

Food System Innovations, Science Communication, and Deficit Model 2.0:
Implications for Cellular Agriculture

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Garrett M. Broad, Ph.D.
Associate Professor of Communication and Media Studies
Fordham University
ORCID ID: 0000-0001-5217-1862
E-mail: gbroad@fordham.edu

Charlotte Biltekoff, Ph.D.
Associate Professor of American Studies & Food Science and Technology
University of California, Davis
ORCID ID: 0000-0002-8407-0772
E-mail: cbiltekoff@ucdavis.edu

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ABSTRACT

This commentary examines the emerging field of cellular agriculture, which aims to use the tools of synthetic biology to create a world of abundant, nutritious, sustainable, and ethical meat and other animal products without animal slaughter. Concerned that a lack of public acceptance could present an obstacle to success, the field has coalesced around a set of communicative practices – based not only in sharing information, but also in communicating shared values – that industry leaders believe will prove effective at persuading the public. We term this paradigm “Deficit Model 2.0,” a hybrid framework that retains essential elements of the traditional deficit model of science communication while incorporating new understandings of culture and public engagement into the approach. We outline the deficiencies of this perspective and offer suggestions for a more sustainable approach to cellular agricultural and its food system communication strategy.

Keywords: Cellular agriculture, deficit model, science communication, cell-cultured meat, sustainability

Introduction

The first morning of the two-day New Harvest 2019 conference included a mix of talks on the science, engineering, and entrepreneurship of cell-cultured meat (alternately referred to as cell-based meat, cultivated meat, and lab-grown meat, among other names). It was the fourth annual event hosted by the non-profit organization New Harvest, a research institute focused on advancing the science of cell-cultured meat and building the field of cellular agriculture (which also includes products such as animal-free dairy, biofabricated leather, and other attempts to create animal-derived goods using synthetic biology). Just before the lunch break, the conversation shifted to the prospects of consumer engagement, as Deborah Arcoleo, founder of Transparency Ventures and former Director of Product Transparency for The Hershey Company, took to the stage. “I’m going to share with you a little bit of my experience working in ‘Big Food’ and what we’ve learned in that environment about trust and transparency,” Arcoleo began, using air quotes to indicate her misgivings with a term often used to deride the food industry. “Then I’ll pivot a little bit to what I think this means for the emerging new field of cellular agriculture” (New Harvest, 2019). The presentation’s takeaways were clear – people do distrust “Big Food,” but trust can be built through greater transparency. Importantly, Arcoleo emphasized, facts and data are not enough – instead, new food tech innovators need to emphasize shared values with the public, present stories via trusted messengers, directly address fears, and offer clear and simple solutions.

At the time of this writing, the first commercial sales of cell-cultured meat were recently made in Singapore, while animal-free dairy products are beginning to appear in the United States retail market. The biggest boosters of cell-cultured meat are bullish on its prospects, insisting that we are but a few decades away from leveraging the tools of biotechnology to create a world of abundant, ethical, cruelty-free, nutritious, and sustainably produced meat, without the need to

raise and slaughter animals at all. One of the biggest potential obstacles to that transformative success, as they understand it, is a consuming public that might not fully understand or accept this new product and its inherent advantages. In the words of Bruce Friedrich of the alternative protein advocacy group the Good Food Institute, “it is possible to provide the same meat-centric dishes that people love by cultivating meat directly from animal cells. This method will use far less land and water. It will help curb the rising antimicrobial resistance driven by modern industrial animal agriculture. It will help us feed 10 billion people on a planet with finite, increasingly depleted resources. But only if consumers embrace it” (Friedrich, 2019). Will cell-cultured meat have the chance to transform the world, cell-cultured meat advocates wonder, or will it become mired in unnecessary public controversy, stalling out before it can change much at all?

As two food systems scholars who have conducted multiple years of fieldwork, separately, on the topic of cellular agriculture, we write this commentary, collectively, to share several concerns about the emerging field’s approach to communication and the public. Our big-picture goal is to push those involved in cellular agriculture to consider how their communicative practices might enable or constrain their contribution toward a sustainable food system in the future. A sustainable food system, as we understand it, is one that delivers food security and nutrition for all, at the same time as it has a positive or neutral impact on the natural environment, promotes broad-based benefits for society, and encourages equitable economic benefits (Nguyen, 2018). Notably, in this current article, our aim is not to assess the technical or economic viability of cell-cultured meats at this stage, a topic that has been explored in depth elsewhere and remains an ongoing challenge (Santo et al., 2020). Instead, we strive to articulate 1) why key communicative assumptions that permeate the nascent cell-cultured meat community

are deficient, and 2) what a more transformative and sustainable approach to communicating cellular agriculture, in line with the core promises of the industry, could actually look like.

From the Deficit Model to Deficit Model 2.0

The dominant mode of professional science communication that developed in the mid-20th century assumed that a cognitive deficit could explain a lack of societal support for various initiatives in science and technology (Wynne, 2006). As a report from the National Academies (2017) explained it, “In this model, ‘the science’ of an important question is settled, and stands immutable and clear to the experts; the task of communication is simply to explain the facts to the public” (p. 21). For many years, this “deficit model” guided how the food industry introduced novel food technologies to the public, as well as how they responded to growing public concerns about food industry impacts (Lusk, Roosen, and Bieberstein, 2014). For example, the Alliance to Feed the Future (AFF) was created in the 2000s as a direct response to “Real Food” advocates who criticized the industrialized food system. The AFF developed school curriculum materials that emphasized “Real Facts” about the merits of industrial food, a stance that assumed any criticism was simply a product of ignorance that could be corrected through education (Biltekoff, 2016).

At the same time, decades of science communication research has shown that the deficit model has multiple deficits of its own. Among other limitations, the perspective tends to ignore the complexity inherent to scientific “facts,” assumes a single communication approach can be applied effectively to diverse audiences, deflects institutional responsibility as a source of mistrust, and fails to consider how different value systems might lead to different conclusions about what actions are appropriate (National Academies, 2017). Starting around the 1990s, then, a “grand narrative” began to take shape across a diverse set of global institutions that the public

communication of science and technology needed to move away from the deficit model.

Communicators operating in the public and private sectors were encouraged by academics and policymakers to engage the public in transparent dialogue, to consider the values at the root of public perceptions, and to micro-target messaging based on demographic and psychographic differences (Trench, 2008).

Instead of being replaced, however, the deficit model has evolved in only minor ways or, in many instances, persisted largely untouched from its original form (Wynne, 2006; Marris, 2015). We term this updated paradigm, “Deficit Model 2.0,” a hybrid framework that retains essential elements of the traditional deficit model, but also incorporates new understandings of communication, culture, and publics that are distinct from science communication of the past. In Deficit Model 2.0, science communicators recognize that cultural worldviews influence public perceptions, but they still believe that negative public reactions are largely the product of public misunderstanding, scientific or otherwise. In this context, industries may make more of an effort to gauge public opinion before taking new technologies and products to the market, but they rarely incorporate stakeholders into the early stages of defining key problems, articulating desired benefits, or developing appropriate solutions. Public concerns are taken more seriously than in the original deficit model, but they are still addressed instrumentally, as a challenge to be overcome through targeted messaging, rather than as something to be understood, respected, and responded to. In this process, there remains little room for ambiguity or ambivalence, as the public is forced into a binary decision to either “accept” or “refuse” the innovation, with those in the latter category often dismissed as “anti-science.” Fundamentally, Deficit Model 2.0 differs from its predecessor in that it encourages leaders in science and industry to understand that a host

of intersecting social and economic factors can lead to public distrust, but it still encourages little to no reflexivity about science and industry's own role in breeding that distrust.

Organizations like the Center for Food Integrity (CFI), an industry funded non-profit that offers the food industry guidance on how to communicate with a wary public, demonstrate the evolution of the deficit model. Notably, CFI's "Trust Model" emphasizes the importance of confidence over competence, insisting that communicating shared values to consumers is far more powerful than demonstrating fact-based expertise. Their work consistently highlights the importance of market segmentation, arguing that understanding the differing mindsets of "consumer food tribes" is key to successfully reaching them. Ultimately, CFI's membership is encouraged to listen and ask questions of consumers, to deploy value-driven messages based on that feedback, and to use transparency to neutralize consumer bias against "Big Food" (Center for Food Integrity, 2015).

The field of cellular agriculture is taking shape at a moment when the Deficit Model 2.0 approach, embodied by the likes of CFI, has become a norm in science communication and across the food industry. CFI's work was actually cited by Arcoleo in her presentation at New Harvest, while recent research by CFI has applied its model directly to the topic of alternative proteins (Center for Food Integrity, 2019). The remainder of this commentary explores what this communicative context means for cellular agriculture, and what alternative approaches to public engagement might exist.

Deficit Model 2.0 and Cellular Agriculture

At this stage, the most prominent voices who promote the transformative potential of cellular agriculture are entrepreneurs, investors, scientists, and other advocates who have either emerged from within the industry itself or are closely linked to it. Developing communicative norms in this landscape reflect a mix of traditional and evolved forms of deficit model thinking.

Fundamentally, the community's anticipatory focus on "consumer acceptance" as its primary social challenge is quintessential deficit-oriented thinking (Biltekoff and Guthman, Under Review). Industry-rhetoric emphasizes that the future of cell-cultured meat and other alternative proteins will depend on their ability to compete with conventional animal products on the basis of taste, price, and convenience. Recent years have also seen a proliferation of academic research studies that test out different terms for cell-cultured products, assess the impact of risk and benefit frames, and investigate what might prevent technological embrace (Bryant and Barnett, 2020). There is, of course, truth to the idea that these factors will influence consumer perceptions and behaviors. In this formulation, however, engagement begins downstream, with technologies already fully conceptualized and the public understood merely as consumers in need of implicit or explicit persuasion. Upstream practices of participatory dialogue – about the benefits that cellular agriculture could and should bring, as well as the risks that might emerge in concert – are given short shrift.

Other communication activities demonstrate minor evolutions in line with Deficit Model 2.0. Primary is an insistence that the field, inhabited by startups and venture capital though it may be, is driven by an ethical mission rather than by a simple profit motive. Here, some even contrast cellular agriculture to earlier innovations in genetically modified (GM) foods, arguing that cell-cultured meat's mission orientation will prevent the backlash experienced by the corporate-dominated GM food industry. Mohorčich and Reese (2019) provide a thorough rebuttal to this claim, demonstrating how early GM food innovators were actually mission-driven too, and that, "Cultured meat is not associated with large corporations for the simple reason that large firms have not yet bought out the startups developing cultured meat" (p. 3-4). Additional research has shown that public communication strategies that actively promote grand societal

promises while minimizing profit motives can actually generate more distrust and skepticism; the public is not averse to profit per se, but they want profit-seeking entities to be transparent about that fact too (Marris, 2015).

Indeed, cell-cultured meat advocates insist that an industry-wide commitment to transparency – in both scientific processes and public relations – will protect cell-cultured meat from public backlash (Khan, 2020). Yet, it is clear that the norms of privately-funded science are leading to high levels of secrecy about cell-cultured meat inputs and impacts, regardless of rhetorical commitments by industry leaders to the contrary. Since limited public funding has been allocated to support cellular agriculture, most research is conducted by venture-backed companies with strong intellectual property protections, as well as a propensity to enforce non-disclosure agreements that can limit knowledge sharing (Chiles et al., 2021). Despite calls from several cellular agriculture non-profit advocacy groups about the ways transparency and open data could accelerate the scientific endeavor and engender public confidence, there is little to suggest that this is actually being put into practice by the most prominent industry actors (Guthman and Biltekoff, 2020).

At least one more hallmark of Deficit Model 2.0 deserves attention – that is, the cell-cultured meat community’s psychographically segmented understanding of the public. Gone are the days of a one-size-fits all outreach approach, supplanted by an understanding that different audiences will need different messages and messengers to be convinced. They assert that the uptake of cell-cultured meat will happen gradually, among different market segments over time, in line with the classic “diffusion of innovations” curve (Szejda and Urbanovich, 2020). Some cellular agriculture insiders do recognize that cultural factors or negative media coverage could prevent rapid diffusion, but their public-facing projections remain sunnier than many other

observers'. Here, again, key elements of deficit thinking are on display – including an instrumental and downstream model of public engagement, a forced binary between public acceptance and rejection, and extremely limited reflexivity about institutional culpability in breeding mistrust.

While many advocates for cellular agriculture are motivated by environmental and animal welfare concerns, their commitment to alternative proteins signals a belief that market-driven technological innovation offers the best – if not only - chance for achieving their goals. They have therefore adopted a stance to public engagement that mirrors the introduction of new technologies and new food products writ large. The problem with this approach, however, is that the field of cellular agriculture is not simply proposing new products – it is proposing an entirely new way of growing food, as well as new cultural, financial, and interspecies relationships. If advocates for cellular agriculture hope to create a sustainable food system that effectively incorporates environmental, social, and economic considerations, then the complexity of that challenge calls for a level of public engagement that deficit-oriented approaches – including Deficit Model 2.0 – are insufficiently equipped to address.

Beyond Building Trust

So, with these communicative critiques in mind, what could the field of cellular agriculture actually do to chart a more sustainable path forward? Fundamentally, advocates should recognize that innovation and politics are never entirely separate; advancing a holistic vision of sustainability requires more than good innovation followed by good marketing, but rather ongoing stakeholder engagement on questions of socio-technical meaning. These principles have been central to the growing field of responsible innovation, for instance, which

advocates for a, “transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and social desirability of the innovation process and its marketable products” (von Schomberg 2011, p. 9). Similarly, Asaro (2000), in advocating for a critical approach to participatory design, calls for a practice of representational democracy in design, in which, “everyone who has engaged the technology and is in a position to assess its usefulness in their daily practices has the ear of those who have the power to alter its potential usefulness” (p. 287-288).

Other frameworks related directly to the world of food technology have recently been offered up in this vein, including Broad’s (2019) notion of “food tech justice,” which emphasizes the need to prioritize just transitions as part of the innovation process. Elsewhere, Montenegro de Wit’s (2021) concept of “technological sovereignty” emphasizes the right for people to co-create agricultural technologies that reflect, respond to, and mobilize communities’ collective knowledge and power. Such approaches offer no guarantee of consensus, and they are likely to introduce unanticipated dynamics that may slow or redirect the pace of innovation in the short-term. However, the prospects of long-term food system sustainability – across its intersecting social, economic, and environmental elements – can be improved through practices informed by these concepts.

At a practical level, then, we believe that cellular agriculture needs to move beyond an approach that aims to “build trust” in its products once they are ready to be sold (downstream), and instead takes the time to engage the public through multi-stakeholder dialogue and participation (upstream). Before the field commences its micro-targeted messaging and its marketing of shared values, it needs to better understand what members of the public actually want from contemporary food systems, what ethical principles and practices they want reflected

in it, as well as what concerns and questions they have about new food technologies and the industries that commercialize them. In moving beyond Deficit Model 2.0, innovators in cellular agriculture will be forced to reckon with legitimate concerns – including questions about political, economic, and environmental governance– that publics bring to science and technology decision-making. Doing so would also put the field on a better footing to address any scientific misunderstandings about the enterprise that may indeed exist, but in a way that respects existing public knowledge, and recognizes that public perceptions of science and technology have reasons to be nuanced and contextual.

Related, we believe that the field of cellular agriculture needs to take stock of the fact that the technology’s purported benefits need not, and likely will not, be taken at face value, nor will those benefits necessarily be distributed equitably. While promises of an abundant, sustainable, and ethical source of slaughter-free animal products may be convincing to insiders, broader publics may be skeptical of these commitments, and could have entirely different priorities all together. The industry will need to actually deliver on its promises of transparency, particularly when it comes to life-cycle assessment and safety-related data on human, animal, and environmental health. Several non-profits and other open science advocates have called for open-access, publicly funded research to address key knowledge gaps and promote wider public engagement (Smith, Shah, and Blaustein-Rejto, 2021). Yet, in a field that is already populated by highly capitalized startups and several incumbent corporate powers, public investment could actually be seen as an unfair giveaway, unless there are clear public interest commitments. What might a mature cellular agriculture industry do, for instance, to advance food-related community economic development and ensure just transitions for rural agricultural workers? How might the industry prioritize the creation of healthy food options and bolster global nutrition?

The traditional deficit model viewed the public as a unified mass in need of scientific education in order to get them to accept and consume the products of technological innovation. Outreach strategies in line with Deficit Model 2.0 have offered minor updates, recognizing the need for transparency and the communication of shared values while segmenting the public into communities of interest. As this commentary has outlined, both approaches have fundamental deficits of their own. If advocates for cell-cultured meat and cellular agriculture are serious about being part of a sustainable food system, they must recognize that a sustainable transition will require attention to complex sets of intersecting environmental, social, and economic dynamics. In order to pursue a vision of food system transformation, we suggest that they start by transforming the way they think about public communication. They should focus not only on the public's understanding of science, but also on how science can better understand its publics.

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