COLLEGE OF CHARLESTON
FACULTY RESEARCH AND DEVELOPMENT COMMITTEE
GRANT APPLICATION COVER SHEET

(Deadlines are 5:00 pm on the dates shown below. Submit the complete grant application electronically to the Chair of the Faculty R & D Committee. Submit the cover sheet signed and dated to the Dean of the Graduate School by the 5:00 pm deadline.)

_X_ First Round (10/01/10)_____ Second Round* (01/21/11) _____ Third Round (04/01/11)

NAME: Agnes Ayme-Southgate DEPARTMENT: Biology_____ PHONE:953-6544

PROPOSAL TITLE: Analysis of Projectin PEVK Isoforms And Biomechanics of Dragonfly Flight Muscles

*In which fiscal year will your project take place? X FY 10-11 ___FY 11-12

Which category of award do you seek? (Check one)

_X_____ Faculty Research Grant _____ Faculty Development Grant _____ Faculty Professional Support

Check all sub-categories that apply.

_____ Starter Grant (Check if the period of the grant is during your tenure-track appointment as a faculty member at the College of Charleston and your proposal meets the Starter Grant criteria.)

_____ Teacher-Scholar Grant (Check if your proposal meets the Teacher-Scholar Grant criteria..)

_____ Continuous Study Award (Check if your proposal meets the Continuous Study Award criteria.)

Total Amount requested? $ 3,200

Have you received Faculty R & D support for a funding period in the calendar year 2010?
(Yes/No) No (If yes, list the amounts and dates in the spaces below)

_____ _____ _____ _____ _____ _____

Do you expect to receive funds from any other source for this project?
(Yes/No) No (If yes, list the sources(s) and amount(s) of the funding below)

_____

Does the proposal involve research on human or vertebrate animal subjects? (Yes/No) ___No_____
(If yes, include a brief statement describing the status of the Institutional Review Board (IRB) and/or Institutional Animal Care and Use Committee (IACUC) application. Such an approval must be obtained before research and development funds can be released.)

SIGNATURE, Applicant Agnes Ayme-Southgate Date 9/28/10

Department Chair/Dean: Funds for successful proposals will be transferred into the departmental R & D account.

SIGNATURE, Department Chair/Dean _____ Date 9/28/10

RECEIVED
SEP 30 2010

SUMMARY

I am applying for a faculty research grant to perform a pilot study for a project in collaboration with Dr. Jim Marden at PennState University. The goal is to complete enough sample analysis by next Spring so as to have solid preliminary data to submit a grant proposal to NSF in July 2011 and have a good chance to be funded..

All living organisms have the uncanny ability to adapt to changes in their environment, and amongst individuals of a species some are better adapted for certain activities than others (I cannot run a marathon, but many humans can). In this context, my research has been focused on understanding at the molecular level the variation in flight physiology and mechanical performance among different insects.

The information used towards the cellular production of proteins is contained within genes, and is transferred to intermediate molecules, known as messenger RNAs (mRNAs). Special types of protein variations can be created at the mRNA level by cutting and pasting back together different parts of the original mRNA, a process known as alternative splicing. This allows the cell to make proteins that vary from each others in a small specific part of the protein while the majority of the protein stays the same; these are known as protein isoforms (a little bit like wearing the same suit, but changing the tie).

Muscle cells contain repeated units called sarcomeres that can individually contract and stretch, and it is the summation of the activity from all the sarcomeres of a muscle that allows for movement. The boundaries of each sarcomere are known as the Z bands, and short, relatively inextensible, connecting C-filaments link the Z-band to the myosin contractile filaments creating a rigid structure. The insect C-filaments contain two extremely large proteins, projectin and kettin/*Sls* and have been proposed to be responsible for the stiffness of flight muscles in several insects like fruitflies and waterbugs. The idea that particular isoforms of specific muscle proteins can confer differences in sarcomeric properties and muscle mechanics is strongly supported by many examples. Deciphering the correlation between protein isoforms, muscle stiffness and mechanical power is critical to our understanding of muscle performance in general, including in human cardiac muscle.

The contribution of projectin and kettin/*Sls* to the stiffness of the flight muscles in more basal insects like the dragonflies is unknown. This proposal initiates a project aimed at understanding the structure and function of projectin in dragonfly flight muscles. In this proposal we will look at the possibility of alternative splicing in the dragonfly projectin protein, and how differences in the amount of different isoforms correlates with flight parameters such as power output. Dr Marden can provide us with samples of dragonfly flight muscles for which they have established the mechanical data. We perform the molecular analysis to determine the presence and ratio of different projectin isoforms. We have already run this protocol for a few of the available samples, and the preliminary data are encouraging in that there seems to be a statistically significant correlation between isoforms distribution and power. However the degree of confidence for the fitness of the current data is too low to be publishable or even used in a grant proposal. The goal is to analyze more samples to be able to raise this degree of confidence so that we can submit an NSF proposal next July and have a good chance to be funded. If successful, we plan to carry the analysis to include more individuals, and look at different wild populations and ecological niches.

BUDGET

Enzymes and reagents for RT-PCR amplification	$1600
Amplified fragments analysis (AFLP). has to be performed by an outside company (Genewiz) as we do not have the equipment $5/ capillary gel run ~ 200 runs	$1,000
Miscellaneous items (tubes, chemicals etc)	$400
Fluorescent primers for AFLP	$200
Total	$3,200

Analysis of Projectin PEVK Isoforms and Biomechanics of Dragonfly Flight Muscles

The beautiful dragonfly, *Libellula pulchella (*Twelve-spotted Skimmer)

PROJECT DESCRIPTION

1) Insect muscles

All living organisms have the uncanny ability to adapt to changes in their environment, and amongst individuals of a species some are better adapted to certain activities than others. The biological understanding for such adaptation and fitness is still very much a "work in progress". In this context, my research has been focused on understanding at the molecular level the flight physiology of various insects. The performance of these muscles can be measured, for example as wing beat frequency or power output. The amount of force a muscle can develop depends on many factors, with muscle stiffness being one of them. The stiffness of the flight muscles was shown to be notably high in diverse insects such as the fruitfly *Drosophila melanogaster*, the waterbug (*Lethocerus indicus)*, the bumblebee (*Bombus terrestris)* and the dragonfly (Thorson and White, 1983; Peckham et al, 1990; 1992; Peckham and White, 1991). Sarcomeres, the functional units of muscle cells are compact in the flight muscles of these insects. Short, elastic connecting C-filaments link the myosin filaments to the Z-band working as a spring to create a rigid structure (Figure 1; reviewed in Trombitas, 2000; Bullard et al, 2002; 2005). There may therefore be a correlation between muscle stiffness and the presence and structure of the C-filaments. The two extremely large proteins of the C-filaments, projectin and kettin/*Sls* have been proposed to be responsible for the high stiffness of flight muscles in *D. melanogaster* and *L. indicus* (Moore et al, 1999; Vigoreaux et al, 2000; Bullard et al, 2000; 2005; Kulke et al, 2001; Burkart et al, 2007). However, the contribution of these two proteins to the stiffness of dragonfly flight muscles is unknown. This proposal focuses on structure and function of projectin in dragonfly flight muscles.

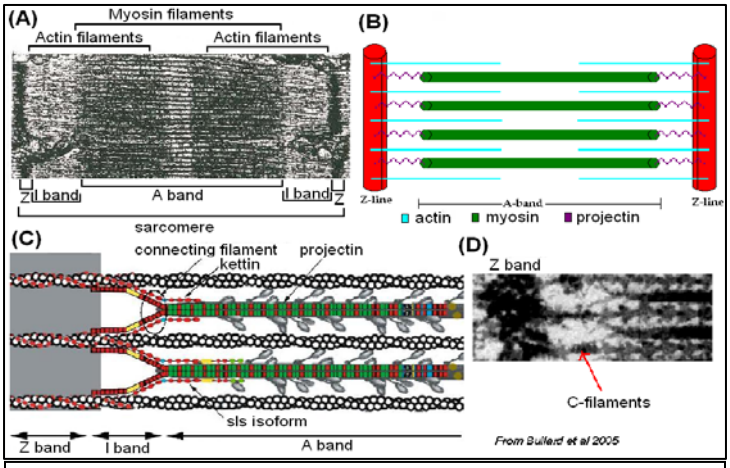


Figure 1: *A) EM image of the sarcomeric unit B) Corresponding diagram C) Proposed model for C-filament in D. melanogaster and D) EM image of C-filament.*

2) Projectin PEVK and elasticity

The projectin gene, initially described in *D. melanogaster* has now been fully characterized in seven other insects (Ayme-Southgate et al, 2008; Ayme-Southgate et al, manuscript in preparation). We also have partial analysis in progress in eight other

species, including the dragonfly, *Libellula pulchella*. The elastic "spring" region of the projectin protein has been proposed to reside within the PEVK domain so-named because of an elevated content in the four amino acids P (proline), E (glutamic acid), V (valine), and K (lysine) (Southgate and Ayme-Southgate, 2001; Southgate et al, 2008). PEVK domains with different sizes are created inside cells at the RNA level by cutting and pasting back together different parts of the original mRNA, a process known as alternative splicing. Our current splicing analysis reveals that the PEVK domain of the dragonfly *L. pulchella* is alternatively spliced, and in the flight muscles there is one major variant with four to five other less abundant alternative splice forms (Figure 2)

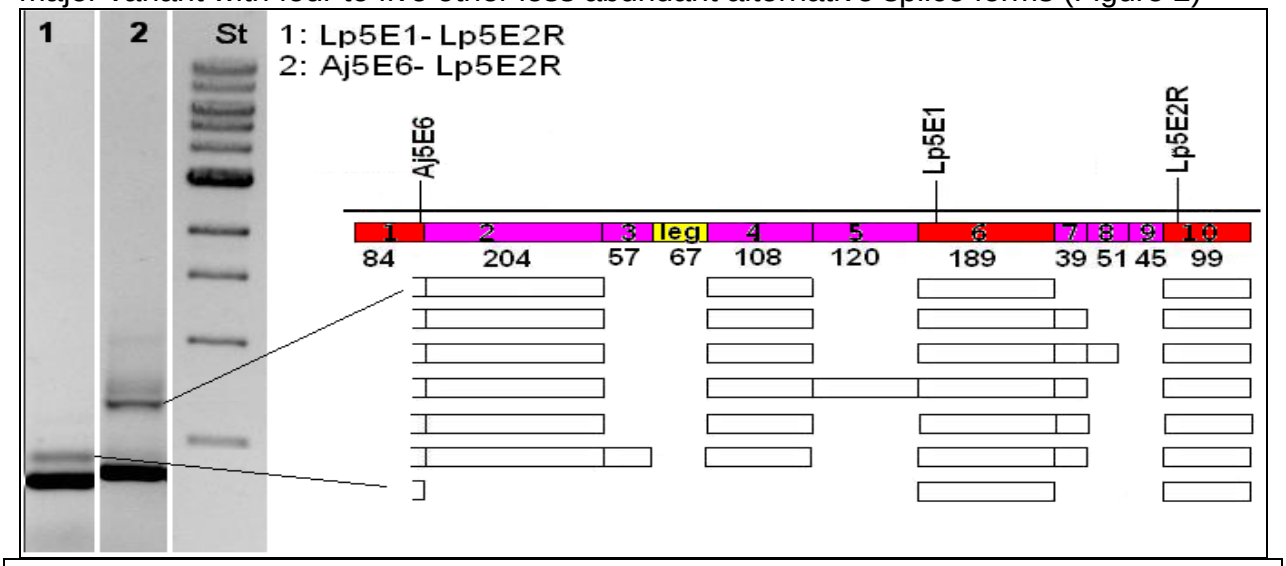


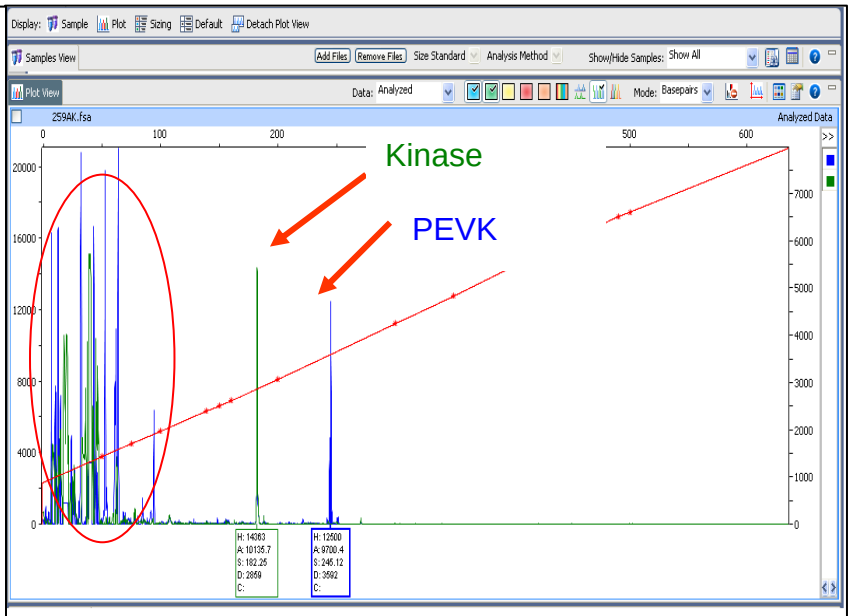
Figure 2: L. pulchella PEVK isoform analysis*. A) RNA from flight muscles was extracted and used in RT-PCR reactions with 2 primer combinations producing multiple splice variants. B) Diagram of the exon-intron and alternative splicing pattern resulting from this analysis, indicating the exon size in base pairs and the position of the primers.*

The idea that particular isoforms of specific muscle proteins can confer differences in sarcomeric properties and muscle mechanics is supported by many examples. The vertebrate elastic protein titin is considered the ortholog to insect projectin. In titin different sizes of its PEVK domain are related to different muscle stiffness, with the shortest isoforms leading to the highest stiffness in cardiac muscles (reviewed in Granzier and Labeit 2005). Similarly, Dr. Marden's laboratory at PennState University uses the basalar flight muscle of the dragonfly *Libellula pulchella* as a model system for studying the relationship between the muscle contractile performance and the mixture of two specific Troponin T isoforms, a protein involves in muscle excitation-contraction coupling (Marden et al., 1999; 2001; Fitzhugh and Marden, 1997; Schilder and Marden 2007).

If projectin is indeed responsible for part of the muscle stiffness, distinct projectin isoforms and different combinations of such splice variants could confer differences in muscle stiffness, ultimately affecting flight muscle performance. To this purpose, we have an ongoing collaboration with Dr. Marden who is providing us with samples of dragonfly flight muscles and help with the statistical analysis

3) Proposed experimental plan and preliminary data: Total RNA from *L. pulchella* flight muscles is extracted using a standard protocol (Ayme-Southgate et al, 2008). Specific DNA fragments representing alternate variants of the PEVK region are created using a molecular enzymatic protocol known as RT-PCR. Each PEVK fragment is labeled during the reactions with a fluorescent dye, and the amplified fragments are separated by capillary electrophoresis in an ABI sequencer using a protocol known as Amplified Fragment Length Polymorphism (AFLP). The machine provides a chromatogram for each sample where each peak corresponds to a distinct splice form and can be quantified according to the amount of fluorescence detected (Figure 3; GeneScan 2.1; Applied Biosystems). The AFLP protocol is performed by an outside company, Genewiz in New Jersey as we do not have the equipment. We receive the chromatograms on which we perform the analysis

Figure 3: chromatogram of raw data following AFLP. *Each sample from the RT-PCR reactions is run by capillary gel electrophoresis. We analyze the data using a peak-scanner software, GeneScan from ABI. This provides a chromatogram where the size of the fragment, as well as the height of the peak and the area under the peak can be calculated. the kinase fragment is used in all samples as an internal quantitative contol as this peak is expected to stay the same in all samples*



Dye/Sample Peak	Size	Height	Area in Point	Area in BP	Data Point	Begin Point	Begin BP	End Point	End BP
B, 123	244	4833	43389	3684	3582	3567	243.001	3584	244
G, 93	182	14363	115573	10135	2859	2839	180.493	2889	185

We use the peak heights from the GeneScan profiles to determine the relative quantity of each projectin alternative splice forms. The peak height for each fragment is normalized to the kinase fragment (another domain of the projectin protein) in that lane. To ensure that we are in the linear range for the detection sensitivity of the sequencer, multiple dilutions of each RNA sample are analyzed. To ensure reproducibility of the results, the best dilution for each RNA sample is used in at least two separate RT-PCR reactions and the results are averaged. Statistical analyses are performed to identify correlation between the ratio of projectin splice forms for each individual muscle sample and the corresponding mechanical data, such as work output, passive and active stiffness. We have performed this protocol for some of the available samples, and the preliminary data are encouraging in that there seems to be a significant correlation

(Figure 4). We however have only six data points, which is not sufficient for any publication or even a grant proposal.

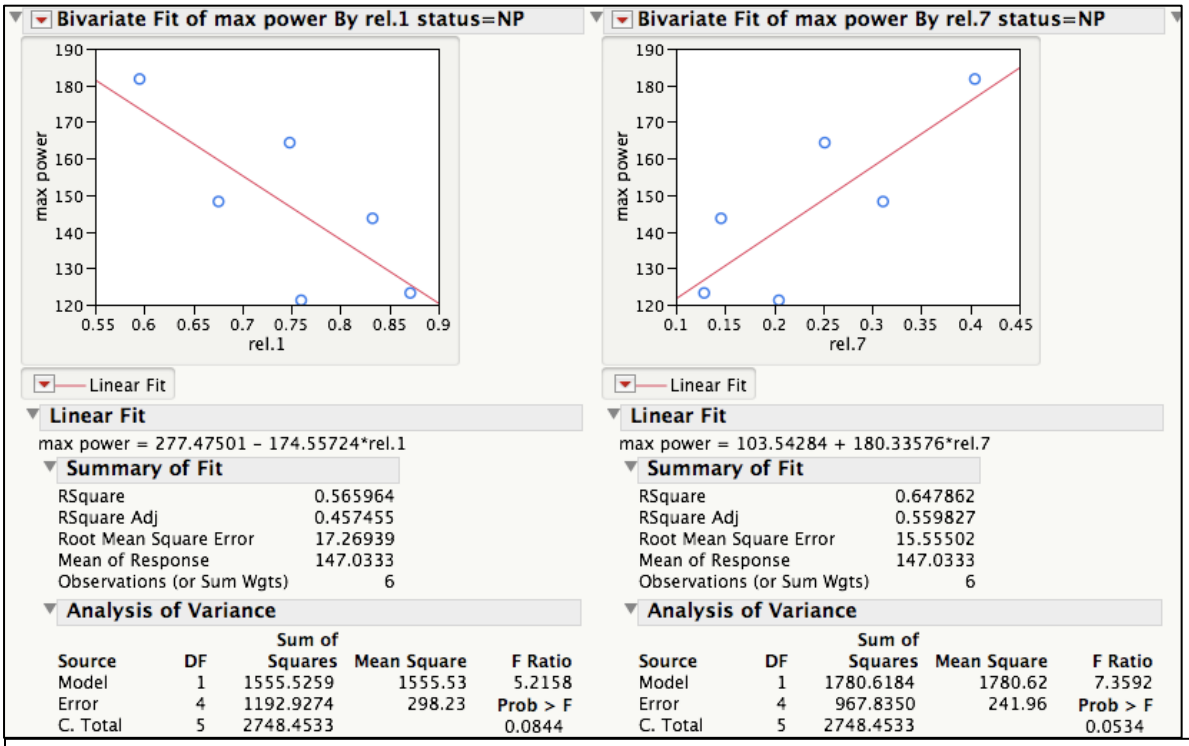


Figure 4: Bivariate statistical analysis between the relative amount of two PEVK isoforms and flight power output*. There is a negative correlation for the small PEVK isoform (rel1) and a positive correlation for the larger isoform (rel7)*

The goal for this proposal is to perform the above analysis on a larger number of samples to be able to raise this degree of confidence so that we can submit an NSF proposal next July and have a good chance to be funded. If successful, we want to carry the analysis to include more organisms, and look at different populations and ecological niches. As we also have information for the projectin protein in honeybee, I am also planning to start a similar line of investigation as a collaboration with Dr. Jason Vance, who is working on this organism and just joined the Biology department at the College.

4) Timetable

January: prepare RNA from frozen muscle samples (~ 50)
February- early April: Perform the RT-PCR amplification reactions and send for AFLP. We need to run at least 2 reactions for each sample and run 2 dilutions through the AFLP to ensure reproducibility and linear range.
April: GeneScan data compilation and statistical analysis with help from Dr. Marden's lab.
Prepare summary for grant proposal

AGNES AYME-SOUTHGATE

PROFESSIONAL PREPARATION

University of Geneva, Switzerland, Diploma in Biology (B.S.) 1980
University of Geneva, Certificate of Specialization in Molecular Biology 1981
University of Geneva, Ph.D. in Biology 1985
Massachusetts Institute of Technology, Postdoctoral Fellow, Biology, 1985 to 1992

APPOINTMENTS

2005-present: Associate Professor, Department of Biology, College of Charleston, Charleston, SC
1999-2005: Assistant Professor, Department of Biology, College of Charleston
1992-1999: Assistant Professor, Department of Biological Sciences Lehigh University, Bethlehem, PA

AWARDS

2006 Distinguished Faculty Advising Award (College of Charleston)
1987-1989 Muscular Dystrophy Association Postdoctoral Fellowship
1985-1986 Swiss National Foundation for Scientific Research Exchange Fellow

RESEARCH

My research interests are centered on understanding which differences in protein structure and composition underlie the various structural and physiological modes found in insect flight muscles, and how these properties has changed during insect evolution.

PUBLICATIONS

indicates undergraduate students

- Ayme-Southgate A, Southgate RJ, Philipp* RA, Sotka AA, and Kramp* C. (2008) The Myofibrillar Protein, Projectin, Is Highly Conserved Across Insect Evolution Except For Its PEVK Domain. *J. Mol. Evol.* **67**(6):653-69 DOI 10.1007/s00239-008-9177-2 (online prior to publication)
- Ayme-Southgate A, Saide J, Southgate R, Bounaix* C, Camarato A, Patel S and Wussler C.* (2006) In Indirect Flight Muscles *Drosophila* Projectin has a short PEVK domain, and its NH_2-terminus is embedded at the Z-band. *J. Muscle Cell Motility,* **26**, 467-477. e-pub: DOI 10.1007/s10974-005-9031-8
- Ayme-Southgate A and Southgate R. (2006) Projectin, the elastic protein of the C-filaments. In" *Nature's versatile Engine: Insect Flight Muscle Inside and Out*" Ed. Vigoreaux, J. Landes Bioscience Publishers. e-pub in 2004
- Ayme-Southgate A, Bounaix C*****, Riebe T.E and Southgate R. (2004) Assembly of the Giant Protein Projectin During Myofibrillogenesis In *Drosophila* Indirect Flight Muscles. *Bio Med Central Cell Biol.* **5:**17 (30 Apr 2004)
OPEN ACCESS: http://www.biomedcentral.com/1471-2121/5/17
- Southgate R and Ayme-Southgate A (2001) Alternative Splicing of an Amino-Terminal PEVK-like Region Generates Multiple Isoforms of Drosophila Projectin. *J. Mol. Biol.,* **313**,1035-1043

- Ayme-Southgate A, Southgate R and Kulp-McEliece M. (2000) Drosophila Projectin: A Look at Protein Structure and Sarcomeric Assembly. In "*Elastic Filaments of the Cell*". pp 251-263. Eds Granzier and Pollack. Kluwer Academic/Plenum Publishers
- Benian G.M., Ayme-Southgate A., Tinley, T.L. (1999) The Genetics and Molecular Biology of Titin/Connectin-like Proteins in Invertebrates. *Rev of Phys. Biochem. and Pharm*. **138**, 235-68 Springer-Verlag.
- Daley J, Southgate R and Ayme-Southgate A**.** (1998) Structure of the Drosophila Projectin Protein: Isoforms and Implications for Projectin Assembly. *J. Mol. Biol.* **279**, 201-210
- Ayme-Southgate A, Southgate R, Saide J, Benian G and Pardue M.L. (1995) Both synchronous and asynchronous muscle isoforms of projectin (the *Drosophila bent* locus product) contain functional kinase domains. *J. Cell Biol.* **128**, 393-403
- Bendena W.G, Ayme-Southgate A, Garbe J.C and Pardue M.L. (1991) Expression of Heat Shock Locus HSR-Omega in Non-Stressed Cells During Development in *Drosophila* melanogaster. *Dev. Biol*. **144**, 65-77
- Ayme-Southgate A; Vigoreaux J.O, Benian G and Pardue M.L. (1991) *Drosophila* Has A Twitchin/Titin-Related Gene That Appears To Encode Projectin. *Proc. Natl. Acad. Sci. USA* **88**, 7973-7977
- Ayme-Southgate A, Lasko P, French C. and Pardue M.L. (1989) Characterization of the Gene for mp20: a *Drosophila* Muscle Protein That Is Not Found in Asynchronous Oscillatory Flight Muscle. *J. Cell Biol*. **108**, 521-531
- Pauli D, Tonka C-H. and Ayme-Southgate A. (1988) An Unusual Split *Drosophila* Heat Shock Gene Expressed During Embryogenesis, Pupation and in Testis. *J. Mol. Biol*. **200,** 47-53
- Southgate R, Mirault M-E., Ayme A. and Tissieres A. (1985) Organization, Sequences and Induction of Heat Shock genes, in "Changes in Gene Expression in Response to Environmental Stress" (B. G. Atkinson and D.B.Walden eds) pp.3-30. Academic Press, NY.
- Ayme A, Southgate R and Tissieres A. (1985) Nucleotide Sequences Responsible for the Thermal Inducibility of the *Drosophila* Small Heat Shock Protein Genes in Monkey Cos Cells. *J. Mol. Biol*., **182**, 469-475
- Ayme A and Tissieres A. (1985) Locus 67B of *Drosophila* melanogaster Contains Seven, Not Four, Closely Related Heat Shock Genes. *EMBO J*., **4**, 2949-2954
- Southgate R, Ayme A and Voellmy R. (1983) Nucleotide Sequence Analysis of the *Drosophila* Small Heat Shock Cluster at Locus 67B. *J. Mol. Biol.* **165**, 35-57.

COLLABORATORS

Dr. Kuan Wang: Chief, Laboratory of Muscle Biology
National Institutes of Arthritis and Musculoskeletal and Skin Diseases
National Institutes of Health, Bethesda. Maryland. USA 20892

Dr. Jim Marden: Professor of Biology
Pennsylvania State University, College Park PA

GRANT SUPPORT

Proposal Title: Domain targeting of the insect protein projectin.
Funding agency: National Institute of Health, NIH-SC-INBRE program (Molecular Models and Chemical Approaches to Disease Processes)
Date: 8/01/2005- 7/31/2010
P.I. for the College of Charleston: Jim Deavor (previously Norine Noonan)
coP.I.: Agnes Ayme-Southgate, Christopher Korey, Elizabeth Meyer-Bernstein, Pamela Riggs-Gelasco, Justin Wyatt.
This grant provides mostly funds for teaching release, faculty summer salary, student stipends and acquisition of large equipments.

Proposal Title: Insect projectin: roles in sarcomere assembly and flight.
Funding agency: NIH-AREA, Grant #: 1 R15 AR053137-01
Date: 9/30/2005-8/31/2008
P.I. Agnes Ayme-Southgate
Total funding: $228,000

Proposal Title: Myofibrillogenesis in *Drosophila* and the Role of Projectin.
Funding agency: National Science Foundation, grant # MCB-9996318
Date: 3/1/1999- 5/31/2003
P.I.: Agnes Ayme-Southgate
Direct cost: $271,139
Total funding: $351,633

Proposal Title: Study of the protein interactions involved in sarcomeric assembly in *Drosophila melanogaster.*
Funding agency: South Carolina BRIN (FUTURE Program)
P.I.: Agnes Ayme-Southgate
Date: 5/16/2003- 5/15/2004
Direct cost: $8,000 no indirect costs allowed

Proposal Title: Molecular Genetics of *Drosophila* Projectin: A Third Filament Protein.
Funding agency: National Science Foundation, grant # MCB-9316975,
P.I.: Agnes Ayme-Southgate
Date: 3/1/94-8/31/98
Total funding: $ 360,000

Proposal Title: Myofibrillogenesis in *Drosophila* and the Role of Projectin.
Funding agency: National Inst. of Health, grant# 1-R15-ar43388-01,
P.I.: Agnes Ayme-Southgate
Date: 6/1/95-5/31/98
Total funding: $ 113,992

PRESENTATIONS (last 5 years only)

* undergraduate students in bold

2009 Agnes Ayme-Southgate and **Catherine Gumps**. Insect flight evolution, calcium cycling and calcium ATPase pump. Poster presentation National Drosophila Conference, Chicago, IL.

2009 Agnes J. Ayme-Southgate, Richard J. Southgate, **Drew Philipp**, and **Jeff Jankowski**. How do insects fly: bioinformatics analysis of projectin, a myofibrillar protein. Poster presentation National Drosophila Conference, Chicago, IL.

2009 **Cynthia Oliva** and Agnes Ayme-Southgate. Projectin and myofibril assembly in *Drosophila* flight muscles. Oral presentation, South Carolina Academy of Science Annual Meeting, Columbia, SC

2009 **Catherine Gumps** and Agnes Ayme-Southgate. Phylogenetic analysis of the insect calcium ATPase pump. Poster presentation, South Carolina Academy of Science Annual Meeting, Columbia, SC

2009 Agnes Ayme-Southgate and Richard Southgate. Bioinformatics of insect muscle proteomes: evolution and functional analysis. Oral presentation, South Carolina Academy of Science Annual Meeting, Columbia, SC

2008 Richard Southgate, **Drew Philipp**, and Agnes Ayme-Southgate. How do insects fly: bioinformatics analysis of projectin, a myofibrillar protein. Arthropod Genomics Symposium, Kansas City MO, April 2008

2008 **Drew Philipp**, Richard Southgate, and Agnes Ayme-Southgate. How do insects fly: bioinformatics analysis of projectin, a myofibrillar protein. South Carolina Academy of Science Annual Meeting, April 2008, Clemson, SC

2008 **George Miller** and Agnes Ayme-Southgate The importance of calcium cycling for insect flight: a molecular and phylogenetic study. South Carolina Academy of Science Annual Meeting, April 2008, Clemson, SC. This presentation received the Outstanding Undergraduate Research at the SC Academy of Science Annual Meeting at Clemson University.

2007 **Catherine Kramp** and Agnes Ayme-Southgate, Analysis of projectin in Hymenoptera in the context of insect flight evolution. Oral presentation, South Carolina Academy of Science Annual Meeting, April 2007, Columbia, SC. CK received the "Horace Byrne Explorers Club Award" for her paper. This award is given for "outstanding undergraduate research that explores the cutting edge of science".

2007 **Danielle Adler** and Agnes Ayme-Southgate, Identification of the elastic domain within the IFM-specific isoform of projectin. Poster presentation South Carolina Academy of Science Annual Meeting April 2007, Columbia, SC

2007 **Drew Philipps**, Richard Southgate and Agnes Ayme-Southgate, Analysis of projectin in *Drosophila virilis* and the pea aphid, *Acyrthosiphon pisum.* Poster presentation South Carolina Academy of Science Annual Meeting, April 2007, Columbia, SC

2007 **George Miller**, Richard Southgate and Agnes Ayme-Southgate, The importance of calcium and the mp20 protein in asynchronous insect flight muscle. Poster presentation South Carolina Academy of Science Annual Meeting, April 2007, Columbia, SC

2006 A. Ayme-Southgate, **D. Adler**, and **C. Kramp**. Muscle Elastic Proteins: Conservation and Evolution in Insects. IDeA (NIH-INBRE) conference Washington DC July 20-21

2006 Ayme-Southgate, A.; **Adler, D**.; Southgate, R. Identification of the elastic domain within the IFM-specific isoform of projectin. Poster presentation National Drosophila Conference Houston, TX

2006 Ayme-Southgate, A.; **Kramp, K.; Veloso, A.; Winkowski,M**. Projectin assembly and domain interactions in IFM myofibril. Poster presentation National Drosophila Conference Houston, TX

2006 **Danielle Adler, William Hartley, Catherine Kramp, Artur Veloso** and Agnes Ayme-Southgate Myofibril assembly and elasticity in drosophila flight muscles. Poster presentation, South Carolina Academy of Sciences meeting.

SCIENTIFIC SOCIETY MEMBERSHIP

Society for Comparative and Integrative Biology
American Association for the Advancement of Science

TEACHING

Courses taught at the College of Charleston

Biol111	Introduction and cell and Molecular Biology	3 credits
Biol 322	Development Biology with laboratory	4 credits
Biol 212(now 305)	Genetics	3 credits
Biol 312	Molecular Biology with laboratory	4 credits
Biol 453	Advanced genetics	3 credits
Biol 435	Introduction to genomics with Dr. Christine Byrum	

Biol 399 and 450: undergraduate research and Bachelor Assay

Courses taught at Lehigh University:

BiolS 101: Genetics, average enrollment 80-100 students/semester.
BiolS 251/225: Writing and Molecular Biology, average enrollment 5 students/semester.
BiolS 202: Medical externship conducted in parallel with a volunteer program at St Lukes Hospital, Bethlehem, PA.

BiolS 376: Classical and Molecular Embryology
BiolS 391: Undergraduate Research

Graduate courses taught at Lehigh University
BiolS 433: Advanced Topics in Developmental Biology (graduate course), average enrollment 20-25 students/semester.
BiolS 406: Colloquium Seminar, average enrollment 10-15 students/semester.
BiolS 405: Special Topics on Cytoskeleton, with Dr. Cassimeris

Graduate students mentoring
I have mentored 3 Ph.D. students at Lehigh University:
John Daley 6/93 to 4/98
Michelle Kulp 6/94 to 1/99
Teresa Riebe 6/94 to 12/99

Graduate students committees
I have served on three thesis committees for Master in Marine Biology at the College of Charleston: Jamie Colman, Andrew Baltzeggar and Melissa Yencho. I also was on both Master (3) and Ph.D. (13) degree student committees at Lehigh University.

Interests
Teaching both introductory biology and advanced genomics course.
I will participate this summer in a HHMI-sponsored workshop from the Genomics Education Partnership (http://gep.wustl.edu/) to integrate genomics and bioinformatics education into undergraduate courses.

SERVICE

ADVISING
Pre-med and pre-vet advisor,
Faculty advisor for the prevet society at the College of Charleston
Chair of the Health Profession committee (Academic year 2005-2006)

COLLEGE SERVICE
Fall 2009: Curriculum committee (I was on Sabbatical leave for Spring 2010)

2008-2009: College Academic Standard Committee

2008 and 2009: Distinguished Advising Award committee

2005-2009: Senator representative to Faculty Senate for Biology Department

2004-2006: Curriculum committee. Chair for the 2005-2006 academic year

2003-2004: Graduate School council: Biology Department representative

2001-2004: Faculty Research and Development Committee.

DEPARTMENTAL SERVICE

New Faculty Search Committee

Fall 2008: Marine Genomics 2nd position (chair)
Fall 2007: Marine Genomics 1st position (chair)
Spring 2005: Molecular Biology (Chair)
Spring 2004: Invertebrate Zoology search
Spring 2003: Genetic search
Summer 2002: Visiting Physiologist search
Spring 2001: Parasitology search

Committee:

Chair advisory committee: 2010
Curriculum committee: Fall 1999/Spring 2000 and Fall 2001- Spring 2003, Fall 2007 to 2009
Research and Development committee: Fall 2003- Spring 2006
General Biology committee: Fall 2000/Spring 2001
Assessment committee: Fall 2000/Spring 2001
Space, Equipment and Facilities: Fall 2002- Spring 2003
Chair council: 2008 to 2009

Other:

Open house for the Biology Department
Summer orientations: 2004 and 2005

EXTERNAL SERVICE

Consultant for biotechnology firm: FMC-agroproduct division, Princeton, NJ
School presentations:

- September 2006: The beauty of cells, Porter-Gaud School 5th grade
- May 2008: DNA day, Porter-Gaud School 6th and 12th grades
- May 2001: the Human Genome Project, Porter-Gaud School 6th grade
- December 1999: DNA and Genetics, Sea Island Academy 5th grade

James H. Marden

1. Education

B.S., University of Miami, 1981
M.S., University of Vermont, 1983
Ph.D., University of Vermont, 1988
NSF Postdoctoral fellow, Brown University & Univ of Texas, 1988-1989

2. Appointments

2004 - present Professor, Pennsylvania State University
1998 - 2004 Associate professor, Pennsylvania State University
1992 - 1997 Assistant professor, Pennsylvania State University
1990 - 1992 Visiting assistant professor, Colgate University

3. Publications:

Five most relevant to proposed project (student co-authors underlined)

Schilder, R.J. and Marden, J.H. 2007. Parasites, performance and proteomics: effects of gregarine gut parasites on dragonfly flight muscle composition and function. *Journal of Experimental Biology*, 210: 4298-4306.

Schilder, R.J. and Marden, J.H. 2006. Metabolic syndrome and obesity in an insect. *Proceedings of the National Academy of Science* 103, 18805-18809.

Marden, J.H. and J. R. Cobb. 2004. Territorial and mating success of dragonflies that vary in muscle power
output and presence of gregarine gut parasites. *Animal Behaviour* 68, 657–665.

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Five additional relevant publications (student co-authors underlined)

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2008. Weight and nutrition affect pre-mRNA splicing of a muscle gene associated with performance, energetics and life history. *Journal of Experimental Biology*, 211, 3653-3660.

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Montooth, K.L., J.H. Marden and A.G. Clark. 2003. Mapping determinants of variation in energy metabolism, respiration and flight in *Drosophila*. *Genetics* 165: 623-635.

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4. Five types of synergistic activities

a. University level service arising primarily from research reputation established by NSF funding: Penn State
Task Force on Interdisciplinary Graduate Research (2007-2008) – we produced a formal report to the Dean
of the Graduate College on how to stimulate more interdisciplinary graduate education across the university.

b. National level service: Three times served on NSF grant review panels since 2005, and served on the Committee of Visitors that reviewed a Division within the Biology Directorate over the period of 2004-2007.

c. Recent communication of research results to the general public: Co-authored a paper in *American Scientist*;
interviewed on camera for WBAL TV program on parasite effects on metabolism; consulted with History Channel and BBC about TV programs about the evolution of insect flight.
d. Outreach: Provided partial financial support ($5K) and taught a day-long module for a workshop for high
school teachers: “Evolution: How important is it to a good science education?” (http://teachscience.psu.edu/evolution.html). Collaborated with an elementary school teacher on a laboratory exercise in which students built models of surface skimming insects in order to study evolution by gradual elaboration of morphology and function.
e. International education and outreach continued from past NSF support (Career Award): Coordination and
teaching of an annual field research course for 20 Penn State undergraduates in a developing country (Costa Rica). Now taught for 15 consecutive years, involving 300 U.S. students and 12 Costa Rican graduate student TA’s. In 2006 we provided natural history books (INBIO series, in Spanish) for a new library in the remote Osa Penninsula town of Los Planes (http://www.campanario.org/junglenotes.php). In 2008 we gave laptop computers to a pair of teenage boys who we’ve watched grow up on the border of Corcovado National Park. Their previous lack of access to computers was an obstacle in their struggle to be competitive in their schooling.
Brayan and Cristian with laptops, and PSU
undergraduate Leslie Wickes

5. Collaborators and co-editors

i. Collaborators and co-authors (48 months):
Adrian Bejan (Duke); Gary Blissard (Boyce Thompson Inst.); Thorsten Burmester (Univ. of Mainz); Doug Crawford (Univ. of Miami); Heinz Decker (Univ. of Mainz); Scott Edwards (Harvard); Doug Emlen (Univ. of Montana); David Erickson (Cornell); Wolfgang Erker (Univ. of Mainz); Martin Feder (Chicago); Howard Fescemyer (Penn State); Mikko Frilander (Univ. of Helsinki); Ted Garland (UC Riverside); Robert Gilmour (Cornell); Christoph Haag (University of Fribourg); Silke Hagner-Holler (Univ. of Mainz); Ilkka Hanski (Univ. of Helsinki); Laura Levine (Wash. St. Univ.); Christian Pick (Univ. of Hamburg); Rainer Rupprecht (Univ. of Mainz); Marjo Saastamoinen (Univ. of Helsinki); Axel Schoen (Univ. of Mainz); Tony Zera (Nebraska)
Co-Editors (24 months): Alex Córdoba (Universidad Nacional Autónoma de México); Jill Lancaster (Edinburgh);
ii. Grad/Postdoc Advisors: Larry Gilbert; Bernd Heinrich; Jon Waage
iii. Advisor / Postgrad Sponsor (past 5 yrs): Mark Darlington; Kristi Montooth; Kristjian Niitepold; Scott