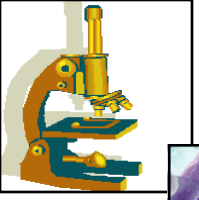

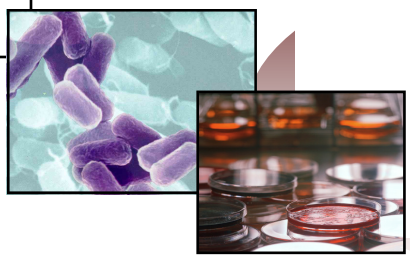

IBASM NEWSLETTER

Volume 15, Issue 1
August, 2012

Greetings from the President: Becky Sparks-Thissen

I hope you've had a productive and relaxing summer! I enjoyed meeting many of your at our meeting in April and look forward to seeing you again for next year's meeting. Congratulations to all who gave a poster or a talk! I continue to be impressed with the level of your enthusiasm and quality of the science you present.

Keep our annual meeting in mind as you plan out your schedules for the upcoming academic year. It will be held at McCormick's Creek State Park April 12-13. As most of you already know, the annual meeting is a good place for undergraduate students, graduate students and postdocs to present their research. It has been particularly useful for my students, coming from a small institution where they are the only students working in microbiology, to get to know other students who have similar interests. We hope to add a panel on potential careers in microbiology to the schedule to give students a chance to interact with individuals who have chosen different careers paths using their microbiology degrees.

In addition, Tom Schwann from Rocky Mountain Laboratories will be giving a talk as our Branch Speaker on Lyme disease. It promises to be an exciting meeting and I hope to see you all there!

We will be announcing the next student grant competition soon. These grants support graduate student or undergraduate research and provide funds up to $1000. Be sure to keep your eyes open for this opportunity!

Finally, IBASM has a Facebook page (http://www.facebook.com/#!/IBASM). We will be posting information about grant opportunities and meeting information on this page. Please send any suggestions regarding information you would like to see to rlsparksth@usi.edu.

Best wishes for the upcoming fall semester.

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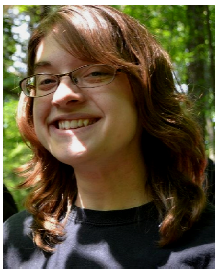
Message from the Past President — Jennifer Metzler

I hope this edition of the newsletter finds that you have had a great summer with some rest and relaxation time enjoyed by all. It has been quite hot and dry this summer, so maybe fall is looking as good to you as it is to me.

My tenure as President of IBASM has come to an end, and I am very pleased to pass this office on to our very capable new President Rebecca Sparks-Thissen. Yet again, she planned a wonderful meeting for us this year at Wabash College. I am very sad that I was unable to attend this year, due to some unforeseen circumstances. However, I did hear great things about the meeting and student presentations. Becky has already put into motion the plans for our 2013 meeting at Turkey Run State Park so look for details on that in an upcoming edition of the newsletter.

I am pleased to announce that our grants program awarded a total of four grants over the 2011-2012 academic year. In the fall round of applications, we awarded grants to Lisa Smelser and Terry Bowers both of Ball State University. Ms. Smeler's proposal was entitled "An examination of the effect of simvastatin pretreatment on immunologic memory and survival response in response to secondary infection." Mr. Bower's project is "Co-culture of *Streptomyces griseus* with selected industrial microbes to increase antibiotic yields." In the spring round we awarded grants to Ruijie Huang of Indiana University and Anapuma Ramalinga of Indiana State University. Ms. Huang's work is "*Streptococcus mutans* biofilm protein expression regulated by nicotine." Ms. Ramalinga's project is entitled "Characterization of the invasive nature of a hypothetical protein from community associated *Staphylococcus aureus* MSSA476." Congratulations to all of our awardees, we look forward to hearing about your work at our next meeting. We will be continuing our grant opportunity for both undergraduate and graduate /professional students in good standing with IBASM in the spring, so be sure to look at the next edition of the newsletter for that announcement.

Message from the Student Representative — Breanna Brenneman



I am so excited to be the undergraduate student representative for IBASM this year! I am a senior Microbiology major with a minor in Chemistry at Ball State University. My ultimate goal is to earn a Ph.D. in Cancer Biology and become a professor and researcher in pediatric oncology, specifically brain cancer. I am beginning the process of studying for the GRE and selecting graduate schools. I have participated in microbiology research at BSU, which I presented as a poster at the Spring IBASM Meeting. I am currently interning at Western Kentucky University's Biotech REU program, sponsored by the National Science Foundation. I am also the president of BSUASM and the secretary of SAACS (Student Affiliates of the American Chemical Society) at Ball State.

As Student Representative for IBASM, I want to improve the communication between IBASM and its student members by ensuring that the website is current and possibly creating a Facebook page, where updates and information can be readily available for students. As the Web Master for BSUASM this past year, I created a similar Facebook page for BSUASM and communication has already increased as a result. I would like to see IBASM provide more interesting events at the IBASM Spring Meeting, such as a collaborative session with professionals in industry and academia. I hope to provide students with more rewards for their efforts in presenting research through posters and talks. This includes actually providing an award for talks and placing an increased emphasis on the competitive nature of the poster presentations. Many students I talked to were not aware of the awards offered by IBASM for presenting research. I would also like to increase awareness of the IBASM Spring Meeting at universities statewide. I know that at BSU many students are not aware of this great opportunity for sharing their research and collaborating with intelligent professors. One of my initiatives as BSUASM president will be to change that and as a result increase attendance at the IBASM Spring Meeting. I look forward to working with our great professional members and helping these goals become a reality!

Please consider me a resource and email me at brbrenneman@bsu.edu if you have any questions or suggestions.

Special Thanks to All Judges!

On behalf of all of the students in the poster competition I would like to express sincere appreciation to all of the members who volunteered their time to judge at the meeting.

Students were evaluated in 5 different categories: professional appearance, scientific thought, creativity, thoroughness and presentation (abstract, oral and poster). This was no easy task! Next time you see any of these persons please thank them for sweating through a very difficult challenge:

Team #1: Undergraduate division = *Dominique Galli (IUSD) and Amy Cheng Vollmer (Swarthmore College)*

Team #2: Undergraduate division = *Richard Gregory (IUSD) and Kathleen Dannelly (ISU)*

Team #3: MS division = *Becky Sparks-Thissen (USI) and Jeffrey Hughes (Millikin University)*

Team #4: Ph.D. division = *John McKillip (BSU) and Tanya Soule (IPFW)*

From the Desk of Jim Mitchell-...Educational Representative

Students contributed a total of 14 posters and 3 oral presentations at the IBASM meeting. The quality of all the presentations was awesome and it was very informative for me to see the range of different research areas. Grace Walworth (Millikin Univ.) won first place and both Stephanie Gates (Millikin Univ.) and Nicolas Gallina (Indiana State Univ.) shared second place in the undergraduate division.

Cullen Taylor (IU Bloomington) received the *Leland S. McClung* award for 1st place in MS division and Hillary Madinger (Ball State Univ.) received 2nd place. Sowmya Nagarajan (Purdue Univ.) received the *Leland S. McClung* award for 1st place in PhD division and Ruijie Huang (IU Dental School) received 2nd place. **Congratulations !!!**

The socializing which occurred during the open poster session was almost deafening at times, but a great opportunity for students to visit with each other and also interact with professionals who can provide valuable ideas and advice for future education and employment. All of us who viewed the poster segment and attended oral presentations look forward to even a greater number of participants next year, and I hope to possibly see students compete in the high school division. Winners received a certificate and a monetary gift when a short paper is published in the IBASM newsletter.

2012 IBASM Award Recipients

This spring the IBASM recognized two of its members with an IBASM award.

Dr. Kathleen Dannelly from Indiana State University in Terre Haute is this year's recipient of the Academic Teaching Award. Dr. Dannelly is an Associate Professor for micrcobiology who teaches undergraduate and graduate courses at ISU. A group of nine ISU students had nominated Dr. Dannelly for the award. PhD candidate Anupama Ramalinga who wrote the nomination letter and also introduced Dr. Dannelly at the IBASM Annual Spring Meeting at Wabash College described her as a "first-class teacher who inspires students in every aspect of the educational experience". Ms. Ramalinga also praised Dr. Dannelly for the research mentorship and academic counseling she provides to all of her students.

The 2012 recipient of the Powell Award for Outstanding Service went to Dr. Shivi Selvaratnam for her continued dedication to the branch as the editor of the IBASM newsletter. Dr. Selvaratnam is a Technical Environmental Specialist in the Office of Water Quality at the Indiana Department of Environmental Management. She is a longtime member of the IBASM, who has served the branch as an editor and member of the executive committee for more than a decade.

Dr. Shivi Selvaratnam accepting the H.M. Powell Award for Outstanding Service to IBASM from outgoing Branch President, **Dr. Jennifer Metzler** at the May Planning Meeting.

IBASM Academic Teaching Award

Do you have a great professor who deserves a teaching award? We call on all student IBASM members to nominate their favorite lecturer/instructor for the IBASM Academic Teaching Award 2013. Your nomination letter should explain why you think your teacher deserves the award. Please provide as many details as possible. Also, your letter will carry more weight if you can get some of your peers to co-sign it.

The IBASM Awards Committee consisting of Dominique M Galli (IU School of Dentistry), John McKillip (Ball State University), and Doug Stemke (University of Indianapolis) will select the awardee based on your letter and additional information obtained from the nominee's departmental chair. The award will be presented at the IBASM Annual Spring Meeting in 2013 where the awardee will be expected to give an oral presentation. Note, that the awardee must be a member of the IBASM at the time the award is received. Please send your nominations to dgalli@iupui.edu on or before November 1, 2012.

McClung First Place Graduate (Ph.D. Division) Winner

Transcriptional Regulation in *Synechocystis* sp. PCC 6803 by Duplicated *hik31* Operons as Master Regulators of Central Metabolism

Sowmya Nagarajan* and Louis Sherman

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Introduction

Synechocystis is a unicellular, freshwater cyanobacterium and a model organism for production of renewable biofuels like bio-diesel, ethanol, hydrogen, and bio-plastics. This microbe has a genome of 3.57 Mb that consists of one circular chromosome and seven plasmids (1, 2). *Synechocystis* is metabolically diverse and grows in alternating light-dark cycles with or without glucose as an added carbon source (3). Biofuels research is currently a very relevant topic and cyanobacteria are considered the most promising alternative biofuel sources. Hence, regulatory proteins that enhance growth, metabolite production, or signaling are being explored.

Signal transduction systems in *Synechocystis* sp. PCC 6803 are important for sensing, responding and adapting to different environmental changes. These include the Two-Component System (2CS) proteins that are usually a Histidine kinase (Hik) that acts as an environmental sensor and a cognate Response regulator (Rre) with a DNA-binding module (4) that binds to and activates and/or represses targets. *Synechocystis* has 47 Hiks and 45 Rres that make up >2.5% of the genome (5). The signaling genes which interest us are 2 closely duplicated operons on the chromosome (C3: sll0788-sll0790) and on the plasmid psysX (P3: slr6039-slr6041). They each contain a Hik (*hik31*), an Rre and a Hypothetical protein (Hypo) in the same order (Figure 1). Although each pair of duplicated proteins is 95-98% identical, their upstream promoter regions have both common and different regions for coordinated and differential regulation.

These genes are interesting because they were highly expressed in several important growth and stress conditions impacting energy generation pathways and growth in the Wild Type (WT) and various mutants in microarray studies (6, 7). This is the first study of both regulatory genes with this arrangement in bacteria and plasmid-encoded genes in *Synechocystis*. The location of the duplicate on the plasmid may enable retention of both copies and reduce selective pressures so that their functions are conserved. The hypothetical protein in each cluster may bind to small metal ions like Fe^{2+}, Zn^{2+}, and Cl^- and then activate the corresponding Hik (8), making these operons three-component systems. Our overall goal is to determine the function of both sets of these genes, their relationship to each other, as well as their impact on central metabolism and industrial relevance. Our overall hypothesis is that the two copies are not redundant in function, yet share a regulatory relationship and control target genes in central metabolism.

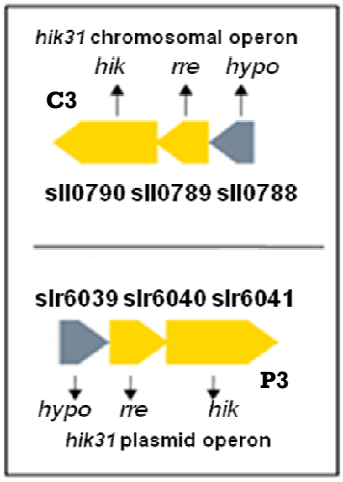

Fig.1 Duplicated genes

Experimental Methods

Six deletion mutants were made, deleting the chromosomal operon (Δ*C3*), the plasmid operon (Δ*P3*), both operons (Δ*C3P3*), the chromosomal *hik31* (Δ*hikC*), the plasmid *hik31* (Δ*hikP*), and both *hik*s (Δ*hikCP*). Many growth experiments in basic conditions of light, dark, carbon, air content, pH and metal stress conditions were performed. Measurements of doubling time and pigment content; ultrastructural analysis by electron microscopy; and RT-PCR and microarrays to analyze global gene transcription were carried out.

real-time Reverse Transcriptase Polymerase Chain Reaction (real-time RT-PCR): target mRNA for *hblC* and *nheA* genes.

Results & Discussion

Phenotypic analysis suggested that both operons are not redundant. Both Δ*C3* and Δ*P3* grew similarly in autotrophic (minimal media) continuous light and high CO_2 conditions, but showed differences in ten other growth conditions involving high light, dark, all conditions with glucose and low O_2. Δ*C3* grew better than the WT in the light in autotrophic conditions and in high CO_2 with glucose. Δ*P3* grew very poorly in light-dark cycles and continuous dark conditions both with and without glucose and stored carbon and nitrogen in intracellular inclusions. Both copies are involved in similar functions in the light but different ones in the dark. Δ*C3P3* did worse than Δ*C3* and Δ*P3* in the light, but intermediate to both in the dark with glucose. Both Δ*P3* and Δ*C3P3* cells were larger, had division defects and reduced glycogen reserves and pigment content. The growth data showed a regulatory role for both operons in high light, the chromosomal *hik* in high CO_2, and the plasmid operon in low O_2 conditions (9). Metal stress experiments indicated a role for both copies in mediating Ni, Zn and Cd tolerance

Model for function of C3 and P3: Figure 2 represents our model for the function of these genes. Both operons display both negative (C3) and positive (P3) control with each other and their targets. The chromosomal copy (C3) is involved in autotrophic growth with minimal media in the light (targets in carbon fixation, photosynthesis and energy metabolism). The plasmid copy (P3) is involved in heterotrophic growth with glucose in the dark (targets in carbon breakdown, respiration, and cell division). Both copies control shared targets in photosynthesis, glycolysis and metal transport. For the operon mutants, light and dark takes precedence over glucose and high CO_2, whereas for the *hik* mutants, light and dark takes precedence over high CO_2 and then glucose. This hierarchy is important in separating the functions of the operons from the *hiks*.

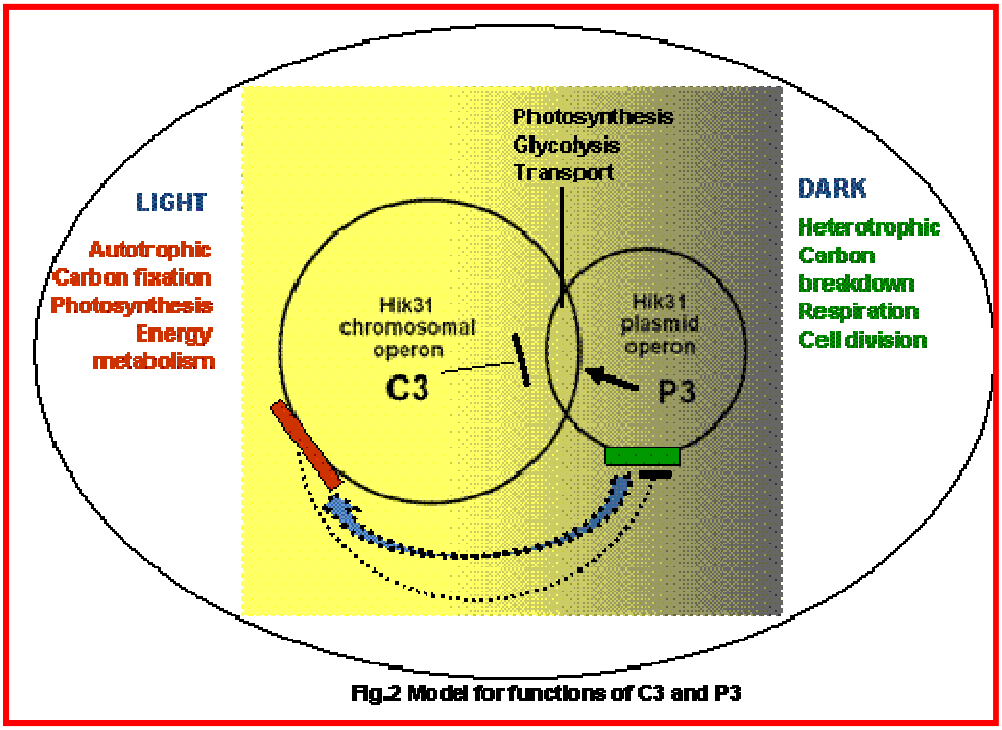

Fig.2 Model for functions of C3 and P3

Regulatory relationship between C3 and P3: RT-PCR results for gene expression showed that both copies of the 3 genes are temporally and differentially regulated in autotrophic (C3) and heterotrophic (P3) conditions in the light and the dark. C3 may down-regulate P3 in glucose conditions whereas P3 may up-regulate C3 in continuous light conditions. C3 was always expressed more abundantly than P3. We infer that C3 is the primarily expressed copy, and that P3 acts as a back-up to maintain appropriate gene dosages in high demand conditions. Both operons share an integrated regulatory relationship, are induced in high light, glucose and in active cell growth and down-regulated in high CO_2 (10). In addition, P3 is up-regulated in the dark. Figure 3 shows our current model for the regulatory relationship between both operons.

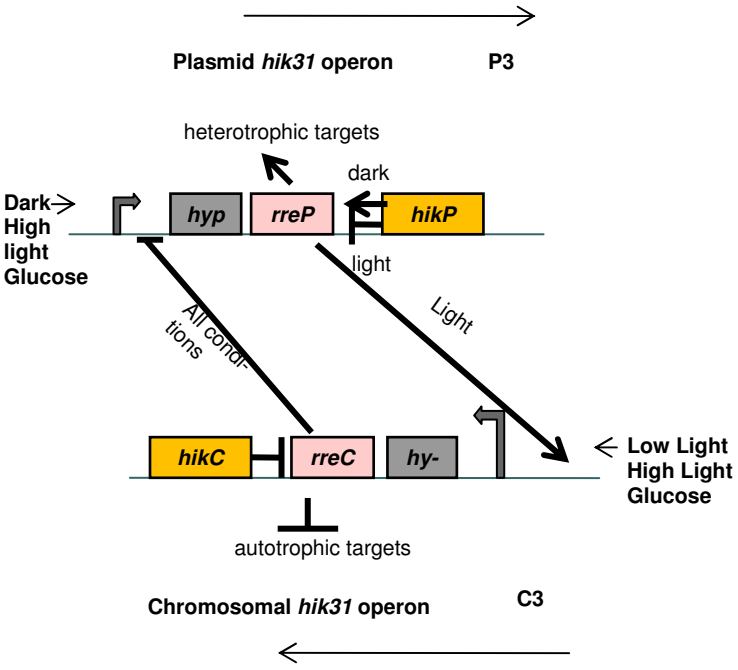

Fig.3 Regulatory relationship between C3 and P3

Microarray for P3 targets: Microarray analysis of the wild type (WT) and Δ*P3* after addition of glucose in a 12 hour light-12 hour dark growth cycle revealed significant impact on transcription in the mutant (FDR≤0.01, Fold-Change ≥1.5) and up to 45% of the genome was differentially expressed. Gene categories that were up-regulated included several transporters and chaperones, whereas genes involved in photosynthesis, respiration, glycolysis, chemotaxis and cell division were down-regulated. We believe that the plasmid copy is an important regulator that controls metabolism at night and influences cell division and chemotaxis

In conclusion, we consider the *hik31* operons to be master regulators that impact central metabolism with both primary (photosynthesis and carbon fixation) and secondary effects (carbohydrate breakdown and cell division) on target gene regulation. Our results reveal new connections between gene regulation in the diurnal cycle of this organism, carbon and nitrogen processing metabolic pathways and metal transport, and have implications for improved growth for biofuel production. Another microarray is underway for the WT and Δ*C3* in light-dark conditions with glucose as done for the WT and Δ*P3*. This will determine the specific targets of each individual operon, as well as the collective group of targets likely to be regulated by both operons, and this information will be valuable for the field of biofuels research.

References

1. Kaneko, T., and Tabata, S. (1997) *Plant Cell Physiol*. **38** (11), 1171-1176.
2. Kaneko, T., et al. (2003) *DNA Res*. **10**, 221-228.
3. Singh, A. K., and Sherman, L. A. (2005) *J. Bacteriol.* **187** (7), 2368-2376.
4. Stock, A. M., Robinson, V. L., and Goudreau, P. N. (2000) *Annu. Rev. Biochem*. **69**, 183-215.
5. Mizuno, T., Kaneko, T., and Tabata, S. (1996) *DNA Res* **3**, 407-414.
6. Singh, A. K., Li, H., Bono, L., and Sherman, L. A. (2005) *Photosynthesis Res*. **84**, 65- 70.
7. Kahlon, S., Beeri, K., Ohkawa, H., Hihara, Y., et al. (2006) *Microbiol.* **152**, 647–655.
8. http://www.pdb.org
9. Summerfield, T.C., Nagarajan, S. and Sherman, L.A. (2011) *Microbiol.* 157, 301-312.
10. Nagarajan, S., Sherman, D.M., Shaw, I., Sherman, L.A. (2012) *J.Bacteriol.* 194 (2) 448- 459.

Second Place (M.S. Division) Winner

Biogeochemistry of Microbial Biofilms in Devils Hole, Nevada

Hilary L. Madinger, Melody J. Bernot, Kevin P. Wilson, and Jeffrey A. Goldstein
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Death Valley National Park, Pahrump, NV

Abstract

Microbial biofilms, which likely have spatially and temporally variable biogeochemistry, provide basal resources and habitat for the endangered Devils Hole pupfish (*Cyprinodon diabolis)* in Devils Hole, Death Valley National Park, Nevada. We examined biofilm biogeochemistry using microelectrodes to measure concentration gradients of dissolved oxygen (DO), sulfide (H_2S), pH, and temperature (°C) in *Spirogyra*, filamentous cyanobacteria, and *Beggiatoa* microbial biofilms. Maximum DO concentrations varied temporally in *Spirogyra*, ranging from 12.2 mg O_2/L during indirect light exposure to 36.7 mg O_2/L with direct light exposure. In *Beggiatoa*, DO was below 8.2 mg O_2/L regardless of light exposure. Sulfide concentrations were highest in anoxic *Beggiatoa* microbial biofilms (maximum = 63.9 mg H_2S/L). Microbial biofilm temperature was influenced by both light exposure and microbial biofilm type; whereas, microbial biofilm pH differed only among microbial biofilm types. These data suggest that changes in microbial biofilms may alter DO and H_2S dynamics in the Devils Hole ecosystem.

Introduction

Formed in Paleozoic times, Devils Hole is a limnocrene in southern Nevada (Riggs *et al.* 2002). The physiochemical characteristics of Devils Hole include water temperature which consistently averages 33.5 ± 0.01°C and low dissolved oxygen (DO) concentrations (3.6 ± 0.2 mg O_2/L) (Gustafson and Deacon 1998; Wilson and Blinn 2007). Consistent with other thermal environments, Devils Hole is characterized by low organismal diversity (Naiman 1976). Specifically, 77 bacteria and algal species have been identified representing cyanobacteria, diatoms, and green algae; however, only about 12 species are abundant at any one time (Shepard et al. 2000). Microbes and invertebrates in Devils Hole have an annual population cycle characterized by higher abundance in summer and lower abundance in winter (Minckley and Deacon 1975). This causes decreased food availability in winter for the only vertebrate present in Devils Hole - *Cyprinodon diabolis*, the endangered Devils Hole pupfish (Riggs and Deacon 2002).

Microbial biofilms are critical to all aquatic ecosystems because they are the energy base for ecosystem food webs (Shepard et al. 2000). Thus, they are involved in fundamental ecosystem processes including nutrient cycling and energy flow (Murdock and Wetzel 2009). While allochthonous carbon is also added to the ecosystem via terrestrial litterfall, microbial biofilms are the dominate source of carbon in Devils Hole and contribute carbon to the ecosystem via autotrophic and chemoautotrophic production, particularly in the summer (Wilson and Blinn 2007). Differences in the microbial biofilm types present arise from differing light limitations, grazing, and nutrient availability (Fairchild et al.1985; Biggs 1994; Barranguet et al. 2005).

Because benthic microbial biofilms have limited water flux on the interior of the film, steep chemical gradients form, which are best measured using microelectrodes. A wide variety of parameters can be measured with microelectrodes including microbial biofilm dissolved oxygen (DO), sulfide (H_2S), pH, and temperature (°C). These measurements can be used to identify microbial biofilm characteristics such as nutrient assimilation and metabolic rates (de Beer et al. 2006; Arnon et al. 2007).

Study Objectives

The objective of this research was to enhance our understanding of microbial biofilms in the unique habitat of Devils Hole. We addressed two primary research questions:

How do dissolved oxygen and sulfide concentrations vary spatially within Devils Hole microbial biofilms? We hypothesized that DO would be highest in *Spirogyra* and lowest in *Beggiatoa* because *Spirogyra* is dependent on direct light and *Beggiatoa* is not phototrophic. H_2S concentrations were hypothesized to be highest in *Beggiatoa* because it is a sulfur oxidizing bacteria.

How do dissolved oxygen and sulfide concentrations vary with light exposure in Devils Hole microbial biofilms? We hypothesized that DO would be higher during direct light due to increased photosynthesis. H_2S concentrations were hypothesized to be higher during indirect light due to anoxic conditions within the biofilms.

Materials & Methods

Devils Hole has a 5.6 x 2.6 m shallow shelf (0.00 – 0.75 m deep) which receives ~5 h direct light in July and no direct light in December - January (Wilson and Blinn 2007). Microbial biofilm chemical gradients were measured in August, October, and December 2011. Chemical profiles of DO, H_2S, pH, and temperature were measured using Clark-type microelectrodes (Unisense) in three microbial biofilm types (*Spirogyra*, filamentous cyanobacteria, and *Beggiatoa*) during direct light exposure (August and October) and indirect light exposure (August, October, and December). Differences in microbial biofilm biogeochemistry during direct and indirect light were assessed using t-tests within each microbial biofilm type. Interactions between light exposure and microbial biofilm type, as well as microbial biofilm type and sample date, were analyzed with a two-way ANOVA followed by Tukey's HSD multiple comparison tests on significant effects.

Results

Spirogyra was most abundant in August. No *Spirogyra* was present in December. Filamentous cyanobacteria and *Beggiatoa* were present at each sampling event. *Beggiatoa* microbial biofilm abundance and location changed daily.

Mean biofilm temperature was influenced by both light exposure and biofilm type with a statistical interaction between these main effects ($p > 0.001$) (Fig. 1). The mean temperature was 30.6°C in *Spirogyra*, 31.6°C in filamentous cyanobacteria, and 30.9°C in *Beggiatoa*. The maximum temperature was 33.0°C during direct light in *Spirogyra* and the minimum was 29.2°C during indirect light in *Beggiatoa*. Mean pH differed significantly by microbial biofilm type ($p = 0.036$). Mean pH was 7.79 in *Spirogyra*, 7.68 in filamentous cyanobacteria, and 7.92 in *Beggiatoa*. The maximum pH measured was 10.05 during indirect light in *Beggiatoa*. Minimum pH measured was 6.95 during direct light in filamentous cyanobacteria.

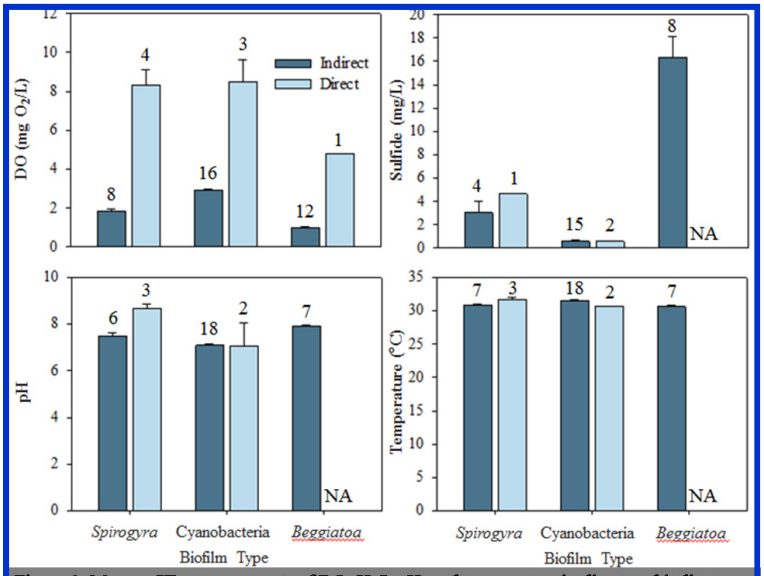

Figure 1. Mean ± SE measurements of DO, H_2S, pH, and temperature in direct and indirect light by biofilm type across sample dates. Number of replicates indicated above each bar, NA signifies no measurement.

Mean DO differed significantly with light exposure ($p < 0.001$) and microbial biofilm type ($p < 0.01$) but there was no interaction among these factors. Maximum DO in *Spirogyra* varied by light exposure, ranging from 12.2 mg O_2/L during indirect light to 36.7 mg O_2/L during direct light ($p < 0.01$). In *Beggiatoa*, DO was below 8.2 mg O_2/L regardless of light exposure.

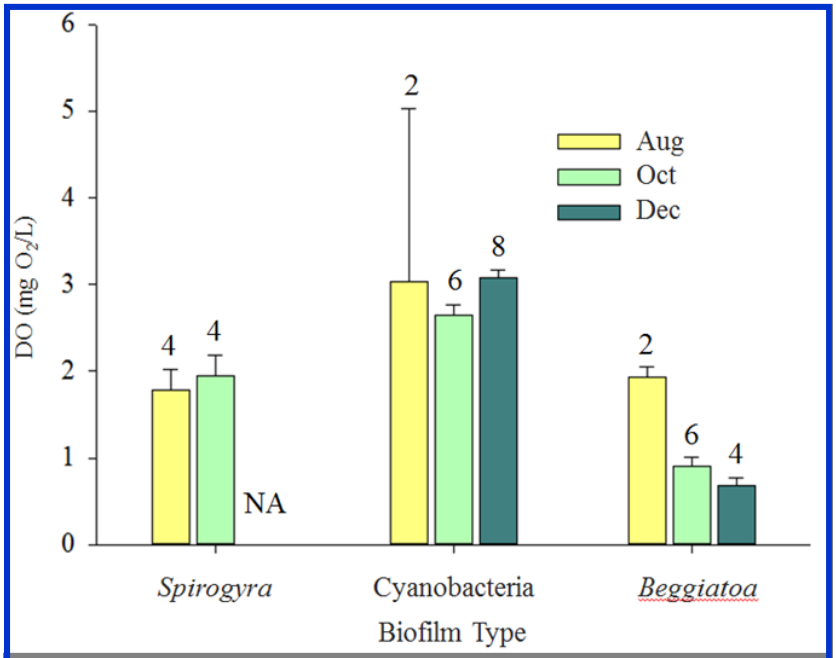

Figure 2. Mean ± SE DO within three biofilms during indirect light across three sampling dates. Number of replicates indicated above each bar, NA signifies no measurement.

Indirect light measurements indicated DO concentrations vary among biofilm types (Fig. 2). Filamentous cyanobacteria had 53% higher DO during indirect light than *Spirogyra* or *Beggiatoa* ($p < 0.001$). However, the mean DO of *Beggiatoa* biofilms decreased at each sampling event and the mean DO range of *Beggiatoa* (1.2 mg O_2/L) across the three sampling events was three times larger than filamentous cyanobacteria and seven times larger than *Spirogyra*.

Anoxic *Beggiatoa* produced maximum H_2S concentrations of 63.9 mg H_2S/L. The maximum H_2S in non-*Beggiatoa* microbial biofilms was 24.2 mg H_2S/L. Mean H_2S concentration varied significantly by microbial biofilm type ($p < 0.001$) but not light exposure ($p > 0.1$).

Discussion

The spatial variation of chemical gradients in Devils Hole microbial biofilms was consistent with our hypotheses. Microbial biofilm DO varied with microbial biofilm type and light exposure. Specifically, DO was highest in photosynthesizing *Spirogyra* and lowest in sulfur oxidizing *Beggiatoa*. Additionally, DO was higher in all microbial biofilms during direct light as compared to indirect light. Supporting the second hypothesis, the H_2S chemical gradients in Devils Hole were attributed to *Beggiatoa* abundance.

Spatial and temporal variation in microbial biofilm chemical gradients characterizes this unique desert ecosystem. Further, these gradients may shift in response to changes in microbial biofilm abundance. Due to differences in DO and H_2S concentrations in the three primary microbial biofilms types found in Devils Hole, changes in each microbial biofilm abundance could influence the ecosystem DO and H_2S concentrations.

Changes in the chemical gradients of Devils Hole microbial biofilms may influence the egg survivorship, juvenile recruitment, and metabolism of *C. diabolis*. H_2S has been shown to cause significant mortality to the amphipod *Rhepoxynius abronius* in estuaries and marine environments at concentrations of 1.47 mg/L (Knezovich et al. 1996). High H_2S concentrations in *Beggiatoa* may influence the growth of Devils Hole invertebrates and possibly *C. diabolis* eggs.

Understanding the changes in the spatial and temporal biogeochemistry of Devils Hole is critical for the management of native species in Devils Hole. Further research should address the production rates of microbial biofilms to understand the ecosystem dynamics of Devils Hole microbial biofilms.

Literature Cited

Arnon S, Gray KA, Packman AI. Biophysicochemiscal process coupling controls nitrate use by benthic biofilms. Limno Oceanogr 2007; 52: 1664-1671.

Barranguet C, Veuger B, Van Beusekom SAM, Marvan P, Sinke JJ, Admiraal W. Divergent composition of algal-bacterial biofilms developing under various external factors. Eur J Phycol 2005; 40: 1-8.

Biggs BJF. Response of two trophic levels to patch enrichment along a New Zealand stream continuum. N Z J Mar Freshwat Res 1994; 28:119-134.

De Beer D, Sauter E, Niemann H, Kaul N, Foucher J-P, Witte U, Schlüter M, Boetius A. *In situ* fluxes and zonation of microbial activity in surface sediments of the Haakon Mosby Mud Volcano. Limnol Oceanogr 2006; 51: 1315-1331.

Gustafson MAS, Deacon JE. 1998. Distribution of Larval Devils Hole Pupfish Cyprinodon diabolis Wales, in relation to dissolved oxygen concentrations in Devil's Hole. Final report to the National Parks Service, Death Valley National Park, Death Valley, California 92328.

Fairchild GW, Lowe RL, Richardson WB. Algal periphyton growth on nutrient-diffusing substrates: an *in situ* bioassay. Ecology 1985; 66: 465-472.

Kemp MJ, Dodds WK. Centimeter-scale patterns in dissolved oxygen and nitrification rates in a prairie stream. J N Am Benthol Soc 2001; 20: 347-357.

Knezovich JP, Steichen DJ, Jelinski JA, Anderson SL. Sulfide tolerance of four marine species used to evaluate sediment and pore-water toxicity. Bull Environ Contam Toxicol 1996; 57: 450-457.

Minckley CO, Deacon JE. Foods of the Devil's Hole Pupfish, *Cyprinodon diabolis* (Cyprinodontidae). Southwest Nat 1975; 20: 105-111.

Murdock JN, Wetzel DL. FT-IR microscopy enhances biological and ecological analysis of algae. Appl Spectrosc Rev 2009; 44: 335-361.

Naiman RJ. Primary production, standing stock, and export of organic matter in a Mohave Desert thermal stream. Limnol Oceanogr 1976; 21: 60-73.

Riggs AC, Carr WJ, Kolesar PT, Hoffman RJ. Tectonic speleogenesis of Devils Hole, Nevada, and implications for hydrogeology and the development of long, continuous paleoenvironmental records. Quaternary Res 1994; 42: 241-254.

Riggs AC, Deacon JE. 2002. Connectivity in Desert Aquatic Ecosystems: the Devils Hole story. Spring-fed wetlands conference symposium. Desert Research Institute, Las Vegas, NV.

Shepard WD, Blinn DW, Hoffman RJ, Kantz P. Algae of Devils Hole, Nevada, Death Valley National Park. West N Am Naturalist 2000; 60: 410-419.

Wilson KP, Blinn DW. Food web structure, energetics, and importance of allochthonous carbon in a desert cavernous limnocrene: Devils Hole Nevada. West N Am Naturalist 2007; 67: 185-198.

Award papers from other winners will be published in the next issue of the newsletter.

Photos from the 2012 Annual Meeting

Hilary Madinger receiving her award from IBASM's Education Representative **Dr. Jim Mitchell**

Sowmya Nagarajan receiving her award from IBASM's Education Representative **Dr. Jim Mitchell**

Cullen Taylor receiving his award from IBASM's Education Representative **Dr. Jim Mitchell**

IBASM thanks Dr. John McKillip for his continued dedication as its photographer.

Highlights from the Journals of the ASM, July 2012 (from ASM Tipsheet)

UVC Light Kills Wound Bacteria

Ultraviolet (UVC) light can eradicate wound-infecting bacteria on mice increasing both survival and healing rates, according to a paper in the July 2012 issue of *Antimicrobial Agents and Chemotherapy*. The light did not damage the animals' skin or delay wound healing, says principal investigator Michael R. Hamblin, of the Massachusetts General Hospital, and the Harvard Medical School, Boston, MA.

Skin infections range from the superficial, to the life threatening, which are rare except among immunocompromised patients. However, "…these infections are becoming worrisome due to bacterial resistance to conventional antibiotics," the researchers write.

Unlike with antibiotics, bacteria probably cannot develop complete resistance to UVC light, "although it is possible that variants with enhanced DNA repair systems may emerge," the investigators note, adding that only four times more radiation would be needed to decimate *Deinococcus radiodurans*, a species that is famous for its radiation resistance, than in the case of *E. coli*.

In the study, the investigators infected the mice with bioluminescent strains of gram-negative *Pseudomonas aeruginosa*, and *Staphylococcus aureus*, the former "noted for its invasive properties in mouse wound models," according to the report. The dimming of the bioluminescence—down to near zero—indicated the fate of the infective bacteria. The mice were exposed to UVC light 30 minutes after inoculation.

For both bacteria UVC treatment reduced bacterial contamination of wounds by 10-fold compared to untreated mice. In addition, treatment increased the survival rate of mice infected with *P. aeruginosa* and the wound healing rate in mice infected with *S. aureus*.

"These results suggested that UVC light may be used for the prophylaxis of cutaneous wound infections," write the researchers.

(T. Dai, B. Garcia, C.K. Murray, M.S. Vrahas, and M.R. Hamblin, 2012. UVC light prophylaxis for cutaneous wound infections in mice. Antim. Agents Chemother. 56:3841-3848.)

Copper Surfaces Could Reduce Hospital Acquired Infections

Research from the Medical University of South Carolina suggests that adding copper to hospital surfaces which are commonly touched by medical personnel and patients could help reduce the risk of hospital-acquired infections. The findings appear in the July 2012 issue of the *Journal of Clinical Microbiology.*

Hospital-acquired infections kill around 100,000 people annually in the United States—equivalent to a wide-body jet crash every day of the year. About five percent of patients admitted to US hospitals—nearly 5,500 daily, or two million annually—get sick from the hospital, adding $45 billion ($45,000,000,000) to the annual cost of healthcare.

In this study, the microbial burden on commonly touched surfaces in the medical intensive care units of three hospitals was determined, first to assess the risk from those surfaces, and second, to determine whether or not copper surfacing would lower that burden, and those risks. The study was divided into two phases, pre- and post-copper, and lasted for 43 months.

During the pre-copper phase, "We learned that the average microbial burden found on six commonly touched objects was 28 times higher than levels considered benign, and thus represented a risk to the patient," says Michael Schmidt, a researcher on the study. Installing copper surfaces, he says, resulted in an 83 percent reduction of that microbial burden, leading the team to conclude that copper surfaces on commonly touched objects could provide a substantially safer environment.

"Given that the average hospital acquired infection in the United States conservatively adds an additional 19 days of hospitalization and $43,000 in costs the use of antimicrobial copper surfaces warrants further study and optimization," says Schmidt, adding that this is the fourth leading cause of death, after cancer, heart disease, and strokes. He notes that "Copper has been used by humans for millennia, first as tools and then as a tool to fight the spread of infectious agents."

(M.G. Schmidt, H.H. Attaway, P.A. Sharpe, J. John, Jr., K.A. Sepkowitz, A. Morgan, S.E. Fairey, S. Singh, L.L. Steed, J.R. Cantey, K.D. Freeman, H.T. Michels, and C.D. Salgado, 2012. Sustained reduction of microbial burden on common hospital surfaces through induction of copper. J. Clin. Microbiol. 50:2217-2223.)

MICROBIOLOGY IN THE NEWS

(from: http://www.eurekalert.org/bysubject/index.php?kw=33)

Sake, soy sauce, and the taming of the microbes

Current Biology

July 12, 2012

We all know that humans have domesticated plants and animals for our sustenance and enjoyment, but we've tamed various microbes as well. Now researchers reporting online on July 12 in Current Biology, a Cell Press publication, show that the mark of that domestication on microbes, and specifically on the mold used for thousands of years to brew sake and soy sauce from rice and soybeans, looks rather unique.

http://www.eurekalert.org/pub_releases/2012-07/cp-sss070812.php

A deeper look into the pathogen responsible for crown gall disease in plants

Journal of Biological Chemistry

July 11, 2012

This "Paper of the Week" by Wai Mun Huang and colleagues at the University of Utah Health Sciences Center and the University of Minnesota reveals new insights into the molecular properties of the rod-shaped soil bacterium *Agrobacterium tumefaciens*, the pathogen responsible for crown gall disease, a tumor-forming infection in plants, such as tomatoes, walnuts, grapes and beets.

http://www.eurekalert.org/pub_releases/2012-07/asfb-adl071012.php

Programmable DNA scissors found for bacterial immune system

Science

June 28, 2012

An international team of researchers has discovered a programmable RNA complex in the bacterial immune system that guides the cleaving of DNA at targeted sites. This discovery opens a new door to genome editing with implications for the green chemistry microbial-based production of advanced biofuels, therapeutic drugs and other valuable chemical products.

http://www.eurekalert.org/pub_releases/2012-06/dbnl-pds062812.php

Important Dates

February 2013:	Registration form due for Annual IBASM meeting
March 2013:	Abstract form due for Annual IBASM meeting
April 12-13, 2013:	Annual IBASM meeting at McCormick's Creek State Park
May 18-21, 2013:	113th Annual Meeting of the ASM, Denver, CO

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