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Can you "Design" Your Own Food?

Soumitro Chakraborty
BSc (Hons.) Agriculture, Central Agricultural University, Imphal, Manipur.
Pin- 795004

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Summary

The article explores the evolving dynamics between humans and food, focusing on the concept of designing food for diverse needs. It covers historical aspects of crop improvement and genetic engineering, highlighting the progress in genetically modified foods. The perspective of food-human interaction, including innovations like 3D food printing. It also addresses the rising demand for novel foods due to economic, social, and health factors, emphasizing a shift towards healthier consumption habits. Challenges related to genetic modification, such as ecological concerns and food neophobia, are acknowledged. Despite these challenges, the discussion concludes optimistically, emphasizing a transformation in our relationship with food. It is becoming more intentional and multifaceted, evolving from mere sustenance to a holistic, multisensory experience.

Introduction - "Designing" food

Food is a central part of the human experience. And with the evolution of man, food has evolved along with it. (R.Dunn, et al., 2020). It has been argued that food has shaped human society, having a great impact on human health, cultural diversity, economy, and politics (Machin & Chen, 2021).

The world of "designing food" is ablaze with new innovations surrounding food accessibility and augmenting our experiences associated with our meals. Food design amalgamates the concepts of food science, food psychology and food culture to arrive at solutions to our problems related to food (Zampollo & Peacock, 2016). At its core, it involves all the ideas and processes that improve our individual and communal interactions with food.

Genetic engineering and crop improvement processes as a means to create desirable food characteristics

When we talk about tailoring our food to suit our needs, crop improvement practices for the benefit of humanity have been a part of such alterations since the birth of agriculture

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(Agriculture., 1984). Initially done through selection and later by the process of breeding. We chose plants that showed characteristics that we desired and cultivated them. Thereby selecting phenotypic expressions that in-turn selected the genes associated with them. After the first biological revolution and the foundation of mendelian genetics, these practices gained more precision and we manipulated genomes to produce new cultivars that matched not only our requirements but also our desires. For instance, in banana (both the vegetable and the dessert kind) traits like sterility, parthenocarpy and vegetative propagation were selected during domestication. When it was found that triploid forms of banana bore larger fruits and grew more vigorously, we chose them to be the versions on our tables. (Sharrock, 1995)

Later the doors to molecular genetics and genetic engineering opened and led mankind to endless possibilities. Permutations and combinations of genes that are not even possible in nature and hence introducing a much diverse and accessible gene pool to experiment with. (National Research Council (US) Board on Agriculture, 1984). Mankind explored the new potentials of genetic engineering in sphere of crop sciences and successfully improved our reservoirs of food.

As the quality of life continued to enhance, people found themselves endowed with increased opportunities to exercise their personal discretion over what they desired their food to be like. And as a consequence, in addition to development in agronomic traits, there has been a stress on developing traits that are in-tune with the consumer preferences as well. From apples that never brown to pineapples with pink flesh, we have done it all. Fleshy fruits like apples show browning when left exposed to oxygen, which oxidizes the phenolic compounds present in them. In an attempt to curb this issue, the Arctic® apples concept was developed by silencing PPOs (Polyphenoloxidases) responsible for the phenomena. And these apples don't brown at all! (Stowe, 2021) . Similarly, the Pinkglow™ pineapple has a characteristic pink flesh that is credited to lycopene accumulation as a result of the modified carotenoid pathway.

We have also used biofortification to improve the nutrient density of our staple food crops by general plant breeding practices or transgenic methods as well. (Bouis, Howarth, McClafferty , Meenakshi, & Pfeiffer, 2011)

Man has been toying with the way our food looks and tastes. But food is no longer seen solely as a mode of acquiring energy. It also an entity that brings people together on the table

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and encourages dialogue. Hence, our interaction with food is just as pivotal to this conversation in the modern context.

The perspective of food-human interaction

The arena of food-interaction design and associated technological augmentation, although important, is less talked about. But this area of research and development has never been more exciting.

In 2017, the idea of EdiPulse was to design chocolate treats using a food printer. The "print" was based on the physical activities undertaken by the person on the day. Hence cultivating a healthier relationship with treats and snacking. (Khot, Lee, D, L, & F.F, 2015) In a similar approach, the concept of shape-changing food where 2D films of food materials can transform into 3D food during cooking , was ideated the same year (Yang, et al., 2017). TastyFloats is another such design where food morsels are transported mid-air in a contactless manner with the use of technological advancement in acoustic levitation (Vi, et al., 2017). How fascinating!

These innovations shed light on aspects of food that go beyond the act of eating. And these are a consequence of our constant need for novelty.

Ever growing need and demand for new foods

Similar to art and fashion, our desires to consume certain foods have changed vastly in just the last generation. Given the fact that humans are complex beings, these trends have been impacted by an array of factors. From an economic standpoint, McCluskey rules out a few possible drivers of this change. The impact of the influential people in the food realm, consumers willing to spend more and a growing need to customize has contributed to the same (McCluskey, 2015).

And from a socio-demographic view, the growing problem of diet related chronic diseases call for the future food policies to take into consideration the implications of changing trends in not only the agricultural sector but also the health sector (McCluskey, 2015) . That would mean we develop a common social consensus in favor of consumption habits that are healthier. The beginnings of such motives are evident given the fact that there has been growing interest in organic food globally over the past decade.

Challenges- Food neophobia and criticisms

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Although innovation is the ability to see change as an opportunity and not a threat, when the conversation shifts to something that is as fundamental to human life as food, skepticism is bound to loom over it. And the concerns are validated by a number of issues.

Biological concerns

Bacillus thuringiensis (B.t.), a gram-positive bacterium has been seen as a biocontrol agent since the last five decades owing to its ability to synthesize a wide range of insecticidal proteins that are toxic to many invertebrates. (Schnepf, Crickmore, & Van, 1998). Hence making it an excellent means to control pests without taking up chemical measures. Later it was published that pollen from B.t. corn could kill monarch butterflies and other insects that are not a pest to the crop being cultivated. (Losey, Rayor, & Carter, 1999).Therefore, the cost of pest control here is possibly generating ecological imbalances and even accelerate the loss of biodiversity of the fauna in the area.

In a similar vein of genetic modification of plants in an agricultural context, gene transfer to non-target organisms is also a problem. Plants engineered to tolerate herbicides may cross-breed with weeds and transfer the genes that imparts herbicide tolerance, (Whitman, 2000) The weeds then become difficult to control by herbicide application. The alteration of the natural sources we obtain our foods from may have serious ecological implications and has rightly been criticized.

Food neophobia

As an extension to the aspect of human-food interaction discussed above, people's attitude towards consumption of certain foods also influences the way these innovations unfold and are perceived at a local or global level.

Food neophobia is the reluctance to eat a novel food serving as an adaptive value to protect us in a potentially hostile environment (Pliner, 1993). Which means we are reluctant to consume foods that we haven't seen before. And this has protected humans throughout years of evolution to avoid potential dangers.

People have had unfavorable opinions on GMO foods for a while now. Although it depends on factors such as their knowledge of GMO foods, societal and media influences, the general consensus skews south.

Conclusions

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We have come a long way in the way we perceive and utilize foods for our benefit. Our interventions are growingly intentional and precise. As scientific advances make our food more nutritious, farming practices more efficient and our dining experiences more pleasurable, we are witnessing our changing relationship with food. It is no longer an activity aimed at mere sustenance but more of a holistic, multisensory and multifaceted approach to food.

References

Agriculture., N. R. (1984). *Genetic Engineering of Plants: Agricultural Research Opportunities and Policy Concerns.* Washington (DC): National Academies Press (US). Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK216396/

Bouis, H. E., Howarth, E., McClafferty , B., Meenakshi, J., & Pfeiffer, W. (2011). Biofortification: a new tool to reduce micronutrient malnutrition. *Food and nutrition bulletin, 32*(1-suppl1), S31-S40.

Khot, R., Lee, j., D, A., L, H., & F.F, M. (2015). Tastybeats: Designing palatable representations of physical activity. *33rd Annual ACM Conference on Human Factors in Computing Systems*, (pp. 2933-2942). doi:https://doi.org/10.1145/2702123.2702197

Losey, J. E., Rayor, L., & Carter, M. (1999). Transgenic pollen harms monarch larvae. *Nature, 399*(6733). doi:https://doi.org/10.1038/20338

Machin, D., & Chen, A. (2021). Designing food packaging to present healthy and ethical diets to the New Chinese middle classes. *Food,Culture & Society, 26*(1), 79-101. doi:https://doi.org/10.1080/15528014.2021.1981592

McCluskey, J. J. (2015). Changing food demand and consumer preferences. *Agricultural Symposium Federal Reserve Bank of Kansas City*. Retrieved from https://www.kansascityfed.org/Agriculture/documents/7025/mccluskey-paper.pdf

National Research Council (US) Board on Agriculture. (1984). *Genetic Engineering of Plants: Agricultural Research Opportunities and Policy Concerns.* Wahshington (DC): Genetic Engineering of Plants: Agricultural Research Opportunities and Policy Concerns. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK216396/

Pliner, P. P. (1993). Reduction of neophobia in humans by exposure to novel foods. *Appetite, 20*(2), 111-123. doi:https://doi.org/10.1006/appe.1993.1013

R.Dunn, R., Amato, K. R., Archie , E. A., Crittenden, A. N., Arandjelovic, M., & Nichols, L. M. (2020, February 19). Dunn, R. R., Amato, K. R., Archie, E. A., Arandjelovic, M., Crittenden, A. N., & Nichols, L. M. (2020). The internal, external and extended microbiomes of hominins. *frontiers, 8*(2020). doi:https://doi.org/10.3389/fevo.2020.00025

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Schnepf, E., Crickmore, N., & Van, R. (1998). "Bacillus thuringiensis and its pesticidal crystal proteins. *Microbiology and molecular biology reviews, 62*(3), 775-806. doi:https://doi.org/10.1128/mmbr.62.3.775-806.1998

Sharrock, s. (1995). Collecting the Musa gene pool in Papua New Guinea. *Collecting plant genetic diversity. Technical guidelines*, 647-658.

Stowe, E. (2021). Development of the Arctic® apple. *Plant breeding reviews, 44*, 273-296.

Vi, C., Marzo, A., D, A., Memoli, G., Subramaniam, S., Drinkwater, B., & Obrist, M. (2017). Tastyfloats: A contactless food delivery system. *2017 ACM International Conference on Interactive Surfaces and Spaces*, (pp. 161-170). doi:https://doi.org/10.1145/3132272.3134123

Whitman, B. D. (2000). *Genetically modified foods: harmful or helpful?* CSA Discovery guides. Retrieved from https://web.mnstate.edu/robertsb/307/ANTH%20307/genetically%20modified%20organisms.PDF

Yang, W., L , Y., T , Z., C , C., D, L., & H , I. (2017). Transformative appetite: shape-changing food transforms from 2D to 3D by water interaction through cooking. *2017 CHI conference on human factors in computing systems*, (pp. 6123-6132). doi:https://doi.org/10.1145/3025453.3026019

Zampollo, F., & Peacock, M. (2016). Food Design Thinking: A Branch of Design Thinking Specific to Food Design. *The Journal of Creative Behaviour, 50*(3), 203-210. doi:https://doi.org/10.1002/jocb.148