

Creating Health: Applying the Science of Lifestyle Medicine

Mark Pettus MD

- Week 1: Epigenetics and Health: How well do you fit into your genes?
- Week 2: Inflammation: The bad gift that keeps giving
- Week 3: Metabolic Health: How to become a member of this exclusive club.
- *Week 4: Circadian Rhythms and Health: Riding the rhythms of life*



OLLI at Berkshire Community College

For the Joy of Learning!

1

Circadian Rhythm and Health: Riding the rhythm of life



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October 14, 2022


2

Key Considerations



- Acute-chronic disruption of circadian entrainment are drivers of acute care outcomes and perhaps all chronic, complex disease.
- We are living in a modern environment more disconnected from our evolved, entrained biologic systems.
- Greater attention to alignment between light quality, timing and exposure are accessible interventions for current-future consideration.

3



- In this life we are not separate from nature. We are a part of nature, part of a complex ecosystem.
- Our biology is synchronized with the rhythms of nature.
- When we become disconnected from our innate diurnal rhythms our biology becomes disrupted.
- Over time, this impacts our health and quality of life at many levels.

4



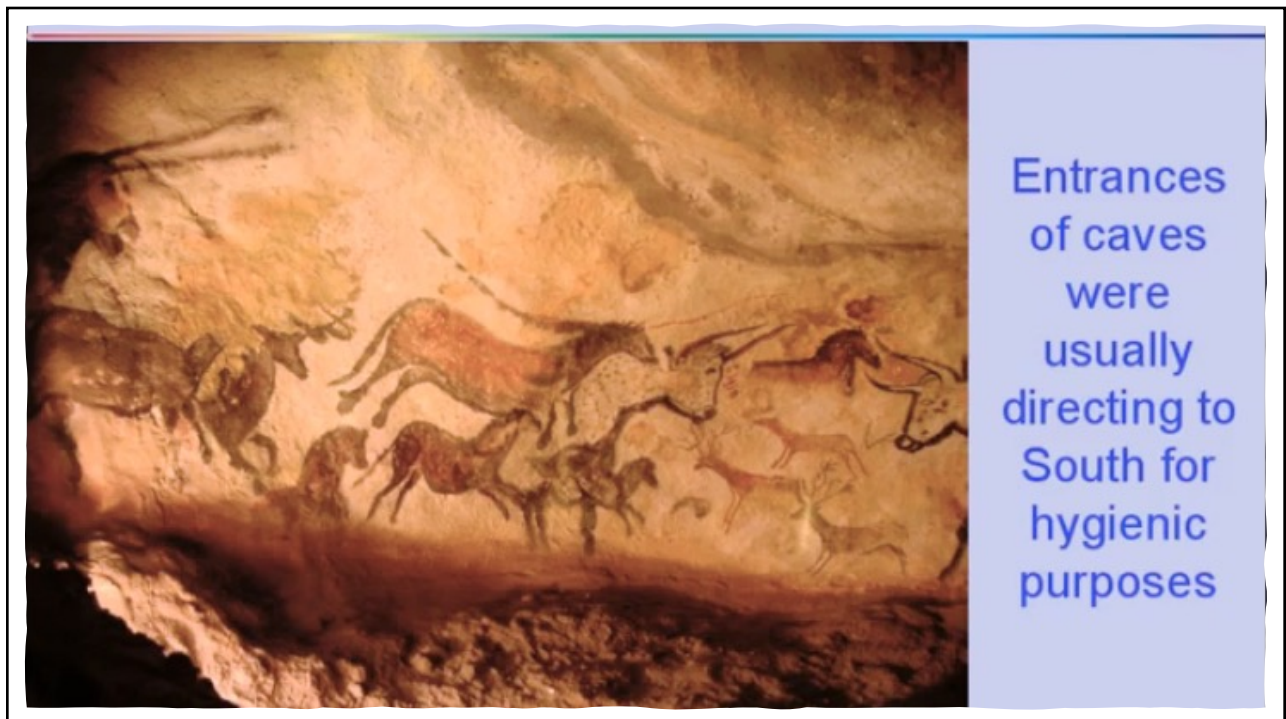
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8


Heliotherapy



Hippocrates
460 B.C. - 377 B.C


Hippocrates prescribed heliotherapy (sunbathing) for **both medical and psychological** purposes.

Philostratus claimed that all of the Olympian athletes took sunbaths in order to strengthen their muscles and bones.



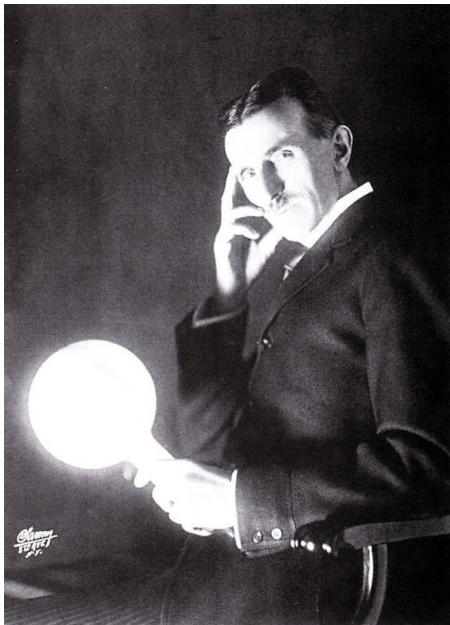
Philostratus
c.170 - c.247

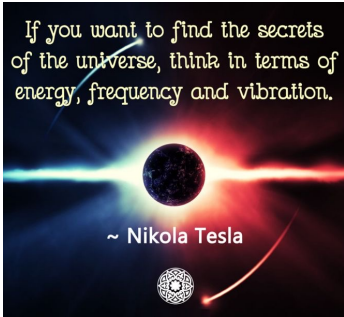
Beneficial effects of UV radiation on diseases other than cancer
Asta Juzeniene



Bikini Mosaic in the Villa Romana del Casale, 4th century

9





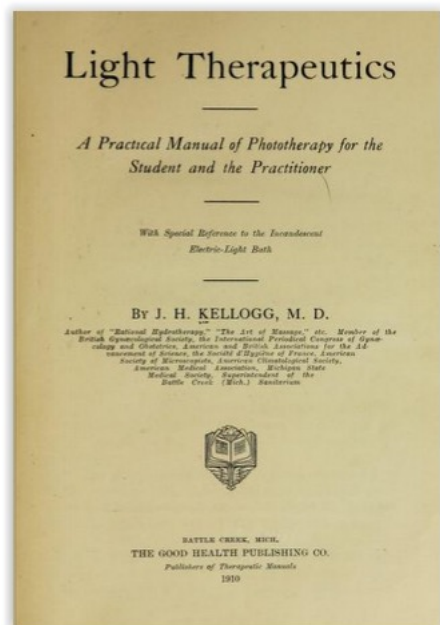
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Neils Ryberg Finsen

- Islandic physician-scientist awarded the 1903 Nobel Prize in Medicine for his
- ***“contribution to the treatment of challenging diseases especially e.g. lupus vulgaris with concentrated radiation from light. He has opened a new avenue for medical science.”***



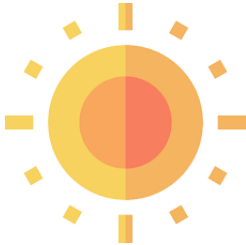
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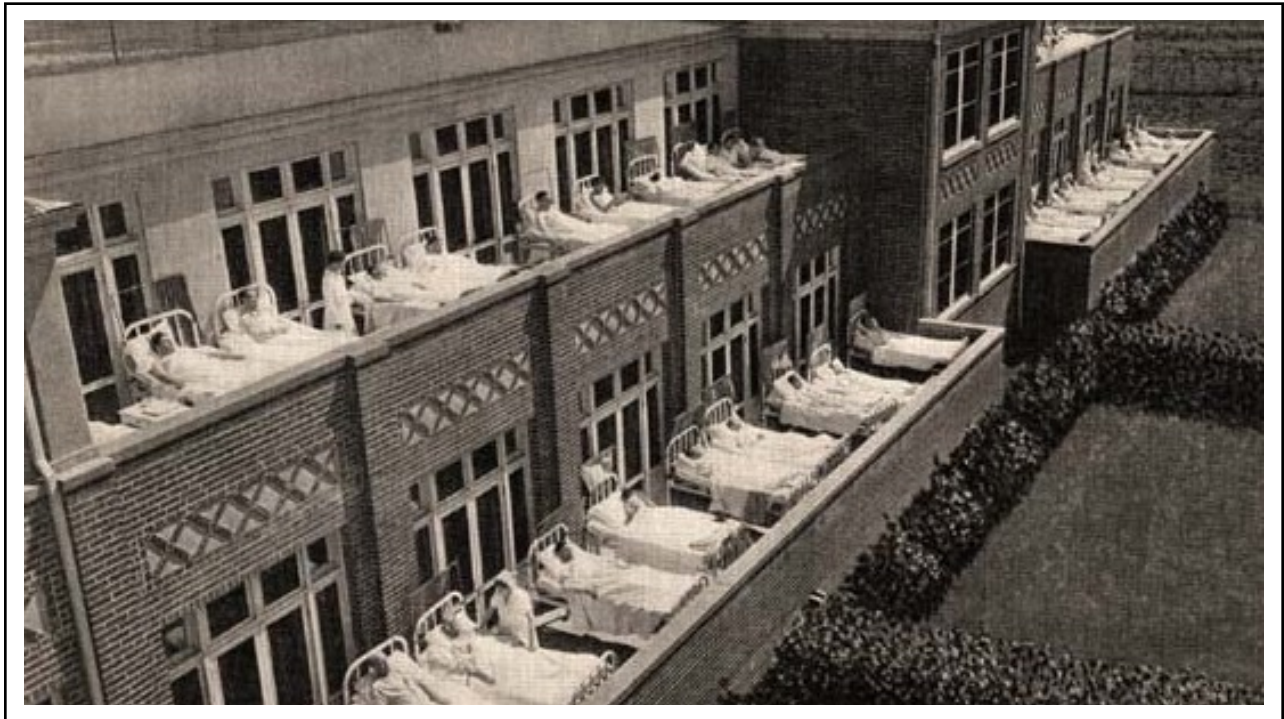
Heliotherapy

By the year 1933, there were over 165 diseases for which sunlight proved to be a beneficial treatment



- Old studies revealed exposing patients to controlled amounts of sunlight cured some infections, lowered blood pressure, lowered blood sugar, and increased the # of wbc.
- Treatment for gout and rheumatoid arthritis
- Treatment of anemia
- Eczema, acne, herpes
- Lupus
- Sciatica
- Wounds, burns

14



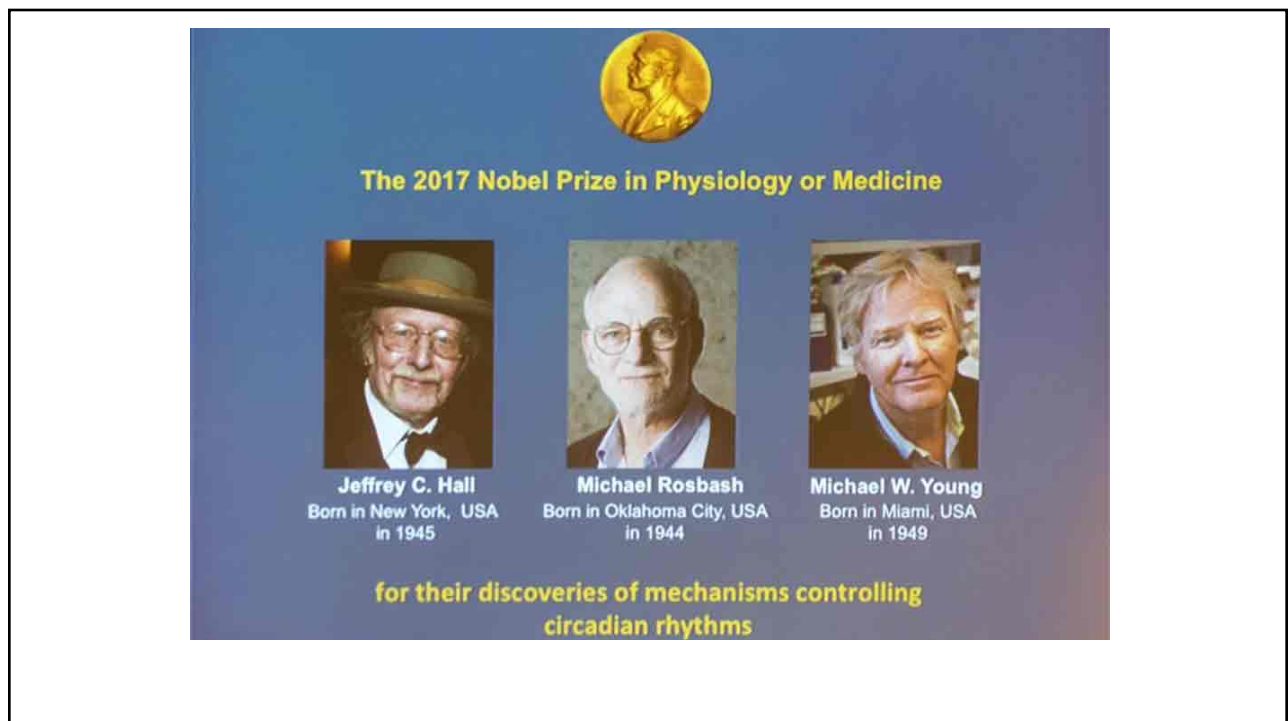
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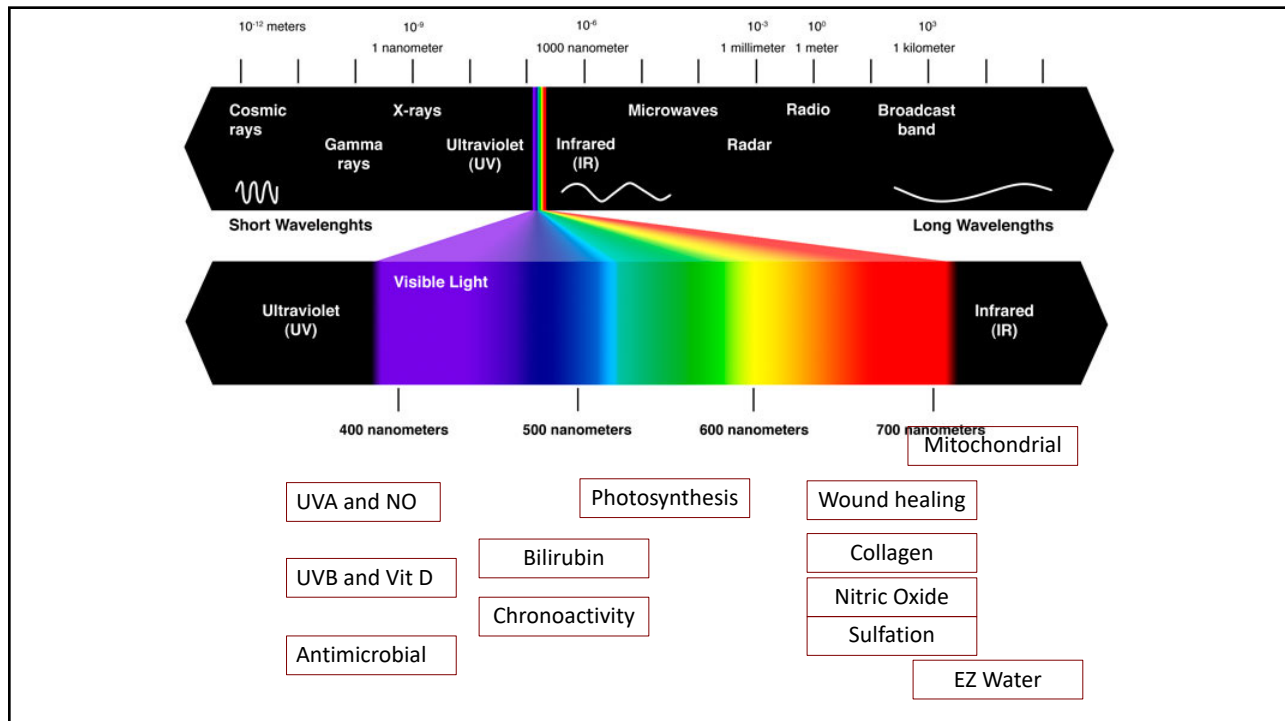
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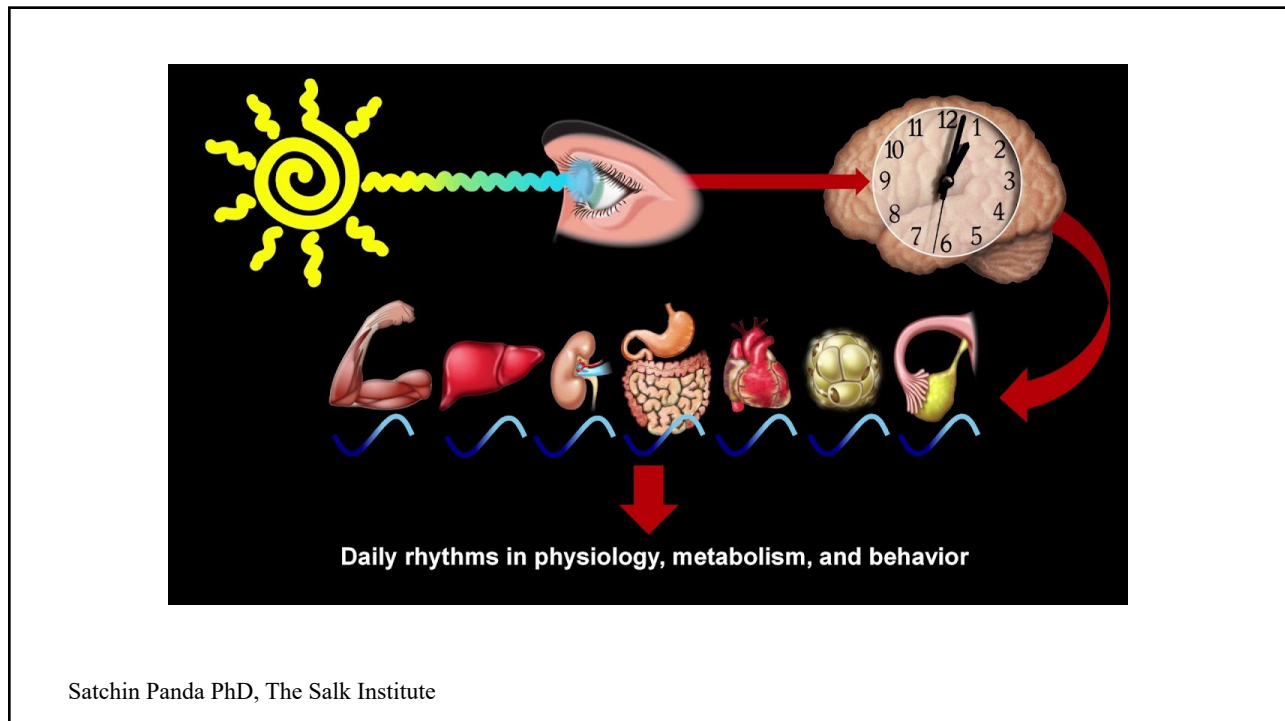
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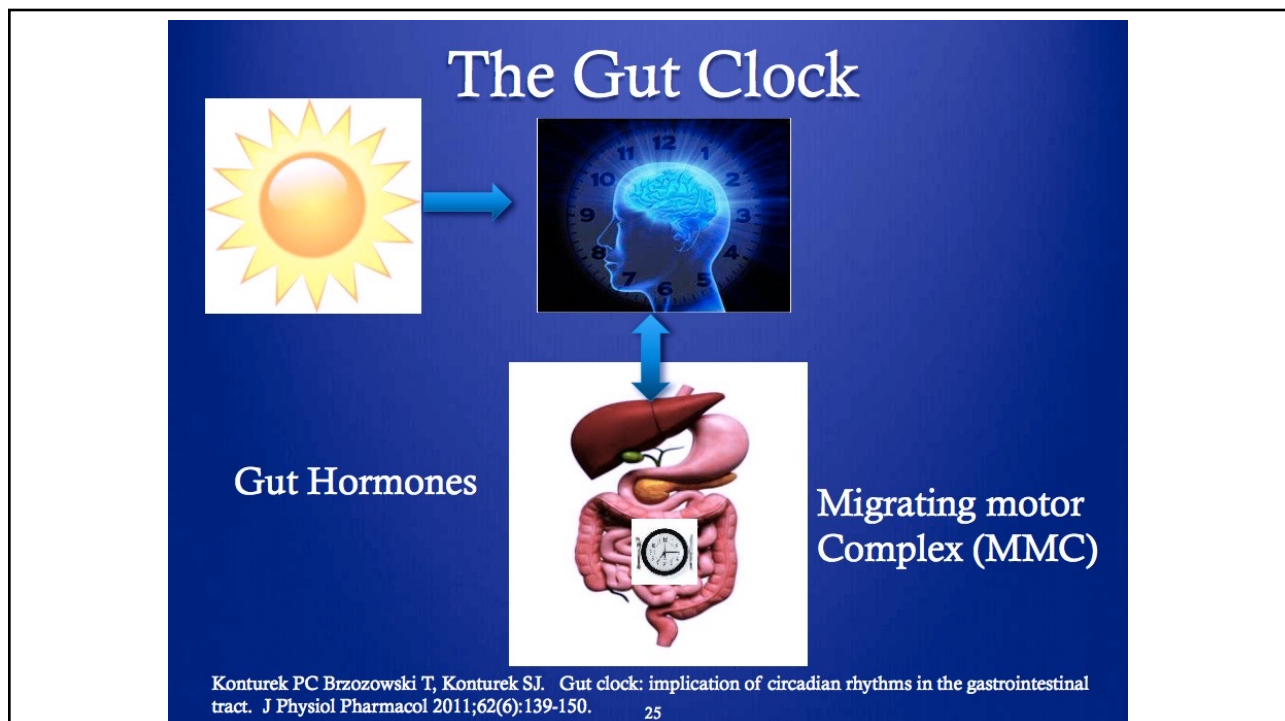
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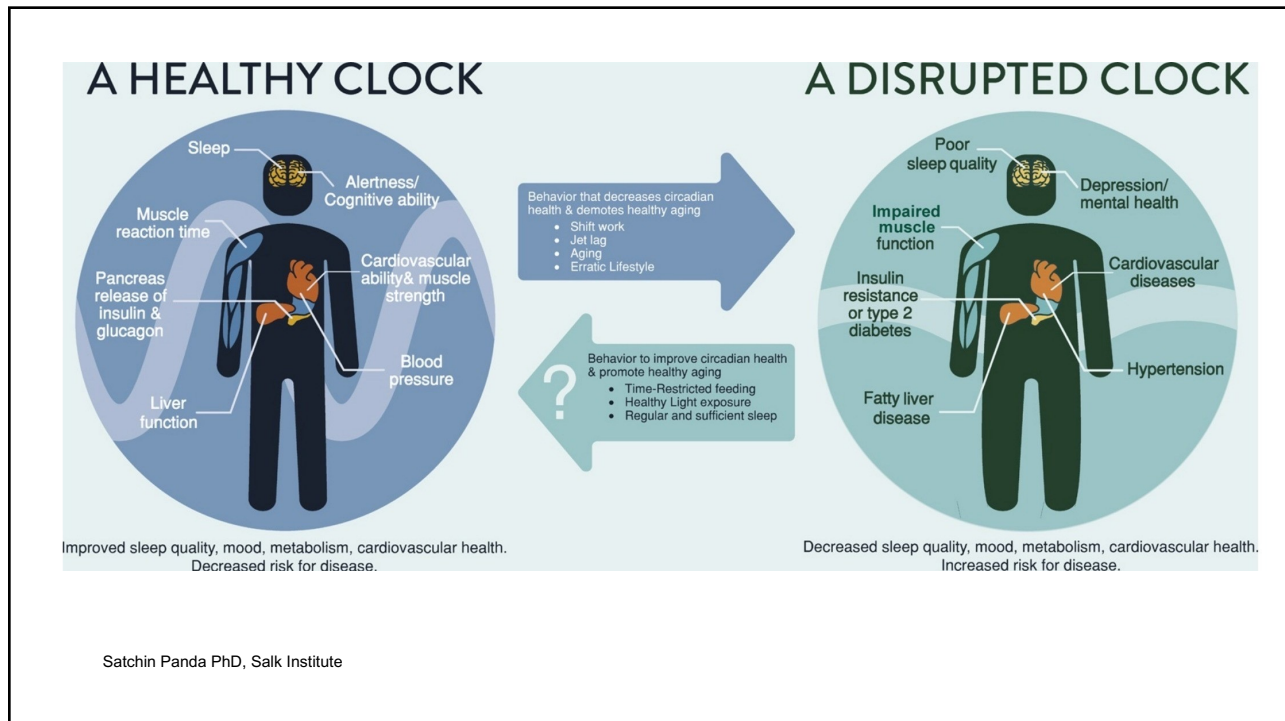
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21



22



23



Fluorescent Lights and Night Shift Workers

- NHS- Nurses Health Study (Harvard)
- 120,000 nurses followed 30+ years
- 30% increase of breast cancer after 15 years of night work
- Other studies have shown increased risk up to 60%

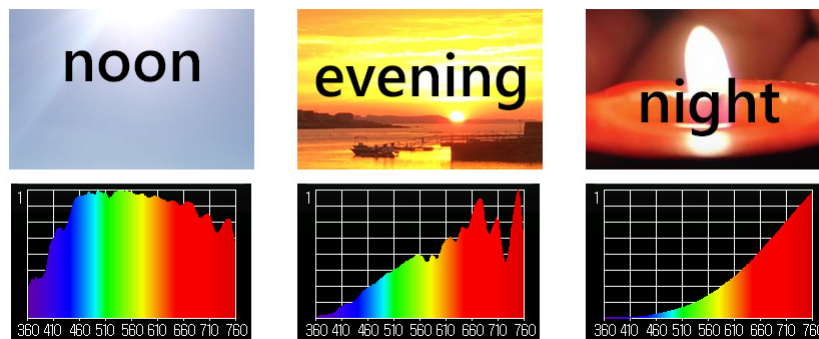
24

Circadian Rhythm and Health

- *MI, angina, stent thrombosis, stroke, arrhythmia, aortic dissection more common in early morning hours*
- *Infarct size larger in morning hours*
- *Increased cancer and cardiovascular disease risk in night-shift workers.*
- *ICU delirium and "post hospital syndrome"*
- *Obesity and insulin resistance*
- *Behavioral health: Depression, PTSD, GAD, BPD*

25

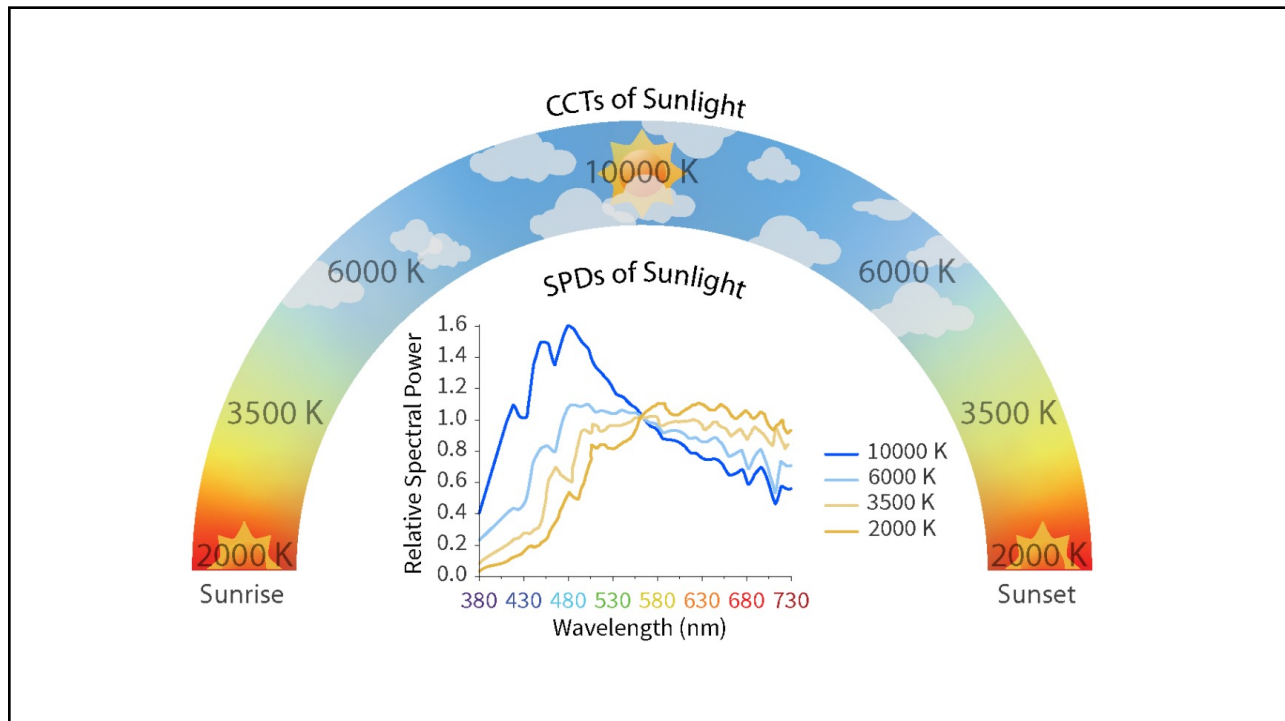
Sunlight and Circadian Entrainment



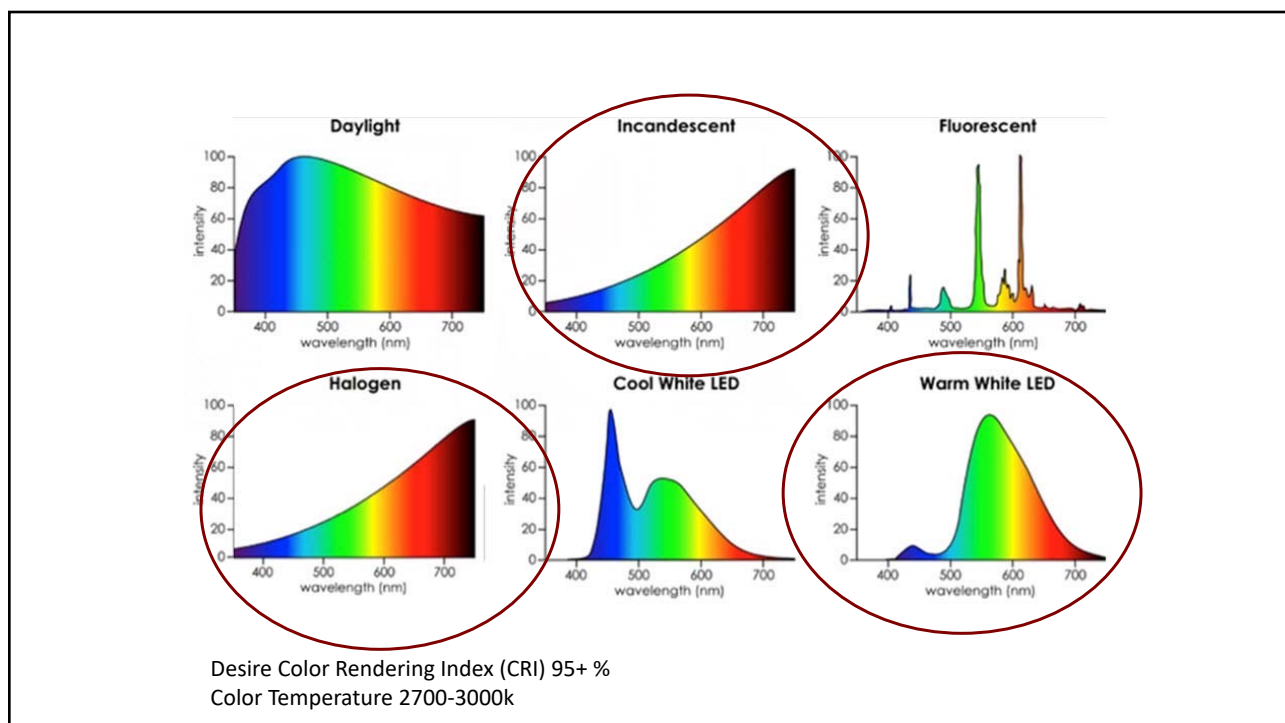
Blue Light: Turns on our circadian clocks in morning hours

Orange-Red: Healing frequencies that turn clocks off in evening-overnight

26



27



28

Lighting Research Center

BACKGROUND APPLICATION RESOURCES HELP

LIGHTING FOR HEALTHY LIVING

This website integrates recent developments in lighting research and education, bridging them to lighting applications in real-world situations by providing design suggestions that meet the unique needs of the people who occupy specific places.

To learn more about lighting and its impact on the circadian system, visit the **Background** page.

To learn more about how to apply circadian-effective design, visit the **Application** page.

[Background](#) [Application](#)

<https://www.lrc.rpi.edu/healthyliving/>

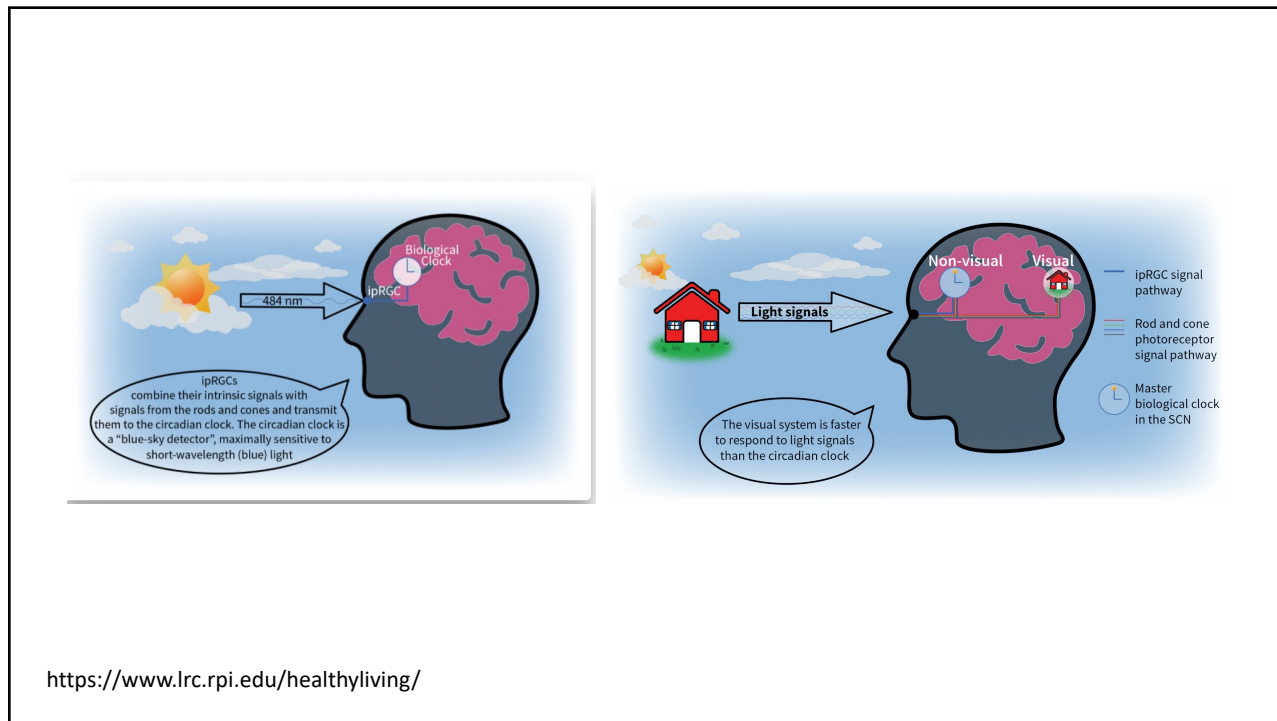
29

Radio
Microwave
Infrared
780 nm
Light
380 nm
Ultraviolet
X-ray
Gamma ray

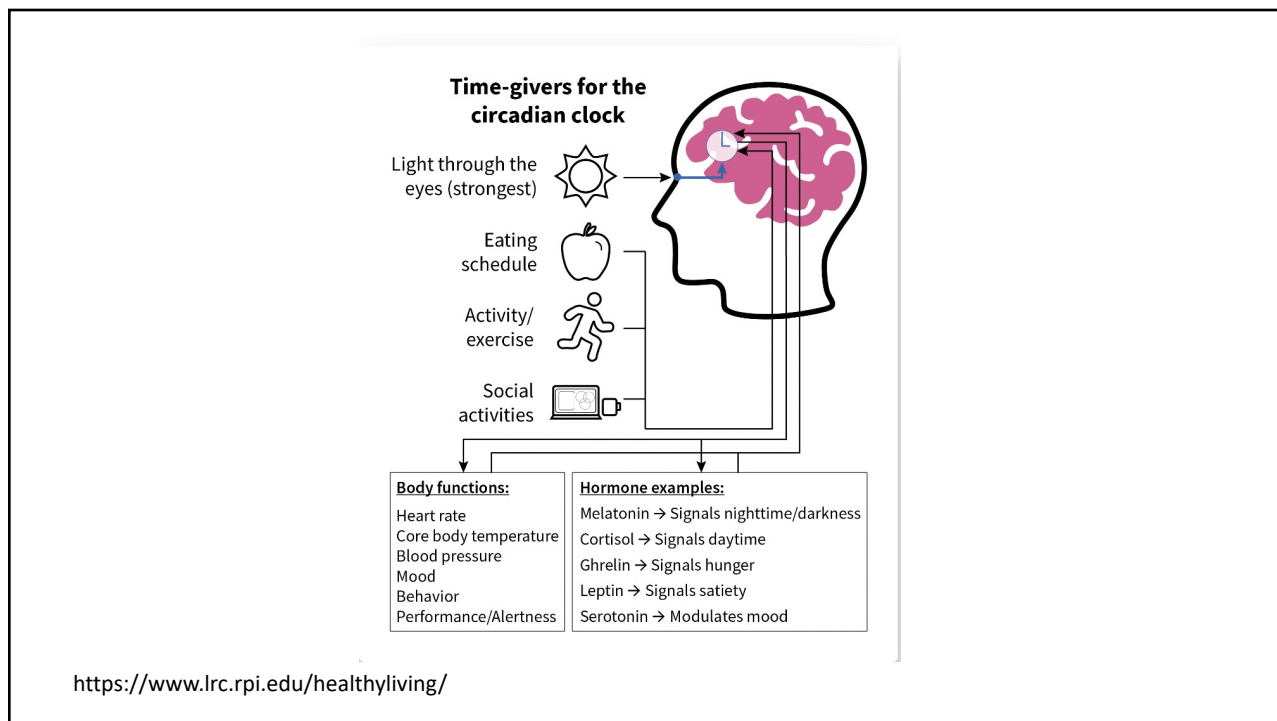
Adapted from *Human Factors in Lighting (Second Edition, p.4)*, by Peter R. Boyce, 2003, London: Taylor & Francis. Copyright 2003 by Peter R. Boyce.

<https://www.lrc.rpi.edu/healthyliving/>

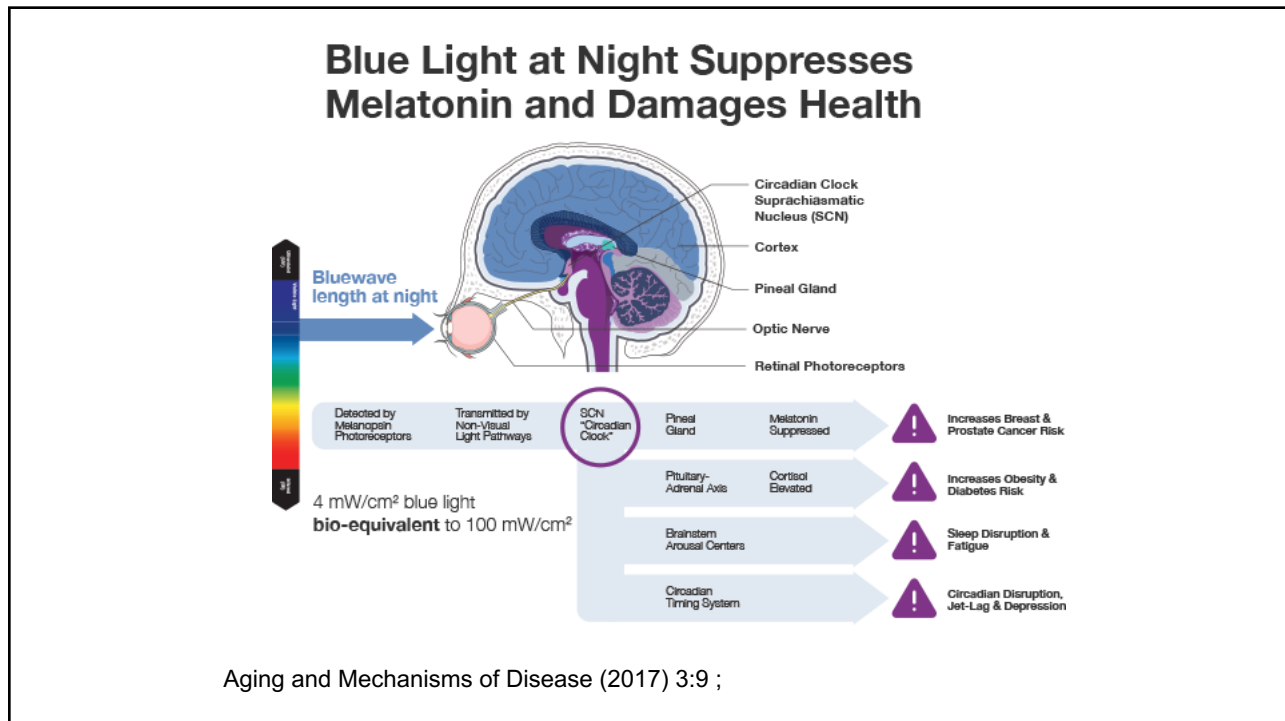
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31



32



33

How exposure to blue light affects your brain and body

BY DISRUPTING MELATONIN, SMARTPHONE LIGHT RUINS SLEEP SCHEDULES. THIS LEADS TO ALL KINDS OF HEALTH PROBLEMS:

The disruption to your sleep schedule might leave you distracted and impair your **MEMORY** the next day.

There's some evidence that blue light could damage our vision by harming the **RETINA** over time — though more research is needed.

A poor night's sleep caused by smartphone light can make it **HARDER TO LEARN**.

Researchers are investigating whether or not blue light could lead to **CATARACTS**.

Over the long term, not getting enough sleep can lead to **NEUROTOXIN** buildup that makes it even harder for you to get good sleep.

There's a connection between light exposure at night and the disturbed sleep that come with it and an increased risk of breast and prostate **CANCERS**.

People whose melatonin levels are suppressed and whose body clocks are thrown off by light exposure are more prone to **DEPRESSION**.


By disrupting melatonin and sleep, smartphone light can also mess with the hormones that control hunger, potentially increasing **OBESITY RISK**.

SOURCES: Nature Neuroscience; Harvard Health Publications; ACS, Sleep Med Rev, American Macular Degeneration Foundation; European Society of Cataract and Refractive Surgeons; JAMA Neurology


TECH INSIDER

Aging and Mechanisms of Disease (2017) 3:9 ;

34

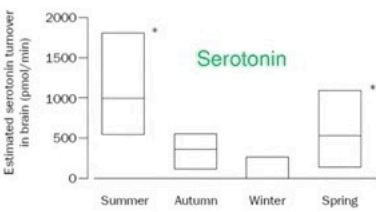


The effect of sunlight on pain stress and depression



- ✓ Stress
- ✓ Pain
- ✓ Analgesic use (21%)

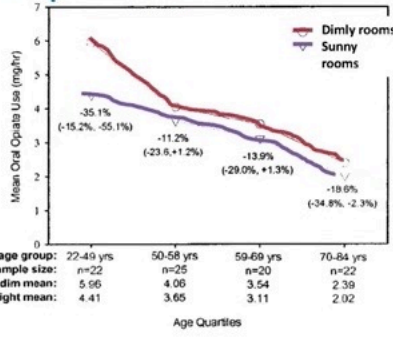
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Estimated serotonin turnover in brain (pmol/min)

Summer Autumn Winter Spring

Serotonin



Mean Oral Opiate Use (mg/hr)



Age Group	Dimly rooms	Sunny rooms
22-49 yrs (n=22)	5.96	4.41
50-58 yrs (n=25)	4.06	3.65
59-69 yrs (n=20)	3.54	3.11
70-84 yrs (n=22)	2.39	2.02




Age Quartiles

Light (470 nm) increases the concentration of serotonin.

Walch et al (2005) *Psychosomatic Medicine*

35

-  MORE ENERGY
-  IMPROVED MOOD
-  BETTER SLEEP AT NIGHT

Sunlight enters through your eyes. >>>

Acting through the hypothalamus, sunlight regulates our circadian rhythm through complex pathways that include melatonin, serotonin and body temperature. >>>

Improving your circadian rhythm has dramatically positive effects on your body and mood.

36

REVIEW ARTICLE

Vitamin D Deficiency

Michael F. Holick, M.D., Ph.D.

N Engl J Med 2007; 357:266-281 | July 19, 2007 | DOI: 10.1056/NEJMra070553



- Author of the UV Advantage
- Sunblocks with factor 15+ reduce sulfated cholcalciferol by 99.9%
- More thoughtful dosed sunlight exposure could reduce cancer incidence in USA by as much as 50%
- Melanoma risk significantly reduced with occupational sun exposure

37

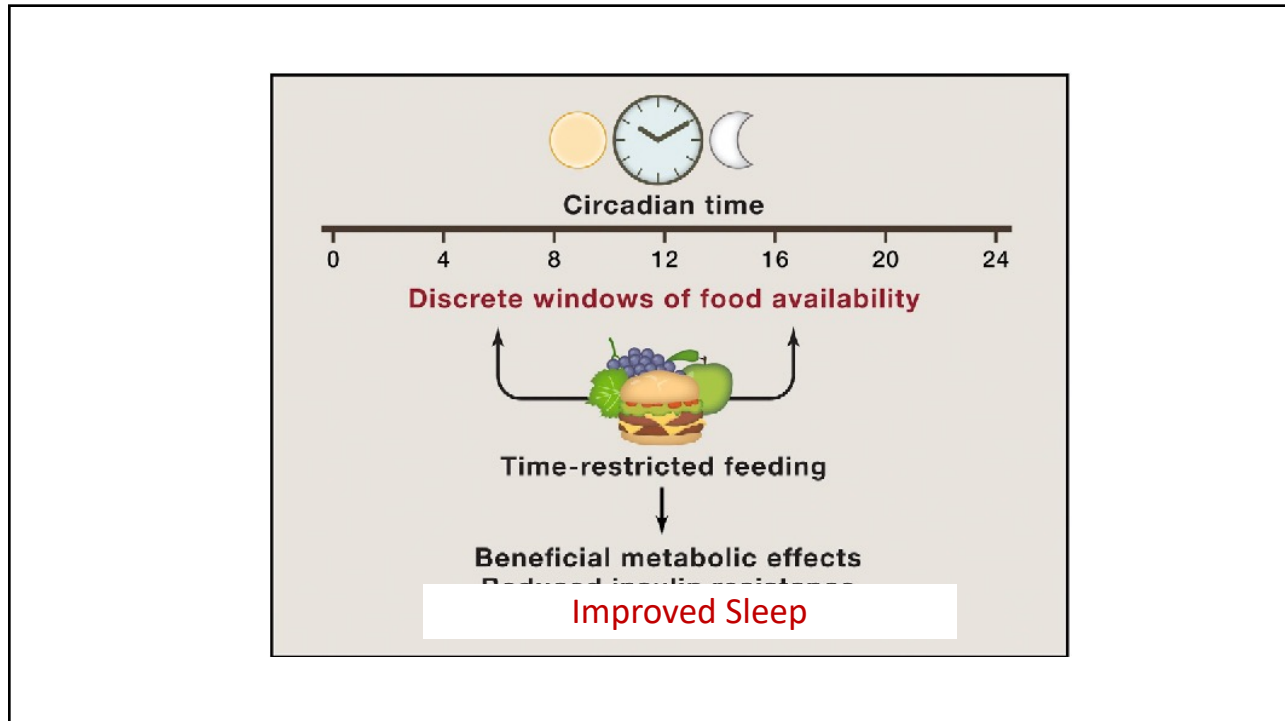
Forest Bathing



- Shinrin-Yoku
- Global health and quality of life improvements
- Improvements in mind and mood
- Grounding
- Lower inflammation
- www.shinrin-yoku.org

Int. J. Environ. Res. Public Health **2017**, *14*, 851;
doi:10.3390/ijerph14080851

38



39

Light therapy

Light therapy is effective in up to 85% of Seasonal Affective Disorder (SAD) cases.

Exposure to very bright light for up to 4 hours per day (average 1-2 hours)

Light intensity:

Average office lighting	200-500 lux*
Light dose for treatment	2,500-10,000 lux
Bright summer day	Up to 100,000 lux

*Lux is a measure of light intensity

- Subject sits 2-3 ft. (61-91 cm) away from specially designed light box
- Keep eyes open, but do not look at the light directly
- Treatment is usually effective within 3-4 days

Effect of light:

1. Light enters eyes
2. Optical nerve guides light to internal clock in the brain, the SCN**
3. Level of melatonin hormone (high when it's dark, influences mood) is reduced
4. Higher concentration of neurotransmitter serotonin in the brain improves mood

**SCN = Suprachiasmatic nucleus of the hypothalamus

Equipment

- **Full-spectrum bulbs:** Similar to outdoor daylight
- **Cool-white lamps:** Enhance cool tones, such as blues, greens, grays, whites
- **Triphosphor lamps:** Mixture of three phosphors to provide visible light
- **Biaxial lamps:** Two cylindrical, long-lasting

© 2006 MCT Source: SAD Association, Depression Therapy Germany (www.depression-therapie-forschung.de) Graphic: Jutta Scheibe, Eel Poll

SAD

- Full spectrum
- 10k lux
- 30"
- Dawn exposure

40

Sleep Hygiene

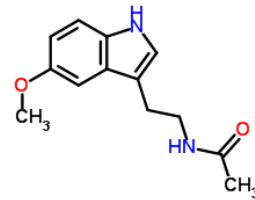
- Regular schedule-consistency
- Limit daytime napping
- Complete darkness
- Cooler temperature
- Bedroom for sleep and sex
- Relaxing rituals (Epsom salts bath, lavender)
- Limit screen time in the bedroom
- Maximize comfort
- Ideally not food consumption 2+ hours before bedtime
- Minimize stimulants e.g. caffeine, alcohol



41

Melatonin

- Hormone of darkness
- Very sensitive to blue light
- Facilitates sleep cycle
- Increases cell regeneration
- Anti-oxidant activity; ROS scavenger
- Antagonizes Aromatase and lowers estrogen production in tissues
- Modulates immune regulatory function
- Antagonizes cortisol
- Key substance for chronobiologic adaptation (day/night and summer/winter)



42

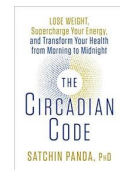
Supplements to Assist Sleep

- Melatonin 1-3 mg
- L-theanine 200-400 mg
- Chamomile, Passionflower tea (Sleepy Time)
- Glycine 3-5 grams
- CBD/THC



43

Summary



- Environmental light quality and timing are drivers of circadian rhythm.
- Meal timing appears to be a major driver of circadian rhythm
- Sensible sunlight e.g. 15-20" in am (7-10a) and later afternoon/evening (4-7p) without protection or sunglasses
- Spend as much time outdoors as possible e.g. forest bathing
- Warm halogen/LEDs as substitutes for CFUs in rooms where you spend time after sunset
- Blue blocker glasses after sunset when exposed to bright light e.g. watching television.
- Full-spectrum/dawn light at 10k lux for 30" for seasonal affective disorder, sleep disruption, improved cognition.
- Blue-blocker settings on tech devices


44



45

Zeitgebers

Summary: Entrain Circadian Rhythms

 <p>Go Outdoors ...</p>  <p>... Exercise ...</p>  <p>... Eat ...</p>	<p>Best strategy:</p> <p>Bright natural light in the day Orange light at night Daily exercise Intermittent fasting Feeding only in the daytime Warm temperatures in day, cool at night Social interactions in the day Stress in the day, no stress at night Regular sleep schedule</p>	 <p>... Interact ...</p>  <p>... Love ...</p>  <p>... Sleep</p>
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Logan et al. *Journal of Physiological Anthropology* (2015) 34:9

46