

Are Probiotics the catalyst for a medical shift from Individualism towards Interspecies approaches?

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Introduction

The limits of medicine are ever-expanding. Since the beginning of the new millennium, this expansion has included and indeed encouraged the use of probiotics for a variety of ailments. This has occurred because science has shown us irrefutable proof that we are not alone in our bodies or individual in our healing processes (Gilbert et al., 2012). Human beings live closely with innumerable microorganisms on our skin, in our mouths and, most notably for this essay, inside our gastrointestinal tract (Gupta and Garg, 2008). This essay explores how medicine is shifting toward interspecies approaches to medicine using a three-pronged approach. First, this essay compares medical individualism and interspecies approaches to medicine. By briefly looking at these two concepts, this essay provides a foundation for the reader to understand a concept key to this essay's argument, symbiosis. Second, this essay offers a brief account of the history of probiotics as a scientific field. Third, this essay takes inspiration from Anna Lowenhaupt-Tsing and uses 'histories of encounter', a framework proposed by Tsing in her acclaimed book 'The Mushroom at the End of the World' (Tsing, 2005). Using Tsing's framework, this essay explores how probiotics and human beings have interacted from ancient history until today, beginning with a humble food, yoghurt.

Medical Individualism vs Interspecies Approaches

In most conceptions of human evolution, humans have been positioned in opposition to other species (Lestel and Taylor, 2013). From hunting to domestication, disinfection, poaching, deforestation and more, the story is typically one of dominance, competition, and mutually exclusive survival (Lestel and Taylor, 2013). In mythology, history and academia, there is a particular emphasis on surviving individually and satisfying our interests, at times to the detriment of other species and even other human beings (Tsing, 2015). This idea has permeated many scientific fields, such as economics with the capitalist market concept or the survival of the fittest concept in population genetics (Tsing, 2015). Medicine has been one of the strongest proponents of the concept of the individual.

To look at medical individualism, we must begin with Michel Foucault and his acclaimed work, 'The Birth of a Clinic'. Foucault details how medicine's critical eye came to focus on the individual normal body (Foucault, 2003). He notes the rise of the notion of an autonomous individual agent, of the independent citizen in the modern age (Foucault, 2003). It is this notion that gripped much of academia and led to theories such as Capitalism and focused the clinical gaze on the individual. As a result, the 'body itself' (Rose, 2007, Chapter 1, p. 10), how it behaves, what it looks like and how it experiences disease became the centre of clinical observation (Rose, 2007). The focus on the body itself excluded the environment and other species. In this theory, humans are singularly and individually responsible for their health, and the publication of defined parameters of what is considered healthy gave rise to self-management and the extension of medical influence over previously un-medicalised topics (Rose, 2007).

Interspecies approaches to medicine take a diametrically opposite approach. They challenge the idea of individuality and are focused on the phenomenon of shared life (Lestel and

Taylor, 2013). The emergence of organised systems of individuals pioneered by ecologists in the late 19th century gave rise to the concept of symbiosis (Gilbert et al., 2012). Symbiosis is defined as the relationship of two or more distinctive organisms existing together for the advantage of one or both organisms (National Geographic, 2019). This idea that both parties can benefit from a relationship with each other is the basis of all interspecies approaches (Gilbert et al., 2012). Symbiosis fundamentally opposes the individual theory of medicine because it posits that humans are part of a collective. However, probiotics are a unique example of symbiosis because they are both a paradigm of symbiosis and fit quite well within medical individualism.

A brief history of Probiotics

Contrary to popular belief, the concept of probiotics is more than a century old. The idea was first introduced by Elia Metchnikoff, one of the 1908 Nobel prize laureates in Physiology or Medicine. In 1908, Metchnikoff published a book titled 'The Prolongation of Human Life', in which he suggested that a benefit of consumption of fermented milk products by Bulgarian peasants was a longer life span (Metchnikoff, 1908). This theory and Metchnikoff's research are the foundation of probiotics as we know them today (Podolsky, 2012).

The term 'probiotic' was first used to describe substances produced by one organism which stimulate the growth of another organism by Lilly and Sitwell in 1965 (Lilly and Sitwell, 1965). To understand the mechanism of probiotics, we must understand their site of action, the gastrointestinal (GI) tract. The GI tract is one of the largest surface areas in the body, second only to the respiratory tract (Gupta and Garg, 2008). It is home to over 500 separate species of bacteria, known as gut flora, which are essential to homeostasis (Gupta and Garg, 2008). Homeostasis is defined as the maintenance of internal variables within narrow limits to achieve a relatively constant state (Asarian et al., 2012). The maintenance of Homeostatic limits is essential to survival. Illness is often recognised by the disruption of these limits. A typical example of this is a fever, which is when body temperature increases beyond the homeostatic limit of 37 degrees Celsius (Asarian et al., 2012). The gut flora performs multiple functions, including assisting digestion, defending the host from invading pathogens and stimulating the immune system (Gupta and Garg, 2009). The use of antibiotics, irradiation and other treatments can cause disruptions and alterations to the composition of the gut flora and its functions (Gupta and Garg, 2009). The introduction of beneficial bacteria or probiotics is a means to reinstate the microbial equilibrium and return the gut flora to regular or even improved functioning.

In 2001, The World Health Organisation and Food and Agriculture Organisation officially defined probiotics as 'live microorganisms' which confer health benefits on the host (FAO/WHO, 2001). These new definitions were part of a movement taking place within many sectors of the scientific world. The early 2000s saw microbial life become a key model within studies of possible extra-terrestrial life, the politics of food, biomedical advancements, and ecological futures (Paxson and Helmreich, 2014). Where microbes had been previously seen as the bane of ecosystems, the beginning of the new millennium saw them repackaged as an integral part of ecosystems (Paxson and Helmreich, 2014). This positive view of microbes paved the way for probiotics to become mass-marketed and popular in ways they had never been before.

Histories of Encounter

The second chapter of Anna Lowenhaupt-Tsing's acclaimed book is titled 'Contamination as Collaboration'; within this chapter, she proposes a framework for discussing diversity and biodiversity within communities through a 'rush of troubled stories' (Tsing, 2015, Chapter 2, p.34). She writes of encounters and how they transform and shape people, places, and communities. Contamination is a keyword in this chapter that is used not with a negative connotation but rather as a catalyst for change; in fact, Tsing redefines contamination to mean 'transformation through encounter' (Tsing, 2015, Chapter 2, pg. 28). Survival, she argues, is made possible by collaboration; collaboration results in contamination (Tsing, 2015). Tsing illustrates this point by critiquing the scholarly focus on individual advancement within several fields. She looks to the evolution of economics and population genetics, both of which pay attention to a singular actor whose objective is to satisfy their own best interest (Tsing, 2015). These fields mirror the evolution of medicine described by Foucault in their focus on the individual. Yet, as Tsing notes, all these fields pay particular attention to the precarity of survival. The mere acknowledgement of our precarious state of being is an admission of vulnerability to others and, arguably, a need for help (Tsing, 2015). To state that we survive or thrive alone is a fantasy (Tsing, 2015); even in economics, the market cannot exist without the public. To illustrate the interconnectedness of survival, Tsing tells a story of how a Japanese fungus and two east Asian ethnic groups came to thrive in the Oregon forests. Her analysis of how the matsutake mushroom came to fruit in Oregon moves through several eras of history and tells the tale of the Hmong and Mien people (Tsing, 2015). Through oppression, displacement, and contamination, two distinct peoples and one fungus came to be the backbone of the mushroom industry far from their native homes. Stories of migration and grit such as this are familiar in every land (Tsing, 2015). Still, Tsing's story also provides a framework for how to write about the transformative encounters between people and other species. It is through this framework that the 'histories of encounter' (Tsing, 2015, pg. 28) between people and probiotics will be explored.

To begin our exploration, we must go back over 8000 years and look to a humble food, yoghurt. Humans have long been aware of yoghurt as a way of preserving milk and improving health. Yoghurt has been known by many names through the eras, Dahi in India, Matsoni in Japan (Fisberg and Machado, 2015), Leben raib in Saudi Arabia and Egypt (Metchnikoff, 1908) and many more. It is recognised worldwide as a fermented milk product that provides the body with digested lactose and viable strains of bacteria such as *Lactobacillus bulgaricus* (Fisberg and Machado, 2015), Streptococcus, Lactococcus and more (Aryana and Olson, 2017). Archaeological evidence shows that it was introduced into the human diet sometime between 10,000 and 5,000 BC (Mukhopadhyay, 2008) when domestication of milk-producing animals became popular and ways to extend the usable life of milk were sought (Fisberg and Machado, 2015). Evidence of knowledge of the health benefits of ingesting fermented milk products has been found as far back as 6000 BC in Indian Ayurvedic texts (Fisberg and Machado, 2015). Over the ages, as medicine and science progressed, the health benefits of yoghurt were largely forgotten. Furthermore, the advent of germ theory cast microbes in the worst possible light. It is here, at the beginning of the 20th century, that we find the father of our probiotic concept, Elie Metchnikoff, and the bacterium *Bacillus bulgaricus*.

In 1908, Metchnikoff published his theory of how toxic bacteria from the large intestine could be transformed into a friendly colony of *Bacillus bulgaricus* (Podolsky, 1998). Metchnikoff argued that the Bulgarian peasant population's frequent consumption of yoghurt grew bacterial colonies in their GI tract, which gave them long life (Metchnikoff, 1908). This

theory drew on millennia of encounters between people and bacteria and birthed probiotics. It could be argued that probiotics existed long before Metchnikoff, and he simply legitimised the concept. The publication of this theory had significant effects. First, it boosted the yoghurt industries of Eastern Europe (Podolsky, 1998). By this time farming and food preservation methods were advanced, and yoghurt was no longer the only way of preserving milk; indeed, the need to preserve milk had dramatically decreased because commercial farming made milk widely available. It was only the poor populations that relied on this ancient preservation technique. Metchnikoff's proposal and subsequent research gave yoghurt an elevated status; it was not only considered sustenance but medicine. Following Metchnikoff's publication, yoghurt was marketed and sold in pharmacies as medicine (Fisberg and Machado, 2015). The rise of the yoghurt industry from this point forward has become meteoric and given birth to popular products such as flavoured yoghurts and frozen yoghurt (Aryana and Olson, 2017). Yoghurt is now the most produced cultured dairy product and is the focus of research around the effects of probiotic dairy products (Aryana and Olson, 2017).

Metchnikoff's theory also inspired academic interest in probiotics and GI tract disease. This paid off largely in the 1990s, when research into probiotics expanded exponentially, resulting in the creation of the term 'Microbiome', referring to the genetic material of microbes living in human hosts (Podolsky, 2012). Probiotics as an official field took off and is now a multibillion-dollar industry worldwide (Podolsky, 2012). It has been recognised by many scholars and institutions that good gut health is dependent on a robust colony of gut flora in the GI tract (Gupta and Garg, 2009). Probiotics have proven to be effective in clinical conditions such as *Helicobacter pylori* infections, various cancers, inflammatory bowel disease, surgical infections and more (Gupta and Garg, 2009). The dominant medical model, biomedicine, is slowly accepting the role probiotics have played and continue to play in disease treatment and prevention. Research into probiotics and probiotic foods is ongoing all over the world, intending to allow food to be classed as medicine and the associated diet to be classed as treatment (Petrova et al., 2021). A new form of medicine has been made accessible by bacterial cultures, where food is the input, bacteria the processing unit and healing is the output.

Through all these advances, the role of the public cannot be overlooked. The individual medical model empowered citizens to take charge of their own health (Rose, 2007); this power is now being used to access and popularise non-biomedical treatments and approaches to healing. The public is drinking kombucha, yoghurt and kefir in large amounts allowing the probiotic beverage industry to grow. The market for probiotic supplements is expanding. As time goes on, the power to shift the trajectory of medicine is not only in the hands of doctors and scientists but also in the hands of the public. As people continue to be transformed through encounters with probiotics (Tsing, 2015), so too will the dominant medical models be transformed.

Conclusion

Proponents of medical individualism can no longer ignore probiotics because the body itself has a mutually beneficial symbiotic relationship with bacteria. Bacteria live inside of, on top of and alongside human beings and thus have come under the purview of the clinical gaze. Arguably, bacteria are part of the body itself. It is here that probiotics have become a gateway to new frontiers. As probiotics are continuous with gut flora and thus already an intrinsic part of the human body, they sit at the convergence of humans and other species. They are other,

and yet they are part of us. The symbiotic relationship humans and gut flora share prevent clear boundaries. The proximity to another species has forced us to reconsider the specifics of humanity (Lestel and Taylor, 2013). This grey area has allowed medicine to embrace probiotics and yet maintain individualism theories to a certain extent. Accepting bacteria, a formerly reviled microbe, as integral to our continued survival has left the door open for other species to make the same leap. Some species, such as hookworms, are already entering the conversation about what it means to be human (Lorimer, 2019). Interspecies approaches are already being implemented in biomedical practice as antimicrobial approaches to treatment and healthcare are now supplemented with probiotic approaches to rebuilding microbial colonies within hosts (Lorimer, 2019). Medicine accepts that we cannot treat ourselves without treating the species in relationship with us.

From ancient Egypt to 20th century Bulgaria and into the present, probiotics and bacteria have interacted with humans on many levels. Probiotics and the ongoing research surrounding them are catalysing a shift in the medical toward interspecies approaches. Biomedical and individual models of medicine are dominant and likely will be for the foreseeable future. Still, the brick wall between humans and other species has been broken down and replaced with a door, to which probiotics are the key.

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