Skin Sciences Institute

Division Photo

First Row: *R. Boissy, M. Visscher, V. Narendran****; Second Row*** *G. Kasting, S. Hoath, R. Wickett*

Division Data Summary

Research and Training Details	
Direct Annual Industry Support	$537,380
Peer Reviewed Publications	15

Faculty Members

Steven B. Hoath, MD, Professor ; *Medical Director, The Skin Sciences Institute*

Marty O. Visscher, PhD, Research Professor ; *Director, The Skin Sciences Institute*

Vivek Narendran, MD, Associate Professor ; *Director Newborn Nursery Christ Hospital, Director NICU University Hospital, Director Perinatal Outreach Program*

Raymond E. Boissy, PhD, Professor ; *Director, National Vitiligo Foundation*

W. John Kitzmiller, MD, Associate Professor ; *Head, Division of Plastic and Reconstructive Surgery; Director of Wound Care Drake Hospital*

Steven T. Boyce, PhD, Professor ; *Director, Department of Tissue Engineering, Shriners Burns Institute*

R. Randall Wickett, PhD, Professor ; *Director, Skin Pharmaceutics and Cosmetic Science Graduate Program*

Gerald B. Kasting, PhD, Associate Professor ; *Past Co-chairman, Gordon Research Conference*

Diya F. Mutasim, MD, Professor ; *Chairman, Department of Dermatology*

Charles L. Heaton, MD, Professor ; *Director, Sexually Transmitted Diseases Clinic and Training Program, Department of Health*

Zalfa Abdel-Malek, PhD, Associate Professor

Neville G. Pinto, PhD, Professor ; *Assistant Dean of Graduate Studies*

Trainees

- **Shona Burkes, PhD,**
- **Jodi Eubanks, PhD,**
- **Marisa Robinson, PhD,**
- **Jennifer Davis, PhD,**
- **Santosh Yadav, PhD,**
- **Shannon O'Brien, MD,**
- **Maria Victoria deCastro, MSN,**
- **Lesa Combs, ,**
- **Nancy Schwegman, ,**
- **Jill Winer, ,**
- **Lori Perkins, ,**
- **Claire Burkhart, ,**
- **Teresa Taylor, ,**
- **Theresa Flower, ,**
- **Tamina White, ,**
- **Linda Sluder, ,**
- **Shelly Sargent, ,**
- **Louise Smith, ,**
- **Maureen Rider, ,**
- **Amy Heubner, ,**
- **Elizabeth Mason, ,**

Significant Accomplishments

Biomarkers of Epidermal Innate Immunity in Premature Infants

Epidermal innate immunity is a complex process involving a balance of pro- and anti-inflammatory cytokines, structural proteins, and specific antigen presenting cells against a background of neuroendocrine modulators, e.g., cortisol. In the third trimester, the skin forms an intact environmental and innate immune interface, the stratum corneum (SC). Innate immunity is conferred by SC anti-infective lipids, anti-microbial host defense proteins and a physical barrier. Full term infants rely on these protective mechanisms during transition to a microbe-rich setting at birth. The premature infant is poorly equipped for environmental stressors due to skin immaturity and risks of infection and irritation. The skin produces cortisol and corticotropin releasing hormone (CRH). Skin CRH may exert both pro and anti-inflammatory effects. The skin neuroendocrine system can potentially mount a progressive, intensity-dependent, highly coordinated stress response to noxious stimuli. We examined the ontogeny of this system by simultaneously quantifying biomarkers of innate immunity, i.e., Keratin 1,10,11, Keratin 6, involucrin, albumin, fibronectin, cortisol, IL-1, TNFa, IL-6, IL-8, MCP1 and IP10 in premature and full term infants, adults and vernix caseosa. IL1a was elevated and TNFa reduced in infants. IL-6, IL-8 and MCP1 were higher in premature versus term infants and adults. Skin cortisol and albumin were elevated in premature infants. The preterm biomarker profile was unique with differences in structural proteins, albumin, IL-6, IL-1b, IL-8 and MCP1. The higher infant IL1a may be associated with skin barrier maturation. The elevations in skin cortisol for preterms may reflect a neuroendocrine response to the stress of birth. Whether the associations of cytokines and cortisol reflect a localized stress response; e.g., chorioamnionitis, remains to be determined. The method is promising for investigating responses to stressors in clinical settings.

Influence of TNF-α Polymorphism -308 on Chronic Irritant Dermatitis in Health Care Workers

Routine hand hygiene is effective for preventing hospital acquired infections yet compliance nationally is 30-57%. Irritant contact dermatitis (ICD) is the primary reason for compliance failure in health care workers (HCWs). Higher bacterial counts are associated with increased skin compromise. We had shown that HCW skin did not recover from the effects of hand hygiene indicating substantial, chronic skin damage. A polymorphism at position 308 of the tumor necrosis factor (TNF) gene has been implicated in the onset and severity of ICD and high secretion of TNFa. Patients with the TNF2 allele (A) were more likely to have ICD than those with the TNF1 allele (G). Additionally, atopic subjects are more likely to experience increased inflammation and impaired barrier function than non-atopics. We examined the effects of TNF

polymorphism -308 and atopic classification on hand skin irritation in three clinical contexts: (1) during exposure and recovery from repetitive hand hygiene, (2) following aggressive treatment (cream), and (3) onset and progression of inflammation on undamaged skin. HCWs with the TNF A had significant erythema after several days off while G showed recovery. After intensive cream treatment, erythema was lower for G without atopy than A with and without atopy. SC dryness was generally higher in atopics than non-atopics. The A group experienced greater irritation on undamaged skin than G and G recovered more quickly. Both TNF polymorphism and atopy contribute to irritant susceptibility. The results suggest that creams designed to mitigate inflammation are appropriate. The findings have implications for strategies to mitigate inflammation and identify HCWs at risk. Addition of an intensive treatment to hand skin care may help achieve "clean hands without compromise". Progress against this WHO agenda will require collaborations among experts in infection control, improvement science, public policy, skin research and development.

Effect of Chlorhexidine Gluconate on Skin Integrity at PICC Sites in Neonates

The Centers for Disease Control (CDC) advises skin disinfection with 2% chlorhexidine gluconate (CHG) before insertion of central lines to prevent nosocomial infections. Limited evidence precludes a recommendation for infants < 2 months. NICU patients are at risk for skin compromise due to prematurity, irritants and stress. We examined the effects of CHG on irritation and stratum corneum (SC) integrity in a collaborative study on infants in with the CCHMC Regional Center for Newborn Intensive Care. Repetitive application of CHG and a semipermeable adhesive dressing to central line site skin resulted in greater skin compromise, i.e., erythema, dryness and barrier integrity (poorer) versus untreated skin. By week 3, erythema and dryness were comparable for the CHG + dressing and dressing only and both were higher than the untreated site. This study appears to be the first to examine the effects of the dressing within the context of the CHG + dressing treatment on PICC skin condition SC integrity among NICU patients. The findings highlight the contribution of tapes and dressings to the skin compromise observed in clinical settings. Dressings with inherently higher water vapor permeability are expected to minimize the skin breakdown at PICC sites, but the adhesive characteristics and exposure conditions (e.g., incubator temperature, humidity, etc) need to be considered and evaluated. Investigation and/or development of alternatives that do not occlude the skin surface or strip the outer stratum corneum layers are important for insuring skin barrier integrity and creating conditions for barrier maturation in the neonatal population.

Division Publications

1. Visscher MO. Recent advances in diaper dermatitis: etiology and treatment. *Pediatr Health.* 2009; 3: 81-96.
2. Visscher M, Odio M, Taylor T, White T, Sargent S, Sluder L, Smith L, Flower T, Mason B, Rider M, Huebner A, Bondurant P. Skin Care in the NICU Patient: Effects of Wipes versus Cloth and Water on Stratum Corneum Integrity. *Neonatology.* 2009; 96: 226-234.
3. Canning J, Barford B, Sullivan D, Wickett R, Visscher M. Use of digital photography and image analysis techniques to quantify erythema in health care workers. *Skin Res Technol.* 2009; 15: 24-34.
4. Hachiya A, Sriwiriyanont P, Fujimura T, Ohuchi A, Kitahara T, Takema Y, Kitzmiller WJ, Visscher MO, Tsuboi R, Boissy RE. Mechanistic effects of long-term ultraviolet B irradiation induce epidermal and dermal changes in human skin xenografts. *Am J Pathol.* 2009; 174: 401-13.
5. Boissy RE, Spritz RA. Frontiers and controversies in the pathobiology of vitiligo: separating the wheat from the chaff. *Exp Dermatol.* 2009; 18: 583-5.
6. Visscher MO. Update on the use of topical agents in neonates. *Newborn Infant Nurs Rev.* 2009; 9: 31-47.
7. Hachiya A, Sriwiriyanont P, Kobayashi T, Nagasawa A, Yoshida H, Ohuchi A, Kitahara T, Visscher MO, Takema Y, Tsuboi R, Boissy RE. Stem cell factor-KIT signalling plays a pivotal role in regulating pigmentation in mammalian hair. *J Pathol.* 2009; 218: 30-9.
8. Visscher MO, Sullivan D, Sullivan S, Barford B, Dock M, Sommers MS. Quantitation of epidermal and mucosal tissue injury using contrast agents and imaging techniques. *Skin Res Technol.* 2009; 15: 180-6.
9. Yadav S, Wickett RR, Pinto NG, Kasting GB, Thiel SW. Comparative thermodynamic and spectroscopic properties of water interaction with human stratum corneum. *Skin Res Technol.* 2009; 15: 172-9.
10. Chawla S, deLong MA, Visscher MO, Wickett RR, Manga P, Boissy RE. Mechanism of tyrosinase inhibition by deoxyArbutin and its second-generation derivatives. *Br J Dermatol.* 2008; 159: 1267-74.
11. Kasamatsu S, Hachiya A, Higuchi K, Ohuchi A, Kitahara T, Boissy RE. Production of the soluble form of KIT, s-KIT, abolishes stem cell factor-induced melanogenesis in human melanocytes. *J Invest Dermatol.* 2008; 128: 1763-72.
12. Kasting GB, Bhatt VD, Speaker TJ. Microencapsulation decreases the skin absorption of N,N-diethyl-m-toluamide (DEET). *Toxicol In Vitro.* 2008; 22: 548-52.
13. Barai ND, Boyce ST, Hoath SB, Visscher MO, Kasting GB. Improved barrier function observed in cultured skin substitutes developed under anchored conditions. *Skin Res Technol.* 2008; 14: 418-24.

14. Kasting GB, Miller MA, Bhatt VD. A spreadsheet-based method for estimating the skin disposition of volatile compounds: application to N,N-diethyl-m-toluamide (DEET). *J Occup Environ Hyg.* 2008; 5: 633-44.
15. Bhatt VD, Soman RS, Miller MA, Kasting GB. Permeation of tecnazene through human skin in vitro as assessed by HS-SPME and GC-MS. *Environ Sci Technol.* 2008; 42: 6587-92.

Grants, Contracts, and Industry Agreements

Industry Contracts

Hoath, S

Kao Corporation	$ 396,427

Visscher, M

The Procter & Gamble Company	$ 140,953

Current Year Direct Receipts	**$ 537,380**

Funded Collaborative Efforts

Visscher, M

Comparison of Pulsed-Dye laser and Compression therapy on Skin Properties of Scars
International Firefighters Association

John K. Bailey	9/1/08 - 6/30/09	5 %
	-	%

Total $ 537,380