

# Fatigue

## And Motorcycle Touring

by Don Arthur, M.D.

**A**S THE SUN sets and the miles pass, fatigue becomes our shadow but never our friend. The pleasures of a riding vacation can melt into frustration if a rider pushes the day's miles beyond his or her abilities. This article discusses the elements of fatigue, how to recognize its subtle signs, and how to ride more safely.

### SLEEP

Our brains are complex organs that fatigue during waking hours, accumulating a physiologic debt that is repaid only by sleeping. During sleep, the chemical balance is restored in those areas of the brain which are required for conscious activity. This cycle is normal and immutable. The exact mechanism has been extensively studied and is so complex that, for all practical purposes, it could be called "magic."

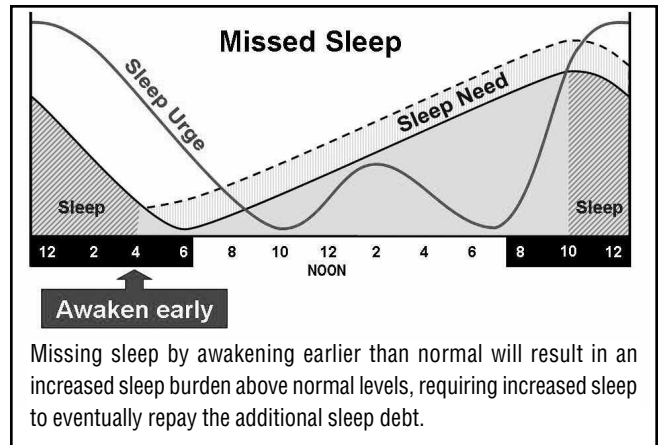
Each individual requires a specific, genetically set, amount of sleep. Most people need about eight hours, but the normal range is somewhere between six and 10 hours. Einstein required 10 hours of sleep each night. Sleeping two hours less than required significantly decreases one's performance and alertness. These effects are cumulative—sleeping less each night eventually results in a sleep debt that must be repaid to return the brain to baseline function. The good news is that the debt does not have to be paid in full hour-for-hour but it must eventually be paid by obtaining deep sleep, not multiple short naps. Unfortunately, one cannot bank sleep—accumulate sleep in anticipation of the need.

### CIRCADIAN RHYTHM

Our internal physiologic clocks regulate all of our body's automatic functions—including the sleep-wakefulness cycle. Each person is programmed with his or her own requirements and cycle times. This internal clock tries to keep us on a normal 24-hour sleep rhythm and is synchronized to light (day) and dark (night) cycles.

Traveling through different time zones shifts the clock forward or backward, temporarily disrupting the normal circadian rhythm. In general, accommodation to such effects takes one day for every time zone traversed.

Light deprivation at night has two effects. Our body's sleep center interprets darkness as a signal to initiate sleep. Compounding this circadian signal, the lack of stimulation and visual cues at night deprive the brain of the activity that would help maintain alertness. Without the higher level of stimulation offered during daylight

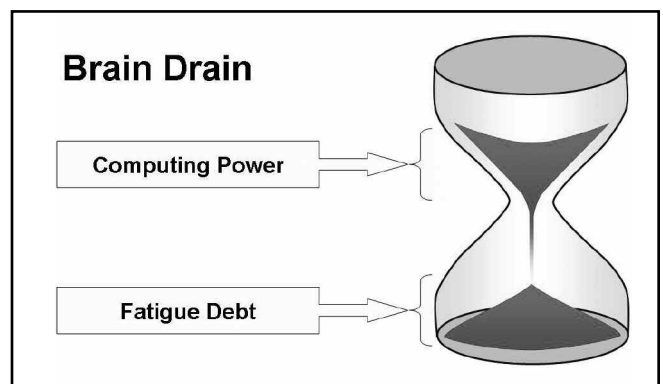
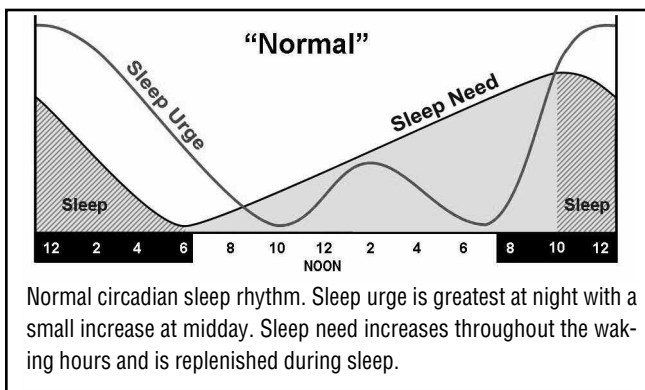


hours, our brains more easily slip into the sleeping mode. Increasing external stimulation may help extend wakefulness by temporarily overcoming the circadian preference to induce sleep. Studies have shown that greater physical fitness allows individuals to tolerate circadian rhythm shifts better.

Researchers have also documented a "drone effect" which describes individuals who become momentarily functionally incapacitated, also known as microsleeps. These periods manifest as a few seconds of open-eyed sleep, paralysis, blurred vision, or other effects of which the victim might be unaware except for a vague feeling of having missed something—parts of a conversation or a section of highway. This is particularly significant to a motorcyclist, who, traveling at 70 mph, covers 103 feet per second, or the length of a football field in just three seconds.

### FATIGUE EFFECTS

Our brains are marvelous computers but they grow weary of constant activity and must be refreshed. Much like an hourglass, our mental processing power slowly ebbs as the fatigue debt increases. The transition affects all performance functions and occurs in such an insidious, gradual manner that we are not usually aware of the decrement. This is especially true if we are engaged in a high-skill or high-tempo activity where the activity distracts attention from the growing fatigue debt.



Although responses to fatigue are individual, there are three common factors that seem to predicate one's functional decrement: 1. Task skill level, 2. level of training, and 3. inherent biological factors. The more practiced and proficient one becomes in a given task and the more complex the task, the greater the resistance to fatigue. Likewise, greater levels of training and experience seem to have protective effects. We cannot control genetically imprinted biological functions but we can certainly affect skill and training levels. In general, less experienced riders are at greater risk than those who have built up their experience level, giving more credence to the wisdom of building one's riding limits.

**Sleepiness:** While it might seem obvious that sleepiness would result from fatigue, we must keep in mind that our brains interpret fatigue as a signal to sleep. The greater the fatigue, the stronger will be the sleep center's inducement to sleep. This may trigger sleep even when unintended—and unanticipated. Microsleeps are one manifestation of the body's drive to obtain the rest needed to reverse the effects of fatigue. Microsleeps may occur during periods of otherwise normal and highly functional activity, causing unexplained variable and unpredictable performance. Concentration failures can occur during periods of activity which appear otherwise normal.

Microsleeps can manifest as failure to recognize hazards, failure

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to take appropriate action in the face of an emergency, inability to make decisions, inability to concentrate, loss of time, failure to negotiate a turn, forgetfulness, and many other symptoms which can be disastrous to a motorcyclist.

The greater the fatigue, the greater is our tendency to underestimate the fatigue burden and magnitude of the drive to sleep. This adds to the danger of unrecognized fatigue effects.

**Mental changes.** As our "computing" power and speed decrease when fatigued, our ability to gain and process new information becomes impaired. The slower we receive and appreciate information, the more delayed our responses become. This is manifested in slower decision-making and longer reaction times. Overall, this reduces our vigilance and increases our risks.

A common symptom of profound fatigue is traveling at a much slower speed than normal. This happens because the brain is processing riding information (apparent speed over the road, scenery passing, motorcycle vibration, wind pressure, etc.) more slowly. Thus, a slower speed may take up the same amount of available brain computing power as normal speed does when the brain is rested. The speeds feel the same to our fatigued brain.

These and other effects are exacerbated at night. As our darkened surroundings provide fewer clues to reality, our mind has less data with which to make proper decisions. As fatigue increases and cues decrease, judgment becomes increasingly faulty. Our minds may "fill in" our perception gaps, causing us to perceive things which are not real. Mistaken perceptions—even hallucinations—are possible as our minds fill in the picture or our surroundings when real data are unavailable or are missed.

Fatigue impairs memory—our ability to store new information and retrieve old information. Stories abound about riders who are critically low on fuel, but ride past an open filling station, forgetting to stop. Unfortunately, these lessons wait to be learned again and again, even by experienced riders.

As information processing becomes more difficult, our tendency is to choose options which require the least effort or have the least risk even if the choice has a lower probability of success than one which is more complex and requires greater thought. We can become fixated on a task and be unable to resolve conflicting thoughts or decision criteria. This could result in effective immobilization, loss of situational awareness, or skipping critical safety actions.

**Psychological changes:** As fatigue increases, sleep becomes an increasingly prominent focus, both consciously and subconsciously. Mood slowly degrades, interfering with socialization functions. This further adds to one's stress and compounds the difficulty in communicating with others.

Fatigue also affects one's motivation as the brain increasingly focuses on satisfying the fatigue debt. This decreased motivation may result in a change in other habits such as eating and drinking less. This can be disastrous if dehydration is added to fatigue.

As we become increasingly unable to perform tasks normally and inhibitions wane, we can become impatient, frustrated, and angry.

A dangerous and insidious effect of fatigue is refusal to recognize the need for sleep and inability to take effective action.

## **PREPARATION**

There are several things you can do to prepare for a period when you expect less sleep than normal:

**Begin rested.** Don't start a fatiguing activity in a state of sleep deficit. Obtain your normal rest for several days prior to the activ-

## **SYMPTOMS OF FATIGUE WHILE RIDING**

### **Slow Reaction Time**

- Braking hard to avoid hazard
- Spilling drinks

### **Reduced Awareness/Vigilance**

- Driving slower than normal
- Being surprised by a passing car
- Tailgating
- Not seeing deer or other road hazards

### **Impaired Memory**

- Passing a gas stop when low on fuel
- Forgetting your wallet after fueling
- Forgetting your spouse's birthday call

### **Impaired Decision-making**

- Not stopping to rest when tired
- Taking an inappropriate route
- Inability to choose from a diner menu

### **Loss Of Situational Awareness**

- Failing to recognize a stop sign or signal
- Not putting the kickstand down
- Failing to put feet down when stopping
- Stopping in a high gear
- Failing to go when light changes
- Inserting eye drops while wearing glasses

### **Performance Decrement**

- Inability to calculate purchase amounts
- Inability to formulate routing plans
- Failure to communicate with riding buddies
- Fixating on a task

ity. If you're going to start an activity early in the morning, try to phase your sleep so you get your normal rest time before awaking. In other words, if you require eight hours of sleep, but will start an activity at 6 a.m., try to be asleep at 9 p.m. the prior evening and give yourself time to awaken and prepare for the day's activities.

**Proper nourishment.** Proper nourishment and hydration is an important preparation. Eating three small meals each day is preferable to having one or two larger meals. Your brain needs the energy sources food supplies—so breakfast is important. Because the body's circadian rhythm produces a natural drowsiness in mid-afternoon, a protein and carbohydrate snack can help stave off this effect.

**Do not overeat.** Large meals are hard to digest and shunt blood and energy away from the brain.

Many small meals are better than a few large feasts.

**Put your mind at rest.** Have all your pre-ride preparations done before retiring the night before a long ride. Tie up the loose ends which might interfere with your ability to rest.

**Physical fitness.** Many studies have shown that people who are physically fit are more able to tolerate the effects of fatigue. A long-standing daily routine should maintain tone and endurance. Carrying less weight will also reduce riding fatigue.

**Prepare your ride.** Your motorcycle should be configured to increase your comfort and decrease the work of riding. Make sure you have a routine and all your equipment is thoroughly road tested. Your bike should fit you, not vice versa.

Here are some important aspects of ride preparation:

**Avoid caffeine.** Caffeine can be useful in helping extend fatigue tolerance. But, its effectiveness is greatly enhanced if used sporadically. If you rely on caffeine every day, your body will expect its nor-

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mal supply. If you don't consume your normal amount of caffeine, you will likely experience fatigue sooner than someone who seldom drinks caffeine. This is one stressor you don't need while riding.

If you are unaccustomed to caffeine, consuming some can help stave off some of the effects of fatigue.

**Alcohol.** Alcohol and riding don't mix and should be avoided for several days prior to a ride. The toxic products of alcohol metabolism adversely affect brain activity long after the noticeable effects have disappeared. Alcohol also interferes with the body's ability to properly process other nutrient sources.

**Alcohol and caffeine are also diuretics—they cause increased urination.** This has two negative effects for riders. Most important, it causes dehydration which can adversely affect performance and

increase susceptibility to fatigue. Also, increased urination means more frequent unscheduled stops.

### COUNTERMEASURES

**Motorcycle and equipment.** Your bike should be configured to produce the least fatigue. Put another way, you should eliminate those things which increase the labor of riding or contribute to developing fatigue. Your motorcycle and all its equipment should be second nature to you—as familiar in the dark and rain as in your garage.



[www.aeroflowscreens.com](http://www.aeroflowscreens.com)

A sufficient windshield to significantly reduce buffeting wind pressure and deflect rain will considerably increase fatigue tolerance. Fatigue ensues much more rapidly when a rider is continually bracing against wind pressure, using torso and leg muscles to remain upright and arm muscles to grip the handlebars. Rain adds another significant level of stress that a good laminar-flow windshield will alleviate. Laminar-flow windshields allow a certain amount of air to flow up the windshield's backside to direct air up and over the rider and minimize a motorcycle's aerodynamic drag.

It's amazing how the constant din of road noise can induce fatigue. Hearing protection significantly decreases this stress. Although not intuitive, most disposable hearing protection cuts out the background noise of the road while allowing conversation and other meaningful sounds to be heard more clearly. They will also decrease the long-term hearing loss associated with exposure to constant environmental noise.

**The ride.** There are many aspects of the actual ride which can affect the accumulation of fatigue debt. The more challenging the ride, the more fatiguing it will be. Some riding factors which quickly produce fatigue are:

- Severe time constraints
- Bad weather
- Excessive heat or cold
- Unfamiliar roads
- Monotonous scenery
- Extended night riding



### PREPARING YOUR RIDE

#### Personal Gear

- Comfortable riding suit, boots, gloves
- Properly fitting helmet
- Waterproofing
- Heating and cooling aids
- Skin and lip hydration and protection

#### Ergonomics—your bike must fit you

- Properly fitted and comfortable seat
- Comfortable riding position
- Convenient footpeg and control locations
- Mirrors correctly located
- Windshield

#### Packing

- Put things in the same place every time
- Put frequently used things on top
- Take only what's necessary
- Be able to find everything in the dark

#### Repair kits

- Take the tools you'll need
- Pack a tire repair kit and means of inflation
- Know how to use them!
- Towing service

#### Communication—your link with others

- CB or FRS radios
- Cell phones—for when you're stopped
- Phone cards for emergencies

- Increased threats—wildlife and traffic
- Riding conditions beyond the rider's ability
- Complex tasks required while riding
- Distractions—mechanical or family problems

Although many of these factors cannot be totally avoided, their impact can be somewhat controlled. Severe time constraints can be minimized by properly planning one's route. Don't bite off more route than you and your bike can swallow. Leave a time and distance cushion toward the end of your route. Know your limits ahead of time and stick to them. Make a promise to yourself and others...write it down. Plan your ride, then ride your plan. Don't try to extend the ride on the fly, when fatigued.

**Effective resting.** There is no substitute for sleep in paying the fatigue debt. Once fatigued, functional ability must be refreshed by replenishing the brain's nutrients and restoring its very delicate chemical balance.

Fortunately, an hour-for-hour sleep payback isn't required. But prolonged, solid sleep is necessary to bring the brain back to a pre-fatigue level of function. Repetitive sleep deprivation has a cumulative effect; the longer you wait to repay the debt, the more sleep you will need.

Some sleep is better than no sleep, but merely resting is no substitute for sleep. Performance tests have shown improved mental and physical function even after very short naps regardless of whether a person notices the difference. Research has shown that any amount of sleep over five minutes is helpful and will have a cumulative effect. The more naps taken, the better.

Waking from a nap longer than 45 minutes but less than two hours can cause sleep inertia, a state of groggy disorientation which lasts 15–20 minutes. Thus, the most effective nap is one which lasts at least five minutes but not longer than 45 minutes.

Two hours of continuous sleep ensures a complete sleep cycle. Therefore, one should sleep for at least two hours if choosing to nap for more than 45 minutes.

The body's normal circadian sleep rhythms tend to favor sleep between 2 a.m. and 8 a.m. as well as between 2 p.m. and 5 p.m. Therefore, timing naps to coincide with the internal circadian clock will allow you to fall asleep more quickly and will enhance the nap's effectiveness.

Whenever naps are taken, you should seek a comfortable location which will allow uninterrupted sleep with minimal external stimulation.

There is perennial debate about whether to combine gas, meal and rest stops. Many experienced riders advocate taking gas and meal stops separately from rest stops to decrease fatigue by breaking



**You cannot overcome fatigue! You must learn to recognize it and take effective action—  
REST!**

*No ride is worth your life!*

riding time into manageable segments. A converse argument can be made that, since meaningful rest cannot be accomplished without sleeping longer than five minutes, separating rest stops from gas/food stops doesn't truly decrease one's fatigue debt. It's your ride; you decide.

**Socialization.** Maintaining interactive contact with others is a way of increasing wakefulness in the short term. Since language is a very high intellectual function, talking with someone (even on the CB) is often helpful in maintaining wakefulness. However, if profoundly fatigued, one will be even more prone to falling asleep immediately after the conversation ends.

**Exercise and other external stimulation.** Walking or performing exercises will help increase alertness because the

physical activity requires concentration and increases blood flow. However, vigorous activity may only increase fatigue by rapidly depleting nutrient stores and adding muscle fatigue to existing body stress. Standing on the motorcycle's footpegs, letting the wind hit your face, eating hot candy, and the many other tricks only serve to temporarily increase wakefulness. Their effects are very short-lived and do not remove any of the fatigue debt. Rest is still the answer!

**Nutrition and hydration.** Maintaining proper hydration is essential in staving off the effects of fatigue. Dehydration can be deadly when combined with the summer heat and insensitive (non-sweating) water loss which occurs while riding. Dehydration significantly decreases mental and physical functioning and can accelerate fatigue and dramatically magnify its effects.

Symptoms of dehydration include headache, nausea, dry lips and mouth, muscle weakness and decreased concentration. Many of the symptoms of dehydration are the same as those of fatigue.

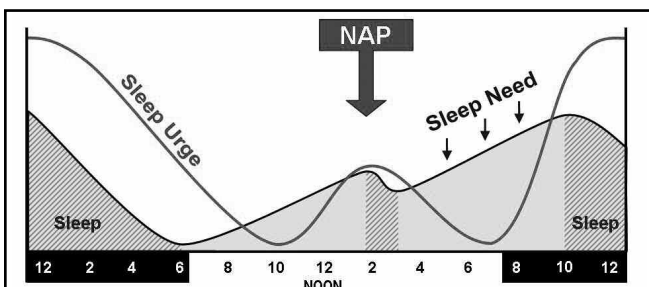
**Solution:** Stay ahead of hydration needs. Drink beverages which will add to body water reserves. Plain or flavored water drinks as well as "electrolyte" drinks (such as Gatorade) will suffice. Don't get behind. If you have a headache, you're already behind and will need to drink at least a quart immediately. Many riders carry a convenient water-delivery system which includes a hose from which the rider can drink while riding.

**Caffeine.** Caffeine can be helpful in improving wakefulness. However, people who drink caffeine regularly are less sensitive to its effects. To gain maximal effect from caffeine, a rider should stop ingesting caffeine for several days prior to the time when it will be needed.

Caffeine use can be strategically timed for maximum benefit. Caffeine is most effective in improving mental awareness in the 100–200mg (4–8 ounces of coffee) range. It takes approximately 30 minutes to have a peak effect and the effects last three to four hours (although significant amounts of caffeine remain in the blood for many more hours).

Avoid caffeine within eight hours of sleep since it will make falling asleep more difficult, shorten the duration of sleep, and disrupt restful sleep.

**Drugs.** Although the military has experimented with a variety of stimulant drugs, none have reduced the body's fatigue debt or its need for rest. They may improve performance and wakefulness for very short periods but do not enhance long-term (days) performance and can significantly decrease performance after the first dose has worn off. There is no place in any sport for stimulant drugs, period. 🚫



Napping takes advantage of the circadian midday sleep urge and repays part of the daily sleep debt, prolonging wakefulness.