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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 a nap.Credit: John Gibbens/Alamy

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

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 shown[3] 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.”

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References

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