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FIRST PERSON

First person – Jaya Kumari

First Person is a series of interviews with the first authors of a selection of papers published in Biology Open, helping early-career researchers promote themselves alongside their papers. Jaya Kumari is first author on 'Developmental expression patterns of toolkit genes in male accessory gland of *Drosophila* parallels those of mammalian prostate', published in BiO. Jaya conducted the research described in this article while a graduate student in Pradip Sinha's lab at the Department of Biological Sciences and Bioengineering, Indian Institute of Technology Kanpur, Kanpur, India. Jaya is currently an early-career postdoc in the lab of Pradip Sinha, investigating development and carcinogenesis in *Drosophila* organs with squamous epithelial cells.

Jaya Kumari

What is your scientific background and the general focus of your lab?

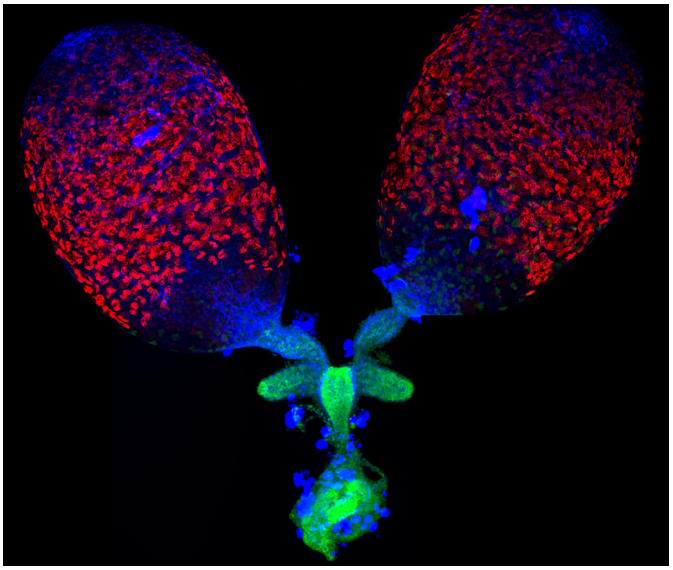
I did an undergraduate in Industrial Biotechnology. It was during the last semester's project that I found my calling in research. At IIT Kanpur, I became interested in research involving model organisms, such as the fruit fly. Its genetic tractability and conservation with higher organisms fascinate me. I was particularly attracted to the development of organs that appeared to be least understood. I found the male accessory gland (MAG) was one such organ. Like the mammalian prostate, *Drosophila* MAG produces a protein-rich seminal fluid that leads to post-mating responses in females. Two major unresolved questions about MAG appeared most engaging to me: Does *Drosophila* MAG follow the same developmental design as its analogous mammalian counterpart, the prostate? Further, does MAG carcinogenesis display common underpinnings with prostate or squamous cell carcinomas, for instance? Although MAG was not a primary organ of interest in my graduate mentor's laboratory, I embarked on its study given its fascinating structure and unique developmental features.

How would you explain the main findings of your paper to non-scientific family and friends?

Anatomical complexity of animals increases as they climb the evolutionary tree. One may thus wonder if increasing anatomical complexity of organs also means a proportional increase in the required gene sets. An enduring and surprisingly emergent lesson from evolution is that complexities do not follow a linear progression in gene numbers. Instead, distant organisms may use common sets of genes to build diverse arrays of organs. This set of conserved genes is also referred to as genetic toolkits: namely, those which are deployed in shaping the organ in question. I have examined the toolkit genes in *Drosophila* MAG to test if these may be common with the mammalian prostate. My study shows that a select set of toolkits are common between MAG and prostate. Thus, these analogous organs from very distant phylogeny display essential ground plans of development

What are the potential implications of these results for your field of research?

The MAG and the prostate have been historically considered to be functionally equivalent. However, they display distinct embryonic origins: MAG is mesodermal while the prostate is endodermal. The adult tissue architecture is also very different. MAG comprises simple epithelia with two secretory cell types, one of which is also highly squamous. Currently, there are also no known progenitor cells; MAG is considered quiescent. Prostate, in mice, on the other hand, has columnar luminal cells as well as progenitor cells. Much of the prostatic branching also occurs in the adult, unlike *Drosophila* where the organogenesis is largely complete during pupal development. Thus, we are still trying to understand how much of the MAG may be considered to be a prostate. My work sheds some light in this direction suggesting that developmentally these organs may have a lot in common. I found that there is genetic toolkit



Visualizing development of male accessory gland in *Drosophila*.

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conservation and a common underlying developmental design of tube formation between these analogous organs.

What has surprised you the most while conducting your research?

In the evolutionary timeline, the invertebrate *Drosophila* separated nearly 500 million years ago from their vertebrate counterparts. Yet signatures of their common origins are deeply imprinted in their shared signalling cascades and developmental designs. For instance, the location of *Hox* gene clusters is similar between the invertebrate *Drosophila* and the mammals. I was surprised to find that even with different embryonic lineages equivalent organs such as *Drosophila* MAG and mammalian prostate could display many developmental parallels. This is also what makes model organisms such as the fruit fly relevant for research including those for developmental underpinnings as well as mechanistic resolution of human diseases.

“I was surprised to find that even with different embryonic lineages equivalent organs such as *Drosophila* MAG and mammalian prostate could display many developmental parallels.”

What, in your opinion, are some of the greatest achievements in your field and how has this influenced your research?

The work done by Ahmad and Baker (Ahmad and Baker, 2002) stands out as a seminal piece of research in the domain of MAG development. Although the work was focused on atypical organization and regulation of the genital disc, it inevitably laid the foundation for understanding MAG development. At the same time, the analogy of the MAG and the prostate was being well established. The labs of Mariana Wolfner, Tracey Chapman, and others established the role of accessory gland proteins and their functions in male fertility and post-mating responses. Of late, the focus is on disease modelling in the MAG, particularly, a possible underpinning of prostatic cancer, if any, which has been recently claimed (Rambur et al., 2020). All these developments motivated me to further probe developmental and also disease parallels between the *Drosophila* MAG and the mammalian prostate.

What changes do you think could improve the professional lives of early-career scientists?

Mentorship is very important. The right mentorship can help early-career scientists take up new challenges, while not losing time, focus, or confidence. Today there are lots of opportunities as well as huge competition so sometimes early-career scientists may find themselves in a dilemma. A good mentor could be strong support for early-career scientists and help them embark on fruitful careers based on their interest, calibre, and calling.

“The right mentorship can help early-career scientists take up new challenges, while not losing time, focus, or confidence.”

What's next for you?

There are more interesting revelations from the MAG that we are eagerly waiting to investigate further. Despite the setback in our work due to COVID, I am optimistically looking forward to a productive time in the immediate future with our next publication on the squamous cell carcinogenesis mechanisms in *Drosophila* MAG. I completed my PhD defence during the pandemic and am aiming to secure my next research engagements, meet new mentors, and hope that the thrill of science continues in my career path.

Reference

Kumari, J. and Sinha, P. (2021). Developmental expression patterns of toolkit genes in male accessory gland of *Drosophila* parallels those of mammalian prostate. *Biology Open* **10**, bio058722. doi:10.1242/bio.058722