

Medical Education Systems, Inc.

Course 916

Jet Lag and Sleep



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Jet Lag and Sleep

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Learning Objectives

- Define and discuss the term “Jet Lag”
- Explain the cause of Jet Lag
- Identify the steps that can be taken to prevent or minimize the effects of Jet Lag
- List and discuss the steps that can be taken to “treat” the symptoms and side effects of Jet Lag

Overview

Jet lag, or desynchronization, is a temporary condition that some people experience following air travel across several time zones in a short period of time. This causes the traveler's internal clock to be out of sync with the external environment. People experiencing jet lag have a difficult time maintaining their internal, routine sleep-wake pattern in their new location, because external stimuli, like sunshine and local timetables, dictate a different pattern. For this reason, one can feel lethargic one moment and excited the next. Jet lag creates a double bind for vacationers and business people who must cross several time zones to reach their destination, but who are also intent on maximizing sightseeing or productivity. As travelers attempt to adjust their internal clock to a new external environment, symptoms result with varying intensity.

Jet lag (desynchronization) occurs while rapidly crossing time zones, or, more specifically, it occurs after crossing the Earth's meridians. Meridians demarcate geographic position in relation to the Earth's poles and, ultimately, define time zones. Jet lag is a unique sleep disorder because its onset is not necessarily caused by abnormal sleep patterns, like insomnia. Travelers who sleep normally prior to transmeridian travel are not immune to jet lag; the symptoms result when a person's internal clock attempts to acclimate to a new external environment. This acclimation involves circadian rhythms that, among other functions, are associated with the body's management of sleep.

Signs and Symptoms

In addition to the "tired-wired," "soar-crash" feeling that travelers experience after long, rapid air travel, there are numerous symptoms that may occur with jet lag, such as insomnia, daytime fatigue, stomachaches, headaches, irritability, and decreased awareness. The degree of disruption varies greatly among people; some may not be bothered at all. Jet lag is a transient sleep disorder and is classified differently than other, more serious disorders. Although jet lag occasionally lasts for a week or more, travelers usually return to their normal sleep-wake pattern after a day or two. For many travelers, jet lag can catalyze the effects of certain conditions associated with the head and nervous system that are not related to specific sleep-wake patterns. For example, many symptoms attributed to jet lag are actually caused by the environment of the airplane--dry air (humidity in an airplane is very low), pressurization, noise, vibrations, and a cramped environment. These symptoms may include dry eyes, dry and irritated nose and sinuses, headaches, earaches, muscle cramps, and abdominal distention (bloating). Occasionally, dizziness or swollen feet and ankles may occur.

Circadian Rhythms

Circadian rhythms pertain to changes in body function that occur throughout a 24-hour period. Circa is the Latin word for "about," and diem is the Latin word for "day." The body operates with many circadian rhythms, such as body temperature regulation, endocrine (gland and hormone) function, airway function, and kidney (renal) function.

For instance, body temperature slowly rises throughout the day, drops dramatically around midnight, and begins to rise again before 6 a.m. These changes in temperature are often felt during fever, when fluctuations are intensified by high body temperature. The body also regulates breathing patterns. So patients with asthma often have more bronchoconstriction and more difficulty with their asthma during the night when airway function fluctuates to compensate for sleep.

Mental alertness and the propensity to fall asleep are regulated by circadian rhythm. There are two peak times of day at which a person is most susceptible to falling asleep, 3 a.m. to 5 a.m. and 3 p.m. to 5 p.m. This circadian tendency has serious ramifications in our society. There are a disproportionate number of automobile accidents between 3 a.m. and 5 a.m. compared to the number of people on the road at these times. This increase in automobile accidents is partly attributable to conflicts between circadian rhythms and, for instance, atypical lifestyle or shift work constraints that put drivers on the road at these times. Decreased vigilance can combine with sleepiness and result in an accident. Apparently, circadian rhythms are evident in all types of activity.

Most people have experienced the urge to fall asleep in the late afternoon, after eating lunch. It is not necessarily the food that makes people want to fall asleep at this time, but the time of day. Again, the routines of environment conflict with circadian rhythms, which can influence one's ability to function.

All the rhythms mentioned above occur in humans within a cycle of approximately 24 hours. The exact length of the cycle is not known and is probably slightly longer than 24 hours, perhaps 24.7 to 25 hours. These natural rhythms occur even in the absence of daylight or darkness. Studies in which people live without any way of knowing what time of day it is have shown that these people continue to follow a 24-hour schedule. That is, they sleep for about eight hours, and their waking activity levels correlate with those found for individuals under normal conditions of time and light-dark cycles. It seems the influence of circadian rhythm is unavoidable.

People naturally synchronize their internal clocks with day-night cycles, which allows them to be awake during the day and to sleep during the night. The body regulates this chiefly through the eyes. Light stimulates nerves in the retina that pass a signal through a chain of nerves to the brain. Some of these nerves feed the hypothalamus, a part of the brain that regulates body temperature, water and sugar ratios, and fluid secretions and which houses the suprachiasmatic nucleus, a bundle of nerves that controls the body's circadian rhythms. When, for example, bright light stimulates the optic nerves, the optic nerves send the signal to the suprachiasmatic nucleus, which then triggers circadian rhythms, resulting in the synchronization of the body's 24-hour cycle with the earth's 24 hour cycle.

Can Jet Lag be Avoided?

Although the effects of jet lag vary among travelers, almost everyone experiences some change after air travel. Inherent differences in body condition among travelers determine varying strategies for jet lag management. These include good sleep, proper nutrition, and, sometimes, the use of medication.

Avoiding the factors that contribute to jet lag may be the best defense against it. Primary prevention means getting good sleep prior to a transmeridian flight. Since sleep-wake disturbance is the most widely felt effect of jet lag, being well rested before travel can only help the body cope with the inevitable change in time zone. This includes avoiding alcohol, caffeine, and nicotine, which are associated with restless sleep.

Furthermore, people have explored the use of melatonin as a remedy for jet lag. Melatonin is a hormone that is synthesized naturally by the pineal gland in the brain and is inhibited when the retina of the eye is exposed to light. Melatonin is also thought to influence circadian sleep-wake rhythms, because its effects on sleep-wake regulation are similar to those caused by exposure to light. Because melatonin is believed to impact circadian rhythm, taking melatonin at bedtime may advance one's biological clock, that is, advance the body's need for sleep.

Although travelers often claim benefit from its use, the use of melatonin has not been studied extensively and, at this time, is not largely recommended for jet lag therapy. Similarly, early morning bright light may advance a person's sleep phase and allow them to go to sleep earlier. Travelers who arrive in sunny places may find it easier to adjust to a new bedtime.

Conversely, bright light in the evening can delay a person's sleep phase and make it difficult for them to fall asleep at night. Therefore, depending on the contrasts between a traveler's time zone and a new time zone, exposure and avoidance of bright light at certain times may help resynchronize one's rhythm.

Sleeping pills (hypnotics) may be of limited benefit for the first two days following flight, especially if one needs a full night's sleep to perform the next day. Short-acting hypnotics are generally recommended to avoid effects that carry over into the day hours. Over-the-counter medications typically have a lot of carry-over effects that can cause drowsiness and other significant problems for travelers who must perform. Physicians can advise travelers about what method of management is best for them.

Finally, travelers with sinus complications, who are extra-sensitive to the dry, pressurized, and noisy environment of an airplane, may find it beneficial to maintain hydration, proper nutrition, and proper sleep before flight. When the sinuses dry out and experience drastic pressure changes, they become irritated. Often, sinus-related symptoms occur with jet lag. In fact, some travelers claim their sinus problems cause the type of jet lag that they experience, which involves headache, earache, neck pain, congestion, and general grogginess. It may be beneficial for sinus sufferers to take a decongestant, as well as plenty of water, before traveling. Alcohol dehydrates the sinuses and tends to intensify the symptoms of sinus complications, so avoiding it may result in less severe sinus-related jet lag.

Sleep & Travelers

Whether you're a "Road Warrior" who has piled up thousands of Frequent Flier Miles, or someone who is planning a vacation to a distant location, you are likely to experience the phenomenon of "jet lag," which can have a profound effect on your sleep and alertness. This online brochure has some advice for travelers on what you can do now to help get a better night's sleep--when you arrive at your destination and when you return home.

JET LAG: THE TRAVELING SLEEP DISORDER

Every day, millions of travelers struggle against one of the most common sleep disorders—jet lag. For years, jet lag was considered merely a state of mind. Now, studies have shown that the condition actually results from an imbalance in our body's natural "biological clock" caused by traveling to different time zones. Basically, our bodies work on a 24-hour cycle called "circadian rhythms." These rhythms are measured by the distinct rise and fall of body temperature, plasma levels of certain hormones and other biological conditions. All of these are influenced by our exposure to sunlight and help determine when we sleep and when we wake.

When traveling to a new time zone, our circadian rhythms are slow to adjust and remain on their original biological schedule for several days. This results in our bodies telling us it is time to sleep, when it's actually the middle of the afternoon, or it makes us want to stay awake when it is late at night. This experience is known as jet lag.

TAKING THE AIR OUT OF JET LAG

Some simple behavioral adjustments before, during and after arrival at your destination can help minimize some of the side effects of jet lag.

- Select a flight that allows early evening arrival and stay up until 10 p.m. local time. (If you must sleep during the day, take a short nap in the early afternoon, but no longer than two hours. Set an alarm to be sure not to over sleep.)
- Anticipate the time change for trips by getting up and going to bed earlier several days prior to an eastward trip and later for a westward trip.
- Upon boarding the plane, change your watch to the destination time zone.
- Avoid alcohol or caffeine at least three to four hours before bedtime. Both act as "stimulants" and prevent sleep.
- Upon arrival at a destination, avoid heavy meals (a snack—not chocolate—is okay).
- Avoid any heavy exercise close to bedtime. (Light exercise earlier in the day is fine.)
- Bring earplugs and blindfolds to help dampen noise and block out unwanted light while sleeping.
- Try to get outside in the sunlight whenever possible. Daylight is a powerful stimulant for regulating the biological clock. (Staying indoors worsens jet lag.)
- Contrary to popular belief, the types of foods we eat have no effect on minimizing jet lag.

WORRYING ABOUT SLEEP

According to experts, stress or the potential for stress is another problem that can lead to sleeplessness. Two common travel related stress conditions are the "First Night Effect" and the "On-Call Effect." The first condition occurs when trying to sleep in a new or unfamiliar environment. The second is caused by the nagging worry that something just might wake you up, such as the possibility of a phone ringing, hallway noise or another disruption.

Try these tips on you next trip to help avoid travel-related stress and subsequent sleeplessness.

- Bring elements or objects from home like a picture of the family, favorite pillow, blanket or even a coffee mug) to ease the feeling of being in a new environment.
- Check with the hotel to see if voice mail services are available to guests. Then, whenever possible, have your calls handled by the service.
- Check your room for potential sleep disturbances that may be avoided; e.g., light shining through the drapes, unwanted in-room noise, etc.
- Request two wake-up calls in case you miss the first one.

QUIET PLEASE!

The Sleep Environment

The most common environmental elements affecting sleep are noise, sleep surface, temperature or climate, and altitude. Your age and gender also play a part in determining the level of sleep disturbance caused by these factors. One study found that women are more easily awakened than men by sonic booms and aircraft noise, while other research indicates that men may be more noise sensitive. Children are generally insensitive to extreme noise levels. However, this high threshold declines with age.

Noise

We have all experienced that dripping faucet, the barking dog or that blaring stereo next door that has kept us awake. Indeed, experts say the intensity, abruptness, regularity, intrusiveness, familiarity and regularity of noises all affect sleep.

Noises at levels as low as 40 decibels or as high as 70 decibels generally keep us awake. Interestingly, however, the absence of a familiar noise can also disrupt sleep. City dwellers may have trouble falling asleep without the familiar sounds of traffic. Or a traveler may find it difficult to sleep without the familiar tick, tick, tick of the alarm clock at home.

Some noises, although annoying at first, can gradually be ignored, allowing sleep to follow. Studies show people can get used to noises such as city traffic in about one week. However, important noises, like a parent's baby crying, a smoke alarm or even one's own name being called, are not easily assimilated and generally snap us awake.

Experts are also studying the ability of certain sounds to induce sleep. "White noise," such as caused by a fan, air conditioner, or radio static, can often block out unwanted noise and encourage sleep.

Sleep Surface

Little research is available and not surprisingly on how much sleeping surfaces affect our slumber. For the most part, we know people sleep better when horizontal and not cramped by space. As with noise, however, women and more mature people appear more sensitive to variations in sleep surfaces.

Temperature/Climate

The point at which sleep is disturbed due to temperature or climate conditions varies from person to person. Generally, temperatures above 75 degrees Fahrenheit and below 54 degrees will awaken people.

Altitudes

The higher the altitude, the greater the sleep disruption. Generally, sleep disturbance becomes greater at altitudes of 13,200 feet or more. The disturbance is thought to be caused by diminished oxygen levels and accompanying changes in respiration. Most people adjust to new altitudes in approximately two to three weeks.

SNOOZE CUES

Behavioral

Modifying your behavior and taking sleeping pills are both commonly accepted measures used to minimize certain sleep disorders.

As mentioned, certain behaviors can help your body better adjust to new time zones and surroundings. Although there are no guarantees to a fast and sound sleep, simple adjustments in your behavior when traveling may help you get the quality of rest needed to start the day refreshed.

Sleep Aids

According to NSF's 2002 *Sleep in America* poll, 15% of the respondents reported using either a prescription sleep medication (8%) and/ or an over-the-counter (OTC) sleep aid (10%) to help them sleep at least a few nights a month. While pills do not resolve the biological imbalance caused by jet lag, they may help manage short-term insomnia brought on by travel. Be sure to discuss the use of sleeping pills with your doctor before you try them. Sleep medication can cause side effects.

Melatonin

One OTC product receiving a lot of attention lately is melatonin. Melatonin is a naturally secreted hormone in humans that affects the body's circadian rhythms. There is some evidence that when administered during the day, melatonin increases the tendency to sleep, but at night, the amount of sleep is unaffected. Currently, melatonin is largely available only in health food stores and is not regulated. Therefore, melatonin is, at present, an experimental approach to sleep problems and travelers should consult their physicians before using it.

WHAT'S THE FUTURE OF SLEEP?

Although experts agree that a variety of analytical and anecdotal data exists about sleep, significant gaps still remain. Few definitive studies exist in the area of travel and sleep, making it impossible to know how prevalent travel-related areas of environmental and stress effects. NSF plans to expand its research and unravel more mysteries locked in the realm of sleep.

DON'T GO TO BED YET...

Since we spend a good portion of our lives sleeping, this self-quiz should be easy. Answer true or false to the following statements:

1. Jet lag can be controlled by carefully managing your dietary intake several hours before a flight.
2. "White noise," such as that caused by a fan or radio static, can block out noise and actually promote sleep in some cases.
3. According to sleep experts, pharmaceuticals are not an accepted method of sleep control and should be avoided.
4. Small amounts of alcohol prior to bedtime can be an effective way to induce sleep.
5. Due to the most recent research and studies regarding sleep, many of the mysteries surrounding that field have been solved.

Answers:

1. **False.** There is no conclusive evidence that diet can in any way minimize jet lag.
2. **True.** Studies indicate that "white noise" may help induce sleep.
3. **False.** Experts say, if taken as directed, sleeping medications can be an effective sleep manager. However, they have no effect on re-aligning the body's biological imbalance caused by traveling to a different time zone.
4. **False.** Although alcohol may initially cause sleepiness, later in the evening it acts as a "stimulant" and can keep you awake.
5. **False.** Scientists agree that more studies are needed to confirm what relatively little is known about sleep.

Overview

Jet lag, or desynchronization, is a temporary condition that some people experience following air travel across several time zones in a short period of time. This causes the traveler's internal clock to be out of sync with the external environment. People experiencing jet lag have a difficult time maintaining their internal, routine sleep-wake pattern in their new location, because external stimuli, like sunshine and local timetables, dictate a different pattern. For this reason, one can feel lethargic one moment and excited the next. Jet lag creates a double bind for vacationers and business people who must cross several time zones to reach their destination, but who are also intent on maximizing sightseeing or productivity. As travelers attempt to adjust their internal clock to a new external environment, symptoms result with varying intensity.

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In addition to the "tired-wired," "soar-crash" feeling that travelers experience after long, rapid air travel, there are numerous symptoms that may occur with jet lag, such as insomnia, daytime fatigue, stomachaches, headaches, irritability, and decreased awareness. The degree of disruption varies greatly among people; some may not be bothered at all. Jet lag is a transient sleep disorder and is classified differently than other, more serious disorders. Although jet lag occasionally lasts for a week or more, travelers usually return to their normal sleep-wake pattern after a day or two.

For many travelers, jet lag can catalyze the effects of certain conditions associated with the head and nervous system that are not related to specific sleep-wake patterns. For example, many symptoms attributed to jet lag are actually caused by the environment of the airplane--dry air (humidity in an airplane is very low), pressurization, noise, vibrations, and a cramped environment. These symptoms

may include dry eyes, dry and irritated nose and sinuses, headaches, earaches, muscle cramps, and abdominal distention (bloating). Occasionally, dizziness or swollen feet and ankles may occur.

According to the National Sleep Foundation's Web Site

The basics of "jet lag" are that:

Anyone who has ever flown is likely to have experienced some degree of time zone change disorder, commonly known as jet lag. Until recently, jet lag was not treated as a medical condition. It is now included as one of the 84 known or suspected sleep disorders and affects millions of people each year.

Jet lag occurs when the body's biological clock is out of sync with local time. When traveling to a new time zone, our bodies are slow to adjust and remain on their original biological schedule for several days. The result is that we feel excessively sleepy during the day or wide awake at night.

People may experience jet lag in varying degrees. In general, the severity of jet lag symptoms is directly related to the number of time zones crossed by a flight. Jet lag symptoms typically last longer following eastward flights. Flying east usually results in difficulty initiating sleep, whereas flying west results in early morning awakenings. All age groups are susceptible, but individuals over the age of 50 are more likely to develop jet lag than those under the age of 30. Also, individual susceptibility tends to vary considerably and it is possible that pre-existing sleep deprivation will intensify jet lag.

The Symptoms of jet lag include:

- Daytime sleepiness
- Nighttime alertness (insomnia)
- Loss of appetite and other
- Gastrointestinal dysfunction
- Mood disturbances
- Difficulty concentrating or focusing

Regarding Treatment, the site indicates that:

Researchers believe that gradually adjusting your bedtime to coincide with the time zone of your destination in the days before travel may prevent or reduce jet lag. On average, it takes about a day for each hour of time zone change to recover from jet lag.

In addition to adjusting your sleep schedule, prescription sleep aids may help reduce the amount of sleep lost as a result of jet lag. Over the counter sleep aids and alcohol should be avoided. Non-prescription sleep aids can cause sleepiness long after the intended sleep time and exacerbate the sleepiness associated with jet lag. Alcohol can disrupt sleep. Daytime sleepiness can be treated with caffeine, as long as it is not taken in the few hours before bedtime.

Melatonin, a naturally secreted hormone that regulates the body's internal clock, is used by some people to initiate sleep when traveling. Currently, melatonin is largely available only in health food stores and is not regulated. Therefore, melatonin is, at present, an experimental approach to sleep problems and travelers should consult their physicians before using it. Pregnant or breast feeding women and children should not take melatonin for jet lag. Melatonin (0.5mg) is probably only of use

when traveling east. Travelers can take it a few days before, during or after traveling east and should take it ~5-7 hours before their usual bedtime in their old time zone. Melatonin can induce sleepiness so people should not drive or operate heavy machinery for several hours after ingestion.

On Coping with Jet Lag, the site indicates that:

The following are additional steps you can take to minimize jet lag:

- Shift your sleep times before you travel. In the few days before traveling west, go to bed and wake up 1 hour later each day. In the few days before traveling east, go to bed and wake up 1 hour earlier each day.
- Regulate your light exposure before you travel. In the few days before traveling west, seek evening light and avoid morning light. In the few days before traveling east, seek morning light and avoid evening light. People can use a bright light box to get light, although people who experience migraines, mood disorders or have eye diseases should first consult with their physician before using one.
- Regulate your light exposure in your new time zone. If you traveled west, on arrival, seek morning light and avoid afternoon light. If you traveled east, on arrival seek evening light and avoid morning light. Weather conditions permitting, people can seek light by going outdoors and wearing only lightly tinted sunglasses. Do not look directly at the sun. Light can be avoided by staying indoors away from windows, wearing very dark sunglasses when outside and by sleeping.
- Avoid alcohol and caffeine for at least 3-6 hours before bedtime.
- Avoid heavy exercise close to bedtime.
- Bring earplugs and blindfolds to reduce noise and light while sleeping.

Another way to view what many call Jet Lag is what the researchers at Stanford call “The Time Zone Change Syndrome.” **What is Time Zone Change Syndrome?**

Time zone change (jet lag) syndrome consists of varying degrees of difficulties in initiating or maintaining sleep, excessive sleepiness, decrements in subjective daytime alertness and performance, and somatic symptoms (largely related to gastrointestinal function) following rapid travel across multiple time zones.

What are the symptoms?

The symptoms begin within 1 or 2 days after air travel across at least 2 time zones. A discernable disruption of the normal circadian sleep-wake cycle is present.

- Insomnia
- Excessive sleepiness
- Decreased daytime performance
- Tired muscles

- Headaches
- Moodiness
- Altered appetite
- Stomach problems
- Increase in the frequency of nocturnal awakening to urinate
- Generally feeling unwell

How can these symptoms be avoided when traveling?

It is important to adapt yourself to the routine of your destination as soon as you board your flight.

- Reset your watch for the new time zone
- Control sleeping, including naps, to optimize sleep at the appropriate time in your new locale. Many travelers go to bed immediately after arriving on an overnight flight. They usually fall asleep quickly but sleep a relatively short time, tending to awaken at a time corresponding to the late morning of their hometime. Then later that night they would have problems falling asleep because of their unadjusted circadian system which would be telling them that it is not time to sleep yet. To counteract this, it is better to limit your sleep to no more than 2 hours immediately after arrival.
- Eating foods that contain tryptophan (turkey, milk) can help induce sleep at the proper time at your destination. Some people even resort to taking small doses of hypnotics to produce sleep. Drugs such as temazepam (Restoril), brotizolam, and triazolam (Halcion) have been shown to produce high-quality sleep after extensive shifts in sleep schedules or after time zone transitions.
- Exposure to daylight can help reset your clock. Take a one-hour walk as soon as you get up.

Things to avoid that will slow down adaptation:

- long or inappropriate naps
- excessive caffeine
- social isolation
- poor sleep hygiene

British Airways has published information to help travelers deal with the problems of Jet Lag:

Jet lag

All air travelers want to arrive at their destination feeling rested and alert, but as air travel has become faster, the human body has found it increasingly difficult to keep up. Lack of sleep and disruption to the circadian clock (the brain's timekeeper) can lead to fatigue, digestive upset, and headaches. It can downgrade our decision-making by up to 50 per cent, communication skills by 30 per cent, memory by 20 per cent, and attention by 75 per cent.

British Airways doctors joined forces with Alertness Solutions to help business travelers and holidaymakers beat jet lag and sleep disruption. Alertness Solutions is a US consulting firm that translates scientific knowledge on sleep, circadian factors, alertness and performance into practical strategies that improve productivity and safety in our society. Visit [Alertness Solutions](http://www.alertnessolutions.com/Resources_Info/resources.html)(http://www.alertnessolutions.com/Resources_Info/resources.html)

The information contained there includes web links to resources and publications. In addition, there are “exercises”:

How sleepy are you? Try these two sleepiness scales:

THE EPWORTH SLEEPINESS SCALE

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

0 = no chance of dozing
1 = slight chance of dozing
2 = moderate chance of dozing
3 = high chance of dozing

SITUATION	CHANCE OF DOZING
Sitting and reading	_____
Watching TV	_____
Sitting inactive in a public place (e.g. a theater or a meeting)	_____
As a passenger in a car for an hour without a break	_____
Lying down to rest in the afternoon when circumstances permit	_____

Sitting and talking to someone	_____
Sitting quietly after a lunch without alcohol	_____
In a car, while stopped for a few minutes in traffic	_____

To check your sleepiness score, total the points . [Check your total score to see how sleepy you are.](#)

and the [The Stanford Sleepiness Scale:](#)

Stanford Sleepiness Scale

This is a quick way to assess how alert you are feeling. If it is during the day when you go about your business, ideally you would want a rating of a one. Take into account that most people have two peak times of alertness daily, at about 9 a.m. and 9 p.m. Alertness wanes to its lowest point at around 3 p.m.; after that it begins to build again. Rate your alertness at different times during the day. If you go below a three when you should be feeling alert, this is an indication that you have a serious sleep debt and you need more sleep.

An Introspective Measure of Sleepiness The Stanford Sleepiness Scale (SSS)

Degree of Sleepiness	Scale Rating
Feeling active, vital, alert, or wide awake	1
Functioning at high levels, but not at peak; able to concentrate	2
Awake, but relaxed; responsive but not fully alert	3
Somewhat foggy, let down	4
Foggy; losing interest in remaining awake; slowed down	5
Sleepy, woozy, fighting sleep; prefer to lie down	6
No longer fighting sleep, sleep onset soon; having dream-like thoughts	7
Asleep	X

To ascertain “how is your sleep” they offer the sleep test from SleepNet:

<http://www.sleepnet.com/sleeptest.html>

This sleep test is not intended as medical advice. If you think you may have a sleep disorder, contact a physician, regardless of the results of this test.

Click on the checkbox beside each statement that is true for you. If a statement does not apply or is false, simply go on to the next statement. If you make a mistake click the checkbox to remove the checkmark. To have the test scored simply click the button at the end of the test and you'll immediately receive your score. You may **print your results** and take them to you physician.

- 1. I have been told that I snore.
- 2. I have been told that I hold my breath while I sleep.
- 3. I have high blood pressure.
- 4. My friends and family say that I'm often grumpy and irritable.
- 5. I wish I had more energy.
- 6. I sweat excessively during the night.
- 7. I have noticed my heart pounding or beating irregularly during the night.
- 8. I get morning headaches.
- 9. I suddenly wake-up gasping for breath.
- 10. I am overweight
- 11. I seem to be losing my sex drive.
- 12. I often feel sleepy and struggle to remain alert.
- 13. I frequently awake with a dry mouth.
- 14. I have difficulty falling asleep.

- 15. Thoughts race through my mind and prevent me from sleeping.
- 16. I anticipate a problem with sleep several times a week.
- 17. I wake up and cannot go back to sleep.
- 18. I worry about things and have trouble relaxing.
- 19. I wake up earlier in the morning than I would like to.
- 20. I lie awake for half an hour or more before I fall asleep.
- 21. I often feel sad and depressed.
- 22. I have trouble concentrating at work or school.
- 23. When I am angry or surprised, I feel like my muscles are going limp.
- 24. I have fallen asleep while driving.
- 25. I often feel like I am in a daze.
- 26. I have experienced dreamlike scenes upon falling asleep or awakening.
- 27. I have fallen asleep in social settings such as movies or at a party.
- 28. I have trouble at work because of sleepiness.
- 29. I have dreams soon after falling asleep or during naps.
- 30. I have "sleep attacks" during the day no matter how hard I try to stay awake.
- 31. I have had episodes of feeling paralyzed during my sleep.
- 32. I wake up at night with an acid/sour taste in my mouth.
- 33. I wake up at night coughing or wheezing.
- 34. I have frequent sore throats.
- 35. During the night I suddenly wake up feeling like I'm choking

- 36. Other than when exercising, I experience muscle tension in my legs.
 - 37. I have noticed (others have commented) that parts of my body jerk during sleep.
 - 38. I have been told that I kick at night.
 - 39. When trying to go to sleep I experience an aching or crawling sensation in my legs.
 - 40. I experience leg pain or cramps at night.
 - 41. Sometimes I can't keep my legs still at night, I need to move them to feel comfortable.
 - 42. Even though I sleep during the night, I feel sleepy during the day.
-

The also point you towards a sleep debt calculator (in a pdf file):

http://www.alertness-solutions.com/Resources_Info/Exercises/slp_debt_exer.pdf

They also show you how to use a Jet Lag Calculator (another pdf file):

http://www.alertness-solutions.com/Resources_Info/Exercises/jet_lag_exer.pdf

British Air finishes by saying that “It is hoped you will find the information provided useful and that it helps you to better manage your rest and alertness when you are next traveling. “

Another handy jet lag calculator can be found at:

<http://www.fleetstreetclinic.com/calc.php>

A medical site on the WWW (http://www.medicinenet.com/jet_lag/article.htm) describes Jet Lat as follows:

What is jet lag?

Jet lag is a temporary disorder that causes fatigue, insomnia, and other symptoms as a result of air travel across time zones.

What are other symptoms of jet lag?

Besides fatigue and insomnia, a jet lag sufferer may experience anxiety, [constipation](#), [diarrhea](#), confusion, [dehydration](#), [headache](#), irritability, nausea, sweating, coordination problems, and even memory loss. Some individuals may report additional symptoms, such as heartbeat irregularities and an increased susceptibility to illness.

What is a time zone?

A time zone is a geographical region in which every clock keeps the same time. In all, the world has 24 time zones, one for each hour in the day. Each zone runs from north to south in strips of approximately 1,000 miles (1,600 kilometers) wide. (The actual width of each zone varies to accommodate political and geographical boundaries.) As the earth rotates, dawn occurs at a set hour in one time zone, then an hour later in the time zone immediately to the west-- and so on through the 24-hour cycle. Thus, in the U.S., when it is 6 a.m. in the Eastern Time Zone, it is 5 a.m. in the Central Zone, 4 a.m. in the Mountain Zone, and 3 a.m. in the Pacific Zone.

Why does jet lag occur?

Jet lag occurs because the body of a traveler cannot immediately adjust to the time in a different zone. Thus, when a New Yorker arrives in Paris at midnight Paris time, his or her body continues to operate on New York time. It is ready to eat, not [sleep](#). As the body struggles to cope with the new schedule, temporary insomnia, fatigue, irritability, and an impaired ability to concentrate may set in. Meanwhile, the bowels may malfunction in reaction to the changed bathroom schedule, and the brain may become confused and disoriented as it attempts to juggle schedules.

How does the body keep time?

A tiny part of the brain called the hypothalamus acts as a kind of alarm clock to activate various body functions such as hunger, thirst, and sleep. It also regulates body temperature, blood pressure, and the level of hormones and glucose in the bloodstream. To help the body tell the time of day, fibers in the optic nerve of the eye transmit perceptions of light and darkness to a time-keeping center within the hypothalamus. Thus, when the eye of an air traveler perceives dawn or dusk many hours earlier or later than usual, the hypothalamus may trigger activities that the rest of the body is not ready for, and jet lag occurs.

What is the role of melatonin in jet lag?

Melatonin is a hormone that plays a key role in body rhythms and jet lag. After the sun sets, the eyes perceive darkness and alert the hypothalamus to begin releasing melatonin, which promotes sleep. Conversely, when the eyes perceive sunlight, they tell the hypothalamus to withhold melatonin production. However, the hypothalamus cannot readjust its schedule instantly; it takes several days.

Does the direction of travel matter?

Yes. Travelers flying north or south in the same time zone typically experience the fewest problems because the time of day always remains the same as in the place where the flight originated. To be sure, these travelers may experience discomfort, but this usually results from confinement in an airplane for a long time or from differences in climate, culture, and diet at the destination location. Time does not play a role.

Travelers flying east, on the other hand, typically experience the most problems because they lose time -- lots of it. For example, on a flight from Washington, D.C., to Mecca, Saudi Arabia, a traveler loses eight hours. Meals, sleep, bowel habits, and other daily routines are all pushed ahead eight hours.

Travelers flying west gain time and usually have an easier time adjusting than eastward travelers. However, they too experience symptoms of jet lag after landing because they still must adjust to a different schedule.

Do the symptoms of jet lag vary in intensity?

Yes. Persons flying across only one or two time zones may be able to adjust without noticeable effects of the time change. Those flying across three or more time zones, on the other hand, will likely develop noticeable symptoms of jet lag. Generally, the intensity of symptoms varies in relation to the number of time zones crossed and the direction of travel.

What are the best ways to cope with jet lag?

The following are twelve tips to help travelers minimize the effects of jet lag:

Tip 1: Stay in Shape

If you are in good physical condition, stay that way. In other words, long before you embark, continue to exercise, eat right, and get plenty of rest. Your physical stamina and conditioning will enable you to cope better after you land. If you are not physically fit, why not begin shaping up several weeks before your trip? There's no better time.

Tip 2: Get Medical Advice

If you have a medical condition that requires monitoring (such as diabetes or heart disease), consult your physician well in advance of your departure to plan a coping strategy that includes medication schedules and doctor's appointments, if necessary, in the destination time zone.

Tip 3: Change Your Schedule

If your stay in the destination time zone will last more than just a few days, begin adjusting your body to the new time zone before you leave. For example, if you are traveling from the U.S. to Europe for a one-month vacation, set your daily routine back an hour or more three to four weeks before departure. Then, set it back another hour the following week and the week after that. Easing into the new schedule gradually in familiar surroundings will save your body the shock of adjusting all at once.

Tip 4: Avoid Alcohol

Do not drink alcoholic beverages the day before your flight, during your flight, or the day after your flight. These beverages can cause dehydration, disrupt sleeping schedules, and trigger nausea and general discomfort.

Tip 5: Avoid Caffeine

Likewise, do not drink caffeinated beverages before, during, or just after the flight. Caffeine can also cause dehydration and disrupt sleeping schedules. What's more, caffeine can jangle your nerves and intensify any travel anxiety you may already be feeling.

Tip 6: Drink Water

Drink plenty of water, especially during the flight, to counteract the effects of the dry atmosphere inside the plane. Consider taking your own water container aboard the airplane.

Tip 7: Move Around on the Plane

While seated during your flight, exercise your legs from time to time. Move them up and down and back and forth. Bend your knees. Stand up and sit down. Every hour or two get up and walk around. Do not take sleeping pills and do not nap for more than an hour at a time.

These measures have a twofold purpose. First, they reduce your risk of developing a blood clot in the legs. Research shows that long periods of sitting can slow blood movement in and to the legs, thereby increasing the risk of a clot. The seat is partly to blame. It presses against the veins in the leg, restricting blood flow. Inactivity also plays a role. It decelerates the movement of blood through veins. If a clot forms, it sometimes breaks loose and travels to the lungs, lodges in an artery, and inhibits blood flow. The victim may experience pain and breathing problems and cough up blood. If the clot is large, the victim could die. Second, remaining active--even in a small way--revitalizes and refreshes your body, wards off stiffness, and promotes mental and physical acuity.

Tip 8: Break Up Your Trip

If you are traveling across eight, ten, or even twelve time zones, break up your trip, if feasible, with a stay in a city about halfway to your destination. For example, if you are traveling from New York to Bombay, India, schedule a stopover of a few days in Dublin or Paris. (At noon in New York, it is 5 p.m. in Dublin, 6 p.m. in Paris and 10:30 p.m. in Bombay.)

Tip 9: Wear Comfortable Shoes and Clothes

On a long trip, how you feel is more important than how you look. So treat your body to comfortable clothes and shoes. Avoid items of apparel that pinch, restrict, or chafe. When selecting your trip ensemble, keep in mind the climate in your destination time zone. Dress for your destination.

Tip 10: Check Your Accommodations

Upon arrival, if you are staying at a hotel, check to see that beds and bathroom facilities are satisfactory and that cooling and heating systems are in good working order. If the room is unsuitable, ask for another. It's no fun to go to bed on a hot August night only to discover that the air-conditioning doesn't work!

Tip 11: Adapt to the Local Schedule

The sooner you adapt to the local schedule, the quicker your body will adjust. Therefore, if you arrive at noon local time (but 6 a.m. your time), eat lunch, not breakfast. During the day, expose your body to sunlight by taking walks or sitting in outdoor cafes. The sunlight will cue your hypothalamus to reduce the production of sleep-inducing melatonin during the day, thereby initiating the process of resetting your internal clock.

Tip 12: Use Sleeping Medications Wisely--Or Not At All

Try to establish sleeping patterns without resorting to pills. However, if you have difficulty sleeping on the first two or three nights, it's okay to take a mild sedative if your physician has prescribed one. But wean yourself off the sedative as soon as possible. Otherwise, it could become habit-forming.

Should I take melatonin?

Another option -- a controversial one -- is synthetic melatonin, which is classified in the U.S. as a dietary supplement. A study in the March 18, 1989, British Medical Journal reported that taking synthetic melatonin tablets can help travelers restore normal sleeping patterns.

In that study, twenty volunteers traveling back and forth between New Zealand and England took daily doses of either 5 milligrams of melatonin or a placebo (a blank) before, during, and after their flights. Those taking melatonin returned to their normal sleep patterns in 2.85 days on average compared with 4.15 days for those taking a placebo.

However, scientists in the U.S. and many other countries are not yet convinced that enough evidence exists to prove the efficacy of over-the-counter (OTC) melatonin tablets. These scientists also point out the following: (1) No information has been compiled on the long-term effects of taking melatonin. (2) No watchdog measures are in place to assure that all OTC melatonin products meet minimum standards. In an FDA meeting held on June 8, 1999, Adrian Fugh-Berman, Ph.D., chairman of the National Woman's Health Network, argued that melatonin should not be considered a dietary supplement and should be removed from the market.

Nevertheless, if you think you'd like to try melatonin tablets, it would be a good idea to check first with your healthcare provider.

Yet another health/air travel-oriented site, <http://www.flyana.com/jetlag.html>, has put forth the following information regarding Jet Lag:

Jet Lag Has Many Symptoms:

Everywhere around the world, business people blame bad days on jetlag. Every day, athletes around the world blame poor performances on jetlag.

Jetlag affects us physically, mentally, and emotionally. A physical example is swollen feet. A mental example is disorientation. An emotional one is anxiety.

Swollen feet are caused by the low [air pressure](#) on board and lack of circulation from sitting for long periods without moving. To remedy this, wear travel shoes a half size too large (use cushion inserts on the ground).

Abstaining from alcoholic beverages while on board (and drinking lots of water instead) is both a physical and a mental remedy--it helps to offset [dehydration](#), and it promotes mental clarity.

Jetlag Symptoms (Partial List)

constipation	impatience
clammy sweat	insomnia insecurity
diarrhea	irregular heartbeat
disorientation	lightheadedness
dry cough	loss of libido
dry eyes	low blood sugar
dry skin	memory loss
ear ache	nausea
fatigue	reactions to drugs
headache	sore throat
hemorrhoids	susceptibility to illness
impaired coordination	swollen feet
impaired vision	

What causes jetlag?

How are we to alleviate the symptoms of jetlag so that they do not interfere with our mental acuity and physical vitality?

Jetlag is caused by a complex combination of circumstances.

First, there are the environmental deviations of traveling--shifts in time, alterations in magnetic fields, modifications in climate, and diversities in cultures.

As if this weren't enough, we are forced into a sickening environment while flying in commercial jets, where we are deprived of air and humidity and exposed to recirculated germs and chemicals, radiation, pesticides, noise, and dehydration.

No Quick Fix

There is no quick fix to alleviate all the symptoms of jetlag. There is no single pill or remedy for all these symptoms because of all the different things that cause jetlag.

We can cope, however, with a little consciousness in our daily life.

First of all, spend some time outside during daylight hours. Even being in a room with windows helps to enlighten our body clocks. Natural light automatically cues our cells to the new local cosmology.

If you can do only one thing, adjust your bedtime to the new, local timetable as soon as possible. Along with the adoption of the local bedtime, try doing what the locals do: their food preferences, meal times, recreational activities, and even the way they dress.

It also helps to schedule work and other important activities at times when you are likely to have maximum energy:

...in the evenings, after flying east,
...in the mornings, after flying west.

Strategies

1. Spend some time every day outdoors.
2. Set your watch to local time.
3. Sleep and eat on local time.
4. Schedule work for maximum energy according to your home time.

Set your watch, focus your mind

All our internal cycles (temperature, sleep, cravings for sweets, reactions to medications, and more) are programmable, like computers.

You can program yours to bounce back from jetlag with adaptability and resilience.

Start by focusing your thoughts and feelings on your desired goals--determine to enjoy well-being as you skirt the globe.

And be sure to set our watch to your destination local time as soon as possible after takeoff.

"Jetlag is not psychological; it is *cycle* logical."

Preventing Jet lag

Jet lag is entirely dependent upon the number of time zones crossed, and not, as is often believed, the actual length of the flight. People tend to find that traveling east has the greatest effect upon the body.

Jet lag is unlike all other sleep disorders, in that it is not caused by abnormal sleep patterns such as insomnia. In fact, those who live quite a rigid lifestyle, tend to suffer worst, especially if you sleep and awake at roughly the same time every day and eat your main meals at approximately the same time.

Travelers with less of a daily routine are effected far less by jet lag. Babies, for example, tend not to suffer from jet lag.

Studies carried out by NASA show that for every time zone a traveler passes, one day is required to fully regain your natural rhythm and energy levels.

Any of the following can also contribute to jet lag:

Alcohol: The effect of alcohol on the body is multiplied at altitude, so drinking even relatively small amounts of alcohol can compound tiredness and intensify hangovers upon arrival.

Solution: Avoid drinking alcohol the night before flying. Above all do not drink at all during the day of flying or while flying.

Dehydration: Air cabins tend to rely on recycled air via air conditioning units. This inevitably dries both the skin and can lead to dry nasal and throat membranes.

Solution: Drink plenty of water prior to flying and ensure that you carry a bottle of water with you the flight to regularly take small drinks from. An intensive moisturizer is also useful to prevent the skin from becoming too dehydrated and dry.

Headaches and a sore throat may become accentuated in such a dry atmosphere.

Solution: Again, it is essential to drink plenty of water before and during the flight to combat such conditions.

Pre-flight condition: If you start your flight stressed and tired, then it is unlikely that you will emerge much fresher.

Solution: A good night's sleep prior to flying and some light exercising (maybe a brisk walk in the morning) will put your body in a far better 'flight-condition', ready to face the potential effects of jet lag.

Immobility: Prolonged period of immobility will naturally tire the body and invoke lethargy.

Solution: Keep moving, walk around the cabin at regular interval to keep the blood pumping around your body.

Using Time Zones to prevent Jet Lag

By understanding how time zones are split up around the world, it is possible to create a strategy to prevent jet lag. It is best to arrive in daylight hours, as sunlight naturally alerts the body, consequently there is a greater likelihood that you will readjust to local time faster, and not sleep through the day.

Thus if you leave London at midday and travel for six hours west towards New York, upon arrival the local time will be 13:00 hours, though your body will still be set on London time, which is actually 18:00 hours, thus your body will start to anticipate darkness, an evening meal and sleep.

To counter jetlag, you need to now try and stay awake until the early evening, when you can enjoy a good nights sleep. By planning to arrive during daylight hours, this should be easier, than arriving during darkness.

If you arrive during the night, you will need to try and get some immediate sleep to be ready to start the following day in line with local time. Naturally, this can be difficult if the time your body is still adjusted to is daylight hours as you will probably not feel tired until the following day at your destination, when really you should be staying active.

By planning ahead your flight departure and arrival times, so that you arrive at your destination during daylight hours, it can be possible to significantly curb jetlag.

Sleep and Circadian Rhythms

Circadian rhythms are regular changes in mental and physical characteristics that occur in the course of a day (*circadian* is Latin for "around a day"). Most circadian rhythms are controlled by the body's biological "clock." This clock, called the *suprachiasmatic nucleus* or *SCN*, is actually a pair of pinhead-sized brain structures that together contain about 20,000 neurons. The SCN rests in a part of the brain called the *hypothalamus*, just above the point where the optic nerves cross. Light that reaches photoreceptors in the *retina* (a tissue at the back of the eye) creates signals that travel along the optic nerve to the SCN.

Signals from the SCN travel to several brain regions, including the *pineal gland*, which responds to light-induced signals by switching off production of the hormone melatonin. The body's level of melatonin normally increases after darkness falls, making people feel drowsy. The SCN also governs functions that are synchronized with the sleep/wake cycle, including body temperature, hormone secretion, urine production, and changes in blood pressure.

By depriving people of light and other external time cues, scientists have learned that most people's biological clocks work on a 25-hour cycle rather than a 24-hour one. But because sunlight or other bright lights can reset the SCN, our biological cycles normally follow the 24-hour cycle of the sun, rather than our innate cycle. Circadian rhythms can be affected to some degree by almost any kind of external time cue, such as the beeping of your alarm clock, the clatter of a garbage truck, or the timing of your meals. Scientists call external time cues *zeitgebers* (German for "time givers").

When travelers pass from one time zone to another, they suffer from disrupted circadian rhythms, an uncomfortable feeling known as *jet lag*. For instance, if you travel from California to New York, you "lose" 3 hours according to your body's clock. You will feel tired when the alarm rings at 8 a.m. the next morning because, according to your body's clock, it is still 5 a.m. It usually takes several days for your body's cycles to adjust to the new time.

To reduce the effects of jet lag, some doctors try to manipulate the biological clock with a technique called light therapy. They expose people to special lights, many times brighter than ordinary household

light, for several hours near the time the subjects want to wake up. This helps them reset their biological clocks and adjust to a new time zone.

Symptoms much like jet lag are common in people who work nights or who perform shift work. Because these people's work schedules are at odds with powerful sleep-regulating cues like sunlight, they often become uncontrollably drowsy during work, and they may suffer insomnia or other problems when they try to sleep. Shift workers have an increased risk of heart problems, digestive disturbances, and emotional and mental problems, all of which may be related to their sleeping problems. The number and severity of workplace accidents also tend to increase during the night shift. Major industrial accidents attributed partly to errors made by fatigued night-shift workers include the Exxon Valdez oil spill and the Three Mile Island and Chernobyl nuclear power plant accidents. One study also found that medical interns working on the night shift are twice as likely as others to misinterpret hospital test records, which could endanger their patients. It may be possible to reduce shift-related fatigue by using bright lights in the workplace, minimizing shift changes, and taking scheduled naps.

Many people with total blindness experience life-long sleeping problems because their retinas are unable to detect light. These people have a kind of permanent jet lag and periodic insomnia because their circadian rhythms follow their innate cycle rather than a 24-hour one. Daily supplements of melatonin may improve night-time sleep for such patients. However, since the high doses of melatonin found in most supplements can build up in the body, long-term use of this substance may create new problems. Because the potential side effects of melatonin supplements are still largely unknown, most experts discourage melatonin use by the general public.

Avoid and Combat Jet Lag

A doctor's advice on avoiding jet lag.

by Lawrence Bryson, M.D.

Modern jet planes can cross many time zones in a relatively short period of time. When you arrive at your destination, the body clock which regulates your sleep, wakefulness, and other activities may be disturbed. This disruption can produce irritability, fatigue, sleep difficulties, poor concentration, loss of appetite, and other discomforts. Jet lag is not a problem on north-south flights which do not cross time zones. And, it is generally easier to adjust to a time shift when traveling from east to west than from west to east.

A number of strategies have been developed to minimize jet lag. One of the simplest involves switching to the sleeping and eating schedule of your destination, either while in flight or immediately upon arrival. Unless you initiate this strategy before departure, however, it only reduces the length of time when jet lag is a problem. It does not prevent jet lag or lessen the initial discomfort.

Another approach adjusts the body clock with diet. The "Anti-Jet-Lag Diet," developed by Dr. Charles F. Ehret of Argonne National Laboratories, alternates days of "feasting" on high-protein breakfasts and lunches and high-carbohydrate dinners with days of "fasting" on small, low-calorie meals. Start by feasting on the fourth day before arriving at your destination, then fast on the third day, feast on the second, and fast one day before. During the first three days, drink beverages which contain caffeine only between 3 and 5 pm. On the day before arrival, however, you should drink caffeine in the morning for a westbound flight or between 6 and 11 pm for an eastbound flight. Do not drink alcohol

on the plane. To obtain a wallet-sized card outlining this diet, send a stamped, self-addressed envelope to Anti-Jet-Lag Diet, OPA, Argonne National Laboratory, 9700 South Cass Ave., Argonne, IL 60439.

A third technique uses light to reset the body clock, because light has the ability to inhibit the production of a brain hormone that triggers sleep. If you are traveling from east to west and arrive during daylight, go outside and take a walk in the sun. If you are traveling from west to east, avoid the sun for the rest of the day. The next morning, no matter which direction you have traveled, take a walk outdoors in the sunshine. Avoid wearing sunglasses when outdoors during the first few days, and keep lights on indoors during the daytime.

A computerized service combines these strategies to provide travelers with instructions customized around their particular itineraries. For information, contact Jet Ready, Kinetic Software, Inc., 12672 Skyline Boulevard, Woodside, CA 94062 (415) 851-4484.

Although no anti-let-lag protocol is completely effective, these techniques will help you minimize the inconvenience. All of these techniques will work better if you also:

- * Exercise regularly during the two or three weeks before your departure to build up your resistance to fatigue.
- * Schedule your flight so that you arrive in the late afternoon or evening and are not faced with a full day's activities.
- * Get a good night's sleep the night before your travel.
- * Take a nap on a long flight, preferably during the hours corresponding to nighttime at your destination.
- * Don't smoke, drink alcohol, or take unnecessary medications during your flight.
- * Get up and walk around during your flight.
- * Drink plenty of fluids on the plane.

Diabetics take note: You will need help from your doctors in adjusting your insulin dosage to compensate for the change in time zones.

HIGH ALTITUDE

Not only trekkers, skiers, and mountain climbers, but even ordinary sightseers are at risk for high altitude (or mountain) sickness. Today's travelers can arrive at high altitudes without having adequate time for their bodies to acclimate. Many ski resorts and mountain cities, for example, can be reached directly by jet planes which abruptly deposit travelers a mile or more above sea level. The result can be mountain sickness, which is caused by a reduction in the amount of oxygen reaching the brain and muscles because of the lower atmospheric pressure at high elevations.

To prevent mountain sickness, take enough time - two or three days - for your body to become accustomed to the higher altitude. Don't plan vigorous activities right away. If you will be flying directly to a high-altitude destination, your doctor might prescribe acetazolamide. However, some people should not take this drug, so medical approval is important.

Mountain sickness is more common at elevations above 10,000 feet, though some people begin to show symptoms at elevations as low as 5,000 feet. Symptoms range from mild discomfort - headache, nausea, sleep difficulties, loss of appetite, shortness of breath, and fatigue - to more acute disorders -

confusion, reduced urine output, inability to sleep, intense headache, marked breathing difficulties, delirium, loss of memory, and unconsciousness. Extreme cases of mountain sickness can be quite serious and even fatal.

Trekkers and mountain climbers should allow their bodies to adjust at an altitude of 6,000-8,000 feet for a few days before going higher. You may climb higher during the day, but return to sleep at an elevation no more than 1,000 feet higher than the night before.

How to Jettison Jet Lag

By Christine Haran

Even the most enthusiastic travelers can find their willingness to explore new territory hindered by jet lag. That's because the body's inability to immediately adjust to a new time zone can leave travelers feeling fatigued and cranky. But there are steps you can take—before, during and after your flight—to minimize jet lag. Below, Dr. Gary Zammit, director of the Sleep Disorders Institute at St. Luke's-Roosevelt Hospital in New York City, and Dr. Brooke Judd, of the Dartmouth-Hitchcock Medical Center in Lebanon, New Hampshire, explain why jet lag occurs and how to cope with it.

What is jet lag?

GARY ZAMMIT, MD: Jet lag is a condition that is caused by high-speed travel across multiple time zones. It is characterized by difficulty falling asleep and staying asleep at desired times in the new time zone, or feeling tired during the day, as well as physical symptoms like general malaise and gastrointestinal symptoms. People with jet lag may also have problems with irritability, attention, concentration and memory, probably as a consequence of their sleepiness.

BROOKE JUDD, MD: What is basically happening is you are resetting your circadian rhythm, an internal body clock that regulates your temperature, regulates when you release hormones throughout the day, and sets your sleep-wake cycle. When you travel across a significant number of time zones, your circadian rhythm is not in sync with the schedule of the destination you have traveled to, and this causes difficulties.

Are some people more prone to jet lag than others?

GARY ZAMMIT, MD: We do not know who is more susceptible to jet lag, but older people, people who have sleep disorders, or people who have irregular sleep schedules prior to travel, may have more problems. And people who have poor sleep habits may also have difficulty adjusting their sleep schedules when they're in their destination time zone.

What kind of time difference does there have to be to trigger jet lag?

GARY ZAMMIT, MD: We do not know the minimum time difference that triggers jet lag for everyone, but we do know that the more time zones crossed over a short period of time, the more likely someone is to suffer jet lag symptoms.

Is it harder to travel in one direction than another?

BROOKE JUDD, MD: It is harder to travel, as a general rule, from West to East. When you travel from West to East, you're arriving in a location where the time is later than what your body is telling you. It is usually much easier to make yourself wake up than make yourself fall asleep. Traveling from

East to West is a little bit easier because you are arriving in a location, and it is earlier than your body is expecting it to be.

GARY ZAMMIT, MD: This difference has to do with our basic physiology. The internal body clock runs on a rhythm that is slightly longer than 24 hours. We synchronize to a 24-hour rhythm by external cues such as sunlight, and that enables us to train the body clock to our environment. But if left alone, that body clock is going to run slightly longer than 24 hours. Because it runs a little bit longer, we are able to stay awake a little bit longer naturally. And that is why when we travel East to West, we can probably stay up a little bit later and get in sync with the new time zone more easily than when we travel West to East.

How does your body's natural release of melatonin affect your body clock?

BROOKE JUDD, MD: The sleep-wake cycle is partly modulated through melatonin. Through a variety of hormonal pathways, the body clock signals melatonin to be released as it gets darker.

Melatonin tells your brain that it's nighttime now, it's time to get sleepy. When you change the schedule by many hours, you are altering this process. It takes a couple days for your internal rhythms to catch up to the new timetable. Sometimes we can manipulate that by taking melatonin supplements at different times.

When is the use of melatonin supplements appropriate?

BROOKE JUDD, MD: Although it is not particularly useful as a general sleeping pill, melatonin is very useful in jet lag. In general, when you are traveling from West to East, you are trying to make your body clock think it is nighttime sooner, so you would take the melatonin in the evening. If you are traveling from East to West, you want to activate yourself a little bit more, so you would take it in the morning. How you continue to take it is actually a little bit more complex and is probably worth reviewing with a physician. There's not one standard protocol that would fit for everybody.

Is there anything that can be done to prevent jet lag before you leave?

GARY ZAMMIT, MD: Simple behavioral changes can help significantly reduce the likelihood of jet lag or reduce the severity of the symptoms. One thing is to try to anticipate life in the new time zone. Some people may begin to schedule their daily routines in their home time zone according to a schedule that is consistent with the destination time zone. Other people might set their watch to the new time zone before they board the plane or change their eating schedule.

What can be done to get in sync with a new time zone once you have arrived at your destination?

GARY ZAMMIT, MD: Arriving at your destination time zone in the morning and getting exposure to bright sunlight is exactly what you want to do because most important body clock cue is the rising and setting of the sun. If you are in your destination time zone at the end of the day, you want to make sure that you're getting little exposure to light.

BROOKE JUDD, MD: Appropriately timed melatonin can be useful. It can also be appropriate to use a prescribed sleeping pill to help get your sleeping on the new schedule.

What kinds of medications are best for jet lag?

BROOKE JUDD, MD: There is not really one medication that is better for jet lag than another. You would probably want to go with one that is a shorter acting or intermediate acting sleeping pill rather than the ultra-short-acting or long-acting pill.

GARY ZAMMIT, MD: Medications that people might use for sleep fall into a few general classes. Over-the-counter products might offer some temporary relief from a sleep problem, but are associated with other adverse effects, such as dryness, dry mouth, dry eyes or residual effects, exactly the things you want to avoid when you are traveling.

People need to make decisions about prescription medications by talking to their primary care physician or specialists who are treating them. You should probably do a test run with any sleep medication before you travel.

Should you ever take sleep medications on the plane?

GARY ZAMMIT, MD: Currently, there are no indications for the use of a sleep-promoting agent while in flight. However, we know that some travelers do use them successfully on overnight flights. If someone makes that choice, the important thing is to make it in association with a physician and to recognize that using a sleep medication during flight is going to result in impairment in the event of any emergency. And depending on the duration of the flight, the sleeper may experience some impairment after landing.

You Can Suffer From Jet Lag...Or You Can Do What This International Airline Captain Does

Wednesday - May 04, 2005

Pilot Paul (Article Warehouse - May 04, 2005) -- Whatever the reason for your travel, you have made a considerable investment. It costs you time and money. If you're stuck in a hotel room suffering from jet lag symptoms, you're missing out.

Obviously, you'd like to make the most of your trip. You will get the greatest return on your investment if you're out of your hotel room enjoying your destination. I can help you achieve this.

"What Is Jet Lag?"

In simple terms, jet lag is the disruption of your body's internal clock, or circadian rhythm. This clock sets your sleeping and waking times. It is complex and sensitive. Flying east or west messes it up. That's because you cross time zones much faster than your body can adjust.

What are common jet lag symptoms? They include:

- * Headache
 - Disorientation
 - * Anxiety
 - * Exhaustion
 - * Indigestion
 - * Dehydration
 - * Impaired Coordination

Obviously, these things could ruin your trip. Following these guidelines will reduce your jet lag symptoms and let you enjoy your trip even more.

I'll break this discussion into three sections:

- * Before Your Trip
- * During Your Flight
- * At Your Destination

A. Help Prevent Jet Lag Before You Leave Home

1. **Get Plenty Of Sleep.** NASA found that getting as much sleep as possible beginning two days before your trip is significant in minimizing jet lag symptoms.
2. **Reduce Your Stress.** All that running around can make you more stressed.
3. **Exercise.** If you exercise regularly, make it a priority to keep that routine just before you travel. Also, continue it at your destination.

B. Things You Can Do During Your Flight To Reduce Jet Lag

1. **Arrive Early At The Airport.** Not rushing to make your flight will help reduce stress and make you more relaxed. That way you'll rest better on the plane.
2. **Begin Adjusting To The New Time Zone And Schedule.** When you get on the plane, set your watch to your destination's time. Then think about when you'll eat and sleep there. Try to begin eating and sleeping at those times.
3. **Sleep As Much As You Can On the Plane.** This is a key factor in reducing jet lag.
4. **Wear Comfortable clothing.** Comfortable clothes, warm socks and a sweater will enable you to sleep better.
5. **Drink Plenty of Water.** Not soda, not alcohol, not caffeine, but water.
6. **Get Up and Stretch Frequently.**
7. **Use a Footrest.** The first and business class seats have these, but even in coach, you can benefit from using a footrest. Use a carry-on bag or travel footrest.
8. **Loosen Your Shoes.**
9. **Pills and Supplements.** In a word...

Don't.

My complete jet lag article at www.pilot-pauls-travel-accessories.com/jet-lag.html has a detailed discussion about the dangers of pills and supplements for jet lag.

C. Adjusting At Your Destination

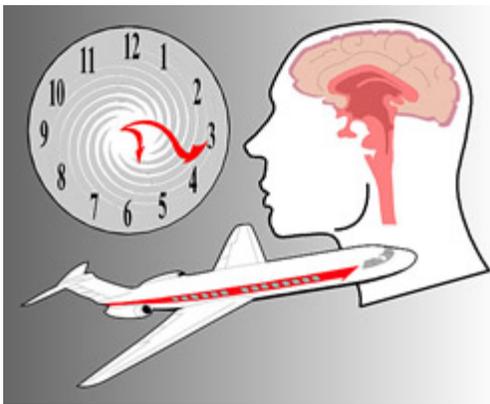
1. Try To Eat On The New Schedule. This helps your body clock adjust to minimize your jet lag symptoms.
2. Try To Sleep On The New Schedule. This is often easier said than done. There is a full discussion about sleep adjustment and napping at www.pilot-pauls-travel-accessories.com/jet-lag I have also written extensively about how to sleep better in any hotel room. You can learn all those sleep tips by visiting: www.pilot-pauls-travel-accessories.com/sleep-tips
3. Exercise. This is also among the important jet lag remedies. If you have a regular exercise routine, you'll want to continue it now.
4. Get out in the Sunlight. This is simple to accomplish as long as you have a sunny day.

Studies have shown that exposure to bright light helps shift the circadian rhythms (body clock), and therefore reduce the jet lag symptoms.

Recent Studies of the Jet Lag Phenomenon

A new understanding of jet lag

Study explains why biological clock is slow to reset after transmeridian travel



By Fariss Samarrai

A new study demonstrates that the brain's central timekeeper — the biological clock that regulates waking and sleeping cycles — has two parts that fall out of synchrony during light schedule shifts of six hours, the time it takes to fly across the Atlantic.

The finding may explain, at least in part, why transmeridian travelers suffer from jet lag, the malaise experienced after crossing several time zones. The new understanding could eventually lead to the development of medicines that would “reset” the biological clock so travelers could adjust much

more quickly to rapid time zone changes.

Dan Addison



Most people require about two-and-a-half days to adjust to a six-hour flight from Europe to the United States, and even longer after an eastbound trans-Atlantic flight. The study also may have implications for ways to treat shift workers — health care providers, factory employees, truck drivers, etc. — who encounter alertness problems, and those with sleep disorders.

A team of researchers at the University of Virginia and at Leiden University Medical Center in the Netherlands published their findings in the May 24 - June 6, 2005, issue of the journal *Current Biology*.

File photo

The investigators found that the dorsal and ventral sections of the suprachiasmatic nucleus (SCN), the brain's central timekeeper, adjust to shifts in light schedules at vastly different rates, potentially causing or contributing to the difficult period of adjustment that most people experience after air travel across several time zones.

The researchers found that the ventral part of the SCN, which is directly connected by a nerve to the light-sensing retina, synchronizes rapidly with a new light schedule, even a radically shifted schedule. But the dorsal part of the clock requires several additional days to adjust. This results in complex signaling patterns that may adversely affect the functioning of tissues and organs throughout the body for a period of several days.

Importantly, the study identifies the neurotransmitter GABA (gamma-aminobutyric acid) as the link between the two clock parts that eventually pulls them back into synchronization, according to co-investigator Gene D. Block, biology professor and vice president and provost.

Block likens GABA to a weak rubber band linking pendulums swinging at different rates. If the “rubber band” could be made stronger, such as using a drug to enhance GABA, the ventral and dorsal parts of the central timekeeper could more quickly move back into harmony. The symptoms of jet lag might then be reduced or eliminated.

“The key here is, we now know what the ‘rubber band’ is: the neurotransmitter GABA that ultimately

brings the clock back into synch,” Block said. “This could lead to future therapies for jet lag. This is the first time that we have a mechanistic understanding of the coupling between the different parts of the clock. We are hopefully on our way to suggesting strategies for shifting the clock more quickly in response to unnatural light cycle changes.”

Block said that future therapies, using this new knowledge, might also benefit shift workers and older people who suffer from sleep disorders.

In nature, day and night cycles shift slowly as the seasons change. The body is able to adjust to the slow changes and is in fact adapted to these seasonal cycles. But transmeridian flight is an unnatural manipulation of the light cycles, forcing the body to try to rapidly adjust to abrupt light cycle shifts.

This sudden disruption in the normal pattern can compromise the normal function of organs. The result often is sleeplessness or sleepiness, reduced alertness, indigestion, fatigue and possibly ulcers.

“This new finding adds support to the emerging view that the central timekeeper, the SCN, is more complex than previously thought, and in fact adjusts to light cycle shifts at a different rate within its own structure,” Block said. “Most importantly, the new research identifies the mechanism that couples the two parts of the SCN clock.”

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He suggested that the differing rates of synchronization that occurs in the central clock may be part of a complex evolutionary adaptation to seasonal light changes, but the mechanism, in effect, becomes confused when confronted with unnatural and dramatic shifts in light schedules.

‘Social jet lag’ causes fatigue and illness

By Clive Cookson in Munich Published: July 17 2006

Half the people in modern urban societies suffer from “social jet lag” because their body clocks are seriously out of step with their real lives, the Euroscience forum in Munich heard on Monday.

The result was chronic fatigue and an increased susceptibility to disease, researchers found. They concluded that employers should tell staff to wake up in their own time and come in to work when they feel ready to.

Till Roenneberg, a circadian rhythm researcher at Ludwig Maximilians University in Munich, coined the phrase “social jet lag” after a survey of 40,000 people in Germany and Austria – and a more detailed follow-up study of 500 – showed a persistent mismatch of at least two hours between their biological clocks and the demands of their jobs or education.

The reason, according to Prof Roenneberg, is that humans evolved to live out of doors, where full daylight constantly resets their internal clocks. In the absence of strong light, the body clock has a running period longer than 24 hours per day. Interior light levels are hundreds of times lower than daylight, he said, “so we lose our main signal for locking onto external time”.

“During the working week many people with office jobs spend only 10 or 15 minutes per day outside, with no roof over their head,” said Prof Roenneberg. Public transport operators could help by ordering buses and trains with glass roofs, to give commuters maximum daylight on the way to and from work.

He told the meeting it was simple to detect an individual’s “chronotype”, which showed how well or badly his or her internal clock was attuned to the external world.

One striking research finding was that people suffering from social jet lag were much more likely to smoke. “Among those who had no social jet lag, 10 per cent smoked; at two hours the proportion was up to 30 per cent and at four hours we found 60 per cent smoked.”

Biological clock researchers say society as a whole pays far too little attention to the stresses caused by the mismatch between modern life and the ancient human body clock.

“It is extraordinary how we marginalise internal time,” said Russell Foster of Oxford University. “Part of the answer lies in better education. In many medical schools today, a future doctor might receive just one lecture about sleep and the circadian rhythm in the course of a six-year medical education.”

Employers and schools could do a lot to help, by adjusting their working hours, said Martha Merrow of Groningen University in the Netherlands. “Schools should open later; I think 10am would be sensible but no one wants the inconvenience of making the change.”

According to Prof Roenneberg, “those people who suffer the least social jet lag are late types who can choose their own working times. Employers should say: ‘Please wake up in your own time and come in when you are ready.’”

Sleeping With the Lights On: Discovery of New Fruit Fly Protein Illuminates Circadian Response to Light

June 28, 2006- By: Karen Kreeger

Researchers at the University of Pennsylvania School of Medicine have identified a new protein required for the circadian response to light in fruit flies. The discovery of this protein - named JET - brings investigators one-step closer to understanding the process by which the body’s internal clock synchronizes to light. Understanding how light affects circadian (24-hour) rhythms will likely open

doors to future treatments of jetlag.

The body's 24-hour clock controls a multitude of internal functions such as periods of sleep and wakefulness, body temperature, and metabolism. Although circadian function produces a stable rhythm in the body, the biological clock will reset in response to light. The human condition known as jet lag takes place during the period when the body is attempting to resynchronize to the environmental light changes brought on by travel, namely from one time zone to another.

A mutant fruit fly that possesses jetlag-like behaviors enabled senior author Amita Sehgal, PhD, Professor of Neuroscience at Penn and a Howard Hughes Medical Institute (HHMI) Investigator, and colleagues to identify the gene and subsequent protein that aids in the response of the internal biological clock to light. The researchers report their findings in most recent issue of Science.

To test the circadian rhythm of fruit flies, Sehgal and others exposed wild type (control) and mutant flies to several light and dark settings - constant darkness, constant light, and equal periods of light and darkness (a light-dark cycle). During exposure to constant light for one week, the controls developed a disrupted sleep pattern after a few days, while the mutants maintained a regular circadian rhythm. The mutant and control flies displayed no behavioral differences during their exposure to constant darkness and the light-dark cycle. However, when the fruit flies were shifted from one light-dark cycle to another, the mutant flies took two days longer to adjust their sleep-wake cycle to the new light-dark schedule.

"The behavior of the mutant flies is similar to that displayed in a person who has prolonged jetlag," notes Sehgal. In search of answers to the mutant's defective circadian response to light, Sehgal and colleagues looked to the molecular details of the clock cells in the jetlag flies. When a fruit fly is exposed to light, a photoreceptor called cryptochrome (CRY) transduces the light signal and kicks off a series of reactions within the clock cells of the brain. Under normal conditions, CRY will respond to light by binding to a protein called timeless (TIM). A second protein, a member of the F-box protein family, also binds to TIM, signaling TIM for cellular destruction.

Genetic analysis revealed that the jetlag flies possess a mutation in a gene that encodes a member of the F-box protein family. A closer examination of the protein produced by the mutated sequence led researchers to JET, a new protein within the F-box protein family.

"Since the degradation of TIM always happens in the presence of light, the animal associates the absence of TIM with daytime hours," explains Sehgal. The mutated JET protein reduces the light-dependent degradation of TIM and the circadian response to light.

Sehgal and others were able to reverse the behaviors in the jetlag flies by genetically replacing the mutated gene sequence with the normal sequence, which led to the production of the wild-type (control) JET protein. When the jetlag flies acquired the normal JET protein, regular TIM degradation took place and the fruit fly was better able to adjust to shifts in the light-dark cycle.

Future studies in the Sehgal lab will focus on continuing to identify other molecules required for the circadian response to light. "Some of the molecules required for the circadian light response in flies may be conserved in humans. Over time, we will have a better understanding of how the human clock responds to light and may be able to design drugs to treat jetlag," concludes Sehgal.

Glossary of Sleep Terminology

advanced sleep phase syndrome (ASPS)

disorder in which the major sleep episode is advanced in relation to the desired clocktime, that results in symptoms of compelling evening sleepiness, an early sleep onset, and an awakening that is earlier than desired. This is classified as a circadian rhythm disorder. The sleep phase occurs well ahead of the conventional bedtime and the tendency is to wake up too early. The major complaint may concern either the inability to stay awake in the evening, or early morning awakening insomnia, or both.

altitude insomnia

insomnia that occurs when people go to higher altitudes. Usually accompanied by headaches, loss of appetite, and fatigue. Twenty-five percent of individuals who go from sea level to 2,000 meters will have some symptoms. Also called Acute mountain sickness, Acosta's disease, Alpine sickness, and hypobaropathie.

anesthesia

complete or partial loss of sensation, usually caused by artificially produced unconsciousness.

antihistamines

drugs which combat the effects of histamine. (Histamine is a chemical released by certain cells of the body.) Used to reduce nausea and sickness. Drowsiness is a detrimental side-effect when used for these purposes, but this drowsiness is desired when the drugs are used to treat insomnia.

arousal

awakening from sleep. Also sometimes refers to a change from a "deeper" stage of non-REM sleep to a "lighter" stage

arousal disorder

parasomnia disorder presumed to be due to an abnormal arousal function. Classical arousal disorders: sleepwalking, sleep terrors and confusional arousals.

arousal threshold

in scientific studies this is a parameter that measures how easily a sleeping person is awakened.

benzodiazepines

group of medicines called central nervous system (CNS) depressants. First developed in the 1950's, these drugs tranquilize and sedate. They work by slowing down the activity of the central nervous system. They slow the messages going to and from the brain to the body, including physical, mental and emotional responses. Also referred to as 'minor tranquilizers'.

Benzodiazepines include Diazepam (brand names Valium, Ducene) , Oxazepam (Alepan, Murelax, Serepax), Nitrazepam (Alodorm, Mogadon), Flunitrazepam (Rohypnol), and Temazepam (Normison, Euhypno).

Benzodiazepines (ben-zoe-dye-AZ-e-peens) belong to the group of medicines called central nervous system (CNS) depressants (medicines that slow down the nervous system).

Some benzodiazepines are used to treat insomnia.

biological clock

a collection of cells that regulates an overt biological rhythm, such as the sleep/wake cycle, or some other aspect of biological timing, including reproductive cycles or hibernation.

brain waves

the brain's spontaneous electrical activity studied by electroencephalography (EEG).

bruxism

teeth grinding or jaw clenching during sleep. The term "clenching" means you tightly clamp your top and bottom teeth together, especially the back teeth. The stressful force of clenching causes pressure on the muscles, tissues, and other structures around your jaw.

cataplexy

sudden muscle weakness associated with narcolepsy. It is often triggered by emotions such as anger, surprise, laughter, and exhilaration. No loss of consciousness is involved – i.e. it is not a black out or a faint, and, despite the phonetic similarity of 'narcolepsy' and 'cataplexy' with 'epilepsy', not epileptic in nature. You are fully conscious, you just can't move.

cerebral cortex

the brain's outer layer of gray tissue that is responsible for higher nervous function.

circadian

exhibiting a periodicity of 24 hours.

circadian rhythm

relating to or exhibiting approximately 24-hour periodicity, especially related to fluctuation of behavioral and physiological functions, including sleep waking. Sometimes to a different (e.g., 23 or 25 hour) periodicity when light/dark and other time cues are removed. Circadian Rhythm Sleep Disorders are disorders that are related to the timing of sleep within the 24-hour day. Some of these disorders are influenced by the timing of the sleep period that is under the individual's control (e.g., shift work or time zone change). Others in this group are disorders of neurological mechanisms (e.g., irregular sleep-wake pattern and advanced sleep phase syndrome).

CPAP - Continuous Positive Airway Pressure

a machine that helps a person who has apnea breathe more easily during sleep by sending blowing air at a constant, continuous pressure. During sleep, CPAP patients wear a face mask connected to a pump that forces air into the nasal passages at pressures high enough to overcome obstructions in the airway and stimulate normal breathing.

There are two major types of CPAP machines: Nasal CPAP and Bilevel positive airway pressure, or BiPAP. In nasal CPAP, the airway pressure delivered into the upper airway is continuous during both inspiration and expiration. BiPAP differs from CPAP in that the pressure during expiration may be adjusted separately from the pressure delivered during inspiration.

delayed sleep phase syndrome

circadian-rhythm sleep disorder thought to result from the endogenous circadian pacemaker being “stuck” at a later-than-normal phase, relative to the desired sleep-wake schedule. The basic pathophysiology of DSPS remains poorly understood.

deep sleep

refers to combined non-REM sleep stages 3 and 4.

delayed sleep phase

disorder in which the major sleep episode is delayed by 2 or more hours of the desired bedtime. This causes difficulty awakening at the desired time. Symptoms include:

- Complaint of insomnia or excessive sleepiness
- Inability to fall asleep at the desired time
- Inability to wake up at the desired time
- Depression (sometimes)
- This sleep pattern has been present for 3 months

delta sleep

stage of sleep in which EEG delta waves are prevalent or predominant (sleep stages 3 and 4, respectively). Called "slow wave" sleep because brain activity slows down dramatically from the "theta" rhythm of Stage 2 to a much slower rhythm of 1 to 2 cycles per second called "delta" and the height or amplitude of the waves increases dramatically. In most adults these two stages are completed within the first two 90 minute sleep cycles or within the first three hours of sleep. Contrary to popular belief, it is delta sleep that is the "deepest" stage of sleep and the most restorative.

delta waves

brain waves with a frequency of 1 to 3 hertz that emanate from the forward portion of the brain during deep sleep in normal adults.

desynchronization

in the context of sleep studies and disorder diagnosis, refers to lack of alignment between external signals and the biological clock.

diagnostic sleep study

monitoring of several physiological activities. Usually performed to determine the absence or presence of a specific sleep disorder. The sleep study can occur in a sleep disorders center or in a patient's home with portable recording equipment.

diurnal

active or occurring during the daytime; repeating once each day.

drowsiness

sleepiness

electroencephalogram (EEG)

a measurement of the electrical activity associated with brain activity.

electromyogram (EMG)

a measurement of the electrical activity associated with muscle movements.

electrooculogram (EOG)

a measurement of the electrical activity associated with eye movements.

endocrine system

the ductless glands in the body that secrete hormones.

entrain

to reset or align with the biological clock.

enuresis

bed-wetting

epworth sleepiness scale

a scale indicating propensity to sleep during the day as perceived by patients. From the subjective answers to 8 questions. A sample is at <http://www.stanford.edu/~dement/epworth.html>

The scale was developed by researchers in Australia and is widely used by sleep professionals around the world to measure sleep deprivation. Excessive daytime sleepiness (EDS) (also "excessive daytime somnolence") - subjective report of difficulty in staying awake, accompanied by a ready entrance into sleep when the individual is sedentary

EDS suggests the presence of a significant sleep disorder and is different from fatigue. Depression, anxiety, stress, and boredom are commonly thought to cause excessive sleepiness, but in fact these conditions cause fatigue and apathy.

endogenous rhythms

rhythms driven by an internal, self-sustaining biological clock rather than by signals that are external to the organism (for example, light).

exogenous rhythms

rhythms that are directly regulated by an external influence, such as an environmental cue. They are not generated internally by the organism itself.

fatigue

feeling of tiredness, weariness or lack of energy usually associated with lower performance (physical or mental). Fatigue is different from drowsiness. In general, drowsiness is feeling the need to sleep, while fatigue is a lack of energy and motivation. Drowsiness and apathy (a feeling of indifference or not caring about what happens) can be symptoms of fatigue. Fatigue often develops in response to physical exertion, emotional stress, boredom, or lack of sleep.

GABA (Gamma-Aminobutyric Acid)

an amino acid neurotransmitter (C₄H₉NO₂) in the brain. Believed to be involved in muscle relaxation, sleep, diminished emotional reaction and sedation.

hallucination

a false and distorted perception of objects or events.

homeostasis

the ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its internal processes.

homeostatic regulation of sleep

refers to the neurobiological signals mediating the pressure or urge to sleep.

hypersomnia

excessive sleep, characterized by recurrent episodes of unusual daytime sleepiness or prolonged nighttime sleep. Different from feeling tired due to lack of or interrupted sleep at night, persons with hypersomnia are compelled to nap repeatedly during the day, often at inappropriate times such as at work, during a meal, or in conversation. These daytime naps usually provide no relief from symptoms. The symptoms are typically treated, not the underlying problem. Stimulants, such as amphetamine, methylphenidate, and modafinil, may be prescribed. Other drugs that doctors sometimes use include clonidine, levodopa, bromocriptine, antidepressants, and monoamine oxidase inhibitors. Page on [hypersomnia](#).

hypnagogic hallucination

a “greater-than-life-like” dream experience. Sometimes associated with narcolepsy.

hypnogram

a graphical summary of the electrical activities occurring during a night's sleep.

hypothalamus

the part of the brain that lies below the thalamus and regulates body temperature and metabolic processes.

hypnotics

medications that cause sleep or partial loss of consciousness.

hypocretin

peptide involved in sleep cycle. Also called orexin.

imidazopyridines

relatively new class of drugs inducing sleepiness. related to benzodiazepines. They include zolpidem (Ambien) and alpidem

insomnia

complaint describing difficulty in sleeping. People with insomnia have one or more of the following:

- difficulty falling asleep
- waking up often during the night and having trouble going back to sleep

- waking up too early in the morning
- unrefreshing sleep.

Insomnia can cause problems during the day, such as sleepiness, fatigue, difficulty concentrating, and irritability. Page on [insomnia](#).

jet lag

describes a combination of symptoms induced by a major rapid shift in environmental time during travel to a new time zone. Called "jet" lag because of the often noticed after airplane flights. Fatigue, irritability, dehydration, and a broken sleep pattern are common symptoms of jet lag.

light sleep

term used in clinical practice to describe non-REM stage 1, and sometimes, stage 2 sleep. People in light sleep drift in and out of sleep and can be awakened easily. Eyes move very slowly and muscle activity slows. People awakened from stage 1 sleep often remember fragmented visual images. Many also experience sudden muscle contractions called hypnic myoclonia, often preceded by a sensation of starting to fall.

light therapy

form of therapy where the person is exposed to bright light at the appropriate time of day to effect the timing, duration and quality of sleep. Also used in the treatment of Seasonal Affective Disorder.

luteinizing hormone

a glycoprotein secreted by the pituitary gland. It stimulates the gonads to secrete sex steroids.

melatonin

a hormone secreted by the pineal gland that is derived from the amino acid tryptophan, which helps synchronize biological clock neurons in the suprachiasmatic nucleus.

micro-arousal

partial awakening from sleep. An episode where a sleeper partially awakes, but is not aware of it

micro-sleep

period lasting up to a few seconds during which people appear to be asleep in otherwise waking periods. Cause for concern for people in certain critical jobs.

multiple sleep latency test (MSLT)

a common sleep test given at sleep labs in the diagnosis of sleep disorders. The multiple sleep latency test records brain waves (via EEG), heart rate (via EKG), muscle activity and eye movements. Often given as a series of "nap tests". nap short period of sleep at a time separate from the major sleep period, especially during the day

narcolepsy

sleep disorder characterized by brief attacks of deep sleep, and with symptoms including excessive sleepiness, cataplexy, sleep paralysis, hypnagogic hallucinations, overwhelming

daytime sleepiness (even after adequate nighttime sleep), and an abnormal tendency to pass directly from wakefulness into REM sleep. Not all narcoleptics have all of these symptoms.

natural short sleeper

Person who habitually and spontaneously sleeps substantially less in a 24-hour period than is expected for a person in his or her age group, and does not have excessive sleepiness. Although there is a broad range of variation in the individual need for sleep, the typical adult requires an average of 7 to 10 hours each night. Short sleepers have a daily total sleep time of less than 75% of the age-related norm, and awaken spontaneously.

neurotransmitter

a chemical produced by neurons that carries messages to other neurons.

nightmare

unpleasant and/or frightening dream that usually awakens the sleeper. Unlike night terrors, nightmares occur during REM sleep.

night terrors

also known as sleep terrors, or pavor nocturnus. Incomplete arousal from slow wave sleep accompanied by a state of intense fear and agitation sometimes experienced, especially by children, on awakening from a stage of sleep not associated with dreaming but characterized by extremely vivid hallucinations. The person awakens in terror with feelings of anxiety and fear but is unable to remember any incident that might have provoked those feelings. In contrast, people who wake up from nightmares often recall some of the dream.

nocturia

urination at night especially when excessive

nocturnal

relating to or taking place at night.

nocturnal sleep-related eating disorder (NS-RED)

eating while sleepwalking. Typically the person doesn't remember eating when he or she wakes up.

nocturnal Enuresis

Bedwetting. Urinating during sleep NREM non-REM sleep - a normal part of sleep accounting for typically 75-80% of sleep time. Characterized by slower and larger brain waves than in REM.

obstructive sleep apnea (OSA)

a disorder in which breathing is frequently interrupted for brief intervals during sleep, resulting in intermittent decreases in blood oxygen levels and transient arousals from sleep, leading to poor sleep quality and excessive daytime sleepiness.

orexin

protein neurotransmitter or neuropeptide active in the sleep cycle and in appetite. Peptide family comprised of two peptides, orexin-A (hypocretin-1) and orexin-B (hypocretin-2). Subject of great research at this time. Deficiency is associated with narcolepsy.

photoperiod
the light/dark or day/night cycle.

photoreceptor
a molecule or structure that can detect light.

pons
the brainstem region critical for initiating REM sleep.

parasomnias
disorders that intrude into the sleep process and create disruptive sleep-related events. These behaviors and experiences occur usually while sleeping, and are most often infrequent and mild. They may happen often enough or become so bothersome that medical attention is required. The parasomnias are typically classified as: (1) arousal disorders (2) sleep-wake transition disorders (3) parasomnias usually associated with REM sleep and (4) other parasomnias.

phase advance
a shift earlier in time, for instance if someone starts going to bed earlier and waking up earlier.

phase delay
a shift later in time, for instance if one's sleep cycle moves ahead on the clock

polysomnogram (PSG)
continuous and simultaneous recording of physiological variables during sleep, i.e., EEG, EOG, EMG (the three basic stage scoring parameters), EKG, respiratory air flow, respiratory excursion, lower limb movement, and other electrophysiological variables. See [polysomnograms](#).

polysomnograph
a test of sleep cycles and stages through the use of continuous recordings of brain waves (EEG), electrical activity of muscles, eye movement (electrooculogram), breathing rate, blood pressure, blood oxygen saturation, and heart rhythm and direct observation of the person during sleep

obesity-hypoventilation syndrome
a condition related to obstructive sleep apnea in which a very obese person does not breathe sufficient air during sleep or while awake. Also called Pickwickian syndrome

obstructive apnea
apnea due to a mechanical obstruction, such as a very large uvula or tongue in the back of the mouth, or a problem with the trachea.

rebound insomnia

sleep difficulties after discontinuing use of a hypnotic medication.

REMS latency

period of time from sleep onset to the first appearance REM.

REMS Motor Atonia

when the large skeletal muscles go limp during REM sleep.

REM period

REM portion of a NREM-REM cycle; early in the night it may be as short as a half-minute, whereas in later cycles longer than an hour.

REM Sleep Behavior Disorder (RBD)

very rare disorder in which sleeper acts out dreams, often violently, and has bodily movement. The body is usually paralyzed during REM sleep. People often report an ongoing, hallucinatory REM dream episode during their activity. May be a warning sign of Parkinson's disease. Often associated with neuropathologies including: vascular insult, tumors, and brain degenerative disorders.

rapid eye movement (REM) sleep

deep sleep period with rapid eye movements. Normal part of sleep cycle. Recurs cyclically several times during a normal period of sleep. Characterized by increased neuronal activity of the forebrain and midbrain, by depressed muscle tone. Most dreaming occurs in this stage, which accounts for about 20% of sleep in adults.

REM Sleep Rebound

increase in REM sleep following unnatural reduction. Extension of time in, and an increase in frequency and density of REM sleep episodes.

restless legs syndrome (RLS)

sleep disorder characterized by a deep creeping, or crawling sensation in the legs that tends to occur when an individual is not moving. There is an almost irresistible urge to move the legs; the sensations are relieved by movement. The sensations have the following features: · Occur during periods of inactivity · Become more sensitive in the evening and at night · Are relieved by movement of the limb · Often cause difficulty staying or falling asleep, which leads to feelings of daytime tiredness or fatigue · May cause involuntary jerking of the limbs during sleep and sometimes during wakefulness Up to 8% of the adult population may have this condition.

seasonal affective disorder (SAD)

a form of depression caused by inadequate bright light reaching the biological clock in the suprachiasmatic nucleus. Consequently, treatment often involves the use of light therapy.

sedatives

chemicals (sometimes medicines) tending to calm, and reduce nervousness or excitement and foster sleep. Many medicines are sedatives; sometimes they are administered for that purpose.

Sometimes sedation is an undesired side effect. Common sedatives include Antihistamines, Benzodiazepines, Imidazopyridines, and herbal sedatives.

sleep

the natural periodic suspension of consciousness during which the powers of the body are restored, characterized by lessened consciousness and slowed-down metabolism

sleep apnea

condition where the sleeper repeatedly stops breathing for 10 or more seconds during sleep. The Greek word "apnea" literally means "without breath." There are three types of apnea: obstructive, central, and mixed; of the three, obstructive is the most common. Can be dangerous as people with sleep apnea sometimes stop breathing hundreds of times during the night and often for a minute or longer.

sleep architecture

NREM/REM stage and cycles of sleep and time spent in each stage. Also called sleep-timing mechanism. One's sleep architecture changes with age. Middle-aged and elderly people tend to spend less time in deeper sleep than younger people. By age 60 or 70, many adults experience a decrease in the proportion of time spent in delta sleep. The percentage of REM sleep remains relatively stable.

sleep cycle

term used by scientists and sleep researchers to describe the pattern of sleep stages, especially the NREM-REM cycle

sleep debt

physiological state that results from recurrent sleep deprivation occurs over time. When an individual does not experience sufficient restorative daily sleep required to maintain a sense of feeling rested and refreshed.

sleep deprivation

acute or chronic lack of sufficient sleep.

sleep disorders

general term applied to a broad range of illnesses, including dysfunctional sleep mechanisms, abnormalities in physiological functions during sleep, abnormalities of the biological clock, and sleep disturbances that are induced by factors extrinsic to the sleep process

sleep fragmentation

sleep interruption due to frequent or sustained awakenings or early morning awakenings

sleep hyperhidrosis

profuse sweating that occurs during sleep

sleep hygiene

conditions and practices that promote continuous and effective sleep. These include bedtime routines, regular bed and arise times. And regularly getting enough sleep to avoid sleepiness during the day. For some people, can also refer to limiting alcoholic and caffeinated beverages

prior to bedtime and using exercise, nutrition, and environmental factors so that they enhance, not disturb, restful sleep

sleep inertia

feelings of grogginess and/or sleepiness that persist longer than 10 to 20 minutes after waking up. Symptoms include what goes under the scientific term is transitory "hypovigilance" or low vigilance, along with confusion, disorientation of behavior and impaired cognitive and sensory-motor performance. Happens often when a person is aroused from deep sleep in the first part of the night. More on [sleep inertia](#).

sleep hyperhydrosis

profuse sweating during sleep.

sleep latency

the time between going to bed and sleep onset. Similarly, the term "REM sleep latency" refers to the time between sleep onset and the onset of the first episode of REM sleep. The term "sleep efficiency" refers to the proportion of time in bed that is spent sleeping.

sleep maintenance

sleep fragmentation

sleep paralysis

temporary inability to talk or move when falling asleep or waking up. It occurs normally during REM sleep.

sleep talking

utterance of speech or sounds during sleep without awareness of the event. Takes place during stage REMS, representing a motor breakthrough of dream speech, or in the course of transitory arousals from NREMS and other stages. The person is not fully consciousness and retains no memory of the talking. Symptoms include:

- speech or utterances during sleep
- episodes are not associated with awareness of talking
- polysomnography (sleep recording) shows episodes of sleep talking that can occur in any stage of sleep
- possible association with psychiatric disorders such as anxiety disorders
- possible association with medical disorders such as febrile illness (fever)
- possible association with other sleep disorders such as sleepwalking, obstructive sleep apnea
- syndrome, or REM sleep behavior disorder

sleepiness

somnolence, drowsiness - state where the subject finds it difficult to maintain the wakeful state and falls asleep if not actively kept aroused. Differs from simply a feeling of physical tiredness or listlessness.

sleepwalking

somnambulism. A sleep disorder where the person gets out of bed and walks around during sleep. Typically occurs in the first third of the night during deep NREM sleep (stages 3 and 4). This sleep disorder affects an estimated 10 percent of all humans at least once in their lives. Most common among children from the ages of 4 to 12. Boys sleepwalk more frequently than girls and that it is between the ages of 11 and 12 that the most cases of sleepwalking are reported.

somniloquy

talking while asleep

snoring

noise produced with inspiratory respiration during sleep owing to vibration of the soft palate and the pillars of the oropharyngeal inlet. Forty-five percent of normal adults snore at least occasionally, and 25 percent are habitual snorers. Problem snoring is more frequent in males and overweight persons, and it usually grows worse with age. Problem snorers may develop obstructive sleep apnea.

Stanford Sleepiness Scale

7-point rating scale consisting of seven numbered statements describing subjective levels of sleepiness/alertness. An example can be seen at <http://www.stanford.edu/~dement/sss.html>

suprachiasmatic nucleus (SCN)

the part of the brain (in the hypothalamus) that contains the biological clock.

thalamus

a part of the brain consisting of two large ovoid structures at the base of the cerebrum. It acts as a vital relay station between the sensory nerves and the cerebral cortex.

thermoregulation

the process of regulating body temperature.

ultradian rhythm

A periodicity of less than 24 hours.

unihemispheric sleep

a type of sleep in which one side of the brain is asleep while the other is awake. This phenomenon is observed most notably in birds (like those that make long, transoceanic flights) and aquatic mammals (like dolphins and porpoises).

uvulopalatopharyngoplasty (UPPP)

an operation on the throat to treat severe snoring and sleep apnea. Soft tissue on the back of the throat and soft palate (the uvula) is removed. The tonsils and possibly other excess tissue may also be removed, if present.

white noise

heterogeneous mixture of sound waves extending over a wide frequency range that may be used to mask unwanted noise that may interfere with sleep

zeitgebers

German for "time givers". External cues that affect the Circadian cycle. Examples include sunlight, familiar morning noises and sounds, and meals.

Post Test

Select the *best* answer to each of the following items. Mark your responses on the Answer Form.

1. Jet lag, or _____, is a temporary condition that some people experience following air travel across several time zones in a short period of time.

- a. insomnia
- b. desynchronosis
- c. transmeridian syndrome
- d. None of the above

2. Travelers who sleep normally prior to transmeridian travel are _____ to jet lag; the symptoms result when a person's internal clock attempts to acclimate to a new external environment.

- a. immune
- b. not immune
- c. prone
- d. None of the above

3. For example, many symptoms attributed to jet lag are actually caused by the environment of the airplane, such as _____.

- a. cramped environment
- b. dry air (humidity in an airplane is very low),
- c. pressurization
- d. All of the above

4. The body operates with many circadian rhythms, such as _____.

- a. endocrine (gland and hormone) function
- b. airway function
- c. body temperature regulation
- d. All of the above

5. Inherent differences in body condition among travelers determine varying strategies for jet lag management. These include _____.

- a. proper nutrition
- b. good sleep
- c. use of medication
- d. All of the above

6. _____ may be of limited benefit for the first two days following flight, especially if one needs a full night's sleep to perform the next day.

- a. Sleeping pills
- b. Sedatives
- c. Hypnotics
- d. All of the above

7. Some simple behavioral adjustments before, during and after arrival at your destination can help minimize some of the side effects of jet lag. Among those adjustments are:

- a. Anticipate the time change for trips by getting up and going to bed earlier several days prior to an eastward trip and later for a westward trip.
- b. Upon arrival at a destination, avoid heavy meals (a snack—not chocolate—is okay).
- c. Avoid any heavy exercise close to bedtime. (Light exercise earlier in the day is fine.)
- d. All of the above

8. The higher the altitude, the greater the sleep disruption. Generally, sleep disturbance becomes greater at altitudes of _____ feet or more. The disturbance is thought to be caused by diminished oxygen levels and accompanying changes in respiration.

- a. 5,280
- b. 9,800
- c. 13,200
- d. 40,000

9. While pills do not resolve the _____ imbalance caused by jet lag, they may help manage short-term insomnia brought on by travel.

- a. natural
- b. homeostatic
- c. biological
- d. synaptic

10. _____ is a naturally secreted hormone in humans that affects the body's circadian rhythms. There is some evidence that when administered during the day, melatonin increases the tendency to sleep, but at night, the amount of sleep is unaffected.

- a. Suprachiasma
- b. Desynchronia
- c. Methania
- d. Melatonin

11. Since sleep-wake disturbance is the most widely felt effect of jet lag, being well rested before travel can only help the body cope with the inevitable change in time zone. This includes avoiding _____.

- a. nicotine
- b. caffeine
- c. alcohol
- d. All of the above

12. The symptoms of jet lag begin within 1 or 2 days after air travel across at least 2 time zones. A discernable disruption of the normal circadian sleep-wake cycle is present. Those symptoms include which of the following:

- a. Tired muscles
- b. Moodiness
- c. Increase in the frequency of nocturnal awakening to urinate
- d. All of the above

13. A time zone is a geographical region in which every clock keeps the same time. In all, the world has 24 time zones, one for each hour in the day. Each zone runs from north to south in strips of approximately _____ miles wide.

- a. 1,000
- b. 2,000
- c. 3,000
- d. 6,000

14. A helpful way to minimize the impact of jet lag is to begin adjusting to the new time zone and schedule. When you get on the plane, set your watch to your destination's time. Then think about when you'll eat and sleep there. Try to begin eating and sleeping at those times.

- a. True
- b. False

15. All age groups are susceptible, but individuals over the age of 50 are more likely to develop jet lag than those under the age of 30.

- a. True
- b. False

16. A new study demonstrates that the brain's central timekeeper — the biological clock that regulates waking and sleeping cycles — has two parts that fall out of synchrony during light schedule shifts of six hours, the time it takes to fly across the Atlantic.

- a. True
- b. False

17. Most people require about _____ to adjust to a six-hour flight from Europe to the United States, and even longer after an eastbound trans-Atlantic flight.

- a. one-and-a-half days
- b. two-and-a-half days
- c. three days
- d. none of the above

18. Importantly, one study identifies the neurotransmitter GABA (gamma-aminobutyric acid) as the link between the two clock parts that eventually pulls them back into synchronization.

- a. True
- b. False

19. The investigators found that the dorsal and ventral sections of the suprachiasmatic nucleus (SCN), the brain's central timekeeper, adjust to shifts in light schedules at vastly different rates, potentially causing the difficult period of adjustment that most people experience after air travel across several time zones.

- a. True
- b. False

20. Till Roenneberg, a circadian rhythm researcher at Ludwig Maximilians University in Munich, coined the phrase “social jet lag” after a survey of 40,000 people in Germany and Austria – and a more detailed follow-up study of 500 – showed a persistent mismatch of at least two hours between their biological clocks and the demands of their jobs or education.

- a. True
- b. False

21. According to one study, half the people in modern urban societies suffer from “social jet lag” because their body clocks are seriously out of step with their real lives.

- a. True
- b. False

22. One striking research finding was that people suffering from social jet lag were much more likely to smoke. “Among those who had no social jet lag, 10 per cent smoked; at two hours the proportion was up to 30 per cent and at four hours we found 60 per cent smoked.”

- a. True
- b. False

23. According to one study, those people who suffer the least social jet lag are late types who can choose their own working times. Employers should say: ‘Please wake up in your own time and come in when you are ready.’”

- a. True
- b. False

24. Researchers at the University of Pennsylvania School of Medicine have identified a new protein required for the circadian response to light in fruit flies. The discovery of this protein - named JET - brings investigators one-step closer to understanding the process by which the body’s internal clock synchronizes to light.

- a. True
- b. False

25. In one study, researchers were able to reverse the behaviors in the jetlag flies by genetically replacing the mutated gene sequence with the normal sequence, which led to the production of the wild-type (control) JET protein. When the jetlag flies acquired the normal JET protein, regular TIM degradation took place and the fruit fly was better able to adjust to shifts in the light-dark cycle.

- a. True
- b. False

26. In scientific studies, the arousal threshold is a parameter that measures how easily a sleeping person is awakened.

- a. True
- b. False

27. _____ is(are) group of medicines called central nervous system (CNS) depressants.

- a. Diurnals

- b. GABA
- c. Benzodiazepines
- d. None of the above

28. _____ is the ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its internal processes.

- a. Hypersomnia
- b. Homeostasis
- c. Hypnogram
- d. None of the above

29. _____ is the part of the brain that lies below the thalamus and regulates body temperature and metabolic processes.

- a. Hypocretin
- b. Orexin
- c. Hypothalamus
- d. None of the above

30. A _____ is a shift earlier in time, for instance if someone starts going to bed earlier and waking up earlier.

- a. rebound insomnia
- b. REMS latency
- c. phase advance
- d. None of the above

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