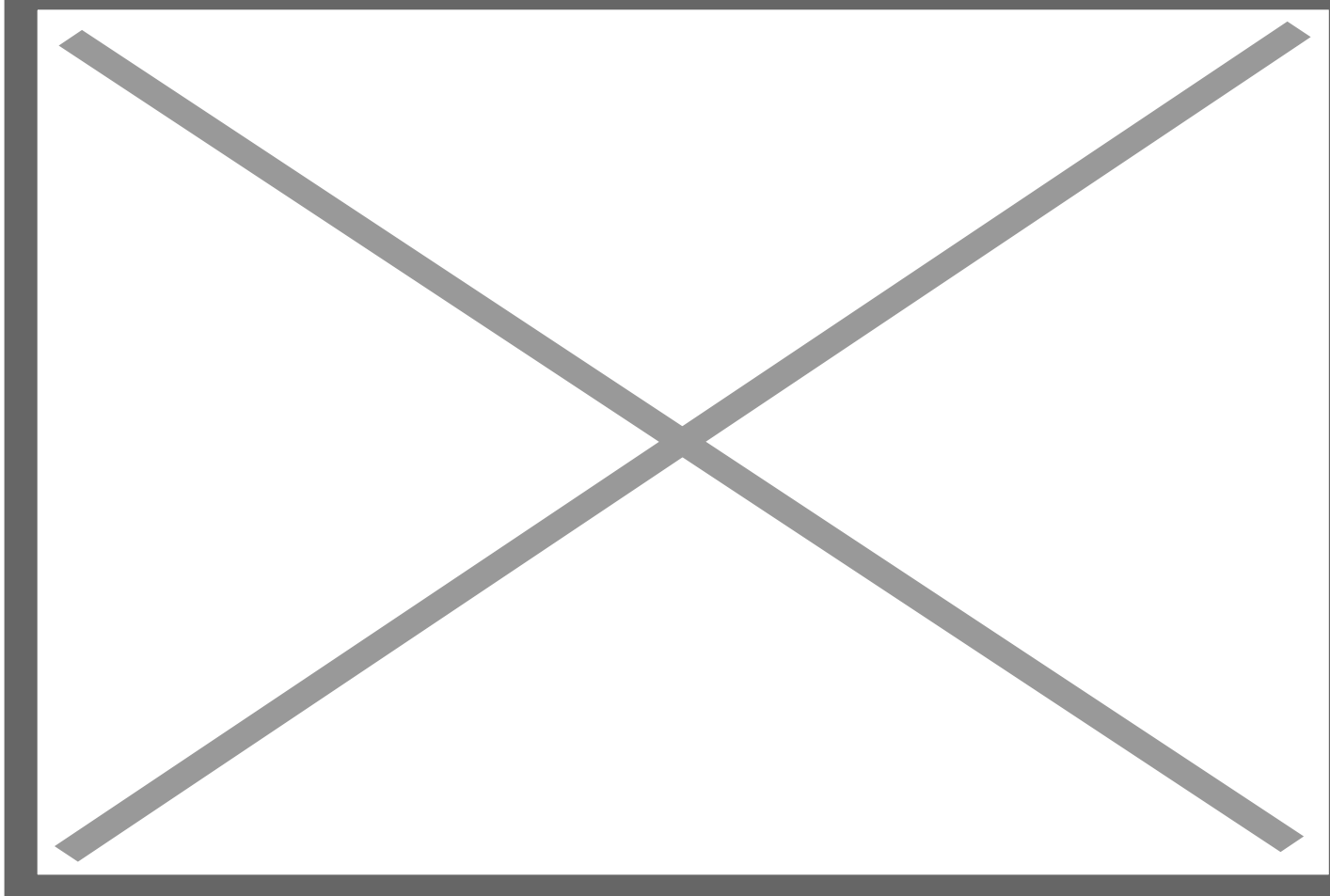


Here's a primer on the technology behind lab-grown meat

Between population growth and rising economic status, global demand for food protein is expected to continue to increase for a few more decades. There are many good reasons why animal-based meats are likely to remain a critical part of our food supply, but there is a great deal of interest in “alternative proteins” – particularly in forms that can imitate meat. There has been a great deal of investment in this area and some initial commercial success with plant-based options like [Impossible Burgers](#) or [Good Catch](#) seafoods. However, there are two major challenges that would need to be overcome for alternative meats to make a significant contribution to the food supply: they need to be affordable, and they need to provide an eating experience that can drive consumer enthusiasm. What people are looking for when eating meat is a complex “[organoleptic experience](#)” involving appearance, flavor, aroma and texture/mouth-feel. When imitating something like a hamburger patty or sausage patty these features can be provided by combining many processed components, but key features of other meats may not be amenable to that approach.

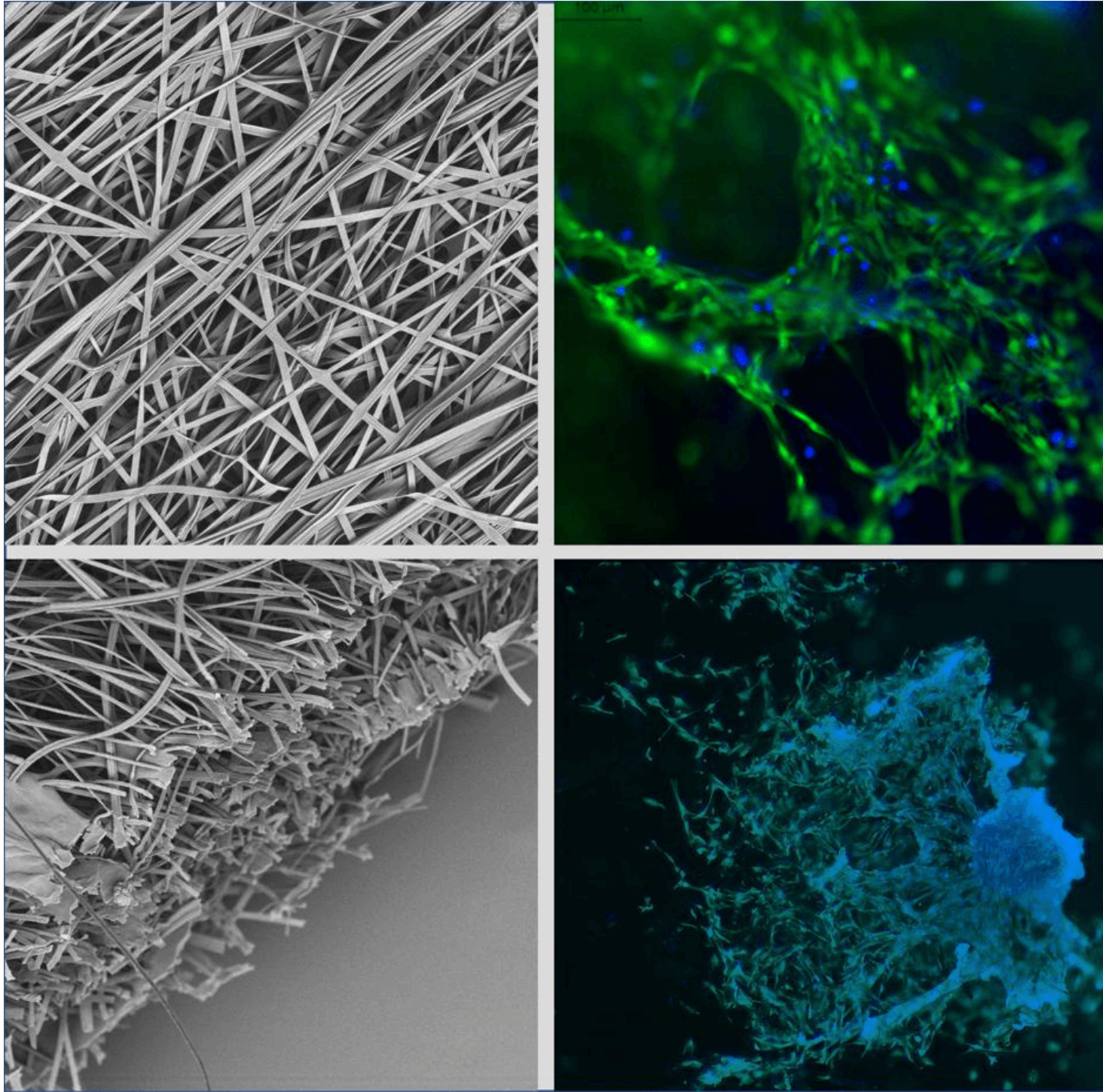
One approach that is only now on the cusp of commercialization is known as “cultured” or “lab-grown” meat. In this kind of system, actual animal cells are raised on a growth medium in an artificial environment in which they can be protected from contamination. These would normally be muscle cells since that is what meat consists of, but fat cells could also be included in some fashion. While the use of cells could certainly create something more like conventional meat, there is still the issue of the complex three-dimensional characteristics of the target products that wouldn't be replicated by just a group of cells. A lab-grown beef or salmon filet or (hopefully someday) a slice of bacon would require more complex organization of the cells. Currently the only lab-grown or cell cultured meat on the market is a chicken nugget product that has been [approved for sale in Singapore](#). The regulatory process for this technology is still developing in other countries including the US.

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Matrix Food Technologies founder Eric Jenkusky Credit: Matrix Food Technologies

There is a company which has developed what they hope will become an enabling technology for many different kinds of cultured meat products in the future. It was founded in 2019 and got seed-stage funding in late 2020. Its' co-founder, Eric Jenkusky, had 30 years of experience with National Defense companies. He sees alternative meats as partners with the traditional animal industry because as he says, "the problem pie is large enough to have a slice for everyone." The company's name, [Matrix F.T.](#) for "Food Technologies" is not a [movie](#) reference, but a literal description of what they provide on a nano-scale. They make three dimensional nanofiber scaffolds and microcarriers that can organize the way that animal cells will grow. In something like an animal muscle there are natural "extra-cellular matrices" that perform this function, but in this case, Matrix F.T. makes these micro-scaffolds out of plant-originated components using an "electro-spinning" and "electro-spraying" process



Nano-scale matrices (black and white), matrices after cell growth (color) Credit: Matrix Food Technologies (composed by Steven Savage)

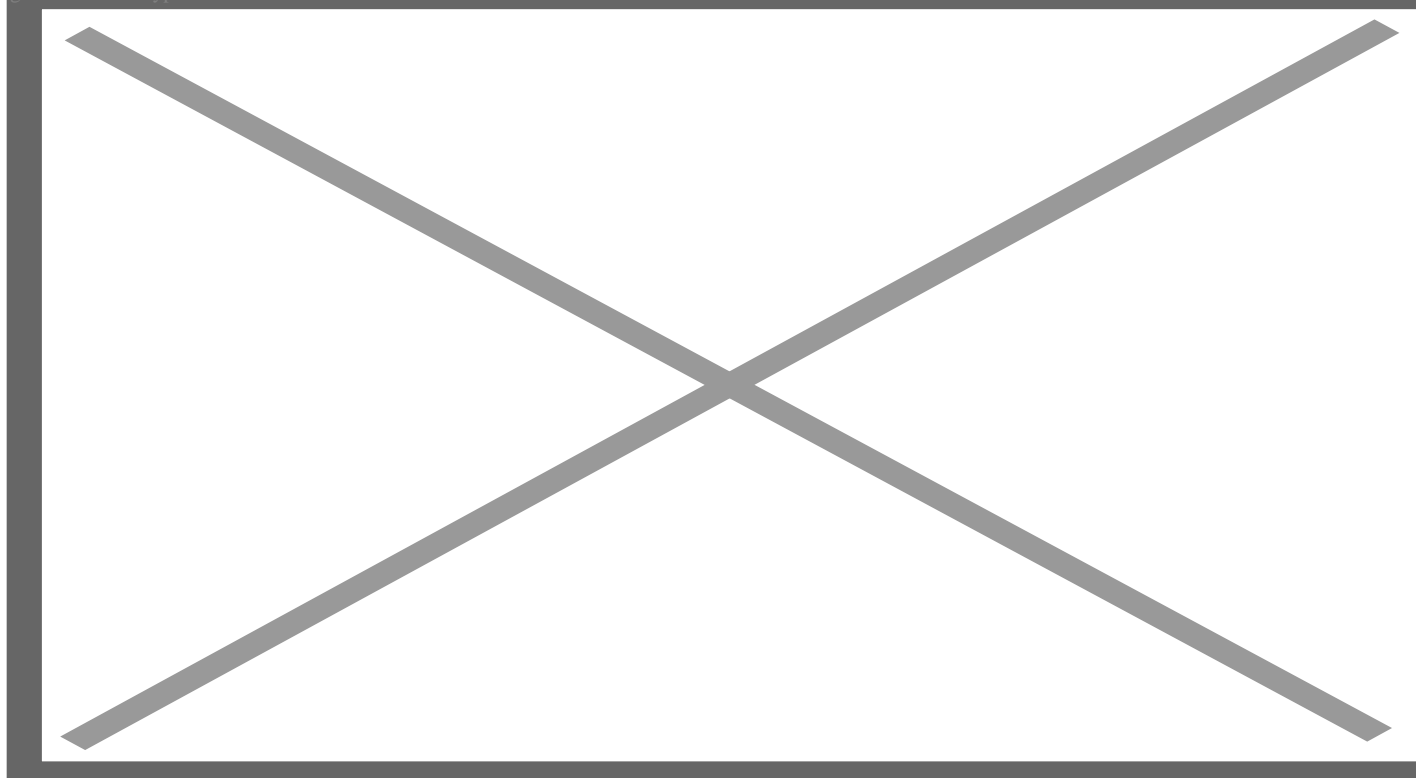
They can also embed growth factors and other signal molecules in the matrix that will influence how the cultured cells grow and differentiate so that they can imitate specific meat properties. The matrix

components can be consumed by the growing cells by the time the process is over, or they can remain to provide structure since they are plant based and edible. On the one hand it may seem odd to feature the fact that they are using plant-based materials to grow animal cells, but this means that no animal ingredients must be used to generate the food beyond the original cells that were gathered through a tissue biopsy. Whether vegans will be interested in cell culture meat remains to be seen, but the target market is much broader than that.

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Production of unstructured meat products and structured meat producing using primary cells from an animal source. Credit: Post et al. 2020 and Guan et al. 2021

The details of how a nano-matrix is customized for each potential partner has to be worked out under material transfer agreements with each client company so that trade secret components are protected. Currently 30 cultured cell players are working with Matrix F.T. of the 100-140 companies in this pre-commercial space. It will be interesting to see how the category develops, but if it succeeds it is likely that the Matrix F.T. technology will be functioning in the background for at least some of the ultimate products.

As stated earlier, only Singapore has yet to approve a cell culture meat product, but several products are under review by regulatory authorities in the US, Europe and elsewhere. Israel may be the next country to approve. In the US both USDA and FDA approvals are needed and as of now there are not any known

sticking points and the President's recent executive order about technology support may help. Matrix F.T. is also in the process of getting FDA facility approval.



Cows can live on grass and thus give us access to cellulose – the most abundant source of plant-stored energy on the planet. Credit: Getty

(Background note about why animal based foods will continue to be important even as alternative protein products are introduced: Technically virtually all food is plant-based because only plants and some algae are able to convert sunlight into usable energy that is involved in all the potential protein sources – some of which involve animals along the way. And animals greatly enhance the food supply because they are able to thrive on food sources that would be unpalatable or undigestible for humans. Ruminants like cows also (with the help of bacteria) give humans access to the vast amount of plant-based energy stored as cellulose – something that only serves us as dietary fiber. They can also provide us with meat and dairy products when raised partially or completely through grazing on lands that may not be suitable for crops that directly feed people.)

Steven Savage works topics ranging from biotechnology, to bio-fuels, to pesticide residues assessments and technologies that reduce food waste. He holds a PhD in plant sciences from UC Davis and frequently works as a consultant. Steven also has a role in the PopAgriculture podcast. Follow Steven on Twitter [@grapedoc](https://twitter.com/grapedoc)

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