# Microbes, Autoimmunity, and Cancer: 69th Annual Montagna Symposium on the Biology of Skin

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## INTRODUCTION

The Annual Symposium on the Biology of Skin, now the Montagna Symposium on the Biology of Skin, was initiated at Brown University in 1950 by William Montagna on the basis of the need to communicate investigative work in cutaneous biology and to provide a forum in which basic scientists studying human and animal skin could exchange knowledge with clinically trained scientists in investigative dermatology. Today, the mission of the Montagna Symposium on the Biology of Skin is to (i) thoroughly cover 1 aspect of skin biology annually, identifying unsolved problems and long-term goals; (ii) facilitate the exchange of knowledge, providing a proving ground for new concepts and sharing resulting insights with the greater scientific and medical community; (iii) integrate topics at the interfaces of disciplines, fostering new collaborations, such as those leading to the development and translation of animal models, where necessary, to human benefit; and (iv) encourage young investigators in academic and investigational dermatology to build collaborative relationships with established physicians and scientists. Since 1950, >5500 scientists, physicians, and students from around the world have attended the symposium and benefited from its collaborative format.

The theme of the 69th annual symposium, "Microbes, Autoimmunity and Cancer," explored the concept that the skin provides a barrier to external threats, such as contact allergens, UVR, microbes, and wounding, but must also survey for neoplastic changes. The cells of the innate and adaptive immune system that reside in the skin and/or are recruited upon perception of a threat are critical to determining the outcome of the response (Figure 1). The innate immune system, composed of cell types, including Langerhans cells, dendritic cells, macrophages, keratinocytes, and neutrophils, provides an immediate response but also instructs the adaptive immune response, which includes T and B cells and confers immunologic memory. The adaptive immune response can, in turn, further activate the cells of the innate immune system. The immune system generally deals effectively with insults but can become overexuberant, resulting in autoimmunity. The conference brought together international researchers whose collective expertise captured all of these elements, creating an integrated picture of the field.

Supplementary Table S1 highlights the symposium program and speakers, which were crafted to bring the entire group together with respect to state-of-the-art science in the field—and then creatively explore the boundaries of our current knowledge and ways to apply that knowledge to clinical care. Thus, the first section of the conference focused on what is known about how the microbiome influences skin homeostasis and immunity. Participants learned the state-of-the-art science behind the composition and diversity of the microbiome, how it influences the innate and adaptive immune mechanisms, how some microbes protect against external threats, and how the complex interaction of the skin microbiota and the immune system leads to the development of cancer and immune-mediated skin disorders. A whole session focused on the role of microbiota in autoimmunity and how the skin microbiota is involved in erroneous targeting of self-antigens within the skin. It became clear throughout the conference that the skin microbiota and gut–skin microbiota axis influence the onset, progression, and perpetuation of autoimmune conditions and offer remarkable opportunities for therapies.

Interestingly, autoimmunity and cancer are on 2 ends of the immune spectrum; immune system over-reactivity (autoimmunity) and failure to react (cancer) were stressed in a third session. More specifically, speakers showed us mechanisms through which skin microbes both promote and inhibit cancer development and how the microbial stimulation of inflammatory cytokine release and the generation of ROS contributes to the initiation/progression of or protection against malignancy. A robust discussion between basic scientists and clinicians explored innovative opportunities to harness microbial communities for cancer prevention and treatment. This discussion extended into the next session, where it became clear that the modulation of the microbiome has the capacity to improve or worsen responses to immunotherapies. Another robust discussion ensued, which

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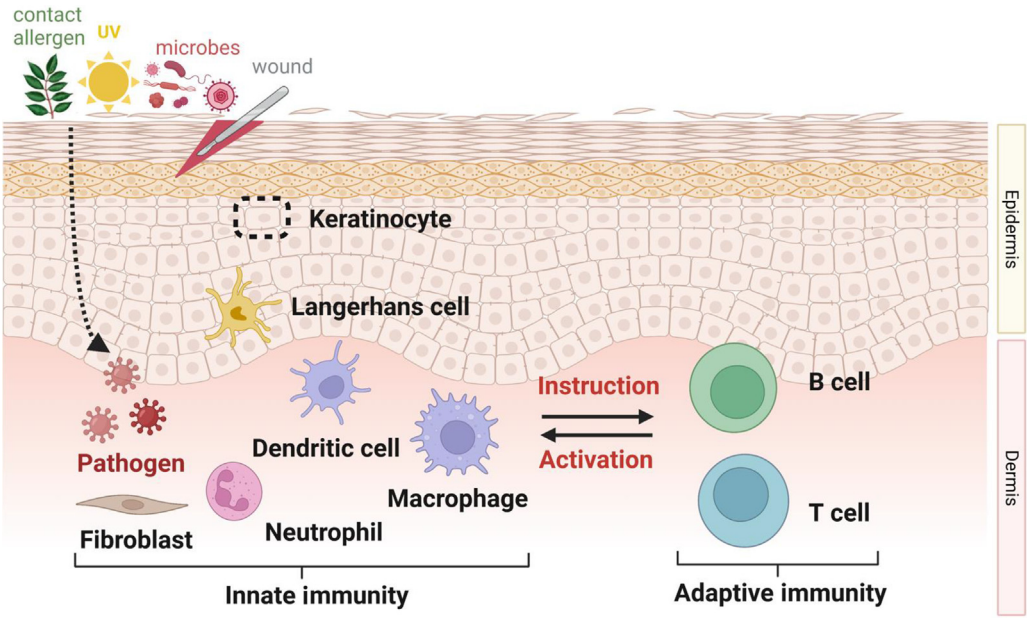


**Figure 1.** Cells of the innate and adaptive immune systems.

explored the potential of personalized microbiota-based interventions for enhancing immunotherapy responses and improving cancer treatment outcomes. Then, having summarized and elucidated many of the complex relationships between the microbiome and the immune systems, the group delved into how the microbiome tied into the neurological system and how technologies could be used and developed to further capitalize on these relationships to improve skin health.

Throughout this symposium, experts in clinical dermatology, skin immunology, cutaneous oncology, and commensal microbiology were assembled to create an up-to-date, data-driven think tank. The symposium was punctuated by exciting poster sessions and shared meals, and together, we gained a better understanding of how microbes both influence and can be used to modulate the immune system in health and disease. Next year's meeting, the 70th anniversary of the symposium, is entitled "Visualizing the Future of Skin Biology and Dermatology" and is designed to spark a similar think tank–style experience to propel dermatology forward through science.


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## CONFLICT OF INTEREST

The authors state no conflict of interest.

## Supplementary Table S1. Speaker Program

| Date/Session/Speaker | Session Moderator/Lecture Title |
|---|---|
| Thursday, October 20, 2022 | |
| Sancy Leachman | |
| Robert L. Modlin | Introductory Comments |
| Keynote: Yasmine Belkaid | "Multikingdom control of skin immunity" |
| Friday, October 21, 2022 | |
| Sancy Leachman | |
| Robert L. Modlin | Introductory Remarks |
| Session 1: Microbial immunity and pathogenesis | Session Moderator: Daniel Kaplan |
| Robert L. Modlin | "Linking immune responses and lipid metabolism to antimicrobial responses in skin" |
| Daniel Kaplan. | "Cutaneous neurons modulating immune responses" |
| Roberto Ricardo-Gonzalez | "Innate type 2 immunity controls hair follicle commensalism by Demodex mites" |
| Isaac Chiu | "Neuro-immune interactions in host defense" |
| Annemieke de Jong | "Recognition of bacterial lipids by human T cells through CD1a" |
| Nathan Archer | "Neutrophil-intrinsic TNF receptor signaling orchestrates host defense against Staphylococcus aureus" |
| George Agak | "To trap a pathogen: TH17 cell-mediated extracellular traps release and their role in host defense in acne" |
| Ricardo Cibotti | Funding Forum: Emerging challenges and opportunities |
| Session 2: The microbiome in infection, autoimmunity, and cancer | Session Moderator: Robert Modlin |
| Julie Segre | "Human Skin Microbiome: Finding Friends and Foes" |
| Tiffany Scharschmidt | "Early life immune-microbe crosstalk in skin" |
| Erin Chen | "Defining the functional properties of commensal-induced T cells by redirecting them against a non-native antigen" |
| Lynn Petukhova | "Monogenic mutations implicate STAT1 in hidradenitis suppurativa pathogenesis." |
| Heidi Kong | "The Microbiome in Human Skin Disease" |
| Keisuke (Chris) Nagao | "Intersection of tissue, immunity and the microbiota in skin" |
| Saturday, October 22, 2022 | |
| Session 3: Autoimmunity | Session Moderator: John O'Shea |
| John O'Shea. | "Lymphocytes and Superenhancers" |
| Teri Greiling | "Lupus and the microbiota" |
| Raymond Cho | "Single-cell interrogation of inflammatory skin disease" |
| Michel Gilliet | "Targeting immune pathways in inflammatory diseases" |
| Sarah Whitley | "Local IL-23 is required for proliferation and retention of skin-resident memory Th17 cells" |
| Ian Boothby | "Early Life Inflammation Primes a Th2-Fibroblast Niche in Skin" |
| Keynote: Laura Mackay | "Local Immune Protection by CD8+ Tissue-Resident Memory T Cells" |
| Sunday, October 23, 2022 | |

(*continued*)

## Supplementary Table S1. Continued

| Date/Session/Speaker | Session Moderator/Lecture Title |
|---|---|
| Session 4: Tumor immunology and prevention | Session Moderator: Niroshana Anandasabapathy |
| Niroshana Anandasabapathy | "Cancer immune surveillance in tissues: where it begins and ends" |
| Jean Tang | "Small molecule and gene therapy approaches for BCC and SCC prevention in rare diseases" |
| Shruti Naik | "Immune-epithelial crosstalk in skin inflammation and repair" |
| Liang Deng | "Reprogramming tumor microenvironment by a second-generation recombinant modified vaccinia virus Ankara" |
| Zach Garrison | "A novel MIF modulator as a melanoma therapeutic" |
| Kazumasa Oya | "Eribulin mesylate exerts antitumor effects via CD103" |
| Sergei Koralov | "Clonal evolution and microbial triggers in Cutaneous T Cell Lymphoma pathogenesis" |
| Session 5: Immune and biologic intervention | Session Moderator: Richard Gallo |
| Richard Gallo | "Pathogen Response in the Skin" |
| Eynav Klechevsky | "Regulation and dysregulation of Immune Responses by human skin dendritic cell subsets" |
| Philip Scumpia | "Refining immunomodulatory biomaterials for skin applications" |
| Brian Kim | "Neuroimmune Regulation of Itch" |

Abbreviations: BCC, basal cell carcinoma; SCC, squamous cell carcinoma; STAT1, signal transducer and activator of transcription; Th, T helper.