RAJA SINGH PAULRAJ

POSITION TITLE: **Post-Doctoral Research Fellow**

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	START DATE MM/YYYY	END DATE MM/YYYY	FIELD OF STUDY
Southern Institute, Chennai, India	DMLT	06/2004	06/2005	Medical lab Technology
University of Madras, Chennai, India	B.Sc.	07/2005	05/2008	Zoology
TN Teachers Education University, Chennai, India	B. Ed.,	08/2008	05/2009	Biological Science
University of Madras, Chennai, India	M.Sc.	07/2009	04/2011	Zoology
University of Madras, Chennai, India	M.Phil.	08/2011	09/2012	Endocrinology
University of Madras, Chennai, India	Ph.D.	02/2013	04/2018	Zoology - Endocrinology
Marshall University, WV, USA	Postdoctoral	01/2019	Present	Gastrointestinal Physiology

A. Personal Statement

My academic training and research experience have provided me with an excellent background in multiple biological disciplines specifically in biomedical sciences including molecular biology, biochemistry and gastrointestinal physiology. As a predoctoral student (M.Phil. in Endocrinology), I was able to conduct research in nimbolide effect on insulin like growth factor (IGF) system in androgen independent prostate cancer cell line (pc-3)". As a doctoral student, my research focused on prostate cancer cell (PC-3) line with nimbolide for their anticancer molecular mechanism: Involvement of NF-κB, MAPK and PI3K-Akt pathways" using in vitro and molecular docking analysis. I used western blot, immunofluorescence and docking techniques in order to individually assess proteins of cell survival and proliferation of prostate cancer with anticancer drug nimbolide. As part of the postdoctoral training, I am currently involved in the proposed project with specific focus on understanding the molecular regulation of Na-bile acid co-transporter ASBT in in vivo rodent models as well as in IEC-18 cells in vitro. My postdoctoral training over the last year has given me the required expertise to handle the in vivo systems and the in vitro

models of intestinal epithelial cells. In these systems, I will conduct functional and molecular studies to determine the regulation of ASBT using the proposed techniques. Under the expert supervision and guidance of the PIs in this grant, I believe that I will be elevating my potential as a scientist with the keen ability to analyze, interpret and extrapolate my experimental findings to a broader systemic relevance and significance. With my research background and experience, I am well suited for this project and I can definitely play a very productive role in the proposed project.

B. Positions and Honors

Positions and Employment

From Jan 2019 - Postdoctoral Researcher, Marshall University

Other Experience

1. Participated in "7 days' workshop on Drug Discovery Technology: practical approach of computational tools & methods in Drug discovery and ADMET property prediction" conducted by BIODISCOVERY GROUP LIFE SCIENCES INDIA, New Delhi and Department of Biological Sciences, Bangalore University, Bangalore during 5th – 12th Mar 2014.

2. Acquired hands on training on ChemSketch & Molecular Docking 2nd - 6th May 2016 DBT-Bioinformatics Infrastructure Facility Center, Holy Cross College (Autonomous), Trichy 620 002.

Honors

July 2013 to September 2014	Research Fellow (UGC - UPE - Phase II - Theme B- Herbal Sciences
Dec 2014 - July 2017	JRF (Junior Research Fellow) in DST PURSE Phase II

C. Contribution to Science

1. **Early Career:** My early career scientific contributions were studies on developing anticancer drugs. Cancer is still one of the major causes of mortality in both developing and developed countries. At present, in spite of intensive interventions, a large number of patients suffer from poor prognosis. Therefore, the effort for finding new anticancer agents with better efficacy and lesser side effects is underway. According to the traditional recommendations and experimental studies, numerous medicinal plants have been reported to have anticancer effect. Through my early career studies, we have found some of the phytochemicals like lycopene, quercetin, dially disulfide and nimbolide inhibits the cancer cell survival and proliferation signaling pathway like IGF1/PI3K/Akt, TNFα/TNFR1/NFκB, and induce the apoptotic pathway molecules in breast cancer in women and prostate cancer in men.

1) Sugantha Priya E, Sathish Kumar T, **Raja Singh P**, Balakrishnan S, Arunakaran J **(2016)**. Impact of Lactational Exposure to Polychlorinated Biphenyl Causes Epigenetic Modification and Impairs Sertoli Cells Functional Reglation in F1 Progeny. Reproductive Science, 25(6):818-829. (**JIF: 2.429). PMID: 28359186.**

2) Sugantha Priya E, Dhanaraj T, **Raja Singh P**, Arunakaran J (**2017**). Ameliorative effect of α-tocopherol on polychlorinated biphenyl (PCBs) induced testicular Sertoli cell dysfunction in F(1) prepuberal rats. *Experimental and Toxicologic Pathology*. 2017; 69(8):681-694. **(JIF: 1.975). PMID: 28739394.**

3) Arunakaran J, Elumalai P and **Raja Singh P (2017).** Nimbolide inhibits cell survival and proliferation of IGF1 mediated PI3K-Akt and MAPK signaling in human breast cancer cells and TNF-α/TNFR1 mediated signaling molecules in prostate cancer. Modern Applications of Bioequivalence & Bioavailability, 1(1): 555554. **Review.**

4) Balakrishnan S, Mukherjee S, Das S, Bhat FA, **Raja Singh P**, Patra CR, Arunakaran J **(2017)**. Gold nanoparticles-conjugated quercetin induces apoptosis via inhibition of EGFR/PI3K/Akt-mediated pathway in breast cancer cell lines (MCF-7 and MDA-MB-231). *Cell Biochemistry and Function,* 35(4):217-231. **(JIF: 2.134)**. **PMID: 28498520.**

5) Arunkumar R, **Raja Singh P**, Elumalai P, Sambantham S, Jhansi Rani N, Dinakaran P, Arunakaran J **(2016).** Antiangiogenic and anti-invasive effect of dially disulfide: an in vitro investigation using prostate cancer cell line and in vivo using zebrafish embryo model. *Journal of Bioequivalence & Bioavailability* 8: 260-271. **(JIF: 4.34).**

6) Balakrishnan S, Bhat FA, **Raja Singh P**, Mukherjee S, Elumalai P, Das S, Patra CR, Arunakaran J **(2016)**. Gold nanoparticle-conjugated quercetin inhibits epithelial-mesenchymal transition, angiogenesis and invasiveness via EGFR/VEGFR-2-mediated pathway in breast cancer. *Cell Proliferation,* 49(6):678-697. **(JIF: 3.084). PMID: 27641938.**

7) Sugantha Priya E, Sathish Kumar T, Balaji S, Bavithra S, **Raja Singh P**, Sakthivel D, Ravi Sankar B, Arunakaran J **(2016)**. Lactational exposure effect of polychlorinated biphenyl on rat Sertoli cell markers and functional regulators in prepuberal and puberal F(1) offspring. Journal of Endocrinological Investigation, 40(1):91-100. **(JIF: 1.994). PMID: 27614457.**

8) Sathish Kumar T, Sugantha Priya E, **Raja Singh P,** Arunakaran J **(2016)**. Lactational exposure of PCBs downregulates critical genes in Leydig cells of F1 male progeny (PND21). *Andrologia* (AND-16-257) **(JIF: 1.45). PMID: 27785823.**

9) AB Firdous, S Balakrishnan, **P Raja Singh**, J Arunakaran **(2015).** Molecular implications of different MicroRNAs in the pathogenesis of prostate cancer. *International Journal of Genetics & Cancer* 2 (1 & 2).

10) Elumalai P, Brindha Mercy A, Arunkamar R, Sharmila G, Bhat FA, Balakrishnan S, **Raja Singh P,** Arunakaran J **(2014).** Nimbolide inhibits invasion and migration, and down-regulates uPAR chemokine gene expression, in two breast cancer cell lines. *Cell Proliferation,* 47(6):540-52. **(JIF 3.28). PMID: 25377085.**

11) Bhat FA, Sharmila G, Balakrishnan S, Arunkumar R, Elumalai P, Suganya S, **Raja Singh P,** Srinivasan N, Arunakaran J (**2014**). Quercetin reverses EGF-induced epithelial to mesenchymal transition and invasiveness in prostate cancer (PC-3) cell line *via* EGFR/PI3K/Akt pathway. *The Journal of Nutritional Biochemistry,* 25 (11):1132–1139 **(JIF: 4.686). PMID: 25150162.**

12) Bhat FA, Sharmila G, Balakrishnan S, **Raja Singh P,** Srinivasan N, Arunakaran J (**2014**). Epidermal growth factor-induced prostate cancer (PC3) cell survival, proliferation is inhibited by quercetin, a plant flavonoid through apoptotic machinery. *Biomedicine and preventive nutrition,* 4(4): 459–468.

13) Bhat FA, Sharmila G, Balakrishnan S, **Raja Singh P**, Suganya S, Srinivasan N, Arunakaran J (**2014**). Quercetin, a natural dietary flavonoid, acts as a chemopreventive agent against prostate cancer in an *in vivo* model by inhibiting the EGFR signaling pathway. *Food and Function,* 5(10):2632-2645 **(JIF: 2.907). PMID: 25164625.**

14) Sharmila G, Bhat FA, Arunkumar R, Elumalai P, **Raja Singh P**, Senthilkumar K, Arunakaran J (**2014**). Chemopreventive effect of quercetin, a natural dietary flavonoid on prostate cancer in *in vivo* model. *Clinical Nutrition,* 33(4):718-726. **(JIF: 4.581). PMID: 24080313**

15) Sugantha Priya E, Selvakumar K, Bavithra S, Elumalai P, Arunkumar R, **Raja Singh P**, Brindha Mercy A, Arunakaran J (**2014**). Anti-cancer activity of quercetin in neuroblastoma: an *in vitro* approach. *Neurological Sciences,* 35(2):163-170. **(JIF: 1.495). PMID: 23771516.**

2. **Graduate Career (PhD):** My graduate research study focused on understanding the anti- prostate cancer properties of nimbolide, a phytochemical obtained from the neem tree. Prostrate cancer cells were treated with various concentrations of nimbolide, which showed a dose-dependent decrease in cell viability compared to control. Further, it inhibited the cell survival and proliferation signaling molecules like IGF1/PI3K/AKt, and TNFα/TNFR1 mediated NF-κB and MAPK pathways and induced apoptosis in prostate cancer. These data generated compelling grounds for further preclinical evaluation of nimbolide for prostate cancer management.

   Raja Singh P, Sugantha Priya E, Balakrishnana S, Arunkumara R, Sharmila G, Rajalakshmi M, Arunakaran J (2016). Nimbolide inhibits androgen independent prostate cancer cells survival and proliferation by modulating multiple pro-survival signaling pathways. Biomedicine and Pharmacotherapy, 84:1623-1634. (JIF: 2.191). PMID: 27889231

   Raja Singh P, Sugantha Priya E, Balakrishnan S, Arunkumar R, Sharmila G, Rajalakshmi M, Arunakaran J (2016). Inhibition of cell survival and proliferation by

nimbolide in human androgen-independent prostate cancer (PC-3) cells: Involvement of the PI3K/Akt pathway. Molecular and Cellular Biochemistry, 427(1-2):69-79. (JIF: 2.613). PMID: 28025797.

Raja Singh P, Arunkumar R, Sivakamasundari V, Sharmila G, Elumalai P, Sugantha Priya E, Brindha Mercy A, Senthilkumar K, Arunakaran J (2014). Anti-proliferative and apoptosis inducing effect of nimbolide by altering molecules involved in apoptosis and IGF signalling via PI3K/Akt in prostate cancer (PC-3) cell line. Cell Biochemistry and Function, 32(3):217-228 (JIF: 2.134). PMID: 23963693.

3. **Postdoctoral Career:**

With my co-investigators, I was able to demonstrate the regulation of intestinal Na-dependent Glutamine co-transport by alcohol in a rodent model and an in-vitro model of intestinal epithelial cells. The mechanism of regulation by alcohol was found to be due to a decrease in the number of brush border membrane glutamine transporters B0AT1.

. Butts M, **Singh Paulraj R**, Haynes J, Arthur S, Singh S, Sundaram U. Moderate Alcohol Consumption Inhibits Sodium-Dependent Glutamine Co-Transport in Rat Intestinal Epithelial Cells in Vitro and Ex Vivo. Nutrients. 2019;11(10):2516. doi: 10.3390/nu11102516. PubMed PMID: 31635319.

Complete List of Published Work in My Bibliography:

https://www.ncbi.nlm.nih.gov/myncbi/1LMBkN_mNB-kh/bibliography/public/

D. Additional Information: Research Support and/or Scholastic Performance

Scholastic Performance

YEAR	COURSE TITLE	GRADE
2009	Cell and Molecular Biology and Bioinformatics	B
2010	Biochemistry and Biophysics	B
2010	Genetics and Biostatistics	A
2010	Developmental Biology	A+
2010	General and Comparative Physiology	A
2012	Research Methodology	A