1. Read the article *Metals and Health: Requirements and Risks*
2. Complete the Hunting for Metals assignment. Fill out the chart on page 5, or recreate it on a separate sheet of paper.
3. For each element that you included in your chart, research the element's function or purpose in the human body. Record your findings below.

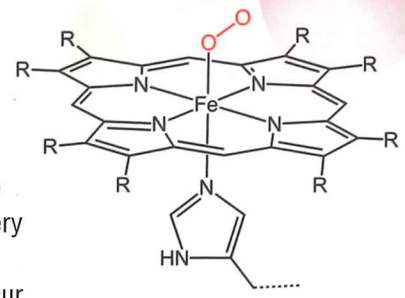
# Metals and Health: Requirements and Risks

**By Regina Malczewski**

We all know about solid metals that are shiny and bendable and that conduct electricity, but it turns out that small amounts of dissolved forms of metals also exist inside our bodies. They are very important to us! Like other chemicals, they interact with living things in many ways. Certain metals are important for good health, but other metals can be dangerous when they are present in the body.

The metals most commonly linked with human health are **iron** (Fe), **copper** (Cu), **zinc** (Zn), and **cobalt** (Co). These metals are an important part of enzymes, which are enormous molecules in the body that control the speed of chemical reactions. Enzymes do many things, including producing energy, healing wounds, and controlling infections.

Vitamins often contain metals, and they help enzymes to do their work. In fact, cobalt is at the core of vitamin B12. Copper is found in the active site of many enzymes, and is very important in the production of energy. Blood cells use zinc to protect us from viruses and bacteria. And speaking of blood, it wouldn't be red without the iron that is present in a subunit called a heme that is part of a huge molecule called hemoglobin. Hemoglobin is found in our red blood cells, where the iron binds to oxygen and carries it throughout the body. Hemoglobin is like a delivery truck bringing oxygen where it needs to go.




This is model of a heme. Can you find the iron (Fe) at the center? Iron is special because it can grab and let go of oxygen.

While small amounts of metals are important for good health, problems can occur if there is too much of a certain metal, or even certain forms of a metal. Metals like **chromium** (Cr), **nickel** (Ni) and **lead** (Pb) can be very hazardous. The effects depend on the metal, the form, the amount, and how it gets into the body. For example, lead can be present in drinking water, which leads to lead poisoning. This was a real problem recently in Flint, Michigan, where they had to clean the lead out of the water before people could drink it. Lead is especially harmful to young children, and can slow their brain development.

Chromium, meanwhile, helps control blood sugar and cholesterol, and has a role in treating some mental disorders. However, one form of chromium causes lung cancer and liver problems. Nickel is a metal that helps us to absorb iron if it is present in small amounts in the body. However, skin contact with nickel in jewelry, coins, and phones can cause skin rashes, swelling, blisters, allergies, and long-term health problems.

Metals are crucial to good health. In fact, a good diet includes vitamins and minerals, which are nutrients that include metals. Metals are also important in the health of other animals and also in all kinds of plants — they truly ARE marvelous!

Elements spotted

Fe Iron

Cu Copper

Zn Zinc

Co Cobalt

Ni Nickel

Pb Lead

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## Milli's Safety Tips Safety First!

**ALWAYS:**

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Use all materials carefully, following the directions given.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

**NEVER** eat or drink while conducting an experiment, and be careful to keep all of the materials away from your mouth, nose, and eyes!

**NEVER** experiment on your own!

# Hunting for Metals

**By Avrom Litin and David S. Heroux**

## Introduction

Everyone loves to go on a scavenger hunt! Did you know you can hunt for metals in your kitchen? Every packaged food is required by law to include a food label, where nutritional and calorie information are listed. Food labels also list all ingredients in that food, and that is where we can find out if there are any metals in that food. Substances containing metals can contribute to a healthy diet. Even vitamin B12 contains the metal **cobalt** (Co).

Check the picture of a food label below to see where you can hunt for the metals listed on a food package. We have also included a table below listing some common ingredients that contain metals. Let's see how many metals you can find, and if you can match them to their symbol on the periodic table!

**Common metal-containing ingredients in foods**

| Name of food | Name of ingredient | Metal | Element Symbol |
|---|---|---|---|
| Iodized salt, salty snacks | Sodium chloride | Sodium | Na |
| Snacks | Ferrous sulfate or reduced Iron | Iron | Fe |
| Many foods | Calcium chloride | Calcium | Ca |
| Potatoes | Potassium | Potassium | K |
| Baked goods | Sodium bicarbonate (baking soda) | Sodium | Na |

## Materials

- Periodic table of elements (see pages 2-3)
- Data table (see below)
- Packages of food from your kitchen

## Procedures

Gather some packaged foods from your kitchen; we recommend vitamin supplements, cereals, packaged snacks, and canned foods. Find both the nutritional label and the ingredient list on the packaging. See if you can find any of the metals from the periodic table on the list. Sometimes the metal will be listed as a compound, which is a substance where the metal is bound to other elements. Sometimes the label will just say "minerals," which also contain metals. Fill out the data table below, including the symbols for each metal from the periodic table.

## What metals did you find?

| Food name | Name of the ingredient containing a metal | Element symbol of the metal (from the periodic table) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

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**Nutrition Facts**

**Serving Size 5 oz. (144g)**
**Servings Per Container 4**

**Amount Per Serving**

**Calories** 310 **Calories** from Fat 100

| | % Daily Value* |
|---|---|
| **Total Fat** 15g | **21%** |
| Saturated Fat 2.6g | **17%** |
| Trans Fat 1g | |
| **Cholesterol** 118mg | **39%** |
| **Sodium** 560mg | **28%** |
| **Total Carbohydrate** 12g | **4%** |
| Dietary Fiber 1g | **4%** |
| Sugars 1g | |
| **Protein** 24g | |

**Vitamin A** 1% • **Vitamin C** 2%
**Calcium** 2% • **Iron** 5%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

| | Calories | 2,000 | 2,500 |
|---|---|---|---|
| Total Fat | Less Than | 65g | 80g |
| Saturated Fat | Less Than | 20g | 25g |
| Cholesterol | Less Than | 300mg | 300mg |
| Sodium | Less Than | 2,400mg | 2,400mg |
| Total Carbohydrate | | 300g | 375g |
| Dietary Fiber | | 25g | 30g |

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

### How does it work? / Where's the chemistry?

All matter is made up of elements on the periodic table, including foods. Many ingredients in foods contain common elements like carbon, oxygen, and hydrogen, but some ingredients contain metallic elements like iron, sodium, and zinc. These elements are found in smaller amounts in foods, but your body needs them just the same for good health. There is another story in this issue of *Celebrating Chemistry* that tells you about metals and health. Be sure to read it!