A Humanistic Nutritional Revolution

You don't have to know a great deal about various cereal crop plants to have learned that corn (maize) is a domesticated plant. It is hardly recognizable as a direct relative of its wild Mexican ancestor, (*Teosint*e) an ancestor separated by a mere handful of genes from today's version.

Most humans today might not recognize that they are primarily grass eaters. We think cattle do that. Cereal grains, however, are grass seeds, seeds that provide over 50% of all the protein consumed by humans. Only eight cereal grains produce this result; wheat, maize, rice, barley, sorghum, oats, rye and millet. Wheat, corn (maize), and rice are 75% of the world's total.

Because we are human, we chose specific plants—the plants did not choose us. Carefully chosen and improved plants provided better sources of food—plants then cultivated and improved nearer to home, rather than gathered randomly in scattered locations in the wild. Surprisingly, this began only about 10,000 years ago. We called the plant engineering we did then: plant domestication. It was the first 'agricultural revolution.'

Homo sapiens have existed about 90,000 years before that first agricultural revolution, living in a sustainable hunting, fishing, and gathering manner, until population and societal intensification forced a settling down and domestication of plants and animals for food use. Wheat was domesticated only 10,000 years ago, both corn and rice, 7,000 years past. That short time frame reminds us that plants didn't exist to be useful to man, but that we now depend on seeds from these cereal grain plants, as a food source. Whereas plants evolved seeds to serve as stored resources for quick germination, and their carbohydrates and proteins and lipids reflect these specific requirements for seedling survival. Hence seeds are a long way from being ideal foods for animals and humans. We have described this problem as a breeder's dilemma in that yields and nutritional selections are often in conflict. Our insect and animal friends remind us of this conflict by mercilessly grazing on those very plants that we have selected for high human nutrition.

When men are overly plentiful and food is scarce, the immediate human need is for calories even at the expense of protein and lipids and vitamins, just fuel to sustain the human engine. This was the pressing need that gave birth to the second great agricultural revolution, the Green Revolution. This came when many highly populated nations faced starvation.

The breakthroughs came first in wheat and rice, when both were genetically dwarfed and selected for yield and agronomic characteristics including insect and disease resistance. These relatively quick technical fixes gave us tripled yields of green revolution crops that helped large nations on the brink of starvation and war traverse to a period of food security, These spectacular results won Norman Borlaug and his colleagues a Nobel Peace Prize.

In this way we have perhaps let ourselves be painted into a corner that is going to require a technological fix of immense proportions. Whereas there is still only so much sun, so much land, so much water—but there will be as many as 3-5 billion more stomachs to fill, not including the stomachs of even more animals from which we derive another major portion of our protein and caloric energy.

The next agricultural revolution doesn't so much call for just greater total yields and better utilization of resources, but requires that we derive a greater nutritional value from cereal grains, both those consumed by humans and by

animals. It seems not a moment too soon, that man is starting to deeply understand the genetics of man, animals and plants. We can now further ‘domesticate’ plant life to more completely meet human nutritional requirements and concomitantly we can better protect these super nutritional plants pests, predators, disease, draught, salinity and so on.

A number of other challenges are surfacing to which we have neither had the time, the understanding nor the expertise to respond. While the human genetic constitution has changed little in 15 millennia, our nutritional needs have changed markedly. To begin with, many illnesses, diseases, allergies, indicate a need to make cereals more useful to a wider group of consumers, including those whose own genetics may not utilize certain cereals well at all. Although humans have consumed cereal grains for at least 10,000 years, this is very short in biologic time and as such is not something to which mankind is widely adapted.

It is only rather recently that we have discovered vitamins, minerals and certain anti-nutrients. More recent is the knowledge that cereal peptides can elicit disease and dysfunction. Only in the 1950’s was it known that autoimmune reactions were possible; for example, that wheat gluten is a causative agent in celiac disease for those who have the genetic predisposition for this disease. While these cereal caution flags are now known, cereal grains can be used in a majority of diets without noticeable adverse health effects, There remains the chance to improve the fact that cereals are not always an optimal food for human digestion. We are well aware of significant nutritional shortcomings, such as near absences of vitamin A, B12, C and D in most cereal grains. We know we can improve the nutritional components of cereal grains, often by the insertion of genes from other plants or microbes such as bread yeast and probiotic bacteria.

The paucity of many of the essential amino acids reduces the effective protein content of plant-based foods in regard to human nutrition. Both man and animals are unable to synthesize ten of the “essential” twenty amino acids. To deliver more of the essential amino acids per unit of protein should enable cereal diets to become more efficient. Improvements in five major amino acids are critical, so much so that even a 15% increase would be its own “Humanistic Nutritional Revolution”, a seminal agricultural milestone.

We note that the major sources of human energy throughout the world are eight cereal grains. To succeed at making this a successful endeavor, perhaps we need to realize that modestly subsidizing farmers who specifically grow more nutritious crops, to make up for their loss in yields, will allow us to greatly reduce the huge subsidies and price in human suffering that we are inheriting from our first and second agricultural revolutions. “Humanistic nutrition” is what we term this current challenge of making food crops more compatible with the genetic makeup of humankind. Leadership may come from a small nucleus of scientists with support from proactive philanthropic organizations, as happened in the case of upstart Norman Borlaug’s (and collaborating colleagues’) efforts to catalyze the still ongoing green revolution. Change happens that way.

We all are aware of what a difference a few genes can make! Cereal grains are separated by a mere few genes from being a significantly more advanced and human achievement.

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