International year of
CRYSTALLOGRAPHY

Try this CRYSTAL BUILDING

By Charles Bond, with help from Billy Bond and Anna Bond

YOU WILL NEED

- A set of LEGO™ blocks, or other building blocks, all of the same size and shape. In this example we will use 4x2 standard LEGO™ blocks.
- Your imagination.

WHAT TO DO:

1. Start building a wall of LEGO™ (see Figure 1 for some examples).
2. Make sure that the relationship between one brick and the next is repeated throughout the whole wall. If you have an overlap of two "knobbles" between bricks, make sure it is the same for every pair of bricks. If you have any gaps, make sure they are the same for every brick.
3. Try and build your crystal so that the edges follow straight lines.

A wall is a kind of tessellation, a tiling pattern of bricks. Because the pattern extends in only two dimensions (i.e. up/down and left/right), this is the same as a "two-dimensional crystal". It only counts as a crystal if it repeats perfectly all the way across and up the object. If you look at the overall shape of your whole crystal, you can see that it will depend on the shape of the individual building blocks and their arrangement relative to each other.

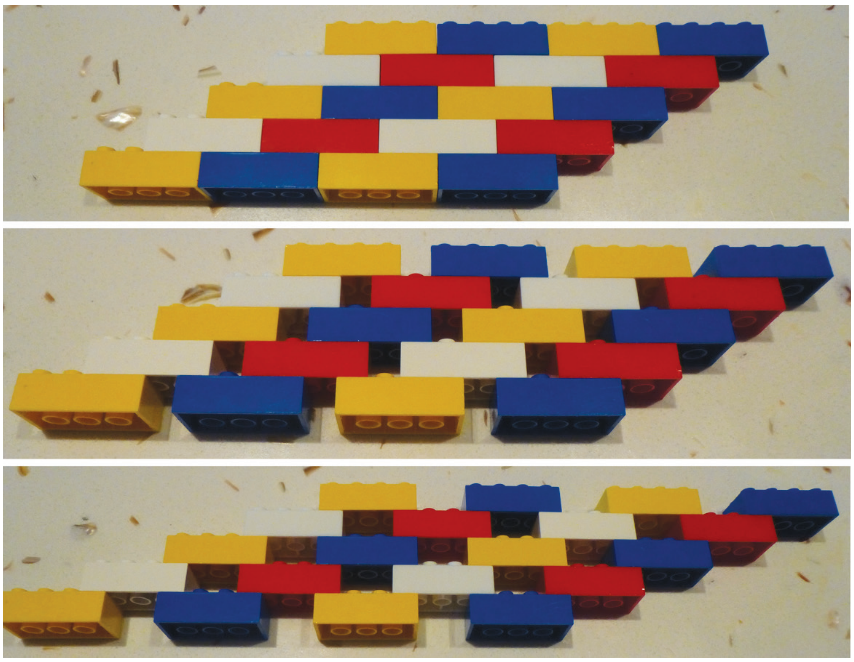

Figure 1: Examples of LEGO™ walls.

This is the same as real crystals observed in nature. They have straight edges and faces, and the shape of the crystal tells us something about the size and arrangement of the atoms that make up the crystal. A good example is sodium chloride (table salt): if you look at table salt under a microscope, or even with a magnifying glass, you will see that the crystals are cubic in shape. The atomic structure of a sodium chloride crystal has a cubic arrangement of sodium and chloride ions.

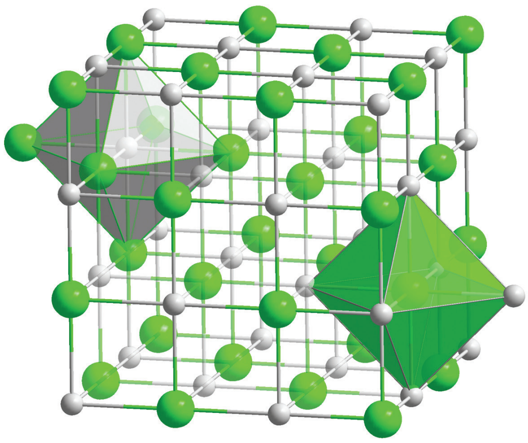

Figure 2: The atomic structure of a sodium chloride crystal. Source: http://en.wikipedia.org/wiki/File:NaCl_polyhedra.png

In 1915, Australian scientist Lawrence Bragg and his father William were awarded the Nobel Prize in Physics for working out that you could use X-rays to tell you the atomic structure of crystalline materials, such as salt.

4. Now, try building a three-dimensional crystal (see Figure 3). This works best if you start by building a two-dimensional crystal layer on a LEGO™ base. Then you can build upwards layer by layer, like when you build the tower for a game of Jenga. If you have enough bricks you can go on forever in all three dimensions.

One feature of crystals is that they are often beautiful, because of the way they reflect light from their flat surfaces, called facets. Hold up your crystal (remove the base) and look down one of the holes, at how light is reflected off all of the facets.

Could a real chemical crystal have holes in it? In fact, right now, scientists around the world are designing molecules that crystallise with holes just like your LEGO™ model. The reason for this is that these holes can be used as sticky containers for gas molecules like carbon dioxide. The scientists hope that materials made from these crystals can be used to remove greenhouse gases from the atmosphere.

Professor Charlie Bond *was educated in crystallography while studying for a PhD at the University of Manchester, UK. His research, at UWA's School of Chemistry and Biochemistry is into the structure of biological macromolecules.* ***Billy and Anna Bond*** *are students at Wembley Primary School.*

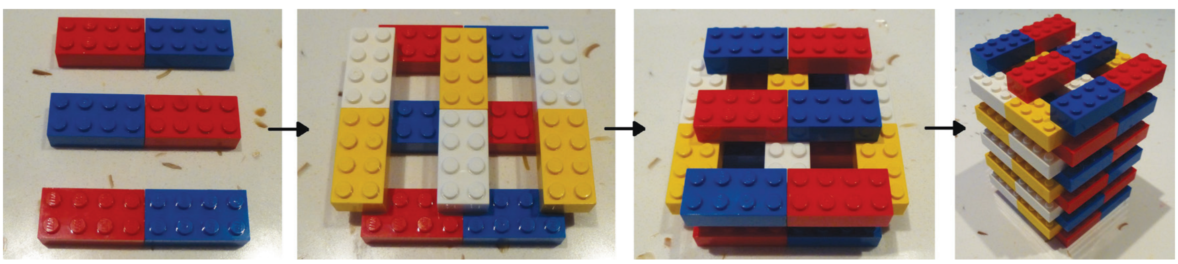

Figure 3: Example of a 3D LEGO™ crystal.