# "Daniel and the Old Lion Hunter"

## Theme

"When the speed of a moving fluid increases, pressure in the fluid decreases, and vice versa."

Daniel Bernoulli
Swiss mathematician and scientist
(1700 – 1782)

## Who?

**Daniel Bernoulli** — Swiss scientist who discovered that the faster a fluid is traveling, the lower its pressure

## What?

**fluid** — a substance that can change shape under pressure; a gas or a liquid

**conservation of energy law** — the total energy in a fluid stays the same no matter what shape the fluid takes

**Kinetic Theory of Gases** — belief that gases are made up of tiny particles and that their random, constant motion hitting the walls of a container creates pressure

## Where?

**Basel, Switzerland** — city where Bernoulli lived most of his life and taught at the university

**St. Petersburg, Russia** — city where Bernoulli taught from 1725 to 1733 and studied mathematics

*"Daniel, that is enough demonstration for now!"*

## QUEST SHEET

### Fast Air, Low Pressure!

**Materials:**

**For classroom demonstrations:** wooden dowel, two balloons on strings (Demonstration 1); medium-size fan, wooden dowel, piece of paper, tape (Demonstration 2). **For each team:** 3" x 3" piece of an index card, a pushpin, a large thread spool, 2 in. piece of straw for each student (Activity 1); glass with water, scissors, two straws for each student (Activity 2)

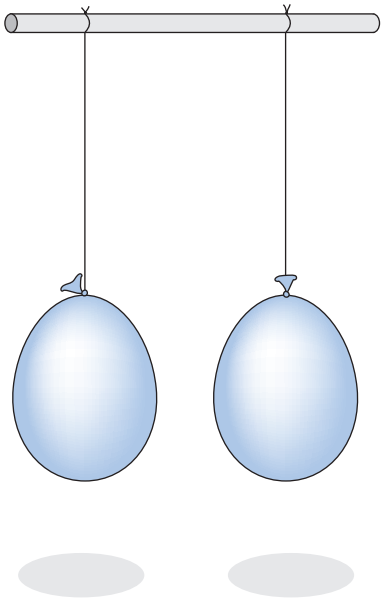
### Demonstration 1

**Predict:**

What will happen when someone blows a stream of air between the two balloons suspended from the dowel?

**Observe:**

What happens?



Does this agree with your prediction?

Yes No

**Explain:**

Why did the balloons move this way?

## Activity 1

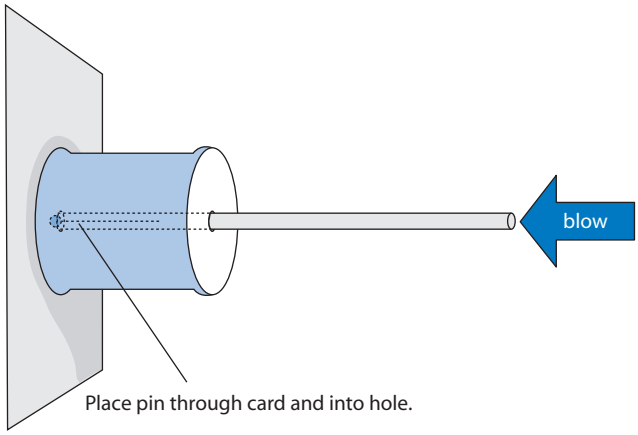
Take turns within your teams performing this experiment. Everyone should use his or her own straw.

First hold the index card up close to your mouth and blow. As you probably suspected, the card just blows away.

Now push the pushpin into the center of the index card. (The pushpin helps to keep the card roughly centered on the spool, but does not provide any support.) The experimenter then pushes one end of the straw into the hole in the spool of thread. With one hand, position and hold the index card against the other end of the spool, sticking the point of the pushpin into the hole. Blow very hard into the straw and slowly let go of the card.

**Observe:**

What happens?



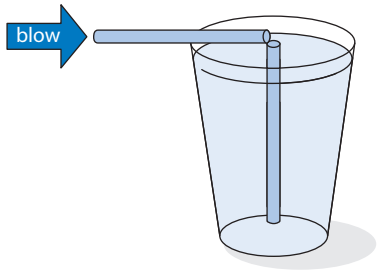

**Explain:**

Why did this happen?

## Activity 2

This activity demonstrates the operation of a paint sprayer (or perfume sprayer) as explained in *Newton at the Center*, page 226. Take turns doing the "spraying."

Fill the glass ¾ of the way full with water. Cut one straw to stand vertically in the center of the glass ½ in. above the surface of the water. Use one hand to hold this straw in place but do not allow it to touch the bottom of the glass. Then position the second straw horizontally at a 90-degree angle to the "standing" straw so that air exiting this straw will zip across the top end of the standing straw. (Straws must be well aligned for the full effect.) Now blow (hard!) through the horizontal straw.




(If nothing happens, adjust the position of horizontal straw and try again. If still nothing happens, shorten the horizontal straw a bit.)

**Observe:**

What happens?

**Explain:**

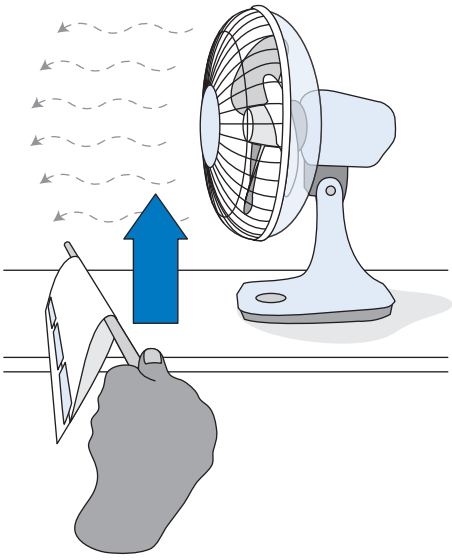
Why did this happen?

## Demonstration 2

The shape of an airfoil (a cross section of an airplane wing) is designed with Bernoulli's Principle in mind. Observe this classroom demonstration.

**Observe:**

What happens when air flows over the top of the paper wing?



**Explain:**

Using Bernoulli's Principle, explain why the wing behaved as it did.

Scientists Speak

Daniel Bernoulli (1700 – 1782)