



# Sir Isaac, THE ALCHEMIST

Newton's alchemical investigations could have helped yield his fundamental breakthroughs in optics

NATALIE ANGIER

SIR Isaac Newton was a towering genius in the history of science, he knew he was a genius, and he didn't like wasting his time. Born on December 25, 1642, the great English physicist and mathematician rarely socialised or travelled far from home. He didn't play sports or a musical instrument, gamble at whist or gambol on a horse. He dismissed poetry as "a kind of ingenious nonsense" and the one time he attended an opera he fled at the third act. Newton was unmarried, had no known romantic liaisons and may well have died, at the age of 85, with his virginity intact. "I never knew him to take any recreation or pastime," said his assistant, Humphrey Newton, "thinking all hours lost that were not spent on his studies."

No, it wasn't easy being Newton. Not only did he hammer out the universal laws of motion and gravitational attraction, formulating equations that are still used today to plot the trajectories of space rovers bound for Mars; and not only did he discover the spectral properties of light and invent calculus. Sir Isaac had a

whole other full-time career, a parallel intellectual passion that he kept largely hidden from view but that rivalled and sometimes surpassed in intensity his devotion to celestial mechanics. Newton was a serious alchemist, who spent night upon dawn for three decades of his life slaving over a stygian furnace in search of the power to transmute one chemical element into another.

Newton's interest in alchemy has long been known in broad outline, but the scope and details of that moonlighting enterprise are only now becoming clear, as science historians gradually analyse and publish Newton's extensive writings on alchemy—a million-plus words from the Newtonian archives that had previously been largely ignored.

Speaking last week at the Perimeter Institute for Theoretical Physics in Waterloo, Ontario, William Newman, a professor of the history and philosophy of science at Indiana University in Bloomington, described his studies of Newton's alchemical oeuvre, and offered insight into the central mystery that often baffles contemporary Newton fans. How could the man who vies in surveys with Albert Ein-

stein for the title of "greatest physicist ever", the man whom James Gleick has aptly designated "chief architect of the modern world", have been so swept up in what looks to modern eyes like a medieval delusion? Sir Isaac the Alchemist, Dr Newman said, was no less the fierce and uncomprom-

**Newton was a serious alchemist, who spent night upon dawn for three decades of his life slaving over a stygian furnace in search of the power to transmute one chemical element into another**

ising scientist than was Sir Isaac, author of the magisterial *Principia Mathematica*. There were plenty of theoretical and empirical reasons at the time to take the principles of alchemy seriously, to believe that compounds could be broken down into their basic constituents and those constituents then reconfigured into

other, more desirable substances.

Newton and his peers believed it was possible to prompt metals to grow, or "vegetate," in a flask. At the time, miners were pulling up from the ground twisted bundles of copper and silver that were shaped like the stalks of a plant, suggesting that veins of metals and minerals were proliferating underground with almost florid zeal. Pools found around other mines seemed to have extraordinary properties.

Dip an iron bar into the cerulean waters of the vitriol springs of modern-day Slovakia, for example, and the artifact will emerge agleam with copper, as though the dull, dark particles of the original had been elementally reinvented. "It was perfectly reasonable for Isaac Newton to believe in alchemy," said Newman. "Most of the experimental scientists of the 17th century did. Alchemy was synonymous with chemistry and chemistry was much bigger than transmutation."

The alchemists had their triumphs, inventing brilliant new pigments, perfecting the old—red lead oxide, yellow arsenic sulfide, a little copper and vinegar and you've got bright green verdigris. The chemistry lab replaced the

monastery garden as a source of new medicines. Alchemists also became expert at spotting cases of fraud. It was a renowned alchemist who proved that the "miraculous" properties of vitriol springs had nothing to do with true transmutation. Instead, the water's vitriol, or copper sulfate, would cause iron atoms on the surface of a submerged iron rod to leach into the water, leaving pores that were quickly occupied by copper atoms from the spring.

For Newton, alchemy may also have proved bigger than chemistry. Newman argues that Sir Isaac's alchemical investigations helped yield one of his fundamental breakthroughs in physics: his discovery that white light is a mixture of coloured rays, and that a sunbeam prismatically fractured into the familiar rainbow suite called Roy G. Biv can with a lens be resolved to tidy white sunbeam once again. "I would go so far as to say that alchemy was crucial to Newton's breakthroughs in optics," said Newman. "He's not just passing light through a prism—he's resynthesising it." Consider this a case of "technology transfer," said Newman, "from chemistry to physics."