

Food as Medicine: Cultural Heritage, Chinese Medicine and Nutrigenomics

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The use of food as medicine is as old as antiquity and expressed within many indigenous medical systems, as well as a major facet of Eastern medical systems. It is only recently that biological sciences have accepted the fact that nutrition plays a major role in chronic disease. This shift in paradigm happened with the acceptance of epigenetics, which indicates that a relationship exists between our environment and genes. This realization opens a major modification in perspective within the scientific community, which is in its infancy of understanding dynamic relationships with the environment. Using food as medicine (diet) in science is specifically referred to as nutrigenetics and nutrigenomics, or nutritional genomics. Here, the focus is nutrient-gene interactions and identifying specific foods that trigger genes. This paradigm shifts protocol based medicine (the "one size fits all" mentality currently implemented as managed health care with pharmaceuticals) to "Modern" medicines approach, transitioning to "Personalized" medicine.

In Eastern medical systems, this synergistic relationship with the environment is already well understood on multiple levels simultaneously. It is articulated within an associated diagnostic methodology that has withstood the test of time.

It is important to understand cultural heritage and Chinese Medicine, and its application associated with food as medicine. This legacy of intangible knowledge, beliefs and practices that have been inherited from past generations, to be maintained presently with a responsibility to protect and preserve generations to come.

Eastern medical systems place significant importance upon using food and medicinal herbs as treatments to counterbalance disease. It is equally important to understand the scientific basis of food as medicine and its interpretation. It is also paramount to understand patterns of progress associated with the political and economic drive within big business, organizations and associations in the pursuit of profits. This drives socioeconomic and political policy that affects human beings globally.

Cultural Heritage

According to the United Nations Educational, Scientific and Cultural Organization cultural heritage is the "legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations".¹ Issues triggering cultural heritage and traditional medical knowledge stems from many factors. One in particular is biopiracy related to traditional medicine knowledge and India dealing with pharmaceutical industry.

Biopiracy is a term that refers to the use of intellectual property systems to legitimize the exclusive ownership and control over biological resources, products and processes that have been used over centuries in non-industrialized cultures - basically, according to Dr. Vandana Shiva the theft of

indigenous knowledge! In the forefront for many years, Dr. Shiva battled biopiracy in India protecting the rights of the people and their cultural heritage against exploitation of natural resources for profit. The American Heritage Dictionary defines biopiracy as, "the commercial development of naturally occurring biological materials, such as plant substances or genetic cell lines, by a technologically advanced country or organization without fair compensation to the peoples or nations in whose territory the materials were originally discovered."²

The first legal precedent of this nature involved the Neem tree (*Azadirachta indica*). The incident took place in the early 1990s in Europe, and it is considered the most important victory to date in regards to biopiracy. During this time patent applications were being submitted from numerous private companies. One patent in particular was submitted from an agrochemical giant named W.R. Grace for the neem tree's fungicide properties. For centuries, the neem tree's uses were well known and freely sustainable to the locals of India. This changed when this company was able to "claim" the neem tree as a "significant resource" in just a few years. Shortly thereafter, a factory was set up that collected the seeds and extracted the pesticide. The locals used the neem seeds to produce oil that they used for heating and lighting. Of course now the price increased so much that the locals could not afford to buy them. The repercussions due to this patent affected the locals way of life not only did they lose access to the seeds, but it also hurt their own economy.^{3,4,5}

In response "The Neem Challenge" was started in 1994 to revoke a patent on the properties of neem originally given through the European Union as a fungicide. Shiva stated, "The neem tree is India's sacred goddess... our sacred heritage. Neem in Sanskrit is referred to as sarva roga nivarini -a term that means cure for all ailments. To take this ancient knowledge from us is blatant and exploitive biopiracy."⁴ On May 10, 2000, the Neem patent was revoked!

Another costly legal battle involved the medical use of turmeric (*Curcuma longa*) to heal wounds, a plant that possesses a therapeutic properties that had been well known in India for generations. In 1999, the Indian government fought and won to revoke the U.S. patent on turmeric.⁶

Both of these cases inspired an electronic data base of Ayurvedic knowledge that was established in 2003, called the Traditional Knowledge Database Library (TKDL) in order to prevent future patent appropriations of medical knowledge. The offer to make this database was a preventative one in order to improve the available prior art information, they would prevent commercial exploitation and propertization by pharm companies. China also has a Traditional Chinese Medicine Patents Database which is a comprehensive record of traditional acupuncture, herbal medicine, and mineral drugs that can be accessed and searched by international patent examiners.^{7,8}

The significance of patent litigation basically gives exclusive rights to make, sell, and distribute that particular product. These biodiversity patents tend to establish monopolies in medicine, livestock and seeds because the corporations that own these "exclusive rights" can control the production and distribution. According to Dr. Shiva, "Patent claims over biodiversity and indigenous knowledge that are based on the innovation, creativity and genius of the people of the Third World are acts of biopiracy. Since a patent is given for invention, a biopiracy patent denies the innovation embodied in indigenous knowledge. The rush to grant patents and reward invention has led corporations and governments in the industrialized world to ignore the centuries of cumulative, collective innovation of generations of rural communities."^{8,9}

The bottom line and food for thought here, according to Dr. Shiva, "biopiracy and patenting of indigenous knowledge is a double theft because first it allows theft of creativity and innovation,

and secondly, the exclusive rights established by patents on stolen knowledge and steal economic options of everyday survival on the basis of our indigenous biodiversity and indigenous knowledge. Over time, the patents can be used to create monopolies and make everyday products highly priced."⁹

Science in Transition

Prior to 2001, human complexity was understood as the more complex an organism is, the greater number of genes it possesses. The focus within biology is the mechanistic mindset (no invisible forces, measure only physical matter), that humans are separate from the environment, nature verses nurture (cannot have two competing theories; it must be one or the other), and the goal within science was to dominate nature. The last frontier was biotechnology and bioengineering, which has been achieved as seen with genetically engineered organisms. It is interesting to note that since Quantum physics' identification of quarks, leptons etc., we can no longer just look at physical matter because it is the invisible forces that create the physical matter.

Since the Genome Project, it was discovered that humans had fewer genes than a mouse, and thus human complexity needed to be reexamined. It also changed the perspective that we are not mutually exclusive from the environment and there is a dynamic relationship between the environment and humans. This opened the door for epigenetics to get published in more prestigious journals and recognition that there is a dynamic relationship with the environment affecting gene expression. This was also the catalyst for this paradigm shift. This identified that other factors are involved that trigger genes, like our environment around us rather than the perspective of what we are born with. The viewpoint of nature verses nurture also is challenged. In this mindset, there cannot be two competing theories; it must be one or the other - well, Darwin was not completely correct, nor Lammark completely wrong!

More importantly, it validates what indigenous and Eastern medical systems have been articulating for centuries with their specific individualized diagnostic methodologies that encompass not only the dynamic relationship with the environment, but also the role of consciousness - which is also considered part of the macrocosm.

Holistic Approach in Science

Traditionally, biomedical research is implemented from the reductionist perspective. Basically this means that the biochemical components and their interactions involved are identified and associated with their biological organization. However, this perspective does not address how these outcomes have occurred. This inter-related perspective (holistic) change in biology took place in 2000 with the emerging of "Systems Biology." This is the scientific perspective of a more holistic approach when dealing with biological interactions. This is an inter-disciplinary field dealing with complex interactions between components and biological inter-relationships as their function and behaviors. This is typically addressed through cell signaling, metabolic networks, and enzymes. The goal is to maintain scientific rigor and at the same time put the pieces back together and observe the integration in order to develop different ways of thinking. So far the collection of quantitative data used is in the form of metabolomics, high-throughput techniques, proteomics and transcriptomics in order to create validation models.¹⁰ This is a paradigm shift from single variable research methods to inter-relationship multivariable method. In systems biology this is considered a system wide approach.

Nutrition - Paradigm Shift

Prior to 2003, nutrition was seen as the amount a kilocalories consumed, biochemically based, and broken down into macronutrients (carbohydrates, fats and proteins) and micronutrients (vitamins and minerals). Nutrition was not typically associated with the cause of disease outside of vitamin/mineral deficiencies like scurvy, and the current epidemic of obesity being a precursor to cardiovascular disease and diabetes within clinical medicine.

Nutrition was seen as a threat to the pharmaceutical companies, most often when dealing with cancer treatments. Heated legal battles ensued through the fifties and sixties involving nutritional treatments used to treat cancer, to the point that laws were being passed criminalizing all cancer treatments except surgery, radiation, and chemotherapy - yes, this happened in California!

Since 2003, science is accepting that we are part of the environment and the realization that nutrition plays a vital role in chronic disease with new fields emerging as nutrigenetics and nutrigenomics. Nutrigenetics identifies the effect of a single gene/single food compound relationships and is a branch of nutritional genomics, which aims to identify genetic susceptibility to diseases and genetic variation in the effects of nutrient intake on the genome.¹¹ Nutrigenomics (AKA nutritional genomics) identifies developing an understanding of how the whole body responds to a food via systems biology and is focused on the role specific foods have in activating genes that affect susceptibility to certain illnesses, like cancer.^{11,12,13} This field also explores the role of vitamins, minerals, and bioactive food compounds in gene expression and the effect that individual genetic variation can have on the body's response to specific foods.^{10,14,15}

With this new revelation, "personalized" medicine is becoming more prevalent. Nutrients from macromolecules and micromolecules can trigger changes with the DNA structure, gene expression, and metabolism, in turn triggering chronic disease. From this perspective, it is believed the way in which nutrients are metabolized, assimilated, excreted, and stored can be influenced via individual genetic variation.

Conclusion

Utilizing food as medicine in indigenous medicine is a matter of survival in some cultures, and encompasses a large part of Eastern Medical systems for millennia. Food is also considered a natural resource, one that is and has been challenged globally with genetically modified organisms and biopiracy. Science has progressed into new territory by scientifically acknowledging that nutrients and diet are precursors for chronic disease. These nutrients are now identified as important factors that trigger genes to be silenced or activated.

Biomedicine prior to 2003, looked at the human as the macrocosm and the cells as the microcosm. The scientific underpinnings are based upon single variable research. Since 2003, the macrocosm is the environment, or in this case, nutrition, and the microcosm is the genome. This certainly is more in line with progress and a major paradigm shift within science; however, compared to Eastern medicine, is still a limited perspective. In Eastern medicine, the macrocosm is the universe and the microcosm is the human and everything within the human. Here, there are many more interactions and interrelationships present and addressed simultaneously that are articulated as precursors to chronic disease. This diagnostic methodology treats specific patterns of differentiation for the individual disease presentation. Eastern medicine addresses the body as a whole, not just the symptoms, and supports as well as balances excesses and deficiencies treating underlying root cause that is associated with disease development.

More importantly, scientific discoveries continue to validate what indigenous and Eastern medical systems have been articulating for centuries with their specific individualized diagnostic

methodologies. These views encompasses not only the dynamic relationship with the environment, but also the role of consciousness within individualized medicine practiced for thousands of years - using food as medicine!

From a political and socioeconomic standpoint, biopiracy and genetically modified organisms historically address patterns of exploitation of natural resources by big business at the expense of the local population. Traditional knowledge was used to reclaim their rights to their "cultural heritage." Dr. Shiva in response to biopiracy and patenting of indigenous knowledge pointed out that "the exclusive rights established by patents for commercial development of naturally occurring biological materials as plant substances or genetic cell lines on indigenous biodiversity and indigenous knowledge will overtime create monopolies and make everyday products highly priced"⁹ as seen with neem trees and turmeric as well as genetically modified seeds.

The scientific realization and implications of nutrigenomics raises serious and mindful questions regarding organic and genetically modified foods and their ramifications associated with chronic disease. It fosters critical inquiry into patterns seen within biopiracy and genetically modified foods being played out globally with big business monopolizing certain markets for profit over public health. Just as important is the availability of nutritional supplements. Politically, over the past few decade there have been numerous bills introduced into Congress involving the removal of nutritional supplements (including medicinal herbs) from the market (freedom of choice) instead to be overseen by medical doctors.

In the early sixties, nutritional dietary changes for treating cancer fairly successfully triggered heated legal battles and was even criminalized and seen as competition to the pharmaceutical industry. Even Dr. Buryznski's research in "personalized gene targeted cancer therapy" has faced similar obstacles with big pharma. Science is now in its infancy of understanding our relationship with our environment and validating food being used as medicine. Only time will tell if, historically, this pattern will repeat itself within this new field of nutrigenomics and nutrigenetics. Food for thought!

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