

# SUMSRI Newsletter

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Fall, 2008



**Front row:** Staci White, Angela Buck, Linden Johnson, Rachel Karpman, Isidora Jimenez, Amanda Phillips (GA), Takisha Harrison, Michele Josey, Tiffany Jackson-Henderson. **Back Row:** Samuel Ivy, Holly Sontag, Kevin Tolliver (GA), Cheryl Outing, Cliff Taylor, Megan Boggess, Brett Jefferson, Beth Fowler (GA) and Megan Bernstein.

## NEWS FROM SUMSRI 2008

The Tenth Sumsri group arrived in Oxford, in Public Health and now sets up clinical trials Ohio, on May 31 ready to take on the challenges presented by open-ended mathematics and statistics problems for the next seven weeks. Although they arrived as strangers to each other and to Miami University, they soon discovered new friends, and common interests with people from across a wide spectrum of backgrounds and experience.

They jumped immediately into short courses in real analysis (Dr. Patrick Dowling) and abstract algebra (Dr. Dennis Keeler), mathematical writing (Dr. Thomas Farmer) and GRE preparation (Dr. Dennis Davenport). They divided into research groups to investigate aspects of number theory with Dr. Edray Goins, algebra with Dr. Reza Akhtar and multivariate statistics with Dr. Vasant Waikar.

Nine colloquium talks by research mathematicians were held during the seven weeks. Dr. Rebekkah Dann, (SUMSRI 1999), presented the first talk on how to set up clinical trials. Dr. Dann recently received her doctorate

After the first three intensive weeks, the short courses ended; instruction in research techniques; and background topical information came to an end. Investigation into how to solve the unsolved problem kicked into high gear. Small groups met to discuss the problem and test out new ideas.

A graduate school panel discussion about how to apply, what to expect from different programs and scholarship information saw the return of Anthony Franks (SUMSRI 2006), now a graduate student in statistics at North Carolina State University. He was joined by representatives from several other regional universities.

Research papers from this year's Sumsri groups can be found at: <http://www.users.muohio.edu/porterbm/sumj//2008/TOC08.html>.

*Join the Sumsri Facebook circle of friends.*

Find Sumsri friends from the summer you participated. Post interesting internship opportunities on the Sumsri page. Rate them as good or bad. Find out who is going to your university from Sumsri and help welcome them to their new research home. Find the best graduate programs that have welcomed former Sumsri participants.

### *Help Us Recruit the next Sumsri participants!*

Do you have promising students or classmates who are thinking about the possibility of going to graduate school? Do you think they could benefit from the intensive summer work at Sumsri?

**Send them to:**

<http://www.units.muohio.edu/sumsri/>  
Or call 513-529-8118

# Number Theory—Dr. Edray Goins

Dr. Goins led six young researchers in search of elliptic curves, ably assisted by teaching assistant, Beth Fowler (University of Tennessee at Knoxville, SUMSRI '06). Using the research papers written by previous SUMSRI groups on this issue as a launching point, these young researchers utilized the Redhawk Parallel Computing Center to look at **“4-COVERING MAPS ON ELLIPTIC CURVES WITH TORSION SUBGROUP  $\mathbb{Z}^2 \times \mathbb{Z}^8$ ”**.

In their paper, they considered elliptic curves over  $\mathbb{Q}$  with the torsion subgroup  $\mathbb{Z}^2 \times \mathbb{Z}^8$ . In particular, they discussed how to determine the rank of

the curve  $E : y^2 = (1-x^2)(1-k^2)x^2$ , where  $k = (t^4 - 6t^2 + 1)/(t^2 + 1)$ ,

and  $t = 9/296$ . They used a 4-covering map



Left to right: Sam Ivy (Morehouse College), Staci White (Shawnee State University), Michele Josey (North Carolina Central University), Cliff Taylor (Grand Valley State University), Cheryl Outing (Spelman College), and Brett Jefferson (Morgan State University) and Dr. Edray Goins (Purdue University)

$$\hat{C}'_{d_2} \rightarrow \hat{C}_{d_2} \rightarrow E$$

in terms of homogeneous spaces for

$d_2 \in \{-1, 6477590, 2, 7, 37\}$ . They provided a method to show that the Mordell-Weil group is  $E(\mathbb{Q}) \cong \mathbb{Z}_2 \times \mathbb{Z}_8 \times \mathbb{Z}^3$ ,

which would settle a conjecture of Flores-Jones-Rollick-Weigandt and Rathbun.

# Algebra—Dr. Reza Akhtar

Dr. Akhtar led five participants through an exploration of **“THE STRUCTURE OF UNITARY CAYLEY GRAPHS”**. Amanda Phillips (Purdue University, SUMSRI '04) joined as teaching assistant. Their research investigated the unitary Cayley graph of a ring  $R$  is the graph whose vertices correspond to elements of  $R$  and whose edges are pairs  $\{u, v\}$  such that  $u-v$  is a unit in  $R$ . They investigated various structural properties of unitary Cayley graphs (primarily when  $R$  is the ring of integers modulo  $n$ ), in particular clique and chromatic number, vertex and edge connectivity, planarity, and crossing number.

Megan Bernstein looked at **“REPRESENTATIONS OF GRAPHS BY RINGS”**. A graph is representable by a ring if its vertices can be labeled with distinct ring elements so the difference of the labels is a unit in the ring if and only if the vertices are adjacent. She explored representation by rings composed of the direct products of cyclic rings, including an upper bound on the representation number for a graph with a fixed number of vertices and representation numbers for various families of graphs.



Left to right: Rachel Karpman (Scripps College), Megan Bernstein (University of California-Berkeley), Dr. Reza Akhtar, Amanda Phillips (GA), Tiffany Jackson-Henderson (St. Augustine's College), Isidora Jimenez (Mills College), Megan Boggess (Columbia Union College).

# Multivariate Statistics—Vasant Waikar

Dr. Waikar led his group in “**USING REAL FIGURES TO INVEST IN REAL ESTATE: A MULTIVARIATE STATISTICAL ANALYSIS OF THE US HOUSING MARKET**”. Assisted by Kevin Tolliver (Auburn State University, SUMSRI ‘04), four undergraduates took a statistical look at the investment housing market. For many Americans, investing in property is a quick and easy way to make money. The real estate game has become a very popular phenomenon, even for those without a millionaire’s wallet. However, due to recent struggles in the economy, for some, investing has become more of a burden than a success story. Using multivariate statistical analysis techniques such as Principal Component Analysis, Factor Analysis, and Discriminant Analysis, we determine the factors having the most effect on housing markets. We also discover which of the 50 US states’ housing markets are likely to provide a stable or risky investment for those wishing to dabble in real estate.

“A seemingly minor dislocation originating in the housing sector, such as a higher rate of foreclosures, might cascade through the rest of the economy in unforeseen ways, for example, in a collapse in bank earnings or a hiccup in the huge market for securities that back residential mortgages.”

Jeffrey Knight  
Chief Investment Officer of Global Asset Allocation at Putnam Investments



*Left to right: Kevin Tolliver (GA), Angela Buck (St. Mary's University), Holly Sontag (Butler University), Takisha Harrison (Alabama A&M University), Linden Johnson (Albany State University), and Dr. Vasant Waikar.*

## SUMSRI after 10 years!

The Summer Undergraduate Mathematical Sciences Research Institute was envisioned to serve a perceived need—to empower underrepresented students with math majors to see themselves in graduate school, prepare themselves for graduate school and enter graduate school in mathematics and related sciences with confidence. Identified needs proved to be true for women and many students from four year liberal arts colleges. SUMSRI was created to fill a void between undergraduate education and graduate school by offering short courses in mathematics, review for the GRE and teach mathematical research and writing methods as well as the opportunity to do innovative research. SUMSRI also saw the need for its students to have financial assistance to attend regional and national conferences in order to see the work of others, and present their own work in a forum of their peers. SUMSRI could not have operated without the generous funding of the National Security Agency, the National Science Foundation and Miami University. Wedge Corporation provided additional start up funds in the first two years.

SUMSRI’s organizers have learned a lot over the years. The writing course has developed to help participants know how to write good abstracts and other parts of a research paper. Technological developments have permitted students to put together their presentations on PowerPoint, use Miami’s parallel computing center to assist their research, and so much more. Team-work is still very much a part of the SUMSRI program along with plain hard work.

Over the past 10 years, there have been many short term successes.

- Several SUMSRI research groups have won awards for the posters or presentations at national meetings.
- A majority of the SUMSRI participants applied to and entered graduate school from the very start.
- Just last year, SUMSRI received the “Programs that Make a Difference” award from the American Mathematical Society.

But it is just now that former SUMSRI participants are really showing what they are made of. Whether it is teaching in schools and colleges, doing research or statistical analysis at leading health and governmental institutions or refining the details on a PhD dissertation, these bright mathematicians and statisticians are making a difference. Please take a look at the following pages to learn just how much.

# Where are they now? SUMSRI in the world...

1999—

**Kathleen (Bellino) Hickey**—

Celebrating 6 years at SPAWAR Systems Center in San Diego, CA, doing research into underwater acoustics signal processing. The Hickeys have just purchased their first house.

**Rebekkah Dann**—working with GlaxoSmithKline to design and implement clinical trials.

**Melissa Desjarlais**—teaching at Valparaiso University.

**Sandrina Gould**—teaching in Alabama.

**Duke Hutchings**—Teaching in the Computer Science Department at Elon University in North Carolina.

**I really push the internships and fellowships. Getting outside funding will help you do what you want to do when you want to do it. Also, study hard!!**

Bethany Lyles Goldblum  
SUMSRI '99

**Bethany (Lyles) Goldblum**—newly married and soon to be mom, Bethany, is also the Clare Boothe Luce Postdoctoral Fellow at UC Berkeley in the Dept. of Nuclear Engineering. She will be teaching Radiation Biophysics in the Spring semester.

**Megan Ruhnke**—working at the Census Bureau in DC.

**2000—**



SUMSRI 2000 students study in the dorm hall.

**Lindsay Kellam**—

assurance specialist, PriceWaterhouseCoopers.

**Betsy LaPlant**—statistician, Mayo Clinic.

**Brandon McKenzie**—

working in insurance in IN.

**Bethany (McLemore) Loeffler**—recruits

teachers for the Johns Hopkins Center for Talented Youth summer programs and raising Joseph and Sophie.

**Candace Porter**—working on PhD in biomedical statistics at Univ. of South Carolina.

**Dana (Thompson) Allen**—teaching 6th grade math, on the curriculum committee, coaching the winning girls volleyball team AND received her master's in curriculum and instruction with an endorsement for ESL.

**Victoria (Pace) Wood**—Dissertation in Industrial and Organizational Psychology accepted.

**2001—**

**Khalilah Beal**—received the Outstanding Graduate Student Instructor Award last year at UC, Berkeley.

**Sarah (Breede) Culp**—Business

planning & operations analyst at Avaya, Inc.

**Sarah (Burke) Buzzell**—now in sunny Florida.

**Ledah (Casburn) Rutledge**—

software developer for PTV America.

**Jennifer (Everson) Davis**—

Completed PhD last year. She is



The Director's dinner at the Waikar's has become an annual event, thanks to Mrs. Sarla Waikar's excellent cooking! Drs. Waikar and Akhtar share the fare with SUMSRI '08 participants.

now a Senior Software Engineer at Rockwell Collins. She works in the Information Assurance group in the Research & Development Center looking at projects that are 3-5 years from manufacture.

**Christy (Finch) Gautre**—working for Shell Oil and studying toward her master's in applied physics at the University of New Orleans.

**Melissa Hildt**—continues to teach mathematics to high school students in Maryland.

**Lisa McGee**—data analyst for Progressive.

**Christian Roldan-Santos**—survived the flooding in Iowa. Finishing PhD while teaching at Kirkwood Community College.

**2002—**

**Kelly Anderson**—Teaching math at College of the Mainland, TX.

**Megan (Breit) Goodwin**—Math instructor at Anoka-Ramsey Community College. Part of Project ACCCESS, a professional development initiative for beginning faculty at two-year colleges. Working on a second master's degree in Math Ed.

**Leigh Cobbs**—writing her dissertation at Rutgers on "Constructing lattice subgroups of Kac-Moody groups" and starting her job search.

**Mary (Cunningham) Comeau**—recently married. Working as biostatistician in genetic diseases.

(Continued on page 5)



SUMSRI 2001—Isn't this a fire hazard?

**Didier Deshommes**—software engineer in NC.

**Andrea Falden**—Program Officer with The Winston-Salem Foundation in NC.

**Dave Friedenberg**—Grad student and instructor in Statistics at Carnegie Mellon Univ.

**Cheryl Gerde**—completed specialist degree in Instructional Technology at UGA.

**Shenek (Heyward) Alston**—Annaliese was born in June. Still working on her dissertation.

**Stacy Hoehn**—Grad student at Notre Dame University.

**Laura Lynch**—qualified for PhD, starting work on dissertation in commutative algebra at UNL.

**Catherine (Nightingale) Schmurr**—living in Oregon with new husband.

**Monique (Richardson) Taylor**—received the Certificate of Accomplishment in Teaching from NCSU in Mathematics.

#### 2003—

**Lori Hoffman**—working on her dissertation in Coalescent Theory (a method of modeling genealogical relationships) in Columbus, OH.

**Sarah (Horton) Gaudet**—consultant for Arbonne International

**Maria Joseph**—passed her written

PhD preliminary examinations at Iowa State University

**April Kerby**—finished with classes and now working on her dissertation in Spatial Clustering. “I'm trying to incorporate the actual georeference location on an observation into the clustering algorithm.”

**James Lawrence**—Actuarial apprentice at Milliman, Inc. in CO.

**Alicia Richardson**—completed masters work at Howard U. Working on her dissertation in Cryptology.

**Nancy Rodriguez**—graduate research fellow at UCLA in math.

**Natalie Scala**—grad student in industrial engineering, Univ. of Pittsburgh. “I am continuing in the PhD program, focusing on applications of Operations Research to

**You can do it! Being a graduate student is hard work, but if you give it 110% and make use of the resources available to you, you'll be alright!**

Maria Joseph  
SUMSRI '03

Engineering Management.”

**Andrea Watkins**—working on PhD in Stochastic Partial Differential Equations at Duke.

#### 2004—

**Sarah Blight**—graduate student in Mathematics at Rutgers.

**Jarrod Cunningham**—Taking a break from University of Tennessee to take care of his Dad's estate.

**Nancy Ho**—passed her PhD qualifying exams at University of Oklahoma. Searching for a dissertation advisor.

**Jon Middleton**—passed all but one qualifying exam for his PhD in UCSD.

**Karen Lostritto**—has completed her teaching assistantship and is now studying for your PhD

qualifying exams at Yale.

**Amanda (Phillips) Kinzel**—still working on PhD at Purdue, married in August, 2008. SUMSRI teaching assistant in 2007& 2008.

**Julie Rogers**—Passed qualifying exams for PhD in mathematics at Auburn Univ., looking at design theory problems.

**Kevin Tolliver**—working on his PhD in Statistics at Auburn University. Was SUMSRI teaching assistant in 2007& 2008.

**Kendall Williams**—graduate student at Howard University in math.

**Frannie Worek**—grad assistant teaching Physics at University of Maryland.

#### 2005—

**Kate Ansaldi**—University of Nebraska at Lincoln-Math

**Natalia Cordova**—grad student at Colorado State Univ.

**AdriAnne Demski**—University of Pittsburgh

**Jenny George**—Ohio State University, working through qualifying exams.

**Clyde Gholston**—North Carolina Central University, math.

**Helen Hauser**—has returned to Ohio University from Germany where she taught English to Germans. As a grad student in Ohio, she now teaches German to Americans.

**Janelle Jones**—just completed a year with Americorps working in public health.

**Kevin Mugo**—Purdue University, Math grad student, teaching for the first time this year and loving it! Got to travel around US this summer,

**Josh Svenson**—OSU, going for the PhD.



Kevin with the Algebra triplets! SUMSRI '04



*The Statistics Twins—AdriAnne and Janelle—present their research at JSM '06.*

Study important subjects from undergrad the summer before school starts...it will make things much easier by having it fresh in your mind.

Lindsay Moomaw  
SUMSRI '07

#### 2006—

**Emilola Abayomi**—Florida State University, teaching two statistics sections while finishing her masters.

**Chantelle Bicket**—University of Nebraska at Lincoln, math. Volunteers with Girls, Inc.

**Ashley Brooks**—math grad student at Univ. of North Carolina, Charlotte.

**Jennifer Erin Esp**—biostatistics at UC-Davis. Recently married Chris.

**Elizabeth Fowler**—University of Tennessee at Knoxville, math. Was a teaching assistant at SUMSRI this past summer.

**Anthony Franklin**—North Carolina State University, Statistics

**Samantha Graffeo**—University of Colorado, Denver, math.

**Shannon Grant**—University of Washington, biostatistics.

**Katherine Hastings**—Clemson University, math.

**Danielle Hiance**—completed MSW.

Now studying for PhD in Social Work at Ohio State with a minor in statistics.

Creating a computer program to simulate AA meetings dynamics.

**Janelle Jones**—attending Illinois State University's International Program, combining Economics with a year in the Peace Corps.

**Whitney Ross**—working as Analyst/Junior Consultant at a Management consulting firm in Georgia. Studying to take actuarial exams.  
**Edward Washington**—entered the applied math grad program at NCA&T.

#### 2007—

**Andrea Austin**—first year grad student in biostatistics at Brown U.

**Kate Benson**—first year grad student at University of Iowa.

**Yesenia Cruz**—getting married in Dec. '08. Applying to grad schools in Germany to be close to husband, Luis.

**Christina McIntosh**—studied at the NIH National Cancer Institute in the biostatistics branch during summer '08.

**Lindsay Moomaw**—entered NCSU graduate industrial engineering program

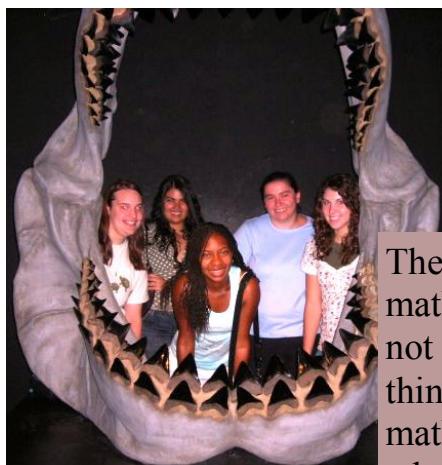
**Alicia Smith**—completed summer REU in Computational Biology at UMBC, considering a job offer or possibly grad school.

**Ashley Swandby**—is in her first year at NCSU in Statistics.

**Melissa Tolley**—entered grad school at NCSU.

**Bryant Watkins**—At University of Maryland, Baltimore County in applied math and computer science (combined BS/MS program)

**Jamie Weigandt**—passed four of 5 qualifying exams. Looking for new school to do his PhD.



*The Jaws of a Dilemma! To be or not to be a mathematician?*

I made an investment and went to Ken Ribet's 60th birthday conference at the MSRI over the summer, and that was pretty fantastic. I got to meet a lot of famous number theorists like Richard Taylor, Barry Mazur, Ken Ribet, William Stein and more. This was awesome for me, because at SUMSRI you really just get to hear legends about these people. I actually even got a chance to talk with Mazur for a short time about our project.

Jamie Weigandt  
SUMSRI '07

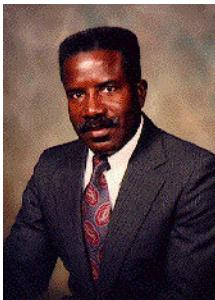


*Whitney and Samantha demonstrate how we all need support sometimes!*

There are multiple ways to use a mathematics background, it does not always have to be the way you think of it. I'm beginning to use mathematics in social work, a field where most people fear math.

Danielle Hiance  
SUMSRI '06

*Thank you to all former research seminar directors who have come to Oxford to spend a summer being inspired by SUMSRI's talented group of students!*



**Dr. Earl Barnes** led research seminars in 1999 and 2000 to discover new aspects of the traveling salesmen problem. He came to SUMSRI from Georgia Tech to help us get SUMSRI off to a good start. He is now sharing his expertise with students at Morgan State University.

**Dr. Chawne Kimber** joined the SUMSRI staff in 2001 and 2003 to lead a research seminar in the algebras of Josephus and Escher. Dr. Kimber teaches at Lafayette College in Easton, PA.



**Dr. Daniel Pritikin** led a 2001 research seminar on graph theory looking at the Lights Out game. Dr. Pritikin continues at Miami University teaching and organizing our high school math contest.



**Dr. Jillian McLeod** joined SUMSRI in 2002 to lead a group studying coding theory. She now teaches at Mt. Holyoke in Massachusetts.



**Dr. Sheldon Davis** joined the SUMSRI faculty in 2003 to lead a research seminar looking into aspects of the Continuum Hypothesis. Dr. Davis now teaches at University of Texas in Tyler, TX. (Pictured here with Andrea Watkins.)



**Dr. Edray Goins** (Purdue University) and **Dr. Reza Akhtar** (Miami University) have shown their continued support of SUMSRI by leading their research seminars in Number Theory and Algebra for five continuous years.

**Dr. Vasant Waikar** led his multivariate statistics research seminar for all 10 years of SUMSRI's existence. He also joined Dr. Dennis Davenport as Co-Director of SUMSRI for the past eight years.

**Dr. Dennis Davenport**'s contribution as creator and Director of SUMSRI for the past 10 years cannot be surpassed. His belief in this program brought it into being, made sure it was financed, recruited participants, and taught whatever needed to be taught, did whatever needed doing in order to make SUMSRI a success.

Thanks to the many  
**Graduate School  
Representatives** who have  
come every year to inform  
SUMSRI participants about their  
opportunities in higher  
education.



*There are too many others to be thanked.  
Many have no photos to remind us of their contributions.*

Starting in 2000, SUMSRI drew back former participants as teaching assistants. The first one was Duke Hutchings (right). He was joined by Angela Grant (right) and Natalia Trofimenko. Angela returned again in 2001 to be joined by Lindsay Kellam (right) and Charles Hague. Both Angela and Lindsay returned in 2002, joined by Eric Appelt. Photos are more available in later years, thanks to advancing technology. And you can see below how many SUMSRI participants returned to assist students as they faced the challenges of compressed schedules, new mathematics and new geographic and social situations. Not pictured are Thayer Morrill and Sara Pearson, TAs in 1999.



Candace Porter (2000), Christian Roldan Santos (2001) and Lynne Spencer assist the 2003 research groups.



Lakeshia and Leigh returned to SUMSRI in 2005 and were joined by Shenek Heyward (2002).



Amanda Phillips (2004), Maria Salcedo & Kevin Tolliver (2004), assist in 2007.

*And thanks to Miami staff and faculty who helped make SUMSRI possible.*

The SUMSRI faculty and TAs were joined by lots of people from Miami University who helped with housing, meals, payroll, accounting, grants administration and more. There are really too many to mention. SUMSRI would not have been possible without their contributions of time, money and expertise.



Lakeshia Legette, Leigh Cobbs (2002) and James Lawrence (2003) in 2004.



Laura Lynch (2002), Holly Attenborough and Shelly-Ann Meade joined the SUMSRI staff as TA's in 2006.



Beth Fowler (2006) joined Kevin and Amanda as TAs in 2008.