Introduction

SEVERAL IMPORTANT RECENT DEVELOPMENTS in pure mathematics are featured in this volume of *What's Happening in the Mathematical Sciences*. **"Prime Clusters and Gaps: Out-Experting the Experts,"** page 18, talks about new insights into the distribution of prime numbers, the perpetual source of new problems, and new results. Recently, several mathematicians (including Yitang Zhang and James Maynard) significantly improved our knowledge of the distribution of prime numbers. Advances in the so-called Kadison-Singer problem and its applications in signal processing algorithms used to analyze and synthesize signals are described in **"The Kadison-Singer Problem: A Fine Balance,"** page 72. **"Quod Erat Demonstrandum,"** page 64, presents two examples of perseverance in mathematicians' pursuit of truth using, in particular, computers to verify their arguments. Also, **"Following in Sherlock Holmes' Bike Tracks,"** page 52, shows how an episode in one of Sir Arthur Conan Doyle's stories about Sherlock Holmes naturally led to very interesting problems in the theory of completely integrable systems.

On the applied side, **"Climate Past, Present, and Future,"** page 36, shows the importance of mathematics in the study of problems of climate change and global warming. Mathematical models help researchers to understand the past, present, and future changes of climate, and to analyze their consequences. Economists have known for a long time that trust is a cornerstone of commerce. **"The Truth Shall Set Your Fee,"** page 28, shows how recent advances in theoretical computer science led to the development of so-called "rational protocols" for information exchange, where the seller of information is forced to tell the truth in order to maximize profit.

Over the last 100 years many professional mathematicians and devoted amateurs contributed to the problem of finding polygons that can tile the plane, e.g., used as floor tiles in large rooms and walls. Despite all of these efforts, the search is not yet complete, as the very recent discovery of a new plane-tiling pentagon shows in **"A Pentagonal Search Pays Off,"** page 86. The increased ability to collect and process statistics, big data, or "analytics" has completely changed the world of sports analytics as shown in **"The Brave New World of Sports Analytics,"** page 96. The use of modern methods of statistical modeling allows coaches and players to create much more detailed game plans in professional baseball and basketball as well as create many new ways of measuring a player's value. Finally, **"Origami: Unfolding the Future,"** page 2, talks about the ancient Japanese paper-folding art and origami's unexpected connections to a variety of areas including mathematics, technology, and education.

Sergei Gelfand, Publisher

Fire Tower (2013). *Curved folds represent both a departure from tradition in origami and an area of active research. (Courtesy of the artists, Erik Demaine and Martin Demaine.)*