

## FIRST PERSON

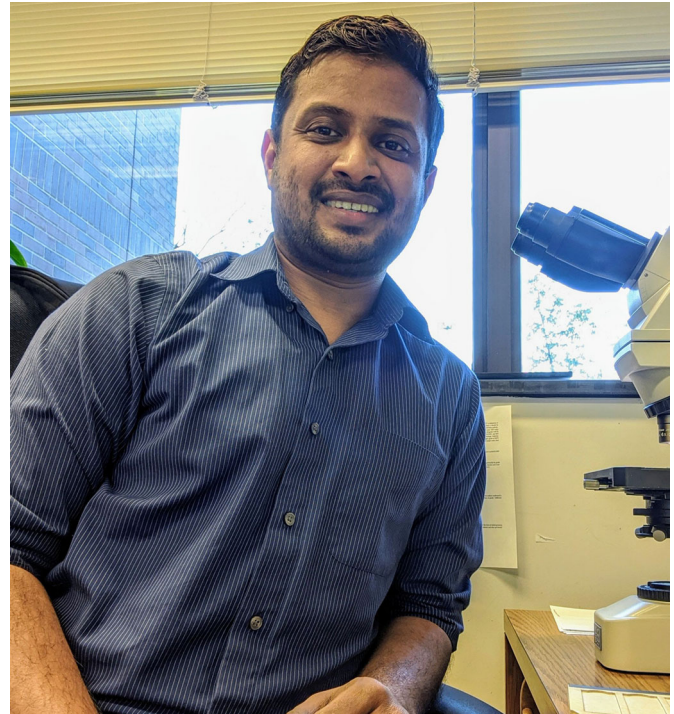
# First person – Viju Vijayan Pillai and Prasanthi Koganti

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. Viju Vijayan Pillai and Prasanthi Koganti are co-first authors on 'Efficient induction and sustenance of pluripotent stem cells from bovine somatic cells', published in *BIO*. Viju conducted the research described within this article while a PhD student in the lab of Vimal Selvaraj at Cornell University, Ithaca, NY, USA, and is now a resident veterinary anatomic pathologist at Purdue University, Indianapolis, IN, USA, investigating reproductive pathology and early embryonic development. Prasanthi is a postdoctoral associate in the lab of Vimal Selvaraj at Cornell University, investigating molecular mechanisms that regulate cellular functions.

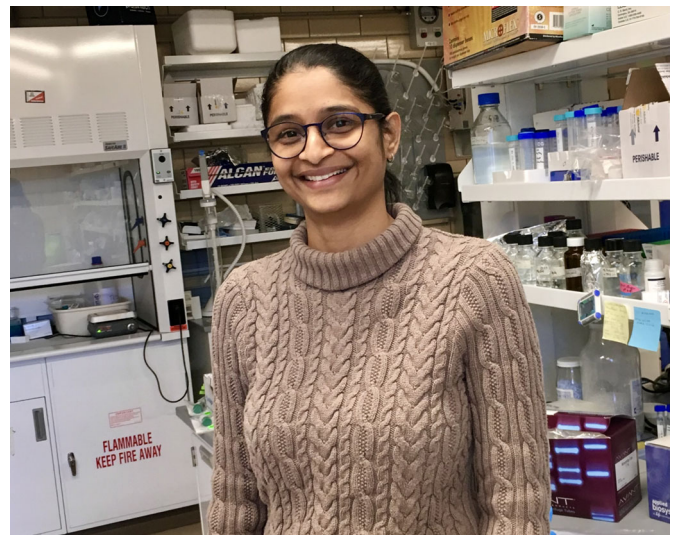
### What is your scientific background and the general focus of your lab?

VP: After graduation with a degree in veterinary medicine from India, I practiced as a veterinarian for a couple of years before accepting a graduate student position in Dr Selvaraj's lab at Cornell University. At Cornell, I became interested in mechanisms underpinning early embryonic development and fertility in animals. My thesis focused on understanding the molecular basis of pluripotent stem cell derivation and sustenance in cattle. In addition, I also worked on characterizing the microenvironment of early bovine embryo and factors regulating placentation and implantation in ruminants. After my doctoral studies, I headed back to my clinical roots to pursue a clinical residency position in anatomic pathology at Purdue University College of Veterinary Medicine. My work here is mostly clinical, providing diagnostic biopsy and autopsy services. I am also involved in collaborative research projects requiring pathology expertise.

PK: I have a unique background with research experience in molecular biology, epigenetics and cell biology using plant and animal models. My research career started as a plant biologist at International Crops Research Institute for Semi-Arid Tropics, aiming to develop pest-resistant pigeonpea and sorghum to address huge losses incurred by marginal farmers due to insect pests and  $\beta$ -carotene-fortified transgenic pigeonpea to fight vitamin A deficiency in developing countries. During my doctoral degree at West Virginia University, I shifted my gears to study non-coding RNA and DNA methylation in myogenic gene regulation under hormonal influence in rainbow trout. This experience has broadened my expertise in using bioinformatics as a key tool in understanding basic biological mechanisms. My current position in Dr Selvaraj's lab at Cornell University as a postdoctoral associate provided possibilities to solve basic biology questions exploiting cell biology and systems biology approaches and advanced techniques using rodents and bovine model species.



Viju Vijayan Pillai



Prasanthi Koganti

Our lab is distinctive with multifaceted projects and research models. Two major areas that we focus on are (1) understanding the basic functional aspects of proteins involved in mitochondrial cholesterol import during steroidogenesis and (2) establishing tools [*in vitro* culture of bovine trophoblast and bovine induced pluripotent stem cells (biPSCs)] necessary to improve genetic traits (genetic manipulation) that would enhance production and welfare in bovine species using assisted reproduction. More details of our lab can be found at <https://blogs.cornell.edu/selvaraj/>.

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

Cattle is an important livestock species that has been bred for more than 10,000 years for nutrition. This selective breeding for human-beneficial traits like increased milk production resulted in decreased life span and metabolic disorders. Fortunately, advances in bovine genome sequencing and engineering opened new avenues to improve genetics of domesticated cattle. These advanced molecular techniques are only feasible with availability of suitable laboratory resources. Induced pluripotent stem cells (iPSCs) are cells derived from an animal and reprogrammed to behave like pluripotent cells derived from embryonic origin. Successful methods were developed to induce pluripotency in bovine species before, but their long-term maintenance was difficult, making them insufficient for genetic manipulation. In our current study, we developed methods to maintain pluripotent cells and establish biological signals necessary for their maintenance.

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

Establishment of biPSCs has been a challenge to the field because of difficulties to sustain long-term maintenance. Our research, for the first time, successfully established reproducible methods for induction, self-renewal and long-term sustenance of biPSCs. This enabled us to establish transcriptional networks and signalling pathways that support pluripotency. These findings will benefit the field by laying a foundational understanding of regulatory mechanisms of pluripotency, thus opening scope to design physiologically relevant *in vitro* conditions that are imminent for genetic remodelling in livestock.

**“[...] different species respond differently to cellular reprogramming, although it is broadly considered a ‘pan-species phenomenon’.”**

### What has surprised you the most while conducting your research?

We were really surprised at how different species respond differently to cellular reprogramming, although it is broadly considered a ‘pan-species phenomenon’. It seems that livestock in general are quite refractory to traditional reprogramming techniques and pluripotency maintenance strategies. We had to spend a considerable amount of time optimizing efficient iPSC derivation strategies and conditions to successfully reprogramme bovine cells.

The astounding aspect during the conducting of this research was the extent of bioinformatics tools that are available in the current day. If we had to conduct similar research a decade ago, it would have been nearly impossible. The availability of transcription factor and signalling pathway databases led to an unprecedented depth in our understanding and efficient use of transcriptomics data. We think that this multipronged systems biology approach and supportive functional studies will hold as an illustration for reliable use of big data.

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

In the field of induced pluripotent cells, derivation of iPSCs from humans with hope of use in regenerative medicine is the most influential breakthrough. These cells were generated by expression of transcriptional factors that can reprogramme the genome from an adult to an embryonic-like state, thus transforming them to induced pluripotent cells. This laid a foundational study for deriving biPSCs.

**“Understanding basic science is the foundation for applied sciences, so it’s unfortunate that funding is extremely limited for professionals from basic sciences.”**

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

Understanding basic science is the foundation for applied sciences, so it’s unfortunate that funding is extremely limited for professionals from basic sciences. We wish that funding agencies would recognize the importance and allocate more funding to basic sciences.

### What’s next for you?

VP: I will be done with my residency training in 2022. I plan to start a research program at the intersection of basic reproductive physiology and pathology.

PK: I plan to advance our current understanding of cellular functions using systems biology and discovery research approaches.

### Reference

Vijayan Pillai, V., Koganti, P. P., Kei, T. G., Gurung, S., Butler, W. R. and Selvaraj, V. (2021). Efficient induction and sustenance of pluripotent stem cells from bovine somatic cells. *Biol. Open* **10**, bio058756. doi:10.1242/bio.058756