OMB No. 0925-0001 and 0925-0002 (Rev. 10/15 Approved Through 10/31/2018)

# BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.

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NAME: Marcela I Henao-Tamayo

eRA COMMONS USER NAME (credential, e.g., agency login): mhenao7

POSITION TITLE: Assistant Professor, Department of Microbiology, Immunology & Pathology

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)* | Completion Date MM/YYYY | FIELD OF STUDY |
| School of Medicine, Univ of Antioquia, Colombia | M.D. | 1999 | Medicine |
| University of Antioquia, Colombia | M.Sc. | 2004 | Medical Sciences and Immunology |
| Colorado State University | Ph.D. | 2009 | Microbiology and Immunology |
| Colorado State University | Post-Doc | 2009-2011 | Immunology |

# Personal Statement

As a woman from Latin America, I firmly believe that Excellence in education and researchrequire diversity so as to foster the capacity to see the human experience from the perspective of others who interpret the world in considerably different ways. Through an open exchange of different beliefs, experiences, and values, individuals acquire the necessary critical skills that will serve them throughout their lives. Having a diverse faculty creates a comprehensive and deeper educational experience and contributes to the creation of an academic environment where students and faculty have the resources to participate in an increasingly complex and diverse world.

Members of my laboratory include, undergraduate and graduate students, postdoctoral fellows and research scientists. I believe that the diversity in gender, color and nationality in my laboratory is a result of me being a Latin American woman, students feel welcome as I am the first one to be an underrepresented minority in our field. Thanks to my initial training as a medical doctor in South America, students and technical staff in the lab often includes ambitious college graduates who continue on to graduate school, veterinary and medical school. In order to adequately train all personnel to work inside the Biohazard level 3 facility, I implement different instructing techniques, focused to facilitate researchers to work in an effective and safe manner. I believe that the opportunity and responsibility acquired by working safely in this environment also enhances the scientific process by encouraging discussions and promoting a deeper appreciation of important scientific concepts and challenges.

In order to work efficiently and risk free in the Bio Hazard level-3, protocols and techniques need to be adequately written and prepared. There is little room for mistakes, and all data collected is annotated in laboratory books and scanned out in order to keep appropriate records. All results are analyzed using commercial software and every experiment is repeated at least twice with multiple replicas in order to efficiently lead to a valid conclusion. The results prepared by the lab members are always reported to me and I verify that they are accurate. Animal gender, age and pathological conditions are kept strictly monitored. Additionally, we work with a biostatistician in order to ensure we are using adequate controls and numbers of animals and in each experiment.

I firmly believe I have the knowledge, enthusiasm, training and leadership necessary to successfully carry out the proposed project.

1. Henao-Tamayo M, Obregón-Henao A, Creissen E, Orme I, Shanley C, and Ordway D. Differential expression of BCG vaccine derived efficacy in C3Heb/FeJ and C3H/HeOuJ mice exposed to a clinical strain of Mycobacterium tuberculosis, Clin Vaccine Immunol. 2015 Jan;22(1):91-8. PMID: 25392011
2. Henao-Tamayo M, Ordway DJ, Orme IM. Memory T cell subsets in tuberculosis: What should we be targeting? Tuberculosis (Edinb). 2014 Jun 17. PMID: 24993316
3. Henao-Tamayo, M, Ordway, D. J., Irwin, S. M. Shang, S., Shanley, C., Orme, I. M. Phenotypic definition of effector and memory T-lymphocyte subsets in mice chronically infected with Mycobacterium tuberculosis. Clin Vaccine Immunol 2010; 17, 618-625. PMCID 2849327
4. Henao-Tamayo M, Palaniswamy GS, Smith EE, Shanley CA, Wang B, Orme IM, Basaraba RJ, DuTeau NM, Ordway D. Post-exposure vaccination against Mycobacterium tuberculosis. Tuberculosis (Edinb). 2009; 89:142-8. PMID:19264552
5. Henao-Tamayo M, Junqueira-Kipnis AP, Ordway D, Gonzales-Juarrero M, Stewart GR, Young DB, Wilkinson RJ, Basaraba RJ, Orme IM. A mutant of Mycobacterium tuberculosis lacking the 19-kDa lipoprotein Rv3763 is highly attenuated in vivo but retains potent vaccinogenic properties. Vaccine. 2007;25:7153-9. PMID:17804126

# Positions and Honors Positions

2015 - Co-Director of CSU Flow Cytometry and Cell Sorting Facility, Colorado State University, Fort Collins, CO

2014 - Assistant Professor**,** Department of Microbiology, Immunology & Pathology, Colorado State University, Fort Collins, CO

2011 – 2014 Research Scientist, Department of Microbiology, Immunology & Pathology, Colorado State University, Fort Collins, CO

2009 – 2011 Post Doctoral Fellow, Department of Microbiology, Immunology & Pathology, Colorado State University, Fort Collins, CO

2004 – 2009 PhD Student, Department of Microbiology, Immunology & Pathology, Colorado State University, Fort Collins, CO

2003 – 2004 Visiting Scientist, Orme Laboratory, Department of Microbiology, Immunology & Pathology, Colorado State University, Fort Collins, CO

2001 – 2003 Research Fellow/MD, Group of Cellular Immunology and Immunogenetics, School of Medicine, University of Antioquia, Medellin, Colombia

2000 Research Scientist/MD, Group of Cellular Immunology and Immunogenetics, School of Medicine, University of Antioquia, Medellin, Colombia

1999 Young Investigator, Group of Cellular Immunology and Immunogenetics, School of Medicine, University of Antioquia, Medellin, Colombia

# Honors

* Honorary Member School of Medicine 2015, Universidad de Antioquia, Columbia
* AAUW American Association of University Women International Fellow 2010
* Special Mention for Young Investigators 2000. University of Antioquia. Medellin – Colombia

# Other Experience and Professional Memberships

2006- The American Association of Immunology 2008- American Society of Microbiology

2010- TBnet

2011- STOP TB Drugs Group, World Health Organization

2010- AAUW (American Association of University Women)

2004 DAKOCytomation MOFLO certified in 2004 to present operator course for cell sorting

2006 BD LSRII operator course certified in 2006 to present multi-parameter "12-color" LSR II Flow Cytometer operation and analysis.

2012 BD FACSAria III cell sorting operator course certified in 2012 to present multi-parameter cell sorting operation and analysis.

# Contribution to Science

*Mycobacterium tuberculosis* (*Mtb*) infects one third of the world’s population and is a leading cause of morbidity and mortality. Furthermore, TB is frequently associated with HIV infection in a significant number of cases and is a primary pathodiagnostic of progression to AIDS. Ominously, the global health consequences of TB are likely to increase in coming years with the emergence of drug-resistant TB strains and the lack of effective vaccines. Presently, the global tuberculosis (TB) epidemic affects over 8 million cases per year, and MDR-TB rates are estimated to be in excess of 650,000/year.

* 1. My studies in the area of tuberculosis have shown, amongst other things, that BCG vaccination induces effector memory T cells but very few central memory T cells (which are the ones that supposedly confer long lasting protection after vaccination), possibly explaining the variability and limited longevity of this vaccine. Furthermore, in order to evaluate the acquired immune response during the clinically relevant re- infection process occurring in developing countries, I pioneered the re-challenge model of tuberculosis infection. My results indicated that memory immunity is far from stable, and prone to attrition, perhaps by transitioning to short lived cells. Disappearance of CD4+ central and effector memory cells in the lungs of re-infected animals, correlated with the high expression of the exhaustion marker PD-1, which could explain why treated TB patients in Africa are more likely to get re-infected after treatment.
     1. Henao-Tamayo MI, Ordway DJ, Irwin SM, Shang S, Shanley C, Orme IM. Phenotypic definition of effector and memory T-lymphocyte subsets in mice chronically infected with Mycobacterium tuberculosis. Clin Vaccine Immunol. 2010 4:618-25. PMID:20107011
     2. Henao-Tamayo M, Irwin SM, Shang S, Ordway D, Orme IM. T lymphocyte surface expression of exhaustion markers as biomarkers of the efficacy of chemotherapy for tuberculosis. Tuberculosis (Edinb). 2011: July;91(4):308-13. PMID21530406
     3. Henao-Tamayo M, Obregón-Henao A, Ordway DJ, Shang S, Duncan CG, Orme IM. A mouse model of tuberculosis reinfection. Tuberculosis (Edinb). 2012;92:211-7. PMID: 21530406
  2. For many years the tuberculosis animal research field mainly used laboratory adapted strains, while the differences in immune response to infection with clinical strains were completely unknown. With a team of investigators I started comparing the basic biology of laboratory vs. newly emerging clinical strains of *M. tuberculosis*. These studies demonstrated that in contrast to the laboratory strain, clinical isolates initiate an early robust pro-inflammatory type 1 immune response, which is then replaced by the emergence of Foxp3+ regulatory T cells. This studies were corroborated both in the mouse, as well as, in the guinea pig model. Furthermore, based on my interest in vaccines, I evaluated the impact that highly virulent clinical strains of

1. *tuberculosis* have on the immune response generated after BCG vaccination. My studies showed that contrasting to laboratory adapted bacterial strains in which BCG induced protection is maintained during chronic stages of the disease, infection with highly virulent clinical strains wanes after an early protection (30 days). This loss in protection correlated with the arrival of increasing numbers of regulatory T cells in the lungs of infected mice
   1. Ordway DJ, Shang S, Henao-Tamayo M, Obregon-Henao A, Nold L, Caraway M, Shanley CA, Basaraba RJ, Duncan CG, Orme IM. Mycobacterium bovis BCG-Mediated Protection against W-Beijing Strains of Mycobacterium tuberculosis Is Diminished Concomitant with the Emergence of Regulatory T Cells. Clin Vaccine Immunol. 2011;18:1527-35. PMID: 21795460; PMCID:
   2. Shang S, Harton M, Tamayo MH, Shanley C, Palanisamy GS, Caraway M, Chan ED, Basaraba RJ, Orme IM, Ordway DJ. Increased Foxp3 expression in guinea pigs infected with W-Beijing strains of M. tuberculosis. Tuberculosis 2011 Sep;91(5):378-85 PMID: 21737349
   3. Ordway D, Henao-Tamayo M, Harton M, Palanisamy G, Troudt J, Shanley C, Basaraba RJ, Orme IM. [The hypervirulent Mycobacterium tuberculosis strain HN878 induces a potent TH1 response](http://www.ncbi.nlm.nih.gov/pubmed/17579073) [followed by rapid down-regulation.](http://www.ncbi.nlm.nih.gov/pubmed/17579073) J Immunol. 2007 Jul 1;179(1):522-31. PMID: 17579073.
   4. Recently, while studying a new strain of mice in order to develop a new vaccine screening model, I found a predominant cell type in the lungs of three different murine models that develop lung necrosis after *M. tuberculosis* infection. In contrast, these cells were barely present in control strains that did not undergo necrosis. MDSCs (Myeloid Derived Suppressor cells) have previously been described in cancer models and in models of chronic inflammation where, importantly, they have been shown to have a potent immunosuppressive effect that can adversely affect disease outcome.
      1. Henao-Tamayo M, Obregón-Henao A, Creissen E, Orme I, Shanley C, and Ordway D. Differential expression of BCG vaccine derived efficacy in C3Heb/FeJ and C3H/HeOuJ mice exposed to a clinical strain of Mycobacterium tuberculosis, Clin Vaccine Immunol. 2015 Jan;22(1):91-8. PubMed PMID: 25392011; PMCID: PMC4278923.
      2. Obregón-Henao A, Henao-Tamayo M, Orme I and Ordway DJ. Gr1intCD11b+ Myeloid-Derived Suppressor Cells in Mycobacterium tuberculosis Infection. Plos One. 2013 Nov 1;8(11). PMID: 24224058; PMCID: PMC3815237.

**Complete list of publications:** [http://www.ncbi.nlm.nih.gov/sites/myncbi/marcela.henao-](http://www.ncbi.nlm.nih.gov/sites/myncbi/marcela.henao-tamayo.2/bibliography/40832324/public/?sort=date&amp;direction=ascending) [tamayo.2/bibliography/40832324/public/?sort=date&direction=ascending](http://www.ncbi.nlm.nih.gov/sites/myncbi/marcela.henao-tamayo.2/bibliography/40832324/public/?sort=date&amp;direction=ascending).

# Research Support Ongoing Research

**1 R01 AI127475 - 01AI** (Henao-Tamayo,PI) 07/01/2017 – 06/30/2021 4.0 calendar

NIH/NIAID $1,520,000

“Vaccine induced memory immunity in tuberculosis”

*The purpose of this R01 application is to investigate whether memory immunity induced in mice after vaccination with different types of candidates [rBCG, protein fusion in adjuvant, live attenuated mutant] induce similar or different subsets of CD4 memory T cells.*

**CSU - Internal Facility** (Henao-Tamayo,PI) 07/01/2016 - 06/30/2019 1.77 calendar

Colorado State University $250,000

"Flow Cytometry Core Facility"

The purpose of this core is to manage multiple flow cytometers across the campus, provide support and continued training for current and potential users.

**1 R01AI105053-01** (Rodell, PI) 08/22/2013 – 07/31/2018 2.40 calendar

NIH/NIAID $1,487,000 (sub only)

“Recombinant yeast vaccines for sensitive and drug-resistant M. tuberculosis”

*The purpose of this subcontract to GlobeImmune is to test the efficacy of TB vaccines made using their unique yeast based expression platform. We will immunize animals with these vaccines and test their capacity to protect against subsequent infection with TB using our standard animal challenge models at CSU.*

**1R21 AI121099-01A1**  (Orme, PI)03/15/2016 - 02/28/2018 6.23 calendar

NIH/NIAID $416,750

"Novel vaccine boosting candidates for tuberculosis"

*In this project, we propose to use two very potent “live attenuated mutants” as BCG boosting vaccines in the relevant guinea pig model of tuberculosis, to determine if this approach can improve the degree of protection compared to BCG alone, while potentially overcoming the negative effects of regulatory T cell induction.*