

## Physiology and Physics:

### What We Need to Know to Be Better Performers

# Physiology

It has been my experience as an educator that many of today's trombonists appear to be fighting the instrument. By this I mean that they are not allowing their body to work in a manner that is most natural. Hand positions (both right and left) are awkward at best, and do little to contribute to making music. In fact, they frequently hamper rendering a musical performance.

We have all seen the students grasping the slide brace with the right hand in a hammer and jerk the slide back and forth like sawing wood. It is my opinion that this problem begins in the first months of playing. As long as the young student is playing whole and half notes, he can manipulate the slide efficiently enough to keep up with the rest of the class. They may even make it through quarter notes at a moderate tempo. The moment that quicker movements are required however, the band director suddenly becomes concerned about his 'lagging' trombone section.

I suggest that if trombonists learn the following physical factors regarding how to effectively use their body, they will experience musical success more quickly.

- 1) **Keep the weight of the instrument in the left hand.** This will enable the right hand to move the slide more freely. The slide will wear more evenly since it is not bearing the weight of the instrument. The instrument should rest firmly in the fleshy part where the thumb meets the palm. Do not bend the wrist; keep it straight. Yes; sometimes you may catch a small piece of skin when you bring the slide in. Even the professionals do it occasionally!
- 2) **The palm of the right hand should be toward the player.** The wrist bends back and forth naturally in this manner and will allow movement between at least two, and perhaps three, adjacent positions.
- 3) **Hold the slide brace between the thumb and first two fingers of the right hand.** This is most natural 'grip' we use when picking up a small object. Pick up a pen or a pencil that is lying on a table. You will probably pick it up in the same manner described above which represents an acceptable slide grip.
- 4) **Use the wrist when changing positions as much as possible.** Try to eliminate excessive use of the arm. This will be beneficial to the 'flow' of the slide in fast passages. It can also improve pitch by not moving the slide too far between half-steps.
- 5) **Try not to stop the slide between every position when executing rapid passages.** This is

especially important during chromatic lines. Its technique requires critical coordination between the tongue and the slide, but it is vital to develop technical facility.

# Physics

If students have an understanding of the laws of physics concerning the production of sound, they tend to practice more efficiently. Even younger players can learn that four 'laws' determine the pitch of all sound. The teacher may have to use analogies in explaining that **length, tension, diameter, and density of a vibrating column are the determining factors of pitch**. Everyone has a basic concept of how pitches are changed on a string instrument, so using that example will usually suffice as an introduction to these principles of physics. Since the lips are the vibrating membranes for brass performers, it is important that the player understands how the lips work in conjunction with the mouthpiece and the rest of the instrument. The more vibrations per second, (Hz) the higher the pitch. Fewer vibrations result in lower pitches.

- 1) As we ascend, the **tension of lip muscles** creates faster vibration of the lips. They work in the same manner as tightening a string.
- 2) Since the lips contain muscle tissue, **the density of the lips** also changes when ascending, thus creating more vibrations per second. The more dense a vibration material, the more rapid its vibrations.
- 3) As our **aperture decreases in size**, the length of the vibration column becomes shorter. Like a shortened string, the pitch is raised.
- 4) The **diameter of the vibrating column is affected** when the mouthpiece is pressed to the lips. A smaller diameter vibrating column results in higher pitch. Unfortunately, this pressure is usually excessive and hinders performance. It is important to use a little pressure as possible in order to control the embouchure and prevent leakage of air at the corners of the mouth.

The development of the embouchure using these four elements working together will assist the student in progressing naturally. It is the combination of performer's vibrating membrane (lips) and the lengthening of tubing in a brass instrument that produces changes in pitch. No magic, just old-fashioned physics!

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