Trends in Cognitive Sciences

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Science & Society

Toward consumer acceptance of cultured meat

Daniel L. Rosenfeld [1] and A. Janet Tomiyama [1,*]

Cultured meat is an alternative protein that offers health and environmental advantages over conventional meat, yet many consumers are resistant to eating cultured meat. In this article, we review reasons for consumer resistance and suggest that proper communication about the production and benefits of cultured meat can improve consumer acceptance.

Current levels of meat production and consumption pose threats to human health and environmental sustainability, while causing the suffering and death of billions of farmed animals each year [1,2]. Animal agriculture also promotes the emergence of zoonotic diseases, creating the risk of future pandemics [3]. To ensure a healthier and more sustainable future, shifts away from conventional meat toward alternative proteins like cultured meat (meat produced via culturing animal cells *in vitro*) are critical. However, consumers are largely unwilling to incorporate such alternative proteins into their diets, with 60% of consumers who are unfamiliar with cultured meat refusing to try it and even 36% of those familiar with it refusing as well [4]. Here, we synthesize the main determinants of consumer acceptance of cultured meat, highlight key areas of focus for cognitive scientists, and suggest promising directions for future research.

Cultured meat as a unique alternative protein

A systemic review by Onwezen and colleagues [4] laid out five main types of alternative proteins that people may eat in place of conventional meat: pulses (i.e., beans and lentils), algae, insects, plant-based meat alternatives, and cultured meat. We draw attention to cultured meat (see Box 1), as we see it as most pertinent to cognitive science for two reasons.

The first reason is attitudinal malleability. Consumer acceptance of cultured meat is lower than that of pulses, algae, or plant-based meat alternatives [4]. While it is important to research consumer attitudes toward a variety of alternative proteins, understanding consumer attitudes toward cultured meat may be most important in the coming years. At present, cultured meat is not yet widely available for public consumption. Therefore, as most consumers have not engaged with cultured meat firsthand, their attitudes toward it may be more malleable. This malleability may mean that well-designed interventions can have large impacts on boosting consumer acceptance.

A second reason why cultured meat is particularly opportune for cognitive science research lies in its physical composition. Compared with other alternative proteins, cultured meat is most like conventional meat; it can be identical in its physical essence and is different only in its method of production (grown from isolated animal cells, rather than from rearing animals). Therefore, the gap between cultured meat and conventional meat is not one of physical substance but one of psychological appraisal. While many barriers to consumer acceptance exist, the majority of consumers across cultures say they are at least open to trying cultured meat [5]. Thus, we believe that gaining a better understanding of consumer attitudes would have the most significant impact on increasing the acceptance of cultured meat compared with other alternative protein sources.

Communicating cultured meat to the public

Given that consumer acceptance of cultured meat relies heavily on perceptions of how it is produced, we see particular promise for cognitive science to focus on the issue of transparency in the production of cultured meat and its communication to the public. One lesson from the backlash toward genetically modified organisms (GMOs) was that consumers perceived GMO companies as being secretive [6]. Indeed, a significant barrier to consumer acceptance of cultured meat is distrust, including distrust in science as well as distrust in the food industry and food safety [4,7,8]. Distrust in the scientific process behind producing novel alternative proteins such as cultured meat may increase food neophobia among many people, making them more wary of trying these novel foods. Educating consumers about the process and technology behind producing novel alternative proteins may be an effective way to foster transparency, increase trust, and combat food neophobia, in turn improving consumer acceptance [9].

In addition, despite the strong evidence substantiating adverse environmental impacts of conventional meat production and the benefits of cultured meat, consumers are largely unaware of the environmental impacts of meat production [10], which may hinder their appreciation of cultured meat. Transparently communicating the environmental and/or health benefits of alternative protein production is an effective way to increase their willingness to eat these proteins [4,10], though these effects may be attenuated among people who hold strongly positive attitudes toward meat consumption at baseline [9].

Although transparency can improve consumer acceptance of cultured meat by

Box 1. Cultured meat versus plant-based alternatives

Cultured meat is a positive alternative to conventional meat, in terms of both environmental improvements and animal rights. But how does cultured meat compare with other alternative proteins? The cost of production, especially compared with plant-based alternatives that already have infrastructures in place, is likely to be higher, particularly in the beginning phases. Given that cultured meat will need some source of animal cells, the environmental impact of cultured meat will likely be smaller relative to adopting a 100% plant-based diet. However, one biopsy from one cow is capable of creating one billion burgers in 1.5 months [11]; therefore, the animal farming impact could be deeply mitigated in theory. Meat, in particular red meat, has potentially health-harming effects, whereas a plant-based diet is generally health-promoting. There are, however, some developing technological advances wherein cultured meat can be 'tuned' to incorporate healthier fats and other nutrients that may ameliorate this challenge [15]. Cultured meat also is less familiar to the public than plant-based alternatives like Beyond Burger and Impossible Meat, which are available widely throughout the food industry. This lack of familiarity could be considered a drawback of cultured meats, but it also lends an opportunity, as discussed in this paper, for cognitive scientists to make a powerful impact in improving consumer uptake.

increasing perceived benefits and promoting institutional trust, transparency is a double-edged sword. In fact, some forms of transparency may hinder acceptance [4,9]. For example, transparent communication about alternative protein production may reduce consumer acceptance when it conjures up perceptions of these proteins as overly processed, unnatural, or artificial [9]. The perceived unnaturalness of cultured meat is a leading barrier to consumer acceptance [11] and consumers are more willing to eat cultured meat when it is described as 'clean meat' than when it is described as 'lab-grown meat' [5]. In informative messages about cultured meat, rather than combating concerns about unnaturalness by arguing that cultured meat is actually natural, it is more effective to argue that conventional meat is unnatural [12]. This effect suggests that reframing conventional meat as an undesirable product may be a potent indirect way to increase the appeal of cultured meat, without the need to endorse cultured meat directly. Overall, to maximize consumer acceptance of cultured meat, there appears to be a balancing act between promoting trust among consumers and thoughtfully conveying the safety and value of cultured meat without inadvertently framing it as unnatural or overly technological.

Future directions

Two promising areas of future research to promote consumer acceptance of cultured meat are social norms and habit formation. Alternative proteins like cultured meat are precisely that: alternative. By definition, cultured meat constitutes a deviance from a traditional norm, which poses a barrier to consumer acceptance. When people perceive the consumption of alternative proteins as socially normal and acceptable within their social networks, then they are more open to consumption [4]. As cultured meat becomes more socially normal, consumption of it could become more habitual. Consuming meat is a longstanding habit for many consumers and sensory and contextual cues can lead consumers to eat meat without much conscious deliberation [9]. As people see others consuming cultured meat and are exposed to greater marketing and distribution of cultured meat throughout society, their consumption of conventional meat would likely become less habitually driven and more consciously deliberated. This shift could help make highly committed meat-eaters more open to messaging that encourages the consumption of cultured meat. Testing social norm interventions and evaluating the impact of changing social norms over time in society are promising areas of focus for future research.

Echoing calls by Onwezen and colleagues [4], the extant literature would benefit from more studies examining interventions in real-world settings and more research conducted among non-Western samples. Within populations, whether Western or not, it would also be valuable to be attentive to meaningfully different consumer subgroups, such as individuals from urban versus rural communities [13]. Rural communities have unique concerns about cultured meat, namely the risk that it will take away farm jobs. When studying consumer acceptance of cultured meat, it may be useful to assess attitudes within specific food contexts (e.g., willingness to eat spaghetti with meatballs made of cultured meat) rather than attitudes in general (e.g., willingness to eat cultured meat). Some evidence suggests that the culinary context in which an alternative protein appears can influence consumer acceptance levels [10].

To achieve maximal gains toward maximizing consumer acceptance of cultured meat, a double-pronged approach would be valuable, where some interventions focus on testing basic mechanisms driving acceptance while others apply integrative models to observe the effects of targeting multiple factors simultaneously, with a primary focus on overall intervention effect sizes. Working from suggestions by Siddiqui and colleagues [14], it is likely that interventions would achieve the greatest shifts in consumer acceptance by providing participants with information on cultured meat, enhancing familiarity, strengthening perceived benefits, targeting social norms, and ensuring cultural appropriateness simultaneously. These efforts would likely be most effective when concerns about cultured meat's price, taste, and capacity to satiate are also assuaged.

Lastly, we note that our perspective in this article has focused on individual-level factors, which overlook the broader food environment in which eating behaviors occur. To create systemic and lasting change in the way people eat meat, it is important to address regulations, financial incentives, availability, accessibility, and social inequalities pertinent to meat

consumption as well as the desirability of cultured meat.

Concluding remarks

As the health, ethical, and environmental costs of conventional meat production continue to mount, there is increased value in entertaining a shift toward cultured meat. Many social, psychological, and structural barriers inhibit consumer acceptance of cultured meat, and research from cognitive science can provide a deeper understanding of these barriers and pinpoint effective strategies for overcoming them. In the coming years, with the public emergence of cultured meat, research into this novel protein source in particular may prove to be societally valuable and scientifically enlightening.

Acknowledgments

This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE-2034835. Dr Tomiyama's time is supported by the following grants: NIH R01DK128575, NIH R01HL158555, and NSF BCS2220295. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or the National Institutes of Health.

Declaration of interests

No interests are declared.

[1]Department of Psychology, University of California, Los Angeles, CA, USA

*Correspondence:
tomiyama@psych.ucla.edu (A.J. Tomiyama).

https://doi.org/10.1016/j.tics.2023.05.002

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