AMERICAN SCIENTIST

CONTENIDO

VOLUME 101, No. 2, MARCH-APRIL 2013

DEPARTMENTS

82 From the Editor.

83 Letters to the Editors.

87 **Macroscope.** The music of math games *Keith Devlin.*

92 **Computing Science** First links in the Markov chain. *Brian Hayes*.

98 Marginalia Mining the boreal north. Nancy Langston.

103 Engineering An anthropomorphic model. *Henry Petroski.*

108 Earth Art. The Umbrellas. *Robert Louis Chianese.*

Science ObserverThe beetle breaking point • Elemental energy • In the news.

142 **Sightings**. A new looking glass: Historic Harvard plates.

SCIENTISTS' BOOKSHELF

144 Scientists' Reviews.

Hispanic Enlightenment botanicals • Math history • Cognitive science and art • Rachel Carson.

FROM SIGMA Xi

155 Sigma Xi Today.

Meadows becomes president elect.

- Associate members to nominate.
- Remembering Stanford Ovshinsky.

FEATURE ARTICLES

114 **Not Just Going with the Flow.** Aquatic animals can modify their fluid environment to improve efficiency. *Frank Fish and George Lauder.*

124 Adventures in Mathematical Knitting. Rendering surfaces in a tactile, three-dimensional medium requires creativity. *Roger J. Mortimer.*

134 Athletics and Herbal Supplements. Do current products enhance athletes' hearth and performance? *David S. Senchina.*

THE COVER

Abstract mathematical surfaces can be hard to visualize— but they are much easier to grasp mentally when they can be picked up and moved around. Mathematician sarahmarie belcastro began rendering surfaces in knitting when she was in graduate school. The cover shows a Klein bottle —a surface whose inside is contiguous with its outside— knitted by belcastro in 2013. It has a hole, visible at upper left, that can slide along the object to reveal other aspects of the structure, A Photograph of this Klein bottle in another configuration is shown at the beginning of "Adventures in Mathematical Knitting," on page 125. At right is a knitted torus— a surface whose shape is that of a hollow doughnut. (Cover photograph by Austin Green.)