



# **Clean Meat: How Growing Meat Without Animals Will Revolutionize Dinner and the World**

*Paul Shapiro*

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Paul Shapiro gives you a front-row seat for the wild story of the race to create and commercialize cleaner, safer, sustainable meat—real meat—without the animals. From the entrepreneurial visionaries to the scientists' workshops to the big business boardrooms—Shapiro details that quest for clean meat and other animal products and examines the debate raging around it.

Since the dawn of *Homo sapiens* some quarter million years ago, animals have satiated our species' desire for meat. But with a growing global population and demand for meat, eggs, dairy, leather, and more, raising such massive numbers of farm animals is woefully inefficient and takes an enormous toll on the planet, public health, and certainly the animals themselves.

But what if we could have our meat and eat it, too? The next great scientific revolution is underway—discovering new ways to create enough food for the world's ever-growing, ever-hungry population.

Enter clean meat—real, actual meat grown (or brewed!) from animal cells—as well as other clean foods that ditch animal cells altogether and are simply built from the molecule up. Also called lab-grown meat, cultured meat, or cell-based meat, this race promises promise to bring about another domestication. Whereas our ancestors domesticated wild animals into livestock, today we're beginning to domesticate their cells, leaving the animals out of the equation. From one single cell of a cow, you could feed an entire village. And the story of this coming "second domestication" is anything but tame.

## Clean Meat: How Growing Meat Without Animals Will Revolutionize Dinner and the World Details

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# **From Reader Review Clean Meat: How Growing Meat Without Animals Will Revolutionize Dinner and the World for online ebook**

**Ann Aylott says**

**Very VERY INTERESTING**

Wow, had no idea that the raising of farm animals is so detrimental for our environment, more so than automobiles. Going down I-5, between North and South, California, there is miles of cattle, slopping in mud up to their bellies, the smell, is unbearable, you can taste it. (Not to mention the poor animals) We need to do away with this, and thank goodness, it is now in our future!!!! Evidently Churchill, in his genius, foresaw this as a must in our future. This book talks about just how much land, water, feed, etc. it takes to put meat on our table. It is amazing, very thought provoking. I learned a lot.

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**Colleen says**

A fantastically well-told and important story about the history of the future. Highly recommend!

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**Elizabeth says**

An important and eye-opening book about what we eat now, and why we need to be eating something different as soon as possible.

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**Kate Lawrence says**

Very engrossing account of the new technologies and companies that can grow meat, milk, leather and other animal products outside of an animal. This promises a future in which, if consumers get on board, farm animal suffering and slaughter by the billions would no longer be necessary, and the environmental degradation caused by livestock greatly alleviated. Even the health hazards of meat would be reduced, as clean meat will be free of antibiotic residues, fecal contamination, and disease producing organisms. I'd known a little about the culturing of meat but not about leather, milk, egg whites or foie gras. (Foie gras, because it is easier to culture and sells--in its animal version--for something like \$100/lb., may be the first of the clean meat products to be marketed.) In the book we meet the innovators who are developing these products and the methods used; I understand much better now what those processes are. I didn't give five stars here because parts of the book are repetitious, especially the first chapter, and the book lacks an index, which would have increased its usefulness. But I still urge everyone concerned about sustainable, humanely-produced food to read it. It's one of the most hopeful books about the future that I've read in quite awhile.

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## **Paulo A. Reimann says**

### **Well written**

Superb book about something ain't futurology anymore. The balanced view about humane treatment, animal farm slash industry and customer perception, trend, not necessarily vegan. Breakthrough technologies, totally disruptive.

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## **Simon Eskildsen says**

Growing meat outside of an animal has always seemed like dark magic to me. I wanted to develop my understanding of this rapidly developing field. Agricultural reform is a large part of mitigating climate change, but pushing people to stop eating meat is not going to work. So, just like we are building electric cars that'll be cheaper, faster, and better than those powered by gas—we need to do the same for meat.

The technology to grow tissue artificially is much further along than I thought. It was pioneered in the medical field to grow e.g. livers, and a couple of people in the medical field independently made the observation: "If we're trying to do this for complex human issue, why not for animals and meat?" Especially since a kidney is much more complex than ground beef.

Imagine taking a biopsy from a cow, ladling it with nutritious jelly and mounting it on an artificial skeleton in a sterile environment. That's, grossly simplified, the process. It turns out to work. For the time being, it remains expensive (this is partly why some companies are starting upmarket, with e.g. foie gras). It's interesting that depending on the motivation, companies in the space focus on different types of clean meats. For example, those optimizing for animal welfare are starting with chickens. Those most concerned about climate change are attacking artificial beef. There are players all over this space, whether in milk, eggs, chicken, turkey, or narwhals (if we can replicate any flavour, you can eat as much ortolan meat as you want!). The toughest thing is to convince consumers. Everyone in the space knows public acceptance is going to be the largest hurdle, not technology. That's why it needs to be tastier and cheaper first.

An interesting analogy from this book is that we can compare this to how we used to hunt the planet dry from whales for whale fat for lamps. Then, one day, someone figured out how to extract kerosene from oil and the industry rapidly declined. Today, it'd seem bonkers to us that a beluga would have to die to light your condo. Many of the players in this budding industry think we'll look at animal slaughter the same way in a few decades (not even hipsters are burning whale oil for light!).

Interesting topic, but the big thing I was missing were more in-depth explanations of how all this works. The author is more focused on the business and the stories. Due to the low information density, this was a really quick audiobook on 2x speed without losing much.

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## **Jeff Clark says**

I am incredibly excited about the future of clean meat. Unfortunately this book is the opposite of exciting. It is repetitive, disjointed, lacking overall narrative and feels 10x longer than it needs to be. The content that there is, is sometimes interesting, but like the cultured meat that is the book's topic, this one is overpriced

and not yet viable. Maybe there is just not yet enough of a story to tell.

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### **Justin says**

Really repetitive. Should have been an article, not a 240-page book. The author's hard-on for entrepreneurs and venture capitalists was very off-putting.

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### **Antonia says**

Fantastic! Great audio, too. I've actually started eating tofu. I never thought it would come to this!

Will be back to review...

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### **Andrea says**

This book was amazing. It is awesome what science can do for us. As a vegan I am constantly trying to "save the earth" and clean meat can be the next step to what we need to do to help that out! I think it is interesting that people might be turned off by this concept and not jumping up and down to make this happen. No feces, pus, etc....in meat that is grown in a lab! I hope to see this happen on a large scale within a few years. This can change the world, save the animals, and maybe make people a bit healthier with meat that isn't as bad for you!

I'm glad that Paul wrote this book and I hope it becomes more and more popular so people can see that there are options out there with the advancement of science.

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### **superxmania says**

History in progress. The book is maybe not a masterpiece itself but the topic... future happening right now.

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### **Peter Tillman says**

<https://www.wsj.com/articles/review-c...>

"A brisk and engaging case, "Clean Meat" advocates without overselling, anticipating our uneasiness with a process that many will at first glance reject as "unnatural." An odd objection, given that all but a slight percentage of meats now come from factory farms, and those places aren't exactly a picture of nature's wonders in all their glory."

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## **Rebecca Ash says**

Really fascinating read! A good place to start if you are looking to learn about cellular agriculture. Note that it is written assuming you already know and understand the negative effects of conventional meat and dairy (human health, environmental, economic, etc.)

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## **Marina says**

Really interesting book, making me think a lot on how activist can be effective for animals' sake.  
Must-read!

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## **Simon Newstead says**

Enjoyed reading this overview of clean meat, which refers to a way to grow cultured meat without needing animals in the process.

These clean meats together with plant-based meat alternatives have the potential to end industrial farming in our lifetimes (over 50 Billion land animals killed in industrial conditions each year)

Quick summary:

- Basically two main types, acellular and cellular

### **ACELLULAR:**

- uses yeast / bacteria with specifically designed genes that grow the resulting material (eg casein protein, gelatin etc)
- the techniques already used for years to mass synthesize insulin, rennet (used in nearly all cheese consumed today)
- the engineered yeast is removed before consumption, so the food can be called GMO free
- Example startups - Perfect Day (dairy), Clara Foods (egg whites), Geltor (gelatin)..

### **CELLULAR:**

- multiplying tissue cells (extracted from a tiny sample from an animal), by feeding it the serum (food containing nutrients) and having it grow on a scaffold
- Cellular serums are being developed that are fully plant based (early work was mostly on animal derived serums)
- Example startups - Memphis Meats (beef etc), Hampton Creek (chicken, foie gras etc), Modern Meadow (leather)

### **BOTH:**

- vastly lower environmental footprint as well as eliminating mass animal suffering
- example, a cow requires 23 calories to deliver just 1 calorie to end consumer of a burger, with cellular that ratio comes down to 3 calories to 1
- costs have been rapidly declining as tech gets better, first burger cost \$300,000 now predicted to shortly be at \$11 within a few years (more of an engineering than research challenge now)

- expect first commercial products within 3-5 years
- expect to hit price parity with meat within 5-10 years even without any special subsidies
- other benefits over animal source include ability to have it healthier (eg take out cholesterol and lactose from milk, reduce saturated fat in beef etc)
- big players are increasingly invested in the space (Bill Gates, Li Ka Shing, VCs etc) as well as growing investment from the big meat producers (Cargill, Tyson etc)
- significantly cleaner and safer than traditional meat production (which has a lot of problems due to low hygiene of slaughter and processing)

Open question whether plant-based meats will reduce or obviate the need for clean meats by the time they become commercially viable, given their rapid improvements.

In any case it's too risky to just bet only on plant-based meats, so clean meat is a very important plan B for the world's future...

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