ADVANCES

Whisky researchers are at the forefront of the science of food-fraud detection.

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FOOD SCIENCE

Whisky Fakers

Scientists are developing better methods for detecting liquor and food fraud

Whisky auctioneer Isabel Graham-Yooll was examining a seller's collection in London last year when she noticed some of the liquors were slightly off-color—and several bottles seemed a little too full. She called the police, who arrested the seller for fraud. If the case goes to court, prosecutors may be able to count on more than just Graham-Yooll's knowledge of fine whiskies; emerging laboratory techniques could help identify the liquors in question.

Whisky researchers are finding themselves at the forefront of the burgeoning science of food fraud detection. The spirit is a handy test substance because of its complexity: its main components–water and barley or other cereals–and its production method create unique chemical and biological signatures. And the time whisky spends in a wood cask helps to impart its golden color and unique aromas. "If [a new testing] technique works for whisky, then we can be sure it works for other spirit categories," says Shona Harrison, the analytical services manager of the Scotch Whisky Research Institute (SWRI) in Edinburgh, whose work is funded by several liquor companies. Harrison and other researchers are fighting food and beverage fraud on

multiple fronts—from monitoring global trade data to adapting laboratory-detection tools for use in the field.

Fakes are often a response to sudden bursts of demand for a particular product. Counterfeit Scotch, for example, is most common in places where legitimate suppliers cannot keep pace with consumers' thirst for the liquor. And in the past couple of years a New Zealand honey called mānuka experienced a spike in popularity that was followed by a glut of bogus mānuka on the market.

Copper whisky stills.

Slapping high-end labels on bottom-shelf commercial whisky, honey or other products primarily harms the owner of the high-end brand. But when fraudsters replace the product consumers think they are buying with something else altogether, it can sicken or even kill people; this happened in India last year when six people died and 30 more fell ill from methanol poisoning after drinking black-market liquor. Food fraud is also lucrative—criminals can pocket tens of thousands of dollars per shipment of counterfeit product, and the sentences for getting caught are much more lenient than those for trafficking illegal drugs.

Detecting bad batches of something already on store shelves may be too late. So food technologist Katharina Verhaelen of the Bavarian Health and Food Safety Authority and her colleagues developed software that monitors food import data in Germany on a monthly basis and flags suspicious changes in product volumes or prices. The system helped to identify adulterated hazelnuts associated with a record price jump, Verhaelen's team reported in the December issue of *Food Control.*

Researchers are also using media reports to help detect and track counterfeit food. In a study published in November, supply chain researcher Yamine Bouzembrak of Wageningen University in the Netherlands and his colleagues took a public health alert program called the Medical Information System (MedISys), which scans online news and records potential cases of food contamination, and repurposed it for detecting cases of fraud. As of late September they had identified and confirmed 5,174 separate food fraud incidents, Bouzembrak says, and were set to meet with several European authorities at the November Food Integrity Conference in Nantes, France. They planned to discuss incorporating the updated tool, MedISys-FF, into early-warning systems for food contamination.

As methods for monitoring food fraud in the market have developed, so has commercial technology for detecting it at the molecular level. At a conference in 2017 Harrison encountered a portable spectrometer—a device that splits light shone through a liquid into its component wavelengths and measures their intensities to identify compounds in the liquid. The customized device allowed minimally trained users to measure trace levels of sugars that are useful for verifying a wine's identity. Harrison realized she could also use it to help distinguish whiskies based on their chemical characteristics, a task that otherwise requires bulkier lab equipment. Harrison's institute, SWRI, bought one of the portable spectrometers to complement its existing profiling abilities.

Chemist David Ellis and his colleagues at the University of Manchester in England, who collaborate with the SWRI researchers, are now developing other spectroscopic methods for profiling Scotch. Whisky producers and distributors "seem particularly interested in 'through-bottle' methods at the moment," Ellis says. His group's technology might someday allow anyone to quickly screen bottles and decide whether to send them to the whisky authorities for a full analysis or whether it is safe to buy and enjoy them. —*Lucas Laursen*

LEON HARRIS *Getty Images (brewery);* DAN RAFLA *Getty Images (Everest)*

BOTANY

High-Altitude Flora

Hardy plants adapted to life on Mount Everest

The upper slopes of Mount Everest are a punishing place for plant life: high levels of ultraviolet radiation scorch the mountain, temperatures regularly fall below freezing, and the icy, rocky terrain can hardly be called good soil. But now scientists have identified three new species of plants capable of surviving this kind of place. Among the highest-elevation plants known to science, the specimens—collected decades ago but never studied until now—reveal unique adaptations to life on the roof of the world.

On May 25, 1952, a Swiss expedition gathered three plant samples on Everest at roughly 6,400 meters. (The summit, which was first reached the following year, is 8,848 meters.) The dried specimens were placed in an herbarium in Geneva and sat forgotten until 2017, when Cédric Dentant, a botanist at Écrins National Park in Gap, France, rediscovered them.

Dentant carefully analyzed the plants—each no more than a few centimeters long—and found several attributes that most likely contributed to their survival in such harsh surroundings, he reported in October in *Alpine Botany.* One of the plants had stems that burrowed into the ground, anchoring it in the unstable terrain; another had a cushionlike shape that limited heat and water loss; and two, according to notes made by the 1952 mountaineering team, grew in rock crevices, which are heated by sunlight and are often warmer than the surrounding alpine environment. "We're facing the limit of life," Dentant says, referring to the extreme conditions in which these plants grew.

Scientists nearly missed out on studying these high-altitude plants, says Sonja Wipf, an alpine plant ecologist at the WSL Institute for Snow and Avalanche Research SLF in Davos, Switzerland. "Not because they were growing on inaccessible rocky ledges," says Wipf, who was not involved in the new research, "but because they were 'buried' in an herbarium." —*Katherine Kornei*