



November 2020

Lab Made 實驗廚房

Anna Cummins

Follow this and additional works at: <https://repository.vtc.edu.hk/ive-hosts-ambrosia>



Part of the [Food and Beverage Management Commons](#)

Recommended Citation

Cummins, Anna (2020) "Lab Made 實驗廚房," *AMBROSIA 客道 : The Magazine of The International Culinary Institute*: , 38-43.

Available at: <https://repository.vtc.edu.hk/ive-hosts-ambrosia/vol9/iss1/16>

This Article is brought to you for free and open access by the Hotel, Service & Tourism Studies at VTC Institutional Repository. It has been accepted for inclusion in AMBROSIA 客道 : The Magazine of The International Culinary Institute by an authorized editor of VTC Institutional Repository. For more information, please contact wchu@vtc.edu.hk.

From air-based protein to “molecular” whiskey, start-ups are creating ingredients that increasingly disconnect agriculture from production. The separation of farm and plate is a new frontier – one that may hold the answer to humanity’s growing food insecurity. 由空氣製造的蛋白質到「分子」威士忌，初創公司研發越來越多不靠農業生產的食材，這或許可以解決越來越緊張的糧食危機。 **By Anna Cummins**

Lab made

實驗廚房

In a laboratory just outside Helsinki, scientists are making food out of thin air. If this sounds like space-age technology, that’s because it is – the concept of using microbes to convert air into food was initially developed for the space industry in the 1960s.

“By empowering naturally occurring organisms with electricity, it’s possible to turn carbon dioxide into a high-protein food,” explains Dr Pasi Vainikka, co-founder and CEO of Finnish tech start-up Solar Foods. At the Solar Foods pilot lab, microbes harvested from soil samples are fermented in large steel tanks. Incredibly, these organisms require only two things to multiply: carbon dioxide from the air and hydrogen, which is obtained by “splitting” water using electricity.

The final product, named Solein, is siphoned from the tanks and dried into a tasteless powder. Solein is a “complete” protein, with a similar amino-acid profile to meat or soya. It can be incorporated into thousands of food products, from bread to packet soups. When the bacteria are modified, they can be used in lab-grown alternatives to meat, egg and dairy.

Vainikka and his co-founder Dr Juha-Pekka Pitkänen describe Solein as the “world’s most environmentally friendly protein”. Because Solar Foods uses renewable energy sources, such as wind and solar, Solein is billed as a carbon-neutral food source, with minimal land requirements and no water wastage. The process may be extraordinary, but the pilot lab – filled with large steel tanks and the occasional waft of something sulphurous – is more akin to a brewery than a NASA facility.

Last autumn, Solar Foods raised €3.5 million from four investors and is gearing up to move into a much larger facility. While COVID-19 has slowed progress this year, the founders say Solein will be ready for the mass market within five years. They seek to compete with soya on price within a decade.

位於赫爾辛基近郊的一座實驗室裡，科學家們正嘗試用空氣製造食物。如果你覺得這聽起來像太空科技，那是因為確實如此。這種利用微生物將空氣變成食物的概念，正是早在1960年代開始研發的太空科技。

芬蘭初創科技公司Solar Foods的創辦人之一兼行政總裁Pasi Vainikka博士解釋：「用電流刺激天然的有機體可以將二氧化碳轉化成高蛋白質食物。」在Solar Foods的先導實驗室裡，從泥土樣本收集所得的微生物會放在大型不鏽鋼容器裡進行發酵，裡面的有機體只要有空氣中的二氧化碳及從水電解出來的氫氣這兩種物質，即可以倍速增長。

利用虹吸管將製成品從不鏽鋼容器吸出來，然後製乾，變成無味的粉末，稱為Solein。Solein其實是全蛋白質食物，所含氨基酸跟肉類和大豆的類似，可以加入麵包和湯包等數以千計的食品內。另外，使用不同細菌，甚至可以在實驗室裡製造出肉類、蛋和牛奶的替代品。

Vainikka與另一位創辦人Juha-Pekka Pitkänen博士形容Solein為「世上最環保的蛋白質食物」。Solar Foods使用風力和太陽能發電等再生能源，因此，Solein被譽為是零碳足跡的食物來源。而且，實驗室佔用的土地面積少，生產過程也不會耗費水源。雖然製作過程非比尋常，但設有大型不鏽鋼容器和偶爾飄盪著硫磺味的先導實驗室，比起太空總署設施更像一座啤酒廠。

去年秋天，Solar Foods從四位投資者那裡獲得350萬歐元資金，正準備搬到更大的設施。雖然今年由於受到新冠肺炎疫情影響，發展步伐放緩，但兩位創辦人表示，Solein可於五年內面市，並期望十年內能在價格上跟大豆爭一長短。

受全球暖化和水源不足影響，全球糧食供應本來已備受壓力，新冠肺炎疫情的爆發無疑是雪上加霜。聯合國估計，全球糧食產量需在2050年增加五至七成才能應付需求。Vainikka有感而發：「新冠肺炎突顯了食物系統透明度不足的問題，近二十年出現的大流行病大部分都跟動物有關。」

Plant-based non-dairy
products produced by
Miyoko's Creamery
Miyoko's Creamery
以植物製造的非奶類製品





食物製造所產生的溫室氣體排放量佔全球總排放量的四分之一，其中肉類和奶類的比例最為顯著。消費者也留意到問題所在：根據市場調查公司SPINS於2020年3月發表的報告，過去兩年，在美國售出的糧油雜貨之中，以植物製造的產品銷量上升29%，含動物成分的貨品則相對減少29%，前者的市場銷售額現時達到50億美元。

美國廚師兼食譜作者Miyoko Schinner於2014年在加州創辦Miyoko's Creamery並任職行政總裁，其公司專門用植物食材如腰果、燕麥、豆類和種子等生產無鹽發酵牛油、芝士和麵包醬等。

Schinner談到成立公司的目標時表示：「大家明白肉類的壞處，但卻不知道奶類帶來的損害。奶類對環境和動物所造成傷害跟肉類一樣，甚至有過之，所有乳牛到最後幾乎都會變成食物。」

Miyoko's Creamery的內部分析亦指出，他們在生產過程中所排放的溫室氣體比同類奶類產品少十至二十倍。Schinner舉例說：「一畝的腰果樹每年出產的腰果可以製造6,000磅芝士，但一畝草地只可以生產182磅奶類芝士。」

Miyoko's Creamery的產品在味道和質感上均媲美奶類牛油和芝士等，沒有素食替代品的缺點。該公司亦採用一種可濃縮植物奶營養的技術，提升產品的營養價值。

Schinner敢於採用新的技術和製造過程，但她卻不認為自己的產品是「實驗室產物」。她表示，雖然公司「會採用微生物學層面的科學技術」，但其產品卻是用「真正的有機和全天然食物」及以發酵等傳統技術製造。

The COVID pandemic and subsequent economic crisis have exacerbated severe issues in the global food-supply chain, which is already under strain from global heating and depleting water resources. The UN estimates that food production must increase by 50 to 70 percent by 2050 to meet demand. "COVID has underlined the lack of transparency in the food system," muses Vainikka. "Most of the pandemics we've had in recent decades originated from animal contact."

While food production is responsible for around a quarter of global greenhouse emissions, meat and dairy, in particular, have an outsized impact on that figure. Consumers are taking note: according to a March 2020 report by market intelligence firm SPINS, grocery sales of plant-based foods that directly replace animal products have grown by 29 percent in the USA in the past two years, and the market now stands at US\$5 billion.

American chef, cookbook author and CEO Miyoko Schinner founded Miyoko's Creamery in 2014. The Californian start-up produces cultured butters, cheeses and spreads, using plant-based ingredients such as cashews, oats, legumes and seeds.

"People understand why meat is bad. But people don't understand why dairy is bad," says Schinner of her motivations. "Dairy is as destructive to the environment and animals as meat is, if not worse. Nearly all dairy cows end up as meat."

An in-house analysis by Miyoko's Creamery indicates its products are between 10 and 20 times lower in greenhouse-gas emissions than comparable dairy items. "An acre of cashew trees can produce enough nuts to make 6,000 pounds of cheese a year, while an acre of grasslands can produce 182 pounds of dairy cheese," Schinner explains.

Most of the pandemics we've had in recent decades originated from animal contact

近二十年出現的大流行病大部分都跟動物有關

– Dr Pasi Vainikka, Solar Foods

Miyoko's Creamery has been acclaimed for achieving a creamy taste and texture comparable to that of dairy butter and cheese – something that evades many plant-based dairy alternatives. The company also uses a technique to concentrate the nutrients in their plant milks, thereby improving the nutritional profile of the finished product.

Schinner is a pioneer of new techniques and processes, but prefers not to think of her products as "lab-made". She says that, while the company "uses science at a microbiological level", her products are made from "real, organic, whole foods", adopting traditional techniques such as fermentation to achieve the result.

Terminology is an integral part of the narrative and vision of Miyoko's Creamery. In July this year, the company won the first round of a landmark legal dispute with the State of California over the use of the words on its packaging. The case began when the Department of Food and Agriculture ordered the company to drop words such as "butter" and "hormone-free" from its vegan butter, stating that such terms cannot apply to non-dairy items.

"We chose to fight this case, not just for ourselves but for the whole industry," Schinner says. "Food is evolving, and language also evolves. Language must reflect current cultural norms and changes in the economy of food."



Opposite page: Solar Foods Process

This page, from top: Chef Miyoko Schinner; Miyoko's plant-based cheese on the production line

對頁：Solar Foods的生產情形
本頁上至下：廚師Miyoko Schinner；Miyoko's的
植物芝士生產線

It's only an hour's drive from Miyoko's 30,000-sq-ft facility in Sonoma Country to the headquarters of Endless West, in San Francisco's Dogpatch neighbourhood. Founded in 2015, this beverage technology start-up is similarly wrestling with the implications of law and language, as it pushes boundaries in its field.

The company, helmed by co-founder and CEO Alec Lee, creates wine and spirits at a molecular level – adding flavours by infusing beverages with molecules that are extracted from natural sources. Its first product, Glyph, is billed as the first whiskey ever to be made “note by note”, without barreling or ageing. It's produced in around 24 hours but is designed to taste as if it's been aged for years.

While the legal definition of Glyph in the USA is “spirit whiskey with natural flavours”, the company opts for “molecular spirit,” arguing that its molecular process marks them out as different from other products. “It's a function of regulation lagging behind innovation,” says Lee.

Like Schinner, Lee is quick to clarify that the flavours Endless West uses are not “lab-made”. “What takes place in our lab is our process, where we explore, experiment and map out everything we want to create,” he says. “When it comes to the making and production of our products, we manufacture everything in a facility that looks a lot like a distillery, and all our ingredients come from nature.”

There are significant environmental advantages in Endless West's process, compared with conventional spirit-making methods – these include a water saving of 65 percent more, a 30 percent reduction in carbon dioxide emissions, and reduced pesticide applications and land use.

Lee is happy to admit that, for now, the brand is focusing on gaining respect among its peers, and clarifying to the world exactly what it's doing. “We obviously don't mind the mad-scientist reference in jest, but more often than not it's said in a way that mischaracterises what we do,” Lee says.

“Our most immediate goal as a brand is to gain widespread acceptance. The only way we can be remotely impactful from an environmental perspective is when there's broad adoption of any drink made via processes like ours. And that requires a shift in the way consumers, industry professionals and regulators all think about drinks made this way and whether the greater majority will eventually embrace it.”

While there's been a predictable outpouring of scepticism from many corners of the spirits industry, which is steeped in tradition, Lee keenly points out that Glyph has won more than a dozen blind-tasting spirits awards. “That's the real curveball, in my opinion,” Lee says. “The industry is used to seeing spirits that comprise the typical and expected inputs, such as age-based whiskey. We're starting from scratch completely.”

While technology has the potential to change the way we enjoy, and even define, food and drink, there's no doubt that – among the many challenges to face on Earth in the coming century – food production is perhaps highest among them.

And if the challenges can't be surmounted? There's a backup: the team at Solar Foods are already working with the European Space Agency to find a way to create protein for a crew of six astronauts, on the inevitable mission to colonise Mars. 🍌



This page, from left: “whiskey” production at Endless West; co-founder and CEO Alec Lee

本頁左至右：Endless West的「威士忌」生產過程；酒廠創辦人之一兼行政總裁Alec Lee



Miyoko's Creamery的理念和遠見也可見於公司在專門術語上的執著。今年7月，該公司就產品包裝上的用字與加州政府對簿公堂，並贏得首回合的勝利。案件的起因是當地食品及農業部下令公司在其植物牛奶的包裝上刪除牛油和不含賀爾蒙的字眼，指這些字詞不適用於非奶類製品。

Schinner表示：「為了自己及整個行業，我們決定要打這場官司。食品工業在演變，用詞也在演變。語言必須反映當前的文化常態及食物經濟的改變。」

Endless West的總部位於三藩市Dogpatch區，距離Miyoko佔地30,000平方呎的工廠僅有一小時車程。這家成立於2015年的飲品科技初創公司，同樣就法律和語言文字的涵意展開類似的爭辯，挑戰這個行業的陳規。

這間由Alec Lee與友人創辦並兼任行政總裁的公司，將分子技術用於釀製葡萄酒及烈酒上——將從天然材料取得的分子加入酒裡，為酒添加各種味道。酒廠的首個產品Glyph被稱為第一款直接將各種味道注入酒內而無需放入木桶陳釀的威士忌，24小時釀成的酒卻有陳年佳釀的風味。

Glyph在美國的法律定義為「味道天然的威士忌烈酒」，但公司卻希望改成「分子烈酒」，因為分子技術是此酒與其他威士忌有別的地方。Lee說：「這是規例追不上創新步伐的問題。」

Lee也跟Schinner一樣，急於澄清Endless West所採用的調味劑並非實驗室產物。他說：「我們只是在實驗室裡就我們想要創作的產品，進行各種探索、實驗和嘗試。然而，說到生產方面，我們所有產品都在一個類似酒廠的地方製造，並且用的都是天然材料。」

與傳統的釀酒方法相比，Endless West的生產過程對環境有顯著的好處，包括能夠節省逾65%的水、二氧化碳排放量減少約30%，以及減少使用殺蟲劑和生產設施佔用較少土地等。

Lee樂於承認，目前，品牌的焦點是爭取同行的尊重，讓世人了解他們的工作。他說：「我們不介意被笑稱為瘋狂科學家，可是許多時候大家的說法卻會讓人對我們的工作產生誤解。」

“We don't mind doing the mad-scientist reference in jest

我們不介意被笑稱為瘋狂科學家”

– Alec Lee, Endless West

「作為一個品牌，我們現時最重要和迫切的目標是讓大眾接受我們，如果要對環保方面產生影響，我們唯一能做的是，讓類似我們的飲品製造方法獲得廣泛採用，而這必須由消費者、業內人士和條例規管等各方面都作出改變，讓所有人都認同這種方法，然後大眾才會慢慢接受。」

儘管面對釀酒業內來自四面八方的意料之內且植根傳統的各種懷疑態度，Lee很高興地指出Glyph已在十多個蒙瓶試酒的比賽中得獎。他說：「那是真正的出乎意料。釀酒業一直以來只著眼於以傳統和意料之內的方法釀製的烈酒，如陳年威士忌等，我們完全是從零開始。」

儘管科技或許可以改變我們對食物和飲品的享用方式以至定義，但在地球於未來世紀將面對的種種挑戰中，食物生產毫無疑問將仍舊是當中最嚴峻的考驗。

萬一無法克服這些困難怎麼辦？也有後備方案：Solar Foods正跟European Space Agency合作，為六名太空人研發蛋白質食物，為移民火星作準備。🍌



Molecular-spirit “whiskey”, designed to taste as if it's been matured for years

新鮮釀製的分子威士忌，以味道媲美陳年佳釀為目標