



# SCIENTIST IN RESIDENCE PROGRAM™

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## Science Unit: **Structures** Lesson 10: **Big Build**

**Summary:** In this lesson, students work in groups to **create freestanding structures** that are large enough to completely cover at least one student. They build their structures using rolled and taped newspaper “rods” formed into triangles. Students observe how **triangular shapes** to provide **strength** to a frame.

**Science skills:** Mechanical manipulation, exploration, curiosity, inferring

**School Year:** 2013/2014

**Developed for:** Champlain Heights Annex Elementary School, Vancouver School District

**Developed by:** Ingrid Sulston (scientist); Mona Francis and Ramona Smith (teachers)

**Grade level:** Presented to grades 2/3; appropriate for grades 2 – 7 with age appropriate modifications

**Duration of lesson:** This activity requires two blocks of time:  
(1) “Rod Preparation” - 1 hour and 20 minutes (Plus additional time, as required. After the initial lesson, let students build rods whenever they have time until you have enough (~50 rods per group).  
(2) “The Big Build” - a whole morning, or longer.

**Notes:** The *Big Build* part of this lesson requires a lot of classroom space (so tables must be cleared), or it can be done needs a gym or activity space. Rod preparation can be done in the regular classroom space.  
An activity that uses the same materials, but with a different goal, is the “Building Bridges” activity in Lesson 3 (Domes and Towers) of the “Structures” unit Scientist in Residence Program: [www.scientistinresidence.ca/pdf/physical-science/Structures/SRP\\_Structures\\_Lesson%203%20WF.pdf](http://www.scientistinresidence.ca/pdf/physical-science/Structures/SRP_Structures_Lesson%203%20WF.pdf)

## Objectives

### Students will:

- Learn how to make a strong rod from a piece of newspaper and tape.
- Learn a method for fastening rods together in a strong manner.
- Experience how the stability of triangles enables construction of a large frame structure.
- Use teamwork to design and build a large frame structure.

## Background Information

Building free-standing large frame structures allows students to put their acquired understanding of materials, fasteners and strong shapes to use. This activity starts with the simplest materials, newspaper and tape, yet with patience and teamwork students can build a structure large and strong enough to get into.



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## Vocabulary

- Frame: The skeletal framework of a structure that is sometimes covered with an outer skin.
- Rod: Long straight piece that makes up a frame.
- Fastener: Device for connecting the ends of rods.

## Materials

- Stiff rods, plastic or wood, 1 or 2cm in diameter and ~40cm long e.g. pieces of broom handle or conduit pipe. One for each pair of students.
- Newspapers (a few for each pair of students). Take out the smaller pages of shiny advertisements.
- Masking tape, one roll for each pair of students.

## In the Classroom

### Introductory Discussion

- Tell the students that they will be building a structure large enough for at least one student to get into (and might fit more). Their structure, however, will only be made from newspaper and tape, and must stand up on its own.
- Prepare students by letting them know that this project will take some time and requires some patience. During the first lesson the class will be starting to make many “rods” from the newspapers. In a later lesson, when there are enough rods, they can be fastened together to make the structures.

Processes of science that the students will focus on: mechanical manipulation, exploration, curiosity, inferring, designing experiments

## Science Activities

### (1) Activity Title: Rod Preparation

Purpose of Activity: Prepare many rods for the structures.

Methods and Instructions:

Set-up prior to experiment: none

Students work in pairs.

#### 1. Show students how to make newspaper rods:

- Make a stack of eight sheets of newspaper.
- Roll the stack tightly around the plastic/wooden rod.
- Use three small pieces of masking tape to secure the ends and centre of the newspaper so that it forms a rod.
- Remove the plastic/wooden rod from inside the newspaper roll (ref. 1).
- Make sure the rods are tight and stiff.





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NOTE: Each stack of newspapers can be rolled along its length (as shown in the photo above). However, wide pages rolled along their width produce longer rods - which are preferable for building large structures more quickly.

2. Spend some class time making a common bin of rods. Store the rods upright so that they do not get bent. Make sure the rods are tight and stiff.
3. Students can continue to add to the bin of rods throughout the following days, whenever they have time. The class will need about 50 rods for each group of four students.

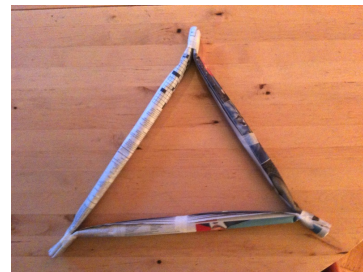
## (2) Activity Title: Big Build

Purpose of Activity: Build a structure large enough to hold at least one student.

Methods and Instructions:

Set-up prior to experiment: bins of the rods prepared by the whole class should be distributed around the room for all to use.

1. Students work in groups of four.
2. Show students how to tightly join the newspaper rods:
  - Flatten the ends of two newspaper rods. Hold the flat faces tightly together and bind them tightly with masking tape, to make a strong and flexible joint. (See photo and ref. 1)
  - Two students should work together to make each joint. This will allow the strongest joints to be made, as some hand strength and coordination is needed.
  - To be strong, a joint must be both **flat** and **tightly taped**.
  - Often during the *Big Build*, additional rods will be added to a joint. The end of these additional rods should also be flattened and added to the stack of flat rod-ends, then taped tightly.
  - Students should be reminded throughout the *Big Build* to make their joints in this manner. As more weight is added to their structure, weak joints will not support the load. Strong individual joints will ensure success of their larger structure as they build it.
3. Introduce **strong shapes** that can be used for the *Big Build*:
  - Introduce (or review) the superior strength of triangles in structures.
  - Ask students to build a triangle from three newspaper rods, assembling the joints as demonstrated in the image included.
  - Ask them to test how strong the triangle is. NOTE: If there is weakness, point out the most likely source is a joint that is not flat and/or bound tightly with tape.
  - Check and assist in the students' work to ensure strong, flat joints.





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4. Once students are confident about joining rods together and building strong triangles, let the *Big Build* begin!
5. Allow a morning (or longer) for students to work on their structures. Assist where needed, but make sure the students are designing and building their own structures as much as possible.
6. Groups can borrow ideas from each other.
7. Once the frame is in place, students may want to add a skin of a single sheet of newspaper.



## Closure Discussion

As a class, visit each structure and observe how the student(s) fit inside. Each group can discuss the design and construction challenges they faced, along with their solutions and successes.

## References

Caney, Steven. 2006. Steven Caney's Ultimate Building Book. p. 298 onwards. Running Press Kids.