

# Research and development

The foundation of Givaudan's continued commercial success is a longstanding commitment to research and development programmes in both the Fragrance Division and the Flavour Division.

Creative and innovative programmes are a clear focus on the current and future needs of customers is essential for us to retain our competitive edge in the fragrance and flavour industry.

As part of these programmes, our scientists merge analytical precision with human sensory response in developing systems and technologies that help the business perform successfully in the market.

In 2010, Givaudan invested CHF 336 million in research and development, more than any other Company in the industry. This investment will allow us to deliver on short- and mid-term research initiatives. It also gives us an opportunity to invest in promising long-term programmes.

During the year, the Fragrance Division's global Research & Technology organisation focused on the discovery of new fragrance molecules and their applications in fine fragrances and consumer products, concentrating research resources and programmes in line with industry and consumer lifestyle trends.

The Science & Technology organisation of the Flavour Division continued its commitment to developing a strong programme which addressed business growth with a focused ingredient discovery pipeline, new process technologies and a creative approach to sensory science.

**R&D spend**  
in millions of Swiss francs

2010 – 336

2009 – 326

## Fragrance Division

During 2010, Fragrance Research & Technology worked to sustain a vibrant and relevant organisation in which innovation and discovery can thrive and reap rewards.

A review of the career structures within the technical functions of Givaudan revealed the need for a different approach in order to be commensurate with the experience and knowledge that is developed over a long career of dedicated research. The new Dual Career Ladder is specific to Research & Technology in Givaudan and reflects the value that the business places on technical understanding specific to fragrance, recognising that researchers generate value through expert knowledge.

Activity within Fragrance Research & Technology was repositioned under three pillars in 2010: Wellbeing, Hygiene and Delight. These three pillars provide focus for research activity and technology development to support consumer-perceptible benefits for fragrance. Together they provide a framework that encompasses the many and diverse areas of expertise within Givaudan.

## Well-being

The Sensory research team has developed multiple connections with academia to explore new fragrance benefits, aiming at determining methods and fragrance formulations to enhance mood and ultimately lead to consumer benefits such as improved sleep. The programme is in its early development phase and has already shown promising initial results.

On a day-to-day basis, Sensory Science continues to support the three business units of the Fragrance Division via its global network. Regional sensory teams in Singapore, São Paulo, Ridgedale (NJ), Paris and Ashford provide expertise in fragrance profile, longevity and odour masking properties to our business partners to support product claims.

## Hygiene

Our researchers have discovered gender differences in the composition of human sweat – a discovery that is now being utilised to refine fragrance design for deodorising and antiperspirant products.



**Fragrance ingredient design**

The latest findings from TecnoScent™, a collaboration between Givaudan and ChemCom SA, will radically change the way that future fragrance molecules are designed.

Screening of fragrance materials on several olfactory receptor cells simultaneously has verified that for every receptor there are odour molecules that are agonists and antagonists. This means that some materials will activate a receptor whilst others will shut it down.

The field of molecular olfaction is still young, but the new concepts being developed may be put in use already. The chemical processes in the human nose itself will define the design of fragrances and fragrance ingredients in the future.

This knowledge enables our fragrance development teams to create perfumes to specifically block, mask or even remove malodour from masculine or feminine sweat as we identify specific materials that work best for each gender. In the same arena our partnership with TecnoScent™ has identified routes for blocking the perception of malodour by nasal receptors – this discovery leads to the possibility of designing products to protect people from offensive odours that are inevitable in crowded areas, for example, or even to enable individuals to control what they smell.

**Delight**

The search for new ingredients for fragrance design remains the life blood of Givaudan and the ultimate quest for our research teams. Responding to the demands of the market today, however, our focus throughout 2010 has been to re-evaluate our current palette to identify how Research & Technology can support the macroeconomic climate and the sustainability of our industry. We are currently exploring innovative synthesis techniques of our lead ingredients to lower their cost and thus make them more accessible for use in developing markets.

On the discovery front, we have developed the first bio-converted Patchouli-like accord: Akigala. This material will open doors to new creative avenues for both masculine accords and signature feminine fragrances.

Two new captive ingredients were introduced to Givaudan perfumers in 2010: Cassyrane™ and Sylkolide™. Cassyrane™ is the first sulphur-free cassis top note and confers a very comfortable and pleasant character, whilst Sylkolide™ is a revolutionary musk. The latter is set to become a future classic musky note. It brings a modern musky backbone that is noticeable throughout a fragrance and combines wonderfully with the red fruit facets that characterise this ingredient.

Delivering fragrance at the key touch points of the product experience remains a key priority at Givaudan. Recent advances in polymer chemistry have helped us progress the performance of our lead technology, Mechacaps™ which is used in laundry products and fabric conditioners worldwide.

Last but not least, Givaudan is the key contributor from the fragrance industry to the development of in-vitro methods of testing ingredients for skin sensitisation. Our work was published this year and we hope this will set the standard for the industry as the 2013 ban on animal testing under the 7th amendment of the EU Cosmetic Directive draws closer. Our dedicated team in the Research & Technology hub in Dübendorf, Switzerland continues to lead research in this area.

“The ability to accurately predict which flavour will appeal to consumers is critical to food and beverage manufacturers around the world. Getting this right has significant economic value and the knowledge gained provides additional focus for Givaudan’s science & technology programme.”

### Flavour Division

Creation of high performance flavour systems requires a combination of artistry and technology. Leadership in the development of innovative solutions is considered essential to deliver differentiated and sustainable product offerings making foods and beverages taste better and improving quality of life.

The ability to accurately predict which flavour properties will appeal to consumers is critical to food and beverage manufacturers around the world. Getting this right has significant economic value and the knowledge gained provides additional focus for Givaudan’s science & technology programme.

Aided by its SmartTools sensory measurement technology, Givaudan sensory science, in conjunction with our analytical profiling team, continues to deliver a significant body of information on key global flavours as diverse as citrus, vanilla, mint, tea, coffee, dairy, cheese, beef and chicken. These consumer insights have resulted in a series of TasteEssentials® flavour product categories which address application-specific customer requirements from soups, sauces and snacks to beverages, ready-meals and foodservice menu items.

The emotional reaction to flavour stimuli can have a significant impact on purchasing decisions. Techniques to measure people’s cognitive response are being investigated to better calibrate the effect of emotion on decision-making. Investigation of genetic drivers of sensitivity to taste are of interest since these could suggest a rationale for dietary preference. A major study is under way with the USA National Institutes of Health (NIH) to provide detailed knowledge of this effect and there has been widespread interest in the initial findings across the scientific community.

Delivery of the appropriate flavour impression at the right moment with the precision required is a critical factor for marketplace success. Patented technologies within our PureDelivery® flavour encapsulation platform has employed advances in material science to address stability, authenticity and release dynamics which result in enhanced performance in customer food and beverage products.

Predictive modelling and simulation of materials interactions have accelerated the development of unique solutions such as our proprietary system for sequential release of distinct flavours in chewing gum applications. In addition, magnification of aroma release can be a source of positive product differentiation. The broad spectrum of application-tuned core encapsulation technologies available suggested a number of formula adaptations for fruitful development of engineered release of volatiles in food products that Givaudan is currently investigating.

A key element of our innovation strategy has been the development of a strong pipeline of unique, proprietary ingredients. A focused natural products discovery programme leverages TasteTrek™ expertise to investigate new sensory space –whether molecules arise from exotic botanicals in the rainforest or traditional cooking techniques. Our association with the University of California, Riverside has created an opportunity to explore and sustain the biodiversity of its citrus grove. The outcome has been identification of several orange-, lemon- and grapefruit-based molecules of interest for further development as ingredients in beverages and other applications.

Effective modification of taste attributes has become a major flavour development activity. There is increased global demand for products with lower levels of salt, sugar and fat leading to interest in salt reduction technology, sweetness modulation materials and bitterness-masking agents. Our investigation of solutions includes a rational design approach which utilises knowledge of molecular biology to integrate taste receptor-based bioassays into probes for novel tastant molecules. Powerful cheminformatics tools have been designed to expand upon this effort with in-silico modelling capabilities. Expertise in organic chemistry, biotechnology and process engineering are employed to translate these discoveries into TasteSolutions® for food and beverage applications.

Advanced bioprocesses such as fermentation and enzyme catalysis have become especially powerful tools for the creation of building blocks which address the growing demand for natural flavourants. In 2010, four novel taste molecules received the generally recognised as safe, or GRAS approval from the Flavour and Extract Manufacturers Association (FEMA) targeting sweetness modulation and umami character. These are expected to have a significant impact on future development efforts.

Body and mouthfeel deficiencies surface when healthy taste modulation alternatives are introduced. Therefore, the development of ingredients which can correct these problems has been a targeted area of investigation. A building block collection containing a series of dairy-type natural bioingredients to provide richness and body have been developed to rebalance finished products.

Besides having a strong internal discovery team, Givaudan has pursued open innovation objectives through collaboration with external academic and industrial partners. These networks focus on adjacent and complementary technologies and also serve as windows to emerging technologies with potential value.



#### **Flavourist training**

The area of taste technology which relates to salt, sugar, MSG and fat reduction poses considerable challenges to flavourists trying to reduce the level of these ingredients in foods and beverages – while maintaining the great tastes that consumers expect. Givaudan has established centres of excellence in Naarden, the Netherlands, Cincinnati, USA and Dübendorf, Switzerland to train experts who then acquire the expertise to train colleagues in Asia, Latin America and beyond. The new skills acquired are enabling lower-salt/sugar/fat/ MSG flavours to be created for new products for which consumers express a preference over the standard product. More than 25 flavourists have received intensive training which lasts from several weeks to several months.