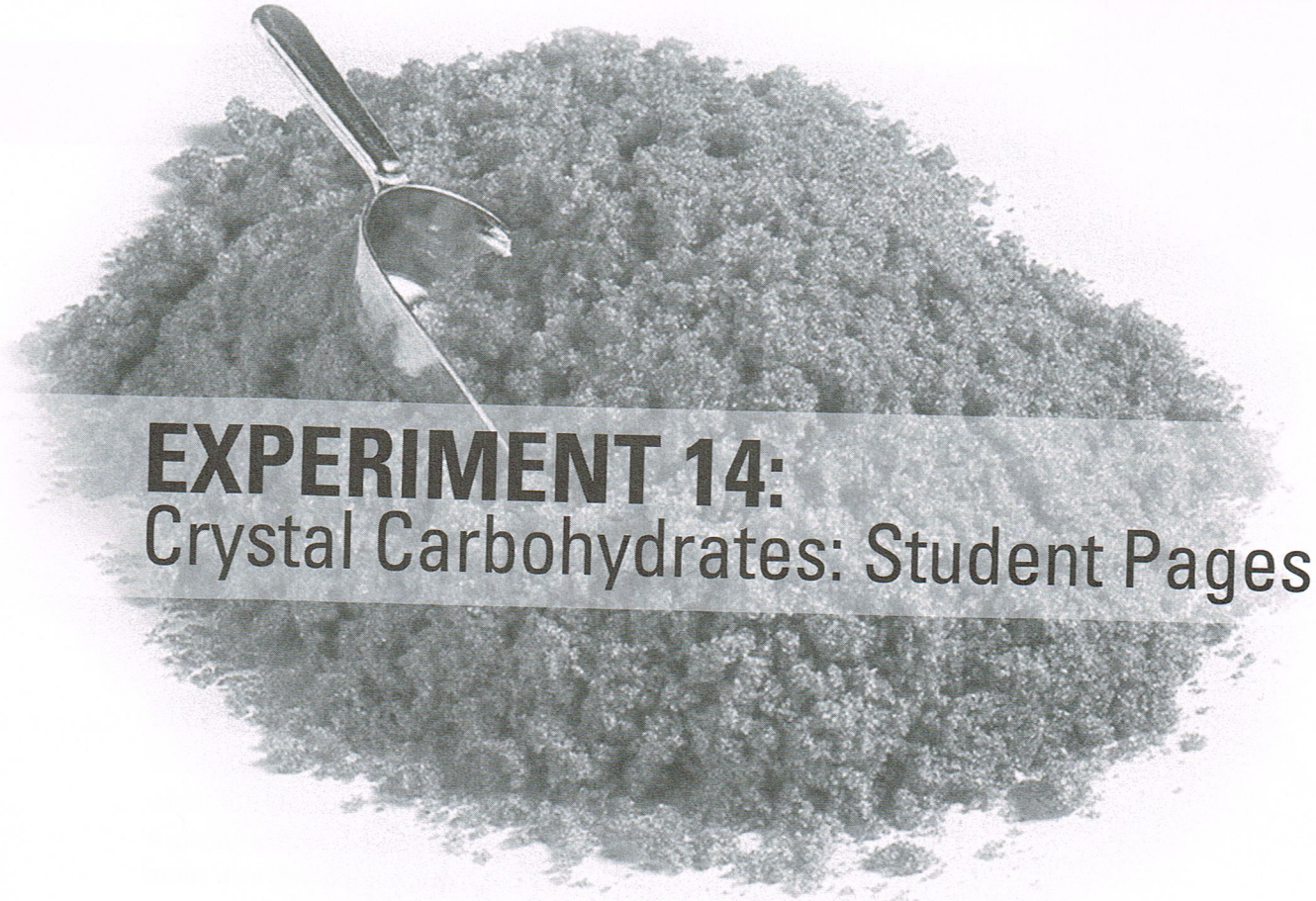

EXPERIMENT 14:
Crystal Carbohydrates: Student Pages

CREATING A DATA TABLE TO ANALYZE HOW SUGAR STRUCTURE IMPACTS THE FORMATION OF BUTTERSCOTCH CANDY

BACKGROUND

From the title of this experiment alone, I know that I have your attention. That's right; in this lab we are working with sugar. The average U.S. student consumes about 40 lbs. of sugar each year! And this desire for sugar is nothing new. Cravings for sweets date back to the 16th century when a teaspoon of sugar sold for almost $5. Can you imagine what a piece of candy would have cost?

But why is sugar so good? Sugar, which goes by the scientific name *sucrose*, is an ideal energy source for the human body. Figure 14.1 shows the molecular structure of sucrose, which is made up of carbon, oxygen, and hydrogen atoms.

The sucrose molecule packs a lot of calories (human energy units) into a small amount of substance. It is also easy for the human body to digest, providing instant energy.

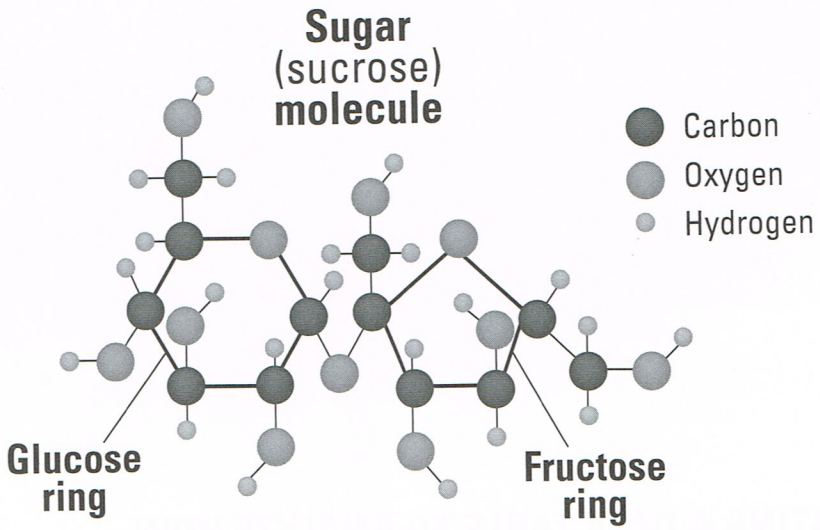

Figure 14.1: Sugar (sucrose) molecule.

With all these good qualities, why do people warn you to stay away from eating too many sweets? Although sucrose provides energy, the body quickly synthesizes that energy. This causes you to experience a sugar "high" before you "crash" and your body is left feeling tired. Second, sucrose is often considered to be an empty calorie source because it doesn't come along with the vitamins and minerals that our body requires. Finally, once the body has absorbed enough sugar, the remaining sucrose is converted into fat stores, which can lead to health problems. So what is the lesson here? Sugar can be consumed in moderation. It isn't healthy to eat all 40 lbs. in one day; however, you certainly do not have to completely remove it from your diet.

In what form do you consume sugar? It is found in almost all foods from fruits to cereals, but in its most highly concentrated form, sugar is obtained through candy. Candy aligns the chains of sugar in a way that is pleasing to the mouth and body. These molecules will interact like Legos that lock together to form crystals, similar to what is seen in rock candy. However, not all sweets want crystallization of sugar. You can prevent crystallization from occurring using a couple of methods, such as adding acid. Acid breaks down the chain into its two subparts—glucose and fructose—making it difficult for the sugar molecules to stay together. You can also add other sugars into the mix, like glucose, to prevent the

crystals from forming. Finally, you can use fats like butter to prevent the sucrose molecules from locking into place.

In this experiment, several lab groups will create the sucrose candy of butterscotch using the acid method of preventing crystallization. Several other lab groups will prepare their candy with a mix of different kinds of sugars. One other group will volunteer to make its candy without the acid to see the difference in how sugar reacts when it starts to make chains. We will then compare sugar structures of all three methods to observe the differences in structure.