

DIVERSITY IN ASTROBIOLOGY: SURVIVING FINANCIAL, INSTITUTIONAL AND TECHNICAL EXTREMES. Donald K. Walter¹,¹South Carolina State University, 300 College St., Orangeburg, SC 29115; dkw@physics.scsu.edu.

Introduction: We discuss the development of an astrobiology program at an undergraduate institution, South Carolina State University (SCSU), a Historically Black College/University (HBCU) in a rural setting. Included are successes and barriers encountered over the past seven years to developing curriculum, research and outreach programs.

Background: SCSU is an HBCU located in the rural community of Orangeburg, South Carolina. Out of a student body of 4,500, approximately 3,900 are undergraduates, and 95% of them are African-Americans. While SCSU offers B.S. degrees in biology, chemistry, physics and other STEM fields, no related graduate programs are currently available.

The University has developed a small but active astronomy program over the past 15 years, which has lead to involvement in the field of astrobiology. SCSU participated in an organizing meeting at the Goddard Space Flight Center in 2002 that was hosted by the NASA MU-SPIN project and Tennessee State University (TSU). From that meeting came the development of the Minority Institute Astrobiology Collaborative (MIAC) with SCSU joining as a charter member. Since that time SCSU has attempted to develop a program in astrobiology with some success, but has recently encountered numerous financial, institutional and technical barriers to further development.

College Curriculum Development: Prior to joining MIAC, there was no astrobiology-related coursework on the campus of SCSU. The author and others submitted a successful proposal under the NASA MUCERPI 2003 program that provided funding to enhance space science and develop new astrobiology coursework at the school.

Support from the MUCERPI award led to the development of an astronomy minor for non-physics majors and an astronomy option (concentration) within the physics B.S. degree. Existing courses in astronomy and earth science for non-science majors were enhanced. Three new, upper level courses were approved by the University in astrophysics, astrobiology and scientific image analysis respectively.

Currently a total of three of the twenty physics majors are enrolled in the astronomy option under the physics B.S. degree; however, none of them are participating in astrobiology related activities, largely because of the barriers to faculty research in this field (see below). Limited attempts to interest biology and chemistry majors in astrobiology and possibly an as-

tronomy minor have been largely unsuccessful. This is due in part to the lack of involvement by SCSU biology and chemistry faculty in astrobiology.

Research: The multidisciplinary nature of astrobiology lends itself to collaborations among biologists, chemists and astronomers as well as others. SCSU has a molecular biologist with research experience that includes the study of microorganisms in toxic waste dumps which could easily be extended to extremophile studies in astrobiology. However, this faculty member has chosen to pursue cancer-related research. A chemist at SCSU expressed an interest in branching out into the field of astrobiology, but lack of funds prevented him from pursuing his interest. Since that time he has become fully funded in another research area and does not have time to participate in astrobiology related work even if funds become available.

The author is an astronomer who spent two summers (2004 and 2007) working with Michael Mumma and his team at the Goddard Center for Astrobiology (GCA). The later experience was funded by the NASA Astrobiology Institute Minority Institution Research Support (NAI-MIRS) Summer Sabbatical program. During 2007, the author and GCA members designed a program of cometary study that would allow SCSU's experience in optical astronomy to complement the infrared (IR) work at GCA.

The science goals of this work will address some of the outstanding questions about comets through optical narrowband imaging and through a multiwavelength approach in collaboration with the IR spectroscopic work underway at GCA. The 1.3 meter telescope at Kitt Peak National Observatory, known as the Robotically Controlled Telescope (RCT), is managed by a consortium of institutions that includes SCSU as discussed in Gelderman et. al. [1], [2]. Guaranteed access to this facility will allow unprecedented temporal coverage of comets during pre and post-perihelion passage.

SCSU and GCA have contributed funds to purchase a set of narrowband filters centered on select emission bands and adjacent continuum regions in the spectra of comets. The RCT filter set is listed below and is a subset of the Hale-Bopp set described by Farnham, Schleicher & A'Hearn [3]. Recently the RCT has experienced a number of technical problems and is under repair, preventing the filter set from being tested outside of the laboratory. Once the RCT is ready, SCSU will be able to move ahead and finally

participate in astrobiology related research with collaborators at GCA.

RCT Filter Set:

Species	Central Wave-length (Å)	FWHM (Å)
OH (0-0)	3090	62
UV Continuum	3448	84
CN ($\Delta v = 0$)	3870	62
C3 (Swings System)	4062	62
Blue Continuum	4450	67
C2 ($\Delta v = 0$)	5141	118
Green Continuum	5260	56
NH2 Continuum	5660	20
NH2 (0,10,0)	5720	100

Outreach: SCSU has participated in a number of K-12 and general public outreach activities in the past. These have included holding workshops for middle and high school teachers using NASA astrobiology curriculum materials as well as school and public talks on the subject. SCSU's involvement in outreach has declined significantly in recent years because of the lack of funding. Currently, it is collaborating with TSU in providing science support to a local, South Carolina teacher who is implementing astrobiology materials developed under TSU's "Astrobiology in the Secondary Classroom Project: An interdisciplinary curriculum developed by a collaboration of scientists and educators from three different minority communities."



Barriers and the Future: Increasing diversity in astrobiology is a challenge at any institution without a previous history of involvement in the field. SCSU is an undergraduate institution, in this case meaning it has limited resources for research and does not have a graduate program in the STEM disciplines. Additionally, SCSU is an HBCU in a rural setting in a state that does not have extensive involvement in astrobiology.

Institutional barriers also include a faculty that concentrates its research efforts on the medical and industrial fields. The SCSU administration has developed its own plans for growth in enrollment and research in

fields largely related to energy and the environment. This in turn makes it unlikely that the school will support hiring new faculty in astrobiology related research, unless they have strong ties to environmental research.

Once the technical barrier of the RCT is resolved, SCSU can engage in cometary research. At least one faculty member will be involved as will several undergraduate students. Expansion in this area will be limited by funding.

References:

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- [2] Gelderman, R., Guinan, E., Howell, S., Mattox, J.R., McGruder, C.H., Walter, D.K., Davis, D.R., and Everett, M. (2003) *Bulletin of the American Astronomical Society*, 35, 766
- [3] Farnham, T.L., Schleicher, D.G. and A'Hearn, M. F. (2000) "The HB Narrowband Comet Filters: Standard Stars and Calibration" *Icarus*, 147, 180-204

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