G.H. Hardy, Applied Mathematician

By Lloyd N. Trefethen

Bob O'Malley's memorable article about the discovery of a copy of Green's Essay in New Jersey (*SIAM News*, November 2007) prompts me to offer an applied mathematical book story of my own.

At the end of World War II, my parents, Lloyd and Florence Trefethen, were in their twenties. Discharged from the Navy, what to do next? They decided to enroll as graduate students at Cambridge University. After crossing the Atlantic on the merchant ship *American Traveler*, they arrived in October 1946 for four years of chill and rationing in gloomy postwar Britain. Needless to say, these were the best years of their lives.

American students on the GI Bill had a bit of extra money to spend, and my parents spent theirs on old books. They browsed regularly at the G. David antiquarian bookshop in St. Edwards Passage and stall in Cambridge market. My mother bought Swift, Milton, and Boccaccio, and my father bought d'Alembert, Humboldt, and Faraday. I grew up in Massachusetts eating dinner next to a serene wall of leather-bound books. My father liked to take down his favorites and show them to me.

He is gone, my mother is in a smaller apartment, and in 2000 the books crossed the Atlantic again, this time to my own bookshelves here in Oxford. Suddenly I wanted to get to know better these old volumes. The ancient ones are the most impressive to hold, but I soon found the beautiful gilt-trimmed Victorian science books the most interesting to read. So gentlemanly, earnest, and elegantly illustrated! And one of the finest of all, bound in deep red leather with gold filigree on the spine and its pages brightly trimmed in gold, was John Tyndall's *Heat: A Mode of Motion*, published in its eighth edition in London in 1890.

Leafing through this book one day, I noticed a bookplate on the inside front cover:

Ex Certamine
Quotannis Proposito
quo
Physicam Scientiam
Inter Wiccamicos Alumnos
Roundell, Comes de Selborne
Augeri atque honestari voluit
Hunc Librum
Victoris Praemium
Reportavit
Godofredus Haroldus Hardy
Die: VII Mensis: Aprilis
A.D.
M,DCCC,XCI

Maybe I'd seen it before, but on this occasion I looked more carefully. For the first time I noticed that handwritten name near the bottom,

Godofredus Haroldus Hardy

Well, this sent me back to Miss Kenney's ninth-grade Latin class. Godofredus Harol-

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dus Hardy! Reading over some of the other words, it doesn't take long to figure out Physicam Scientiam, and as for Wiccamicos Alumnos, well, Wykehamist is the traditional name for a student at the famous English "public school" Winchester, which was founded in 1382 by William of Wykeham, Bishop of Winchester. Here's a translation:

In the competition
set annually
by which
Roundell, Earl of Selborne
wished the physical sciences
to be promoted and honoured
among students of Winchester
Godfrey Harold Hardy
carried away
this book
as the winner's Prize
7th day of April
1891

Wow! Hardy was the top physics student in one of England's top schools, and I've got his prize book on my shelf! He would have been 14 when this book was presented to him, just the age I was in that Latin class. And now I noticed properly the gold designs on my book's cover—the coat of arms of the Selborne family with the motto "Palma virtuti" on the front, and the coat of arms of the school with the motto "Manners Makyth Man" on the back.

Hardy was a great mathematician who revitalized British pure mathematics after a dull nineteenth century. He is also famous for his disparagement of applied mathematics. "For my own part," he wrote in sec. 20 of *A Mathematician's Apology* (1940), "I have never once found myself in a position where such scientific knowledge as I possess, outside pure mathematics, has brought me the slightest advantage." (The *Apology* is in the public domain and can readily be found online; it is short and beautifully written.) The same essay goes on to make a sequence of startling statements, like these:

> It is undeniable that a good deal of elementary mathematics . . . has considerable practical utility. These parts of mathematics are, on the whole, rather dull. . . . The 'real' mathematics of the 'real' mathematicians . . . is almost wholly 'useless'. (sec. 21)

> 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. (sec. 25)

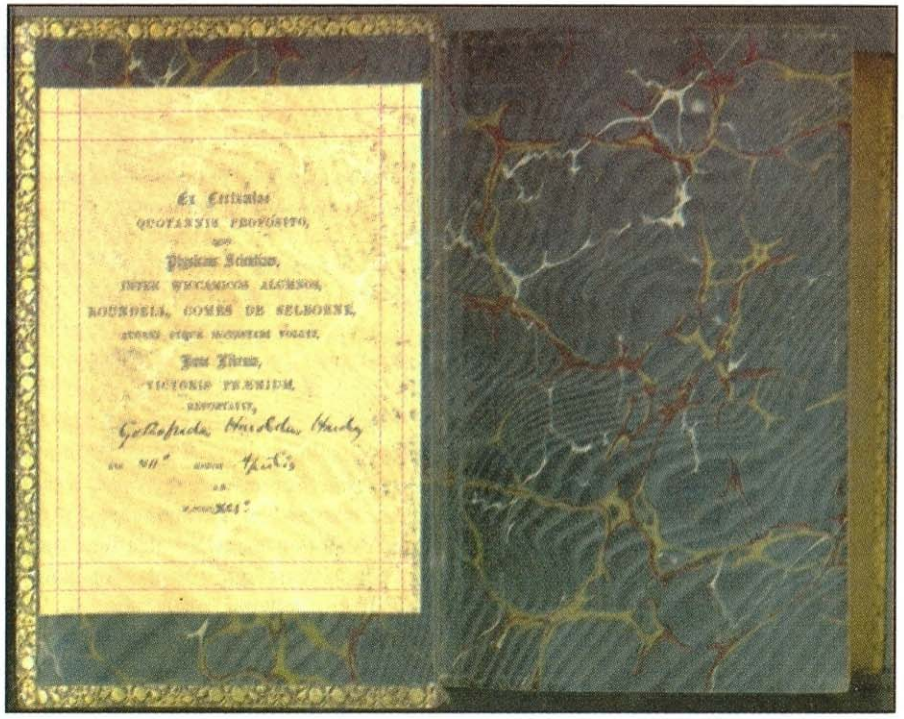
> No one has yet discovered any warlike purpose to be served by the theory of numbers or relativity, and it seems unlikely that anyone will do so for many years. (sec. 28)

> I have never done anything 'useful'. No discovery of mine has made, or is likely to make, directly or indirectly, for good or ill, the least difference to the amenity of the world. (sec. 29)

Hardy did not know that relativity would soon bring nuclear weapons, quantum mechanics would become the foundation for the electronics revolution, and number theory would grow into the basis of cryptography and financial transactions. Indeed, he wrote his *Apology* at the beginning of a war that was destined to change the relationship of science to society forever. His fellow mathematicians down the road at Bletchley Park helped to win it.

Hardy wrote his Apology *at the beginning of a war that was destined to change the relationship of science to society forever.*

Hardy may have turned his back on the



sciences as an adult, but clearly he excelled at them as a teenager. But how in the world did I end up owning Exhibit A in a proof of this proposition? Hardy died a famous man, the preeminent mathematician in Britain. Who would give away something as special as his high school physics prize?

I learned the answer in the October 2001 *London Mathematical Society Newsletter*, in which a note by Norman Biggs began

THE LIBRARY OF G.H. HARDY
After Hardy's death in 1947 his books were inherited by J.E. Littlewood.

Professor Biggs told me subsequently that according to Hardy's will, his lifelong friend and collaborator Littlewood was given the first choice of his books. A few decades and changes of hands later, many of them found their way to the Members' Room at the London Mathematical Society, where they can be seen today.

But not my beautiful Tyndall. I can guess what happened. When Hardy died, Littlewood must have looked over the undoubtedly very full bookshelves in Hardy's rooms in Trinity College. I'll bet he kept the books that dealt with serious mathematics and sold off most of the rest. My father must have spotted Tyndall soon after it reached David's. To judge by a mark in pencil, it seems he bought the book for 5 shillings. It sat in our dining room as I was growing up and learning mathematics, and it must have been there as I read *A Mathematician's Apology* for the first time and heard the moving story of Hardy and Ramanujan. We never realized what a precious volume we had.

Thanks, Dad—and Miss Kenney.

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