RONALD E. MCNAIR
POST-BACCALAUREATE ACHIEVEMENT PROGRAM
FLORIDA INTERNATIONAL UNIVERSITY
MIAMI, FLORIDA

UNDERGRADUATE RESEARCH JOURNAL
SUMMER 2008
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McNair Postbaccalaureate Achievement Program

The Ronald E. McNair program prepares students for doctoral studies through involvement in research and other activities. Students are from disadvantaged backgrounds and have demonstrated strong academic potential. Institutions work closely with students as they complete their undergraduate requirements. Institutions encourage students to enroll in graduate programs and then track their progress through successful completion of advanced degrees. The goal is to increase the attainment of Ph.D. Degrees by students from underrepresented segments of society.

The McNair program provides the following services: academic counseling, financial aid assistance, mentoring, research opportunities, seminars, summer internships, and tutoring. Guidance for students seeking admission and financial aid to graduate programs is also provided.
Dear Reader:

I am pleased to offer this publication representing the research activities of the Ronald E. McNair Postbaccalaureate Fellows at Florida International University. In its second four year cycle of funding from the United States Department of Education, the McNair program has served well over one hundred and twenty five students, many of whom are enrolled in masters and doctoral (Ph.D.) programs at some of the nation’s most prestigious institutions of higher learning.

Central to the core mission of Florida International University is the provision of a high quality undergraduate research experience for its students. FIU is quite fortunate to be the recipient of only four Ronald E. McNair Postbaccalaureate Achievement grants in the state of Florida and the only one in Miami-Dade County. The central mission of the McNair program is to expose our undergraduate students to cutting edge research conducted by world class faculty. Each year FIU selects twenty-two such students and pairs them with faculty involved in scientific research in a variety of STEM disciplines—Engineering, Biomedical Engineering, Chemistry, Physics, Mathematics, etc.

It goes without saying that the entire staff of the McNair program here at FIU is extremely proud of the many achievements of our McNair Fellows. It is for this and other reasons that we gladly share with you this publication which aptly describes some of the research activities of our McNair students. In an event that you will find the reading of the research papers as enjoyable and enlightening and I did when I first read them.

Sincerely,

[Signature]

Dr. E. George Simms
Director, Pre-College, Grants & Ronald E. McNair Programs
George T. Simms  
Director of Pre-Collegiate Programs and Grants  
Florida International University  
MARC 414  

Dear Dr. Simms,  

I am pleased to introduce the first edition of the Florida International University Ronald E. McNair Research Publication. The document illustrates some of the outstanding research activities of our McNair students.  

In its second cycle of funding from the United States Department of Education, the McNair program makes it possible for a select group of students to engage in high quality research under the tutelage and guidance of world class research faculty. FIU is the only McNair grant recipient in South Florida.  

McNair Students typically have economically disadvantaged backgrounds but demonstrate strong academic potential. The goal of the McNair program is to increase the number of FIU students majoring in Science Technology Engineering and Mathematics disciplines (STEM) who subsequently obtain PhD degrees.  

In its brief history, the FIU McNair program has already established itself as a highly successful program with many of its graduates publishing their research in highly respected scientific journals and pursuing graduate degrees at leading research universities.  

Regards,  

Ronald M. Berkman  
Executive Vice President and Provost
November 7, 2008

Dr. George E. Simms  
Director of Pre-Collegiate Programs  
Florida International University  
University Park—MARC 414  
Miami, FL 33199

Dear George,

I extend my sincere congratulations to the students and staff of the Ronald E. McNair Post Baccalaureate Achievement Program on this first official publication of the research activities of the McNair Fellows. It is evidence of the hard work and dedicated efforts of both the faculty mentors and students alike. Graduate education and research are extremely valuable, and the research experience the McNair program provides will undoubtedly bode well for any graduate endeavor. The program has successfully prepared program participants from disadvantaged and underrepresented groups for doctoral education.

The unique opportunity afforded by the FIU McNair faculty is paramount to assist and support low income, first generation college students, and those from underrepresented groups in pursuing doctoral studies.

I congratulate each of our McNair Fellows and wish them continued success in all future endeavors.

Sincerely,

George E. Walker, Ph.D.  
Senior Vice President for Research and Graduate Education  
Dean of the University Graduate School
Dear Ronald E. McNair Students, Faculty and Staff:

On behalf of the Division of Student Affairs and Undergraduate Education, I am pleased to offer my congratulations to the Ronald E. McNair program on the publication of the First Edition of the McNair Research Journal. This document represents the first of what I hope will be many publications produced by the McNair program. This premier publication contains a significant body of work by some of Florida International University's finest scholars. It represents what happens when students and faculty work together collaboratively to explore and solve problems of an academic nature. It is indeed the embodiment of teaching and learning at its best. It is for this reason that Florida International University is honored to be the recipient of the Ronald E. McNair program.

Critical to the success of the McNair program and any student directed research is the involvement of dedicated faculty mentors who frequently provide guidance, encouragement and support to each student. We are extremely thankful and appreciative to those faculty members who have opened their laboratories and welcomed our students.

As we begin the second cycle of funding of the McNair program, I look forward with great anticipation and excitement to the program continuing to provide quality research opportunities for some of FIU's best and brightest students.

Congratulations and best wishes in the coming year!

Rod J. Jones, D.S.W.
Vice President, Student Affairs and Undergraduate Education
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McNair Fellow Presenter: Sandra Neptune
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Faculty Mentor: Dr. Marilyn Montgomery
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McNair Fellow Presenter: Denisse Aranda
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Research Topic: High Temperature Aerogels in the Al2O3-SiO2 System for Thermal Protection Systems

McNair Fellow Presenter: Bryan Arriete
Major: Physics
Faculty Mentor: Dr. Steven Hudson
Research Topic: Harmonic Analysis

McNair Fellow Presenter: Jeanette Castro
Major: Nursing
Faculty Mentor: Dr. Alejandro Barbieri
Research Topic: Rab5 Regulation During the Adipogenesis of 3T3-L1 Cells

McNair Fellow Presenter: Crystal Reyes
Major: Psychology
Faculty Mentor: Dr. Marilyn Montgomery
McNair Fellow Presenter: Rafael Badui  
Major: Physics & Mathematics  
Faculty Mentor: Dr. Mirroslav Yotov  
Research Topic: Moduli Space of Degree Two Real Plane Curves

McNair Fellow Presenter: Ishtiaq Syed  
Major: Mathematics  
Faculty Mentor: Dr. Mirroslav Yotov  
Research Topic: Moduli Space of Degree Two Real Plane Curves

McNair Fellow Presenter: William Zambrano  
Major: Biology  
Faculty Mentor: Dr. Wolfgang Dillmann  
Research Topic: Characterization of Mitochondrial Protein O-GlcNAcylation in Type 2 Diabetic Hearts

McNair Fellow Presenter: Mohammed Oosman  
Major: Biology  
Faculty Mentor: Dr. Stephen Becker  
Research Topic: Entamoeba Histolytica and its Ability to Undergo Apoptosis

McNair Fellow Presenter: Eladio Mendez  
Major: Chemistry  
Faculty Mentor: Dr. David Kreller  
Research Topic: An HPLC Technique for Studying Adsorption of Humic Substances to Mineral Surfaces

McNair Fellow Presenter: Marlon Bright  
Major: Computer Engineering  
Faculty Mentor: Dr. Masoud Sadjadi, Dr. Rosa Badia  
Research Topic: Application Profiling and Prediction in The Grid Enviroment
Florida International University

**FACTS AT A GLANCE:** Florida International University is Miami-Dade County’s first public, four-year university. Our powerful record of innovation and research continues to improve the quality of life in our communities.

**HISTORY AND GROWTH:** FIU was founded in 1965 and opened for classes in 1972 with 5,667 students – the largest opening day enrollment in U.S collegiate history. Today it has more than 38,000 students, almost 1,000 full time faculty and more that 120,000 alumni. FIU is one of the 25 largest universities in the nation, based on enrollment. The University offers more than 200 bachelor's, master's and doctoral programs in 21 colleges and schools.

**FACULTY:** Ninety-five percent of the University’s full-time, tenured, and tenure earning faculty hold doctorates or the highest degree attainable in their field.

**RESEARCH:** FIU emphasizes research as a major component of its mission. Sponsored research funding (grants and contracts) from external sources for the year 2005-2006 totaled $92 million. The University is ranked as a Research University in the High Research Activity category of the Carnegie Foundation’s prestigious classification system.

**NATIONAL RECOGNITION:** FIU is the youngest University to have been awarded a chapter of Phi Beta Kappa, the Nation’s oldest and most distinguished academic honor society. FIU recently ranked among the best values in a public higher education in the country, according to Kiplinger's Personal Finance magazine’s 2006 survey, “100 Best Values in Public Colleges.” FIU ranked among the top 5 nationally for in-state students and among the top 100 nationally for out-of-state and international students.

FIU recently ranked 3rd in granting bachelor degrees to minorities and 9th in granting masters degrees to minorities (among the top 100 degree producing colleges and universities), according to Diverse Issues in Higher Education, June 1, 2006.

FIU's College of Law led all the universities in the state with the highest pass rate of 94.4% on the 2007 Statewide Florida Bar Examination. The second highest pass rate belonged to Florida State University with 88.2%.

U.S. News & World Report ranks FIU's undergraduate international business program among the top 15 in the nation and their graduate programs among the top 25. The University has also been named one of the “10 Cool Colleges for Entrepreneurs” by Fortune Small Business magazine. Our Executive MBA program was recently ranked in Florida by the Financial Times.

The School of Hospitality and Tourism Management is one of the nation’s top programs. Other acclaimed programs include Creative Writing and Marine Biology.
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<td>Dr. Nikolaos Tsoukias</td>
<td>Assistant Professor</td>
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**Ronald E. McNair Advisory Board**

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  - Chair and Associate Professor
  - Molecular Microbiology & Immunology

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  - Associate Professor
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  - Physics Department

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Pre-Collegiate Programs & Grants  
Ronald E. McNair Program

Dr. Jason Scott Hamilton  
Associate Director  
Pre-Collegiate Programs & Grants  
Ronald E. McNair Program
Transient Nitric Oxide Release in the Vasculature

Luis Alonso, Nikolaeo M. Tsoukas
Department of Biomedical Engineering
Florida International University
Miami, Florida

ABSTRACT

Nitric Oxide (NO) is an important molecule which is endogenously produced by endothelial cells (ECs) in blood vessels. It has been linked with many physiological processes (i.e. relaxation of vascular tone) as well as pathological conditions (i.e. hypertension). Despite many significant research contributions on the subject, many facts about NO remain unclear: NO release by the ECs suffices to induce relaxation. However, it is uncertain how this can take place knowing the proximity of the red blood cells to the site of NO production and the fast consumption of NO by Hemoglobin (Hb). We have previously suggested that the duration and period of a transient NO release plays an important role in the mechanism that allows NO to cause vascular toning by inducing and reducing the smooth muscle. To explain this paradox, this project addresses the significance of the transient nature of NO production in the arterial endothelium by modifying the NO-oxidation applied to rat mesenteric arteries. The role of the frequency of calcium (Ca++) mediations in the vascular wall will have to be addressed in the future. Two hypotheses that the NO-oxidation encode information which is transmitted through NO diffusion to the SM and this will be confirmed by imposing Ca++-mediations and assigning the resulting NO levels. This information obtained from this work gives us a better perception of the NO signaling pathway, and this information could be applied to the development of new treatments.

INTRODUCTION

Nitric Oxide (NO) • EC-SMC interactions through molecules such as NO are important for the regulation of vascular tone and blood flow. • NO is produced as a result of the enzymatic reaction of L-Arginine by Nitric Oxide Synthase (NOS) in the EC and diffuses to the SMC, where it activates soluble guanylylcyclase (sGC). • NO plays an important physiological and pathological role.

NO Paradox • In the reconstitution, the close proximity of the EC and SMC interactions is the NO and the fast consumption of NO by Hb suggests that more NO production will be unnecessary by blood. • As the result remains unclear how much NO can remain unreacting by Hb and from this information regarding the concentration levels that are present within the SMC. • NO availability is determined by the balance between EC, SMC, and consumption by TRPM. Unfortunately, both remain largely unidentified.

Transient NO Studies

- A burst of NO production can be observed after activation of endothelial cells by Ca++-sustaining agonists. • Transient bursting of NO with durations large enough to activate sGC followed by a period of rest or no release while SMC density decreases, may provide more efficient way for maintaining vascular tone.

HYPOTHESIS

The central hypothesis of this proposal is that transient NO release by the arterial endothelium plays an important physiological role in regulating vascular tone.

- Aim 1: Study the effect of exogenous NO delivery to the smooth muscle. • Aim 2: Study the effect of transient NO delivery on pathological arteries. • Aim 3: Analyze the role of endothelial calcium oscillations on microcirculation tone.

METHODOLOGY

Sprague-Dawley Rat
Mesenteric Artery
Porcine GJ

RESULTS AND CONCLUSION

Dose Response Studies

- Acetylcholine (ACh) induced a dose-dependent relaxation. • Maximum relaxation: 94.5±5.1% • Minimum relaxation: 94.5±5.1% • Maximum relaxation (EC50) was obtained at 0.14±0.15 μM. • Results for NO-induced concentration and ACh-induced relaxation agree with published data, validating the procedures used to conduct these studies.

FUTURE WORK

The previous results are part of an ongoing study. Additional experiments are required to further elucidate the proposed mechanisms:

- Test vessel sensitivity to various concentrations of NO.
- Test vessel sensitivity to various frequencies of NO.
- Investigating the role of endothelial Ca++-mediations on microcirculation tone.

ACKNOWLEDGMENTS

The author is grateful for the support given throughout the duration of this project by the following people:
- Dr. Nikolaeo Tsoukas
- Ronald E. McNair Program at Florida International University
- American Heart Association (AHA 13980957)
- Labs and the Laboratory of Vascular Physiology and Biomechanics

REFERENCES

Effectiveness of an Exercise Protocol with the Distal Segment Fixed
Following Primary Unilateral Knee Replacement

McNair Postbaccalaureate Achievement Program

Arangis, Pamela (1); Mark D, PhD, PT, CSCS; (2); Student, Health Sciences, McNair Recipient, Florida International University, Miami, Florida.

2: Assistant Professor, Department of Physical Therapy, Florida International University, Miami, Florida.

Introduction

Before undergoing joint replacement surgery, many patients will report a decrease in joint function and overall function. In many patients, the knee extension on the involved side is worse than before. In addition, many patients report loss of muscle strength and function, which may limit their ability to perform daily activities. The purpose of this study was to determine the effectiveness of an exercise protocol for patients with knee joint replacement.

Hypotheses

Fifty-one individuals with knee joint replacements who had received a primary unilateral total knee joint replacement, had completed outpatient care services, are living at home, and will start rehabilitation at an outpatient orthopedic center pre and post surgery.

Subjects

Methods

- Randomly assigned into two groups.
- Control group (TFP+OMH, n=19, 65.90 yrs. old, standard physical therapy group).
- Experimental group (TFP+OMH, n=32, 61.69 yrs. old, standard physical therapy group).

Results

- Asymmetry index between Groups at Initial Visit for Stand to Squat
- Asymmetry index between Groups at Discharge for Stand to Squat

Testing

- Weight used during an isokinetic leg press was recorded as 25% of body weight to avoid the weight used on the first day of testing and training.
- Patients were asked to complete at least 15 repetitions for the first visit.

Discussion

Individuals were re-assessed after PT to begin a specific lower limb protocol to start the distal segment fixed without difficulty.

Discussion

Acknowledgments

The author would like to thank the following centers for their support and help throughout the course of the research.

- Mark D. Brown, PT, PhD, CSCS
- Ronald H. McNair Post Baccalaureate Achievement Program
- Baptist Hospital
- Rehabilitation Hospital
- Rehabilitation Program
- Baptist Hospital
- Burn Program
- Rehabilitation Program
- Baptist Hospital
- Physical Therapy Program
McNair Postbaccalaureate Achievement Program

Background and Significance

- Prior research on jury decision making focuses on individual jurors as opposed to the decisions made by entire juries. Existing research also focuses upon the final outcome as opposed to the deliberation process a jury goes through to decide upon a verdict.
- The Story Model, formalized by Pennington and Hastie (1986, 1989, 1990, 1992), seeks to account for the ways juries make decisions by asserting that jurors impose a narrative organizational structure on testimony and evidence heard at trial that facilitates comprehension of the evidence and the drive of the deliberation process. Thusly, the Story Model proposes that juries will form a collaborative story during the deliberation process.
- Three phases of the Story Model:
  - Evidence evaluation through story construction
  - Representation of decision alternatives through verdict categories
  - Decision determination through the classification of the story in the best-fitting verdict category

- While Pennington and Hastie have created a model that accounts for juror decision making, this model has not yet been applied to decision making at the jury level. In this current justice system, juries, and not individual jurors, are the entities which make decisions and thusly research on the application of the Story Model to jury deliberation is essential.
- In the process of forming a collaborative story, the deliberation style of a juror is also important. In an evidence-driven deliberation style jurors discuss more extensively the evidence, as well as the order of evidence presented, and participate in story construction. Verdict-driven jurors, however, are characterized by the argument of one side over another without the construction of complete stories.
- Research on shared mental models also suggests the benefit of an evidence-driven over verdict-driven deliberation. Juries serve as a team with an end goal of a verdict decision and each individual team member has their own organized knowledge structure helping them interact with their environment. The degree of this shared mental model is related to team performance.
- The aim of the current study is to determine the effects of evidence order and deliberation style on the stories juries create. Additionally, we seek to assert whether or not these variables through jury discussion will create a change in the consistency of juror stories from that of the consistency prior to discussion.

Hypothesis

Evidence order (story order vs. witness order) and deliberation style (evidence-driven vs. verdict-driven) will affect the consistency of stories (chronological & linkage) juries create.

Methods

Participants

- A total of 183 community members and 179 undergraduate students were recruited to act as mock jurors (n = 362).
- Participants were screened for jury eligibility before enrolment in the study. (Over 18, US Citizen, English-speaking).

Community Members

- 54.4% female, 45.6% male, 27.7% Caucasian, 25% African American, 38% Hispanic, and 8.1% Other.
- Mean juror age was 31.33 years and 16.3% had previously served on a jury.

Undergraduate Students

- 65.1% female, 34.9% male, 19.8% Caucasian, 19.2% African American, 59.6% Hispanic, and 6.6% Other.
- Mean juror age was 21.28 years and 3.4% had previously served on a jury.

Design and Materials

- The study had a 2 (Evidence Order: Prosecution-Story Order vs. Prosecution-Witnesses Order) x 2 (Deliberation Style: Evidence-Driven vs. Verdict-Driven) between-subjects factorial design.
- Evidence order manipulation occurred such that participants heard either the opening/closing statements of the prosecution presented in story order and the statements of the defense presented in witness order, or vice-versa.
- Juries were assigned to be victim-driven (taking an initial poll and working towards a consensus) or evidence-driven (no poll until at least half-way through deliberations).

Dependent Measures

- Pre and post-deliberation questionnaires were filled out by each participant (individually). During the pre-deliberation questionnaire participants were provided with twenty pieces of evidence and were asked to choose up to 15 to construct a personal narrative. During the post-deliberation questionnaire participants created a second narrative and ranked the likelihood of defendant’s guilt.
- Multiple coders coded portions of the pre and post-deliberation questionnaires and interrater reliability was high.

Procedure

- Participants were recruited for a study on “Jury decision making in a murder case.” Community members were run in groups of six and student participants were run in groups of 7 or 8. Participants viewed one of four versions of the victimized-stimulus and pre-deliberation questionnaires were administered. Participants then spent 30 minutes in deliberation towards a unanimous verdict. After deliberation, participants completed the post-deliberation questionnaire form.

Results

- A Univariate ANOVA was conducted comparing deliberation style, evidence order, and sample type to the chronological and linkage scores (groupings of two common chronological evidence pieces common amongst jurors) of the pre and post-deliberation questionnaires.
- For chronological order, there was a significant main effect of sample (F = 24.934, p < .000) and deliberation style (F = 5.193, p = .023).
- For linkage order, there was a significant main effect of sample (F = 19.793, p < .001), evidence order (F = 3.861, p = .05), deliberation style (F = 29.483, p < .001), and the interaction between sample and deliberation style (F = 13.689, p < .001). A comparison of means also showed a significantly higher consistency score for the interaction between sample and deliberation style in the student category with (Ms=57.53) for evidence-driven and (Ms=59.06) for verdict-driven.

Conclusions

- In the current study it is hypothesized that deliberation style and evidence order will influence the consistency of stories that juries create. The statistical tests conducted show a confirmation of this hypothesis.
- Although present research shows significant results in favor of the hypotheses, as the research is the first to look at juries as opposed to individual jurors, further research is needed to indicate strong evidence on the effects of these variables on story consistency. These further studies should control specifically for these variables, closely examining them to accurately identify what is truly affecting story consistency.
- The data suggests that deliberation style, especially coupled with sample type, may cause juries to become more consistent through deliberation, especially evidence-driven deliberations. This may confirm the idea that the story model presents that juries work together to form a collaborative story. It also supports the theory of shared mental models which suggests the pooling of individual thoughts to create a greater collective whole.
- According to these implications, although these findings should be replicated further, it would be wise to further consider the dynamics of deliberations at the jury level. Research on shared mental models shows that an individual juror who is viewed to have a greater expertise on the subject may harmonize influence other jurors in the process of their decisions. Thusly, juror relationships and juror personality should also be evaluated in further replications of this experiment.

Acknowledgements & References

I would like to thank the following people for their invaluable assistance in completing this project:

- Dr. Margaret Readon, who has been there for me step by step of the way.
- Dr. Jason S. Hamilton and Dr. George Simms - McNair Postbaccalaureate Achievement Program
- Sandra Neptune and Laura Oramas


Reverse Phase Ion Pairing Separation of Heparin Oligosaccharides

Nellymar Membrelo, Christopher Jones, and Dr. Cynthia K. Larive, Department of Chemistry, University of California-Riverside, Riverside, California 92521 and Florida International University, Miami, FL, 33199.

Introduction

Heparin is a glycosaminoglycan (GAG) widely used as an anticoagulant. It is found in the granules of mast cells. This GAG has a long polyanion comprised of repeating disaccharide units containing a D-glucuronic acid 1-4 linked to a L-iduronic acid. The sulfates of the oligosaccharide can be determined or unmodified. The disaccharides can also be detected at the C6 and C3 position of the D-glucuronic acid and at the C2 position of the L-iduronic acid. Because of its structural diversity, heparin molecules are a wide range of biological processes making it a pharmacological target for treatment of several diseases including certain types of cancer and cystic fibrosis. However, heparin's high negative charge density, polydispersity and heterogeneity make it a challenge to characterize at the molecular level. A method for the analysis of heparin and heparin oligosaccharides was established in this study using reverse phase ion-pairing (RPPI-UPLC) high-performance liquid chromatography (HPLC) coupled to electrospray time-of-flight mass spectrometry (ESI-MS). This work extends the RPPI-UPLC-ESI-MS method for the separation of mixtures of linear and branching heparin oligosaccharides. In addition, the molecular basis of the RPPI-UPLC separation mechanism has been examined and the role of competition between different ion-pairing reagents in the resolution of heparin oligosaccharides was explored.

Results

The separation of the heparin oligosaccharide fraction produced by enzymatic digestion of heparin was attempted using the same competitive ion-pairing mechanism used above. A buffer consisting of 2.50 mM TBA and 11.5 mM tributylamine was used to carry the mobile phase for the separation of the heparin oligosaccharide. This buffer is shown to be suitable for the separation of heparin oligosaccharides. The separation was performed on a 2.1 x 150 mm Acquity UPLC BEH C18 column packed with 1.7 pm coated Waters particles. The detector was coupled to a quadrupole time-of-flight mass spectrometer. The separation was monitored by the ion-pairing mechanism. The mobile phase was monitored every 0.1 min. The results showed that the compounds were resolved into different peaks. The results were consistent with the theoretical predictions. The peaks were identified by comparison between TBAA and MBA.

Conclusion

Our work shows that successful separation of all heparin oligosaccharides could be achieved using a competitive reverse phase ion-pairing HPLC system. The separation of heparin oligosaccharides is difficult because of the size and complexity of the oligosaccharides. Our data confirmed the difficulty in separating larger oligosaccharides by reverse phase ion-pairing. Therefore, an additional separation based on another characteristic of the oligosaccharides was needed. The RPPI-UPLC system used in this work is not capable of separating a linear or branching oligosaccharide. The separation work will result in selecting a linear or branching oligosaccharide. The separation is to be confirmed by the structure of each component in the mixture obtained by enzymatic digestion.

Acknowledgements

Members of the Larive group: NSF grant CHE-0524053 and NSF CHE-0535611; Ronald E. McNair Post Baccalaureate Achievement Program

References


Parent Responsiveness to Child Bids during Parent-Child Interaction and Child Psychological Adjustment

Lauren Oramas, Melody Whiddon, & Marilyn J. Montgomery

Department of Psychology, Florida International University • Miami, Florida

Research Aims

The current study will seek to examine the relationship between parent-child interaction at the micro-level and psychological adjustment among the Hispanic-American population.

Hypothesis: Hispanic children from mother-child dyads with more parent responsiveness to child bids during interaction will have lower scores on measures of psychological problems.

Psychological problems are operationalized by the following SCID-A scales: aggression-provoking behavior, self-control problems, somatic complaints, DSM affective problems, DSM somatic problems, DSM oppositional defiant problems, and DSM conduct problems, as well as the externalizing problems and total self-report problem scores.

Methods

Participants

A total of 24 mother-child dyads of Hispanic origin were included in the final sample.

- Mean child age was approximately 6.56 years with a range of 5 to 12 years.
- 19 (or about 90%) of the children used were male and 5 (or about 20%) were female.
- The mean parent age was 36.14 years with a range of 26 to 52.

Measures

- Parent Responsiveness to child bids was coded using the Noldus Observer.
- Parent responses were assigned a value ranging from zero to three depending on the type and contextual appropriateness of the response.
- Accept-engage was assigned a value of 3.
- Ignore was assigned a value of 1.
- Accept was assigned a value of 0.

- A mean of total parent responsiveness was calculated to determine how responsive, overall, a mother was to the bids of her children.
- Counts of each type of child bid and parent response, as well as the overall number of bids, were also calculated.

- The Structured Clinical Interview for Children and Adolescents (SCID-A) was used to assess child psychological adjustment.

- The SCID-A is a paper-and-pencil measure containing 247 questions that measure a child’s self-report problems as well as a mother’s perception of a 6 to 18 year old child’s behaviors.
- The scales and subscales used were the Aggression-Provoking Behavior, Self-Control Problems, Somatic Complaints, DSM Affective Problems, DSM Somatic Problems, DSM Oppositional Defiant Problems, and DSM Conduct Problems subscales as well as the Externalizing Problems and Total Self-Report Problems scales.

- It is reported to be reliable (r = .78, p < .01) (McConaughy & Achenbach, 2001) and highly correlated with the Child Behavior Checklist, which has a strong empirical basis with validity and reliability (Achenbach & Edelbrock, 1983; Biederman et al., 2001; Shewman & Johnson, 1996).
- A computer scoring program, Assessment Data Manager (ADM), was used to determine age-normed subscale T-scores for the used scales and subscales.

Results

Table I. Means, Standard Deviations, and Ranges for Study Variables, N=24

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent-Child Interaction</td>
<td>3.94 (0.43)</td>
<td>2.7</td>
<td>5.0</td>
</tr>
<tr>
<td>Number of Child Bids</td>
<td>10.3 (0.02)</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Mean Parent Responsiveness</td>
<td>2.70 (0.32)</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Number of Parent Responses</td>
<td>10.0 (0.00)</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Parent Reactivity</td>
<td>0.49 (0.25)</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Number of Parent Reactions</td>
<td>4.46 (0.37)</td>
<td>2.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Total Number of Child Bids</td>
<td>16.1 (0.50)</td>
<td>10.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Total Parent Responsiveness</td>
<td>3.23 (0.06)</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Child Behavior Checklist</td>
<td>2.1 (0.62)</td>
<td>0.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Self-Control Problems</td>
<td>1.88 (0.50)</td>
<td>0.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Somatic Complaints</td>
<td>4.87 (2.26)</td>
<td>0.0</td>
<td>10.0</td>
</tr>
<tr>
<td>DSM Affective Problems</td>
<td>7.5 (1.5)</td>
<td>3.0</td>
<td>10.0</td>
</tr>
<tr>
<td>DSM Somatic Problems</td>
<td>5.80 (2.2</td>
<td>2.0</td>
<td>8.0</td>
</tr>
<tr>
<td>DSM Oppositional Defiant Problems</td>
<td>5.80 (2.2</td>
<td>2.0</td>
<td>8.0</td>
</tr>
<tr>
<td>DSM Conduct Problems</td>
<td>5.24 (2.88</td>
<td>2.0</td>
<td>11.0</td>
</tr>
<tr>
<td>DSM Problem Scores</td>
<td>0.67 (0.97)</td>
<td>0.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Table II. Correlates of Parent-Child Interaction and Child Problems, N=24

<table>
<thead>
<tr>
<th>SCID Compliance Scores</th>
<th>Mean (SD)</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Symptoms Score</td>
<td>3.94 (0.43)</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Aggression-Provoking Behavior</td>
<td>2.57 (0.56)</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Self-Control Problems</td>
<td>2.1 (0.62)</td>
<td>0.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Somatic Complaints</td>
<td>4.87 (2.26)</td>
<td>0.0</td>
<td>10.0</td>
</tr>
<tr>
<td>DSM Affective Problems</td>
<td>7.5 (1.5)</td>
<td>3.0</td>
<td>10.0</td>
</tr>
<tr>
<td>DSM Somatic Problems</td>
<td>5.80 (2.2</td>
<td>2.0</td>
<td>8.0</td>
</tr>
<tr>
<td>DSM Oppositional Defiant Problems</td>
<td>5.80 (2.2</td>
<td>2.0</td>
<td>8.0</td>
</tr>
<tr>
<td>DSM Conduct Problems</td>
<td>5.24 (2.88</td>
<td>2.0</td>
<td>11.0</td>
</tr>
<tr>
<td>DSM Problem Scores</td>
<td>0.67 (0.97)</td>
<td>0.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Conclusions

Data analyses revealed correlations that were in anticipated directions.

- Results suggested that children whose parents were more responsive during parent-child interaction had less adjustment problems.
- Significant correlations were found between parent-child interaction and child symptomatic problems.
- Children whose parents were more responsive overall were found to have less aggressive/violent breaking behavior and self-report problems.
- Children whose parents tended to ignore their bids for interaction were found to have more self-control problems and externalizing problems.
- Children whose parents tended to respond to their bids for interaction by engaging tended to have children with less aggressive/violent breaking behavior and somatic complaints.
- Children who made more bids for interaction tended to have more self-control problems.
- Significant correlations were also found between parent-child interaction and DSM child problems.
- Children whose parents were more responsive overall were found to have less oppositional defiant and conduct problems.
- Children who responded to their child’s bids for interaction were found to have more aggressive/violent breaking behavior.
- Children whose parents tended to respond to their bids for interaction by engaging were found to have more oppositional deficit problems.
- Finally, children who made more bids for interaction were found to have more effective, somatic, and conduct problems.

Implications for Future Research Directions

- Future studies should use larger populations.
- Because a small sample size such as the one used in this study will detect only robust findings, more significance may exist in the data.
- Future studies should investigate other child characteristics.
- The current study used only Hispanic mother-child dyads. Findings must be generalized with caution, as they can only be generalized to Hispanic populations where the mother is the primary caregiver to the child.
- Future studies should test cause and effect by using different statistics in order to get closer to causality as possible.
- Because the current study yields only correlational results, causal relationships cannot be determined.
- Future studies should investigate the possibility of parental training in this area of responsiveness.
- The results of the current study contribute to existing literature by shedding light on specific parent behaviors and parent-child interaction qualities which are linked to child psychological adjustment and suggesting promising areas for early interventions.
- By learning which aspects of parent-child interaction are most important, we can train parents to interact optimally with their children.

Acknowledgments:

I would like to thank the following people for their invaluable assistance in completing this project:
- Dr. Marilyn Montgomery
- Melody Whiddon, Youth and Family Development Program Lab Manager
- Sandra Neptune and Crystal Reyes, Youth and Family Development Program Undergraduate Research Assistants
- Harold E. McFadden Baccalaureate Achievement Program
- The Psychology Research Initiatives Mentoring Experience Program

References:


**Novel Technique for the Fabrication of Microfiber Arrays for Gecko Adhesives**

**Edgar Felipe Garay, Brian Bush, Roya Maboudian**

**Abstract**
A method using nanosphere lithography and metal induced etching was developed in order to fabricate silicon nanowires (SiNW) that can be used as molds for imprinting microfiber arrays on a polymer surface. These vertically aligned microfibers can mimic the adhesive properties of gecko foot-hair nanostructures.

In addition, preliminary results suggest that the formation of SiNW is not entirely due to the fabrication process described below, but by defects on the metal film used as the catalyst in the etching process. More work is currently underway to explore the mechanism of the formation of SiNW due to film defects.

**Introduction**

• Improving the fabrication process of dry adhesives is beneficial for developing technologies in other fields.
• Understanding adhesives properties is the key to new advances in mobility.

**Gecko Foot Structure**
Recent studies discovered that this amazing ability comes from specialized toe pads that enable geckos to climb vertical surfaces and even hang from ceilings.

Gecko’s have long been known to exhibit an amazing ability to climb or stick to many types of surfaces.

**Fabrication Process**

• This method is based on a technique developed by Peng et al. in which they make use of nanosphere lithography and metal induced etching in order to create arrays of ordered silicon nanowires.
• This procedure will be adapted in order to fabricate large areas of silicon nanowire arrays that will be later used as a mold for making polymer nanotext arrays.

![Fabrication Process Diagram](diagram.png)

**Silicon Nanowires**

• SiNW produce from Si (100) substrates are vertically aligned and have a diameter of about 500-800 nm.
• There are some smaller nanowires of about 10 nm in diameter.
• It is believed that these small nanowires are due to pinholes and irregularities in the silver film.

![Silicon Nanowires](diagram.png)

**Conclusion/Discussion**

• A new method for fabricating SiNW that could be used as a mold for making polymer fibers was conceived.
• Every step in the fabrication process can be controlled by means of more elaborate techniques and superior equipment available at the industrial level.
• The chemistry behind silver induced etching could be modified in order to control the formation of SiNW without the need of using nanosphere lithography to pattern the silver film. This process could be exploited as an inexpensive way to fabricate SiNW.

**Support Information**
This work was performed under the auspices of the NSF by University of California Berkeley under contract No. 0425914

**Contact Information**
Edgar Garay, egaray@fiu.edu, 305-348-0553
Brian Bush, bbush@berkeley.edu, 510-643-3489
Predictors of Treatment Completion among Adolescent Sex Offenders

Ingrid Boveda-Sardinas
Florida International University

Donald S. Strassberg, Ph.D.
University of Utah

**Background**

- Previous literature examining juvenile sex offender (JSO) characteristics, recidivism rates, and personality profiles have yielded mixed results.

- JSO’s, like their adult counterparts, appear to be a heterogeneous group (Smith, Monat-kowsky, & Disher, 1987; Veniziano & Veniziano, 2001).

- Previous physical and/or sexual abuse or neglect, low self-esteem, academic truancy, and a prior history of perpetrating sexual or nonsexual abuse have all been identified as common offender characteristics. (Davis & Leitenberg, 1997; Veniziano & Veniziano, 2002).

- In addition, history of sexual abuse, verbal threats at first offense, young offender age, and treatment non-compliance have all been previously implicated as contributing to sexual and non-sexual reoffending. (Kahn & Chambers, 1991; Langstrom & Granin, 2000; Rasmussen, 1999).

**Methods**

Fifty-four male adolescents (Mage = 15 yrs, range = 12–18 yrs) referred for residential treatment for sexual offending were administered the following instruments upon admission:

- Minnesota Multiphasic Personality Inventory (MMPI-A)
- Beck Depression Inventory (BDI)
- Outcomes Questionnaire (OQ-45)

**Results**

- JSO’s in our sample were comparatively similar in their MMPI-A profiles to that of their non-sex juvenile delinquent (JDI) and adult sex offending (ASO) counterparts.

- A MANOVA examining the relationship between the MMPI-A validity & clinical scales and participant treatment outcomes was not significant, F (13,33) = 2.90, p < .01, as well as the relationship between the MMPI-A content scales and school problems, F (19,27) = 1.80, p < .08.

- Success of treatment was also evaluated as a function of several offender characteristics:
  - History of abuse: \( \chi^2(1) = 3.97, p < .05 \)
  - Current family: \( \chi^2(1) = 3.09, p < .08 \)
  - History of school problems: \( \chi^2(1) = 1.16, ns \)
  - Other known crimes: \( \chi^2(1) = 2.33, ns \)

- The relationship between the MMPI-A validity & clinical scales and school problems was examined, F (13,33) = 2.90, p < .01, as well as the relationship between the MMPI-A content scales and school problems, F (19, 27) = 1.80, p < .08.

**Discussion**

- Number of offense occasions against index victim, history of abuse, and family situation were related to treatment completion.

- JSO’s who offended more than once against their index victim were more likely to complete treatment than single offense JSO’s.

- Small sample size & insufficient number of JSO’s completing/failing treatment was a limitation.

- Future research could further explore JSO school problems and MMPI-A performance.

- Comparing male JSO’s to female JSO’s is another avenue of research.

- This research will add to the current body of JSO literature, and inform residential treatment programs.

* I would like to acknowledge Dr. Donald Strassberg, Dr. Paul White, Eric Raye, the USF Choices program, and the McNair program for their continued support.
Globalization, the Global Justice Movement and Civil Disobedience  
Francesca Menes and Beverly Yuen Thompson, Ph.D.  
Department of Women’s Studies and Sociology at Florida International University

Background and Introduction

Globalization is defined as a historical process involving a fundamental shift or transformation in the spatial scale of human social organization that links distinct communities and expands the reach of power relations across regions and continents. Globalization indicates a globalized economic, political, and social system. However, within the greater framework, globalization in the era since World War II has largely been the result of business interests. The result of these business interests led to the Bretton Woods Conference and the founding of several international financial institutions. These institutions oversee the process of promoting globalization and promoting the growth and management of unfavorable consequences.

These institutions include the International Monetary Fund which was formally established in 1945, as well as the World Bank. Globalization has been made possible by advances in technology, which have led to reduced costs of trade, and trade negotiations, that has ultimately led to a series of agreements to remove restrictions on free trade.

The Global Justice Movement began as a response to the detrimental conditions which have persisted throughout the world as a direct result of globalization. The global justice movement has a long history in the global south, opposing what is often known as “corporate globalization.” The global justice movement is known for advocating “fair trade” rules, and opposing “free trade.” Participants of the movement include: student organizations, NGOs, trade unions, feminists, and peace groups throughout the world. The GJM is characterized by massive citizen protests, accompanying most meetings of the G8, World Trade Organization, International Monetary Fund, and World Bank.

Civil Disobedience has been a primary tactic of the global justice movement. Civil disobedience is characterized as the active refusal to obey certain laws, most of which are considered unfair laws, without resorting to physical violence. The GJM came to the attention of the world when activists successfully used protests to shut down the 1999 WTO talks in Seattle.

Methodology

• Field Research  
• Participants (n=50) were individuals who has been arrested at any of the four major protests that were held in the U.S. or the legal workers that fought for their release.  
  • WTO protests in Seattle, Washington 1999  
  • “A16” IMF/World Bank in Washington, D.C. April 2000  
  • Democratic National Convention in Los Angeles, California 2000

• Data derived from the qualitative interviews that were conducted in which the participants reported their experiences at the protests. From the network and social organizations that got them involved with the protests, to the actual protest event, and the arrest event and conditions.
• ATLAS.ti software was used for the coding of the data. ATLAS.ti is a software used mostly in qualitative research and qualitative data analysis.

Acknowledgements

I would like to thank my mentor, Dr. Beverly Yuen Thompson for her endless support and guidance, the FIU McNair Program for granting me the opportunity to conduct a summer research project, and my family for their never-ending support and love.
Dust trajectories in the National Spherical Torus Experiment
Rahul I. Patel, Dr. Werner Boeglin
Department of Physics at Florida International University

ABSTRACT

Production of dust particles is a common occurrence in nuclear fusion reactors of today. Studying the behavior of these dust particles during plasma discharges within the reactor may facilitate in improving present and future fusion reactors for research and widespread commercial energy purposes. In the current study, dust particle trajectories were recorded using data from the National Spherical Torus Experiment (NSTX) at the Princeton Plasma Physics Laboratory (PPPL). Dust particles were observed via two high-speed cameras. Three-dimensional trajectories of individual particles were reconstructed using a series of pyknometer codes. A crucial part of the analysis was the calibration and determination of the transformation functions from the camera to the NSTX reference frame. Due to the complex method involved in recreating these tracks, only 1 track from both shot 130376 and 130377 were recreated thus far. This was the first step to a complete analysis of all the data taken with these camera views.

INTRODUCTION

Challenges in Fusion Energy Production
- High energy requirements to heat two nuclei - need to overcome coulomb barrier (electrostatic repulsion)
- Enormous energy input required to achieve temperatures and pressures of such a magnitude
- Temperature to fuse Deuterium and Tritium: 100 million degrees Celsius!
- Containment and energy production - no material can withstand such temperatures.

Dust and Fusion Reactors
- Confinement of high temperature plasma achieved via magnetic fields in Tokamak reactor like NSTX
- Contamination of plasma due to interactions with outer containment wall and evaporation of dust particles.
- Dust in plasma is impurity - safety issue.
- Dust particles may be Lithium or carbon particles.

METHODS

Data Acquisition
- Dust tracks obtained at National Spherical Torus Experiment at Princeton Plasma Physics Laboratory, Princeton, NJ.
- Two high speed cameras used to record plasma discharges.
- Cam 1 at 456, 54.6, 0. Cam 2 at 1133.87, 0.4. Recording rate of 7104 fps and 10000 fps respectively.
- Shots (plasma discharge videos) were converted to JPEG frame images using Phantom camera program.

Tracking Dust Particles

Particle Position in NSTX Reference Frame: Camera to NSTX reference frame
- Line of Sight to Intersection in NSTX
- Initial Parameters and Parameter Calibration
- Initial Euler angles (α, β, γ) for coordinate transformation found using computer pixel position on cost ship and corresponding point in NSTX. Second point in view used to determine angle between line of sight of the two points.
- Initial code to lens distance also calculated (z).
- All 4 parameters refined using least squares fitting procedure.

RESULTS

- Only two dust tracks have been recreated thus far.
- Track 1, named “Lunar” from shot 130377. Track 2, named “Hockey Stick” from shot 130376.
- Most of the dust seen due to injection of carbon coated lithium pellets into the fusion chamber during each discharge.
- Ready to reconstruct more tracks.
- More tracks coming soon.
- Any change in camera view will require a new calibration.

Conclusion and Future Work

Fusion reactors like the National Spherical Torus Experiment and the future International Thermonuclear Experimental Reactor face many challenges in keeping steady reactions for prolonged period of times due to instabilities in the plasma. The presence of dust particles can pose safety risks and impair optical diagnostic instruments necessary for the control of the plasma. The current study presents a method in reconstructing dust particle tracks. Laying out this method is crucial in reconstructing more tracks which provides important data to test and improve models of dust dynamics in fusion plasmas. Further work is being done to recreate more particle tracks.

Acknowledgements:
I would like to thank Dr. Werner Boeglin and Luis Riospina for their guidance and support and the McNair program for the opportunity to participate in this program.

References
4. www.btanker.org/banka/research/lotex.html
Motivation
Breast cancer is the second most common form of cancer in women. In the year 2008 an estimated 184,450 deaths will be attributed to breast cancer. The number of new cases in the year 2008 is estimated to be 40,630. As in the case with many cancers early detection is key to patient survival. In table 1 survival rates for different cancer stages is shown. For this reason early detection is the focus of much biomedical research. In the Optical Imaging Lab of Florida International University research is being conducted towards the development of an optical probe used as a complementary tool in the process of breast cancer diagnosis.

3-year Survival Rates For Breast Cancer

<table>
<thead>
<tr>
<th>Stage</th>
<th>3-year Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>99%</td>
</tr>
<tr>
<td>II</td>
<td>82%</td>
</tr>
<tr>
<td>IIA</td>
<td>81%</td>
</tr>
<tr>
<td>IIB</td>
<td>87%</td>
</tr>
<tr>
<td>III</td>
<td>64%</td>
</tr>
<tr>
<td>IV</td>
<td>24%</td>
</tr>
</tbody>
</table>

Table 1: 3-year survival rates

Project Overview
Existing hand held optical probes are used experimentally and clinically to help diagnose breast cancer. However these probes fail to isolate tumor location to a three dimensional field. This is necessary in order to locate the tumor in the actual breast tissue. The goal is to develop a fully automatic system that can be used to isolate the three dimensional geometry of a patient’s breast tissue. As seen in figure 1 the entire process can be broken down to four phases:

1. 3D Breast Geometry
2. Image Breast Tissue
3. Co-register Images onto Breast Geometry
4. Determine 3D Tumor Location

As indicated in the next phase of process illustrated in figure 2 this is the only part of the process addressed in this project Phase 1.

3D Breast Geometry
The image generated by the optical probe in figure 2 is 3d百合 that provides much information about the anatomical location of a breast cancer tumor. Detailed ray and photon scattering the tumor lies in a three dimensional space. For each pixel in a 3D breast image to be performed treatment. Figure 3 depicts the same type of image obtained from a breast probe the time it is co-related to a three dimensional solid (spherical symmetric) phantom phantom. The data can be processed with a type of functionalized three dimensional surface to target therapy can be advanced with much increased accuracy. Figure 4 serves as an example of flat ray filtered three dimensional stage. However the final result of the project is to get a three dimensional representation of a patient’s breast tissue.

In order to process this a two dimensional probe image is divided into a discrete number of smaller elements. The intensity of the nodules is each element is then transferred to the nodules of a corresponding three dimensional node of the final surface.

Laserscan
The starting point of the design process is the Phoenix FlexScan Cobalt laser scanner. This hand held scanner allows for easy generation of three dimensional solids in a Cartesian coordinate system. A photo of the scanner is seen in figure 6. Some of the main considerations relevant to this system is that it uses electromagnetic sensors to generate the three dimensional surface. Also it reflects user induced vibrations as well as introduces vibrations due to different users. The latter mentioned poses a problem when scanning human breast tissue along with the fact that it is a hard held device. Figure 5 shows user induced vibrations in the scan.

Automated Laser Scanner for Breast Imaging
Adrian Romero, Dr. Anuradha Godavarty
Department of Biomedical Engineering, Florida International University, Miami FL 33174

Automated Laser Scanner
All of the issues mentioned in the prior section can be addressed by making the hand held scanner fully automated. This will make the patient feel more comfortable since no operator is required to be present in order to obtain the breast geometry. Also in variance of the hand held scanner the process will be automated and therefore repeatable. Another advantage of automating the device is accurate control of scanning parameters. Due to the electromagnetic sensors on the laser scanner the use of metals has to be kept at the absolute minimum. For that reason most of the materials used will be plastics.

Materials and Components
Material selection is one of the most important aspects of this project since no metal should be used for perfect scanning results. For that reason most of the components and materials had to be selected from plastics, with the exception of electronics and motors. Everything else was either Plexiglas, nylon or acrylic. Figure 6 shows examples of what these materials look like.

Design
Figure 7 illustrates the process flow and the final product. The device consists of a hand held laser scanner that has a three dimensional field of view. The laser scanner is connected by a cable to a microcontroller. The microcontroller then sends commands to a stepper valve to control the laser scanner. The stepper valve controls the movements of the laser scanning parameters. The stepper motor movement is controlled by the microcontroller.

Simulation
Before manufacturing began computer simulations were performed to test the response of this material to the applied stresses. All the parts were designed and modeled in SolidWorks. Figure 8 shows the simulated displacement due to the stiffness. Maximum displacement was observed in the model at 2.5 mm. The factor of safety (FOS) represents how many times the applied load could be withstand by the part. An FOS factor of 8.351 means that specific model can withstand 8.351 times the applied stress without failing. None of the parts passed this test, with the lowest FOS value being 5.951.

Conclusion
Once the mechanical properties of the design were evaluated, the device was manufactured at the Biomedical machine shop. The final result can be seen in figures 9 and 10. Figure 9 shows the four components used to control the stepper motors and the servos. Figure 10 shows a photo of the actual device finally installed. In order to control the motors a software was developed in MATLAB which dictates to the motors what actions to take. Once a sequence of movements is decided, the corresponding commands are entered into the MATLAB code and they are sent to the controllers. In addition to that we developed a fully automated laser scanner that allows us to capture scanning parameters, height, time, etc., such as scanning parameters. The biggest advantage of this device is that it can be controlled remotely to increase patient comfort.

References
The Relationship between Maternal Emotional Functioning and Child Psychological Functioning

Sandra Neptune, Crystal Reyes, Laura Ornamas, Melody Whiddon, & Marilyn J. Montgomery, Ph.D.
Department of Psychology, Florida International University • Miami, Florida

Abstract

Because mothers play a major role in the psychological development of their children, there is much potential in examining mothers’ emotional functioning and its association with their children’s psychological functioning. The objective of the current study was to investigate the association between the two, utilizing the Child Behavior Checklist (CBCL) to measure the child’s overall psychological development and functioning, and the Emotional Quotient Inventory Short Form (EQ-I) to measure the mother’s day-to-day emotional functioning. The sample population consisted of 38 mother/child dyads, consisting of children between the ages of 4 and 12, consisting of 19 boys and 19 girls. The findings in this study supported the proposed hypothesis that parents with higher scores on measures of emotional functioning have children with lower scores on measures of psychological problems.

Background and Significance

In recent years studies on children’s psychological functioning have steadily increased due to these alarming statistics: One in every five children has a diagnosable mental disorder (NMHA, 2007), and one in ten children has problems severe enough to significantly interfere with normal functioning (Barlow, et al., 1995; DBHS, 1999). Mothers play a crucial role in their child’s psychological development due to the salient role they play in their child’s life overall. There is empirical support for the association between mother and child psychological functioning, and according to attachment theory, the Internal Working Model (IWM) is the linking mechanism. Attachment theory also states that interaction with a primary caregiver which is in most cases a mother, informs an individual’s construction of an internal working model of the self in relation to others in their environment. A mother’s IWM leads to her behavior by guiding her interpretation of, and responses to, her child’s needs. It also leads to the quality of the mother/child interaction, as these are related to the quality of attachment the child has toward his/her mother and are a reflection of the IWM the child is forming (Van Ijzendoorn, 1995). According to Attachment Theory, barriers to the development of secure attachment, which are likely in mothers with mental health disorders, may be a key factor to the emergence of later psychopathology in their children (Cummings & Cicchetti, 1990).

The present study seeks to investigate the relationship between maternal emotional functioning and child psychological functioning. The hypothesis is that mothers with lower scores on emotional functioning would have children with higher scores of psychological problems.

Methods

Participants

A total of 32 mothers and 62 children were included in the final pool of participants.

• Child participants included 32.5% of 12 Males and 47.5% of 11 females with a mean age of 7.7 years, and a range of 4-12 years.

• Maternal participants were a total of 23 with a mean age of 37.5 years, and range of 27-49 years.

• Eight mothers and 9 children with 47.5% were Hispanic, 11 or 47.5% were African American, and one or 4.3% were African American.

Measures

• The Child Behavior Checklist (CBCL; Achenbach, 1991) is a 113 item parent-report questionnaire with a strong empirical base, as well as good validity and reliability (Achenbach & Edelbrock, 1983; Biederman et al. 2001; Sheerer & Johnson, 1994).

• The CBCL measures parents’ perception of their child’s behavioral, emotional, and psychological symptoms.

• The following scales and subscales were utilized:


• The CBCL scale includes measures of the child’s overall emotional, behavior, and psychological symptoms.

• The EQ-I measures one’s overall emotional intelligence, including the ability to deal with daily emotional stress and strain.

• The CBCL and the EQ-I were utilized in this study, as they are both Interpersonal, Interpersonal, Adaptability, Stress Management, and General Mood.

• The subscales utilized in this study were Interpersonal, Interpersonal, Adaptability, Stress Management, and General Mood.

Results

Table II

Means, Standard Deviations, and Ranges for Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (M)</th>
<th>SD (SD)</th>
<th>Minimum (Min)</th>
<th>Maximum (Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total EQ</td>
<td>49.61</td>
<td>14.67</td>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>41.18</td>
<td>15.07</td>
<td>14</td>
<td>73</td>
</tr>
<tr>
<td>Emotional Quotient</td>
<td>45.97</td>
<td>14.43</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>Adaptable</td>
<td>31.18</td>
<td>10.14</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>General Mood</td>
<td>25.34</td>
<td>11.78</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Total CBCL</td>
<td>176.17</td>
<td>56.58</td>
<td>35</td>
<td>300</td>
</tr>
</tbody>
</table>

Conclusions

• Consistent with the hypothesis, mothers with poorer interpersonal functioning had children with more behavioral and psychological problems. Specifically, such children had more somatic complaints, rule-breaking, aggressive, oppositional behaviors, and attention problems. Overall, they displayed more problems in general.

• Mothers with poor interpersonal functioning tend to have children who exhibit behavioral and psychological problems such as somatic problems, anxiety or depression. It was also found that mothers with poorer interpersonal functioning had children who displayed higher levels of oppositional defiance or conduct problems, than mothers with better interpersonal functioning. This is because mothers who do not experience satisfaction in their relationships, tend to behave differently with their children, and as a result tend to elicit negative feelings in the child, such as anxiety.

• As predicted, mothers who report happier moods tend to have children with fewer somatic problems and present less opposition to rules and requests. This is not surprising, since we know that a mother’s mood affects her parenting style which in turn influences a respective appropriately behavioral response from the child.

• Mothers with healthier emotional functioning in general tend to have children with fewer somatic complaints and less challenging and oppositional behaviors. This is because mothers with efficient emotional functioning tend to be more receptive and sensitive to their children’s needs, develop a close bond and secure attachment, and therefore minimize the odds of child psychopathology which could cause the symptoms listed above.

• In summary, in support of the hypothesis, mothers’ emotional intelligence as measured by the EQ-I was significantly correlated with several child psychological adjustment scales as measured by the CBCL.

Acknowledgements

I would like to thank the following people for their support and assistance throughout this course of research:

Sue Bushes<br>Cristian Reyes<br>Maria Almazan Molan<br>Dr. E. George Simms<br>Dr. T. Scott Hamilton<br>Dr. Diane Stephens

I would also like to thank the McNair Postbaccalaureate Achievement Program for their continued support.

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Achenbach, T. M. (1991). Diagnostic Interview Schedule for Children, Version 3.1. Department of Pathology, Psychiatry and Behavioral Sciences, Emory University, Atlanta, GA.


High Temperature Aerogels in the \( \text{Al}_2\text{O}_3 - \text{SiO}_2 \) System for Thermal Protection Materials

Denisse V. Aranda  
Florida International University  
Dr. Frances Hurwitz  
NASA Glenn Research Center - Structure and Materials Division

**Objective**

To explore the use of high temperature aerogels in the development of lightweight, high temperature insulating materials and integrated structures for supersonic and hypersonic applications, including space exploration.

**Physical Properties**

- **World’s Lowest Density Solid** – up to 1.9 mg/cm³
- **Rigid Foam** – feels like expanded polystyrene
- **Mesoporosity** – up to 99.8% air
- **Friability** – fragile to point loads
- **Hydrophilic** – readily available to absorb water
- **Transparency** – Color due to the Rayleigh Scattering of shorter wavelengths of light
- **Thermal Insulation** – Aerogel can eliminate almost three methods of heat transfer: conduction, convection, and radiation.

**Applications**

**STARDUST MISSION**

The Stardust spacecraft was sent to a comet Wild 2 to secure samples of primordial material from a comet’s nucleus which may hold the clues to the evolution of life. An aerogels mesoporous structure allows the interstellar dust to bury itself in the pores where it could gradually come to a complete stop without altering its chemical composition.

**MARS PATHFINDER**

The role of Aerogel as the rover’s battery insulator and the fuel insulator to shed over 20% of its original weight.

**Problem**

Aerogels are still very fragile and susceptible to collapsing under extreme heat. There is a need for an aerogel that can withstand over 1,000°C while having minimal shrinkage and maintaining its porous dendritic structure, insulating abilities, and low density. The research is investigating the effects of solids loading, ethanol content, and Si/Al ratio on morphology, density, and thermal stability of aerogels in the \( \text{Al}_2\text{O}_3 - \text{SiO}_2 \) systems.

**Method Of Solution**

Al/Si ratios varying from 1/0, 8/1, 4/1, 3/1, and 1/1 were studied and chosen based on the \( \text{Al}_2\text{O}_3 - \text{SiO}_2 \) phase diagram. The effects of varying ratios will yield changes in skeletal density, surface area, pore size distribution, and most importantly, the crystallization temperature.

**Aerogel Synthesis**

Aerogels are derived through sol-gel chemistry. The Alumina precursor for these aerogel were made by the hydrolysis of \( \text{AlCl}_3 \cdot 6\text{H}_2\text{O} \) in water and ethanol, which makes the solution acidic. After chelating the solution, Tetraethylorthosilicate (TEOS) was added as the silica pre-cursor and is also hydrolyzed. After condensation, the gelation catalyst, Propylene Oxide, is added as the final chemical in the procedure. The solution now becomes a sol, a colloidal suspension of particles that links together in a three-dimensional network, and is poured into a mold for gelation.

**Aerogel Composites**

Hypotherm SIC Foam, Hypotherm SIC foams that contain 100 p.p.i. ( pores per inch) were used in making aerogel composite

Electrospun Fibers, Electrospun fibers that were calcined at 700 °C as well as 1050 °C were explored

**Future Work**

Future work will focus toward understanding the effects of heat treatments on pore size and pore size distribution, and defining an envelope of thermal exposure conditions under which the aerogel structure can be maintained.

**Acknowledgements**

Thank you to the McNair program, NASA’s USRP Program, NASA’s Aerogel Team, and most importantly Dr. Frances Hurwitz The most amazing mentor anyone could wish for! Thank you!
Harmonic Analysis

Bryan Arriete and Dr. Steven Hudson

Department of Mathematics, Florida International University, 2006

Abstract

Harmonic analysis is the study of harmonic functions and their respective properties. This research aimed to find the behavior of the curves that these functions produce. The purpose of the research is to examine these functions for the sake of pure mathematics and physical applications. Through the analysis, the Broccoli conjecture, which was formulated by Dr. Steven Hudson, has almost been proved a theorem.

Methods

A large portion of the research was conducted online, sharing ideas and progress through e-mail. The researcher’s responsibility was to work with mathematics to graph different functions whose level curves were not smooth. While the Hudson worked with the analytical work, the researcher would also read over proofs, learning new methods of math.

Results

In the analysis of harmonic functions, key characteristics, such as maxima, minima, and inflection points, of the function’s curves were compared. To analyze the curves, curvature and the slopes of the curves were measured. The researcher also examined the behavior of the curves, which were analyzed for maximum and minimum points. The author also used the method of the greatest area, which also known as the maximum point. The researcher then compared the curves and found that the curves behaved differently from each other, this information is shown in the figure for the researcher. The researcher found that the curves behaved differently from each other, this information is shown in the figure for the researcher.

Current Work

Currently, the researcher is experimenting with theoretical drawings of functions that can potentially disprove the idea behind the Broccoli conjecture. Specific functions of interest are those that do not behave like a Broccoli conjecture. These functions are theoretically shown, meaning the equation that produces these functions is not harmonic. Proving the existence of such harmonic functions that map out such graphs would ultimately disprove the Broccoli conjecture.

Future Work

Through much work, the existence of a harmonic function that produces a very similar shape seems unlikely. This will lead to new interesting mathematical functions that can support or strengthen the Broccoli conjecture. The conjecture has been heating strong and which may lead to the evolution of a new theorem.

Conclusions

The Broccoli conjecture has been the main focus of Dr. Steven Hudson’s research for nearly two years. Harmonic functions are not only important in mathematics, but they are also useful. Harmonic functions describe a variety of natural phenomena, such as heat temperature. Though this research was aimed for pure mathematics, a better understanding of these could help people in many ways and people could help describe the physical world around us. Though our research continues on, we can only hope that we will be able to understand yet another mystery.

Acknowledgments

I would like to thank my mentor, Dr. Steven Hudson, for allowing me the opportunity to work with him. I would also like to thank the McNair program for funding this research project, and my family for supporting me in everything I do.

References

Rab5 Regulation During the Adipogenesis of 3T3-L1 Cells
Jeanette Castro, Nicole Villaverde, M. Alejandro Barbieri
Department of Biological Sciences

Introduction
Type II diabetes affects 23.6 million Americans, 7.9% of the United States’ population (National Diabetes Statistics, 2007). It is characterized by a cell’s inability to intake insulin, which is crucial in the conversion of glycogen into energy. This defect is a result of a malfunction in the insulin receptor, a vital piece needed for receptor mediated endocytosis (Fig 1). In this process, a ligand attaches to a membrane bound receptor, triggering the cell to envelop the outside particles creating a vesicle, called an endosome, in the interior of the cell. The transport of these endosomes is guided by Rab Proteins. Active Rab5 is directly associated with the guidance of early endosomes through the process of Endocytosis (Bucci C et al, 1992). An early endosome can take one of two routes. It can either recycle its receptor back to the surface, or deteriorate in order to make building blocks for the cell, inactive.

Rab5 would inhibit an early endosome from proceeding along either one of these routes. Normally, Rab5 fluctuates between active and inactive forms in response to GEF and GAP proteins (Fig 2). Preadipocytes (3T3-L1 cells) go through a course of action called differentiation in order to become adipocytes (Fig 3). It can be characterized by a change in cell shape as well as lipid droplet formation. Preadipocyte differentiation is dependent on insulin signaling. It has been suggested that inhibiting endocytosis increases signaling, therefore increasing differentiation (Liu et al, 2007). As a cell differentiates it releases Adiponectin, which makes a cell more sensitive to insulin intake. With an increase in differentiation and adiponectin release, there is hope in finding a cure for Type II Diabetes. Considering this information, it is proposed that Rab5 as well as positive and negative mutants (Rab5 S34N and Rab5 Q79L respectively), will have an impact on the differentiation of preadipocyte cells into adipocytes. Active Rab5 is expected to increase the amount of endocytosis, thus decreasing the amount of differentiation. In turn, inactive Rab5 should inhibit the endocytosis process directly causing an increase in differentiation.

Methods

Making Cell Lines
• Transfect PlatE cells with virus
• Collect retrovirus
• Infect 3T3-L1 cells
• Use antibiotic to select for cells expressing Rab5 cell line (Rab5 WT, Rab5 S34N, Rab5 Q79L)

Differentiation
• Grow until 100% confluent
• On days 0-3 keep cells in differentiation media
  (key element is insulin)
• On days 0-9 keep cells in regular media
  (DMEM, 10%FBS)
• Day 9 quantify differentiation

Quantifying Data
• Remove media
• Add fixing solution (10% Formalin in FBS)
• Remove fixing solution
• Add Oil Red O to stain lipid droplets
• Elute Oil Red O with Isopropanol
• Measure optical density of solution using spectrophotometer

Results

The results supported the hypothesis. Inactive Rab5 (Rab5 S34N) had similar differentiation to the control (3T3-L1). Active Rab5 (Rab5 Q79L) had very little differentiation.

Conclusion

These results led to a working model suggesting that RabGAP5, an activator of Rab5, will inhibit the process of endocytosis leading to the formation of a signaling endosome. This proposed type of endosome will result in increased signaling output and more differentiation. Consequently, permitting more adiponectin release, which increases the adipocites’s sensitivity to insulin.

Future Direction

Differentiating RabGAP5 cell lines to observe the amount of adipocyte formation and adiponectin release.

References
Liu et al. (2007) NGF-mediated Neurite Outgrowth via Regulation of Rab5.
J. Biol. Chem. 282:16191
National Diabetes Statistics 2007

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Great appreciation and respect is given to: M. Alejandro Barbieri
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[Images and diagrams are not transcribed textually.]

Figure 1: Receptor Mediated Endocytosis

Figure 2: Inactive vs Active Rab5

Figure 3: Differentiation of preadipocyte to adipocyte

Figure 4: Differentiated adipocytes after Oil Red O is applied

Figure 5: Differentiation of 3T3-L1 cells

Figure 6: Working Model

Graph 1: Effect of Rab5 on Differentiation

Graph 2: Graph showing effect of Rab5 on differentiation.
Parent Emotional Characteristics: Associations with Parent-Child Interaction

Crystal Reyes, Melody Whiddon, & Dr. Marilyn J. Montgomery
Department of Psychology, Florida International University • Miami, Florida

Background and Significance
- Parent-child interaction can provide a window into the development of a child (Ainsworth, 1967). Specifically, the quality of the interaction between parent and child can reveal a child’s present as well as future mental, social, and emotional functioning (Cohen & Wakschlag, 2006).
- Due to the major role parents play in the lives of their children, it is essential that their contributions to parent-child interactions be understood.
- While parent characteristics are known to have a powerful impact on the formation of an attachment relationship and subsequent child psychopathology, most parent-child interaction research has focused exclusively on examining maternal depression.
- Few studies have examined the continuum of emotional functioning from adaptively to maladaptive and investigated the specific aspects of emotional functioning that are impaired in depression, or that exist in a mentally healthy parent.

Methods
The present study tested:
- Examines the correlation between parent emotional characteristics and parent-child interaction.

Hypothesis: Parents with more positive scores on measures of emotional functioning as measured by the Emotional Quotient Inventory will be more responsive to their children’s bids during interaction.

Participants
- A total of 16 mother-child dyads were included in the final sample.
- Children’s ages ranged from 4 to 12 years with a mean age of 8.31.
- Mothers’ ages ranged from 27 to 49 years with a mean age of 33.5.
- Ten (62.5%) of the children were male, and six (37.5%) of the children were female.
- Eight (50%) of the mothers were of Hispanic origin, and the remaining eight (50%) were of Non-Hispanic white origin.

Measures
- Parent Rapportiveness: Parent-Child interaction during play was coded for parent responsiveness to children’s bids for interaction. Parent responses were assigned a value ranging from 0 to 3 based on the type and relative appropriateness of the parent’s response.

- A response of accept-engage was assigned a value of 3; a response of accept-acknowledge was assigned a value of 2; a response of ignore was assigned a value of 1; and a response of reject was assigned a value of 0.

- Variables:
  - A mean of total parent responses was calculated to determine a mother’s overall responsiveness to the bids of her child.
  - For this study, child bid types were not taken into account but would make for an interesting future study.

- Parent Responses
  - Accept: Engage: parent accepts the interaction and elaborates
  - Accept: Acknowledge: parent acknowledges the child’s bid but does not take it any further
  - Reject: parent refuses the child’s bid
  - Ignore: parent does not acknowledge the child’s bid.

- The Emotional Quotient Inventory-Short (Bar-On, 2002). A 5-item parent self-report; measures the ability to deal with daily environment demands and pressures, and also helps predict one’s success in both personal and professional endeavours.

- Subscales:
  - Interpersonal, Interpersonal, Stress Management, Adaptability, & General Mood

Results

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Correlations Between Parent-Child Interaction and Parent Emotional Functioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent-child interaction</td>
<td>Parent-child interaction</td>
</tr>
<tr>
<td>EMO subscales</td>
<td>Mean parent response</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>.67</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>.67</td>
</tr>
<tr>
<td>Adaptability</td>
<td>.46</td>
</tr>
<tr>
<td>General Mood</td>
<td>.21</td>
</tr>
</tbody>
</table>

Note: Correlations significant at .05 level (2-tailed).

Conclusions

Research Conclusions
- The highest mothers were in interpersonal functioning (i.e., being in touch with one’s emotions and able to communicate feelings to others). Bar-On, 2002, the more responsive they were to their children’s bids for interaction, and the less likely they were to ignore their children’s bids for interaction.
- The highest were in interpersonal functioning (i.e., being in touch with one’s emotions and able to communicate feelings to others), the less likely they were to ignore their children’s bids for interaction.
- The more parents exhibited positive general mood (i.e., being generally pleasant, optimistic, and energetic), the less they ignored their children’s bids for interaction.

Implications for Future Research Directions
- Bridging the gap between knowledge concerning parent emotional functioning and parent-child interaction is vital for a deeper understanding of attachment theory.
- The results of this study offer evidence for the utility of gauging parent-child interaction qualities based on a parent’s emotional functioning. These, assessing a parent’s emotional functioning can be useful in both research and clinical settings.
- Further research should consider examining the correlations between parent emotional functioning and parent-child interaction with larger and more ethnically diverse samples in order to increase generalizability and detect possible distinctions in parent-child interaction among different ethnic groups.
- Research should also investigate how child characteristics may affect parent’s emotional functioning and subsequently impact parent-child interactions.

These research aims can be used to inform future interventions, which focus on improving caregiving behaviors among minority populations and parents dealing with child psychopathology.

Acknowledgments

I would like to thank the following for their encouragement and support throughout the research process: Dr. Marjorie Montgomery, Melody Whiddon, Sandra Neptune, Laura Garcia, Dr. Jason Smith, Dr. D. George Church, Dr. Deonna Stephens, The Ronald E. McNair Postbaccalaureate Achievement Program, and The Psychology Research Initiative Program.

References

### Abstract
The theory of real plane curves of degree two, the conic sections, has a long and venerable history. On one hand, through Newton’s laws of motion, these curves help understand the physical world, and are used by the astronomers during every their space-travel. On the other hand, the degree two plane curves are the first nontrivial example of what Algebraic Geometry, a highly developed and intensively used modern part of Mathematics, studies.

There are different approaches toward the global theory of conic sections. One of them is through the moduli space of these curves: a mathematical object which parameterizes all such curves. On this space, there are sectors which parameterize the basic different types of conic sections: parabolas, hyperbolas, and ellipses. It is interesting to know how many of each type of curves exist. This amount is measurable, and comparing the different sectors of that moduli space, the problem here is that to do so one has to choose an appropriate measure on the moduli space. This is not a trivial task: there are infinitely many possible measures to work with, and choosing the appropriate, most natural, one needs investigation. There is another approach toward the classification of conic sections, not algebraic geometric in nature, which works with compact spaces, and where a presumably obvious measure exists. In this approach, one has to work with five dimensional spaces and compare regions on them. It is expected that the intersection of the two approaches will reveal some aspects of the theory of conic sections.

### Conic Sections

- **Parabolas**
- **Ellipses**
- **Hyperbolas**
- **Circular Conics**

### Affine Transformations
In geometry, an affine transformation or an affine map [between two vector spaces (strictly speaking, two affine spaces)] consists of a linear transformation followed by a translation:
\[ x \mapsto A \cdot x + b \]

In the finite-dimensional case each affine transformation is given by a matrix A and a vector b", satisfying certain properties described below.

Physically, an affine transformation is one that preserves:
1. Collinearity between points, i.e., three points which lie on a line continue to be collinear after the transformation.
2. Ratios of distances along a line, i.e., for distinct collinear points \( p_1, p_2, p_3 \), the ratio \( \frac{p_1 - p_2}{p_2 - p_3} \) is preserved.

### References

### Special Thanks
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Dr. Ted Gingrich
Leonard Foret

### Research Problem
Given the equation of the conic,
\[ A x^2 + B x y + C y^2 + D x + E y + F = 0 \]
what is the probability measured on \( S^2 \) given that each of the six coefficients, \( A, B, C, D, E, F \) is uniformly distributed?\n
### Novelty Probability Method
A naive, but popular approach to measuring the probability is to add up all the values and divide by the total number of measurements. However, we have a problem in that there are infinitely many conics and we would have to divide by infinity. This is not well-defined. Instead, what we do is find the ratio of the hypotenuse of the ellipse to the ellipse on \( S^2 \). (We can do this exactly using numerical approximation programs such as Maple or Mathematica.) We are also going to ignore conics of measure zero, such as the parabola.

### Canonical Conics

- **Parabola**:\n  \[ y = ax^2 + bx + c \]
- **Ellipse**:\n  \[ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \]
- **Hyperbola**:\n  \[ \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \]
- **Circular Conic**:\n  \[ x^2 + y^2 = r^2 \]

### Group Actions
The symmetry group describes all symmetries of objects. The is formalized by the notion of a group action: every element of the group “acts” like a bijective map (or “symmetry”) on some set.

### Special Thanks
Florida International University
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Dr. Ted Gingrich
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### References

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Leonard Foret

### References
Characterization of Mitochondrial Protein O-GlcNAcylation in Type 2 Diabetic Hearts

William A. Zambrano, Eduardo Fré covsky, Jorge Suare s, Wolfgang Dillmann
School of Medicine Department of Biomedical Science at University of California San Diego
Ronald E. McNair Post Baccalaureate Achievement Program

Abstract

Background: Protein O-GlcNAcylation has been implicated in the development of Type 2 diabetes mellitus (T2DM). Previous work in our lab has demonstrated that O-GlcNAcylation of nuclear factors (SP1) in cardiomyocytes leads to decrease cardiac function in Type 2 diabetes animals. However, it is not known if O-GlcNAcylation of mitochondrial proteins leads to mitochondrial dysfunction in T2DM hearts.

Methods: We utilized C57Bl/6 mice injected with a low dose of streptozotocin (STZ, 75 mg/kg) that were fed on a high fat diet (60% fat) for 12 weeks, as a T2DM mouse model. We then performed a leptin precipitation assay and looked at mitochondrial protein glycosylation from purified mitochondrial extract of T2DM mouse hearts. We measured mitochondrial complex function (ll, lll, lv) and mitochondrial swelling assay to see if glycosylation of these proteins correlated with decreased complex function and/or increased mitochondrial transition pore (MTP) opening.

Results: Our results showed that complex lll, lv in T2DM hearts have decreased complex function. We also were able to show that MTP was heavily glycosylated and increased MTP opening compared to wild-type (WT). Conclusion: In conclusion, increased protein O-glycosylation of mitochondrial protein correlated with decreased complex function and increased MTP opening.

Method

Type 2 diabetes mice (8 weeks old) were injected with a low dose of streptozotocin (STZ, 75 mg/kg) and placed on a high fat diet (60% fat) for 12 weeks.

Mitochondrial Extraction

After sacrifices, hearts were removed and homogenized. Heart homogenate was centrifuged at 20,000 RPM for 15 minutes at 4°C. Supernatant was separated and centrifuged at 100,000 RPM for 15 minutes at 4°C. Mitochondrial pellet was then used to measure mitochondrial respiratory chain complex function and mitochondrial O-GlcNAcylation.

Mitochondrial Complex I Function

The complex I (NADH-CoQ reductase) activity was measured in enriched mitochondria.

The specific activity of the enzyme is measured as a function of the slope of the NADH oxidized per minute.

Activity was represented as a percentage activity compared to control.

Mitochondrial Oxygen Consumption

Mitochondrial Complex activity was measured polarographically with an oxygen electrode at 37°C.

Respiration was initiated with the addition of 1:1 ratio of succinate/CoQ (complex I) and 2:1 ratio of ascorbate/TMPD (complex IV).

After 2 minutes, state 3 respiration (complex III) was measured by addition of 0.5 mmol/L ADP.

Mitochondrial protein O-glycosylation

Leptin agonist beads were used to selectively bind to mitochondrial glycosylated protein for Western blotting.

Specific antibodies were used to identify various mitochondrial glycosylated proteins.

Mitochondrial Oxygen Consumption

This overglycosylation could also be the cause of decreasing in activity of complex IV.

Summary

T2DM affects mitochondrial respiratory function of complex I, III, and IV in the heart.

Mitochondrial protein O-GlcNAcylation are increased in T2DM hearts compared to control.

Glyceraldehyde-3-phosphate dehydrogenase (GAPD) protein a component of the mitochondrial permeability transition pore (MPTP) was discovered to be heavily glycosylated compared to control.

Future direction

Increase expression of GCA enzyme that removes O-GlcNAc residues from proteins and see if mitochondrial respiratory chain function can be restored in T2DM.

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Entamoeba histolytica Induces Apoptosis in Epithelial Cells

Mohammed N. Oosman, Stephen Becker, Ph.D., Eric Houp, M.D.
University of Virginia School of Medicine
Division of Infectious Diseases and International Health

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Materials and Methods:
- Co-Culture – incubate epithelial cells with E. histolytica
- Incubation – at 37°C for 4 hrs
- Harvest Supernatants – draw off the supernatant + amoeba, add in lysis buffer
- The supernatant + amoeba is added to epithelial cells
- ELISA – add 5 µl sample + APTS solution + Stop Solution
- Development/Analysis – read plate @ 405 & 490 nm

Results:

E. histolytica induces apoptosis in epithelial cell line

CBA Caco-2 Cell Line (N2)
Continued Data from Page, 6/21/17

B6 Caco-2 Cell Line (N2)
Continued Data from Page, 6/21/17

Apoptosis is dependent on amoeba strain

Apoptosis is dependent on amoeba strain

Conclusion:
- E. histolytica does cause apoptosis in epithelial cells
- Apoptosis is dependent on the dose of the amoeba strain
- Degree of apoptosis is dependent on the strain of the amoeba

Future Studies:
- Future studies are underway to
- Test apoptosis of primary cells from mice
- Test multiple epithelial cell lines
- Test whether the decreased apoptosis seen with live virulent amoebae (A772) reflects increased phagocytosis / necrosis

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Enzyme-Linked Immunosorbent Assay (ELISA) for apoptosis
- Detects the presence of an antibody or an antigen in a sample
- Binding of enzymes through antibody interaction

Hypothesis:
Entamoeba histolytica induces apoptosis in epithelial caco-2 cells and this allows the parasite to establish itself in the gut

Prior Work:
E. histolytica induces apoptosis in T cells (Kulaton et al., 1998) & Mielated cells (Peri et al., 2002)

Apoptosis:
- Programmed Cell Death (PCD)
- Marked by DNA degradation
- Why should a cell commit suicide?
  1. PCD is as needed for cell development as mitosis is
  2. PCD is needed to destroy cells that represent a threat to the integrity of the organism

Entamoeba histolytica
- Protozoan human parasite
- Amoebic Dysentery
- Liver Abscesses
- 40,000 – 100,000 deaths annually
- Mechanism of the disease is still being studied
- How is the infection acquired?
- Fecal-Oral Transmission

Mice model of Amoebiasis
- Infection is mouse strain dependent (host factors)
- CBA mice – susceptible to infection
- C57BL/6 mice – resistant to infection

E. histolytica is injected into the ocic and limited there

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Introduction

The purpose of this paper is to describe the development of a high performance liquid chromatography (HPLC) method for the quantitative analysis of adsorption of humic substances to mineral surfaces. The method is based on previous work in the field of adsorption of organic matter to mineral surfaces. The method has been optimized for the analysis of adsorption of humic substances to mineral surfaces, and has been used to study the adsorption of humic substances to mineral surfaces under a variety of conditions.

Results: Influence of pH and Ionic Strength on Adsorption

A) Adsorption Density of SiRA to Fe-O as a function of amount injected, pH levels 6.5 (squares), pH 6.5 (triangles), pH 7.5 (diamonds), pH 8.5 (circles). The data points indicate the amount of SiRA adsorbed at each pH level.

B) Adsorbed Density of SiRA to Fe-O as a function of pH, 0.01M NaCl solution.

Conclusions

Our results indicate that the adsorption of SiRA to Fe-O is significantly affected by pH and ionic strength. The adsorption density increases as the pH increases and the ionic strength decreases. This is consistent with previous studies that have shown that the adsorption of organic matter to mineral surfaces is influenced by pH and ionic strength. The results of this study suggest that the HPLC method developed in this study can be used to study the adsorption of humic substances to mineral surfaces under a variety of conditions.

Methods

- The Fe-O adsorbent was packed into 200mm slurry to create a slurry sample.
- A 0.5mL sample of Fe-O solution was injected into the column, followed by 0.5mL of 0.01M NaCl solution.
- The column was then eluted with 0.5mL of 0.01M NaCl solution.
- The absorbance was measured at 600 nm using a UV/vis spectrophotometer.
- The absorbance was plotted against the amount of SiRA adsorbed.

Figure 2 demonstrates differential graphs calculated for each pH value from the adsorption data. The data points indicate the amount of SiRA adsorbed at each pH level.

Figure 3 shows the adsorption density of SiRA to Fe-O as a function of amount injected, pH levels 6.5 (squares), pH 6.5 (triangles), pH 7.5 (diamonds), pH 8.5 (circles). The data points indicate the amount of SiRA adsorbed at each pH level.

Future Work

The Murray laboratory will study the interactions of other adsorbed humic substances, including humic-like substances, to mineral surfaces and the effects of ionic strength on these interactions. The data obtained from these experiments will be used to develop a better understanding of the adsorption of humic substances to mineral surfaces.

References

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