Six Technologies That Could Shake the Food World

Printed meals, edible bar codes and facial-recognition technology for cows are among the innovations transforming the food industry.

By Annie Gasparro And Jesse Newman
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A machine that prints chicken nuggets. Fake shrimp made out of algae. Edible coverings that keep fruit fresh.

These inventions—and many more—are part of a technological revolution that is poised to shake up the way we eat.

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treatment of animals. There is also a growing awareness of the harmful effect that food production can have on the environment.

Now big food companies and entrepreneurs are taking advantage of advances in robotics and data science to meet those challenges—and the trend will likely continue as technology improves, and natural ingredients become easier to cultivate.

It also helps that venture capitalists are flocking to the companies cooking up these innovations. This year is on pace to set a record for this decade for venture investment in food technology, according to the PitchBook Platform data provider. As of mid-September 2018, VC funds had invested more than $2 billion into the industry, compared with about $1.5 billion annually in 2016 and 2017.

Investors say the food industry is playing catch-up now after historically lagging behind in technological advancements. U.S. food and agriculture sectors have historically been among the least digitized in the nation, says Sanjeev Krishnan, chief investing officer and managing director at S2G Ventures, a venture-capital firm that invests in food and agriculture companies.

“But that is changing on a monthly, even weekly, basis,” he says.

Here’s a look at some of the breakthrough technologies that may have a big impact on what we eat, and how our food is made.

**Printing your food to order**

A new technology promises to let people choose their own ingredients and create food the way they want it—by using a 3-D printer.

The machine, called the Foodini, replaces the usual plastic ink to create food through essentially the same process that people now use to make toys and pencil holders. Restaurants and bakeries are using the Foodini to make intricate desserts and garnishes, and a home version will be available in a couple of years.
Among other uses, says Lynette Kucsma, co-founder of Foodini maker Natural Machines, the home machine will allow parents to place ground chicken into one of its stainless-steel ingredient containers and breadcrumbs in the other. Then parents can let their children pick a shape like dinosaurs or stars, and the Foodini will print—and cook—chicken nuggets in that form. Natural Machines also plans to have inputs for fat and calorie content that will adjust the size of the nuggets or cookies that come out.

The current commercial version costs $4,000, but Natural Machines expects that to come down over time.

“People want to know what’s in their food and control their food,” says Ms. Kucsma. “This...
the oven. The inventors initially developed the device with a grant from the National Aeronautics and Space Administration.

**Protein from algae**

There is a shallow blue-green pool of water in the New Mexican desert, and it isn’t a mirage: It is a site for growing algae, plants rich in protein and Omega 3.

It is also a potential solution for a global food dilemma. The world is running out of land for raising animals for food, experts say. Algae grow well in brackish water and in the desert because of the abundant sunshine and the fact that they don’t need fresh water—potentially bringing more unused land into productive use.

Now advances in algae farming are making it a popular ingredient in new foods like algae-based protein bars and vegan shrimp, as well as other products such as fish feed and food coloring.

**Big Appetite**

U.S. venture-capital deal activity in food-tech firms over the past decade:

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*Data as of 9/17/2018
Source: PitchBook

When Miguel Calatayud became chief executive of Iwi Life in 2016, the company was growing algae for fuel. Then it started making Omega 3 supplements, and now it is working on algae protein bars and shakes, which it expects to be on sale next year.

**The Covid Storm Series**

WSJ takes a look at the causes of the Covid-19 catastrophe and the bungled response that followed.
infused Springwave water off the market two years ago so it could improve its taste. Algama is now preparing for a relaunch.

“Success is people not knowing the protein is coming from algae,” Mr. Calatayud says.

For other companies, algae’s flavor isn’t a problem. Several are leveraging the taste, like Thrive, a cooking oil; Good Catch, a brand of fish-free tuna; and New Wave Foods, which makes vegan shrimp.

**Codes to chew on**

When food makes people sick, grocery stores and restaurants yank it off their shelves and menus, and regulators race to find the source. But companies and officials often struggle to determine exactly from where the tainted food came.

Now many companies are trying to improve traceability in the food-supply chain, as producers, distributors, retailers and restaurants confront costly recalls and more stringent regulation to prevent the spread of food-borne illnesses.

One possible solution: edible bar codes, a DNA-based “fingerprint” designed to make food traceable back to its source within minutes.

The technology, developed at a government-sponsored research facility, was first used to simulate a biological attack, helping officials track how pollutants might move through the New York City subway system.

A deadly listeria outbreak tied to cantaloupe in 2011 later inspired the idea to use the bar codes on food, says Anthony Zografos, who licensed the DNA technology. His company, SafeTraces, now sells the technology to farmers, packers and food processors.

“In this day and age, we should be able to find out quickly where [tainted food] came from,” says Mr. Zografos.

Applied to food, the bar codes are invisible, tasteless and safe to eat. Created by combining segments of seaweed DNA into a unique signature, the bar codes can be applied to a single food item like an apple or a silo full of wheat used in flour.
information about the fruit’s origin—from the farm where it was grown to the row where it was picked.

Of course, food that is eaten completely can’t be tracked. But the technology is also aimed at managing risks. If a farmer or food processor learns there’s a problem with their product, they can trace it to a specific lot, potentially limiting the scope of a recall.

Waste not, want not

Farmers, grocers, restaurants and consumers waste billions of dollars’ worth of food each year, devouring resources like water and energy while millions of people around the world go hungry. Now, from tech startups to corporate giants like Walmart Inc., companies are trying to address the problem.

One of the newest weapons is the dreck left at the bottom of a wine press.

Using organic agricultural byproducts like grape skins, Apeel Sciences developed an ultrathin edible coating that can be applied to the surface of fruit. It slows evaporation and oxidization, forces that eventually cause fruit to spoil.

The result, says James Rogers, founder and CEO of Apeel, is produce that stays fresh up to three times longer, cutting down on the amount that ends up thrown away.

“It is good business to reduce perishability,” says Mr. Rogers, whose treated avocados are sold at Kroger Co., Costco Wholesale Corp. and Harps Food, a chain based in Springdale, Ark.

Mr. Rogers, a materials scientist, says the inspiration for Apeel has its roots in his early studies on preventing rust in steel. The company’s coating has proved effective for more than two dozen types of fruits and vegetables, from strawberries to green beans, he says.

Beyond curbing food waste, Mr. Rogers says the invisible, tasteless “microclimate” that Apeel applies to each piece of fruit allows farmers to harvest produce when it’s ripe, rather than prematurely, resulting in a better-tasting, more nutritious product.

Next up for Apeel: a skin for citrus products and asparagus. The company says asparagus

The Covid Storm Series

WSJ takes a look at the causes of the Covid-19 catastrophe and the bungled response that followed.

READ
Cameras for cows
Facial-recognition technology is helping farmers track cows on dairy farms—and give them insight into the animals’ behavior.

The same software used to catch jaywalkers in China and verify travelers boarding airplanes can identify cows using their faces and the patterns of their hides. From there, it can monitor how much an individual animal eats and drinks, and how it acts.

If a cow deviates from its normal food or water intake, for instance, farmers can have an alert sent to their phones, encouraging them to put out more food or assess the animal’s health.

“Every action gets reduced to ‘cow X did Y for Z amount of seconds,’ ” says David Hunt, co-founder and president of Cainthus, a Dublin-based company that brought facial recognition to the dairy barn.

Farmers have gleaned other insights into cows’ behavior. Dairy cows prefer drinking in groups, for instance, and they often run out of food at night. What’s more, the path a feed truck takes through a barn can determine how much the cows that are inside eat.

Cainthus’s software and analytics can help farmers adjust feeding regimens or tend to sick animals, potentially boosting production and profitability. The company says its cameras have been installed in barns housing 14,000 cows in North America and in others across Europe.

With a recent investment by agribusiness giant Cargill Inc., Mr. Hunt says, Cainthus eventually plans to take its facial-recognition technology beyond the farm gate, to track cows during transport and at slaughterhouses.

SriRaj Kantamneni, a managing director at Cargill, says the company also plans to use facial-recognition technology on species including hogs, poultry and in aquaculture.

The food computer
Think you could never find a tomato in the U.S. that tasted as good as that one you ate fresh off the vine in Tuscany?

The Covid Storm Series
WSJ takes a look at the causes of the Covid-19 catastrophe and the bungled response that followed.
The idea: set up a controlled environment—usually in a space about the size of a shipping container—where every aspect of a plant’s needs are controlled and tracked. So, water, root-zone temperature, sunlight, mineral consumption and other factors are monitored and adjusted through electrical meters and devices that dose the plant with substances it would encounter in its environment, such as chemicals released by insects.

By tracking all those factors and tinkering with them, the researchers can find the ideal growing environments for the plants—as well as simulating different environments to see how the plants react to those.

Mr. Harper is using the technology in arrangements with companies like Nutella owner Ferrero SpA. The goal: to find new regions where crops can grow by mimicking those climates in the growing chambers. He’s also using the computers to gather data on what climates produce the best-tasting or most nutritious fruits and vegetables.

“It is a fundamentally different way of thinking about where we plant things and why,” he says.

Nutella is looking for new places to grow hazelnuts because the vast majority are grown in Turkey, and when weather damages the crops there, as it did in 2014, prices skyrocket.

Normally, the company would plant test plots in different real-world environments outside Turkey, but that would “cost a lot and take a long time,” Mr. Harper says. “We can simulate 10 candidates and see which does best in less than half the time.”

In the future, farmers will be able to use data gathered from tests so that they can immediately see if their crop would grow well under certain conditions.

“To design your produce to the best possible nutrition and taste and in the most efficient way is a tremendous capability,” says Maria Velissariou, chief science and technology officer of the Institute of Food Technologists, a professional society.

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