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The Melanocyte in Biology and Medicine Generate

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Description

The melanocyte in biology & medicine generated and amplified a growing understanding of the scientific basis of and clinical and pathologic relationship between melanoma, a by-product of uncontrolled growth of melanocytes, and vitiligo, a disorder of undesirable death of melanocytes. This meeting, at salishan resort on the oregon coast, incorporated the full spectrum of pigment cell biology and chemistry, as well as the biological underpinnings of clinical disease. Each of seven sessions, incorporating session keynote and established and junior investigator talks, endeavored to (i) present cutting-edge pigment cell biology and/or chemistry; (ii) emphasize the application of science to melanoma, vitiligo, and other medical disorders; (iii) bring together widely divergent disciplines to enhance transdisciplinary discussion on these topics; and (iv) support promising young investigators with an interest in this topic area.

Human Model Systems

Hensin tsao, margaret tucker, and kenneth kraemer described over 40 years of research into melanoma and XP genetics and its direct impact on patients. The spectrum of familial melanoma has been expanded to include familial atypical mole and melanoma syndrome and the BAP1 tumor syndrome. Sequencing of large cohorts identified association with mutations. Detailed study of XP patients revealed a 10,000-fold increase in non-melanoma skin cancer and a 2,000-fold increase in melanoma in patients under 20 years; comparison of non-melanoma skin cancer and melanoma in these patients showed differential anatomic site distributions and genetic mutational associations relative to the general population, suggesting differential mechanisms of carcinogenesis.

With this unique audience, michael shared the remarkable story of how the pigmentation and physical characteristics of pigeons have been used to uncover important pigmentation genes, their functions, and utility as a model system for better understanding evolutionary genetics and diversity of color. Not only do some of the same genes that underlie color variation in birds also regulate pigment diversity and disease in humans, but also surprising molecular links emerged between color patterning in pigeons and vision defects in both pigeons and humans.

In a fascinating convergence of disciplines leading to transdisciplinary discussion, Karen osborn presented on the diversity of form and function in ocean creatures that live in the mid water “twilight zone,” where light is so scarce that everything looks dark to the human eye. Deep-sea fish, such as viperfish, are super black, absorbing of light to make them all but invisible. Using sophisticated microscopy, Osborn and colleagues revealed that the secret to being super black was not only black pigment but also the arrangement of pigment granules into complex organized structures that trapped virtually all light.

Genetically engineered mouse models and/or specialized cell lines have enabled investigation of various aspects of melanoma and vitiligo pathogenesis and treatment. Helen michael presented her work in the glenn merlino lab on the use of DNA sequencing of UV-induced melanomas in hepatocyte growth factor transgenic mice to identify a series of genes that drive the pathogenesis of these melanocytic lesions. Lively discussion followed on the potential influence of the dermis in this melanoma model.

Catherine van raamsdonk presented data on a novel mouse model for uveal melanoma, leptomeningeal melanoma, and blue nevus like melanoma. In the mouse, mutant GNAQ, when expressed in the melanocytic lineage, leads to marked proliferation of melanocytes in the uveal tract, leptomeninges, and dermal melanocytic neoplasms recapitulating the distribution of tumor with Gq pathway mutations in the human.

Pivoting to a vitiligo model, zhussipbek mukhatayev described an innovative approach to vitiligo treatment based on regulatory T cells targeted, through chimeric antigen receptor technology, to a molecule that is upregulated in vitiligo skin. Preliminary evidence suggested that these cells act as immunosuppressive engines, decreasing the expression of signature cytokines and representing a promising approach for suppression of vitiligo.

Understanding the basic biology of DNA damage repair and the phenotype of patients with genetic repair syndromes has opened multiple avenues for cancer therapy with the goal of improving chemotherapy for cases where targeted therapy and immunotherapy are unavailable. Sarah arron discussed multiple compounds in clinical development

targeting ATM, CHK1/2, and nucleotide excision repair, which regulate the cell cycle and allow repair of DNA damage.

A clinician-driven panel discussion addressed recent developments in sunscreen-based prevention of skin cancer. Panelist discussed sunscreens causing death of coral reefs, whereas douglas brash noted the development of biodegradable bio-adhesive nanoparticle sunscreens.

Supporting young investigators full fills a primary mission of both the montagna symposium on the biology of skin and the pan American society for pigment cell research. Young investigators, in dedicated short-talk sessions, explored mouse models of basic melanocyte biology, improvement of treatment options for melanoma, and clarification of the order and identity of mutations acquired during melanomagenesis from phenotypically normal cell to metastatic status.

Two of these presentations highlighted results from the use of CRISPR technology. Corinne Rauck showed that excision of the adhesion protein CEACAM1 decreased tumor growth upon transplantation into syngeneic and immune deficient mice. This suggests potential for targeting of CEACAM1 with other immune checkpoint antigens, including in advanced melanoma.

Noel turner used a congenic mouse melanoma cell model to discover that immune checkpoint inhibitors impede growth of the melanoma cells treated with UV-b compared with the untreated parental tumors. This was IFNR-dependent, correlating efficacy with the increased somatic mutations and immunogenic neo epitopes that are considered hallmarks of human melanoma vulnerability to immune checkpoint inhibitors.

Stem Cells and Development

A focus of this session was development and disease progression in zebrafish models. David parichy presented his group's work on single cell RNA sequencing to identify transcriptomic signatures in postembryonic neural crest derived cells in zebrafish. Two different classes of pigment cells exhibited distinct trans criptomic responses to thyroid hormone in pigment cell development, suggesting different modes of lineage establishment, which provides insight into endocrine factor roles in postembryonic development of vertebrate pigmentation. E. Elizabeth Patton discussed MITF activity in melanoma progression in zebrafish, identifying a new target for 5-nitrofurans, which selectively target melanoma subpopulations that are enriched for ALDH1 activity and have tumor initiating potential. Morgan sturgeon showed that loss of magnesium in trpm7 zebra fish mutants via magnesium-exporter Slc41a1 is at least partly responsible for the cell death of melanocytes.