Professional Development Dermatology

UCD CHARLES INSTITUTE SEMINAR SERIES

UCD School of Medicine
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Charles Institute of Dermatology

Analysing light for life

Attendees at UCD's Charles Institute Seminar Series heard a presentation on artificial lighting and its implications for chronodisruption and human health

The Charles Institute, Ireland's national dermatology research and education centre, played host to a range of guest speakers who covered a variety of topics ranging from skin cancer to psoriasis, among others. The series, which was sponsored by RELIFE (part of the A.Menarini group), was designed to provide expert practical advice from a range of distinguished national and international experts in their respective fields and was chaired by Prof Desmond Tobin, Professor of Dermatological Science at UCD School of Medicine and Director of the Charles Institute of Dermatology. Each seminar in the series was broadcast to attendees with a special interest in dermatology in other locations, who accessed each talk remotely via an audio link.

Attendees at the seminar series heard a presentation from Dr David Baeza (PhD), Adjunct Professor at the Faculty of Pharmacy in Universidad San Pablo CEU, Spain, who spoke on the theme of 'Artificial Lighting: Blue Light and Chronodisruption'. Dr Baeza is qualified in the fields of pharmacy, optics and optometry and holds a Masters degree in renewable energies, along with a range of other qualifications in related areas, and is an expert in photobiology and serves as consultant for research and analysis of consumer products for national and regional administrations in Spain.

Dr Baeza provided an outline of the nature of light emitted by electronic devices and stated: "Light is the main synchroniser of the human biological clock. Human circadian rhythm disruption is based on our way of life… in terms of chronodisruption, international committees have studied non-visual effects of light because there are no official, independent publications that provide any guidance on what kind of light we need in our classrooms, our hospitals, and pretty much everywhere," Dr Baeza told the attendees.

The energy of a proton is directly proportional to its frequency and is inversely proportional to its wavelength, he explained. "I like to say that the frequency of a photon is like a key, and the chromophore is like the lock. Chromophores are a group of molecules that unlock the energy of a photon and they only absorb a certain amount of energy — no more and no less." He also described the effects of sunlight on human physiology compared to UV tanning devices and explained how he has been measuring the output of hundreds of these devices in Spain each year for some 15 years. "I have found 30-to-35 different spectral distributions. Every one of these have different proportions of UVB and UVA, so the effects of the skin are very different in every one of them." This is also important for physicians in assessing the dose of psoralen when administering PUVA therapy to patients, Dr Baeza pointed out.

UV absorption

He also outlined the positive effects of UV absorption and told the seminar: "Radiation is not absolutely positive or negative; it depends on the dose… if we do not know the irradiance from a device, we cannot calculate the dose." He also pointed to new research, which shows that "UVA radiation of human skin vasodilates arterial vasculature and lowers blood pressure and results in less overall incidence of cardiovascular disease".

Dr Baeza told the attendees: "Red light stimulates the process of ATP synthesis, because it is absorbed by cytochrome C oxidase in the mitochondria, and near-infrared [light] produces micro-vibrations of carbon-hydrogen in bones , in all the molecules of the skin and the muscles," said Dr Baeza. "So the consequence of this absorption of red and near-infrared light is ATP synthesis, increased temperature, vasodilation and biostimulation." The process is similar to the absorption process in the human eye, he added.

Dr Baeza also highlighted media "scaremongering" on the potential damage to human skin via natural sunlight and pointed to studies on the irradiance produced by electronic devices . "I call this 'scare science'," he said. "I think our job is to improve people's health, not to generate panic."

He also referred to research which pointed to "a pandemic of myopia. There is very interesting research that puts forward a new perspective on this… one researcher suggests that there is 10 per cent less myopia in Taiwan since 2010. It is recommended that schoolchildren spend one-and-a-half hours outdoors every day and that one or two hours of their classes should be held outdoors," he said. "It is also suggested that blackboards should receive 1,000 lux of light. European standards say that our desks should receive 500 lux… and other research shows that blue light stimulates dopamine secretion in the eye. If the light is too dim, the dopamine levels in the eye decrease and the consequence of that is an elongated eyeball… myopia is related to time spent outdoors and German research shows that there is a 30 per cent less risk of myopia in children if they spend two hours each day outdoors."

Human beings have evolved to be designed for hunting over long distances, he pointed out, and this is the reason for the ocular evolution of the human eye . "This is why we often have blue wallpaper on our computers, for example, because this means our eyes require less effort for accommodative function and convergence. It's all based on ergonomics."

Night shifts

People such as doctors and nurses who work night shifts face certain challenges in terms of absorbing an appropriate amount of light, Dr Baeza pointed out. "These people receive electric lighting at a time when they would normally have hours of darkness," he said. "They are often unable to adjust completely to these imposed patterns of sleep-wake because of rest days and adjustment in sleeping patterns. This is the reason that the international agency for cancer research has mentioned these workers as being at a higher risk of cancer."

This type of chronodisruption is linked in research to not only cancer development, but also to progression when a person's molecular clock is disrupted. There is a clear link between the skin and chronodisruption in terms of cortisone levels, pruritus and dermatitis, he explained. Consequences of a disrupted circadian rhythm include increased risk of cardiovascular disease, immune system deregulation, breast cancer, obesity, diabetes, metabolic syndrome, accelerated ageing, mood disorders, depression, affective disorders, cognitive impairments and skin diseases, he pointed out, suggesting that "the simple solution is light during the day, and darkness at night".

Dr Baeza concluded his talk by stating: "We need more research focused on vitamin D status. Now we have LED, UVB monochromatic LED, and UVA monochromatic LED and we need to be exact in terms of the doses of these. The standards of the International Illumination Committee states that it is possible to maintain vitamin D levels using UV sources designed specifically for that purpose," he said.

"Our team has developed three prototypes," he continued, "and I believe we need more UVB for vitamin desynthesis. In conclusion, it think it is very interesting to study the effects of obstruction of blue light with cytochrome P 450, as there seem to be very few or no papers written about this. We are offering to conduct research with dermatologists on how to improve vitamin D synthesis, with minimal risk, to copy the visible light from a given part of the world with LED.

"In Western countries, we have less indoor light than we need and I am sure this is one of the causes of depression and problems with alcoholism," he added. "The effects of blue light from electronic devices is open to interpretation but I believe phototherapy with visible light is healthy… as for the future, I believe we can do a lot of good things. We can produce guidelines for the use of devices for both children and adults, as well as for those who assess the effects of working in certain buildings, because nobody knows the quantity of blue light emitted by overhead lights."

Mixed messages

During an interactive Q&A session following the presentation, Prof Tobin raised the issue of the average person now living in a maladapted environment and receiving mixed messages in terms of nutrition, use of sunglasses and selecting an appropriate source of vitamin D intake. "Somebody pointed out that around 5 per cent of the entire human genome is supposed to operate partially through the vitamin D receptor, which of course is a consequence of the fact that we evolved under sunlight," said Prof Tobin, who also explained that the World Health Organisation has listed sunlight as the only carcinogen that can also potentially be beneficial.

Prof Tobin also explained that in tanning salons, while the output of the first bulb on a sunbed is measured, when it is replaced, the irradiance levels from possibly cheaper replacement bulbs is not assessed, which poses potential hazards for users. Dr Baeza responded: "When I was studying for my PhD, I read between 100 and 150 papers and in only three of those the researchers had measured the output of UV tanning devices… when you see a patient, you have no idea how many times they have been in Miami, or Cuba, for example, so the problem for the biologist is that you also do not know what level of irradiation someone has received from a UV tanning device," said Dr Baeza. "They could have been receiving anything between UV4 and UV25. The law in Spain dictates that every year, the output from these UV tanning devices must be measured. Also, in Spain, we are skin type 3 and 4 — in Ireland, you are skin type 1 and 2."

Dr David Baeza

Speaking with the ***Medical Independent (MI)*** following his presentation, Dr Baeza commented on the difficulties faced by general practitioners in Ireland when the need arises to offer advice to the public in general, and particularly to concerned parents, regarding the use of technology and social media and the effects these may have on sleep patterns.

"The most clear advice would be to say that at 10pm, electronic devices should be switched off and left outside of the bedroom," he explained. "For example, if a child has a device close to them and it is turned on, they will probably wake up three or four times during the night to see what's going on with WhatsApp, for instance. That's why these devices should be left outside the room."

However, he also addressed the obstacles to implementing such a regime. "I try this with my own children and it can be very difficult," he told MI. "It's also a very easy thing to forget to do. There is a very addictive component to these devices and social media, which is why the devices should be out of the room completely. If the device is close to them, it will promote dopamine release and stimulate adrenaline, so people do not sleep so well because of this. That applies to adults as well as children," he concluded.

Relife has had no input into the content of the series or article.