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## Features

### The Big Yawn

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#### Fish do it, violinists do it, even salivating lions do it

THINK of a yawn. Your jaw tightens, your nostrils flare and you suck in a great lungful of air as your mouth stretches open wide. If it's a good yawn, you'll hold that pose until your neck muscles clench, your eardrums ring and your eyes start to water. You might even finish it off with a yelp of pleasure or a satisfied sigh.

Are you yawning yet? You will be. And when you do, so will the guy across the room. And the woman next to him. Because yawning is contagious, and once you start, there's almost nothing you can do to stop. Of course, the big question is: why do we yawn at all? What can we possibly get out of a six-second stint with our mouths agape-besides an opportunity to offend our conversational partners? Is it a craving for oxygen? Too much carbon dioxide in the blood? Time for bed?

It's none of the above, says Robert Provine, a psychologist at the University of Maryland, Baltimore County, who first became curious about yawning when he realised that nobody had really studied this common-if not always appropriate-behaviour. "Most scientists are looking for the deep and obscure," Provine says. "I look for the significance of the everyday behaviours that people have neglected. Perhaps it's my perverse nature." So he, and some similarly perverse psychologists, set out to determine when, why and how we yawn. Along the way, they found something unexpected: yawning appears to prime our brains for change.

Conventional wisdom has long held that we yawn to invigorate our weary brains with a refreshing burst of oxygen. If this were true, Provine reasoned, then people who are running low on oxygen-or high on carbon dioxide-should yawn more often than normal. To test this theory, Provine first had to figure out how to make people yawn.

Actually, it wasn't all that difficult. People yawn all the time. But to bump the frequency even higher, Provine took advantage of yawning's legendary contagiousness and asked a bunch of undergraduates to think or read about yawning. (Why the mere mention of yawning might trigger your jaw to drop isn't clear-but have you noticed that you're yawning more than usual as you read this feature?)

#### Huffing and puffing

Back in the lab, Provine told the students to think about yawning while they inhaled mixtures of air that were either high in oxygen, high in carbon dioxide or normal with respect to both gases. Although the doctored mixes made the undergrads breathe faster, neither altered their baseline rate of yawning, which held steady at about 24 yawns per hour. Exercise, which also speeds up breathing, didn't change the yawning rate either.

The results just didn't make sense to Provine. So convinced was he that yawning and breathing were linked, he tested another round of undergraduates using even higher concentrations of O<sub>2</sub> and CO<sub>2</sub>. But the results were the same. "I had them huffing and puffing and still saw no effect," says Provine.

Why then do we yawn? To ready our brains for switching gears, says Ronald Baenninger, a psychologist at Temple University in Philadelphia. Baenninger asked people to wear motion-sensing wristbands as they went about their normal routines and to hit a button on the device whenever they yawned. After collecting data for two weeks, Baenninger found that yawning tended to precede periods of activity. Within 15 minutes of yawning, his subjects were generally engaged in some form of hustle or bustle.

There is also plenty of anecdotal evidence that yawning helps the brain to gear up for something big, says Provine. Olympic athletes yawn before a competition, paratroopers yawn before their first jump, undergraduates yawn before final exams, and violinists yawn before a concert. "I've never seen so much yawning as before a marathon," notes Baenninger. And it's not that the runners, jumpers and virtuosos are tired or bored, he says. They're simply working to maintain a certain level of physiological arousal, so they'll be prepared for the main event.

"We yawn in situations where there is nothing to stimulate us, but it would be bad to lose the level of arousal," Baenninger explains. Why we yawn before bed, though, is still a mystery, he says. Perhaps we struggle to stay awake and alert, but sleep simply wins out in the end.

What makes a yawn so refreshing? It's not the oxygen, agrees Baenninger. But the secret may still lie in the blood: yawning routes an extra helping of blood to the brain. What the blood does once it's there is anyone's guess, but Baenninger believes that it helps to perk us up. In support of this theory, researchers have found that people also yawn when they are suffering from a haemorrhage or motion sickness, both of which tend to decrease the amount of blood available to the brain.

So yawning marks a change in the activity of the brain-or "brain state", in psychologists' parlance. Addicts going through opiate withdrawal yawn compulsively, says Provine. So do people with brain lesions. But schizophrenics almost never yawn, he notes.

### **Cascade yawning**

Yawning in preparation for a change of pace-or brain state-is not exclusive to

humans, says Baenninger. Male Siamese fighting fish yawn before attacking a rival. Lions, wolves and primates in zoos are prone to fits of yawning about an hour before feeding time-perhaps so that they'll be fully primed for the biggest activity of the day. Damsel fish yawn between exertions, such as eating and courting, says Arthur Myrberg, a marine biologist at the University of Miami.

Still, if yawning is simply a tool that animals and humans use to keep their minds focused and ready for action, why is it so contagious? Perhaps yawning plays a role in synchronising the activity of a group, says Provine. A domino-like cascade of yawning could help to signal group members that it's time to get it together and do something. Such organisation may be especially important for creatures like primates that live in family groups, says Baenninger. One young male may wake, stretch and let out a noisy yawn. Pretty soon, the entire troupe will have yawned itself awake and be ready to go hunting for food-an activity that would be risky for a lone individual.

Such a scenario begs the question of whether yawning is catching in animals as well as humans. Unfortunately, primates in the wild can go hours without yawning, so it's hard to know if their yawns are contagious, says Baenninger. Fish appear to be immune to catching yawns.

Happily for Provine, that's not so for undergraduates. He showed his students videos of people yawning to find out just what part of the yawn makes it so infectious. Apparently it's not the gaping mouth. Students who saw a video of a yawning face with the mouth blocked out yawned just as often as students who saw the full thing-eyes, mouth and all. So while covering your mouth might be considered polite, it probably won't protect your office mates or your dinner date from catching your eye-watering, nose-scrunching, jaw-dropping yawn.

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