HISTORICAL CHEMISTRY

The Case of Combustion

People throughout history have transformed substances by burning them in air. Yet at the dawn of the scientific revolution, very little was known about the process of combustion. In attempting to explain this common phenomenon, chemists of the 18th century developed one of the first universally accepted theories in their field. But as one man would show, scientific theories do not always stand the test of time.

Changing Attitudes

Shunning the ancient Greek approach of logical argument based on untested premises, investigators of the 17th century began to understand the laws of nature by observing, measuring, and performing experiments on the world around them. However, this scientific method was incorporated into chemistry slowly. Although early chemists experimented extensively, most considered measurement to be unimportant. This viewpoint hindered the progress of chemistry for nearly a century.

A Flawed Theory

By 1700, combustion was assumed to be the decomposition of a material into simpler substances. People saw burning substances emitting smoke and energy as heat and light. To account for this emission, scientists proposed a theory that combustion depended on the emission of a substance called *phlogiston,* which appeared as a combination of energy as heat and light while the material was burning but which could not be detected beforehand.

The phlogiston theory was used to explain many chemical observations of the day. For example, a lit candle under a glass jar burned until the surrounding air became saturated with phlogiston, at which time the flame died because the air inside could not absorb more phlogiston.

A New Phase of Study

By the 1770s, the phlogiston theory had gained universal acceptance. At that time, chemists also began to experiment with air, which was generally believed to be an element.

In 1772, when Daniel Rutherford found that a mouse kept in a closed container soon died, he explained the results based on the phlogiston theory. Like a burning candle, the mouse emitted phlogiston; when the air could hold no more phlogiston, the mouse died. Thus, Rutherford figured that the air in the container had become "phlogisticated air."

▲ *Antoine Laurent Lavoisier helped establish chemistry as a science.*

A couple of years later, Joseph Priestley obtained a reddish powder when he heated mercury in the air. He assumed that the powder was mercury devoid of phlogiston. But when he heated the powder, an unexpected result occurred: Metallic mercury, along with a gas that allowed a candle to burn, formed. Following the phlogiston theory, he believed this gas that supports combustion to be "dephlogisticated air."