BIOGRAPHICAL SKETCH

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NAME: Rosenblum, Michael David

eRA COMMONS USER NAME (credential, e.g., agency login): MICHR1

POSITION TITLE: Associate Professor

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
University of Western Ontario, Canada	HBSc	05/1997	Cell Biology
Medical College of Wisconsin, Milwaukee	PhD	06/2003	Immunology
Medical College of Wisconsin, Milwaukee	MD	06/2006	Medicine
University of California, San Francisco	Residency	07/2010	Dermatology

A. Personal Statement

Scientifically, I am a formally trained basic immunologist. Clinically, I'm a board-certified dermatologist. I completed my residency in Dermatology at UCSF followed by a post-doctoral research fellowship in the laboratory of Dr. Abul Abbas at UCSF. I am currently an Associate Professor in the UCSF Department of Dermatology. I dedicate 85% of my time to basic research and the remaining time taking care of patients with inflammatory and autoimmune skin diseases. The central focus of my laboratory is to understand the fundamental mechanisms of how immune responses are regulated in tissues, and how this knowledge can be exploited for therapeutic benefit. Because of its complex immunological properties, its accessibility, and potential for clinical translation, the skin is the model peripheral tissue that we currently study. Approximately 60% of our research employs a reductionist approach, utilizing transgenic mouse models to ask fundamental questions of how the immune system functions in tissues. The remainder of our research focuses on doing functional immunology with human tissue and humanized mice.

B. Positions and Honors

Positions and Employment

1998-2006 Medical Scientist Training Program (MSTP), Medical College of Wisconsin
2006-2007 Medical Internship, Aurora St. Luke's Transitional Year Program, Milwaukee, WI
2007-2010 Dermatology Resident, UCSF Department of Dermatology, San Francisco, CA
2009-2012 Postdoctoral Research Fellowship, Laboratory of Abul K. Abbas, UCSF
2012- 2017 Assistant Professor of Dermatology, UCSF Department of Dermatology, San Francisco, CA
2017- Associate Professor of Dermatology, UCSF Department of Dermatology, San Francisco, CA

Other Experience and Professional Memberships

2005- Member, Society for Investigative Dermatology
2007- Medical licensure, California
2010- Board Certification, American Board of Dermatology
2012- Member, Federation of Clinical Immunology Societies (FOCIS)
2012- Member, UCSF Biomedical Sciences (BMS) Graduate Program
2012- Member, UCSF Immunology Graduate Program

Honors

2004	Outstanding Doctoral Dissertation Award, Medical College of Wisconsin
2006	Armand J. Quick Award for Outstanding Senior Medical Student in Biochemistry, Medical College of Wisconsin
2014	NIH Director's New Innovator Award
2015	Charles & Daneen Stiefel Scholar Award in Autoimmune & Connective Tissue Diseases
2019	William Montagna Lecturer, Society for Investigative Dermatology, Annual Meeting

C. Contribution to Science

1. Elucidating the Function of Regulatory T cells in Skin

To date, my most significant contribution to science is providing a better understanding of how immune responses are regulated in tissues. A large body of research has focused on how the immune system is activated but relatively less is known about how immune responses are controlled. These processes are essential in preventing autoimmunity, mitigating tissue damage during infection and promoting tumor growth. To this end, we have focused on understanding how regulatory T cells (Tregs) function in tissues, with a special emphasis on mechanistically dissecting the role of these cells in skin. Using a reductionist approach in mouse model systems, we have discovered that Tregs can differentiate into memory cells that utilize unique pathways for their establishment and long-term maintenance in tissues. These cells play a major role in wound healing and establishing tolerance to commensal microbes. Most recently, we have discovered that Tregs in skin play a major role in augmenting the function of epithelial stem cells:

a) **Rosenblum MD**, Gratz IK, Paw JS, Lee K, Marshak-Rothstein A, Abbas AK. Response to self antigen imprints regulatory memory in tissues. *Nature*. 2011 Dec 22;480(7378):538–42.

b) Ali N, Zirak B, Sanchez Rodriguez R, Pauli ML, Truong H-A, Lai K, Ahn R, Corbin K, Lowe MM, Scharschmidt TC, Taravati K, Tan MR, Ricardo-Gonzalez RR, Nosbaum A, Bertolini M, Liao W, Nestle FO, Paus R, Cotsarelis G, Abbas AK, **Rosenblum MD**. Regulatory T cells in Skin Facilitate Epithelial Stem Cell Differentiation. *Cell*. 2017 June 1;169(6):1119-29.

c) Kelly A. Remedios, Bahar Zirak, Priscila Munoz Sandoval, Margaret M. Lowe, Devi Boda, Evan Henley, Shrishti Bhattrai, Tiffany C. Scharschmidt, Wilson Liao, Haley B. Naik, **Rosenblum MD**. The TNFRSF Members, CD27 and OX40, Coordinately Limit Th17 Differentiation in Regulatory T cells. *Science Immunology*. 2018. Dec 21;3(30):1-13.

d) Anubhav N. Mathur, Bahar Zirak, Ian C. Boothby, Madge Tan, Jarish N. Cohen, Thea M. Mauro, Pooja Mehta, Margaret Lowe, Abul K. Abbas, Niwa Ali, **Rosenblum MD**. Regulatory T cells Control a CXCL5/IL-17 Axis of Inflammation to Promote an 'Alternative' Fate for Hair Follicle Stem Cells During Barrier Repair. *Immunity*. 2019. [IN PRESSS]

2. Translation to Humans

A major focus of my research program is to translate our findings in animal models to humans. In addition, we utilize discovery approaches with human tissue to identify critical immunoregulatory pathways that we then functionally dissect in our mouse model systems. In this capacity, we have made significant contributions to understanding the fundamental biology of Tregs in human tissues, both in health and disease. We have found that similar to mice, human skin contains a unique population of tissue-resident memory Tregs. These cells are associated with hair follicles and have a predilection to reside around these structures. In addition, we discovered that alteration of Treg function plays a minor role in achieving a response to immune checkpoint inhibition therapy in human melanoma.

a) Sanchez Rodriguez R, Pauli ML, Neuhaus IM, Yu SS, Arron ST, Harris HW, **Rosenblum MD**. Memory regulatory T cells reside in human skin. *J Clin Invest*. 2014 Mar;124(3):1027–36.

b) Daud AI, Loo K, Pauli ML, Sanchez-Rodriguez R, Sandoval PM, Taravati K, Tsai K, Nosrati A, Nardo L, Krummel MF, **Rosenblum MD**. Tumor immune profiling predicts response to anti-PD-1 therapy in human melanoma. *J Clin Invest*. 2016 Sep 1;126(9):3447–52.

c) Cordoro KM, Hitraya-Low M, Taravati K, Sandoval PM, Kim E, Sugarman J, Pauli ML, Liao W, **Rosenblum MD**. Skin-infiltrating, interleukin-22-producing T cells differentiate pediatric psoriasis from adult psoriasis. *J Am Acad Dermatol.* 2017 Sep;77(3):417–24.

d) Dall'Era M, Pauli ML, Remedios K, Taravati K, Sandoval PM, Putnam AL, Lares A, Haemel A, Tang Q, Hellerstein M, Fitch M, McNamara J, Welch B, Bluestone JA, Wofsy D, **Rosenblum MD**. Adoptive Regulatory T Cell Therapy in a Patient with Systemic Lupus Erythematosus. *Arthritis & Rheumatology*. 2018 [IN PRESS]

3. Collaborative Studies and Review Articles

My laboratory is also involved in a number of important collaborative studies involving aspects of adaptive immunity and immune regulation. Recent publications are shown below. In addition, as a mid-career investigator in the field, I have contributed to several review articles. Examples include:

a) Barry KC, Hsu J, Broz ML, Cueto FJ, Binnewies M, **Rosenblum MD**, Combes AJ, et al. A natural killer-dendritic cell axis defines checkpoint therapy-responsive tumor microenvironments. *Nature Medicine*. 2018 Aug;24(8):1178–91.

b) Ali N, **Rosenblum MD**. Regulatory T cells in skin. *Immunology*. 2017;152(3):372–81.

c) **Rosenblum MD**, Way SS, Abbas AK. Regulatory T cell memory. *Nature Reviews Immunology*. 2016 Feb;16(2):90–101.

d) **Rosenblum MD**, Remedios KA, Abbas AK. Mechanisms of human autoimmunity. *J Clin Invest*. 2015 Jun;125(6):2228–33.

Complete List of Published Work in MyBibliography:
https://www.ncbi.nlm.nih.gov/pubmed/?term=rosenblum+md

D. Research Support

Ongoing Research Support

DP2 AR068130 (Rosenblum) 09/30/14 - 06/30/19
NIH NIAMS Director's New Innovator Award
Functional Manipulation of Memory Regulatory T cells in Skin
Role: PI

R01AR071944 (Rosenblum) 07/01/18-04/30/23
NIH/NIAMS
Elucidating the Cellular and Molecular Mechanisms of How Regulatory T cells in Skin Regulate Fibroblast Activation and Tissue Fibrosis
Role: PI

R21AR72195 (Rosenblum) 07/01/17 – 06/30/19
NIH NIAMS
Elucidating the Functional Role of Layilin Expression on Regulatory T cells in Health and Disease.
Role: PI

UM1AI110498 (David Wofsy, PI) 05/01/14 - 04/30/19
NIH/NIAID
Autoimmunity Center of Excellence (ACE)
The UCSF ACE grant focuses on the use of autologous regulatory T cells to treat autoimmune diseases.
Role: Protocol Co-Chair and Director of Mechanistic Studies

Completed Research Support

Dermatology Foundation (Rosenblum) 07/01/15 - 06/30/18
2015 Stiefel Scholar Award in Autoimmune &/or Connective Tissue Diseases
The Role of Regulatory T cells in Hair Follicle Homeostasis and Alopecia Areata
The major goals of this project are to dissect the cellular and molecular mechanisms of how Tregs influence hair follicle biology.
Role: PI

BWF 1010934 (Rosenblum) 09/01/12 - 08/31/17
Burroughs Wellcome Fund Career Award for Medical Scientists (CAMS)
Memory Regulatory T cells in Inflammatory and Autoimmune Disease
The major goals of this project are to define the cellular and molecular mechanisms responsible for establishing and maintaining memory regulatory T cells in the skin.
Role: PI

K08 AR062064 (Rosenblum) 07/01/12 - 06/30/17
NIH NIAMS
Mechanisms of Immune Regulation in the Skin
The major goals of this project are to define the dominant cellular and molecular mechanisms of immune regulation in the skin using a transgenic mouse model of inducible self-antigen expression.
Role: PI

R21 AR066821 (Rosenblum) 08/01/14 - 07/31/16
NIH NIAMS
Elucidating the Fundamental Biology of Memory Regulatory T cells in Skin
In this proposal, we will address the following specific aims: (1) Elucidating the role of the EGFR pathway in the generation, maintenance and function of mTregs in murine skin. (2) Functional manipulation of the EGFR pathway in human skin in vivo. (3) Elucidating the dominant pathways utilized by mTregs in skin from SCC and PSO patients.
Role: PI

NPF (Rosenblum) 06/15/14 - 06/14/16
National Psoriasis Foundation
Dissecting the Role of Memory Regulatory T cells in Psoriasis
The major goal of this application is to functionally define how mTregs regulate IL-17-mediated inflammation in skin. Specific cells in the body are responsible for preventing the immune system from attacking normal healthy tissues. We have identified a population of these cells in the skin of mice and humans. In the skin of patients with psoriasis, these cells appear to be functioning abnormally. We propose that patients develop psoriasis, at least in part, because these cells are not functioning properly. The current grant application will try to discover how and why these cells are functioning abnormally in psoriasis skin. In doing so, we hope to discover new ways to repair the function of these cells to treat psoriasis.
Role: PI

SRF 01 (Rosenblum) 05/01/13 - 04/30/14
Scleroderma Research Foundation
A translational approach to study the pathogenesis of scleroderma using antigen-inducible and humanized mouse models
Role: PI

Dermatology Foundation (Rosenblum) 07/01/11 - 06/30/12
Physician-Scientist Career Development Award
Mechanisms of Peripheral T cell Tolerance to Epidermal Self-antigen
Role: PI