Name: _____ Date: _____

The Problem With a Purr

Reading level 14 · 1230 words

Rest your palm on a purring cat and you will feel the sound before you decide to listen to it. The purr as a whole spans roughly 25 to 150 vibrations a second, which physicists write as hertz, and its deepest part sits at about 25 to 30 hertz. A cat that weighs about ten pounds can produce notes lower than the lowest bass sounds of an average human voice. That ought to be impossible. As a rule, the larger the animal, the longer its vocal folds and the lower its pitch, which is why a double bass plays lower notes than a violin. A small cat with a bass voice breaks the rule, and for decades no one could say exactly how it gets away with it.

Most of us read a purr as a smile. The evidence has never quite supported that. The sound is heard most often at a nursing mother's side or under a petting hand, yet cats also purr during a visit to the veterinarian and while recovering from an injury. A signal that turns up in contentment and in distress is a poor mood meter. Leslie Lyons, then at the University of California, Davis, School of Veterinary Medicine, wrote in Scientific American that it is more plausible to call purring a means of communication and a potential source of self-healing than a plain report of pleasure. Kittens purr from the start, while they suckle, and a purr may be one way a mother and her litter reassure each other.

The modern study of the question begins around 1991, when three zoologists recorded purring from domestic cats at a shelter and from a cheetah and a cougar, the largest cats known to purr. They confirmed that the sound continues through the whole breathing cycle, in and out, and that breathing only alters it. Then they went after the old idea that the purr comes from deep in the body. In their view the diaphragm and the muscles around the ribs contribute nothing beyond ordinary breathing. The sound is made in the larynx, where the vocal folds modify the flow of air. Even this is not unanimous: Lyons's 2003 answer still lists the diaphragm among the muscles involved.

That answer left a second problem: how the larynx makes a note that low. For roughly fifty years the standard explanation was active muscle work. A cat, the theory went, tightens and relaxes the muscles of its larynx as often as thirty times a second, with the brain issuing a command for every twitch. Then a team that included the voice scientist Christian Herbst, of the University of Vienna, tested the larynges of eight cats that had been euthanized because of terminal illness. When they pushed warm air through, the tissue purred at 25 to 30 hertz, with no brain signal and no muscle contraction at all. The folds shook in a way that resembled the creaky "vocal fry" some people use when they talk, a passive process in which flowing air keeps the tissue vibrating on its own.

The Vienna team proposed that the key is a pad of tissue embedded in each vocal fold, which

may make the fold denser and slow its vibration. It is a satisfying idea, and it echoes an older discovery: in 1989 an anatomist found a large pad of springy tissue near the front of the vocal folds of lions, tigers, jaguars and leopards. Even so, the critics have a fair point. Testing a larynx that has been removed from the body, one of them said, is like taking the mouthpiece off a wind instrument and studying its sound alone. A dead voice box is not a living cat, and a Swedish linguist who was not involved admitted that science still does not know how a cat does it.

There is a further twist, and it comes from the hungry purr. Karen McComb and her colleagues at the University of Sussex recorded ten cats and found that when some cats want food, they hide a whine inside the purr, a high note comparable in frequency to the cry of a human infant. They played the recordings to fifty listeners. People rated the hidden-cry purrs as more urgent and less pleasant, and this held even for people who had never owned a cat. The explanation reported with the study is that a cat can vibrate the muscles beneath its vocal folds very slowly to make the rumble, which leaves the inner edges of the folds free to produce the higher cry at the same moment.

Notice that this mechanism relies on muscles, while the Vienna result suggests muscles may not be needed. The two accounts sit side by side in print, and a fair reader keeps both open: a larynx that can purr passively in a laboratory does not prove that a living cat never adds muscle control. Think of a flag in a steady wind: no hand moves it, yet it keeps flapping. The passive process in the folds has a name, flow-induced self-sustained oscillation. So the open question is not whether it exists but how much a living cat leans on it. The Sussex study also found that not every cat uses the hidden cry. It seems to appear more often in cats that live one-on-one with a person.

Why can lions roar but not purr? The nineteenth-century anatomist Richard Owen divided the cats into purrers and roarers, and a later anatomist blamed the difference on one small throat bone, the hyoid. The old rule held that a lion's hyoid is partly elastic and a cheetah's is stiff, so one cat roars and the other purrs. But the snow leopard has the elastic kind and purrs, so the bone alone does not decide it. A review of the evidence tallied twenty of thirty-six cat species reported to purr and said that for the other sixteen there was not enough information to know. For nearly half the cat family, then, the question is simply unanswered.

Then there is the possibility that purring does something for the cat itself. Lyons noted that vibrations in the frequency range of a purr have been reported to strengthen bone and to promote healing, and she suggested that purring may be a way for a cat to heal itself while it rests. That is a hypothesis, and a very careful one. The evidence for the frequency effect comes from studies of bone and tissue in other settings, not from watching a purring cat mend. No study has shown that a purr mends a cat, and a cat that purrs while injured may simply be calling for help or calming itself.

So why do cats purr? For comfort, for kittens, for food, possibly for healing, and by a mechanism that is still partly unsolved. Each answer explains part of a sound that most people have felt under their own hands. None of them explains all of it. The cleanest test would be to watch a living cat's larynx as it purrs, with an MRI machine or with probes placed in the throat. But a cat does not purr on command, and it usually purrs only when it is comfortable, so an experiment of that kind would probably not go well. The question stays open for a simple reason: the experiment keeps waiting for a cat that agrees.

Questions

1. What puzzled scientists about the pitch of a purr?

A. A small animal usually has a higher voice than a purring cat
B. Cats purr only at night
C. A purr is too quiet to record

2. What did the Vienna team find when they pushed warm air through the larynges of eight cats that had been euthanized?

A. The larynges stayed silent
B. The tissue purred with no brain signal or muscle contraction
C. The larynges made a high squeal

3. Why do critics say the Vienna result is not the final word?

A. The tissue came from voice boxes outside the body, not living cats
B. The scientists disliked cats
C. The cats were too young

4. In this book, what does "hypothesis" mean?

A. A fact that everyone has proved
B. An idea that has not yet been proved
C. A kind of cat sound

5. What does the snow leopard show about the hyoid idea?

A. Cats with an elastic hyoid never make any sound
B. The hyoid is the biggest bone in a cat
C. The bone alone does not decide whether a cat purrs

6. Why does the book say the cleanest experiment keeps waiting for a cat that agrees?

A. A cat does not purr on command and usually purrs only when comfortable
B. Cats are too small to scan
C. Scientists are afraid of cats

Words to know

hertz: vibrations per second
larynx: voice box
hyoid: throat bone
diaphragm: breathing muscle
hypothesis: idea to test
oscillation: back-and-forth shaking

Answer key: The Problem With a Purr

1. A. A small animal usually has a higher voice than a purring cat
2. B. The tissue purred with no brain signal or muscle contraction
3. A. The tissue came from voice boxes outside the body, not living cats
4. B. An idea that has not yet been proved
5. C. The bone alone does not decide whether a cat purrs
6. A. A cat does not purr on command and usually purrs only when comfortable