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Does the duck-billed platypus dream?

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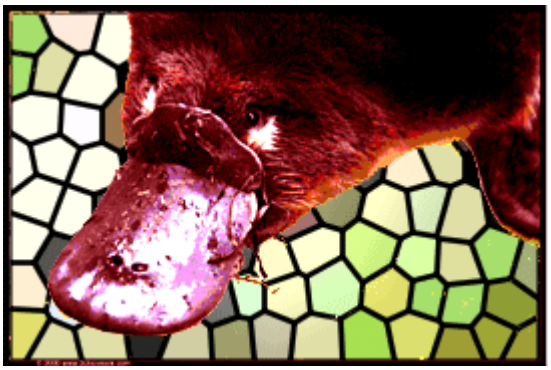

You can see a dog dreaming: it twitches and whines, and its eyes move in "rapid eye movement" (REM) sleep. In fact, dreaming in dogs and cats is quite similar to human dreaming. But a recent study of dream patterns in the duck-billed platypus, the odd-looking Australian marsupial, reveals an interesting surprise.

In humans, dreaming has all the earmarks of a conscious state

In humans, dreaming has all the earmarks of a conscious state. Our brains look like they are awake: They shows massive amounts of "gamma activity," the high-frequency, low-intensity and irregular electrical waves that can be seen simply by placing electrodes on our scalps. People also give vivid dream reports (if they are awakened immediately after REM rather than waiting until the next day). That is, they SAY they were conscious of something in their own minds. We can't ask dogs and cats to report their dreams, but the same brain pattern occurs in a very wide range of mammals. Their eyes move (REM), their EEG goes into gamma, their bodies become limp, and they block incoming stimuli. Physiologically it looks like dogs and cats, and perhaps a very wide range of mammals, are conscious during REM dreams.

When did conscious dreaming arise? We know that Freud was wrong in 1900 about the origins of dreams. He argued that dreams represented an effort of the brain to protect itself from the

disturbing anxieties of repressed thoughts, which emerged in consciousness at night. But if that were true, other mammals would not dream --- unless you see your dog or cat as being repressed. Mammals do not repress a lot of emotional impulses, as far as we can tell.

Freud was wrong in 1900 about the origins of dreams

The duck-billed platypus is interesting because it is one of the earliest mammals that still survive. Mammals arose more than 100 million years ago in evolution. Does the platypus show the basic physiology of conscious dreaming?

Siegel et al (1999) showed that platypus is different. In the first EEG study of platypus ever done, they showed it has all the usual signs of mammalians sleep and waking. Platypus showed gamma activity during waking, while its deep sleep shows large, slow, regular, delta waves. It was difficult to wake the animals up during delta (higher arousal thresholds).

And yes, platypus also showed a great deal of REM --- more so than any other animal known. From five to 8 hours per day, platypus has the typical sign of dreaming. (What would Freud think?)

The platypus has all the usual signs of mammalians sleep and waking

But there was a great surprise. Platypus showed no typical gamma waves during REM. These gamma waves are the best brain index of consciousness we have today. They normally suggest that humans and animals are conscious when they dream. But platypus dreamed while the EEG "was moderate or high in voltage, as in non-rapid eye movement sleep in adult and marsupial mammals." Interpretation: Platypus' brain looked unconscious during its dreams.

We still can't ask platypus or any other mammal whether it is conscious of its dreams. But the best physiological measures we have today indicate that platypus, at least, may not be conscious at those times. Its brain suggests an absence of consciousness in dreams.

Platypus showed no typical gamma waves during REM

Siegel et al propose that REM sleep –-- the index of dreaming --- "may have been present in large amounts in the first mammals … it may have evolved in pre-mammalian reptiles." Those ancestral reptiles lived more than 100 million years ago.

Platypus may be bringing a message from the earliest years of mammalian evolution.

Sleep in the platypus.
Siegel JM, Manger PR, Nienhuis R, Fahringer HM, Shalita T, Pettigrew JD

Neuroscience 1999;91(1):391-400

We have conducted the first study of sleep in the platypus Ornithorhynchus anatinus. Periods of quiet sleep, characterized by raised arousal thresholds, elevated electroencephalogram amplitude and motor and autonomic quiescence, occupied 6-8 h/day. The platypus also had rapid eye movement sleep as defined by atonia with rapid eye movements, twitching and the electrocardiogram pattern of rapid eye movement. However, this state occurred while the electroencephalogram was moderate or high in voltage, as in non-rapid eye movement sleep in adult and marsupial mammals. This suggests that the low-voltage electroencephalogram is amore recently evolved feature of mammalian rapid eye movement sleep. Rapid eye movement sleep occupied 5.8-8 h/day in the platypus, more than in any other animal. Our findings indicate that rapid eye movement sleep may have been present in large amounts in the first mammals and suggest that it may have evolved in pre-mammalian reptiles.