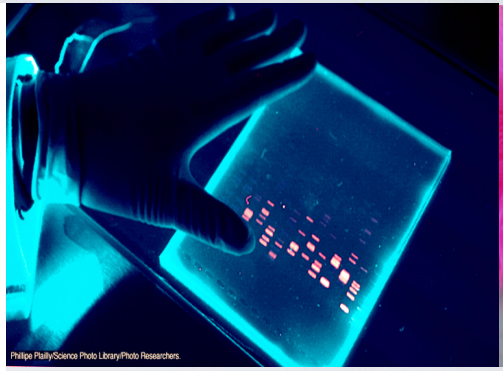


Fatigue Management and Shiftwork in Forensic Science

How tired are you, really???

The worst person to ask is the person that you are worried about!

Circadian Rhythms

We have an intrinsic biological clock with a cycle of roughly 24-25 hours.

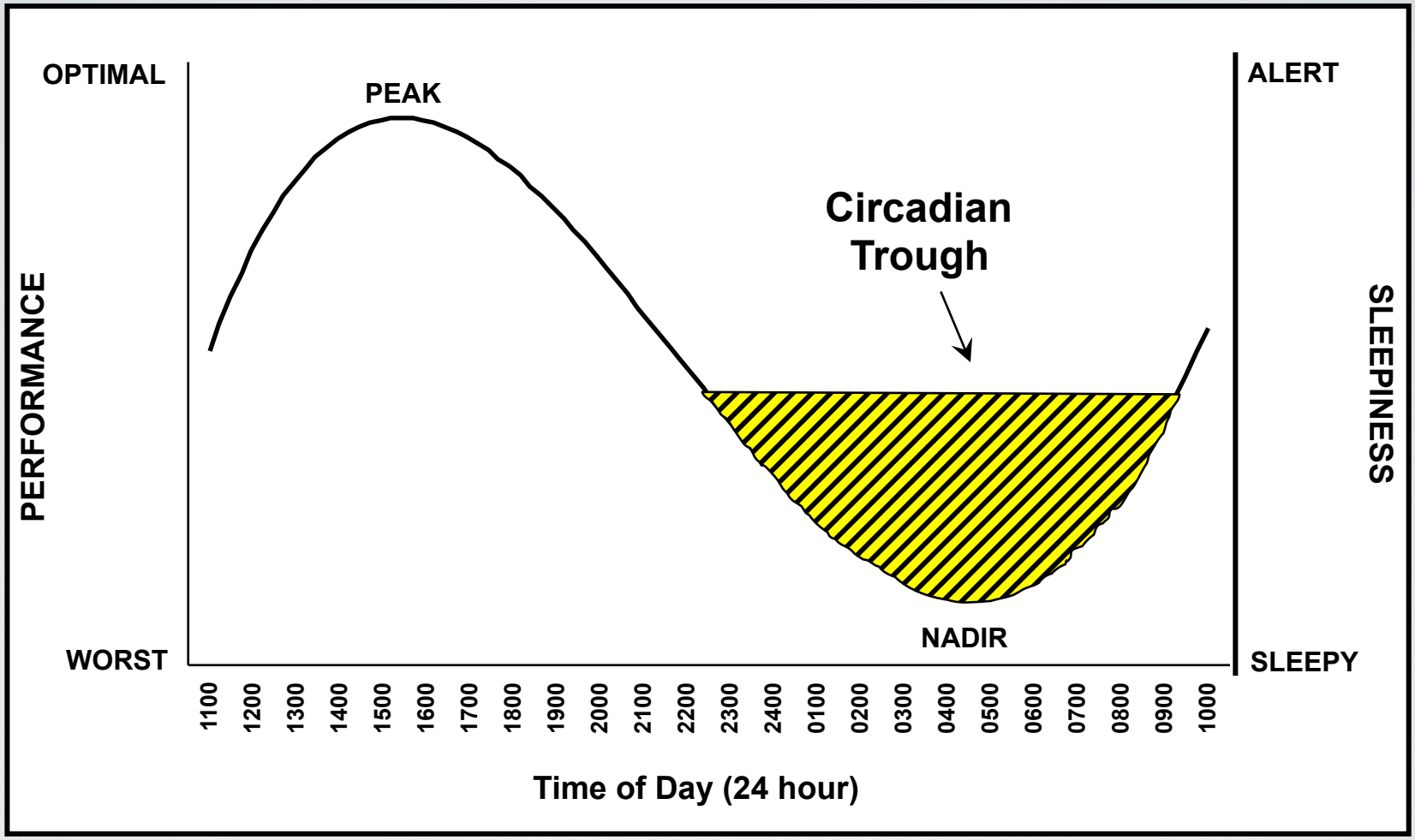
Many bodily functions cycle about these daily circadian rhythms

a) Blood Pressure
b) Heart Rate
c) Core Body Temperature
d) Others...

Perhaps most important is that performance also cycles about normal circadian rhythms.

Given the typical circadian cycle, performance peaks between 1200 and 2100 hours and falls to a minimum circadian trough between 0300 and 0600 hours.

Circadian Rhythms



Circadian Rhythms

While the body clock is inherently capable of monitoring the passage of time, it differs from most clocks in that it is flexible and must be set, or synchronized, before it can accurately predict the timing of events.

Entrained by external synchronizers, Zeitgebers

a) Sunrise-Sunset
b) Ambient Temperature
c) Meals
d) Social Cues

Shiftwork and the Circadian Cycle

- The problem with shiftwork is that it requires individuals to function during circadian trough and to sleep during natural periods of wakefulness.

Adverse Impact of Shiftwork

- Sleepiness
- Performance decrements
- Insomnia
- Gastrointestinal problems
- Cardiovascular problems
- Mood changes
- Family issues

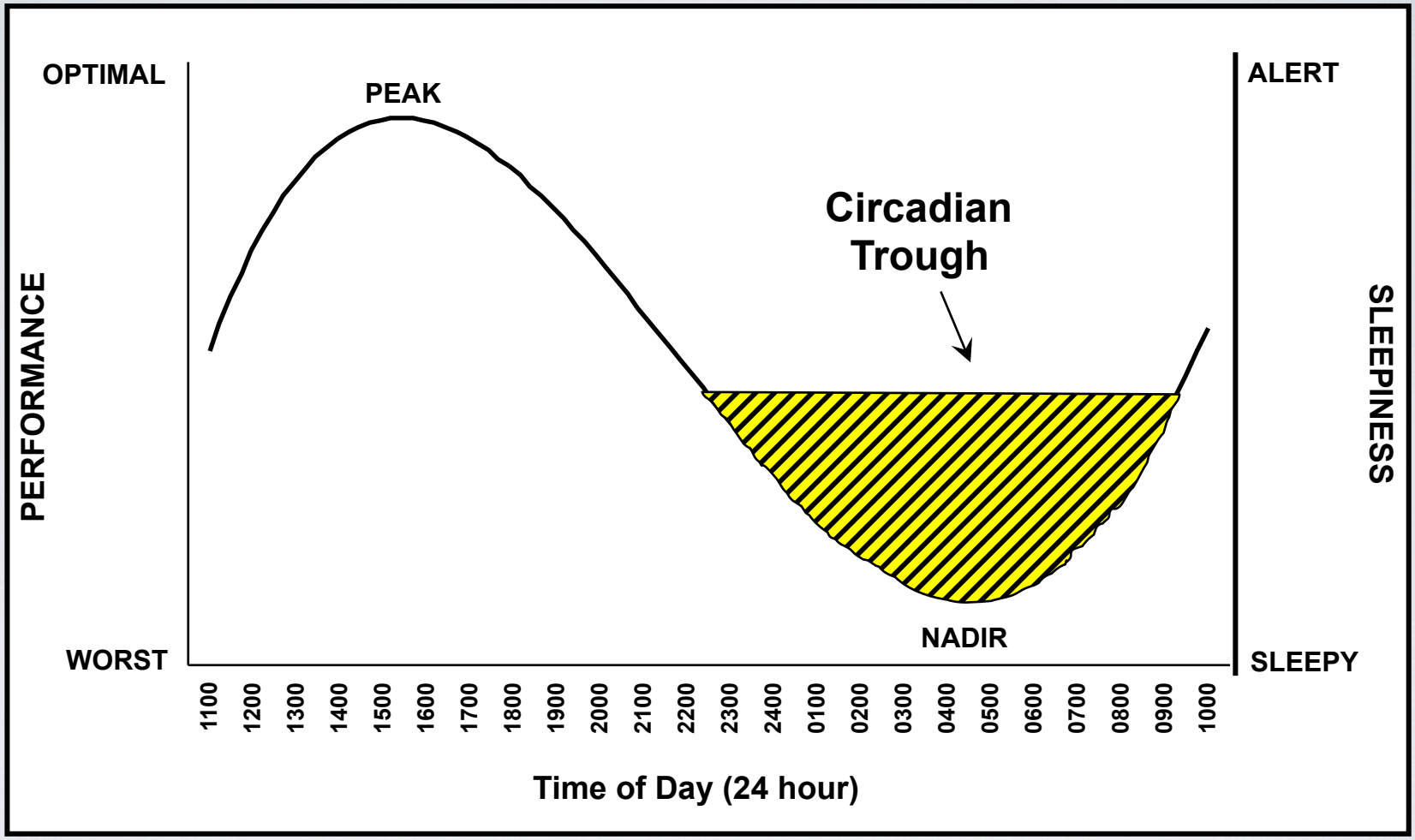
Sleep

Our sleep/wake cycle is closely tied to our circadian body temperature

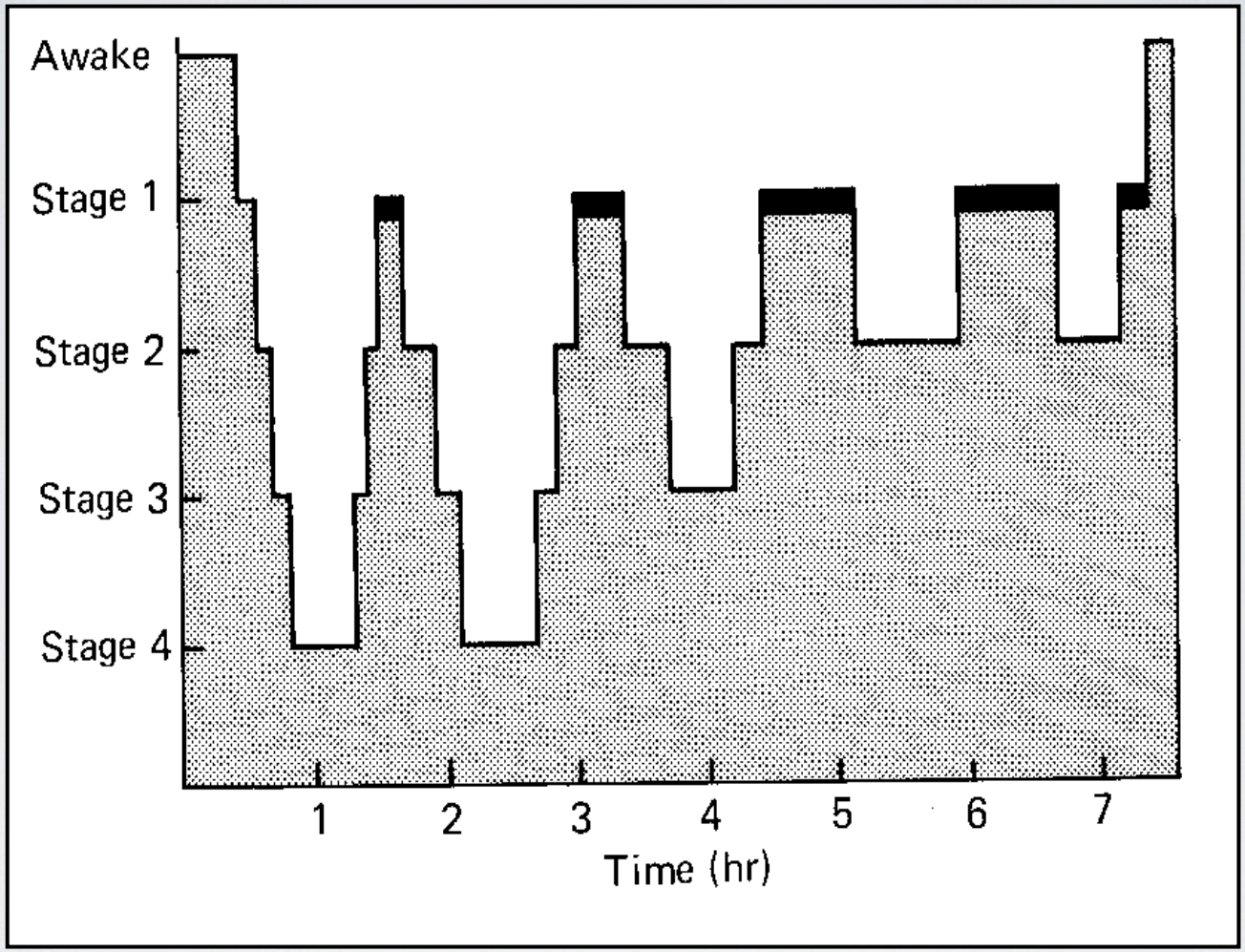
a) Cave studies

Got Sleep?

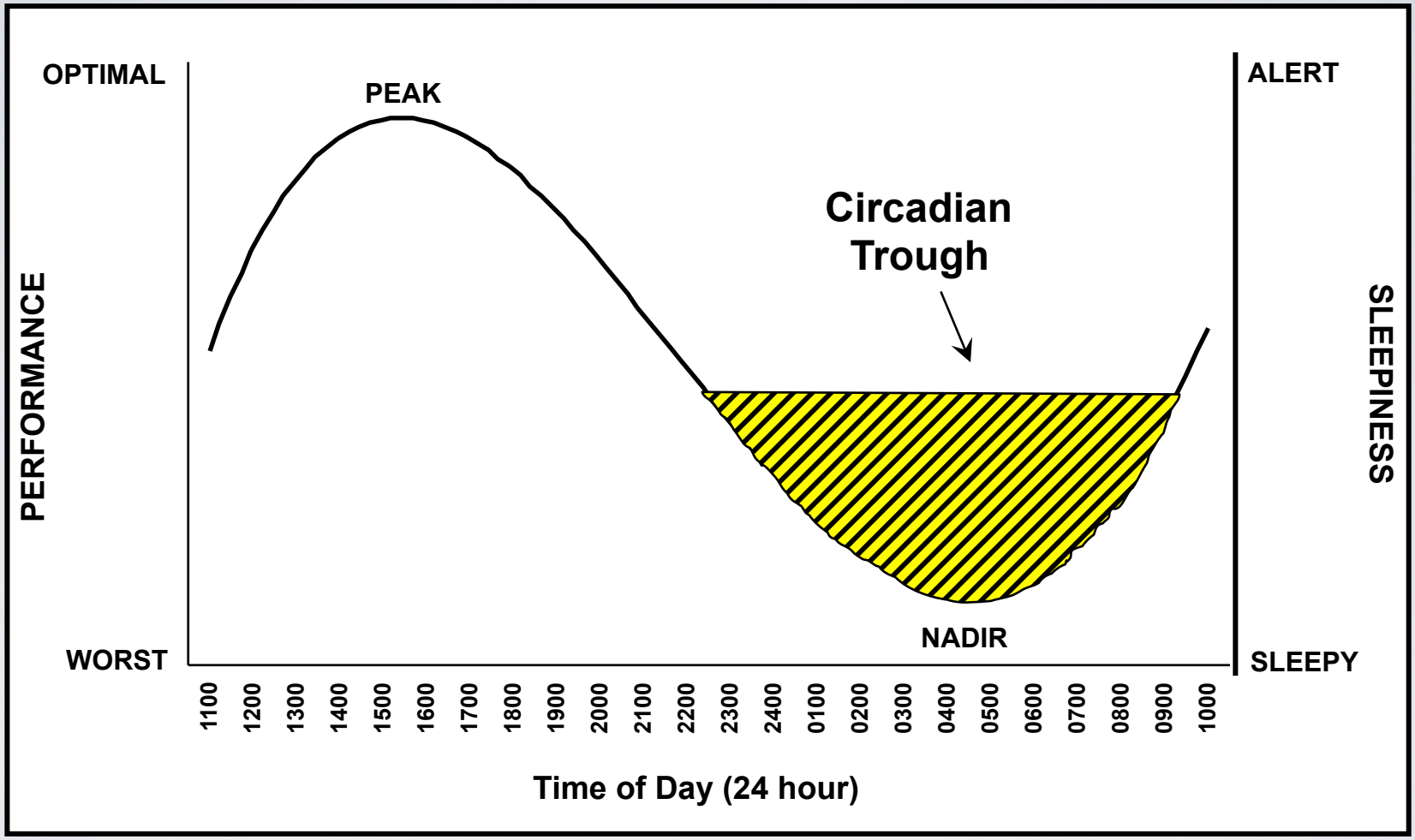
Circadian Rhythms



Stages of Sleep



Circadian Rhythms



Sleep

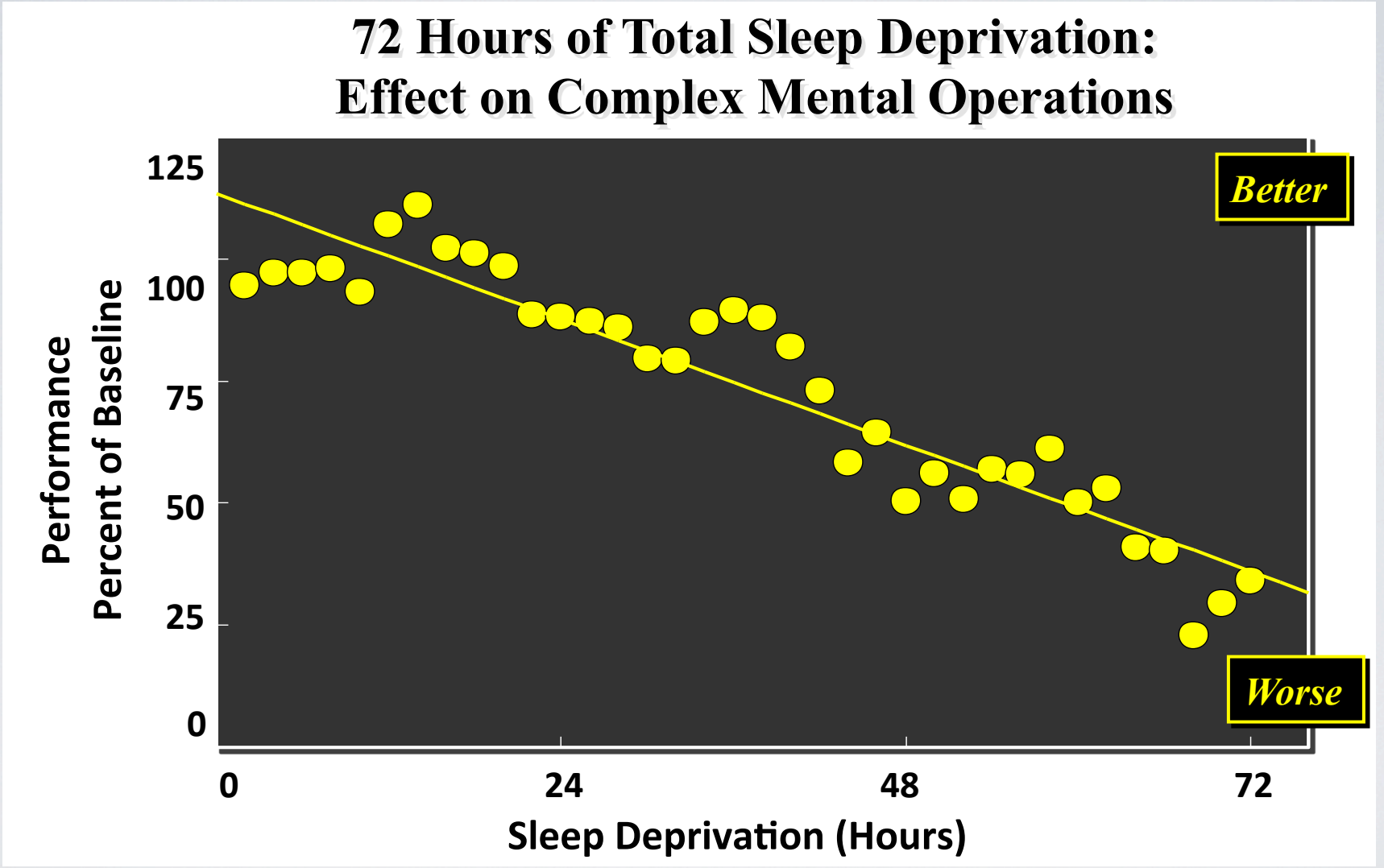
The duration and "quality" of sleep is dependent upon body temperature

- People sleep longer and report a better night's sleep when they retire near the temperature trough.

It is the timing of sleep, not necessarily the amount of sleep, that is most significant.

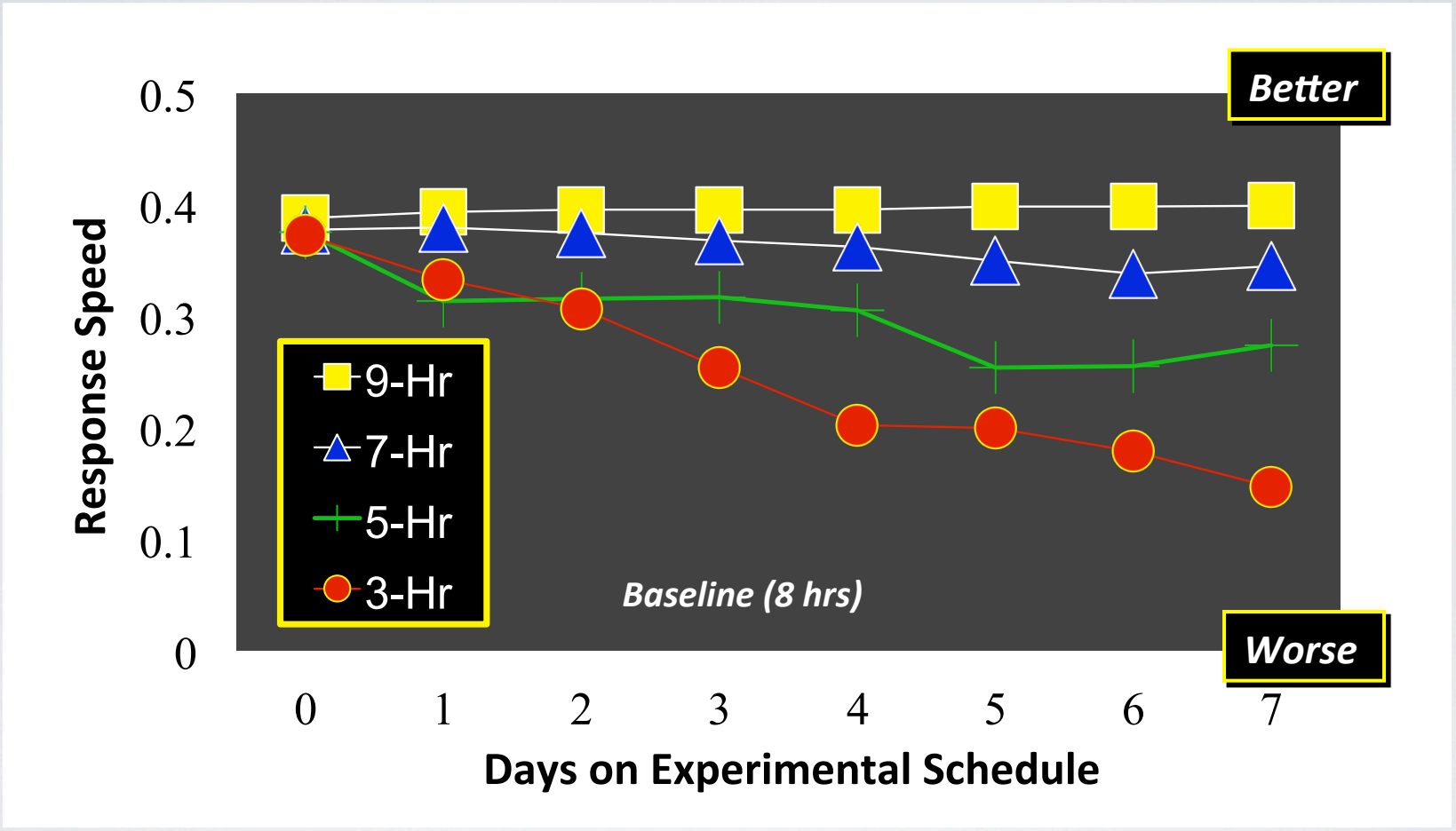
Got Sleep?

How Much Sleep Do You Really Need?



Got Sleep?

How Much Sleep Do You Really Need?

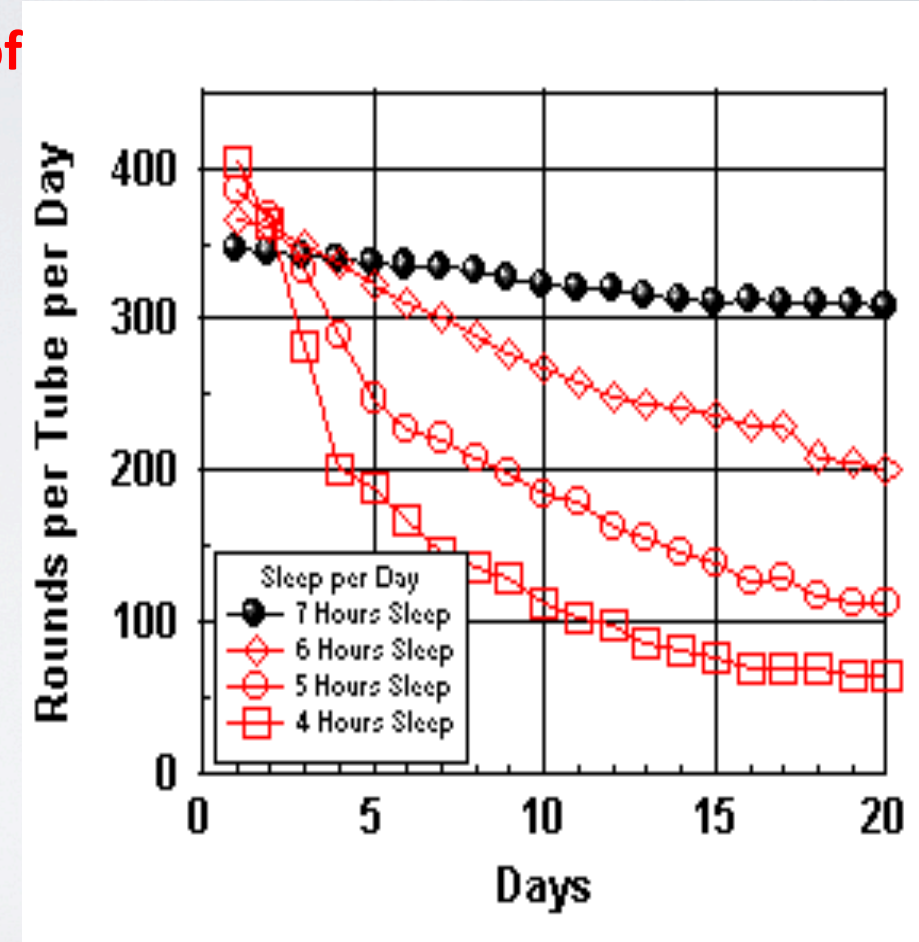


How Much Sleep Do You Really Need?

Sleep/Performance Model Prediction of Artillery Battery Productivity During Continuous Operations

- Normal amounts of sleep sustain performance indefinitely
- Less than normal amounts of sleep degrade performance
- For a day or two, less than normal amounts of sleep increase aggregate output

Department of Behavioral Biology Walter Reed Army Institute of Research



Got Sleep?

How Much Sleep Do You Really Need?

- When physical and mental workload exceed normal limits, the minimum amount of sleep needed to sustain performance is more.
- A minimum of 5 hours of uninterrupted “core” sleep during the circadian trough is necessary to maintain performance in the lab.
- Sleeping in excess of 10 hours may produce sleep drunkenness.

Got Sleep?

Napping

- When sleep is not available or shortened by operational concerns, strategic naps are a viable alternative.
- Even naps as short as 10 min are restorative in nature
- Long naps (typically greater than 1 h) may leave the individual feeling more tired than before napping (Sleep Inertia)
  a) Sleep inertia may last 5-20 min upon awakening
- Practice Napping

Napping

Degradation in Cognitive Performance in Sleep Deprivation With and Without Daily Nap (30 minutes)

- Sleep deprivation degrades cognitive performance
- The sleep/performance system is sensitive to even brief amounts of sleep
- A daily 30 minute nap improves performance when compared to total sleep deprivation

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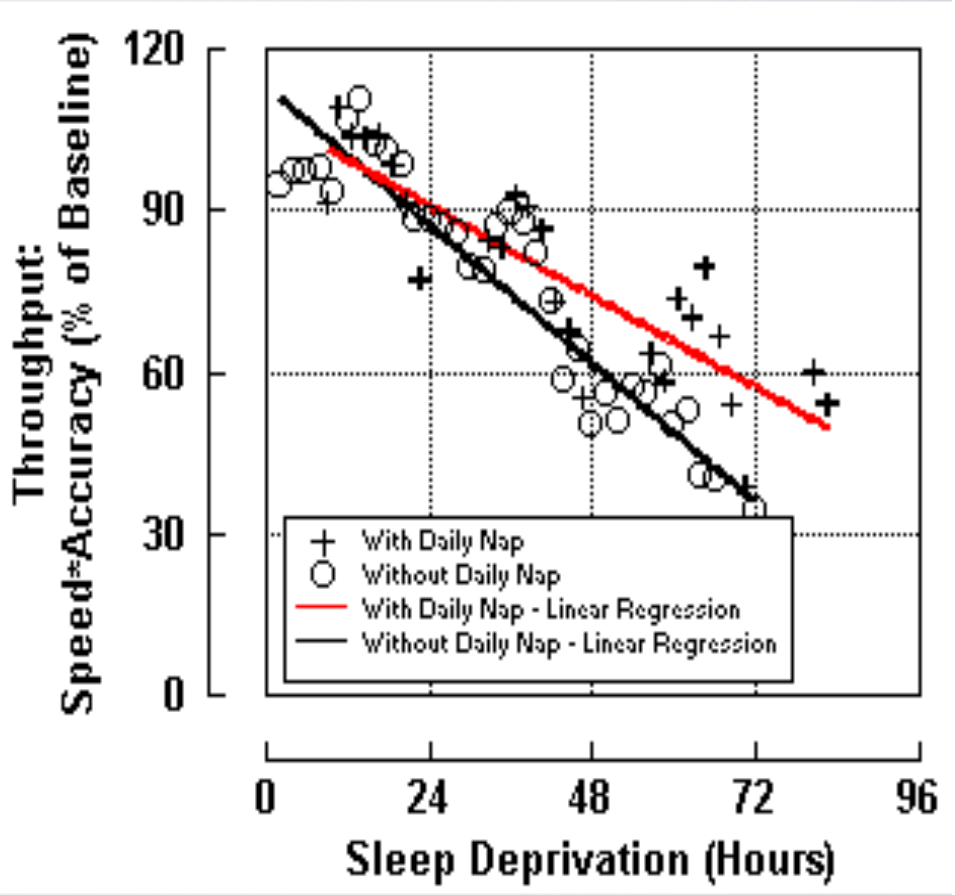

Got Sleep?

Countermeasures to Fatigue

Non-Pharmacological

a) Napping
b) Light Exposure
c) Physical Activity

Pharmacological

a) Caffeine
b) Other Stimulants

Common Questions Regarding Shiftwork

- What type of shift rotation is optimal?
- Can individuals adapt to night shift?
- Do traditional 2nd and 3rd shifts require different duty and rest periods?
- Can a break in duty during a shift extend the duty period?
- How much duty time can be extended with follow-on and/or make-up rest?

Sweet Dreams