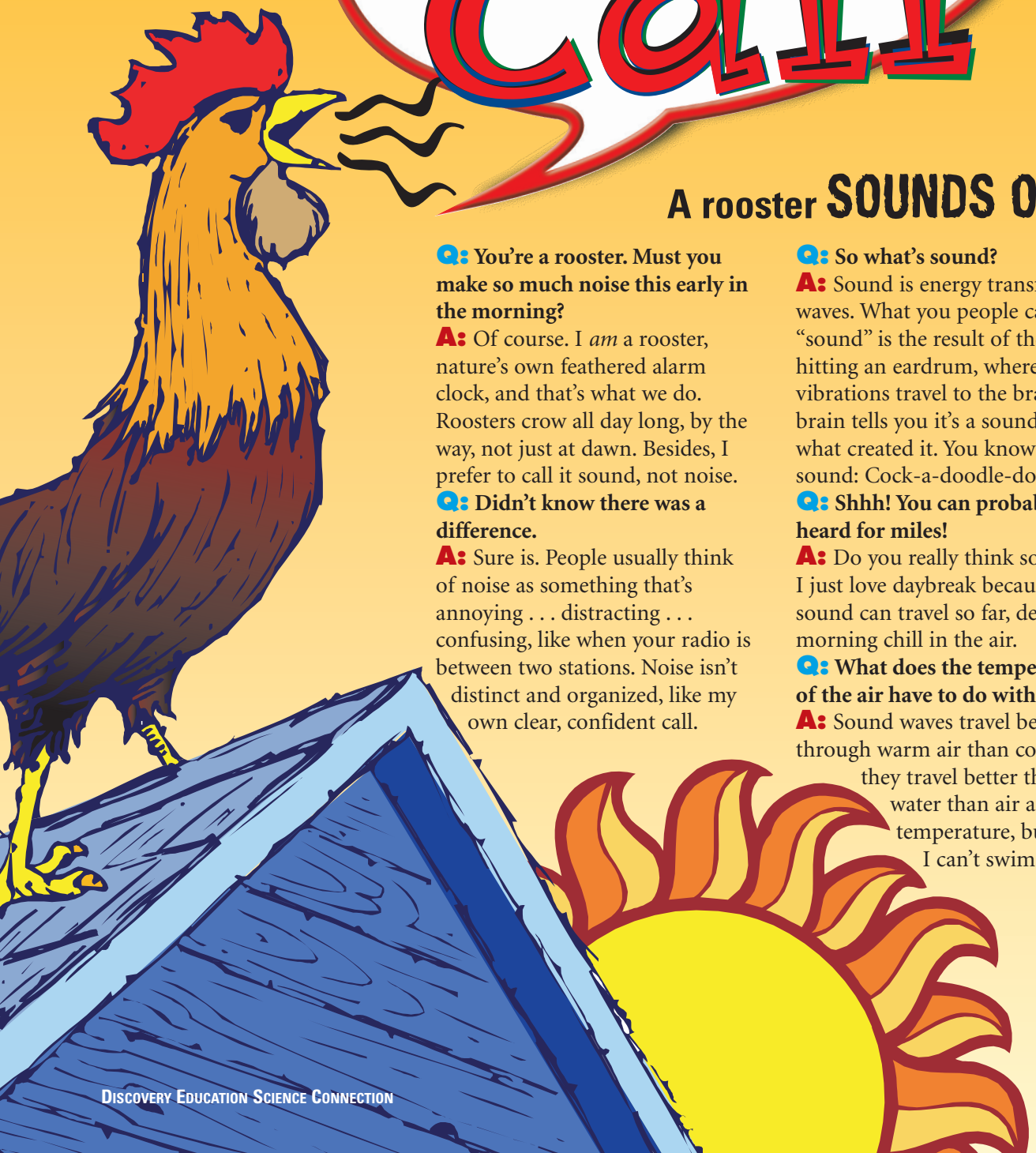
Q&A

Wake-Up Call



A rooster SOUNDS OFF

Q: You're a rooster. Must you make so much noise this early in the morning?

A: Of course. I *am* a rooster, nature's own feathered alarm clock, and that's what we do. Roosters crow all day long, by the way, not just at dawn. Besides, I prefer to call it sound, not noise.

Q: Didn't know there was a difference.

A: Sure is. People usually think of noise as something that's annoying . . . distracting . . . confusing, like when your radio is between two stations. Noise isn't distinct and organized, like my own clear, confident call.

Q: So what's sound?

A: Sound is energy transferred by waves. What you people call "sound" is the result of the waves hitting an eardrum, where the vibrations travel to the brain. Your brain tells you it's a sound and what created it. You know my sound: Cock-a-doodle-doo!

Q: Shhh! You can probably be heard for miles!

A: Do you really think so? Great! I just love daybreak because my sound can travel so far, despite the morning chill in the air.

Q: What does the temperature of the air have to do with sound?

A: Sound waves travel better through warm air than cold. And they travel better through water than air at any temperature, but since I can't swim, that

doesn't do me much good. But in the morning, there's not much going on out here. That means there aren't many other sound waves to get in the way of my own. So even though it's colder, I can really make an impression.

Q: Where do sound waves come from?

A: All sounds start with vibrations. The sounds I make begin with vibrations in my throat. Strong bands of muscles called vocal cords start shaking and moving when I feel the urge to crow. Vibrations make the air move, and those motions are sound waves.

Q: How does sound form waves?

A: The back-and-forth motion of the vibrations creates waves. It happens as tiny particles of air or water or whatever the sound is traveling through are crushed together, pushed forward, and then fall back. Back, forth. In, out. You can't see the waves, so just think of them as ripples in a pond, spreading out in circles when you toss in a pebble.

Q: So the waves travel out?

A: You got it. Imagine that the pebble symbolizes the source of the sound. The speed at which the ripples are pushed out from the center is called the frequency. The faster those ripples are pushed, the higher the frequency. Like this: cock-a-doodle-doo!

Q: Okay, okay. Then where do the waves go?

A: They spread out in all directions, bouncing off, moving through, or being absorbed by anything that gets in the way—trees, rocks, whatever. All the bouncing can change the sound. Make it lose its edge. Get soft and dull. Notice that I'm standing up here on top of the roof?

Q: How could I not?

A: I picked this perch carefully. If I went inside the barn and crowed, my sound waves would bounce off the walls and chickens and get absorbed by hay and eggshells. My sound would be muffled. I'd lose most of my audience, which would be a tragedy.

Q: Well, maybe not for all your listeners. All right, I see how sounds are made, but how do people actually hear them?

A: With those two flaps on both sides of your head. Or, actually, because of what goes on inside those flaps. The sound enters your ear and reaches your eardrum. They hit the tight surface of your eardrum and produce more waves. These new waves reach three little bones in your middle ear. Those bones may be small, but they have a lot of power. They beef up the vibrations so they're two or three times as strong. The amplified vibrations now go to your inner ear, which is filled with fluid. That's where they get transferred.

Q: Transferred?

A: Changed. Connected. Charged. We're talking electricity. The inner ear is where the energy of sound is changed into the energy of electricity. Electrical signals that travel along a big bundle of fibers called the auditory nerve. At last they're ready for the big time.

Q: To be heard?

A: More than that. To be understood. Changed from being just a bunch of electrical signals to a recognizable, familiar sound, one people can pin a name on. Like bow-wow—it's a dog! Or chirp, bleep—it's a fax machine. Or cock-a-doodle-doo—it's you know who!

Q: (sigh) Don't you ever stop?

A: I'm almost finished. All this recognition goes on in your brain. It picks through the sounds and selects the right picture to go with each one. That's not easy, since your brain recognizes about 400,000 different sounds. Then it commands the body to take some action: Let in the dog. Send the fax. Wake up.

Q: Wait. Are you saying that the brain sorts out sounds even when we're asleep?

A: Yep. The human brain is simply amazing. That's why a person can sleep through noisy traffic outside the window and still wake up when the alarm goes off. An electrical, mechanical, or nice feathery alarm that goes . . .

Q: No! Please! Don't make another . . . sound!

A: COCK-A-DOODLE-DOO!

Activity

WHERE, OH, WHERE **Explore sound waves with your friends. Find an open space such as a field, and have a few friends gather around you at a distance of about 10 feet (3 m). Put on a blindfold. Your friends should take turns making a sound: clap, snap, shout, or stomp. After each noise, you should point in the direction in which you think the sound came from. Are you correct every time? What would make this test harder?**

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