# Application Summary

## Competition Details

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| **Competition Title:** | 2020 CTL/BP Junior Faculty Teaching Excellence Award |
| **Category:** | Institutional Awards - CTL |
| **Award Cycle:** | 2020 |
| **Submission Deadline:** | 03/02/2020 at 11:59 PM |

## Application Information

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| **Submitted By:** | Brian Hammer |
| **Appplication ID:** | 4368 |
| **Application Title:** | Annalise Paaby |
| **Date Submitted:** | 03/02/2020 at 1:15 PM |

## Personal Details

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| **Applicant First Name:** | Brian |
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**Primary School or Department**
Biological Sciences

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|---|---|
| **Primary Appointment Title:** | associate professor |

## Application Details

**Proposal Title**
Annalise Paaby

**School of Biological Sciences**
Atlanta, Georgia 30332-0230 USA

March 2, 2020

**RE: Annalise Paaby – CTL/BP Junior Faculty Teaching Excellence Award nomination**

It is my pleasure to nominate Dr. Annalise Paaby, an Assistant Professor in the School of Biological Sciences, for the CTL/BP Junior Faculty Teaching Excellence Award. Annalise is a unique teacher and mentor of students outside and in the classroom. By making personal connections with her students and developing a respectful environment, she puts her students at ease and creates an environment where learning occurs. Her "Stats" course and activities outside the classroom prepare her mentees for success beyond the doors of Georgia Tech.

Annalise is a Class of 1969 Teaching Fellow whose deploys diverse strategies in her Experimental Design & Statistical Methods ("Stats") course she has taught four times as a solo instructor. Student typically view this course as one to be endured, but Annalise creates a classroom environment where students feel respected and valued. In that place students learn. In her class of nearly 100, she abandons PowerPoint presentations and instead opts for delivery of lecture content on the white board, complemented by Learning Catalytics assessments. Annalise acknowledges that the methods used in this field have remained unchanged for a century works. Thus, into her lectures she infuses discussions of both the fundamental concepts and applications of statistics. She strives for students to understand and master the content not simply do well in the course. In fact she accompanies her syllabus with a guide on How to get an A in this course" with a goal of leaving no student behind. Annalise focuses her efforts on providing clear guidance so that students develop the skill to choose the appropriate statistics application for the task at hand. To this end she splits course time to allow lecture on concepts, followed by time for in-class problem solving. Testimonials speak of the success of this style and of Annalise as an approachable teacher who connects the course material to research in biology in a passionate and enthusiastic manner. Annalise Paaby LOVES teaching stats, and students notice.

Annalise's enthusiasm for mentoring extends beyond her classroom and into her lab where she provide personal mentoring to each lab member. Each of her lab members has unique backgrounds and goals. In regular conversations with each lab member Annalise provides guidance tailored to that trainee. After her lab members depart from Georgia Tech she remains in contact with them, providing them with support long after their time on our campus. Her former lab members recount the lengths Annalise would go to create a comfortable environment where all felt welcome to contribute. Both within and outside the classroom Annalise keeps her attention on her primary responsibilities – her students.

The CTL/BP Junior Faculty Teaching Award is given to recognize excellent teaching and educational innovation – Annalise Paaby is an excellent choice.

Sincerely,

J. Todd Streelman
Professor and Chair
School of Biological Sciences
Petit Institute for Bioengineering and Bioscience
Georgia Institute of Technology

Annalise Paaby
Biological Sciences

# REFLECTIVE STATEMENT ON TEACHING

During my postdoctoral training at New York University, I took the train out to Long Island for a Communicating Science workshop at Cold Spring Harbor Laboratories. My small workshop group, comprised of STEM PhD students and postdocs like myself, was assigned to the "Connect to Your Audience" session hosted by two dramatic arts professors and Alan Alda. At the start of the session, we each stood up and delivered a prepared one-minute explanation of our research; at the end, we would repeat this exercise, presumably with improved diction, charisma and connection to our audience. But for the next four hours, we engaged in theater games like miming our feelings, intuiting a partner's intentions with our eyes closed, and performing extemporaneous debates by shouting nonsense noises. It was… not what any of us expected. The shared identity in a Venn diagram of theater kids and science nerds is probably always a narrow sliver, but that day it was empty (except, perhaps, for Alan Alda). It was excruciating. Two young women shed tears and had to be coaxed to even stay in the room. Scientists have varying levels of comfort speaking in front of a group, or even speaking and writing about our work. But to *perform*? To shed the ego—or maybe embrace it?—and engage on an emotional plane? That's just not us.

But—and how can I even convey the miracle that occurred?—*it worked*. Like, really worked. At the end of the session, like bonded survivors of a natural disaster, or prison, we spoke directly and plainly to one another. The words were the same, more or less; it wasn't about what we said, but how we said it. This was such a transformative moment for me. I realized the power in this experience. If you want to communicate with someone, if you want them to hear you, connect with them. This is a useful philosophy for teaching and giving scientific talks, of course, but as you may imagine, it turns out it holds well for Life in general.

**My philosophy on being in front of a classroom: Connect with the audience**

I believe that my biggest contribution to teaching since I have been at Georgia Tech has been through my role as instructor in BIOL 4401, Experimental Design & Statistical Methods, also known as "Stats." I have taught it each year I have been on campus, once as a co-instructor and I'm currently in my fourth semester as a solo instructor. A required course for our Biology majors, it is historically unpopular here and everywhere. Budding biologists and physicians are generally enthused about marine ecology or disease pathology, not parametric probability distributions. Students view this class as a requirement to be endured, not a topic of inspiration. And critically, many students approach this requirement with trepidation. Our Georgia Tech undergraduates have exceptional facility in quantitative subjects compared to the national average, but many of our Biology majors consider themselves "non-quantitative" types compared to their peers on campus. Students routinely admit fear and anxiety around taking Stats, and that they entered the course anticipating a bad experience.

My definition of a successful class is one in which the students learn a lot and feel confident and inspired doing it. To combat their dread, raise their confidence, and summon their interest, I use the lessons I learned in that workshop to connect with my students. The first class of each semester begins with fun, and funny, examples of how statistics can lead us astray: clusters of meteorite discoveries around Roswell, New Mexico that suggest a cosmic connection to this

region (but likely represent biased sampling); how "p-hacking" political data can support partisan views one way or another; the inference that cats land safely on their feet if they reach terminal velocity in a fall (they don't, that study's fallacy was missing data).

**Respect**

Perhaps the definition of connecting with another person is to respect their experience and point of view. I consider it *essential* that my students know that I respect their experience. When I show respect for my students, they return that respect to me twofold. I learned this lesson on the very first day of my very first teaching assignment. I was a first-year graduate student and I walked into my laboratory section of 18 undergraduates, some of them nearly my age. I was really, really nervous. A flurry of emails had gone out earlier in the week emphasizing that the students must bring their lab binders on the first day. But these messages were flying because students in earlier sections didn't have them, because the bookstore ran out. When I asked them to open their binders, one student didn't have his. He was extremely apologetic. I said okay—and feeling like I might be violating some kind of Never Turn Your Back on the Animals code, dashed to the mailroom across the hall and photocopied the day's lesson from my binder. When I returned, the students tittered, and I began to panic. Had I lost authority? Someone blurted out, "I can't believe you just did that!" But it turned out they were dumbfounded by my disinterest in discipline and willingness to "help." I realized then how they saw me, and how mutual respect was the key to this whole thing.

In my Stats class, I begin my campaign to show my investment in their experience before the semester even begins. Along with the syllabus, I post at least two other course documents: "How to Get an A" and "Textbook Options." As teachers we often lament the conflict—perceived if not genuine—students face between investing in the learning process versus getting a good grade. I believe Stats offers a somewhat unique opportunity to minimize this conflict. (I expand upon this below.) In "How to Get an A," my goal is to communicate the message that I am here to support their learning. I explain the study methods that will, and probably will not, work in my class. I explain my rationale for not using a textbook, which includes not imposing a cost burden, something I know is very meaningful to some students. "Textbook Options" continues this message, recognizing that students vary in their learning styles, and I provide suggestions on whether and how to seek out additional resources.

In 2016, I was a Class of 1969 Teaching Fellow. One of my co-fellows, Mechanical Engineering assistant professor Matt McDowell, mentioned that he tells his students directly that he is there to support them. Now I do exactly the same, stealing his language. I say to the classroom, "This class may be hard for some of you. We cover an enormous amount of material. I am here to guide you every step of the way—we are collaborators, and our common goal is for you to master this stuff."

**No student left behind**

I believe that tension between prioritizing learning versus getting a good grade can be minimized in Stats. Although the course is, at its core, deeply conceptual—I tell my students that statistics is hard not because the procedures are hard (we have computers for that) but because choosing an

appropriate statistical application requires true comprehension of the underlying probabilistic framework—it is also comprised of a very specific set of procedures. These procedures are static; the formula for a one-sample t-test has not changed in 100 years and it is not going to change any time soon. I infuse each new procedure with a discussion of concepts, and I have a running theme in my classroom that we traverse between "Probability World" (the architecture of which is defined by conceptual frameworks) and "Statistics World" (the application of data to the frameworks). By teaching this way, to master the procedures is to master the concepts.

I leverage the fact that Stats has so much procedure-based content to make the expectations for success crystal clear. I have classified every element of my curriculum into a "concept" or a "procedure" and each day, I write in the corner of the whiteboard the new concepts introduced and the new procedures we performed. The exams test only the execution of procedures, and the students know that if they master the procedures, they will ace the exams. Defining very clear expectations, down to the last detail, is fundamental to the success of this class.

Some courses—surely the best courses—ask students to stretch their minds on exams or other assessments, to make new connections beyond what was delivered in the classroom. Stats is not one of those classes. Although it is an upper level course, it covers fundamental material. The goal is for students to achieve basic facility in analyzing quantitative data in a research setting. I choose to assess the students on and only on pre-defined content in order to maximize my ability to define expectations for them. One reason for this is because the enrollment in this course is growing: the first time I taught as a solo instructor, I had 25 students; this semester I have 91. At a certain point, defining scope becomes an issue of scale. It also allows me to maximize the amount of content; we cover a lot of material.

Ultimately, by defining extremely clear expectations, organizing the course content in a transparent way, and delivering step by step details on how to execute each procedure, I offer every student in the classroom the opportunity to master the material and earn a high grade.

**Teaching style and methodology**

With large class sizes, student experience level and ability varies. This is how I maximize classroom time for the strongest students while simultaneously supporting weaker students: Most days, I spend half the time lecturing, and then the students complete a problem, individually or collaboratively—their choice—on the new material. While the students are working, the TAs and I circulate, answering questions. In this way, the strongest students make good use of their time, and a few may leave the classroom that day having mastered new material with little need for review. The students for whom this work is harder receive individualized attention and leave the classroom with a clear set of notes, including a sample demonstration of the concept and procedure; an example problem they attempted on Learning Catalytics with an answer key, often with extended explanations; and a set of additional self-test problems available to them on Learning Catalytics, which they may access (or not) at their leisure.

I have tweaked this approach over the years, and I routinely ask for feedback from the students; a few weeks ago, for example, I reduced the typical time spent problem solving on Learning Catalytics and increased the time in lecture. I credit my colleague Dave Garton, who developed

much of the content I use in this course, and introduced me to the heavy use of Learning Catalytics in the classroom. Dave is a master teacher, and this method really works for this course: for the last three years, a substantial majority of students report that they learned an "exceptional" amount.

I do not care for PowerPoint; I find it difficult to remain connected to an audience while delivering material pre-created on slides. In Stats, I avoid PowerPoint completely and deliver all lectures at the board. I cover, erase and re-cover the white boards many times in a lecture. My lecture material is carefully curated, and constantly modified to improve clarity and organization. I write on the board to pace the class; what I write, they write. Their notes become their textbook. Questions and discussion are dynamic, because the students are engaged doing exactly what I am doing; they are not "interrupting" an orally delivered lecture.

**On clarity and being a good explainer**

I enjoy writing, and I enjoy finding the best way to communicate an idea. It's an intellectual challenge that I find extremely satisfying to tackle. I've developed a course syllabus on Communicating Science, aimed at graduate students in Biological Sciences, and I hope to roll it out in the next year or two. As a postdoc, I participated in evening workshops hosted by science writer Stephen Hall, in addition to the Day of Torment with Alan Alda.

I absolutely love teaching Stats—which is not exactly a favorite among faculty, either—and I think a reason why is because its success rests a great deal on being able to distill difficult concepts with clarity. I work extremely hard to find the right words to help students understand. I am not a trained statistician; I am completely self-taught, and I think this is an asset in this course.

**Beyond the classroom**

My research lab is not especially large: I have mentored four undergraduates, two graduate students (plus an additional three rotation students), two high school students, two postdocs (plus an additional two visiting postdocs), and three technicians. Thus, I would not say that my mentorship influence is impressive in terms of numbers.

However, I think a strength of mine is that I am especially good at supporting people individually. This is hard to illustrate; like most advisors, I meet with my trainees one-on-one in standing weekly meetings as well as engage with them informally. I inquire about their goals and experiences, and work with them to make plans that best serve them and the lab. A good illustration of my mentorship might be how I have supported the experiences of my research technicians. While research techs serve a different role than academic trainees, I have never viewed these staff as outside the sphere of mentorship. I believe extremely strongly in supporting people in their chosen career trajectories, and that I am especially well-positioned to do that working at a university.

I have had three research techs, and all three have chosen to continue education in life sciences research while working in my lab. Erick White was my first tech, and we had many

conversations about his career interests. We stayed in touch after he left the lab, and I provided occasional ongoing advice via email. Erick is now a PhD student in Integrative Biology at Oregon State University. J.C. Alexander is one of my current techs, and—amongst many, many conversations about her career goals—I encouraged her to attend seminars across campus that interested her, to explore her curiosity for microbiology. She has since switched her plans from veterinary school to a PhD in microbiology, and is now considering offers from top tier graduate programs across the country. Francisco Valencia, also a current tech in my lab, discovered that his licentiate from Guatemala was not recognized as a postgraduate degree in the United States, so I encouraged him to take advantage of the free tuition program here at Georgia Tech. He is now working on his masters degree in Bioinformatics part-time.

Despite the fact that these activities do interrupt their hours spent at the bench, supporting their career development does not come at the cost of research progress in the lab. I have a high level of loyalty and commitment from my lab members, and enthusiasm and optimism about their future translates into enthusiasm and dedication at work. I also see direct benefits. For example, as Francisco has learned new computational skills, he has become project leader in a bioinformatics effort that supports our biggest experimental research project in the lab.

Annalise Paaby
Biological Sciences

# ILLUSTRATIONS OF TEACHING EXCELLENCE AND IMPACT ON STUDENT LEARNING

## I. USE OF R STATISTICAL COMPUTING

In my Stats class, the students use R to learn how to handle and analyze quantitative data, which is a departure from how this course is taught by other instructors. I am now in my fourth semester of implementing R in the course.

R is a free, open-source, command-line programming language for statistical computing and graphics. Extremely powerful and flexible, it is the platform of choice for analyzing data in contemporary quantitative science research. Although using a statistical software package with a graphical interface would be pain-free, I think the students are better served using tools that directly translate to contemporary research.

A very small minority of students enter the class having been exposed to R, and some have never used any command line. This spring, 91 students in my class will end their semester with proficiency in parsing and manipulating datasets, plotting figures, and performing basic statistical tests in R.

## II. CIOS SCORES

***Courses I have taught at Georgia Tech***

| | | |
|---|---|---|
| Experimental Design & Statistical Methods | BIOL 4401 | Course for Biology majors; Also heavily attended by our MS Bioinformatics students; Co-taught once, now in fourth semester teaching it solo |
| Frontiers in Molecular & Cellular Biology | BIOL 8803 | Graduate seminar; co-taught with 6-7 other faculty four times |
| Introduction to Evolutionary Biology | BIOL 3600 (UG)<br>BIOL 6600 (GR) | Required course for our Biology majors; Co-taught one time |

***CIOS scores for Experimental Design & Statistical Methods, taught solo***

| Term | # Students | Response | Respect for Students | Instructor Enthusiasm | Instructor Effectiveness | Course Effectiveness | Amount Learned |
|---|---|---|---|---|---|---|---|
| Spring 2019 | 84 | 61.9% | 4.8 | 4.8 | 4.7 | 4.8 | 4.6 |
| Spring 2018 | 57 | 64.9% | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 |
| Fall 2016 | 26 | 69.2% | 4.9 | 4.9 | 4.8 | 4.8 | 4.6 |

### *CIOS scores for remaining courses*

| Term | Course | # Students | Response | Respect for Students | Instructor Enthusiasm | Instructor Effectiveness |
|---|---|---|---|---|---|---|
| Fall 2018 | Frontiers in Molecular & Cellular Biology | 6 | 100% | 4.8 | 4.9 | 4.9 |
| Fall 2017 | Frontiers in Molecular & Cellular Biology | 7 | 57.1% | 4.8 | 4.8 | 4.8 |
| Fall 2017 | Introduction to Evolutionary Biology (UG) | 31 | 93.5% | 4.7 | 4.9 | 4.7 |
| Fall 2017 | Introduction to Evolutionary Biology (GR) | 7 | 100 | 5 | 5 | 4.9 |
| Fall 2016 | Frontiers in Molecular & Cellular Biology | 9 | 33.3% | 4.8 | 4.8 | 4.8 |
| Fall 2015 | Experimental Design & Statistical Methods | 40 | - | *CIOS scores not reported for Instructor* | | |
| Fall 2015 | Frontiers in Molecular & Cellular Biology | 7 | - | *CIOS scores not reported for Instructor* | | |

## III. CIOS COMMENTS

### *Passion and enthusiasm*

"Professor Paaby is such a great lecturer! I think she's really engaging in the way she lectures, and I really appreciate that she takes the time to write on the board along with the students-- that's not always easy, so I think it's a really interesting aspect to the way she teaches."

"I greatly enjoyed this course and I think it's because of Dr. Paaby's incredibly enthusiasm and clarity in teaching this class."

"She's amazing! I absolutely loved her lectures, she's very engaging and wonderful"

"Dr. Paaby is kind, knowledgeable, and enthusiastic. She was usually clear in her notes and tried to be precise in her Paaby diction, which I appreciated. She was also always extremely accessible and thorough on Piazza."

"Dr. Paaby's passion and enthusiasm for the subject matter is amazing and really shows in how hard she works to share her knowledge and make sure we understand it. She has a great way of explaining things and relating them to previously learned material."

"Dr. Paaby is a great lecturer. Her passion for the topic really came through in each class."

### *Maintaining the students' interest*

"Kept the class interesting with Learning Catalytics/group work. Honestly one of the best teachers I've had. Dr. Paaby is incredibly well-spoken, and she very easily kept my attention during class. Great knowledge of the subject area, including "real world" application of the topics."

"Dr. Paaby is a really talented lecturer. I learned a lot from her whiteboard notes, and I don't think I was ever bored during one of her lectures."

"Her lectures were very effective. The notes clearly taught each topic and prepared us for exams. She is engaging and tries to keep the lectures entertaining."

"Excellent teacher, stimulated my interest for the subject, tried really hard to include experiments & examples. Made lectures thoughtful, not just passively listening & reading powerpoint slides. Challenged students to the right degree."

"This was by far my favorite class this semester. Mainly, because I have never had a professor that can keep me focused and paying attention to the material taught in class for the entire hour and a half long class until I took this one. The professor's style of teaching with us taking notes directly from the whiteboard, and not from some powerpoint was extremely valuable. I have enjoyed this class mainly because of the way it was taught."

"The class was always really interesting, and Dr. Paaby always took the time to thoroughly answer people's questions during lectures. Really respectful to all the students and managed to keep the class interesting the whole time."

### *Successful course methods*

"I loved the way she taught. She wrote everything we needed to know very explicitly out on the board and took great care to ensure that everyone understood the concepts. I also liked that writing things out on the board kept things at a good pace and allowed us to process the material easier than it would have been if it had been presented through say, a powerpoint."

"I really liked using R, even just the command line for simple things. Using an actual program that is used for "real world" statistics made the material feel relevant. I know this isn't a Computer Science course, so some students might be hesitant to do any kind of "coding," but the files you uploaded to walk us through the program were very thorough and incredibly helpful."

"I liked the homeworks using R, I found them helpful even though I already have experience using R. I am recommending this class to any graduate student that is looking to better understand the statistical methods behind all the programs we are already regularly using, especially if Dr Paaby is the instructor."

"In-class Learning Catalytics were a great way to apply the methods we had just learned while it was still fresh in our minds and also have the opportunity to ask questions about the material as they came up while we were working on the assignments."

"Dr. Paaby is one of the best professors I've had. She has a great respect and concern for students - if questions are raised on Piazza or in class, she takes the time to answer them thoroughly. If certain concepts aren't clear to students in class, she'll write up a Learning Catalytics for extra practice for students to get more experience and get more familiar with material. She posts handouts and information on Canvas to further our understanding of material. She's also really sweet and kind in class and so open to consulting with students. I can tell Dr. Paaby enjoys her job and really loves teaching."

"I liked how lectures were all hand-written. It really made sure I was paying attention and even helped me learn material better bc I had to translate was was written/explained in my own words for my notes. I also enjoyed the structure of the course and how it was taught because it really was all cumulative and built on previous material."

"The lectures were written on the board, which was interactive, refreshing and helped me learn."

"Overall, this course helped me a lot. I previously took MATH 3215 (Probability and Statistics) and I left that course more confused than I entered it in regards to probability and statistics. That course focused solely on the theoretical math behind the tests, and assumed we had already been exposed to this stuff before. I took this course (Bio 4400) [sic] to reinforce my statistical concepts, and since this course focused on the how and when to use the statistical tests, I really learned much more than the previous course."

"She cares about students, a lot. It takes time and effort to write out the notes on board, but she did it instead of just showing powerpoints."

### *Connecting the material to research in biology*

"The course is very focused on the statistics that is applicable to fields of biology. I have done research with a professor in the past and have taken lab courses that did individual research. The information I learned in this course would have helped immensely. As I prepare for a career, I am sure what I have learned in this class will help me better understand and manipulate data."

"Loved the fact she came up with really innovative problems in class and overall made it a very interesting course."

"She brought the perspective of a biologist and not just a statistician, which I really appreciated."

"Dr. Paaby's lectures included a lot of experiments related to the subject matter. They were really interesting."

"Occasionally introduced new and interesting examples that related to current events and advances in the field."

I really liked learning these stat tests, especially the regression and ANOVA, because I believe these will be extremely applicable to future work I may do in science.

### *Clarity*

"I enjoyed the way that the professor always gave thorough examples for the concepts that she taught. It made understanding the concepts more clear. She was always open to questions and was able to answer them very effectively (in a way I could understand what she was saying and apply it to later concepts)"

"Great clarity and strong instruction in class"

"Great at explaining the material as well as communicates what you need to know."

"Dr Paaby explained concepts in a way that made them easy to understand and connect to the biological world. I definitely feel like I know how to apply these concepts to my own research."

"Her lectures really explained every concept well to me. I felt like I had a good grasp of everything presented in her lectures."

"She's very patient and willing to answer questions, and she's really good at explaining concepts. As a whole, I think she's great at teaching! :-)"

"She knew exactly how to explain the concepts in an effective way where I was able to have a deep understanding of the formulas so that I could do problems on my own without confusion."

"Dr. Paaby was super nice, and I thought her lectures were exceptional. The lectures were well organized and really well written."

"I greatly enjoyed this course and I think it's because of Dr. Paaby's incredibly enthusiasm and clarity in teaching this class. The homeworks and Learning Catalytics (LC) assignments were all informative and detailed and better help me understand unclear concepts in class. As I spent more time with these resources, my grades in the class improved."

"I honestly wished I had taken a class like this much earlier at my time at GT. This statistics class has taught me way more than the engineering statistics course."

***I got them to ~~like~~ tolerate stats!***

"I didn't realize that I liked the subject matter as much as I do until I took this course."

"I just enjoyed all of it! I liked the way that the subject matter flowed and the general composition of the course."

"Thank you Dr. Paaby. You are truly a great, fun, enthusiastic professor and I learned a lot. The material itself isn't very exciting but you really made is interesting and showed how it's applicable to our lives as biologists. Thank you."

***General positivity***

"Best professor I ever had at Tech."

"One of the greatest professors I've had. She asked the class what teaching style worked best with us and then changed the class to teach us better. It was such a dynamic form of teaching that many do not do. And it worked amazingly."

"This was one of the greatest courses I took."

"Great professor, great teacher, great scientist!"

"Nothing more that I can ask for."

## IV. THANK A TEACHER AWARD

I received two "Thank a Teacher" awards in 2019 from students in the Stats class. Excerpts:

"Thank you so much for being so patient with me this semester. When dealing with someone with as many disabilities as I have, it is easy to become frustrated with me, like most other professors have. I get so upset when I cannot control what happens to my body. […] I have gotten so used to slowly becoming the "problem child" for my professors throughout the semester that I just assumed that's how it would be for all of my professors. I am usually after to ask for help because of my embarrassment, but you have showed me so much kindness and understanding that I felt comfortable enough to visit you in your office to ask for help, which is HUGE for me. As a result, I not only love your class, but I feel like I am actually GOOD at your class. Thank you so much for showing me that it is still possible to love a class and to feel comfortable in my own skin. I have truly enjoyed your class this semester, and I only hope that I can have another professor like you in the future."

"I just want to say think you for being an amazing instructor. You are always energetic, well-spoken, and teach the material with clarity and care. You really want every student to succeed and you try to accommodate us when we are confused by explaining it in multiple ways, asking us what we need, and being very responsive on Piazza and in the classroom. That really puts you way above the average professor at Georgia Tech. You also deal with a student in our class who persistently asks questions in a rude way. You handle him quite gracefully though and I really respect that. Thanks again for being such an exceptional teacher!"

## V. TRAINEE PROFESSIONAL DEVELOPMENT AND SUCCESS

These are the people I have mentored in my lab:

### *High School Students*

| | | |
|---|---|---|
| Joanna Baker | Summer 2019 | Still in high school |
| Felicitas Shen | Summer 2019 | Still in high school |

### *Undergraduates*

| | | |
|---|---|---|
| Diptodip Deb | Fall 2015 – Spring 2018 | Now software engineer at Janelia Research Campus |
| Ria Joshi | Fall 2017 – Spring 2018 | Now Biology major at Georgia Tech |
| Debora Postma | Summer 2016 | Now graduate student in City Planning at Georgia Tech |
| Samiha Choudhury | Fall 2015 – Fall 2016 | Graduate of Georgia Tech |

### *Graduate Students*

| | | |
|---|---|---|
| Ling Wang | Fall 2019 – | Current lab member; PhD candidate in Biology |
| Samiksha Kaul | Fall 2016 – | Current lab member; PhD candidate in Biology |
| Stephen Klusza | Fall 2018 – Spring 2019 | Part-time Masters student in Bioinformatics |
| Kai Tong | Spring 2018 | Rotation student; Current PhD candidate in Ratcliff lab |
| Lijiang Long | Spring 2016 | Rotation student; Current PhD candidate in McGrath lab |

### *Poctdoctoral Trainees*

| | | |
|---|---|---|
| Han Ting Chou | April 2016 – | Current lab member |
| Corinne Simonti | September 2019 – | Current visiting lab member (co-advised by Joe Lachance) |
| Katherine Silliman | April – June 2019 | Visiting postdoc; Now postdoc at Auburn University |
| Nick Testa | Sept 2016 – Dec 2017 | Now data scientist at PNC Bank |

### *Technicians*

| | | |
|---|---|---|
| Francisco Valencia | August 2018 – | Current lab member; Part-time Masters student in Bioinformatics |
| J.C. Alexander | September 2018 – | Current lab member; Soon off to get PhD in Microbiology |
| Erick White | August 2015 – July 2016 | Now PhD candidate in Integrative Biology at Oregon State |

Letters of support:

Matthew Torres – colleague in School of Biological Sciences

Zainab Arshad – current undergraduate who was a student in Stats course

Alec Zhan – current undergraduate who was a student and then TA for Stats course

Jacqueline Alexander – current lab technician

Diptodip Deb – former undergraduate research now employed at HHMI Janelia

**Matthew P. Torres, Ph.D.**
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February 11, 2020

Dear CETL/BP Review Committee:

This letter serves to document my review of teaching for Dr. Annalise Paaby in fulfillment of her application to the CETL/BP junior faculty teaching excellence award. To conduct this review, I attended her class *BIOS 4401 – Experimental Design and Statistical Methods* on 2/11/2020 and reviewed the class syllabus and supporting documents. I have known Annalise for about 5 years since her arrival at Georgia Tech. After reviewing her teaching **I can say with confidence that she is an outstanding instructor with a very deep commitment to her students and to the pursuit of excellence in her approach**.

**Classroom Dynamics**

Dr. Paaby's BIOS 4401 class is an introductory course on probability distributions and statistical testing, using techniques commonly applied in biology research. The class covers a breadth of commonly encountered statistical regimes in biology such as descriptive statistics, probability distributions, hypothesis testing, analysis of variance, among other topics essential for the success of a modern experimental biologist. There is no formal textbook required for the course as almost all of the material is provided by Dr. Paaby, although she provides several pre-approved external resources available to the students for review. The Spring 2020 class has about 75 students and Dr. Paaby is supported by 3 teaching assistants.

I am very impressed by the amount of thought Dr. Paaby puts into the structure of her class. This is particularly important for a statistics class in which students are intended to leave the course with a knowledge of how to directly apply and interpret statistical tests. Moreover, the material can be difficult to convey to the un-initiated student and keeping the material and delivery engaging is essential for success. Dr. Paaby and her course design exemplify all of these characteristics. Within each topic, she utilizes one lecture period to introduce the overview and examples of a statistical analysis, followed by hands-on application using real data in the following class period.

In the *overview lecture*, which I attended, Dr. Paaby is very well organized and starts each class with a *Learning Catalytics* digital quiz (non-graded) where students are allowed to interact with each other to answer the questions. Paaby uses the quiz to stimulate thinking about the upcoming topic. She then proceeds logically through each concept in a step-by-step fashion where she draws all figures on the whiteboard (no powerpoint!). I think this serves the students very well as it controls the flow of information in a way that allows students the time to take notes, which is essential when powerpoint slides are not provided. Paaby is a talented artist on the board and the students really seemed to enjoy when she used her artistry creatively to convey the concept of a T-test. This brought some lightheartedness to the lecture that clearly kept students interested. Paaby is also very conversational in her speaking style that, coupled with moving around the room to access the entire whiteboard, comes off as friendly and accessible….down to earth and fun. I really enjoyed sitting in the classroom and watching the lecture unfold on the whiteboard! As students asked for clarification on the topic of T-distributions (for example), Paaby used the opportunity to solidify their existing knowledge (by asking them questions that led them to understand) before by clarifying the concept using an

alternative example. This went beyond just answering the question directly, and was likely beneficial for students to understand the material from an alternative view.

In the following *applications lecture*, which I did not attend, Dr. Paaby provides example data to the students to employ the statistical tests that they learned in the previous lecture. In-class exercises are worth 20% of the grade, and so this aspect of the course has been thoroughly developed by Paaby. Students are provided with ample step-by-step guidance organized such that they can retain the approach by memory. Students break out into groups to discuss what they've done, compare and interpret their results. This mix of theory followed by practice is an outstanding way to solidify these statistical concepts in a way that should be truly useful to them in the future.

**Commitment to Student Success**

I think Paaby's approach to cycle between theory and practice in her class requires a considerably amount of work on her part, which she does because she really cares about students "getting it". **She is very committed to the success of her students and enjoys interacting with them in the classroom.** Indeed, her syllabus states: "*My goal is for every student to earn a good grade in the course. I believe this is possible!*", which is an excellent place to start with a classroom of young overwhelmed students. She supplements this with rigor and transparency in her high expectations by making herself widely available to students through office hours, and also states in her syllabus that she welcomes students to bring her attention to conceptual or administrative issues as soon as they arise. As further example of her care for student success, Paaby provides a syllabus supplement called: "*How to get an A in BIOS 4401*", which is a one-page document that describes the habits of highly successful students. Among many recommendations, she encourages students to form study groups, which most students do naturally already. However, Paaby also states that she will *"…at any point during the semester…help you find study partners.*" I believe this goes above and beyond the typical commitment to student success and is likely a big part of what makes her class so successful.

If I were to summarize my view of Dr. Paaby as instructor it would be as follows: She is a tough but fair professor who cares about her students enough to be extraordinary! Georgia Tech and its students are lucky to have her.

Sincere Regards,

24th February 2020

Dear CTL Selection Committee,

I am honored and pleased to write a letter of support for Dr. Annalisa Paaby, regarding her nomination for CTL Junior Faculty Teaching Excellence Award. I was a student in her class BIOL-4401 (Experimental Design & Statistical Methods) in Spring of 2019. Dr. Paaby, through this course, helped me understand and implement key statistical concepts that I found immediately useful in my research and continue to use today.

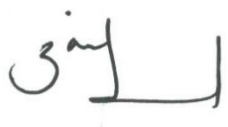
Dr. Paaby introduced us to the importance of statistical analysis in biological research and its relevance through the course of a project, from experiment design to interpretation of results. Towards implementing these concepts, she taught systematic step-by-step approaches to problem solving that simplified the otherwise lengthy and intimidating mathematical exercise. This I imagine is particularly difficult to do in a class taken jointly by graduate and undergraduate students from different academic backgrounds. Along with the theoretical content of the course, she also encouraged us to become familiar with relevant computational resources for practical use.

An average class for this course consisted of a detailed lecture introducing general statistical problems and their stepwise solution, followed by in-class exercises, where we got to immediately test our understanding of the topic. The focus of these exercises was learning and not strictly evaluation, and Dr. Paaby made sure we understood this. Through the course I learnt how numbers can be deceiving and what is an unbiased way to evaluate a hypothesis. Her class covered all statistical concepts and terms we are often asked in interviews for jobs and internships.

Dr. Paaby's best quality as an instructor is how she is candid and approachable both inside and outside class. It is clearly visible from the first day in her class that she is passionate about the subject and excited to teach it. And she keeps this energy up throughout the semester. During the course she gave frequent short assignments and encouraged notetaking in class, which really helped us prepare for exams and saved us a lot of last-minute panic. She was patient in listening to our questions and thorough in her explanations. On the day of one of the midterms for the course, I had to leave town to attend a seminar and Dr. Paaby was very accommodating in terms of re-scheduling and allowed me to take the test a day before.

I often find myself praise her and recommend this course to my peers/juniors, and so really appreciate this opportunity to support her nomination. She is passionate about the subject and respectful to students. Her instructions are precise, and she makes sure everyone does well in the course and for this I think Dr. Paaby deserves this award.

Sincerely,



Zainab Arshad

To the Junior Faculty Teaching Excellence Award Committee:

It is a great honor bestowed upon me to write this letter in support of Dr. Annalise Paaby for her nomination for the Junior Faculty Teaching Excellence Award. I've had the unique opportunity to experience Dr. Paaby's passionate and engaging teaching style in Experimental Design and Statistical Methods as both a student of hers and currently her undergraduate teaching assistant, and the energy level and clear passion she demonstrates towards teaching her students never ceases to amaze me, and is evident in every lecture she gives.

As a student in her class, I didn't know what to expect; I had never heard of Dr. Paaby nor did I know anyone that had taken her class. On day 1, Dr. Paaby made a strong impression as an incredibly approachable person that I instantly felt comfortable talking to, and that hasn't changed at all over time. Her enthusiasm was contagious, and she made an environment conducive to active learning and group collaboration. Throughout the course of the semester, my view of statistics changed from apathy to genuine passion as Dr. Paaby instilled in me a strong interest in the subject. She facilitated active learning and engaged her students through numerous methods. One thing I noticed that set her apart from the rest was her persistence in teaching a concept until every single one of her students fully understood. No student was ashamed to ask a question, and Dr. Paaby never hesitated to answer each question as clear as possible and to the fullest extent, even if it would set the lecture slightly behind. In addition, she integrates into her homework and classwork real-life examples in biology, such as testing if the mean weight of a population of reptiles has significantly changed over a period of 60 years, thus answering the age-old question that students always ask: "When am I ever going to use this in the real world?". Another feature of Dr. Paaby's class that I greatly appreciated and had never seen before was periodic surveys to gather student feedback about the structure about the course and what could be changed. This wasn't so she could take notes and make changes next semester; it was for immediate changes to the course based on student opinion, something that I thought was incredibly thoughtful of her and rare for a professor. For example, she asked whether students wanted more time for in-class work or if her lectures were too fast-paced, among other things; she adapted quickly and effectively, and students definitely appreciated such a swift response. The many facets of Dr. Paaby's teaching philosophy shaped my teaching as well in that my teaching style has become comparable to hers because I know firsthand how effective it is.

Overall, Dr. Paaby's uniquely enthusiastic yet informative lecturing and teaching style create a classroom where students are comfortable and learn effectively. Her integration of real-life and applicable examples into the homework and classwork help students understand the impact and purpose of what they're learning, and her periodic student surveys allowed students to voice their opinions about the course. As both her former student and TA, I believe Dr. Annalise Paaby is one of the strongest and most effective instructors that Georgia Tech has to offer, and I can't think of any professor more deserving of this award.

Sincerely,

Alec Zhan
Georgia Institute of Technology
Undergraduate – School of Biological Sciences

Dear Selection Committee,

I am honored to write this letter of support for Dr. Annalise Paaby. I am a recent graduate from the School of Humanities and Sciences at Ithaca College. I have known Dr. Paaby for a little under two years and I have interacted extensively with her throughout my Post baccalaureate years. These interactions have shown me that Dr. Paaby is an excellent researcher mentor, who values her lab and her students.

I met Dr. Paaby in the summer of 2018 as a senior undergraduate student applying for research positions and have since been working in her lab as a research technician. As a research mentor, Dr. Paaby prioritizes my understanding of any background material pertaining to the different projects in her lab and encourages me to be an active participant in the projects I am assigned to. When I first joined the lab, Dr. Paaby provided me with journal articles needed to understand the background information of the project I would be working on. She also provided me with a brief overview of the project that explained the goals I should try to aim for and the different questions I should ask myself to lead me towards tackling these goals. This worked as a great resource for me since I was new in the lab, and I was starting a project from the ground up. Having clear goals, and a strong foundation was pivotal to my ability to be successful in this project and other projects in her lab. Her ability to convey information showed her proficiency in the field and facilitated my overall comprehension of the project, and different topics in evolutionary biology.

Dr. Paaby fosters a welcoming environment where I felt comfortable discussing anything about my project. This has been pivotal to my development as a researcher because while she was always available for me to talk to about troubleshooting an experiment or improving upon an existing experimental design, she also granted me the granted the opportunity to work more independently. That independence has allowed me to further develop my laboratory skills and my analytical skills.

Not only has Dr. Paaby played an important role in my development as a scientist in the lab, she has also played a pivotal role in my decision to further pursue my career goals. On many occasions, Dr. Paaby has offer guidance or advice on attending graduate school and answered any specific questions I had about going into the research field. From the moment I entered her
lab, Dr. Paaby has been vocal about providing me with the resources I needed to be successful in what I wanted to do. Whether that was pointing out different seminars I could attend or being willing to email other faculty on my behalf, she is always willing to advise me on what was the best course me for me to take. Also, she is always willing to advocate for members in her lab, including myself, if they needed her help. It is qualities like that, that make Dr. Paaby a role model for the kind of exemplary mentor that I want to be in the future. Overall, Dr. Paaby has played an instrumental role in my research career because of her excellent mentorship, and her dedication to providing me with an environment in which I could grow as a scientist.

Sincerely,

Jacqueline Alexander

Biology – Ithaca College 2018

hhmi | janelia

2019-02-28

Dear Award Committee,

I am writing to strongly recommend Dr. Annalise Paaby for the CTL/BP Junior Faculty Teaching Excellence Award. I am a former undergraduate student of Georgia Tech and I spent three years in Dr. Paaby's lab from 2015 to 2019, when I graduated. Dr. Paaby's approach to mentoring and managing her lab is something to aspire to. I left Dr. Paaby's lab after working together to process her microscopy data and joined the Turaga Lab at Janelia Research Campus (Howard Hughes Medical Institute), where I am doing research applying machine learning to neuroscience. I have fond memories of my three years working with Dr. Paaby, and I believe these were crucial experiences in guiding me to continue research at the intersection of machine learning and biology.

I joined Dr. Paaby's lab in 2015 as a computer science undergraduate student in the Fall of 2015. I was interested in the application of machine learning to biological data, and Dr. Paaby graciously chose to take on a student outside of the Biology department. I worked with Dr. Paaby to develop an image processing and machine learning pipeline designed to count single molecules in smFISH microscopy images, which is exactly the sort of collaboration between computer science and biology I was seeking: an application of powerful methods that bring insight from data that would be incomprehensibly complex or large to manage otherwise. Dr. Paaby and I had multiple discussions on what kinds of approximations would be okay to make for the image processing, e.g. regarding the shapes of the cells in 3D. Dr. Paaby always offered this advice in a collaborative manner that really made me feel I was capable of contributing to the scientific questions being asked. I found this a very genuine way of keeping lab morale high.

Not only did Dr. Paaby find a project that combined my two interests, she also spent hours teaching me things in the wet lab like how to pick *C. elegans* worms with a thin hook or all the different behaviors of worms. During lab meetings, where we had lab members of diverse backgrounds and levels of experience, Dr. Paaby would lead discussions and pose questions in an engaging way that made everyone comfortable contributing to the conversation; she once explained *par* genes using pictures of asymmetric body builder muscles. This is a very generous way to create an interdisciplinary lab, and is exactly the kind of environment I would like to create if I were ever to run my own lab.

After graduating, I joined Janelia Research Campus, a neuroscience research campus that is part of Howard Hughes Medical Institute. I have continued to work on the frontier of applications of machine learning to biological data, such as automatically building 3D wiring diagrams of the brain or automatically designing microscopes for the task of whole brain imaging in zebrafish. I attribute my good fortune of being able to play with such exciting data to the guidance of Dr. Paaby. She is certainly one of the most kind, fair, and supportive PIs — at Georgia Tech and around the world. Please contact me if you require further assistance.

Sincerely,

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