Mycowood violins treated with fungi rival the sound of the famous Stradivarius violin

Fungi Used in Making Beautiful Music

The famous sound of the Stradivarius is now affordable!

By Andre Hsiung, MS

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When Andre is away from microbiology, he is also an amateur violinist and can be found on Saturday mornings in a local violin shop, where he is an apprentice violin appraiser/maker. If you find an old violin in your attic or neighborhood garage sale, please be sure to give him a call!

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When it comes to the subject of fine bow stringed instruments, especially the violin, the name Stradivarius usually comes to mind.

Just as microorganisms are used to produce fine wine, can they also be used to make musical instruments that can rival, or even exceed, the beautiful resonant tones of a Stradivarius?

Antonio Stradivari was an Italian luthier and crafter of stringed instruments such as violins, cellos, guitars, violas, and harps. He lived in the city of Cremona, Italy, from 1644 to 1737. The Latinized form of his surname, *Stradivarius*, as well as the colloquial "Strad" is often used to refer to his instruments.

It is estimated that he made 1,000 to 1,100 instruments and that around 650 of these instruments survived to modern day, including 450 to 512 violins. Although many great violin makers lived in Cremona, other parts of Italy, and throughout Europe, Stradivari is generally considered the greatest and most significant artisan in this field.

His instruments are regarded as amongst the finest bow stringed instruments ever created, highly prized, and still played by soloists and professionals around the world; they are also highly coveted by the collectors.

Figure 1: Antonio Stradivari crafting one of his famous violins that were unmatched...until now!

Unfortunately, Stradivari died without revealing any of his secrets, but the general consensus among experts is that a combination of factors (wood selection, varnish, design, etc) made his instruments so unique.

To illustrate the value of his violins, one of his fiddles called "Lady Blunt" (named after its first publicly known owner–Lady Anne Blunt), was auctioned by the Tarisio auction house in 2011 for $15.9 million U.S. dollars.

Besides Stradivari violins, other instruments made by other renowned Cremona, Italian, and European makers from the 1600s to 1700s are also easily sold to collectors for the price of at least a couple hundred thousand to upwards of a couple million dollars.

Needless to say, these prices make these instruments price prohibitive to the great majority of musicians, and even the most talented soloists would have to partner with wealthy corporate sponsors to play these instruments.

With the severe shortage of fine instruments and hundreds of fine musicians graduating yearly from the finest music schools such as Julliard, the Cleveland Institute of Music, and the Paris Conservatory, etc, these aspiring musicians need to resort to much more affordable instruments without compromising sound quality.

A few months ago, a colleague shared with me an article describing the work of a Swiss wood researcher Professor Francis W. M. R. Schwarze (Empa, Swiss Federal Laboratories for Materials Science and Technology, St. Gallen, Switzerland) who had succeeded in modifying the wood for a violin through treatment with special fungi. This treatment alters the acoustic properties of the instrument, making it sound indistinguishably similar to a Stradivarius. In a dinner talk at a conference, Schwarze reported on his research and gave a preview of what his wood treatment method could mean, particularly for young violinists.

Low density, high speed of sound, and a high modulus of elasticity—these qualities are essential for ideal violin tone wood. In the late 17th and early 18th centuries, Stradivari used a special wood grown only in the cold period between 1645 and 1715. In the long winters and cool summers, the wood grew especially slowly and evenly, creating a low density and high modulus of elasticity. Until now, modern violin makers could only dream of wood with such tonal qualities.

However, Professor Schwarze's developments could soon make similarly good wood available for violin making. He discovered two species of fungi (*Physisporinus vitreus* and *Xylaria longipes*), which decay Norway spruce and sycamore—the two most important kinds of wood used for violin making—to such an extent that their tonal quality is vastly improved.

Figure 2: **Physisporinus vitrius,** ***a white fungus growing on wood in the wild. It is used on the violin's top plate.***

Figure 3: **Xylaria longipes,** ***also known as "dead man's fingers" growing in the wild. This fungi is used on the sycamore wood of the bottom plate of the violin.***

"Normally, fungi reduce the density of the wood, but at the same time, they unfortunately reduce the speed with which the sound waves travel through the wood," the researcher explained. "The unique feature of these fungi is that they gradually degrade plant cell walls, thus inducing a thinning of the walls. But even in the late stages of wood decomposition, a stiff scaffold structure remains via which the sound waves can still travel directly."

Even the modulus of elasticity is not compromised; the wood remains just as resistant to strain as before the fungal treatment—an important criterion for violin making.

Professor Schwarze uses the vegetative state of two fungi, *Physisporinus vitreus* for the top plate and *Xylaria longipes* for the bottom plate, with thread-like cells that actively colonise the wood and secrete enzymes which ultimately alter the wood structure and its acoustic properties. After six to nine months of exposure to the fungi, the sycamore wood will be 15% less dense than before treatment.

Before the wood is further processed to a violin, it is treated with ethylene oxide gas. "No fungus can survive that," Professor Schwarze said. This ensures that fungal growth in the wood of the violin is completely stopped.

Together with the violin makers Martin Schleske and Michael Rhonheimer, Professor Schwarze developed violins made of mycowood, (wood treated with wood-decaying fungi). In 2009, the violins were played in a blind, behind-the-curtain test versus a genuine Stradivarius from 1711. All the violins were played by the British violinist Matthew Trusler. The result was surprising for all participants: both the jury of experts and the majority of the audience thought that the mycowood violin that Schwarze had treated with fungi for nine months was the actual Strad. "Of course, such a test is always subjective," Professor Schwarze said. "There is no clear-cut, scientific method for measuring tonal quality." The actual Stradivarius came in second place. Schwarze's untreated violins came in last place.

Currently, Professor Schwarze is working on an interdisciplinary project to develop a quality-controlled treatment for violin wood, with successful, reliable, and reproducible results. Until 2014, within the scope of the project that is funded by a Swiss Foundation, 30 additional violins will be made from fungal-treated wood.

Regarding what opportunities this project can lead to, Schwarze explained, "The successful implementation of biotechnological methods for treating soundboard wood could, in the future, give young musicians the opportunity to play on a violin with the sound quality of an expensive—and, for most musicians, unaffordable — Stradivarius."

It is obvious that there are clearly two market segments for the violin enthusiasts: the collectors and the musicians. While all musicians typically care about is the sound quality, the collectors are solely concerned with the origin, identity and the craftsmanship.

As a personal experience, I have been to appraisal events where collectors and appraisers don't even play the instruments (not even pluck the strings) and they just look at the instruments as if they are fine oil paintings. When a fine instrument is uncovered or confirmed, the sense of jubilation is intoxicating, in addition to instantaneous wealth.

Hopefully, Professor Schwarze's work will confirm the viability of mycowood and allow so many talented musicians to produce high quality sounds without spending a fortune. Most importantly, from a violin connoisseur and appraiser's standpoint, nothing can substitute the exhilarating experience of holding a Stradivari violin.

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The author repairing an old Italian cello, possibly made by Pietro Guarneri of Mantua, 1693. Original label shown below.