

A statement of purpose comprised of the following three components:

- Describe your most meaningful research experience(s) to date. We are interested in what the big picture question was, how you designed experiments to answer it, and what your results told you about the scientific problem. Please include a brief discussion of what you would have done next if you were to continue working on this question.

Applications are evaluated by faculty working in a wide range of fields, so be sure to focus on the high level scientific concepts and not only the specific techniques you used. (Limited to 750 words)

My interest in biology and research was fostered by teachers and mentors who were passionate about the subject and wonderful at transferring that knowledge and passion to their students. I became interested in animal behaviour when I audited the animal behaviour course as a first-year undergraduate, and deepened my interest by doing an online project with Prof. Raghavendra Gadagkar after my second year, where I read books on animal cognition, brood parasitism, and evolution of female sexuality in primates, while also doing a literature review on principles of social immunity.

Eusocial insects stand out for their altruistic behaviours, sparking my curiosity to unravel the intricacies of cooperative behaviour. From an evolutionary standpoint, it's interesting to consider why individuals, at great personal cost, might cooperate for the benefit of the group. Mechanistically, understanding the genetic and neurobiological bases that drive cooperative behaviours provides a window into the complex dynamics of social organisms.

Prof. Sylvia Cremer has done pioneering work on group-level anti-parasitic behaviour in eusocial insects, known as social immunity. I joined her lab in the summer after my third year to study social immunity in ants. I worked with Linda Sartoris, a PhD student who was studying the effect of pathogen experience on hygienic behaviour and mechanisms of information transfer about the pathogen. She had designed an experiment to expose an isolated adult ant to fungal spores in the first phase and in the second phase, transfer it to another container with a naive ant and larvae to study the shift in hygienic brood care behaviour. Contrary to expectation, the fungal-experienced ant reduced its larval grooming as compared to the control experiment and did not influence the allogrooming behaviour of the naive ant. To understand this unexpected result, I conducted a survival experiment, revealing that low concentrations of fungal spores were fatal to larvae but not worker ants due to their self-grooming ability. Thus, ***the pathogen-experienced ant reduced larval grooming to minimise the risk of low-level contamination.***

Expanding on this work, I wanted to test if the presence of a pathogen-experienced ant would affect the brood care behaviour of the naive ant in the context of ***induced larval grooming*** by exposing adult ants to contaminated larvae in the second phase. However I didn't find any significant effect of recent pathogen experience on induced brood care. Despite the absence of conclusive results, this experience fueled my passion for experimental work, enhancing my skills in designing, conducting

and analysing controlled experiments. I also acquired lab skills and techniques like maintaining ant colonies, fungal spore extraction, DNA extraction and qPCR.

In order to best study the effects of pathogen experience, we would have to study it at the colony level rather than through dyadic interactions. I would expose an ant to fungal spores, reintroduce it to the colony and quantify the difference in level of activity, frequency of allogrooming, and time spent caring for the brood in the colony. It would also be interesting to capture the shift in the chemical profile of the colony to study how individuals communicate about a pathogen threat as compared to a predator or an invasive conspecific threat.

After studying ants, I wanted to explore complex and nuanced cooperative behaviour in primates, where individual experiences and social cognition play a very important role. For my master's thesis, I approached Prof. Judith Burkart at the University of Zurich and secured a grant from the A.H. Schultz Foundation to study cooperative behaviour in common marmosets. Like humans, marmosets exhibit proactive prosociality, group-level coordination and joint action via perspective-taking. Biobehavioural synchrony is hypothesised to be the proximate mechanism of cooperation in humans. Through my project, I aim to study behavioural synchrony and pose imitation in marmoset dyads before and after they perform a cooperative task. I'm using DeepLabCut to quantify posture synchrony and gaze following in marmosets and correlate their synchrony with their level of cooperation. Studying the processes of synchronisation in marmosets will help us understand the *overlap of proximate mechanisms regulating cooperation and social cognition in humans and marmosets*.

Through this research experience, I have expanded my skill set, working with marmosets, fabricating experimental tasks and building an analysis pipeline. I have experience working with and handling diverse animal models across behavioural paradigms and have developed the ability to swiftly learn new tools and software. In addition to my research experience, I have fortified my theoretical background through advanced elective courses in ecology, evolution, animal behaviour, and neuroscience, as well as statistical learning, generalised linear models and bioinformatics.

My masters research has expanded my skill set, adding to my experience with diverse animal models, behavioural experiments, and the use of new tools and software. Each project has built upon the elements of the previous one, culminating in a comprehensive and multifaceted approach to understanding animal behaviour.

- Indicate what scientific area(s) you would like to study in graduate school and how your interests would fit within the Rockefeller Ph.D. program and the research of the Rockefeller faculty. (250 words)

In my prospective PhD research at Rockefeller, I aim to study collective behaviour and social structure in ants with Prof. Daniel Kronauer. I'm fascinated by the idea of local interactions between individuals giving rise to astounding complexity in the regulation and functioning of the colony as a whole.

My curiosity extends to various facets of ant colony dynamics, ranging from the evolution of eusociality to the nuances of chemical communication between individuals. Specifically, I'm interested in understanding the processes underlying collective decision-making within the colony, especially in the context of pathogen exposure: what kind of stimuli do the ants detect and respond to; does the colony reach a consensual decision; are there key individuals playing a crucial role in these decisions? I want to use controlled experiments to answer these questions and modelling approaches to identify patterns in complex behaviour.

I have cutting-edge research experience with diverse animal models and proficiency with various experimental and analytical tools. I want to build upon my competencies and use multidisciplinary approaches to understand complex mechanisms underlying behavioural phenomena. If accepted into the program, I'd like to rotate with Prof. Vanessa Ruta to study the neural circuits underlying courtship strategies in drosophila, and Prof. Leslie Vosshal to explore the interplay between genetics and sensory processing in mosquitoes. The intellectually vibrant and multidisciplinary environment at Rockefeller promises not only to enrich my academic journey but also to foster interdisciplinary collaborations that will enhance the depth and breadth of my research pursuits.

- Describe how your background and experiences would contribute to the Rockefeller community, including any adversity you had to overcome in your academic pursuits. (250 words)

I grew up in an orthodox community where education is valued, but not for women. I set high goals, fought for my ambitions, and moved to a different city for my undergrad studies, supporting myself by securing a grant from the Indian government after clearing a very competitive exam in high school. In my first year of undergrad, lacking a strong background in maths and programming, I had a hard time keeping up with the courses and performed poorly. I worked on my fears and opted for challenging elective courses such as mathematical biology, statistical learning, climate modelling and GLMs. I also relearned programming in Python and R by working on research projects with a computational component, developing the perseverance needed to overcome challenges.

I'm also passionate about science communication. One of my articles on brood parasitism in cuckoos was published on a well-known website, showcasing my proficiency in translating complex concepts for a broader audience. I'm also committed to fostering inclusivity within academia. I worked on an investigative journalism project, interviewing several PhD students about their experience and writing an article about the challenges they face in the Indian academic landscape, characterised by diminishing funding and, at times, a toxic work culture. In writing that article, I wanted to shed light on the struggles and initiate conversations and actions towards creating a more supportive academic environment for all. Through my active participation, I aspire to be an advocate for inclusivity, bridging diverse perspectives and backgrounds within the scientific community.