparative and developmental transriptomics is whether the most recent common ancestor of amoebozoans fruited like a protosteloid amoeba. Should this hypothesis be supported, it would suggest strongly that the amoebozoans had a terrestrial origin.
- I have also become interested in encouraging those studying eukaryote phylogeny to consider the hypotheses that the last common ancestor of extant eukaryotes was a terrestrial organism and that eukaryotes may have evolved in terrestrial habitats.
- Systematics and biogeography of the amoebozoan slime molds in the groups known as protosteloid amoebae, dictyostelid cellular slime molds, and myxomycetes. Our most recent projects are NSF funded grants to study the worldwide distribution of the slime molds and to train new taxonomists in the revisionary systematics of the group. The former has been publicized in *The New Yorker*, on the NPR program *Living on Earth*, and in statewide newspapers in Arkansas.
- Research Travels include: Hawaiian Islands (1998, 99, 2000, 04, 05, late 06 early 07, 09), New Zealand (2004, 05), Argentina (2005), Spain (2005), Germany (2004, 05), China (Spring 2007)
- Web dissemination of mycetozoan reseach: The Eumycetozoan Project (http://slimemold.uark.edu). This site provides material to professional biologists and amateurs interested in the biology of protostelids, dicytostelid cellular slime molds, and myxomycetes.
- Modern documentation of protist morphology. Many taxa of protists are very poorly illustrated, and it is not clear in many cases what the organisms associated with taxonomic names look like. We have excellent light microscopy facilities and access to many protists, and we are making an effort, whenever possible, to document protist taxa with good light micrographs.
- Classification of eukaryotes (Adl et al. 2005, 2012; Schnittler et al. 2012).

Publications (* - Graduate Students former and present):

Zahn, GL, JD Shadwick, DE Hemmes, and **FW Spiegel.** Submitted. Protosteloid amoebae as a flagship group for investigating the global distribution of naked terrestrial amoebae. J. Eukaryotic Microbiol. Under review.

Tice, AK, LL Shadwick, AM Fiore-Donno, S Geisen, S Kang, **FW Spiegel**, K Wilkinson, M Bonkowski, K Dumack, DJG Lahr, E Voelcker, S Clauss, J Zang, and MW Brown. Submitted. Expansion of the Acanthamoebidae (Centramoebida, Amoebozoa). Biology Direct. Under review.

Shadwick, L* and **FW Spiegel.** 2016. A new amoeba with ballistosporous protosteloid fruiting, *Luapeleamoeba hula*, n.g., n.sp. Acta Protozoologica. Under review.

Tice, AK*, JD Silberman, AC Walthall, KND Le, **FW Spiegel**, and MW Brown. 2016 (in press). *Sorodiplophrys stercorea*: another novel lineage of sorocarpic multicellularity. J. Eukaryotic Microbiol.

Spiegel, FW. 2016. Unikonts, evolution and diversification of (with emphasis on fungal-like forms). In: Kliman, RM (ed.), Encyclopedia of Evolutionary Biology. Vol. 4, pp. 325-332. Oxford: Academic Press. Invited.

Spiegel, FW, LL Shadwick, G Ndiritu, MW Brown, M Aguilar, and JDL Shadwick. 2016 (in press). Protosteloid Amoeboazoa (Protosteliids, Protosporangiida, Cavostellida, Schizoplasmodiida, Fractoviteliida, and sporcarpic members of Vanellida, Centramoebida, and Pellitida). In: JM Archibald, AGB Simpson, and C. Slamovits, eds. Handbook of the Protists (Second Edition of the Handbook of Protoctista by Margulis et al.) Springer Reference Works (e-book).

Schnittler, M, Novozhilov, YK, Shadwick, JDL, **Spiegel, FW**,García-Carvajal, E, and König, P. 2015. What substrate cultures can reveal: Myxomycetes and myxomycete-like organisms from the Sultanate of Oman. Mycosphere 6:356-384. DOI: 10.5943/mycosphere/6/3/11.

Kudryavtsev, A, MW Brown*, A Tice*, **FW Spiegel,** J Pawlowski, and OR Anderson. 2014. A revision of the order Pellitida Smirnov et al., 2011 (Amoebozoa, Discosea) based on ultrastructural and molecular evidence, with description of *Endostelium cystalliferum*. n. sp. Protist 165:208-229. DOI:10.1016/j.protis.2014.02.003

Zahn, G*, SL Stephenson, and **FW Spiegel.** 2014. Ecological distribution of protosteloid amoebae in New Zealand. PeerJ 2:e296; DOI 10.7717/peerj.296.

de Haan, M, C Cocquyt, A Tice*, G Zahn*, and **FW Spiegel.** 2014. First records of protosteloid amoebae (Eumycetozoa) from the Democratic Republic of the Congo. Plant Ecology and Evolution 147:85-92. dx.doi.org/10.5091/plecevo.2014.883.

Adl, SM, AGB Simpson, CE Lane, J Lukes, D Bass, SS Bowser, MW Brown*, F Burki, M Dunthorn, V Hampl, A Heiss, M Hoppenrath, E Lara, L Le Gall, DH Lynn, H McManus, EAD Mitchell, SE Mozley-Stanridge, LW Parfrey, J Pawlowski, S Rueckert, L Shadwick*, CL Schoch, A Smirnov, and **FW Spiegel.** 2012. The Revised Classification of Eukaryotes. J. Eukaryot. Microbiol. 59:429-493

Schnittler, M, YK Novozhilov, E Carvahal, **FW Spiegel.** 2012. Myxomycete diversity in the Tarim basin and eastern Tian-Shan, Xingian Prov., China. Fungal Diversity. In press. DOI 10.1007/s13225-012-0186-5.

Schnittler, M, YK Novozhilov, M Romeralo, M Brown*, and **FW Spiegel.** 2012. Myxomycetes and myxomycete-like organisms. In: Frey, W (ed). Engler's Syllabus of Plant Families, Part 1/1, Blue-green algae, myxomycetes and myxomycete-like organisms, Phytoparasitic protists, heterotrophic Heterokontobiota and Fungi p.p. Bornträger, Stuttgart. Pp. 40-88.

Spiegel, FW. 2012. Contemplating the first Plantae. Science 335:809-810. DOI:10.1126/science.1218515. Invited.

Brown, MW*, JD Silberman, **FW Spiegel.** 2011. A contemporary evaluation of the acrasids (Acrasidae, Heterolobosea, Excavata). Eur. J. Protistol. In press. DOI:10/1016/j.ejop.2011.10.001.

Spiegel, FW. 2011. Commentary on the chastity of amoebae: re-evaluating evidence for sex in amoeboid organisms. Proc. R. Soc. B. 278:2096-2097. DOI: 10.1098/rspb.2001.0608.

Aguilar, M*, **FW Spiegel**, C Lado. 2011. Microhabitat and climatic preferences of protosteloid amoebae in a region with a Mediterranean climate. Microb. Ecol. DOI: 10.1007/s00248-011-9843-6.

Brown, MW*, JD Silberman, and **FW Spiegel.** 2011. "Slime molds" among the Tubulinea (Amoebozoa): molecular systematic and taxonomy of *Copromyxa.* Protist 162:277-287. DOI: 10.1016/protist.2010.09.003.

Brown, MW*, JD Silberman, and **F.W. Spiegel.** 2010. A morphologically simple species of *Acrasis* (Heterolobosea, Excavata), *Acrasis helenhemmesae* n. sp. J. Eukaryot. Microbiol. 57:346-353. DOI: 10.1111/j.1550-7408.2010.00481.x.

Romeralo, M. **FW Spiegel,** and S Baldauf. 2010. A fully resolved phylogeny of the social amoebas (Dictyostelia) based on combined ncSSU and ITS rDNA sequences. Protist 161:539-548. DOI: 10.1016/j.protist.2009.12.006.

Ndiritu, GG*, **FW Spiegel,** and SL Stephenson. 2009. Rapid biodiversity assessment of myxomycetes in two regions of Kenya. Sydowia 61:287-319.

Shadwick. L*, **FW Spiegel,** JDLShadwick*, MW Brown*, and JD Silberman. 2009. *Eumycetozoa=Amoebozoa?*: SSUrDNA Phylogeny of protosteloid slime molds and its significance for the amoebozoan supergroup. PLoS One 4:e6754.

Brown, MW*, **FW Spiegel,** JD Silberman. 2009. Phylogeny of the "forgotten" cellular slime mold, *Fonticula alba*, reveals a key evolutionary branch within Opisthokonta. Mol. Biol. and Evol. 26:2699-2709. DOI:10.1093/molbev/msp185.

Shadwick JD*, SL Stephenson and **FW Spiegel**. 2009. Distribution and ecology of protostelids in the Great Smoky Mountains National Park. Mycologia 101:320-328. DOI: 10.3852/08-167.

Ndiritu, GG*, **FW Spiegel**, and SL Stephenson. 2009. Distribution and ecology of the assemblages of myxomycetes associated with the major vegetation types in Big Bend National Park, USA. Fungal Ecology 4:168-183. DOI:10.1016/j.funeco.2009.03.002.

Ndiritu, GG*, Winsett, KE, **Spiegel, FW** and Stephenson, S.L. 2009. A checklist of African Myxomycetes. Mycotaxon 107:353-356. DOI: 10.5248/107.353.

Ndiritu, GG*, Stephenson, SL and **Spiegel FW** 2009. First records and microhabitat assessment of protostelids in the Aberdare Region, Central Kenya. J. Eukaryot. Microbiol. 56:148-158. DOI: 10.1111/j.1550-7408.2008.00382.x.

Brown, MW*, **FW Spiegel,** and JD Silberman. 2007. Amoeba at attention – phylogenetic affinity of *Sappinia pedata.* J. Eukaryotic Microbiol. 54:511-519. DOI: 10.1111/j.1550-7408.2007.00292.x

Lindley, LA*, SL Stephenson, and **FW Spiegel.** 2007. Protostelids and Myxomycetes isolated from aquatic habitats. Mycologia. 99:504-509.

Aguilar, M*, C Lado, and **FW Spiegel.** 2007. Protostelids from deciduous forests: first data from southwestern Europe. Mycol. Res. 111:863-872. DOI: 10.1016/j.mycres.2007.05.010.

Adl, SM, BS Leander, AGB Simpson, JM Archibald, OR Anderson, D Bass, SS Bowser, G Brugerolle, MA Farmer, S. Karpov, M Kolisko, CE Lane, DJ Lodge, DG Mann, R Meisterfeld,

L. Mendoza, O. Moestrup, SE Mozley-Standridge, AV Smirnov, and **F Spiegel**. 2007. Diversity, nomenclature, and taxonomy of protists. Syst. Biol. 56(4):1-6. DOI: 1080/10635150701494127.

Spiegel, FW, JD Shadwick*, LA Lindley*, MW Brown*, and G. Ndiritu*. 2007. A beginner's guide to identifying the protostelids. Available as a pdf on the Eumycetozoan Project website: http://slimemold.uark.edu/Handbook1_3rd.pdf.

Lindley, LA*, SM Edwards, and **FW Spiegel.** 2006. Variations in nucleolar morphology in eumycetozoans. Revista Mexicana de Micologia. 23:75-81**.**

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Spiegel, FW, JD Shadwick*, and L Lindley-Settlemyre*. 2005. A beginner's guide to identifying the common protostelids. Revised, May, 2005. Available as a pdf on the Eumycetozoan Project website: http://slimemold.uark.edu/Handbook1.pdf (Better pictures for some species and several new species have been added since the first in 2004.)

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Swanson, AR*., JD Shadwick*, DE Hemmes, and **FW Spiegel**. 2004. Ecological succession of ictyostelid slime molds on the island of Hawai'i. Syst. Geogr. Pl. 74:67-79.

Swanson, AR*, **FW Spiegel,** and JC Cavender. 2002. Taxonomy, slime molds, and the questions we ask. Mycologia 94:968-979.

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Moore, DL* and **FW Spiegel**. 2000. The effect of season on protostelids communities. Mycologia 92:599-608.

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Moore, DL* and **FW Spiegel**. 1995. A new technique for sampling protostelids. Mycologia 87:414-418.

Spiegel, FW, DL Moore*, and J Feldman. 1995. *Tychosporium acutostipes*, a new protostelid which modifies the concept of the Protosteliidae. Mycologia 87:265-270.

Rusk, S, **FW Spiegel,** and SB Lee. 1995. Design of polymerase chain reaction (PCR) primers for amplifying nuclear ribosomal DNA from slime molds. Mycologia 87:140-143.

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Cisar, CR, DO TeBeest, and **FW Spiegel**. 1994. Sequence similarity of mating type idiomorphs: A method which detects similarity among the Sordariaceae fails to detect similar sequences in other filamentous ascomycetes. Mycologia 86:540-546.

Cisar, CR, **FW Spiegel**, DO TeBeest, and C Trout. 1994. Evidence for mating between isolates of *Colletotrichum gloeosporioides* with different host specificities. Current Genetics 25:330-335.

Spiegel, FW and J Feldman. 1993. Fruiting body ultrastructure in the protostelid *Schizoplasmodiopsis vulgare*. Mycologia 85:894-897.

Xia, J-Q, FN Lee, KS Kim, and **FW Spiegel.** 1993. Characterization of monoclonal antibodies to conidial antigens of *Pyricularia grisea*. Exper. Mycol. 17:170-181.

Spiegel, FW 1991. A proposed phylogeny of the protostelids. BioSystems 25:113-120.

Spiegel, FW and J Feldman. 1991. Microtubular cytoskeletons of the trophic cells of five eumycetozoans. Protoplasma 63:189-198.

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Cox. EC, **FW Spiegel**, G Byrne, JW McNally, and L Eisenbud. 1988. Spatial patterns in the fruiting bodies of the cellular slime mold *Polysphondylium pallidum*. Differentiation 38:73-81.

Spiegel, FW and J Feldman. 1988. The trophic cells of *Clastostelium recurvatum*, a third member of the myxomycete-like protostelids. Mycologia 80:525-535.

Spiegel, FW, J. Feldman, and WE Bennett. 1986. Ultrastructure and development of the amoebo-flagellate cells of the protostelid *Protosporangium articulatum*. Protoplasma 132:115-128.

Spiegel, FW and J Feldman. 1986. Mitosis in the protostelid *Ceratiomyxella tahitiensis* (Eumycetozoa). Can. J. Bot. 64:932-942.

Spiegel, FW and J Feldman. 1985. Obligate amoebae of the protostelids: significance for the concept of Eumycetozoa. BioSystems 18:377-386.

Best, SC* and **FW Spiegel**. 1984. Protostelids and other simple slime molds of Hueston Woods State Park. In: Hueston Woods State Park and Nature Preserve, Proceedings of Symposium, April 16-18, 1982. (G.E. Willeke, ed.). Miami University, Oxford, OH. 116-121.

Spiegel, FW 1984. *Protostelium nocturnum*, a new, minute, ballistosporous protostelid. Mycologia 76:443-447.

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Spiegel, FW and EC Cox. 1980. A one-dimensional pattern in the cellular slime mould *Polysphondylium pallidum*. Nature (London) 286:806-807.

Spiegel, FW, LS Olive, and RM Brown, Jr. 1979. Roles of actin during sporocarp culmination in the simple mycetozoan *Planoprotostelium aurantium*. Proc. Natl. Acad. Sci. USA 76:2335-2339.

Spiegel, FW and LS Olive. 1978. New evidence for the validity of *Copromyxa protea*. Mycologia 70:843-847.

Manuscripts in Preparation:

Shadwick, JD*, **FW Spiegel**, LA Shadwick*, and JD Silberman. The morphological and genetic diversity of *Protostelium mycophaga*. To be submitted to J. Eukaryotic Microbiol.

Tice, AK*, JD Silberman, MW Brown*, and **FW Spiegel**. Evidence for the validity of the genus *Pocheina* (Excavata, Heterolobosea). To be submitted to Protist or J. Eukaryotic Microbiol.

Spiegel, FW. Was LECA a Landlubber? To be submitted to Current Biology or Bioessays.

Swanson, AR, DE Hemmes, and **FW Spiegel**. Dictyostelid slime molds associated with a small Hawaiian *kipuka*. To be submitted to Biogeography or J. Eukaryotic Microbiol.

Geisen, S, EAD Mitchell, DM Wilkinson, S Adl, and 46 others, including **FW Spiegel.** Soil protistology rebooted: 66 fundamental questions to start with. To be submitted to ISMEJ.

Research Funding (* with former graduate students):

NSF Systematics. PI: BSR83-07376, Comparative study of the flagellate protostelids (Eumycetozoa). 1983-1986. $85,000.

NSF Systematics. PI: BSR86-00639, Comparative study of the flagellate protostelids (Eumycetozoa) – nonflagellate states. 1986-1989.

NSF Systematics. PI: BSR89-00190, Comparative study of the protostelids (Eumycetozoa) – nonflagellate species. 1989-1992 with no cost extension to May, 1993. $159,000.

USDA Collaborating Investigator in USDA funded Center for Alternative Pest Control. USDA89-34195-4378. Project: Mating between different strains of *Colletotrichum gloeosporioides* with D.O. TeBeest and C.R. Cisar. 1989-1993. approx. $50,000.

NSF Equipment Grant. CoPD (PI: Walter Bottje): BIR94-13897, Development of a cell isolation and characterization center. 1994. $244,790.

National Geographic Society PI: #6372-98. Simple slime molds of Hawaii.1998-2000. $6714.

NSF PI (Co-PIs, Stephenson, Cavender, Lado, Schnittler): DEB03-16284. PBI: Global Biodiversity of Eumycetozoans. 2003-2010. $2,075,523.

NSF PI (Co-PIs, Stephenson, Cavender, Moncalvo) DEB03-29102. PEET: A revisionary study of the Eumycetozoans. 2003-2010, $500,000.

*NSF CoPI (PI MW Brown) DEB1456054, Examining the macroevolutionary trajectories in Amoebozoa, a major lineage of eukaryotes. 2015-2018. Pending formal notification of funding. $825,009.

Service and Administrative Experience (*Mycology related)

University:

Member, Task Force on Improving Science, Mathematics, and Engineering Education in Arkansas -1990-1991
Member, Emergency Preparedness Committee - 1986-1989
Member, Parking and Transit Committee – 1992-1995
Member, Science and Engineering Building Users' Committee (to help develop plans for the renovation of SCEN) – 1992-1994
Member, Catastrophic Leave Committee – 1995-1998
Member *ad hoc* Committee to Revise Catastrophic Leave Policy - 2000
Member, Research Council – 1996-1999, Vice Chair - 1997/98, Chair-1998/99
Member, University Core Curriculum Committee – 2001-2004, 2007-2008
Member, Toxic Substances Committee – 2002–2009
Member, EM Users' Committee – 2002–present
Member, Research and Sponsored Programs Advisory Committee -2006-2009
Member, Faculty Senate – 2006-2008
Member, Campus Council – 2007-2008
Member, Environment Dynamics Program Executive Committee – 2008-2012
Member, Graduate Council – 2013-present

College:

Chair, Committee to Develop BS Major in Biology – 1990
Member, Faculty Development Committee – 1990-1991
Member, Search Committee for Chair of Department of Biological Sciences - 1991
Member, Premedical Advisory Committee – 1996–2005, 2006-2008
Member, Academic Programs Committee – 2004–2005, 2006-present, Vice Chair – 2004-2005, 2006-2007, 2013-2014, Chair 2007-2008, 2014-present.
Member, College Cabinet – 2004-2008, 2013-present, Vice Chair – 2006-2007, Chair – 2007-2008, 2013-present.
Department Representative at several recruiting functions – 1991–present

Department: (selected activities):

Vice-Chair – 1991-1994
Coordinator of General Biology – 1994-1995
Faculty Supervisor of Freshman Biology Labs – 1996-1997
Curriculum Committee, *ex officio* Member - 1991-1994, Member - 1997-2005; Chair - 2001-2002, 2004-2005
Member, Graduate Studies Committee – 1992-1995, 1997-1998
Undergraduate Advising for Orientation – 1991-1998, 2001-2004
Member, Personnel Committee – 1994-1997, 2000
Chair, *Ad hoc* Committee to develop Principles of Biology – 1995-1996
Member, Search Committee for Biology Educator - 1996-1997

Member, *Ad hoc* Committee on Advising – 1997-1999
Member, *Ad hoc* Committee on the format of Principles of Biology – 1999-2000
Member, Search Committee for COOP Assistant Leader, Fisheries - 1999
Coordinator of Principles of Biology – mid fall 2000-2003: responsible for organizing course, maintaining web site, keeping records, oversight of TA prep, handling student concerns.
Vice-Chair for Academics – July 2001-July 2004: responsible for course and room assignments, interaction with undergraduate students, TA assignment, summer advising, standing in for chair when necessary.
Member, Search Committee for Evo-Devo position – 2002-2004, Chair 2003-2004
Member, Advising Committee – 2003-2005
Chair, Awards Committee – 2003-2004, 2006-2008
Chair – July 2008 -2012
Chair, Undergraduate Studies Committee, 2012-present.

Professional Organizations:

Arkansas Academy of Science
- Judge, Graduate Student Papers – 1989
- Program Chair – 1991 Annual Meeting

International Society for Evolutionary Protistology
- Symposium Co-organizer – 1987
- Associate Editor, Special Issue of BioSystems – 1990

Mycological Society of America
- Member, Finance Committee – 2015-present
- Member, Sustaining Membership Committee -1984-1986
- Chair, Endowment Committee – 1988-1991
- Member, Endowment Committee – 1998-2000, 2004-2007
- Member, Program Committee – 2007-2009
- Judge, Graduate Student Presentations at Annual Meeting – 1986, 1989
- Symposium Organizer – 1984, 1990
- Associate Editor, *Mycologia*, 1994-1995
- Developed and coorganized with Don Hemmes the Photo Show Component of the Annual Auction - 1995-2001
- Assisted Don Hemmes with Annual Auction – 1998-2005

3rd International Congress for the Systematics and Ecology of Myxomycetes
- Member Organizing Committee for 1999 Congress in Beltsville, MD

Phi Kappa Phi
- President elect UAF Chapter - 1993-1994
- President UAF Chapter – 1994-1999

Sigma Xi
- President elect UAF Chapter – 1993-1994
- President – 1994-1995

Northwest Arkansas Regional Science and Engineering Fair

Chair, SRC Committee – 1996-present (missed 2004 Fair because of collecting trip)

5th International Congress for the Systematics and Ecology of Myxomycetes
Member, Scientific Advisory Board for Congress in Tlaxcala, Mexico

President-elect (2013-2014), President (2014-2015), Past President (2015-present) International Society of Protisologists

Service to State or Nation:

State:

Advised junior high teacher, Dawna Stewart, on summer project in Arkansas STRIVE program with Ralph Henry – 2002

Ex officio Nonvoting Member, Arkansas Game and Fish Commission – 2008-present

National and International:

Member, NSF Systematics Panel, 1988-1992, 2016

Member, NSF Systematics, Special Panel on Monographic Systematics – 1994, Developed guidelines for Partnerships for Enhancing Expertise in Taxonomy (PEET)

Member, NSF Systematics, PEET Panel – 1999, 2005

Member, NSF Living Stock Collections Panel – 2004

Member, NSF Biotic Surveys and Inventories/Planetary Biodiversity Inventories Panel - 2008

Member, NSF Genealogy of Life Panel - 2014

Member, ORAU/NSF Graduate Fellowships Panel in Biology – 1996-1998

Member, Special Committee on the Nomenclature of Fungi with a Pleomorphic Life Cycle of the International Committee of Botanical Nomenclature. 2006-2011.

Member, International Commission on the Taxonomy of Fungi. 2006-2011.

Reviewer: *Mycologia, Canadian Journal of Botany, Canadian Journal of Microbiology, Nova Hedwigia, Journal of Protozoology/Journal of Eukaryotic Microbiology, Progress in Protistology, European Journal of Protistology, Journal of the American Microscopical Society*, *Protist, Proceedings of the Royal Society B, PLoS ONE, Science, Molecular Biology and Evolution, Molecular Phylogenetics and Evolution, Soil Biology and Biochemistry, Biologia,* McGraw-Hill, W.C. Brown, Pearson, Macmillan, NSF, Oak Ridge Associated Universities, *Journal of Biological Control*

Consultant, Eukaryote Tree of Life Project, Laura Katz, PI, 2007

Other Professional Service and Awards:

Guided Mushroom Walks for the University Museum several years between 1983 and 1999.

Identified fungi for area hospitals in potential poisoning cases many years

between 1982 and present.
Identified fungi for local industries many years between 1982 and present.
Named to Shore Regional High School Distinguished Alumni Hall of Fame, April, 2002.
William H. Weston Award for Excellence in Teaching, Mycological Society of America, 2015

Memberships in Professional Societies:

American Association for the Advancement of Science (no longer active)
Arkansas Academy of Science (no longer active)
Beta Beta Beta
Botanical Society of America (no longer active)
International Society for Evolutionary Protistology
International Society of Protistologists
Mycological Society of America
Phi Kappa Phi
Sigma Xi

Outside Interests:

Nature photography, fishing (especially fly fishing), fly tying, natural history photography, and cooking.