

**Consumer Attitudes Towards Cell-Based Meat: Who Is Likely to Try It and Can This Be  
Changed Through Functional Matching?**

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PY451: Final Thesis Project

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May 4, 2022

## Abstract

Although meat consumption contributes to climate change, animal suffering, antibiotic resistance, and several other problems, large segments of the population are unwilling to change their eating habits. Cell-based meat has been proposed as a potential solution to replace meat without sacrificing taste. Despite the potential benefits of this alternative, many questions remain about consumer acceptance. The present study investigated how individual differences and motivations for eating/avoiding meat affect participants' likelihood of trying cell-based meat. Additionally, the description of the product was manipulated to explore if matching the framing to the consumer's motivation increased likelihood. Participants took an approximately 6-minute survey that asked about food motivations, likelihood of trying cell-based meat, and measured individual differences. Motivation matching did not significantly increase the likelihood of trying cell-based meat. Most of the individual differences were not significantly related, but men and those higher in masculinity were more likely to try the product. Because this demographic is resistant to other meat substitutes, cell-based meat could provide an alternative for certain groups of people that would otherwise consume traditional meat. Food decisions are difficult to change, so it is possible that these descriptions were not enough to demonstrate significant effects. Further research should devise stronger manipulations for effective advertising surrounding cell-based meat.

*Keywords:* cell-based meat, meat alternatives, framing, functional matching

## **Consumer Attitudes Towards Cell-Based Meat: Who Is Likely to Try It and Can This Be Changed Through Functional Matching?**

Reducing meat consumption and finding alternatives is one of the largest dilemmas of this generation. Animal agriculture now surpasses the transportation sector in contributions to global greenhouse gas emissions (Steinfeld, et al., 2006), accounting for 18% of all human-induced global greenhouse gas emissions. Because climate change is an imminent threat, it is critical to find alternatives to animal products. However, approximately 56 billion land animals are reared and slaughtered for human consumption every year (Koneswaran & Nierenberg, 2008) and global meat consumption is on the rise (FAO, 2018), with livestock inventories expected to double by 2050 (Steinfeld et al. 2006). Despite the consequences, large segments of the population are still not willing to change their meat-eating habits (Hartmann & Siegrist, 2017). Therefore, it could be a major advantage to find an alternative that is similar in taste to meat without the detrimental aspects.

One alternative is plant-based products, which are made from processed plant ingredients. Some plant-based products are not meant to taste like meat (such as black bean burgers). However, many brands are attempting to make products that mimic the look and taste of the product they are trying to replace. For example, the Beyond Burger uses beet juice to give the impression of bleeding like a real burger and the Impossible Burger uses heme, which is the iron-rich molecule found in blood (Impossible Foods Inc., 2022). Although these products are popular, there is still a race to make the most accurate meat substitute.

A new alternative is cell-based meat, which is grown from the cultivation of animal cells (Bryant & Barnett, 2018). These cells are removed from the animal and grown externally so that production does not require factory farming practices (Post, 2014). The goal is to create an

essentially identical substitute for meat that imitates the taste and texture. The product has not yet been commercialized in the United States, but it is under development in several private and public research laboratories (Lee et al., 2020) and has been approved for sale in Singapore (Ives, 2020).

Cell-based meat is advantageous over traditional meat for a variety of reasons. For example, it is more environmentally friendly than current farming practices. One analysis projected cell-based meat to use 7-45% less energy, 78-96% lower global greenhouse gas emissions, 99% less land use, and 82-96% less water use, depending on the type of traditional meat with which it was compared (Tuomisto & Joost Teixeira de Mattos, 2011). Another more obvious advantage is that the animal cells are grown in a facility, so no animals suffer. In factory farms, antibiotics are given to the animals, which contributes to antibiotic resistance. Because cell-based meat does not use animals, antibiotics are not necessary. Therefore, this technology could help prevent non-communicable diseases (Bianchi et al., 2018). It would also eliminate the need for antibiotics and hormones in the final food product that people consume (Fernández, 2020).

Because of these potential benefits, it appears that cell-based meat will soon become prevalent. The global cell-based meat market was valued at \$1.64 million in 2021 (Allied Market Research, 2022) and is predicted to be worth \$20 million by 2027 (MarketsandMarkets Research, 2021). One report estimated that 35% of all meat will be cultured by 2040 (A.T. Kearney, 2019). Even traditional meat producers understand the significance; two of the world's largest conventional meat companies, Tyson and Cargill, now have a stake in Upside Foods, the first cell-based meat company (Mayhall, 2019).

The next step for researchers is to find ways to make the product marketable to consumers. Although this technology would allow people to avoid the ethical dilemma of eating animals as well as have huge environmental impacts, it is currently unknown if the public is willing to accept it. Therefore, it would be advantageous to understand how people think about the product, what type of people are likely to try it, and how to get more people to choose this alternative.

### **Individual Differences**

Political identity, age, and education are integral to one's identity and affect decision-making. Previous studies have found that liberal participants are more likely to try cell-based meat (Bryant & Barnett, 2018; Slade, 2018; Wilks et al., 2019). In contrast, a belief that farming is an important activity for society, an idea associated with conservatism, predicts lower willingness to purchase cell-based meat (Slade, 2018). Younger generations are more likely to try cell-based meat than older generations (Bryant & Barnett, 2018; Slade, 2018; Wilks et al., 2019) and those with more education are more likely than those who are less educated (Slade, 2018).

Gender is another part of identity that influences food choice. Men consume more meat in general than women (Pfeiler & Egloff, 2020). One study attempted to explain this difference and found that male undergraduates used more direct strategies to justify meat eating, such as endorsing pro-meat attitudes, denying animal suffering, and believing that animals are lower in the hierarchy than humans and that it is human fate to eat animals (Rothgerber, 2013). Female participants used more indirect strategies, like dissociating animals from food and avoiding thinking about the treatment of animals. Male justification strategies were correlated with greater meat consumption, whereas female justification strategies were correlated with less meat

consumption. Those who eat meat frequently are less likely to purchase plant-based burgers, but they appear no more or less likely to purchase cultured meat burgers (Slade, 2018). Therefore, eating large quantities of meat does not necessarily mean that men will avoid cell-based meat. Indeed, previous research has found that men are more likely to try cell-based meat (Pfeiler & Egloff, 2020). However, this effect could have been due to masculinity (the way gender is expressed), and not gender itself. Red meat has especially been associated with masculinity in Western cultures (Nath 2011), so people high in masculinity may be more likely to try a product like cell-based meat that closely emulates red meat. Additionally, masculine standards of toughness and daringness increase adventurous eating (Nath 2011). It is possible that these elements of masculinity are driving the effect found of men being more likely to try cell-based meat (not simply identifying as a man). On the other hand, women tend to be more concerned about nutrition, health, and perceived safety of foods than men (Bäckstrom et al, 2003; Holm & Møhl, 2000; Lea & Worsley, 2001), so they may be more hesitant to try this novel product due to such concerns. Women also tend to be higher in disgust sensitivity (Bassett, 2017), a trait correlated with less willingness to try cell-based meat (Siegrist & Hartmann, 2020). Therefore, masculinity should be measured in addition to gender and disgust sensitivity should be controlled for to determine what is driving this gendered effect.

Personality is another individual characteristic that affects food choice, specifically openness to new experience, conscientiousness, and analytical thinking. All three of these characteristics have been consistently associated with political attitudes. Openness to experience is positively predicted by liberalism and conscientiousness by conservatism (Carney et al., 2008; Hirsh et al., 2010; Sibley et al., 2012), suggesting that those high in openness would be more likely to try cell-based meat and participants high in conscientiousness would be less likely to try

it. Analytical thinking is correlated with liberalism (Talhelm et al., 2015) and more education (Sinclair, 2014), traits associated with higher likelihood of trying cell-based meat (Bryant & Barnett, 2018).

Food neophobia is the final individual difference known to correlate with willingness to try cell-based meat. People high in this trait are less likely to try cell-based meat (Siegrist & Hartmann, 2020). To ensure that the effects emerging are not driven by this known predictor, food neophobia needs to be controlled for.

### **Motivations and Food Choice**

The most common motivators for eating meat are hedonic (pleasure) and normative. One study found that hedonically motivated meat eaters have positive attitudes towards meat consumption, are averse to plant-based alternatives, and have some curiosity about lab-grown meat (Possidónio et al., 2021). Given that cell-based meat is designed to look and taste like meat, it makes sense that those motivated by the hedonic experience of meat eating show some curiosity to try it. Those motivated by normative behavior will likely be more averse to trying it because social norms have a strong effect on food choice. For example, one study found that although children do not view fast food to be fun or healthy, there was a positive association between perceived social acceptability and consumption of fast food (Tarabashkina et al., 2016). Since meat consumption is a cultural norm in the United States and cell-based meat is not part of traditional diets, it will likely be difficult to persuade people motivated by normative behavior to try cell-based meat.

The most common reasons for refraining from eating meat are environmental and ethical (Hagmann, 2019). People motivated by these factors already wish to reduce the meat industry's environmental footprint and/or to treat animals more humanely. Because they will just need to

connect the product to their existing concerns, people with these motivations will likely be more easily convinced to try cell-based meat than those motivated to eat meat for hedonic or normative reasons.

### **Framing**

Considering peoples' initial motivations and attitudes is important for acceptance of any message, otherwise the intended outcome cannot be guaranteed. For example, several studies of antiracism advertising in the United Kingdom found a backlash effect among individuals whose attitudes were ambivalent toward ethnic minorities (Maio et al., 2008). A failure of the advertisements to address the relevant functions of the participants' attitudes may have led to this problem, highlighting the importance of using frames directed at specific groups of consumers.

Previous functional matching studies have shown that content is more persuasive when it matches the functions of one's attitudes (Watt et al., 2008). For example, one study found that persuasive messages motivated people to initiate volunteer service to the extent that the messages were tailored to the specific motivations important to the individual (Clary et al., 1998). Messages that matched the person's motivations were more persuasive and the person was more likely to intend to volunteer in the future than participants who received mismatched messages to their motives. Volunteers whose motivational concerns were served by their participation derived greater satisfaction than those whose concerns were not met, and they were more likely to continue serving (Omoto & Snyder, 1995). Functional matching has also been demonstrated in attitudes towards climate change (Bayes et al., 2020) and culturally congruent advertising appeals (Zhang & Gelb, 1996). Therefore, matching descriptions of cell-based meat to consumers' existing dietary motivations will likely increase the chance that participants try the product.



There will be four descriptions of cell-based meat, each framed around a different food motivation. One frame used will be about how food critics think cell-based meat tastes just like meat to target hedonic meat eaters. Another frame will discuss how popular the product is becoming to make it sound like normative behavior. A third frame will explain environmental benefits of cell-based meat over traditional meat. The final frame will describe how cell-based burgers could end animal exploitation to attract ethical meat-avoiders.

When participants' motivations match the argument shown, they are expected to be more likely to try cell-based meat. However, some frames will likely be more effective overall than others. Science-based sustainability arguments have been found to be insufficient at reaching consumers (de Boer & Aiking, 2017). Instead, framing plant-based options as savory and satisfying dishes and highlighting the similarities to traditional meat are more effective approaches (Byrant & Barnett, 2018). Such methods create less concern about naturalness. Therefore, the hedonic frame, which focuses on the product's similarity to conventional meat, will likely be the most effective overall. The normative frame will also likely be relatively effective because of the strong effects social desirability can have on attitudes towards food, as demonstrated by the fast-food study. Environment and animal ethics frames will likely not be effective for most consumers, unless the participant entered the study with these motivations.

### **The Present Study**

The goal of the present study was to gain a more nuanced understanding of which groups of people are likely to consume cell-based meat and the mechanism through which this operates. Food decisions are complicated; individual differences and motivations for eating/avoiding meat likely relate to one another and affect consumers' decision to try cell-based meat or not.

Additionally, I manipulated descriptions of the product to see if framing that matches participant's food motivations increased likelihood of trying the product.

**H<sub>1</sub>:** I predict that liberal, younger, and more educated participants are more likely to try cell-based meat than conservative, older, and less educated participants. Liberal, younger, and more educated participants are less conscientious, more open, more analytical, more environmentally motivated, and more motivated by animal ethics. Conservative, older, and less educated participants are more conscientious, less open, less analytical, and more motivated by normative framing.

**H<sub>2</sub>:** I predict that, when controlling for disgust sensitivity, women are more likely to try cell-based meat than men, but higher levels of masculinity lead to greater likelihood of trying the product. Women are more open, more environmentally motivated, and more motivated by animal ethics. Men are less open and more motivated by hedonics.

**H<sub>3</sub>:** I predict that participants higher in openness and CRT are more likely to try cell-based meat, while those higher in conscientiousness are less likely.

**H<sub>4</sub>:** I predict that participants are more likely to try cell-based meat when descriptions match their motivations for or against eating meat. Because disgust sensitivity is a known predictor of likelihood of trying cell-based meat, it will be controlled for.

**H<sub>5</sub>:** I predict that hedonic and normative frames are more effective overall than environment and animal ethics frames.

## **Method**

### **Participants**

In total, 504 participants were recruited from MTurk with reimbursement of \$0.85 for participation. Forty-three of these participants were excluded from analysis either for incomplete responses or finishing the survey too quickly. In trial runs, it took an average of 82 seconds to click through the survey without reading, so people who took 110 seconds or less were excluded for not taking enough time. Additionally, people who responded with anything other than male or female for the gender question were excluded due to the small sample size. This group included one participant who answered non-binary, one who answered transgender male, and one who self-described as “assigned female at birth/agender.” After these exclusions, 457 participants remained for analysis.

Of these participants, 331 were male and 146 female, creating a predominantly male sample. The sample was very slightly liberal leaning, with an average political identity of 3.81 on a 7-point Likert scale. There were 65 participants who identified as strongly liberal, 95 liberal, 49 somewhat liberal, 84 moderate, 29 somewhat conservative, 90 conservative, and 46 strongly conservative. The mean age was 37.07, with ages ranging from 19 to 89. The average response to level of education was 4.46 on a 7-point Likert scale, with four participants completing 12th grade or less, 46 who graduated high school or equivalent, 58 with some college but no degree, 35 with an associate degree, 256 with a bachelor’s degree, and 58 with a postgraduate degree.

## **Materials and Procedure**

Participants took an approximately 6-minute online Qualtrics survey which asked food motivation questions, their likelihood of trying cell-based meat, and measured individual differences.

## **Measures**

**Motivation.** Participants were asked how much they agreed with four statements about food opinions. Each statement corresponded to one of the four motivations (hedonic, normative, environment, and animal ethics). Items were measured on a 7-point Likert scale with anchor points from *strongly disagree* to *strongly agree* (see Appendix A for items included).

**Vignettes.** Participants were randomly assigned to one of four conditions describing cell-based meat (hedonic, normative, environment, or animal ethics). The base description was the same for each condition. At the end of this description, a final 1-2 sentences were added that framed the benefits of cell-based meat around one of these conditions (see Appendix B for full vignettes).

**Likelihood of Trying Cell-Based Meat.** Following the vignette, participants were asked how likely they are to try cell-based meat, evaluated using a 7-point Likert scale with anchor points from *extremely unlikely* to *extremely likely* ( $M = 3.69$ ).

**Food Neophobia.** Food neophobia was measured using the Food Neophobia Scale–Revised (Damsbo-Svendsen et al., 2017; see Appendix C for items included in scale,  $\alpha = .72$ ). This scale consists of 6 items measured on a 7-point Likert scale with anchor points *strongly disagree* to *strongly agree*. The 6 scores were averaged to get a composite food neophobia score ( $\alpha = .729$ ,  $M = 3.745$ ).

**Disgust Sensitivity.** Disgust sensitivity was measured using the Disgust Sensitivity Scale (Muris et al., 1999; see Appendix D for items included in scale;  $\alpha = .91$ ). This scale consists of 3 items measured with *not disgusting at all*, *slightly disgusting*, or *very disgusting*. The 3 scores were averaged to get a composite disgust sensitivity score ( $\alpha = .432$ ,  $M = 2.220$ ).

**Openness.** Openness was measured using the openness section of the Big Five Personality Trait Short Questionnaire (Morizot, 2014; see Appendix E for items included in scale,  $\alpha = .712$ ). This scale consists of 10 items measured on a 7-point Likert scale with anchor points *strongly disagree* to *strongly agree*. The 10 scores were averaged to get a composite openness score ( $\alpha = .804$ ,  $M = 4.190$ ).

**Conscientiousness.** Conscientiousness was measured using the conscientiousness section of the Big Five Personality Trait Short Questionnaire (Morizot, 2014; see Appendix F for items included in scale,  $\alpha = .712 - .808$ ). This scale consists of 10 items measured on a 7-point scale with anchor points *strongly disagree* to *strongly agree*. The 10 scores were averaged to get a composite conscientiousness score ( $\alpha = .871$ ,  $M = 4.719$ ,  $SD$ ).

**Analytic Thinking.** Analytic thinking was measured using the Cognitive Reflection Test (CRT)–Adapted Version (Albaity et al., 2014; see Appendix G for items included in scale). This test consists of 3 items measured for correctness. Correct answers were totaled to get a composite CRT score ( $M = 1.6135$ ).

**Political Identity.** Political identity was measured using a 7-point Likert scale with anchor points *strongly liberal* to *strongly conservative* ( $M = 3.81$ ).

**Gender Expression.** Participants were asked, “how masculine are you?” This question was evaluated using a 7-point Likert scale with anchor points *not masculine at all* to *strongly masculine* ( $M = 4.77$ ). They were then asked, “how feminine are you?” This question was evaluated using a 7-point Likert scale with anchor points *not feminine at all* to *strongly feminine* ( $M = 3.79$ ).

**Gender Identity.** Participants were asked what gender identity they identify with the most. Response options included: male, female, non-binary, transgender female, transgender male, and prefer to self-describe with a text box.

**Age.** Age was evaluated with a slider from 0 to 100 ( $M = 37.07$ ).

**Education.** Participants were asked the highest level of education they have completed: 12th grade or less, graduated high school or equivalent, some college with no degree, associate degree, Bachelor's degree, post-graduate degree.

**Geography.** Participants were asked in what city and state they reside.

## Results

### H<sub>1</sub>

I predicted that liberal, younger, and more educated participants would be more likely than conservative, older and less educated participants to try cell-based meat. None of the three variables were correlated with likelihood overall. However, when correlations were run on each condition separately, age was negatively correlated with likelihood of trying the product in the environment ( $r = -.32, p = .000$ ) and animal ethics ( $r = -.234, p = .014$ ) conditions, indicating that younger participants were more willing to try the product than older participants when presented with these two frames.

### H<sub>2</sub>

An ANOVA revealed that gender was significantly related to likelihood of trying the product ( $F = 15.970, p = .000$ ). Men ( $M = 3.85$ ) were more likely than women ( $M = 3.35$ ), an effect that remained when controlling for disgust sensitivity. This result was the opposite of my hypothesis, but consistent with previous literature. Next, I hypothesized that those higher in

masculinity would be more likely to try the product, which was the correlation found ( $r = .229, p = .000$ ).

### **H<sub>3</sub>**

Higher conscientiousness scores were negatively correlated with likelihood, as hypothesized ( $r = -.263, p = .000$ ). However, contrary to prediction, CRT was also negatively correlated with likelihood ( $r = -.139, p = .003$ ) and openness was not significantly correlated at all. Conscientiousness was significant in all conditions when running the correlation on each condition separately (hedonic condition:  $r = -.287, p = .002$ ; normative condition:  $r = -.241, p = .009$ ; environment condition:  $r = -.270, p = .003$ ; animal ethics condition:  $r = -.255, p = .008$ ). However, CRT was only significantly correlated with less likelihood in the hedonic condition ( $r = -.323, p = .000$ ).

### **H<sub>4</sub>**

Contrary to my hypothesis, matching the participants' motivations for eating/avoiding meat to the framing of the description of cell-based meat did not increase participants' likelihood of trying the product. A bivariate correlation analysis between the four motivations and likelihood of trying cell-based meat revealed no significant effect. Instead, the animal ethics motive positively correlated with participants' likelihood in all the conditions ( $r = .323, p = .000$ ). Unexpectedly, the normative motive negatively correlated with likelihood of trying the product in the normative condition ( $r = -.204, p = .030$ ).

To further investigate this relationship, a multiple regression was run between the four motivations and likelihood of trying the product, separately for each of the four framing conditions. The hedonic condition was not statistically significant ( $F = 2.282, p = .065$ ). The normative condition was significant ( $F = 15.083, p = .000$ ), with the environment motive

predicting likelihood of trying cell-based meat in this condition ( $\beta = 4.782, p = .000$ ). The environment condition showed a significant effect ( $F = 6.88, p = .000$ ) in which the hedonic motive ( $\beta = 2.114, p = .037$ ) and environment motive ( $\beta = 3.176, p = .002$ ) both predicted the likelihood. The animal ethics condition also showed a significant effect ( $F = 6.231, p = .000$ ) in which the environment motive predicted likelihood ( $\beta = 3.013, p = .003$ ). These results indicate there is still no evidence of motivation matching increasing likelihood. Instead, the environment motive drove likelihood in all the conditions (besides the hedonic condition, which was not significant).

Food neophobia was then added to the regression to ensure that it was not confounding the results. In this multiple regression, the hedonic condition was significant ( $F = 2.450, p = .038$ ), but none of the individual variables were predictive of likelihood. The normative condition showed a significant effect ( $F = 14.016, p = .000$ ), with both the environment motive ( $\beta = 4.764, p = .000$ ) and food neophobia ( $\beta = -2.370, p = .020$ ) predicting likelihood. The environment condition also showed a significant effect ( $F = 6.657, p = .000$ ), with the environment motive ( $\beta = 2.992, p = .003$ ) and food neophobia ( $\beta = -2.195, p = .030$ ) predicting likelihood. The animal ethics condition showed the same trend ( $F = 6.987, p = .000$ ) of environment motive ( $\beta = 3.036, p = .003$ ) and food neophobia ( $\beta = -2.487, p = .015$ ) predicting likelihood. Therefore, the environment condition was predictive of likelihood of trying cell-based meat, independent of the effect of food neophobia.

Taken together, these results are in line with my prediction that consumers motivated by the environment and animal ethics are more likely to try the product, regardless of the condition. These two motives were strongly correlated across all the conditions (hedonic condition:  $r = .558, p = .000$ ; normative condition:  $r = .570, p = .000$ ; environment condition:  $r = .569, p$



=.000; animal ethics condition:  $r = .536, p = .000$ ), probably because they are values-based ethical stances. Importantly, the hedonic and normative motives did not negatively correlate with the dependent variable (besides in the normative condition).

## **H<sub>5</sub>**

To see if the normative and hedonic frames were more effective than the environment and animal ethics frames overall, an ANOVA with each of the four conditions and likelihood of trying cell-based meat was run. This analysis was non-significant ( $F = .515, p = .672$ ), indicating that none of the frames were more persuasive than the others.

## **Discussion**

Individual differences did not affect willingness to try cell-based meat nor did these differences correlate to one another in the expected directions. Previous research has found political ideology, age, and education to be related. Specifically, liberal individuals tend to be younger (Maniam & Smith, 2017) and more educated (Report, 2016; Bialik & Fry, 2019). Liberalism has also been correlated with openness (Carney et al., 2008; Hirsh et al., 2010; Sibley et al., 2012), a predictor of activism (Curtin et al., 2010). Consistent with this association, the liberal, younger, and more educated demographic demonstrates greater concern for the environment (Bialik & Fry, 2019) and support for animal welfare (Hoffarth et al., 2019). Liberals and those with more education tend to think more analytically (Talhelm et al., 2015), which could increase considering the benefits of cell-based meat and dispelling initial fears that have no basis. Taking all these correlations into account, I predicted that liberal, younger, and more educated participants would be more open, think more analytically, be more motivated by animal ethics and the environment, and therefore be more likely to try the product. In contrast, conservatives tend to be older (Maniam & Smith, 2017) and less educated (Report, 2016; Bialik

& Fry, 2019). This demographic tends to be less open (McCrae et al., 1999). Because eating meat is part of the traditional American diet, those who are less open may be more likely to follow this eating habit and more resistant to trying cell-based meat. Conservatives are also more conscientious (Carney et al., 2008), so they may focus more on the potential dangers of cell-based meat. They are lower in analytical thinking, which could lead to decisions based on intuition and discourage considering the benefits of cell-based meat (Carney et al., 2008; Talhelm et al., 2015). Additionally, conservatives tend to be more motivated by social norms, partially because they have more rigid cognitive styles (Désilets et al., 2020; Fernandes & Mandel, 2013). Therefore, I predicted that conservative, older, and less educated participants would be less open, more conscientious, think less analytically, be more motivated by the normative condition, and be less likely to try cell-based meat.

In line with this logic, younger participants were more likely to try the product in the environment and animal ethics conditions. Because concern about environmental protection tends to be stronger in younger generations (Milfont et al., 2021), it is possible that when these motives were primed, younger participants were more likely than older ones to identify with the message and try cell-based meat. However, for the most part, these individual differences did not correlate with one another as previous literature implied, nor did they correlate with motivations as expected. For example, while liberals were more open, more analytical, and more environmentally motivated, they were unexpectedly more conscientious. Previous research has found correlations between conscientiousness and conservatism (Carney et al., 2008; Hirsh et al., 2010; Sibley et al., 2012), but these results suggest that conscientiousness may be more context dependent. Given that participants were just primed by an ethical question about food, it is possible that they were responding to the conscientiousness questionnaire through this lens and

answered differently than if given the questionnaire in isolation. Conscientiousness decreased the likelihood of trying cell-based meat as hypothesized, but because political identity was not correlated with conscientiousness, liberals were not more likely to try cell-based meat overall. In this way, many of the individual differences did not appear related to likelihood of trying cell-based meat at all and the expected patterns did not emerge. Future research should further investigate how these individual differences interact in the context of a food decision question to find nuances in which are related to cell-based meat.

Men and masculine participants were more likely to try the product. While I did predict those higher in masculinity to be more likely, I hypothesized higher likelihood in women. Women were more open, but openness was not associated with greater likelihood. Those who were motivated by the environment and animal ethics were more likely to try the product, but there was no correlation between motivation and gender, so women were not more likely to try the product. Masculinity did predict higher likelihood, possibly due to its association with daring food decisions. Considering masculine aversion to other vegan alternative meat products (Roe & Hurley, 2018), this finding may be initially surprising. However, cell-based meat is unique both in its similarity to traditional meat and the adventurous nature of the food. While I predict that these are the mechanisms that masculinity operates through, future research should investigate this relationship further. Cell-based meat could provide a more environmentally and ethically beneficial food choice for groups of people that would typically avoid meat alternatives.

Of the personality traits, only conscientiousness acted as expected by decreasing likelihood of trying the product. Because cell-based meat is such a novel development, those high in conscientiousness were likely sensitive to social acceptability and focused on the negative possibilities. Indeed, conscientiousness was positively correlated with the normative

motivation. Interestingly, conscientiousness was negatively correlated with masculinity. This reduced amount of conscientiousness is another potential mechanism through which masculinity acted to increase likelihood of trying cell-based meat. Women were higher in conscientiousness, which could have contributed to the gender difference found. The precise mechanism through which conscientiousness interacts with other individual differences to affect likelihood of trying cell-based meat cannot be determined from this study alone, but it seems to be an important factor. I predicted that openness would increase likelihood, but this trait was not correlated for unknown reasons and replication should be attempted. Contrary to what was hypothesized, CRT decreased likelihood. However, this was only the case in the hedonic condition. In this condition, the argument that cell-based meat tastes the same as traditional meat was based on one professional taste tester's opinion. The other three conditions all implied greater implications. In the normative condition, the growing popularity in the market suggested large-scale acceptance of the product. The environment and animal ethics frames expressed broad impacts for the planet and animals involved. Higher CRT scores did not decrease likelihood of trying cell-based meat in these conditions, possibly suggesting that those high in CRT need more confirming evidence to try cell-based meat or they experience a backlash effect. A future direction would be to devise more complex articles about the benefits of cell-based meat to determine what arguments are convincing for those higher in CRT.

The results did not support my hypothesis that motivation matching would increase likelihood of trying cell-based meat. Rather, participants' feelings about trying new foods and their values-based beliefs about meat consumption mattered more. People high in food neophobia were less likely to try cell-based meat and those who entered the study motivated by the environment and animal ethics were more likely to try cell-based meat, regardless of

condition. The other two motives (hedonic and normative) did not predict likelihood overall. Therefore, motivation towards eating traditional meat does not necessarily relate to resistance towards cell-based meat, which is promising for convincing larger segments of the population to try the product.

Unexpectedly, the normative motive only negatively correlated with likelihood of trying the product in the normative condition, which implies some sort of backlash effect. Perhaps telling people who were motivated by social norms that this new product will be a staple in people's diets soon caused concern for these participants. Rather than wanting to try the product, such a drastic change from what they are used to likely created even more resistance. This condition was the only one in which the vignette predicted a large shift in the future (becoming a staple in the American diet), while the others were centered on current knowledge and potential benefits. Further research should ensure that the frames are more equivalent to prevent a backlash effect.

It is notable that none of the framing manipulations had an overall effect on likelihood of trying cell-based meat. Rather, the consumer's individual differences and motivations were the only variables that mattered. This finding points to the immobility of people's food decisions, so stronger manipulations should be devised for effective advertising surrounding cell-based meat. Because food-related decisions are entrenched in identity and hard to alter, it is possible that the short descriptions were not enough to change attitudes. Since this product is new, many participants likely have not heard of cell-based meat yet and therefore were not in a position to have their attitudes shifted. The element of surprise may have rendered the frames irrelevant. In the real world, when hearing these frames repeatedly, the initial shock of the product will wear off and consumers may then shift their decision when considering framing that is consistent with

their prior motivations. As the context changes, more research will need to be conducted to keep up to date with consumer attitudes about cell-based meat and effective advertising for this changing population.

One limitation of the current study is that the participant's decision to try cell-based meat was measured hypothetically. Consumers may respond differently when presented with the product, although hypothetical food choice experiments have been shown to have real world validity (Chang et al., 2009). Additionally, this study only gauged the likelihood of trying the product, which does not speak to whether people would become frequent consumers or choose it over other alternatives. It did not include potential price, accessibility, or any other factors. For these reasons, theoretically reporting being likely to try the product does not necessarily translate to purchasing the product in real life. More externally valid measures of trying the product, such as giving participants a lunch option, should be tested.

Finally, analyses would benefit from ensuring a representative sample of the population. Race and ethnicity were not reported, so it cannot be determined if these factors were proportionate to the population. Because food is a large part of culture, these results could be specific to certain demographics. Future research should explore differences between races/ethnicities. Additionally, this study only considered people in the United States. A more cross-cultural understanding of consumer acceptance is still needed. While a few studies have started this work, the data is limited to very few countries (Siegrist & Hartmann, 2020).

Overall, this study provides insight into consumer attitudes towards cell-based meat, an economically promising product with the potential for great environmental, animal welfare, and public health and safety benefits. As expected, people who are motivated by animal ethics and the environment were more likely to try this product. Additionally, it appears to be a promising

alternative for men and masculine individuals, a demographic of people that typically avoids other meat substitutes. As the product enters the market and gains name recognition, it is likely that familiarity will contribute to wider acceptance overall. Future research should continue to monitor consumer attitudes as these changes occur. Because of the potential benefits and the predicted prevalence in the global market, more research devoted to the underlying mechanisms behind acceptance of cell-based meat is necessary to devise effective advertising that promotes this product.

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## Appendix A

### Motivations

To what extent do you agree with the following statements:

- 1) Meat tastes really good to me.
- 2) Eating meat is socially acceptable.
- 3) Eating meat is bad for the environment.
- 4) Eating meat raises ethical concerns for animal welfare.

Measured on a 7-point Likert scale from *Strongly disagree* to *Strongly agree*.

## Appendix B

### Vignettes

- 1) Cell-based meat is a new meat substitute in which meat is grown from the cultivation of animal cells. These cells are removed from the animal and grown externally so that production does not require factory farming practices. The final product imitates the taste and texture of traditional meat. In fact, Michal Ansky, professional taster and Master Chef judge, could not tell the difference between cultivated chicken and a conventionally raised product in a blind taste test.
- 2) Cell-based meat is a new meat substitute in which meat is grown from the cultivation of animal cells. These cells are removed from the animal and grown externally so that production does not require factory farming practices. The final product imitates the taste and texture of traditional meat. This product is becoming increasingly popular. In the next few years, we can expect to see this product on American shelves and it will become a staple in people's diets
- 3) Cell-based meat is a new meat substitute in which meat is grown from the cultivation of animal cells. These cells are removed from the animal and grown externally so that production does not require factory farming practices. The final product imitates the taste and texture of traditional meat. A potential benefit of this product is that it could be much more environmentally friendly than traditional meat production, significantly reducing global greenhouse gas emissions, energy, water and land use.
- 4) Cell-based meat is a new meat substitute in which meat is grown from the cultivation of animal cells. These cells are removed from the animal and grown externally so that production does not require factory farming practices. The final product imitates the taste

and texture of traditional meat. Because the animal cells are grown in a facility, no animals must be slaughtered. Therefore, this product could be the end of factory farming and drastically reduce animal exploitation.

## Appendix C

### Food Neophobia

1. I am constantly sampling new and different foods. (R)
2. If I don't know what is in a food, I won't try it.
3. I like foods from different countries. (R)
4. At dinner parties, I will try a new food. (R)
5. I am afraid to eat things I have never had before.
6. I will eat almost anything. (R)

Measured on a 7-point Likert scale from *Strongly disagree* to *Strongly agree*. “(R)” indicates item scores were reversed.

## Appendix D

### Disgust Sensitivity

- 1) How disgusting would you find it to eat your favorite soup from a soup bowl, after it had already been stirred by a thoroughly washed fly swatter?
- 2) How disgusting would you find it to drink your favorite lemonade, when a non-toxic leaf from a houseplant falls into your glass and goes to the bottom?
- 3) How disgusting would you find it to eat your favorite cookie, after a bite had been taken by a waiter in a restaurant?

Measured on a 3-point Likert scale from *Not disgusting at all* to *Very disgusting*.

## Appendix E

### Openness

I see myself as someone who . . .

- 1) Is original, often has new ideas.
- 2) Is curious about many different things.
- 3) Is ingenious, reflects a lot.
- 4) Has a lot of imagination.
- 5) Is inventive, creative.
- 6) Likes artistic or aesthetic experiences.
- 7) Is not really interested in different cultures, their customs and values.
- 8) Likes to reflect, tries to understand complex things.
- 9) Has few artistic interests.
- 10) Is sophisticated when it comes to art, music or literature.

Measured on a 7-point Likert scale from *Strongly disagree* to *Strongly agree*.



## Appendix F

### Conscientiousness

I see myself as someone who . . .

- 1) Works conscientiously, does the things he/she has to do well.
- 2) Can be a little careless and negligent.
- 3) Is a reliable student/worker, who can be counted on.
- 4) Has a tendency to be disorganized, messy.
- 5) Perseveres until the task at hand is completed.
- 6) Does things efficiently, works well and quickly.
- 7) Plans things that need to be done and follows through the plans.
- 8) Has a tendency to be lazy.
- 9) Is easily distracted, has difficulty remaining attentive.
- 10) Can do things impulsively without thinking about the consequences.

Measured on a 7-point Likert scale from *Strongly disagree* to *Strongly agree*.

## Appendix G

### Analytical Thinking

- 1) A bat and a ball together cost 110 cents. The bat costs 100 cents more than the ball. How much does the ball cost? (Answer: 5 cents)
- 2) If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? (Answer: 5 minutes)
- 3) In a lake, there is a patch of roses. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake? (Answer: 47 days)