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# Chapter 13

## Past and Future Trends

### Introduction

As I undertook to write this chapter, I realized how it could easily turn into an exercise in nostalgia about the recent past of some familiar names from the flavor industry, and while this would be fun to write, it would nonetheless, like family movies, bore the average reader to distraction. Instead I have simply tried to set the present flavor industry in an historical context and give an indication of the types of change that are inherent in the current climate.

### History

Legend has it that the earliest use of herbs and spices was to preserve food from spoilage or, failing that, to cover the taste of food that had already spoiled. Other stories attributed medicinal (or even magical) powers to specific aromatic plants. Despite all these conflicting claims, the main driving force was clearly the flavor these herbs and spices imparted to food. The earliest flavorist was a combination of chef and pharmacologist, and it seems that not much has changed; virtually all first-rate flavorists are also enthusiastic chefs. The blending of seasonings and food represents the opportunity to exercise the same skills on a much simpler stage.

Records of the use of herbs and spices date back to the very beginnings of our oldest literature. The earliest documents in India mention mustard, turmeric, black pepper and asafetida. Slightly later records add ginger, cumin, cloves, coriander, spikenard, cardamom, cinnamon and nutmeg. Spikenard is a close relative of valerian. Ancient Persian spices also included fenugreek. There are Old

Testament references to cinnamon, cassia, spikenard, saffron, galbanum, calamus, onions and garlic (in addition to the expected frankincense and myrrh).

Egypt used spices such as anise seed, cumin, marjoram, myrrh and cassia for cooking and also to pickle dead bodies. Roman recipes refer to anise seed, caraway, mint, mustard, ginger, basil, bay, marjoram, fennel, rue, cumin, thyme, oregano, coriander, black pepper, and the highly prized, but sadly now extinct relative of asafetida, silphium. The use of ginger root and soy sauce in China both date back 2300 years to the early Han dynasty. Within a hundred years they were supplemented by coriander, black pepper, nutmeg, cardamom, cinnamon and cloves from India. Traditional flavors from the Americas included chilies, cocoa, saffrafrs, wintergreen, allspice and vanilla.

## How Flavors Developed

It is possible to visualize medieval liquor blenders as primitive flavorists, culling their brew to a delicious, inebriative, and profitable state, but their skills were actually closer to those of a Roman chef. The modern flavor industry didn't really start in a recognizable form in the first half of the nineteenth century. It was closely linked to the fledgling pharmaceutical industry and concentrated on the production of extracts and distillates from herbs and spices. The growth of the flavor industry paralleled the growth of its potential customers, especially the beverage industry in the United States. Root beer is a typical example. An early "root beer" would have contained oils and extracts from wintergreen, saffrafrs, anise seed and cinnamon. This combination had an attractive flavor and it was possible to imagine medicinal benefits from some of the ingredients.

Around 1850, simple oils and extracts were supplemented by aliphatic esters, followed by progressively more complicated chemicals, such as vanillin, over the next 50 years. For the first time it became possible to attempt more complicated flavors, such as strawberry. A typical late 19th-century strawberry flavor would have contained isoamyl acetate, benzyl acetate, rose otto, ethyl butyrate and vanillin. A vivid imagination would be required to pick this flavor out as specifically strawberry rather than just generally fruity.

The next 50 years saw the introduction of some good synthetic chemicals such as ethyl methyl phenyl glycidate and the identification (by bucket chemistry) of a few major chemicals in nature, raspberry ketone being the best example. A typical strawberry flavor from the 1930s would have contained ethyl butyrate, ethyl acetate, isoamyl acetate, isoamyl butyrate,  $\gamma$ -undecalactone, ethyl methyl phenyl glycidate,  $\alpha$ -amyl cinnamic aldehyde, orris extract, vanillin and methyl anthranilate. This flavor would now begin to have some resemblance to strawberries, but would be flat, cooked and missing many key notes.

By 1960 some of the more obvious gaps in strawberry flavor key notes would have been filled and the flavor would be recognizable, fairly realistic and less restricted to the cooked category. Typical components would be maltol, vanillin, methyl heptine carbonate,  $\alpha$ -amyl cinnamic aldehyde, ethyl methyl phenyl

glycidate, ethyl butyrate,  $\gamma$ -undecalactone, methyl cinnamate, methyl anthranilate, diacetyl, ethyl butyrate and ethyl hexanoate. Some of the aforementioned gaps that had been filled (out of pure luck) by chemicals that fulfilled somewhat the same function in nature, such as methyl cinnamate. Unfortunately, many had been filled by chemicals that had no counterpart in nature, such as methyl heptene carbonate.

Analytical methods quickly began to make their mark in the latter part of the twentieth century and added greatly to the repertoire of raw materials in use. This would gradually lead to the replacement of less suitable components and the addition of previously unavailable characters. A typical flavor from the end of this period of transition would contain ethyl maltol or furaneol, depending on stability constraints, ethyl butyrate, ethyl hexanoate, ethyl methyl phenyl glycidate, *cis*-3-hexenol, *cis*-3 hexenyl acetate, *cis*-3-hexenyl butyrate,  $\gamma$ -decalactone, methyl cinnamate, butyric acid, methyl jasmonate and diacetyl. This strawberry flavor would be much more realistic and capable of a wide variety of different profiles.

The key recognition characters for strawberry are candy, peach, fruity and guava. The most important secondary character is leaf green. It is interesting to chart the progress of our strawberry flavor in these very simple terms over the past 100 years.

The following symbols have been used:

- 0 Indicates the character is completely absent.
- 1 Indicates the true character is absent and a poor substitute is used.
- 2 Indicates the character is present but incorrectly represented.
- 3 Indicates the character is present and well represented.

	1900	1930	1960	2000
Candy	1	1	2	2/3
Peach	0	2	2	3
Fruity	3	3	3	3
Guava	0	0	2/3	2/3
Leaf Green	0	0	1	3

This chart only covers the simplest and most basic elements of a strawberry flavor, but it makes clear that progress has been steady. We can expect similar refinement of the remaining characters in the coming decades. Some of the major components from the flavors of the past still find use but at much lower levels, corresponding to their real function in nature. Good examples are vanillin, benzyl acetate, methyl anthranilate, isoamyl acetate, isoamyl butyrate and benzyl acetate.

## How Flavor Companies Developed

The earliest companies were, for the most part, family owned. Family ownership had its advantages in that it allowed management to focus on long-term growth and strategy rather than short-term returns and tactics; however, many family companies faced problems of succession, and in the long term the harsh financial discipline of Wall Street has also proved to have its advantages. Family ownership has declined of late and will continue to decline in subsequent years. The flavor companies are now for the most part, though certainly not exclusively, part of much larger conglomerates, a reality that has also proved to be a difficult structure to sustain, as the larger parent company generally fails to understand the business of its smaller subsidiary and thus stifles effective decision making.

The need for realistic applications technology has gradually increased in the flavor industry. Initially this was driven by the need to ensure that flavors would work in their specific application. This is obviously a critical ongoing need. No customer has the time or patience to work with flavors that have not been tested and proven to work.

As the food industry matured and the third world began to industrialize, smart flavor companies realized that there was money to be made from enabling this process. The applications technology requirement expanded considerably to cover the skills needed to set up and operate a plant from scratch. Extensive raw material knowledge was also required to allow the new plants to use indigenous (and often highly unusual) ingredients. These requirements could only be met by seasoned professionals, with broad experience in their own industry.

In the latter part of the twentieth century, most consumer product companies began to realize that they could not do absolutely everything cost-effectively and with a reasonable level of competence. The most obvious result, and one very welcome to the flavor industry, was a reduction in the number of major customers with in-house flavor creation capabilities. These enterprises had always suffered from the parallel problems of lack of project diversity and lack of novel ingredients. It was also difficult to attract the best flavorists from the flavor industry because they would quickly lose touch with the latest developments.

The gradual reduction in application facilities in many food companies was a less obvious outcome. This change put additional pressure on flavor companies to increase application resources and to ensure that they were closely aligned to the industries they served.

The keys to success for the early flavor companies were:

- A good new raw material discovery program
- A good raw material production base
- Outstanding creative flavorists
- An effective, targeted sales force

All four of the above cost money and require a high level of organization. It has become increasingly difficult for small companies to survive. In particular,

they cannot afford progressively more expensive discovery and synthesis programs. Without effective, broad-based research the best flavorists may be reluctant to work for them and customers may fear they are getting outdated flavors. Additional technical requirements in the applications, delivery and sensory areas are also difficult to fund.

Academic training for flavorists was mainly in the disciplines of chemistry or pharmacology. An academic background is still considered useful, but pharmacology has been replaced by food technology. A scientific education provides little more than the bare bones of a background for such a demanding creative profession. Effective on the job training has normally been in the form of an elaborate and laborious apprenticeship scheme. Few companies can afford that luxury today, and the quantity and quality of training has declined. Given the gradual reduction in product life cycles in an evermore competitive environment, the need for top-notch creative flavorists has increased and the best industry talents are in a very competitive position indeed.

Customers are making more impersonal, consumer driven decisions, so the value of an aggressive sales force is reduced somewhat. The most important functions of the sales force have become opening the door for a capabilities presentation and analyzing the customer's buying cycle. No sensible customer is going to allow a sale to be "closed" in the traditional way unless it is to their benefit. This trend is partially counterbalanced by increasing globalization and the need to be represented effectively in all significant markets.

The rapid increase in global regulatory and safety requirements, coupled with the exponential increase in documentation, puts additional pressure on any small flavor company trying to work with the steadily contracting number of major global customers.

## **The Future**

No epoch in the history of our industry has unfolded entirely according to expectations, but it is interesting to consider a number of key drivers of change in the twenty-first century.

## **Analysis**

Most flavor companies are working on the assumption that raw material research will continue for many years along relatively conventional lines: evermore detailed analysis of nature, followed by evermore ingenious syntheses of the new chemicals that have been discovered. Sadly, I suspect that each successive truly novel ingredient will become more and more difficult to find and less and less game-changing in its impact.

This not to suggest that the conventional approach has run its course. For relatively simple flavors, such as strawberry, our present knowledge probably

covers most of the useful ingredients that occur naturally in the fruit. It is reasonable to predict that most of the remaining gaps will be filled by analytical and synthesis research of natural foods over the next 20 years. When we look at more complicated flavors, such as coffee, we have frankly not made quite as much progress and there is more potential for improvement. The work is likely to shift gradually from aroma to taste research over that period.

Our industry will continue to learn from the pharmaceutical industry. Combinatorial chemistry and rapid screening assays are the natural tools for the challenging area of research into taste components and some success is highly likely, especially in the area of compounds that alter our perception of sweetness. Medical research does shift the blame around for many of our health issues with disturbing regularity, but concern over sugars in the diet is unlikely to abate.

The same analytical techniques could be applied to revolutionize the traditional approach to aroma research. This research could be concentrated on the most cost-sensitive profiles of flavor formulations and would be very likely to uncover novel chemicals that would be more powerful and much cheaper in use than existing chemicals.

## **Delivery**

Delivery technology is likely to be another rapidly increasing capability for most flavor companies. Increases in flavor quality will come from discovery and synthesis programs, but the ability to recreate those flavors in challenging applications will require novel delivery platforms.

Our current delivery systems are capable of giving reasonable results in the most difficult areas but all involve some trade-off within respect to aroma quality. This is especially true of the various forms of powder flavors currently in use.

## **Regulations**

Regulatory issues have a strong bearing on the probable direction of future flavor creation and have followed a rather surprising course. Constraints imposed by bureaucracy waxed in the United States during the 1970s but then waned in the 1990s. Europe is going in the opposite direction, from a very simple, liberal regime in the seventies to the mammoth bureaucracy of the European Union in the twenty-first century. This is unlikely to slow progress. Research in the flavor industry will be driven by the most encouraging regulatory climate and the other regions are certain to be forced by commercial pressure to fall in line.

## **Sensory**

The use of sensory science in flavor creation will also increase, even though the overall usefulness of this tool has probably been overstated. It is also likely

that this area of expertise will gradually move from food companies to flavor companies—which are in a position to put it to more effective use.

In the future, sensory resources will be allocated more strictly according to results and will shift into the areas of genuine multidimensional analyses and emotions. Multidimensional analyses will only be used for major projects because of the high level of computer resources required. The evaluation of emotions linked to profiles will become much more common in flavor projects (as has long been the case for fragrances).

## **The Internet**

At first sight it seems strange that so many consumers are using the Internet to buy everything under the sun, but similar changes in habits have not really taken hold in the flavor industry. Several companies have attempted to sell stock flavors from Web sites but without any notable success, which at first struck me as strange, but then it occurred to me that perhaps the motivation driving consumers to buy from an Internet company is the fact that they know they can get precisely what they want without having to accept an alternative. It is the same motivation that works in reverse for flavor companies. Why accept something that is basically “take it or leave it” from a big company via the Internet when you can get a small company to tailor-make something for you?

In the next few years, a second generation of Web sites, driven more by customer service than the needs of operations, will take these lessons to heart and allow genuine customization of flavors. In order for this approach to work, plants will need to operate on a made-to-order basis and a much higher level of automation will be essential—but then that is inevitable in operations in any case.

## **Companies**

Small flavor companies will certainly survive and be very successful in niche markets. Indeed, the largest flavor companies (with some exceptions) have become increasingly reluctant to invest in small and (for them) unprofitable niches. It will become increasingly difficult for small flavor companies to become large by organic growth. Acquisition offers a possible route to growth, but only makes economic sense if the acquisition target brings some real technical advantage. This criteria is met in very few cases. The flavor industry of the future will be split into three or four very large global companies and many smaller niche companies.

For most of the last fifty years, the differentiation between the major players has been obvious to most of us within the industry and, I suspect, relatively obvious to most of our global customers. As conventional research becomes slowly less productive, many of those differences may fade. It will no longer be essential to involve any specific supplier in a specific project and this will enable the many global customers possessing core lists to trim them even further.

Smaller suppliers will concentrate more on providing superb customer service, the one area where the major companies cannot really compete. They will remain local or, at best, regional suppliers, driven by the need to provide rapid and flexible service and also to avoid having to deal with all the complexities of global regulations.

### **The Customers and the Consumers**

If sensory science has helped us understand some of the subtleties behind consumers' historical preferences, its usefulness in this respect is limited; and it does nothing to enlighten us about the direction of future trends.

All the best commercially successful flavorists recognize the importance of customers and hence consumers in the flavor creation process. The days when a flavorist could expect to sit in a laboratory and simply make a flavor that satisfied nothing more than their own personal whims are long gone. The most difficult challenge is to find a mechanism that makes this process dependant on something more scientific than the personal chemistry between the two parties.

Professor Eric von Hippel of the MIT Sloan School of Management has had considerable success in recent years applying his research into user innovation to develop practical tools to facilitate new product development. His techniques might seem to be most obviously applicable to software development but in practice they have yielded incredible results in every conceivable industry where they have been implemented.

In one sense user innovation sounds threatening because, viewed simplistically, it seems to do away completely with the need for R&D, marketing and a host of other departments. In reality, it simply formalizes and improves upon the process of consumer understanding and adds the vital dimension of being "ahead of the curve" rather than simply reactive.