Implementing a Bridge Retention Model for Students with Disabilities in STEM

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Alabama Alliance for Students with Disabilities in STEM (AASD-STEM)

- Funded by the National Science Foundation (NSF) Research in Disabilities Education (RDE) Division in 2009.

- Aim: To broaden the participation and achievement of persons with disabilities in science, technology, engineering and mathematics (STEM) and associated professional careers.

AASD-STEM Goals

Goal 1: Increase the Quality of Students with Disabilities Completing Associate and Baccalaureate Degrees in Science, Technology, Engineering, and Mathematics (STEM) Disciplines;

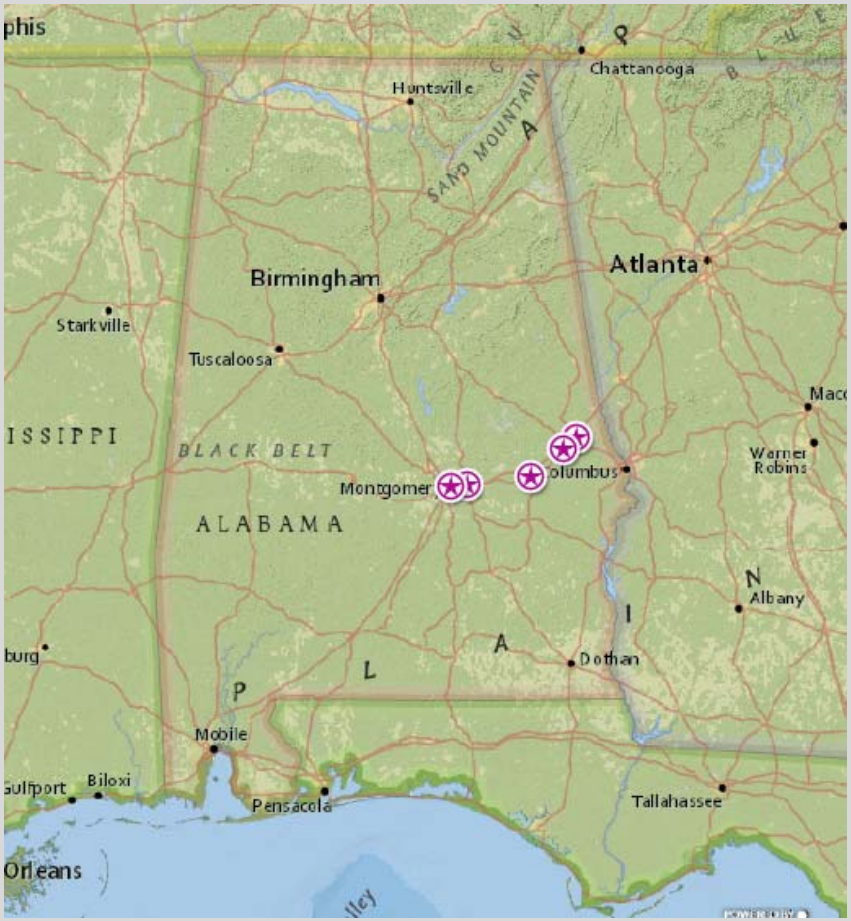
Goal 2: Increase the Number of Students with Disabilities Completing Associate and Baccalaureate Degrees in STEM Disciplines and entering STEM graduate degrees or STEM workforce;

Goal 3: Increase the Number of Students with Disabilities Completing Graduate Degrees in STEM Disciplines; and

Goal 4: Increase the number of high school students with disabilities going to college.

AASD-STEM Partner Institutions

- Auburn University
- Auburn University Montgomery
- Alabama State University
- Tuskegee University
- Southern Union State Community College
- Eight local public school districts in East/Central Alabama



AASD-STEM Bridges

Bridge to the Baccalaureate: Freshmen and Sophomores

Bridge to the Post-Baccalaureate: Juniors and Seniors

Graduate Bridge: Students pursuing Master's and Doctoral degrees

Evidence-Based Practices: Academic & Social Integration for Bridge Participants

- Mentoring/Tutoring
- Monthly Group Meetings
- Weekly Cluster Meetings
- Annual Conference
- Summer Research Internships
- Financial Support

Findings

Students have shown significant improvements in the following areas:

- Explaining their academic and social strengths and weaknesses
- Discussing challenges with other AASD-STEM students
- Establishing meaningful connections with faculty
- Establishing supportive peer relationships
- Knowledge and interest in STEM research and employment opportunities
- Academic self-efficacy and intention to persist in STEM

Outcomes

- Over 220 student participants to date
- 138 research presentations given by 81 students
- 121 completed Bachelor's degrees
- 68 summer research internships
- 49 academic awards/honors
- 17 completed graduate degrees (2 PhD; 15 MS)
- 4 student publications
- 1 patent

Impacts: Advocacy

- Increased self-advocacy knowledge and self-advocacy behavior frequency among participants
- More students using Campus Disability Services
- A meaningful community and support system for both academic and social issues

AUM Center for Disability Services

- AUM CDS serves approximately 200 students
- Disability categories served (in ranking order):
  - ADHD
  - Psychological
  - Medical/Health
  - Learning Disabilities
  - Mobility, hearing and vision impairments

Disability Support Services

- A variety of services are offered, but are not limited to:
  - Note taking
  - Test proctoring arrangements
  - Assistive technology equipment, lab and training services
  - Interpreter & captioning services
  - Lab and library assistance
  - Housing accommodations

Disability Support Services

- Service and emotional support animals
- Adaptive sports equipment
- Alternate formats
- Captioning videos
- Tactile models
- Documentation review for college entrance exams e.g. ACT Residual, MAT, GRE, PRAXIS
- Meal Plan Exemptions

AUM AASD-STEM

- Recruitment methods
- Monthly STEM meetings
- Summer research internships
- Management and data collection
- Student organization created
- AUM Undergraduate Research Symposium
- Collaboration with ASU

AUM & ASU Collaboration

Initial Studies in Protein Stability and Protein-Protein Interactions

Shelby Nunnelee1,2,3, Chris Palmer 2,3, and Dr Robert Villafane 2,4,
1 STEM Scholar (AUM); 2 AUM; 3 Program in Microbiology, Alabama State University; 4 PI

INTRODUCTION

Bacterial viruses (phages) such as *Salmonella* phage P22 (Fig 1) have long been used to model important cellular processes or interactions in part because standard molecular biology and biochemical techniques can also be used in this simple system. The last step in the assembly of Phage P22 is our model system for protein-protein interaction (see Fig 2, PPI). The addition of the tailspike protein (TSP) to the tail-less virus particle is our PPI model (Figs 2 & 3) . The formation of multisubunit proteins and signal pathways are just two examples of the essential nature of PPIs. Life could not exist without PPIs. Similarly, how does a trimeric protein, like the P22 TSP, keep itself trimeric so that it can interact with another protein surface. Our studies and results pertain to this latter question.

The P22 TSP consists of two domains. The first domain is the N-terminal domain, the first 110 amino acids (110aa) of the protein, and it takes the shape of a dome (Fig 4) . This domain is critical for our PPI by interacting with the viral particle structure (Fig 3). The second domain consists of the rest of the protein, aa111-666. Since the 3D structure of the P22 TSP is known, it is possible to do some "structure gazing". By using a molecular visualization program called Rasmol, it was possible to show that the first 23 amino acids in each of the three chains of the N-terminal domain was localized to the middle center of the dome. Since these structures begin at the dome top (amino acid 23) and go right through to the bottom of the dome, we have termed these as "stems". All amino acids in the stem, except aa23, are located in the dome interior.

RESULTS AND DISCUSSION

Further analysis of the P22 TSP stems have indicated that as these stems go down through the middle of the dome that they branch out and are actually located in the adjacent polypeptide chain. This datum can be seen in Fig 5 where the yellow stem from one chain is located in the adjacent chain. The aa1-13 are localized in the adjacent "wall" of the adjacent polypeptide chain. We suggest that these "crosslinks" between adjacent chains are the source of interactions that stabilize the domain structure. These crosslinks are expected to involve hydrophobic amino acids. Fig 6 shows one stem structure and indicates that four out of six of the amino acids which should interact with the adjacent chain (aa6-11) contain hydrophobic amino acids (A6, V8, V9, V10). All of these hydrophobic amino acids interact with other hydrophobic amino acids of the dome wall to form these hydrophobic interactions. We have transferred A6 and V9 to a plasmid containing the P22 tail gene. Our current efforts are aimed at obtaining other mutations in the tail gene and determining the stability of these mutant proteins through calorimetry and other biochemical studies.

We thank the NSF STEM Program at Auburn University at Montgomery (AUM) and Tamara Massey for support (SN) and the other members of the Villafane lab for their suggestions and help: Sam Johnson, Jeremie Williams and Aretha Williams of the Program in Microbiology at the Alabama State University.

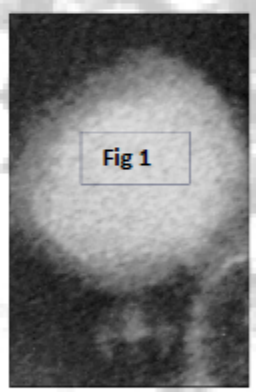


Fig 1

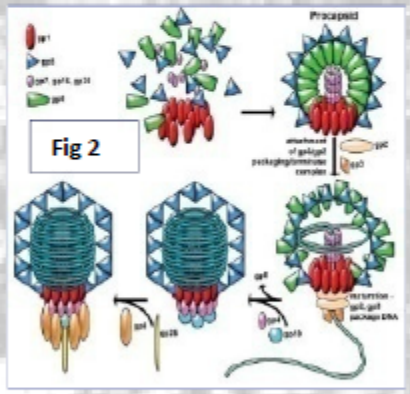


Fig 2

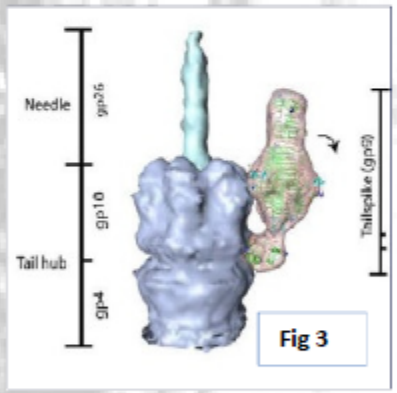


Fig 3

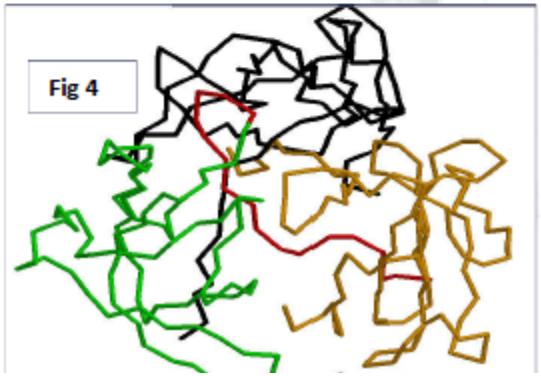


Fig 4

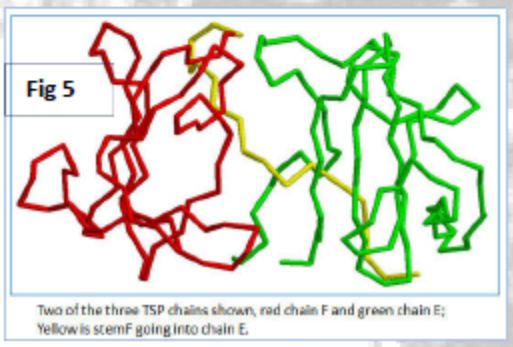


Fig 5

Two of the three TSP chains shown, red chain F and green chain E; Yellow is stemF going into chain E.

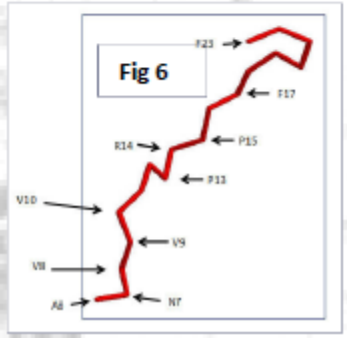


Fig 6

AASD-STEM Photos

Expanding the AASD-STEM Model

South East Alliance for Persons with Disabilities in STEM (SEAPD-STEM)

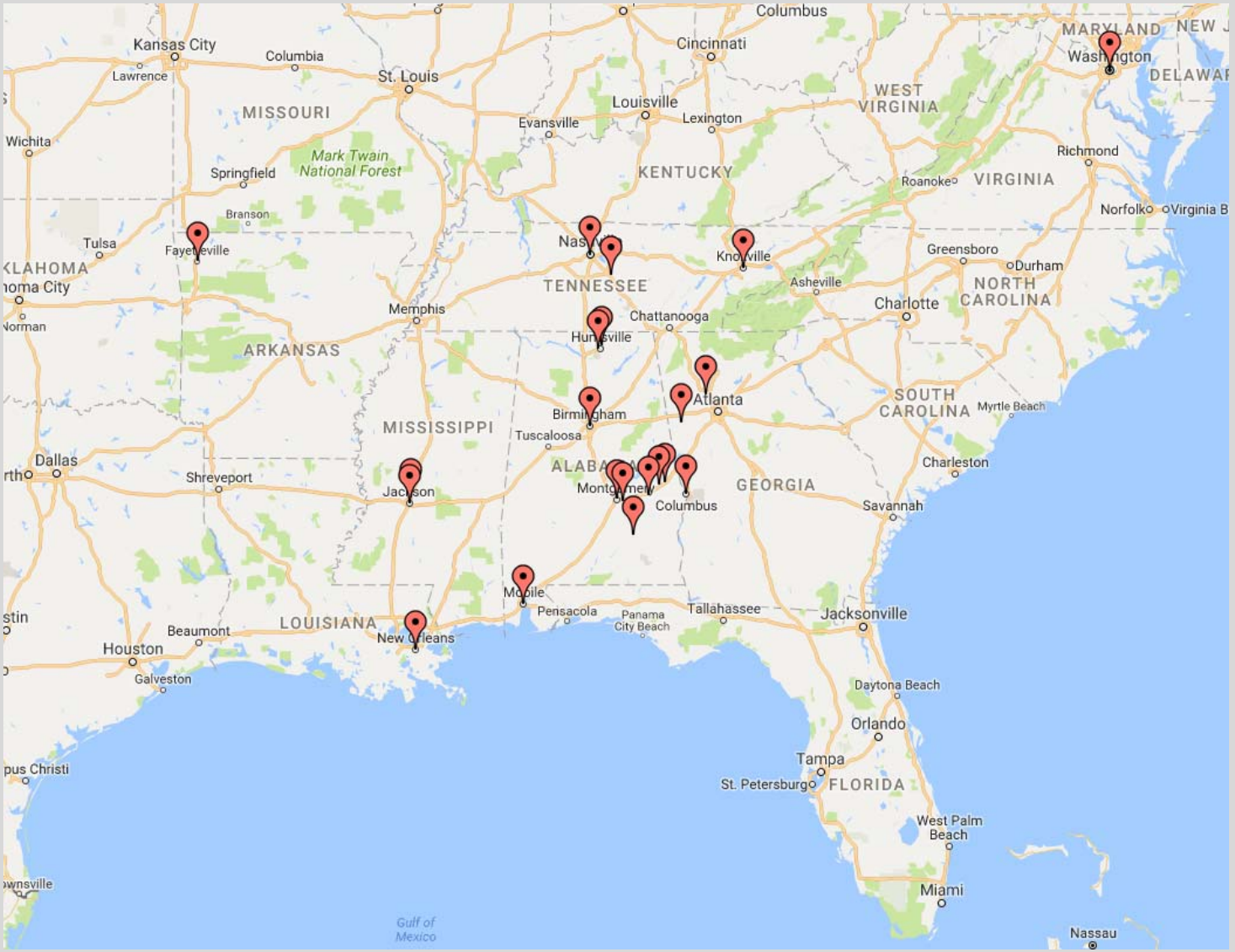
- Selected in 2016 by the National Science Foundation (NSF) as one of 37 alliances to receive funding for a pilot project under the NSF INCLUDES program

- 21 institutions in Alabama, Arkansas, Georgia, Louisiana, Mississippi, Tennessee, and Washington, D.C.

South East Alliance for Persons with Disabilities in STEM (SEAPD-STEM)

- Alabama A&M University
- Alabama State University
- Auburn University
- Auburn University Montgomery
- Bishop State Comm. College
- Southern Union St. Comm. College
- Troy University
- Tuskegee University
- Univ. of Alabama at Birmingham
- Univ. of Alabama in Huntsville
- University of Arkansas
- Columbus State University
- Kennesaw State University
- University of West Georgia
- Xavier University of Louisiana
- Jackson State University
- Tougaloo College
- Middle Tennessee State University
- Univ. of Tennessee Knoxville
- Vanderbilt University
- Gallaudet University

South East Alliance for Persons with Disabilities in STEM (SEAPD-STEM)



South East Alliance for Persons with Disabilities in STEM (SEAPD-STEM)

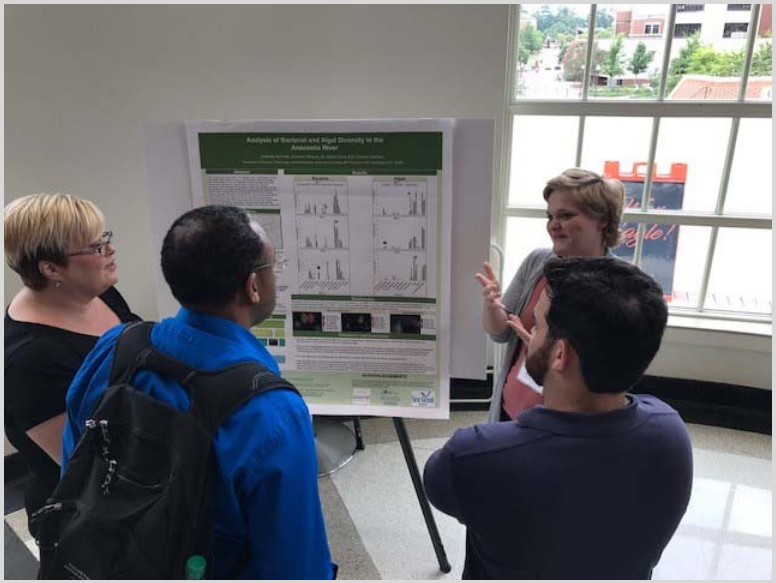
Goals are to ensure the success of persons with disabilities in STEM at all levels:

- Undergraduate students
- Graduate students
- Postdocs
- Junior faculty

South East Alliance for Persons with Disabilities in STEM (SEAPD-STEM)

- AASD-STEM Bridge activities are currently taking place at 8 pilot sites, including University of Tennessee Knoxville
- First SEAPD-STEM INCLUDES Annual Conference was held in August 2016 at Auburn University

SEAPD-STEM Photos



Thank you!

Questions/Discussion?