

CONNECTIONS: SCIENCE AND MUSIC



Yvonne Caruthers

Monday, November 14, 2005

11 a.m.-12 p.m. ET

Grades 4-8

When viewing *Connections: Science and Music* and participating in this guide's suggested activities, the following National Standards for Music will be addressed: 6, 7, 8.

Program Notes

What do science and music have in common? More than you might think. As scientists develop new materials, musicians benefit from improved instruments. As scientists learn more about the human body, musicians are sometimes able to change their playing techniques, decreasing wear and tear on their bodies. Music, in turn, is gaining the attention of scientists who want to learn about how the human brain interprets and responds to different aspects of music.

The Science of Sound Waves

What are sound waves? Sound is produced when an object moves or vibrates. The vibration makes a sound wave. If your finger plucks a musical instrument's string, the string vibrates and disturbs the air around it—making a sound wave. You hear the sound when the wave carries the vibration to your ear. Sound waves can travel through air, glass, water, and even paper. Sound waves are measured by frequency, the number of vibrations per second. If many sound waves pass in one second, the frequency is high. If only a few sound waves pass in the same second, the frequency is low.

The pitch of a note—how high or how low it sounds—depends on the frequency, the higher the pitch; the lower the frequency, the lower the pitch.

Did You Know...

- the measurement for frequency of sound waves is called “Hertz” abbreviated “Hz”? The measurement was named after Heinrich Hertz, a German scientist who discovered and created radio waves in the late 1800s.
- bats can hear better than any other living creature? People can hear sound produced by sound waves traveling from 20 to 20,000 Hz. Bats can hear up to 120,000 Hz. These sounds are too high for people to hear, but they are music to a bat's ears.

How Instruments Make Sound

String Instruments

On string instruments, such as the cello and double bass, the strings vibrate when they are plucked or when the musician draws a bow across the string. A short length of string vibrates rapidly; a longer string vibrates slowly. Musicians change the length of their strings by pressing the strings down against the fingerboard.

The strings on the instrument do not make much sound by themselves. The instrument's body acts as a resonating chamber to amplify the sound from the vibrating strings.

Woodwind Instruments

Some woodwinds, such as clarinets and bassoons, have reeds made of a short length of cane (a slender, flexible, woody stem of a plant, such as bamboo). The reeds vibrate when the woodwind player blows into the instrument. The vibrating reed makes a column of air inside the instrument vibrate and produce sound. Changing the length of the air column by pressing or releasing keys makes the pitch lower or higher.

The main difference between the clarinet and the bassoon is that the clarinet has one reed, while the bassoon has two reeds that are connected—a double reed.

About the Program

Developed by Yvonne Caruthers, a National Symphony Orchestra musician, *Connections: Science and Music* demonstrates surprising facts about the relationships between science and music. With the use of live performance, recorded music, slides, and discussion, musicians Yvonne Caruthers on cello, Jeffery Weisner on bass, Truman Harris on bassoon, Laurel Ohlson on horn, and Phil Snedecor on trumpet explore science and music with the student audience.

Instructional Activities

Hear the Pitch!

You need a ruler, two pencils, and rubber bands of varying thickness. Stretch a rubber band over the ruler. Then slide a pencil under the rubber band at each end of the ruler, so the band's middle part can vibrate freely. Pluck the rubber band; listen to the sound.

Next, slide the pencils closer together, so the vibrating part of the band is shorter. Pluck again. Has the sound changed? If so, how?

Try various thicknesses of rubber bands and vary their tension. What differences do you hear?

Internet Resources

For more information, visit:

library.thinkquest.org/C0120343/sciencefriday.com/kids/sfkc20030509-2.html

What to Look and Listen for

- The way your emotions change when the musicians play different types of music.
- The unique sound or timbre (pronounced TAM-bur) of each instrument. A cello and a bass may produce the same note, but it will not sound the same.
- High and low pitches. (Remember, the higher the pitch, the higher the frequency.)

Additional resources related to *Connections: Science and Music* can be found on pages 28-29. General Dynamics is the proud sponsor of the NSO's 75th Anniversary Season. Washington Gas is the proud sponsor of the NSO Family Season.