Department of
Genetics

RUTGERS
School of Arts and Sciences

Undergraduate Newsletter

3rd Edition May 2019

CONGRATULATIONS TO THE GRADUATING CLASS OF 2019

The Genetics Department would like to congratulate all of the graduating seniors on their outstanding achievements. You all worked very hard to get this far, and we wish you the very best in your future endeavors.

Vice Chair and Undergraduate Director—Dr. Chris Rongo

A Note from the Vice Chair

As Vice Chair and Undergraduate Director for the Department of Genetics, it is my pleasure to get to know our majors and watch them truly grow into independent thinkers and scientists. Our goal for the educational mission of the department is to develop a curriculum that builds the skills needed to navigate the professional world of the 21st century. To foster compelling writing and excellent communication skills. To sharpen our students' analytical and problem-solving skills. To learn to adapt to rapidly changing technology and a rapidly changing world. To be more than just consumers of information, but to be producers of new information in our society. We require all of our majors to conduct independent research with our faculty to achieve these very goals, as research grows these specific skills in our students through a direct connection with our faculty. This regular newsletter will continue to solidify that connection and help all of us move towards these important goals.—Chris Rongo, Ph.D.

The Genetics Department Graduating Class of 2019

Danielle Albaciete
Emily Ali
Jimena Argenal
Madhuri Bhupathiraju
Olivier Boivin
Emily Fokas
Samantha Fong
Melissa Gandhi
Kevin Ghorishizadeh
Sneha Gupta
Laura Hegemann
Lindsey Hernandez
Stacy Jaison
Zainab Jamali
Michelle Karpenos
Matthew Kiel
Om Kothari
Kyle Kremiller
Archana Kumar
Jonathan Kunkel-Jure
Lauren Lairson
Nehali Lathia
Amy Lee
Jessie Liao
Anisha Mahat
Saad Mansuri
Tristan Mekarzel
Kayla Munir
Rohin Nair
John Nowak
David Ohm
Robert Perez
Muhammed Rahim
Chinmay Rele
Adiba Salim
Devora Schapiro
Julie Schoeni
Ruhi Shah
Kaylynn Shuleski
Reshma Thomas
Sarah Trackman
Kiet Tran
Justin Wong

Please visit the Genetics Department website for photos of our graduating seniors: genetics.rutgers.edu

Genetics Department Honors Program

The Departmental Honors Program was established to provide highly motivated seniors with an opportunity to immerse themselves in an original scientific research project. Students are expected to conduct their own research project during their senior year, culminating in a written thesis around mid -April. Then, students will present their research at the annual Departmental Honors Symposium. Students in this program are also eligible to apply to the three departmental academic awards.

THE DUNCAN AND NANCY MACMILLAN AWARD FOR RESEARCH EXCELLENCE- This award recognizes a graduating senior, majoring in Genetics, who has demonstrated outstanding accomplishment in Research by the completion of a project of publication quality. The Awardees are:

Melissa Gandhi **Om Kothari**

THE HOWARD C. PASSMORE AWARD FOR DISTINGUISHED ACADEMIC ACHIEVMENT- This award recognizes a graduating senior, majoring in Genetics, who has demonstrated outstanding achievement in academic coursework, participation in research and commitment to service. The Awardees are:

Aishee Bag **Justin Wong**

THE DEPARTMENT OF GENETICS AWARD FOR EXCELLENCE IN A RESEARCH PRESENTATION- This award is presented to a graduating senior, majoring in Genetics, who shows extraordinary skills in scientific communication to an audience of peers at the Departmental Honors Day. The Awardees are:

Emily Fokas **Muhammed Rahim**

Pictured: Justin Wong

The 2019 Genetics Department Honors Program Participants/Mentor

Danielle Albaciete
(Mentor, Dr. Estela Jacinto)

Aishee Bag
(Mentor, Dr. Jinchuan Xing)

Emily Fokas
(Mentor, Dr. Michael Verzi)

Samantha Fong
(Mentor, Dr. Nancy Walworth)

Melissa Gandhi
(Mentor, Dr. Victoria Abraira)

Laura Hegemann
(Mentor, Dr. Lei Yu)

Lindsey Hernandez
(Mentor, Dr. Melissa Rogers)

Michelle Karpenos
(Mentor, Dr. Sharon Bzostek)

Om Kothari
(Mentor, Dr. Michael Verzi)

Kyle Kremiller
(Mentor, Dr. David Alland)

Anisha Mahat
(Mentor, Dr. Michael Verzi)

Muhammed Rahim
(Mentor, Dr. Shridar Ganesan)

Chinmay Rele
(Mentor, Dr. Christopher Ellison)

Reshma Thomas
(Mentor, Dr. Linda Brzustowicz)

Adiba Salim
(Mentor, Dr. David Crockett)

Justin Wong
(Mentor, Dr. Steven Zheng)

Genetic Counseling Certificate

The Department of Genetics offers an undergraduate Genetic Counseling Certificate Program (GCCP). The GCCP program is intended for a select group of students interested in applying to the masters-level programs in genetic counseling. The goal is to provide students with guidance, coursework, and relevant clinical experience to improve their graduate school applications. The Awardees are:

Kaylynn Shuleski **Sarah Trackman** **Kiet Tran**

Certificate in Computational Genetics

The Department of Genetics offers a Certificate in Computational Genetics (CCG). The volume of data being generated in genetics has been expanding tremendously in recent years, and career opportunities for geneticists with computational and quantitative expertise are also growing. This certificate program is intended for students who are interested in applying to graduate-level programs, and/or planning careers in Computational Genetics, Statistical Genetics, Bioinformatics, or other programs in quantitative biomedical related research. The goal of the CCG is to provide students with guidance, coursework, and relevant data design and analysis experience to prepare them for graduate studies in the field. The Awardees are:

Chinmay Rele (Dr. Chris Ellison's Lab)

"The Genetics faculty is amazing! I really enjoyed interacting with the professors and learning from them."- Muhammed Rahim (SAS' 19)

Kaylynn Shuleski, Class of 2019

Senior Kaylynn Shuleski first began her path towards genetics during a middle school science class. She went to a small private school with only 16 students in her grade. They had an assignment to go home and record certain traits their parents had. Then, in class the next day, they learned about dominant and recessive genes. They did a project to determine the likelihood of having the same features themselves. "I'm adopted, so I recorded these traits and then the next day I couldn't do any of the experiments," Kaylynn says. "I couldn't see if I had a widow's peak because of my father or my mom or anything. Most of the other kids in my class took it at face value, but I couldn't really trace it back anywhere which made it more interesting."

Kaylynn actually chose Rutgers because it is one of few schools with a specialized genetics program. "Most people are interested in biology first, and then get into genetics, but for me it was the other way around," Kaylynn says. Her favorite class is Social, Legal and Ethical Implications of New Genetics with Dr. Schindler. This course ties in not only the ethical implications but all the other things that need to be considered when someone comes in for genetic testing.

After graduation, Kaylynn plans to pursue her master's degree in Genetic Counseling at the Icahn School of Medicine at Mount Sinai.

Aishee Bag, Class of 2020

Junior, Aishee Bag has just completed her last semester as an undergrad, but she isn't finished just yet. Instead, Aishee will begin her M1 medical school coursework next year as part of the accelerated joint BA/MD program with the Robert Wood Johnson Medical School. This program will allow her to complete her combined undergraduate and medical education in just seven years.

As part of the Honors College, Aishee's acceptance into this program meant she did not need to complete an honors thesis for the Genetics major. She chose to do so anyway, becoming the first Genetics student ever to complete an honors thesis in her junior year.

"When I first joined the thesis class it was intimidating because it was all these seniors and I didn't know many of them. I knew if I took it as a senior, I would be taking the class with a lot of my friends," Aishee says, "but eventually, I stopped noticing the difference."

Aishee's interest in genetics goes all the way back to middle school. "The first lessons I remember were on Darwin and Punnett Squares. I especially loved the unit on DNA and Mendelian Genetics. I found it super interesting to learn about how your genes can affect your traits or cause different disorders."

After completing her M.D., Aishee would like to focus on women's and children's health.

Student Spotlight

Natalie Turner, Class of 2020

When deciding on her major, junior Natalie Turner knew she wanted to study biology, but she wasn't sure which area to specialize in. She also had an interest in computer science and was looking for a way to combine the two. She did some research into the Department of Genetics and a Computational Genetics certificate is offered along with the major. "It really builds on the Genetics major and allows you to look really closely at computational approaches to solving genetic problems," Natalie says. "I also really liked the emphasis the department puts on research."

Natalie is currently an Undergraduate Researcher in Dr. Nakamura's lab, working on computational analysis of RNA sequencing and chip sequencing. "I got really lucky and my lab does both wet lab and computational work so I'm getting a little bit of both. "

Natalie got into the Nakamura lab after taking Developmental Genetics with Dr. Barr, "I talked to her about potentially joining her lab, but since I was interested in the computational program, she helped me find my lab and it was really great how much she cared."

After graduation, Natalie plans to work in biotech and apply her knowledge of both genetics and computer science to meaningful research of genetic diseases. After which she plans to pursue her Ph.D. with a focus in Genomics.

Chinmay Rele, Class of 2019

From Bombay, to Dubai, to Singapore, senior Chinmay Rele has lived all over the world, but settled on New Jersey to pursue his degree in Genetics. Currently an undergraduate researcher in Dr. Ellison's lab, Chinmay chose Rutgers over MIT because of the research requirement for the major. "At MIT, they don't let undergraduates do research, whereas here it was required," Chinmay says, "it was the simplest decision ever."

Chinmay will also be graduating with his certificate in Computational Genetics, but he wouldn't say that was his original plan. "I worked with Dr. Brzustowicz on some clinical stuff in humans but I didn't like it as much so I moved to her wet lab. And when my project was over my supervisor suggested that I talk to Dr. Ellison. I moved over to his wet lab but he gave me a side computational project. He said if I didn't like it, I could go back to the lab. But I ended up really liking it."

Chinmay's favorite part of his lab is that every year or two they learn a new program. The first year it was Python, then it was R and in two years it'll be something else. If I have a lab, I am going to run it that way."

Chinmay plans to take some time off after graduation and then pursue a PhD. in Bioinformatics and Evolutionary Genetics.

"The best part of the major is the relevancy of its subject matter to today's advancement in treatment. The technology we have today because of research in genetics is mind-blowing." -Stacy Jaison (SAS '19)

The Ethics of Genetic Prediction

Archana Kumar

A Brief History of Genetic Testing

In the early 1900s, inherited diseases were first linked to chromosomes. By 1961, Robert Guthrie developed the first method to screen newborn babies for the metabolic defect, phenylketonuria (PKU) in which amino acid buildup causes mental retardation. A small amount of blood was taken from the newborn's heel often without the parent's knowledge. If the infant tested positive, a strict diet would be able to preserve brain function. This first genetic test was accurate, the disease was treatable, and nearly everyone was tested. In the years to follow, genetic screens would encompass more diseases and disorders, and some would become routine. Serum marker tests are offered to all pregnant women and "indicate elevated risk of neural tube defects or trisomy 21 (Down's syndrome) in fetuses". As the number of genetically testable diseases increased, so did the number of necessary considerations and precautions needed to be taken prior to screening. Genetic testing is now available for over 2000 conditions and options include diagnostic testing, carrier testing, prenatal testing, and presymptomatic testing (among other sub-branches). In order to dissect the complexities that encompass genetic testing of diseases, we'll focus specifically on the genetic test for Huntington's disease.

Huntington's Disease

At the very end of chromosome 4 lies a gene that codes for the production of a protein called "huntingtin"; the exact function of this protein is unknown. One region of this gene contains a segment in which the nucleotides cytosine, adenine, and guanine (CAG), repeat in this order between 10-35 times in healthy individuals. When an individual has more than 35 CAG repeats on chromosome 4, they develop what is known as Huntington's disease, a neurodegenerative disorder that affects approximately 30,000 Americans. The mutated trinucleotide repeat causes the huntingtin protein to become deformed, clump, and cause cell death in the brain. Cells of the basal ganglia, a region of the brain responsible for motor function, and the cortex, responsible for memory and perception, are most heavily affected.

Symptoms

- uncontrolled movement of the arms, legs, face and upper body
- alterations in mood, depression, anxiety, anger, irritability
- decline in thinking and reasoning skills, poor memory, concentration

Inheritance

The Huntington's disease gene mutation is dominantly transferred with wide variation in onset age, the average being 40 years old. Children of gene carriers have a 50% chance of inheriting the mutation, and those who inherit the gene will eventually develop the disease.

Documentary and Decision to Test

Last week I watched a documentary called "Twitch," that follows 18 year old Kristen Powers as she undergoes genetic testing for Huntington's disease. This documentary was unlike any I had seen before and discussed in entirety the process of a young adult making the decision to undergo testing, her counseling, her thoughts throughout the process, and the final results. In order to breakdown the documentary, we'll look at each factor in the decision to test or not to test separately. Each factor will be examined both in terms of the documentary as well as in a broader view.

Family Dynamics and Upbringing

In "Twitch", we learn that Kristen Powers' mother had Huntington's disease and passed away due to the illness when Kristen was a teenager. She recounts her mother's episodes and angry outbursts and reflects on the fact that she was her younger brother's main caretaker for the majority of their childhood. She tells the audience that if tests positive for the Huntington's disease gene, she would likely not have children. The fact that Kristen had to take on responsibilities far out of a normal child's capabilities, witness her mother's condition worsen as years went on, and deal with her mother's passing at a young age play large roles in her decision to get tested at the age of 18. Patients looking to get tested for the HD gene have often witnessed a parent or close family member suffer from the illness and have first-hand experience of the pain and extreme emotional distress the illness causes. Knowing whether or not you have the HD gene can influence family planning, financial planning and even how you approach dating.

Age, Emotional Impact and Mental Health

Minors are not tested for Huntington's Disease unless there is a medically compelling reason, such as strong suspicion of HD symptoms or a clinical diagnosis. This is extremely important because potentially being told that you have an incurable fatal illness has the potential to wreak havoc on one's mental health. In "Twitch" Kristen was not a minor and eligible to make the decision for herself to receive her test results. We see her meet with a genetic counselor multiple times to discuss how she would feel if the test were negative/positive. Among neurodegenerative diseases, suicide rates in Huntington's disease patients are the highest; the completed suicide rate is 5.7%, and 26.7% of HD patients acknowledge at least one suicide attempt. These statistics are devastating and a patient's mental health must be the priority when considering testing and the potential results.

Ethics and the Ending

Beneath all of the personal challenges and hardships lies the question: Is it ethical to test for a fatal disease with no known cure or treatment?

The ethical principle of autonomy guides the fact that legal adults are allowed to choose for themselves whether or not they get tested. Many feel that having the question hanging above them may be far worse than getting a positive result. The principle of beneficence may shift the argument in the opposite direction, as receiving positive test results can trigger depression, anxiety and a wide range of emotional trauma. Conversely, a negative result can provide immense relief to a patient. However one can argue that after receiving a positive test result, patients are better equipped to prepare for the future in whatever way they see fit, and that a negative result can trigger survivor's guilt. The ending of the "Twitch" documentary reveals to us that Kristen tested negative for the HD gene. The documented relief of her step-parents and boyfriend was heartwarming and it gave the viewer a sense of peace.

Faculty Mentions

Professor and Department Chair Tara Matise teaches Quantitative Biology and Bioinformatics, which is often the first time Genetics majors learn how to code. She heads the Laboratory of Computational Genetics which represents her joint interest in human genetics, data science, statistical genetics and bioinformatics. AUG (Association of Undergraduate Geneticists) sat down with Dr. Matise to discuss her teaching methods, computer programming, the genetics major, and more.

AUG: How will a major in Genetics help students in the future and why is it a worthwhile field?

Dr. Matise: Students who major in Genetics generally have developed either a curiosity for genetics or are going on to medical or dental school where a knowledge of genetics will be important and may even give then an edge over their peers. Genetics plays a role in determining so much of our physiology. There are seemingly endless studies that will advance our understanding of the biological mechanisms that control gene expression and gene function. The list of areas of study goes on and on, providing research opportunities for you, future genetics scientists, and medical professionals with a degree in Genetics!

AUG: Quantitative Biology and Bioinformatics is sometimes the first class Genetics majors take to learn how to code. How do you feel about introducing students to computer science and what are the most important lessons you want them to learn?

Dr. Matise: I fell in love with computer programming while in high school—in the early 1980s. Sometimes I think I could have made a fine computer programmer, but even better I get to combine my love of computer programming with my deep interest in genetics. The number of scientists who benefit from having basic programming skills is growing. They may generate large datasets or use data from public databases and may sometimes need to merge them for combined analyses. Today's students who gain basic programming skills will have an advantage over their peers who don't code and will bring additional skills to their future labs. I really enjoy teaching these skills. Perhaps the most important lesson I want my students to take with them is to go slow when programming. Programming gives you power to avoid tedious work if done "manually" or to do things that are simply not possible without a computer. But if not done extremely carefully, undetected coding errors can lead to incorrect outcomes, which can lead to research delays or incorrect conclusions. Always take the time to check whether your outcomes make sense, test every part of your code independently as much as possible, and always respond honestly when asked about your work. Don't be afraid to say "I don't know," or "I didn't think to check that."

AUG: What is something that you like to do for fun outside of your work?

Dr. Matise: When I'm not working I really enjoy spending time with my husband and two daughters. We like to ski, play board games, and stream movies at home. I also enjoy gardening, reading, and eating my husband's delicious cooking .

GENETICS DEPARTMENT FACULTY

Maureen Barr, Professor
Linda Brzustowicz, Distinguished Professor
Chris Ellison, Assistant Professor
Judy Flax, Associate Research Professor
Doreen Glodowski, Instructor
Derek Gordon, Associate Professor
Gary Heiman, Associate Professor
Jessica Joines, GCMP Program Director
Tara Matise, Professor & Chair
Kim McKim, Professor
Tetsuya Nakamura, Assistant Professor
Bryce Nickels, Professor
Chris Rongo, Professor & Vice Chair
Amrik Sahota, Research Professor
Karen Schindler, Associate Professor
Premal Shah, Assistant Professor
Michael Sheldon, Research Professor
Gleb Shumyatsky, Associate Professor
Andrew Singson, Professor
Jay Tischfield, Distinguished Professor
Michael Verzi, Associate Professor
Jinchuan Xing, Associate Professor

Not Pictured:
David Axelrod, Professor
Marco Azaro, Assistant Research Professor
Andy Brooks, Research Professor
Jennifer Moore, Associate Research Professor
Christine Seymour, GCMP Assistant Program Director
Juan Wang, Assistant Research Professor
Lei Yu, Distinguished Professor

"Because genetics plays such an integral role in our physiology, our development, and our health, the field of genetics is extremely important."- Dr. Tara Matise (Professor & Chair -Genetics)