

**“JUST WHEAT!”**  
by  
**David L. Armstrong**

(Presented to the Holland Professional Club April 12, 2018)

Wheat has been around for a long, long time. In a recent Wall Street article about Biblical antiquities, the following was quoted, “Antiquities lay piled on tables and documents peeked from boxes: 4000-year-old tablets tracked the Sumerian wheat sales...” Wheat is so prevalent in our diets that it warrants being a topic for this group. And trust me, there is enough controversy surrounding wheat. It is a timely and intriguing topic.

This is a strange topic for me. I do not speak from the knowledge of an agronomist, a plant breeder, a nutritionist or a geneticist. You might remember our family has suffered dramatically from Lyme’s Disease. The process of diagnosis and treatments spanned several years. Non-traditional research and treatments brought several books to my daughter’s attention on a variety of topics. Several were on wheat. Knowing my background, she said, “Dad you have to read these books”. Being somewhat obedient, I did—mostly one!

Being a professor and Associate Dean in the College of Agriculture and Natural Resources, researchers in this area were part of my environment. Not to be defensive, but I personally believe the accomplishments of agricultural productivity, food quality, food safety, and nutritional knowledge is nothing short of phenomenal. The research history is rich and has made this temperate climate of the USA a wonder of the world. Of course there are, and will continue to be, unintended consequences in this area of research—sometimes even good ones. But, let me remind you, there are unintended consequences of doing nothing. This paper will provide enough good fodder for debate on both sides.

As a college student, I worked for a corn breeder, Dr. Stringfield at Ohio State University---at \$1.00 per hour by the way. The field was charted; he knew every plant in the field. My job was to cultivate the field using a G-Allis Chalmers, straddling the rows at a very low speed careful not to damage a single plant. I was a favorite employee until I accidentally

dosed on the job. Several plants had to be removed from the charts. This experience does not qualify me to talk on this topic, but I did see the long horizon in their research and the detail that was required. Any researcher like Dr. Stringfield would spend 20 plus years on a single experiment. Many would spend a lifetime with no real impact on the industry. Another note about the unusual personalities of this type of researcher. A young, baby-faced geneticist was hired as Michigan State's first Hannah Professor. This designation essentially meant he received a typical salary multiplied by two. He was required to give a scientific seminar as part of his candidacy. For the early 70's it was very technical, postulating that it could be possible some day to have a tomato plant that had potatoes on the root system. One of the sage old plant breeders in the group said. "I took very copious notes on this material is it proprietary or secret?" To which the young prof said, "Heavens no, these are thoughts I had yesterday—they are old"! Jane sold him his new house.

Another man, whom I met, traveled with and who is at the center of this "Wheat Thing!" Let me introduce him: **Norman Ernest Borlaug** (March 25, 1914 – September 12, 2009) was an American agronomist and humanitarian who led initiatives worldwide that contributed to the extensive increases in agricultural production termed the Green Revolution. Borlaug was awarded multiple honors for his work, including the Nobel Peace Prize, the Presidential Medal of Freedom and the Congressional Gold Medal.

Borlaug received his B.Sc. in Forestry in 1937 and Ph.D. in plant pathology and genetics from the University of Minnesota in 1942. He took up an agricultural research position in Mexico, where he developed semi-dwarf, high-yield, disease-resistant wheat varieties. During the mid-20th century, Borlaug led the introduction of these high-yielding varieties combined with modern agricultural production techniques to Mexico, Pakistan, and India. As a result, Mexico became a net exporter of wheat by 1963. Between 1965 and 1970, wheat yields nearly doubled in Pakistan and India, greatly improving the food security in those nations. Summary is also referenced in Wikipedia.

Borlaug was often called "the father of the Green Revolution", and is credited with saving over a billion people worldwide from starvation.

According to Jan Douglas, executive assistant to the president of the World Food Prize Foundation, the source of this number is Gregg Easterbrook's 1997 article "Forgotten Benefactor of Humanity". The article states that the "form of agriculture that Borlaug preaches may have prevented a billion deaths." He was awarded the Nobel Peace Prize in 1970 in recognition of his contributions to world peace through increasing food supply.

On the farm, the kitchen had a flour bin, with a little scoop inside. It seemed to me, Mom was always scoping some flour for this or that during a day of cooking, baking, canning, freezing, drying, etc. Our weekly trip to the country town often included buying a 50 pound bag of flour. Everything was cooked and baked from scratch. The meals were big. As I look back, the meat was cooked to the point of cremation, with generous amount of potatoes and gravy and there was always a vegetable--maybe a lettuce salad in season and a desert. Always home-made bread. Talk about wheat! What is abundantly clear from my daughters forced reading is that "wheat flour" in my Mother's kitchen is not the same flour that is in our kitchen today. In my small slice of time on this earth, I have seen wheat of yesterday, today and probably tomorrow. Fifty years have changed wheat completely. Let me try to explain.

There are several books on wheat. None of them seem to like wheat in the human diet. I have referenced several things, but "Wheat Belly" by Dr. William Davis is my heavy. If you want to "swear" in wheat, this would be great manual.

Quoting Dr. Davis, "Once upon a time, an individual weighing 250 pounds or more was a rarity, today it's a common sight among the men and women walking the mall, as humdrum as selling jeans at the GAP. Retired people are overweight or obese, as are middle-aged, adults, young adults, teenagers, even children. White-collar workers are fat, blue-collar workers are fat. The sedentary are fat and so are the athletes. White people are fat, black people are fat, Hispanics are fat, Asians are fat. Carnivores are fat, vegetarians are fat. Americans are plagued by obesity on a scale never before seen in the human experience. No demographic has escaped the weight gain crisis".

I know what you're thinking, 'Why would an overweight, 82 year-old farm boy and agriculture educated even think of reading this "Book" let alone use it as the basis for a professional Club Paper. I should have written it under an assumed name, like Patrick Irish, Mike Hill, or Joel Tanis. This presentation is not about the eating habits and food abuses of the American. It is about research, the blame of research and the understanding on good/evil of all new things. I will talk more about this later.

Over most of the 10,000 years that wheat has occupied a prominent place in the caves, huts, and adobes and on the tables of humans, what started out as harvested einkorn, then emmer, followed by cultivated *Triticum aestivum*, changed gradually and only in small fits and starts. The wheat of the 17<sup>th</sup> Century was the wheat of the 18<sup>th</sup> Century which in turn was much the same as the 19<sup>th</sup> Century and for the first half of the 20<sup>th</sup> Century.

If it walks like a duck and quacks like duck, it is probably a duck. This logic is also evident in wheat. When comparing the "new" to the "old" wheat one might say, it looks like wheat, it has the color of wheat, it bakes like wheat, taste like wheat etc, etc, it is just "New Wheat". Although better in many dimensions; dwarf, therefore will be resistant to lodging, heat resistant, disease and drought resistant, higher in basic nutrients—especially protein, higher yielding, it is therefore unequivocally better wheat!

The plant researchers I knew were amazing, methodical and patient with their field of work. Some would dedicate a professional lifetime with virtually no major breakthroughs. Yes, through the process of repetition and trial and error they made advancement, but they rarely made the headlines. I do not know to bring this talk to a close or a conclusion, but I can tell you what is occurring today--only one thing.

Simplicity beyond complexity is a good axiom. Matter-of fact, designers often use this quote. The "new" wheat was thought of in this same axiom, in fact the new may have made the art of wheat farming more simple, however the new wheat itself was much more complex. It appears now, complexity that was never anticipated.

Plants such as wheat have the ability to retain the sum of the genes of their forbearers. Wheat that originally had 14 chromosomes ended up having 28 chromosomes years later. The wheat of yesterday has been virtually replaced by the new Norman Borlaug variety and it has 72 chromosomes. *Triticum* wheat of today is the product of breeding to generate greater yield and characteristics such as disease, drought and heat resistance. This dwarf or “new” wheat accounts for over 90 percent of wheat raised in the world today. Think of the movement from zero “New Wheat”, in the mid-twentieth century, to over 90 percent today. I graduated from High School in 1953, so during my adult life, my Mother’s wheat is so small of a percentage it has been ignored. The “old wheat” is maybe raising its head, but do not count on a big turnaround any time soon.

“Wheat Belly” was written by a physician, a cardiologist. He touts himself as a physician and an author. Let me list some things that may help pull this together.

1. First, remember this book made number one the New York best selling list. It has been read and read by millions.
2. Dr. Davis was a Type 2 diabetic with other health issues—mood swings, mind fog, joint pain, acid reflux etc... He somehow convinced himself that wheat was the culprit. He went on a non-wheat diet and became cured in all the areas that was effecting his health—diabetics, mind clarity, weight and more.
3. There is evidence that Dr. Davis is telling the truth, but I asked you to be cautious.
4. He tried the diet on his patients and they also had spectacular results.
5. His experiences prompted the book, “Wheat Belly”. His references are many, but critical reviews do not support his honesty in the quotes. Selective editing was often sited.
6. The allegations and/or hypotheses are rather specific:
  - a. The population prior to the 1950’s did not experience the same characteristics as those after 1950’s. This sets the stage for The “Old Wheat Era” versus the “New Wheat Era”.
  - b. Prior to 1950’s, Celiac Disease, (Gluten Toxicity) did not exist or at least was not diagnosed, obesity was not as prevalent, neither was mental illness.

- c. It is true Celiac Disease nearly doubled as did most of Dr. Davis's other evident observations—all due to the “New Wheat”. At least that is the premise of the book.
- d. The reason stated most often is the complexity of the “New Wheat”. The quadrupling of the chromosome counts was, in his mind, the reason.
- e. And lastly that insufficient testing at launch of the “New Wheat” ushered in a “bundle” of unintended consequences.

To me the book, “Wheat Belly” by Dr. Davis couldn’t be the last word. The research and literature refuting “Wheat Belly” are plentiful. I will summarize with a specific case. Dr. Donald Kasarda, USDA, was skeptical of the book, “Wheat Belly”—he never thought of wheat as toxic, but furthermore was convinced the ‘New Wheat’ did not have more gluten than the “Old Wheat”. This point of controversy was central to Dr. Davis’ argument. He proceeded to pull together the research and literature on this specific topic and there were many studies. None of the studies showed significant differences in the amount of gluten in the “New Wheat”. Dr. Kasarda presented his findings to the Celiac Disease Symposium in 2017.

Questions still remain what about the other symptoms Dr. Davis references in “Wheat Belly”. Again there was no scientific evidence to support these claims either. I am not suggesting that wheat, or excessive wheat in the diet may cause some problems. I am only interested in “Old Wheat” versus “New Wheat”. That is the issue in many foods today.

However, it appears that nearly one percent of the population is toxic to wheat. Therefore Dr. Davis in “Wheat Belly” could be correct. If you are in the “one percent” group you are observing a 100 percent affect. I find it strange that all of his patients were in the “one percent” group. Or is it true that if we all eliminated wheat from our diet we would be a changed population? There would be differences. Just as there would be difference in eliminating sugar, reducing protein, being a practicing vegan or you finish my sentence. But the “one percent” group is over three million persons in the U.S. alone. Once in a great while, I read some of the fine print attached to my prescription bottles. Often I think, I hope I am not in the “one percent” group or that I do not want the cure

to be worse than the disease. You may dismiss my editorial commentary.

But there is more. If you do not like the “New Wheat” it can be changed. Today and tomorrow’s researchers in this area make the processes of the plant breeders I knew as truly “Old School”. Let me introduce CRISPR.

“The CRISPR Pioneers” by Alice Park appeared in Time magazine in 2016. I quote, Dr. Carl June’s lab at the University of Pennsylvania like any other biological research hub. There are tidy rows of black-topped workbenches flanked by shelves bearing boxes of pipettes and test tubes. There are ad hoc signs marking the different workstations. And there are postdocs buzzing around, calibrating scales, checking incubators and smearing solutions and samples onto small glass slides.

Appearances aside, what June is attempting to do here on the eighth floor of the glass encased Smilow Center of Translational Research in Philadelphia, is anything but ordinary. He has built a career trying to prove the odds for people with intractable end-stage disease, and now, in the university’s brand new cell-processing lab, he’s preparing to launch his most ambitious study yet; he’s going to try to treat 18 people with stubborn cancers, and he’s going to do it using CRISPR, the most controversial new tool in medicine—a gene-editing technology.

Developed just four years ago by two groups—Jennifer Doudna, a molecular and cell biologist at the University of California Berkeley, Max Planck Institute in Berlin; and Feng Zhang, a biomedical engineer at the Broad Institute of Harvard and MIT—CRISPR allows scientists to easily and inexpensively find and alter virtually any piece of DNA species. In 2016 alone it was used to edit the genes of vegetables, sheep, mosquitoes and all kinds of cell samples in labs. Now, even some call for patience and extreme caution, there’s a worldwide race to push the limits of CRISPR’s capabilities.

Soon, Dr. June’s patients will become the first people in the world to be treated with CRISPR’d cells –in this case, cells genetically edited to fight cancer. Like many people with cancer, the patients have run out of options. So building on those that developed CRISPR, Dr. June’s

team will extract their T cells, a kind of immune cell, and use CRISPR to alter the three genes in those cells, essentially transferring them into super fighters. The patients will then be infused with the cancer-fighting cells—then you wait and see if they did their job.

But, whether it succeeds or fails, it will provide scientist with critical information. Different than yesterday, CRISPR is inexpensive and repetitive trials can happen fast. There is high confidence CRISPR has therapeutic potential that will lead to the development of radical new therapies not just for people with cancers, but as well as for genetic diseases such as Sickle-cell anemia and cystic fibrosis and chronic conditions, like type-2 diabetics and Alzheimer's.

Using CRISPR on humans is hugely controversial, in part because it is so easy. The fact that it allows scientist to efficiently edit any gene—for many cancers. But also potentially for the predisposition for red hair, for being overweight, for being good at math---worries ethicists because of what could happen if it gets into the wrong hands. As of now, the National Institutes of Health (NIH), by far the world's largest sponsor of scientific research, will not fund studies using CRISPR on human embryos. And any new way of altering genes in humans must get ethics and safety approval from the NIH, regardless of who is paying for it. The NIH also disapproves the use of CRISPR on so-called germ-cell cells---those in an egg, sperm or embryo---since any such change would be permanent and inheritable. Mention the Polo ponies....

Private funding is pouring in to organizations and institutes. The research is moving fast in the CRISPR world. So simple and inexpensive is the technique, and so frenzied is the medical community about its potential, that it would be foolish to bet on anything else. To quote, “with technology like CRISPR –you have lit a fire”

CRISPR journey from the lab bench to cancer treatment may seem quick. After all, as recently as a couple of years ago only a minuscule number of people even knew what-- clustered regularly interspaced short palindromic repeats—that's CRISPR in long hand —was. The medical community is on fire with this development. It seems new, but this technology is actually at least hundreds or maybe millions of years old. It was bacteria that originally used CRISPR as a survival

mechanism to fend off infection of viruses. The ultimate freeloaders, viruses never bother developing their own reproductive system, preferring instead to insert their genetic material into that of other cells—including bacteria. Bacteria fought back holding onto snippets of a virus' genes when they were infected. The bacteria would then surround there viral DNA fragments with a gene sequence that effectively cut them out altogether.

Bacteria have been performing that clever evolutionary stunt for millennia, but it wasn't until the early 2000's that food scientist at a Danish yogurt company realized just how clever the bacteria system was when they noticed that their cultures were turning sour. They discovered that the cultures were CRISPRing invaders, altering the taste considerably. It made for bad dairy, but scientific discovery was immediately recognized as a big one.

About a decade later in 2012, the scientist named tweaked the system to make more standardized and user friendly, and showed that not just bacterial DNA but any piece of DNA has this ability. This was the game changer. Scientist have been mucking with plant, animal and human DNA ever since.

Another side bar, if I may. In my young days, I worked in a small dairy processing plant. The entire integrated dairy operation was managed by Jane's father. I made the cottage cheese and I have made a train load—small and large curd, creamed and plain, salted and unsalted etc. We used a culture to treat the milk and create the cottage cheese. Our maintenance of the culture was the “core” of our success. If the culture got polluted, I did not know what I know today, it would foul the vat, creating little pink bacterial farms in the souring the milk. When this happened, we had to destroy the batch and obtain a clean culture.

My objective of the paper was to see if the “Old Wheat” and the “New Wheat” were a mistake and bane on society. I will tell you, wheat may be a villain, but the “New Wheat” is not the culprit. I also wanted you to know, that the manipulation of gene material is here to stay! The techniques are here, they are affordable and the research is in high gear. Yes, there will be many questions of controls, ethics, testing and verification and despite all of that there will be problems. But, the prospects of finding cures to Alzheimer's would be a miracle, but there

will surely be unintended consequence, back to the ‘New Wheat”, it saved millions from starvation, but did it have some unintended consequences. The discussion after tennis, I mentioned I was thinking on this ‘Wheat” thing. And one asked, since you have done all this reading, are you going to eliminate wheat from your diet? And I said, “It is so much everywhere, it is a mountain I am not willing to climb”. Just think about the people that have to.

I conclude with some thinking by Melvin Krantzberg, a scientist that probably one has ever heard of. He died in 1995. Dr. Krantzberg, a professor of the history of technology at Georgia Tech. wrote a on the topic extensively. Many believe his thinking should be the foundation for those doing technology research—almost like a Hippocratic Oath. Only the bullet points!

1. “Technology is neither good nor bad; nor is it neutral”. He uses DDT as a case.
2. “Invention is the mother of necessity”. Yes, I know it sounds backwards. Every technological invention seems to require additional inventions to make it fully effective. Think of the Smart Phone, before and after.
3. “Technology comes in packages, big and small”. It is the interaction that needs the attention. Technological inventions create and destroy every time.
4. “Although technology might be a prime element in many public issues, non-technological factors take precedence in technology policy decisions”. More broadly, lawmakers are taking the history of privacy, data transparency, national security and antitrust issue in tech—more because of a shift in our culture than in technology itself.
5. “All history is relevant, but the history of technology is the most relevant.
6. “Technology is a very human activity”.

Is true, that is just wheat?!?!

Thank you