

# CIRCADIAN RHYTHMS

- ❑ On a daily basis, we should all be in tune with a 24-hour or circadian rhythm.
- ❑ Twenty-four hour biological rhythms affect body temperature, alertness, performance, blood pressure, immunity, hormones, bone turnover, neurotransmitter function, etc.
- ❑ All of our rhythms are interconnected so if you strengthen one rhythm you positively affect the others. But this is a double edge sword. If you allow one rhythm to be disrupted it will also take the others and wander off with them as well.
- ❑ A poison given to an animal at one time of the day can kill it but when given 12 hours later it will not.
- ❑ When a medicine or supplement is given can have very different effects on health (best time to take most medicines and supplements is not known).
- ❑ Hormones: The right amount, at the right time, and in the correct sequence with other hormones is what really matters.
- ❑ We are completely dependent on consistent exposure to specific external cues in order to stay synchronized to a period of exactly 24 hours.
- ❑ When you go to sleep is important in dictating rhythms but it pales in comparison to when you wake up and what you do when you wake up. This is the most important part of the day for providing the cues our biological watch needs to remain accurate.

## Primary Cues:

- ❑ Light & Dark (probably need a minimum of 3 hours exposure to sunlight quality of light to maximally entrain rhythms...maybe more in some people)
- ❑ Meal Timing (eating breakfast and lunch is most important)
- ❑ Social Conditioning: A routine behavior done at the same time everyday can and will have some influence as an external cue for keeping our biological clock accurate.

## Disruptive Factors (dyschronogens):

- ❑ High stress
- ❑ Nighttime artificial lights
- ❑ TV and computer use (especially at night)
- ❑ Electromagnetic fields
- ❑ Sleep deprivation
- ❑ Flying across time zones
- ❑ Caffeine intake (excessive)

- ❑ Alcohol intake (dose-dependent)
- ❑ Medicines/Drugs
- ❑ Supplements (possibly depending upon when given)
- ❑ Hormones (depending upon when given)

**Example:** If we were to take very healthy young men and subject them to 5 days of military training that includes sleep deprivation, food deprivation, and intense physical activity, we will completely abolish their circadian rhythms. This is stress! Even 4-5 days of rest will not be sufficient at this point to reestablish the normal rhythmic order of our biological watch.

Note: It takes lesser amounts of dyschronogens to be equally disruptive for an older or less healthy population (remember our metaphor about the camel and straws).

## Temperature

- ❑ It should ride a wave and have a wide change between morning low and evening high.
- ❑ Can range from low of 96°F {35.7°C} to high of 100 °F {37.7°C}
- ❑ Newest studies show that average for young adults using accurate thermometers and taken across the day is 98.2°F {36.7°C}
- ❑ Lowest point is normally 2 hours before waking (starts to rise before waking)
- ❑ Highest point is early evening (starts to drop before sleep)
- ❑ Larger diurnal amplitude is associated with better health and better physical fitness (lowest temperature can be up to 1 degree lower in very fit athletes when compared with sedentary people)
- ❑ We are most sensitive to the rhythm establishing cues of light and food when temperature is at its lowest.
- ❑ The further away from your low point in temperature we get, the less impact light will have on resetting your clock.
- ❑ Basal body temperature is completely unreliable. Just a few of the reasons why:
  - REM sleep = temperature all over the place.
  - Doesn't take into account rhythms
  - Doesn't take into account physical fitness
  - Doesn't take into account that highest cortisol levels of the day = lowest point of metabolic rate. So if you have a normal cortisol rhythm and a high cortisol surge in the am (which very healthy people usually do) temperature will be very low upon waking.

