https://www.nature.com/articles/d41586-018-05353-0

https://mobile.nytimes.com/2018/06/07/science/seals-mammals-sleep-brain.html

https://www.newscientist.com/article/2171076-seals-only-sleep-with-half-their-brain-when-theyre-out-at-sea/

https://www.irishexaminer.com/breakingnews/lifestyle/outdoorsandgarden/richard-collins-is-rem-as-critical-as-sleep-time-it-comes-with-850840.html

destruction, but few reasons to think the border fence clashes would end anytime soon.

## *Pixar Co-Founder Will Leave Disney, Citing 'Missteps'*

By BROOKS BARNES

John Lasseter had been on leave since November, citing what he called "missteps" that made employees feel uncomfortable. He will be a consultant for Disney until the end of the year.

MORE NEWS

- **Taliban Announce Brief Cease-Fire, Offering Afghans Hope for Lull in War**
- **Justice Dept. Requests Delay if DACA Injunction Is Issued**
- **Austria Closes 7 Mosques and Seeks to Expel Turkish Imams**
- **KFC Will Test Vegetarian 'Fried Chicken'**
- **Ex-C.I.A. Officer Is Convicted of Spying for China**

## Got a confidential news tip?

The New York Times offers several ways to get in touch with and provide materials

73 Comments

### A New Space for Raphael and Michelangelo Masterpieces

By ELISABETTA POVOLEDO

Eike Schmidt, the Uffizi's director, is rearranging the famed gallery so works can have a dialogue with one another and the public can get up close.

### Art Is Becoming a Financial Product. Thank Blockchain.

By SCOTT REYBURN

Investors have shied away as an asset class. But new technology could make it a better bet.

### Hot Heads: Why Mammals Need R.E.M. Sleep

By CARL ZIMMER

Sleeping fur seals toggle between two brain patterns: one while at sea, the other on land. Researchers suggest that R.E.M. sleep serves to warm the brain.

23 Comments

ABOUT NEW YORK

### A Test for New York's Specialized Schools? Fair Admissions

By JIM DWYER 9:18 PM ET

The arguments over the specialized high schools exam are proxies for deeper issues of opportunity and fairness across the city's schools and neighborhoods.

### 45 Stories of Sex and Consent on Campus

**The Washington Capitals have finally done it.** They won their first Stanley Cup, rallying to beat the Vegas Golden Knights, 4-3, in Game 5.

1d **Nontraditional jobs** such as driving for Uber or freelance writing have become less common since 2005, a survey found, though the data may not fully capture the shifting landscape.

1d A Georgia dermatologist who posted videos online showing herself **dancing to a hip-hop song while performing surgery** has been suspended by the state's medical board.

1d A Texas man nearly died after the **severed head of a Western diamondback rattlesnake** that he had just decapitated sank its fangs into his hand and held on for about 30 seconds.

2d **A lost John Coltrane recording** from 1963 will be released for the first time. His classic quartet cut the album two years before "A Love Supreme."

2d In states hit hard by the opioid crisis, **politicians are using somber ads** to defend their record, promise action and share heartbreaking stories.

# *Hot Heads: Why Mammals Need R.E.M. Sleep*

Sleeping fur seals toggle between two brain patterns: one while at sea, the other on land. Researchers suggest that R.E.M. sleep serves to warm the brain.

**By Carl Zimmer**

- June 7, 2018

Image

Fur seals can switch off and on R.E.M. sleep when they're in the sea and on land, a pattern never seen before. Scientists believe it might mean R.E.M. sleep helps generate heat in our skulls, like shivering for the brain.CreditMickrick, via Getty Images

On a December evening in 1951, Eugene Aserinsky, a physiologist at the University of Chicago, placed electrodes on the scalp of his 8-year-old son, Armond, before putting him to bed. Then the scientist retired to another room to watch a row of pens quiver across a rolling sheet of paper, recording the electrical activity in the boy's facial muscles.

Hours later, the pens started to swing wildly. To judge from the chart, it seemed as if Armond were awake, his eyes darting about the room. But when Aserinsky looked in on him, his son was fast asleep.

Aserinsky had discovered R.E.M. sleep.

Eventually he and other researchers learned that during this state, the brain shifts from low-frequency to high-frequency electrical waves, like those produced in waking hours. When Aserinsky woke his subjects from R.E.M. sleep, they often reported vivid dreams.

Almost all mammals experience R.E.M. sleep, but even today researchers debate why it exists. On Thursday, a team of American and Russian researchers reported that fur seals may provide an important clue.



While they swim, fur seals switch off R.E.M. sleep entirely. It returns when they come back to land — a pattern never seen before.

Jerome M. Siegel, a sleep expert at the University of California, Los Angeles, and a co-author of the new study published Thursday in Current Biology, said that the seals provide evidence that our brains switch to R.E.M. sleep from time to time to generate heat in our skulls.

“R.E.M. sleep is like shivering for the brain,” he said.

Many scientists have argued that our brains require R.E.M. sleep each night to function properly. One clue comes from experiments in which researchers deprive rats of R.E.M. sleep for a few days.

As soon as the rats can sleep normally again, they experience a “rebound,” spending more time each night in R.E.M. — as if they need to catch up.

Some studies have suggested that the brain needs R.E.M. sleep to keep its metabolism in balance. Rats deprived of R.E.M. will eat more, and yet they also will lose weight.

This disruption can be lethal. “If you deprive rats of R.E.M. sleep, they’ll die in two weeks,” said Dr. Siegel.

But other findings have raised doubts about the importance of R.E.M. Certain types of antidepressant drugs reduce R.E.M. sleep in users, for example, without evidence of harm.

R.E.M. isn’t even essential for dreaming. Researchers have found that people also dream during periods of so-called slow-wave sleep.

Some of the most puzzling evidence about R.E.M. sleep has come from the sea.

In the 1970s, a Russian biologist named Lev M. Mukhametov placed electrodes on the heads of dolphins. He discovered that they can put one side of the brain to sleep as they swim while the other side remains alert. Then they can switch, putting the other hemisphere to sleep.

But as hard as Dr. Mukhametov and his colleagues looked, they never found a dolphin in R.E.M. sleep.

In the 1990s, Dr. Siegel and Dr. Mukhametov started collaborating on studies of relatives of dolphins and found the hemisphere-switching sleep pattern in other species, such as gray whales.

More recently, the scientists wondered what they might find if they looked at a species between the two ends of the spectrum: a mammal that regularly slept both at sea and on land.



The researchers decided to study four fur seals. The animals spend weeks or months swimming in the ocean, but they come on land to mate and rear their young.

Oleg I. Lyamin, a neuroscientist who splits his time between U.C.L.A. and the Severtsov Institute of Ecology and Evolution in Moscow, implanted electrodes in the seals and strapped data recorders to their backs.

The fur seals lived in a pool where they could swim around or haul themselves onto a dry platform. After two days of recordings, the researchers took away the platform.

For up to two weeks, the seals could only swim in the pool. Then the researchers put the platform back, allowing the fur seals to doze out of the water again.

On the platform, the researchers found, the fur seals slept much as land mammals do. Their entire brains slipped into slow-wave sleep, interrupted from time to time by periods of R.E.M.

But when the seals had to sleep in the water, the brain patterns resembled those of dolphins. Only one hemisphere of their brain slept at a time. What's more, the fur seals experienced almost no R.E.M. sleep.

"The R.E.M. sleep pretty much goes to zero and stays there as long as they're in the water," said Dr. Siegel.

When the seals got back on the platform, ordinary R.E.M. sleep returned. Their long spell of R.E.M.-free sleep did them no apparent harm, and they didn't experience any R.E.M.-sleep rebound.

The results undermine the idea that R.E.M. sleep is essential to mammals, like food and water, Dr. Siegel said. In fact, the earlier studies on R.E.M. deprivation might not have been as compelling as they once seemed.

In those earlier studies, researchers kept animals from going into R.E.M. sleep by waking them up. "In some experiments, they wake up the animals a thousand times a day," Dr. Siegel said.

Image

Fur seals in various states of repose on the Pribilof Islands in Alaska. When they sleep in the water, their brain patterns resemble those of dolphins, but when they sleep on land, R.E.M. sleep returns.CreditEnrique R. Aguirre Aves, via Getty Images

The stress of being awakened over and over could have done the animals harm, rather than just the lack of R.E.M. sleep in particular.

A more telling clue about R.E.M. sleep can be found in human behavior, Dr. Siegel thinks. When people wake up on their own, they tend to move out of R.E.M. sleep and become alert. Those awakened from slow-wave sleep are groggy and disoriented.

Dr. Siegel and his colleagues propose that the brain cools during slow-wave sleep. To keep the brain from getting too cold, however, the brain periodically unleashes a torrent of activity. Oxygen-rich blood flows into the brain to fuel the activity, warming the brain in the process.



“It keeps the brain temperature within a functional limit by cycling on and off the same way your heater in your house might do at night,” Dr. Siegel said.

NEWS · 07 JUNE 2016

# Fur seals can go weeks without REM sleep

*Animals switch off need for restorative sleep phase while at sea without experiencing any apparent ill effects.*

Alex Fox

A northern fur seal pup catches an ap... Credit: John Gibbens/Alamy

RELATED ARTICLES

Jellyfish caught snoozing give clues to origin of sleep

Why poor sleep and forgetfulness plague the ageing brain

Sleep therapy can change bad memories

SUBJECTS

Animal behaviour Brain Neuroscience



Northern fur seals (*Callorhinus ursinus*) can forgo rapid eye movement sleep for up to two weeks while at sea with no visible hardship, according to new research. This flies in the face of previous studies on land mammals such as rats, in which depriving the animals of rapid eye movement (REM) sleep for a week or more led to problems including weight loss, hypothermia and eventually, death.

Nearly all land mammals and birds experience REM sleep. This is the brain's most active sleep phase and has been associated with learning and processing memories. But now, results[1] published on 7 June in *Current Biology* point to another function: regulating brain temperature.

Like whales and dolphins, northern fur seals switch off half of their brain to catch some Zs at sea in order to maintain a low level of alertness. The researchers wanted to see whether the seals skipped REM sleep in the water, as whales and dolphins do[2]. They also thought that the fur seals could offer a good way of investigating the functions of REM sleep without causing the stress of interrupted sleep that can muddy the results of similar studies in other mammals.

## Just add water

Continue text from Nature:

The study authors used four captive northern fur seals, fitting them with electrodes that recorded electrical activity in the animals' brains, eyes, muscles and hearts. The scientists allowed or prevented the seals from sleeping on land by raising or lowering the water level in their pool — thereby exposing or submerging a platform they could use to rest.

When the northern fur seals slept in water — wild ones can spend up to 10 months of the year at sea during migration — the seals experienced little or no REM sleep. But when the animals slept on the platform, they resumed a cycle of non-REM and REM sleep without showing any need to recoup lost REM sleep. Terrestrial mammals such as rats that have been deprived of this sleep phase, by contrast, usually experience longer bouts of REM sleep when they're allowed to recover.

It's as though northern fur seals aren't being deprived of REM sleep at all, says study co-author Jerome Siegel, a neuroscientist at the University of California, Los Angeles. Siegel and his colleagues couldn't see any adverse signs of REM sleep deprivation in the seals, so they wondered what function the phase served in these animals.

Keeping warm

Previous research has shown3 that the brain is warmer when an animal is awake or experiencing REM sleep, and cooler during non-REM sleep. Siegel's team found that when northern fur seals sleep on land, their brain switches to alternating between non-REM and REM phases like most other mammals. He thinks that the REM phase kicks in to keep the seals' brain from getting too cold.

"Maybe in these seals, because half their brain is awake and warm when they're in water, they don't need [REM sleep]," says Thomas Wehr, a psychiatrist and former chief of the US National Institute of Mental Health's clinical-psychology branch in Bethesda, Maryland.

But others counsel caution when interpreting the study results. REM sleep might serve different functions in northern fur seals than in other species, says Markus Schmidt, a neurologist at the Ohio Sleep Medicine Institute in Dublin. Tasks performed during REM sleep could be taken care of during non-REM phases, or while the seals are awake, he says. It's also possible that the loss of REM sleep could have negative effects that aren't easily noticed, Schmidt adds.

"There is flexibility across species as to how they express these states of non-REM, REM and wakefulness," says Schmidt. "This study points to a need to learn more about what other species are able to forgo REM, or sleep entirely, without a rebound effect."

doi: 10.1038/d41586-018-05353-0

https://www.newscientist.com/article/2171076-seals-only-sleep-with-half-their-brain-when-theyre-out-at-sea/
DAILY NEWS

7 June 2018

# ● ● ● ●● ●● ● ●● ●● ●● ● ● #

## ● ●● ●● ●● ● ● ●  ● ●●● d

At most half asleep
Hoberman Collection / UIG via Getty

By **Sam Wong**

One species of seal sleeps in a way that has never been seen in any other animal. Their odd habits may help explain the function of “REM” sleep, the form of sleep in which we have our most vivid dreams.

REM is short for “rapid eye movement”, because humans in REM sleep move their eyes back and forth even though their eyelids are shut. REM sleep seems to be essential for most mammals’ health. If rats are deprived of REM sleep, they lose weight, suffer hypothermia, and eventually die.

Cetaceans like whales and dolphins are an exception. They sleep half of their brain at a time, so they can remain vigilant by keeping half the brain awake. Studies have failed to find evidence for REM sleep in cetaceans.

To see if there were more exceptions, Jerome Siegel of the University of California, Los Angeles and his colleagues studied northern fur seals, which live in the north Pacific. They are semi-aquatic, living mostly on land during the breeding season but spending most of their lives in the sea.
The team implanted electrodes into the brains of four captive juvenile seals and recorded their brain activity. The seals had access to a dry platform for some of the time, but this was removed for periods of 10 to 14 days to simulate time spent at sea.

## Two styles of sleep

On land, the seals' sleep consisted of both REM sleep and slow-wave (non-REM) sleep, with 80 minutes of REM sleep a day. In the water, their average amount of REM sleep fell to just 3 minutes a day. That's less than the rats got during experiments on REM sleep deprivation.

Unlike any animal studied before, the fur seals spent some time sleeping with their whole brain, and some time sleeping with half the brain like dolphins. The proportion of half-brain sleep increased from 62 per cent on land to 94 per cent in water. They may do this to watch out for predators like sharks and orcas, and to keep their nostrils above water to breathe.

After being deprived of REM sleep, most mammals catch up by spending extra time in this phase of sleep. However, the fur seals showed little or no "rebound" when they returned to the land. They also showed no apparent ill effects from going without REM sleep for so long.

The most popular idea about the function of REM sleep is that it is involved in the long-term storage of memories. However, Siegel says there is lots of evidence against this. For example, some antidepressant drugs abolish REM sleep, but this appears to have no impact on people's memory.
The ill effects seen in sleep deprivation experiments in animals may be a consequence of repeatedly being woken up, Siegel says. "If you're totally sleep-depriving a rat, you're awakening them 1000 times a day," he says. "This is way outside normal behaviour."

## Warming up the brain

Siegel believes it's more instructive to study how different species normally sleep.
As part of the new study, he and his colleagues reviewed data on how other mammals sleep. They found that the amount of time each species spends in REM sleep correlates with the amount of non-REM sleep time, but REM is absent in species that don't put their whole brain to sleep.

To explain this, they propose that REM sleep is needed to regulate the brain's temperature. When the whole brain is in non-REM sleep, it cools down. REM may be needed to bring the temperature back up. Previous studies have found that humans and other animals are more alert when they are woken at the end of REM sleep than after non-REM sleep.

The idea was put forward in 1992 by psychiatrist Thomas Wehr of the National Institute of Mental Health in Maryland. "This article adds to the story," he says. "Animals that are perfectly capable of producing REM sleep dispense with it, for as long as some part of the brain is kept warm by the waking state."
Brain warming may be important, but probably isn't the whole story, argues zoologist John Lesku at La Trobe University in Melbourne, Australia. "If the function of REM sleep were only to modestly increase brain temperature, then one wonders why we would not just wake up," he says. "This might suggest that REM sleep serves other functions, unrelated to brain warming."
**Journal reference:** *Current Biology* **,** DOI: 10.1016/j.cub.2018.05.022