The Scent of Money

The story of an obsessed scientist and his controversial quest for a unified theory of smell.

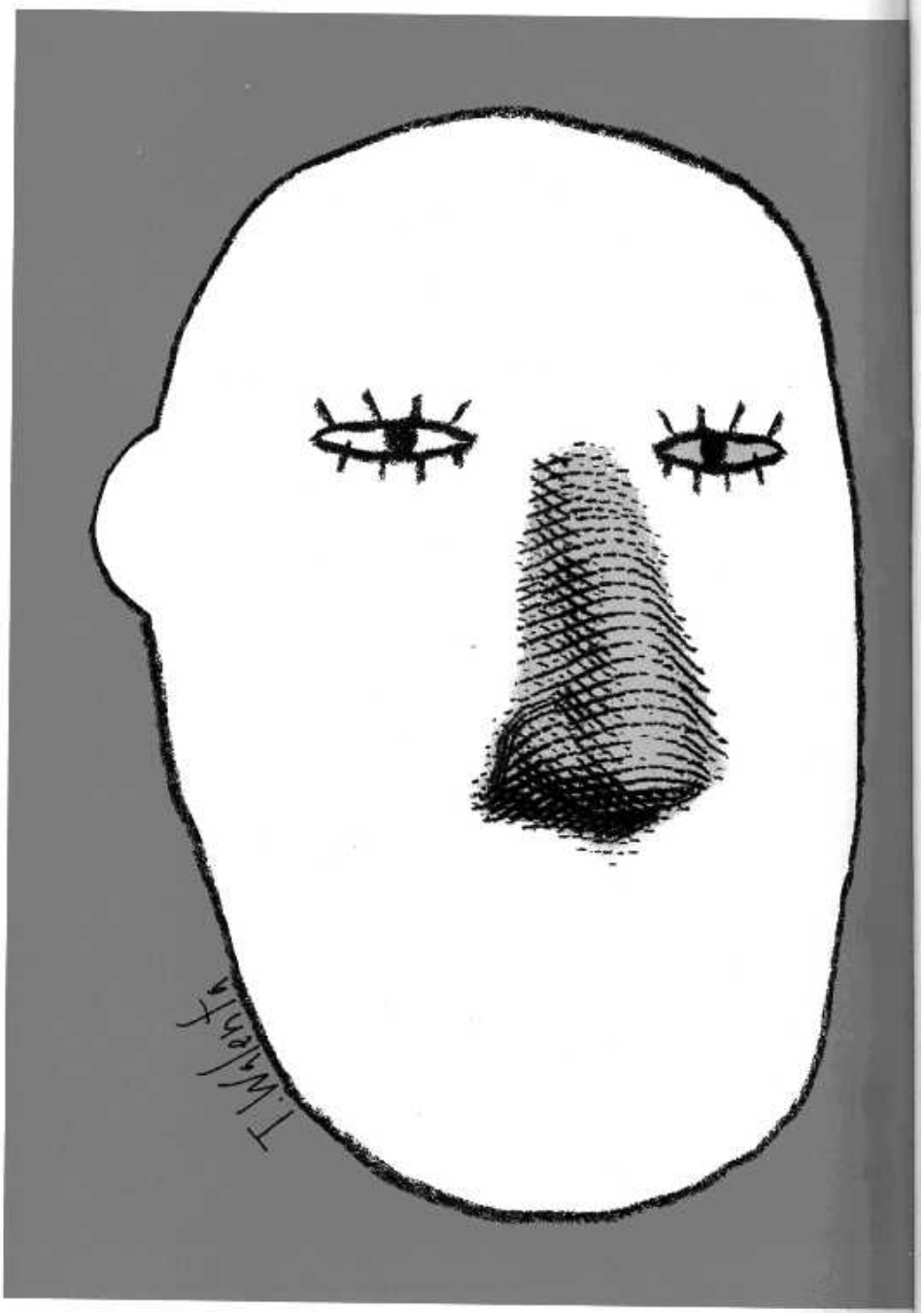
BY SUSAN ADAMS

THE SMELL INDUSTRY generates $11 billion a year. That's what's spent on olfactory ingredients in Tide detergent, Palmolive soap, Chanel No. 5 and a host of other aromatic products. Yet as author Chandler Burr points out in his elegant new book, *The Emperor of Scent* (Random House, $25), chemists toiling at the industrial conglomerates that produce scents have been engaged in educated guesswork: No one has understood how the sense of smell really works.

Until, perhaps, now. Burr thinks he's found the man who has solved the mystery: Luca Turin, an eccentric scientist whose nose has the olfactory equivalent of perfect pitch. Burr's book is an acutely entertaining profile of Turin. But it is also an illustration of what happens when a maverick scientific theory threatens conventional wisdom.

Until Turin came along, most people thought scent came from a molecule's shape. Each molecule has a unique configuration of bumps and curves. When a lemon's citral molecule, for instance, hits the receptors in our noses, those receptors recognize the particular ridges and valleys, and can provide our brain with one clue about the identity of the fruit being sniffed.

Turin, though, doesn't buy the shape theory. It is molecular vibrations, he insists, that are responsible for smell. A scientific polymath with a Ph.D. in physiology and biophysics from the University of London, Turin also has a rarefied hobby: perfume. Even as a child growing up in Geneva and Paris, he was interested in it. Early in his scientific career he landed a research post in Nice, close to



the great perfume center of Grasse. There he indulged his obsession, scouring the region for out-of-circulation fragrances to add to his personal collection.

Turin's passion led him to write the first-ever perfume guide, a kind of Zagat's for the nose. Called, simply, *Parfums: Le Guide*, it appeared in 1992, became a French bestseller, and is currently out of print.

Turin had great fun penning his reviews, giving raves to fragrances he liked ("Thanks to Rive Gauche, mortals can at last know the scent of the goddess Diana's bath soap") and slamming those he hated ("57 for Her is a sad little thing, an incongruous dried-prunes note with a metallic edge that manages the rare feat of being at once cloying and harsh"). But the most startling thing about Turin's guide was the precision with which he translated a sensual experience into words (Gucci's Rush "smells like an infant's breath mixed with his mother's hair spray").

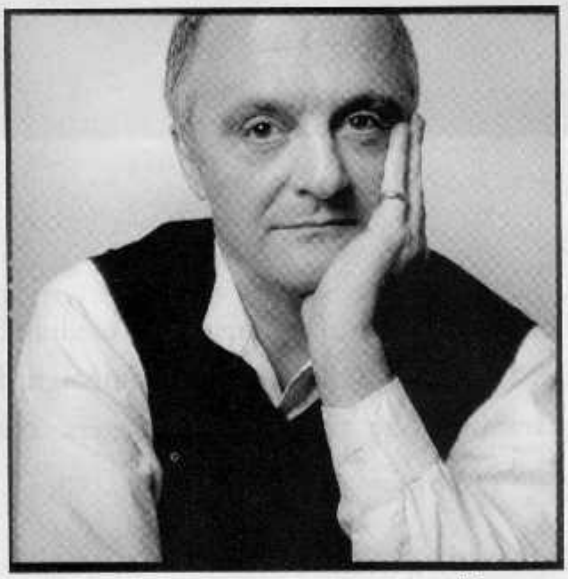
The book caught the attention of perfume manufacturers, who invited him inside their secret labs. At Quest International, the England-based conglomerate that is one of the seven large fragrance producers in the world, Turin observed that the creation of new smell molecules was little more than costly trial and error. Environmental and toxicology testing for one new smell molecule can run upwards of $250,000.

Shortly after publishing his book Turin happened on an article about a gadget that analyzed molecules, called an electron-tunneling spectroscope. A lightbulb went on in his head. He remembered an earlier article he'd read about a radical—though discredited—theory: that smell came not from a molecule's shape, but from its vibration. The only instruments capable of measuring such vibrations, though, were spectroscopes—4-foot-long glass-and-metal optical devices that used infrared light. Imagining one made of human flesh seemed absurd.

The device described in the more recent article, however, did not use optics. It used electrons to measure a molecule's electrical charge. Turin's theory: that nasal receptors were tiny spectroscopes, measuring vibration by measuring electron current.

The most appealing thing about Turin's hypothesis was that he was now able to develop an algorithm that could predict smell from vibrational data. Commercially available quantum chemistry software could calculate the frequency. But Turin needed to calculate intensity of vibration as well. Interested parties can find one version of the resulting algorithm in Burr's book, though Turin says he's since refined it.

If Burr is to be believed, Turin can punch the structure of a molecule into a computer and in 48 hours get smell predictions for 3,000 variations. For instance, chemists have not yet figured out an easy way to make a synthetic patchouli scent. If Turin wanted to work on this using his algorithm, he'd start with one of patchouli's components—say, a molecule that smells earthy or woody—and try varying its structure in small ways. His computer would tell him which combinations were most likely to smell like the real thing. The old, more costly and time-consuming way of inventing smells requires chemists to make molecules and then sniff them. About two new molecules a week can be tested, at a cost of up to $3,000 each.



Luca Turin, father of the "nose-as-spectroscope" theory.

Obviously the Big Seven were intrigued. So was the scientific community. But Turin's work challenged the status quo in such a profound way that smell specialists had a tough time believing he was correct.

Where was his proof? Turin found plenty of molecules that were shaped the same but smelled different, thus throwing doubt on the shape theory. But it's tougher to prove a positive—to predict from a molecule's vibrational structure exactly how it will smell—and he struggled to concoct an experiment that would satisfy his scientific and industrial peers.

Turin tried unsuccessfully for a year to publish an article in the British science journal *Nature*. A BBC documentary about his quest, aptly titled *A Code in the Nose*, finally lit a fire under the Big Boys, two of whom asked him to do some molecule testing. Ultimately, though, they declined to apply his theories.

Why? Here Burr gets a bit carried away: The rejection of the vibration theory is because of "scientific corruption, corruption in the most mundane and systemic and virulent and sadly human sense of jealousy and calcified minds and vested interests." Could it be, perhaps, that skeptics are simply waiting for better proof?

Since Burr finished research on his book, Turin has become chief scientist at Flexitral, a new privately held company in Chantilly, Va., where he is concocting fragrance and flavor molecules. After just one year, and with an investment of less than $1 million from private individuals outside the fragrance industry, Flexitral has come up with two products.

One is a stable lemon-flavor molecule called Acitral. The most commonly used lemon-flavor molecule, citral, fades within 30 days when put in an acid medium like lemonade. The citral molecule has a double bond in its tail, which, when it comes into contact with acid, forms a circular structure. Once citral gets into this circular form, it loses its lemony scent and starts to stink. Acitral, according to Turin, has no double bond and lasts longer.

The second is a molecule bearing a lily of the valley scent, much used in fresh floral fragrances. Turin says he's on his way to closing a licensing deal with one of the Big Boys for it. If he collects royalties on either product, his competitors in academia and industry may wake up and smell the profits. F

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