



D-Light Research Symposium: UV, vitamin D and our health.

Contributions from Perth and our international colleagues



Friday 25 September, 2015



10am - 5pm



Telethon Kids Institute
Seminar room,
100 Roberts Rd, Subiaco

Dear Symposium Delegate,

On behalf of Telethon Kids Institute and as joint convenors of the D-Light Program, we are pleased to welcome you to this Symposium, 'UV, vitamin D and our health'.

The timing of this Symposium is significant since 2015 coincides with the International Year of Light and the 30th anniversary of the signing of the Vienna Convention, the first international treaty to recognise ozone depletion as a global issue of concern.

We are particularly pleased to welcome a number of the national and international scientists to this Symposium who have been visiting Perth for the United Nations Environment Program (UNEP): Environmental Effects Assessment Panel on Ozone and UV.

We are looking forward to hearing from our international speakers, who are involved with research in countries with a very different UV environment to our own.

The Symposium is also an excellent opportunity to showcase the UV and Vitamin D research we're doing in WA within the D-Light showcase program.

D-Light is a large, multi-disciplinary and unique group looking at the risks and benefits of sun exposure across the spectrum of age groups. We work in close collaboration with Cancer Councils to ensure there is a consistently strong 'translation' focus to our work. Sharing and collaborating through occasions such as this Symposium is fundamental to D-Light.

Collectively we hope to promote a better understanding of the whole picture of Vitamin D, UV and health rather than focusing on isolated pockets of research.

Thank you to those who will be presenting today. We look forward to your contributions and we hope you will make the most of this gathering to network, explore collaborative opportunities and consider new horizons for research.



Professor Robyn Lucas

Head, National Centre for Epidemiology and Population Health
Australian National University



Professor Prue Hart

Principal Research Fellow, People Leader
Telethon Kids Institute

Programme

10.00	Professor Jonathan Carapetis	Welcome	Chair: Dr Shelley Gorman
10.00	Professor David Mackey	Outdoor activity, Vitamin D and Myopia	
10.30	Dr Debbie Palmer	Early life vitamin D status and the development of infant eczema	
10.50	Dr Caitlin Wyrwoll	Vitamin D and glucocorticoid interactions in early life: implications for adult neuropsychiatry?	
11.10	Dr Elysia Hollams	Repeated periods of vitamin D deficiency in childhood are associated with increased risk for asthma and related conditions: findings from a high-risk birth cohort.	
11.30	Dr Lucinda Black	Developing a protocol and assay to measure 25-hydroxyvitamin D concentrations in saliva	
11.50	Discussion		
12.00	Sandwich lunch provided		
12.30	Professor Antony Young	Telethon Kids Institute Seminar Photoprotection and Vitamin D	Chair: Professor Prue Hart
1.45	Photos of D-Light members and those attending symposium		
2.00	Dr Shelley Gorman	Sunlight, nitric oxide and obesity: investigating mechanisms by which ultraviolet radiation suppresses signs of obesity and metabolic dysfunction	Chair: Dr Debbie Palmer
2.20	Professor Trevor Mori	Vitamin D status and the relationship with cardiometabolic risk factors in a Western Australian adolescent population	
2.40	Dr Hayley Christian	The Solar UV Exposure and Physical Activity of Children Attending Childcare (SunPAC) study	
3.00	Professor Prue Hart	How UVB phototherapy may suppress immunity	
3.20	Discussion		
3.30	Afternoon tea		
3.45	Dr Richard McKenzie	UV Radiation and its Variability: An App to Fill a Void	Chair: Dr Elysia Hollams
4.15	Associate Professor Craig Sinclair	Balancing the Risks and Benefits of Sun Exposure for Better Health	
4.35	Professor Robyn Lucas	Gaps in our knowledge of sun exposure and health	
4.55	Discussion and close		

Keynote speaker profiles



Professor Antony Young

Head, Photobiology Unit
King's College London

Professor Young has been involved in research on the effects of ultraviolet radiation (UVR) on human skin for the past 25 years. The European Commission (EC), UK Department of Health, UK Medical Research Council, research charities and industry have largely funded this research. Professor Young has a long-standing interest in photoprotection, and is also currently working on vitamin D, the photobiology of different skin types and the development of natural marine sunscreens. He was recently the coordinator of a 4-year EC €4.5 million project, within its Framework 7 Environment and Climate Change Programme, entitled "The impact of climatic and environmental factors on personal ultraviolet radiation exposure and human health". This multi-national project assessed the beneficial and detrimental health impacts of UVR in field studies of human populations in work and leisure situations in different European countries.

Professor Young is an active member of the American Society for Photobiology (ASP) and the European Society for Photobiology (ESP). He has been chairman of the British Photodermatology Group (BPG), a faculty member of the American Academy of Dermatology (AAD), and is currently an associate editor of Photodermatology, Photoimmunology and Photomedicine and section editor of the Journal of Dermatological Science. Professor Young is also a member of the United Nations Environment Programme (UNEP) - Environmental Effects Assessment Panel.



Dr Richard McKenzie

Emeritus Research Scientist
NIWA Lauder, Central Otago, New Zealand

Dr McKenzie is an atmospheric research scientist with an interest in UV radiation, its variability, its environmental impacts, and its interactions with climate change. He has extensive experience with measuring and modelling spectral UV irradiance, and measuring trace gases (e.g. ozone) and aerosols that affect UV propagation through the atmosphere. He has published about 150 papers in the peer-reviewed literature, and has convened several conferences and workshops on UV radiation. Initially Dr McKenzie focused on the effects of ozone change and other atmospheric parameters on UV radiation, especially in the New Zealand context. But more recently, his focus has moved to UV radiation and its effects- both positive and negative - on humans. He believes that communication of science, in simple terms that can be grasped by the public, is key. He works closely with relevant health and environmental agencies both in New Zealand and internationally. He has been closely involved with the development and calibration of the personal UV dosimeter badges and their use in clinical trials. He has also helped to develop methods to process, analyse and interpret data from them. In addition to ongoing roles at NIWA and with UNEP, Dr McKenzie is now a private UV Consultant to 'l'Oreal (Paris), and is currently involved in the development of educational UVI Apps.



➤ **Associate Professor Craig Sinclair**
Head, Prevention Division
Cancer Council Victoria

Craig Sinclair is the Director of the World Health Organization's (WHO) Collaborative Centre for UV Radiation and Head of Cancer Prevention at the Cancer Council Victoria, Australia. At the Cancer Council Victoria, Craig is responsible for the development and delivery of cancer prevention and screening programs including sun protection, tobacco control (Quit Victoria), obesity prevention, cervical and bowel cancer screening and general practitioner training. He also chairs the Public Health committee for Cancer Council Australia. He has an adjunct appointment as Associate Professor at the Queensland University of Technology and in 2010, the United States Environment Protection Agency (EPA) awarded Craig with the Montreal Protocol Award for his substantial contribution to human health protection.

Abstracts



Outdoor activity, Vitamin D and Myopia

Professor David Mackey | Lions Eye Institute

Increased time spent outdoors reduces the chances of developing myopia. People with myopia have lower vitamin D levels. People with a history of skin cancer have lower rates of myopia. We're trying to work out the right balance between outdoor activity to prevent myopia without increasing the risk of skin cancer. In our pilot Kidskin study we are currently looking at a cohort of West Australian children studied in the 1990s who were randomised to either standard sun protection or increased sun protection. We're aiming to find out if there are higher rates of myopia in those who spent less time outdoors.



Early life vitamin D status and the development of infant eczema

Dr Debbie Palmer | University of Western Australia

A "vitamin D hypothesis" has been proposed to explain the increased prevalence of eczema in regions with higher latitude. There is evidence that vitamin D acts through multiple pathways that influence the risk of eczema development. Most notably, this includes effects on skin barrier function, early immune development and bacterial defense. These biological effects are in keeping with observational studies that have indicated a link between vitamin D status and eczema outcomes, including lower serum vitamin D concentrations associated with increased incidence and severity of eczema symptoms. Measurements of cord blood 25-hydroxyvitamin D [25(OH)D] concentrations in infants, with a hereditary risk of allergic disease, have found a higher cord blood 25(OH)D concentration appears to be associated with reduced risk of eczema in early childhood. This has now been observed



in two separate Australian cohorts, in Adelaide (n=270) at latitude of 35° South and in Perth (n=231) at latitude of 32° South. In these two Australian cohorts, no associations between cord blood 25(OH)D concentrations and development of allergic sensitisation, allergic rhinitis or asthma in early childhood until 3 years of age were found. Several randomised controlled trials of early life vitamin D supplementation for the prevention of eczema in infancy are now underway.

Vitamin D and glucocorticoid interactions in early life: implications for adult neuropsychiatry?

Dr Caitlin Wyrwoll | University of Western Australia

Epidemiological studies and animal models have highlighted a link between early life vitamin D deficiency to subsequent alterations in neurodevelopment and adult neuropsychiatric disorders. Recent research by our group in rodent models has revealed a novel and potentially crucial role of the hypothalamic-pituitary-adrenal (HPA) axis in vitamin D deficiency. The HPA axis produces glucocorticoids, which are classically referred to as 'stress' hormones, but these hormones have an additional critical role in the maturation of fetal and neonatal tissues. The developing brain is particularly sensitive to glucocorticoids and over-exposure has negative ramifications for brain development and subsequent adult behaviours. Our data demonstrate that vitamin D deficiency in rodent pregnancy results in increased exposure of the fetal brain to glucocorticoids, and alterations in fetal neural gene expression and adult behaviours indicative of autism spectrum disorder-like behaviour. Unravelling the significance of vitamin D and glucocorticoid interactions will be crucial for the proper understanding of how vitamin D deficiency impacts on neurodevelopment and later health.

Repeated periods of vitamin D deficiency in childhood are associated with increased risk for asthma and related conditions: findings from a high-risk birth cohort.

Dr Elysia Hollams | Telethon Kids Institute

Human studies investigating whether low vitamin D is a risk factor for asthma or allergy in childhood have yielded conflicting results; the majority of these studies have taken a single 25(OH)D measure per child, at ages that vary greatly between studies. We hypothesized that inadequate vitamin D during childhood promotes development of asthma by increasing susceptibility to two major asthma risk factors: allergic sensitisation and severe respiratory infection. We measured 25(OH)D from plasma samples collected at eight specific ages between birth and age 10 years in children within the high-risk Childhood Asthma Study (CAS) cohort and conducted cross-sectional and longitudinal analyses relevant to this hypothesis.

Developing a protocol and assay to measure 25-hydroxyvitamin D concentrations in saliva

Dr Lucinda Black | Telethon Kids Institute

Currently, paediatric data for the prevalence of vitamin D deficiency in a representative sample of the Australian population are not available. This is largely because venepuncture is often considered invasive, painful and an unnecessary burden for healthy children. However, childhood may be a critical time to maintain optimal vitamin D status, both for bone health and for non-skeletal conditions, including asthma, allergy, cardiometabolic health and cognitive function. This project aims to develop a protocol and assay to measure 25-hydroxyvitamin D (25(OH)D) concentrations in saliva for the assessment of vitamin D status, while maintaining precision and accuracy compared to measuring 25(OH)D concentrations in serum samples. This would provide an easy and painless way to

assess vitamin D status in children in population studies, to diagnose vitamin D deficiency in paediatric patients without taking blood, and to regularly monitor vitamin D status during treatment of vitamin D deficiency.



Photoprotection and Vitamin D

Professor Antony R Young | King's College London

Terrestrial ultraviolet radiation contains UVB and UVA. UVB is essential for vitamin D synthesis, but is also the main cause of sunburn and skin cancer. Sunscreen use is advocated to reduce the sun's adverse effects, but may compromise vitamin D status. We studied the impact of sunscreens on vitamin D status during a one-week sun-holiday in Tenerife (28°08'N; 16°73'W) in March. There were two sunscreen intervention groups to compare two formulations with the same sun protection factor (SPF = 15). One protected against UVB, and the other against UVB and UVA (broad-spectrum). Healthy Polish volunteers were given the sunscreens daily and advised on correct application. Comparisons were also made with a discretionary sunscreen use group in Tenerife and a non-holiday group in Poland (51°45'N; 19°27'E). Serum 25(OH)D₃, assessed by mass spectrometry, showed that baseline vitamin D status was similar ($p = 0.19$) across the four groups. There was an increase ($p = 9 \times 10^{-8}$) of 28.0 ± 16.5 (SD) nmol/L 25(OH)D₃ in the discretionary use group, which had sunburn (assessed by reflectance spectroscopy) on 5 body sites. Both intervention sunscreens inhibited sunburn. The broad spectrum, and UVB sunscreen groups showed increases ($p \leq 6.7 \times 10^{-5}$) of 19.0 ± 14.2 and 13.0 ± 11.4 nmol/L 25(OH)D₃ respectively, the former being greater ($p = 0.022$) than the latter. The non-holiday group showed a fall ($p = 0.08$) of 2.5 ± 5.6 nmol/L 25(OH)D₃. Our data show that sunscreens may be used to prevent sunburn, yet allow vitamin D synthesis. Furthermore, a broad-spectrum sunscreen enables better vitamin D synthesis than a primarily UVB sunscreen for a given SPF.



Sunlight, nitric oxide and obesity: investigating mechanisms by which ultraviolet radiation suppresses signs of obesity and metabolic dysfunction

Dr Shelley Gorman | Telethon Kids Institute

Obesity is a crucial health and economic problem for Australians. In recent studies, we have found that frequent skin exposure to a low non-burning dose of ultraviolet radiation reduced weight gain in mice fed a high fat diet. These findings were independent of circulating vitamin D, and could not be mimicked by vitamin D supplementation. We are now starting to characterise the biological mediators (like nitric oxide) affected by ultraviolet irradiation and their potential to prevent obesity. Our novel findings suggest that ongoing exposure to safe doses of sunlight may prevent the development of obesity and metabolic dysfunction.



Vitamin D status and the relationship with cardiometabolic risk factors in a Western Australian adolescent population

Professor Trevor Mori | University of Western Australia

Using prospective data from the Western Australian Pregnancy Cohort (Raine) Study we investigated vitamin D status, predictors of serum 25-hydroxyvitamin D (25(OH)D) concentrations and cardiometabolic risk factors in adolescents and young adults. At 14 and 17 years 4% and 12%, respectively had serum 25(OH)D <50 nmol/l. Caucasian ethnicity, being sampled at the end of summer, exercising more, having a lower BMI, a higher calcium intake and a higher family income were significantly associated with higher serum 25(OH)D concentrations. Hierarchical linear mixed models with maximum likelihood estimation were used to investigate associations between vitamin D at 17 and 20 years and cardiovascular risk factors. Serum 25(OH)D was inversely associated with BMI and insulin resistance, and

in girls it was positively associated with triglycerides. There were no significant associations between serum 25(OH)D and high-density lipoprotein-cholesterol or systolic blood pressure.

The Solar UV Exposure and Physical Activity of Children Attending Childcare (SunPAC) study



Dr Hayley Christian | University of Western Australia
Ms Zakia Jeemi | University of Western Australia

The Solar UV Exposure and Physical Activity of Children at Childcare (SunPAC) study is part of the three year (2015-2017) Healthway-funded PLAYCE study (Play Spaces and Environments for Children's Physical Activity). The SunPAC study aims to investigate solar ultraviolet radiation exposure and physical activity levels of children aged 2 to 5 years and associations with modifiable characteristics in centre-based childcare. These modifiable characteristics include sun protection policies and practices; physical activity policies and practices; and shade cover. It is anticipated that findings from the SunPAC study will help highlight the influence of childcare sun protection and physical activity policies and practices on time spent outdoors and solar UV exposure and physical activity levels of young children.



UV Radiation and its Variability: An App to Fill a Void



Dr Richard McKenzie | NIWA Lauder, New Zealand

UV radiation is both harmful and beneficial, yet our bodies have no way of sensing it in real time. UV information is provided to the public in terms of the UV Index (UVI): but there is poor public understanding of what that it means. I will explain what the UVI is; and how it varies as a function of solar zenith angle, ozone, clouds, aerosols, altitude, and surface reflectivity – and the resultant peak UVI levels expected globally. I will also show the optimal exposure needed to maintain adequate vitamin D levels without getting sunburnt. I will introduce a new UVI App that has been developed for the New Zealand/Australia/Pacific/Antarctic region. The App aims to better inform the public about how the UVI is expected to vary throughout the

How UVB phototherapy may suppress immunity



Professor Prue Hart | Telethon Kids Institute

We have an NHMRC-funded trial to give UVB phototherapy to participants with Clinically Isolated Syndrome, a pre MS condition. We propose that UVB phototherapy may prevent or dampen any progression to MS. But how may UVB phototherapy regulate immune responses? We propose that there is an epigenetic imprinting by signals from UV-irradiated skin on bone marrow macrophage and dendritic cell progenitor cells. In turn, the daughter cells differentiating from these progenitor cells have altered immunological functions

day, and the times that protection is needed. It can be used to plan daily activities to optimize sun exposure, and as an educational tool. A further development of the App will provide global coverage, and will allow users to investigate effects of solar zenith angle, cloud cover, aerosol extinctions, or snow cover. In addition to providing the daily progression of UVI at the current location and time, results can also be displayed for any location, and for any season.



Balancing the Risks and Benefits of Sun Exposure for Better Health

Associate Professor Craig Sinclair | Cancer Council Victoria

Exposure to ultraviolet radiation (UV) accounts for around 99% of non-melanoma skin cancers and 95% of melanomas. On the other hand, there is good evidence that exposure to sunlight enhances vitamin D levels that can have an impact on improving bone and musculoskeletal health. This paradox creates a significant challenge for those working in public health, and especially in cancer agencies, to ensure an appropriate balance is communicated to the general public that takes into account the risks and benefits of sun exposure.

This year, over 25 experts came together from across Australia to update the 2007 Risks and Benefits of Sun Exposure position statement, a joint statement of the Australian and New Zealand Bone and Mineral Society, Osteoporosis Australia, Cancer Council Australia and the Australasian College of Dermatologists. The results were surprising. This presentation explores what we have learnt from ten years' experience in communicating this balance, but more importantly, what have we learnt, based on the best available evidence, to enable us to reshape our public health messaging to ensure the right balance of risk is communicated to the general public in relation to UV.



Gaps in our knowledge of sun exposure and health

Professor Robyn Lucas | Australian National University

Over the past 35 years we have built a strong evidence base that shows the risks to health of excessive exposure to health. More recently we have recognised the importance of some sun exposure to maintain vitamin D levels, and most recently begun to recognise that there may be other benefits of sun exposure. This recognition of a need to consider both risks and benefits, and that vitamin D supplementation may not reap all the benefits has revealed gaps in our knowledge. We don't know what "excessive" means in quantitative terms. This depends to an extent on skin type and age, but our measures of skin type are crude and most of our research on risks vs. benefits has been done on adults only. We are recognising the importance of the pattern of sun exposure, but need more information on rates of repair of damage, and the effect of exposing different areas of skin for different times under different conditions of ambient UV radiation. There is much yet to understand in order to be able to provide clear, evidence-based guidelines to Australians of all ages and skin types.





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