

Circadian Rhythm Disorders

Ann C. Halbower, MD

Director, Pediatric Sleep Research

The Children's Hospital Sleep Center, UCDHSC

Sleep Disorders

Common medical complaint

- Sleep disordered breathing
- Parasomnias
- **Circadian rhythm disorders**
- Narcolepsy
- Seizure
- Insomnia



Wake

Sleep

Sleep Pressure

100

50

0

0

8

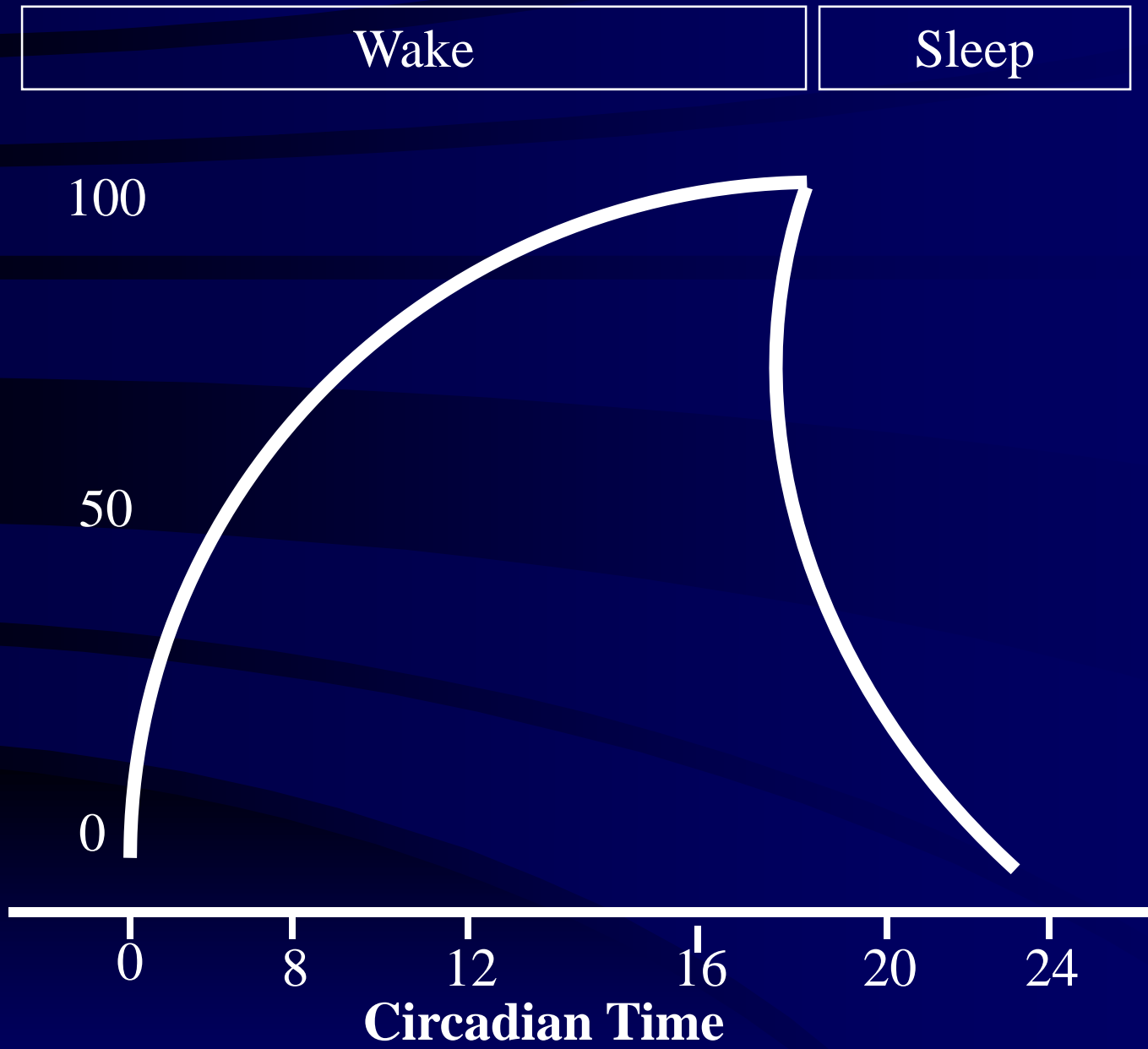
12

16

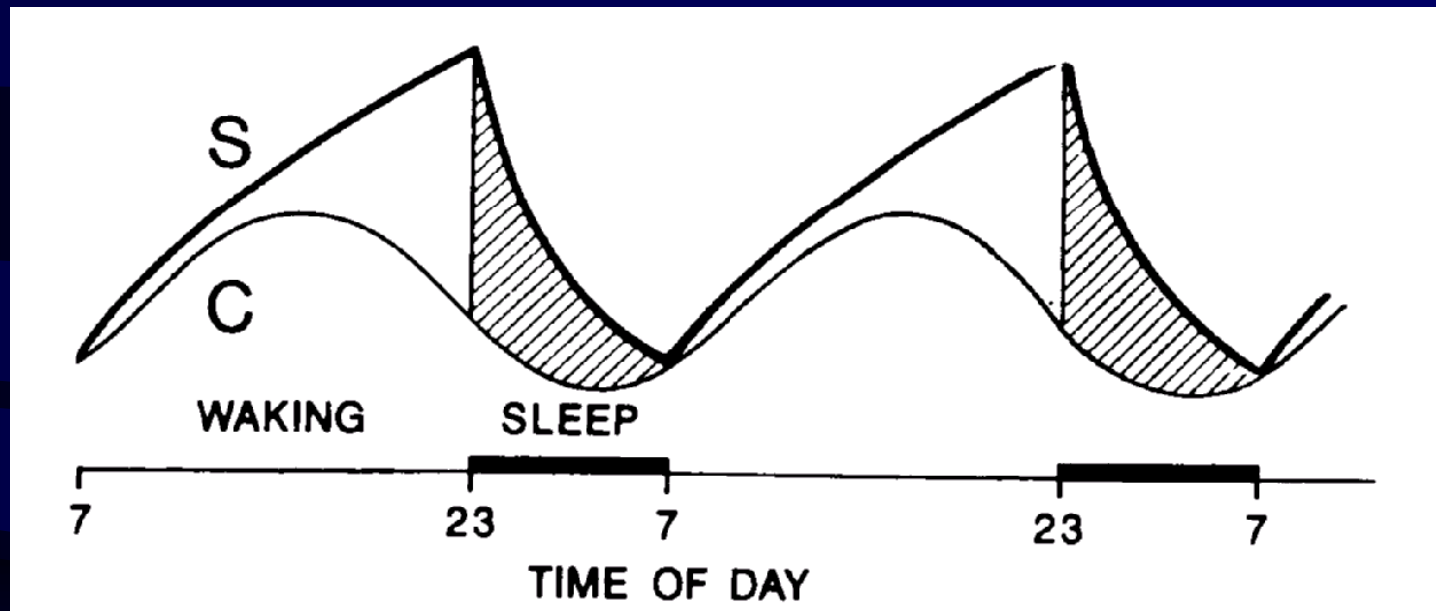
20

24

Circadian Time



Circadian Rhythms

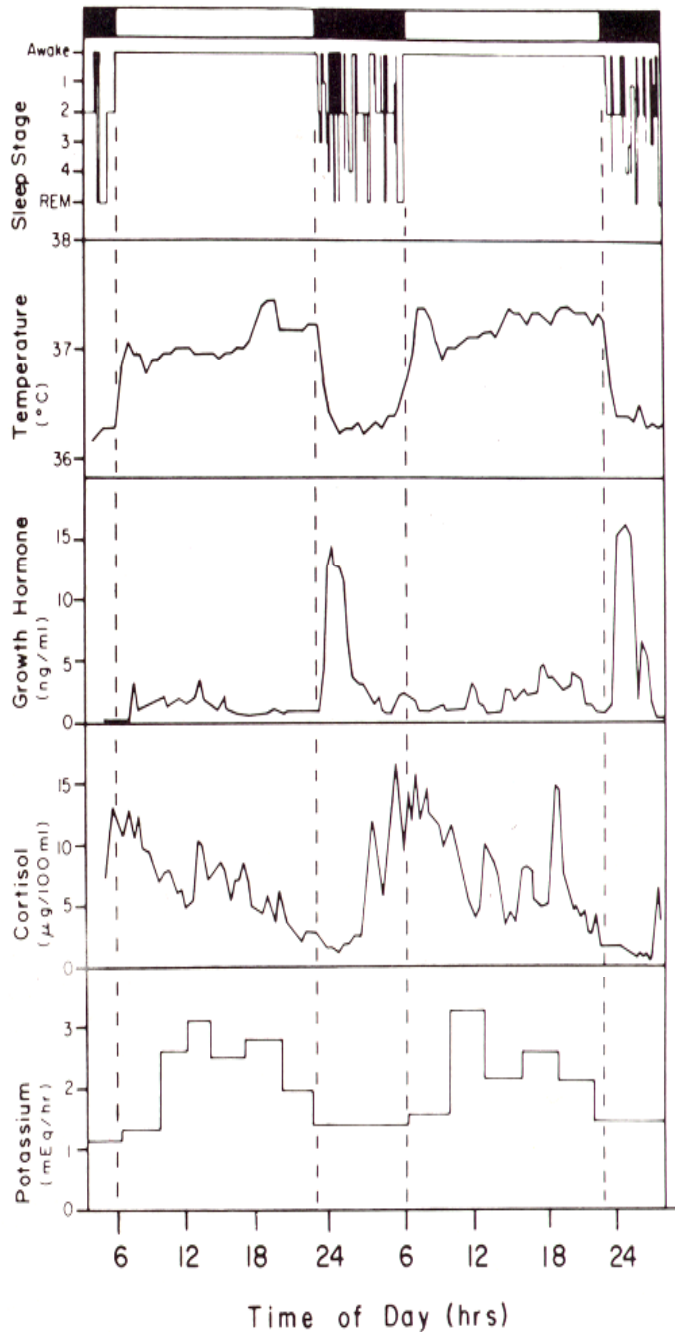


Moore-Ede, *N Engl Med J*, 1983

Rhythmicity of physiological functions

Blood pressure

Drug toxicity and effectiveness



Circadian Rhythm

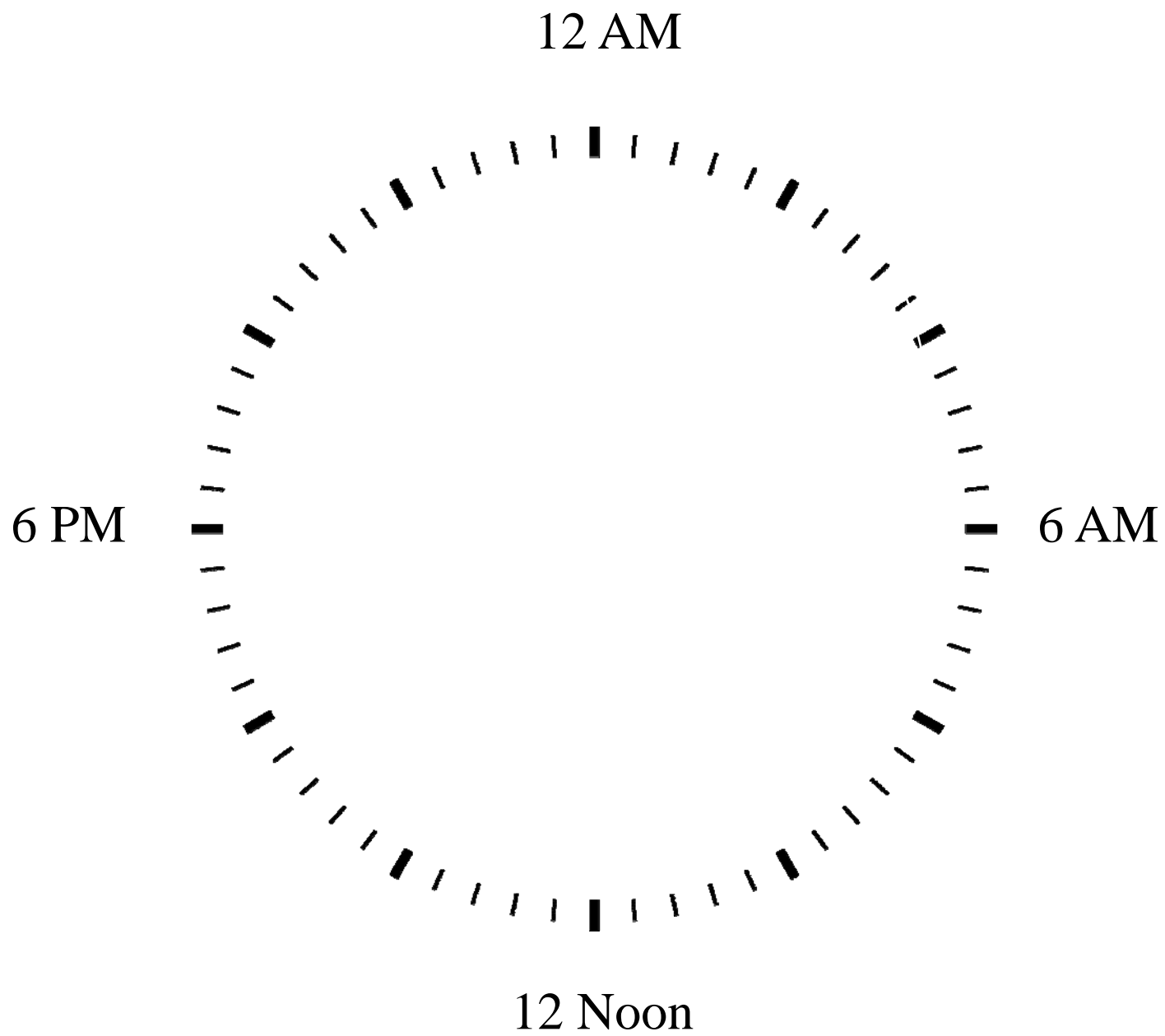
- **Internal clock: suprachiasmatic nucleus, the central pacemaker**
- **Cycle about 24 hours (longer in kids, shorter in elderly)**
- **Light is the most important synchronizing stimulus (Zeitgeber = time giver)**
- **Intrinsic periodicity of the sleep wake cycle**
 - **environmental factors; social activities, posture, exercise**

Circadian Rhythm Disorders

- **Mismatch: patient's internal rhythm versus external social cues**
- **Most patients sleep well, not at desired time.**

Examples:

- **Jet lag**
- **Shift work sleep disorder**
- **Delayed and advanced sleep phase syndromes
(night owls and larks)**



Daytime Sleepiness



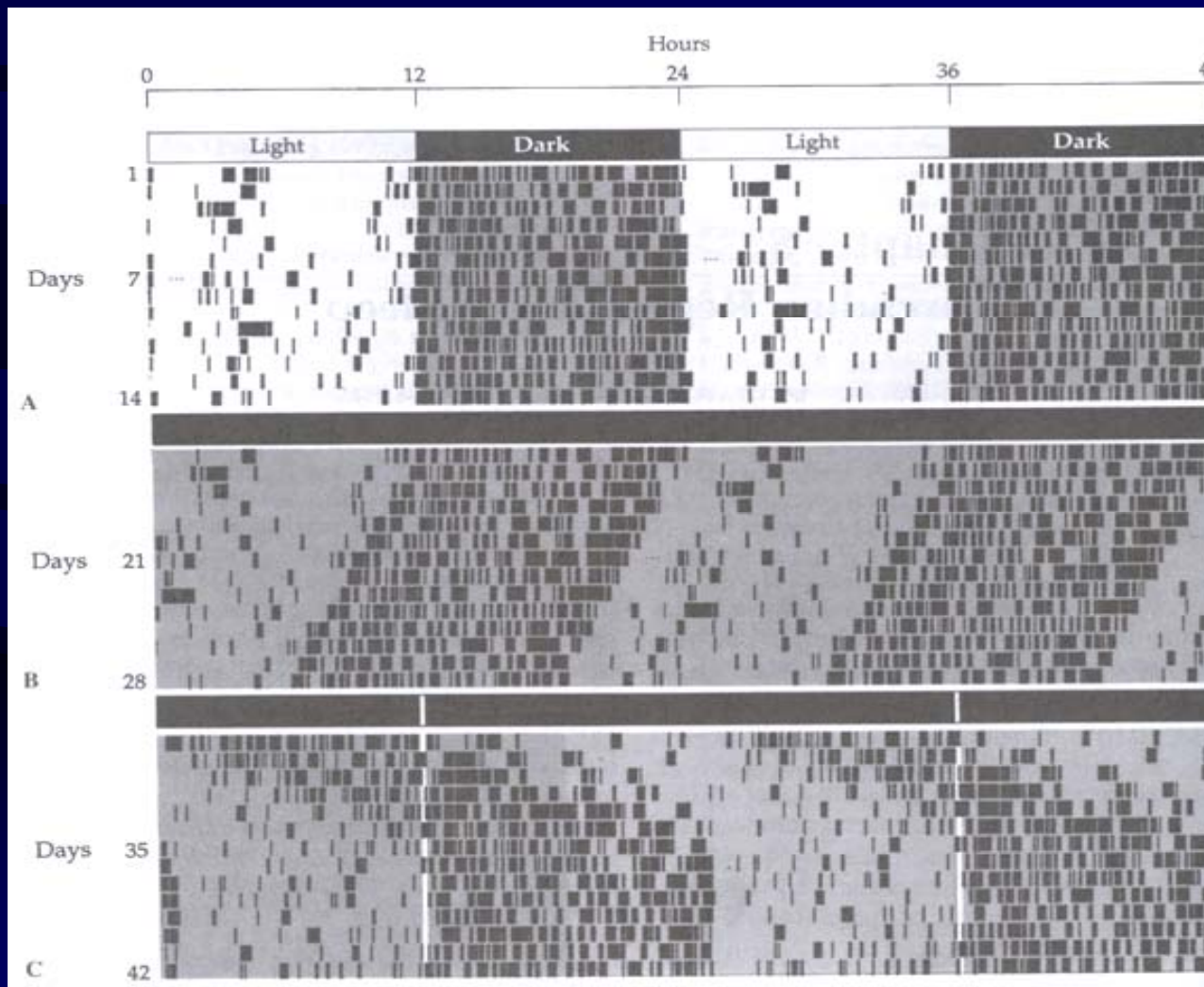
Delayed Sleep Phase Syndrome

- **Typical in teenagers**
- **Late to bed, late to rise**
- **Worsens in summer while out of school (typical social cue)**
- **Associated with depression or co-morbid psychological problems**
- **Family history**
- **Labeled as “willful or lazy” children**

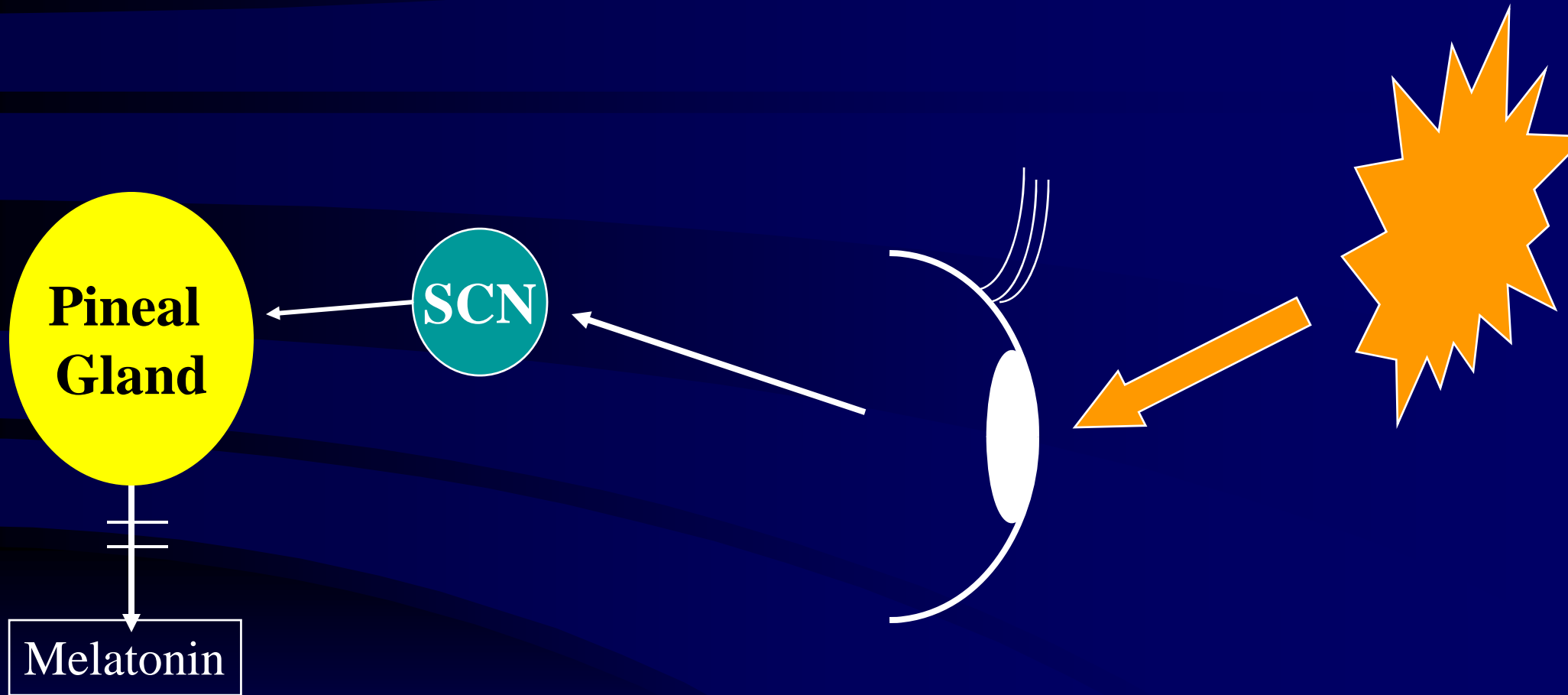
Light Therapy

- **Internal circadian rhythm is driven by suprachiasmatic nucleus (SCN) - a neuronal clock**
- **Light stimuli affect the timing of the clock through the retinohthalamic tract**
- **Light causes an alerting response in the SCN and drives sleep away.**

Light Entrainment of Circadian Rhythm

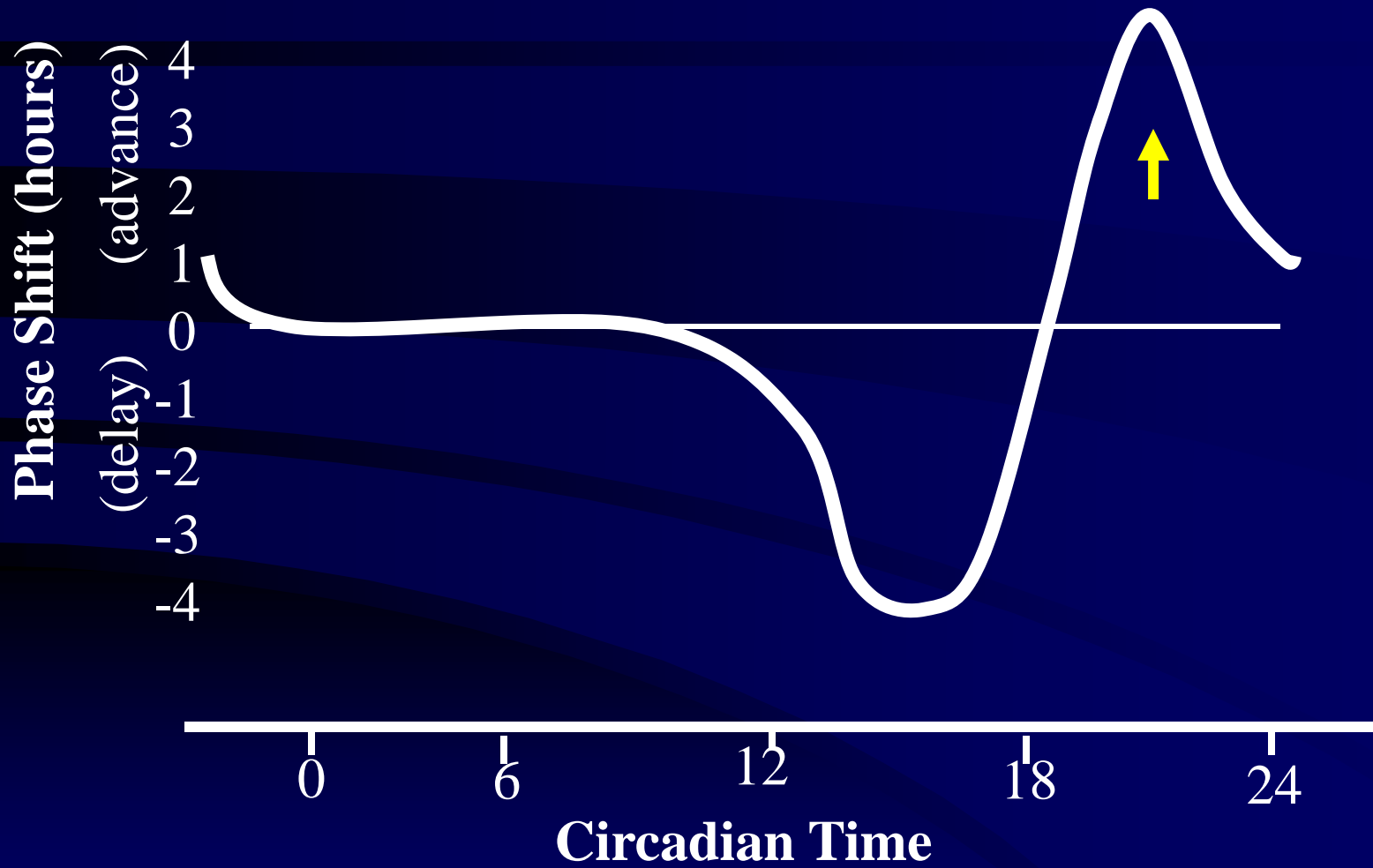


Photic Suppression of Melatonin



Photic Phase Response Curve

Wake	Sleep
------	-------



Light therapy for Circadian Rhythm Disorders

- **Sleep Phase Delay: Light in circadian morning after temperature nadir**
- **Sleep Phase Advance: Light in PM**
- **Light measured in “lux” :10,000 lux 20-25 minutes**
- **Light for major affective disorders**

Medication

- **Melatonin: Released by pineal gland, regulated by light exposure**
- **Not FDA approved or monitored**
- **Used in small dose 5 hours before bed can shift sleep phase over a few days. Continued use needed**
- **Effect improved with posture and low light**

- **Ramelteon (Rozerum)**
- **Melatonin receptor agonist**
- **8 mg 30 min before bedtime**

Non-responders



Differential Diagnosis of Hypersomnolence

- **Insufficient sleep**
- **Drug use, illicit, prescription, or OTC**
- **Central nervous system problems**
- **Untreated sleep apnea**
- **Periodic limb movement disorder**
- **Narcolepsy**
- **Seizure disorder at night**

Guidelines for Good Sleep Hygiene

- **Scheduled bedtime, NO PROLONGED NAPS**
- **Wake time is what regulates next day: weekends need to be on weekday schedule- vary less than 2 hours**
- **Use hygiene rules including exercise or hot bath in daytime, cool dark room at night.**
- **Wake to light**
- **Avoid light at night: TV, computer**
- **Avoid caffeine after noon, OTC medications**