ANTENNA

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Image © David Farley, d-farley@ibiblio.org

My name is Dr ANTENNA!

Have a go at my toothpick puzzle and check out what great science splashes out when young people put scientists on the spot with curly questions, in "Scientists Answer the Big Questions". On the back page you can learn how scientists think.

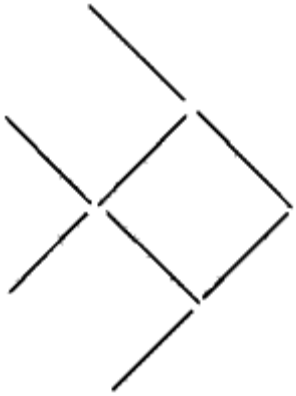
Let me know what you think about the ANTENNA, or any suggestions you have for the next issue. E-mail me at: newsletter_editor@anzaas.org.au

Happy toothpicking!

Dr ANTENNA

FLIPPING FISH

Arrange eight toothpicks (or matches) in the shape of a fish. Move toothpicks until the fish is facing another direction. How many did you move?



Try to get the fish to change directions by moving fewer toothpicks than you did the first time.

What is the minimum number of toothpicks that must be moved to make the fish face another direction?

Answer on back page.

Source: http://www.aimsedu.org/Puzzle/fishwork.html

SCIENTISTS ANSWER THE BIG QUESTIONS!

Q: Why do we have hiccups?

A: When you eat very hot food, it may irritate a passage inside you, or you may have a built-up of gas in your stomach, which presses against the diaphragm. The diaphragm is an organ which separates your chest from your stomach. It tightens up and pulls air into the lungs. But because it has tightened up, the air can't get through all the way to the lungs, and it is stopped short by the diaphragm. We feel a dump when this happens, and describe the dumping feeling as hiccuping. So hiccups are a way of telling us that body is trying to get rid of the hot food or gas in the stomach.

Q: When a fly lands upside down on the ceiling, does it do a barrel role or a loop-the-loop?

A: Nobody knows for sure, but the few high-speed movies that have been taken of flies landing on a ceiling suggest that they do something similar to a 'loop-the-loop". Actually it is not a fully flying loop-the-loop: the fly approaches the ceiling from below and when it is close enough to the ceiling it stretches out its front legs so that its front feet touch the ceiling. Then it flips over, pivoting about its front feet -- it does a back somersault.

Professor Mandyam Srinivasan

For details, see "Insects in Flight" by W. Nachtigall, George Allen & Unwin 1974, Fig. 47 (page 119).

Q: When did planets first appear?

A: Planets are born around the same time as their ``parent'' stars. Our own star, the Sun, was born about 5000 million years ago (that's 5 billion years ago). It was a big ball of gas and dust which shrank as gravity pulled it all together. It also had a disk of gas and dust swirling around it, and from this disk the planets were born.

Birth of the planets: artist's painting.
Source: http://www.spacedaily.com/images/protodisk-rawlings-bg.jpg

Eventually all the gas and dust disappeared leaving our nine planets behind as well as lots of **asteroids and comets.**

Dr Rosemary Mardling PhD

Sources: http://www.anzaas.org.au/vic/ScienceWeek
http://www.4to40.com/qa

HOW DO SCIENTISTS REASON?

Learning about the **scientific method** is almost like saying that you are learning how to learn. You see, the scientific method is the way scientists learn and study the world around them. It can be used to study anything from a leaf to a dog to the entire Universe.

The basis of the scientific method is asking questions and then trying to come up with the answers. You could ask, "Why do dogs and cats have hair?" One answer might be that it keeps them warm. BOOM! It's the scientific method in action.

QUESTIONS AND ANSWERS

Just about everything starts with a question. Usually, scientists come up with questions by looking at the world around them. "Hey look! What's that?" See that squiggly thing at the end of the sentence? A question has been born. So you've got a scientist. When scientists see something they don't understand, because they are scientists, they probably have some huge urge to answer questions and discover new things. The trick is that you have to be able to prove every answer you give. If you can't test your answer, other scientists can't prove it to see if you were right or not.

As more questions are asked, scientists work hard and come up with a bunch of answers. Then it is time to organize. One of the cool things about science is that other scientists can learn things from what has already been proved. They don't have to go out and prove everything again and again. That's what makes science special: it builds on what has been learned before.

This process allows the world to advance, evolve, and grow. All of today's advancements are based on the achievements of scientists who already did great work. Think about it this way: you will never have to prove that water (H_2O) is made up of one oxygen (O) and two hydrogen (H) atoms. Many scientists before you have proved that fact. It will be your job as a new scientist to take that knowledge and use it in your new experiments.

EXPERIMENTAL PROOF

Experimental proof is what makes all of the **observations** and answers in science **valid** (proved). The proof shows that the statements are correct and accurate. It sounds like a simple idea, but it is the basis of all science. Statements must be proved.

Scientists start with observations and then make a **hypothesis** (a guess), and then the fun begins. They must then prove their hypothesis with trials and tests that show why their data and results are correct. They must use controls, which are **quantitative** (based on values and figures, not emotions). Science needs both ideas (the hypothesis) and facts (the quantitative results) to move forward. Scientists can then examine their **data** and develop newer ideas. This process will lead to more observation and refinement of hypotheses.

THE WHOLE PROCESS

There are different terms used to describe scientific ideas based on the amount of experimental proof.

Hypothesis
- a statement that uses a few observations
- an idea based on observations without experimental proof

Theory
- uses many observations and has loads of experimental proof
- can be applied to unrelated facts and new relationships
- flexible enough to be modified if new data/proof introduced

Law
- stands the test of time, often without change
- experimentally proven over and over
- can create true predictions for different situations
- has uniformity and is universal

You may also hear about the term "**model**." A model is a scientific statement that has some experimental proof or is a scientific concept that is only accurate under limited situations. Models do not work or apply uder all situations in all environments. They are not universal ideas like a law or theory.

Source: http://www.biology4kids.com/files/studies_scimethod.html

A. Flipping Fish

You need a minimum of 2 toothpicks to make the fish face up or down, and 4 to make it face left (which can be done in 2 different ways).