Circadian Rhythms and Mental Health

Elaine Boland, PhD, DBSM

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Elaine Boland, PhD, DBSM

Dr. Elaine Boland is a licensed clinical psychologist with board certification in Behavioral Sleep Medicine.

Prior to opening her private practice in early 2025, she held a dual appointment as Assistant Professor in the Psychiatry Department of the University of Pennsylvania and Research Psychologist at the Corporal Michael J. Crescenz VA Medical Center in Philadelphia.

During that time she conducted research on the mechanistic underpinnings of the insomnia and depression comorbidity as well as the influence of circadian rhythms on the development of depression in women experiencing symptoms of perimenopause.

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Disclosures/Conflicts of Interest

I have no conflicts of interest to disclose. Generative AI was not used for the development or content of this presentation.

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Learning Objectives

1. Describe the relationship between circadian rhythms and various mental health disorders
2. Identify symptoms of circadian misalignment that may arise in clinical practice
3. Apply strategies for collaborating with behavioral sleep medicine specialists and safely integrating circadian rhythmicity into clinical practice

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Circadian Rhythms Are Ubiquitous

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Circadian Rhythms Are an Open System

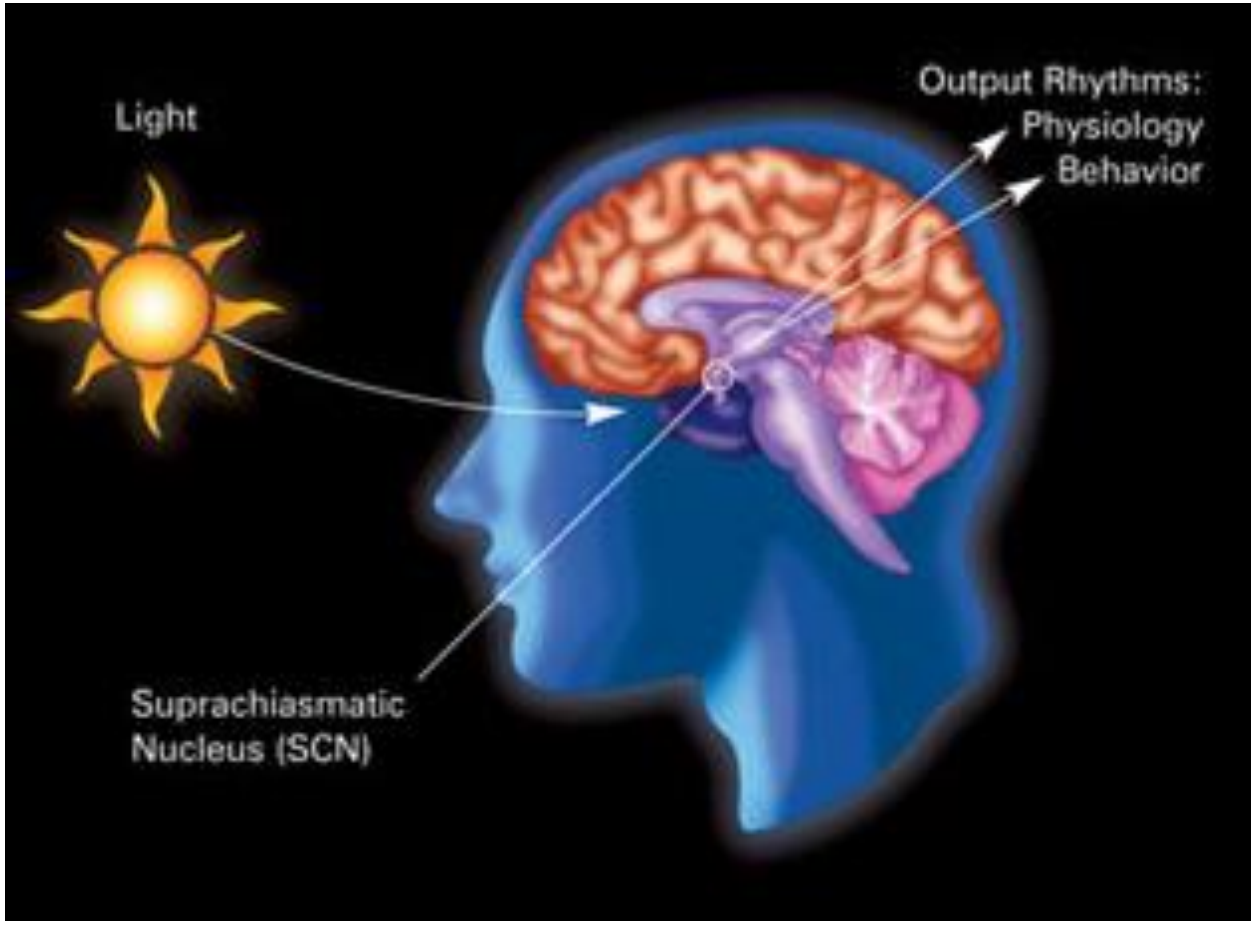

Image credit: http://www.maxmednik.com/home/can-you-feel-the-rhythm

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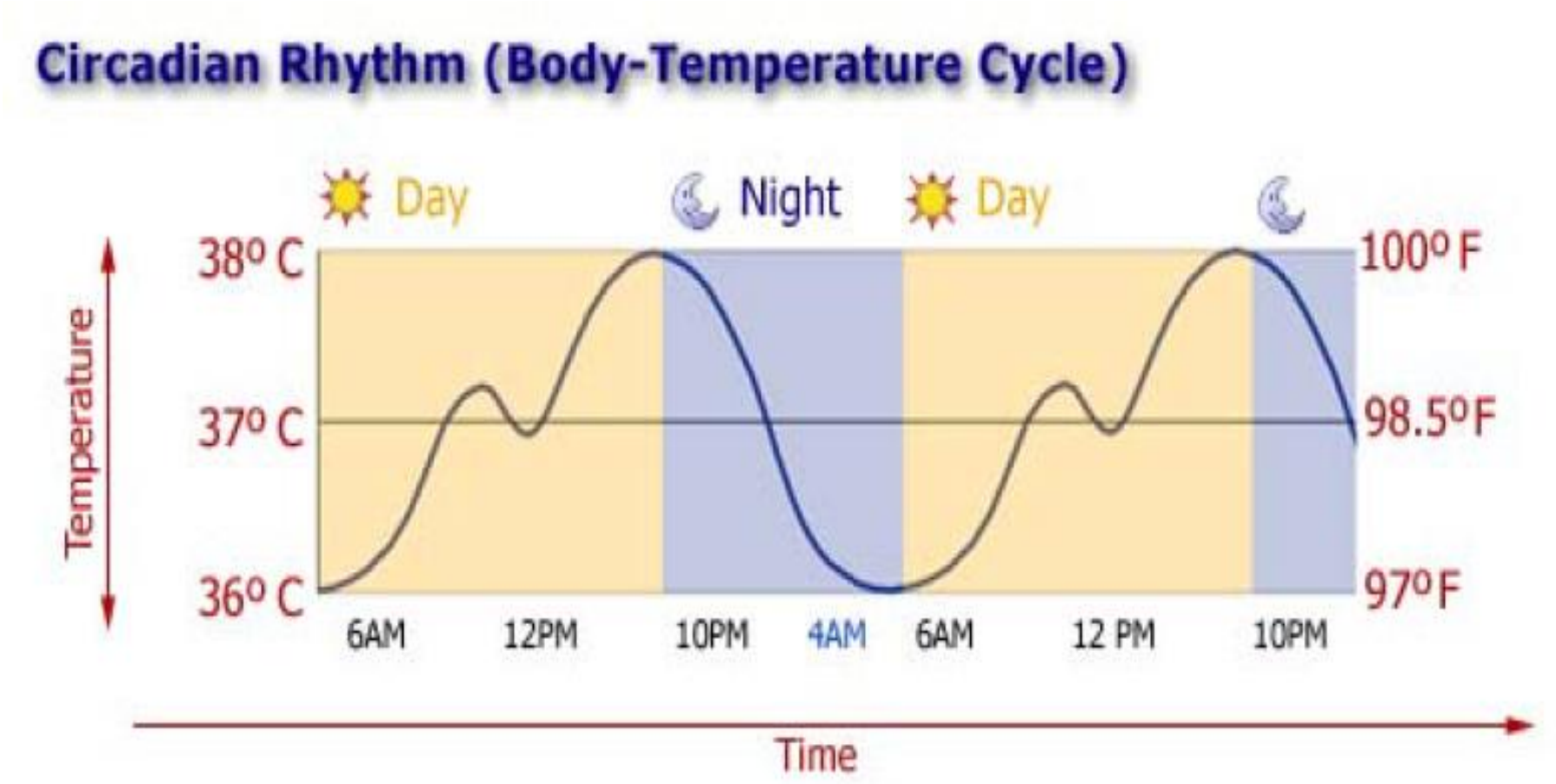
Rhythm of Alertness Closely Follows Temperature Rhythm



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Circadian Disruption Is Implicated in Mental Health Disorders

- Major Depressive Disorder
- Bipolar Disorder
- Anxiety
- Obsessive Compulsive Disorder
- Schizophrenia

Walker et al., 2020 Translational Psychiatry

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How Does Circadian Disruption Manifest?

- Disturbances in phase
  - Chronotype: body's natural preferences for timing of sleep and alertness
- Altered Rest/Activity Rhythms
  - Overall reductions
  - Irregularity

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Disturbances in Circadian Phase - Chronotype

Owls (eveningness)

- Difficulty waking up in morning and/or prolonged time to feel fully awake
- Difficulty falling asleep before very late into night
  - Often associated with difficulty disengaging from nighttime activities

Larks (morningness)

- Difficulty staying awake in evening (involuntary evening “naps”)
- Early wake-up time (unable to sleep in)
  - Note: Early morning waking can also be a symptom of depression

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Chronotype in Psychiatric Disorders

- Eveningness associated with worse course in MDD[1]
- Shift towards morningness after treatment; morningness independent predictor of response
- Greater eveningness in individuals with bipolar disorder compared to controls[2]
  - Mixed evidence of association with depression symptoms
- Greater rates of eveningness in schizophrenia than general population, similar to bipolar I profiles[3]
- Eveningness associated with worse symptoms in OCD[4]
  - Increased prevalence of OCD at higher latitudes[5]

[1]Corruble et al., 2013 Chronobiology International; [2]Takaesu, 2018 Psychiatry and Clinical Neurosciences; [3]Linke et al., 2021 Schizophrenia Research; [4]Cox & Olatunji, 2022 Journal of Affective Disorders; [5]Coles et al., 2018, Journal of Obsessive Compulsive and Related Disorders;

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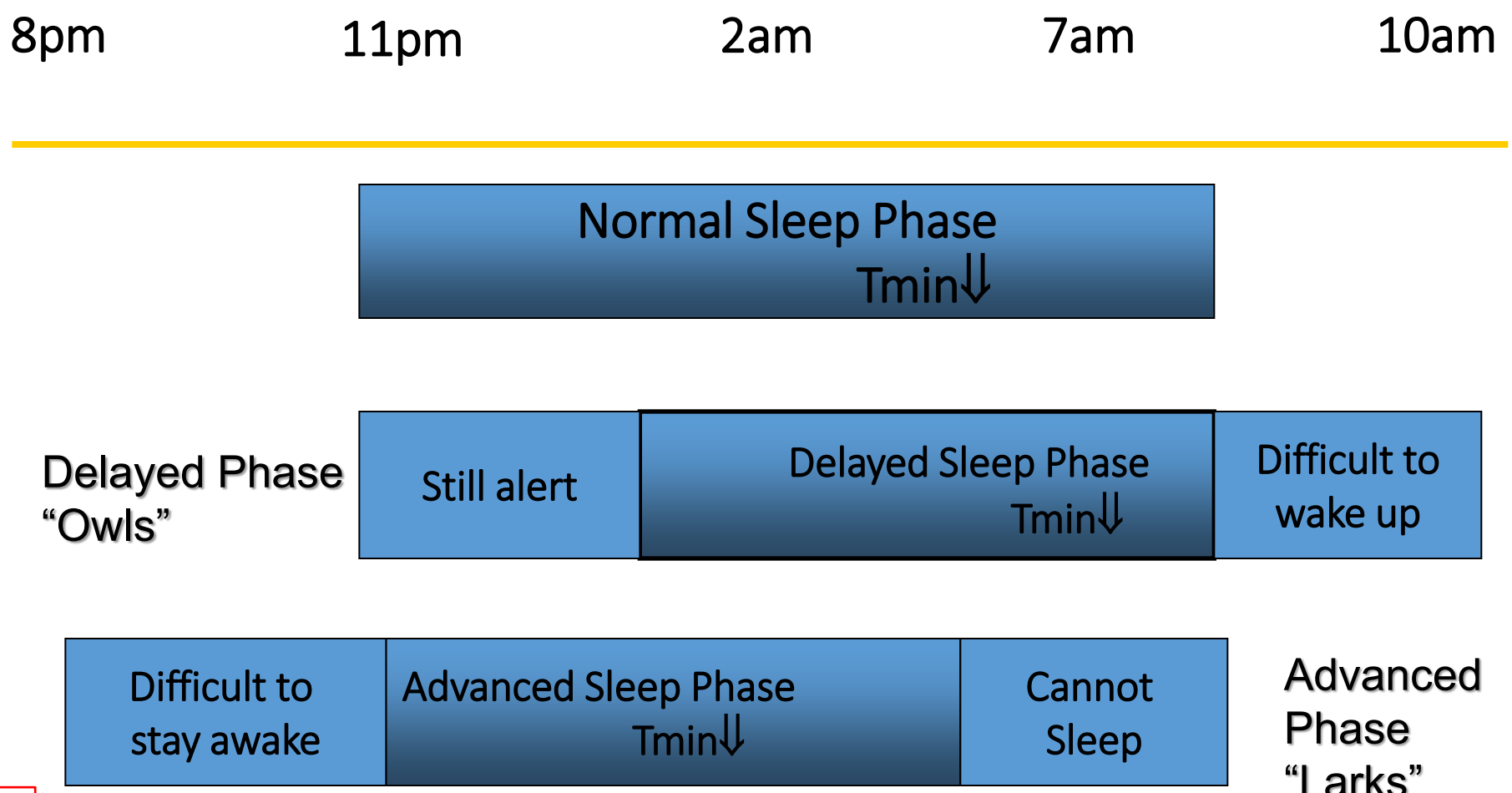
Disturbances in Phase: Circadian Misalignment



Tmin = Core body temperature minimum

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Intrinsic Sleep/Wake Disorders

- Advanced Sleep Wake Phase Disorder
  - Advanced (earlier) timing of sleep
  - Sleep offset about two or more hours prior to desired wake time
  - Present at least 3 months
  - May present as early morning awakenings/terminal insomnia
  - Excessive sleepiness during the day
  - Sleep quality is generally good when advanced schedule maintained

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Intrinsic Sleep/Wake Disorders

- Delayed Sleep Wake Phase Disorder
  - Delayed (later) sleep onset relative to desired bedtime
  - May have initial insomnia
  - Significant difficulty waking at required time due to later phase
  - Normal sleep quality when delayed schedule is maintained
  - Symptoms present for 3 months
  - When associated with internal circadian misalignment (DLMO after desired bedtime), greater odds of MDD symptoms1

[1]Murray et al., 2017 *Sleep*

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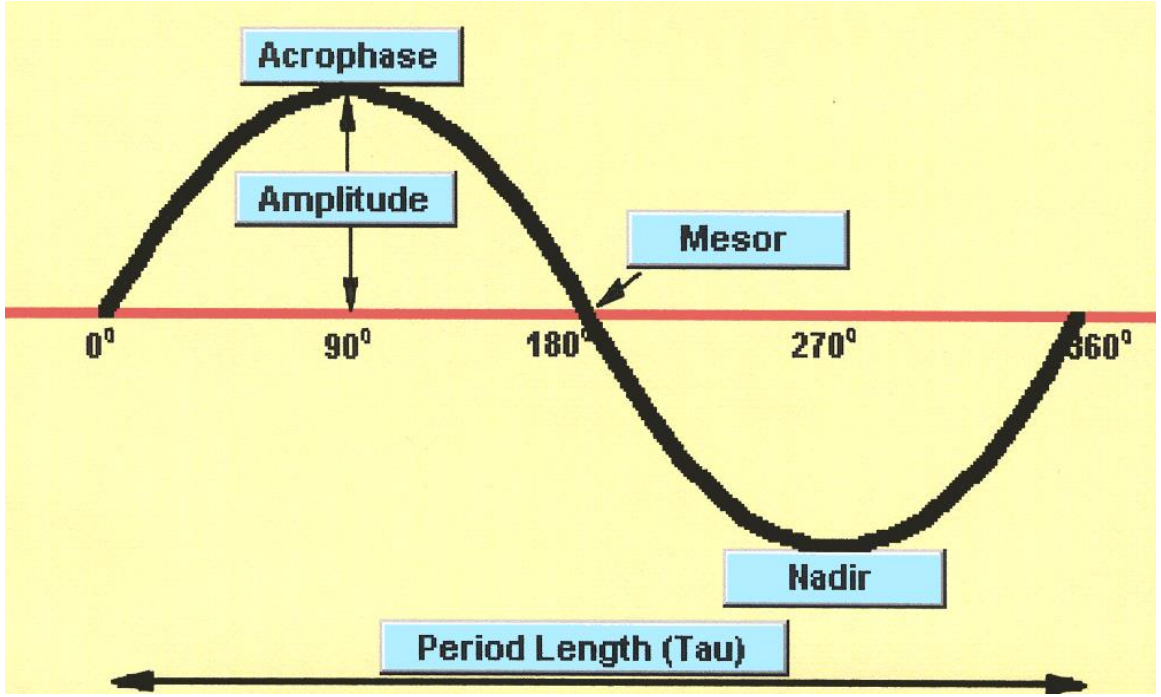
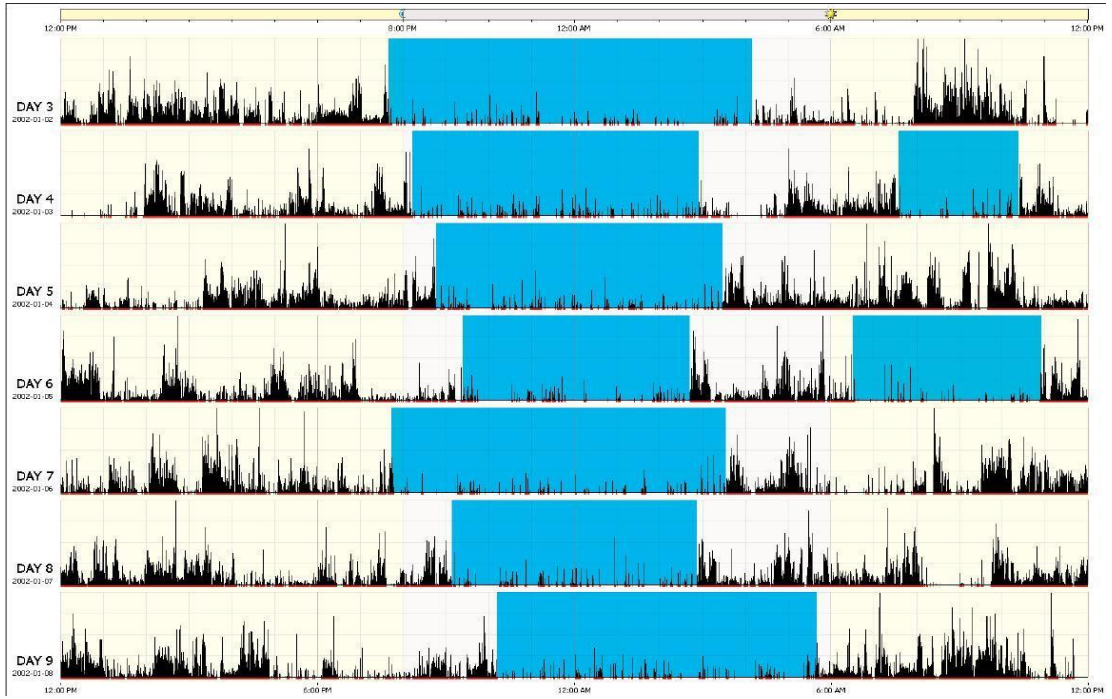
Alterations in Rest/Activity Rhythms (RARs)

- RARs are typically obtained via actigraphy to “quantify the regularity, shape and timing of repeated 24-hour sleep-wake cycles.”[1]





[1]Smagula, 2016 *Current Opinion in Psychiatry*

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RARs and Psychiatric Symptoms

- Compared to individuals with “early and robust” RARs, those with “later and irregular” RARs had greater lifetime depression symptoms and lifetime manic/hypomanic symptoms.[1]
- Compared to “early and robust” RARs, those with ”later and narrow” RAR’s had greater lifetime depression symptoms.[1]
- In a study of stroke survivors, greater fragmentation of RARs was associated with greater depression symptoms.[2]

[1]Smagula et al., 2018 *Journal of Psychiatric Research;* [2]Stahl et al., 2023 *Archives of Physical Medicine and Rehabilitation*

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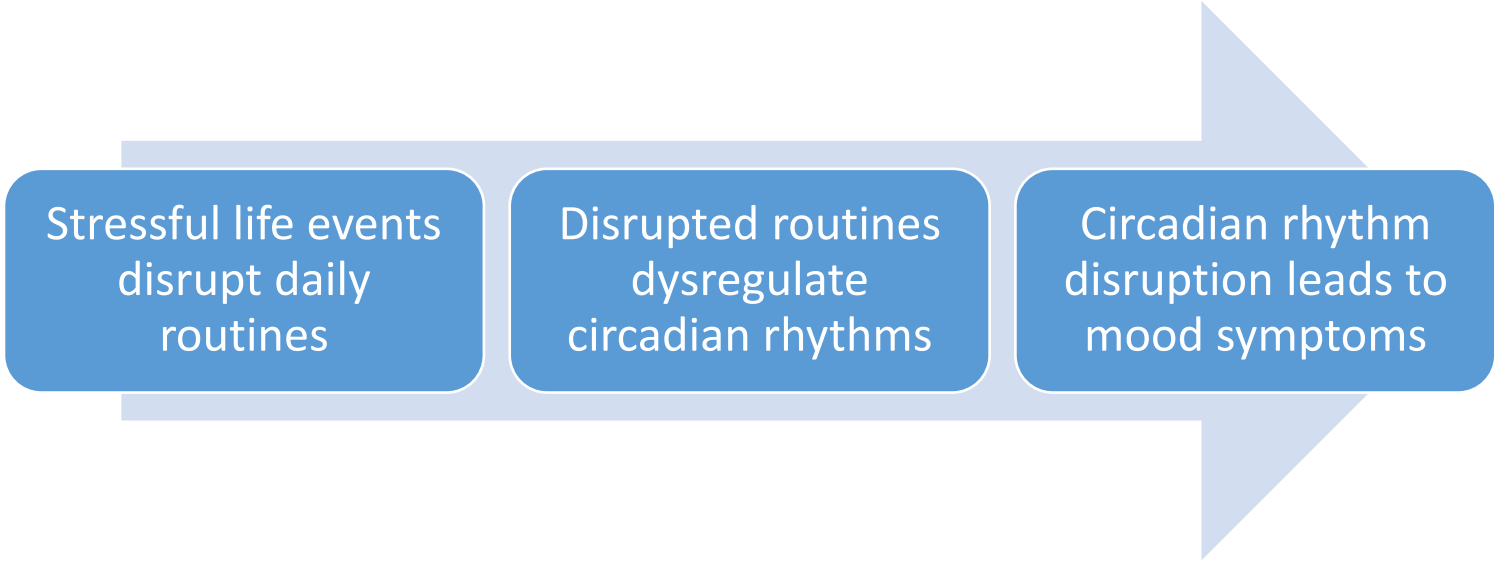
Social Zeitgeber Theory[1]



Social rhythm irregularities have been observed in both unipolar and bipolar depression[2]

[1]Ehlers, Frank & Kupfer, 1990, *Archives of General Psychiatry;* [2]Germain & Kupfer, 2008 *Human Psychopharmacology: Clinical and Experimental*

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Treatments for Circadian Disruption

- Chronotherapeutics
  - Melatonin
  - Light Therapy
- Sleep scheduling
- Behavioral Activation

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Phase Response Curve

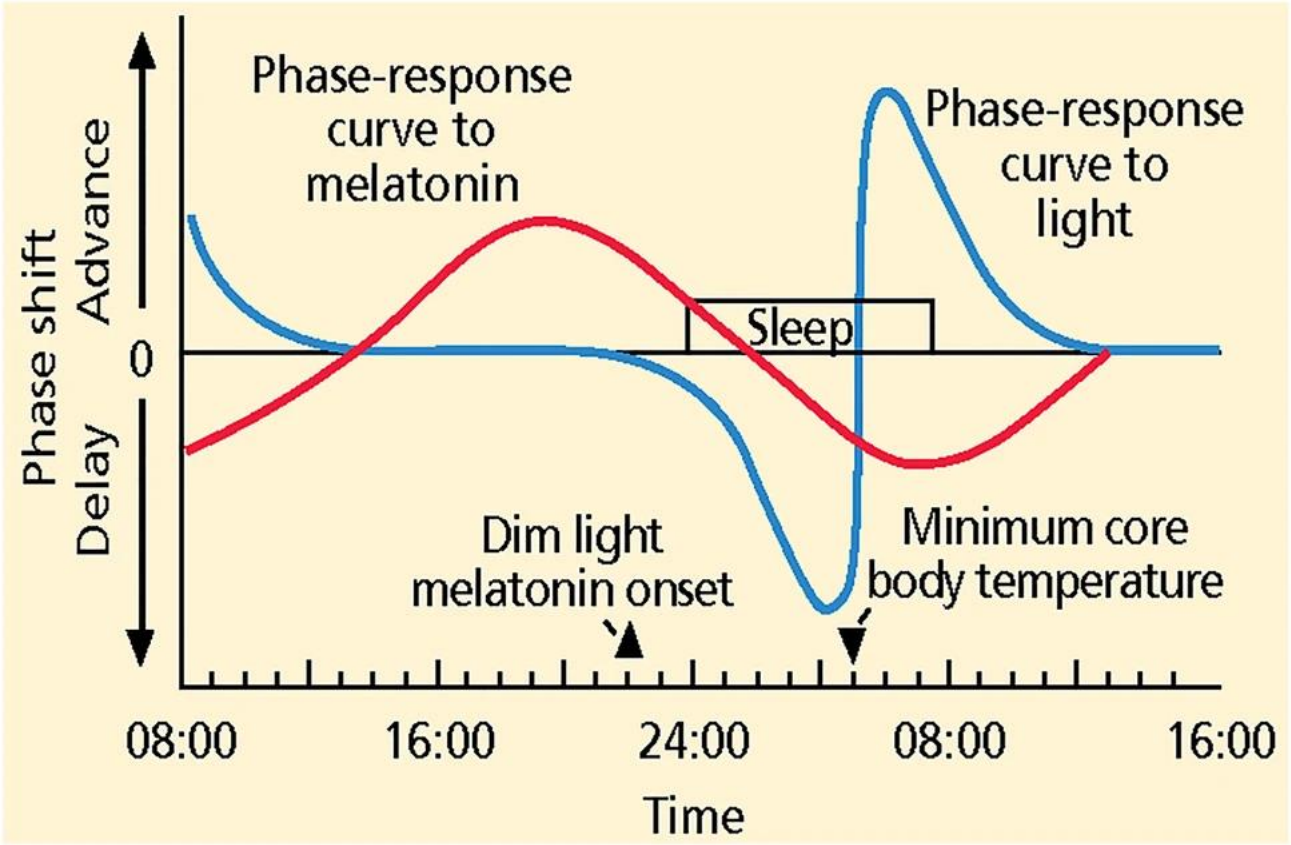

Image: Steele et al., 2021 *Neurotherapeutics*

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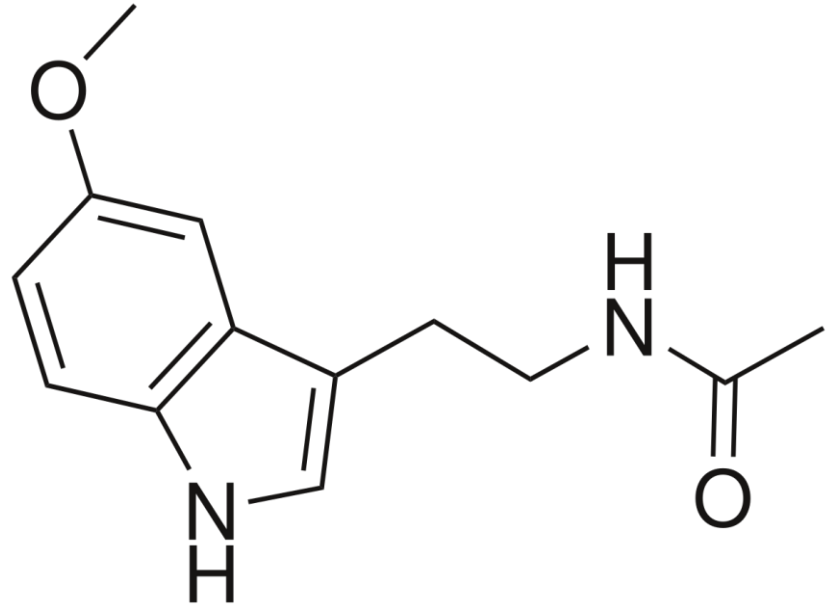
Melatonin

- Optimal dose remains unclear[1]
- Timing more important than dose, but less can be better
- Phase Response Curve is 180 degrees out of phase with light
  - Afternoon dosing will advance rhythm
  - Morning dosing will delay rhythm
  - Studies vary in timing:
    - 1.5 – 2 hours before typical bedtime in DSWPD
    - Between 19:00 and 21:00 in DSWPD
    - 1 hour before bedtime in N24SWD
    - 21:00 in N24SWD



[1] Auger et al., 2015 *Journal of Clinical Sleep Medicine*

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Melatonin – Side Effects

- Sold as OTC supplement but should be administered with physician monitoring/consent if non-prescriber
- Adverse effects:[1]
  - Headaches
  - Somnolence
  - Hypotension
  - GI upset
  - Increase in depressive symptoms
  - Case reports urging caution in those on Warfarin or those with epilepsy

[1] Auger et al., 2015 *Journal of Clinical Sleep Medicine*

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Bright Light Therapy

- Timed administration of bright light exposure
- Light exposure to periphery of eyes
  - Light boxes
  - Wearable technology
- Use caution/consult with physician:
  - Eye conditions (e.g., macular degeneration, photosensitivity)
  - Certain skin conditions (e.g., as seen in lupus)
  - Those taking photosensitizing medications
  - History of bipolar disorder (monitor)
- Can be associated with headaches (migraines in those susceptible), eyestrain, nausea, agitation; usually short-lived.[1]

[1] Auger et al., 2015 *Journal of Clinical Sleep Medicine*

Bright Light Therapy - Timing

- Delayed Sleep Phase:
  - 2-3 hours before natural wake time[1]
- Advanced Sleep Phase:
  - 20:00 to 23:00, 2 hours duration[2]
  - Between 19:00 and 21:00; before nadir of core body temperature[1]
- In Bipolar Disorder:
  - Recommendation is for mid-day light exposure, often used for mood effects as opposed to shifting circadian rhythms[3]

[1]Zee et al., 2013 *Continuum*; [2]Campbell et al., 1995 *Journal of the American Geriatric Society*;[3]Wang et al., 2020 *PLoS One*

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Sleep and Activity Scheduling

- Regular sleep/wake times are key components of circadian regularity
- Align with chronotype when possible, but avoid social jet lag (e.g., extreme shifts from weekdays to weekends)
- Routine/regular social zeitgebers[1]
  - Consistent meal times
  - Consistent exercise times
  - Rewarding activities at regular times!

[1]Sabet, Dautovich, & Dzierzewski, 2021 *Journal of Affective Disorders*

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Assessing for Circadian Disruption in Clinical Practice

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Morningness-Eveningness Questionnaire

2. What time would you go to bed if you were entirely free to plan your evening?

8:00 – 9:00 PM	5
9:00 – 10:15 PM	4
10:15PM – 12:30 AM	3
12:30 – 1:45 AM	2
1:45 – 3:00 AM	1
3:00AM – 8:00 PM	0

3. If there is a specific time at which you have to get up in the morning, to what extent do you depend on being woken up by an alarm clock?

Not at all dependent	4
Slightly dependent	3
Fairly dependent	2
Very dependent	1

4. How easy do you find it to get up in the morning (when you are not woken up unexpectedly)?

Not at all easy	1
Not very easy	2
Fairly easy	3
Very easy	4

70 – 86	Definitely Morning
59 – 69	Moderately Morning
42 – 58	Intermediate (Neither)
31 – 41	Moderately Evening
16 – 30	Definitely Evening

Horne et al., 1976 *International Journal of Chronobiology*

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Consensus Sleep Diary

Consensus Sleep Diary-Core ID/Name:_____

	Sample							
Today's date	4/5/08							
1. What time did you get into bed?	10:15 p.m							
2. What time did you try to go to sleep?	11:30 p.m							
3. How long did it take you to fall asleep?	55 min.							
4. How many times did you wake up, not counting your final awakening?	3 times							
5. In total, how long did these awakenings last?	1 hour 10 min.							
6. What time was your final awakening?	6:35 a.m.							
7. What time did you get out of bed for the day?	7:20 a.m							
8. How would you rate the quality of your sleep?	☐ Very poor ☑ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good
9. Comments (if applicable)	I have a cold							

Carney et al., 2012 *Sleep*

Visual Sleep Diary

TWO WEEK SLEEP DIARY

INSTRUCTIONS:
1. Write the date, day of the week, and type of day: Work, School, Day Off, or Vacation.
2. Put the letter "C" in the box when you have coffee, cola or tea. Put "M" when you take any medicine. Put "A" when you drink alcohol. Put "E" when you exercise.
3. Put a line (I) to show when you go to bed. Shade in the box that shows when you think you fell asleep.
4. Shade in all the boxes that show when you are asleep at night or when you take a nap during the day.
5. Leave boxes unshaded to show when you wake up at night and when you are awake during the day.

AMERICAN ACADEMY OF SLEEP MEDICINE — WAKE / SLEEP

SAMPLE ENTRY BELOW: On a Monday when I worked, I jogged on my lunch break at 1 PM, had a glass of wine with dinner at 6 PM, fell asleep watching TV from 7 to 8 PM, went to bed at 10:30 PM, fell asleep around Midnight, woke up and couldn't got back to sleep at about 4 AM, went back to sleep from 5 to 7 AM, and had coffee and medicine at 7:00 in the morning.

Today's Date	Day of the week	Type of Day Work, School, Off, Vacation	Noon	1PM	2	3	4	5	6PM	7	8	9	10	11PM	Midnight	1AM	2	3	4	5	6AM	7	8	9	10	11AM
sample	Mon.	Work		E					A				I									C M				
2/2	MON	WORK											I									C				
3/2	TUES	WORK											I									C				
4/2	WED	WORK									A		I									C				
5/2	THURS	WORK									E		I									C				
6/2	FRI	WORK									A	A			I							C			C	
7/2	SAT	OFF		A						A	A	A			I							C			C	
8/2	SUN	OFF											I									C				

week 1

week 2

https://sleephub.com.au/plan-to-manage-insomnia/

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Actigraphy & Wearables

- Used to infer sleep and wake with reasonable accuracy
- Can assess circadian activity patterns
- Used to diagnose circadian disorders
- Lots of masking effects
- Uncertain algorithms

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Best Practices for Collaborating With BSM Professionals

- Unlike some therapies, BSM treatments can often happen concurrently with other therapies
  - Exceptions: Prolonged Exposure/EMDR/Intensive protocols
- Make relationships with local sleep centers / BSM specialists
  - Check on the Society of Behavioral Sleep Medicine provider directory https://www.behavioralsleep.org/
- Great opportunity for cross-referrals
  - BSM interventions can often be a gateway to other mental health treatments
- Consider treatment timing – the best time is not always now!
- Understand the limits of your skills/knowledge and when to reach out or refer
- Consider additional training to help fill the supply/demand gap[1]

[1]Perlis et al., 2008 *Journal of Clinical Sleep Medicine*

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What Can a Non-BSM Specialist Do?

- Promote schedule regularity[1]
- Promote exposure to daylight
- Promote reductions in nighttime light exposure[2]
- Align activities with chronotype if possible

[1]Sabet, Dautovich, & Dzierzewski (2021) *Journal of Affective Disorders;* [2]Bedrosian & Nelson, 2013 *Molecular Psychiatry*

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Clinical Resources

- Society of Behavioral Sleep Medicine
  - https://www.behavioralsleep.org/
  - Directory of BSM professionals, many of whom have PSYPACT
  - Resources on how to work toward DBSM/get additional training
- University of Arizona Webinar Series
  - BSMinar - University of Arizona Behavioral Sleep Medicine Seminar (sleephealthresearch.com)
  - Weekly (often) webinars on topics related to circadian rhythms and behavioral sleep medicine topics

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Q&A With Dr. Boland

- We will now discuss select questions that were submitted via the Q&A feature throughout the presentation.
- Due to time constraints, we will not be able to address every question asked.

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