my bailiwick in physics, getting impatient with the technicalities. Lightman's introductions rarely gave me an appetite for unfamiliar fare: a bite or two was quite enough. I suspect that non-physicists will feel the same when they come across the three-line master formula at the heart of Steven Weinberg's unified theory of electromagnetism. They will not, I fear, have been much encouraged to persevere by Lightman's comment: "Even without knowledge of any of the symbols or their meanings, one must be impressed" by the formula's "economy and power". Some hope.

I have long been an admirer of Lightman, and was expecting *The Discoveries* to be an elegant and palatable introduction to modern science. Sadly, it is instead an indigestible and tedious read that I believe will have only limited appeal. One of the most creative chefs of science writing has shown that tapas are not his forte. ■

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A Titan of physics

Huygens: The Man Behind the Principle
by C. D. Andriesse
Cambridge University Press: 2005. 360 pp. £55

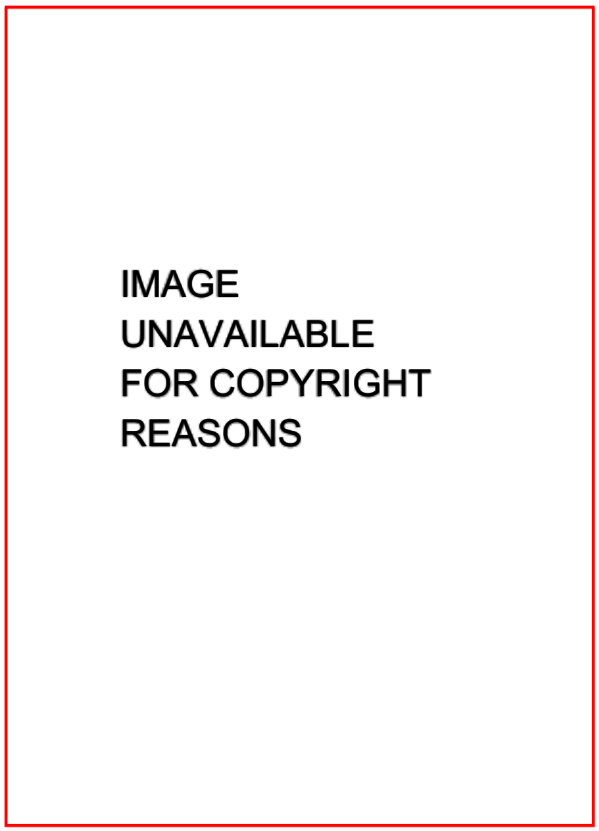
Owen Gingerich

Had Isaac Newton never lived, Christiaan Huygens would have iconic status for characterizing physical science in the second half of the seventeenth century. Like Newton, Huygens made enormous contributions in mathematics, mechanics and optics. He anticipated Newton in finding the formula for acceleration in the case of circular motion and brilliantly used it to determine the value of the constant of gravitational acceleration, *g*. He invented the pendulum clock, correctly interpreted the rings of Saturn, found the formula of the catenary curve adopted by a chain fixed at each end, and enunciated the fundamental principle of the wave motion of light.

Huygens was born in Holland in 1629, the second son of a domineering father, Constantijn, who was both a poet and a government diplomat. Christiaan's older brother, also named Constantijn, became a military officer and worked both independently and cooperatively with his younger sibling in making telescope lenses. In 1666, Christiaan, with his reputation as a mathematician already well established, went to Paris to play a leading role in the formation of Louis XIV's new Académie des Sciences. But in 1681, following the death of the minister Jean-Baptiste Colbert, whose patronage had energized the academy, Huygens was no longer welcome in France as the country turned against the Protestants.

In 1661 Huygens had visited London, meeting Robert Boyle and Robert Hooke, where he observed a transit of Mercury across the face of the Sun. In 1689, around the time of William of Orange's coronation as king of England, he again visited London, where he met Newton and Edmond Halley at a meeting of the Royal Society. There was, however, little love lost between Newton and Huygens.

Unlike Newton, who has an abundance of substantial biographies, accounts in English on the life and works of Huygens have been few and far from adequate. This biography by C. D. Andriesse, a physicist at Utrecht University, brings a wealth of newly translated information, making it the richest source of information in English about the seventeenth-century Dutch polymath. The book makes ample use of Huygens' surviving correspondence, diaries and notebooks, as well as his published volumes. Huygens was a somewhat erratic publisher, often holding back works for many years (and thus occasionally losing priority), so having access to the manuscripts was an essential part of this project.



Christiaan Huygens emerges from Isaac Newton's shadow.

ARG+IMAGES/NIMATALLAH

Andriesse's book is a fascinating account, but is by no means an easy read. The flow is interrupted from time to time by technical interludes that explain, for example, Huygens' work with musical temperaments or the production of an isochronous pendulum. These require the reader to be familiar with terms such as 'tonic' or 'evolute'. However, such sections can be easily skipped by a reader impatient with these illuminating mathematical excursions.

More problematic is a torrent of proper names, both of people and geographical locations. For someone familiar with Dutch history and geography, these may pose no difficulty, but the account would have been rendered more widely accessible with a few strategically placed maps and a glossary of personal names. For instance, the first chapter, which is entitled 'Titan', ends with a paragraph concerning Huygens' discovery of the brightest satellite of Saturn, which he named Titan. Andriesse concludes by remarking that Titan is a fitting image for his subject, quoting a Latin couplet written by Huygens, translated as:

Let them remain as signs of my sagacity, and their names
That I write across the heavens be an echo to my fame.

Thereafter Andriesse often (and rather confusingly) refers to Huygens simply as Titan.

What makes the book an erratic read are the long sections from letters or diaries, filled with trivia (albeit colourful) and innuendo (regarding attractive ladies whom Huygens may or may not have taken to bed); these are interspersed with details of his mathematical or scientific achievements. My lingering impression is that the book is too uneven, and even perhaps too disturbing, to be recommended with enthusiasm.

On deeper reflection I realize that the book mirrors Huygens' own personality and psychology. Huygens was beset by painful episodes of melancholy when for many months he seems to have accomplished nothing, followed by great spurts of creative frenzy. The development of the wave theory of light, leading to the principle of the book's subtitle, occurred after a particularly devastating melancholic episode. Andriesse goes so far as to say: "It is thanks to this crisis that we have Christiaan's magnificent piece of work on light." All of this suggests to me that Huygens might well have suffered from

bipolar disorder (manic-depressive illness).

Huygens was never as interested in philosophy as his contemporaries Newton or Leibnitz, but in his sixties he nevertheless managed to write a more general view of the Universe, his *Cosmotheoros*, and once more his scientific and instrumental genius flashed forth. He devised a way quantitatively to reduce the brilliance of sunlight to that of the star Sirius, thereby photometrically determining the distance to a typical nearby star. "What bounds of number must we set, especially if we consider the infinite Power of God!" he exclaimed. "Really, when I have been reflecting thus with myself, methought all our Arithmetick was nothing, and we are vers'd but in the very Rudiments of Numbers." It was his last great work. As the printing began, his health steadily deteriorated, possibly from cancer, and he died before the book was published, in 1695. ■

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SCIENCE IN CULTURE

A vision of birth

A nativity scene painted by Hugo van der Goes bears a medical message.

THE ART ARCHIVE/GALLERIA DEGLI UFFIZI FLORENCE/DAGLI ORTI

Martin Kemp

Christmas inevitably brings with it traditional images of the nativity of Jesus Christ. Many show the Virgin Mary kneeling before her son, who lies naked on the ground. We tend to accept this imagery without a second thought, because it is so familiar. But it arose at a particular point in history and carried with it specific associations and meanings that could be adapted to specific contexts.

The image of the Virgin Mary kneeling comes from one of the visions of Saint Bridget, a fourteenth-century Swedish noblewoman. Her vision, she said, made her an eye-witness to Christ's birth: "The Virgin, kneeling with great reverence, placed herself in prayer, with her back to the crib. And while she thus remained at prayer, I beheld her child move in her womb, at once in a moment and in a twinkling of an eye, she brought forth her son...I could not perceive how... she brought forth ...the glorious babe lying naked and most pure on the ground."

The idea of a birth that was miraculously quick and painless served to reinforce the dogma of the virgin birth and the doctrine of the Immaculate Conception. Mary was free of the sins and stains that women suffered following the fall in the Garden of Eden.

In one of the greatest of all paintings of Saint Bridget's account of the nativity, this message was adapted for a particular medical context. Hugo van der Goes' huge three-panel altar-piece was commissioned in Bruges by a banker for the Medicis, Tommaso Portinari, and his wife Maria in about 1475. It was shipped to Portinari's native Florence on its completion a few years later. The central panel depicts the nativity with the shepherds, Joseph, angels in ecclesiastical garments, and the ubiquitous ox and ass. The left panel contains Tommaso with two sons and two male saints; in the one on the right, Maria is accompanied by one daughter and two female saints.

This great painting was destined for the chapel of Sant'Egidio, which was attached to the Hospital of Santa Maria Nuova. With 220 or so beds arranged in men's and women's wards, and a staff of physicians, surgeons and apothecaries, the hospital served as a European model in its emphasis on curative procedures.

An obvious medical allusion is apparent in the painting's foreground. The vase containing the irises and lilies is an albarello, almost certainly from Valencia, of the kind used specifically for the storage of medicinal herbs and minerals. The Venetian drinking glass beside it contains columbines and carnations, which, like the lily, iris and violets scattered on the ground, were used extensively for therapeutic purposes.

Less obviously medical is the miraculous nature of Christ's delivery. However, the presence of the chapel and the emphasis on devotion in effecting cures and alleviating suffering reminds us that the health of the spirit and the well-being of the body were conjoined in Renaissance medical practice. The Virgin Mary, through her painless birth, could act as an inspiration for those in pain to rise above their suffering through spiritual contemplation.

For a twenty-first-century viewer concerned with childbirth, the image may bear other resonances. The favoured birth position in the West from the eighteenth century onwards — lying on the back — has been challenged by those who advocate a return to more traditional and 'natural' methods, including positions that involve kneeling. Perhaps for Saint Bridget, mother of eight children, kneeling to give birth was not that extraordinary, but the absence of pain was undoubtedly unique.

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