Bio Files

April 2015

Missouri S&T Department of Biological Sciences

Upcoming Events

Graduation Reception
Havener Center
May 15, 3-5 PM

Graduation Ceremony
Gale Bullman Building
May 15, 6 PM

Identifying Algorithmic and Physiologic Determinants of Sleep

Insufficient sleep affects millions of Americans, resulting in cognitive, cardiovascular, and metabolic problems that may explain the decreased lifespan. Unfortunately, we know little about how sleep is regulated at the molecular level, or how sleep restores us to face each new day, thus effective treatment options are limited. The Sleep Biology Laboratory in the Biological Sciences Department uses the power of fruit fly genetics to understand how sleep is regulated and how to mitigate the consequences of sleep deprivation. "The fruit fly is an outstanding organism to explore the genetic and biochemical pathways contributions to sleep and wakefulness regulation. Not only do they sleep at night, but they have many homologous pathways permitting quick discovery of mechanisms that may result in novel therapies for human with sleep difficulties" says lab director MATT THIMGAN.

One approach the Sleep Biology Laboratory is interested in is what molecular mechanisms regulate the ability to sleep. There is a conflict between sleep and eating. Both processes are critical, but we cannot hunt for food and sleep at the same time. This suggests that metabolic disruption may lead to sleep disruption. In fact, data from DR. THIMGAN demonstrated that starvation results in waking, but how this occurs is not well understood. To understand this phenomenon, a graduate student, CARLOS RIVERA, and a visiting scholar, RONG FAN, are working on what metabolic pathways may underlie the increased wakefulness in response to starvation and why one does not experience the same consequences as waking induced through sleep deprivation. Results from these experiments may provide sleep deprived people with temporary relief and allow them to remain at their cognitive best, even after a night of sleep deprivation.

COURTNEY FIEBELMAN, graduate student, and SAHITYA INJAMURI, undergraduate student, evaluating fly sleep behavior.

To determine what constitutes restorative sleep, the Sleep Biology Laboratory is collaborating with investigators from the Center for Statistical and Computational Modeling of Biological Complexity to mathematically model the transitions between sleep and wakefulness. Differences in fragmentation, consolidation, or other as yet undiscovered factors may determine how restorative sleep is. These factors may subsequently help determine lifespan. A Master's student, COURTNEY FIEBELMAN, and an undergraduate, SAHITYA INJAMURI, are collecting data from flies with different mutations to determine molecular mechanisms that regulate sleep as well as biochemical changes associated with aging, and how they might relate to consolidated sleep.

Many students are working in the lab on novel aspects of sleep regulation. AARON LATAL and MADDIE KRUPER are working on a mutation screen to identify novel genes. THOMAS CONGDON is working on localizing where these sleep-related genes are expressed. DILLON BARTON is implementing a device to understand how to wake an animal. LISA KINDER is applying a novel technique called optogenetics, in which a light activated channel is expressed in cells responsible for either sleep or wakefulness. MEAGAN WINDSOR is working on a memory assay and CARON HARADA uses a learning assay to test what effect fragmented sleep has on the cognitive function of an animal. HARRIET LUMILA is working on an assay that tests the brain plasticity in flies that have difficulties sleeping. JULIE NGUYEN is screening for new cells that regulate sleep. These experiments will establish new lines of investigation to pursue sleep regulation.

"I want to stress that getting the proper amount of sleep is critical to one's health and quality of life. But under circumstances in which you can't, this great group of students is working with each other to find a way to help," says DR. THIMGAN.

Department Update

The Missouri S&T Department of Biological Sciences is an academic community focused on learning and discovery. The S&T BioSci community provides a supportive, collegial, challenging and rewarding environment for its faculty, students and staff.

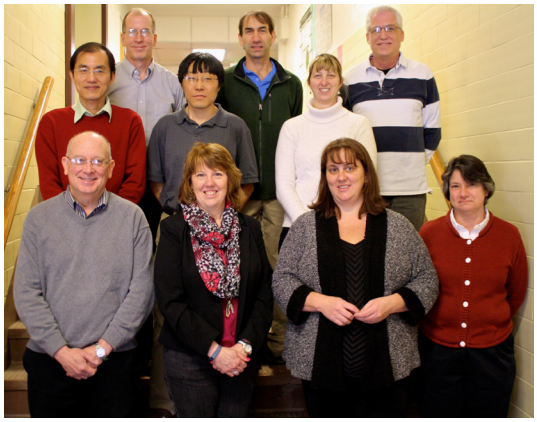
Strategic Plan: The BioSci faculty embraces the following Strategic Statement: To become the school of choice for 450 biology majors by 2020 by offering outstanding learning and research opportunities and career preparation in an inclusive and interactive academic community.

Students: A record 74 students graduated from the BioSci department in this academic year. More than half graduated with honors, and 158 BioSci students were named to the Provost's Academic Scholars List in 2014 (which we recognize with a certificate and a large chocolate bar). The department set new records (yet again) in number of students with OURE research grants, number of majors, and student credit hours. Our students contributed one-third of the papers at the Undergraduate Research Day Conference (and won a corresponding number of awards). RON METTS, SIERRA COMER, and MARLENE MALMBORG shared the 2015 Troutbusters Scholarship.

BioSci graduates participating in the Missouri S&T Commencement ceremony in December

Alumni and Development: We are pleased to recognize in this newsletter those who generously supported the department in 2014. Donations to the department increase to a record $16,900. The consistent support we receive from our alumni and friends provides the means to strengthen our academic community and support innovation in both teaching and research.

Faculty: DR. KATIE SHANNON and MS. TERRY WILSON earned Faculty Achievement Awards, and DR. DAVID WESTENBERG was recognized with an Outstanding Service Award. DR. ANN WEST received a Teaching Commendation based on student evaluations. DR. MELANIE MORMILE was named special assistant to the provost for faculty affairs, effective Feb. 9.



BioSci faculty. Back: Dave Westenberg, Nev Niyogi, Ron Frank. Center: Yue-Wern Huang, Chen Hou, Katie Shannon. Front: Robert Aronstam, Terry Wilson, Julie Semon, Melanie Mormile. Not pictured: Matt Thimgan

Research: In 2014, BioSci faculty members published 15 peer reviewed research publications and book chapters, and presented 22 papers at national and international meetings. Under the leadership of DRS. MATT THIMGAN and RON FRANK, the Center for Statistical and Computational Modeling of Biological Complexity was instituted and hosted seminars as well as a visiting scholar.

As always, I am pleased to provide you with this update. Many further details on our activities are available on our website (biosci.mst.edu), look under the "Useful Links" section to access our Annual Report, and our Facebook Page ("Missouri S&T Biology'). Your comments and suggestions are welcome. And of course, I invite you to visit the department for a tour and update.

Sincerely,

Robert S. Aronstam, Ph.D.
Professor and Chair, Biological Sciences

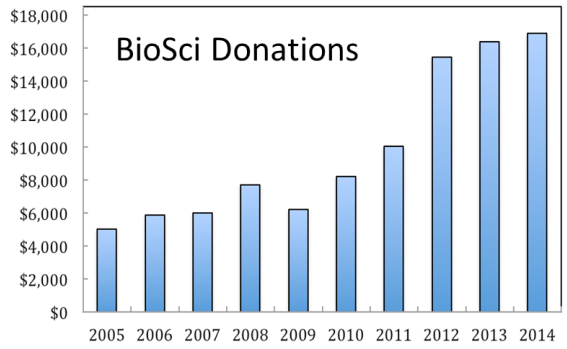
2014 Research Partners

We are pleased to recognize those who generously supported the department in 2014. Donations to the department increase to a record $16,900. The consistent support we receive from our alumni and friends provides the means to strengthen our academic community and support innovation in both teaching and research.

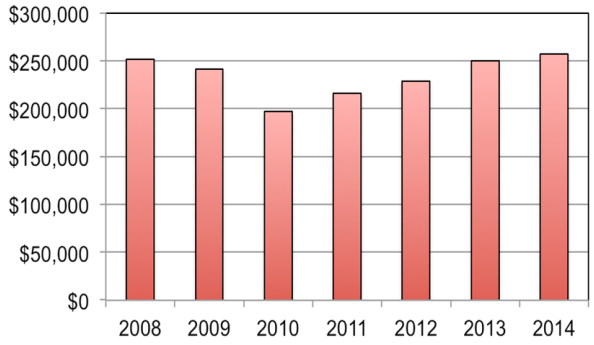
Contributions are welcome at any time and can be made on the S&T web site (giving.mst.edu) (be sure to designate Biological Sciences as the recipient fund). The cadre of BioSci alumni continues to grow, although half have graduated in the last 10 years, reflecting our recent consistent growth.

Finally, TroutBusters of Missouri renewed their funding of scholarships for S&T Ecology students, and Mr. Fred Kielhorn continued his strong support of the iGEM student design team.

We appreciate all you do to support the department and its students and hope you will continue to be able to do so. We welcome your feedback on any of our activities or plans, and invite you to visit when you are in Rolla.



Donations to the BioSci department. Excludes donations to specific programs and gifts in kind.



Value of BioSci endowment funds at the end of the indicated calendar years. The Gale-Hufham, Heilbrunn and Summers funds provide student scholarships; our other funds support faculty and student research.

Donations < $100

Tina Almond
Kathleen B. Bottroff
Richard S. Campos
Gary Wayne Hammock
Brian Harris
Katherine Harris
Katie M. Herington
Habiba R. Inusah
Avery B. Joseph
Lisa Lindesmith
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Robert B. Young

Donations up to $100

LaChelle Arredondo
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William Rich
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Donations $250 - $499

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Katherine Phillips
Robert L. Phillips
Paul Stricker

Donations $500 - $599

Baxter International Foundation
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Rebecca Fiechtl
Mark Statler

Donations > $1000

Joan Aronstam
Robert S. Aronstam
ExxonMobil Foundation
Fred Kielhorn
Joseph A. Safron
Troutbusters of Missouri

Ron Metts, Sierra Comer, and Marlene Malmborg were the winners of the 2015 Troutbusters Scholarship

December Graduates

Twenty-five Missouri S&T students received a B.A. or B.S. and one recieved an M.S. in Biological Sciences during the Dec. 2014 Missouri S&T Commencement ceremony (see picture under Department Update).

One graduate student, TRAVIS THOMPSON, defended his Master's thesis in December. He was mentored by DR. DEV NIYOGI, and his thesis was entited, "Ecology of a Declining Great Plains Fish, *Fundulus sciadicus*, in the Missouri Ozarks." TRAVIS has accepted a positions with the U.S. Geological Survey in Rolla, MO.

Teaching and Service Awards for Biological Sciences Faculty

DR. KATIE SHANNON and MS. TERRY WILSON each received a Faculty Achievement Award, DR. DAVE WESTENBURG received an Outstanding Faculty Service Award, and DR. ANN WEST received a Teaching Commendation from the Missouri S&T committee on Effective Teaching.

DR. SHANNON teaches Cell biology, Cancer Biology, Senior Seminar, and Developmental Biology. She is also the department Undergraduate Educational Coordinator, iGEM advisor, and Service Learning Coordinator.

PROFESSOR WILSON teaches Principles of Biology and Biodiversity, as well as the laboratories for Cell Biology, General Biology and Biodiversity. She is also the Project Lead the Way Biomedical Sciences Coordinator, among many other things.

DR. DAVE WESTENBERG teaches Microbiology, Pathogenic Microbiology, Biological Design, and Genetics. He serves as advisor to several student organizations, chairs the Biology Scholarship committee, and serves on numerous committees. Professionally, he is active within the American Society for Microbiology, including chair of the Committee on K12 Outreach.

DR. ANN WEST teaches a problem-based learning class, Biomedical Problems.

Postdoctoral Scholar Research in Extremophiles

In the human body, bacteria outnumber human cells by more than ten-fold. These bacteria play many roles, including: digesting food, keeping you slim, making you fat, regulating the immune system, and even affecting cancer progression.

The gastrointestinal tract is one of the top sites for bacteria to live. DR. YI CUI'S research experience has focused on the bacteria in the gastrointestinal tract of the human body. DR. CUI studied the mechanism of intestinal barrier function regulation associated with bacteria, the pathogenesis of colitis associated colorectal cancer in intestinal epithelial O-glycosylation deficient mice, and tumor associated immune response.

DR. CUI earned an MD in 2009 and a PhD in 2012 from Xiangya Medical College of Central South University in China.

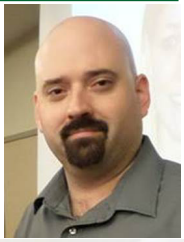
She then was a postdoctoral fellow at the Oklahoma Medical Research Foundation before coming to Missouri S&T. DR. CUI began working as a postdoctoral fellow in DR. MELANIE MORMILE'S lab in 2015, working on the characterization of extremophiles from Lake Brown, Australia.

Dr. Melanie Mormile named to new position

DR. MORMILE was named special assistant to the provost for faculty affairs. In this new position, DR. MORMILE will assist with faculty awards, workload development, promotion and tenure, and other issues related to faculty affairs.

DR. MORMILE has been a member of Missouri S&T faculty since 1999. During that time, she received Woman of the Year in 2008; Faculty Excellence Awards in 2002, 2003, 2004, 2006, and 2008; and three Outstanding Professor Awards presented by the Eta Kappa Chapter of Chi Omega. This new position is a half-time post; she will still continue to teach courses and conduct research.

Alumni Spotlight



ADAM MARTIN (MS, 2004) successfully defended his PhD in Chemistry at Missouri S&T on April 9th. "My Master's Degree in Biology at Missouri S&T set me on a career path that has served me well for the last 10 years. I used that degree to get a job as a Molecular Biologist in the department of Biological Sciences and was eventually promoted to Sr. Research Scientist. I had a pretty simple idea of what I wanted to be when I grew up: I was going to work with DNA. Thanks to my degree here at MS&T, that has been my reality ever since."

Faculty News

Faculty Publications, 2014

Chang, M., Y.-W. Huang, R.S. Aronstam and H.-J. Lee, Cellular delivery of noncovalently-associated macromolecules by cell penetrating peptides, Curr. Pharmaceut. Biotechnol. 15: 267-275, 2014.

Dissel, S., L. Seugnet, M.S. Thimgan, N. Silverman, Y. Suzuki, P. Thacher, M.M. Burnham and P.J. Shaw . Differential activation of immune factors in neurons and glia contribute to individual differences in resilience/vulnerability to sleep disruption. Brain Behavior and Immunology. 2014 Oct 30. pii: S0889-1591(14)00472-3, 2014.

Hayes, M., L. Jiao, T. Tsao, I. King, M. Jennings and C. Hou, High temperature slows down growth in tobacco hornworms (Manduca sexta larvae) under food restriction. Insect Science, DOI: 10.1111/1744-7917.12109, 2014.

Hou, C., Increasing energetic cost of biosynthesis during growth makes refeeding deleterious. American Naturalist, 184: 233-247, 2014.

Huang, Y.-W., H.-J. Lee, L.M. Tolliver and R.S. Aronstam, Delivery of nucleic acids and nanomaterials by cell-penetrating peptides: opportunities and challenges. BioMed Research International, 2014.

McFerrin, H.E., S.D. Olson, M. Gutschow, M., J.A. Semon, D.E. Sullivan and D.J. Prockop, Rapidly Self-Renewing Human Multipotent Multipotent Marrow Stromal Cells (hMSC) Express Sialyl Lewis X and Actively Adhere to Arterial Endothelium in a Chick Embryo Model System. PLoS One Aug 21;9(8):e105411, 2014.

Mormile, M.R., Going from Microbial Ecology to Genome Data and Back: Studies on a Haloalkaliphilic Bacterium Isolated from Soap Lake, Washington State. Frontiers in Microbiology, 5: 628. doi:10.3389/fmicb.2014.00628, 2014.

Paul, V.G., S.D. Minteer, B.L. Treu and M.R. Mormile, Ability of a haloalkaliphilic bacterium isolated from Soap Lake, Washington, to generate electricity at pH 11.0 and 7% salinity. Environmental Technology, 35: 1003-1011, 2014.

Roush, D.W., D.A. Elias and M.R. Mormile, Metabolic capabilities of the members of the Order Halanaerobiales and their potential biotechnological applications. Current Biotechnologies, 3: 3-9, 2014, 2014.

Semon, J.A., C. Maness, X. Zhang, X., S. Sharkey, M.M. Beutler, F.S. Shah, A.C. Pandey, J.M. Gimble, S. Zhang, B.A. Scruggs, A.L. Strong, T.A. Strong and B.A. Bunnell, Comparison of human adult stem cells from adipose tissue and bone marrow in the treatment of experimental autoimmune encephalomyelitis. Stem Cells Res Ther Jan 9;5(1):2, 2014.

Thimgan, M.S., L. Seugnet, J. Turk and P.J. Shaw, Identification of genes associated with resilience/vulnerability to sleep deprivation and starvation in Drosophila. SLEEP. pii: sp-00336-14, 2014.

Zhang, S., S.D. Danchuk, R.W. Bonvillain, B.A. Scruggs, A.L. Strong, J.A. Semon, J.M. Gimble, A.M. Betancourt, D.E. Sullivan and B.A. Bunnell, Interleukin-6 mediates the therapeutic effects of adipose-derived stem cells in lipopolysaccharide-induced acute lung injury, Stem Cells Jun;32(6):1616-28, 2014.

Zhang, X., A.C. Bowles, J.A. Semon, B.A. Scruggs, S. Zhang, A.L. Strong, J.M. Gimble and B.A. Bunnell, Transplantation of Autologous Adipose Stem Cells Lacks Therapeutic Efficacy in the Experimental Autoimmune Encephalomyelitis Model. PLoS One Jan 21;9(1):e85007, 2014.

Book Chapters, 2014

Liu, B.R., Y.-W. Huang, R.S. Aronstam and H.-J. Lee, Chapter 8: Cell-Penetrating Peptide-Mediated Protein Uptake in Cyanobacteria. In Cyanobacteria: Ecological Importance, Biotechnological Uses and Risk Assessment. Douglas Davison (ed.): Nova Science Publishers, Hauppauge, New York, pp 171-181, 2014.

Invited Talks, Seminars, 2014

Hou, C., Energy allocation and tradeoff during animals' growth: Two examples of universality in biology. Colloquium seminar, Physics Department, University of Missouri-Columbia, March, 2014.

Huang, Y.-W., Materials for Biomedical Applications. Frontiers in Biopharmaceuticals Conference, Taiwan Normal University. Taipei, Taiwan, May 23, 2014.

Huang, Y.-W., Biology and Beyond National Taiwan Normal University. Taipei, Taiwan, 2014.

M. Thimgan, How Neo sees sleep: Mathematical approach to identify adequate sleep, Missouri University of Science and Technology, Department of Biology, 2014.

Mormile, M., Going from microbial ecology to genome data and back again: Studies on a haloalkaliphilic bacterium isolated from Soap Lake, Washington State. Department of Geological Sciences, University of Missouri, Columbia, Missouri, October 10, 2014.

Westenberg, D.J., Flipping the Microbiology Laboratory to Improve Student Preparation. Missouri S&T Board of Trustees, Rolla, MO April 24, 2014.

Westenberg, D.J., Technology to Achieve Active Learning: Digital Transformation – Impacts on Research, Science and Teaching, San Francisco, CA, September 12, 2014.

Westenberg, D.J., The Plant Whisperers: How Environmental Microbes Tame the Plant Kingdom. 2014 Albrecht Lecture, University of Missouri, Columbia, MO, April 23, 2014.

Conference Abstracts, Presentations, 2014

C. Hou, Energetics of Unitary and Super-organisms in Response to Stresses. National Academy Keck Future Initiative: Collective Behavior, Irvine, CA, November, 2014.

Edwards, T. and M.R. Mormile. pH Dependent Antibiotic Resistance of an Alkaliphilic Halotolerant Bacterium from Soap Lake, Washington, Ann. Meet. Am. Soc. Microbiology, Boston, MA, 2014.

Hou, C., Food restriction-induced changes in energy budget and metabolic scaling during ontogeny: A case study on hornworms. Gordon Research Conference: Unifying Ecology Across Scales, Biddeford, ME, July, 2014.

Thimgan, M., Relationship of sleep and wake bouts in Drosophila, American Professional Sleep Societies, 2014.

Semon, J.A., Comparison of Adult Stem Cells in the Treatment of a Mouse Model of Multiple Sclerosis, Midwest Conference on Cell Therapy and Regenerative Medicine, Kansas City, MO, 2014.

Semon, J.A., Mesenchymal Stem/Progenitor Cells in the Treatment of a Mouse Model of Multiple Sclerosis, Phelps County Regional Medical Center - Missouri S&T Collaboration, Rolla, MO, 2014.

Shannon, K.B., Adventures in Flipping-Flipped Fridays in Cell Biology, Society for the Advancement of Biology Education Research (SABER) Annual Meeting, Minneapolis, MN, 2014.

Shannon, K.B., Analysis of a Cell Model Project. Poster, Society for the Advancement of Biology Education Research (SABER) Annual Meeting, Minneapolis, MN, 2014.

Shannon, K.B., Cdc14 Regulates Actin Ring Formation in Budding Yeast Via Dephosphorylation of Iqg1, American Society for Cell Biology Annual Meeting, Philadelphia, PA, 2014.

Shannon, K.B., Flipped Fridays in Cell Biology, American Society for Cell Biology Annual Meeting, Philadelphia, PA, 2014.

Shannon, K.B., Flipped Fridays: Adventures in flipping Cell Biology, Talk, Teaching and Learning Technology Conference, March 13-14, Missouri S&T, Rolla, MO, 2014.

Westenberg, D.J., Flipping the Microbiology Laboratory to Improve Student Preparation and Increase Student Interaction. Teaching and Learning Technology Conference, Rolla, MO, 2014.

Westenberg, D.J., P. Mixter, R. Gyure and M. Martin, That's EDUtainment. ASM Conference on Undergraduate Education, Boston, MA, 2014.

Huang, Y.-W., L.M. Tolliver, F.Y.S. Hou, R.S. Aronstam and H.-J. Lee, Influence of Transition Metal Oxide Nanoparticles on Cell Death and Cell Cycle in A549 Cells, Annual Meeting of the Society of Toxicology.. Phoenix, AZ, USA, 2014.

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Extremophiles from the Land Down Under

What are the limits to life on Earth? Extremophilic bacteria are used provide answers to this question. These answers can help to guide people on the quest to determine if there is life elsewhere in our Solar System and beyond. For example, there is good evidence that Mars once had bodies of water that were acidic and had salt present. Thus far, there have been very few haloacidophilic bacteria described, and no bacteria identified that can grow at high salinity and pH values below 4. If bacteria were isolated and characterized that could grow under these conditions, it would be possible to identify biomarkers to be used to help identify if there was previous life on Mars.

Acidic saline lakes in Western Australia

DR. MELANIE MORMILE recently received a NASA EPSCoR grant to study the microbial communities in acidic saline lakes in Australia. She traveled to Western Australia from December 26-January 11. While there, she was able to collect samples from four lakes with pH values below 3.0 and salt concentrations at saturation. In addition, each of these lakes possesses high metal concentrations. These were truly extreme environmental conditions! She preserved a number of water and sediment samples that were used for DNA extraction, along with salt samples. **DR. YI CUI**, a postdoctoral fellow in **DR. MORMILE'S** lab has been busy performing the DNA extractions. **DR. CUI** will send these samples to the University of Missouri, Columbia, DNA Core Lab so they can be used for metagenomic analysis. The metagenomic data will provide information on the microbial communities present in the lakes. It is predicted that the microbial communities will be different in each of the lakes due to differences between the ions present in these environments.

There are also a number of undergraduate students working with **DR. MORMILE** on this project. AVA HUGHES is attempting to isolate and characterize organisms that can grow with complex sources from sediment samples taken from each of the lake. She has successfully gotten growth in all of the enrichments that she set-up, including cultures with a pH of 2. KATLYN LONERGAN, a student earning her minor in Biological Sciences, is focused on isolating microorganisms directly from salt crystals collected from the lakes. It will be interesting to see if KATLYN'S cultures differ from AVA'S. MADDEN STEWART is preparing enrichments from the sediment samples for organisms that can break down biomass under these extreme conditions. If MADDEN is successful, the organisms she isolates and characterizes might be useful for biofuel production. Thus, there are practical applications for microorganisms isolated from extreme environments on Earth.

DR. MORMILE and JONATHON KNAPP analyzing collected samples