

## FIRST PERSON

# First person – Gayatree Mohapatra

First Person is a series of interviews with the first authors of a selection of papers published in Journal of Cell Science, helping early-career researchers promote themselves alongside their papers. Gayatree Mohapatra is the first author on 'A SUMOylation-dependent switch of RAB7 governs intracellular life and pathogenesis of *Salmonella* Typhimurium', published in Journal of Cell Science. Gayatree conducted the work in this article as a PhD student in the laboratory of Chittur Srikanth at the Regional Centre for Biotechnology, Faridabad, India, where she is studying the regulation of bacterial pathogenesis by post-translational modifications (PTMs).

### How would you explain the main findings of your paper in lay terms?

Acute gastroenteritis that is caused by *Salmonella* Typhimurium is a serious health hazard worldwide. Upon infection of epithelial cells, *Salmonella* resides intracellularly within a membranous compartment, the *Salmonella*-containing vacuole (SCV). Through its residence in SCVs, *Salmonella* rapidly neutralizes the immune-regulatory mechanisms of the host. The pathogen hijacks a key post-translational modification, SUMOylation, which is capable of governing fundamental processes in the cell. SUMOylation is a protein modification that involves the addition of either a single SUMO or a chain of SUMO polypeptides to a target protein, which can dramatically alter its fate or activity. In our work, we observed SUMOylation modification of Rab7, which acted as a 'SUMO-switch' governing Rab7 function and stability. Unexpectedly, the SUMO-modification of Rab7 was inhibited by *Salmonella* for its own advantage. A series of tightly knitted experiments revealed that *Salmonella* tweaked the SUMO-switch of Rab7 for stabilizing SCV and for better intracellular life. Our work, thus, not only identifies a novel form of *Salmonella*-host crosstalk but also unravels a hitherto unknown mode of regulation of Rab7, a protein which plays a vital role in multiple cellular processes. Thus, we unveil a mechanism of broad interest, well beyond a *Salmonella*-host crosstalk.

### Were there any specific challenges associated with this project? If so, how did you overcome them?

SUMOylation of a protein is a sensitive and feeble event, which is often lost during detection with different methodologies. Moreover, at any given point of time, only a very small fraction, 5–10% of total protein, remains in the SUMOylated state. Even the slightest fluctuation in the cellular physiology can potentially trigger a signaling cascade usually originating from PTMs, such as SUMOylation. In the current work, we investigated the connection of SUMOylation to *Salmonella* infection. However, dissecting the precise components of host cells that undergo SUMOylation alteration was our objective. We had to design a strategy involving biochemical, molecular biological, computational methodologies. This was a very cumbersome procedure, which not only involved multiple techniques but also required meticulous planning and analysis.

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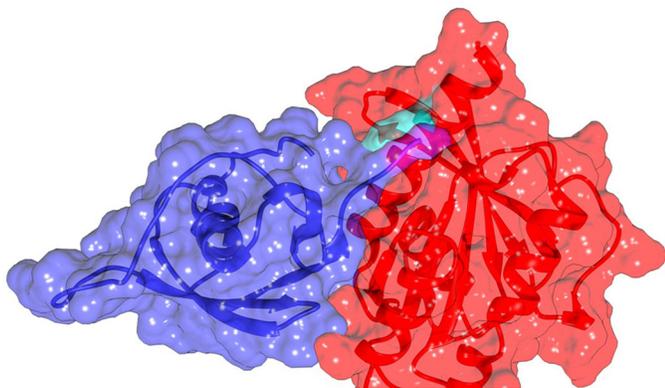
By using such a pipeline, we were able to identify the GTPase Rab7 to be SUMOylated specifically at lysine 175. This was the most interesting and challenging part of my work.

### When doing the research, did you have a particular result or 'eureka' moment that has stuck with you?

Previously, we have shown that *Salmonella* blocks SUMOylation for a successful infection. By contrast, upon SUMO upregulation, there is a compromise in bacterial multiplication and the stability of SCV. But the exact SUMO-dependent intrinsic mechanism involved was not comprehended earlier. From the complex SUMO proteome analysis of control and *Salmonella*-infected samples, we identified Rab7GTPase potentially getting SUMOylated. Moreover, the revelation of the importance of Rab7 SUMOylation in *Salmonella* intracellular multiplication was extremely fascinating. Specifically spotting Rab7 SUMOylation and its direct contribution in *Salmonella* biology was the 'eureka' moment for my paper.

### Why did you choose Journal of Cell Science for your paper?

Journal of Cell Science is a reputed journal in the field of cell biology. It has a wide range of audience, and publishes articles of good quality and with important discoveries in the field of cell biology. More importantly, the review process is very thorough and fast, which improved our work substantially.



**Model depicting the SUMO2-Rab7 complex.** Surface representation of a docked model of SUMO2 (blue) in complex with Rab7 (red). Gly97 of SUMO2 (magenta) and Lys175 of Rab7 (cyan) are specified.

### **Have you had any significant mentors who have helped you beyond supervision in the lab?**

My PhD supervisor Dr Chittur Srikanth is instrumental in shaping this work to this level. The striking part of his mentorship is to look at any of my data I feel negative about, and to extract a stimulating take-home message and useful information from that. For him to get maximum output from a person is to allow him/her to work independently. Whenever I feel low in my work, he always offers support, helping me to accomplish my work.

### **What motivated you to pursue a career in science, and what have been the most interesting moments on the path that led you to where you are now?**

I live in a country where most of the people still live below the poverty line. Poverty affects quality and standard of living, such

as lack of sanitation, which in turn leads to serious food-borne or water-borne diseases and high mortality. So this actually motivated me to work in deciphering a small but important part in *Salmonella* infection biology and impart something to the society for the betterment of people's lives.

### **Who are your role models in science?**

I consider Dr Abdul Kalam, the famous Indian nuclear scientist, as my role model. His vision has inspired and ignited the budding brain of many young Indians like me. Being famous as the 'Missile Man of India', Dr Kalam came from utmost poverty and reached the zenith of success in science and guided young Indians to dream until your dream comes true. One of his famous quotes is "we should not give up and we should not allow the problem to defeat us". This kept me moving and motivated to accomplish my goal at any cost.

### **What's next for you?**

I will be in research in the future. I would like to pursue my career in the field of drug discovery or vaccine development, which is a current and pressing need in highly populated and developing countries like India.

### **Tell us something interesting about yourself that wouldn't be on your CV**

I enjoy playing badminton in the evening after a whole day of work. This is just to get rid of the monotony and to unwind after a strenuous day at work. I like to do gardening too. I have some pet plants on my hostel balcony. They are soothing and satisfying.

### **Reference**

Mohapatra, G., Gaur, P., Mujagond, P., Singh, M., Rana, S., Pratap, S., Kaur, N., Verma, S., Krishnan, V., Singh, N. et al. (2019). A SUMOylation-dependent switch of RAB7 governs intracellular life and pathogenesis of *Salmonella* Typhimurium. *J. Cell Sci.* **132**, jcs222612.