Note about this sleep project proposal (Tina Saey, Nov. 1, 2010): This was the first proposal for the package. As you can see, what I had in mind for the main feature did not materialize.

Sleep is a fundamental process of life for most animals. Some scientists argue that even nematodes and fruit flies sleep, but there is still lively debate about what sleep actually is and whether it is a universal activity for animals.

This project will introduce readers to the latest sleep research.

Feature One: This feature lays the groundwork for the project. It will be a beefy feature that tackles the questions of what sleep is and what it is good for. I will concentrate on human sleep, pulling in research on rodents, fruit flies and other animals where it aids understanding of the basic processes of sleep. This feature will take us through a day describing:
Sleep's relationship to circadian rhythms, including a description of people's natural rhythms as seen in sleep lab studies in which people have no time cues and rely solely on their own internal rhythms to tell them when to sleep and wake.
Sleep homeostasis – new research suggests that astrocytes lull neurons in the basal forebrain to sleep with adenosine, the neurotransmitter equivalent of warm milk. We will also discuss melatonin and other brain chemicals that make us sleepy.
Sleep stages – we will describe the various stages of sleep, showing how electrical activity in the brain changes in each stage and describing what scientists think each stage does. Slow wave sleep has been implicated in weakening connections between neurons to make way for new learning. REM sleep helps people find creative solutions to problems. And various stages of sleep may be involved in other aspects of learning and memory and in regulating emotions.
Waking – if adenosine is warm milk for neurons, acetylcholine and noradrenaline are like shots of espresso, waking the brain up. I will describe the process of waking up and discuss sleep inertia.
This story needs to cover a lot of ground. We should consider a Darwin project-style compromise with a more comprehensive package for the web with sort of highlight story for the magazine.

A sidebar to this story would be short synopses of how animals sleep:
Do bullfrogs sleep? Chiara Cirelli of the University of Wisconsin and Jerry Siegel of UCLA disagree over this. Cirelli says yes, Siegel says no, based on the same data.
Why scientists say fruit flies and nematodes sleep.
Dolphins sleep with only half their brain at a time – again there is disagreement over whether the slow waves that dominate one hemisphere of the dolphin's brain at a time really constitute sleep.
Sparrows sleep 14 hours a day in winter, but 9 or less in the summer. Some migratory birds don't sleep at all until they reach their destination.
Human parents think they are sleep deprived when they have a newborn in the house. That's nothing compared to what the killer whale goes through. Killer whale moms and their babies don't sleep at all for up to 4 months after the calf is born, and they don't experience rebound sleep to try to catch up those lost zzzzs.
We should maybe address the difference between sleep and hibernation as well.
Plenty of other cool examples are out there.

Feature Two: "You can sleep when you are dead." That derisive statement belittles sleep as time wasted, but new research shows that if you don't snooze enough, you could lose your life sooner than planned.
A myriad of epidemiological studies have linked lost sleep to obesity, heart disease, diabetes, and shortened lifespan. Rats die if deprived of sleep for more than a couple of weeks. Severely insomniac fruit flies have much shorter lifespans. Scientists are beginning to get a molecular handle on what happens to the body and brain when a person doesn't get enough sleep.
Some people think sleep is an energy-saving measure, but new research shows that the brain is alive with activity during sleep and Brazilian researchers have discovered that people lose weight during sleep, but not while sitting in bed doing nothing more than playing video games or watching TV, suggesting that people are really more active when asleep. We will describe research into the link between obesity and sleep loss – grehlin, a hunger-promoting hormone increases after even a few hours of sleep deprivation. Sleep deprivation also increases inflammation and may change response to insulin. We will also delve into how sleep loss contributes to disease, including mental illnesses such as PTSD.
People's brains respond differently to sleep deprivation. Some people get groggy and lose the ability to concentrate with only a few hours of sleep loss. On the other hand, some people remain alert and mentally sharp even after being awake for days. We'll visit a lab at the U of Pennsylvania studying the effects of sleep deprivation on people, including their quest to discover how much sleep you need to recover from a week's worth of sleep restriction (getting only 4 hours of sleep a night).
New (including some unpublished) genetic data is uncovering variations that contribute to the response to sleep deprivation.

Related to this story, we will have a **commentary** from Dr. Charles Cszeiler on sleepy drivers and medical errors due to sleep deprivation, and his efforts to get legislation to change medical residents' hours and ban sleepy drivers from the road.

We might also want **tips** on how to get a good night's sleep to accompany this, at least on the web.

Feature Three: I originally proposed a feature on sleep's connection to mental illness. But in talking with readers and friends it seems people are more interested in two other areas: sleep disorders and dreams.
Sleep disruption is a common problem for people with many different mental illnesses, developmental disorders affecting the brain – such as autism – and neurodegenerative diseases. It is not clear whether sleep loss is a cause or symptom of the disorders, or perhaps both. Most of the data is descriptive and epidemiological evidence for a link. I'm not sure there is enough hard evidence here to base a feature on, and am leaning toward just mentioning mental illness in the sleep deprivation story. The difficulty with that is that the nature of the research is very different than the molecular studies showing how sleep deprivation affects the body and we may be shoe-horning too much into one story.
New research is beginning to unravel the causes of sleep disorders such as narcolepsy and insomnia. I have not explored this issue as much, but there were several sessions on insomnia at the SLEEP meeting, including a discussion of whether insomnia should be included in the next DSM for psychiatric disorders. Some people are now using cognitive behavioral therapy to treat insomnia, although it is not widespread. There is some evidence that insomniacs brains work differently and remain very highly metabolically active and don't benefit from the restorative

properties of sleep. Researchers are also beginning to track down genetic causes of the disorders, including restless leg syndrome and sleep walking.
Dream research has largely been confined to psychoanalysis. The idea that dreams means something has fallen out of favor and many scientists say that dreams are merely random synapses firing, but some evidence suggests that the content of dreams may be important. Robert Stickgold at Harvard University is a leading proponent of the new dream research. He finds that dream content is shaped by waking activity. A new study in *Neuron* shows that mice need to replay memories during sleep to consolidate the memories, perhaps suggesting that the content of the dream (in this case nightmare, since it was fear memories) helps solidify the memory. Some PTSD and schizophrenia research also suggests that dream content is important in modulating symptoms of the disorders.
Whichever of these we pick for the third feature, we should consider sidebars or other ways to address the other two issues.

Other fun **tidbits** might be sleep myths, such as you need 8 hours of sleep of night or you should never wake a sleep walker. In fact, scientists say there is a wide range of sleep needs (as little as 6 hours and as much as 10 hours are in the "normal" range) and sleep walkers are in more danger if you don't wake them. Up to 30 percent of sleep walkers have committed crimes in their sleep, including murder. So by all means, wake a sleep walker, just do it carefully so they don't injure you.
Interesting finding: sleep walking happens during slow wave sleep, but contrary to popular belief sleep walkers aren't harder to wake up during that stage of sleep than other people. They are more difficult to wake during REM sleep though.