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A few years ago, I ate lunch in a canalside restaurant in The Hague called Meat Lobby. Its walls were decorated with paintings of various farm animals that you might find listed on a typical restaurant menu: cows, sheep, chickens and pigs. There were also, jarringly, dogs. Customers often felt surprised or shocked by the appearance of this animal next to those of the farmyard, I was told by co-owner Niko Koffeman, a member of the Dutch senate and animal-rights activist, and that was the point. Many people would feel it disconcerting to suggest eating dogs, he says, but why do we not also find it odd to eat the other animals too?

The Meat Lobby was the flagship restaurant of The Vegetarian Butcher, a Dutch food company that has been making plant-based alternatives for everything from chicken to beef for more than a decade. Over lunch I tasted a tuna mousse that contained no fish; a yakitori skewer in which the chicken was made with textured soy, in a convincing imitation of the world's most popular bird; a burger, made from soya and named MC^2 in honour of that celebrated vegetarian, Albert Einstein, that looked, smelled and had the same bite as its beefy cousin; and the Vegeterrier, a convincingly pink hot dog made from broad beans.

Where The Vegetarian Butcher has led for years fashioning new vegan cuisine that has the feel of animal meat, startups and conglomerates around the world are catching up fast. They are all gunning for a market that aims to recreate the flavour and feeling of eating meat, but without

an animal in sight.

Meat alternatives are not new but the latest swell in interest is different. Whereas imitation-meat burgers were once pilloried as dry, dull and tasteless, the adjectives now being attached to them verge on the superlative. A Californian company produces the Impossible Burger. Nestlé, a food-and-drinks giant, launched the Sensational Burger in Europe, known as the Awesome Burger in America.

The majority of these meat-free products are aimed at flexitarians who are motivated by concerns about their health and the environment, rather than vegetarians or vegans. As a result newer alternative-meat producers are competing more explicitly with the meat industry—their products come nearer to mimicking the smell, texture and taste of meat.

As such, the new plant-based meats utilise the full arsenal of tools from modern biotechnology. Food scientists at Silicon Valley startups believe that to truly replicate the experience of eating meat that comes from animals, it is necessary to deconstruct and understand every element of that experience. In a series of articles this week, we explore how new technologies are building not only new types of plant-based-meat, but could also be the future of all food.

So what makes meat taste like meat? Smell, taste and how the food feels in the mouth all work together to provide the full sensory experience. At the molecular level, this comes from the way the constituent proteins, fats and sugars within a piece of meat interact during cooking (such as via the Maillard reaction that browns meat) and afterwards as it is eaten, which carnivores love and instinctively know as “meaty”.

Each new entrant to the plant-meat market has tried to untangle the meaning of meatiness and then recreate it as closely as possible with ingredients from plants. Impossible Foods’ soya-based burger, for

example, contains haem, an iron-rich molecule that exists in living things to help proteins carry oxygen. Haem gives beef its reddish colour and is involved in creating the aromas and resulting meaty flavours when it is cooked. Beyond Meat's burger contains extracts of beetroot to give the plant-based patty colour and the ability to "bleed" when bitten into.

Whereas vegetarians may not have been looking for the flavours and colours conferred by haem or beetroot extract in the previous generations of veggie burgers, Impossible Foods and Beyond Meat are betting that these ingredients will enhance carnivores' appreciation of their burgers.

According to the UN's Food and Agriculture Organisation, raising animals for meat, eggs and milk is one of the most resource-intensive processes in agriculture, accounting for 14.5% of global greenhouse-gas emissions. Anything that can reduce the world's growing consumption of animal meat—and its enormous associated environmental impact—will be welcome.

Elsewhere in the paper we look at farming seaweed and use genetics to map how humans first reached remote corners of the Pacific ocean.

Thank you for reading this edition of Simply Science. If you have any thoughts or feedback about this newsletter or The Economist's science coverage in general, feel free to contact me at: alok@economist.com.

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