Society for Light Treatment and Biological Rhythms

Program and Abstracts: Volume 26

26th Annual Meeting
June 27-29, 2014

Schloss Schönbrunn Conference Center
Vienna, Austria

www.sltbrmeeting.org

Matthäus Willeit, SLTBR President 2012-2014

Local arrangements are made courtesy of:

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Contact SLTBR at sltbrinfo@gmail.com

Message From Our President & Local Host

Dear Friends & Colleagues,

On behalf of the 2013-2014 organizing committee and board of directors, I would like to welcome you to the 26th Annual Society for Light Treatment and Biological Rhythms meeting!

As my last year as president, I am delighted to host the meeting in Vienna. In addition to the exciting program, I hope that you will also find time to enjoy the city and special attractions during this time of year!

I would like to thank both our new and returning sponsors, who have made this meeting possible. I also hope for both the participants and the sponsors that there will be a lot of interaction during the coffee breaks and poster session.

Last, but certainly not least, I would also like to give a warm welcome to our incoming president, Prof. Klaus Martiny, who will take the position of president for the next two fiscal years. I look forward to the future with Prof. Martiny leading the organization.

Thank you again for your support & participation,

Matthaeus Willeit, MD
Dept. of General Psychiatry
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And, with special thanks for a private donation from Dr. Fritz Grass

Scientific Program

Friday, June 27, 2014

09:30 Welcome, Introduction & Program Overview **Maria Theresia Room**
Matthäus Willeit (Medical University of Vienna, Austria)

09:45 Teaching course for newcomers to the field – hosted by Center for Environmental Therapeutics
An introductory survey for clinicians, researchers, and corporate members, with an emphasis on the therapeutic and physiological effects of light, applications, and caveats

09:45 **Ins and Outs of Light Therapy**
M. Terman (Columbia University, New York, USA)

10:30 **The Eye: Phototransduction and Ocular Health**
F. Hafezi (University of Geneva, Switzerland)

10:45 **Chronotherapeutics: Applications of Light Therapy and Sleep/Wake Manipulations**
A. Wirz-Justice (University of Basel, Switzerland)

12:00 Lunch Break/Poster Session
All presenters will be required to display their posters by 12:00
Posters will remain on display through Sunday (11:00)

Symposium I

14:00 Direct Biological and Behavioral Effects of Light
Chairs and Moderators
K. Roecklein (University of Pittsburgh, USA), D. Oren (Yale University, New Haven, USA)

14:00 **Effects of Prior Light History on the Melanopsin-Driven PIPR in SAD**
K. Roecklein, (University of Pittsburgh, USA)

14:30 **Aberrant light influences mood and learning through melanopsin-expressing retinal ganglion cells**
T. LeGates, (University of Maryland, Baltimore, USA

15:00 **A Vienna story 114 years later: How the reinterpretation of Freud's dreams can inform the biology of psychiatry**
D. Oren, (Yale University, New Haven, USA)

15:30 **Non-visual light perception in the brains of worms and vertebrates**
K. Tessmar-Raible, (Max Perutz Laboratories, Vienna, Austria)

16:30 Coffee break/Poster Session
Presenters with an odd number will be asked to remain in front of their posters.

17:00 Special Lecture: Pharmacological treatment of depression in Seasonal Affective Disorder
Chair and Moderator - S. Kasper (Medical University of Vienna, Austria)
N. Praschak-Rieder (Medical University of Vienna, Austria)

17:30 Oral Presentations I

17:30 **The nuclear receptor REV-ERBα regulates Fabp7 and modulates adult hippocampal neurogenesis**
U. Albrecht, (University of Fribourg, Switzerland)

17:45 **Blue light increases morning serotonin levels in sleep-restricted individuals**
M. Figueiro, (Rensselaer Polytechnic Institute, USA)

18:00 **The influence of carbon monoxide on the secretion of melatonin in vitro**
M. Koziorowski, (University of Rzeszow, Poland)

18:15 **The effect of the dawn light simulation on cognition and cardiac protection**
A. Viola, (University of Basel, Switzerland)

Saturday, June 28, 2014

08:00 Registration Opens

Symposium II

09:00 Clocks, sleep and mood disorders
Chair & Moderator
U. Albrecht (University of Fribourg, Switzerland)

09:00 **Human Sleep & Circadian Phenotypes in relation to Psychosis**
K. Wulff (Oxford University, United Kingdom)

09:20 **About the role of monaminergic neurons, clock neurons and glia cells in the control of sleep in Drosophila melanogaster**
C. Foerster (University of Würzburg, Germany)

09:40 **Clock effects on sleep**
P. Franken (University of Lausanne, Switzerland)

10:00 **Circadian dysregulations in mouse models of depression**
D. Pollak, (Medical University of Vienna, Austria)

10:30 Coffee Break & Poster Session
Presenters with an even number will be asked to remain in front of their posters.

11:00 Keynote Lecture: Retinal and brain circuits underlying the effects of light on mood

Samer Hatter (Johns Hopkins University, Baltimore, USA)

12:00 Lunch Break

13:30 Oral Presentations II

13:30 **The SAFE study: Electronic Monitoring of patients with depression when discharged from in patient wards**
K. Martiny, (IAA Mental Health Centre Copenhagen, University Hospitals Copenhagen, Denmark)

13:45 **Midday light therapy for bipolar depression: a randomized control trial**
D. Sit, (University of Pittsburgh, USA)

14:00 **The relation between chronotype and treatment outcome with LT on a fixed time schedule**
S. Knapen, (University Medical Center Groningen, The Netherlands)

14:15 **Dawn Simulation vs. Bright Light in SAD: Treatment effects and subjective preference**
K. Danilenko, (Siberian Branch of the Russian Academy of Medical Sciences, Novsibirsk, Russia)

14:30 Siegrun Appelt (Artist, Vienna): Langsames Licht / Slow Light

15:00 Coffee Break & Poster Session
Presenters with both even and odd numbers will be asked to remain in front of their posters.

15:30 SLTBR Board Meeting (by invitation only)

19:00 Congress Reception – sponsored by Philips **Schloss Schönbrunn Terrace**
(All paid registrants & sponsors welcome)

Sunday, June 29, 2014

Symposium III

08:00 **SLTBR Annual Business Meeting** (SLTBR Members only)

09:00 **Chronobiology of Aging and Dementia**
Chairs and Moderators
D. Kunz (Charité - Universitätsmedizin Berlin, Germany),
M. Münch (Charité - Universitätsmedizin Berlin, Germany)

09:00 **Effects of healthy aging on spectral sensitivity to light**
C. Gronfier (Stem-cell and Brain Research Institute, Strasbourg, France)

09:20 **Light supplementation in older people living in the community and in care homes**
D. Skene (University of Surrey, United Kingdom)

09:40 **Aging modulation of the impact of light on cognitive brain functions**
V. Daneault (University of Montreal, Canada)

10:00 **Effects of light on emotions and immunological variables in demented patients**
M. Münch, (Charité - Universitätsmedizin Berlin, Germany)

10:20 **Melanopsin-based direct photic regulation maintains a sleep-wake cycle in arrhythmic clock-disabled mice**
P. Bourgin (Strasbourg University, France)

10:40 **Break/Poster Session**
Presenters with both even and odd numbers will be asked to remain in front of their posters.

11:15 **Oral Presentations III**

11:15 **An examination of perinatal photoperiod and adult response to chronobiological stress in a large international sample**
M. Young, (Illinois Institute of Technology, USA)

11:30 **Comparison of light-induced melatonin suppression in children and adults**
S. Higuchi, (Kyushu University, Japan)

11:45 **Toward a working threshold for nocturnal melatonin suppression by white light**
M. Rea, (Rensselaer Polytechnic Institute, USA)

12:00 **News on Biophotons, An old story retold, A Review.**
F. Grass, (University Clinic for Psychiatry and Psychotherapy Vienna, Austria)

12:15 **Final Remarks by SLTBR President / Meeting Closure**

Abstract Listing

STUDYING HEALTH EFFECTS OF LIGHT ON ELDERLY PEOPLE WITH DEMENTIA. METHODOLOGY CONSIDERATIONS

Mariëlle P.J. Aarts (1), Emelieke R.C.M. Huisman (2), Babette C.E.L. Mattheus (1), Helianthe S.M. Kort (2)
(1) Department of the Built Environment, Eindhoven University of Technology, (2) Faculty of Health Care, University of Applied Science Utrecht

Objective
Research has demonstrated that light has positive effects on the health and well-being of people with dementia. These studies demonstrating both short therm as long therm health effects used an electrical lighting system providing around 1000 lx vertically at eye level during the day time. When using light as a drug, unclear is what exactly the recepy should be. Unknown aspects are what is the most adequate light spectrum, what is the optimum exposure time of exposure, what is the influence of light exposure during the night, is daylight as effective or even more effective as electric lighting, how influence eye diseases the results. The commonly used method for this type of research is a clinical trial using a combination of qualitative and quantitative data collection. Since the goal of this type of research is to search for a correlation between light exposure and health condition, knowledge of light and lighting is essential as well. In order to reach this goal it is important that research groups have both knowledge on how to assess health results as well as knowledge on how to assess the lighting condition people have been exposed to. The goal of this study was to determine the research methodology and protocol for determining the health impact of a ceiling mounted lighting systems under non-laboratorium conditions.

Methods
Light Measurements were performed in four communal living rooms with different orientations in a psycho-geriatric care facility for people with dementia in the Netherlands. Since living rooms tend to have daylight openings a distinction between daylight and electric lighting was made. The daylight was assessed for a complete year, both by light simulation tools (Radiance) as well as by measurements during the shortest daylight period of the day (December). The light measurements included the illuminance and the color temperature of both the daylight as well as the electric lighting at a grid and for four orientations in the room. The communal living room was shared by 8-9 residents. All were diagnosed with different types of dementia but were relatively active. Also observations studies for 8 days during daytime from 9 am to 5 am were performed to register how long people stayed in the living room, at what position in the living room, what they did and whether they had their eyes opened or closed. Additionally, 4 observation evenings were included from 5 pm to 10 pm.

Results
The results of the lighting simulation showed that the position in the room and the viewing direction has a large influence on the amount of light people perceive at the eyes and that for these specific living rooms between 30% and 95% during the year, 1000 lx is provided by daylight only.
During daytime, on average 68% of the residents was present and during the evening it was 72% of the residents. People were most of the time eating and drinking (30% of the time), just sitting (26%) and chatting (15%). 11% of the time during daytime, people slept in the living room. The viewing direction was forward for 69% of the time and having the eyes closed for 18%, and looking downward for 12% of the time.

Conclusions
When studying the correlation between light exposure and health related effects under non-laboratorium conditions it is important to take the following into account when designing the research set-up.
The amount of daylight has to be monitored as well to come to a robust conclusion. Future study is needed to exam whether applying light-therapy by ceiling mounted luminaires is very effective. For about 30% of the time people are in the living room with the specific lighting condition, no direct light can stimulate the photo-sensitive (ganglion) cells in the retina.

Funding: This research is part of a bigger research program called BEZO. Externally funded by the Dutch SIA RAAK-publiek program.

THE IMPACT OF BROAD SPECTRUM BRIGHT LIGHT ON APPETITE IN HEALTHY YOUNG INDIVIDUALS

Mohammed AlBreiki (1), Benita Middleton (2), James Ebajemito (2), Shelagh Hampton (1)
Department of Biochemistry & Physiology, School of Bioscience & Medicine, Faculty of Health & Medical Science. University of Surrey.

Objective
This study aims to investigate the effect of broad spectrum bright light (>500lux) on appetite in healthy young individuals after a set meal ,and assess gender differences.

Methods
A favourable ethical opinion was obtained from the University Ethics Committee. Seventeen healthy participants, 8 females (22.2±2.59 SD years and 23.62 ±2.3 kg/m2) 9 males (22.8±3.5 years BMI=23.8±2.06 kg/m2) were randomised to a two way cross over design protocol; dim light condition (<5lux) and bright light condition (>500lux), separated by at least seven days. Each session started at 18:00h and finished at 06:00h the next day. Participants consumed an isocaloric and non-caffeinated evening meal (1066 Kcal, 38g protein, 104g CHO, 54g fat, and 7g fibre). The meal time were individualised based on melatonin onset (Dim light onset (DLMO)) obtained from participants' 48 consecutive urinary collection. In order to assess subjective appetite, an electronic visual analogue scales (VAS) was used (ProDiary). Appetite was assessed prior to and at regular intervals after the meal over a 5h postprandial period, 3 major parameters are reported; hunger, fullness and prospective food consumption. Statistical analysis was carried out using Statsoft STATISTICA with three factor repeated measures ANOVA (gender, time, treatment) on the satiation data.

Results
The results of 17 subjects for perceived hunger and desire to eat are shown below. Statistical analysis showed significant differences in hunger and desire to eat between bright light and dim light treatment (p= 0.013, p=0.009) respectively. However there was no statistical significance in subjective fullness rating (p=0.57).There was no effect of gender however there was a trend toward an interaction between treatment and gender in the desire to eat (p=0.08).

Conclusions
The results indicate that bright light increases hunger and desire to eat in healthy individuals. These interesting findings need investigating further initially by assessing hormones involved in satiation such as leptin and ghrelin.

Funding: This work was supported by Health authority in Abu Dhabi, United Arab Emirates.

RECOVER - IS HEALTH- PROMOTING LIGHT IN A PATIENT ROOM POSSIBLE?

Dominik Alder
XAL GmbH, Auer Welsbachgasse 36, 8055 Graz

Objective
To use the advantages of dynamic, daylight-like lighting in hospitals for the recovery of patients.

Methods
In January 2012, XAL started a research project together with the Institute of Spatial Design, Graz University of Technology, questioning: What is better light in a hospital. Specifically, color temperature and position of lighting (direct, indirect, illuminated ceiling) were studied. Following the preliminary studies for different lighting situations, two mock-up rooms were discussed and evaluated with an international panel of experts.
Development: Different lighting prototypes were built, a variety of LED light colors were tested, mixed together, beam angle and direction were optimized, light curve sequences for individual day parts written, tested and refined.

Results
Light is life!
With the analysis of daylight, XAL has approached the creation of a new patient room lighting system. The name of this system can be taken literally: "RECOVER". We want to support the patients with convalescence. RECOVER is a lighting system for rooms with1-4 beds, consisting of a controller integrated in a dual - flush-mounted box with 2 or 4 light sensors for the EXAMINATION LIGHT, a key selector switch for selection of the 4 pre-programmed lighting programs and the required 1 - 4 RECOVER bed lights, supplemented by a light and motion sensor for ceiling installation. Application: hospitals, rehabilitation centers, senior residences ...In the RECOVER bed light, a nurse call system (e.g. SCHRACK SECONET - *VISOCALL* or ZETTLER - *MediCall*) can be installed using a plug-in module, which then could be connected to a patient terminal. With this terminal, the built-in reading light can be controlled. The RECOVER bed lamp has three types of light: a reading light, an examination light and an indirect ceiling light. Each of the three types of light is absolutely glare-free for patients and nursing staff, emitted from recessed slots. The top cover is made of easy-care, detergent resistant and water-proof acrylic tub. The examination light of each bed lamp is switchable 24hours on the wall-side switch. The indirect ceiling light is set via the key switch by the nursing staff. 4 light programs can be selected. Besides OFF and ON (e.g. as cleaning light) the staff can choose the appropriate day lighting mood for the patient. For severely injured or newly operated patients a dim light is recommended. At ENERGY SAVE a time and brightness -dependent light program is stored, providing only the necessary light level that is prescribed by the institute operator or NORM. The pre-programmed setting is, for example, from 6:00 to 21:00, a regulated brightness of e.g. 100lx in case natural lighting is not sufficient. For patients who are to get quickly back on their feet, the nursing staff can select the ACTIVATE program. This program provides a nice-weather-day with early dusk, dawn, very bright morning light level, reduction for a siesta, second brightness peak in the afternoon, warm evening light and sunset. Everything to motivate the patients and to increase joy of living.

Conclusions
The Daylight program ACTIVATE helps the patient to recuperate during the day by simulating the typical diurnal light colors. In the morning, after twilight and sunrise atmospheres, the patient gets high light-intensity at a high color temperature to quickly suppress the sleep hormone MELATONIN, and produce large amounts of the hormones CORTISOL for alertness and SEROTONIN for motivation. This increases the patients' joy of living and the feeling of taking part in life. The desire for faster recovery grows.
The high color rendering of the lunch light makes the food look appetizing, followed by a siesta light supporting the afternoon resting phase by dimmed warm white light. A second afternoon brightness peak cheers the patients up again. Towards the evening, the light color is getting warmer and brightness decreases, the illuminated part of the ceiling is reduced, the patient can come to rest. The day ends with a beautiful sunset atmosphere. Get well soon - RECOVER by XAL.

THE EFFECTS OF EXPOSURE TO BLUE LIGHT ON FLIGHT-CREW ALERTNESS DURING LONG HAUL FLIGHT OPERATIONS.

Lori J. Brown (1), Toine Schoutens (2), Geoffrey Whitehurst (1), Troy Booker (1), Travis Davis (1), Spencer Locinski (1), Ryan Diehl (1)
(1) Western Michigan University, Kalamazoo, Michigan USA (2) DAVITA Nederland BV, The Netherlands

Objective
Fatigue is a common complaint for aviation crew-members, with particular concern among long haul flight-crew. Effective countermeasures are not well established. The study aimed to investigate the efficacy of blue light therapy to improve alertness in flight crew-members.

Methods
Fourteen long haul flight crew members, males and females, working during the day and night as a pilot or flight attendant, participated in this study. During the 4 week study, the crewmembers wore actigraph wrist bands, recorded self-assessed levels of sleepiness, fatigue, and completed daily psychomotor vigilance tests. In the third and fourth weeks, the flight crew-members were exposed to blue light (BL) in field-based treatment with short wavelength (blue, 465nm) light therapy. A repeated measures multivariate analysis of variance (MANOVA) was conducted, using IBM SPSS Statistics 20 software, to test the intervention effect of blue light (IV) on both flight and cabin crew alertness, measured by the 4 DVs; KSS, SP, PVTR, and PVTL.

Results
A one-way MANOVA revealed a significant multivariate within-subject main effect for time (pre and post light intervention), Wilks' λ = .609, F (4,55) = 8.843, p <. 001, partial eta squared = .391, and the power to detect the effect was .999. The analysis also revealed a significant multivariate between-subject main effect for position (flight/cabin crew), Wilks' λ = .506, F (4,55) = 13.429, p <. 001, partial eta squared = .494, and the power to detect the effect was 1.000.
The results show that there was a significant difference in alertness between pre-intervention and post-intervention for each crew member, and that 39.1% of the variance is explained by pre/post light intervention. Thereas also a significant difference in alertness levelsnbetween pilots and flight attendants with 49.4% of the variance is explained by position (flight/cabin crew).

Conclusions
Exposure to blue light increased alertness, among flight crew-members. The effects of blue light on reaction time varied according to the crew-member position. After controlling position, treatment with high-intensity blue light therapy resulted in reduced fatigue and sleepiness during the treatment phase. There was also significant treatment effect observed psychomotor vigilance performance among cabin crew. Blue light therapy appears to be effective in alleviating fatigue and sleepiness and may offer a noninvasive, safe, and non-pharmacological alternative to current countermeasures.

Funding: The study was funded by Western Michigan University, Faculty Research and Creative Activities Award (FRACAA). Equipment for the study was provided by Nature Bright Company. Lori Brown serves as scientific advisor for Nature Bright Company. KSS, SP and PVT data was collected by Jeppesen CrewAlert, a Boeing Company, using the Jeppesen CrewAlert APP and Boeing alertness model.

AGING MODULATION OF THE IMPACT OF LIGHT ON COGNITIVE BRAIN FUNCTIONS

Veronique Daneault (1,2,4) Marie Dumont (2), Marc Hébert (3), Julien Doyon (1,4) Julie Carrier (1,2,4) Gilles Vandewalle (1,2,4)

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Objective
Light exposure, particularly blue light, is being recognized as a potent mean to stimulate alertness and cognition in young individuals. Aging is associated with changes in alertness regulation and cognition. Whether the effect of light on cognitive brain function changes with aging is unknown, however. In this study, we investigated the acute effect of blue light on non-visual cognitive brain activity as a function of age.

Methods
Thirty subjects (16 young: 23y; 14 older: 61y) completed fMRI measures with undilated pupils. During fMRI acquisitions, subjects performed an auditory working memory 2-back task while alternatively exposed to darkness or short (45s) monochromatic blue light (480nm), presented at low (7x1012ph/cm2/s), medium (3x1013ph/cm2/s), and high (1014ph/cm2/s) irradiance levels.

Results
fMRI analyses revealed that blue light exposure induced higher brain activation in the amygdala, thalamus and cerebellum in young than in older subjects (p corrected<0.05). In addition, compared to older subjects, young subjects showed enhanced brain responses to increasing light irradiance in the prefrontal cortex, occipital cortex, and cerebellum (p corrected<0.05). Thus, the impact of light on subcortical and cortical brain areas involved in the ongoing cognitive process differs between young and older individuals.

Conclusions
These results support the notion that aging differentially affects brain reactivity to light during an ongoing task in regions taking part in the salience and executive networks.

Funding: IRSC, CRSNG, FRSQ

DAWN SIMULATION VS. BRIGHT LIGHT IN SAD: TREATMENT EFFECTS AND SUBJECTIVE PREFERENCE

Konstantin V. Danilenko, Iana A. Ivanova
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Objective
Dawn simulation is an alternative, time-saving light therapy for seasonal affective disorder (SAD, winter depression; Golden et al., 2005). In parallel groups comparison studies, dawn simulation has been found to be less effective than bright light (Lingjaerde et al., 1998), similarly effective (Terman and Terman, 2006) and elsewhere more effective than bright light (Avery et al., 2001). This study investigated the treatment outcomes in the crossover design and preference for a particular type of light therapy, and extends our preliminary published data (Hayes and Danilenko, SLTBR-2005).

Methods
In all, 40 DSM-IV-diagnosed SAD patients (2 m and 38 f; age mean ± SD 46.1 ± 13.1 y; range 21-76 y) were treated with bright light or dawn simulation for a week in 1995-2014 (crossover, counterbalanced order). The interval between two treatment sessions ranged from 20 days to 5 years. Bright light (Lumie® light box) was white light 4.300 lux at a distance of 30-41 cm for 30-45 min shortly after awakening. Dawn simulation (Lumie® dawn simulator) was a gradually increasing light during the last 30 min of sleep achieving 100 lux at the distance of 50 cm from the pillow at the alarm beep, and subjects were asked to place the dawn simulator closer to their open eyes (30 cm : 250 lux) for a further 15 min. The self-rating version of the Structured Interview Guide for the Hamilton Depression Rating Scale - Seasonal Affective Disorder Version was completed on the day before and day after the treatment session.

Results
Depression score reduced similarly following dawn simulation and bright light: 42.2% and 43.8%, respectively (median values, p=0.28, Wilcoxon test); efficacy ratio was 17:23. The preference for dawn simulation vs. bright light was also similar (19:21). Bright light was preferred for long-term therapy since patients seem to feel immediate positive effects and found light box simple to use. Dawn simulation was preferred for a less intense, more "natural" action (particularly on recovering from sleep), for time-saving and in cases where bright light caused eyestrain (N=3).

Conclusions
Dawn simulation is as effective as bright light in the treatment of winter depression. Though many patients point out a greater direct effectiveness of the bright light, some advantages of dawn simulation seem to increase patients' compliance and, thus, treatment outcome. Potential confounders of the study results are yet to be analyzed.

Funding: The study was supported by Lumie®.

MANIC EPISODE OF BIPOLAR DISORDER: LIGHT EXPOSURE INFLUENCES THE CLINICAL COURSE

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Objective
Many evidences demonstrate the correlation between bipolar patients and chronobiology. Those patients are more sensitive to the biological effects of light, which can exert an antidepressant effect and trigger rapid mood swings. The orientation of rooms in a Canadian ward provided a "natural experiment" on the relationship between sunlight exposure and length of hospitalization for depression. In 1999 at San Raffaele-Turro Hospital in Milan this result was replicated: inpatients located in the East side rooms (E group) had a shorter hospitalization than inpatients located in the West side rooms (W group). In 2010 we conducted a retrospective study reviewing charts of manic patients admitted at San Raffaele-Turro Hospital of Milan (Italy) and at Santa Croce Clinic of Locarno (Swiss). We found that, in contrast to depressed patients, manic W group had a significantly shorter hospitalization than E group. We presented these results at the SLTBR Meeting 2012 in Montreal.
The aim of our study is to confirm our previous results and to assess if light exposure influences also the clinical course of a Manic Episode.

Methods
We selected 45 inpatients over 18 years old who met DSM-IV-TR criteria for BD. The study was conducted at Santa Croce Clinic, Orselina (Swiss) and at the Mood Disorders Unit of San Raffaele Hospital, Milan (Italy). The inclusion criteria were: Axis I diagnosis of BD; a Manic Episode with a Young Mania Rating Scale (YMRS) score > 20; absence of other diagnosis on Axis I, II or III. East side rooms and West side rooms were randomly assigned according to the availability. Patients were treated with an antipsychotic, mood stabilizers and/or benzodiazepines in an open-label trial. During a period of four weeks patients clinical course was weekley monitored with YMRS. We used STATISTICA 6.0 for the analysis.

Results
E group and W group show no difference regarding clinical, demographic characteristics and YMRS basal scores. Using ANOVA analysis, we found a better improvement of YMRS score in W group than in E group, current effect: $F(4, 148)=4.04$, $p=0.00$. Considering the patients (N° 21, 46.67 %) treated with high antipsychotic doses, as defined by current literature, the YMRS scores improvement was still better for W group patients than for E group, current effect: $F(4, 68)=2.69$, $p=0.03$.

Conclusions
Since the YMRS score improvement was better in W group than in E group, bipolar patients sensitivity to light exposure has been confirmed. Among patients treated with high doses of drugs, only W group patients had a good clinical response: our results suggest that reduction of light exposure and the dark period expansion can have an antimanic effect. Moreover, a lower number of patients in E rooms (58.82 %) than in W rooms (81.82 %) reached the threshold of clinical response, without a significant statistical difference. Our results strengthen the role of light exposure and chronobiology in the management of BD. There are many evidences about chronobiology influence on depression: the encouraging results about manic patients could better define its pathogenetic role.

A TRAIN OF BLUE-LIGHT PULSES DELIVERED THROUGH CLOSED EYELIDS SUPPRESSES MELATONIN AND PHASE SHIFTS THE HUMAN CIRCADIAN SYSTEM

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Objectives: A model of circadian phototransduction was published in 2005 to predict the spectral sensitivity of the human circadian system to narrowband and polychromatic light sources, by combining responses to light from the spectral-opponent "blue" versus "yellow" (b-y) cone bipolar pathway with direct responses to light by the intrinsically photosensitive retinal ganglion cells (ipRGC). In the model, depolarizing "blue" responses, but not hyperpolarizing "yellow" responses, from the b-y pathway are combined with the ipRGC responses. The ipRGC neurons are known to be much slower to respond to light than the cone pathway, so an implication of the model is that periodic flashes of "blue" light, but not "yellow" light, would be effective for stimulating the circadian system. The present study was designed to further the basic understanding of circadian phototransduction by exploring the theoretical hypothesis that brief pulses of short-wavelength light (blue) could evoke a circadian phase shift and nocturnal melatonin suppression, while brief pulses of longer-wavelength (green) light would not evoke the same response by the circadian system. A secondary goal of the present study was to broaden the technical foundations for future clinical applications of light delivery through closed eyelids of sleeping patients.

Methods: A within-subjects study was designed to test the implications of the model regarding retinal exposures to brief flashes of light and to broaden the foundation for clinical treatment of circadian sleep disorders by delivering flashing light through closed eyelids while people are asleep. In addition to a dark control night, the eyelids of 16 subjects were exposed to 3 light-stimulus conditions while they were asleep: 1) 2-s flashes of 111 W/m^2 of blue (peak wavelength approx 480 nm) light once every min for 1 h, 2) 131 W/m^2 of green (peak wavelength approx 527 nm) light continuously on for 1 h, 3) 2-s flashes of the same green light once every min for 1 h.

Results: Two-tailed, paired *t*-tests revealed a significant difference between the dark, control condition and the flashing blue lighting condition ($p = 0.05$), but the differences between the dark, control condition and the continuous green lighting condition and the flashing green lighting conditions were not statistically significant ($p > 0.05$). Two-tailed, one-sample *t*-tests revealed that suppression was significantly greater than zero after the continuous green ($p<0.0001$) and after the blue flash ($p=0.02$) light stimuli, but not after the green flash light stimulus ($p=0.26$).

Conclusions: The present results further our basic understanding of circadian phototransduction and broaden the technical foundations for delivering light through closed eyelids during sleep for treating circadian sleep disorders.

Sponsor: Philips Respironics

BLUE LIGHT INCREASES MORNING SEROTONIN LEVELS IN SLEEP-RESTRICTED INDIVIDUALS

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Objective
Seasonal Affective Disorder (SAD) is considered a subtype of recurrent depression involving episodes that start in late fall and continue through winter, with remission typically occurring in early spring. Research has shown that SAD may be successfully treated by morning light therapy. While the underlying mechanisms of SAD are still under debate, one hypothesis has been that the serotonin-signaling pathway is implicated in the pathophysiology of SAD. Given that blue light (peak = 460 nm) maximally affects melatonin levels and that serotonin is a precursor of melatonin, it was hypothesized that blue light would increase morning serotonin levels. A secondary goal was to investigate whether sleep deprivation altered serotonin levels.

Methods
Twenty-two subjects participated in 4-week, within-subjects study. The mean ± standard deviation age of participants was 37.4 ± 11.3 years. The Institutional Review Board approved the study. Participants experienced the following conditions separated by two weeks on an 8-h sleep opportunity schedule: 1) 8-h sleep opportunity for 5 consecutive days and exposure to 60 minutes of dim red light (< 2 lux at the cornea); 2) 5-h sleep opportunity for 5 consecutive days and exposure to 60 minutes of dim red light; and 3) 5-h sleep opportunity for 5 consecutive days and exposure to 60 minutes of 100 lux of narrowband, 470-nm (blue) light. Light was administered upon waking on day 6 only, after participants spent the night in the laboratory. The first blood sample was collected in dim red light upon waking (T1) and a subsequent sample was collected 60 minutes after participants remained either in dim red light or received blue light (T2). Serum serotonin concentrations were measured in duplicate by ELISA. The limit of detection was 5 ng/ml and the intra- and inter-assay coefficients of variability were determined to be 4.7% and 6.0%.

Results
Serotonin levels change from T1 to T2 was computed for each experimental condition. Serotonin levels decreased from T1 to T2 after sleep restriction while it increased after exposure to blue light and after the 8-h sleep schedule. Compared to the 5-h sleep schedule/dim light exposure, 8-h sleep opportunity or morning blue light exposure significantly increased ($p<0.05$) serotonin levels within 60 min of waking.

Conclusions
Sleep deprivation reduces morning serotonin levels and may be associated with SAD. Blue light modulates morning serotonin levels in sleep-restricted individuals. The increase in serotonin levels after blue light exposure might be mediating the positive effects of morning light on SAD symptoms.

Funding: Office of Naval Research

TIME-OF-DAY AND LIGHT AFFECT THE DYNAMICS OF THE SLEEP HOMEOSTAT IN MICE

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Objective
Sleep is influenced by at least three main processes; i.e., circadian, homeostatic, and light. These three processes interact and their respective influences in humans can only be estimated using intricate laboratory protocols. Although difficult to separate light is known to influence sleep directly as well as indirectly through its capacity to change the phase of the circadian rhythms. Circadian rhythms, in turn, determine the preferred time that sleep occurs. The resulting distribution of sleep over the day drives homeostatic changes in sleep need. This sleep-wake dependent process itself is, however, thought to be independent of circadian and light dependent factors. Moreover, sleep-wake dependent effects on rhythms thought to be mainly circadian in origin have received little attention. Using the mouse as model we found that the dynamics of the sleep homeostat depend on light and circadian time. Conversely, sleep-wake dependent factors importantly contribute to circadian rhythms in clock gene expression, not only in the brain but also in the periphery.

Methods

Results

Conclusions

DIFFERENTIAL ALERTING AND MELATONIN RESPONSE TO MODERATELY BRIGHT LIGHT DURING 40 HOURS OF EXTENDED WAKEFULNESS IN YOUNG AND OLDER HEALTHY VOLUNTEERS

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Objective
Light has distinct non-visual effects on human physiology and behaviour, such as suppressing melatonin and sleepiness, particularly when administered in the late evening. However, whether extended light exposure has a sustained alerting and melatonin suppressing effect during extended wakefulness (40 hours) in young and older volunteers has not been investigated so far. In this study we examined the role of extended light exposure as a countermeasure for the detrimental effects of sleep deprivation on sleepiness and the circadian melatonin profile.

Methods
Twenty four participants (15 young (25.3 ± 0,7) and 9 older (63.2 ± 1,3) have completed the in-lab part of the study, which consisted of a balanced cross-over design with different but a constant light exposure regimes during 40 hours of extended wakefulness. Participants underwent 3 sessions with either a 40-h dim light (DL: 8 lux) exposure, a 40-h white light (WL: 250 lux) exposure or a 40-h blue enriched white light (BL: 250 lux) exposure. Questionnaires were administered hourly to assess subjective sleepiness on the Karolinska Sleepiness Scale (KSS) along with saliva collections for melatonin assays.

Results
Moderately bright light during 40 hours of sustained wakefulness induced a significant alerting response in the older but not young participants (age x light condition, p=0.02), independent on whether the moderately bright light was blue enriched or not. In contrast, melatonin suppression was only significant in the young participants and only in the late evening from 10 pm to 2 am during both non- and blue enriched light at 250 lux (light x time of day p=0.0011, for the young separately.

Conclusions
Our preliminary data indicate that constant exposure to moderately bright light during 40 hours of extended wakefulness has alerting properties, which are age-dependent such that older profit more than young volunteers. Contrariwise, moderately bright light affected circadian phase markers in young but not in older participants, maybe due to the fact that melatonin level in the older was already at a lower level under dim light, such that the light was not strong enough to further suppress melatonin. This data have implications on the use of moderately bright light in night work and shift work settings, where constant light levels are very common, and on age-related changes in the alerting response to light under elevated sleep pressure.

LIGHT THERAPY IN A SIGHTED MAN WITH NON-24-HOUR SLEEP-WAKE DISORDER: A CASE STUDY

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Objective
The non-24-hour sleep-wake disorder (N24SWD) is a very rare condition among sighted individuals, also known as free-running rhythm disorder, since the pattern of sleep and wake cycles is not synchronized to the environmental 24-h light-dark cycle. Potential causes include a prolonged intrinsic tau beyond 24-h, but also alterations in the entrainment process of the endogenous circadian rhythm, e.g. inappropriate exposure to light and/or social and physical activities.
Here we describe the case of a 40-year old sighted patient who reported to have a free-running sleep-wake cycle with a self-calculated circadian period length of 25.5 hours. Using a special calendar on his smart phone, he managed to adapt his life to the altered sleep-wake pattern for more than 3 years after having successfully completed the chemotherapy of a lymphoma. Thus, he did not suffer from clinically relevant symptoms. However, he asked for help due to problems in maintaining alertness and concentration during wakefulness.

Methods
A first clinical assessment was conducted by interviews and self-administered questionnaires (Epworth sleepiness scale ESS, Pittsburgh sleep quality index PSQI). The sleep-wake cycle was objectively measured by actimetric recordings over 4 months. Saliva was collected in 1-3 hour intervals across a 24-48 h period to determine melatonin and assess its internal circadian phase position. The patient also underwent a melatonin suppression test by bright light in the laboratory, which assessed his photic response on the circadian system, as well as a polysomnographic sleep recording. The therapeutic approach was light therapy (Day-Light 10 000 Lux SAD Lamp, Uplift Technologies) for 30 minutes after getting up in the morning.

Results
The actimetry indicated a clear N24SWD with a period length of ca. 25.3 hours with concurrent free-running melatonin profile, but synchronized with the sleep-wake rhythm (i.e. mean phase angle of 3h 38min ±2h 27min). The patient responded with a normal melatonin suppression to bright light and had no sleep disturbances, as assessed by polysomnography and the PSQI score (=2). He did not report daytime sleepiness (ESS=0), but rather to feel more inattentive and unconcentrated.
Light therapy led to a considerable improvement of the sleep-wake cycle in the first week, with a good synchronization to the 24 hours day. Thereafter, the pattern returned to be free-running. However, the patient continued with light therapy, because he felt more active during the wake period.

Conclusions
Light therapy of 30 minutes duration after rise time did only transiently improve free-running sleep-wake and melatonin rhythms in a sighted N24SWD patient, who showed normal non-visual photoreception and polysomnographically assessed sleep. A stable resynchronization of his internal clock by light would probably require longer light treatment durations, since his endogenous tau is more than 60 minutes longer than 24 hours.

MELATONIN AS A PHASE MARKER: WHICH ANALYTICAL APPROACH PERFORMS BEST?

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Objective
Melatonin profiling has become the method of choice for determining the circadian phase of humans. However, multiple analytical approaches are used and new ones are continually developed. Our study sought to determine the optimum data-fitting technique and phase marker calculation from existing methods and those developed by our group.

Methods
Our database contained 137 (full curve) and 65 (onset curve) melatonin profiles from 202 unique subjects across 11 separate studies. In addition, from a subset of 92 subjects at least 2 onset curves are available obtained under similar conditions. Saliva sampling was conducted in our time isolation facility or at participants' homes under dim light (<5 lux) and strict instructions. All samples were analyzed using the BÃ¼hlmann assay (BÃ¼hlmann Laboratories AG, Tilburg, NL). Fitting techniques were divided into full melatonin profile and onset curves. For this purpose we developed our own fits for these curves and compared them to published fits, both full profile (Van Someren & Nagtegaal, 2007) and onset only (Danilenko et al., 2014). The quality of the fit was assessed by comparing Akaike Information Criteria (AIC) values of the models wherever possible. Phase marker accuracy was compared using inter- and intra individual standard deviation (SD). Phase markers for each fit included threshold concentrations of 3pg/ml and 4pg/ml (for both onset and full profile curves), and full profile markers of center of gravity, 25% and 50% of the maximum, and fit onset parameters.

Results
We will present a table of said AIC and SD values with optimum combinations, required number of samples and sample timing highlighted for full profile or onset curve analysis. In addition, we have also compiled normative values for phase markers divided by age, sex and chronotype (assessed by MCTQ, Roenneberg et al., 2007).

Conclusions
We conclude, based on a large collection of salivary melatonin curves and a systematic analysis of the various fitting and phase marker calculation techniques, that fits and phase marker calculations vary minimally in accuracy. The optimal choice for estimating phase depends on the setup of data collection and consists of an advised combination of model + phase marker. A database of normative values of the various phase markers with the different methods is therefore urgently needed and as a first start provided on the basis of the current dataset.

NEWS ON BIOPHOTONS. AN OLD STORY RETOLD, A REVIEW AND AN OUTLOOK.

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Objective
Cell to cell communication by light is an old story. In 1926, the Russian scientist Gurwitsch published an experiment where he showed the induction of mitosis from the tip of an onion root to the shaft of a second onion root. The induction worked when the second root was in a quartz tube, but not when it was in a glass tube. From this, Gurwitsch concluded that UV light caused the effect, which he called "mitogenetic radiation" . Half a decade later, the German physicist, Popp performed experiments with Goniaulax polyedra, a single-cell maritime bacterium capable of the luciferin - luciferase reaction. He placed two cuvettes containing these bacteria on two highly sensitive photomultipliers and recorded a dramatic increase in synchronised photon emission upon removal of an optical separation between the two cuvettes, a clear sign of photo-communication. In 1995, Shen performed experiments with pig neutrophil granulocytes, using a similar experimental design. Two cuvettes with pig neutrophils were placed on two photomultiplier tubes. Bacterial extracts were placed into one cuevette, causing degranulation and light emission. Upon removing the optical separation, light was also emitted from the other cuvette, indicating the induction of degranulation by light.
In 1992, Albrecht-Buehler published a tissue culture experiment in which he inoculated baby hamster kidney cells on one side of a glass film, the opposite side of which was covered with a 2- to 3-day old confluent layer of cells. After 7 hours, the cells attached and spread on the plate in the absence of visible light. Most of the cells had traversed with their long axes in the direction of the whorls of the opposing confluent cells. The effect was inhibited by a thin metal coating on the glass films. In contrast, a thin coat of silicon on the glass did not inhibit the effect, suggesting that the effect was caused by red or near infrared light. He called the phenomenon "cellular vision". Now that we realize that cell to cell communication by light takes place in several cell populations, it seems very likely that the cells with the highest degree of differentiation, neurons also use this mechanism. As stated above, neurons are large cells with an active metabolism that generates photons. They have a wide arborisation, contain little pigment, and are protected from ambient light by bone, connective tissue, and Schwann cells. The signal to noise ratio should be high for photons as signals, and indeed, it was shown that photon guidance in the nervous system is better along the axis tracts. Recently, it was demonstrated by in situ autoradiography that photons can be guided through a spinal root. Also, neurons have prominent hollow microtubules called neurofibrillae, and that their constant inner diameter of 15 nm could provide excellent conditions for photon guidance free of thermal noise. Another point is that, of all biogenic amines, nature chose the ones with the greatest fluorescence (serotonin, dopamine, and norepinephrine) as neurotransmitters for mood reactions; Also, the major hallucinogens , are highly fluorescent substances. It has also been shown that their hallucinogenic properties correlate with their fluorescence properties. A concept of how this might work in the nervous system was presented in Medical Hypotheses earlier. In 2010 Bokkon calculated that the biophoton intensity can be considerably higher inside cells than outside, it was also found that light stimulation at one end of the spinal sensory or motor nerve roots resulted in a significant increase in the biophotonic activity at the other end. And 2014 it was found that the application of glutamate in the hippocampal dentate gyrus results in increased biophotonic activities in its intrahippocampal projection areas.

Methods & Results
A medline literature research with the key word Biophotons gave a number of 39 matching papers.

Conclusions
The proof of photo-communication in neurons, would have a huge impact on many fields of neuroscience, psychiatry, and neurology. Here, we give three possible examples:
(a) A complementary explanation for signal transduction in neurons.
(b) A complementary mechanism of action for hallucinogens, and
(c) A complementary explanation of some symptoms of Alzheimer`s disease.

NITRIC OXIDE EXHALATION DURING LIGHT THERAPY IN ADULTS (A PILOT STUDY)

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Objective
In 1992, Albrecht-Buehler published a tissue culture experiment in which he inoculated baby hamster kidney cells on one side of a glass film, the opposite side of which was covered with a 2- to 3-day old confluent layer of cells. After 7 hours, the cells attached and spread on the plate in the absence of visible light. Most of the cells had traversed with their long axes in the direction of the whorls of the opposing confluent cells. The effect was inhibited by a thin metal coating on the glass films. In contrast, a thin coat of silicon on the glass did not inhibit the effect, suggesting that the effect was caused by red or near infrared light. He called the phenomenon "cellular vision". Now that we realize that cell to cell communication by light takes place in several cell populations, it seems very likely that the cells with the highest degree of differentiation, neurons also use this mechanism. As stated above, neurons are large cells with an active metabolism that generates photons. They have a wide arborisation, contain little pigment, and are protected from ambient light by bone, connective tissue, and Schwann cells. The signal to noise ratio should be high for photons as signals, and indeed, it was shown that photon guidance in the nervous system is better along the axis tracts. Recently, it was demonstrated by in situ autoradiography that photons can be guided through a spinal root. Also, neurons have prominent hollow microtubules called neurofibrillae, and that their constant inner diameter of 15 nm could provide excellent conditions for photon guidance free of thermal noise. Another point is that, of all biogenic amines, nature chose the ones with the greatest fluorescence (serotonin, dopamine, and norepinephrine) as neurotransmitters for mood reactions; Also, the major hallucinogens , are highly fluorescent substances. It has also been shown that their hallucinogenic properties correlate with their fluorescence properties. A concept of how this might work in the nervous system was presented in Medical Hypotheses earlier. In 2010 Bokkon calculated that the biophoton intensity can be considerably higher inside cells than outside, it was also found that light stimulation at one end of the spinal sensory or motor nerve roots resulted in a significant increase in the biophotonic activity at the other end. And 2014 it was found that the application of glutamate in the hippocampal dentate gyrus results in increased biophotonic activities in its intrahippocampal projection areas. Here we performed a medline literature research, and summarize possible implications of findings in this area.

Methods
8 probands of both sexes and varying age were seated before a conventional light therapy lamp (Philips HF 3319) exhaled nitric oxyde was measured by a FeNO measurement device (NIOX MINO). After a dark period of 20 minutes baseline values were taken and then after 15minutes and in some also after 30minutes of light therapy with 10000 Lux the measurements were repeated. 3 of the probands were subjected to control measurements in the dark also at baseline, 15min and some also after 30 minutes.

Results
In our small sample size we could not dedect statistically significant changes of NO exhalation after 15minutes respectively 30minutes illumination with a full spectrum light therapy lamp at 10000 Lux. In a small subset of measurents we saw some changes which may be attributed to stress.

Conclusions
These data are consistent with a concept of a gasotransmitter-mediated humoral phototransduction being a local phenomenon with active effects at the retina being unlikely to be detectable in peripheral blood..
Although we saw a negative result with our full spectrum bright white light lamp it cannot fully be excluded that a program other spectral distribution would bring a positive result.

RETINAL AND BRAIN CIRCUITS UNDERLYING THE EFFECTS OF LIGHT ON MOOD

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Objective
The evolution of life on earth depended on light causing organisms to adapt their behaviors to the solar cycle. It is not surprising that light has profound effects on many behaviors that vary from simple phototropism all the way to complex image vision. In humans, light is used for the conscious perception of images and object tracking and for the subconscious regulation of the pupillary light reflex, circadian rhythms, sleep, mood and alertness. It was merely a decade or so ago that rods and cones were thought to comprise the only photoreceptors in the mammalian eye. However, a third type of atypical retinal photoreceptors, the intrinsically photosensitive retinal ganglion cells (ipRGCs), which express the photopigment melanopsin were recently discovered.

Methods
Using extensive mouse genetic labeling methods, my laboratory has revealed extensive brain regions that are innervated by these cells, including areas important for sleep and mood regulation. In addition, we used innovative light cycles to show that ipRGC stimulation at irregular times during the activity-rest cycle causes mood and learning deficits independent of sleep deprivation or circadian arrhythmicity. Our extensive understanding of the staggering diversity in the ipRGC photoreceptors and the availability of several mouse lines that lack individual subytpes of ipRGCs as well as optogenetics techniques that could specifically activate melanopsin fibers in defined brain targets, will allow us to understand how light modulate sleep and mood.

Results
We have generated an animal line that lacks the majority of innervations in the brain from ipRGCs, but maintains robust innervation in the suprachiasmatic nucleus (SCN), the central circadian pacemaker. This will allow us to test the sufficiency of the SCN for controlling sleep and mood. Recently, we have generated an animal model that will allow us to only eliminate the SCN projections while maintaining innervations to all other brain regions. The use of both of these animals will lead to further understanding of how different brain regions innervated by ipRGCs control behavior.

Conclusions
Our studies will allow us to understand how light perception through atypical mammalian photoreceptors influence mood.

Funding: None

ABOUT THE ROLE OF MONOAMINERGIC NEURONS, CLOCK NEURONS AND GLIA CELLS IN THE CONTROL OF SLEEP IN DROSOPHILA MELANOGASTER

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Objective
The fruit fly Drosophila melanogaster has become a well-accepted model for sleep. As in mammals, the sleep-like state of Drosophila is associated with immobility and reduced sensory responsiveness and it is subject to both circadian and homeostatic regulation, whereby biogenic amines (e.g. dopamine) and GABA strongly influence the latter. In comparison to mammals, the fly's sleep circuitry is clearly more condensed and appears to overlap with the circadian circuit: Four peptidergic circadian clock neurons in each brain hemisphere are simultaneously part of the fly's sleep circuit. The aim of the study was to unravel the role of monoaminergic neurons and glia cells in sleep control.

Methods
We investigated the putative contact between dopaminergic, serotonergic neurons, glia cells and the four peptidergic clock neurons with the help of GRASP and used cAMP-imaging on cultivated brains to judge the physiological response of the clock neurons to these biogenic amines. Furthermore, we recorded the diurnal sleep pattern of mutants that lacked functional transporters for biogenic amines or a glial β-alanyl-biogenic amine synthetase that is part of the dopamine recycling pathway.

Results
We found that the four peptidergic clock neurons receive dopaminergic, serotonergic and GABAergic input as well as light input and that they control the fly's arousal and sleep. Furthermore, we could show that glia cells are also part of this sleep-clock circuit. Glia cells have close contact with neurites of the four clock neurons and dopaminergic neurons, and they appear involved in the reuptake and recycling of secreted dopamine. The genetic manipulation of different neuronal and glial monoamine transporters strongly influenced the flies sleep. The same was true for the manipulation of the glial β-alanyl-biogenic amine synthetase.

Conclusions
We conclude that the fly's sleep is modulated by the interaction of biogenic amines and glia cells with four peptidergic and light-sensitive clock neurons.

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COMPARISON OF LIGHT-INDUCED MELATONIN SUPPRESSION IN CHILDREN AND ADULTS

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Objective
Melatonin secretion in adults is suppressed by light at night. Since children have large pupils and pure crystal lenses, the sensitivity to light is expected to be higher. However, melatonin suppression by light in children remains unclear. We investigated whether light-induced melatonin suppression in children is larger than that in adults.

Methods
Twenty nine healthy primary school children (mean age: 7.4 ± 1.8 yr) and 26 healthy adults (mean age: 41.2 ± 4.8 yr) participated in this study. The first experiment was conducted for two consecutive nights at an accommodation facility. On the first night, saliva samples were collected every hour under a dim light condition (< 30 lx in angle of gaze) from early evening to individual bedtime. On the second night, the subjects were exposure to moderately bright light (580 lx). Pupil diameters were measured by using an electronic pupillometer under dim and bright light. In the second experiments, melatonin was measured under room light at home. The averages of vertical illuminance at eye level at home for adults and children were 144 lx and 121 lx, respectively. Melatonin concentration was analyzed by using a radioimmunoassay and percentage of melatonin suppression was calculated on the basis of the data under the dim light condition.

Results
The melatonin was significantly suppressed by exposure to bright light in both adults and children. Percentage of melatonin suppression at bedtime was significantly larger in children (88.2%) than in adults (46.3%) ($p<0.01$). The pupil diameters in children were significantly larger than those in adults under dim light and bright light. In the home condition, melatonin secretion was significantly suppressed by room light in children ($p<0.05$) but not in adults.

Conclusions
We found that light-induced melatonin suppression was significantly larger in children than in adults, suggesting that melatonin in children is more sensitive than that in adults to light at night. More attention should be paid to the lighting environment at night for children.

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THE RELATION BETWEEN CHRONOTYPE AND TREATMENT OUTCOME WITH LT ON A FIXED TIME SCHEDULE

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Objective
Seasonal affective disorder (SAD) is a disorder characterized by recurrent episodes of major depression in a seasonal pattern with a prevalence of 2-10% in western countries. The therapy of choice is light therapy (LT). It is suggested that LT should be administered relative to the chronotype of the SAD patient, with the optimal timing of LT in morning types being earlier than in evening type patients(1). This study aims to retrospectively investigate the relation between chronotype and the effect of LT on a fixed time in the morning in a population of SAD patients.

Methods
Data from four different studies conducted between 2006 and 2011 at the University Center of Psychiatry in Groningen, the Netherlands was used. Data from 132 patients was used (29 men and 103 women, mean age ± SD, 37.4 ± 11.8 years). Depression score was determined by a structured interview (SIGH-SAD) prior to LT and after LT. Prior to LT morningness/eveningness preference of the patient was determined by the ˜Morningness/Eveningness Questionnaire" (MEQ)(2). All patients received LT at 8:00 AM at the clinic, independent of their chronotype. Statistical analysis is done with a quadratic curve fit, correlating MEQ score with relative therapy success (percentage of SIGH-SAD decrease).

Results
Patients had an average MEQ score of 51.5 ± 8.2. There was no significant relationship between MEQ score and relative therapy success ($F(2,129) = 0.05$, ns). When patients were divided by chronotype (ranging from definite morning to moderate evening) no significant relation between MEQ score and therapy success was found ($F(2,129) = 0.02$, ns).

Conclusions
The lack of a significant relationship between chronotype (as measured by the MEQ score) and therapy success with LT at a fixed timepoint does not support the idea that there is an extra benefit of setting the time of LT to the chronotype of the SAD patients.

LOOKING INTO THE EYE OF ADHD. FIRST DATA ON PHOTOPHOBIA IN ADULTS WITH ADHD.

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Objective
We know from clinical experience that many adults with ADHD wear sunglasses, also on cloudy days and in winter. Asking about this behaviour, they say they are oversensitive to light. This may be related to the high prevalence of delayed sleep phase syndrome (78%) in adults with ADHD. By wearing sunglasses in the daytime, little light may reach their eyes, limiting the synchronisation of the biological clock to the time of the day.
From the literature we learn that 70-80% of children with ADHD have difficulties with visual acuity or with the visual system. Adults also report visual impairments. In children, visual acuity problems diminish with ADHD medications.
The aim of the study is to gain insight into the associations between possible eye dysfunctions and photophobia in adults with ADHD, and the relationship with the delayed circadian rhythm.

Methods
Overview of the literature and first data of an online survey on the oversensitivity to light in adults with ADHD compared to controls (n=495).

Results
Our online survey was filled in by 495 people, of whom 47% with selfreported ADHD (symptoms). 69% of those with ADHD (symptoms) mentioned oversensitivity to light versus 28% of controls. People with ADHD also reported to wear sunglasses significantly longer in every season as compared to controls. Oversensitivity to light was associated with ADHD, age, eye problems, wearing glasses or eye lenses, and with chronic fatigue, but not with a delayed sleep phase. It is unclear what causes the oversensitivity to light in adults with ADHD. Further study on the pupillary response to light (PIPR), the functioning of the melanopsin system in the eye, and the general functioning of the visual system in adults with ADHD may increase our understanding of the link between photophobia and ADHD.

Conclusions
Visual function abnormalities and oversensitivity to light are highly frequent in children and adults with ADHD. Further research on the associations of the increased prevalence of a delayed sleep phase and visual functioning is needed in this group.

THE INFLUENCE OF CARBON MONOXIDE ON THE SECRETION OF MELATONIN BY PINEALOCYTES IN VITRO

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Objective
Melatonin, the major hormone produced by the pineal gland, displays characteristic daily and seasonal patterns of secretion. These robust and predictable rhythms in circulating melatonin are strong synchronizers for the expression of numerous physiological processes in photoperiodic species. Results of in vivo research on wild boar and domestic pig crossbreed conducted by Koziorowski and his colleagues (Koziorowski et al., 2012), indicate that the carbon monoxide, the signaling gas molecule, in the area of an eye is released into the blood vein of the eye depending on the intensity of sunlight. In addition, a study performed in an identical animal model demonstrated that changes in CO concentration in the ophthalmic venous blood have an impact on the protein levels of the melatonin synthesis pathway enzyme arylkylamine N-acetyltransferase (AANAT) with parallel changes in systemic melatonin levels. The aim of this study was to determine the role of carbon monoxide (CO) in the melatonin synthesis in the pineal gland cells in vitro.

Methods
Primary pineal cells cultures were derived from Sus scrofa. Cells were stimulated carbon monoxide-releasing molecule (tricarbonyldichlororutenianu dimer (II)) in different concentration. The AA-NAT and HIOMT gene expression were determined 6, 24 and 48h after treatment. Analysis of the changes in the level of melatonin secretion was performed by measuring the concentration of this hormone by high-performance liquid chromatography (HPLC).

Results
For the first time, we have shown direct effects of exogenous carbon monoxide for the synthesis of melatonin by the pineal gland cells in the concentration and time depend manner.

Conclusions
Based on these results it can be concluded that carbon monoxide may participate in the regulation of melatonin synthesis.

WAKE AND LIGHT THERAPY TO IN-PATIENTS WITH MAJOR DEPRESSION:
A RANDOMIZED CONTROLLED TRAIL, EFFICACY, PREDICTORS AND PATIENT EXPERIENCES

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Objective
Background: About 150,000 Danes will constantly have symptoms of depression, and 20% of those are admitted to a psychiatric hospital at least once. When admitted, the patients are highly tormented and many have suicide thoughts. The treatment of depression in a ward consists of beginning or adjustment of antidepressive medication combined with for instance psychotherapy and exercise offers. Full effect of medical treatment is only reached after 4-6 weeks. Wake therapy is a treatment method, which has appeared to reduce depressive symptoms within hours, and several studies have demonstrated that up to 60% of the patients responded to wake therapy. The method consists in the patients staying awake for one night and the following day, in all 36 hours, which is followed by one night of sleep. Light therapy, antidepressants and stabilization of circadian rhythm have been shown to maintain the effect of wake therapy.

Objective: To examine the efficacy of using wake and light therapy as a supplement to standard treatment of hospitalized patients with depression. Furthermore, the objective is to identify predictors of good effect and to clarify the patientsâ€™ experiences with wake and light therapy with focus on factors related to the patients' adherence.

Methods
Methods: The project is carried out as a randomized controlled study, and the aim is to include 74 in-patients with bipolar or unipolar depression. The patients are allocated to standard treatment or to the intervention, which besides standard treatment will consist of three times wake therapy in one week, and 30 minutes daily light treatment in the entire nine-week study period. Furthermore, the patients will receive ongoing psychoeducation regarding good sleep hygiene and maintaining a stable circadian rhythm. The patients will be requested to keep a diary, and by the end of the intervention, individual semi-structured interviews will be conducted to clarify the patients' experiences.

Results
Preliminary results: The project was initiated at the beginning of 2014, and ahead of this, a pilot study was conducted. In the pilot study, five patients completed the intervention, and after two weeks, response was seen in 60 % of the patients. After nine weeks, three patients were in remission.

Conclusions
Conclusions: The results from the pilot study are promising, and this study can contribute with more knowledge about the efficacy of wake and light therapy and predictors of good effect. The qualitative part of the study will give an insight into the patients' experiences.

THE SAFE STUDY: ELECTRONIC MONITORING OF PATIENTS WITH DEPRESSION WHEN DISCHARGED FROM INPATIENT WARDS

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Objective
We know very little of what happens when patients with depression are discharged from inpatient wards. In the wards patients are kept in a sheltered environment with a stable sleep wake cycle, regular meals and regular physical activities. At the Intensive care outpatient unit for affective disorders (IAA) we receive patients discharged from hospital. From case records and through Hamiltons interview we speculated whether these patient deteriorate when discharged.

Methods
Patient referred to the IAA from affective disorders wards, were included in the study. All patients was instructed to use the Daybuilder PC application and registered daily mood, sleep onset, sleep offset, sleep naps, sleep quality, exercise and medication adherence for a four week period including: some days on the ward, some days without psychiatric assistance, and a period at the IAA.

Results
Preliminary results from 16 patients are presented. Mean sleep onset was 22:56 (3:36) hour: minutes at baseline (mean of days one till three) and 23:46 (1:23) hour:minutes at endpoint (mean of days 26 to 28). Mean sleep offset was 6:33 (1:33) hour: minutes at baseline and 8:14 at endpoint (1:41). Linear regression showed sleep onset to be delayed by 1.5 minutes per day (p=0.07) and sleep offset delayed by 1.6 minutes per day (p=0.03). Hamilton 17 items score was 19.7 (6.1) at baseline and 17.5 (6.5) at endpoint. Mood registration showed large day-to-day variation and a tendency for worsening of mood in the days after discharge but with improvement after inclusion at the IAA.

Conclusions
Sleep was delayed after discharge. Sleep delay is known to be depressiogenic. Day-to-day mood and sleep was highly variable. Electronic monitoring with the Daybuilder application coupled with weekly feedback might help patient avoid a sleep delay and keep a more regular sleep pattern and thus prevent relapse. Study is ongoing and will include a total number of 45 patients. This study will be followed by a randomised controlled study with sleep phase advance compared to standard sleep regime in a similar set-up in patients discharged from inpatient wards.

Funding: This study is supported by a grant from TrygFonden (E-monitoring of depression)

THE I394T SINGLE NUCLEOTIDE POLYMORPHISM OF HUMAN MELANOPSIN GENE MIGHT BE ASSOCIATED WITH SPECTRAL SENSITIVITY OF MELANOPSIN

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Objective
As International HapMap Project reported, there are some missense variants in human melanopsin gene. In our previous studies, we found that I394T single nucleotide polymorphism (SNP) of human melanopsin (OPN4) is associated with pupillary light reflex and that responsiveness of melanopsin to light is different among I394T genotypes. This suggests a possibility that spectral sensitivity to light is also different among I394T genotypes, but it remains unclear. Hence, the aim of this study was to determine the difference in spectral responses among I394T genotypes.

Methods
A total of 35 subjects, including subjects with the TT genotype (10 men and 8 women; 21.8 ± 1.9 years old) and subjects with the TC genotype (9 men and 8 women; 22.4 ± 1.8 years old), participated in this study. Unfortunately, subjects with the CC genotype did not participate in this study.

Participants were exposed to background lights (fluorescent light, 13.7 log photons/(cm2 s)) consistently from the beginning to end of the experiment. Ten monochromatic lights with peak wavelengths of 430 nm, 460 nm, 470 nm, 480 nm, 500 nm, 520 nm, 540 nm, 560 nm, 580 nm, and 600 nm were prepared, and each light was projected to the subjects with an intensity, 14.4 log photons/(cm2 s). In addition, a bright white light condition (15.8 log photons/(cm2 s)) was prepared to determine minimum pupil size. The pupil size of the left eye was measured under each monochromatic light condition after a 1-minute adaptation. The bright condition always preceded the test stimuli, and the order of test stimuli was random for each subject.

Spectral response curve was estimated from standardized percentage pupilloconstriction of each subject using the Levenberg-Marquardt method for a third-order polynomial. The extra sum-of-squares F test was used to compare the fitting models.

Results
While the spectral response curve of TT subjects showed a peak sensitivity to 482 nm light ($R2 = 0.91$), that of TC subjects showed a peak sensitivity to 477 nm light ($R2 = 0.94$). A comparison of the spectral response curves for TT and TC subjects (F test) showed that the fitted curves for the two genotype groups were significantly different ($p < 0.05$).

Conclusions
Our findings suggest a possibility that I394T SNP of OPN4 is associated with peak spectral sensitivity of human melanopsin.

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ABERRANT LIGHT INFLUENCES MOOD AND LEARNING THROUGH MELANOPSIN-EXPRESSING RETINAL GANGLION CELLS

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Objective
Many biological functions oscillate over the course of a day, and the precise timing of these rhythms depends on synchronization to the solar cycle. Variation in day length, shift-work, and transmeridian travel, which disrupt normal exposure to the daily light/dark cycle, can lead to changes in mood and cognition. Several studies have shown that sleep and circadian disruptions underlie the changes in mood and cognitive function associated with irregular light schedules. However, little is known regarding the ability of light to directly influence these functions. The goal of our study was to determine the influence of light on mood and cognitive functions in the context of normal circadian rhythms and sleep. Additionally, we sought to identify the retinal mechanism underlying the ability of light to influence these functions. We focused on a specialized ganglion cell population that are intrinsically photosensitive, ipRGCs, due to expression of the photopigment melanopsin. In addition to their role in regulation of circadian rhythms and sleep, these cells project to limbic regions indicating a possible role in the regulation of mood and cognitive function.

Methods
To gain a better understanding of how light influences mood and cognitive functions, we housed mice in an environment that provided exposure to light pulses throughout the circadian cycle. We used EEG/EMG recording to assess sleep and examined the circadian system by measuring rhythms in general activity, core body temperature, as well as circadian gene expression. Using a combination of behavioral, biochemical, and electrophysiological techniques, we assessed mood related behaviors as well as learning and memory in mice housed under this light environment. We examined mice lacking ipRGCs housed under this disruptive light environment in order to determine the underlying retinal circuit responsible to conveying this light information.

Results
Mice exposed to this aberrant light cycle maintained intact circadian rhythms and normal sleep; however, they elicited increased depression related behavior as well as hippocampal learning deficits with corresponding physiological changes such as elevated corticosterone and deficient long-term potentiation. Chronic administration of the antidepressant fluoxetine rescued the increased depression related behavior and learning deficits induced by this light cycle. Furthermore, this treatment restored normal corticosterone levels and hippocampal long-term potentation. Mice lacking ipRGCs were unaffected by exposure to light pulses throughout the circadian cycle showing that these cells are responsible for conveying light information to areas of the brain that control learning and mood.

Conclusions
Changes in the light environment can lead to disruptions in circadian rhythms and sleep and also cause changes in mood and learning deficits. The contribution of light to the changes observed in mood and cognitive function has been previously considered to occur through the modulation of sleep and circadian rhythms. Our findings present an additional pathway whereby light can more directly impact mood and cognitive functions without first disrupting sleep and circadian rhythms. Additionally, we present a novel role for ipRGCs in conveying light information to influence these functions.

INTRODUCING LED IN OPEN OFFICE, IMPLICATIONS FOR LIGHT APPRAISAL, FATIGUE AND HEALTH.

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Objective
Open office environment are very common in working life. Open offices are cost effective, however such office concept may affect office worker health as well as performance. The present project studied how a LED solution affects energy savings, health, fatigue, mood and light appraisal as well as light exposure during work.

Methods
A new system with in-built LED-lighting, Philips Soundlight Comfort Ceiling, was installed consisting of LED-armed tiles of 60x60 cm with an energy efficiency on slightly more than 70 lumen/W. In the LED condition light levels at work desk increased from 423 lx to 712 lx
Twentyone office workers were measured one week in winter using traditional fluorescent tubes, one week in new lights, and and one month later. Workers answered weekly questionnaires on visual ergonomics, athmosphere, mood states, stress, diaries and wore motionloggers/light meters and performed a cognitive test twice a week (color stroop). Twentytwo office workers in adjoining rooms formed a control group where only fluorescent tubes were changed (from 3000K to 4000K, increasing the light levels at the work desk to 860 lx). A repeated measures mixed model was used to analyse the data using the factors of group, week and time.

Results
Questionnaire data from retrospective ratings demonstrated that the LED luminaires were regarded as giving a better visual comfort, readability, and light distribution ($p<0.001$). Also the new light environment was regarded as being less fatiguing, more comfortable at work and appearing more natural ($p<0.001$). The overall visual ratings made each week were favourable for the LED lighting solution ($p<0.001$). Sleepiness and perceived energy ratings, given six times each day of study showed an effect of week ($p<0.01$), showing a reduction of sleepiness and increase of energy across the experimental weeks in the LED condition. However, feelings of bad mood increased in the LED condition ($p<0.001$).

Conclusions
The present results could influence lighting in both public and private office work places and to help understand the human response. LED integrated in tiles appear to reduce sleepiness and improve energy status among office workers as compared to standard tubes. Also several visual areas seem to be positively improved including readability, visual comfort and light distribution.

Funding: Swedish Energy Agency, Philips Lighting.

ASSESSMENT OF SLEEP STAGES AND RELATIONSHIP TO INTRAOCULAR PRESSURE PATTERNS USING A CONTACT LENS SENSOR

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Objective
To evaluate whether information from a contact lens sensor for 24-h monitoring of intraocular pressure (IOP) patterns can be used to distinguish sleep stages. We further hypothesized that IOP patterns may be higher in the rapid eye movement (REM) phasehere

Methods
12 participants (6 healthy subjects and 6glaucoma patients) underwent simultaneous ambulatory 24-h monitoring of IOP patterns using a contact lens sensor (CLS; Triggerfish, Sensimed AG, Switzerland) and sleep monitoring using a validated wireless system (WS; ZEO, Newton, MA, USA) that collects electrophysiological signals from the forehead with a single bi-polar channel. The CLS measures ocular dimensional changes at the corneo-scleral junction that are assumed to be related to IOP changes. The WS distinguishes 4 sleep stages: wake, light sleep, deep sleep, REM. Intraclass correlation coefficients (ICC) were calculated for comparison of CLS and WS-derived sleep stages.

Results
Data on both IOP and sleep stages could be obtained in 10 subjects (mean age 42 ± 10.2 years; 60% women). Four different patterns of CLS-data could be distinguished during sleep: high-frequency sinusoidal pattern, low-frequency sinusoidal pattern, and irregular pattern. The irregular pattern correlated well with the WS-derived REM stage (ICC=0.91), while the other two CLS stages did not correlate well with WS sleep stages (ICC=0.47). IOP patterns during CLS-derived REM stages were higher than during non-REM sleep stages (128 ± 52 mV vs. 108 ± 42; p=0.044).

Conclusions
Results show a good agreement between CLS and WS recordings of REM sleep. This work further supports a possible use of combined sleep and IOP pattern monitoring in glaucoma patients.

Funding: Sensimed AG (R)

HERE COMES THE SUN: THE EFFECT OF WEATHER ON THE MOOD OF PEOPLE WITH WINTER DEPRESSIVE SYMPTOMS

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Objective
Mood, energy, sleep, appetite, and other symptoms associated with seasonal affective disorder (SAD) also can vary between and within days as a function of weather variables such as sunshine, temperature, and barometric pressure (Howarth & Hoffman, 1984; Molin et al., 1996), just as they do in nonclinical populations (Denissen et al., 2008). By examining a variety of weather variables simultaneously we can begin to differentiate the effect of each variable on mood and the overall severity of the seasonal episode.

The majority of research conducted on SAD uses retrospective self-report, asking participants questions about their thoughts, emotions, or experiences in the recent or distant past. This method makes data reliant on participants' memory and insight. In contrast, the experience sampling method (ESM) allows for the assessment of participants in natural settings, at multiple time points throughout the day, and with less reliance on participant memory and insight (Shiffman, Stone, & Hufford, 2008).

This is the first study to use ESM in SAD and to examine the impact of weather on between-day and within-day variability of mood, vegetative, and cognitive symptoms. We predicted that daily weather would affect daily seasonal symptoms of fatigue, appetite, and mood and that those with greater seasonality in general would be more sensitive to weather variables such as temperature, hours of sunshine, and barometric pressure.

Methods
50 adult participants who experience seasonal depressive symptoms were recruited using community and web-based advertisement. Participants were required to have at least mild current seasonal symptomatology. Interested participants were directed to a website to complete the screening measures.

ESM data were collected from November through February. Participants received a text message prompt on their smartphone 5 times a day for 7 days, approximately every 2-1/2 hours, between the hours of 9 am and 8 pm. They were instructed to click a link and complete the questionnaire "right away" □ after receiving the prompt. In addition, participants were contacted again in spring to complete questionnaires about their seasonal symptomatology this winter as a whole. Hourly weather variables were obtained from the National Climatic Data Center: temperature, minutes of sunlight, inches of snowfall, and barometric pressure. Weather data were matched to the participant by date and zipcode of residence.

Results
The data were analyzed using multilevel modeling to assess mean levels and variability in symptomatology and their relationships with hourly and daily weather variables and their accumulated effects.

Conclusions
We will be able to examine the impact of weather on individuals with winter depression symptoms using real-time data collection. This will allow us to see the hourly and daily impact of weather variables, in order to better understand how they influence their seasonal symptoms.

Funding: Illinois Institute of Technology, Interprofessional Projects Program

EFFECTS OF LIGHT ON EMOTIONS AND IMMUNOLOGICAL VARIABLES IN DEMENTED PATIENTS

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Objective
To test whether a dynamic lighting system has beneficial effects on emotions and immunological variables in severely demented patients.

Methods
During 8 weeks in the fall/winter period dynamic ceiling lighting was compared with conventional lighting in an age matched control patient group. The study and all procedures were approved by the local Ethical Review Board (KEK, Zűrich, Switzerland). Facial emotions were documented by daily observations with the ˜Observed Emotion Rating Scale" (OERS), and the immune response to the annual influenza vaccination was analysed from two blood samples taken before and 4-5 weeks after the vaccination. Immune responses were assessed by testing the individual antibody concentrations in blood plasma by haemagglutination inhibition assays.

Results
Data from 89 patients were included in the analyses (31 men and 58 women). Independent of the lighting system, the amount of light (including daylight) to which an individual patient was exposed to affected emotions and immune response. Pleasure and overall alertness were expressed significantly longer during daily observation periods in patients with higher daily light exposures (low vs. high light group; split by the median of illuminance between 8 am and 6 pm). A diurnal pattern in emotions was observed: significantly longer expressions of pleasure in the morning than in the evening showed an opposite pattern to that of more frequent expressions of anger in the evening than in the morning ($p<0.05$). Immune responses were calculated only in patients who received the flu shot and who had no acute infection (i.e. less than 15,000 Leucocytes/µl). Two patients who had very high values already in the pre-vaccination blood sample (titer >1000) were also excluded. Relative to the pre-vaccination, patients from the high light exposure group showed a significantly greater relative antibody increase to the H3N2 vaccine than patients in the low light group ($p<0.05$), despite similar pre-vaccination concentrations ($n=78$).

Conclusions
Our results provide evidence that a higher daily light exposure positively influences emotions and thus improves quality of life in a severely demented patient group. The enhanced immune response in the high light exposure group indicates that increased Zeitgeber strength by light has potential beneficial effects on the immune system in dementia.

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EFFECTS OF HEALTHY AGING ON SPECTRAL SENSITIVITY TO LIGHT

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Objectives

Sleep and circadian rhythm disturbances are common features of aging. Among other possible causes, these alterations may result from an inappropriate photic entrainment of the circadian clock. The aim of our study was to investigate the effects of the age-related lens yellowing on non-visual sensitivity to light.

Methods

Five young (24-27 y.o) and eight older (55-63 y.o) participants underwent ten experimental night sessions. Nine sessions included a 60-min monochromatic light exposure (LE) to one of nine wavelengths (420-620nm). Plasma melatonin suppression was used to derive individual non-visual sensitivity spectra. Lens density was measured in 18 young and 15 older participants using a validated psychophysical technique.

Results

Lens density measurements showed, as expected, a significant decrease of short wavelength light transmittance (<500nm) in the older participants. Unexpectedly, non-visual sensitivity remained unchanged in the short wavelength region of the spectrum but was greater in the long region (530-560nm) resulting in a shift of peak sensitivity to longer wavelengths (484 nm to 494 nm) in the older. Furthermore, the dynamics of melatonin suppression during the LE was delayed by 15-min in the aged. The amplitude of melatonin suppression was lower compared to young within the first 30-min of LE; and became similar by 45-min.

Conclusion

Our results do not support the hypothesis that increased lens yellowing with age leads to a systematic decrease of non-visual sensitivity to light. Aging of non-visual light responses may involve unknown adaptive mechanisms, and changes in melatonin suppression dynamics could result from a modified photoreceptor contribution and input to the central clock with aging.

A VIENNA STORY 114 YEARS LATER: HOW THE REINTERPRETATION OF FREUD'S DREAMS CAN INFORM THE BIOLOGY OF PSYCHIATRY

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Objective
Perhaps the most prominent intellectual force in 20th century Western psychiatry grew out of the work of Sigmund Freud here in Vienna. This presentation will review Freud's proposed unconscious awareness of fundamental principles of chronobiology and photobiology that are at the core of the phenomenon and light treatment of winter seasonal affective disorder (SAD). This presentation will then review recent data from various laboratories supporting a model of humoral phototransduction that requires direct exploration of physiological concepts that Freud suppressed in himself.

Methods
A historical review of some aspects of Freud's most prominent monograph and relevant light-related scientific discoveries in molecular and cellular biology of the past three decades.

Results
Having lived most of his life and developed his most prominent theories well before the chemist Hans Fischer (who overlapped Freud for a few years in Vienna) discovered the common chemical structures of the chlorophyll and hemoglobin chromophores, Freud would have likely laughed at a concept of humoral phototransduction. Had Freud been consciously aware of winter seasonal depression, however, he might have anticipated how his own consciously suppressed insights might have presaged some molecular biological discoveries of the last 25 years in animal biology and work from the last 5 years in animal physiology in terms of understanding gases as neurotransmitters and the erythrocyte as a potentially light-responsive carrier and generator of bioactive gases and a potentially light-responsive carrier and generator of energy. This biology and physiology has specific potential for understanding some aspects of the direct chemical effects of light in mediating the antidepressant and energizing effects of light in winter seasonal depression.

Conclusions
Freud's insights into psychodynamics heavily influenced 20th century Western psychiatry. SAD and much of the discoveries of modern biological psychiatry do not fit neatly into those insights, however. Exploring the biochemical and behavioral similarities of light responses in the plant and animal kingdoms - an exploration that both Freud, and Charles Darwin, whose work greatly influenced Freud, suppressed in themselves opens a new door to understanding the photobiology of light in the treatment of SAD.

PROTECTIVE EYEWEAR TO BLOCK SHORT-WAVELENGTH BLUE LIGHT IN THE TREATMENT OF DELAYED SLEEP PHASE DISORDER: A CASE REPORT

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Objective
Delayed sleep phase disorder (DSPD) is one of the most common circadian rhythm sleep disorders (CRSD). DSPD is more often in young adults, than in middle-aged or older population. It is often associated with poor school performance or impaired job performance. The treatment so far includes chronotherapeutic tools with light therapy in the morning and melatonin in the evening.

Methods
We here report a case of an 26 year old male with unemployment due to sleeping problems, who was diagnosed as DSPD. Diagnostic tools included patients history and actigraphy. Polysomnography was performed to exclude sleep breathing disorder or neurologic disorder. An initial treatment with morning light therapy had to be stopped because of intolerable side effect of triggering migraine.

Results
Since he uses the protective eye-wear which blocks short-wavelength blue light for 1-3 hours in the evening before going to sleep, sleep quality has markedly improved and he is more able to adapt his circadian rhythm to the social needs.

Conclusions
This case indicates the importance of avoidance of wrong light exposition in the evening in the treatment of CRSD especially DPSD. Further studies should investigate the protection of evening light exposure in the treatment of DPSD systematically.

CIRCADIAN DYSREGULATIONS IN MOUSE MODELS OF DEPRESSION

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Objective
Text hereDysregulation of circadian rhythms such as alterations in sleep/wake cycles and day-time dependent pattern of body temperature and hormone release as well as diurnal mood changes (Carpenter and Bunney, 1971; Branchey et al., 1982; von Zerssen et al., 1987; Souetre et al., 1988; Souetre et al., 1989; Benca et al., 1992) is a key symptom of mood disorders, including anxiety disorders and depression. However, in human patients it is difficult to explore whether the observed circadian and sleep abnormalities are cause or consequence of the disease state and to examine the underlying molecular principles in the brain.

Methods
We are employing specific animal models to elucidate a potential causal relationship between depression-like behavior and alterations in circadian rhythms and to shed light on the molecular mechanisms involved in specific brain regions, focusing on elements of the endogenous circadian oscillatory machinery. We are characterizing the consequences of experimental alterations of the circadian rhythms by constant darkness on depression-like behavior as well analyzing circadian disturbances and associated neurobiological alterations in genetic and environmental mouse models of depression.

Results
We find that constant darkness induces depression-like behavior in mice which is paralleled by reduced hippocampal cell proliferation and elevated levels of the proinflammatory cytokine IL-6 together with alterations of hippocampal clock gene expression (Monje et al. 2011).
In a mouse line selectively bred for high anxiety- and co-segregating depression-like behavior we report altered length of the daily cycle, fragmented ultradiem rhythms and a blunted phase-shift response associated with a selective impairment of clock gene expression in hippocampal tissue (Griesauer et al. 2014). We also induced depression-like behavior in mice based upon the exposure to chronic stress and reveal alterations in clock gene rhythmicity in the basolateral amygdala (Savalli et al. submitted).

Conclusions
Using the constant darkness model we establish a molecular link between chronobiological and inflammatory aberrations in the pathophysiology of depression and propose a pivotal role for the relevance of IL-6. Result in the genetic and stress-induced mouse models of the depression provide experimental evidence that both endogenous and exogenous manipulations compromising emotional behaviors concomitantly impinge on the expression of cores element of the molecular circadian machinery suggesting a causal relationship.

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No conflict of interest to declare.

PERSONALIZED LIGHT THERAPY FOR IMPROVED CIRCADIAN RHYTHM MANAGEMENT

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Objective
Successful application of light therapy in an ambulatory care setting requires the integration of the therapy with, in particular, ambient light levels. The combination of these two factors is expected to enable a more efficient regulation of the circadian rhythm. The beneficial effects of a proper align-ment between a person's circadian rhythm and the light-dark cycle to which that person is ex-posed, continue to be endorsed in the literature. Yet, practical light therapies that sustain this alignment in a flexible and adaptive way remain largely elusive today.

Methods
The mathematical model of the human circadian pacemaker introduced by Kronauer et al. [1982], provides a useful tool to evaluate the integrative effect of light on the human circadian system. In particular, it allows the timing of the core-body temperature (CBT) minimum to be estimated with an accuracy of, typically, plus or minus one hour. We have used this tool to design and evaluate a heuristic algorithm that, on a daily basis, computes a personalized light ˜recipe", aimed at entraining and stabilizing a person's circadian rhythm. The algorithm enables a rapid shift of the CBT minimum to a predefined position in time, and aims to keep it at that position. The recipe is computed in the early evening and consists of an evening light or light deprivation therapy and a morning light ther-apy. Each therapy is described in terms of timing and intensity. The algorithm takes into account ambient light.

Results
Using an existing dataset comprising a fortnight of light exposure data of 20 participants, we pro-vide a proof of concept, illustrating that the algorithm renders successful circadian stabilization, expressed in the context of the model used. Being adaptive, the algorithm is inherently resilient to a certain degree of non-adherence to the therapy. The evaluation provides numerous hints for refinements and improvements.

Conclusions
We have shown the feasibility of providing a personalized light therapy to stabilize a person's circa-dian rhythm in an ambulatory care setting, wherein the ambient light levels to which this person is exposed have been incorporated.

TOWARD A WORKING THRESHOLD FOR NOCTURNAL MELATONIN SUPPRESSION BY WHITE LIGHT

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Objective
Nocturnal melatonin suppression by light has been implicated as a contributing factor to a variety of health maladies such as diabetes, cardiovascular disease and breast cancer. Light exposure at night may or may not suppress melatonin, depending upon spectrum, amount and duration. To help ameliorate social concerns about melatonin suppression by light at night (LAN), it is important that the scientific community provide a working threshold for white light exposures as might be encountered by people in architectural applications. Toward this end the predictive capacity of a computational model of circadian phototransduction was examined for a range of levels and spectra that might be encountered in residences.

Methods
Twenty-nine subjects were exposed to six light levels of warm-white (2700 K light emitting diode (LED)) and 15 subjects were exposed to three light levels of cool-white (6500 K LED) spectra for one hour. The light levels ranged from 8 lx to 720 lx at the corneas. In addition, all subjects experienced a dark, control night.

Results
Statistically reliable nocturnal melatonin suppression was only found at 200 lx and above for both light spectra, although all nocturnal melatonin levels were well predicted by the model. Since (a) inferential statistics are biased against false positives (consequently 200 lx is too high a level to serve as a working threshold), (b) the average measured suppression levels were well predicted by the model and (c) uncertainty in measuring melatonin is between 10% and 15%, a predicted value of 5% melatonin suppression (representing roughly half the measurement uncertainty) from the model was chosen as the criterion working threshold. The warm-white and the cool-white light sources chosen for the study represent the full range of white light sources available for residential applications around the world. The model predicts 5% nocturnal melatonin suppression for one hour exposures by the warm-white source at 50 lx and by the cool-white source at 26 lx. In a separate study, light exposures in North American homes, usually from warm-white sources, averaged less than 30 lx at the cornea.

Conclusions
Therefore, we propose for discussion and consensus by the scientific community a conservative working threshold of 30 lx for 30 minutes. Exposures less than this value should produce no measurable melatonin suppression in adult populations.

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EXPOSURE TO LIGHT IS ASSOCIATED WITH SENSITIVITY OF THE CIRCADIAN SYSTEM TO LIGHT IN SAD: A PHYSIOLOGICAL INTERACTION WITH BEHAVIORAL INACTIVITY?

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Objective
The Integrative Model of SAD proposes an interaction of genetic, environmental, and psychological factors (Rohan, Roecklein & Haaga, 2009). Specifically, retinal subsensitivity to light, particularly in the melanopsin cells that form the light input pathway to the brain for non-visual functions (e.g. circadian entrainment), may underlie retinal subsensitivity. When triggered by low winter light levels, retinal subsensitivity is thought to lead to SAD symptoms. Previous findings suggested that melanopsin cell responding was decreased in SAD (Roecklein et al., 2013). However, the role of light exposure prior to testing has not yet been explored.

Methods
The present study recruited 33 participants with SAD (84% Female; age M = 38.4, SD = 13.6), and 17 non-depressed controls (73% Female; age M = 34.1, SD = 12.8). The Net Post-Illumination Pupil Response (PIPR; Gamlin et al., 2007) was assessed in summer and winter to measure the responses of melanopsin cells. Participants were in light below 50 lux for 60 minutes prior to testing, followed by 11-minute dark adaptation. Red and blue light exposures of 1 second were 15.78nm full width half-maximum (FWHM 632.9nm) and 22.68nm FWHM (467.7nm) respectively. Both were calculated to yield a retinal irradiance of 13.5 log Photons/cm2/s accounting for age-related lens absorption. Light exposure in the days prior to testing was measured using the Actiwatch Spectrum® and analyzed by Actiware software (Phillips Respironics, Murrysville, PA). Total light exposure was calculated for the day of, and each day prior to PIPR testing.

Results
Total photons prior to PIPR testing accounted for significant variance in the PIPR above and beyond age, gender, chronotype, wake time, testing time, time since wake, and photoperiod (R^2 change = .15, β = .40, p = .024) in SAD but not control participants.

Conclusions
These data suggest that prior light levels have a significant impact on melanopsin cell responses in SAD, but not controls. In addition, results indicate that this association between light exposure and the PIPR is not due simply to the diurnal variation in the PIPR, or the greater opportunity to obtain light exposure with increasing duration of time since wake. It is possible that behavioral inactivity, known to be a psychological factor contributing to SAD, exacerbates low light levels, supporting the integrative model.

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HEME OXYGENASE BY PRODUCTS CAN MODULATE LHB SUBUNIT GENE EXPRESSION IN CONCENTRATION DEPENDENT MANNER

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Objective
The temporal control of ovulation and the events that follow depend in large part on the timing of luteinizing hormone (LH) and follicle stimulating hormone (FSH) secretion form the pituitary gland. In seasonal breeding animals, serum gonadotropin levels display robust seasonal variation. These rhythms are dependent upon the activity of pacemaker neurons in the suprachiasmatic nucleus (SCN). As with behavior, gonadotropin secretory rhythms persist in constant conditions. Neuropeptidergic SCN efferents pass temporal cues from the retina to gonadotropin releasing hormone (GnRH) neurons in the preoptic area of the basal forebrain. GnRH stimulates gonadotropin synthesis and secretion from the pituitary gland via the portal vasculature. It was shown that carbon monoxide can be positive stimulator of GnRH releasing from rat's MBH fragments incubated in vitro. Recently, it was discovered that CO was released from the eye into the out flowing venous blood in males of a wild boar and domestic pig crossbreed in a manner dependent on ambient light. Since CO production is synchronized with the seasonal rhythm of heme metabolism we assume that HO-by products can participate in seasonal regulation of gonadotropin gene expression in indirect manner.
The aim of this study was to investigate the role of HO-by-products on gonadotropins subunits gene expression in anterior lobe of the pineal gland.

Methods
Primary pituitary cells culture was derived from Sus scrofa according protocol described in detail previously by Farmer et al. (1993). On day 4 of culture 105 cells/well were stimulated with 1 or 3ÂµM carbon monoxide-releasing molecule (tricarbonyldichlororuthenium(II) dimer (CORM-2); 1 or 3ÂµM hemin; 1 or 3ÂµM bilirubin; 1 or 3ÂµM heme oxyhenase inhibitor (SnPP); 1 or 3ÂµM hemin individually or in combination with 1 or 3ÂµM ZnPP (Protoporphyrin IX zinc(II)) and CORM-2 . The LhB gene expression were determined 6 and 24h after treatment. Messenger RNA (mRNA) levels of LhB were determined by real-time quantitative PCR.

Results
The present studies demonstrate that hemin, a substrate for CO production, can modulate LhB gene expression in concentration and time depend manner in pituitary cells culture. The effect of hemin required heme oxygenase, as the hemin oxygenase inhibitor (ZnPP) blocked the ability of hemin to induce LhB expression and this effect could be mediate by carbon monoxide. The other product of the HO reaction, bilirubin, did not stimulate LhB expression but in 1ÂµM concentration during the short incubation (6h) was inhibitory.

Conclusions
Obtained results suggest that heme and carbon monoxide, but not bilirubin can modulate gonadotropins gene expression.

EFFECTS OF DAWN SIMULATION ON SLEEP IN FIRST YEAR MEDICAL STUDENTS

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Objective
Medical students are known to have poor sleep habits, and use large amounts of caffeine to help compensate for the demands of medical education. Excessive daily caffeine-consumption is known to induce both insomnia & anxiety in the general population. We investigated the effects of Simulated Dawn on sleep, anxiety and caffeine consumption in first year medical students.

Methods
Non-treatment seeking first year medical students were randomized to either receive sleep hygiene instructions [Control; n=20] or sleep hygiene instructions plus Simulated Dawn (Simulated Dawn; n=20) for 3 months. Subjective total sleep duration (sTST), sleep quality (PSQI), state anxiety, and average daily caffeine consumption were obtained at baseline, 1, 2, and 3 months during treatment.

Results
There were no significant baseline differences between the Control and Simulated Dawn groups on any measure.
At two months only, the Simulated Dawn group reported improved subjective PSQI sleep quality (Mann-Whitney U=-2.08, p=0.04).
At 3 months there was a trend towards increased sTST in the Simulated Dawn group compared to the Control group {ANOVA: GxT: F=3.814; df=1, p=0.057)].
At 3 month compared to baseline there was a trend towards increased average daily caffeine consumption in the Control group from an average of 197 to 307.7 mg daily whereas in the Simulated Dawn group there was a decrease in average daily caffeine consumption from 223 to 171 mg [ANOVA (Group: p=NS; Time: p=NS; GxT: F=3.76; df=1, p=0.06)].
There was no association between average daily caffeine consumption and anxiety (as measured by STAI) for either group at baseline; however, at 3-months there was a significant correlation between daily caffeine consumption and anxiety in the Control (r=0.61, p=0.004) but not the Simulated Dawn (r=0.3, p=NS) group.

Conclusions
Our preliminary data suggests that the use of Simulated Dawn may:
Improve subjective sleep quality and duration.
Mediate a cognitive-alertness benefit that leads those treated to use less average daily caffeine compared to those not treated.
By avoiding an increase in caffeine consumption, those treated with simulated dawn may not exceed a threshold of caffeine use leading to increased anxiety.
There may be a circadian component to behaviorally induced insufficient sleep syndrome.

CIRCADIAN OSCILLATION OF AMYGDALA CLOCK GENE EXPRESSOIN AND LOSS OF SYNCHRONY IN A MOUSE MODEL OF DEPRESSION

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Objective
Disturbances in circadian rhythm-related physiological and behavioral processes are frequently observed in depressed patients and several clock genes have been identified as risk factors for the development of mood disorders. However, a direct involvement of the circadian system in the pathophysiology of depression and its molecular regulatory interface has not been described.

Methods
Depression-like behavior was induced in C57BL/6N adult male mice based on a Chronic Mild Stress (CMS) protocol consisting of daily exposure to one of three different stressors (exposure to rat, space restraint, and tail suspension) for 28 days. Mice showing a robust decrease in sucrose preference following CMS, an indicator of anhedonia in rodents, are defined as “anhedonic” and were used as a model of depression. Brains of these anhedonic and control mice were collected at six equally spaced time points during a 24 hours interval and samples of the basolateral (BLA) nucleus of the amygdala were isolated using a micro-punch procedure. Further analysis were carried out with immunohistochemistry and Enzyme-linked immunosorbent assay (ELISA).

Results
Here we demonstrate that chronic mild stress-induced anhedonic behavior is associated with disturbed circadian oscillation of the expression of Clock, Cry2, Per1, Per3, Id2, Rev-erbα, Ror-β, Ror-γ in the mouse basolateral amygdala (BLA). Clock gene desynchronization was accompanied by disruption of the diurnal expressional pattern of vascular endothelial growth factor (VEGF) expression in the BLA of anhedonic mice, also reflected in alterations of circulating VEGF levels.

Conclusions
We propose that aberrant control of circadian rhythmicity related to depression may indeed directly result from the disease state itself and is reflected by plasma VEGF as easily accessible biomarker.

THE NUCLEAR RECEPTOR REV-ERB α REGULATES FABP7 AND MODULATES ADULT HIPPOCAMPAL NEUROGENESIS

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Objective
The function of the nuclear receptor Rev-erb α (Nr1d1) in the brain is, apart from its role in the circadian clock mechanism, unknown.

Methods
Therefore, we compared gene expression profiles in the brain between wild-type and Rev-erb α knock-out (KO) animals.

Results
We identified fatty acid binding protein 7 (Fabp7, Blbp) as a direct target of repression by REV-ERB α . Loss of Rev-erb α manifested in a depression resistant behavioral phenotype and led to overexpression of Fabp7 in various brain areas including the subgranular zone (SGZ) of the hippocampus, where neuronal progenitor cells (NPCs) can initiate adult neurogenesis. We found increased proliferation of hippocampal neurons in Rev-erb α KO mice. In vitro, proliferation and migration of glioblastoma cells were affected by manipulating either Fabp7 expression or REV-ERB α activity.

Conclusions
These results suggest an important role of Rev-erb α and Fabp7 in adult neurogenesis, which may open new avenues for treatment of gliomas as well as neurological diseases such as depression and Alzheimer.

MIDDAY LIGHT THERAPY FOR BIPOLAR DEPRESSION: A RANDOMIZED CONTROL TRIAL

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Objective
The objective was to investigate the clinical efficacy and tolerability of midday light treatment for patients with Bipolar Disorder (BD) Type I or II and a current episode of major depression. The specific aims were to examine the change in depression levels, the proportion of subjects who responded and remitted at Week 6. We assessed response predictors with measures of mood severity, safety, dosing, expectancy and circadian rhythms.

Methods
We enrolled men and women between ages 18-75 with BD-I or II (SCID-confirmed) and a moderate or severe major depressive episode. Eligible patients on stable-dosed antimanic drug(s) were assigned randomly to active treatment or an inactive comparator. We stratified patients based on medication status (with/without antidepressant). We advanced the light-dose by 15 minute increments to a maximum of 60 minutes. The blinded-clinician conducted weekly assessments of mood levels with the Structured Interview Guide for the Hamilton Depression Scale with Atypical Depression Supplement (SIGH-ADS) and the Mania Rating Scale (MRS); safety and tolerability with the Scale for Suicidal Ideation and the Systematic Assessment for Treatment Emergent Effect. At Week 6, participants were evaluated with stringent criteria for treatment response and remission, safety and side effects.

Results
We evaluated 93 potential participants (71% female, 66/93). Common reasons for exclusion included having rapid cycling within one-year, current hypomanic/manic/mixed symptoms or mild depression. Of the 46 randomized patients (65% female, 30/46), seventy-six percent (35/46) received antimanic plus antidepressant medications. Patient characteristics did not differ between intervention groups. An equal number was assigned to each intervention. At Week 6, eighty-three percent (38/46) completed the study. Overall, 54% (25/46) were treatment-responders; and 46% (21/46) were non-responders (13/46) or early withdrawals (8/46). Two patients (4.3%=2/46) who missed 1+ study visits only were treatment-responders; two patients (4.3%) stopped using the light box consistently at Week 5 (1 responder, 1 non-responder). Infrequent new side effects included eye irritation, menstrual cycle changes and reduced appetite. The frequency of having any suicidal symptoms decreased from 11 patients at Week 0, to only four by Week 6. No one experienced a mood polarity switch. Sleep quality improved significantly across time ($t=4.200, p=8.3704\times10^{-5}$) and was associated significantly with daytime activity levels.

Conclusions
Upon completion of the analyses (under still blind-conditions) the investigators will provide additional discussion of the possible differences in treatment response and response predictors. Because of the promising effects to relieve major depression, reduce suicidal ideation and improve sleep quality without de-stabilizing mood, light therapy is a promising option for sub-groups including women with BD and perinatal depression.

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EXPLORING INTER-INDIVIDUAL VARIATIONS IN LIGHT EXPOSURE PATTERNS AND FEELINGS OF VITALITY AS A FUNCTION OF PERSONS' CHRONOTYPE AND SOCIAL JETLAG IN EVERYDAY LIFE.

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Objective

Recent results showed a significant and positive relationship between individuals' daytime light exposure and their feelings of vitality on an hour-to-hour basis in the field (Smolders et al, J Environ Psychol, 36, 270-279, 2013). In this presentation, we will report on additional analyses of this data in which we investigated time-dependent variations in experienced light levels and subjective vitality patterns during the day among early vs. late chronotypes and among persons with a relatively short vs. large social jetlag. Moreover, we explored potential inter-personal differences in the strength of the relationship between light exposure and vitality as a function of individuals' circadian phenotype.

Methods

The method consisted of an experience sampling, combined with continuous measurement of light exposure during three consecutive days from 8 am to 8 pm (N = 38; 48 sessions). The amount of light incident on the eyes was logged with a wearable device, worn close to the eyes on a pair of glasses or headband. Subjective vitality was assessed on an hourly basis with a questionnaire provided by an app on a mobile phone. The average intensity level at eye level (in lx; log transformed) was computed for each 1-hour interval prior to the questionnaires. Individuals' circadian phenotype was assessed with the Munich Chronotype Questionnaire (Roenneberg et al, J Biol Rhythms, 18, 80-90, 2003). Hierarchical linear model analyses were performed, and the data was split based on the median for chronotype (Mdn = 4.78; range 3.14-6.38) or social jetlag (Mdn = 1.25; range 0.00-2.63).

Results

Exploration of inter-personal variations in participants' light exposure and feelings of vitality with external time (i.e., clock time) revealed different patterns as a function of chronotype and social jetlag. Results showed that late chronotypes were exposed to slightly lower light levels and reported lower feelings of vitality in the early morning than early chronotypes. Although persons with a relatively large social jetlag received more light at the eye in the late afternoon and early evening, they reported lower feelings of vitality throughout the day as compared to persons with a short social jetlag. Additional analyses revealed a significant and positive relationship between the average amount of light experienced during the hour prior to completing the questionnaires and feelings of vitality among late chronotypes ($\beta = .14$; $p<.01$), even after controlling for variations in feelings of vitality as a function of clock time. This relationship was not significant among early chronotypes ($\beta = .03$; $p = .36$). Similarly, light intensity was only a significant predictor for subjective vitality among persons with a relatively large social jetlag ($\beta = .13$; $p < .01$), and not among persons with a short social jetlag ($\beta = .05$; $p = .14$). It should be noted that the two phenotype measures are related ($r = .67$, $p < .01$).

Conclusions

The current results suggests that the individuals' experienced light levels during the day and their responses to light in terms of vitality in everyday life depend on their circadian phenotype. These results complement earlier studies which have shown potential inter-personal differences in light exposure patterns throughout the day (Martin et al., Chronobiol Int, 29, 295-304, 2012) and responsiveness to acute effects of light on alertness in the evening (Chellappa et al, J Clin Endocrin Metab, 97, 433-437, 2012) as a function of individuals' chronotype. In the current study, late chronotypes felt more energetic when they were exposed to more light during the previous hour, while the experienced amount of light was not significantly related to variations in subjective vitality among early chronotypes. In line with these results, persons with a relatively large social jetlag seemed to particularly benefit from exposure to higher intensity levels.

IMPLEMENTATION OF CHRONOTHERAPEUTIC INTERVENTIONS FOR NIGHT-SHIFT WORKERS ON A CLINICAL PSYCHIATRIC WARD FOR AFFECTIVE DISORDERS, FIRST IMPRESSIONS

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Objective
To study the possibility and the effects of introducing a supportive chronotherapeutic program for the nightshift of nurses on a clinical psychiatric ward.

Methods
We suggested the use of a chronotherapeutic light therapy program for the night shifts, where the night shift that begins at 22:30 h, started with administrative tasks while applying 30 minutes bright light therapy (BLT) 10.000 lux with a light box (Physiolight LD 220) and afterwards about every 2 hours 15 min of BLT, as an energy boost.
The schedule of LT is as follows:

* From 23:00 till 23:30 BLT
* From 01:30 till 01:45 BLT
* From 03:45 till 04:00 BLT
* From 06:00 till 06:15 BLT

On the way home in the morning it is important to wear sunglasses or blue blocking glasses, to avoid exposure to daylight.
After several nights in a row, at the end of the night shift, people receive 30 min BLT 10.000 lux from 07.30 till 08.00 h.
On the way home in the morning, exposure to light is important and people are encouraged to encounter going outdoors and advised not to wear sunglasses.
Sleep is not recommended within 3 hours (preferably more) after coming home. Bedtime at night is advised at the regular time; occasionally additional melatonin 0.5 mg (available without prescription at local pharmacies) is added at 21.30 h.

We encouraged personnel to take notes at days and night shifts about mood, activities, bed time, sleepiness, tiredness and alertness.

Results
5 nightshift nurses entered our nightshift program, 4 reported their experiences. One of them did not experience any positive or negative effect of the program. The others reported to be more productive during the night, experiencing an improved level of alertness, an easier re-entering their daily routine after night shifts, with less tiredness and less sleeping disturbances.

Conclusions
A chronotherapeutic (BLT) intervention appeared to be easily integrated and accepted in the night shift of nurses. Moreover the majority of participants decided to continue the intervention, considering the advantages they experienced.

AMBIENT HEALING ENVIRONMENTS IN ACUTE PSYCHIATRIC WARDS

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Objective
Seclusion rooms in psychiatry wards are focused on being low-stimuli and high safety, but are often not designed to improve patient wellbeing and thereby do not facilitate the recovery process. Furthermore, there is often no alternative in between housing patients in the general ward or the seclusion room. Using dynamic lighting and an interactive wall in an intermediate room between these two housing options can potentially reduce the number of seclusions, increase the staff and client interaction, reduce trauma in patients and increase staff safety in acute psychiatric wards.

Methods
A workflow analysis was conducted with both staff and (ex-) patients of a crisis unit for psychosis where seclusion occurs to find inefficiencies, needs, and room for improvement. The five most important needs were extracted and these were translated into lighting and interaction applications; i.e. allow the patient to have (some) control over room features, provide structure and information, facilitate contact with caregivers, allow personalization of the room and to provide distraction. The complete intervention was built around an interactive touch screen to be installed in the wall and has tempered class to assure safety. The needs were translated into applications that the patient could control through a touch screen. The applications included the treatment program, adjust the room lighting (indirect cove lighting; white and color), show dedicated themes and pictures, videocalls with caregivers, and a choice of games. Interviews were conducted to establish patient and staff evaluation.

Results
Two intermediate step rooms, or support rooms, and one seclusion room were equipped with the intervention at a new intensive care unit of the crisis unit at the Geestelijke Gezondheidszorg Eindhoven (GGzE). Both patients as well as caregivers indicated being able to control room features such as the lighting enhanced patient empowerment and they rated these room control options as valuable. Also, patients reported that being able to view the treatment program on demand helped to create a predictable environment.

Conclusions
Both patients and staff were very satisfied with the intervention. Patient control of the environment showed to be an important of both patient and staff wellbeing and can aid the recovery of psychiatric patients. Implementing ambient (colored) lighting can be an easy to implement technology to establishing this; app based lighting control can provide patient, and if needed staff, control of the environment and help create a healing environment.

CASE REPORT: IMPROVED HANDWRITING OF A 58 YEAR OLD FEMALE DURING WAKE-THERAPY COINCIDING WITH IMPROVEMENT OF MOOD

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Objective
Chronotherapeutic treatments like sleep deprivation (wake therapy), sleep-phase advance and bright light therapy, influencing the biological clock in the SCN, have been studied for their effect on mood.1 Psychomotor retardation is related to mood disorders and tends to be reversible when the mood disorder is in remission.2
In healthy individuals the production of handwriting during waking itself has a clear circadian rhythm3, slowing down at the time of the onset of melatonin secretion and a trough in the very early morning at around 03:30 hours. Despite deficits of speed and temporal variability, writing fluency does not change significantly across wake sessions indicating that the basic automation of handwriting is preserved at any time.

Aim
This case reports the overnight changes of handwriting and the improvement of mood during Wake light therapy.

Methods
A 58 year old, married female with a refractory bipolar depression was referred for additional wake therapy (WT) to our clinic.
Despite medication (lithium carbonate 800 mg, divalproex sodium extended release (Depakine ChronoTM, Depakote ERTM) 1500 mg, a reduced dosage of 2.5 mg olanzapine) and light therapy in the morning (8 -8.30 a.m.) on a out-patient basis, her mood was still depressed. She was known to have morning tremor probably related to Lithium and valproate.

Results
During the night she wrote down her experiences in a diary that she called her “night-book”. Her handwriting improved during the night (pictures will be shown at the poster). Even her morning tremor was reduced. Evaluation of her mood was also positive. She responded to the additional wake-therapy. Subjectively she experienced less improvement than was observed by the nursing staff and her husband. However the patient was fully surprised to notice the improvement of her handwriting, which enabled her to evaluate the mood-change during the night in a more positive and objective manner.

Conclusions
Psychomotor improvement during the night is related to improvement in mood. Writing in a ˜night-book”, a œnoctary could be a additional method to monitor the objective improvement of mood during wake-therapy and support an objective personal evaluation.

DAWN LIGHT SIIMULATOIN AS A COUNTERMEASURE TO SLEEP-LOSS

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Objective
Light exposure elicits numerous effects on human physiology and behaviour. However, it remains inconclusive whether morning light exposure has beneficial effects on cognitive performance, mood and circadian physiology such as cardiovascular modulation, following sleep restriction (SR). Here we investigated the role of dawn light simulation (DSL) exposure as a countermeasure for impaired cognitive performance and mood during the day after SR and how this light modified the sleep wake transition.

Methods
After a 6-h sleep restriction night, participants were woken-up 2-h before their habitual wake time. We applied a habitual auditory alarm clock or a DSL (polychromatic light increasing from 1.2 lux, 1.9E+16/ m2*s, 1090K, 0.2 m-lux to -250 lux, 2.4E+18/ m2*s, 2750K , 620 m-lux) starting 30 minutes before scheduled wake-up time in a balanced cross-over design. Cognitive tests were performed every 2h during the wake episode and questionnaires were hourly completed to assess subjective mood and well-being. ECG were compared in the two types of wake-up episodes during 30 min of sleep in a still dark environment, 30 min of sleep during the gradual DSL exposure and 30 min of wakefulness after wake-up in a supine position in bed.

Results
Analysis of cognitive performance yielded a significant main effect of “light condition” ($p<0.01$), such that during the first day following SR, performance was significantly deteriorated during dim light but are significantly improved with DsL. The cardiac sympathetic modulation was estimated by the power densities ratio LF/(LF+HF) [LF=0.04 to 0.15 Hz; HF=0.15 to 0.50 Hz]. During the transition from sleep to wakefulness, the classical alarm clock evoked a HR increases from 60.6+2.5 to 89.7+3.7 bpm, while in the DSL condition, HR increases from 67.5+4.8 to 78.4+5.0, resulting in a significant gradient reduction ($p < 0.05$). This finding was corroborated by a significant increase of sympathetic modulation during the 30 minutes of sleep with a gradual DSL, that did not raise further during the following wakefulness.

Conclusions
Our data indicate that exposure to dawn light simulation after SR alleviates decrements in cognitive performance. The DsL was able to maintain higher well-being levels during the following day and prepares cardiac physiology to awakening by “smoothing” the abruptness of sympathetic surge.

BENEFICIAL EFFECT OF MORNING LIGHT AFTER ONE NIGHT OF SLEEP DEPRIVATION: LIGHT GLASSES VERSUS LIGHT BOX ADMINISTRATION

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Objective
Exposure to artificial light improves subjective well-being, mood, cognitive performance and supresses melatonin secretion; relative to the light administration and the exposure time. This photic influence might be especially useful to counterbalance the impact of prolonged wakefulness on sleepiness and performance. However, most people cannot be exposed to bright light therapy at the appropriate time in everyday life or working conditions. Thus, the use of light glasses might represent a powerful alternative. Here, we seek to evaluate the effect of early morning light administration on performance, mood, alertness melatonin, after one night of total sleep deprivation and to determine whether light glasses can be as powerful as light boxes administration.

Methods
24 healthy young (20-35 years old), men and women healthy subjects will participate. Each participant will undergo a balanced cross-over design with three investigation periods spaced more than one week. We propose a protocol in a laboratory setting, in order to control environmental parameters and specifically designed to estimate the differing effects of light under the aforementioned conditions. The participants will follow their habitual life rhythms, before their admittance to the research laboratory to undergo one night sleep deprivation. During the sleep deprivation, cognitive performance will be assessed every two hours. In the morning, the session will begin with a general medical examination, sleep and chronobiological questionnaires, as well as a cognitive test battery session, including mood, alertness and sleepiness questionnaires. The light exposure will last for 30 minutes starting at 4 am, a circadian time at which the performance and vigilance levels are especially decreased (subjects with chronotype within the normal range). The three following lightening conditions will be applied (1) Luminette® (Lucimed, Belgium), (2) Philips Energy-Light (10000 Lux), (3) control condition with dim light exposure (<8 lux). All throughout the testing period, melatonin levels will be measured every hour.

Results
We anticipate early morning light to improve counteracting the negative impact of one night sleep deprivation. We also anticipate that both light administrations will have comparable enhancement effects.

Conclusions
The results, to be obtained, are of further relevance for ergonomical, societal as well as medical investigations. To demonstrate that light administration through light glasses is as efficient as conventional bright light therapy boxes may have direct societal and medical applications, notably for shift workers.

LIGHTWATCHER DATA RECORDER

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Objective
The 'LightWatcher' data recorder is a miniaturized, wearable data acquisition system for lab- and field-measurements in studies that investigate the effect of ambient light level and spectral composition on human test subjects and other biological systems. Typical application areas include studies of human performance, studies of biological rhythms, shift work, light therapy, light design, and architecture.

The data recorder measures and records a unique combination of 12 important ambient variables: Illuminance (Lux), light irradiance in 5 spectral bands (UV-A, Red, Green, Blue, IR), acceleration in 3 orthogonal directions (actimeter), temperature, barometric pressure, and relative humidity. The device measures 20 x 10 x 50 mm and has a weight of only 12 grams. It includes a re-chargeable battery, memory, and a Micro-USB interface for data communication. The device has sufficient battery charge and memory to support recordings with a duration of 1 month without service (re-charge or data download).

Four types of anatomical mounts have been tested and are available for studies with human subjects: The 'eye-glass mount' and the 'headset mount' provide good fixation of the data recorder relative to the head during typical office work and low to medium impact physical activity, and keep the optical axis of the device well aligned with the average principal viewing direction of the subject. Both mounts guarantee comfort even if worn all day long. If discreteness and wearing comfort have prioritiy, then the 'magnetic badge mount' and the 'necklace mount' are practical options to wear the data recorder with optical axis pointing primarily upwards in vertical direction.

The LightWatcher data recorder was initially developed from 2005 to 2010 in the frame of the EU-project EuClock. Since 2011, the development of the device and associated software has been carried further by the company Object-Tracker (A).

We present an overview of the data recorder, present in detail a newly developed data analysis and reporting tool that features intuitive ways to visualize illuminance and spectral irradiance recordings, and present analysis results of data recordings obtained in several indoor office and outdoor light environments in the format of light color raster charts and illuminance spectral irradiance probability distributions.

HUMAN SLEEP & CIRCADIAN PHENOTYPES IN RELATION TO PSYCHOSIS

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Epidemiological data and observations within the general population that possess risk factors for psychosis suggest the manifestation of sleep phenotypes to be present at premorbid phase of psychosis. It is very likely, but currently unproven, that sleep phenotypes promote psychotic experiences in the general population. Previous research has highlighted that psychotic-like experiences are largely more prevalent in the general population than rates of psychotic disorders would predict. Their manifestation may represent the phenotypic expression of the increased proneness for the development of persistent, clinically relevant psychotic experiences. Although a continuous dose-response risk function exists between sub-threshold psychotic experiences and a later clinical disorder, most people with psychotic-like experiences may go through a transitory state and may never progress to a clinical psychotic disorder, or they may develop other types of disorders (e.g. substance abuse). By studying sleep and circadian phenotypes along with a number of empirically validated risk factors in the general population, it is hoped to explore and improve the comprehension of their relationship to risk markers towards psychosis.

AN EXAMINATION OF PERINATAL PHOTOPERIOD AND ADULT RESPONSE TO CHRONOBIOLOGICAL STRESS IN A LARGE INTERNATIONAL SAMPLE

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Objective
Research in rodents has found that the photoperiod in the perinatal period influences the development of the circadian system and affects responses to short and long days later in life (Ciarleglio et al., 2011). Antler & Young (2013) examined this phenomenon in humans. A small sample of young adults (N=66) born in the northern hemisphere in North America, Europe, and Asia experienced the short days of the winter of 2011 in Chicago (41.9°N). Perinatal photoperiod was calculated from date and latitude of birth. A curvilinear relationship was observed between perinatal photoperiod and winter vegetative symptom severity, with lowest symptom severity at a perinatal photoperiod of approximately 12 hours. Both shorter and longer perinatal photoperiods were associated with greater winter vegetative symptom severity. No relationship was observed with cognitive/affective symptoms, which have been hypothesized to result from other mechanisms (Young et al, 1991, 2008). The current study expanded on this previous work with a similar international sample of over 450 participants. In addition to replicating the findings above we explored gender differences and whether perinatal effects are related to prenatal or postnatal mechanisms.

Methods
All graduate and undergraduate students who entered Illinois Institute of Technology in the fall of 2013 were asked by email on February 7, 2014 to participate in a study of birth location and adjustment to winter. The sample was broadly international in birth location: U.S (39%), East Asia (28%), South Asia (13%), Europe and Middle East (14%), Other (6%). In addition to reporting birth date and city of birth, participants completed the Seasonality Assessment Form (Young, et al., 2014) between February 7 and February 19 describing the severity of vegetative and cognitive/affective symptoms during the prior two weeks.

Results
Linear and curvilinear relationships between perinatal photoperiod and vegetative and cognitive/affective symptom severity were assessed using polynomial multiple regression. Whether the nature or magnitude of these relationships differed between men and women was assessed by including sex in the models. In addition, the relationship between symptoms and photoperiod was examined for prenatal and postnatal dates because the mechanisms underlying these effects would be different.

Conclusions
Results will provide a new, large sample test of the effect of early photoperiod conditions on adjustment to later circadian stress in humans, as well as further evidence of what perinatal photoperiods are adaptive and problematic. Gender findings may shed light on the origins of gender differences in prevalence of SAD. Distinguishing prenatal and postnatal effects may provide information about whether mechanisms are in-utero or postnatal.