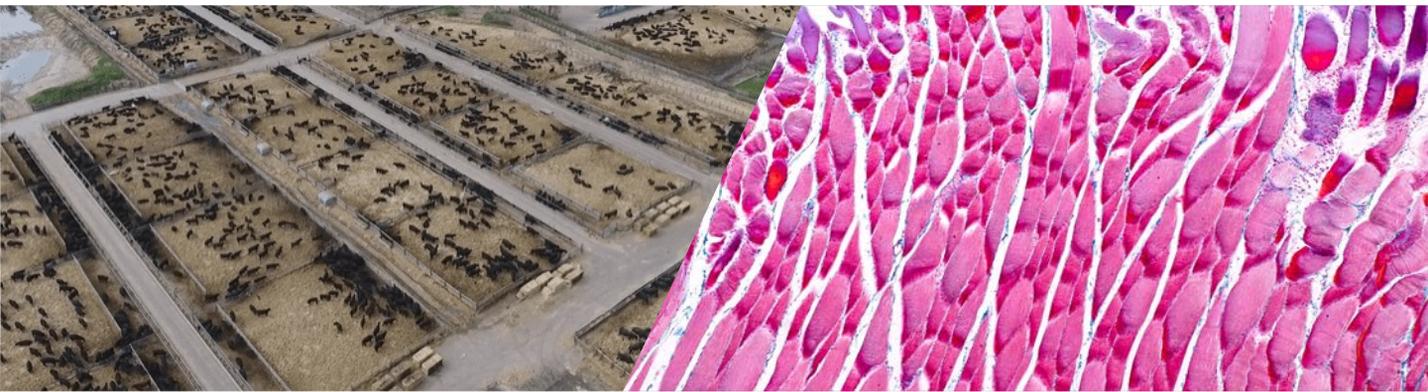


FOOD SYSTEM DISRUPTION

Would you rather eat a burger made the synthetic or regenerative way?

This is a question many of us will have to answer as we shape the **modern food system**, centred on designing foods from the molecule up with ingredients from a range of organisms and cells cultivated locally through precision resource use.

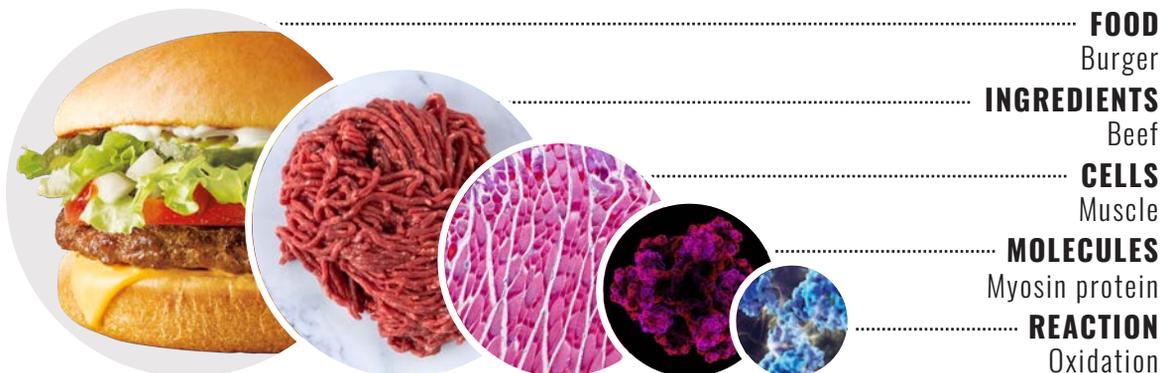
It contrasts with the **industrial food system**, which much like the greater industrial economy, is no longer sustainable. For example, this system is both a villain and victim of the climate crisis, releasing an estimated 20% of emissions while contending with weather extremes.¹ It also leaves up to half of the global population malnourished, due to both lack of nutrients in processed foods and lack of access to food. How is the modern system different? The answer comes with cheese, lettuce, pickle and tomato on top.



Modern synthetic burgers

Modern synthetic burgers are precision-produced to be both irresistible and 90% less resource-intensive.² They are the outcome of a range of modern capabilities, including Big Data analytics, software visualisation, A.I., genomics, 3D bioprinting, robotics and LED lighting, which together are enabling innovators to develop foods at the microscopic levels of cells, molecules and biochemical reactions.³ This is the approach behind modern meat companies, such as Beyond Meat, Impossible Foods and Eat Just.

APPLYING MODERN CAPABILITIES TO VENTURE INTO ONCE HIDDEN REALMS CELLS, MOLECULES AND BIOCHEMICAL REACTIONS



Source: Balance Point Ventures

For example, Beyond Meat began in 2009 with the question: what makes meat, meat? Turning to Big Data software, the company decoded the molecular properties of beef, identifying key factors such as haemoglobin protein ('haem') providing umami taste while triggering satisfaction. It then set out to match the molecules it identified with comparable ones from plants. Beyond Meat sources these alternative ingredients from specialty growers able to produce and extract desired molecules.⁴

BEYOND MEAT BIG DATA SOFTWARE

SWAPPING ANIMAL FOR PLANT MOLECULES TO REPLICATE THE SENSORY EXPERIENCE OF MEAT

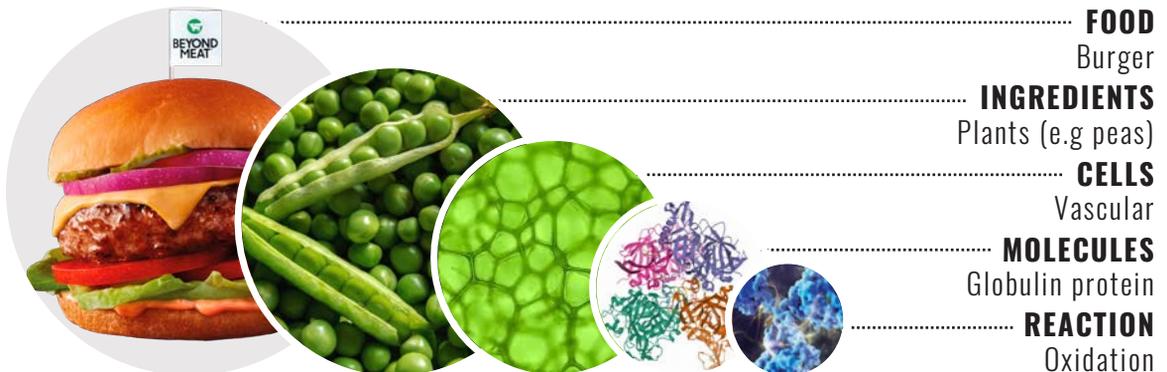


Source: Balance Point Ventures

It then runs the final mixture through a software-controlled extruder to precisely match the desired texture. The result is a mouth-watering burger capable of fooling human senses, evident in the company's \$7B market valuation and growing list of global distribution partners, including Starbucks, PEPSICO and Burger King.⁵

MOLECULAR MIMICRY

A BIOCHEMICAL IMPOSTER DESIGNED TO FOOL THE SENSES



Source: Balance Point Ventures

Competitor Impossible Foods follows a similar approach but with a twist. It adds haem made from genetically modified yeast cells, which has earned its burgers international acclaim for 'bleeding'. 'Precision fermentation' of molecules is a method pharmaceutical companies pioneered in the 1980s to make insulin protein previously sourced from pigs. Food companies soon adopted it to make additives in short supply, such as citric acid. This approach is now reaching the scale required to competitively produce bulk animal proteins, along with many other molecular commodities.⁶

Molecular mimicry doesn't stop there. Eat Just is taking it to the next level by replicating meat with muscle, fat and connective tissue cells cultivated in bioreactors from animal stem cells.⁷ Its ground meat products are already available in Singapore through the FoodPanda app⁸ and rival Upside Foods will soon release its equivalent product in the US.⁹ The next step will be replicating prized cuts of meat by 3D bioprinting cells like ink, which is a process MeaTech and others are developing.¹⁰



There are a growing range of choices when it comes to synthetic patties, but what about for burger toppings? All techniques mentioned above apply to dairy with companies such as Oatly and Ripple Foods leading the way in plant-based molecules,¹¹ Perfect Day in yeast-made dairy proteins¹² and Turtle Tree Labs in milk expressed from animal cells.¹³

For lettuce, pickle and tomato, 'vertical farming', more broadly known as 'controlled-environment agriculture', is gathering force due to improvements in technologies and business models.¹⁴ For example, 80 Acre farms is rolling out modular, software-controlled 'Plantopia' units perfected for individual plant species. Compared to open fields, this model yields 300x, uses 90% less land and 97% less water, runs locally on 100% renewables and eliminates weather-related volatility.¹⁵

The modern synthetic approach is gaining public attention. In 2020, investors directed £3.1B into private meat and dairy companies¹⁶ and comparable sums into listed companies, while \$400m+ went to six vertical farm leaders.¹⁷ Although this approach addresses many industrial issues, it also falls short in other areas. In health, synthetic foods are addictive by design, while containing high concentrations of ultra-processed, pro-inflammatory ingredients lacking in nutrient complexity.¹⁸ Many synthetic ingredients also come from industrial operations. Using less of them slows degradation but it does not (yet) reverse it.¹⁹



Modern regenerative burger

The **synthetic approach** focuses on individual species, while reducing food down to cells, molecules and reactions. In contrast, the **regenerative approach** focuses on the relationships amongst species, elevating food as the outcome of dynamic ecosystems. In doing so, it also elevates the value proposition: revitalising people and the planet. How? By enhancing traditional practices with modern capabilities.

Traditionally, the cow was more than just a piece of meat. We recognised the valuable role of this species in maintaining healthy ecosystems and in turn the role of healthy ecosystems in balancing the Earth overall. During their lifetimes, cows constantly graze grass, leaves and shrubs, which promotes growth, upping plants' intake of carbon and subsequent release of sugars for soil microbes. Cows also stomp carbon and water-containing organic matter back into the ground, while spreading fertiliser in the form of manure and urine. Overall, this supports ecosystem productivity and resiliency. At the end of their lives, cows become sources of carbon-negative, biodiversity-positive, high-quality foods, medicines and materials. **It's the how, not the cow, that matters.**²⁰

APPLYING MODERN CAPABILITIES TO REVEAL ONCE-HIDDEN CONNECTIONS ORGANISMS, ECOSYSTEMS AND THE EARTH SYSTEM



Source: Balance Point Ventures

Today, we're not only aware of these multiple sources of value, but are able to precisely measure, manage and monetise them with modern capabilities. This includes digital platforms, drones, satellites, sensors, robotics, blockchain and more, which are enabling us to record in real-time the carbon and water content of soil, biodiversity from the micro to macro level and nutrient density and diversity. These data can either be packaged and sold or become part of product marketing.²¹

As such, revenue is no longer limited to the sale of commodity food, but rather is a combination of premium product sales and ecosystem services. The growing list of buyers includes: (i) informed consumers connected directly to farms through online platforms such as Farmdrop in the UK,²² Thrive Market in the US²³ and Pinduoduo in China;²⁴ (ii) corporates buying carbon offsets to match net zero commitments (\$14 trillion in revenues committed as of 2020);²⁵ (iii) investors seeking impact returns (£3.9B+ directed to regenerative agriculture in 2020);²⁶ and (iv) governments and organisations offering incentives (UK government is shifting 90% of agricultural subsidies to this area by 2030).²⁷



On costs, reductions are no longer limited to negotiating the price of seeds, fertiliser and equipment, but rather come from optimising beneficial relationships amongst species and applying resources with software-controlled precision.

This value proposition is attracting a range of players applying regenerative practices across a spectrum of basic to advanced. On one end are Big Food companies, including General Mills, Danone and PEPSICO, working with their grower networks to adopt basic practices focused initially on soil health.²⁸ They are also rolling out regenerative brands, such as General Mills' EPIC Provisions bars and Annie's Organic Elbow Cheddar Mac & Cheese.²⁹ On the other end are wilding projects focused on building back the extensive network of ecosystems previously underpinning environmental sustainability. One example is Knepp Wildland in the UK, serving as a biological refuge and provider of premium food and ecotourism.³⁰

Overall, regenerative approach offers an answer to human and ecosystem health. However, it's still in its early stage with modern capabilities not yet widely commercially available and critical mass still building around platforms and accreditation standards. Regenerative foods themselves also don't match the sensory experience of the processed foods people have come to crave. There is an argument to be made for meeting people where they are.

This brings us back to the would-you-rather starting question, which highlights that there is no one modern way, but many. The variations that ultimately dominate will depend on who participates in the creation of modern systems, whether in food or other areas. The answer to this question also needn't be binary. Given the level of disruption ahead, having both options creates greater resiliency, in addition to synergies. For example, the shift to synthetic meat frees land currently used to grow monocultured feedstock, which in turn opens opportunities for regeneration. Overall, the key is to return to sustainability, otherwise we'll end up eating industrial burgers' dust.



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