

Department of Genetics

Undergraduate Newsletter

3rd Edition May 2019

CONGRATULATIONS TO THE GRADUATING CLASS OF 2020

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. Gary Heiman

A Note from the Vice Chair

As Vice Chair and Undergraduate Director for the Department of Genetics, it is my distinct pleasure to congratulate this year's graduating seniors. You completed a challenging major that includes courses that go beyond just learning the concepts of the discipline- you used these concepts to analyze published research and to critically think for yourself. You also conducted cutting-edge independent research, interpreted the evidence, and communicated your findings. These skills will help you navigate the challenging world in the 21st century, in whatever career you plan to pursue. I firmly believe that this genetics degree provides you with the foundation to successfully meet these challenges. I also want to thank the families for the support you have given to your graduates and for allowing us to "borrow" them for these few short years. They have made a mark here. This yearly newsletter celebrates the achievements of our graduates. Please keep in touch and update us on what you are doing in the upcoming years. We really want to know! Please see our alumni webpage on ways to update us. Congratulations on your graduation! - Dr. Gary Heiman, Ph.D.



The Genetics Department Graduating Class of 2020

Emily Ali	Sandra Guirguis	Raphaella Ranjo
Rohan Alibutud	Ayesha Gurnani	Jason Rosen
Aparna Anand	Elani Hillman	Shreya Sarathy
Aishee Bag	Jay Joshi	Neil Shah
Rajkiran Baskaran	Arusa Khan	Rohan Shah
Ben Brik	Brittany Klimek	Soham Shah
Maya Briskin	Justin Koesterich	Nikita Sharma Gyawali
Christopher Capasso	Caroline Kratka	Kevin Shen
Amanda Chen	Hannah Lords	Boris Sotnikov
Sadhana Chidambaran	Matthew Matrongolo	Yasasvi Talagadadeevi
Amanda Coyne	Mayuri Patel	Natalie Turner
Pooja Deshpande	Carina Pizzano	Roshan Vasoya
Arul Ruth Duggimpudi	Olivia Plotsker	Dena Winchester
Angelica Galianese	Archana Ragunath	Thomas Wood
Maria Girgis	Swati Rajput	Aafreen Zaidi

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:

Jay Joshi Roshan Vasoya Thomas Wood

THE HOWARD C. PASSMORE AWARD FOR DISTINGUISHED ACADEMIC ACHIEVEMENT- 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:

Caroline Kratka Soham Shah Dena Winchester

The 2020 Genetics Department Honors Program Participants/Mentor

Aparna Anand
(Mentor, Dr. Christopher Ellison)

Ayesha Gurnani
(Mentor, Dr. Linda Brzustowicz)

Swati Rajput
(Mentor, Dr. Estela Jacinto)

Natalie Turner
(Mentor, Dr. Tetsuya Nakamura)

Ben Brik
(Mentor, Dr. Shridar Ganesan)

Jay Joshi
(Mentor, Dr. Kim McKim)

Soham Shah
(Mentor, Dr. Amrik Sahota)

Roshan Vasoya
(Mentor, Dr. Michael Verzi)

Sadhana Chidambaran
(Mentor, Dr. Premal Shah)

Caroline Kratka
(Mentor, Dr. Karen Schindler)

Nikita Sharma Gyawali
(Mentor, Dr. Shridar Ganesan)

Thomas Wood
(Mentor, Dr. Tetsuya Nakamura)

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 Awardee is:

Dena Winchester

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:

Aparna Anand (Dr. Chris Ellison's Lab)

Sadhana Chidambaran (Dr. Premal Shah's Lab)

Angelica Galianese (Dr. Derek Gordon's Lab)

Sandra Guirguis (Dr. Lei Yu's Lab)

Justin Koesterich (Dr. Jinchuan Xing's Lab)

Hannah Lords (Dr. Jinchuan Xing's Lab)

Soham Shah (Amrik Sahota's Lab)

Natalie Turner (Tetsuya Nakamura's Lab)

Henry Rutgers Scholars

The Henry Rutgers Scholar Award recognizes graduating seniors who have completed outstanding independent research projects leading to a thesis in their major field of study or interdisciplinary thesis. The awards are offered across all departments of the School of Arts and Sciences, representing the highest achievements of the students.

Rohan Alibutud

Caroline Kratka

Soham Shah

Roshan Vasoya

Thomas Wood

Phi Beta Kappa Class of 2020

Aishee Bag

Sadhana Chidambaran

Sandra Guirguis

Caroline Kratka

Archana Raghunath

Raphaella Ranjo

Swati Rajput

Rohan Shah

Soham Shah

Could Your DNA Help Catch A Killer?

Archana Raghunath



Like millions of other people on the internet, I am a big crime junkie. And I mean **big**. There's just something about watching and hearing about stories about serial killers and high profile crimes that is both fascinating and terrifying.

(Side note: I just finished binging Mindhunter, and it was *so good*).

Last year, while listening to an episode of the [Crime Junkies podcast](#), I became introduced to the story of the Golden State Killer.

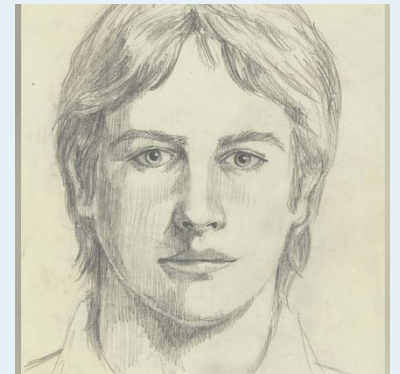
The Golden State What?!

[Joseph James DeAngelo](#), or the "Golden State Killer" as he was dubbed by the media, was a serial rapist, killer, and burglar, who committed over 100 crimes between 1974 and 1986. In the years that the Golden State Killer was active, communities in California were marked by terror and hysteria.

Law enforcement officers were able to develop an initial profile from victim testimonies and evidence found at the crime scene. They deduced that the perpetrator was a white male in his 30s, blonde haired, and was exceptionally confident and manipulative.

Although detectives had DNA evidence (in the form of blood and semen) from the crime scenes, there was never any match in a known criminal database. The case went cold.

Forty two years went by before The Golden State Killer was caught.



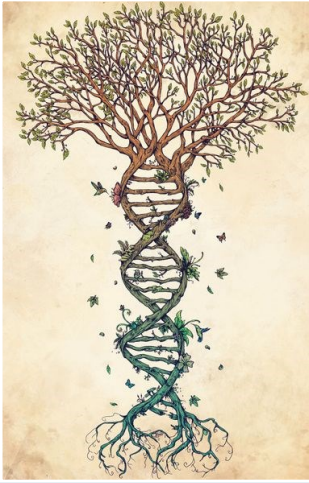
A sketch of the Golden State Killer.

But he *was* caught right?

Right. So this is where it gets *really* interesting.

In 2018, Dr. Barbara Rae-Venter, a genetic genealogist, uploaded DNA found at Golden State Killer crime scene to a website called [GedMatch](#). *What she found transformed the future of law enforcement.*

... But first, some background.



GedMatch works similarly to companies like Ancestry.com and 23andMe that claim to help you discover your family history and origins. [There is a key difference](#), however – 23andMe and Ancestry.com are private companies, while GedMatch is a public database.

GedMatch doesn't even conduct DNA testing itself – You wouldn't send a swab to the website. Rather, individuals might use one of the private companies to get their raw genetic information, and then upload it onto a crowd-sourcing website like GedMatch to find their relatives.

[Genealogy websites look for specific parts of the genome, called SNPs](#) (small nucleotide polymorphisms) to help identify and build your family tree. These SNPs are individual biological markers throughout the DNA that vary between individuals and can be passed down from parents to kids.

So if you ever wondered how these genealogy websites build an entire family tree from a swab of your spit, this is how it's done! Cool, right?

Ok, but what about the Golden State Killer case?

After Dr. Rae-Venter uploaded the DNA of the suspect, it was compared to the thousands of other genetic profiles that had also been uploaded to GedMatch.

DeAngelo hadn't uploaded his own data to the website. But his second, third, and fourth cousins **had**. (For context, you share a *great-great* grandparent with your third cousin)



After spending months building and searching potential family trees, law enforcement officials were finally able to find one man who fit the profile to a tee.

And even though these distant relatives only shared about **two percent** of their genetic information with the Golden State Killer, it was enough for detectives in the case to identify and arrest DeAngelo.

When they took a sample of DeAngelo's DNA, the detectives realized they were right. They had found the killer, **simply using genetic information found in a public database**.



Are Genetic Databases now Law Enforcement Databases?

Since the arrest of the Golden State Killer, law enforcement agencies have rushed to use this genetic technology to arrest suspects in other cold cases. In just one year, GedMatch has been used in over fifteen cases as evidence to arrest perpetrators in rape and murder cases.

At this point, you might be thinking to yourself – “Well, what's the problem? They're catching criminals, right?”

Well, think about it this way. Most users of genealogy services and biotechnology websites have uploaded their genetic information to find members of their family, get insights into their health, or learn about their heritage.

No one uploads their entire raw genome to a website like GedMatch anticipating that their information will be used by law enforcement to prove that someone in their family has committed a crime. Most of the time, law enforcement officers aren't even obliged to inform someone that their DNA is being used in a criminal investigation.

GedMatch also does not have restrictions on what can be uploaded to their website. Most larger websites, like Ancestry.com or 23andMe will reject crime scene evidence as an upload. GedMatch, on the other hand, will accept anything (blood, semen, spit), as long as it is in the form of raw genetic data.

This opens up room for individuals to conduct their own investigations, as long as the sample is sequenced from an external source.

Let's Talk Genetic Privacy

Current US health privacy laws do not completely protect genetic information. Even the Health Insurance Portability and Accountability Act (HIPAA) [doesn't cover](#) direct-to-consumer companies like 23andMe or public crowdsourcing websites like GedMatch.

There are even fewer laws preventing law enforcement agencies from accessing the genetic information on these websites, especially when they are as unprotected as GedMatch is.

Fortunately, in the past few months, GedMatch has changed its privacy policy to restrict law enforcement searches. Additionally, individual users will have to opt-in to their data possibly being used for law enforcement searches when they upload their genome.

But is this enough?



April 27, 2018 We understand that the GEDmatch database was used to help identify the Golden State Killer. Although we were not approached by law enforcement or anyone else about this case or about the DNA, it has always been GEDmatch's policy to inform users that the database could be used for other uses, as set forth in the Site Policy (linked to the login page and <https://www.gedmatch.com/policy.php>). While the database was created for genealogical research, it is important that GEDmatch participants understand the possible uses of their DNA, including identification of relatives that have committed crimes or were victims of crimes. If you are concerned about non-genealogical uses of your DNA, you should not upload your DNA to the database and/or you should remove DNA that has already been uploaded. To delete your registration contact gedmatch@gmail.com

A response by GedMatch to the Golden State Killer Investigation.

Opt in/out laws like the one introduced by GedMatch can be beneficial as well – These allow individuals to say beforehand what they are okay with their genetic data being used for.

This ties into the issue of autonomy and informed consent – Like we talked about before, no one uploads their genetic information to “catch” a member of their family committing a crime. Unless you do, which is, well, different. Most people are using these websites with the intention of using genetics to find out more about their family history.

In the discussion of genetic data being used in criminal investigations, it is important to also consider non maleficence. Using genetic information in investigations can be useful if the right person is caught. However, there have been stories of individuals being wrongly accused just because one of their family members had data on one of these genetic websites. [In one situation, a young man was the prime suspect in a high profile murder investigation, just because his father had submitted his genome to a website like GedMatch.](#)

The form is titled "EVIDENCE AND PROPERTY INVENTORY". It has several sections with fields for information. The top section includes "Property Number", "Date", and "Owner". Below this is a row of six circular icons representing people. The middle section includes "Street", "Turf", "Bad", "Cha", "Of", "Am Impou", "Articles", "on", "Make/M", "Size", "Use", and "y". The bottom section includes "Evidence A.", "Inventory", "Recovered From", "Suspect", "Victim", and "SSN".

Should law enforcement agencies be able to access genetic data for their criminal investigations? Do criminal suspects not deserve genetic privacy?

These questions bring up some social concerns: Because no laws protect genetic privacy on these large, crowd-sourcing websites, individuals may start to distrust science and genetics research. This could lead to individuals choosing not to participate in programs like “[All of Us](#),” which is a public genetic database that aims to increase research into personalized medicine. Additionally, individuals might live their lives in a constant state of panic if they are aware that they might be found through their relatives’ information on a genetic database.

Although use of a genetic database might be huge for forensic science and law enforcement, are we doing enough to protect individual privacy?

What do you guys think? Would you feel comfortable knowing your DNA helped to get someone in your family arrested? Were you shocked to hear about the Golden State Killer arrest?

Student Spotlight



Sadhana Chidambaran, Class of 2020, Computational Genetics Certificate

How did you decide on your major?

I knew coming into college that I was interested in both biology and computer science, so during my freshman year I took introductory courses in both subjects. My favorite topic in my biology class was easily genetics, which lead me to the major. I also learned about the Certificate in Computational Genetics offered by the department which aligned perfectly with my interests.

What is it about your chosen field (and the department) that appeals to you?

Research is a requirement of the genetics major and something I was excited about doing at Rutgers. There are a lot of different topics being researched within the Department of Genetics, so there's something for everybody to study. I also found that the professors in the department were really helpful in figuring out which lab was right for me, which I

appreciated as I didn't have much exposure to research at the time.

Do you have a favorite class/professor within your major?

I recently took Quantitative Biology and Bioinformatics with Dr. Matise. I enjoyed the opportunity to take a class that directly connected genetics with computer science. It was interesting to learn how exactly researchers use different kinds of software and their programming skills in their work.

Following graduation, Sadhana will be pursuing her Ph.D. in Cell, Molecular, Developmental Biology & Biophysics at Johns Hopkins University.



Justin Koesterich, Class of 2020, Computational Genetics Certificate

How did you decide on your major?

When I was entering college I had an interest in biology so I took intro classes which included taking a molecular biology laboratory class. It was in that class that I found my special interest in microbiology and genetics, and after looking at the electives and opportunities I found that human genetics was what I was really interested in.

What is it about your chosen field (and the department) that appeals to you?

I found an interest in the department of Genetics because it had a great set of opportunities and research labs. The department has many different types of research, and has opportunities to help one find and continue research during the summers. The department is also small enough to get a close knit community where everyone can know everyone else, but also large enough to have many opportunities for research. I find this field most interesting because it allows me

to research genes and genetic diseases using computational methods, which combines my passion for genetics with my interest in using computational tools in my studies.

Do you have a favorite class/professor within your major?

I don't have a favorite professor per se because there are many professors in the department that want to help the students succeed, and will help the students in whatever way they can. I would say that my favorite classes were genetics 1 and 2, as well as the Quantitative Biology and Bioinformatics. These are my favorite classes because the genetics classes taught me the information about genetics that I have been interested in since high school and the Bioinformatics class was very fulfilling because it teaches students how to conduct genetic research using computational methods, which is the research field that I want to pursue.

Following graduation, Justin will be returning to Rutgers to pursue a Ph.D. in Molecular Genetics.



Dena Winchester, Class of 2020, Certificate in Genetic Counseling

How did you decide on your major?

When I was in high school, I had a biology project in which everyone was given a genetic disorder or birth defect to research. We had to take care of an egg 'baby' afflicted with the disorder, write a journal detailing all daily activities, therapies, and medications completed, and write a letter explaining the disorder from the perspective of a parent, doctor, or genetic counselor. It was the first time I had heard about genetic counseling, and, eager to learn more about this intriguing occupation, I decided to learn more. From that point, I became determined to obtain an education in genetics in order to become a fantastic genetic counselor. Not many universities have a genetics major, so I was particularly drawn to Rutgers, as they had an established program with a remarkable faculty.

What is it about your chosen field (and the department) that appeals to you?

As a rare disease patient myself, I have been fortunate enough to receive top-notch healthcare from experts in the genetics and endocrinology field. As I delved into patient advocacy and began gathering stories from other patients, I learned that there are many patients who unfortunately do not receive decent healthcare. Many of these patients do not have the fortune of meeting with someone like a genetic counselor, whose role is to provide psychosocial support through the testing and diagnosis process. Rutgers offers so many incredible courses and opportunities that have prepared me for a profession in genetic counseling. I was particularly drawn to Rutgers because of their Genetic Counseling Certificate program, through which I was able to attend a full semester rotation in a genetic counseling clinic. Other courses, such as ELSI and Human Genetics have also taught me so much about what it takes to be an excellent genetic counselor.

Following graduation, Dena will be attending the Masters of Science in Genetic Counseling Program at the Icahn School of Medicine at Mount Sinai.

Faculty Mentions



Assistant Professor Tetsuya Nakamura teaches Evolutionary Biology and conducts research to answer long-standing and classical questions of vertebrate evolution. AUG (Association of Undergraduate Geneticists) sat down with Dr. Nakamura to discuss his class, and the value of the Genetics major.

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

worthwhile field?

Dr. Nakamura: Genetics is a fundamental concept in biology. Although we are very familiar with biological diversity in animals, surprisingly, the underlying genetic mechanisms largely remain elusive. Learning genetics will provide you the basic understanding of how organisms diversify and look as they are in the current world. As my personal opinion, comparing the mechanical logics underlying genetic systems and artificially engineered machines is fun; it always highlights the mysteries in biology – why organismal systems do such complicated ways to achieve their goals?

AUG: Your class, Evolutionary Developmental Biology, is one of the higher-level electives Genetics majors can take. What core concepts in Genetics do you hope your students learn from your class?

Dr. Nakamura: In my class, I teach how we can approach evolutionary developmental mechanisms of vertebrates. To learn the basic concepts and approaches in evodevo, we should assemble knowledge from multiple fields such as comparative anatomy, embryology, and evolution. So, the goal of this class is not memorizing names of bones or genes. Rather, students are expected to learn how we can combine different disciplines to answer long-standing questions in animal evolution. For this reason, my class may be hard for students who are familiar with memorizing textbooks and obtaining good grades. However, this course includes many group discussion and field trip to a museum, which would be great for students to become independent thinkers.

AUG: What is the best part of doing research for you?

Dr. Nakamura: Observing things which no one has reported. Particularly, seeing the phenotypes of genetically modified animals I create in my lab is my favorite since they always show unexpected abnormality (and this makes our science more difficult!), which leads a pioneering hypothesis.

AUG: What is something you like to do for fun outside of teaching and doing research?

Dr. Nakamura: Fishing, camping, reading, and triathlon. Fishing has been my favorite more than 20 years, and sometimes I make skeletal prep from the fish I catch.

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 Matisse, 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
Christina Bergey, Assistant Professor
Andy Brooks, Research Professor
Jennifer Moore, Associate Research Professor
Christine Seymour, GCMP Assistant Program Director
Juan Wang, Assistant Research Professor
Samhita Yadavalli, Assistant Professor
Lei Yu, Distinguished Professor