The Emperor of Scent

By Chandler Burr
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This book is a must read for anyone with an interest in science and scientific research. That does not mean you need to be a research scientist to enjoy it. The book is written in a very easy going style with plenty of quirky humour and clever analogies.

It is the story of Luca Turin and his struggle to have his theory on how we smell recognised, let alone accepted or even debated. Turin is a biophysicist, a perfumer with an uncanny sense of smell and an even more uncanny way of describing each odour.

The generally accepted way in which we smell is that the molecules entering our nose interact with receptor sites on the basis of the molecular shape fitting the receptor site in some way. The brain recognises the smell of a substance by the shape of its molecules.

Turin reasons for challenging this are:

Firstly the mighty monetary and computer power of the giant perfume manufacturing corporations (referred to as "the big boys" in the book) have yet to come up with a way of predicting the smell of a substance or being able to make to order a substance with a particular smell.

Secondly he compares some other body processes that rely on molecular shape with smell.

• Digestion. Although new foods are being produced they are still based around the same fat, carbohydrate and protein molecules that have been around since humans first evolved. We have the necessary enzymes of the correct shape to catalyse the breakdown of these substances. Digestion is rapid. As additional support of this he makes the point that dogs didn't evolve as chocolate eaters and if you feed them chocolate they get sick implying that dogs do not have the necessary enzymes to digest chocolate.

• Immune system. Fighting disease also relies on molecular shape. We need antibodies of the right shape to lock onto and neutralise or destroy the invading pathogens. There are pathogens around that were not there when humans evolved. The immune system has to make the appropriate antibodies of the right shape going through maybe thousands of possibilities before a suitable one is found. This takes days which is why, when we get sick, it takes a few days for us to recover.

• Smell. There are substances around that were not present when we evolved. The molecules of many of these substances have entirely different shapes to those of more traditional smelly substances. Therefore, suggests Turin, the receptors of the right shape won't have developed in our nose. Yet we can smell any new odour instantly.

For Turin, shape may have some contribution to the sense of smell but it is by no means the whole story. As the account of his ideas and struggles to have them acknowledged develops it is clear that Turin reads scientific literature very widely and has an almost encyclopaedic memory of what he has read. He also has the ability to make connections that would by-pass many of us. From all of this he develops a previously discarded proposal that smell is due to vibrations of bonds within molecules.

First problem: if this has any credence how are the vibrations detected? On a laboratory scale bond vibrations are detected and measured by a spectroscope. Turin masters the necessary Physics to understand spectroscopy and then goes in search of molecules and molecular phenomena that could mimic a spectroscope.

Second problem; assembling evidence to support his proposals. The search is on for molecules with different shapes but with bonds of similar vibrational wave numbers that are small enough to be able to be smelled.

The main weapon Shapists have against the vibration theory is enantiomers. Right and left handed molecules have different shapes and smell different but as they have the same atoms bonded to each other their vibrational characteristics will be the same. Therefore the answer to smell is shape not vibration.

Isotope replacement. If you replace hydrogen with deuterium in a bond its vibrational characteristics will change and therefore so should its smell.

Turin tackles these issues with an amazing ability to think outside the square. An interesting aspect is the mixed emotions that can be generated when testing ideas. There is the anticipated excitement that what is predicted will happen and provide evidence to support the theory. There is also the apprehension that the results could be other than predicted and torpedo the theory. He finally assembles a paper which is submitted to Nature. It is rejected by the peer reviewers. Turin answers all their criticisms and it is rejected again.

The story highlights a number of aspects of scientific research:

• The scientific community now expects progress to be incremental and is highly suspicious of any radical change of view.

• Most researchers are so defined in their knowledge that

it is difficult for them to appreciate work outside their field. One of Turin's problems was that he had brought together some fairly sophisticated ideas from chemistry, physics and biology and there was no one to critique his work who was familiar with all three of these disciplines.

- Big corporations have millions of dollars invested in research in established ideas like shape and smell and are reluctant to see the boat rocked.
- Individuals have reputations earned from research into the shape and smell relationship and will fight hard to protect these reputations.

Through the story Chandler Burr weaves Turin's biographical details; his upbringing, education and his relationships. There are many descriptions of perfumes which I found a bit distracting because I was impatient to get on with the story.

There are a few occasions when the main story is suspended while Burr follows up some other work of Turin's. One that I found particularly interesting was his involvement in a case of a woman who found that everything smelled vile. I read this book shortly after there was a similar well publicised and successfully treated case in New Zealand. After many conversations with the woman Turin finally decides that the cause is epilepsy in the olefactory bulb of the brain. Epilepsy is described in the book as a situation where the sensations detected by the brain are not attenuated as should happen but remain and even build up on themselves to distort and overload the brain's messages and responses. Turin recommends to the hospital specialists that they try epilepsy drugs and effects a cure. As I recall the New Zealand case was cured by surgery.

Two-thirds of the way through the book Burr as the author takes the unusual step of becoming part of the story. He explains how he set out to write an objective account of the vibration theory and intended to give a balanced view of both vibration and shape. However the shapists refused to enter into discussion; none, that he could find, had read the Turin paper (subsequently published in a journal other than Nature) and claimed they didn't need to. All flatly rejected the vibration theory without giving substantive evidence to support this stance.

This book is a fascinating read, somewhat shakes your faith in the objectivity of the scientific community and peer reviewing. The ending emphasises that we are dealing with real life here and not a well crafted novel with all loose ends neatly tied up.

In 1995 the BBC Horizon team produced a TV documentary on Turin's work called *A code in the nose*. If anyone has access to this I'd love to see it.

If you can't find the book in a library or book shop, I bought mine second hand through amazon.com for US$3.95 plus handling and postage.

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