

### 4.2.1: Longitudinal Waves

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In Chapters 3 and 4 we saw that vertical springs and horizontal springs behave the same way and can be described by the same equation. In this chapter so far we have seen that transverse waves can be described by a line of masses undergoing transverse (up-and-down) harmonic motion. Can we also have a wave where the particles move with harmonic motion in the horizontal direction?

YES! **Longitudinal waves** are waves where the motion of the material in the wave is back and forth in the same direction that the wave moves. Longitudinal waves are sometimes called **compressional waves**. Sound waves (in air and in solids) are examples of longitudinal waves. When a tuning fork or stereo speaker vibrates it moves back and forth creating regions of **compression** (where the pressure is slightly higher) and regions in between where the air has a lower pressure (called a **rarefaction**). These compressions and rarefactions move out away from the tuning fork or speaker at the speed of sound. When they reach your ear they cause your eardrum to vibrate, sending signals through the rest of the ear to the brain.

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