WHAT IS SAMPLE FOCUSING?
Focusing is the term used to describe the narrowing of the width of a peak. It is used to improve the signal to noise ratio and increase the detection limit of an analysis. When a peak is focused, its bandwidth decreases significantly causing the sample to concentrate in a very small area of the capillary column. The result is a very sharp peak that has a high signal to noise ratio.

The most common way to focus a sample is to cool a selected area of the column. Cooling causes the sample to spend more time in the stationary phase which slows it down. As the sample approaches the cold spot, the leading edge of the sample band will travel slower, and eventually the trailing edge will catch it. The sample band becomes very narrow and the cooling is then turned off, releasing the sample. An example of this process is shown in Figure 1.

COOLING TECHNIQUES

High Pressure Liquid
The most common method of cooling a section of a capillary column is using a high-pressure liquid, usually carbon dioxide. The liquid is brought as close to the column as possible before it expands into a gas. This improves the efficiency of the trap because the cooling is caused by the expansion of the liquid not its temperature. High-pressure liquid traps use large amounts of coolant but can reduce the column temperature to as low as -40°C in a few seconds. An example of a high-pressure liquid cold trap is shown in Figure 2.

Compressed Gas
When compressed gas is used to cool an area of the column, the temperature of the cooling gas must be less than the GC oven. This is because compressed gas cold traps completely rely on the temperature of the gas to cool the column. Cold traps that use compressed gas become more efficient as the oven temperature rises so are particularly useful for trapping semi-volatile and high boiling point compounds. These traps use much less cooling flow than high-pressure liquid traps but transfer it more efficiently. An example of a compressed gas trap is shown in Figure 3.

DISCUSSION
Cold traps that use compressed liquids, like CO₂, are best used to trap volatile compounds. They are very effective at the front of the column when used to compensate for bad injection technique (see Figure 4). Compressed gas cold traps, like SGE’s compressed air trap, are very effective at trapping semi-volatile and non-volatile compounds. They are best placed at the end of the column where they can sharpen up peaks just before they hit the detector. Compressed air traps can also run off a standard air compressor, so they are very economical to run.