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Q&A Roman Kaiser
Perfumes preserved

Roman Kaiser, a chemist at the Givaudan Research Centre in Dübendorf, Switzerland, has recreated the scents of hundreds of rare and endangered plants in his laboratory, some of which he describes in his latest book. Here he explains how he preserves the smell of disappearing flora.

Why study the scents of rare and endangered species?
A third of all flowering plants are expected to become extinct by the middle of this century. Plants are essential for life, so preserving their biodiversity is as important as preventing climate change. My book *Scent of the Vanishing Flora* collects olfactory descriptions for 267 rare and endangered plants (selected from 500 I've studied), a few of which no longer exist in nature. These descriptions will allow experts to recreate them. I've also prepared a small number of boxes containing 60 scent reconstructions, as exemplars. When these plants no longer exist, we will still be able to smell them.

Where have you travelled to collect scents?
As a child I wandered in the forests around our village in Switzerland, so I started with the black vanilla orchid (*Nigritella nigra*) that grows in those mountains. In the 1980s, I visited the Mediterranean countries and the rainforests of Indonesia in Java and Bali. Then the expeditions became bigger. In 1996, I traversed French Guiana with a zeppelin-like dirigible to sample rare and endangered species from the canopy of the rainforest, and I later undertook similar expeditions in Gabon and Madagascar. In 2001, I explored the mountain mist forests of Papua New Guinea, which are rich in species not yet described. I have also visited a plateau close to the western coast of South Africa where you can find a quarter of all bulbous plants that exist.

Why do flowers have a smell?
To attract pollinators. Some flowering plants release their scents at night to attract moths — their fragrances are often similar to jasmine, orange flower or gardenia. Others use mimicry and deception. In my lab I have a species of *Stapelia* from South Africa that, when in bloom, uses a smell like decaying meat to attract carrion flies. In the Andes there are orchids that emit a mushroom-like scent to attract female fungus flies. There is an orchid named after me that attracts male euglossine bees, who visit not for nectar but to use the fragrance to attract female bees. There are many more strategies that flowers apply to get pollinated.

How has the study of natural scents developed?
Until the mid-nineteenth century, we had only natural extracts from plants and animal secretions. With the dawn of modern organic chemistry we could investigate the olfactory compounds within these extracts. By 1970, we knew of hundreds of extracts and more than 1,000 synthetic fragrance and flavour compounds. But this didn't even begin to cover the huge range of attractive natural scents. Fortunately, around this time, modern electronics gave us sensitive devices with which to non-destructively collect micro-samples of scents directly from living plants, preserving their quality as perceived by the human nose. This avoids influencing the original scent, which was a problem with earlier isolation methods such as distillation.

Scent of the Vanishing Flora
ROMAN KAISER
Wiley: 2010/2011. 400 pp. £105/$155

How do you capture a fragrance in the wild?
We place a small absorption trap close to the scent source (usually a flower) and pump the fragrant air through it. The scent molecules are absorbed over minutes or hours. You need no more than 20–200 micrograms for a laboratory investigation using gas chromatography and mass spectrometry. Then you can reconstitute the natural scents from synthetic scent compounds.

How does smell compare to the other senses?
Visual and acoustic perception can be described mathematically, but you can only describe a new smell by comparing it to your existing scent experiences. Novelty in a scent does not manifest itself in a direct way: you will feel uncertain and have trouble describing it. And then you have to study it.

What makes a smell good or bad?
In certain cases, concentration has an enormous role. One powerful olfactory chemical is 4-methyl-4-sulphanylpentan-2-one, probably the most potent odorant in the world. Less than 0.0001% of it in a solution gives the attractive cassis notes in sauvignon blanc wine. But in 1993 we found a Swiss orchid in which the same chemical is present at 0.01%. It has the scent of tomcat urine.

What are the least pleasant odours you've worked with?
I'm sometimes asked by museums to reproduce animal scents, such as the smell of cattle in a barn. I was once asked to make the odour of a skunk. I made a diluted version of it, but the people at the museum were not careful. A dispenser containing just 10 millilitres of a 0.001% solution of the reconstituted skunk scent was spilt, and it contaminated a large part of the building.

What does the future hold?
As analytical systems become more sensitive, we will know more about the composition of natural scents. In the future it will be easier to synthesize organic chemicals with milder methods and less waste. In theory, the process of analysing and recreating a natural odour could be almost automated. But the human nose will still be the most sensitive detector. ■

INTERVIEW BY JASCHA HOFFMAN