



Alternative proteins: a scalable, market-based solution for climate change, food security, & global health

Liz Specht, Ph.D. - VP, Science & Technology



Disclosures



The Good Food Institute is a nonprofit organization powered by philanthropy, with a mission to accelerate the shift to a sustainable, healthy, and just food system.

GFI is primarily funded by individual philanthropists and private grant-making foundations.

GFI only accepts corporate support for event sponsorships and for our research grant program, which makes grants to alternative protein researchers to advance neglected, high-impact, open-access research.

How will we feed 10 billion people by 2050?



Sustainably

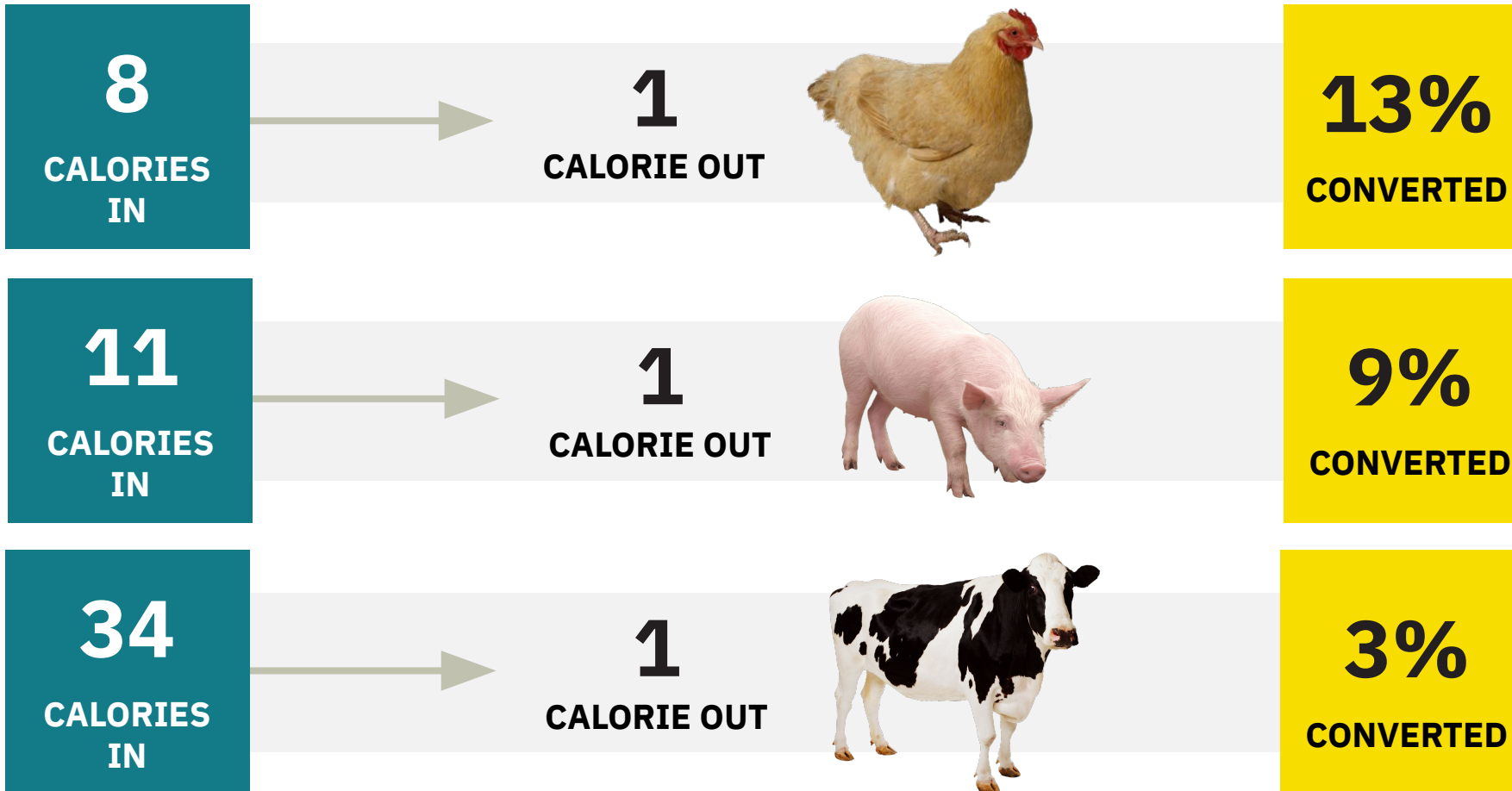


Securely



Safely

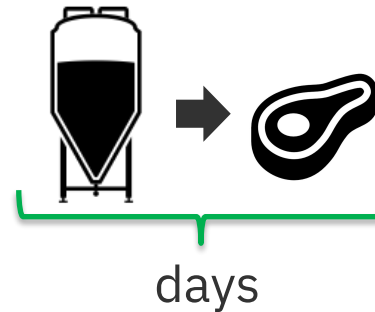
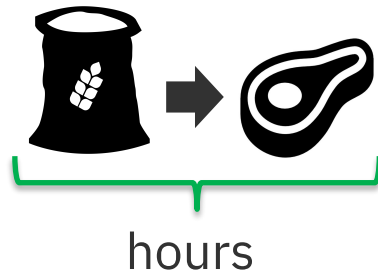
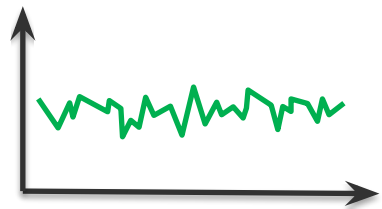
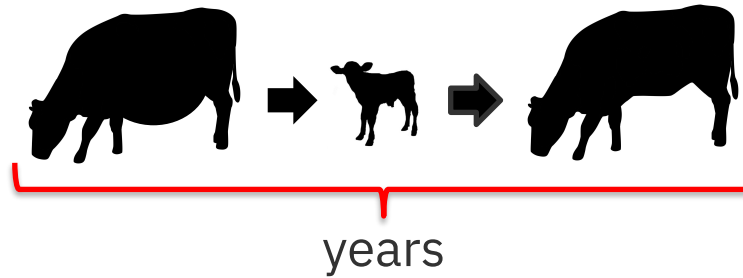
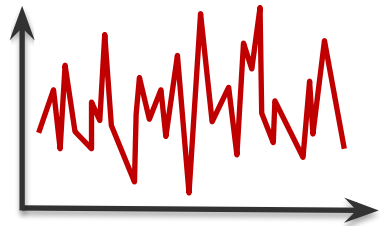
Cycling calories through animals is inherently thermodynamically inefficient



Cycling calories through animals in this way is equivalent to **87-97% food waste** in production.

Conventional meat supply chains are highly vulnerable to production volatility and biosecurity threats

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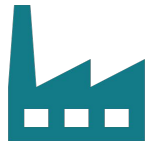
African Swine Fever Virus wiped out roughly half of China's pork production in less than a year, which will take years to recover.

It continues to spread in Asia, Europe, and Africa and has just reached the Caribbean.

Intensive animal farming is among the greatest risk factors for the next zoonotic pandemic



#1. Increasing human demand for animal protein.



#2. Unsustainable agricultural intensification.



#3. Increased use and exploitation of wildlife.



#4. Unsustainable use of natural resources accelerated by urbanization, land use change, and extractive industries



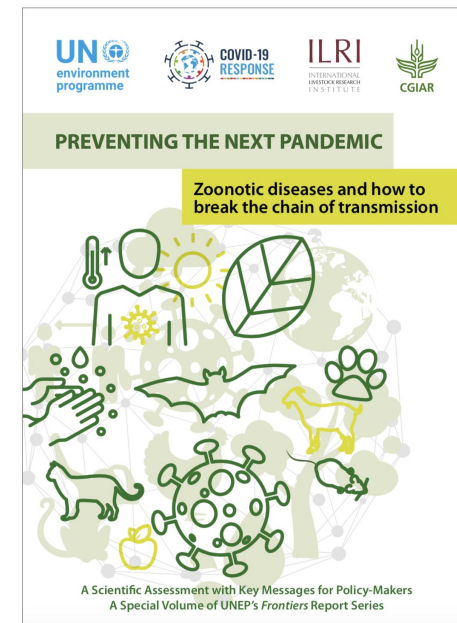
#5. Increased travel and transportation



#6. Changes in food supply



#7. Climate change



The Washington Post

Climate and Environment

The profound planetary consequences of eating less meat

The Guardian

Factory farms of disease: how industrial chicken production is breeding the next pandemic



Deadly Bird Flu Sweeps States,
Straining Farmers

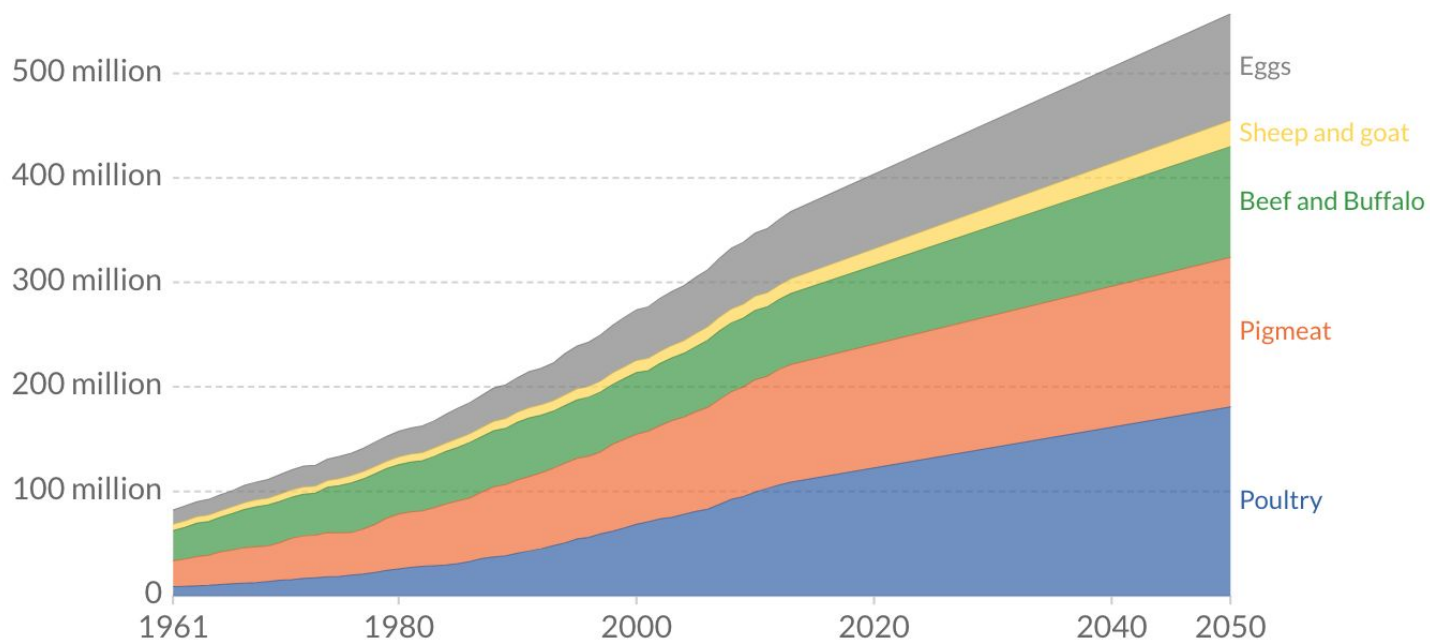
Despite increasing awareness, global meat demand shows little sign of slowing

Global meat projections to 2050

Global meat production projections, as published by the UN Food and Agriculture Organization (FAO) based on future population projections and expected impacts of regional and national economic growth trends on meat consumption. Data from 1961-2013 is based on published FAO estimates; from 2013-2050 based on FAO projections.

Our World
in Data

☐ Relative



Source: UN Food and Agriculture Organization (FAO)

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Rather than convince consumers to change their diets, let's produce meat in a better way — *without the animal.*



Alternative proteins are a scalable, tractable, market-based solution poised for rapid growth

Plant-based



Photo courtesy of Beyond Meat

Fermentation



Photo courtesy of MyForest Foods

Cultivated



Photo courtesy of UPSIDE Foods.

These alternatives completely eliminate the pandemic and antibiotic resistance risks of conventional meat production, and they provide 4x to 100x environmental improvements

Plant-based

- Up to **90%** fewer GHG emissions
- Uses up to **99%** less land
- Uses up to **99%** less water

Source: [GFI Plant-based meat for a growing world](#)

Fermentation

- **90%** reduction in carbon footprint compared to beef

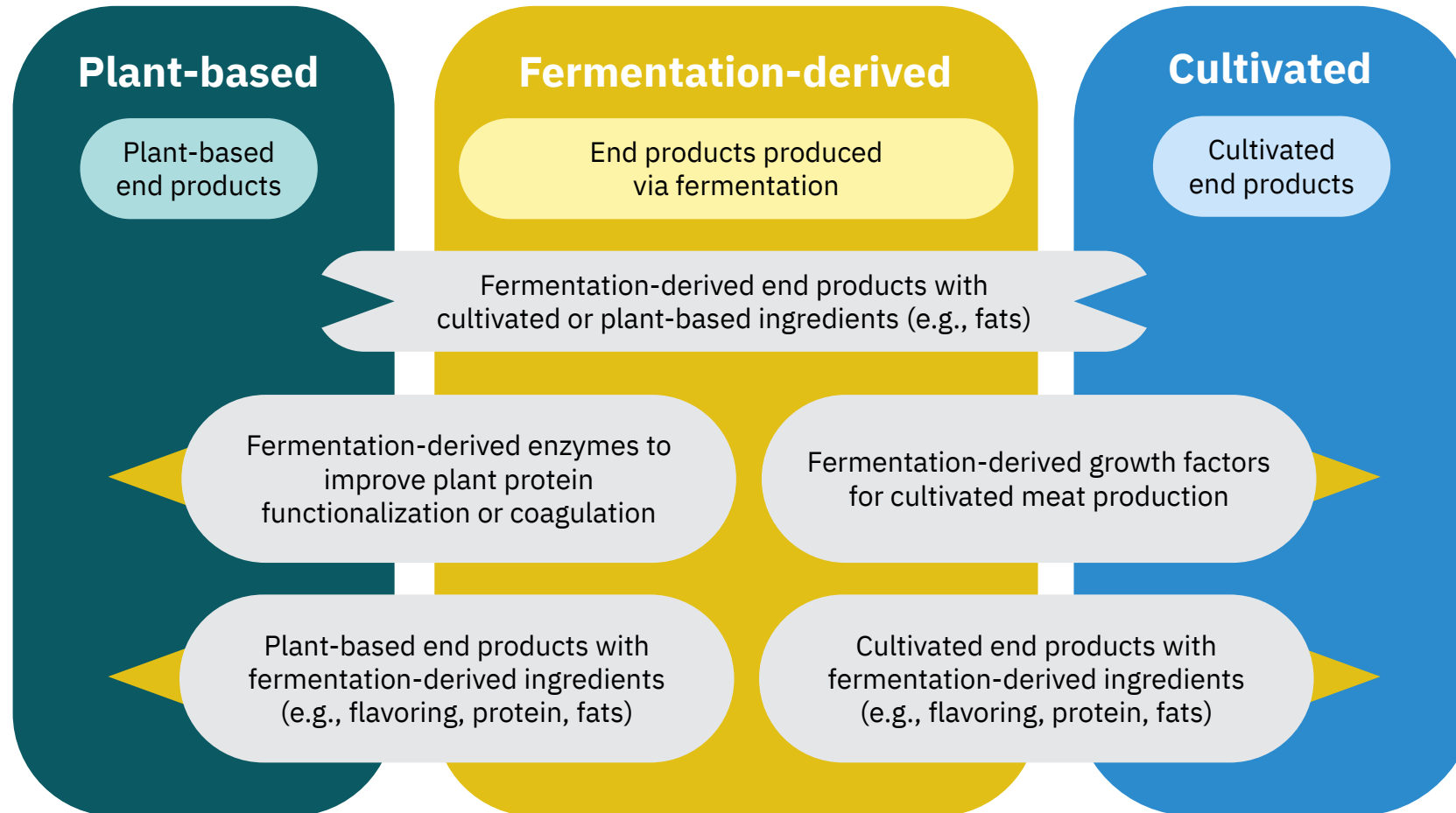
Source: [Quorn 2018 comparison report](#)

Cultivated

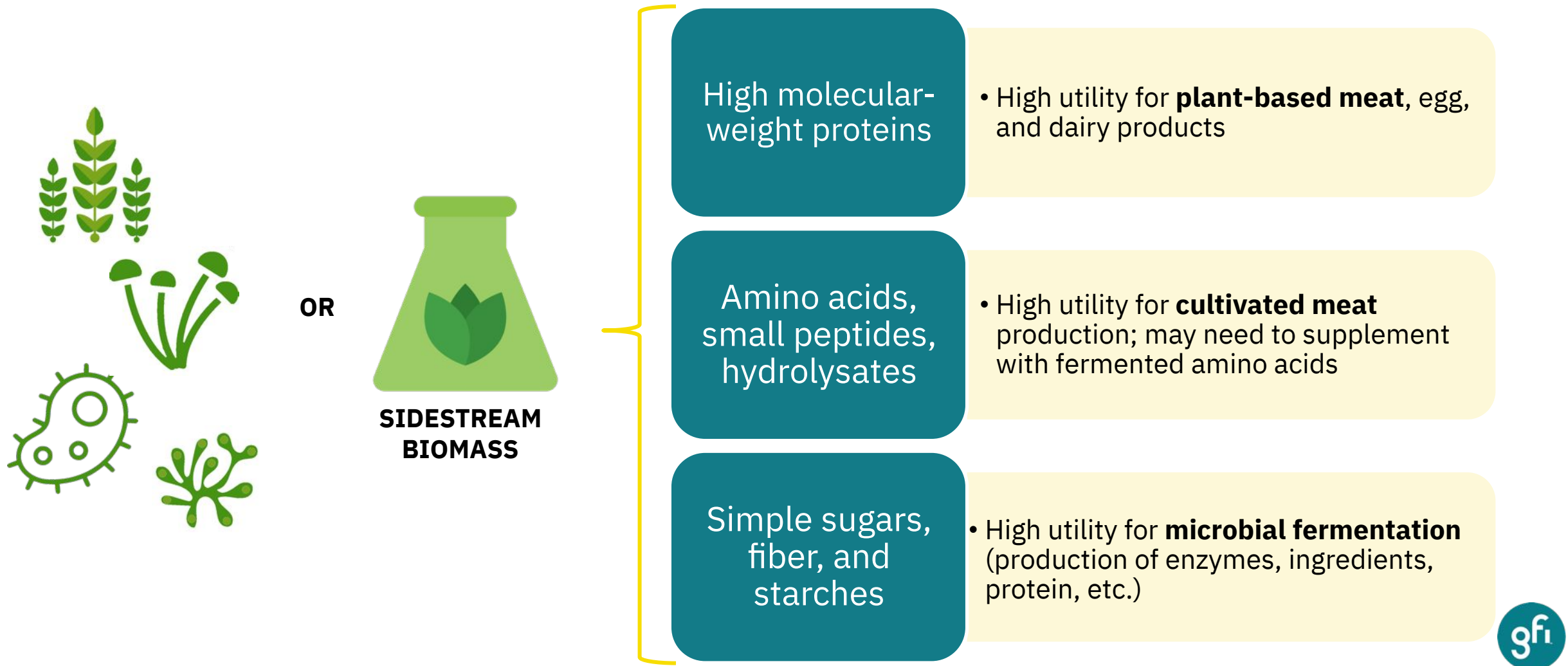
- Projected to use up to **95%** less land; **78%** less water; **93%** less pollution; **92%** fewer GHGs

Source: [CE Delft 2021 LCA/TEA](#)

Hybrid products are the future (and, increasingly, the present) of alternative proteins



Hybrid mindset for feedstock processing too: leverage co-products across all alternative protein platforms to move toward a circular bioeconomy

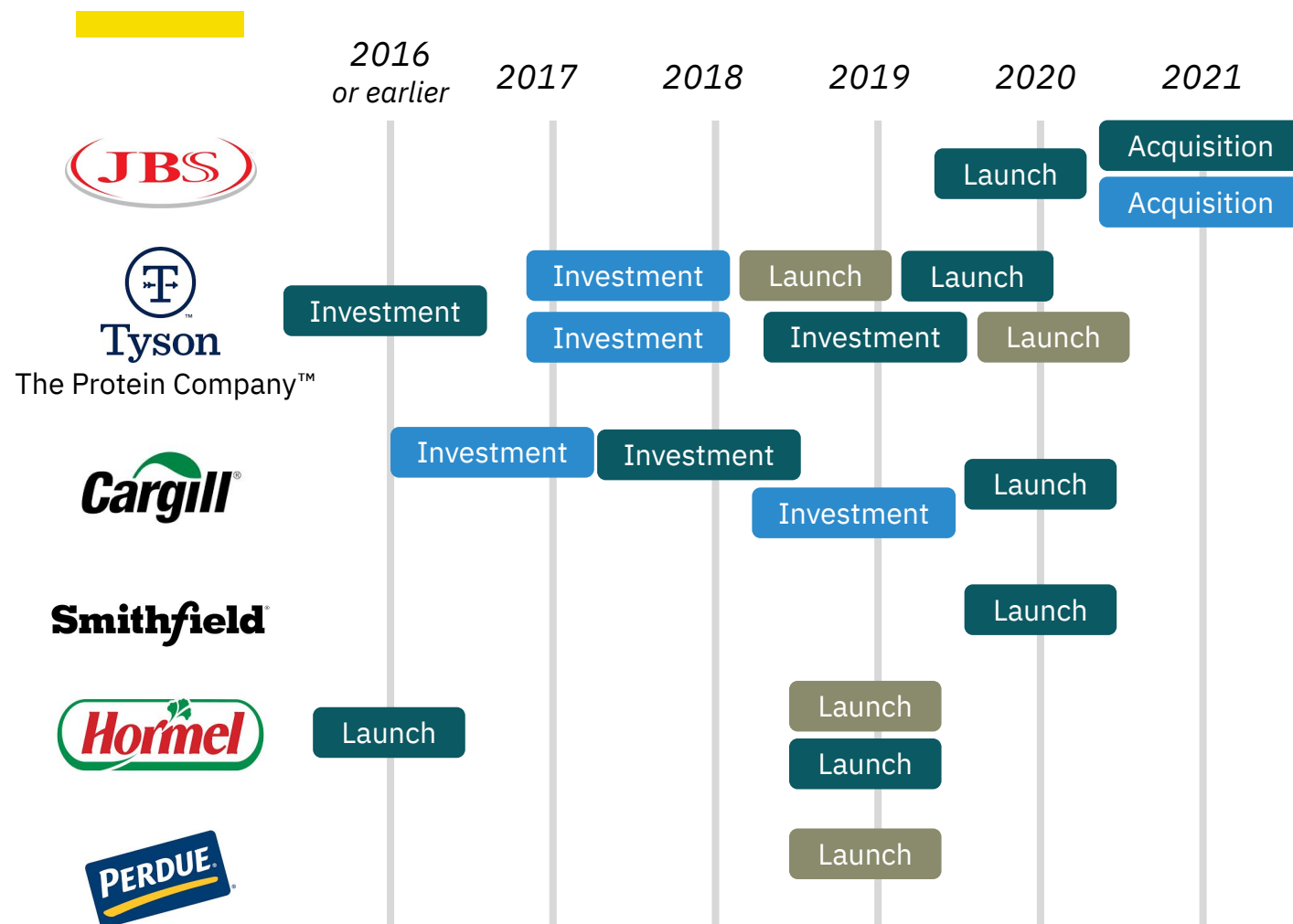


How quickly might the transition toward alternative proteins happen?

How can we accelerate it?

Who will lead the way?

Global meat companies see the writing on the wall and recognize that alt proteins are here to stay



Key: **Plant-based** | **Cultivated** | **Blended**

Key quotes

“This acquisition is an important step to strengthen our global plant-based protein platform.”

—Gilberto Tomazoni, Global CEO

“If we can grow the meat without the animal, why wouldn't we?”

—Tom Hayes, Former CEO

“Producing plant-based products across our global supply chain is the logical next step.”

—Elizabeth Gutschenritter, Managing Director, Alternative Proteins

“We’ve been exploring the alternative protein space, and have taken our time to get it right.”

—John Pauley, Chief Commercial Officer

“Our pursuit is to find smarter ways to create animal-derived products. If plants are a part of that, then we are going to do that.”

—John Ghingo, President, Applegate Farms

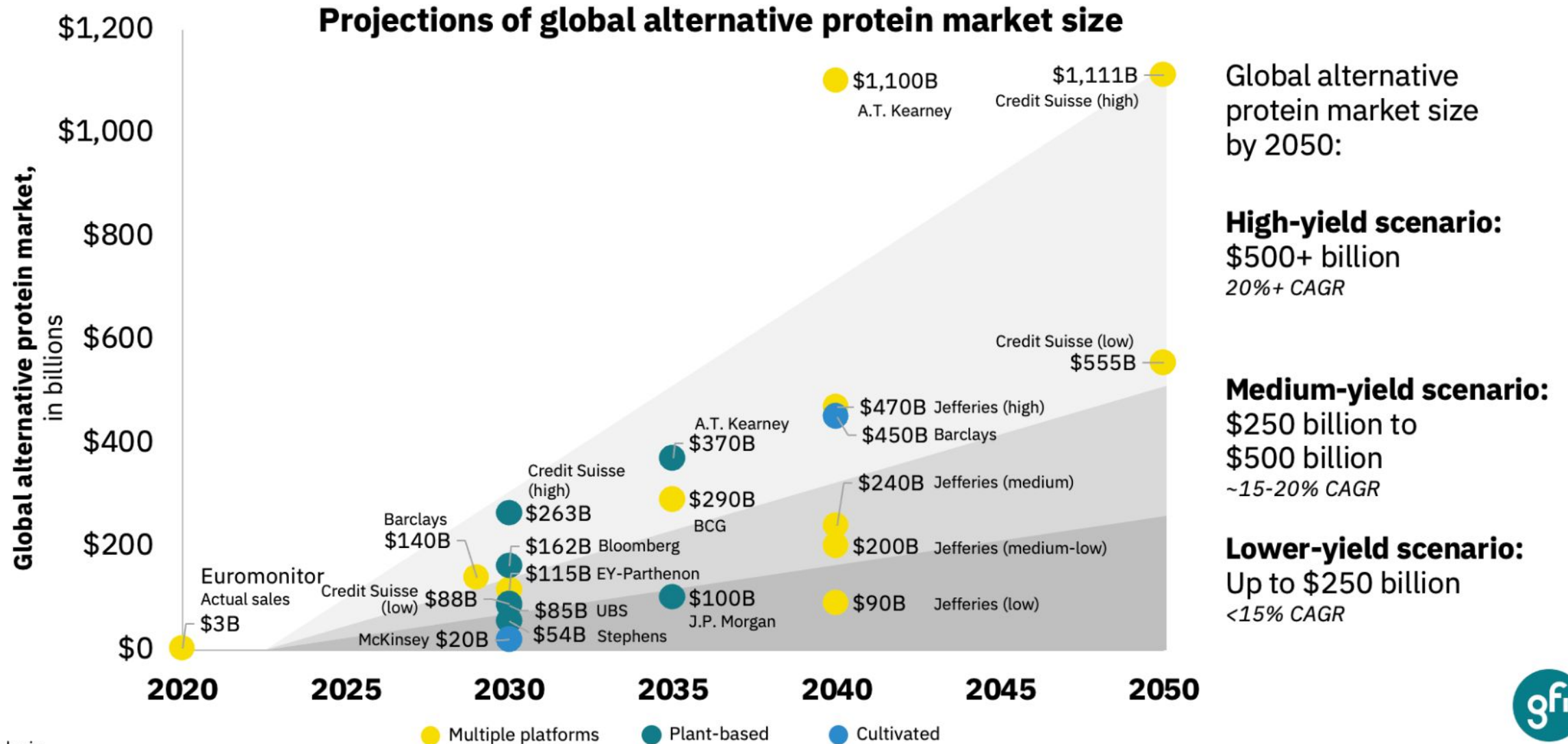
“We wanted to provide an easy way to round out the meal and help parents put an end to the ‘eat your vegetables’ battle.”

—Eric Christianson, Chief Marketing Officer



But the private sector alone can't scale this industry fast enough to mitigate climate, public health, and food security risks

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Three primary mechanisms for accelerating a transition toward alternative proteins



- 1) **Building a robust innovation ecosystem supported by investments in open-access R&D** to reduce costs and improve product desirability.
- 2) **Ensuring a clear path to regulatory approval** to reduce market barriers to entry and incentivize market uptake.
- 3) **Investing in supply chain and manufacturing infrastructure** to alleviate production bottlenecks, accelerate scale-up, and aggressively drive down costs.

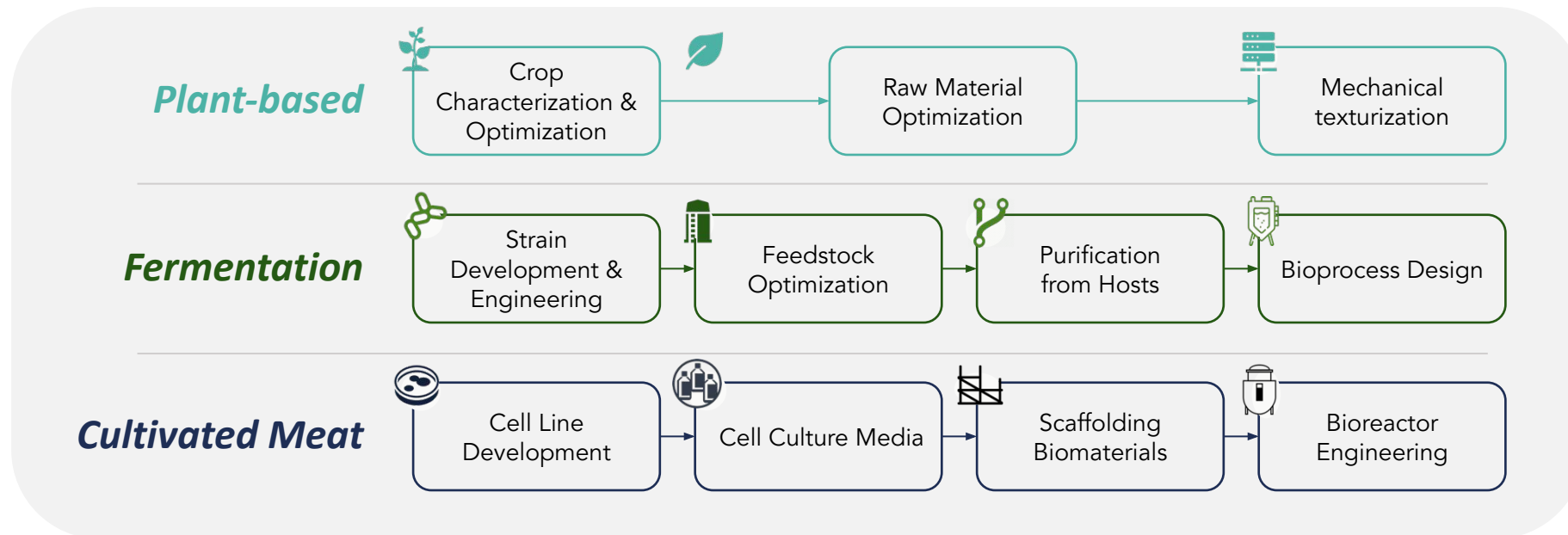
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Even though the market is growing, immense opportunities remain to further improve on sustainability, cost, flavor, and nutrition all across the value chain

Alternative protein products and processes are under continuous refinement.



Defined technical needs and knowledge gaps exist across the entire alt protein value chain



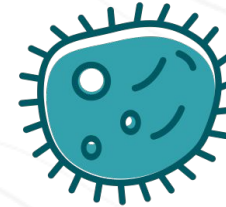
Plant-based research priorities

- **Breeding & engineering for higher protein yields and functionality**
- **Better protein fractionation and functionalization**
- **Improved plant fat profiles**
- **Novel methods for texturizing and structuring plant-based proteins**



Cultivated research priorities

- **Bioreactors capable of supporting high-density, large-volume cell cultures**
- **Scaffolding biomaterials that support cell adherence and differentiation**
- **Cell culture media optimization and recycling methods to reduce costs**



Fermentation research priorities

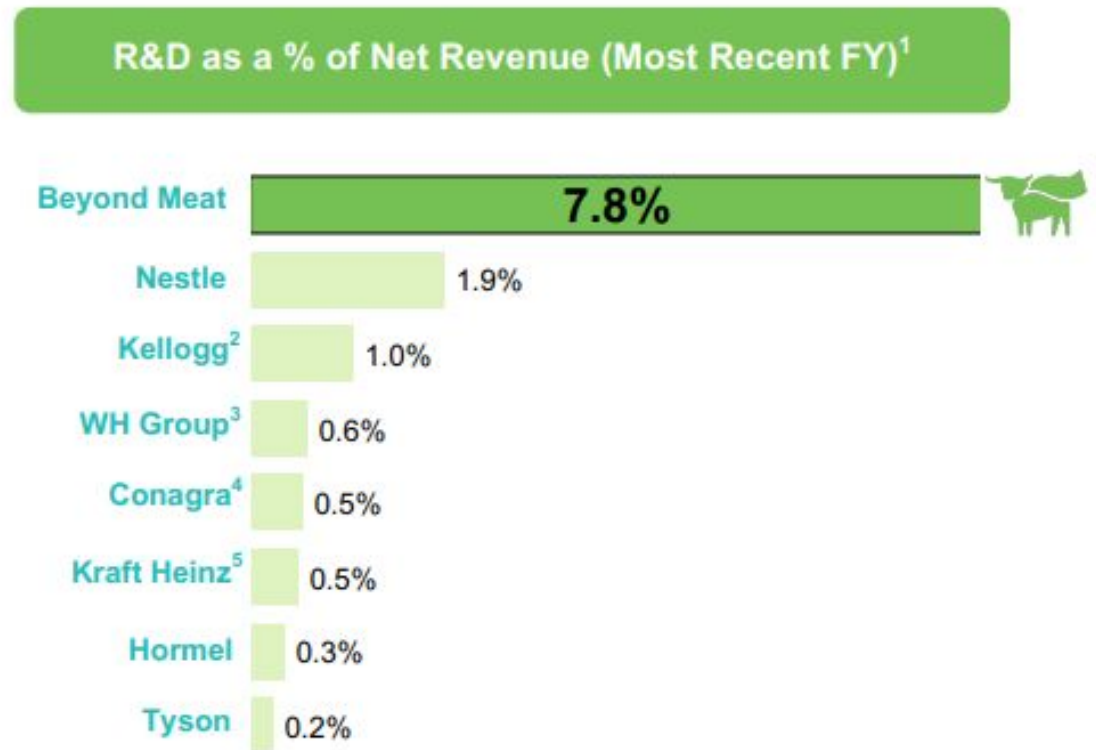
- **Increased titers and yields for fermentation-produced ingredients via strain engineering**
- **Screening and adaptation of novel strains as commercial candidates**
- **Feedstock optimization for leveraging existing biomass streams**

Detailed technology needs are catalogued at www.gfi.org/solutions.

Without open-access knowledge, private companies expend more R&D resources and take longer to bring products to market

Alt protein companies spend an outsized % of revenues on R&D — up to **40x more than traditional food & meat companies.**

Many companies require several years from founding to first product launch because of the R&D burden.



Source: Beyond Meat

Researchers around the world are eager to contribute to advances in alternative proteins

In the last four years, GFI's research grants program has received nearly \$85M worth of proposals, of which we are only able to fund about \$17M.



Governments should be stepping up to address the gap in open-access research funding

Global Innovation Needs Assessments (GINAs)



Global Innovation Needs Assessment on Protein Diversity, funded by UK's FCDO & Climateworks, November 2021:

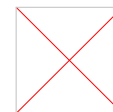
“To unlock the full benefits of alternative proteins, global public spending on R&D and on commercialization needs to increase to at least US\$4.4 billion and US\$5.7 billion per year, respectively.”

By contrast, total U.S. government R&D investment into alternative proteins thus far is on the order of \$20M. Globally, the figure is about \$50M.

Sources:

<https://www.climateworks.org/wp-content/uploads/2021/11/GINAs-Protein-Diversity.pdf>

<https://gfi.org/resource/research-grants-tracker/>



Interdisciplinary approaches are mission-critical



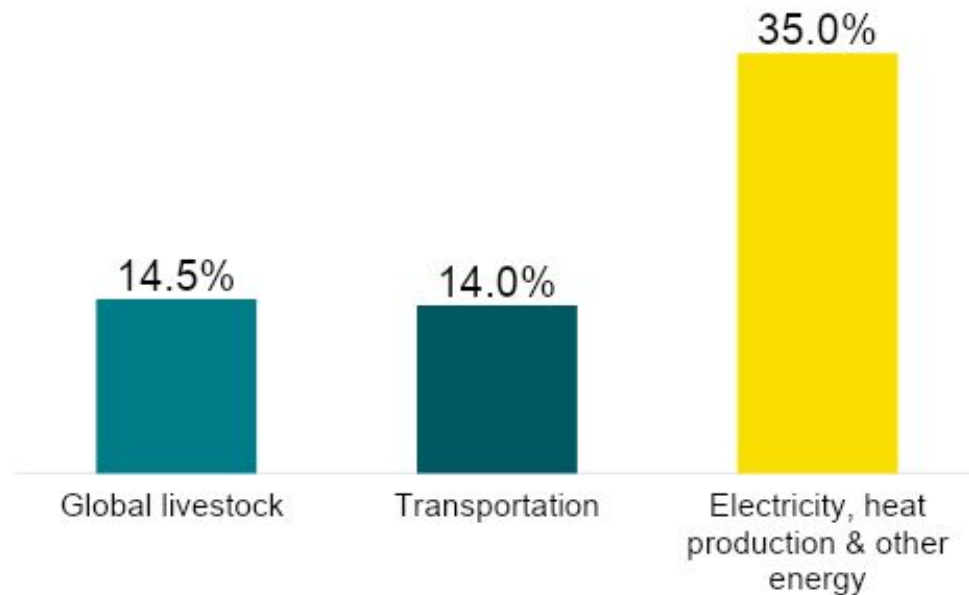
An interagency initiative to prioritize alternative protein-relevant research across many technical domains could dramatically accelerate this sector.



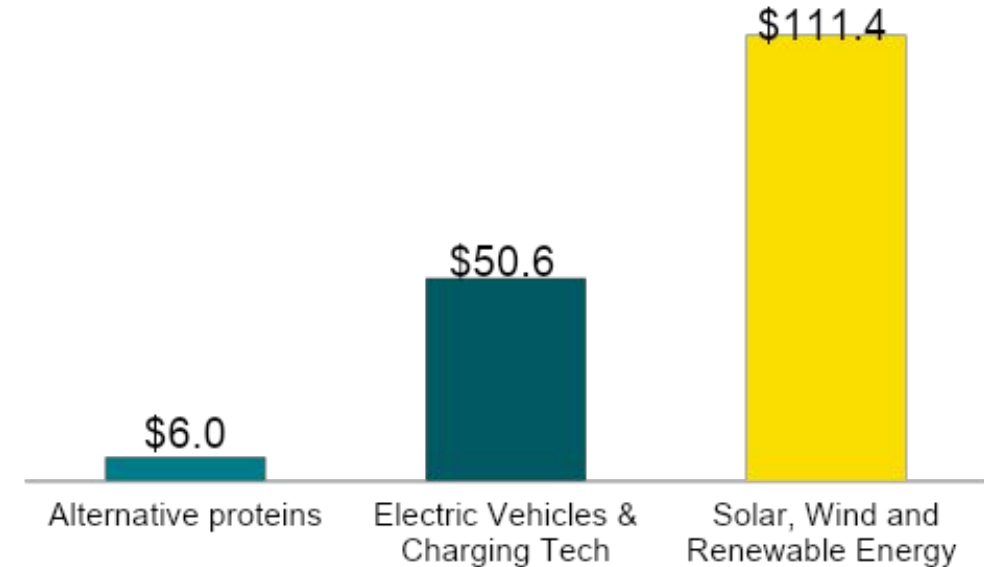
Alternative proteins are massively under-invested as a climate solution relative to their impact



Percent of global GHG emissions



Invested capital, \$ billions
Through December 31, 2020



Note: Invested capital includes accelerator and incubator funding, angel funding, seed funding, equity and product crowdfunding, early-stage venture capital, late-stage venture capital, private equity growth/expansion, capitalization, corporate venture, joint venture, convertible debt, and general debt completed deals. Data has not been reviewed by PitchBook analysts.

Source: U.S. Environmental Protection Agency (EPA), Food and Agriculture Organization of the United Nations FAO); GFI analysis of PitchBook Data, Inc.



Alternative proteins are the one food & ag climate mitigation solution that analogizes to renewable energy & electric vehicles. We need to invest in research and market incentives accordingly.



Thank you!



Contact:

Liz Specht | lizs@gfi.org

