UPCOMING COURSES IN 2013 / 2014

Biological Lighting: February 2014
NA 058-00-27 AA (FNL 27) „Wirkung des Lichts auf den Menschen“

DIN Deutsches Institut für Normung e. V.

Biologisch wirksame Beleuchtung - Planungsempfehlungen

Vorstellung der DIN SPEC 67600:2013-04

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Visual Function

Non-visual Functions

Light and the Brain
The Natural Environment

Day-night cycle with dawn-dusk transitions and seasonal changes in daylength
Daylight is dynamic

sunrise 04:59       sunset 21:14

Copenhagen  55º 40' N, 12º 35' E  15 May 2014
Our ancestors awoke with dawn and slept after dusk
Humans are seasonal, but the seasons have diminished in impact. Is it the advent of artificial light and heating?
Seasonal and social influences on human reproduction
Monthly birth rates in Spain 1900-1978

30% seasonal amplitude
peak spring

End of Civil War
End of World War 2
End of Monarchy
Electrification of entire country

Non-visual function: light is a Zeitgeber = Synchronising agent for the biological clock
Spectral composition of light is relevant.

“circadian” photoreceptor with blue-sensitive photopigment melanopsin.
Light Intensity is Important!

**Lux** (log Skala)

- Midday sun: 100,000
- Daylight: 10,000
- Sunrise: 1,000
- Twilight: 400
- Full moon: 0.2
- Starlight: 0.0001

100-300 lux indoor lighting

Light therapy
Dose-response curve to light

Subjective Alertness

Slow Eye Movements

EEG Power Density (5-9 Hz)

even more sensitive to blue light

Timing of Light Exposure is crucial

Morning light synchronises the biological clock to 24 hours

- Rhythms are advanced

Evening light has the opposite effect

- Rhythms are delayed
Non-visual effects of light are widespread

mood
cognition
alertness
performance
sleep

modified from Vandewalle et al. Trends Cogn Sci, 2009
Light therapy: sensational success in fighting winter depression
Light - how much, when, for whom?

Homes and work places may need to achieve 500 - 1000 lux in the direction of gaze. Energy saving conflicts with health, but not much energy is needed if light is near the eye, and limited to a short period in the morning.

“And the dim fluorescent lighting is meant to emphasize the general absence of hope.”
Schoolkids don't see much morning light

Bright morning light needed by adolescents and young adults, as soon after getting up as possible. School rooms may be too dark: 500 – 1000 lux would help.

OR: more natural: later school times
OR: blue-blocking glasses in the evening
Older persons don't see evening light very much.

Evening light may be important, e.g. while watching TV. Living rooms are too dark. Since the average is 30 lux, small improvements might help.
Architecture modifies length of hospitalisation in depressive patients

Morning: 1400 lux
Afternoon: 3000 lux

West

23.5 days (N=74)

Morning: 15500 lux
Afternoon: 2700 lux

East

20 days (N=113)

Dying in the Dark
Outcome on a cardiac intensive care unit after heart attack (N= 628)

length of stay  mortality

sunny rooms  2.3 days  7.2%
dull rooms  3.3 days  11.6%

Enhancing light intensity in nursing homes

before...

- 20 lux

after...

- 1000 lux

- Slows down cognitive decline
- Increases 24-hr activity rhythm amplitude
- Reduces incidence of depression
- Improves capacities for daily living

Retirement homes: lighting design must include circadian components to enhance sleep quality, wellbeing, health
Older persons with sleep problems spend less time in daylight

Daily profile of light exposure at eye level

Circadian rhythm of melatonin

- Elderly insomniacs during light exposure
- Young Controls
- Elderly Controls
- Elderly insomniacs

Melatonin (pg/ml)

Time of day

K Mishima et al, J Clin Endocrinol Metab (2001) 86:129-34
Light-Dark / Day-Night cycle

important for health and recuperation

- intensive care
- neonatal baby unit
- paraplegic unit
- oncology practice
- nursing homes
Entrainment needs light

Get half an hour a day outdoors!
Most of the population gets less!!!
The First Law of Chronobiology

rhythms better - sleep better -
think better – feel better –
behave better

ENTRAINMENT!
The Second Law of Chronobiology

more light! more darkness!
Effects of light on performance, mood, and health occur through the simultaneous action (and interaction) of various CNS pathways.

When we talk about the effects of light on well-being, it is important to remember that there are several other pathways still waiting for more thorough investigation. Despite all the important advances thus far, we're a long way from having all the answers about how light affects physiology and psychology.
We’ve come a long way in a decade

- Discovery of a novel photoreceptor
- Importance of light for non-visual photic function
- Far broader effects than just on the circadian clock – impacts general health and wellbeing
- Research is still ongoing – lots of surprises ahead, too early for laying down rules
- LEDs (and new development of OLEDs) - unique opportunities to programme lighting spectra, intensity and timing to mimic daylight and enhance function
Entrainment by light: what do we need?

- sunlight?
- white light?
- blue-enhanced light?

- dynamic lighting?
- dawn-dusk simulation?

Many questions & many answers & many more questions...

- e.g. is blue better? But blue-enriched office light competes with natural light as a zeitgeber
- e.g. is more light better? Yes, but not sufficient to improve infrastructure - requires active exposure to light

...depends on situation
Circadian Rhythms and Health
what is important?

Stable internal and external phase relationships

- appropriate entrainment to the light-dark and sleep-wake cycle
- enough light, enough darkness
- adequate retinal function
- sufficient social zeitgebers
- reconsider the zeitgeber function of timed activity and meals
So what will the Circadian House of the future look like?

Watch this space.....!
26th Annual Meeting
Society for Light Treatment & Biological Rhythms

Symposia
• Clocks, Sleep & Mood Disorders
• Direct Neuro-Biological Effect of Light
• Light in the Elderly

June 27-29, 2014
Venue: Schloss Schönbrunn- Vienna
Hotel: Courtyard Marriott, Vienna

Matthäus Willeit, MD
Department of Biological Psychiatry
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Austria

www.sltbrmeeting.org
Teaching Course on Light Therapy
- Ins and Outs of Light Therapy for Circadian Sleep and Depressive Disorders
  M.Terman (Columbia University, New York)
- The dark and bright side of light (on retinal photoreceptors)
  F.Hafezi (University of Geneva)
- Various disorders that can be treated with light
  A.Wirz-Justice (University of Basel)

Symposia
- Direct Biological and Behavioral Effects of Light
- Clocks, sleep and mood Disorders
- Chronobiology of Aging and Dementia

Keynote Lecture:
Retinal and brain circuits underlying the effects of light on mood
S. Hatter (Johns Hopkins University, Baltimore)

+ Oral presentations and posters