New Harvest Annual Report

2019

New Lab - Brooklyn Navy Yard
19 Morris Avenue, Building 128
Brooklyn, New York, 11205

Industry Lab
288 Norfolk Street, #4
Cambridge, MA 02139

TABLE OF CONTENTS

Letter from the Executive Director....5

Leadership Team....5

Why Cellular Agriculture?....6

Mission & Vision....7

Our Theory of Change....8 - 12

Fostering Cell Ag Leaders....10

Filling the Funding Gap....11

2019 Milestones and Achievements by the Numbers....13

Research at New Harvest....14 - 19

Fellowship Program....15 - 17

Peer Reviewed Publications 2019-2020....18

Research Highlights....19

Engagement at New Harvest....20 - 25

New Harvest 2019 Conference....21 - 22

Community Events....23

Press and Speaking Engagements....24

Supporters....26

New Harvest is a 501(c)(3) nonprofit accelerating breakthroughs in cellular agriculture. Founded in 2004, we are the only research institute in the world dedicated exclusively to supporting open, public cultured meat research. This report presents an overview of our accomplishments in the 2019 calendar year.

LETTER FROM THE EXECUTIVE DIRECTOR

It has been six years since I took the reins of New Harvest. This year has been a pivotal point in our growth, and it would not have been possible without the dedication of our employees, donors, partners, and volunteers who all work tirelessly to advance this groundbreaking field. I am deeply grateful for your support.

The limiting factor in cellular agriculture continues to be the lack of dollars dedicated to this important scientific research. Unlike other innovative fields of research, cellular agriculture is not buoyed by multi-million dollar government grants. For long-term biotechnology innovations, this is a serious challenge. We have a lot more work to do!

This year we have been hard at work re-evaluating where we can make a difference, building infrastructure for maximum impact, and on top of that, growing! This transformation was enabled by our first multi-million dollar commitment: an escalating three year contribution from Avina Stiftung, a Swiss foundation dedicated to sustainable nutrition. For the first time, we were able to plan our long-term vision in five and ten-year increments rather than being limited by the uncertainty of next year's funding. For the first time, we could invest in the New Harvest engine to drive cellular agriculture further, faster.

In 2019 we doubled our team in size from three to six people, tripled our researcher headcount, opened a second research-dedicated office in Boston, and hosted our most successful conference to date with new highs for ticket sales, sponsorships, and engagement.

Especially gratifying has been seeing the research we began supporting so many years ago finally be published. Our research fellows published five papers this year, and New Harvest ourself published the world's first peer-reviewed paper on seafood production via cellular agriculture. We are excited to share several more exciting research findings in the coming year!

On behalf of New Harvest, thank you for your ongoing support of our mission.

Isha

Isha Datar
Executive Director

Leadership Team

Isha Datar
Executive Director

Kate Krueger, PhD
Research Director

Lanto Hariveloniaina
Operations Manager

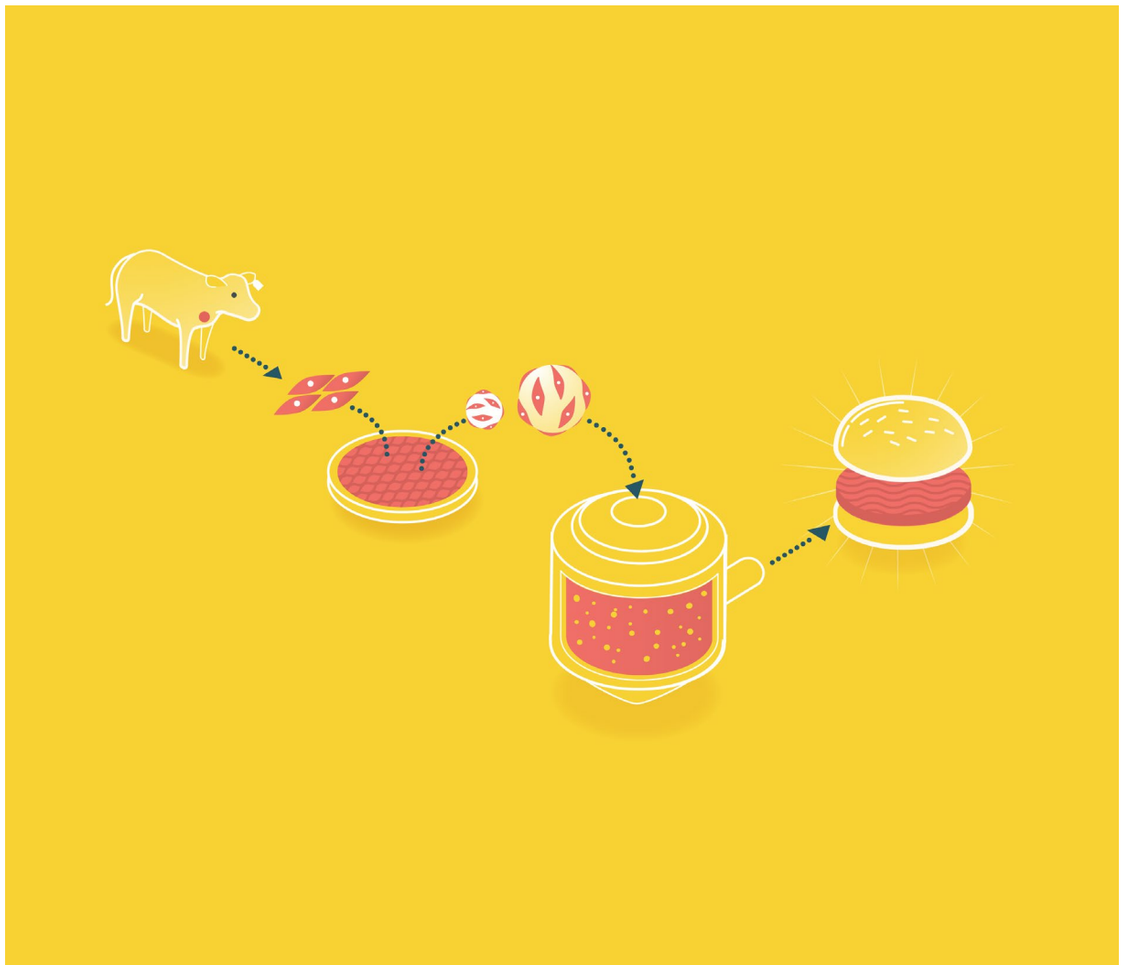
Jeremiah Johnston
Program Manager

Meera Zassenhaus
Engagement Associate

Michela Caffrey
Art Production Associate

Board of Directors: Scott Banister, Karien Bezuidenhout, Andras Forgacs, John Pattison, Vince Sewalt

WHY CELLULAR AGRICULTURE?



The planet is unable to sustain our current model of industrial animal agriculture.

In addition to being resource intensive, large-scale animal agriculture is ground zero for antibiotic resistance and zoonotic disease. No matter how successfully we optimize the use of animals as protein producers, large-scale animal agriculture remains at the mercy of weather events which only promise to be increasingly unpredictable in the years ahead.

Cellular agriculture has the potential to make our food system more resilient by diversifying the way we produce animal products. Instead of intensive crop and animal farming, cellular agriculture allows us to grow meat in factories akin to breweries, replacing feedlots and slaughterhouses with bioreactors. By growing animal products directly from the basic unit of life—the cell—we can make the kind of transformational change demanded by an accelerating climate crisis.

Above all, we can continue eating the foods we love without killing animals.

OUR MISSION is to build and establish the field of cellular agriculture.

OUR VISION is a world where food can be grown from cells, instead of animals, to feed our global population sustainably and affordably.

OUR THEORY OF CHANGE

New Harvest supports people and ideas that are not funded by traditional sources, either because the research is too early stage or because it lies outside the parameters of existing grants.

Despite the potential for cultured meat to mitigate climate change and the existential threat of antibiotic and zoonotic diseases, federal grants relevant to the building blocks of cultured meat—cells, scaffolds, media, and bioreactors— are earmarked for medical research.

That's where New Harvest comes in.

We give researchers the additional support they need to pursue agricultural applications (i.e. meat) of traditionally medical technologies.

As the nonprofit nucleus of a burgeoning cellular agriculture landscape, New Harvest is building the pipeline of talent and expertise necessary to sustain longevity and ongoing innovation in this nascent field.

New Harvest accelerates breakthroughs in cellular agriculture by:

1. Funding and conducting groundbreaking, neglected research

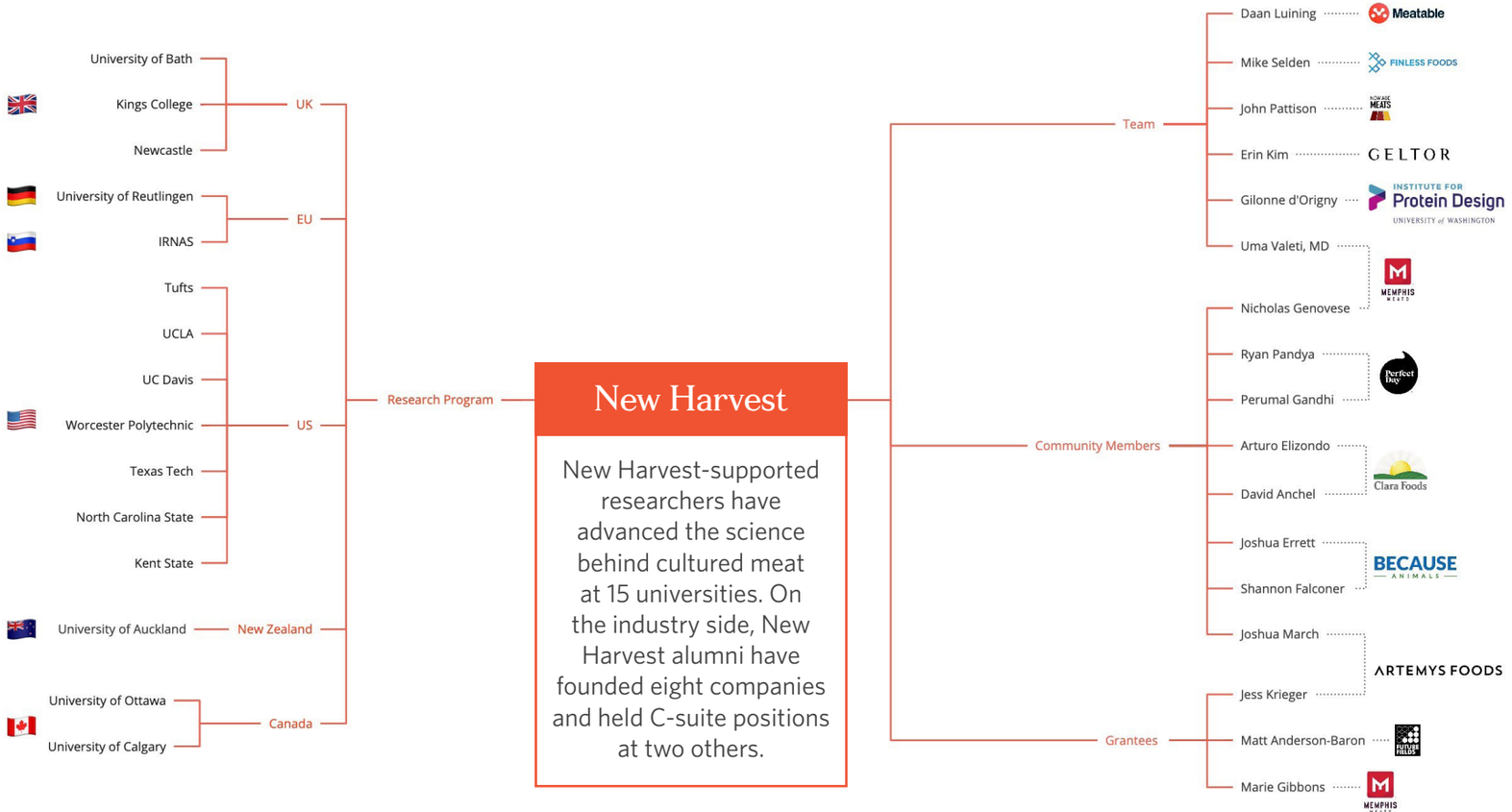
2. Communicating the progress and promise of cellular agriculture to the world

“The concept of cellular agriculture used to feel like science fiction, but discovering New Harvest has opened my eyes to the revolutionary work already being carried out to make it a reality.”

– Scott Allan, New Harvest Research Fellow & PhD Candidate at the University of Bath

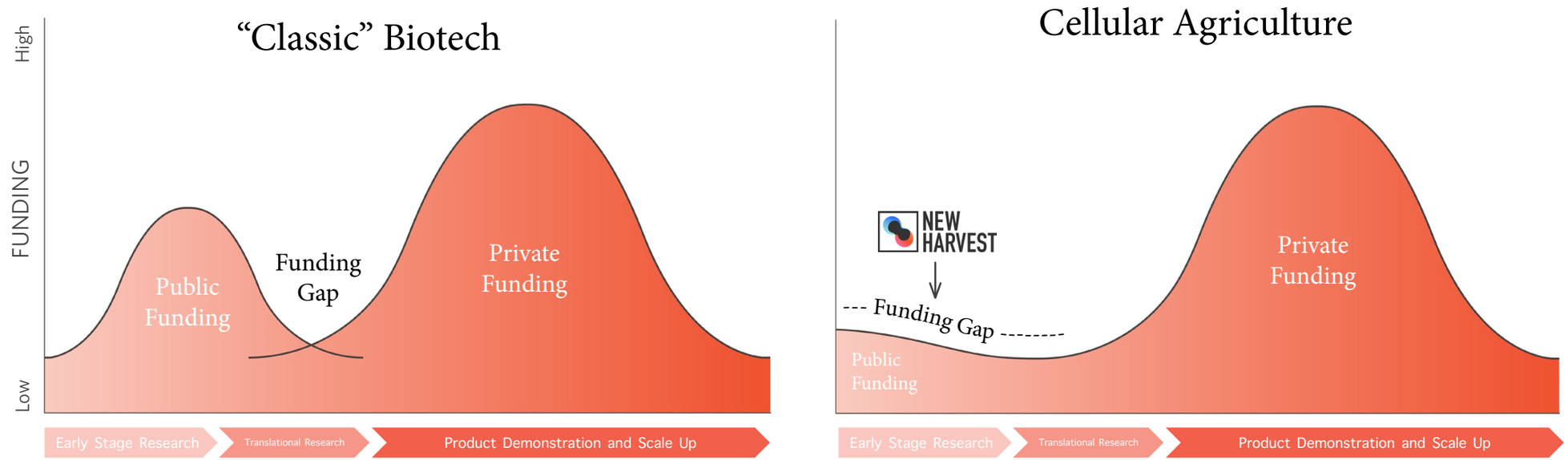
FOSTERING CELL AG LEADERS

New Harvest builds the cell ag talent pool, training the next generation of technical and non-technical leaders in the field through our research program and engagement activities. For every researcher New Harvest funds, many more join the field. As New Harvest fellows take on students of their own, collaborate with other labs, attend scientific conferences, and publish academic papers, they bring new scientists into the fold. This grows and legitimizes the field of cellular agriculture, populating academia and companies alike with experts in the science of cultured meat.



* This information is accurate as of Dec 31, 2019

FILLING THE FUNDING GAP



Scientific breakthroughs in cellular agriculture are limited by a lack of funding for precompetitive, early-stage research. Typically, the trajectory for biotechnology begins with government-funded, basic research that is too expensive and exploratory for companies to conduct in house. Once that discovery-stage research becomes promising, companies translate the findings out of the lab and into products that change the world.

Because it lies at the intersection of food and medical science, cultured meat is outside the scope of existing grants from traditional funding agencies. **New Harvest fills that funding gap, providing researchers with the support they need to conduct that crucial, discovery-stage research which precipitates breakthroughs.** By funding academic research, we create a foundation of open, public data that advances the entire field of cellular agriculture.

“I’m a monthly donor because New Harvest is funding public research in cellular agriculture. Without public research, Finless Foods has a very small hiring pool, a tiny amount of data to go off of, and very few people to share ideas with. The public sector is vital for any industry.”

– Mike Selden, Finless Foods

2019 MILESTONES AND ACHIEVEMENTS

Supported research which to date has yielded **10 peer-reviewed scientific publications**, receiving 56,673 views and 240 citations

Tripled our research headcount to **25 laboratory scientists**

Doubled our team from 3 to **6 full-time employees**

Raised **$1.4 million**

Hosted **300** New Harvest Conference **attendees** from around the world

Closed out the decade raising **$5 million** from **913 donors**

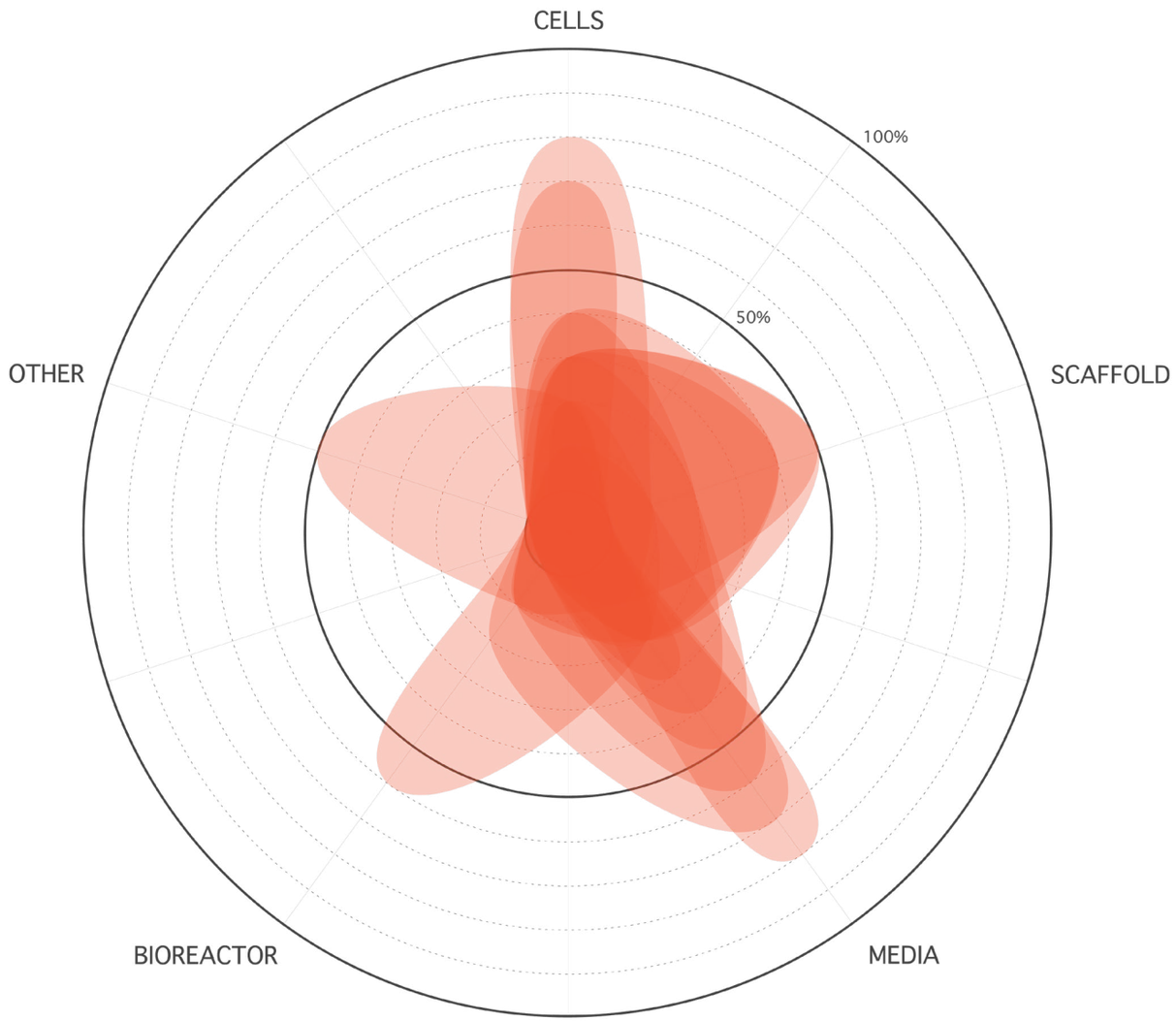
Added **7 additional researchers** to the New Harvest Fellowship Program, doubling it in size

Added **1 new research-dedicated office** in Boston

"New Harvest is the life-blood of Cellular Agriculture" - Shannon Falconer, Because Animals

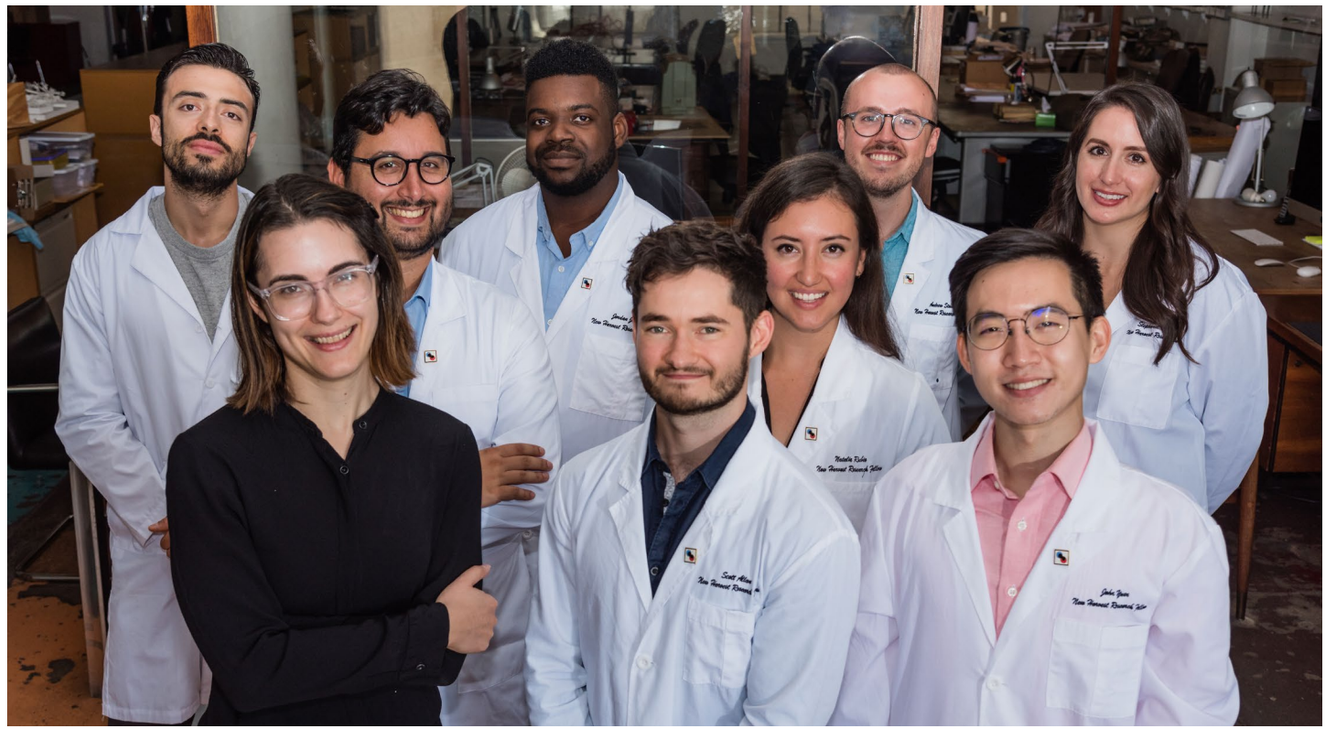
RESEARCH AT NEW HARVEST

New Harvest supports research addressing neglected gaps in the science of cultured meat. Driven by the understanding that "a rising tide lifts all boats," our research program prioritizes public, academic research in order to increase the amount of open-source information available about cultured meat. In a field where knowledge sharing and field-specific training are rare, New Harvest fills a crucial gap, providing tools, resources, and trained talent for cultured meat innovations.



In 2019, we funded 17 projects across six countries in the following key areas >>

FELLOWSHIP PROGRAM



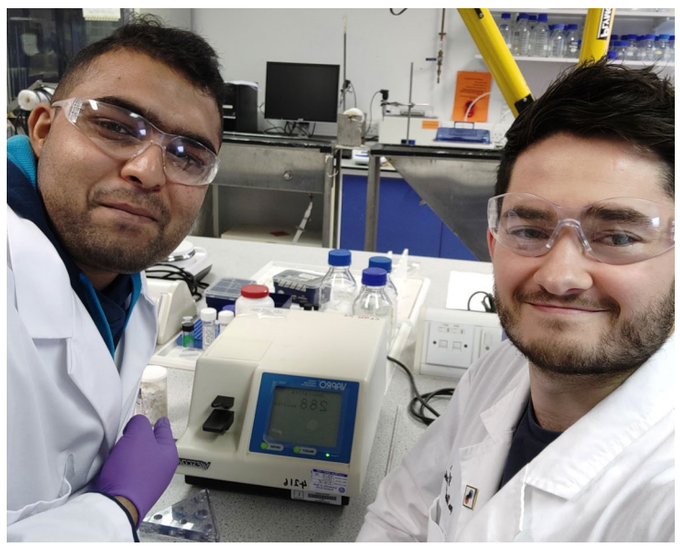
The New Harvest Fellowship is our flagship program. Like the National Science Foundation Graduate Research Fellowship Program and the Shuttleworth Foundation Fellowship Program, **the New Harvest Fellowship funds the individual researcher rather than the project they undertake**. This structure gives our researchers the freedom to follow experimental leads and adjust their work to the rapidly changing needs of the field.

2019 Fellows

Scott Allan
Santiago Campuzano
Zac Cosenza
Ricardo Gouveia, PhD
Jordan Jones
Stephanie Kawecki
Ted O'Neill
Sam Peabody
Natalie Rubio
Cameron Semper, PhD
Kai Steinmetz
Andrew Stout
Jannis Wollschlaeger
John Yuen

“New Harvest awarded me the opportunity to start my graduate degree in cellular agriculture at Tufts University, an opportunity that would have been next to impossible to secure without their network and financial support. Today, New Harvest means having a community of support as I struggle through day-to-day challenges in the lab.”

– Natalie Rubio, New Harvest Research Fellow and PhD Candidate at Tufts University

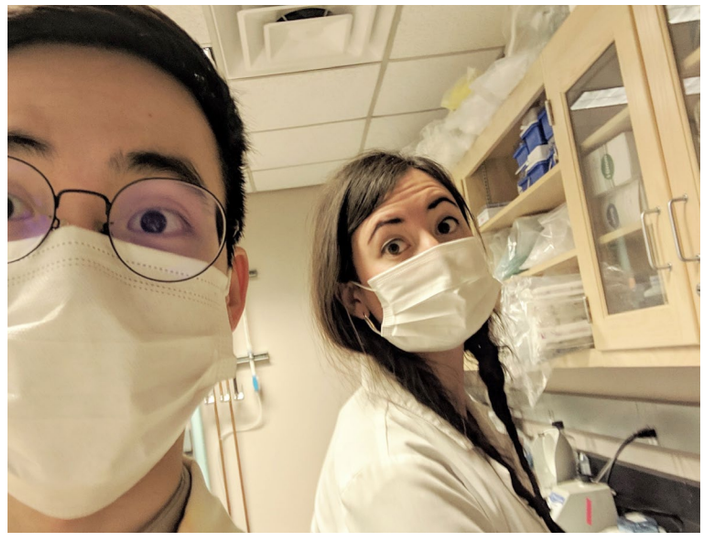


FELLOWSHIP PROGRAM

Once fellows are admitted to our program, they attend a **yearly lab meet** and participate in a **weekly Fellow Up**—a distributed group meeting conducted via Slack that connects our team around the world. These meetings keep our researchers on track and give them a forum to ask questions and share protocols specific to their work. *Most importantly, these meetings create a network of mutual support and mentorship*—a critical component to success in often lonely PhD and postdoctoral research, especially in such a small and novel field.

2019 was a landmark year in which we significantly increased the scope of our work:

- Incoming grant applications doubled
- Seven new research fellows joined our fellowship program, doubling it in size
- New Harvest research fellows published six peer-reviewed scientific publications



PEER-REVIEWED PUBLICATIONS 2019-2020

frontiers in Sustainable Food Systems

REVIEW
published: 17 April 2019
doi: 10.3389/fsufs.2019.00024

Possibilities for Engineered Insect Tissue as a Food Source

*Natalie R. Rubio [1,2], Kyle D. Fish [1], Barry A. Trimmer [2] and David L. Kaplan [1]**

[1] Kaplan Research Group, Biomedical Engineering Department, Tissue Engineering Resource Center, Tufts University, Medford, MA, United States, [2] Trimmer Research Group, Neuromechanics and Biomimetic Devices Laboratory, Biology Department, Tufts University, Medford, MA, United States

foods

MDPI

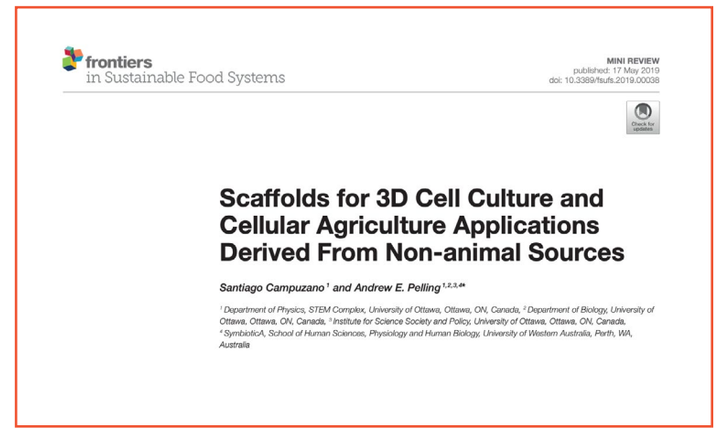
Article

Extracellular Heme Proteins Influence Bovine Myosatellite Cell Proliferation and the Color of Cell-Based Meat

Robin Simsa [1,2,3], John Yuen [1], Andrew Stout [1], Natalie Rubio [1], Per Fogelstrand [3] and David L. Kaplan [1,*]

1 Department of Biomedical Engineering, Tufts University, Medford, MA 02155, USA; robin.simsa@verigraft.com (R.S.); John.Yuen_Jr@tufts.edu (J.Y.); Andrew.Stout@tufts.edu (A.S.); Natalie.Rubio@tufts.edu (N.R.)
2 VERIGRAFT AB, 41346 Gothenburg, Sweden
3 Wallenberg Laboratory, University of Gothenburg, 41345 Gothenburg, Sweden; Per.Fogelstrand@wlab.gu.se
* Correspondence: david.kaplan@tufts.edu; Tel.: +617-627-3251

Received: 10 October 2019; Accepted: 18 October 2019; Published: 21 October 2019



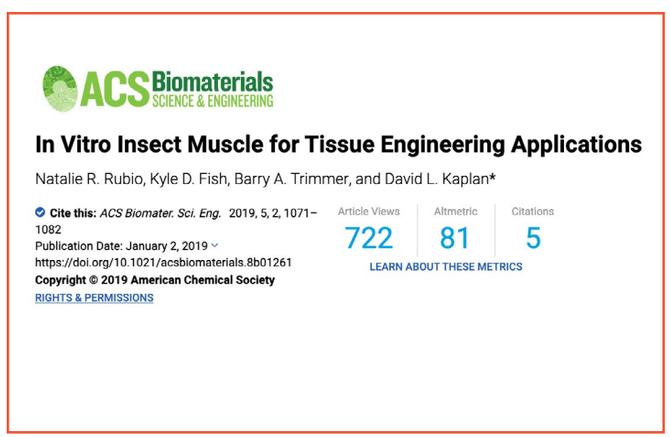
frontiers in Sustainable Food Systems

MINI REVIEW
published: 17 May 2019
doi: 10.3389/fsufs.2019.00038

Scaffolds for 3D Cell Culture and Cellular Agriculture Applications Derived From Non-animal Sources

*Santiago Campuzano [1] and Andrew E. Pelling [1,2,3,4]**

[1] Department of Physics, STEM Complex, University of Ottawa, Ottawa, ON, Canada, [2] Department of Biology, University of Ottawa, Ottawa, ON, Canada, [3] Institute for Science Society and Policy, University of Ottawa, Ottawa, ON, Canada, [4] SymbioticA, School of Human Sciences, Physiology and Human Biology, University of Western Australia, Perth, WA, Australia



ACS Biomaterials SCIENCE & ENGINEERING

In Vitro Insect Muscle for Tissue Engineering Applications

Natalie R. Rubio, Kyle D. Fish, Barry A. Trimmer, and David L. Kaplan*

Cite this: *ACS Biomater. Sci. Eng.* 2019, 5, 2, 1071−1082
Publication Date: January 2, 2019
https://doi.org/10.1021/acsbiomaterials.8b01261

Article Views 722 | Altmetric 81 | Citations 5

LEARN ABOUT THESE METRICS

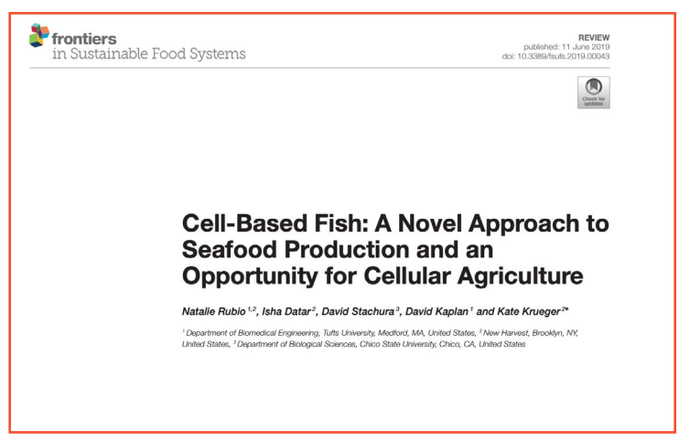
frontiers in Sustainable Food Systems

MINI REVIEW
published: 12 June 2019
doi: 10.3389/fsufs.2019.00044

Bioprocess Design Considerations for Cultured Meat Production With a Focus on the Expansion Bioreactor

Scott J. Allan [1,2], Paul A. De Bank [3] and Marianne J. Ellis [2]*

[1] EPSRC Centre for Doctoral Training, Centre for Sustainable Chemical Technologies, University of Bath, Bath, United Kingdom, [2] Department of Chemical Engineering, University of Bath, Bath, United Kingdom, [3] Department of Pharmacy and Pharmacology, University of Bath, Bath, United Kingdom



frontiers in Sustainable Food Systems

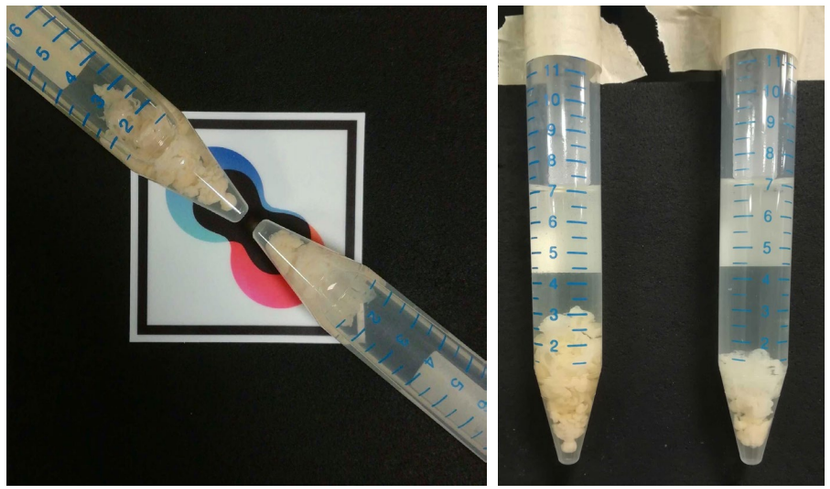
REVIEW
published: 11 June 2019
doi: 10.3389/fsufs.2019.00043

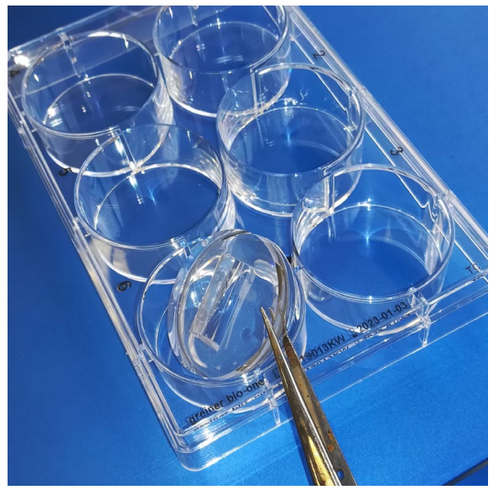
Cell-Based Fish: A Novel Approach to Seafood Production and an Opportunity for Cellular Agriculture

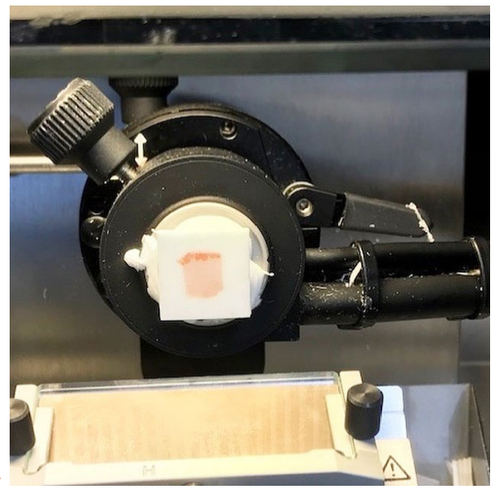
*Natalie Rubio [1,2], Isha Datar [2], David Stachura [3], David Kaplan [1] and Kate Krueger [2]**

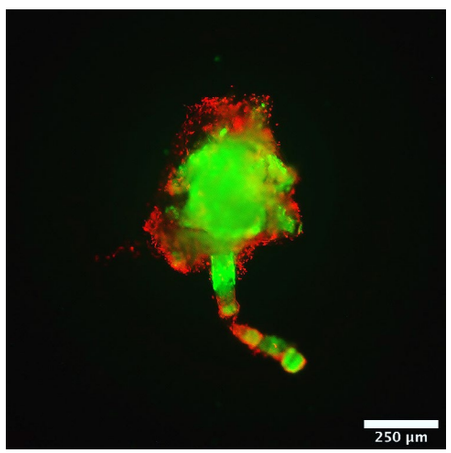
[1] Department of Biomedical Engineering, Tufts University, Medford, MA, United States, [2] New Harvest, Brooklyn, NY, United States, [3] Department of Biological Sciences, Chico State University, Chico, CA, United States

RESEARCH HIGHLIGHTS

1. 

2. 

3. 

4. 

5. 

6. 

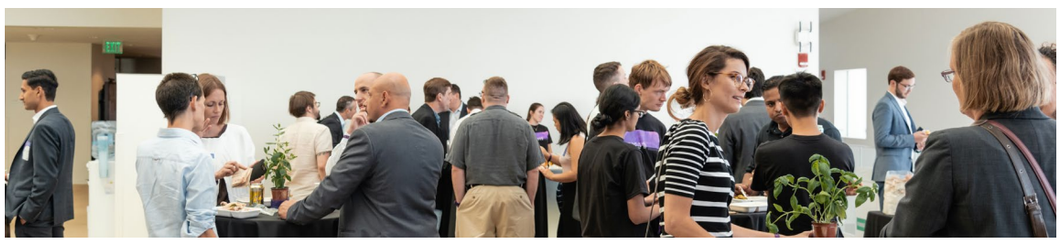
1. Structured (on left) vs. unstructured (on right) muscle tissue. Both were grown *in vitro*, but the structured meat was grown on curved surfaces—inducing the cells to align and form highly organized tissue
2. Custom-made silicon cell culture wells with defined curvature (Dr. Ricardo Gouveia, NH Fellow at Newcastle University)
3. Cryosectioning of marbled beef for scaffold analysis of native tissue (Stephanie Kawecki, NH Fellow at University of California Los Angeles)
4. Fluorescent microscopy image of manduca sexta (caterpillar) embryonic precursor cells differentiated with insect molting hormone 20-hydroxyecdysone (Natalie Rubio, NH Fellow Tufts University)
5. Hydrogel scaffold for growing meat cells in 3D (John Yuen, NH Fellow at Tufts University)
6. Decellularized iceberg lettuce scaffold for bovine cells (Jordan Jones, NH Fellow at Worcester Polytechnic Institute)

ENGAGEMENT AT NEW HARVEST

It is of the utmost importance to start early in engaging the public about cellular agriculture. As a nonprofit, New Harvest is in a unique position to educate and build public trust by being open and transparent about the science of cultured meat. **As we communicate the progress and promise of cellular agriculture to the world, we are guided by pillars of integrity, inclusive expertise, and informed optimism**. Rather than being a spokesperson for the field, New Harvest uses our platform to elevate a diversity of expert voices. Cellular agriculture is a nascent field—there remains much to figure out! We believe the best way to build public trust is to be honest about what we do and don't know and bring stakeholders in early to figure out the thorny nuances alongside us.

NEW HARVEST 2019 CONFERENCE

July 19 & 20 || MIT Media Lab, Cambridge, MA



The New Harvest conference is our annual event convening key stakeholders in the field of cellular agriculture to discuss scientific challenges, regulatory hurdles, and industry developments. As the only major cultured meat event on the East Coast, our conference fills a crucial gap in a cell ag landscape concentrated in the Bay Area.

Capped at 300 attendees, New Harvest's conference is deliberately intimate in order to foster meaningful connections between students, companies, investors, researchers, and policymakers. **In 2019, we saw student attendance grow from 29 to 72**. These students constitute a pipeline of talent and expertise for companies, and the growth in student attendance testifies to our research program's success in growing cellular agriculture as a scientific discipline.

Featured Speakers

Ka Yi Ling, PhD
SHIOK MEATS

Eric Schulze, PhD
MEMPHIS MEATS

Jun Axup, PhD
INDIEBIO

Jonathan Breemhaar
MOSA MEATS

Keith Cox, PhD
SEAFOOD ANALYTICS

Nina Buffi, PhD
OSPIN

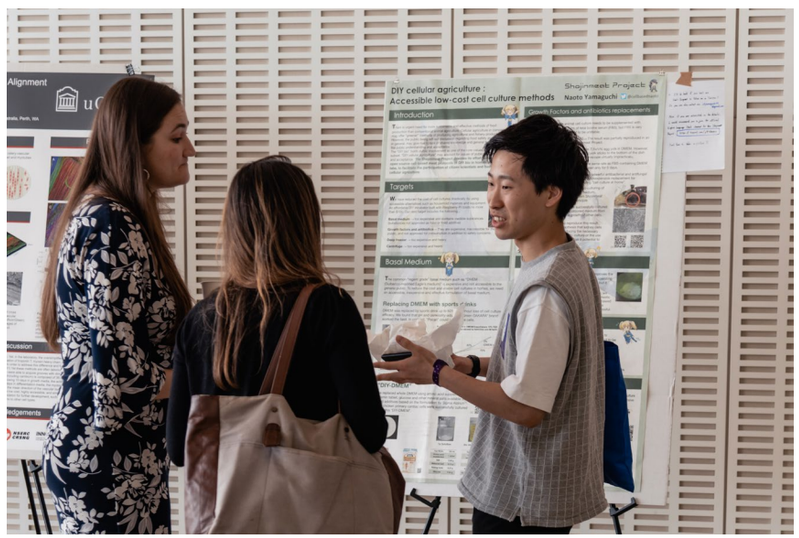
...and many more!

"The New Harvest Conference holds a special place in my heart as it was my very first exposure to the Cell-Ag industry. The connections I made at that conference directly lead to both my investment and entrepreneurship in the Cell-Ag space."
- Dave Schnettler, Co-founder of Lab Farm Foods

"The New Harvest conference is one of the only events in the field that is truly all about pushing the field forward and focused on getting cell ag products on the market."
- Matt Anderson-Baron, Co-founder of Future Fields

1.

2.



3.

4.

5.

1. Eric Schulze of Memphis Meats, Brian Sylvester of Foley & Lardner LLP, and Rohini Banskota of Finless Foods discussing regulatory pathways for cell-based meat
2. Student research posters
3. The audience—rapt with attention!
4. New Harvest Research Fellow Santiago Campuzano presenting about vegetable scaffolds
5. CellLink3D exhibiting a bioprinter

“Before this conference, I knew of Cell Ag and thought it was an exciting idea, but too early and small of a niche to consider for future career prospects. After attending and connecting with so many great entrepreneurs, motivators, and researchers, I was shocked to find how rapidly emerging and expansive this community really is. I left inspired to shift my career aspirations in the direction of Cell Ag to help further advance this field.”

– Cory Jubinville, PhD Candidate at the University of Connecticut

ICE CREAM TASTING with Perfect Day™

Perfect Day started out as the New Harvest Dairy Project, and 2019 marked the sale of their first cell ag dairy product available to the public. We celebrated Perfect Day's commercial debut with a NYC tasting of their limited edition ice cream trio. Community members joined New Harvest in our office to taste pints of Vanilla Salted Fudge, Milky Chocolate, and Vanilla Blackberry Toffee—each of which contained real dairy proteins made without cows and created, instead, via fermentation.

THANKSGIVING DINNER at Genspace

Along with Genspace, a community biolab in Brooklyn, New Harvest co-hosted an interactive potluck to imagine futures of cultured meat production. Using scents provided by International Flavors and Fragrances, visiting artist Finn Stevens created a tasting menu consisting of smell devices coupled with textured yet tasteless foods to ask the question: how can we harness the power of scent to create edible flavor at a fraction of the carbon cost of food we eat today?

LAB TOUR and HAPPY HOUR at GINKGO BIOWORKS™ THE ORGANISM COMPANY

In 2019, we opened a research-dedicated office in Boston. That move allowed New Harvest to be in the thick of the city's biotech hub and collaborate with industry leaders in adjacent fields. Shortly upon arriving, our research director Kate organized a meet-up at Ginkgo Bioworks to connect with local students interested in pursuing a career in cellular agriculture.

OUR TEAM AND RESEARCH FELLOWS SPOKE AT:

92Y Food Summit
American Meat Science Association
Cultivate UK
Cultivated Meat Modeling Consortium
Cultured Meat Symposium
Effective Altruism Global
Gemic
Good Food Conference
Human Nutrition Research Centre at Newcastle University
In Vitro Biology Meeting
International Conference on Cultured Meat
Latin American Poultry Congress
Medical and Biological Sciences Society at St. Peter's School
MIT Media Lab
New America
Peace Accelerators
Reciprocal Meat Conference
South Western Ophthalmology Society Meeting
SynBio Markets
Technical College System of Georgia Leadership Conference
Tufts 3 Minute Thesis Competition
Tufts Food System Symposium
U.S. Government Accountability Office
Vimifos
Viriditas: Engineering Biology for Space Exploration

OUR TEAM AND RESEARCH FELLOWS WERE FEATURED IN:

WSJ
THE NEW YORKER
BBC
POPULAR MECHANICS
QUARTZ
CIVIL EATS
N SERIES explained
grist
The Counter

and more...

“No matter when that avidly-sought ‘first product’ hits shelves, the mission of Cell Ag won’t be finished in a year, or two, or fifty. It will instead be a continuing, challenging, and changing process. Because of this, New Harvest’s dedication to a bottom-up, holistic, product-patient approach—where foundational research and openness are king—is essential for the field’s long-term growth.”

- Andrew Stout, New Harvest Research Fellow and PhD Candidate, Tufts University

SUPPORTERS

New Harvest is 100% donor funded. We would like to give a heartfelt thank you to the over 913 active and engaged members of our community for your financial contributions. When we see cultured milk, meat, and eggs on our dining tables, in grocery stores, or on space stations one day, it will be thanks to you for having the foresight to envision a world that escapes the absurdities of animal agriculture.

Thank you to these foundations from around the world for their generous support of this critical research.

AVINA

SHUTTLEWORTH FOUNDATION

TIPPING POINT PRIVATE FOUNDATION

inVivo

SEAL OF TRANSPARENCY PLATINUM GUIDESTAR

STATEMENT OF VALUES:
New Harvest is an independent 501(c)(3) research institute. We are committed to the independence and autonomy of New Harvest's programming and initiatives. New Harvest does not accept funding that challenges the independence of our organization or the academic freedom of our researchers and fellows.


NEW
HARVEST