BIOGRAPHICAL SKETCH

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NAME: Samuel Tzen-yue Hwang

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POSITION TITLE: Professor and Chairman, University of California Davis, Department of Dermatology

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
Harvard College, Cambridge, MA	AB	06/1984	Biochemistry
University Basel, Basel, Switzerland	PhD	12/1989	Biochemistry
Harvard Medical School, Boston, MA	MD	06/1991	Medicine
Brigham Women's Hospital, Boston, MA	Internship	06/1992	Medicine
Univ. California San Francisco	Residency	06/1995	Dermatology
Univ. California San Francisco	Fellowship	06/1997	Immunology

A. Personal Statement

Dr. Hwang, Professor and Chair of Dermatology at UC Davis School of Medicine, is a board-certified dermatologist with extensive training as a physician scientist. He has a strong interest in immunological diseases of the skin, including psoriasis, and in the biology of skin cancers, including melanoma and cutaneous T cell lymphoma. Starting as a scientist and then senior scientist at NIH, Dr. Hwang has had over 20 years of experience in the field of leukocyte and cancer cell trafficking and has had a long-standing interest in the role of chemokine receptors, including CCR6 and CXCR4 in psoriasis as well as cancer cells. Prior to being appointed tenured Chair and Professor of Dermatology at the University of California Davis in 2016, he was Chair and Thomas Russell Professor of Dermatology at the Medical College of Wisconsin. He has published original and review articles in the *Journal of Clinical Investigation*, *Journal of Experimental Medicine, Cancer Research, Journal of Immunology, Journal of Investigative Dermatology*, *JAMA Dermatology*, and *PNAS*. Lecturing nationally and internationally on psoriasis, Dr. Hwang is recognized for his impactful contributions to basic and translational psoriasis research.

He and colleagues at the Medical College of Wisconsin and NIH were among the first to conclusively demonstrate the role of CCR6 in the development of psoriasiform dermatitis (analogous to human psoriasis). Dr. Hwang's team has earned an international reputation in the use of murine models of psoriasis and CTCL for exploration of disease pathogenesis and treatment. He and collaborators have published extensively on the role CCL20 and CCR6 in psoriasiform dermatitis. He team proved, for example, that CCR6 was critical for the trafficking of epidermal gamma-delta T cells to the skin as Th17 effectors in murine models of psoriasis. Dr. Hwang has collaborated extensively with Dr. Brian Volkman (MCW) to develop specific chemokine receptor antagonists, including the development of a novel CCL20 locked dimeric molecule (CCL20LD) with biased agonist properties, including the inhibition of CCR6-mediated T cell migration and prevention of IL-23 mediated skin and entheseal inflammation in mice (Getschman et al. PNAS 2017; Shi et al. Arthritis & Rheumatol. 2021).

Lecturing nationally and internationally on psoriasis, Dr. Hwang is recognized for his impactful contributions to basic and translational psoriasis research. He was fortunate to have received two Discovery and two Translational Research awards from the National Psoriasis Foundation as well as an RO1 and SBIR phase 1

and 2 support for his work on the role of CCR6 in psoriasis. In 2020, he was awarded the Psoriasis Research Achievement Award by the American Skin Association.

Dr. Hwang is very pleased to extend his close collaboration with Dr. Volkman and the Xlock Team with whom he has had multiple publications in PNAS, Clinical Cancer Research, and Arthritis & Rheumatology.

Ongoing and recently completed projects that I would like to highlight include:

University of California School of Medicine
Pilot Awards for Innovative Studies of a Whole-body, High Resolution Positron Emission Tomography/CT device 2022-2023
PET EXPLORER as a tool for measuring systemic inflammatory changes following short-term dietary intervention
Role: PI

National Psoriasis Foundation
Translational Research Award 2020-2022
Dietary determinants of susceptibility to IL-23-mediated, psoriasis-like skin and joint inflammation
Role: PI

National Psoriasis Foundation
Bridge Award 2021-2022
CCR6 in psoriatic skin and joint disease
Role: PI

NIAMS – SBIR (Phase I)
1R43AR074363-01 2018-2019
Development of an engineered CCL20 protein as a lead therapeutic molecule for psoriasis
Role: Associate PI (PI: Anthony Getschman)

NIAMS- SBIR (Phase II)
2R44AR0743363-02 2020-2022
Development of an engineered CCL20 protein as a lead therapeutic molecule for psoriasis
Role: Associate PI (PI: Anthony Getschman)

Pfizer
Pfizer Aspire Award 2018-2020
CCR6 as a target for IL-23 mediated skin and joint inflammation
Role: PI

Citations:

Getschman AE, Imai Y, Larsen O, Peterson FC, Wu X, Rosenkilde MM, **Hwang ST**, Volkman BF. Protein engineering of the chemokine CCL20 prevents psoriasiform dermatitis in an IL-23-dependent murine model. *Proc Natl Acad Sci U S A*, 114(47): 12460-12465. 2017.

Shi Z, Wu X, Yu S, Huynh M, Jena PK, Nguyen M, Wan YY, **Hwang ST**. Short-Term Exposure to a Western Diet Induces Psoriasiform Dermatitis by Promoting Accumulation of IL-17A-Producing γδ T Cells. *Journal of Investigative Dermatology*, 140(9): 1815-1823. 2020.

Shi, Z. Wu, X. Rocha, C. S. Rolston, M. Garcia-Melchor, E. Huynh, M. Nguyen, M. Law, T. Haas, K. N. Yamada, D. Millar, N. L. Yvonne Wan, Y. J. Dandekar, S. **Hwang, ST**. Short-term Western diet intake promotes IL-23-mediated skin and joint inflammation accompanied by changes to the gut microbiota in mice. Journal Invest. Dermatol., 141(7): 1780-91. 2021.

Shi, Z. Garcia-Melchor, E. Wu, X. Getschman, A. E. Nguyen, M. Rowland, D. J. Wilson, M. Sunzini, F. Akbar, M. Huynh, M. Law, T. Kundu-Raychaudhuri, S. K. Raychaudhuri, S. P. Volkman, B. F. Millar, N. L. **Hwang, S.**

T. Targeting the CCR6/CCL20 axis in entheseal and cutaneous inflammation. Arthritis & Rheumatology, E-publication. 2021.

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2022-present	Section Editor, Journal of Investigative Dermatology
2019-present	Adjunct Chair Professor, Department of Dermatology, Kaohsing Medical Univ., Taiwan
2019-2021	Editorial Board Member, International J. of Dermatol. And Venereol.
2017-present	SID representative to AAD Council on Science and Research
2016-present	Chair and Professor of Dermatology, Univ. California Davis School of Medicine
2016-2021	Board of Directors, Society for Investigative Dermatology
2013-2018	Board of Directors, US Cutaneous Lymphoma Consortium
2012-2017	Section Editor, Journal of Investigative Dermatology
2008-2015	Chair and Professor of Dermatology, Medical College of Wisconsin
2007-2017	Editorial Board, Journal of Dermatol. Science (Japan)
2007-present	Member American Society for Clinical Investigation
2007-2012	Associate Editor, J. Investigative Dermatology
2004-2008	Senior Investigator, Dermatology Branch, National Cancer Institute
2002-2008	Advances in Dermatology, Editorial Board
1997-2004	Investigator, Dermatology Branch, National Cancer Institute
1994-1996	Howard Hughes Physician Fellow, University of California San Francisco

Honors

2022	Keynote Speaker: National Psoriasis Foundation Dermatology Resident Educational Retreat
2021	Keynote Speaker, Taiwanese Society for Investigative Dermatology, Taipei, Taiwan
2021	Keynote Speaker, Frontiers in Immunology Virtual Meeting, Changsha, China
2020	Best Doctors (Dermatology) Sacramento Magazine
2020	Keynote Speaker, Chinese Society for Investigative Dermatology Annual Virtual Meeting Xian China
2020	American Skin Association Award for Research in Psoriasis
2019	Best Doctors (Dermatology) Sacramento Magazine
2019	Keynote Speaker, Taiwanese Society for Investigative Dermatology Annual Meeting Kaohsiung
2019	Plenary Speaker, Chinese Society for Investigative Dermatology Annual Meeting, Changsha
2018	Best Doctors (Dermatology) Sacramento Magazine
2017	Keynote Speaker, Taiwanese Society for Investigative Dermatology Annual Meeting Taipei
2016	Plenary Speaker, Japanese Dermatological Assoc., Central Division, Annual Meeting
2014	Plenary Speaker, JID Shanghai International Dermatology Workshop, Shanghai
2014	10th Anniversary Advancing a Healthier Wisconsin Collaborative Science Award
2014	Plenary Speaker, Tokai University Psoriasis Research Meeting, Tokyo, Japan
2013	Plenary Speaker, Korean Society for Investigative Dermatology, Seoul
2013	Plenary Speaker, Taiwanese Society for Investigative Dermatology, Taipei
2011	Hubert Moss Lecture, Univ. Wisconsin-Madison, Dept. of Dermatology
2011	Visiting Professor, Univ. of Minnesota, Dept. of Dermatology
2010	Keynote Lecture, Milwaukee Academy of Medicine, Milwaukee, WI
2009	Keynote Speaker, Japanese Society for Psoriasis Research, Tokyo
2007	Membership, American Society for Clinical Investigation (ASCI)
2006	International Academic Dermatologist Recognition (Western Japanese Journal of Dermatology)
2004	Astellas/Yale Department of Dermatology Lectureship
1999	Keynote Lecture, University of Tokyo Annual Dermatology Meeting
1998	Albert Kligman Fellowship, International Invest. Dermatol, Cologne, Germany
1996	American Academy of Dermatology Young Investigator Award

C. Contributions to Science

Role of chemotactic receptors in immune cell trafficking and cancer metastasis

Dr. Hwang's initial scientific work focused on the elucidation of the role of chemokine receptors in trafficking of leukocytes and cancers to inflammatory tissues (skin) and sites of metastasis, respectively (T Kakinuma and ST Hwang. 2006).

Among the first to explore the role of chemokine receptors in antigen-presenting cell trafficking, his early immune biology work focused on the migratory chemotactic trafficking of dendritic cells from the skin to regional lymph nodes via CCR7 (Saeki H et al J. Immunol.1999).

In paradigm shifting later work, he showed that melanoma cells could express CCR7 and used this receptor to facilitate nodal metastasis, one of the major negative prognostic factors in melanoma as well as many other solid tumors (HE Wiley, et al. J. Natl. Cancer Inst., 2001). This work was among the first to demonstrate that cancer cells could usurp physiologic mechanisms of cellular trafficking, resulting in metastasis to distant sites.

A. Kakinuma, T, **Hwang, ST**. Chemokines, chemokine receptors, and cancer metastasis. *Journal of leukocyte biology*, 79(4): 639-51. 2006.
B. Saeki, H, AM Moore, MJ Brown, and **ST Hwang**. Cutting Edge: Secondary Lymphoid-tissue Chemokine (SLC) and CCR7 participate in the emigration pathway of mature dendritic cells from the skin to regional lymph nodes. *J. Immunol.*, 162: 2472-5. 1999.
C. HE Wiley, III, EB Gonzalez, W Maki, M Wu, **ST Hwang**. Expression of CC chemokine receptor-7 (CCR7) enhances regional lymph node metastasis of B16 murine melanoma. *J Natl. Cancer Inst.*, 93: 1638-43. 2001.

Investigation of the role of CCR6 in psoriasis

Since 2009, his interests have shifted toward understanding the pathogenesis of psoriasis using murine models of this disease. His laboratory was the first to describe the critical role of CCR6 in trafficking of gamma-delta T cells to the epidermis in psoriasis (MN Hedrick et al. J. Clin. Invest. 2009; Mabuchi T et al. J Immunol. 2011). This body of work demonstrated that CCR6 was vital in order for T helper 17 cells that heavily express CCR6 to migrate to skin and to the epidermis where they produced IL-22 and IL-17, major drivers of psoriatic inflammation. He is considered an expert in the use of IL-23 and imiquimod murine models of psoriasis.

Dr. Hwang and Dr. Volkman collaborated to show that an engineered, dimeric CCL20 molecule (called CCL20LD) could block IL-23-mediated psoriasiform dermatitis (Getchman et al. PNAS 2017). Most recently, in collaboration with Dr. Volkman, Millar, and Raychaudhuri, Dr. Hwang and colleagues showed that CCL20LD could block IL-23-mediated joint inflammation in mice, raising the possibility that blockade of CCR6 could be a novel therapeutic pathway in psoriatic arthritis (Shi et al. 2021)

A. MN Hedrick, A Lonsdorf, A Shirakawa, **ST Hwang**, and JM Farber. CC chemokine receptor-6 (CCR6) is essential for IL-23-mediated psoriasiform dermatitis in mice. *J. Clin. Invest.*, 119: 2317-29. 2009.
B. Mabuchi T, Takekoshi T, **Hwang ST**. Epidermal CCR6+ γδ T cells are major producers of IL-22 and IL-17 in a murine model of psoriasiform dermatitis. *J Immunol*, Nov 15;187(10): 5026-31. 2011.
C. Getschman AE, Imai Y, Larsen O, Peterson FC, Wu X, Rosenkilde MM, **Hwang ST**, Volkman BF. Protein engineering of the chemokine CCL20 prevents psoriasiform dermatitis in an IL-23-dependent murine model. *Proc Natl Acad Sci U S A*, 114(47): 12460-12465. 2017.
D. Shi, Z. Garcia-Melchor, E. Wu, X. Getschman, A. E. Nguyen, M. Rowland, D. J. Wilson, M. Sunzini, F. Akbar, M. Huynh, M. Law, T. Kundu-Raychaudhuri, S. K. Raychaudhuri, S. P. Volkman, B. F. Millar, N. L. **Hwang, S. T.** Targeting the CCR6/CCL20 axis in entheseal and cutaneous inflammation. *Arthritis & Rheumatology*, E-publication. 2021.

Role of Western Diet in increasing susceptibility of skin to psoriasiform inflammation

Since 2018, Dr. Hwang has been collaborating with Dr. Yvonne Wan, a respected NIH/NCI funded investigator at UC Davis and an expert in the metabolic and neoplastic changes in the liver that are mediated by the so-called Western diet (WD) comprised of moderate-to-high fat and high sucrose content. After applying this diet

to mice, we have published both long-term changes to the skin (Jena et al. J. Dermatol. Sci. 2019), leading to increased susceptibility to imiquimod-mediated dermatitis (Yu et al. J. Invest Dermatol. 2019). In our most recent reports, we show that short-term (4 weeks) feeding of the WD in standard laboratory mice results in clinical signs of psoriasiform skin inflammation that was dependent on CCR6+ gamma-delta T cells and accompanied by up-regulation of Th17 cytokines characteristic for human psoriasis (Shi et al J. Invest. Dermatol. 2020). Subsequent work demonstrated remarkable changes in the gut microbiome from mice that had been subjected to the WD and systemic IL-23 treatment (Shi et al. J. Invest. Dermatol. 2021).

A. P. Jena, L. Sheng, K. Mcneil, T.Q. Chau, S.Yu, M. Kiuru, M.A. Fung, **S.T. Hwang**, Y.J. Wan. Long-term Western diet intake leads to dysregulated bile acid signaling and dermatitis with Th2 and Th17 pathway features in mice. *Journal of Dermatological Sciences*, 95(1): 13-20. 2019.
B. Yu S, Wu X, Zhou Y, Sheng L, Jena PK, Han D, Yvonne Wan YJ, **Hwang ST**. A Western Diet, but Not a High-Fat and Low-Sugar Diet, Predisposes Mice to Enhanced Susceptibility to Imiquimod-Induced Psoriasiform Dermatitis. *Journal of Investigative Dermatology*, 139: 1404-1407. 2018.
C. Shi Z, Wu X, Yu S, Huynh M, Jena PK, Nguyen M, Wan YY, **Hwang ST**. Short-Term Exposure to a Western Diet Induces Psoriasiform Dermatitis by Promoting Accumulation of IL-17A-Producing γδ T Cells. *Journal of Investigative Dermatology*, 140(9): 1815-1823. 2020.
D. Shi, Z. Wu, X. Rocha, C. S. Rolston, M. Garcia-Melchor, E. Huynh, M. Nguyen, M. Law, T. Haas, K. N. Yamada, D. Millar, N. L. Yvonne Wan, Y. J. Dandekar, S. **Hwang, S. T.** Short-term Western diet intake promotes IL-23-mediated skin and joint inflammation accompanied by changes to the gut microbiota in mice. *Journal Invest. Dermatol.*, 141(7): 1780-91. 2021.

Elucidation of the pathogenesis of cutaneous T cell lymphoma

Dr. Hwang has also made significant strides in improving our understanding of the pathophysiology of cutaneous T cell lymphoma, a rare form of non-Hodgkin's T cell lymphoma that primarily affects the skin. Because of the lack of spontaneous mouse model of CTCL, Dr. Hwang's lab has developed a novel animal model in which to study the formation of T cell lymphoma in the skin microenvironment (Wu X et al. J Invest Dermatol. 2011). Importantly, this model is dependent on an inflammatory stimulus and responds to commonly used treatments that benefits patients with CTCL. Using this model as well as xenografted human CTCL models, he has demonstrated a role for macrophages in the development of T lymphomas in skin (Wu X et al. Depletion of M2-like tumor-associated macrophages delays cutaneous T cell lymphoma development in vivo. J Invest Dermatol. 2014) and that novel agents such as gallium maltolate (Wu X et al. J. Invest. Dermatol. 2015) or CCR2 antagonists (Wu X et al. J. Invest. Dermatol. 2020). may provide new therapeutic options for patients with CTCL

A. Wu X, Sells RE, **Hwang ST**. Upregulation of inflammatory cytokines and oncogenic signal pathways preceding tumor formation in a murine model of T-cell lymphoma in skin. *J Invest. Dermatol*, Aug;131(8): 1727-34. 2011.
B. Wu X, Schulte BC, Zhou Y, Haribhai D, Mackinnon AC, Plaza JA, Williams CB, **Hwang ST**. Depletion of M2-like tumor-associated macrophages delays cutaneous T-cell lymphoma development in vivo. *J. Invest Dermatol*, Nov;134(11): 2814-22. 2014. 2014.
C. Wu X, Wang TW, Lessmann GM, Saleh J, Liu X, Chitambar CR, **Hwang ST**. Gallium maltolate inhibits human cutaneous T-cell lymphoma tumor development in mice. *J Invest Dermatol*, Mar;135(3): 877-84. 2015.
D. Wu, X. Singh, R. Hsu, D. K. Zhou, Y. Yu, S. Han, D. Shi, Z. Huynh, M. Campbell, J. J. Hwang, S. T.. A Small Molecule CCR2 Antagonist Depletes Tumor Macrophages and Synergizes with Anti-PD-1 in a Murine Model of Cutaneous T-Cell Lymphoma (CTCL). J. Invest. Dermatol., 140: 1390-1400 e4. 2020.

Complete list of Published Work in My Bibliography:
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