

Dr. Geeta Rai

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Department of Molecular and Human Genetics
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Area of specialization: Immunogenetics and Molecular Biology

Ongoing research work in the Lab

1. Understanding the immunopathogenesis and regulatory mechanisms in autoimmune disease Systemic Lupus Erythematosus (SLE).
 - Evaluating the role of Toll like Receptors (TLRs) signaling in the diverse manifestations of this disease.
 - Characterization of novel autoantibody markers in SLE using genomic and proteomic approaches.
 - Delineating the microRNA mediated regulation in the disease.
 - Transcriptomics for distinguishing the SLE subgroups.
2. Understanding the defective mechanisms of the innate immunity in full term low birth weight newborns.
 - Gene expression and proteomics studies of differences from normal birth weight newborns.
 - Netosis impairment and elucidating signaling pathway for netosis
 - Development for novel formulation to increase immune efficiency hematopoiesis.
3. Stem cell studies to develop better tools for regenerative medicine

➤ **Overall goal of my research program is to develop new tools for disease prediction and control.**

Postdoctoral fellowship: Visiting Fellow at National Institutes of Health, Bethesda, MD (USA)
[March 2003-August 2006]

Salient achievement:

‘Development of a model for SLE in genetically defined rabbits’: Genes associated with NK cytotoxicity, antigen presentation, leukocyte migration, cytokine activity, protein kinases, RNA spliceosomal ribonucleoproteins, intracellular signaling cascades, and glutamate receptor activities were significantly up-regulated. These results link increased immune activation with up-regulation of components associated with neurological and anti-RNP responses,

demonstrating the utility of the rabbit model to uncover biological pathways related to SLE-induced clinical symptoms.

Academic Qualifications:

S. No.	Degree	Institution	Year
1.	B.Sc.	Banaras Hindu University	1995
2.	M.Sc.	G.B. Pant University of Agriculture and Technology, Pantnagar	1997
3.	Ph. D.	Sanjay Gandhi Post Graduate Institute of Medical Sciences	2002

Research Projects (7)

S. No.	Title	Funding Agency	Duration	Fund (Rs. in Lakh)
1.	Identification of Neutrophil Function (Netosis) Based Novel Therapeutic Molecular Targets for Immuno-compromised Low Birth Weight Newborns using Genomic and Proteomic Approaches. (PI)	DBT, New Delhi	3 years (2014-2017)	77.58
2.	Induction of transplantation tolerance by lymphohematopoietic chimerism using hematopoietic cell transplantation (HCT). (Co-I)	DST, New Delhi	2014 Recommended for funding	880.00
3.	Development of novel prognostic molecular markers for Systemic Lupus Erythematosus using genomics and proteomics approaches. (PI)	DBT, New Delhi	3 years (2012-2015)	61.07
4.	Role of micro-RNAs in Toll like receptors regulation and autoantibody diversity in Systemic Lupus Erythematosus. (Fellowship grant) (PI)	ICMR, New Delhi	3 years (2012-2015)	8.66
5.	Identification of protein factors responsible for impaired NETOSIS in low birth weight newborns using genetic knockout approach. (PI)	UGC-UPE	2012	2.00
6.	Role of Toll-like receptors in immunopathogenesis of Systemic Lupus Erythematosus. (PI)	DBT, New Delhi	3 years (2010-2013)	39.10
7.	Role of immunological responses in the outcome of sepsis in low birth weight infants. (PI)	DBT, New Delhi	3 years (2008-2011)	17.29

Awards/Honours

1. **Dr. G.P. Talwar Young Scientist Award 2013**

Singh VV, Chauhan SK , Rai R, Soni UK, Ashok Kumar, **Rai G.** Impaired Genetic Mechanisms of Innate Immunity in Low Birth Weight Newborns. *40th Annual Conference of Indian Immunology Society*, University of Delhi, North Campus, New Delhi, November 15 -17, 2013; P-30.

2. **First prize in oral presentation (2013)**

Soni UK, Singh VV, Chauhan SK , Rai R, Ashok Kumar, **Rai G.** Leukotriene B4 receptor regulates Neutrophil Extracellular Trap formation by activation of Gas/Rap1/b-Raf/ERK1/2 signaling pathway. *40th Annual Conference of Indian Immunology Society*, University of Delhi, North Campus, New Delhi, November 15 -17, 2013; P-60.

3. **First prize in oral presentation (2012)**

Chauhan SK, Singh VV, Rai R, Rai M, **Rai G.** TLR7 and TLR9 upregulation associates with autoantibodies against specific nuclear targets in systemic lupus erythematosus. *39th Annual Conference of Indian Immunology Society*, Banaras Hindu University, Varanasi, November 9 -11, 2012; P-40.

4. **Second prize in oral presentation (2012)**

Soni UK, Singh VV, Chauhan SK, Rai R, Kumar A, **Rai G.** HL60 differentiation: Highest ROS activity with maximum survivability of neutrophil-like cells achieved after 120 hrs by All Trans Retinoic Acid (ATRA) induction. . *39th Annual Conference of Indian Immunology Society*, Banaras Hindu University, Varanasi, November 9 -11, 2012; P-59.

Patents (Two)

1. A Pattern Recognition Receptor (PRR) particularly a Toll-like receptor (TLR) which has a unique association with the presence of glomerulonephritis (GN) in Systemic Lupus Erythematosus (SLE)". (Ind. Patent Appln. No.128/DEL/2013).
2. A Novel formulation of Vitamins increases the immune efficiency in low birth weight newborn. (Ind. Patent Appln. No. 2476/DEL/2013).

Publications (32)

Year 2015:

1. Rai R, Chauhan SK, Singh VV, Rai M, **Rai G.** Heat shock protein 27 and its regulatory molecules express differentially in SLE patients with distinct autoantibody profiles. *Immunology Letters*, (2015). (in Press)
2. Thakur AK, **Rai G**, Chatterjee SS, Kumar V. Analgesic and Anti-inflammatory activity of *Andrographis paniculata* and Andrographolide in Diabetic Rodents. *PHARMACEUTICAL SCIENCE*, 2015, 1(1):19-28.

Year 2014:

3. Singh VV, Chauhan SK, Rai R, Kumar A, **Rai G**. Decreased Toll-Like Receptor-4/ Myeloid Differentiation Factor 88 Response Leads to Defective Interleukin-1 β Production in Low Birth Weight Newborns. *The Pediatric Infectious Disease Journal*, 2014, 33(12):1270-6.
4. Chauhan SK, Singh VV, Rai R, Madhukar Rai, **Rai G**. Differential microRNA profile and post-transcriptional regulation exist in systemic lupus erythematosus patients with distinct autoantibody specificities. *Journal of Clinical Immunology*, 2014, 34(4):491-503.
5. Sushma Singh, **Rai G** and Amita Aggarwal. Association of microRNA-146a and its target gene IRAK1 polymorphism with enthesitis related arthritis category of juvenile idiopathic arthritis. *Rheumatology International (Clinical and Experimental Investigations)*, 2014, 34(10):1395-400.
6. Vikas Kumar, **Rai G**, Shyam S. Chatterjee, Soni UK, Ajit K. Thakur. Protective effects of an *Andrographis paniculata* extract and pure andrographolide against chronic stress triggered pathologies in rats. *Cellular and Molecular Neurobiology*, 2014, 34(8):1111-21.
7. Singh GK, **Rai G**, Chatterjee SS, Kumar Vikas. Biochemical mechanisms involved in Neuro-psychopharmacological activity profile of a hydro alcoholic *Fumaria indica* extract. In: *“Traditional Medicine and Globalization – The Future of Ancient Systems of Medicine*, Maven Publishers; Kolkata, 2014, 632-644, 2014.
8. Jain MM, Kumari N, Rai G. A Novel Formulation of Herbs With Potent Anti-Ageing Activity. *European J of Bioinformatics*, 2014, 2:1-5.
9. Gulam Mohammed Husain, Rai R, **Rai G**, Harikesh Bahadur Singh, Ajit K. Thakur, Vikas Kumar. Potential mechanism of anti-diabetic activity of *Picrorhiza kurroa*. *Tang Humanitas Medicine*, 2014, 4 (4):e27.
10. Jain MM, Kumari N, **Rai G**. A novel formulation of veggies with potent liver detoxifying activity. *International Journal of Computational Biology and Drug Design*. 2014 (in Press).
11. Jain MM, Kumari N, **Rai G**. A novel formulation of veggies with potent anti-migraine activity. *International Journal of Computational Biology and Drug Design*. 2014 (in Press)

Year 2013:

12. SinghVV, Chauhan SK, Rai R, Kumar A, Singh SM, **Rai G**. Decreased Pattern Recognition Receptor Signaling, Interferon-Signature, and Bactericidal/Permeability-Increasing Protein Gene Expression in Cord Blood of Term Low Birth Weight Human Newborns. *PLoS ONE*, 2013, 23; 8(4):e62845.
13. Chauhan SK, SinghVV, Rai R, Rai M, **Rai G**. Distinct Autoantibody Profiles in Systemic Lupus Erythematosus Patients are Selectively Associated with TLR7 and TLR9 Upregulation. *Journal of Clinical Immunology*, 2013, 33(5):954-64.
14. Srivastava AK, Kumari N, Khan RA, Rai R, **Rai G**, Tabassum S, Mishra L. DNA cleavage activity and cytotoxicity of mononuclear and trinuclear Cu(II) complexes containing 1H-pyrazole-3,5-dicarboxylic acid as ligand. *Indian Journal of Chemistry*, 2013, 52(A):835-844.
15. Singh GK, Chauhan SK, **Rai G**, Chatterjee SS, Kumar V. Potential antianxiety activity of *Fumaria indica*: A preclinical study. *Pharmacognosy Magazine*. 2013, 9(33): 14–22.

16. Singh GK, **Rai G**, Chatterjee SS, Kumar V. Effects of ethanolic extract of *Fumaria indica* L. on rat cognitive dysfunctions. *AYU*. 2013, 34: (4), 421-429.

Year 2012:

17. Mage RG, **Rai G**. A Rabbit Model of Systemic Lupus Erythematosus, Useful for Studies of Neuropsychiatric SLE. Chapter in Book: ***Systemic Lupus Erythematosus***; InTech - Open Access Publisher, Pg 201-216, 2012. ISBN 978-953-307-868-7
18. Singh GK, **Rai G**, Chatterjee SS, Kumar V. Biochemical mechanisms involved in Neuro-psychopharmacological activity profile of a hydro alcoholic *Fumaria indica* extract. ***Proceedings of 12th International Congress of Ethnopharmacology***, Kolkata, India (February 17-19, 2012), Pg 1-12, 2012.
19. Thorp-Greenwood FL, Coogan MP, Mishra L, Kumari N, **Rai G** and Saripella S. The importance of cellular localisation of probes: synthesis, photophysical properties, DNA interactions and cellular imaging properties of rhenium dppz complexes with known cellular localisation vectors. ***New Journal of Chemistry***, 2012, 36, 64-72. (Cover page article)
20. Singh GK, **Rai G**, Chatterjee SS, Kumar V. Beneficial effects of *Fumaria indica* on chronic stress-induced neurobehavioral and biochemical perturbations in rats. ***Chinese Medicine***. 2012, 3: 49-60.
21. Singh GK, **Rai G**, Chatterjee SS, Kumar V. Anti-aggressive, brain neurotransmitters and receptor binding study of *Fumaria indica* in rodents. ***Current Psychopharmacology***. 2012, 1:195-202.

Year 2011 and before:

22. Singh GK, Chauhan SK, **Rai G**, Kumar V. *Fumaria indica* is Safe During Chronic Toxicity and Cytotoxicity: A preclinical study. ***Journal of Pharmacology and Pharmacotherapeutics***, 2011, 2:191-192.
23. **Rai G**, Ray S, Milton J, Yang J, Ren P, Lempicki R, Mage R. Gene Expression Profiles in a Rabbit Model of Systemic Lupus Erythematosus. ***Journal of Immunology***, 2010, 185: 4446-4456.
24. **Rai G**. Pregnancy, Lactation and Immunological Considerations. A chapter in book: ***Women and Mental Health***, 2009; Indira Sharma (Ed.), Official Publication of Indian Psychiatry Society, (2009) pp 80-88.
25. **Rai G**. Ray S, Shaw RE, DeGrange PF, Mage RG, Newman BA. Models of systemic lupus erythematosus (SLE): Development of autoimmunity following peptide immunizations of non-inbred pedigree rabbits. ***Journal of Immunology***, 2006, 176(1):660-7.
26. **Rai G**, Saxena S, Kumar H, Singh VK. Human Retinal S-antigen:T Cell Epitope Mapping in Posterior Uveitis Patients. ***Experimental and Molecular Pathology***, 2001, 70:140-145.
27. Singh VK, **Rai G**. Cytokines in Posterior Uveitis: An Update. ***Immunological Research***, 2001, 23: 59-74.
28. Singh VK, **Rai G**, Agarwal SS. Role of cytokines in experimental and clinical uveitis. ***Indian Journal of Ophthalmology***, 2001, 49: 81-90.

29. **Rai G**, Kumar A, Singh A, Garg GK. Modulation of antigenicity of mycelial antigens during developmental cycle of Karnal Bunt (*Tilletia indica*) of wheat. *Indian Journal of Experimental Biology*, 2000, 38: 488-492.
30. Singh VK, Biswas S, **Rai G**, Agarwal SS. Immunomodulation in human and experimental uveitis: Recent advances. *Indian Journal of Ophthalmology* 1999, 47: 65-77.
31. **Rai G**, Kumar A, Gaur A, Singh A and Garg GK. Stage dependent changes in protein and isozymes patterns during growth cycle of Karnal bunt (*Tilletia indica*) of wheat in culture. *Indian Journal of Agricultural Biochemistry*, 1999, 12: 59-63.
32. **Rai G**, Kumar A, Garg GK, Singh A, Lakhchaura BD. Development of microtitre ELISAs for detection and quantitation of mycelial antigens of Karnal Bunt (*Tilletia indica*). *Indian Journal of Agricultural Biochemistry*, 1998, 11: 53-55.

Research Thesis Guidance:

Degree	Submitted	In progress
Ph. D.	04	04
M. Sc.	19	04

Memberships of Professional Societies

1. Indian Immunology Society (IIS), New Delhi
2. Indian Society of Cell Biology (ISCB), BHU, Varanasi
3. The Biotech Research Society, India

Conferences/Symposia organized

1. Organizing Committee, International Symposium on Environmental Factors, Cellular Stress and Evolution. October 13-15, 2006, BHU, Varanasi
2. Member of Organizing Committee, International Conference on Emerging Trends in Biotechnology (ETBT), Dec. 4-6, 2009, BHU, Varanasi.
3. Member of Organizing Committee, International Conference on Functional Genomics: Prospects and Challenges. October 2-4, 2010, BHU, Varanasi.
4. Organizing Secretary of BHU-DST-ISLS workshop on „Bioinformatics and Proteomics, Feb 20-26, 2011, Varanasi.
5. Organizing Committee, XXXI All India Cell Biology Conference, Dec. 14-16, 2007, BHU, Varanasi.