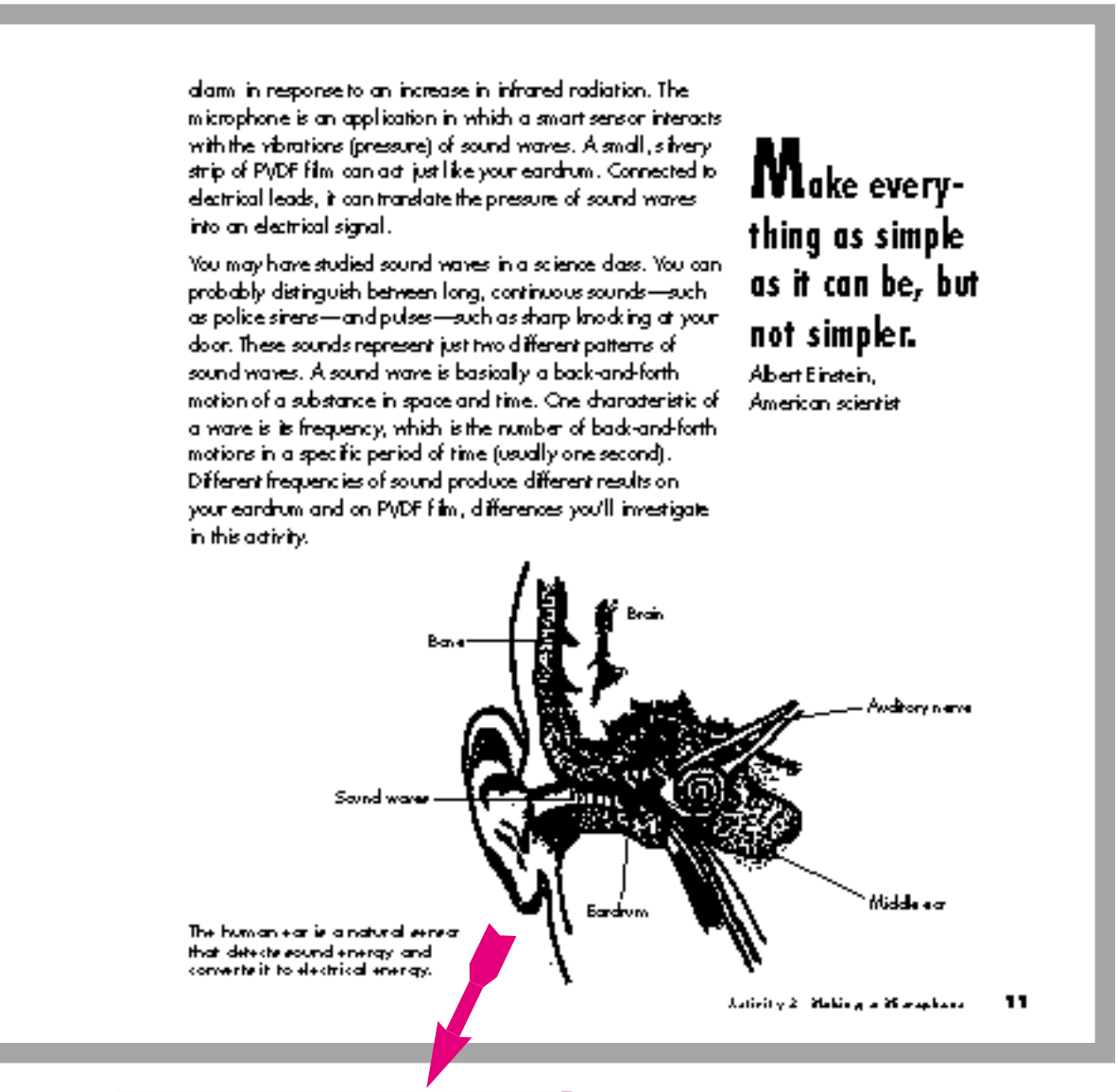

Discussing the Quote

Ask students what they think Einstein might have been referring to when he made this statement. Let students discuss whether they think this is good advice or bad advice for a researcher, a designer, or an engineer. Have them explain why and give some examples to illustrate their explanations. Einstein's quote probably referred to scientific theory, but it is equally true of technological design.

Connection to Biology

You might wish to bring in a model of a human ear to compare the elements of the human ear and the piezo microphone. Have students identify parts of the model that represent the input, processing, and output components.

Multicultural Links

A karaoke machine plays instrumental music to which a person can sing along for fun. As the person is singing, the machine also records the singing and the music, so the person can then play the recording back and hear how he or she sounds as a vocalist. The practice of karaoke singing became popular in Japan in the early 1980s. The word *karaoke* is from the Japanese word *kara*, meaning empty, plus *ōke*, short for the Japanese word *ōkesutora*, meaning orchestra. This means that only the background music is provided, allowing the person using the machine to sing over the orchestra that is empty of real players.

Enriching Science Experiences

Show students an operating paper-cone electromagnetic speaker. (Such speakers are often diagrammed in encyclopedias and physics textbooks.) Demonstrate for them that power supplied to the electromagnet causes the iron diaphragm, which is attached to the bottom of the paper cone, to vibrate in the audio range, producing sound. After they do the activity, help students relate the vibration of the diaphragm to the action of the substrate. You might wish to point out that in speakers, the incoming electrical signal changes (or "vibrates") in step with the sound it represents. The changing signal reproduces the vibrations with fidelity, so the sound coming out of the speaker is the same as the "sound" that went into the recording (CD, tape) or transmitting medium (radio, television) being used.