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RESENHA

KHAN, Ahmed. *Introduction to Cell Agriculture*, ebook available at https://cellagri.mykajabi.com/ebook

Reviewed by George Jacobs (James Cook University, Singapore)

The language around us and the world around us are inextricably bound. Any change in one sooner or later provokes a change in the other. Food has long been an area of change with corresponding and compounding changes in languages. Examples of new terms include ketogenic, flexitarian, and superfood.

This review is being written in May 2019. It seems that every week, new headlines crash onto our consciousness about the rise of foods that offer alternative protein sources, such as Beyond Meat and Impossible Foods, using plant and fungi sources to mimic the look, taste, mouthfeel, and nutritional profile of animal based foods, while minimizing health risks, such as cholesterol, greatly reducing environmental damage, and sparing billions of animals the horrors of modern animal agriculture.

The excitement about these new foods already on the market continues to build, as not only do the range and quality of these plant based and fungi based foods grow, but an additional source of protein alternatives is making major developmental strides and could be ready for market as soon as 2020. These new alternative foods take the mimicry of animal-based foods one step further: real meat, real milk, real eggs, and more but without the animals. Among the animal products which can shift from carcass-derived to cell-derived are not just meat, but also milk and eggs, and not just food but also leather and rhinoceros horns, and even human skin and cartilage. This 'magic' process has various names, including 'clean,' 'cellular,' 'cultured,' and 'lab-grown.'

Ahmed Khan, the author of the book being reviewed here, is the editor of CellAgri (www.cell.ag), a news and research startup which he founded in 2017 with the goal of making it the go-to place for information on cellular agriculture. Ahmed uses the catch-all term "Cell Ag" (short for cellular agriculture) to encompass this broad field of innovative products. His 59-page, free-on-line book provides a layperson-accessible explanation of Cell Ag, its origin, its scientific background, its problems, and its prospects. A key reason for the book is to provide the public with "radical transparency" about exactly what Cell Ag is, because Ahmed hopes that an educated public will be accepting of cell ag products. In addition to downloading the book and reading the CellAgri newsletter, you can listen to Ahmed talk about Cell Ag at https://www.youtube.com/watch?v=-WlAJmQSn2c

The book includes an initial chapter titled Biology 101. There, Ahmed provides the

minimal knowledge needed to understand what cells are and what Cell Ag scientists are attempting to do with cells. So that you can judge for yourself the comprehensibility of Ahmed's writing, here's a paragraph from that chapter (p. 6):

In the laboratory, scientists use cell culture media to grow cells. The cell culture media, which includes the cell culture serum, provides all the nutrients and growth factors that the cells may need to replicate. In this way, the cell culture media makes the cells believe they are still in its body and will grow accordingly, if all the right conditions are in place.

The book's first main chapter is titled Cellular Agriculture: An Introduction. Many reasons exist for Cell Ag, mostly based on the unsustainability of trying to supply traditionally produced meat and other animal products to the burgeoning human population. These reasons for this unsustainability include that animal products wreak havoc on the environment, on human health, and on the lives of the animals involved. Ahmed urges that to help the public appreciate these benefits of Cell Ag, quantitative labels be used compare Cell Ag to factory farmed products, such as showing how much water is saved and how much less cholesterol is ingested.

Safety of the food supply provides another reason for advocating Cell Ag. Indeed, *clean*, such as in *clean meat*, is one of the adjectives used for Cell Ag products. This adjective is used to reflect the health dangers of carcass based products. For example, feces is regularly found in samples of chickens' meat: https://www.foxnews.com/health/meat-poultry-fecal-matter-usda-lawsuit. Furthermore, carcass-based foods are routinely linked to pandemic diseases such as swine flu and bird flu. In contrast, cell ag products are likely to be produced in much more sterile environments.

To overcome fears that Cell Ag products will be some kind of Frankenstein food, Ahmed cautions that ongoing public education will be necessary. Part of this education includes transparency by all those involved in Cell Ag, such as those doing research and those involved in manufacturing processes.

One way to encourage the public to accept Cell Ag products is to publicize that we already use products derived from cellular technology. These products include fermented foods, such as kimchee, tempeh, yogurt, and beer. Plus, did you know that previously, the insulin used by diabetics was derived from carcasses of millions of pigs and cows: https://www.fooddive.com/news/one-order-of-eggs-hold-the-hens-how-acellular-agriculture-will-reshape-fo/524943, but now this insulin is produced in labs, and it's a much safer supply?

The public also needs to know that not all protein alternatives derive from Cell Ag. Fungi based and plant based products, such as Quorn and Beyond Meat, are different from Cell Ag products. Fungi based and plant based involves no animal cells and seeks to seem to the senses as equivalent to animal based products. Cell Ag takes this equivalence a step further, going beyond visceral equivalence to biological equivalence. And, beyond equivalence, these cell ag products could even improve on what is currently in use from animals, such as meat without cholesterol and milk that can be consumed by those who are lactose intolerant.

Cell Ag faces a number of obstacles. First, on the language front, some in the meat

industry are attempting to marginalize Cell Ag products, for example, advocating laws dictating that these products cannot be called 'meat.' Ahmed disagrees, arguing that when examined with a microscope, conventional and cell-cultured meats look similar, which they should as their composition is the same. Also, major producers of carcass-derived meat have already invested in Cell Ag companies, such as Memphis Meats.

A second obstacle facing Cell Ag involves scalability. To have an impact on how people eat, Cell Ag products need to go from being made one-by-one in a lab to being made in their millions in factories. This scaling will provide sufficient supply to meet the demands of what are projected to be 9-10 billion people by 2050 at prices that can fit most budgets. Part of achieving scalability involves developing large enough bioreactors for the cell processes.

A third obstacle to Cell Ag becoming a widely accepted part of people's lives can be seen in objections from what is perhaps an unlikely source: vegans and other vegetarians. Currently, the cells used for Cell Ag and the cell culture media in which the cells grow all derive from animals. Thus, Cell Ag's product cannot be called vegan. Those in the Cell Ag industry, including long-time vegan advocates, are confident that scientific developments will soon allow the industry to overcome these objections, although not all animal advocates share their confidence. One point that vegans, such as myself, might want to bear in mind is that the original 1944 definition of vegan does not talk about zero use of animals but about limiting exploitation of nonhuman animals (https://www.vegansociety.com/about-us/history):

[Veganism is] *a philosophy and way of living which seeks to exclude—as far as is possible and practicable—all forms of exploitation of, and cruelty to, animals for food, clothing or any other purpose; and by extension, promotes the development and use of animal-free alternatives for the benefit of humans, animals and the environment.*
Indeed, in the modern world, it is virtually impossible to live without being complicit in harm to animals: https://www.treehugger.com/green-food/9-everyday-products-you-didnt-know-had-animal-ingredients.html

In conclusion, Cell Ag is a rapidly developing field with a potentially huge impact. Thus, readers will want to stay up-to-date. Thanks to Ahmed Khan for providing this free-to-read book which provides a good foundation for understanding Cell Ag. The book ends with a list of prominent companies and non-profits working in the Cell Ag space. These organizations also provide information of the cell ag process, e.g., https://www.new-harvest.org/cellular_agriculture. Plus, the book has a short list of other information sources.

Note
The book is downloadable at no charge at https://cellagri.mykajabi.com/ebook