From *SIAM News*, Volume 45, Number 5, June 2012

What Lasts?

FROM THE SIAM PRESIDENT

By Nick Trefethen

At Oxbridge, the standard nickname for Oxford and Cambridge, things last a long time. There are fine old stone buildings around every corner, and my Oxford college, Balliol, was founded in 1263. I expect it will still be here in 2263. That's the Copernican Principle at work, which tells us that if you want to estimate how long something will last, a good starting guess is how long it has been here already. SIAM, for example, is pretty sure to reach 100.

So it is easy to get thinking about permanence in this environment. Indeed, England itself is one of the world's great examples of durability, having muddled along since 1066, while other nations came and went.

Who's the most famous Cambridge academic of all time? It must be Isaac Newton, and I don't think it's a coincidence that Newton was a mathematician. What he did *lasts*. And who's the most famous Oxford academic of all time? That's a trickier question. I think the best answer may be Lewis Carroll, whose real name was Charles Dodgson. Dodgson was a mathematician too, quite a good one in fact, and I don't think that's a coincidence either. What keeps *Alice in Wonderland* alive is its quirky logic, its brand of humor nearly timeless and placeless. The author of such a book had to be a mathematician.

Charles Dodgson, aka Lewis Carroll: the most famous Oxford academic ever?

(Admittedly, in the last few years another contender has turned up, J.R.R. Tolkien, thanks to the blockbuster *Lord of the Rings* movies. Has Tolkien, who was certainly no mathematician, grabbed the #1 spot? Well, maybe for the moment, but with a little help from Copernicus, I think Carroll will be back on top eventually.)

There is a paradox of permanence. You might think that what lasts longest should be what's strongest in the engineering sense, like stone buildings. But most of the stone around Oxford is actually more recent than, say, William of Ockham, a scholar here, or Richard the Lionheart, born here, whose names and deeds live on. Eventually material things crumble, while insubstantial things may remain. If you're a fan of the poet Shelley, who was a student here, you'll know his great poem "Ozymandias" about a stone statue decaying in the desert. I enjoy the paradox that an actual stone statue would keep decaying further, whereas the one described in Shelley's poem hasn't decayed any further at all, since it's just an idea. Shakespeare liked this kind of paradox too (but alas doesn't count as an Oxford man, though he surely passed through here on journeys to London).

Life is soft and perishable, yet outlasts rock and steel. For example, I remember being puzzled when I heard that genome studies have contributed to our understanding of how tectonic plates have moved. Comparing genes of one species and another, you can infer evidence of whether one land mass was in contact with another 100 million years ago. How can a piece of DNA be more unchanging than a continent? Of course, it's not the particular piece of DNA that lasts, but the information it carries, copied over and over again from the Cretaceous down to the present.

The great Oxford and Cambridge mathematician G.H. Hardy made much of the permanence of mathematics in *A Mathematician's Apology* (1940). He wrote of the enduring beauty of Euclid's proof that there are an infinite number of primes and of Pythagoras's proof that the square root of 2 is irrational:

- "Archimedes will be remembered when Aeschylus is forgotten, because languages die and mathematical ideas do not."
- "A mathematician, like a painter or a poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made *with ideas*."
- "Beauty is the first test: there is no permanent place in the world for ugly mathematics."

Hardy also famously drifted into statements about applied mathematics that raise an eyebrow or two:

- "One rather curious conclusion emerges, that pure mathematics is on the whole distinctly more useful than applied."
- "The great modern achievements of applied mathematics have been in relativity and quantum mechanics, and these subjects are, at present at any rate, almost as 'useless' as the theory of numbers."
- "I have never done anything 'useful'. . . . The 'real' mathematics of the 'real' mathematicians, the mathematics of Fermat and Euler and Gauss and Abel and Riemann, is almost wholly 'useless'."
- "But is not the position of an ordinary applied mathematician in some ways a little pathetic?"

We can laugh at this stuff, but to tell the truth, Hardy's thoughts are crisp and elegant in context, and when you read the whole essay it comes across as not silly in the least. In fact it is hard not to like Hardy and enjoy his mind; but for all the permanence of his mathematics, the tone of the *Apology* seems powerfully dated, steeped in a 1930s politics now thankfully past.

Since I personally plan to last as long as possible, I hope he was wrong about this one:

- "A mathematician may still be competent enough at sixty, but it is useless to expect him to have original ideas."