Low Brass Network

Toxicity Inside Low Brass Instruments

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Abstract

Whether factually or from stigma, it is universally recognized that low brass musical instruments are amongst the largest culprits of uncleanliness. Yet, there is little research on how to solve such an issue effectively, and many do not even realize how dirty their instrument is. Hoping to alleviate this problem, we analyzed samples of the dirt inside multiple instruments and examined several different factors amongst the instrument samples we used, including frequency of use, instrument brand, and frequency of instrument cleaning. The number of bacteria in a low brass instrument mostly depended on how often it was used and cleaned. The more often an instrument was used to practice, the more bacteria it generally had, and the more often an instrument was cleaned, fewer bacteria were present. More significant numbers of bacteria were present further away from the mouthpiece. These results demonstrate that low brass musicians should attempt to clean their instruments more often to prevent a buildup of bacteria.

Contents

Introduction

Amongst the international low brass community, all musicians are advised to keep their instruments clean of debris, stagnated water, and harmful bacteria. Although musicians are suggested to clean their instruments every month, cleaning and maintaining their instruments can be tedious[4]. The method and time taken to clean one's instrument can greatly affect toxicity inside the instrument. For example, when a trombonist cleans their instrument by simply running it under cold water, the instrument could still contain toxic bacteria, which may cause infections, illnesses, and sickness.

Methods

Before the experiment, all participants were asked to fill out a short survey, which included questions regarding:

- A detailed explanation of cleaning habits
- Methods used for oiling the instrument
- The average amount of time spent playing the instrument
- Model of the instrument

The survey's purpose was to help the researchers make proper correlations after receiving the data from the examination.

The steps taken during the research and experiment process utilized the use of swabs, water, and several machines to extract and prepare the isolated samples from each instrument for examination and research. Each instrument was divided into individual components that would be extracted separately to study specific parts of the instrument. The divisions were as follows:

A. Tuning slide
B. Spit valve tubing
C. Lead pipe
D. Bell
E. First trigger/first valve
F. Second trigger/second valve
G. Third valve
H. Fourth valve

Not all instruments contained the divisions mentioned above. For instance, many trombone models only had the first 4 sections, while some euphonium models consisted of all 8 components.

Materials

- Cotton swabs
- 15mL tubes
- 1.5 mL tubes
- Centrifuge
- Incubator
- Vortex mixer

- 1 0.5-10 µL pipette
- 1 10-100 µL pipette
- 1 100-1000 µL pipette
- 1 1000-5000 µL pipette
- Bottle of agar solution
- Petri dishes
- Microscope (with camera)
- Microscope slides
- Inoculating loop

Extraction and Preparation

After outlining the divisions and planning what locations the bacteria would be extracted from, we used cotton swabs to remove the samples from parts of the instrument. The swabs would be diluted into the water and processed by machines afterward.

1. To start the process, pipette 0.5 mL (500 µL) of water into tubes that will contain the samples after extraction. Label each tube with a number corresponding to an instrument, and a letter corresponding to the instrument's part. (e.g: 1F containing the sample for the second valve of a euphonium).
2. Extract samples by dipping the tip of a swab into the water and sticking the swab into the instrument.
3. After one minute of thoroughly rubbing the swab around the edges of the component, take the swab out and dilute it into the marked tube.
4. Repeat steps until samples from all parts of all instruments have been extracted.
5. Centrifuge all samples.
6. Place the samples in an incubator machine set at a temperature of 40 degrees Celsius for 10 minutes.
7. Remove the tubes and place them in the freezer for around 15 minutes before taking them out.

Culture Growth

1. Take a petri dish out and use a pipette to extract agar from the bottle and transfer it to the dish so that a thin layer of agar is covering the bottom.
2. Wait for the agar to harden.
3. While waiting, draw lines on the petri dish lids to divide the dish into 4 sections, and label the sections for each sample, repeating the process until sections have been made for all samples. After the agar hardens, use a cotton swab to extract the samples from the tube and rub them onto the agar.
4. Repeat for each sample before placing all the petri dishes into the still air box.
5. Wait for a few days until the bacteria have fully grown before proceeding on to examination.

Examination

1. Have the microscope ready and bring out the slides and inoculating loop.

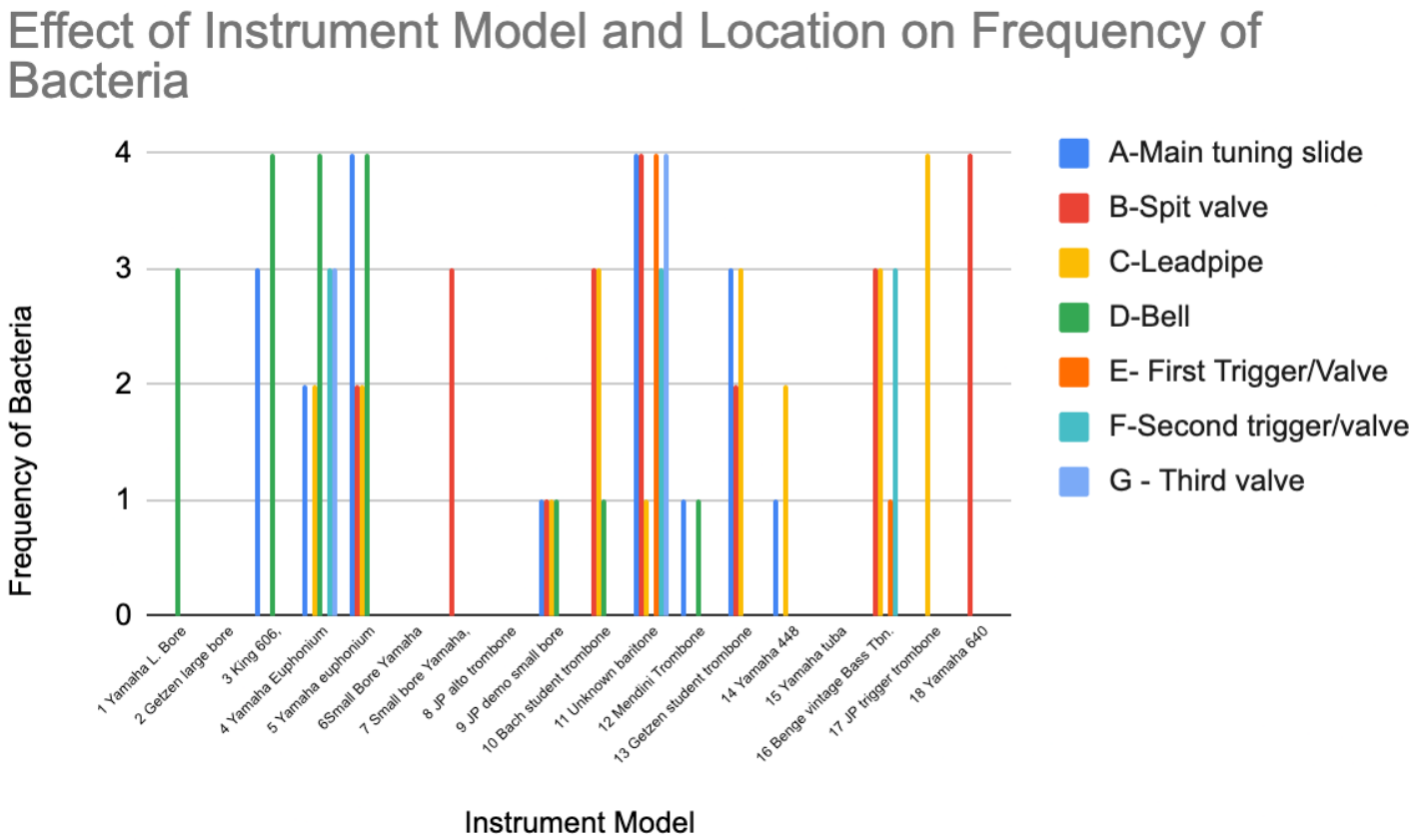
2. Using the inoculating loop, transport the samples from the petri dish to the slide.
3. Examine the sample with the microscope and take a picture using the microscope camera software.
4. Repeat until all samples have been examined.

Findings

To detail our results efficiently, we analyzed the data by examining correlations among each of the factors included in the research survey. This included the frequency of greasing our instrument, the frequency of cleaning sessions, the most recent time we did both, and the time practiced per week.

Health Effects

Among the bacteria/fungi found were E. coli, green mold, black mold (Stachybotrys chartarum), and bacillus subtilis, all of which thrive in moist, dark conditions. According to the CDC, E. coli could pose a risk for diarrhea, stomach cramps and other illnesses[3]. Additionally, multiple mold experts state that green and black mold, declare that green mold can trigger respiratory conditions such as coughing and



allergies[1]. while black mold could result in nasal congestion, sneezing, itchy eyes, etc[2].

Frequency of Cleaning/Most Recent Cleaning

When studying the frequency of cleaning/most recent cleaning, we analyzed correlations between subjects, but also different parts of the same instrument. For different subjects, we noticed there was a small correlation between the frequency of cleaning and the cleanliness of the petri dish.

However, going deeper, we analyzed the cleaning routine of our participants. We noticed that the subjects with healthy cleaning routines, including submerging the trombone in water and completely cleaning it, had fewer amounts of bacteria in their samples. We see this with subjects 2, 6, and 16 above.

Frequency of Oiling/Most Recent Oiling

For the factor of frequency of oiling/most recent oiling, we compared the main tuning slide (#A) for each subject. We noticed that oiling did not have a large effect on bacteria, as different subjects with different frequencies warranted scattered results with no correlation. For example, subjects 8 and 9 both grease their instruments a couple of times every year with no bacteria. Subject 10 greases their instrument weekly without any sign of bacteria. Other subjects who also either grease a couple of times per year or a couple of times per month have varying results, including yellow, brown, and white-colored bacteria. Similarly, the most recent oiling does not have a large effect on bacteria growth, although subjects 6 and 12—who both last greased their instruments six or more months ago, showed signs of bacteria.

Frequency of Practicing and Playing

When examining how the usage of the instrument affects bacterial growth, we compared the lead pipes (#C), as that is the main contact point between the mouthpiece and the instrument's body. We noticed a direct correlation between the amount of time practiced per week compared to the size of the bacteria colony. For example, subjects 7 and 8 practice for one hour per week. Their lead pipes show no signs of bacteria at all, while subject 16 practices for 4 hours per week, resulting in a medium-sized colony in the dish.

Bacteria Inside Instrument Maintenance Solutions

For the factor of the lubricant or grease used, we compared both the brand and usage of lubricants/greases in the instruments. After comparing results from instruments using the same lubricants or grease, we discovered a general trend in the number of bacteria.

The lubricant or grease significantly affected the prevalence of bacteria in the instrument. We found that instruments using the Hetman 11 valve oil or the Yamaha slide cream had no bacteria. Additionally, instruments using Al Cass valve oil, Hetman 2 valve oil, and Rotor Spindle valve oil all had a very small presence of bacteria. Instruments using Yamaha lubricant were

found to have a small presence of bacteria: a little more than the previous ones. Finally, Slide-o-Mix lubricant was found to have the most bacteria out of all the greases and lubricants studied, although only amounting to a scarce amount.

Instrument Model/Instrument Type

For the factor of the instrument model, we noticed that the instrument model does not affect the number of bacteria. The instrument model is not the main determinant and has no correlation.

For the instrument type, there is also no correlation between different instruments. For example, we found that similar types of bacteria were occurring in 11C (baritone) and 7B (small bore trombone). Instrument model and instrument type have minimal correlation with bacteria growth.

Frequency of Bacteria in the Parts of the Instrument

After collecting the frequency of bacteria and all data from the instruments, we found a correlation between the number of bacteria and where the bacteria was extracted from. It was observed that parts of the instrument closer to the mouthpiece contained a lower amount of bacteria as compared to parts further down the tubing, such as the bell and tuning slide.

Bacterial growth increases as the air from your lips travels further down the mouthpiece, showing that extra care should be given to cleaning these sections of the instrument, despite intuitively seeming to be cleaner. This could also be influenced by the bell of the instrument being exposed to the open air and containing a larger hole, allowing for more airborne microorganisms to enter the instrument.

Results Compared to Predictions by Surveyors

Before taking samples, we surveyed the owners to determine what they believed was inside their instruments. We discovered after the experiment that 57% of the instrument owners did not accurately predict the amount of bacteria present. Some instrument owners predicted correctly that there would be bacteria, but overestimated the amount, with some saying “[a] lot of germs…” while having little bacteria present in the sampled portions. Comparatively, other instrument owners did not mention bacteria as a possibility of an outcome for the experiment. The responses that these owners gave generally listed grease or lubricant, or only had a general idea it was dirty, but not contaminated with bacteria.

Conclusion

The research conducted by the Low Brass Network has examined the consequences that occur when sufficient care is not taken to clean your instrument. Many musicians forget to properly maintain their instruments, which poses health risks. This study highlights the consequences of a lack of care regarding low brass instruments. The participants of the study were all high school students that regularly used their instruments.

Our researchers also looked at the issue from multiple angles, not just examining the bacteria but also how oiling methods affect the instrument, as well as the amount of time practiced, and the instruments of the low brass family itself (including model type). The results gave us a more specific breakdown of the way bacteria were present. The types of bacteria were found to be the same in all instruments, regardless of model type, and oiling habits did not influence bacterial growth. The number of bacteria varied as a result of playing habits but was mainly influenced by cleaning habits. The scientists in this study also learned that bacterial colonies grow in different numbers depending on the location of the instrument, as a result of the location's proximity to air.

The main goal of this publication is to help fellow players truly understand how and why they can maximize the cleanliness of their instruments. There are many misconceptions about how to maintain your instrument. The study found that all instruments are affected, no matter what is played or what model is played, meaning that everyone should take initiative to clean their instruments. Furthermore, players that tend to play for longer amounts should be wearier and clean their instruments regularly.

Results also showed a correlation between certain instruments parts, which will help inform players where they should routinely clean their instruments. It is not just the appearance or cleanliness of the instrument that is at stake, but also the health of the player.

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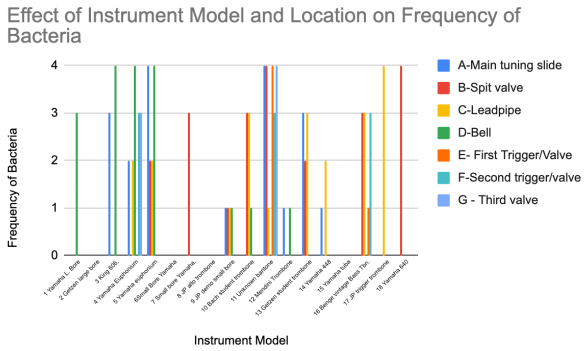
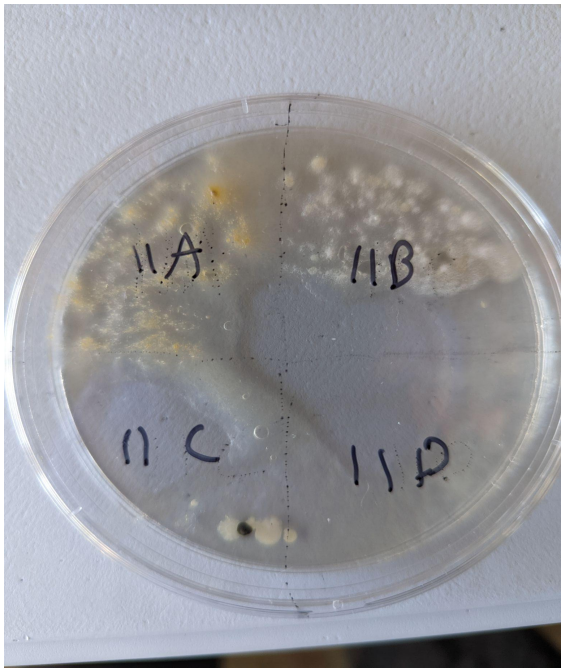
Appendix



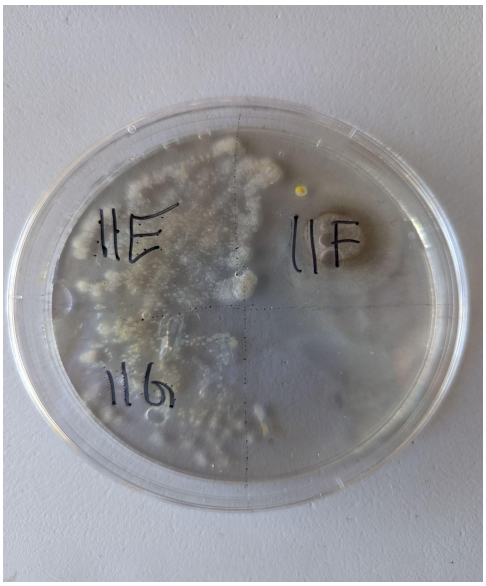
Appendix A

Number	Frequency
0	None
1	Very Low
2	Low
3	High
4	Very High

Appendix B



Appendix C



Appendix D

About Us

Low Brass Network strives to make changes in the low brass community, and this study conducted by its researchers sheds light on how the smallest of actions make an immense difference in the well-being of all players. The Low Brass Network is an international non-profit organization dedicated to spreading knowledge regarding low-brass instruments as well as training future and current generations of low-brass players. Several projects are being implemented to increase the market for low brass and benefit all players worldwide. Please visit us at lowbrassnetwork.org.