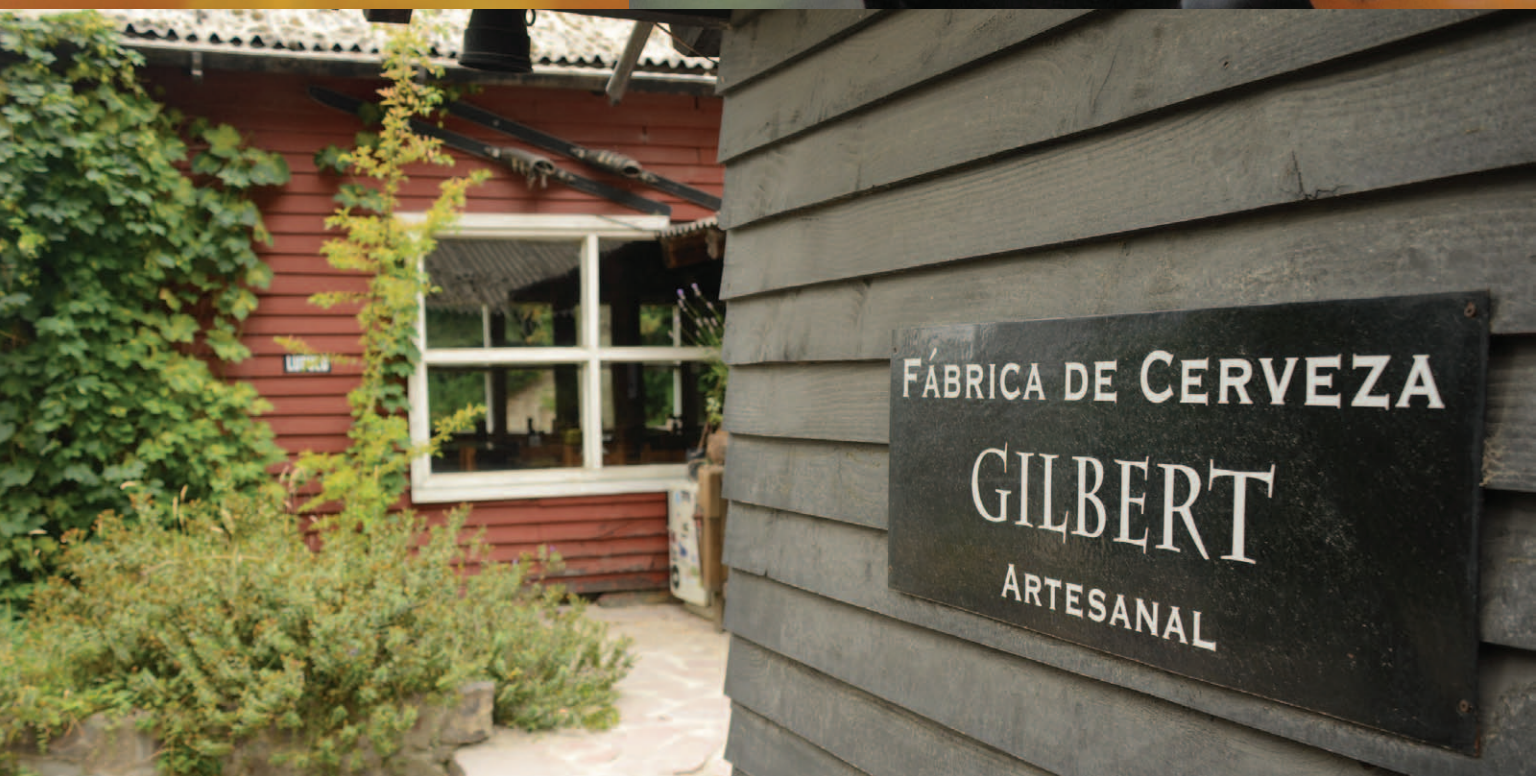
FÁBRICA DE CERVEZA
GILBERT
ARTESANAL

Photos courtesy of Aleszu Bajak and Diego Libkind

The Lager Yeast Genome Project

Renowned worldwide for her wine, Argentina is now adding craft beer to her long list of reasons to visit. Microbreweries are popping up all around the mountain towns of northern Patagonia, satisfying a growing demand among Argentines: beers with complexity. "Argentines are finally developing a taste for hoppier beer," says local brewmaster Tomás Gilbert with a huge smile. He's pouring and capping bottles of his popular Oatmeal Stout.

In 2004, he and his father opened Gilbert Cervecería in a 70-year-old restored horse stable, steps away from Lago Moreno, the clear glacial lake from which they draw water to brew. The other ingredients are local, too. The hops come from El Bolsón, a fertile valley about an hour's drive away, and the grain is grown and malted on the plains near Buenos Aires.

Like most of the 20 other microbreweries in the region, Gilbert offers three styles of beer on tap—a Stout, a Pale Ale and a Blonde—and he's begun experimenting with Wheat beers, English-style Bitter beers and Brown ales. "Unfortunately," sighs Gilbert, "we're still using imported yeasts for each batch we make. But you know, Patagonia may soon have its own yeast to brew with."

Gilbert is referring to the recent discovery made by a scientist from the nearby city of Bariloche. While walking in the woods not far from his laboratory, microbiologist Diego Libkind stumbled upon a familiar smell: ethanol. He knew this meant yeast were hard at work converting sugars to alcohol, the byproduct of organic decomposition. Scattered on the ground were clusters of the globular orange llao llao fungus that had fallen from the deciduous beech trees endemic to this region of Patagonia. Taking a sample back to the lab, Libkind found that living on these edible mushrooms was a species of *Saccharomyces* yeast, the same genus used to brew beer.

S. pastorianus, the yeast strain first used in the 15th century by Bavarian monks to brew lagers, is a hybrid of two other yeast strains: *S. cerevisiae*, and another strain of unknown origin. Libkind, of the University

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Microbiologist Diego Libkind collects samples from trees in Bariloche.

of Comahue's Institute for Biodiversity and Environment Research in Bariloche, is part of a worldwide team of scientists who have been searching for traces of that unknown genetic parent of lager yeast. So when he found this new Patagonian yeast strain, called *S. eubayanus*, to be 99.5 percent identical to the unknown other half of *S. pastorianus*, it was a major breakthrough; the discovery was published in August 2011 in the journal *Proceedings of the National Academy of Sciences*.

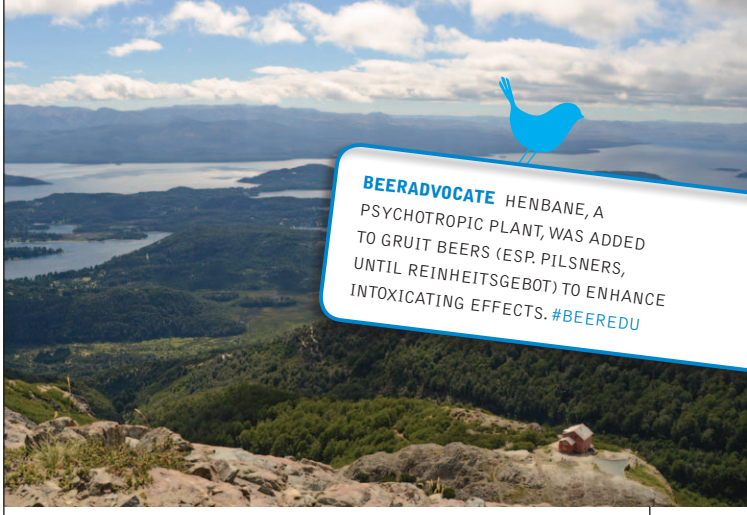
Brewing yeasts must be especially adapted to working under harsh conditions. They have to tolerate high levels of alcohol and sugar during fermentation, an environment that would be poisonous to most yeasts. And lager yeasts must also ferment within a lower temperature range than ale yeasts. How all these adaptations were selected in the lager yeast we know today is the process that Libkind is trying to explain. His study gives a genetic answer to how the lager yeast was domesticated.

"The genetic similarity is unquestionable," said Libkind at a recent seminar in Bariloche. As he explained his results while simultaneously recounting the history of lager brewing, the same question came to everyone in the audience: How did genetic material from a yeast in South America end up in a yeast in Bavaria? Libkind's answer: What if, sometime in the last 500 years, the Patagonian strain hybridized with ale yeast to create the yeast now used worldwide to brew lagers?

"If you knew microorganisms like I know them, you'd know this isn't far-fetched," says Libkind, pointing to yeast's promiscuity, adaptability and tolerance for long voyages—say, a trip across the ocean blue? The genetics told that story, but the logistics were disputable. The Bavarian monks were brewing lagers at a time that essentially coincided with the discovery of the New World. For their yeast to have hybridized with the Patagonian strain seems like it would have been impossible. Libkind and his team postulate that the yeast could have been brought to Europe sometime after the Spanish settled Argentina—whether accidentally or not—and thus have affected a subsequent generation of lager yeasts.

"There's a gap of a few hundred years where we don't know what exactly happened to lager yeast," says Libkind. Perhaps this is where the elements of the Patagonian yeast were picked up. There's also another theory: Europe could have had a yeast strain identical to the Patagonian strain that has since gone extinct. No one has found evidence of that so far, he says, even after the team's five years of research. They traveled to Australia, New Zealand, Europe, Asia and North America in search of a yeast strain like the one found in Patagonia and couldn't find anything remotely close—evidence that lends more credence to the team's otherwise far-fetched theory.

Libkind knows the story is difficult to digest, but he's convinced. He's shown the Patagonian strain is adapted to fermenting under cold conditions, and whether or not it can be domesticated to brew a lager is what he's currently testing. After wrapping up his seminar in Bariloche, we gathered around a pony keg sent over by local microbrewery La Cruz. Libkind says he's pleased that so many microbreweries are calling



Patagonia home and takes a sip of his Pale Ale.

If the Patagonian yeast strain can be genetically modified to become a brewers' yeast, Argentinian breweries would be able to produce truly local beers—which, since the region also sees the highest hop production in South America and produces three-quarters of the country's hops, isn't hard to imagine.

Most hops cultivated in El Bolsón are Cascade, though the Patagonian climate has altered their profile slightly: Northern Patagonia's ample sunshine has bred a Cascade cultivar with a weaker alpha-acid profile than its North American counterpart—3- to 3.5-percent alpha acids versus 4.5 to 7 percent, as found in Oregon. With their sweet, spicy, lemongrass-like aroma, Argentine Cascade hops became a popular substitute for aroma hops like Hallertau and Tettnang during the US hops shortage.

Alfredo Leibrecht, one of the seven hop producers in El Bolsón, is happy to distribute his extra-aromatic Cascade hops to the microbreweries in the region, but he says that it's Cervecería y Maltería Quilmes that overwhelmingly drives demand. The macrobrewery, which is part of the AB-InBev portfolio, purchases almost all of the valley's hops, though the harvest only makes up 15 percent of the hops they need annually for production, according to Leibrecht.

For about 25 years, the region grew German Spalt hops—until Quilmes found out about Cascade, which grew better than Spalt and were more resistant to fungal infections. They told all the farmers to start growing those.

"Now, Quilmes wants Nugget hops," sighs Leibrecht, who farms about 22 acres of Cascade. "Years ago, they loved our Cascades. Now they want something cheaper."

On a small experimental plot, Leibrecht tried to grow new breeds of hops; he recently gave up on growing Willamette, Tomahawk and Columbus hops in favor of focusing on Nugget, which has 14 percent alpha-acids—Quilmes sees Nugget as more bang for their buck. Until craft brewers can outbid the macrobreweries and drive up demand for other types of hops, Leibrecht and the other farmers will grow what sells. Meanwhile, Diego Libkind and his fellow scientists will continue researching the genetic ancestry of the lager yeast that brewers worldwide have been using for over 500 years. Politics of big beer aside, the region is cultivating a burgeoning culture of hyper-local craft brewing.

Aleszu Bajak is a science writer currently living in Argentina.