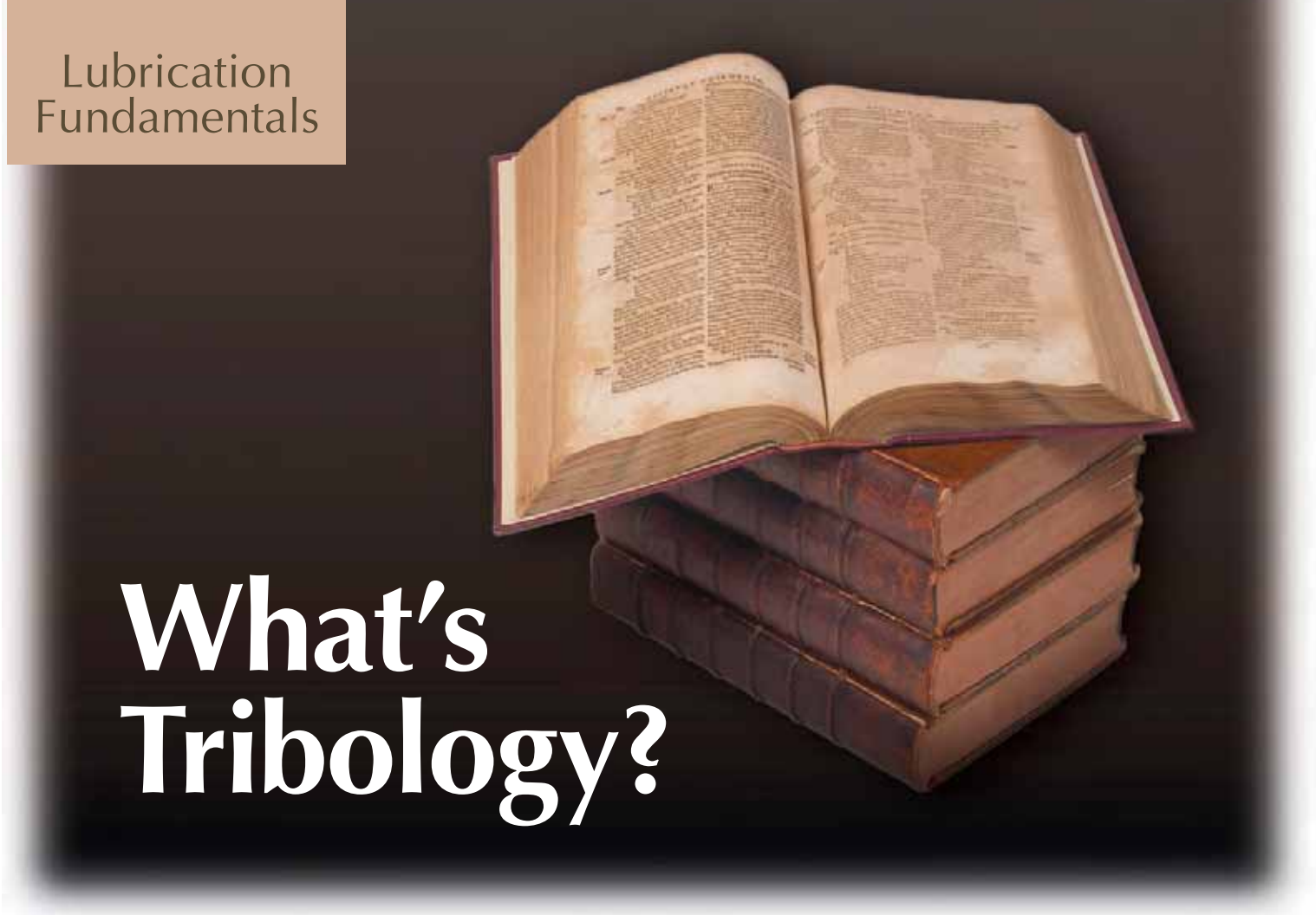

What's Tribology?

The origins of tribology can be traced back to the days of the early pioneers of lubrication engineers and scientists.

Editor's Note: *All articles in this special section were written by Bob Gresham.*

What is this word, tribology? At first glance, some people would probably say, "Well, it was a term coined years ago by the renowned Dr. H. Peter Jost, founder and president of the prestigious International Tribology Council."

Jost is widely known around the world for his support and many contributions to the development of tribology.

Tribology is derived from the Greek word tribos (TREE-bos), which means to rub. Thus, tribology is the study of rubbing or interacting surfaces. It sounds a little like some intellectual aesthete, repeating his snobbish mantra. Have you ever tried to explain the meaning of tribology while stuck on a ski lift or cornered at a cocktail party to someone who has absolutely no concept of lubricants, wear, friction or anything remotely related? This is not trivial.

In ancient times we learned that rubbing certain materials like animal fat on the wheels of our chariots made them run more easily. Further, the wheels and axles did not get hot and wear out as fast. Later, as the industrial revolution began to take hold, we found that machines needed constant maintenance and more and more animal fat to keep them running. Plus, this animal fat didn't always smell well when it got hot. As a result, the practice of lubrication engineering was born.

These early engineers usually solved their problems with empirical solutions born of hard-earned experience and precious little theory. Over time, as the economic incentives grew, these early engineers and scientists of the time teamed together to study friction, wear and lubrication problems.

They learned many things such as the fact

that the theories of people like Leonardo Da Vinci were largely true and could be demonstrated experimentally. The practices of lubrication engineers were often founded in these and other newly discovered principles. But, most important, they learned more and more about the surfaces that come into contact.

For example, they learned about real and apparent areas of contact, which lead to understanding asperities and wear processes. Also, they learned about the importance of machining contact surfaces. In addition, they learned about plastic deformation and contact fatigue. These revelations led to an understanding of how frictionless, ball and roller bearings can fail. This, in turn, led to an understanding of elastohydrodynamic lubrication.

And so it went.

Practical applications

The lubrication engineers often developed practical techniques, while the scientists developed the fundamental insight that not only explains the why and how of things but also the knowledge and insight that allow us to predict how things should work. The lubrication engineers, in turn, figured out practical ways to implement this new understanding. Additionally, they applied their insight to developing sophisticated, proactive, predictive maintenance strategies. Thus, through this give-and-take process we moved forward.

So who are these early lubrication engineers and scientists? That is one of the most intriguing parts of the "what is tribology?" puzzle. They don't fit a mold. We find that tribology is a truly interdisciplinary field.

The early lubrication engineers were often just people with a lot of mechanical aptitude who spent lots of time working in the factory. However, today we find many have mechanical engineering and other advanced degrees. Further, some are employed as sales technical people and work for grease and oil suppliers. Often on their own time, today's engineers are working harder than ever to gain experience and further their technical knowledge through continuing education such as attending STLE education courses and company training.

Moreover, many scientists are chemical and mechanical engineers, while others are chemists and physicists. And we cannot forget metallurgists and advanced materials engineers.

I remember an STLE Annual Meeting where we heard a keynote address from a fellow scientist, Dr. Judith Harrison of the Naval Research Laboratory (U.S. Naval Academy). She most eloquently and visually showed us the level tribologists have reached in trying to understand basic lubrication and wear processes. Her work, which focuses on computer simulations of these processes on the molecular level, almost boggles the mind.

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Dr. Stephen Hsu of the National Institute of Standards and Technology (NIST) once said in a conversation, "Rapid advancements in analytical instrumentations and techniques in the last several decades offer an unprecedented opportunity to analyze the complex chemistry and probe the surfaces for chemical evidence. Recent developments in nanotechnology provide further ability to examine phenomena and mechanisms at the nanometer level. As a result of these advances, our understanding of the complex lubrication system has improved significantly. This [understanding] provides a molecular basis of how lubricant and additives function in lubrication."

Hsu continued, "Monomolecular thin films have been developed to investigate the fundamental mechanism of boundary lubricating films. Results provide additional insights of how antiwear films work in the lubrication system. The prospect for applying this know-how may result in a revolutionary change in our current lubricating technology."

This, then, is the essence of the word tribology. Alas, I still don't know how to answer the question, "What's tribology?" with a one-liner while sitting on a ski lift. TLT