2016 Poster Abstracts

A Review of the Effectiveness of Fluorescence Spectroscopy and Imaging for Non-Invasive Skin Cancer Diagnosis

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Background/Purpose: The prevalence and increasing incidence of skin cancer highlights the importance of early detection. The current diagnostic gold standard of histopathological examination following a skin biopsy requires neoplastic changes to have progressed sufficiently enough to appear as suspicious lesions, which is problematic since advanced disease cannot always be treated. Fluorescence spectroscopy and imaging has been suggested as a potential non-invasive method of preliminary skin cancer detection, using changes in the spectral properties of the skin. Here, we systematically review the relevant literature to evaluate its capability for this application in a clinical setting. **Methods:** In September 2015, a search of online journal databases (Medline (Ovid), Web of Science Core Collection, Google Scholar, and Elsevier ScienceDirect) was performed. Journal articles were required to be freely accessible online using a UBC library login, published within the last 10 years, and involve human patients. Our primary outcome measures were spectral differences between normal and cancerous tissues, and the consistency of the intervention at both correctly diagnosing and differentiating skin malignancies from one another. **Results:** Our search yielded 372 articles, of which 93 remained after applying the criteria. Following independent review by both authors to assess relevancy, 21 articles were deemed to be eligible. These studies reveal numerous trends present in the spectral data of basal cell carcinoma, squamous cell carcinoma, and malignant melanoma. **Conclusion:** Analysis of the spectral data of various skin malignancies may be conducive to the clinical use of fluorescence spectroscopy and imaging for non-invasive skin cancer diagnosis and demarcation.

Category: Pilot/exploratory experiments (for study design, hypotheses creation, etc)

A Systematic Assessment of mHealth Apps for Atopic Dermatitis Self-Management

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Background/Purpose: With 1.7 billion individuals projected to download mobile health applications (mHealth apps) by 2018[1], they have the potential to revolutionize self-management of chronic diseases[2]. Atopic dermatitis (AD) is a chronic condition with global impact; in Canada, the lifetime prevalence and estimated annual cost are 17%[3] and 1.4 billion dollars[4], respectively. Many mHealth apps for AD are available, but no published appraisal exists to ensure content accuracy. Our study seeks to (1) develop a checklist to facilitate appraisal of AD mHealth app content based on current evidence and guidelines, (2) evaluate existing AD mHealth apps based on these checklists, and (3) identify mHealth apps that could be suggested to AD patients based on this review. **Methods:** Guidelines will be reviewed to summarize evidence-based components of AD self-management in a 10-point checklist. We will perform a comprehensive search of AD mHealth apps both within the medical literature and through official app stores (Android, iOS, Windows). Apps that are unavailable in English, or have descriptions that explicitly discourage their use for health purposes, will be excluded. Two authors will judge app compliance with current evidence through use of the checklist, and will use an existing checklist[5] to review accessibility and privacy. **Results:** We identified 123 AD mHealth apps in Android (69), Apple (53), and Windows (1) app stores. Our search of online medical databases identified 5 articles referencing AD mHealth apps not available through official app stores. A 10-point checklist based on AD guidelines[6,7] is currently under development.

Category: Pilot/exploratory experiments (for study design, hypotheses creation, etc)

DRESSING STABALIZATION AFTER MELANOCYTE TRANSPLANTATION USING A PAPER CLIP

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Wound dressing stabilization is challenging in areas of the body with high mobility like the ears and lips. It is particularly important to stabilize dressings in patients with vitiligo undergoing melanocyte transplantation in order to get the melanocytes to take. Our goal was to design and create a simple, effective, and economical technique to assist in dressing stabilization post transplantation. We offer a solution that uses common and economical office supplies: a nitrile glove, gauze, tape, and a paper clip. The paper clip acts as an internal support structure for a soft and supportive cushion made of gauze wrap, which is encapsulated by a nitrile waterproof cover and fastened by medical tape. Once completed it is applied to the inside of the patient's mouth like a hook applying pressure to the dressing from both sides of the buccal mucosa, thereby stabilizing the dressing. This technique is easy for patients to use and can promote the success of melanocyte uptake during the critical first seven days. The product is disposable and eliminates the need for sterilization, and most importantly, the supplies needed are readily available and cost effective. It is very efficient in dressing stabilization in mobile graft sites like the perioral and periauricular areas. So far it has proven to be beneficial in our practice and readily accepted by our patients.

Category: Pilot/exploratory experiments

Mitf-Cre induces melanoma formation in _Braf^{V600E}_ mice without _Pten_ silencing

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A mutation in the BRAF kinase (*BRAF^{V600E}*) is the most prevalent mutation in cutaneous melanoma (occurring in ~65% of melanoma patients) causing the sustained activation of the MAPK signaling pathway[1]. Nevertheless, *BRAF^{V600E}* is also found in benign melanocytic lesions characterized by melanocytes displaying a senescent phenotype. Therefore, *BRAF^{V600E}* in melanocytes is not sufficient to form melanoma and subsequent genetic alterations must override the initial senescence response, leading to their malignant transformation. As evidence, mice with conditional melanocyte-specific expression of *Braf^{V600E}* and *Pten* silencing upon induction by *Tyr-CreER* (*Braf^{V600E};Pten$^{lox/lox}$;Tyr-CreER*) developed melanoma, however mice with wild-type *Pten* expression (*Braf^{V600E};Pten$^{+/+}$;Tyr-CreER*) failed to progress to melanoma. Here, we aimed to determine whether expression of *BRAF^{V600E}* induced by *Mitf-Cre*, the earliest melanocyte-specific Cre line to our knowledge, can also initiate and promote melanoma. We used *Braf^{V600E}* mice with two different *Pten* backgrounds: partial *Pten*-deficiency (*Pten$^{lox/+}$*) and wild-type *Pten* expression (*Pten$^{+/+}$*). We found that *Braf^{V600E};Pten$^{lox/+}$;Mitf-Cre* mice displayed dome-shaped lesions in trunk with 100% penetrance, short latency, rapid emergence such that mice reached the human endpoint within 75-90 days of age and heavily pigmented lymph nodes. Histological analysis of lesions revealed epithelioid and spindle cells, and positive staining for S100B, a common marker for melanoma. On the other hand, *Braf^{V600E};Pten$^{+/+}$;Mitf-Cre* mice tended to develop only single lesions with a long latency. Nevertheless, the characterization of these lesions remains to be determined. This model of *Braf^{V600E};Pten$^{+/+}$;Mitf-Cre* may be used to explore and discover alternative mechanisms to escape this *Braf^{V600E}*-induced senescence, ultimately leading to melanoma progression.

Category: Early experiments with well-defined objectives/hypotheses

A THIRTY-YEAR TREND IN THE INCIDENCE OF DERMATITIS HERPETIFORMIS

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Introduction: Over the last several years there has been a growing trend to go "gluten-free". We hypothesized a decrease in the incidence of dermatitis herpetiformis (DH), a skin disease attributed to gluten sensitivity. **Methods**: Patients with the phrase "dermatitis herpetiformis" in the final diagnosis on a pathology report from 1984-2014 inclusive were identified in the Sunset Database. Cases were excluded if they did not have a positive final diagnosis of DH, or if they were sent as referrals from outside our selected regions. Patient duplicates were narrowed to the first positive diagnosis. Cases were separated into those with and without direct immunofluorescence (DIF) confirmation. The number of new cases per year was determined. **Results**: A total of 888 cases were identified using initial search criteria, and after exclusions, 248 cases of diagnosed DH were identified from 1984-2014. Of those cases, 193 were confirmed with DIF, and 55 were diagnosed as DH without evidence of DIF confirmation. **Conclusion**: The overall trend over the last three decades for all cases of DH diagnosed shows a steady, slow decrease; however, the number of cases of DH diagnosed confirmed by DIF has been relatively stable. We discuss possible reasons for the decrease in total cases of DH diagnosed per year such as: changing dietary habits, earlier diagnosis of celiac disease, preventing the development of DH; and increased use of DIF and serology in the diagnosis of DH. Further studies with a larger population base would be helpful.

Category: Early experiments with well-defined objectives/hypotheses

A Combination of *In Vivo* Near–Infrared and Visible Light Fluorescence Imaging of Skin

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The purpose of this project is to combine two fluorescence skin imaging modalities, i.e. the Near–Infrared (NIR) fluorescence imaging modality and the visible fluorescence imaging modality into a single dual–band fluorescence imaging system. This system takes a novel approach to imaging by taking aligned pictures of skin lesions using both the near–infrared and the visible wavelengths of light, which are respectively 785 nm and 405 nm. These aligned images are expected to show the distribution of multiple skin compounds such as melanin, collagen, elastin, keratin, porphyrin, and NADH, which cannot be given by a single excitation wavelength of light. Therefore, this system will provide more diagnostic information on skin cancers than any single system.

Category: Early experiments with well-defined objectives/hypotheses

COSTS, OUTCOMES, AND WORK-RELATED FACTORS OF OCCUPATIONAL CONTACT DERMATITIS IN BRITISH COLUMBIA: Worker's Compensation Board of British Columbia Analysis, 1990 – 2014

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Background and Purpose: Occupational contact dermatitis detract significantly from worker productivity, results in disability, and necessitates vocational rehabilitation for many workers. Occupational skin diseases accounts for 15 to 20 percent of all occupation illnesses, with the majority of these due to occupational contact dermatitis. Other causes of occupational skin

disease include scabies and dermatophyte infections, cellulitis and occupationally-induced melanoma and non-melanoma skin cancer. There is a paucity of data for province-wide epidemiology of occupational contact dermatitis. **Objectives:** 1 To describe work-related factors, outcomes and economic impact of occupational contact dermatitis among workers in British Columbia. 2 To describe trends in occupational contact dermatitis over a 25-year study period. **Design:** Retrospective analysis of accepted contact dermatitis worker's compensation claims from British Columbia (1990 - 2014). **Methods:** Claims Management Solutions database contains aggregated claims data from 15 Workers Compensation Board of British Columbia offices. The database will be searched by ICD-9 codes for occupational contact dermatitis. Claims accepted for work-related contact dermatitis between 1990 and 2014 will be analyzed. **Analysis of Data:** The following data will be collected from clients: ICD-9 diagnosis, demographic information, occupational exposure, occupation, and monetary amount of claim will be collected for each accepted claim. Total claim amount will be divided into amount accepted for short- and long-term disability, healthcare costs, and costs related to vocational rehabilitation. Data will be analyzed with SPSS Statistics 16.0.

Category: (1) Pilot/exploratory experiments (for study design, hypotheses creation, etc)

PROSPECTIVE STUDY OF ST. PAUL'S HOSPITAL DERMATOLOGY CONSULT SERVICE

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St. Paul's Hospital is a quaternary care hospital in the heart of downtown Vancouver, BC. During the 2014 calendar year, we conducted a twelve-month prospective evaluation of the consult service, in order to gather detailed information on consultation requests, including: the requesting service and care provider; patient demographics; urgency of the request (as assessed

by both the referring team and the dermatology service); acceptance, triaging, or refusal of the request; timeliness of the dermatology team response; resulting presumptive diagnosis; whether a biopsy was requested or performed; and features of the request including whether a clear question was asked, if differential diagnoses were provided, and if a morphological description was given. We also assessed the interaction between the patient's dermatological issue and their overall hospital stay: if the issue was related to the reason for admission, if it was affecting discharge planning, and if it was preexisting or arose acutely during the admission. Finally, we assessed whether the dermatology service felt the consultation was more appropriate for the inpatient or outpatient setting, and multiple factors supporting either setting were explored. The results of this study were compared with a literature search exploring similar reviews of dermatology inpatient consultations at other institutions. The primary purpose of this study is quality assurance. The results are currently in use in efforts to maximize the efficiency of the dermatology service to inpatients, and in targeting topics for continuing medical education activities delivered to the services that frequently request dermatology consults.

Category: Early experiments with well-defined objectives/hypotheses.

The CRH stress hormone receptor is expressed by the mononuclear phagocyte lineage from patients with AA

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Stress responses are believed to play a key role in the pathogenesis of the autoimmune hair loss disease alopecia areata (AA), though the exact interactions of stress hormones and autoimmune diseases remain unknown. Corticotropin-releasing hormone (CRH), the proximal regulator of the hypothalamic-pituitary-adrenal (HPA) stress axis, is a critical immunomodulatory factor in multiple peripheral tissues including human peripheral blood cells. CRH can induce chemotaxis and survival of monocytes in vitro. Notably, decreased monocyte chemotaxis

response to CRH was revealed in lifelong stress exposed centenarians compared to young subjects. CRH-deficient mice are resistant to experimental autoimmune encephalomyelitis (EAE), with a selective increase in Th1-type responses. However, the role of CRH/CRHr in the immune response of AA remains unknown. Here we used multi-label flow cytometry to identify differences in CRHr expression on specific leukocyte subsets of peripheral blood mononuclear cells (PBMC) in AA patients. Then we employed univariate and multivariate Cox regression models to decode the correlation of CRHr and AA outcomes. We found that CRHr were expressed primarily by cells of the mononuclear phagocytes system, the expression of CRHr on MPS cells was increased in 57 AA patients compared with 61 healthy controls (4.09% Versus 1.63%, $p<0.001$). Enhanced CRHr expression was independently correlated with AA incidence ($p=0.005$). Our data indicate that the stress hormone CRH may have a direct impact on the activity of MPS cells via CRHr. Interruption of the binding of CRH and CRHr on MPS cells might be a novel therapy for AA.

Category: Early experiments with well-defined objectives/hypotheses

ANALYSIS OF GENERAL POPULATION INTEREST IN INFLAMMATORY DISORDERS

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Background: Prevalence, quality of life, and economic cost are different methods of assessing the overall burden of different chronic immunologic disorders. In addition, internet search queries is a novel method to determine the interest of different medical conditions and can be used to assess burden. This study explores longitudinal trends in general public's interest in eczema, psoriasis, vitiligo, and psoriatic arthritis. **Objective:** To determine the longitudinal and seasonal effects on interest in eczema, psoriasis, vitiligo and psoriatic arthritis. **Methods:** Internet search query data were obtained from Google. Monthly normalized search volumes (NSV's) were determined for terms: eczema, psoriasis, vitiligo, and psoriatic arthritis from January 2004 to 2015 for Canada, United States and Australia. Using cosinor analysis, seasonal

and geographic effects were tested for data from Canada and United States. Volume searches were used to analyze the trends in popularity of search terms. **Results:** Time series revealed eczema to have the highest Normalized Search Volumes (NSVs). Psoriasis, rheumatoid arthritis and vitiligo were followed in descending order. A continuous increasing trend in NSVs was observed for eczema over the last 2 years as compared to other terms. Cosinar analysis did not reveal statistically significant seasonal effects. A 22% increase in average monthly searches was observed for eczema as compared to psoriasis. **Conclusion:** Internet search queries revealed search queries to be highest for eczema demonstrating strongest interest by the general public. These findings support that eczema, as well as other immunologic conditions have a significant burden. Further studies are needed to confirm these findings.

Category: Early experiments with well-defined objectives/hypothesis

CONTROLLED DELIVERY OF KYNURENIC ACID PREVENTS FIBROSIS IN RAT MODEL

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Abstract: Hypertrophic scars and keloids are devastating fibrotic conditions. Despite advances in knowledge and various therapeutic methods prevention and treatment of these conditions remains a challenge. Our group has previously shown that kynurenic acid (KyA) as a topical formulation reduces hypertrophic scarring in rabbit ear model. In this study we hypothesized that the use of a biocompatible and biodegradable polymer microsphere for controlled slow release of KyA will reduce fibrosis in closed wound in a rat model. The FDA approved Poly (lactic-co-glycolic acid) (PLGA) polymer was used to encapsulate KyA. An animal model of wound healing which involves subcutaneous implantation of pre-cut PVA sponges in rat was used to evaluate the *in vivo* efficacy of the microspheres. The *in vitro* experiments revealed a successful encapsulation of KyA(average encapsulation efficiency=80.65%±18.49) and a release

profile that showed a gradual release over 35 days following a lag phase for 30 days. Both histological examination and hydroxyproline assay of the samples harvested after 66 days revealed a significant reduction in collagen deposition inside and around the PVA sponge implants loaded with KyA microspheres compared to the PVA alone or loaded with empty microspheres (0.3±0.5, 6.74± 2.77, 2.7±o.89 mg collagen/PVA respectively). There was no significant difference between samples collected after 35 days. Our data suggests that gradual release of KyA after 30 days can prevent fibrosis *in vivo* while the lag phase allows normal healing process to occur. This drug delivery system provides a novel approach toward prevention of fibrosis after surgical interventions.

Category: Applied/functional experiments

VERTICAL SECTIONING MULTIMODALITY VIDEO MICROSCOPY OF HUMAN SKIN *IN VIVO*

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Background: Reflectance confocal microscopy (RCM) and multiphoton microscopy (MPM) are non-invasive methods of acquiring morphological images of the skin *in vivo*. Most research in this area focuses on instruments that are configured for two-dimensional imaging in a horizontal plane parallel to the skin surface. In contrast, conventional histopathologic evaluation of the skin is based on vertical tissue sections that show microscopic features and their interrelationships according to their depth within the skin. The ability to depict the skin in the vertical plane during *in vivo* microscopic imaging poses challenges with respect to imaging speed, resolution and extractable information. **Methods:** We developed a laser scanning multimodal microscopy system which combines RCM and MPM, and has the ability to do fast

xz scanning to achieve vertical "optical sectioning" of *in vivo* human skin at half video rates. RCM and MPM images are obtained simultaneously and co-registered thereby providing complementary morphological information. To validate the performance of this system vertical section RCM and MPM microscopic images of normal human skin *in vivo* were obtained at half video rates (15 frames/s). **Results and Conclusions:** Using our system it is possible to discern the following structures: all layers of the epidermis including the stratum corneum, the dermal-epidermal junction, and the papillary dermis. Blood flow is also visible as evidenced by blood cell movement within vessels. The effective imaging depth is about 200 micrometers. This system provides a means of interrogating human skin noninvasively at an orientation analogous to conventional histological sectioning.

Category: Applied/functional experiments

MELANOMA PROGRESSION INVOLVES A PROFOUND NUCLEAR TO CYTOPLASMIC SHIFT OF TRANSCRIPTION FACTOR SUM-6 (SPECIFICALLY UPREGULATED IN MELANOMA GENE SIX)

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SUM-6 is a human homeobox gene that encodes for a transcription factor, which plays a key role in normal embryogenesis. Overexpression of both the gene and nuclear protein has been shown to occur in a variety of cancers such as breast, colorectal, and pancreatic, and has been demonstrated to promote tumorigenesis. The purpose of the current study was to evaluate the expression of the SUM-6 protein and its clinical relevance. Immunohistochemistry using a specific SUM-6 antibody was performed on a tissue microarray consisting of 438 patient biopsies, which included benign and malignant melanocytic tumors. Double-blinded scoring of distinct nuclear and cytoplasmic SUM-6 staining was performed. Univariate analysis revealed that five year disease-specific survival decreased significantly when SUM-6 was excluded from

the nucleus and when SUM-6 levels were elevated in the cytoplasm. We concluded that melanoma progression and metastasis is associated with a profound shift of transcription factor SUM-6 from the nucleus to the cytoplasm. It is interesting to note that in most other cancers, the SUM-6 protein was instead overexpressed in the nucleus. The patients in whom SUM-6 was excluded from the nucleus demonstrated a significantly worse prognosis than the patients who retained nuclear expression. These findings suggest that either the absence of nuclear expression or elevated cytoplasmic presence (or both) of SUM-6 may play a role in the progression of malignant melanoma. Therefore SUM-6 has the potential to become a prognostic marker in the clinic and a possible drug target.

Category: Early experiments with well-defined objectives/hypotheses

TREATMENT OF TUBEROUS SCLEROSIS-ASSOCIATED FACIAL ANGIOFIBROMAS WITH LOW DOSE TOPICAL RAPAMYCIN

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While facial angiofibromas affect up to 93% of patients with tuberous sclerosis complex (TSC) and are a significant cause of cosmetic morbidity, satisfactory treatment remains a challenge. Traditional physical treatment modalities can be painful, may cause scarring and often require repeat treatments. Topical rapamycin is a safe, effective, and well-tolerated treatment for facial angiofibromas when used at concentrations between 0.1% and 1%. Unfortunately, the high cost of the medication at these concentrations precludes its routine use. Lower concentrations of the medication would provide a more financially viable treatment option. To date, there are no objective studies assessing whether low dose topical rapamycin is an effective treatment for facial angiofibromas. We hypothesize that low dose topical rapamycin gel will improve the appearance of facial angiofibromas in TSC patients compared to vehicle. To test this hypothesis we will conduct a proof of concept, randomized, controlled, single blind, comparative study. Participants will be pediatric patients with TSC-related angiofibromas recruited from a pediatric dermatology clinic in Vancouver, British Columbia. Each participant's face will be

divided into quadrants, and each quadrant will receive a once daily application of topical rapamycin gel at 0.03%, 0.015%, or 0.003% concentrations or vehicle alone for six months. Progress will be documented by serial photographs at baseline and each follow-up visit. Treatment efficacy will be assessed by two blinded evaluators using a previously described scoring system for papule redness, size, and flatness. Should the findings support our hypothesis, this study will identify an effective, accessible treatment for TSC-related facial angiofibromas.

Category: (1) Pilot/exploratory experiments (for study design, hypotheses creation, etc)

SLEEP DISTURBANCE IN PSORIATIC DISEASE: PREVALENCE AND ASSOCIATED FACTORS

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In psoriatic disease (PsD), encompassing psoriasis (PsC) and psoriatic arthritis (PsA), disease burden is not limited to physical symptoms, but also includes major social, and functional impairment. This study aims to determine the prevalence of sleep disturbance in psoriatic disease patients and to identify associated factors. The study included 113 PsA and 62 PsC patients, and 52 healthy controls (HC). Validated questionnaires, including the Pittsburgh Sleep Quality Index (PSQI), evaluated quality of life and sleep. Clinical variables were collected by standard protocol. The prevalence of poor sleep quality was 84%, 69%, 50% in PsA, PsC and HC, respectively. Total PSQI score was higher in both PsA and PsC patients compared to HC (9.24 and 7.18 vs. 5.67, $p<0.01$) and higher in PsA patients compared to PsC patients (9.24 vs 7.18, $p<0.0001$). Sleep disturbances, latency, daytime dysfunction, and subjective sleep quality contributed to worse sleep quality in PsA patients compared to PsC patients ($p<0.01$). Controlling for sex and group, anxiety, EQ-5D and FACIT were independently associated with

worse PSQI in PsC and PsA patients ($p<0.05$). Controlling for age, sex, and BMI, actively inflamed joints are independently associated with worse PSQI in PsA patients ($p<0.01$). Poor sleep is associated with fatigue, anxiety, and lower EQ-5D in PsD patients. In patients with PsA, poor sleep is associated with active joint inflammation. This understanding identifies opportunities for therapeutic strategies to address sleep disturbance in psoriatic disease and optimize quality of life outcomes and highlights the importance of screening for sleep disturbance in PsD patients.

Category: Early experiments with well-defined objectives/hypotheses

NOVEL KINASE INHIBITORS AS THERAPIES FOR VITILIGO AND OTHER SKIN DISEASES

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Background and objectives: Recently FDA has given approval of JAK3 inhibitors for treatment of autoimmune diseases such as psoriasis. Emerging results, however, showed that skin biopsies with vitiligo, psoriasis and chronic dermatitis often involve activation of multiple intracellular kinases such as JAK1, JAK2, JAK3 and BTK. Therefore, we hypothesize that agents simultaneously targeting multiple such kinases would be more effective than the single-specificity inhibitors. The objectives of this project are to design and develop novel dual-specificity inhibitors with activities against both BTK and JAK. The long term goal is to develop effective and safe therapies for autoimmune skin disease such as vitiligo, psoriasis, and chronic dermatitis.
Materials and Methods: Novel small molecules were designed and synthesized using proprietary integrated 3D algorithms based on (1) in-house structure-activity relationship models of pilot structures against BTK and JAKs, and (2) 3D models of BTK and JAK proteins. After synthesis and purification, they are screened for activities against BTK and JAKs first by using purified enzymes and then by using cell-based assays.
Preliminary Results: Among 104 novel structures synthesized, 11 have desired duo-specificity against both BTK and JAK3 but with minimal activities against 400 other kinases of the human kinome.
Conclusion and next steps: The integrated 3D algorithm has yielded promising novel chemical entities that warrant further development. Experiments are under way to test these compounds' suitability to treat vitiligo, psoriasis, and dermatitis using *in vitro and in vivo* models.

Category of Study: Early experiments with well-defined objectives/hypotheses

PHOTOTHERAPY FOR TREATMENT OF VITILIGO: A REVIEW OF SELECTED PROTOCOLS USED IN ASIA, NORTH AMERICA AND EUROPE

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Vitiligo is an acquired, progressive depigmenting disorder characterized by the loss of functional melanocytes in involved skin and hair. Phototherapies such as Narrowband UVB(NB-UVB), 308-nm excimer lamp/laser or psoralen-UVA(PUVA) are very important treatments for vitiligo. Till now, protocols of phototherapies for treatment of vitiligo have been reported in North America, Europe and Asia, but no worldwide-accepted protocols have emerged. We thus have reviewed published papers about vitiligo phototherapy in US, Europe, Japan, India and China, and tried to find out generally accepted recommendations as well as differences in phototherapy protocols. By reviewing these papers, we summarized the format of phototherapy, the frequency, dosage and duration of treatment, the combination with other therapies as well as the assessment methods for the evaluation of the treatment response used in different area. Mainly, we found that NB-UVB has been widely accepted as the first line treatment for non-segmental vitiligo, but the protocols varies in different area. For example, the frequency of treatment, initial dose and increase of dosage between two treatment used in Japan was lower than those in North America and Europe. The minimal erythema dose (MED) was still recommended in Japan and China to determine the initial dose but not in Europe and US. Besides, the protocols of PUVA and 308-nm excimer laser/light as well as combination with topic or systemic therapies have also been summarized and compared. This paper may be helpful for clinician to build up their own protocol for treatment of vitiligo.

Category: Pilot/exploratory experiments (for study design, hypotheses creation, etc)

UTILIZATION OF MODERN TECHNOLOGY SMARTPHONE APPLICATIONS TO ENHANCE SKIN CANCER PREVENTION AND REDUCTION OF ULTRAVIOLET EXPOSURE

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Skin cancer rates are increasing at a global level, and this same trend has been shown in the Canadian population. Prevention not only reduces the morbidity and mortality attributable to cancer, but it has also shown to ultimately reduce costs. This study hypothesizes that utilization of modern technology smartphone applications can increase awareness of skin cancer, and reduce UV exposure levels by individuals. The objectives of this study include: i) detect if smartphone application can enhance skin cancer awareness of individuals, ii) detect if smartphone application can reduce UV exposure levels of individuals, iii) analyze demographic factors of individuals likely to use smartphones within the Canadian population. One thousand individuals will be recruited; each will be randomly assigned to a study arm. Group A will have exposure to a smartphone application that includes education on the hazards of UV exposure and link to skin cancer formation. Individuals assigned to Group B will not be provided access to this smartphone application. Measurements will be collected regarding skin cancer awareness and UV exposure levels through survey. Data will be analyzed with descriptive statistics and multivariable regression analysis. To determine the generalizability of these study results a subanalysis will be performed to determine which individuals likely use smartphones in the Canadian population. This study will investigate the use of modern technology to help reduce UV exposure levels, and provide a model for further intervention studies using mobile technology.

Category: Early experiments with well-defined objectives/hypotheses

SEARCHING FOR GENES CONTROLLING DEVELOPMENT OF PRIMARY HYPERHIDROSIS

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Background, Hypothesis and Objectives: Primary hyperhidrosis is characterized by socially disabling excessive sweating in the absence of sweat triggers. It affects about 15% of the general population, and has an unknown pathogenesis. We hypothesize that genetic predisposition plays a significant role in the development of primary hyperhidrosis. The objectives of this study are (1) to define the mode of inheritance, (2) to identity the susceptibility markers in the genome, and (3) to identify the genes involved in the development of hyperhidrosis. **Methods and Materials:** Clinical information and saliva samples were retrieved from the Vancouver Hyperhidrosis Registry and Biobank with approval from UBC Clinical Ethics Board. Complex segregation was used to determine the mode of inheritance. GWAS was performed to identify susceptibility genes. Linkage analysis and exome sequencing were used for identification of gene mutations causing primary hyperhidrosis. **Results:** Primary hyperhidrosis is a complex genetic disease with 66.6% heritability, which is much higher than other common genetically influenced diseases such as vitiligo and psoriasis. Familial primary hyperhidrosis most likely is inherited as an autosomal dominant condition, with the genetic mutations mapping to three different chromosomal loci. Multiple candidate genes were involved, awaiting further confirmation. **Conclusion and clinical relevance**: The genetic inheritance of primary hyperhidrosis is complex involving multiple possible genetic loci and multiple candidate genes. This study will enhance our understanding of primary hyperhidrosis, and provide useful information for developing better hyperhidrosis therapies.

Category: Early experiments with well-defined objectives/hypotheses

PROOF OF PRINCIPLE OF A STOKES POLARIMETRY PROBE FOR SKIN LESION EVALUATION

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Skin lesions are often evaluated using optical diagnostic tools, especially in the field of cancer detection. However, optical modalities such as microscopy variants can require large and expensive equipment, and are slow to perform, making them difficult to integrate into a clinical setting. This project is on the development of a fast, portable, and low-cost optical probe that uses Stokes polarimetry to evaluate skin lesions. Polarization is a property of light waves that describes the orientation and shape of their oscillations. The polarization state can be described using Stokes parameters, and several measurements derived from these parameters such as the degree of polarization, the azimuth and ellipticity angles of the polarization ellipse, and the coordinates on a Poincaré Sphere. The probe shines low-intensity polarization-controlled laser light at a lesion, and analyzes the reflection in order to detect how the light's polarization has been changed due to the light-tissue interaction. Testing with skin phantoms has demonstrated a relationship between phantom roughness, bulk optical coefficients and the degree of polarization, and the azimuth and ellipticity angles. Preliminary testing on in-vivo lesions including nevi and seborrheic keratosis show that lesion sites demonstrate a lower degree of circular polarization as compared to normal skin. In addition, different lesions appear to have unique positions on the Poincaré Sphere. These results indicate that with further testing and refinement, this probe can become both a powerful and practical tool to assist skin lesion evaluation.

Category: Pilot/Exploratory Experiments