

## *Curriculum Vitae*

### **Moanaro Biswas, Ph.D.**

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### **Education**

1998-2001 B.S., Biotechnology, North Eastern Hill University, Shillong, Meghalaya, India  
2001-2003 M.S., Biotechnology, Tezpur University, Tezpur, Assam, India  
2003-2009 Ph.D., Biotechnology, National Institute of Virology, Pune, India

### **Positions and Employment**

2009 - 2012 Postdoctoral Associate, Virginia Polytechnic & State University, Blacksburg, VA  
2013 - 2016 Postdoctoral Associate, University of Florida, Dept. of Pediatrics, Gainesville, FL  
2016 - 2018 Assistant Scientist, University of Florida, Dept. of Pediatrics, Gainesville, FL  
2018 - Present Assistant Research Professor, Indiana University, Indianapolis, IN

### **Awards / Fellowships**

2001 B.S. 3<sup>rd</sup> State Ranking  
2003 University Gold Medalist, Tezpur University  
2003 - 2008 Graduate student scholarship, Indian Council of Medical Research  
2016 Henry A. Kokomoor award for excellence in Pediatric Research, University of Florida

### **Professional Memberships**

2010 - 2012 Member, American Society of Virology  
2010 - 2012 Member, American Association of Immunologists  
2013 - Present Member, American Society of Hematology  
2014 - Present Member, American Society of Gene and Cell Therapy

### **Teaching**

GMS6253: Molecular Therapy III - Immunology of Gene Transfer, December 2016, University of Florida, 1 lecture

### **Committee**

Scientific Advisory Board member ICBR Flow Cytometry Core, University of Florida, 2017

### **Laboratory Mentoring**

#### **Undergraduate Students**

- Veronica Kuteyeva (2017-2018), Medical Honors Program (MHP), University of Florida

- Rania Saboungi (2017-2018), University of Florida

### **Internal**

CTSI 10<sup>th</sup> Annual Meet, Poster session judge, September 2018, Indianapolis, IN  
2018 IUSM Postdoc Symposium, Poster session judge, October 2018, Indianapolis, IN

### **Journal Reviewer**

Translational Research (Elsevier)  
Molecular Therapy Methods and Clinical Development (Cell Press)  
Clinical and Vaccine Immunology (ASM)  
MSphere (ASM)  
Biotechnology and Applied Biochemistry (Wiley)  
Protoplasma (Springer)

### **Grant Reviews**

ANR, French National Research Agency, Generic call for Proposals, May 2018.

### **Extramural Funding**

AWD00215 Biswas, Moanaro (PI) 07/01/16-07/01/19  
Bayer Hemophilia Awards Program  
T cell therapy against factor VIII inhibitors

072395-00002B Biswas, Moanaro (PI) 09/01/2018- 06/30/2021  
National Hemophilia Foundation-Novo Nordisk Early Investigator Award  
Engineered regulatory T cell therapy for tolerance to FVIII

### **Previous Grant Support**

Use of engineered immune cells to improve tolerance to clotting factor therapy in hemophilia:  
Children's Miracle Network (CMN) Pilot Award 2017.

### **Publications**

1. Kwon KC, Sherman A, Chang WJ, Kamesh A, **Biswas M**, Herzog RW, Daniell H. Expression and assembly of largest foreign protein in chloroplasts: oral delivery of human FVIII made in lettuce chloroplasts robustly suppresses inhibitor formation in haemophilia A mice. *Plant Biotechnol J*. 2018 Jun;16(6):1148-1160
2. Rogers GL, Shirley JL, Zolotukhin I, Kumar SRP, Sherman A, Perrin GQ, Hoffman BE, Srivastava A, Basner-Tschakarjan E, Wallet MA, Terhorst C, **Biswas M**, Herzog RW. Plasmacytoid and conventional dendritic cells cooperate in crosspriming AAV capsid-specific CD8<sup>+</sup> T cells. *Blood*. 2017 15;129(24):3184-3195. PubMed PMID: [28468798](https://pubmed.ncbi.nlm.nih.gov/28468798/); PubMed Central PMCID: [PMC5472899](https://pubmed.ncbi.nlm.nih.gov/PMC5472899/). **(co-senior author)**.
3. Wang X, Herzog RW, Byrne BJ, Kumar SRP, Zhou Q, Buchholz CJ, **Biswas M**. Immune Modulatory Cell Therapy for Hemophilia B Based on CD20-Targeted Lentiviral Gene Transfer

- to Primary B Cells. *Mol Ther Methods Clin Dev.* 2017 Jun 16;5:76-82. PubMed PMID: [28480307](#); PubMed Central PMCID: [PMC5415320](#). (**senior author**).
4. **Biswas M**, Rogers GL, Sherman A, Byrne BJ, Markusic DM, Jiang H, Herzog RW. Combination therapy for inhibitor reversal in haemophilia A using monoclonal anti-CD20 and rapamycin. *Thromb Haemost.* 2017 Jan 5;117(1):33-43. PubMed PMID: [27683758](#); PubMed Central PMCID: [PMC5222884](#).
  5. Jain N, Oswal N, Chawla AS, Agrawal T, **Biswas M**, Vrati S, Rath S, George A, Bal V, Medigeshi GR. CD8 T cells protect adult naive mice from JEV-induced morbidity via lytic function. *PLoS Negl Trop Dis.* 2017 Feb;11(2):e0005329. PubMed PMID: [28151989](#); PubMed Central PMCID: [PMC5308832](#).
  6. Herzog RW, Cooper M, Perrin GQ, **Biswas M**, Martino AT, Morel L, Terhorst C, Hoffman BE. Regulatory T cells and TLR9 activation shape antibody formation to a secreted transgene product in AAV muscle gene transfer. *Cell Immunol.* 2017 Aug 1. pii: S0008-8749(17)30120-X. doi: 10.1016/j.cellimm.2017.07.012. [Epub ahead of print] PubMed PMID: 28888664; PubMed Central PMCID: PMC5794662.
  7. Perrin GQ, Zolotukhin I, Sherman A, **Biswas M**, de Jong YP, Terhorst C, Davidoff AM, Herzog RW. Dynamics of antigen presentation to transgene product-specific CD4+ T cells and of Treg induction upon hepatic AAV gene transfer. *Mol Ther Methods Clin Dev.* 2016; 3:16083. PubMed PMID: [27933310](#); PubMed Central PMCID: [PMC5142511](#).
  8. **Biswas M**, Sarkar D, Kumar SR, Nayak S, Rogers GL, Markusic DM, Liao G, Terhorst C, Herzog RW. Synergy between rapamycin and FLT3 ligand enhances plasmacytoid dendritic cell-dependent induction of CD4+CD25+FoxP3+ Treg. *Blood.* 2015 May 7;125(19):2937-47. PubMed PMID: [25833958](#); PubMed Central PMCID: [PMC4424416](#).
  9. Sarkar D, **Biswas M**, Liao G, Seay HR, Perrin GQ, Markusic DM, Hoffman BE, Brusko TM, Terhorst C, Herzog RW. Ex Vivo Expanded Autologous Polyclonal Regulatory T Cells Suppress Inhibitor Formation in Hemophilia. *Mol Ther Methods Clin Dev.* 2014 Jul 30;1PubMed PMID: [25364772](#); PubMed Central PMCID: [PMC4213815](#).
  10. Kumar SR, **Biswas M**, Elankumaran S. Pandemic H1N1 influenza A virus induces a potent innate immune response in human chorionic cells. *Viral Immunol.* 2014 Apr;27(3):129-37. PubMed PMID: [24702460](#).
  11. Dhanasekaran S, **Biswas M**, Vignesh AR, Ramya R, Raj GD, Tirumurugaan KG, Raja A, Kataria RS, Parida S, Elankumaran S. Toll-like receptor responses to Peste des petits ruminants virus in goats and water buffalo. *PLoS One.* 2014 Nov 4;9(11):e111609. doi: 10.1371/journal.pone.0111609. eCollection 2014.
  12. **Biswas M**, Johnson JB, Kumar SR, Parks GD, Elankumarana S. Incorporation of host complement regulatory proteins into Newcastle disease virus enhances complement evasion. *J Virol.* 2012 Dec;86(23):12708-16. PubMed PMID: [22973037](#); PubMed Central PMCID: [PMC3497656](#).
  13. **Biswas M**, Kumar SR, Allen A, Yong W, Nimmanapalli R, Samal SK, Elankumaran S. Cell-type-specific innate immune response to oncolytic Newcastle disease virus. *Viral Immunol.* 2012 Aug;25(4):268-76. PubMed PMID: [22808996](#); PubMed Central PMCID: [PMC3413068](#).
  14. Kumar SR, DeFlube L, **Biswas M**, Shobana R, Elankumaran S. Genetic characterization of swine influenza viruses (H3N2) isolated from Minnesota in 2006-2007. *Virus Genes.* 2011 Oct;43(2):161-76. doi: 10.1007/s11262-011-0618-4. Epub 2011 May 21. PubMed PMID: 21603982.

15. Gopinath VP, **Biswas M**, Raj GD, Raja A, Kumanan AK, Elankumaran S. Molecular cloning and tissue-specific expression of Toll-like receptor 5 gene from turkeys. Avian Dis. 2011 Sep;55(3):480-5. PubMed PMID: 22017051.
16. Elankumaran S, Chavan V, Qiao D, Shobana R, Moorkanat G, **Biswas M**, Samal SK. Type I interferon-sensitive recombinant newcastle disease virus for oncolytic virotherapy. J Virol. 2010 Apr;84(8):3835-44. PubMed PMID: [20147405](#); PubMed Central PMCID: [PMC2849496](#).
17. **Biswas SM**, Kar S, Singh R, Chakraborty D, Vipat V, Raut CG, Mishra AC, Gore MM, Ghosh D. Immunomodulatory cytokines determine the outcome of Japanese encephalitis virus infection in mice. J Med Virol. 2010 Feb;82(2):304-10. PubMed PMID: [20029807](#).
18. **Biswas SM**, Ayachit VM, Sapkal GN, Mahamuni SA, Gore MM. Japanese encephalitis virus produces a CD4<sup>+</sup> Th2 response and associated immunoprotection in an adoptive-transfer murine model. J Gen Virol. 2009 Apr;90(Pt 4):818-26. PubMed PMID: [19264621](#).
19. Dewasthaly SS, Bhonde GS, Shankarraman V, **Biswas SM**, Ayachit VM, Gore MM. Chimeric T helper-B cell peptides induce protective response against Japanese encephalitis virus in mice. Protein Pept Lett. 2007;14(6):543-51. PubMed PMID: [17627594](#).

## Reviews

1. Sherman A, **Biswas M**, Herzog RW. Tolerance induction in hemophilia: innovation and accomplishments. Curr Opin Hematol. 2018;25(5):365-372.
2. **Biswas M**, Kumar SRP, Terhorst C, Herzog RW. Gene Therapy With Regulatory T Cells: A Beneficial Alliance. Front Immunol. 2018 Mar 19;9:554. doi: 10.3389/fimmu.2018.00554. eCollection 2018. Review. PubMed PMID: 29616042; PubMed Central PMCID: PMC5868074. **(Invited Review, senior author)**.
3. Sherman A, **Biswas M**, Herzog RW. Innovative Approaches for Immune Tolerance to Factor VIII in the Treatment of Hemophilia A. Front Immunol. 2017 Nov 24;8:1604. doi: 10.3389/fimmu.2017.01604. eCollection 2017. Review. PubMed PMID: 29225598; PubMed Central PMCID: PMC5705551.
4. Kumar SR, Markusic DM, **Biswas M**, High KA, Herzog RW. Clinical development of gene therapy: results and lessons from recent successes. Mol Ther Methods Clin Dev. 2016;3:16034. PubMed PMID: [27257611](#); PubMed Central PMCID: [PMC4879992](#).
5. **Biswas M**, Terhorst C, Herzog RW. Treg: tolerance vs immunity. Oncotarget. 2015 Aug 21;6(24):19956-7. PubMed PMID: 26119156; PubMed Central PMCID: PMC4652974.

## Oral Abstracts

1. Reprogrammed CD4<sup>+</sup> T Cells That Express FoxP3<sup>+</sup> Effectively Control Inhibitory Antibody Development in Hemophilic Mice. **Moanaro Biswas**, Veronica Kuteyeva, Roland Herzog. **Blood** 2017 130:175
2. Generation of FVIII-Specific Tregs Expressing a Chimeric Antigen Receptor (CAR) to Suppress Inhibitor Development in Hemophilia a Mice. **Moanaro Biswas**, Todd Brusko, Roland Herzog. **Blood** 2017 130:176

3. Wang X, Herzog RW, Byrne BJ, Kumar SRP, Zhou Q, Buchholz CJ, **Biswas M.** CD20 Receptor Targeted Lentiviral Gene Transfer of IgG-Fusion Protein into B Cells to Induce Tolerance in Hemophilia B Mice. **ASGCT Annual Meeting 2017.**
4. Biswas M. Forced expression of FoxP3 in CD4<sup>+</sup> T cells from FVIII immunized mice to control inhibitor development in hemophilia A mice. **ASGCT Annual Meeting 2017.**
5. Combination therapy with CD20 antibody and rapamycin for inhibitor reversal in hemophilia A: preclinical evaluation. **World Federation of Hemophilia 2016 World Congress**, Orlando, FL, 2016
6. Optimal In Vivo Treg Induction and Suppression of Immune Responses by Synergistic Use of Rapamycin and FLT3 Ligand. **Molecular Therapy** 2015 25:S118
7. Characterization of Ex Vivo Expanded Tregs for Suppression of Immune Responses in Hemophilia Treatment. **Molecular Therapy** 2014 22:S304-S305
8. Improving complement evasion strategies of Newcastle disease virus vectors. **M Biswas**, J Johnson, S Kumar, G Parks and S Elankumaran. **American Society of Virology**, Madison, WI, 2012.
9. Oncolytic Newcastle disease infects and kills cancer-initiating cells from glioma cell lines. **M Biswas**, S. Rangunath and S. Elankumaran. **American Society of Virology**, Bozeman, MA 2010.
10. Differential cellular antiviral responses to recombinant oncolytic Newcastle disease virus strains. **M Biswas**, S Kumar, R Nimmanapalli and S Elankumaran. **Eleventh Southeastern Regional Virology Conference**, Atlanta, GA, 2010.