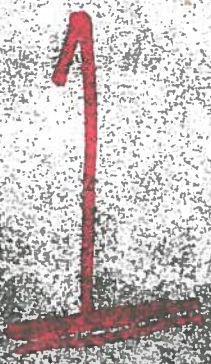
SOLSTICE MEETING

ABSTRACTS

Annual Meeting of the

Society for Light Treatment and Biological Rhythms



NIH, Bethesda, Maryland
June 21, 1989

PROGRAM

08:00-08:30	Registration
08:30-10:30	Paper Session I
10:30-10:45	Coffee/Poster Break
10:45-12:15	Committee Forum: DSM-IV Liaison
12:15-13:15	Lunch/Light Break
13:15-15:15	Paper Session II
15:15-15:30	Coffee/Poster Break
15:30-16:30	Paper Session III
16:30-17:30	Committee Forum: Federal/Industrial Relations
17:30-18:00	Business Meeting/Posters

Paper Session I:

Kern, H.E. - Rate of change of sunlight parameters: effects on human physiology. [3]
Hellekson, C.J. and Booker, J.M. - Epidemiology of SAD in Fairbanks, Alaska. [4]
Partonen, T., et al. - Bright white light treatment in Finland. [5]
Armstrong, S.M., et al. - Human melatonin suppression by light at night. [6]
Oren, D.A., et al. - Supersensitivity of SAD patients to dim light. [7]
Gaddy, J.R., et al. - Light-induced melatonin suppression in winter depression. [8]
Terman, M., et al. - Thirty-minute light therapy at 10,000 lux. [9]
Graw, P., et al. - A classic symptom revisited: diurnal variation of mood in SAD patients predicts long-lasting response to light. [10]

DSM-IV Liaison:

Avery, D., Dunner, D., Spitzer, M., and floor discussion. Questions include: difficulties with the DSM III-R formulation, validation of SAD, structure, and organization of new cross-center study. [11]

Paper Session II:

Lam, R.W., et al. - UV vs. non-UV light therapy for SAD. [12]
Lebegue, et al. - Morning full spectrum vs. cool white light in SAD. [13]
Avery, D., et al. - Phase-typing SAD using a constant routine. [14]
Levendosky, A.A., et al. - Core body temperature in patients with SAD and controls in summer and winter. [15]
Depue, R.A. - Effects of light on the biology of SAD. [16-17]
Lewy, A.J., et al. - The phase-shift hypothesis for winter depression. [18]
Wirz-Justice, A., et al. - Most SAD patients are phase delayed in winter, but respond equally to morning or evening light. [19]
Joseph-Vanderpool, J.R., et al. - Blunted response to corticotropin-releasing hormone (CRH) in patients with SAD is corrected by light treatment. [20]

Paper Session III:

Richter, P., et al. - Light imagination with hypnotized winter-depressed patients. [21]
Stewart, J.W., et al. - Is SAD a variant of atypical depression? Differential response to light therapy. [22]
Yahia, M., et al. - Light therapy for detoxified male alcoholics. [23]
Parry, B.L., et al. - Melatonin and phototherapy in premenstrual depression. [24]

Federal/Industrial Relations:

Brainard, G.C., Waxler, M., and floor discussion. Questions include: safety guidelines for light treatment, criteria for proof of efficacy, and avoiding fraudulent claims.

Poster Presentations:

Schlager, D., et al. - Dawn twilight therapy for winter depression. [25]
Oren, D., et al. - Effects of different light wavelengths in SAD. [26]
Doghramji, K., et al. - Two- versus four-hour evening phototherapy of SAD. [27]
Deltito, J.A., et al. - The effect of bright light treatment on non-SAD unipolar and bipolar spectrum depressed patients. [28]
Brainard, G.C., et al. - Treatment of SAD with a portable, head-mounted phototherapy device. [29]
Williams, T.P. - Photostasis: regulation of daily photon-catch. [30]
Teicher, M.H. and Glod, C. - Rapid resolution of SAD by low-dose alprazolam. [31]
Lahmeyer, H.W., et al. - Sleep and core body temperature in SAD patients during treatment with morning and evening light. [32]
McGrath, R., et al. - A preliminary report on seasonal alcohol abuse and dependence. [33]
Powers, L., et al. - Bright light treatment of night-shift workers. [34]
Lue, F.A.. et al. - Sleep-promoting effects of light on rabbits. [35]
Eastman, C., et al. - The placebo problem in phototherapy for winter SAD. [36]

RATE OF CHANGE OF SUNLIGHT PARAMETERS - EFFECTS ON HUMAN PHYSIOLOGY

Herbert E. Kern *
Inter-Tech
63 Hillside Ave.
Florham Park, NJ 07932

Recent light therapy modalities (e.g., blue light for infant jaundice, bright light for SAD, low energy red laser light for malignancies, UV light for external blood purification) have refocussed attention on the role of light in man's overall physiology. The human organism has been exposed to natural sunlight since the origin of the species. Exposure to the sun's continuum of energy over this extended period has resulted in photochemical/photobiological adaptation basic to the growth and survival of the species. At present we know little about fundamental photo-reactions in the body and how our overall physiology relates to light. Designing experiments to evaluate the effects of sunlight on body function is a formidable task. Design difficulties are confounded by the inconstancies of the sun's parameters amenable to study. Factors such as onset and offset times of twilight periods, sunrise and sunset times, daylength or photoperiod, light intensity, and spectral quality all exhibit continuous daily and seasonal rhythmic variation. Light intensity and spectral quality also show daytime systematic variation but can be perturbed by weather conditions or atmospheric pollution. The above solar factors also change as a function of latitude, the more remote from the equator the more pronounced the change. In human experimentation, measured responses to light signals may be confounded by significant differences in light sensitivity among subjects, with attendant large sample variances. Until light sensitivity classification can be accomplished, these large variances will probably persist.

The brain's sensory systems respond to changes in the external world. Rapidly changing external signals are stressfull, and the brain initiates biochemical intervention in order to maintain homeostasis. Therefore, rate of signal change and its effect on biosystems should be an important area of study. The author has attempted a review of solar data and has calculated daily rates of change of the previously mentioned solar parameters throughout all seasons and as a function of latitude. Maximum positive rates of change center about the spring equinox, whereas maximum negative rates of change are located around the autumnal equinox. Many clinical measurements and other observations taken continuously throughout the year exhibit peak springtime values or effects which correlate well with solar rates of change. These data will be presented in graphical form.

---

* Retired: AT&T Bell Labs, Chemical Research Laboratory

EPIDEMIOLOGY OF S.A.D. IN FAIRBANKS, ALASKA

Carla J. Hellekson, M.D.
Clinical Assistant Professor
University of Washington Medical School
1919 Lathrop Street, Drawer 30, Fairbanks, Alaska 99701
John M. Booker, Ph.D.
Assistant Professor, University of Alaska - Anchorage
3211 Providence Drive, Anchorage, Alaska 99508

Seasonal Affective Disorder (S.A.D.) with recurrent fall-winter depressions of the "atypical" type alternating with spring-summer euthymia or hyperthymia has been described as an affective disorder with a seasonal pattern in D.S.M. III-R (pg. 224). The unique responsiveness of the winter depressive symptoms of phototherapy, as demonstrated in Alaska and elsewhere, has raised questions about the potential clinical population with S.A.D. who may benefit from this new therapeutic modality. An initial national newspaper survey by Potkin, et al (1986) showed a ten-fold increase in prevalence of S.A.D. complaints with increasing latitude in 32 of the "lower 48" states. To look at the epidemiology of S.A.D. in the high latitude community of Fairbanks, Alaska (64 degrees, 49'N), a cross-sectional study was performed during January through March of 1988 with structured interviews of one hour duration by trained interviewers of 310 residents, chosen by stratified, systematic random sampling on the basis of census tract in the Fairbanks North Star Borough. The sample consisted of 49% males and 51% female from ages 21 through 79. Racial makeup was consistent with other descriptions of the Fairbanks population: white 80%, black 10%, Alaska Native 7%, other 3%. Utilizing the criteria of Kasper et al (in press), the prevalence of S.A.D. and subsyndromal-S.A.D. in the Fairbanks population was 8.9% and 19% respectively. "Marked" or "extreme" change in energy level between summer and winter was reported to be 67%, with half of those gaining weight by 10 pounds or more. "Irritability" was reported to be increased by 14% between December and February. S.A.D. epidemiology from this high latitude community will be compared with data from a study of four centers in the "lower 48" by Rosen, et al (in preparation).

REFERENCES

1. Potkin, S.G., et al: Seasonal Affective Disorder: Prevalence Varies with Latitude and Climate. Clin Neuropharmacol 9 (suppl): 181-183, 1986.
2. Kasper, S., et al: Epidemiological findings of Seasonal Changes in Mood and Behavior: A Telephone Survey of Montgomery County, Maryland, USA. Archives of General Psychiatry (in press).
3. Rosen, L.N., et al: Prevalence of Seasonal Affective Disorder Compared at Four Latitudes (in preparation).

BRIGHT WHITE LIGHT TREATMENT IN FINLAND

Partonen T, Appelberg B, Kajaste S, Pihl S, Partinen M, Härmä M
Ullanlinna Sleep Disorders Clinic and Research Center
Tarkk'ampujankatu 1 E, SF-00130 Helsinki, Finland

10 outpatients (8 women and 2 men) aged 21-63 were treated with bright white light in Ullanlinna Sleep Disorders Clinic and Research Center, Helsinki (60° N), Finland in February-March 1988 and in October 1988-March 1989. Light treatment was given for 1 hour in the morning for 5 days. It was administered between 05.30-07.30 hours. The patients were allowed to choose the hour that suited best their working schedules. It was administered in a white-painted room in which the lights situated on the ceiling. The intensity was >2500 lux at the level of the bed. The patients were allowed to move freely and do their morning duties in the room.

The patients were interviewed by a psychiatrist (B.A.) before entering the study. All of them complained depressed mood and other symptoms, which included increased sleep need and morning typed sleepiness. Similar symptoms had been occuring during earlier winters, but not in summertime (except in case # 1). 2 patients had undoubtfully SAD. 7 patients were diagnosed having subsyndromal SAD. 1 patient (case # 1) had delayed sleep phase syndrome (He was not tested with psychological tests.). None of them used any drug treatment.

Whole night polysomnographies were done before and 1 day after the light treatment. Salivary melatonin and cortisol were sampled and body temperature was measured with a Hg-thermometer every other hour for 24 hours before and 1 day after the light treatment. Sleepiness was monitored with a 100-mm-Visual Analogue Scale and Stanford Sleepiness Scale in the same way. Psychologic tests were run 1 week before, 1 day after, and 1 week after the light treatment, and they included: Hamilton's Rating Scale for Depression, Beck Self-Rating Scale for Depression, Symptoms Checking List-90, Helplessness Scale, and Automatic Thoughts Questionnaire.

The results were encouraging. All the patients reported that they feeled themselves better after the light treatment, and the psychological tests showed that symptoms were significantly relieved 1 day after the light treatment. Their symptoms enforced nearly to the baseline values 1 week after the light treatment. With SCL-90 4 cases were recognized as depressives, whereas 2 cases were recognized with HRS or Beck Self-Rating Scale. Interestingly, wide range of symptoms were alleviated by the light treatment. The acrophase of melatonin concentration and sleepiness was advanced by 1-2 hours, but that of cortisol could not be shifted.

The study was granted by The Miina Sillanpää Foundation.

HUMAN MELATONIN SUPPRESSION BY LIGHT AT NIGHT

Armstrong*, S.M., McIntyre, I.M., Norman, T.R. and Burrows, G.D. Department of Psychology and Brain Behaviour Research Institute*, La Trobe University, Bundoora, Victoria 3083, Australia; Department of Psychiatry, University of Melbourne, Austin Hospital, Heidelberg, Victoria 3084, Australia.

The response of plasma melatonin levels of normal human volunteers to a midnight light pulse of one hour duration and intensities of 3000, 1000, 500, 350 or 200 lux (lx) was investigated and melatonin was found to be suppressed by 71, 64, 44, 38 and 16% respectively. Except for the 16%, all levels of suppression were statistically significant; there was no significant difference in suppression between 3000 and 1000 lx. Suppression of melatonin at 500 lx and below in normal humans was contrary to that reported in the literature.

In a second experiment, we investigated whether time of night at which the 1-hour light pulse is given is an important factor in humans. In the rat, the NAT rhythm's response to light differs in the first half and second halves of the night; in the second half there is lack of recovery of the NAT rhythm (Illnerova and Vanecek, 1979, Brain Res., 167: 431). Time of night differences are also found in the chick (Wainwright and Wainwright, 1981, Pineal Function, Elsevier, W. Holland). Human subjects were exposed to 3000 or 1000 lx for one hour at 2100, midnight or 0400 hrs. Time of light administration was found not to be a crucial variable. At midnight and 0400 hrs melatonin was significantly suppressed by light. At 2100 hrs melatonin release was just commencing and levels were not high enough to show significant suppression. In all these cases after cessation of light exposure, melatonin release resumed and the levels reached were those that would have been achieved if the light pulse had not been given, i.e. there was no "rebound effect" even at 2100 hrs.

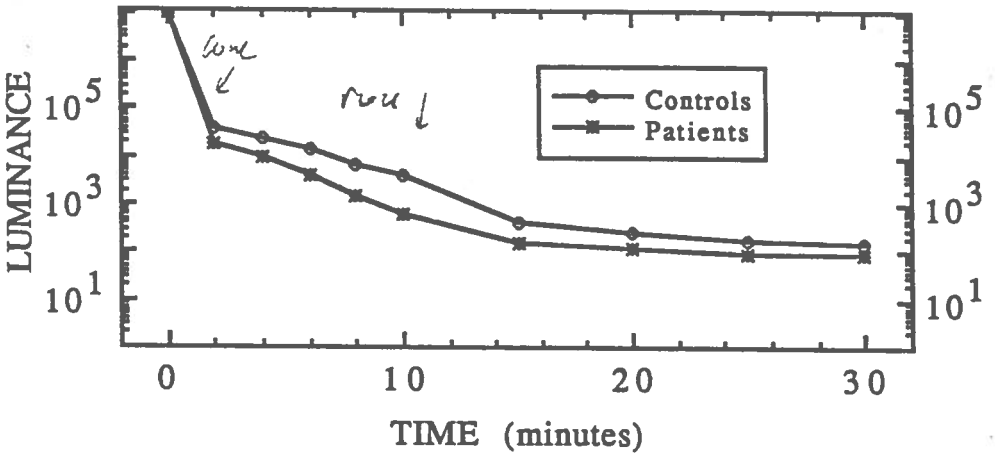
In the rat, it has been shown that there is a reciprocal relationship between intensity and duration of light exposure on the NAT rhythm (Vanecek and Illnerova, 1982, Experientia 38: 1318). In a third experiment, we exposed normal human subjects to either 200, 400 or 600 lx for a 3 hour duration from midnight. At 200 lx, melatonin levels were suppressed although not statistically significant and showed a trend towards recovery even during light exposure. Melatonin levels were significantly suppressed by 30 mins (600 lx) and 60 mins (400 lx) but extended light exposure did not significantly induce further suppression. Therefore, increased duration of low intensity light does not produce an equivalent suppression to that of a higher intensity for a shorter duration.

It is concluded that as for other mammals, the human pineal melatonin system is sensitive to even quite low light intensities (200 lx) but unlike rats, humans show no marked difference in recovery from light exposure in the early versus late night, and show no reciprocal relationship between intensity and duration at dim light exposures.

SUPERSENSITIVITY OF SAD PATIENTS TO DIM LIGHT

DAN A. OREN, M.D., JEAN R. JOSEPH-VANDERPOOL, M.D., and NORMAN E. ROSENTHAL, M.D.
CLINICAL PSYCHOBIOLOGY BRANCH, NIMH
9000 ROCKVILLE PIKE, 10/4S239, BETHESDA, MD 20892

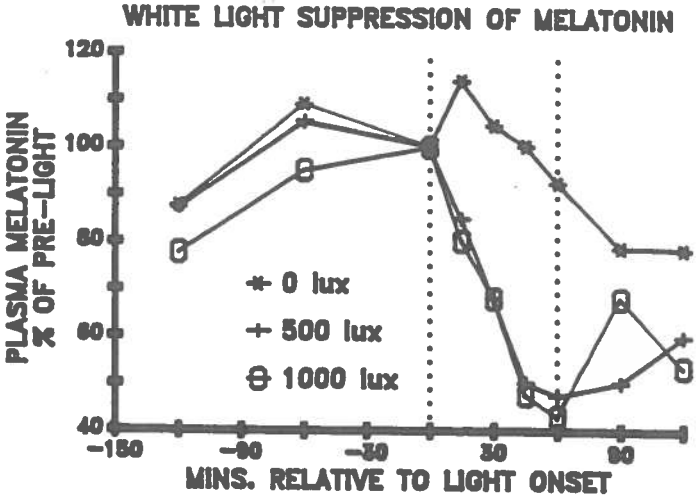
Given that Seasonal Affective Disorder (SAD) is often effectively treated with phototherapy apparently mediated by the eye, and that it is associated with the season of relative light deprivation, we hypothesized that patients with SAD would prove to be less sensitive to dim light than normals. Using a standard protocol for assessing Dark Adaptation Threshold (i.e. consciousness of dim light) we examined 10 depressed SAD patients and 10 age and sex matched controls using a modified Goldmann/Weekers Adaptometer with Bekesy tracking. Depression was evaluated by use of the Hamilton Depression Rating Scale. Patients and controls were medically healthy and medication-free at the time of examination. Controls had no history of mental illness, as determined by SCID. Examination of subjects was performed between 12:00 p.m. and 5:00 p.m. between December 1 and March 17 of one winter. Neither group had taken any psychotropic medications over the five weeks prior to examination. Prior to each exam one eye was randomly selected for examination, while the other eye was covered with an opaque patch. Subjects were exposed for 5 minutes to a ganzfeld light of 2400 asb. A test target of flashing white light was presented in the center of the apparatus. Subjects were asked to fixate on the target as its intensity logarithmically declined from 7 log μμlamberts. Subjects were instructed to press a button when they could not see the light for more than a second, and to release the button when they could. Pressing the button caused the light to increase in luminance and releasing it caused the light to dim. The resulting data curves were examined by a rater who was blind as to whether a graph was that of a patient or a control and levels of dark adaptation sensitivity were identified at 2, 4, 6, 8, 10, 15, 20, 25, and 30 minutes after starting of the procedure. Using an analysis of variance with repeated measures, the patients were found to be **more** sensitive to dim light than normals ($F=4.5$, $p<.05$, $df=1,18$). This study suggests that rather than becoming depressed because they are less sensitive to light than normals, SAD patients have a supersensitivity to dim light. Supersensitive suppression of melatonin in response to light has already been documented as being increased in some non-seasonally depressed patients. Conceivably, the supersensitivity may reflect a visual processing defect contributing to a depressed state in SAD. Or, perhaps more plausibly, the supersensitivity may reflect a compensatory state of "light hunger" created by the brain in concert with its own depressed state of still unknown etiology.



LIGHT-INDUCED MELATONIN SUPPRESSION IN WINTER DEPRESSION

J.R. Gaddy, K.T. Stewart, B. Byrne, K. Doghramji, S. Waldfogel, J. Markoff, M. Rollag, and G.C. Brainard, Departments of Psychiatry, Neurology, & Opthalmology, Jefferson Medical College, Philadelphia, PA and Department of Anatomy, Uniformed Health Services University of Health Sciences, Bethesda, MD

Patients suffering from winter depression have been successfully treated by exposing their eyes to white light of at least 2500 lux for ca. 2 hrs/day. The physiological bases of light's therapeutic effect are as yet obscure, and little is known about other kinds of photobiological responses in patients with winter depression. Therefore, we tested visual psychophysical and neuroendocrine sensitivities to light in winter depression patients. Conscious perception of light was tested with an Octopus 2000 ganzfeld stimulator in seven patients. In five patients we assessed the ability of 0, 500, and 1000 lux of white light presented from 3am to 4am to suppress plasma melatonin levels. Conscious perception throughout the visual fields was not significantly different from clinical norms. On the other hand, patients exhibited an average of 52% suppression of plasma melatonin, relative to pre-light levels, when exposed to an hour of 500 lux of white light. It is commonly thought that this degree of melatonin suppression in normal humans requires at least 2500 lux of white light. Thus, these data suggest that patients with winter depression, though having normal psychophysical sensitivities to light, may be supersensitive to the neuroendocrine effects of light. Patients with manic-depressive disorder may also exhibit such supersensitivity, suggesting that seasonal depression may share some of the biological characteristics of that group.



Supported by BRSG #RR05414 to Jefferson Medical College, USUHS Grant C07049 to M. Rollag and NASA Grant NAGW1196 to G. Brainard.

A CLASSIC SYMPTOM REVISITED: DIURNAL VARIATION OF MOOD IN SAD PATIENTS PREDICTS LONG-LASTING RESPONSE TO LIGHT

P. Graw, K. Kräuchi, A. Wirz-Justice and W. Pöldinger
Psychiatric University Clinic, CH-4025 BASEL, SWITZERLAND

Light therapy is now recognised as the treatment of choice in SAD patients. There is some discrepancy between centres as to relapse rate after withdrawal. We have found a predictor for relapse in our SAD sample, and wish to present this as a strategy for other groups to compare results.

A classic melancholic symptom, diurnal variation of depressive symptomatology (DV), can be estimated by observer rating (Hamilton Rating Scale Item 18a) or self-ratings (VAS morning and evening). In the baseline week before light treatment 73% of 56 SAD patients had morning worsening of mood in the HAMD Item (DV+); 11% had evening worsening (DV-); and 16% no diurnal mood swings (DV0). Subjective VAS daily mood ratings showed a parallel pattern. One week of light therapy (2500 lux, >1h a.m. or p.m.) was clinically effective independent of DV type; relapse was not.

TYPE	N	BASELINE HRS	LIGHT HRS	WITHDRAWAL HRS
DV+	37	19.1±0.6 SEM	8.0±0.7	8.2±0.8
DV-	5	19.4±0.9	9.4±3.4	15.8±2.9
DV0	7	17.4±0.9	6.1±1.4	16.9±3.0

Thus the relatively low relapse rate in our SAD sample may be related to a high percentage of depressives with classic morning low mood. Other groups with a high relapse rate after a week withdrawal may have more patients with atypical or no diurnal mood swings. Since all groups working in the field of light therapy use HAMD ratings, this point could be relatively easily examined retrospectively.

Abstract, SLTBR Annual Meeting, Washington DC June 1989

DSM-IV CRITERIA FOR SEASONAL AFFECTIVE DISORDER

David Avery, M.D. (Moderator)
David Dunner, M.D.
Norman Rosenthal, M.D.
Robert Spitzer, M.D.

The American Psychiatric Association's Task Force on Mood Disorders is currently preparing for DSM-IV and reassessing the status of the seasonal affective disorder criteria in DSM-III-R.

Seasonal pattern was added as a non-coded parenthetical mood descriptor for affective diagnoses in DSM-III-R. Questions posed by the APA Task Force on Mood Disorders for DSM-IV include: a) What were the criteria for inclusion of this term in DSM-III-R and was the inclusion justified? b) Are there data to support or necessitate a change of these criteria?

Among the controversies concerning the criteria are:

1. Are the criteria for 60-day window of onset and offset of the seasonal depression valid? Should the criteria be changed to broader window? Or deleted entirely?

2. Should "seasonal" be changed to "winter" or "fall-winter" since the database concerning a "fall-winter depression" is much greater than for summer depression?

3. Should depression NOS (not otherwise specified), seasonal pattern be retained? Should patients who complain of low mood but do not fulfill criteria for major depression be included in DSM-IV?

4. Is SAD a disorder distinct from atypical depression? E.g., are their responses to treatments different?

5. Should light responsiveness be included in the criteria? Should a remission of symptoms when living closer to the equator count as a symptom of seasonal affective disorder?

The participants will present their perspectives on these and other issues. Other members will also be encouraged to express their views.

UV vs. NON-UV LIGHT THERAPY FOR SAD

Raymond W. Lam, M.D.
Alan Buchanan, M.D.
Campbell Clark, Ph.D.
Ronald A. Remick, M.D.

Department of Psychiatry, University Hospital - University of British Columbia (UBC) Site, 2255 Wesbrook Mall, Vancouver, Canada V6T 2A1

Light therapy is now regarded as the treatment of choice for seasonal affective disorder (SAD). Critical parameters for the therapeutic use of light include intensity of light, duration of exposure, timing of exposure and light spectrum. Spectrum of light has been the least studied treatment parameter. Most SAD studies have used full-spectrum fluorescent lights, but some centres have used cool-white fluorescent or incandescent light with effect. Full-spectrum fluorescent light includes a small amount of ultraviolet (UV) light while the latter two sources emit negligible amounts of UV light. Because of potential medical complications of UV light exposure, the question of whether UV light is critical for antidepressant response is important.

We investigated 11 SAD patients during the winter of 1988/89. Patients were diagnosed by DSM-III-R criteria and were not taking concurrent psychotropic drugs. Subjects entered a triple crossover protocol following one week of baseline conditions with regular sleep schedules. Treatment consisted of exposure to full-spectrum fluorescent light from 06:00-08:00 for one week intervals, separated by one-week withdrawal periods. During each treatment week, subjects were assigned in a random order to wear specially prepared eyeglasses that either: 1) allowed transmission of 2500 lux UV light (UV-light), 2) blocked 99% of UV transmission without affecting intensity (UV-blocked), or 3) reduced light intensity to 500 lux (dim). Blinded raters used the Structured Interview Guide for the Hamilton Depression Rating Scale, SAD version (SIGH-SAD), for weekly ratings.

Data were analyzed using repeated measures ANOVA. Preliminary results show a significant difference in post-treatment reduction of Ham-D scores between conditions, with UV-light being superior to both UV-blocked and dim conditions ($p=0.003$). UV-blocked and dim light conditions did not have significant antidepressant effects.

The results suggest that the UV-spectrum in full-spectrum fluorescent light is important for the therapeutic effect. The implications of these results will be discussed.

Condition	Ham-D Scores: Baseline	Post-treatment
UV-light	21.3 ± 3.5	8.9 ± 7.8
UV-blocked	17.8 ± 3.2	12.8 ± 9.5
Dim	21.6 ± 5.5	15.6 ± 8.8

MORNING FULL SPECTRUM VS. COOL WHITE LIGHT IN SEASONAL AFFECTIVE DISORDER

Breck Lebegue, M.D.

Joanne L. Brown, Ph.D.

Department of Psychiatry

University of Utah Medical Center

50 North Medical Drive

Salt Lake City, UT 84132

ABSTRACT

Twenty three patients were treated with two hours of morning light, either full spectrum or cool white, in a randomized double-blind crossover fashion for six weeks (2 weeks treatment A, 2 weeks washout, 2 weeks treatment B). Response was measured with the Hamilton Psychiatric Rating Scale for Depression (both 21 item and 7 item addendum); Weekly Mood Inventory and the Hypomania Rating Scale. The two treatments were equally effective in reducing and/or eliminating SAD symptoms. Individual patients, however, responded differentially to the two treatment conditions. No ordering effect was found.

No serious side effects were noted; some subjects complained of disrupted sleep cycle, eye pain, headache; and some experienced a mild hypomania, easily managed by decreasing the morning light dose. Additional analysis is currently being conducted (and will be available for the June presentation) to determine the predictors of patient's response to either full spectrum or cool white light.

PHASE-TYPING SEASONAL AFFECTIVE DISORDER USING A CONSTANT ROUTINE

David Avery, M.D.
Kitty Dahl, B.A.
Margaret Savage, M.S.
George Brengelmann, Ph.D.

Harborview Medical Center, ZA-99
325 9th Avenue
Seattle, WA 98104

It has been proposed by Lewy that there is a phase-delay of the strong oscillator (as measured by the dim light melatonin onset) in patients with seasonal affective disorder (SAD). The present study used a constant routine to "unmask" the endogenous circadian temperature rhythm by controlling major variables which influence core body temperature. Women with hypersomnic seasonal affective disorder (n=10) and control subjects (n=9) without any history of depression were studied. Eight SAD subjects were restudied after responding to AM bright light. The mean age for the SAD subjects was 29.6 and for the controls, 28.5. All were drug-free except for one in each group taking birth control pills. For 6 days prior to constant routine the subjects were allowed to sleep only between the hours of 2100 and 0600. During the 39 hours in the hospital, temperature and light (60 lux) were held constant. Subjects were allowed to sleep the first night. During the next 27 hours the subjects were sleep-deprived and at bed rest except for giving a urine collection every 2 hours. Twelve isocaloric meals were consumed every 2 hours. Rectal temperature, skin temperatures, and sweat rates were logged every minute on to a computer. Norepinephrine, cortisol, TSH, and melatonin were drawn every hour. Melatonin was also drawn every half hour from 1800 to midnight.

The temperature data were analyzed by cosinor analysis. The groups were compared with one-tailed and two-tailed unpaired and paired T-tests.

Preliminary data show that the mean rectal temperature acrophase of the SAD subjects was significantly ($p<.05$) phased-delayed relative to controls (17:36 vs 15:44). There was a nonsignificant trend (one-tailed $p=.09$) for the morning bright light treatment to phase-advance the acrophase (17:41 to 16:20). The mean amplitudes of the SAD subjects and controls were not significantly different (.42°C vs .48°C) and did not change with light treatment (.42°C vs .42°C). there was a nonsignificant trend ($p=.07$) for the mesor to be higher in the drug-free SAD subjects compared to drug-free controls (36.87°C vs 36.61°C). The mesor did not change when the SAD patients were restudied (37.01°C to 37.00°C).

CORE BODY TEMPERATURE IN PATIENTS WITH SEASONAL AFFECTIVE DISORDER AND CONTROLS IN SUMMER AND WINTER

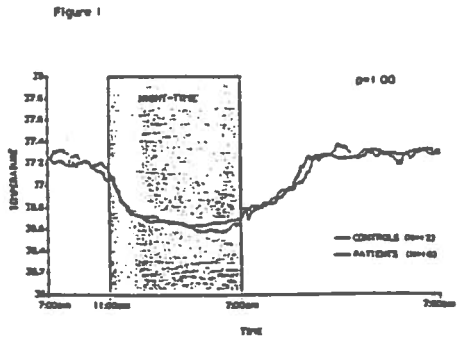
Alytia A. Levendosky, Norman E. Rosenthal, Jean R. Joseph-Vanderpool, Todd Hardin, Elizabeth Sorek, Thomas A. Wehr
National Institute of Mental Health, Clinical Psychobiology Branch

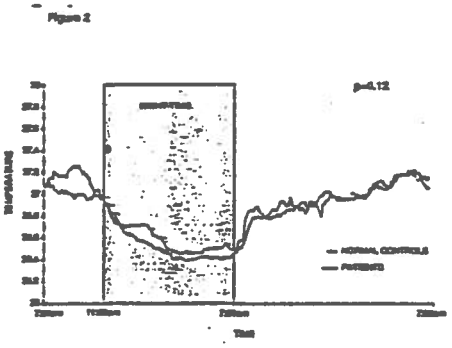
Abnormalities of phase and amplitude in circadian rhythms of core body temperature have been reported previously in depressed patients. In this study we compared the circadian temperature profiles of seasonal affective disorder (SAD) patients and normal controls under 5 separate conditions: controls- summer and winter, untreated patients-summer and winter and light treated patients in winter.

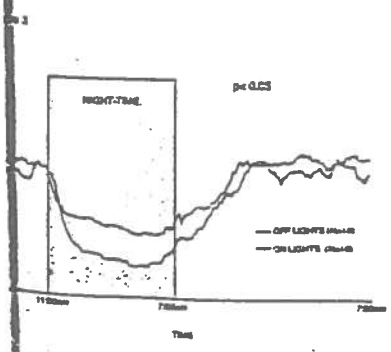
During the winter the patients were on 2 conditions: on and off light treatment. The on-light condition consisted of 9 days of 2 1/2 hours of bright (2500 lux) light treatment in the morning (between 6 and 9am) and 2 1/2 hours in the evening (between 6 and 9pm). The off-light condition consisted of at least 9 days of ordinary room light for the same time periods in the day as above.

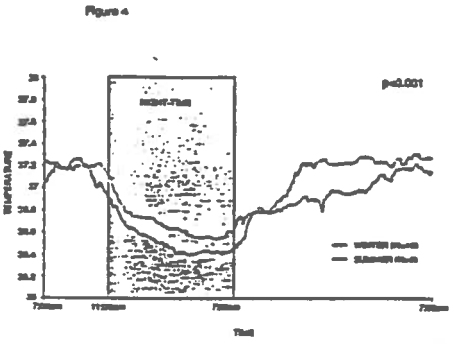
We found that the temperature profiles of the untreated SAD patients during both winter (see Fig.1) and summer (see Fig.2), were no different from those of normal controls ($p=1.00$). During the winter, however, light treatment enhanced the amplitude of the circadian rhythms, by lowering the nocturnal temperature, significantly beyond normal levels ($p<0.05$), although there was no significant effect on phase (see Fig.3). The comparison of the 4 untreated groups (patients- summer and winter, and controls- summer and winter) revealed that the overall temperature rhythms of both patients (see Fig.4) and controls (see Fig.5) were lowered significantly during the summer ($p<0.05$). The amplitudes, however, were unchanged across seasons.

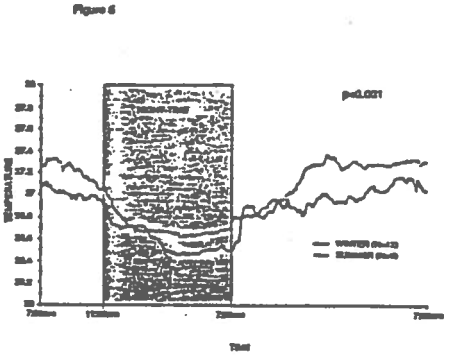
Our initial use of light therapy was inspired to some degree by the observation that patients recovered in summer. In this study, however, we found that the effects of summer and bright light treatment on body temperature profiles are different. These findings would appear to be at odds with 2 current theories of the mechanism of light therapy in SAD: 1) that it is mediated by changing circadian phase in a specific way (Lewy et al., 1987); 2) that it acts by enhancing circadian amplitude (Czeisler et al., 1987). The problem of masking may create an artifact in phase and amplitude of circadian rhythms. A constant routine study might circumvent this problem. If the findings of the present study truly reflect pacemaker function,however, then we may conclude either that light and summer are acting in different ways to produce recovery in SAD patients, or else that effects on amplitude and timing of temperature rhythms do not reflect the mechanism of action of phototherapy.











EFFECTS OF LIGHT ON THE BIOLOGY OF SEASONAL AFFECTIVE DISORDER

Richard A. Depue

Department of Psychology, University of Minnesota, Minneapolis, MN 55455

This study assessed the effects of bright artificial light on the phase position of two circadian rhythms in seasonal affective disorder. Participating in the study were 8 SAD and 6 control subjects, all of whom were premenopausal females. Subjects were excluded if other medical or psychopathology conditions, medications, or Delayed Sleep Phase Syndrome were present. The two groups of subjects were matched for age (range 21-34 years) and weight, and were run between January 5 and February 10.

Subjects were assessed for two weeks in dim (300 L) and two weeks in bright (2500 L) light conditions (6-8 AM and 6-8 PM daily). Thus, in both light conditions, the rest-activity schedule of SAD and control subjects was similar in that rise and bed times did not vary significantly (as verified in activity recordings). These light exposure times were chosen because pilot work indicated that controls did not demonstrate marked phase changes in circadian rhythms under this regimen (i.e., advancing "sunrise" and delaying "sunset" had a combined effect of not changing the phase position of controls' rhythms). All SAD subjects were light responders (all achieved HRSD scores of < 5).

Activity and core body (rectal) temperature were measured continuously via Vitalog monitors at one-minute intervals. Daily time logs of light use, nightly risings, showers, physical exercise, and meals were kept, and subjects were instructed not to turn on any light source if they arose during nighttime hours. Data were edited for these various masking effects.

Results for temperature minimum are shown in Figure 1 (attached). In the dim light condition (natural winter photoperiod of 8.5 hours), the minimum relative to midnight was significantly delayed in SAD subjects relative to controls. The effect of bright light exposure (simulating a 14-hour photoperiod) resulted in no change or a nonsignificant delay in the minimum in controls. SAD subjects, however, demonstrated a significant advance of the minimum of approximately one hour, and this was so for every SAD subject.

Results for the activity rythm are shown in Figure 2 (attached). The activity band was divided into two components in accordance with the exaggerated dip that SAD subjects (and controls) manifest in clinical state and activity level in the early afternoon. The first component was defined as activity from rise time to the end of the afternoon dip (defined individually for each subject, but generally between noon and 3 PM), whereas the second component was defined as the end of the dip until bed time. In dim light conditions, controls showed elevated mean activity in the first compared to the second activity component, and bright light did not affect this differential pattern, although it did raise the mean of both components significantly. SAD subjects, on the other hand, showed equivalent mean activity in both components in dim light conditions; bright light, however, produced an activity pattern that was like controls: an elevated first component of activity relative to the second component.

The change in activity pattern may be viewed as a strengthening of the first component of activity and perhaps as an advance of rhythms (e.g., dopamine) that contribute to the overt activity rhythm. This would be consistent with the advance in the temperature minimum with bright light exposure observed in SAD in this study. One possible interpretation of the combined data is that SAD is characterized by weak coupling between overt rhythms and their Zeitgeber (e.g., light-pacemaker or pacemaker-overt rythm coupling). Pittendrigh has demonstrated that weak Zeitgeber-oscillator coupling can produce delayed phase positions in an oscillator's overt rhythm.

Richard A. Depue

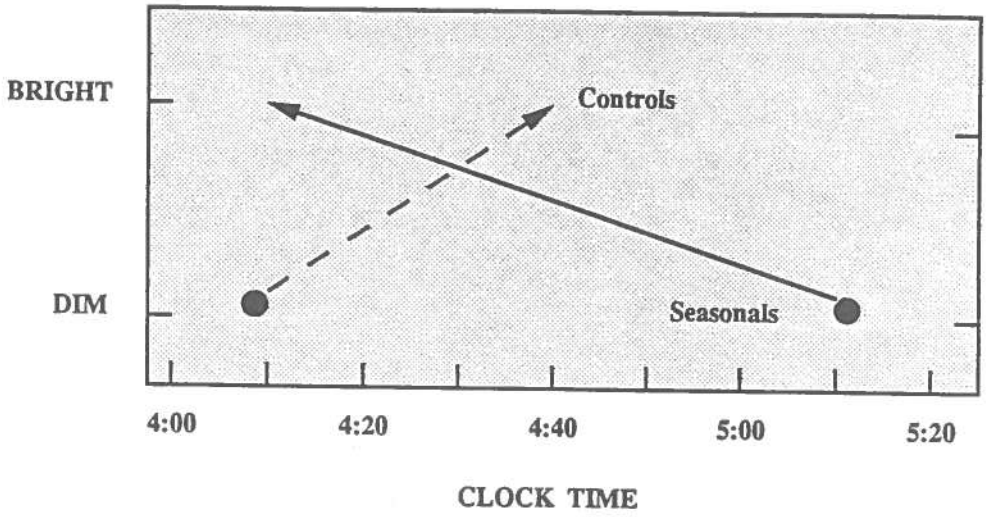


Figure 1: Temperature minimum as a function of light condition.

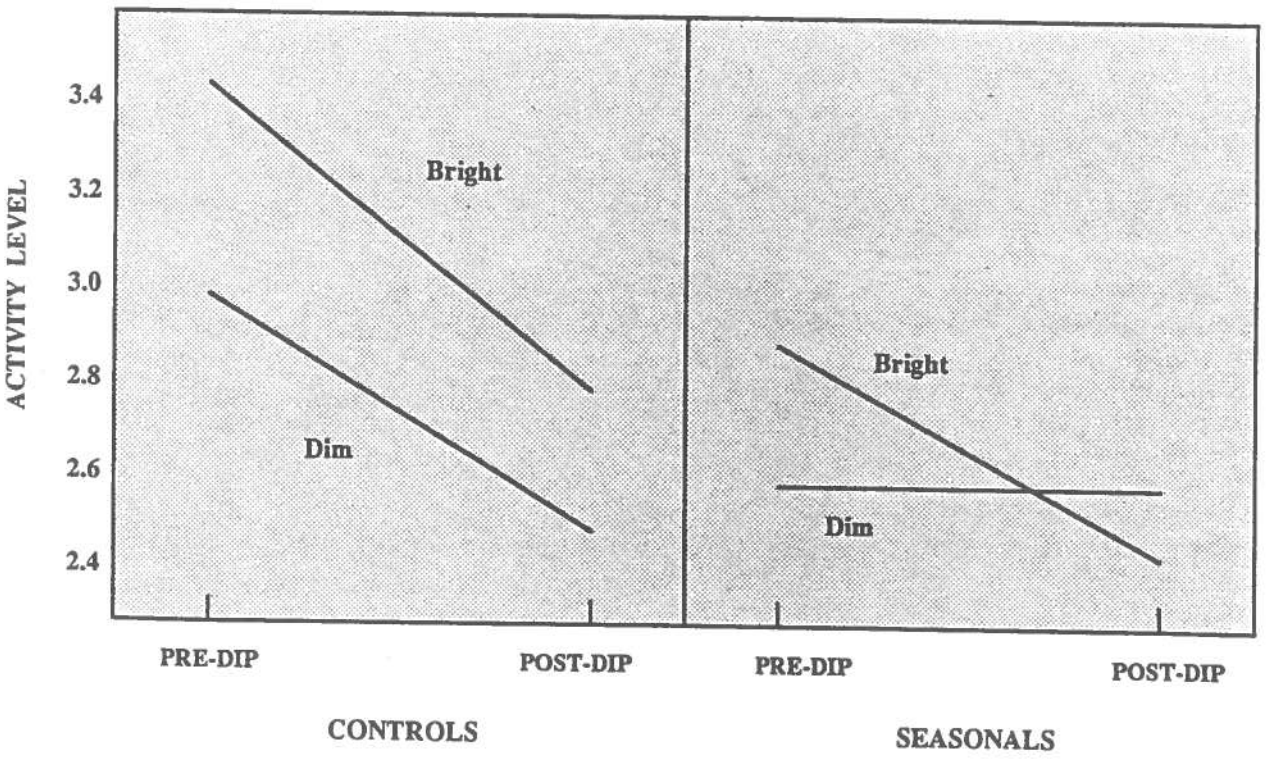


Figure 2: Pre- post-dip activity levels as a function of light condition.

THE PHASE-SHIFT HYPOTHESIS FOR WINTER DEPRESSION

Alfred J. Lewy, Clifford M. Singer and Robert L. Sack
Oregon Health Sciences University
Portland Oregon 97201

When we first began treating winter depression with bright light, we extended day length. The exposure times were 6-9 a.m. and 4-7 p.m. The rationale was to mimic the daylength of that time of the year when the patient would have spontaneously switched out of his depression.

In retrospect, we thought that the original patient was responding mainly to the 6-9 a.m. light and that the 4-7 p.m. light was not having much effect. Consequently, we wondered if extending daylength at both ends of the day was necessary. Since many of these patients complain of morning hypersomnia, we hypothesized that most of them were phase delayed (with respect to sleep as well as with respect to real time) and that they would preferentially respond to a corrective phase advance induced by morning bright light exposure.

Accordingly, what may be the first successful attempt at controlling for the placebo effect (patients had no prior expectation of a superior response from morning light exposure compared to evening light exposure), we compared the antidepressant response of these two light exposure schedules, requiring patients to be awake between 6 a.m. and 10 p.m. and to avoid bright light around twilight. It should be noted that evening light was scheduled between 8 and 10 p.m. to make sure that it was not causing a phase advance. Morning light was significantly more antidepressant than evening light, which did not decrease 21-item Hamilton depression ratings.

Two winters later, we did a similar study, except that evening light was scheduled between 7 and 9 p.m. We did this in order to make sure that the evening light's effectiveness was not being compromised because patients were required to go to bed at 10 p.m. The results were similar to our first controlled study: morning light was significantly more antidepressant than evening light. In this study, however, evening light slightly (but statistically significantly) decreased depression ratings compared to the baseline week.

This past winter, we did a similar study -- except that patients were treated for two weeks under each light exposure and there was a baseline withdrawal week between the different light treatments. Thirteen patients completed this study. Overall, evening light had no antidepressant effect; however, morning light was significantly antidepressant.

We have also found a correlation between the antidepressant and phase-advancing effects of morning light. Furthermore, we have found that delaying sleep is an effective antidepressant in winter depression. Therefore, we have concluded that most winter depressives are phase delayed (at least with respect to when they are euthymic) and preferentially respond to morning light because it provides a corrective phase advance. For the majority of winter depressives, whether or not evening light is effective, and if so, whether or not it is working through any other effect other than a nonspecific (placebo?) effect, are open questions at this time. We have identified a few winter depressive patients who seem to respond best to evening light because it is causing a corrective phase delay.

MOST SAD PATIENTS ARE PHASE DELAYED IN WINTER BUT RESPOND EQUALLY TO MORNING OR EVENING LIGHT

A.Wirz-Justice, P.Graw, K.Kräuchi, J.Arendt, M.Aldhous, B.Gisin, A.Jochum and W.Pöldinger
Psychiatric University Clinic, CH-4052 Basel, SWITZERLAND

The hypothesis that circadian rhythms of SAD patients are phase delayed with respect to the sleep-wake cycle predicts a preferential clinical response to morning light. We have tested this hypothesis in two ways. Patients diagnosed as SAD and with a HAMD-score $\geq$15 entered the study, and after a baseline week were randomly assigned to 1h 2500 lux Vitalites between 7-8 a.m. or 10-11 p.m. for 1 week. No difference was found in any of the rating scales used.

(mean±SD)	BASELINE	LIGHT	WITHDRAWAL	N
AM HAMD	18.1±3.9	7.7±3.3	8.9±6.1	18
Atypical items	7.1±3.2	4.1±2.8	4.1±3.2	
PM HAMD	18.3±2.4	8.8±5.4	10.2±6.1	21
Atypical items	7.4±3.6	3.6±2.9	3.2±3.1	

The circadian rhythm of melatonin was measured as its metabolite, 6-hydroxymelatonin sulfate (6OHMS) in 4-8h urinary aliquots over 48h, collected weekly. Those whose nocturnal secretion exceeded the morning excretion by a factor $>$1.75 represented the usual pattern of high melatonin in the night ("advanced" or A-type SAD). Only 8/29 SAD patients fulfilled this criterion. Those SAD with a "delayed" (D-type) pattern also had a delayed urinary cortisol rhythm compared with the A-type, a tendency to wake later (7:19 vs. 6:46 a.m.) and not take breakfast. The D-type 6OHMS pattern shifted to earlier in summer, and subjective sleep latency was longer in winter (26') than in summer (14'). Although the 6OHMS urine aliquots could pick up phase shifts between winter and summer, and phase shifts and amplitude change related to age, no phase shift of the rhythm induced by 1h light was measurable.

The depth of depression in D-type SAD was no different from A-type SAD, nor was there a differential response to morning or evening light. Response was also independent of whether patients held their sleep constant (either ±0.3h, N=14; or ±0.2h, N=9) or whether sleep was advanced or delayed.

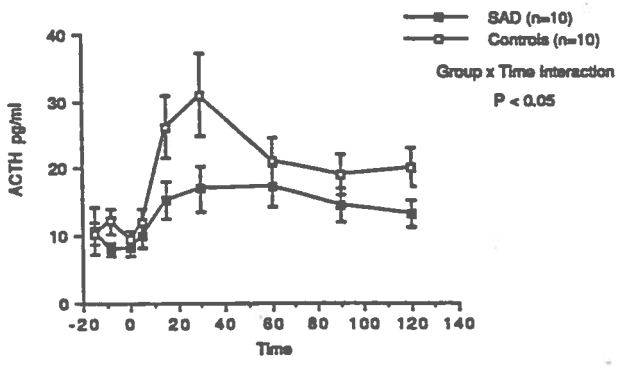
Thus although most SAD patients appear to be phase delayed in winter compared with summer, this is not obligatory, nor is it related to depth of depression or preferential response to morning light. Since 6OHMS in control subjects is also delayed in winter compared with summer, it is not clear whether the SAD findings are pathognomonic or within the normal range.

Abstract, SLTBR Annual Meeting, Washington DC June 1989

BLUNTED RESPONSE TO CORTICOTROPIN-RELEASING HORMONE (CRH) IN PATIENTS WITH SEASONAL AFFECTIVE DISORDER IS CORRECTED BY LIGHT TREATMENT

Jean R. Joseph-Vanderpool, MD, Norman E. Rosenthal, MD Karen A. Kelly, MD
Karen A. Kelly, MD Robert G Skewerer, MD Patricia M Schulz, MSW Philip W. Gold, MD
National Institute of Mental Health, Clinical Psychobiology Branch

ABSTRACT: Seasonal Affective Disorder (SAD), a condition characterized by recurrent winter depressions alternating with remissions in spring and summer has not been previously associated with abnormal HPA axis function, as measured either by plasma cortisol or failure to suppress normally to dexamethasone. We wondered whether this apparently normal HPA axis function in patients with SAD might be related to the relative mildness of their depressions, compared to those of major depressives studied previously; or whether this difference might be a function of the different physical symptoms associated with SAD (most notably overeating, oversleeping and weight gain) as compared with the anorexia, insomnia and weight loss typically associated with other types of depression. To explore this hypothesis, we measured plasma ACTH in response to 100 micrograms of Ovine CRH in 10 patients with Seasonal Affective Disorder (SAD) and 10 controls, before and after light treatments. Depressed patients were studied under both untreated and light treated conditions (2500 lux, full spectrum light 2.5 hours in A.M. plus 2.5 hours in P.M). Compared to controls, patients with SAD showed a blunted ACTH response (GxT = $P < 0.05$). This abnormal response was normalized afer phototherapy (GxT F= $P < 0.05$). The data suggest an abnormality in the Hypothalamic Pituitary Adrenal Axis and a challenge with CRH may be useful in elucidating the site of this abnormality.



IS SEASONAL AFFECTIVE DISORDER A VARIANT OF ATYPICAL DEPRESSION? DIFFERENTIAL RESPONSE TO LIGHT THERAPY

Jonathan W. Stewart, M.D., Frederic M. Quitkin, M.D., Michael Terman, Ph.D., and Jiuan S. Terman, Ph.D.

Depression Evaluation Service and Light Therapy Unit
New York State Psychiatric Institute
722 West 168th Street
New York, NY 10032

The symptomatology of seasonal affective disorder (SAD) has a number of elements in common with that of atypical depression (e.g., hyperphagia, hypersomnia, and intense lethargy). Light therapy, which has been demonstrated to be effective in treating SAD, may reasonably be expected to provide benefit for atypical depression as well if the two entities are in fact manifestations of the same disorder.

For this study, patients had to deny a seasonal component to their disorder and also meet our criteria for atypical depression [Liebowitz et al. (1984) Arch. Gen. Psychiatry 45:129-138]. These criteria require that patients report significant reactivity in mood plus two additional features including hyperphagia, hypersomnia, intense lethargy, and rejection sensitivity. Except for pathological sensitivity to interpersonal rejection, the associated features are typical of patients with SAD.

Eight patients diagnosed as atypical depressives without seasonal pattern were exposed to bright artificial light in morning and evening (2500 lux, 6-8 a.m. and 6-8 p.m.). Results were compared with those of a group of 25 SAD patients treated in a similar protocol. Age, sex, and baseline symptom constellation -- including atypical vegetative symptomatology -- did not differ statistically between the two groups. For both groups, daytime fatigability showed the highest relative severity of any symptom, followed by weight gain.

Following two weeks of bright light treatment, 23 (92%) of SAD patients were rated "much improved" or "very much improved" on the Clinical Global Impressions scale, compared with only one (13%) of the eight atypical patients. Item analysis of Hamilton Depression Rating Scale scores, and addendum for atypical symptoms, revealed significant decreases in severity of 17 of the 29 items for the SAD patients and in none of the items for the atypical patients. Each of the atypical symptoms showed a decrease in severity with treatment in the SAD group; no such reduction was seen in the atypical patient group.

In spite of superficial similarities between SAD and atypical depression, differential response to bright light therapy suggests that the diagnoses delineate separate disorders. Bright light therapy does not appear to be useful in treating atypical depressive disorder.

[Research supported by NIMH Grants RO1 MH42931 and KO2 MH00461. We thank Martha Link for assistance in administering the protocol.]

LIGHT THERAPY FOR DETOXIFIED MALE ALCOHOLICS

MOHAMED YAHIA, M.D., MURRAY ALPERT, Ph.D., JOSEPH A. DELTITO, M.D.*, MARGARET L. MOLINE, Ph.D.*, ROBERT E. McGRATH, Ph.D.**, JOHN FILOSA, R.N./M.S.N.

DEPARTMENT OF PSYCHIATRY , FRANKLIN DELANO ROOSVELT MEDICAL CENTER, VETERANS ADMINISTRATION, MONTROSE NEW YORK, 10548.

*DEPARTMENT OF PSYCHIATRY, NEW YORK HOSPITAL -CORNELL MEDICAL CENTER, WESTCHESTER DIVISION.

**DIVISION OF PSYCHOLOGICAL SERVICES, FAIRLEIGH DICKINSON UNIVERSITY

The efficacy and safety of bright light for the treatment of depressed and anxious features associated with alcoholism were examined in 41 alcoholic volunteers admitted for rehabilitation. Subjects were males, ages 25 to 55, two weeks post cessation of alcohol intake. They were also depressed (according to research diagnostic criteria), had disturbed arousal mechanism (e.g. dysphoria, anxiety, appetite and sleep disturbance, etc.), with no seasonal pattern. Two had post traumatic stress disorder. None was on psychotropic medication. Subjects with organic brain syndrome, psychosis, seasonal pattern of depression, or on psychotropic medication were all excluded. The subjects were randomly assigned for treatment, 22 receiving bright light (2500 - 4000 lux) and 19 receiving dim light (less than 400 lux). Full spectrum light (Vitalites) was used in both groups. Subjects were in separate rooms, exposed to the same external stimuli from 9.00 a.m. to 11.00 a.m., on five consecutive days. Measures pre- and post- light exposure included SCL90, SHEEHAN, SIGH-SAD, and Depression Beck Inventory. Subjects and physicians blind to treatment gave a Global Assessment of outcome (very much improved, much improved, minimally improved, improved, unchanged, minimally worse, much worse, and very much worse). While subjects improved in each group, physicians rated 50% of the subjects receiving bright light as very much or much improved versus 26% of the subjects receiving dim light. They also noted an additional 32% of the bright light group as minimally improved versus 47% of the dim light group. Both subjects with Post Traumatic Stress Disorder were assigned to the bright light group by chance; one was much improved and the other was unchanged. Treatment was well accepted by all subjects. Further analysis of data will show whether an arousal syndrome and/or specific depression in in-patient alcoholics are responsive to bright light.

MELATONIN AND PHOTOTHERAPY IN PREMENSTRUAL DEPRESSION

Barbara L. Parry, M.D.
Sarah L. Berga, M.D.
Daniel F. Kripke, M.D.
J.C. Gillin, M.D.

Department of Psychiatry
University of California, San Diego

Women with Premenstrual Syndrome (PMS) frequently have a history of major depression (MD) or later develop MD. Chronobiological disturbances have been implicated in the pathogenesis of MD. More specifically, the circadian rhythms of REM sleep, temperature, cortisol and temperature are postulated to be abnormally phase-advanced with respect to the sleep-wake cycle in this disorder. By using melatonin as a marker for circadian phase, we sought to determine whether similar chronobiological abnormalities occur in women with PMS. Furthermore, we hypothesized that we might correct these disturbances by administering bright light at critical times of the day and thereby produce clinical benefit. We would expect that bright light administered in the evening would delay circadian rhythms, correct a putative phase-advance disturbance and improve mood. Alternatively, we would expect bright light administered in the morning to advance circadian rhythms, exacerbate phase-advance disturbances and worsen mood.

After a 2-3 month diagnostic evaluation, patients with prospectively confirmed premenstrual depression who met DSM-III-R criteria for late luteal phase dysphoric disorder (LLPDD) and normal controls were admitted to the UCSD Clinical Research Center. Melatonin was sampled every 30 minutes from 1800-0900 in dim light conditions at 4 different phases of the menstrual cycle. Patients then were randomized to a crossover design of 3 different treatment conditions: 2 hours of bright (>2500 lux) evening (7:00-9:00 pm) light, bright morning (6:30-8:30 am) light or dim (<100 lux) evening red light (control condition) administered for one week each month in the luteal phase.

Compared to normal controls (NC), PMS patients had a phase-advance of the midpoint and offset of melatonin secretion in the luteal phase. PMS patients showed a significant reduction in Hamilton ($p<.003$) and Beck ($p<.01$) depression ratings after treatment with bright evening light but not after treatment with bright morning light or dim red light. Though the ratings after treatment with morning light were not significantly different from baseline, they indicated some improvement in mood.

These results suggest a phase-advance disturbance in the oscillator(s) controlling the offset of melatonin secretion in PMS patients and the potential efficacy of phototherapy in this disorder. It is possible that the bright light may be exerting its antidepressant effects through mechanisms other than shifting circadian phase.

DAWN TWILIGHT THERAPY FOR WINTER DEPRESSION

David Schlager, M.D., Michael Terman, Ph.D., and Brian Rafferty, A.B.

Light Therapy Unit
New York State Psychiatric Institute
722 West 168th Street
New York, NY 10032

Bright artificial light exposure to the eyes in awake humans can reverse recurrent wintertime mood and neurovegetative changes in Seasonal Affective Disorder (SAD).[1] Effective exposure durations require up to several hours per day. Normal room-level intensities of light, <500 lux, are ineffective in treating this disorder.[2] Sensitivity to absolute illuminance may depend on many factors including individual history of light exposure[3], state of retinal light-sensitivity (e.g., scotopic vs. photopic)[4], and specific pattern of illumination (e.g., continuously graded light vs. rectangular, on-off light)[5].

Using a bedside apparatus capable of delivering precisely controlled naturalistic illumination patterns[5], we exposed eight winter depressives to springtime dawn twilight profiles during sleep-wake transitions in 14-day home trials. Subjects awoke and were instructed to arise without regard to the artificial light signals. Maximum light intensity at eye-level during twilight exposure was <500 lux. Structured ratings of clinical state are shown below. Administration of the dawn signal was associated with full clinical remission in 6 of 8 subjects. Wrist actigraphic measurements during home-treatment phases indicate that light exposure occurred mainly during sleep. Overnight plasma melatonin showed both complete dawn-induced suppression and circadian phase advances in most subjects. These findings raise the possibility of an innocuous therapeutic bedside intervention -- with dawn twilight intensity <500 lux -- that does not compete with the post-awakening workday commitments of many patients.

Timing of Dawn Twilight Presentation and SIGH-SAD Ratings Before, During, and After Treatment

Subject	Profile	Light Onset[a]	Sunrise	Baseline	Treatment	Withdrawal
1	May 5[a]	3:05 a.m.	4:53 a.m.	14/18[c]	5/3	10/5
2	May 5[a]	3:05 a.m.	4:53 a.m.	10/20	13/18	--[d]
3	May 5[a]	3:05 a.m.	4:53 a.m.	13/10	7/3	13/12
4	Equinox[b]	4:45 a.m.	5:30 a.m.	12/16	5/1	12/13
5	Equinox[b]	4:45 a.m.	5:30 a.m.	15/16	1/1	17/12
6	Equinox[b]	4:45 a.m.	5:30 a.m.	9/13	0/3	10/15
7	Equinox[b]	4:45 a.m.	5:30 a.m.	16/17	6/2	18/10
8	Equinox[b]	4:45 a.m.	5:30 a.m.	16/12	2/2	13/8

[a]At 45° N latitude.
[b]At the equator (0° latitude).
[c]Component scales: HAM-D/Atypical symptoms.
[d]Subject was not withdrawn, given lack of treatment response.

[1]Rosenthal NE, Sack DA, Carpenter CJ, et al. Antidepressant effects of light in seasonal affective disorder. Am J Psychiatry 1985; 142:606-608.

[2]Terman M, Terman JS, Quitkin FM, et al. Light therapy for seasonal affective disorder: a review of efficacy. Neuropsychopharm 1989; 2:1-22.

[3]Penn JS, Williams TP. Photostasis: regulation of daily photon catch by rat retinas in response to various cyclic illuminances. Exp Eye Res 1986; 43:915-928.

[4]Remé C, Terman M, Wirz-Justice A. The visual input stage of the mammalian circadian pacemaking system. Submitted.

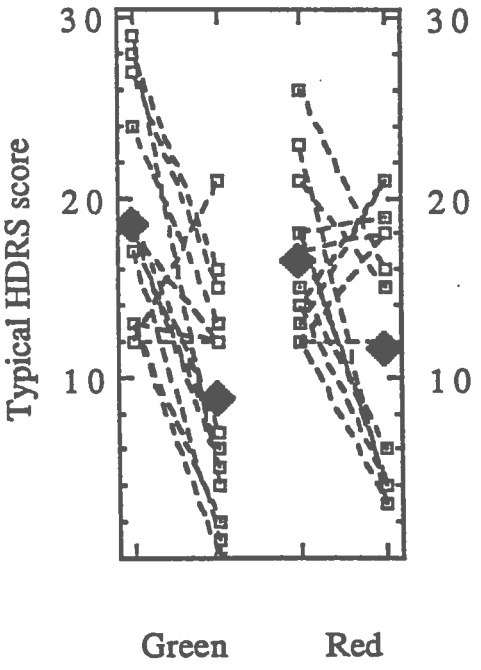
[5]Terman M, Schlager D. Twilight therapeutics, winter depression, melatonin, and sleep. In: Sleep and Biological Rhythms, Montplaisir J, Godbout R (Eds.). London: Oxford Univ. Press (in press).

[Research supported by NIMH Grants SBIR R43 MH40584 and KO2 MH00461. We thank William Gruen, Ambulatory Monitoring, Inc., for loan of actigraph systems.]

EFFECTS OF DIFFERENT LIGHT WAVELENGTHS IN SAD

DAN A. OREN, M.D., GEORGE C. BRAINARD, Ph.D., JEAN R. JOSEPH-VANDERPOOL, M.D., ELIZABETH SOREK, R.N., SCOTT JOHNSTON, B.A., and NORMAN E. ROSENTHAL, M.D.
NIMH, 9000 ROCKVILLE PIKE, 10/4S239, BETHESDA, MD 20892 &
JEFFERSON MEDICAL COLLEGE, 1025 WALNUT STREET, PHILADELPHIA, PA 19107

Although the eye has been implicated in the antidepressant effects of phototherapy in seasonal affective disorder (SAD), specific optimum intensity and wavelength of light needed and its mechanism of action is undetermined. We randomly assigned 14 SAD patients to red or green light treatments for one week in a crossover design. During treatment, patients were exposed to light for two hours each morning. Patients were off light for one week or more between treatments. Therapies consisted of equal quanta exposures (2.3 X 10^{15} photons/sec/cm^2) of colored light comparable in photon density to that achieved by standard, bright, full-spectrum phototherapy at 2500 lux. Light sources were Philips F40R (half-peak bandwidth, 615-685 nm) and F40G (half-peak bandwidth, 505-555 nm) lamps, filtered through a clear pyramidal diffuser, a UF3 ultraviolet filter, and a yellow Roscolux #10 gelatin filter to absorb wavelengths emitted below 450 nm. Despite patients' similar expectations for the antidepressant effect of the lights, mean decreases (±S.E.) in Hamilton Depression Rating scores for red and green lights were 5±2 and 10±2 respectively ($p<0.03$). It appears that green light has efficacy similar to full-spectrum lights at 2500 lux in other studies, whereas red resembles placebo effects in other studies. This study supports the following hypotheses: 1) that the response to phototherapy is mediated by biological rather than psychological/placebo factors; 2) that ultraviolet light is not necessary for an antidepressant response in SAD; and 3) that phototherapy is most efficiently delivered by the green region of the spectrum. It is in this spectral region that rod and cone photoreceptors are thought to be most sensitive.



TWO- VERSUS FOUR-HOUR EVENING PHOTOTHERAPY OF SEASONAL AFFECTIVE DISORDER

Karl Doghramji, M.D.,[1] James R. Gaddy, Ph.D.,[1] Karen T. Stewart, Ph.D.,[1] Norman E. Rosenthal, M.D.,[2] and George C. Brainard, Ph.D.[1]

[1]Jefferson Medical College and [2]the National Institute of Mental Health. Sleep Disorders Center, Jefferson Medical College, 1015 Walnut Street, Philadelphia, PA 19107

Seasonal affective disorder (SAD) has been reliably treated with retinal exposure to bright light, and morning scheduling has been deemed more effective than scheduling at other times. Evening treatment may offer a practical advantage, yet the optimum duration of exposure has not been established. The aim of this study was to compare the relative efficacy of 2 and 4 hours' duration of evening phototherapy.

Six SAD patients who scored at least 14 on the Hamilton Rating Scale for Depression (HRSD) at baseline were treated at home for one week with 2500 lux of white light given either at 6PM to 8PM or 6PM to 10PM. Following the initial phototherapy schedule patients were withdrawn from treatment for a minimum of one week and a maximum of four weeks, and treated on the opposite schedule after symptom reinstatement, i.e., after they attained a HRSD score of at least 12. The order of treatment schedules was counterbalanced across patients. Weekly blind ratings were conducted using the HRSD and HRS Supplement. The study was conducted between November and March.

Repeated measures ANOVA of HRSD scores revealed that both treatments produced positive responses ($F=21.2$, $df=1,5$, $p<0.006$) and with equivalent efficacy ($F=0.146$, $df=1,5$, $p>0.05$). As a group, patients exhibited a similar degree of symptom severity prior to both interventions and the same degree of improvement following both (interaction: $F=0.002$, $df=1,5$, $p>0.05$). The pattern of HRS Supplement scores was similar to that of the HRSD (treatment: $F=135.8$, $df=1,5$, $p<0.001$; time: $F=0.201$, $df=1,5$, $p>0.05$; interaction: $F=1.682$ $df=1,5$, $p>0.05$).

These results suggest that evening phototherapy for as little as 2 hours is effective in the treatment of SAD.

This work was supported by Biomedical Research Support Grant #RR05414 to Jefferson Medical College

THE EFFECT OF BRIGHT LIGHT TREATMENT ON NON-SAD UNIPOLAR AND BIPOLAR SPECTRUM DEPRESSED PATIENTS

JOSEPH A. DELTITO M.D.*, MARGARET MOLINE, PH.D.**
CHARLES POLLAK M.D.**, MARY JO CURRAN B.S.N*
*ANXIETY AND DEPRESSION CLINIC **INSTITUTE OF CHRONOBIOLOGY

NEW YORK HOSPITAL (WESTCHESTER DIVISION)
CORNELL UNIVERSITY MEDICAL CENTER
21 BLOOMINGDALE ROAD
WHITE PLAINS, NEW YORK 10605

A study is in progress to observe the effect of high intensity light treatment on patients with wintertime depression that do not conform to Seasonal Affective Disorder.

These depressed patients, whose DSM III-R diagnoses were either Major Depressive Episode, Bipolar Disorder NOS, Depressive Disorder NOS, or Dysthymic Disorder, were randomized into two treatment groups. One group was treated with full spectrum bright light (2500 lux) and the placebo group was exposed to less than 400 lux. In both groups, light was delivered for two hours per day for seven consecutive days during the morning hours, close to each patient's normal wake-up time.

All light was delivered in a controlled situation at the Chronobiology Laboratory at New York Hospital, Westchester Division. Fifteen subjects were randomized to the treatment cells. Baseline and post-treatment assessments were done using the 1) Structured Interview Guide for the Hamilton Depression Rating Scale - Seasonal Affective Disorders Version ("SIGH-SAD") 2) Hypomania Interview Guide Including Hyperthymia for Seasonal Affective Disorder ("HIGH-SAD") 3) SAFTEE Interview for side-effect assessment 4) Physician's Clinical Global Impression 5) SCL-90, and 6) Sheehan Patient-Rated Anxiety Scale (SPRAS).

A preliminary analysis of change scores in SIGH-SAD suggested that patients in both the unipolar and bipolar groups improved, whether they were assigned a bright or placebo light. The bipolar group improved significantly more than the unipolar patients. Whether these results can be attributed to bright light treatment has not yet been determined; a more detailed analysis of all the collected data is currently underway.

TREATMENT OF SEASONAL AFFECTIVE DISORDER (SAD) WITH A PORTABLE, HEAD-MOUNTED PHOTOTHERAPY DEVICE

George C. Brainard, Karen T. Stewart, James R. Gaddy, Daniel Benson, Brenda Byrne, and Karl Doghramji. Departments of Neurology, Psychiatry and Human Behavior, and Biomedical Instrumentation, Jefferson Medical College, 1025 Walnut Street, Philadelphia, Pennsylvania 19107.

The aim of this study was to demonstrate the utility of a portable, head-mounted phototherapy device, and to determine if it is as therapeutically effective as the standard light box used in treating SAD. The head-mounted device consists of 2 small fluorescent lamps (F4T5-D, G.E., Inc.) mounted underneath the brim of a light-weight pith helmet. The electronic circuitry and rechargeable battery are contained in a sturdy case worn on a shoulder strap. The total weight of this device is 2.4 kg. The conventional light therapy units consist of a 2' by 4' metal box (20 kg) with 6 Vita-Lites (Durotest) mounted behind a UVT plexiglass diffuser. Illuminance was measured with a Digaphot (U.D.T. Inc.).

A total of 6 patients completed the following protocol. Each patient met the diagnostic criteria for SAD, had a score of at least 14 on the Hamilton Rating Scale for Depression (HRSD), and was free of psychotropic medications. Patients received 2 hours of light therapy each morning at home for one week using either the head-mounted device (4,000 lux) or the light box (4,000 lux). Patients then were withdrawn for at least one week until relapse, and then crossed over to the other treatment condition. Patients were rated before and after each treatment by a trained blind rater using the SIGH-SAD, a structured interview guide for the HRSD.

Repeated measures ANOVA revealed that both treatments produced post-treatment HRSD ($F=15.12$, $df=1,5$, $p<0.02$) and SIGH-SAD scores ($F=14.013$, $df=1,5$, $p<0.02$) that were significantly different from pretreatment. Neither pre- nor post-treatment HRSD or SIGH-SAD scores differed significantly in the light box versus the head-mounted phototherapy treatment. Use of the head-mounted device, however, resulted in significant improvement on the SAD items of the SIGH-SAD scores ($F=22.81$, $df=1,5$, $p<.01$). Thus, use of both the light box and the head-mounted phototherapy device produced significant improvement in HDRS and SIGH-SAD scores. There were no significant differences in effectiveness between the two devices except on the specific SAD items of the SIGH-SAD test. Some patients reported that the portable head-mounted device provided greater versatility and ease of use compared to the conventional light box units.

Photostasis: Regulation of Daily Photon-Catch

Theodore P. Williams

Florida State University - Tallahassee, Florida

Retinal rod photoreceptors renew on a daily basis a small fraction of their photon-catching compartments, the outer segments (ROS). This renewal is thought to replace aged molecules with new ones and to do so while maintaining a constant length of ROS.

This presentation gives a very different view of the renewal of ROS. First, no one, including us, has ever found evidence of molecular aging. Second, cone cells renew their outer segments and, in the process, shed new molecules along with the old; this gives us pause in accepting the "molecular aging" hypothesis. Third, perhaps most important, we have shown that renewal of the ROS is the retina's way to change the length of the ROS, not keep it constant. In addition, we have found that renewal permits changes in the concentration of rhodopsin molecules per unit membrane area. Both ROS length and rhodopsin packing-density are regulated by the intensity of ambient lighting: brighter lights, shorter ROS and lower rhodopsin packing density; dimmer lights, just the opposite.

Indeed, we have shown that groups of rats, each group raised at a different intensity, all absorb the same number of photons, 10^{16} photons/eye/day. We have called this "photostasis". I shall present the evidence for this and show that the rat retina is plastic, responding to "new" intensities by changing its ability to absorb light. Such changes result in the absorption of the "photostasis number" of photons. Implications of photostasis on the overall homeostasis of the rat will be discussed.

RAPID RESOLUTION OF SEASONAL AFFECTIVE DISORDER BY LOW-DOSE ALPRAZOLAM

Martin H. Teicher M.D., Ph.D. and Carol Glod R.N., M.S. C.S.
McLean Hospital, Developmental Biopsychiatry Research Program
Belmont, MA

During recent years, Seasonal Affective Disorder (Major Depression, recurrent, with seasonal features) has been recognized as a valid and common psychiatric disorder, and treatment with bright artificial light has been shown to be safe and effective in most patients. However, about 20% of patients with classic symptoms fail to respond to 2500 lux phototherapy, and many patients find this treatment too inconvenient. Thus alternative treatment options are necessary. However, very little has been published on the pharmacological treatment of SADs. O'Rourke et al., presented data demonstrating that fenfluramine was effective in eliminating carbohydrate cravings associated with SADs, and was also quite effective in relieving most of the other symptoms of this disorder. Rosenthal et al., on the other hand, reported that atenolol, an agent which suppresses melatonin, had little efficacy in treating this disorder in most subjects. Although many other agents have undoubtedly been used, little data exists to guide treatment selection. As most patients with SADs have atypical depressive features strongly suggestive of a bipolar spectrum disorder, and also prominent anxiety symptoms, we sought to test the efficacy of alprazolam in a limited clinical sample. We based this choice on data that indicates that alprazolam appears to have rapid antidepressant effects in some patients with mixed depressed and anxious states, and observations that this agent can induce mania or hypomania in some individuals. Our clinical experience suggested that patients with bipolar II disorders, may be extremely responsive to this drug, and that they can have a sustained antidepressant response on very low doses. Alprazolam, was thus administered to six patients diagnosed with Seasonal Affective Disorder (by usual NIMH criteria). Initial HAM-D (with seasonal adaptation) scores were obtained pre and post treatment. Patients were treated with alprazolam, with doses ranging from 0.5 mg to 1.5 mg. daily. This agent produced rapid and dramatic results in four patients, with remission of symptoms emerging about three days after start of treatment. These patients became hypomanic initially, with markedly increased energy and euphoria, which spontaneously abated to a state of euthymia about two weeks after onset of treatment. Two patients had a moderate response, with diminished symptoms of anxiety and depression, but were still symptomatic. One of these patients had an even more limited response to phototherapy, and the other responded paradoxically with a worsening of symptoms. Two subjects were followed for one year; they were easily able to discontinue treatment with alprazolam in the spring, and continued medication free without relapse or untoward effects. The remaining patients continue to receive active treatment, and tapering of alprazolam is planned at the time of their usual remission of symptoms. These results suggest that alprazolam is likely to be a very effective and well tolerated agent for use in the treatment of Seasonal Affective Disorder, and may provide a very useful alternative to phototherapy. Further research including double-blind placebo-controlled studies will be necessary to determine its efficacy in these patients. The prominent response of some patients to alprazolam may arise through the entraining effects of benzodiazepines on circadian clocks, or through stimulation of retinal benzodiazepine receptors.

SLEEP AND CORE BODY TEMPERATURE IN SAD PATIENTS DURING TREATMENT WITH MORNING AND EVENING LIGHT

Henry W. Lahmeyer, M.D., University of Illinois at Chicago Department of Psychiatry; Michael Easton, M.D., Illinois State Psychiatric Institution; Ramiro Sanchez, University of Illinois at Chicago Department of Psychiatry; Maureen Smith, University of Illinois at Chicago, Department of Medicine

University of Illinois at Chicago
Department of Psychiatry
912 South Wood Street MC913
Chicago, IL 60612

Four patients with Seasonal Affective Disorders (SAD) who were depressed during the winter of 1989 underwent a four-week protocol to explore the effect of one hour of evening and morning light (4,000 lux) on mood and several markers of circadian phase.

These markers included sleep, sleep stage, melatonin, and core body temperature. Norepinphrine, EKG, core body temperature, and EEG-measured drowsiness were also measured during light exposure to measure direct physiological effects.

Two patients responded to morning light, one to evening light, and one to both schedules. Morning light phase-advanced both temperature and REM sleep, while evening light phase-delayed both parameters. Sleep appears most "normalized" during the light schedule that produced clinical improvement.

These preliminary results along with the other parameters measured will be presented.

A PRELIMINARY REPORT ON SEASONAL ALCOHOL ABUSE AND DEPENDENCE

Robert McGrath, Fairleigh Dickinson University
Mohamed Yahia, Franklin D. Roosevelt VA Hospital at Montrose
Ellen Kuehl, Fairleigh Dickinson University
Merrill Main, Fairleigh Dickinson University

Mailing Address: Dept. of Psychology, Fairleigh Dickinson University, Teaneck NJ 07666

It has recently been suggested that fall-winter SAD represents one manifestation of a set of cyclic disorders which is characterized by mood and appetite disturbance (Wurtman & Wurtman, 1989). Rosenthal et al. (1988) have made reference to the potential existence of a subtype of alcoholism characterized by a fall-winter exacerbation. We have identified six VA hospital patients whom we believe suffer from this disorder, which we have labeled Seasonal Alcohol Abuse and Dependence (SAAD). In our presentation, we will describe the screening procedure we have developed for identifying SAAD sufferers. We will also provide case histories for several of our patients.

Although work on SAAD is only in the incipient stage, previous research on the etiology of the cyclic disorders as well as theoretical models of excessive alcohol use provide a framework for speculating on the etiology and maintenance of SAAD. We believe the factors involved in the development and maintenance of SAAD episodes may be more complex than those involved in fall-winter SAD, and that SAAD sufferers will accordingly prove to be a more heterogeneous group. We will discuss our heuristic model of SAAD, as it is the basis for generating several important hypotheses about the disorder. Among the most important of these is our speculation that phototherapy will only be effective if used prophylactically with this population, and in most cases only when used in conjunction with other treatment modalities.

BRIGHT LIGHT TREATMENT OF NIGHT-SHIFT WORKERS

Leslie M. Powers, M.D., Michael Terman, Ph.D., and Martha J. Link, B.S.

Light Therapy Unit
New York State Psychiatric Institute
722 West 168th Street
New York, NY 10032

Bright light therapy, now widely used in treatment of seasonal affective disorder, was given in an open trial to a group of newsroom workers on fixed night shift (midnight to 9 a.m., Monday to Friday) to determine its utility in relieving commonly experienced symptoms. Problems include mild depression marked by night- and daytime fatigability, difficulty with daytime sleep, and lapses of alertness on the job. Subjects (n = 8) rated level of alertness, recorded oral temperature, kept logs of sleep and work hours, and wore activity monitors. Baseline data were gathered for two weeks before beginning light treatment. Of five subjects who have completed the study, four showed regular and clear-cut reversals of sleep-wake pattern on weekends, with sleep at night on Fridays and Saturdays, indicative of lack of circadian phase adjustment to the reversed workday schedule. All subjects reported having greatest difficulty with fatigue on the Sunday night/Monday morning shift.

Subjects were exposed to light of 10,000 lux intensity at home for 30 minutes each evening, before going to work, and at the same time on the weekends. Evening light was selected for several reasons: it might elicit circadian phase delays as well as be directly energizing. Either way or both it might allay onset of nighttime sleepiness and the slump commonly reported by night-shift workers around 5 a.m. Furthermore, bright-light exposure at a standard time of day might provide a zeitgeber signal which may otherwise be missing or variable in subjects with erratic outdoor exposure habits, thus stabilizing circadian entrainment.

All subjects showed evidence of response to the light, particularly of increased alertness at work, indicated by either self-rating on visual analog scale or clinical evaluation, or both. Two subjects who had experienced a slump in alertness when work slowed around 5 a.m. reported that the slump was delayed to 7 or 8 a.m. with light treatment. All subjects showed evidence of increased alertness at 11 a.m.

Worker #1 found himself moderately more alert using the lights, and expressed an increased awareness of the negative impact of the work schedule on his sense of well-being. *Worker #2*, whose daily self-ratings reflected the least change in alertness, reported however in clinical interview that he felt significantly improved energy and alertness with the light exposures. He and three other workers have continued their use since completing the study. *Worker #3*, besides exhibiting increased alertness during work hours, reported improved quality of sleep, ability to lose weight by maintaining a diet, increased sociability, and improved mood. Curiously, this worker did not continue with the lights. *Worker #4* was the best adjusted among the group to night work prior to treatment, with maintained daytime sleep on weekends and accompanied by nighttime naps. His initial late-evening light exposures (11 p.m.) were shifted earlier (to 7 p.m.) when the increase in energy continued well into the morning, interfering with his ability to fall asleep as desired at 11 a.m. Improved alertness at work continued with treatment at the earlier hour and did not interfere with his preferred weekday bedtime. *Worker #5* showed the largest increase in alertness in self-ratings, but also reported disturbed sleep and frequent awakenings on weekends with the late-evening light exposure (11 p.m.).

Treatment effects in *Worker #4* and #5 in particular point to the necessity of tailoring a light schedule to the individual so that benefits are not offset by undesirable changes. It may be possible to maintain weekday benefits of light treatment while allowing night-shift workers to flip their sleep schedule on weekends without use of lights.

[Research supported by the Search Charitable Foundation, Ltd., and NIMH Grant KO2 MH00461. We thank Gordon Rothman and research volunteers at CBS News for their participation.]

SLEEP-PROMOTING EFFECTS OF LIGHT ON RABBITS

F. A. Lue, I. Dumov, I.A. Menon, H. Haberman, & H. Moldofsky
Dept. of Psychiatry & Dermatology, University of Toronto
399 Bathurst Street, Toronto, Ontario M5T 2S8.

Exogenous interleukin-1 (IL-1) has been shown to promote sleep in several animal species (1,2,3), and endogenous IL-1 increases in cat cerebro-spinal-fluid during sleep compared to wake (4). Plasma IL-1-like activity increases during sleep in humans (5). Ultra-violet light has been reported to enhance the production of IL-1 in skin cells (6). Patients with seaonal affective disorder report disrupted sleep & respond to bright light treatment (7). We speculated that exposure to light might increase sleep in rabbits.

Methods: Two rabbits (white) trained for a week to remain in an open-top restraining chamber were each studied for 6 hours. Fur from their dorsal side was closely shaved and eyes were covered. Sleep-wake electrophysiology was recorded with fine wire needle electrodes while they were exposed to either light or no light conditions for 2 consecutive hours; commencing in morning (1000) or afternoon (1500) in a cross-over design. Each rabbit was studied at 3-5 day intervals. Light source consisted of a Westinghouse 400 W mercury vapour lamp placed 45 cm. above the back and filtered through a 10 cm. water column (8). No increase in environmental temperature was measured as a result of the light. Recordings were coded and manually scored in 10 second epochs (9).

Results: Rabbits were recorded while in the harness for a mean of 332.6 minutes. There was no significant difference in the recording time in the harness between conditions on or off light (331.6 mins vs 333.6 mins). Recordings in the harness with fine wire needle electrodes resulted in difficulties in differentiating REM sleep. The recordings were therefore scored for stages wake, NREM, and movement time. In comparison to the no light condition, the light condition showed more NREM sleep (mean 142.6 mins vs 118.6 mins $t=3.5$, $n=4$, $p < .05$), more %NREM (mean 43% vs 36%, $t=2.7$, $n=4$, $p<.05$), and less %wake (mean 57% vs mean 64%, $t=-2.6$, $n=4$, $p<.05$). There were no significant differences in the number of stage changes, wakings, or movement arousals, nor in the latency to sleep.

Conclusions: These preliminary results are consistent with the hypothesis that exposure of skin to light promotes sleep in rabbits.

1. Krueger, J.M.; et al Am. J. Physiol.(1984) 246:R994-R999.
2. Tobler, I., et al Europ. J. Pharmacol. (1984) 48:309-318.
3. Totic, S.; & Susic V., Sleep Research (1987) 16:151.
4. Lue, F.A., Inter. J. Neurosci. (in press).
5. Moldofsky, H., Psychosom. Med. (1986) 48:309-318.
6. Kupper, T.S., et al J. Clin. Invest. (1987) 80:430-436.
7. Rosenthal, N.E., et al Arch. Gen. Psychiatry (1984) 41:72-80.
8. Persad, S, et al Photochem. Photobiol. (1983) 37: 63-68.
9. Scherschlicht, R., et al Br. J. Clin. Pharmacol. (1983) 16:29S-35S.

THE PLACEBO PROBLEM IN PHOTOTHERAPY FOR WINTER SAD

Charmane I. Eastman[1], Henry W. Lahmeyer[2] and Lucie G. Watell[2]

[1]Rush-Presbyterian-St. Luke's Medical Center
[2]University of Illinois at Chicago

Studies of the efficacy of bright light treatment for winter seasonal affective disorder (SAD) have been criticized for the lack of a suitable placebo control treatment. Controls such as dim light are adequate only if they produce equal expectations for improvement as bright light. Convincing demonstrations showing no difference in expectations between bright and dim light are lacking. The phase-shift theory of Lewy et al. predicts that light falling on the "dead" zone (afternoon light) or phase delay portion (evening light) of the phase response curve (PRC) will not be effective for the majority of patients. Thus, bright light at these times makes an excellent control treatment for light falling on the advance portion of the PRC (morning light). However, the local times corresponding to these zones have not been precisely defined. Furthermore, when studies show no differences between bright morning light and the control bright light treatment, then the antidepressant responses to both treatments could be attributed to a placebo effect, since the control treatment is effectively lost in this case.

We have been testing a treatment that is similar to light treatment in that it is a "natural environmental" factor which necessitates a precisely timed period of relative inactivity (sitting). This treatment is sitting close to a negative ion generator. Negative ions have been shown to improve mood in certain people, and are implicated in the control of serotonin transmission. Since we are exposed to more negative ions in the summer compared to winter, it is possible that the balance of negative to positive ions is important in the etiology of SAD. In our studies some subjects are exposed to negative ions, whereas others are not. In the latter case the generator is deactivated by changing a circuit within the generator. The deactivated generator provides a placebo control treatment. Patients are informed that they will be randomly assigned to the two groups and that they will not be able to tell whether they are receiving the active or inactive generator. In the following discussion we will only present the results from those patients who were in the deactivated generator group, and who were also tested with bright light.

In a pilot study conducted last winter, light and placebo weeks were alternated in a 5 week counterbalanced design. Bright light treatments (about 4000 lux) included 1 hr of morning light, 2 hrs of (summer) dusk light and a combination of morning and dusk light (1 hr total per day). Eight subjects completed the protocol. ANOVAs showed no differences between antidepressant response to light compared to placebo. Using remission criteria that baseline scores had to be reduced by at least 50%, by the 17-item HDRS, 88% of the subjects responded to light, 50% to placebo, and 13% were non-responders. By the 7 "atypical" items, 75% responded to light, 50% to placebo and 25% were non-responders.

Drawbacks of the pilot study were a small N and a complicated design. This winter we employed a counterbalanced design in which morning light (1 hr of about 7000-8000 lux) was compared to morning placebo in 2-week treatments. So far, 18 subjects have completed the protocol, but more will be added so these results are preliminary. Using the criteria mentioned above, by the 17-item scale, 50% were light responders, 39% were placebo responders and 33% were non-responders. By the atypical scale, 39% were light responders, 39% were placebo responders and 44% were non-responders.

Research supported by NIMH grant MH42768