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The Future of Food is a Berry

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About the Author

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The Future of Food is a Berry

Fresh grapes, blueberries, and raspberries with raspberry and mango FoodBerries, enclosed by water-impermeable edible skins formed by layers of mushroom and algae extracts, and comprising pure fruit purée interiors, with approximately 70% hydration, similar to natural fruit.

The incredible success of the modern food experiment in radically reducing global hunger over two centuries of unprecedented human population growth has led to the hard realization that what seemed to work well till now, cannot work for much longer. Feeding humanity with food that is minimally nutritious, mostly delicious, and economically viable turned out to be easier than avoiding exhaustion of nature's ability to sustain what we remove when we feed ourselves and what we give back when we're done.

Dramatic change has come to the food system before. But changing what is a complex, interwoven, multi-trillion dollar food system will not happen easily, and may not happen at all without auto-catalytic transformation of the kind that human-centric design and technology have produced with broad new paradigms before, as with the first printing press, the first antibiotic or the first personal computer.

All of the articles in this issue of *Boston Hospitality Review* focus on what happens on "our" side of the table, that is, how the demand for food might adapt should we engage with the food we eat, and the air we breathe, mindfully, not just cognitively, but emotionally, and above all, through the hydrated experience of olfaction and flavor. We move to the other side of the table and explore how "brain food" points us to ways we might actually eat well, while eating differently and sustainably, not just for a few of us, but for all of us.

Our modern food system succeeds today to feed the global population by large-scale industrial farming strategies that produce highly refined foods with simplified nutritional matrices, chemical additives, plastic packaging, and other permanent materials that permit global food transport while enduring in the environment for thousands of years. This industrialization of food has accompanied skyrocketing obesity, which now affects roughly half the US adult population, has led to a dramatic rise in diabetes, estimated to affect around 400 million people worldwide, and contributed to the advance of cardiovascular disease, now the principal killer of humanity. Beyond these severe health consequences, the deterioration of brain, gut, and whole body health associated with processing chemicals such as artificial colors, flavors, plasticizers, and preservatives is hard to overestimate. Our food system's contribution to the loss of fertile topsoil and biodiversity, carbon emissions, and plastic appearance in most life forms on the planet are meanwhile contributing to global climactic change and the acceleration of the extinction of species.

In seeking rapid spontaneous change of our food system, scientists, engineers, and increasingly consumers have, perhaps inevitably, turned for inspiration to the natural food system that preceded industrialization. From farms and science labs to stores and kitchens, efforts are fast growing to introduce transformative change within the food industry and facilitate a regenerative source of food, local zero-carbon footprint production, distribution and consumption, elimination of food plastics, and a diet that is natural, fresh, and nutritive.

One of the sectors within the food system where this evolution is most notable is the snack food market. Innovation is moving the $139B global snacking market away from the excessively processed, high-sugar snacks of the last decades to natural, organic, and regenerative agriculture-produced foods that are largely free from the cold chain including nuts, dried fruits, cereals, and minimally processed chips. But missing so far from this movement toward foodstuffs compliant with what can be sustained by our bodies and our natural environment is an integral element of "brain food" — water itself.

Judging by trends in the snacking market, the future of food threatens to remain as dry as a slice of Wonder Bread. This is a problem, as dry food contributes to whole-body dehydration — in a healthy diet, 20% of daily hydration comes from the food we eat. The snacking market has grown as fast as it has, and as dry as it is, even in its turn toward otherwise healthy and regenerative qualities, likely contributes to why US children are now dehydrated as a group (CDC, 2011), and why low-income populations are the most dehydrated of all (Forno & Celedón, 2009). Without hydration, flavor also suffers, which processed foods frequently compensate for by adding sugar.

Nature's hallmark hydrated snack is the berry — arguably one of the most inherently natural forms of "pure food" — having evolved to be eaten, in the process of which it regenerates, via seed dispersal, for the distribution of progeny. With 70-90% water, 5-10% fiber, and 5-20% sugars, the fruit berry is the perfect illustration of a naturally hydrating snack. It also points to the healthy macronutrient balance of minimally processed foods. Further, the fruit berry "tastes good" not as a consequence of a single design variable (as in a simple and intense taste profile typical of processed food today), but as the result of an overall sensory profile that reflects complex combinations of sensory experiences, including factors such as texture and the sweetness and olfactory flavor experience that comes from intrinsic hydration. Making this possible is the fruit skin, itself a nutritional vector, which keeps moisture inside and serves as a kind of edible packaging to permit snacks with water content tantamount to that of a banana, multiple times more hydrated than the dry snacks of today.

For these and other reasons, the "berry-fication" of food is underway.

Over the last ten years food tech companies, including Apeel Biosciences, Mori, FoodBerry, and Notpla, have begun engineering and producing edible skins for preserving unprocessed or minimally processed natural foods (Rios et. al., 2022), with an immediate motivation to extend the shelf life of fruit or vegetables, or to make literal berries of food from any food or drink (Lamppa et. al., 2014), creating foods that range from convenient hydrated fruit and vegetable bites (like mini carrots, but of any fruit or vegetable at all) to easy bites of fully formed, moist peanut butter and jelly bites (seed butter core and strawberry skin) and poppers of coffee (coffee core with a coffee or chocolate skin). These food forms are starting to enter stores and restaurants as delicious and nutritious snacks that extend shelf life, and in some cases provide delightful new food rites and experiences while pointing to a promising "cradle to cradle" model for the food system of tomorrow.

The berry bush, or the fruit tree, can be seen as a metaphor for the future of a sustainable food system. The berry bush produces local, fresh, well-hydrated food

forms that can be consumed locally and within time delays that are sensible to the time scales of local human consumption, while post-consumption waste turns out to be regenerative of what grows next. But, of course, the berry bush can be more than a metaphor. Around one-quarter of all fruit and vegetables sold in the US is estimated to be discarded as food waste. Technology today is not far from being able to produce this nutritious while presently wasteful food source in food berry forms, which might be sold and distributed locally, and with a freshness that lasts for days, no plastic, such as a blueberry or raspberry. In places where natural food production is scarce, food staples like rice or cassava can be prepared in fortified and hydrated forms and distributed *sans packaging* to expand access to better nutrition. Eventually, any home, or any restaurant, might take the produce of its garden or kitchen and package it in food forms that stay hydrated and last when consumers head home, or kids go to school, taking out the processing — and the plastics — that often require national and international routes of transport and places it in the local setting where the food is to be consumed or distributed locally.

Printing of food? Food berries can be made by extrusion processes that resemble printing, allowing on-demand personal design of food with taste and nutrition profiles suited to personal nutrition needs.

These are among the many reasons why the race is on to create hydration barriers for natural or minimally processed foods that resemble berry skins. Among the most advanced of these natural skins are silk fibers (Marelli et. al., 2016) and layers of extracts from mushrooms and algae (Lamppa et. al., 2014). Some of these skins are more capable of providing hydration than others, while all aim to resemble natural protective skins with natural polymer networks and an organized structural hierarchy that permits “edible packaging.”

Functioning as a protective, physical gas and moisture barrier to segregate nutrition from the external environment, food skin technology is advancing today as a waste-free packaging solution that, more than mere packaging, is a nutritious perimeter of a new food form based on the oldest hydrated snack we have, the fruit berry. Growing the range of food that can be produced locally and consumed locally, without plastic and with sufficient shelf life to permit practical farm-to-table timelines, the fruit berry, a brain food that reaches our guts, increases the likelihood that our future of food will not only be accessible and nutritious for a few, but for us all.

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