

Curing the Language of the Food 2.0 Era **

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Summary: The global food system is undergoing tectonic changes involving health, economics, sustainability, and scientific advancement. Emerging innovations target major environmental and global health challenges. Following Kuhn's *Structure of Scientific Revolutions*, such innovative solutions are held back by lack of consumer trust and acceptance including: (i) the intrinsic friction between conservative traditional food choices and the disruptive nature of food innovation and (ii) the confusion caused by competitor ads, less successful past innovation attempts, primordial fear of synthetic biology, and consumer groups that oppose innovation. Ensuring that food innovations improve food systems requires an integrated effort of all stakeholders. First, a new lexicon that accurately describes food choices must be agreed upon. Second, following Popper's *Paradox of Tolerance*, a U.S. interagency regulatory framework must provide crystal-clear prescriptive (rather than responsive and narrative-based) national safety guidelines on new food innovation as to the regulatory clearance path and labeling. Third, a non-partisan organization should focus on consumer research and education at all levels so as to not leave the stage to 'fake-news' on the one hand, and to commercial and potentially less consumer-trusted entities on the other. The focus should be translating the language of technological and consumer-beneficial innovation into Rousseau's emotional language rather than solely to the Chomsky's logical 'internal' language lacking the 'external' language aspect. Hence, an array of practically applicable policy adaptations can improve the language in the Food 2.0 Era to help both consumers and the planet enjoy a healthy future through cost-effective food innovation made available via a safe, sustainable, healthy, and trusted process.

Current realities: The world's leading health challenge of sugar overconsumption is an example of a current reality that did not exist a century ago and must be targeted by disruptive food technology innovation. In 1928, penicillin was discovered by Alexander Fleming, marking a century of curing disease. In parallel with increased longevity attributed to improved treatment of disease, the last century is characterized by a sharp rise of non-communicable diet- and lifestyle-linked diseases with sugar overconsumption defined by large epidemiological studies as the leading global cause of compromised health. Consequently, an emerging reality formed by consumers, health organizations, and governments consists of pressure to cure the food we eat, rather than the diseases caused by it. For the example of sugar overconsumption, this materializes into sugar-tax and anti-sugar consumer education. In addition to looming health challenges, the lack of sustainable methods to support the food and animal feed of the growing population emphasizes the need for disruptive solutions. Thus, the current reality presents an evolving pressure for sustainable and healthy food with consumer trust as a precondition.

Along with the declining consumer trust toward processed food, these factors result in a market-share decline for the large food and beverage multinationals. Moreover, consumers are often confused by what is perceived as contradicting demands for healthy, cost-effective, sustainable, and disruptive solutions. The evolving paradigm shift in our food system exemplifies a classic scientific revolution defined by Kuhn as "a change that is not a normal development-by-accumulation, but a game-changing earthquake that leads to new paradigms." Intrinsic to such disruption, as observed for genetically modified organisms (GMOs) and other synthetic biology food and beverage solutions, communities often refute these disruptive innovations by poorly reasoned rationalizations; ranging from unsystematic data-driven scientific evidence to pseudo-science and "fake news." The public perception of GMOs, anti-vaccination subgroups, and numerous other examples teach us that language and regulation emerging from academic ("ivory

tower”) sources need to be articulated carefully for dissemination to less scientifically literate consumers. Such examples illustrate how revolutionary advances can be hampered by a failure to translate scientific understanding and jargon into narratives that consider the perceived emotional perspectives and primordial fears of the public.

Scientifically credible approaches and challenges: Amai Proteins applies Agile-Integrative Computational Protein Design (AI-CPD) and biotechnological production by fermentation to produce proteins that are compatible with the mass food and beverage market. Amai’s first product is the sweetest protein in the world. Healthy sweet proteins are found in fruits along the equatorial belt. Yet, their usage is compromised by cost and supply, hampered stability (temperature, acidity, fat milieu), and a lingering taste. AI-CPD enables Amai to circumvent the stability and sensory challenges by designing a protein that is similar to proteins that grow in harsh conditions. These proteins are then produced via fermentation biotechnology, thereby enabling sustainable and cost-effective production. This is an example of beneficial production by new synthetic biology and biotechnology methods. While fermentation is an old preparatory method underlying wine, bread, and yogurts, there are successful examples of regulatory-authorized fermentation-based protein products, one of the challenges of materializing the health and sustainable potential is consumer acceptance. This includes obtaining regulatory clearance and positive, accurate labeling, both of which are essential components driving the essential consumer trust. Amai is an example of an emerging synthetic biology category of a novel protein sequence produced by heterologous expression fermentation. To the non-scientific consumer, such innovation may elicit primordial fears related to DNA modification using microorganisms as the biotechnology factory. The fear tends to level off once consumers understand that the product is 100% protein produced by yeast fermentation, namely, it is brewed like beer. An additional fear is caused by past safety incidents, mainly associated with small molecules (not protein macromolecules) and substances that enter the body not by eating them. Hence, while Amai’s product can help solve the world’s leading health concern, it must overcome challenging consumer education due to reasons which are mainly not scientific.

Consumer acceptance is a multidimensional challenge that has been bruised over the years by lack of a common language, natural fear from the unknown, glitches of unsuccessful innovation (or specific batches thereof), negative public relations, biased lobbying, and fake news. In 1754, Jean-Jacques Rousseau claimed that “one does not begin by reasoning, but by feeling...that is why the first languages were singable and passionate before they became simple and methodical.” Reflecting this understanding, Noam Chomsky split language into the categories of *internal (I)* and *external (E)*. While I-language is a mentally represented linguistic knowledge of a native speaker, E-language encompasses other notions of what a language is from a body of knowledge to behavioral habits shared by a community. In the era of new media and fake news, consumer education cannot be abandoned to the private commercial media and conspiracy groups. Rather, there is a need to embrace an accurate language that is tailored to a wary consumer audience who follow Kuhn’s *Structure of Scientific Revolutions*.

The challenge of successfully translating scientific jargon into language that resonates with the logical and emotional reasoning of the public has been partially addressed in the medical field through the adaptation of hospital-oriented jargon (e.g., from *sickness* and *patient* to *health* and *customer*). In food innovation, language designed to reassure consumers of the safety and benefits (e.g., health and sustainability) of innovative foods and ingredients is needed. With a consumer-focused mindset, Amai attempts to use jargon that is not associated with fear. For example, Amai’s proteins are *designed* rather than *engineered* and contain *substitutions* rather than *mutations*. Further, these are not *recombinant* proteins, but proteins produced by heterologous expression. Despite the fact that they are 100% protein, one of the first questions

of consumer brands is whether they are *natural* since AI-CPD was used to alter the protein sequence. Such consumer-education barriers actually slow down the process of embracing consumer-beneficial innovations.

A condition for achieving public trust is the availability of credible, unbiased, clear, and consistent guidelines as to the regulatory process and safety evaluation of innovative foods and ingredients. Answering the clash between disruptive innovation and conservative tradition is not via embracing full tolerance. Rather, Popper's *Paradox of Tolerance* shows that unlimited tolerance leads to the disappearance of tolerance calling for prescriptive credible regulation. The U.S. Food and Drug Administration (FDA) traditionally uses a case-dependent, narrative-based approach to ensure regulatory requirements meet specific food safety needs. The rapidly changing technological developments and shifting cultural priorities that now characterize the public environment make the traditional approach challenging at best. To encompass emerging innovation and maintain consumer trust, a prescriptive, regulatory approach would be more effective. Since the basis for Food 2.0 is increasingly multidisciplinary, regulatory responsibilities can be anticipated to be influenced by a larger number of different stakeholders having distinct perspectives and priorities. Thus, interagency prescriptive guidance may act to stabilize new fields and enhance consumer trust. This may also facilitate better coordination between regulatory agencies with overlapping responsibilities, thus further reducing consumer confusion in understanding safety guidelines.

Evidence-based options and real-world opportunities:

- Form a consortium comprised of regulators and non-governmental organizations tasked with presenting a dictionary of consumer-accepted language that considers consumers views and psychology, positive and negative. The Academy of Hebrew Language is an example of such an entity used to centrally guide a rejuvenating language.
- Form an interagency group including the FDA, U.S. Department of Agriculture, National Institute of Health, and Environmental Protection Agency aimed at (i) coordinating innovative foods and ingredient regulation, (ii) strengthening consumer trust in the resultant products, and (iii) providing clear prescriptive regulatory-clearance roadmaps.
- Form a nonpartisan organization targeting consumer (regulatory) education in the following areas: (i) research into consumer trust and perception and the effectivity of consumer education methods, (ii) dissemination of evolving language and regulation, (iii) education of past and present case studies, and (iv) communication on the specific benefits food innovation can present to humanity and to the planet (e.g., The Davidson Institute of Science Education provides a model approach).

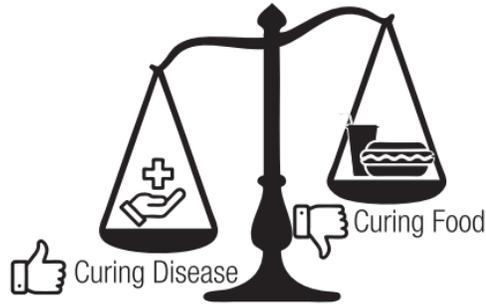
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Popper, K. R., (1945). *The open society and its enemies. Vol. I. The spell of Plato*.
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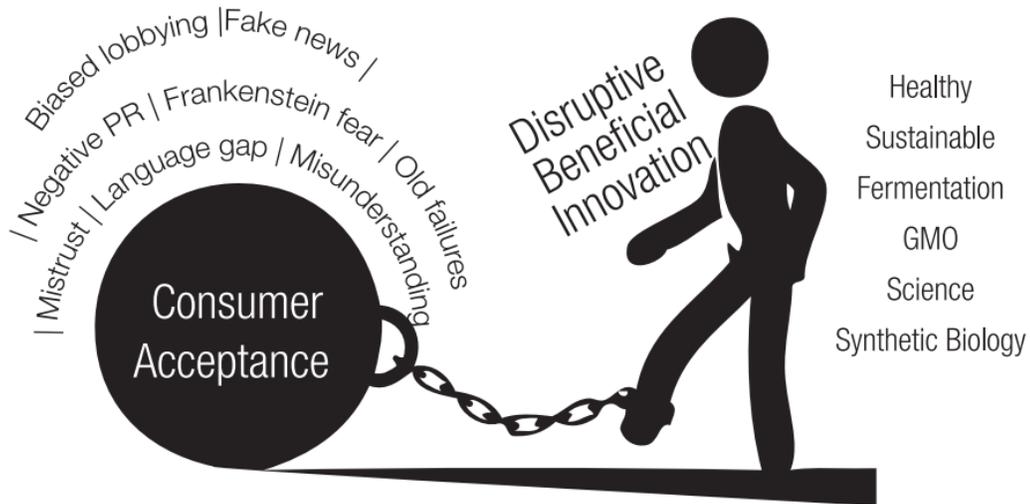
Current state:

Success in curing diseases but not in curing food



The challenge:

Beneficial solutions are held back by lack of consumer acceptance



The solution:

Earning back consumer acceptance via regulation, language and education

	Why (Philosopher)?	Why (reason)?	By whom?	How to solve?
<p>Jean-Jacques Rousseau 1754</p>  <p>Augmenting rational language with lost perception of feeling and emotion</p>	 <p>Noam Chomsky 1986</p>	Focus on internal- and not external language	Regulatory & NGO consortium	External-language rejuvenation
	 <p>Karl Popper 1945</p>	Tolerance paradox	Inter-agency regulatory group	Prescriptive regulatory track to innovation
	 <p>Thomas Kuhn 1962</p>	The structure of scientific revolutions	Non-partisan organization	Consumer perception research & education

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