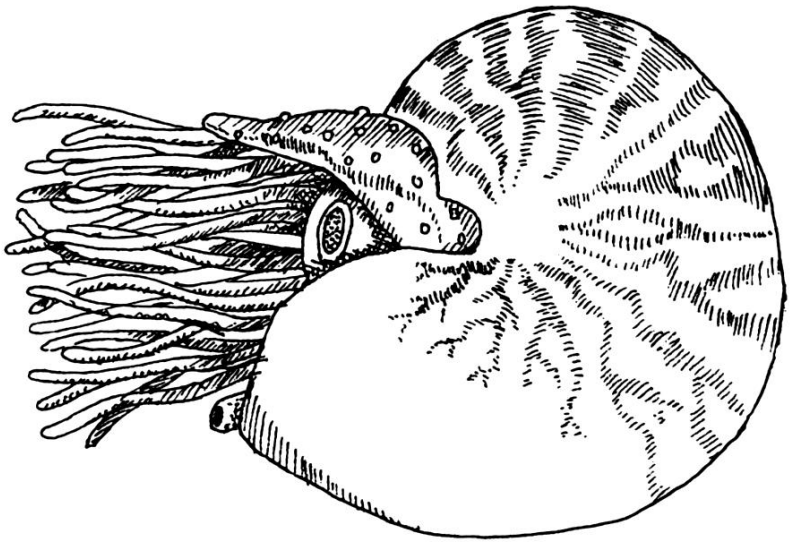
Lyrical
Life Science



Text and Lyrics by
Doug C. Eldon

Performed by
Bobby Horton

Illustrations by
Eric Altendorf

INTRODUCTION

The concept of using lyrics and music to teach and to learn is as ancient as education itself. Songs, ballads, chants and poems have long been helpful in communicating ideas and information. We remember the alphabet song and with little effort remember tunes heard on the playground and around the campfire.

I began using songs to help my sixth grade students with our study of life science. Several students were having difficulty with the amount of new information. Even with visuals, hands-on activities and field trips, I could sense that part of their problem was learning the structures, functions and characteristics described in the language of science. They needed to have the foundation of factual information established in their minds before they could confidently proceed in their studies to classify, compare and analyze life science.

I condensed the most important information from a chapter, section or unit of a textbook and set it to singable familiar melodies. I discovered that by putting the scientific language to music the students found learning to be easier and more enjoyable. Other teachers in the field have had the same experience with scientific information set to music; Tom Evans, now Professor of Education at Oregon State University remarked: "The singing of songs in my middle school science classes was an immediate success. Students became more interested and actively involved in learning science."

In researching the concept of what I call lyrical learning, I found that not only has it been used for a very long time, but that a better understanding of how the brain processes, stores and retrieves information has now made it clear why this way of learning is effective:

1 - singing reinforces what is heard or read, actively involving the whole brain—the left side that deals with language and the right side that deals with music and artistic perception;
2 - the association of new information with familiar melodies makes learning easier;
3 - repetition and rehearsal become recreational, and the redundancy of practicing enjoyable;
4 - rhythms and rhymes make a memorable pattern that is easily recalled;
5 - the information grouped as lines or verses of lyrics becomes visually more memorable than sentences in paragraphs;
6 - the novelty of songs increases emotional involvement and heightens attention.

The lyrics of each tune are content-rich and loaded with scientific terms and concepts that are explained more fully in the text. Illustrations, historical notes and fun facts such as world records are added for further clarification and interest. On the accompanying cassette Bobby Horton takes these educational tunes to a new level of enjoyment and entertainment. All this is for students to learn with confidence to enjoy their scientific world in a new and refreshing way. I hope you enjoy singing these tunes and find life science as fascinating as I have.

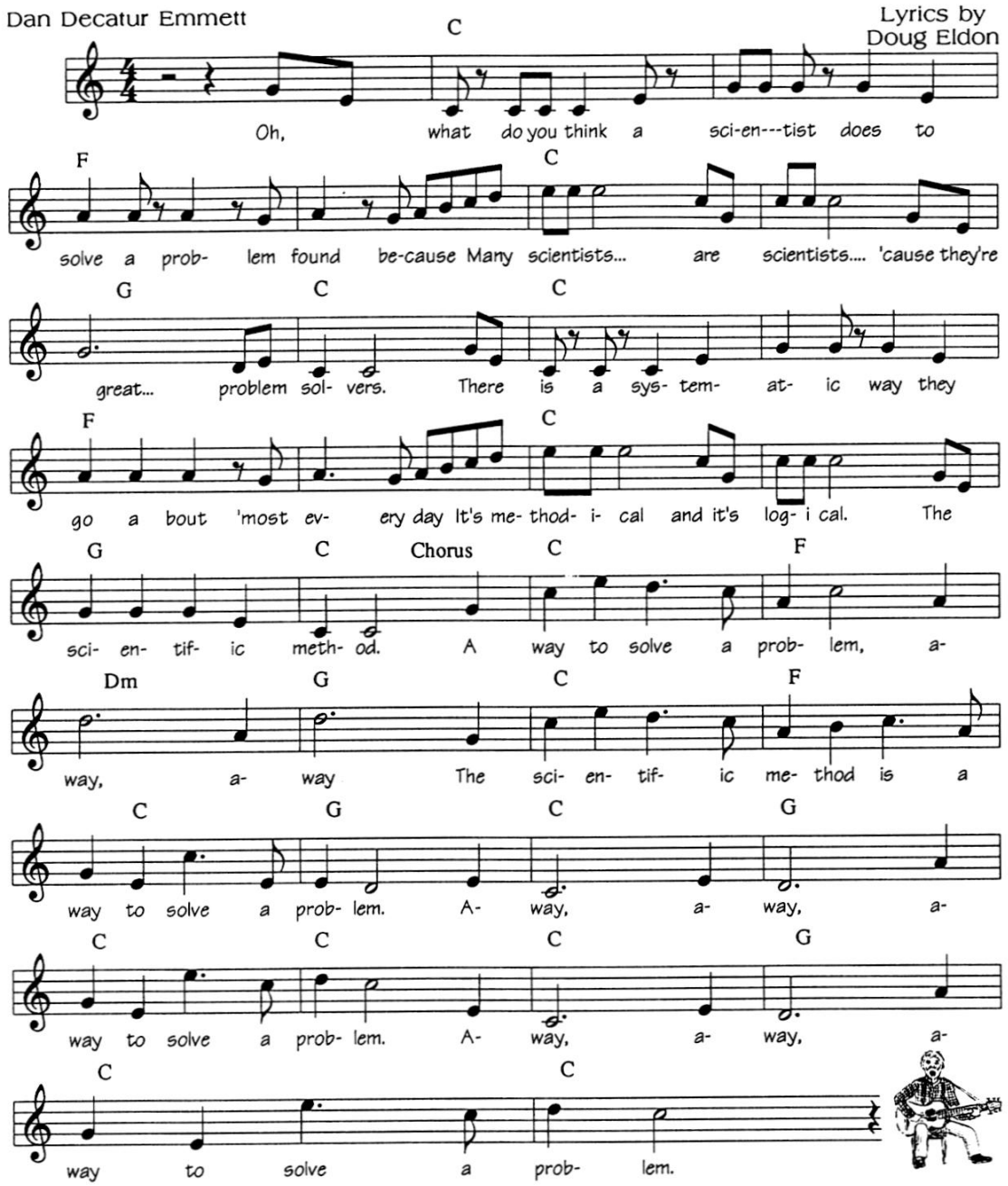
Doug Eldon

THE SCIENTIFIC METHOD

(to the tune of "Dixie")

Dan Decatur Emmett

Lyrics by
Doug Eldon



It may not seem important to you but the first thing that they always do
Is state the problem or ask a question so they know just what they're after
Then they review everything involved that might help get the problem solved
By reading, researching and gathering information

After both of these steps they take they go ahead and then they make
An educated guess; a hypothesis; a possible solution
Then they use scientific tools to measure and test some variables
In experiments which are really meant to give more information

This information they call data, they put together so that later
They can analyze and synthesize, to see just what it all means
Only when they have done all these experiments testing hypothesee
Which may prove or else disprove, then they'll state their conclusior

This is the systematic way a scientist may use any old day
'Cause it's methodical and it's logical the scientific method.

THE SCIENTIFIC METHOD

Dr. Karen Timm is a scientist by profession who is in this book to help with the scientific information. Specifically, she is a veterinary professor and a specialist in laboratory animal medicine. She enjoys her subject so much that she raises Macaws, a species of beautiful tropical birds.

The word **science** means to have knowledge of, or to know. It also means the organized system of knowledge that comes from observation, study and experimentation.

Many scientists spend their time making observations, asking questions and finding problems to solve. In fact, part of the reason they are scientists is that they are good at problem solving and enjoy the challenge of figuring things out. They study and think about what is known and what needs to be learned. Then they may experiment, and use the information gained to answer the question or solve the problem they have. This whole process has been called the **scientific method**.

Doug Eldon is a teacher who enjoys life science almost every day. When he's not in his classroom, he raises silkworms, grows fungi and explores creeks and woods searching for insects and unusual plants. He joins Dr. Timm and adventures throughout the scientific information to show you, the reader, that life science can be very interesting and exciting.

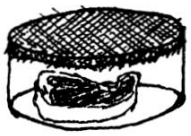
If you study any particular field or branch of science, you will find that there are facts, principles (rules) and methods (ways of doing things). There are also many words or terms that help scientists communicate what they know. One aspect of understanding science is learning the vocabulary; another is learning the systems for organizing information; and still another part is learning to think and to solve problems the scientific way!

A systematic way of doing things is organized and purposeful; it is methodical if it involves orderly steps; and it is logical if it is reasonable, makes sense and is well thought out beforehand. The scientific method combines all of these aspects.

Six steps often included in the scientific method are:

1 - Ask a question or state the problem
2 - Gather information
3 - Make a hypothesis
4 - Experiment
5 - Analyze data
6 - State a conclusion

THE SCIENTIFIC METHOD IN USE



To demonstrate how the scientific method can be used, let's go back to the 1860's when a French scientist named Louis Pasteur was trying to solve one of the most basic questions in the study of life: Where do living things come from?

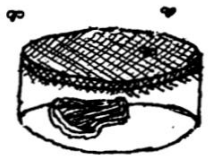
Meat in open container was exposed to flies— maggots appeared on the meat

We know now that living things come from other living things but scientists in earlier times didn't have the knowledge or understanding about how things came to be. Their explanation often was that life occurred all by itself. Nonliving matter was thought to produce living things: frogs were thought to come from the mud of riverbanks, beetles from dung and maggots from decaying meat! This simple explanation became known as the theory of **spontaneous generation**.

Meat in covered container was not exposed to flies— no maggots appeared

Step 1 - Ask a Question or State the Problem

For Pasteur the question was: Do living things come alive spontaneously, or do they all come from parents of the same kind? He was at the time working with microscopic organisms, and so his specific question was: Do germs just appear from nowhere?



Step 2 - Gather Information

Pasteur studied the works of other scientists. He read of the experiment an Italian biologist named Redi had done in 1668 that proved that maggots did not come from meat. If flies were kept off the meat by covering it, the fly eggs could not be laid and maggots did not appear. Pasteur learned from this experiment that Redi convinced scientists that complex creatures came only from others like themselves. But what about microscopic forms of life?

The microscope was first developed and used to see tiny organisms in the early 1700's but it was not until about 1760 that another Italian biologist named Spallanzani seriously began to study microorganisms. Pasteur read of his experiments which showed that microscopic organisms, or **microbes**, did not come to life spontaneously, but were often carried by dust in the air. Spallanzani also discovered that microbes reproduced by dividing, and were killed by boiling.

Scientists use metric tools when conducting experiments

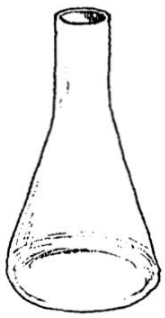
Step 3 - Make a Hypothesis

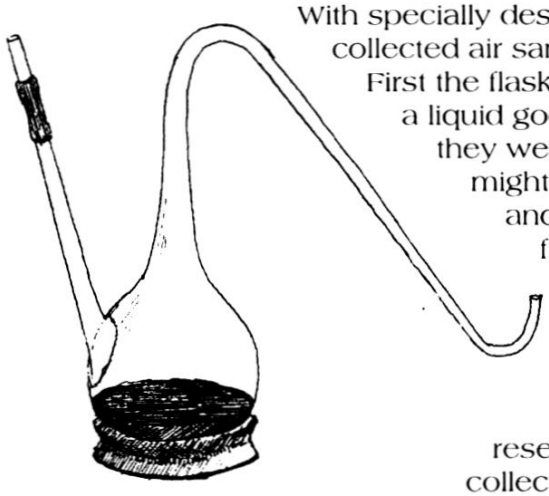
Pasteur used what he learned from Spallanzani and Redi and what he knew from his own experiments to form a **hypothesis** (a possible answer to his question). He basically restated much of what Spallanzani had said one hundred years earlier. That was:

1 - living things come from other living things of the same kind.
2 - some are too small to be seen without a microscope.
3 - they are spread by floating on dust in the air.

Step 4 - Experiment

Spallanzani conducted an experiment which involved boiling a liquid in a glass flask, then sealing it. He found that microbes did not appear in the closed flask, but grew in an open one. He concluded from this experiment that microbes are in the air and boiling kills them. Other scientists still argued that the boiling changed the conditions needed for spontaneous generation to occur and closing the flasks kept oxygen out, which the microbes needed to live and grow. Factors that might affect the results of an experiment are called **variables**. Pasteur had to design an experiment where he could control all the variables in order to prove that microbes indeed were carried on dust in the air, and did not just appear.





Pasteur's swan-neck flask

With specially designed glass flasks, Pasteur collected air samples from different places. First the flasks were carefully prepared with a liquid good for growing microbes. Then they were heated to kill anything that might have been living in the liquid and were sealed. He collected air from a busy city street, a garden yard, a quiet cellar, a nearby hill and a high mountain glacier. He did this by opening the flasks for an instant to let air in, then quickly resealing them. At each location he collected ten to twenty flasks of air. Then he waited to see what would grow.

Step 5 - Analyze Data

Pasteur could have recorded his data in a table such as this:

Location of air sample	Number of flasks	Number with microbes
city street	10	10
garden yard	11	11
quiet cellar	10	1
nearby hill	20	8
high mountain	20	1

By **synthesizing** or putting together his data, Pasteur could clearly see his results. Pasteur reasoned that the air from the city and the yard both had a lot of microbe-carrying dust, but that the air from the cellar was quite still, with little dust. He further reasoned that the air in higher elevations had less and less dust and therefore fewer and fewer microbes.

Step 6 - State a Conclusion

Pasteur learned from experiments others had done; he made a hypothesis; he then performed his own experiments, controlling the variables; and he analyzed the data he gathered. He could now conclude that the dust in the air carried microbes and they did not just appear but come from other microbes of the same kind.

Although the scientific method was not something formally taught or learned by Pasteur, it was the process he used. Scientists continue to use this approach to solve modern scientific problems.

Many scientists still argued for spontaneous generation. After many years of repeating his experiments, Pasteur finally convinced the scientific world that he was right! As you will see in the chapters on viruses, bacteria and protozoa, what became known as the **germ theory** changed science and medicine in many ways.

LOUIS PASTEUR
1822-1895