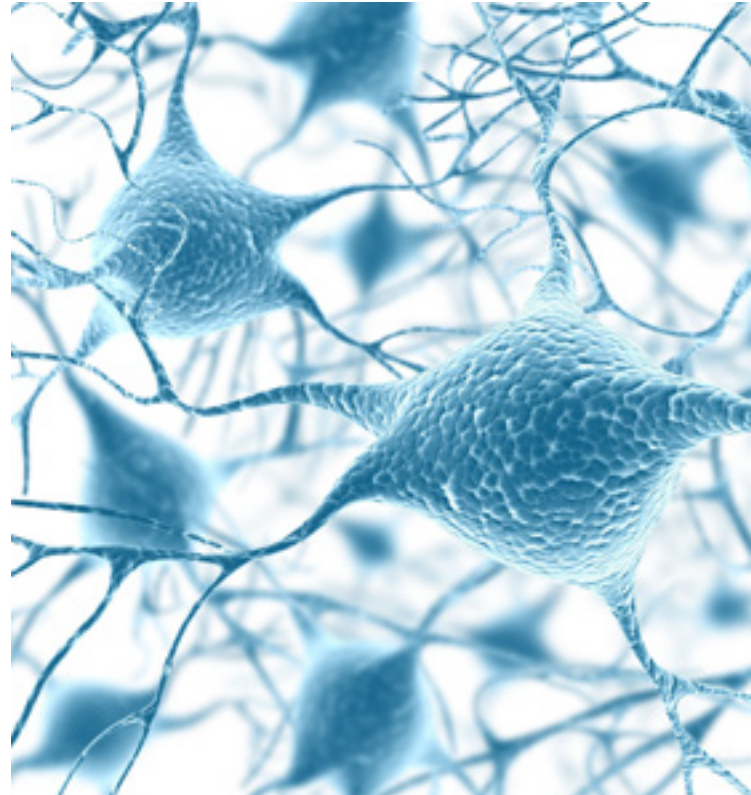


CHRONOBIOLOGICAL PHOTOTHERAPY IN PRACTICE

- › Chronobiological phototherapy
- › Sleep rhythm disruption and its consequences
- › Chronobiological phototherapy for patients with depression
- › Equipment for chronobiological phototherapy
- › Statutory health insurance and chronobiological phototherapy
- › Education in chronobiological phototherapy

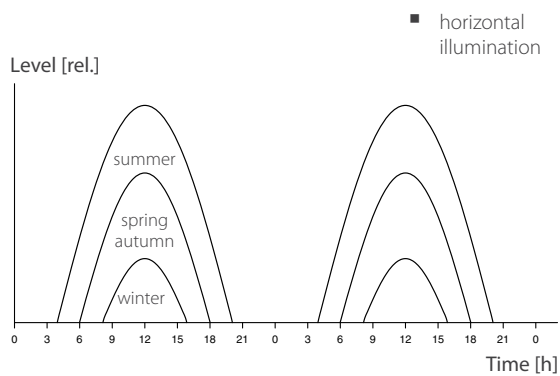


ChBFT.CZ

NASLI®

NATURAL SPECTRUM LIGHTING

INTRODUCTION TO CHRONOBIOLOGY AND ZEITGEBERS

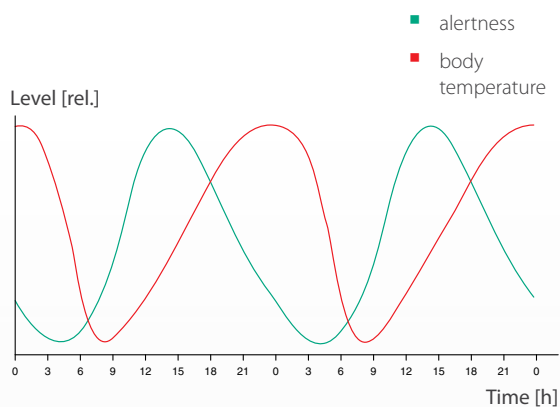


Chronobiology – a field of biology that studies temporal (often cyclic) phenomena in living organisms.

Biorhythm – an endogenous cycle of changes of state, quantity, quality or behaviour of an organism. Daily, monthly and annual rhythms are well known. Daily rhythms include sleep/wake cycle, rhythmical changes in body temperature, blood pressure, heart rate or level variations of melatonin and cortisol.

Circadian rhythm – a biorhythm of approximately 24-hour period, synchronized (by zeitgebers) to 24-hour rhythm.

Photosensitive ganglion cells (ipRGCs) – are about 2 % of retina neurons which contain melanopsin, a (novel) photo pigment most sensitive to blue component of light. These cells signalize illumination level to autonomous nervous system and contribute to pupillary reflex. Discovered 2002 and confirmed 2007.



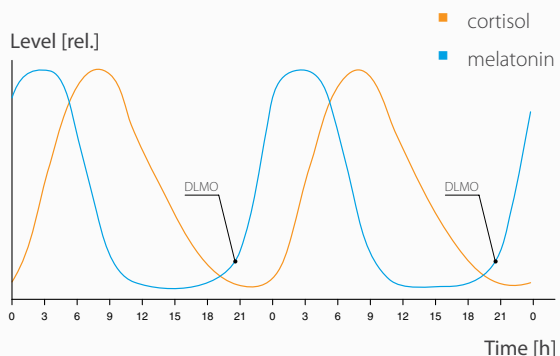
Suprachiasmatic nuclei (SCN) – are two clusters of about 20,000 each, located in hypothalamus above the crossing of optic nerves. SCN harbour central body clock, a gene oscillator of the organism. Organ clock are synchronized from this master clock. SCN control synthesis of melatonin in pineal gland or synthesis of cortisol in adrenal cortex via various brain centres.

Entrainment – is a period adjustment of a free-running biological oscillator from an environmental oscillator. Circadian rhythm is synchronized by daylight and darkness changes due to Earth rotation.

Zeitgeber – (synchronizer, timer) – is a stimulus for entrainment of the circadian rhythm in SCN. Primary and strongest zeitgeber is light.

Non-image forming effects of light – entrainment and phase shift of circadian rhythm, melatonin suppression starting from certain illumination level.

DLMO – (Dim Light Melatonin Onset) – a point of rapid increase of melatonin blood level, the best known marker of circadian phase.



Daylight intensity and circadian rhythm of selected quantities in a healthy human.

Chronobiological Phototherapy in Practice
© Dipl. Ing. Antonín Fuksa et al., 2015
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Translated from Czech original
1st edition, November 2015

CHRONOBIOLOGICAL PHOTOTHERAPY

Phototherapy as a method of chronobiological therapy features properly timed incidence of light of suitable intensity and spectrum to human to remedy depression or to adjust sleep/wake cycle. ChBFT is an abbreviation of Chronobiological Phototherapy in Czech.

ChBFT is suitable therapy for depressions, not only seasonal affective disorder (SAD), but also general non-seasonal depressive disorder and bipolar disorder. ChBFT has rapid onset and short-term duration so pharmacotherapy must be used to stabilize the melioration. ChBFT is evidence-based and well documented by many studies in top medical journals. It is no alternative medicine.

The discovery of circadian rhythm, intrinsically photosensitive retinal ganglion cells, central gene clock in SCN support the therapeutic use of light with anatomical and physiological evidence.

Heliotherapy, treatment with sunlight, is known from ancient times: Hippocrates, Galen, Avicenna or Paracelsus recommend sunlight to treat lethargics. Visible light has, with some exceptions, been considered therapeutically useless for a long time. These exceptions include laser applications, phototherapy of icterus neonatorum, photodynamic therapy or Finsen's discovery of treatment of lupus vulgaris using radiation on the border of UV and visible spectrum.

Natural daylight, night darkness and their daily regular dynamic interchange are the strongest stimuli for setting the master clock of the organism.

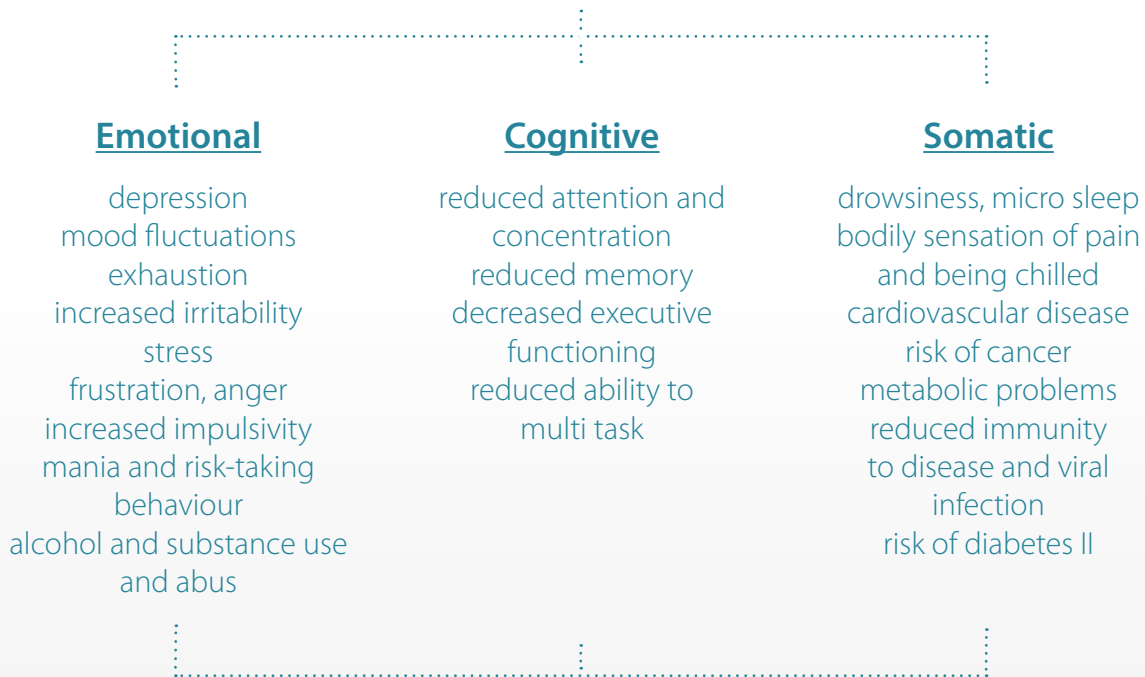
The amount of daylight available to hospitalized patients highly depends on building blueprint, orientation of the room and season of the year. Artificial lighting may not be strong enough to supplement the missing luminous stimulus for the central clock. Step by step, this deficiency of light may eventually lead to disruption of patient's daily rhythm. Chronobiological phototherapy can restore this rhythm.

**Light is the strongest zeitgeber
– a stimulus for adjusting the master clock in SCN.**

Other zeitgeber examples:



SLEEP RHYTHM DISRUPTION AND ITS CONSEQUENCES



Sleep rhythm disruption accompanies majority of psychiatric disorders.

First law of chronobiology



Second law of chronobiology

More zeitgebers:



CHRONOBIOLOGICAL PHOTOTHERAPY FOR PATIENTS WITH DEPRESSION

Methods of chronobiological phototherapy are:

- BRIGHT LIGHT THERAPY (BLT)
- DAWN [AND DUSK] SIMULATION THERAPY (DDS)
- DARK THERAPY
- WAKE THERAPY + BRIGHT LIGHT (WT + BLT)

With 50 to 66 % of responding patients, ChBFT is a relatively successful therapy for different types of depressions. ChBFT has rapid onset, typically the first day. Within 5 to 7 days it is clear if the patient does not react. Pharmacotherapy (onset in weeks) is used to stabilize the rapid melioration achieved by ChBFT. Sole phototherapy without medication is however long-term efficient only for a minority of patients with general depression.

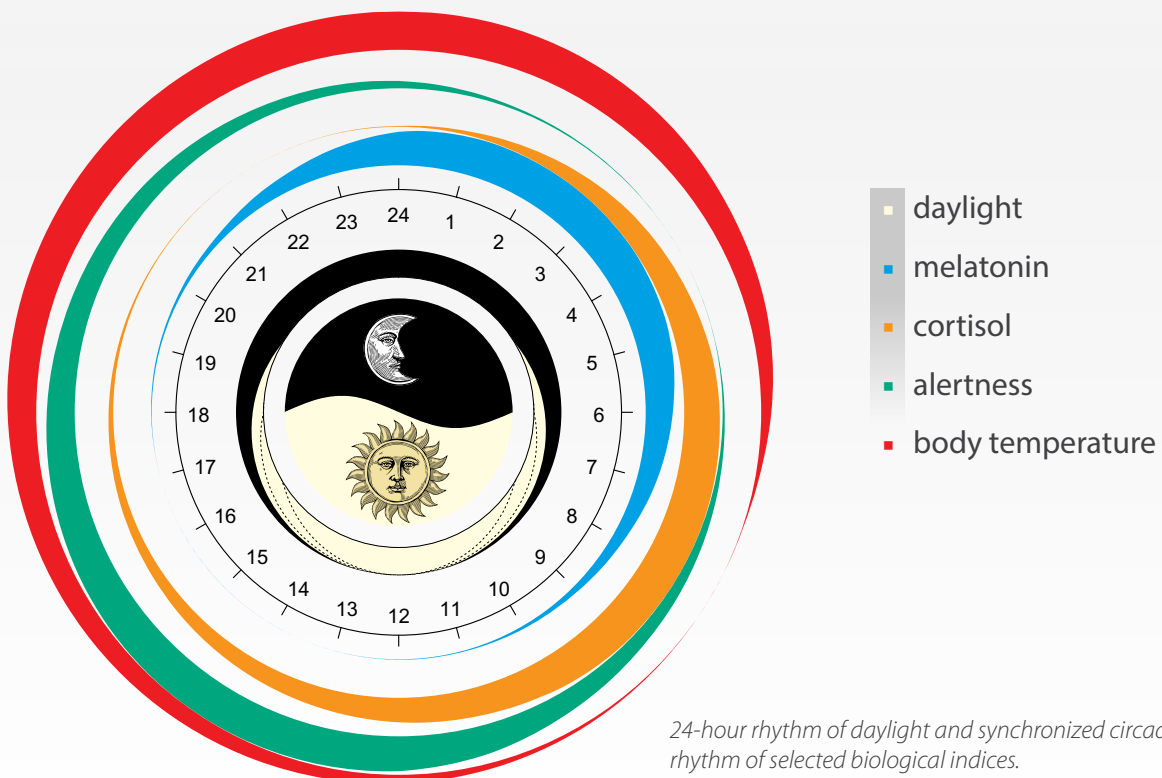
SSRI medication has comparable results in SAD treatment as bright light therapy and some patients suffice with regular home-BLT.

Excellent results are provided by a combination of Sleep Deprivation (SD) therapy, bright light therapy and lithium medication. Responding patients get better in a few days and relapses are rare.

Indications: Seasonal affective disorder (SAD), general depression, depressive phase of bipolar disorder. Adjuvant treatment for schizophrenia, schizoaffective disorders and dementia, including Alzheimer dementia.

Contra-indications: Retinal dystrophy, macular degeneration. Relative: manic phase of bipolar disorder if the patient does not use mood stabilizer.

Side effects: Conjunctiva irritation, nausea, cephalalgia.



EQUIPMENT FOR CHRONOBIOLOGICAL PHOTOTHERAPY

Phototherapeutic luminaires NASLI SunSun

NASLI SunSun are portable luminaires for placement on a table.

Use: for ~20 minute exposure, manual operation
Illumination: 10000 lx at ~0.2 / 0.3 m from the luminaire
Power: 72 and 110 W
Chromatic temperature: T_c 6500 K
Colour rendering index: R_a 93, Circadian index A_c 93
Dimensions: 52 × 32 and 64 × 35 cm



Code	Model	Lamp
0227	SunSun 2 × 36 W	2 × 36 W / 2G11
0228	SunSun 2 × 55 W	2 × 55 W / 2G11

Dimmable phototherapeutic luminaires NASLI MedicoSun®

NASLI MedicoSun are stationary luminaires for suspension under ceiling.

Use: both short-term and all-day-long phototherapy with manual or automatic dimming.

Illumination of the head side of the patient bed is 3000–4000 lx with luminaires suspended at 250 cm. Various models with 4 or 6 lamps are available, T5 of power 49, 54 or 80 W including models with dimming and remote control.

Power: from 196 to 480 W
Chromatic temperature: T_c 6000 K,
Colour rendering index: R_a 93, Circadian index A_c 90.
Dimensions: 43 × 128 to 68 × 158 cm.



Intelligent phototherapeutic luminaire NASLI ADS

NASLI ADS2 is a powerful transportable luminaire for phototherapy on patient's bed.

Illumination is 0 to 2000 lx at the level of patient eyes. Smooth automatic control of illumination and tone of light according to time plan.

Power: max. 240 W

Chromatic temperature: T_c 1800 K to 6500 K

Colour rendering index: R_a 90 to 95,

Circadian index: A_c 17 to 95.

Dimensions: Height 235 cm (transport 185 cm), base 70 × 90 cm.

Autonomous mode: simple control using a remote controller – easily set parameters like wake-up or lights-out time.

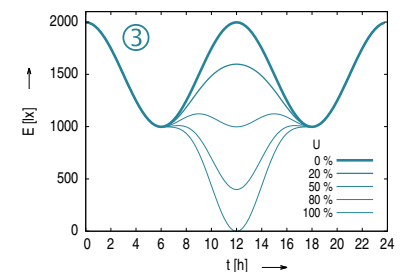
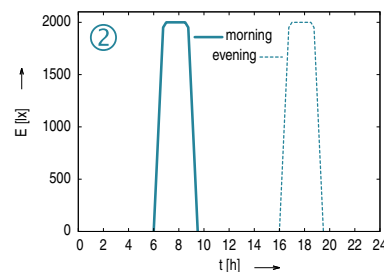
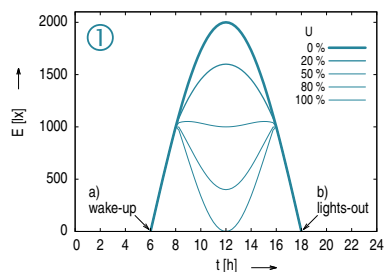
Research mode: instructions for illumination control are read from an interchangeable SD memory card. The control file is tailored in a special PC application.



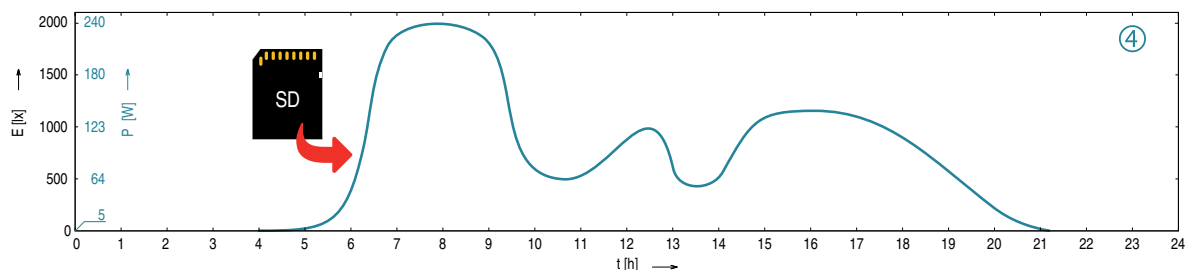
Use:

- > Dawn simulation (1a)
- > Bright light therapy (2)
- > Light during the day (1)
- > Dusk simulation (1b)
- > Combination with sleep deprivation (3)
- > Special schedule on an SD card (4)

Code	Model	Lamp
0257	ADS2max	10 × 24 WT5 / G5 + LED



The parameter U may be set depending to daylight availability to save energy.



Under development: A standalone module for automatic time control of dimmable luminaires (MedicoSun) over the DALI bus, according to a schedule on an SD card.

Conformity: The luminaires are tested to comply with standards for safety (LVD) and electromagnetic compatibility (EMC) of luminaires. According to Czech Ministry of Health, the luminaires are not classified as medical devices (MDD).

STATUTORY HEALTH INSURANCE AND CHRONOBIOLOGICAL PHOTOTHERAPY



[In Czech Republic]

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Collection of Laws No. 326 / 2014

Item 129

326

PUBLIC NOTICE

from 17th December 2014

**Change of Public notice of Ministry of Health No. 134/1998 Coll.,
List of health care services with their point values.**

Item 129

Collection of Laws No. 326 / 2014

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40. In Appendix in Chapter 305 – Psychiatry,
after a service no. 35113, a service no. 35115 is inserted:

Category	P	Carrier	INDX	Time	
“35115	CHRONOBIOLOGICAL THERAPY				
	Methods of chronobiological therapy are phototherapy, sleep deprivation and controlled shifts of sleep/wake cycle.				
OF	6/1 day	S1	1	30	
OM	SH - only on a specialized facility during hospitalization				
Service time	60	ZUM	no		
Points	44	ZULP	no”.		

The treatment may only be provided during hospitalization of the patient on a specialized psychiatric facility, competent on personal level and suitably equipped on a technical level.

Personal competence to provide chronobiological treatment is achieved by undertaking accredited medical courses.

Technical eligibility is supported by a document of ownership or rent of phototherapeutic luminaires, properly certified and accompanied with EC declaration of conformity.

One of the first steps for coverage of these services from Statutory Health Insurance is an application for extension of negotiated services to an involved Health Insurance Provider.

EDUCATION IN CHRONOBIOLOGICAL PHOTOTHERAPY

FOR DOCTORS

The course is intended for psychiatrists

Qualifies the doctor to provide chronobiological treatment on specialized facilities

- › Chronobiological therapy
- › Phototherapy
- › Sleep deprivation
- › Controlled shifts of sleep/wake cycle



FOR NURSES

The course is intended for nurses providing psychiatric services

The course prepares the nurses to new treatment method

- › Introduction to Chronobiology
- › Non-image forming effect of light and their use in treatment
- › Application of phototherapeutic luminaires



Course guarantee:

Pavel Doubek, MD, PhD.
Psychiatric clinic, Ke Karlovu 11
128 08 Prague 2
Czech Republic

Phone: +420 224 965 220
E-mail: doubekpavelmudr@seznam.cz

Dates and applications:

Please visit www.chbft.cz/kurzy for latest information (in Czech)

Course organizer: Blue step spol. s r. o., Jinonická 80, 158 00 Prague 5, CZ

USED AND RECOMMENDED LITERATURE

Terman MR, Wirz-Justice A. *Chronotherapeutics for Affective Disorders: A Clinician's Manual for Light and Wake Therapy*. 2nd edition, Kager 2013. ISBN 978-3-318-02090-8.

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Public notice 326/2014, Collection of Laws, Czech Republic.

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We would like to thank to all the above authors as well to all unlisted who contributed to the development of chronobiology and circadian science that made phototherapy a powerful and recognized method of treatment.

MONOGRAPH UNDER PREPARATION:

“Chronobiological treatment” see more at www.chbft.cz

ABOUT US

NASLI®

NATURAL SPECTRUM LIGHTING

Research, development and production of full-spectrum lamps and luminaires has been our focus in NASLI since 2006. We introduce new findings from less-known areas to practice: non-image forming effects of light and reduction of electromagnetic trace of our devices. We offer authorized light-planning services to wide public. Our portfolio includes biodynamic lighting and programmable luminaire networks for special purposes. Dipl. Ing. Antonín Fuksa, a NASLI development engineer, co-operates closely with several experts and doctors including Mr. Pavel Doubek, MD, PhD., head of Laboratory of chronobiological treatment on Psychiatric clinic of First Faculty of Medicine, Charles University and General University Hospital in Prague.

Selected references

- Psychiatric Clinic, 1. LF UK a VFN, Prague
- Alzheimercentrum Průhonice o.p.s.
- GEMINI Eye Clinic a.s., Zlín, Průhonice
- D. C. M. Clinic, Hradec Králové
- Sampling Centre Třebíč, detached facility of Transfusion & Tissue Department, FN Brno
- Veterinary clinic of Dr. Snášil, Brno

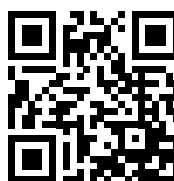
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