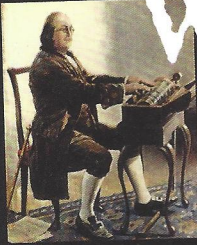


# Benjamin Franklin's Singing Bowls

by Donna Bowman Bratton

It's a very bad idea to get most musical instruments wet; with the glass armonica, it's a must!



**W**hat do the movies *March of the Penguins*, *Eragon*, *Interview with a Vampire*, and *Frida* have in common? Listen closely to each soundtrack and you'll hear Benjamin Franklin's favorite and most scandalous invention, a musical instrument he named the glass armonica. In fact, it was the first musical instrument invented by an American.



Franklin was inspired by the simple trick of running a wet finger around the rim of a wine glass to make it “sing.” For centuries, people in China, India, and Japan have tapped pottery and rubbed glass rims to make music. In the 18th century, musicians tuned wine glasses by adding various amounts of water to produce musical notes. Soon, musical glasses were considered the hottest instruments on the European music scene.

### The Making of a Glass Armonica

Around 1760 in London, Benjamin Franklin attended his first concert of musical glasses. He was fascinated with the exquisite sound. His mind swirled with ideas about designing a musical instrument by tuning glass itself, without water. For months, Franklin sketched, tinkered, and studied. Finally, he had a plan.

He hired a London glassblower to craft thirty-seven leaded glass bowls, varying from three to nine inches in diameter. The thickness and size of each bowl determined the note it would sing. Once completed, an iron rod was placed through a corked opening in each bowl. A flywheel and a foot pedal were attached to allow the bowls to spin by pumping the foot. By early 1761, his musical experiment was complete.

The glass armonica became a hit, especially in England and Germany. As many as 4,000 were made. Professional musicians toured Europe with the instrument. Hundreds of compositions were written for it by great composers such as Mozart, Donizetti, and Beethoven. Queen Marie Antoinette, Thomas Jefferson, and George Washington admired the celestial tones of the glass armonica. But Franklin’s musical creation soon garnered a sinister reputation.

### The Beginning of the End

Musicians began suffering from muscle twitches, numbness, dizziness, temporary paralysis, and hallucinations. Three of the most popular armonica musicians were forced to end their careers. The instrument’s eerie tones and piercing vibrations were blamed for lead poisoning (which can cause some of these symptoms) and for nerve damage. Although there is still debate about the possibility that lead could be leached through glass by contact with the skin, it appears unlikely. But, lead was a common additive in wines, medicines, as a flavoring in foods, in cooking utensils, dinnerware, and in early plumbing fixtures, so it would have been almost impossible, based on the limited medical technology of the time, to pinpoint the exact source of lead within a body. Franklin himself studied

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## What Makes Glasses Sing?

Scientists have experimented with glass for centuries. In 1638, famous astronomer, Galileo Galilei (1564–1642), wrote “. . . a glass of water may be made to emit a tone merely by the friction of the finger-tip upon the rim of the glass. . . .” Today, we call this physics phenomenon *stick-slip-friction*.

Every object has a natural frequency at which it vibrates. Dr. Michael Marder, Physics professor at the University of Texas, explains the natural frequency of glass. “It is hidden in the shape of the object, which leads it to wiggle or vibrate in specific ways. The rate of vibration is the note that comes from the glass.” The note reaches our ears in the form of a sound wave that is circular like the shape of the glass.

Tap a wine glass, or swirl your finger around its rim. As the invisible vibrations of the glass set the air inside it to vibrate at the same frequency, it is said to *resonate*. Resonance makes the vibrations bigger and the sound louder.

“When they [glasses] start to vibrate, they go back and forth at a specific rate,” Dr. Marder says. “To make a note, the glass must vibrate hundreds or thousands of times per second. . . .” Your finger doesn’t have to move that fast, though. “The glass sticks to your finger and releases hundreds of times per second.”

You can’t feel that microscopic sticking and slipping, but the glass still responds. When you add water, the vibrations of the glass drag water molecules with it, slowing down the vibrations. Look closely into the glass as you rub its rim. You’ll see the water vibrate along the edge. D.B.B.



A street performer plays the water glasses in a square in Rome.

the effect of lead to some degree, yet his letters indicate no concern over the glass armonica. As for the nerve damage, it is commonly recorded that the first premier musicians of the armonica, Marianne Davies and Marion Kirchgassner, suffered permanent nerve damage, presumably caused by the glass' vibrations through the nerve-rich fingertips. Other nervous or emotional disorders were blamed on the audible sounds of the glass armonica, which had been credited both with curing melancholy (as was the case when Franklin himself treated a Polish Princess by playing his glass armonica), and blamed for causing madness because of the dramatic range of tone. German towns banned the glass armonica after the death of a child. In 1788, an instruction pamphlet warned against playing the armonica after midnight. Superstitious people believed the haunting sounds could wake the dead.

To make matters worse, Vienna's Dr. Franz Anton Mesmer used a glass armonica to "mesmerize" his patients into a trance. His séance-style treatments were raising eyebrows. The sounds of a glass armonica, he said, helped restore balance and health to the body. In 1784, King Louis XVI of France appointed Benjamin Franklin to lead a commission to investigate Mesmer. In the end,

Mesmer was declared a fraud. The glass armonica was guilty by association. Franklin had accidentally tarnished the reputation of his beloved armonica. By 1830, the glass armonica's tones had been mostly silenced due to superstitions and the changing style of music. Over the next decades, it was most often heard in ghoulish theatrical scenes of madness.

### Glass Armonica Makes a Comeback

They say time heals all wounds. In the late 20th-century, the glass armonica was revived by scientific glassblower, Gerhardt Finkenbeiner. He uncovered the plans for Franklin's glass armonica in the 1980s. To eliminate the lead, he used pure quartz crystal. He also replaced the foot pedal with an electric motor. Today, nobody blames the instrument for making them sick.

In 1990, Cecilia Brauer, a professional pianist with the New York Metropolitan Orchestra, bought a glass armonica. Her experience as a talented concert pianist could not prepare her for the challenges of playing a glass armonica. "I used to play the Tchaikovsky concerto on the piano," Brauer said. "But when I could finally play 'Yankee Doodle' on the glass armonica, I was so happy." Brauer is now one of fourteen professional armonica players in the world.

Today, you can see Benjamin Franklin's original glass armonica at the Franklin Institute in Philadelphia. About eight other 18th-century armonicas are housed in museums across the globe. The "heavenly" sounds of Franklin's musical invention have now become popular with holistic healers and in meditation exercises. Franklin's beloved musical instrument has come full circle and has inspired the creation of other glass musical instruments. 🎵

To play a virtual armonica, access the Franklin Institute at <http://sln.fi.edu/franklin/musician/virtualarmonica.htm>

**Donna Bowman Bratton** is a freelance writer who is currently writing a children's book about Franklin's glass armonica. She lives in Round Rock, Texas.

# Make a Set of Musical Glasses

## WHAT YOU DO:

1. Test the pitch of your glasses by gently tapping them with the spoon. Then rub your finger around the rims, paying attention to the musical note you hear. Be sure to hold the base of the glass with your free hand.

Now that you've heard the frequency of your glasses empty, you're ready to tune them for the song, "Mary Had a Little Lamb," which only requires three notes. You'll recognize the notes by first singing the song to yourself.

The first word, "Mary," has two notes.

2. Add water to your first glass until, when you rub its rim with your finger, it sounds like your voice as you sing the first part of "**Ma** -ry." Place your "E"

## YOU'LL NEED:

3 Clean wine glasses or thin-walled goblets  
Small pitcher of water  
Bowl of water  
(to dip your fingers into)  
Towel (to protect the table from dripping water and to dry your hands)  
Spoon  
3 labels marked C, D, and E  
Clean hands

label (high note) in front of this glass. (Keep your fingertip wet by dipping it in the bowl of water before you rub your finger around each rim.)

3. Add water to the second glass until, when you rub the rim, it sounds like the last half of "**Ma-ry**."

Place the "D" label (in-between note) in front of that glass.

4. Add water to the third glass until it sounds like the word "**had**" in the song.

Place the "C" label (low note) in front of the glass.

5. Now, one glass at a time, slowly play "Mary Had a Little Lamb" by rubbing the glasses in the following order:

EDCDEEE – DDD – EEE – EDCDEEE – CDDEDC

D.B.B.

