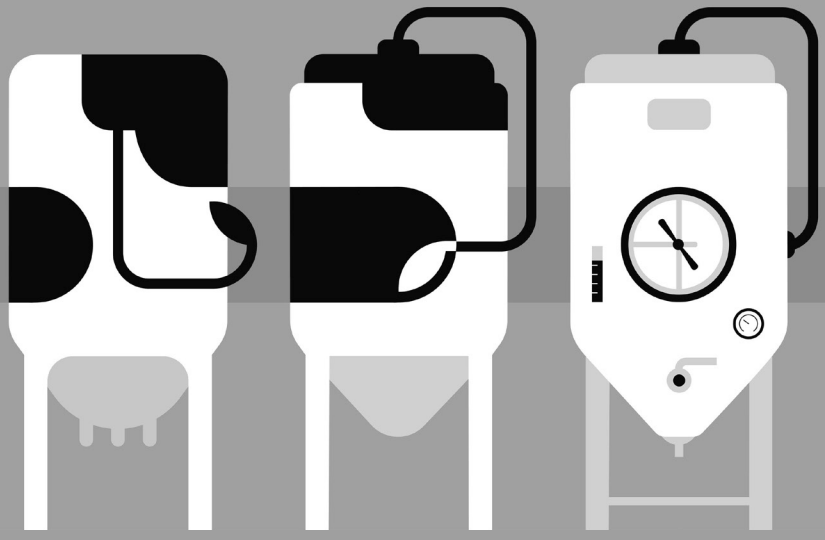

AFTER
MEAT



AFTER MEAT

THE CASE FOR AN AMAZING, MEAT-FREE WORLD

KARTHIK SEKAR, PHD

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Introduction

Welcome to *After Meat*. I'm humbled and gratified to have your time and attention. I intend to make the most of it. I'm Karthik, a scientist in the alternative food space with a research career in biochemical engineering and quantitative/systems biology.

I suspect that you're roughly familiar with the moral and environmental arguments for moving away from animal products, or at the very least, you hold an inchoate sense that animal products are detrimental to the environment and are unethical. Perhaps you're already convinced, as I am, that the eventual replacement of all animal technology—man's use of animals as anything other than pets—i.e. as a source of food, clothing, medicines, or cosmetics—is inevitable. Specifically, you and I might believe that, in the future, humanity will completely eschew traditional animal technology and embrace the clean meat and clean protein revolutions, in which consumer goods are sourced from plants and grown via advanced cellular technology.

The movement away from animal-based foods already has tremendous momentum. Corporate fast food giants Burger King

and McDonald's have both introduced veggie burgers sourced from the well-known, next-generation vegan food companies Beyond Meat and Impossible Foods.[1] The publication *The Economist* declared 2019 to be the "Year of the Vegan," claiming that a quarter of Americans between the ages of twenty-five and thirty-four declare themselves to be vegetarian or vegan.[2] The UK supermarket giant Sainsbury's predicts that a quarter of *all* Brits will be vegan or vegetarian by 2025.

All this being said, I suspect that you might be unfamiliar with the technological reasons for moving away from animal products, and that's the focus of this book. Simply put: raising animals for consumption is an awful technology. All indications suggest that the future of food will ultimately be tastier, healthier, cheaper, kinder, and better for the environment. This will happen *because* we won't use animal products.

In Chapters 1 and 2, we'll discuss a model for how technical progress works. In Chapter 3, we look at the cow as an example, and examine this animal as a bioreactor that society uses to produce steaks, leather, and milk. A cow takes more than a year to grow, and we "waste" more than ninety percent of what we feed the animal to reach the commercially desired body mass, due to the fundamental physics of cow biology (Chapter 4). These are irretrievably terrible metrics. We can do much better with alternative technologies, such as microbial fermentation, which will also be easier to innovate for process efficiency, taste, nutrition, and any other qualities we need or care about (Chapter 5).

An optional, more technical chapter (Appendix A) explains that perfect futurology is impossible, per the laws of physics, so I recommend reading the appendix before you start Chapter 5, which references the appendix. Even though we can't predict the future precisely, we *can* predict with confidence that traditional animal

technology will be replaced based on the best technology and knowledge innovation model. Animal products *will* be replaced. The question is not *if*; it is *when* and *how*.

Further chapters explore issues adjacent or complementary to the technological argument. Chapter 6 explains that animal technology is not necessary for complete nutrition. Chapter 7 discusses how humanity derives and can recalibrate pleasure, an attribute often ascribed to meat-eating. Chapter 8 explains our culinary history and projects a resplendent future gastronomy that's free of animal products. Chapter 9 discusses the role of large institutions, such as government, in facilitating our innovation machine and specific plays for animal technology replacement. In Chapter 10, I explain what every person can do to move humanity beyond our reliance on animal products.

While this book focuses on the technological argument, I wrote it ultimately out of my compassion for animals and their welfare. I hope to accelerate the adoption of a similar attitude in the greater population. I suspect that, once technology has allowed alternatives to outcompete animal products and/or replaced them, we'll societally militate against animal products just as we did against child labor and lead paint. Eventually, we'll universally reevaluate how we treat animals, viewing our past behavior with despair and regret, similar to how we now chide ourselves for our history of tolerating slavery and subjugating women. However, I did not want the morality argument to distract from the main argument that a world after meat is an inevitable reality based on technological innovations. I have, accordingly, allowed this argument to take center stage in Chapter 11, the final chapter.

After Meat covers many topics: biology, physics, chemistry, philosophy, economics, policy, neuroscience, and engineering. The breadth and depth of these topics are supported with a summary

and list of defined terminology located at the end of each chapter; though, you might want to read them *before* tackling the chapter. I suspect this will ease understanding, especially for the more technical first half of the book.

Despite my use of an absolutist tone and verbiage, I do welcome well-intentioned disagreement and clear refutations of anything presented here. Being wrong is part of the knowledge-generation process (Chapter 2), which I hold in the utmost regard. In fact, I take it a step further—I predict many of these ideas *will* be proved wrong or become outdated. Knowledge is ephemeral, much of it waiting to be replaced by more precise understanding as civilization and scientific exploration develops. Probabilistically, it's more likely for something in this book to be wrong simply because there are so many claims here. Therefore, please reach out to me via blog, email, or otherwise to engage about these ideas.[3]

Back and forth emails with beta readers have been some of the most fruitful and joyful parts of writing this book. If contacted, I cannot guarantee that I'll always respond, but know that I'll always appreciate your effort, especially if we both value knowledge generation in good faith: we seek the truth and the best ideas, and we are willing to change our own beliefs.

I will assert many controversial points, and I expect pushback. I hope some of the ideas will gain wider acceptance in the coming years, so much so that they'll seem unremarkable in twenty or thirty years. I ask for a nuanced approach to *After Meat*. Sure, even I might come to regard the chapter on nutrition as baloney within two months of release, but that doesn't automatically discredit the chapter on the intractability of animal technology. Most of the claims can stand independently. An anodyne, risk-adverse book will not push progress and solve as many problems. Instead, I've

strived to make many interesting claims that can be proven false because ultimately that's how we all learn.

I hope you enjoy reading, and I would love to hear your thoughts.

Sincerely,

Karthik Sekar

June 1, 2021

San Mateo, California