Session 2 Primary Care Conference Chico Hot Springs
Type 2 Diabetes, Dementia, Colon and Breast Cancer
How 21st Century Nutrition Helps Cancer Patients

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Type 2 Diabetes

What is insulin's role in human physiology? An update on what Insulin really does.

Over the last 15-20 years studies in humans and lab animals have revealed that insulin plays a critical role in the normal functioning of nearly all human organs. Insulin does not directly lower blood glucose levels. It acts by binding to insulin receptors on liver, fat and muscle cells. Each of these cells are then signaled to carry out specific functions. The effects of insulin resistance are widespread [72].

In the liver, this signaling stops the breakdown of glycogen and the release of glucose into the circulation. It increases glucose uptake and stimulates glycogen synthesis. Insulin also signals the liver to make VLDL, LDL, and HDL in healthy proportions. When insulin signaling is impaired, dyslipidemia occurs which can worsen atherosclerosis. Lack of insulin signaling in the liver causes fat deposition in the hepatocytes that can lead to fatty liver disease. Insulin resistance increases the cholesterol concentration in the bile produced by the hepatocytes which can lead to gall stones. Insulin resistance adversely affects the production of plasma proteins such as fibrinogen and other clotting factors that can lead to a pro-coagulant state.

In muscles, besides telling cells to take up and store glucose and free fatty acids, insulin signaling stimulates muscle growth and repair [75].

In the brain, insulin signals the appropriate production and degradation of Aβ (amyloid beta) by neurons and glial cells [76]. It also signals the endothelial cells that line the lymphatic vessels on the surface of the brain (called glymphatic vessels) to carry out their important role in removing degraded proteins from the interstitial/CSF fluid while we sleep. Insulin supports the structural integrity, metabolic function and proper structure of endothelial cells. This endothelial cell signaling in the lymphatic vessels and glial cells of the brain prevents the accumulation of Aβ and other proteins in the brain that lead to neurodegenerative diseases such as Alzheimer's and Parkinson's disease [77, 78].

In the kidney, support cells that line the outside of the glomerular capillaries called podocytes have been shown to be very insulin sensitive. In an insulin resistant state, the podocytes are not properly signaled. The cells weaken, shrink and cannot properly support the glomerular filtration barrier leading to proteinuria and premature aging of the kidneys. These studies strongly suggest that the most common form of renal failure in the U.S., diabetic nephropathy, is primary caused by insulin resistance rather than the level of the blood sugars [73].

How does UPF cause or worsen diabetes?

The frequency of so many common chronic diseases, including vascular disease and diabetes, has greatly increased since the increased consumption of UPF in the 1970s. Childhood Type 1 diabetes is more common now than 100 years ago and is felt to be due to an interplay of genetics, diet, infection and autoimmune issues. We have a lot to learn about the role of diet on getting Type 1 diabetes. We do know that if you are a Type 1 diabetic, eating a significant portion of your caloric intake in minimally processed plant food will keep your insulin requirements down and make you healthier in the long run.

Type 2 diabetes is a different story. Its cause is much better understood. Simply put, insulin resistance is the condition behind Type 2 diabetes.

Let's start with UPF, which is what most Americans eat. UPF has too much fructose that is too rapidly absorbed leading to cell dysfunction in several organs. This dysfunction worsens insulin resistance. Lots of UPF triggers an abnormal microbiome in our colon that increases the absorption of inflammatory metabolites such as LPS. LPS has been shown to block the insulin signaling which creates worsening insulin resistance. In muscle, liver and fat cells, this leads to poor uptake of glucose and raises the glucose in the blood. UPF contains other inflammatory chemicals such as emulsifiers [79-81], nitrates and nitrites [82], MSG, artificial sweeteners [83, 84], casein, and hundreds of other food additives. All of these can contribute to worsening insulin resistance.

1. Once there is significant insulin resistance in the liver, muscle and fat cells, these organs no longer take up glucose the way they should. The liver is supposed to convert the glucose to glycogen, but this is impaired when the insulin cannot signal the liver cell to to take up glucose. This leads to elevated blood sugars and reduced glucose reserves (less glycogen).
2. The beta cells in the pancreas that make insulin respond to rising blood sugars by releasing more and more insulin.
3. With insulin resistance, beta cells get exposed to higher blood sugar levels, surges of fructose and pro-inflammatory LPS. This creates increasing oxidative stress within the beta cells like what happens in the liver. This causes chain reactions in the beta cell that can lead to early cell death and a reduction in the number of beta cells. Beta cells can reproduce but this is limited. If they die too fast, then the total number of cells decline.
4. The beta cells are asked to produce more and more insulin. Eventually beta cell death outpaces beta cell reproduction. The beta cells then cannot release enough insulin, and the serum glucose goes high. The person is diagnosed with diabetes.

Does going off UPF and going on a mostly minimally processed plant-based diet prevent type 2 diabetes? Can it treat type 2 diabetes?

Many studies show that the more minimally processed plant-based foods people eat and the less UPF they eat the lower their chances are of getting Type 2 Diabetes [74, 8, 85]. Both Type 1 and Type 2 diabetics benefit from shifting off UPF and onto a minimally processed plant-based diet. Their medication requirements go down along with their glycohemoglobin A1c values. It is not unusual for type 2 diabetics to get off most, if not all, their diabetic medications when switching to a plant based whole foods diet especially in the first few years they are diagnosed.

Prior to the discovery of insulin, diabetics were treated with very low sugar and low starch diets. This means they ate very little whole grain foods which are rich in starch, and other vegetables high in starch such as beans, corn and rice. They also were denied sugar and fruit. When insulin began being used to treat diabetes in 1922, researchers began to test whether diabetics could eat starchy plant food. In 1934-36 Himsworth and Rabinowitch published articles [18, 19, 20, 60] about experiments in lab animals and in humans which showed that insulin requirements went down when subjects ate a diet high in whole plant food. Modern studies show the reason for the reduction in insulin resistance is that whole plant food diets prevent and reverse insulin resistance. Insulin resistance is caused by fructose surges in our circulation and by LPS and other metabolites getting into our circulation. This comes from an abnormal microbiome due to not eating enough whole plant food and eating too much UPF.

Insulin resistance (in the old days this was referred to as glucose intolerance) was first shown in the 1930s both in laboratory mammals and in human volunteers to be improved on a diet high in natural whole plant foods. Most whole plant foods are low in fat and protein. Some are high in unprocessed starches (sometimes called complex carbohydrates) or high in fat such as soybeans, avocado, and nuts. All whole plant foods have a wide array of vitamins, minerals, essential fiber and other helpful substances that keep us healthy. Similar studies today show the same thing. Reducing UPF consumption and replacing it with minimally processed plant-based food both prevents and treats Type 2 Diabetes much better than any medication. This is not surprising given what we now know about insulin resistance.

Dementia -- an Update

Dementia is defined as impaired ability to remember, think, or make decisions that interfere with doing everyday activities. It is age related with more than half of people over the age of 93 in the U.S. meeting the criterion for dementia. The beginnings of dementia may start long before people get symptoms.

Example of how early neurocognitive changes can occur:
Studies [86-88] were done on teenagers and young adults <u>**with**</u> hypertension (all had insulin resistance) compared with healthy teenagers and young adults <u>**without**</u> hypertension (and without insulin resistance). All the subjects had neurocognitive tests (assessing processing speed, attention, problem solving, and learning ability) and special MRI and Ultrasound imaging. In healthy teenagers <u>**without**</u> hypertension, the special imaging techniques showed that the regional brain blood flow varied a lot depending on the kind of mental task the subject was doing. This regional blood flow was regulated by the endothelial cells of the smallest arteries (arterioles) and the endothelial cells of the capillaries. Scientists compared the blood flow in specific parts of the brain in the two groups while the subjects were doing a certain task. For example, if the task involved auditory learning and recall of that information, they found a significant difference in the blood flow in the brain between the two groups in the auditory parts of the brain. In the healthy group, the auditory areas of the brain had a significant

increase in blood flow, which was significantly less in the hypertensive group. In addition, the healthy subjects had significant reduction in blood flow to other areas of the brain not needed for this task, while the hypertensive subjects did not. The theory is this blood flow change allows the subject to better focus on what they are doing such as listening and then recalling that information as well as integrating that information into what they have already learned. With reduced blood flow in the non-auditory areas, they are not as distracted by other thoughts and can better focus on the task before them.

Detailed neurocognitive testing showed **reduced** attention, working memory, executive function, learning and recall of new information in the young adults and teenagers **with** hypertension who did not have a healthy shift in the regional blood flow. In other words, endothelial cells lining their blood vessels are dysfunctional at a very young age due to insulin resistance. The theory is that, as these subjects get older, the endothelial cells continue to malfunction. Part of this malfunction can lead to scarring and narrowing of the arterioles (called arteriole sclerosis which plays a role in vascular dementia). This could lead to progressive decline in cognition if left unchecked and uncorrected.

Dementia is a syndrome caused by two categories of diseases. The first is the group of neuro-degenerative diseases such as Alzheimer's, Lewy Body dementia, Frontal Temporal Lobe dementia, and Parkinson's Disease. Alzheimer's is the most studied. The second type is vascular dementia which is due to tiny (usually silent) strokes mostly in the subcortical white matter areas of the parietal and frontal lobes of the brain.

Below we will discuss further about these two categories. The two pathways to dementia have in common many risk factors that are similar. Some of the newest studies show not only that dementia is at least partially reversible in some cases but why this is. The why is found in the endothelial cells that line the glymphatic vessels on the surface of the brain and that line the tiny arterioles and capillaries especially in the subcortical white matter. These endothelial cells are susceptible to insulin resistance which is reversable with diet changes.

Both categories are more common, begin earlier in life and progress faster under the following listed circumstances in order of importance [92]:

a) UPF Diet creates an abnormal microbiome that triggers insulin resistance in the brain. It contains too much fructose which causes intra cellular abnormalities that contribute to the development of dementia. The abnormal microbiome triggers insulin resistance in many types of brain cells. Insulin resistance is now considered a major risk factor for getting dementia.
b) Lack of Cognitive Activity such as reading, writing, working, volunteering
c) Lack of Weekly Exercise of at least 2-3 hours per week
d) Lack of Active Social Contact
e) Smoking Tobacco
f) Regular use of Alcohol (never or rarely drinking alcohol is the healthiest)
g) Genetic factors that increase the risk of vascular disease or neurodegenerative disease.

Are these inherited diseases? These illnesses usually require some genetic tendency coupled with a UPF diet and lack of exercise over many years. For example, if you have a genetic history of hypertension or Alzheimer's disease and eat the typical American UPF diet, you are more likely to get dementia.

Excellent brain autopsy studies [89, 90] done in the US following older assisted living residents (with initial normal cognition) for at least 10 years showed some interesting results. At autopsy (average age of death was 89), 21% had only vascular changes without significant evidence a neurodegenerative disease. 23% had only neurodegenerative changes. 56% had a mixture of both types. Thus, most dementia patients have a mixture of both. This makes sense as both these categories have similar risk factors. The study patients had cognitive testing about once a year until their deaths. All three of these groups showed between 40-70% had cognitive decline during the 10-year study period. Because the largest group was a mixture of both, it may explain why it is so difficult to do studies on folks to determine the cause and treatment of cognitive decline. We are currently unable to accurately determine which patients have which type of disease or both while they are still living. We only can tell accurately at autopsy.

What Causes Alzheimer's Disease and likely the other neurodegenerative diseases?
Current research in humans and animal models strongly suggest two factors that play a significant role [91].

A. Accumulation of Amyloid beta protein (abbreviated Aβ): This protein is produced in the brain by both the nerve cell bodies and by the support and gate keeper cells called astrocytes. These are one type of glial cells that act in support of the brain neurons. The current theory is that Aβ plays a major role in regulating how active a nerve connection is. When there is more accumulation of Aβ at a junction where the axon connects to another nerve cell, it decreases the transmission of signals at this junction. When someone has insulin resistance, too much Aβ is made, and too little is removed. This causes Aβ to accumulate between neurons in the brain, forming plaques. These plaques disrupt cell function and trigger an inflammatory response that further damages neurons. The nerve cell bodies and the astrocytes support cells produce Aβ. Glial support cells clean and move along degraded Aβ especially at night while we sleep. These waste products are moved along to the surface of the brain and are taken up by a complex network of small lymph vessels called glymphatic vessels. Lymph vessels like other vessels are lined by specialized endothelial cells that require insulin signaling to function properly.

   When there is insulin resistance, these cells can malfunction and not do their jobs properly. This can lead to over production of Aβ and reduced cleaning up of the old Aβ protein by the glial cells. There is also some evidence that, when Aβ accumulates, it can get inside of the nerves cells and cause them to malfunction. When there is too much Aβ at connections between nerves, there can be a loss of signaling necessary for normal brain functioning. In Alzheimer's, this disease process affects the part of the brain that controls recent memory. In the case of Parkinson's disease, it happens first in part of the brain that controls movement. The symptoms people get with these illnesses depend on what part of the brain is affected first or the most severely.

B. Accumulation of Tau protein: Tau protein is made inside the brain nerve cells. It is an important part of microtubules inside these cells. These tiny tubules are critical for maintaining the structure of the neuron, acting as a transport system for molecules inside the cell, and functioning as guides when new connections are made between nerves. When there is insulin resistance, these fibers of tau protein build up inside neurons, disrupting the transport of nutrients and other essential molecules within the cells. The damaged Tau protein folds itself up and, if not quickly removed, can trigger a cascade of folding Tau proteins accumulating in the cell. This leads to cell death and contributes to brain atrophy.

C. New Information March 31, 2025: The brain's glymphatic system (the g stands for glial cells) plays an important role in the development of dementia [96]. Lymph vessels are found in most parts of our bodies, but not inside our brain. Lymph vessels are lined like arteries and veins with specialized endothelial cells. Throughout our bodies the lymph vessels return unneeded or degraded protein, white blood cells and fluid back into our circulation. Like our venous system, they start very small and join to make bigger lymph vessels. The larger lymph vessels empty into the subclavian vein in the upper chest area. Inside the skull there is a very significant network of lymph vessel in the meninges that surround the outside of the brain. Mainly when we are sleeping, the brain actively moves the fluid around the cells (CSF and interstitial fluid) toward the outer parts of the brain where it is transported via tubules into the lymph vessels. This fluid contains metabolites that have accumulated during the day. One of those metabolites is thought to be Aβ and its breakdown products. The fluid movement is facilitated by special nerve axon signals that direct the fluid toward the glymphatic tiny vessels in the meninges. The glial cells (special brain cells that are not nerve cells that support and protect the nerves) also facilitate the movement of fluid via the tubules. This is one of the reasons we feel refreshed after a good night's sleep.

Scientific studies of mice in the last 10 years are showing that older mice, who exhibit some dementia like symptoms in testing, have meningeal lymph vessels that function poorly. Most importantly, the reduced cognition is reversable when the mice are given a drug that opens up the glymphatic vessels, so they do a better job of getting rid of degraded unneeded proteins [97, 98]. It also may explain why some humans seem to have reversible dementia. There are well documented cases of cognition improving with a change in diet or with a fecal transplant for C-difficile infection. The theory is that older folks with signs of dementia could well have poorly functioning glymphatic vessels. While they sleep, there is inadequate removal of degraded proteins like Aβ. This leads to a buildup of these proteins that interfere with neuron function. The improvement may well be due in part to an opening up of these glymphatic vessels at night and improved waste removal which facilitates better brain function. Likely this is the result of reversing insulin resistance with a better diet or with a fecal transplant. Endothelial cell dysfunction in the brain arterioles and capillaries as well as in the glymphatic vessels may explain why imaging does not always correlate very well with clinical dementia. Routine imaging is not able to detect reversible endothelial cell dysfunction. Someone with significant cerebral pathology may have resolved their endothelial cell dysfunction so that their clinical dementia is not severe. The opposite may be true. Someone who has only mild findings of vascular disease and/or neurodegeneration on imaging can have moderate to severe dementia due to marked endothelial cell dysfunction.

What causes Vascular Dementia?

Vascular dementia [57] is due to significant endothelial cell dysfunction in arterioles and capillaries of the brain that cause poor or loss of blood supply . The tiny stroke areas are called lacunar strokes, leukoaraiosis, or white matter hyperintensities by the radiologist and these are likely irreversible. The white matter sits under the cortex of the brain. The white matter contains a huge number of axons that connect different parts of the brain. One of the most important functions of these connections is recent memory. When you see, feel, or hear something, your brain transmits that information to other parts of your brain via the white matter to be stored there so you can recall it later. One of the most common symptoms of white matter disease is reduced or loss of recent memory. The blood supply in the white matter has a lot of terminal tiny arterioles that supply nutrients and oxygen to these areas. Terminal arterioles often do not have good collateral blood supply. When the terminal arterioles get marked endothelial cell dysfunction due to insulin resistance, it can trigger arteriole sclerosis (scarring) of the tiny blood vessel as well as improper constriction of the vessel that can lead to lack of oxygen and the death of local nerve cells and axons. On a brain MRI, these are tiny areas often seen in older people. If too many of these occur in some of the critical areas of the white matter, it prevents certain nerves from storing valuable information that your brain has collected while you are awake. Thus, it impairs your memory. The current theory is that these white matter changes occur mostly because of dysfunction of the endothelial cells that line these tiny arterioles and capillaries. Blood flow gets impaired when the endothelial cells do not open up when they should. If they stay closed or nearly closed too long, it can lead to a small spot where there is permanent loss of nerve conduction connecting specific parts of the brain. Endothelial cell dysfunction itself can reduce blood flow to important parts of the brain without a small infarct and create poor memory, inattention, apathy and fatigue.

This, along with glymphatic endothelial cell dysfunction, likely contributes to reversible cognition. This can happen when a person goes off a lot of UPF and begins eating more whole plant food and/or gets a fecal transplant and changes their microbiome for the better. The arteriolar endothelial cells become fully functional again and open up the vessel to better supply that part of the brain. The glymphatic endothelial cells open up more and significantly increase removal of waste products.

Examples of improved cognition in patients with dementia can be found in the scientific literature [94]. The following story [95] illustrates how the microbiome can trigger illness in the brain, and that sometimes these changes in the brain can be reversed.

George is with his wife Esther at the neurologist's office. Over the last 2 years he has become less functional. He does not read any more. He needs help with his medications and bathing. His primary care nurse practitioner put him on two standard medications for Alzheimer's disease a year ago, but he has not improved. He was quite social in the past attending church and playing cards with friends but is no longer interested in these activities. He seems a little depressed and less expressive of emotions. Esther is heartbroken for him but tries to keep those emotions to herself. The neurologist reviewed his brain images, lab work, and mental status tests and confirms he has moderate cognitive loss. The neurologist diagnosed him with moderate Alzheimer's and agrees with the medications he is taking. Over the next 2-3 years his memory worsens. He gets confused about directions and does not drive anymore. He sleeps more during the day. His wife does get some help watching him as she is no longer comfortable leaving him alone.

One evening George became very weak and felt feverish. He also appeared short of breath. Esther called the ambulance, and he was hospitalized for pneumonia and was able to come home after 5 days in the hospital. However, he developed severe diarrhea and went back into the hospital and was treated for a Clostridia difficile infection in his colon. He went home but remained weak and the diarrhea continued. Two other different antibiotic courses failed to resolve the infection. His wife is a retired nurse and decided to try a fecal transplant with her stool to get rid of the Clostridia difficile infection. George cooperates with this, and Esther has carefully followed directions obtained from the gastroenterologist. Over the next few days George's diarrhea resolves, his strength and appetite improve, and his mood seems better. Three weeks later he asked about going to church. Over the next few months, his memory seems to be coming back. He is more alert and emotionally more responsive. Six months later George and his wife visit the neurologist who is also amazed and repeats his mental status exam. The previous exam was before he got sick with pneumonia. Two years ago, George scored 20/30 points on the mental status exam which is moderate dementia. This time he got almost a perfect score at 29/30.

I have had two friends whose fathers were mentally declining who have drastically changed their diet for the better (away from mostly UPF and toward a lot more whole plant food) and their mental status markedly improved. There are studies showing improved cognition in patients put on whole plant-based diets along with an exercise program that show improved cognition [93]. The above cases and studies, along with laboratory models of dementia in lab animals, bring us hope to be able to better understand this lousy medical problem and be able to advance both prevention and treatment of these diseases. Getting rid of insulin resistance and getting the microbiome, endothelial cells and brain cells healthy again can make a difference in our patients' lives.

At this point in time, our health care system has failed to reduce the incidence of dementia. Healthcare, especially the pharmaceutical companies, stubbornly cling to the idea that pills can solve dementia. What works is public education of what is scientifically known to eliminate insulin resistance. As we have all seen in this information era, the more someone sees or hears something, the more likely they are to believe it and act based on that information. Psychologic studies done many decades ago proved this. Understanding precisely how the diet, the microbiome and so many chronic diseases interact with one another is early in this complex scientific journey. It is now well established scientifically that the microbiome is a very important link between diet and many chronic diseases. How this occurs is being worked out for each of these diseases.

Cancer Prevention

Prevention is the act of taking steps to reduce the likelihood of developing a disease or condition. Examples of prevention would be quitting smoking to prevent lung cancer, getting an HPV vaccine to prevent cervical cancer, using sunscreen to prevent skin cancer, and wearing safety glasses to prevent eye injury. Early diagnostic tests are different. They are a way to detect precancerous neoplasia that may progress to cancers or early cancerous lesions and treat them in an early stage. Examples of this would be mammography, pap smears, colonoscopy, freezing actinic keratosis, and lung CTs in high-risk patients.

For over 50 years science has been showing us that breast and colon cancer are highly related to ultra-processed food (UPF) diets, especially processed meat and alcohol. Despite this, the incidence of colon and breast cancer continues to rise. To me, this is no surprise because there is virtually no significant public health messaging letting the public know how to prevent these cancers. Essentially all the money goes into treatment of these cancers with a small amount going into early diagnosis. Next to nothing is spent on telling the public the truth. It seems ridiculous that this country, that spends such a huge amount of money on health care, continues to have an increasing incidence of these well understood but heart-breaking illnesses.

Nutrition and Cancer – Some History

There are many 20th century studies looking at nutrition and cancer. My first interest in this was in 1971 when one of my professors in medical school, who was a well-respected hematologist, took several weeks off to visit a doctor friend in New Guinea. His friend had asked him to come because he was puzzled as to why so many men in a particular native population were dying from hemochromatosis. The two doctors visited one of the native villages to try to figure this out. They discovered that the natives ate mostly a root or tuber grown locally that required that it be boiled for many hours to become edible. They examined the pots they were using. They were very large cast iron pots. It turns out the iron in cast iron is absorbed into the food that is being boiled. The longer it cooks, the more iron the food has. Women were not getting iron overload due to menstruation and childbirth. Nearly all the men had very high iron levels which can cause liver or heart failure and other problems over time. My professor asked his doctor friend, who was a pathologist, about other diseases including colon diseases. The pathologist said he had not seen a case of diverticular disease, colon polyps, or colon cancer in any of the natives. He had been doing autopsies on them for 30 years. My professor was astounded.

About this same time, two articles were published in reputable medical journals from St. Mary's Hospital Medical School in London. The first [100] in 1969 gave good arguments that it seemed likely that colon and breast cancer were related to diet. They suspected that diet played an important role in the development of colon and breast cancer in their own reading of the literature. Their articles reported a comparison of the types of bacteria in the stool of average folks in London with stool bacteria from folks in Uganda. Ugandans (colon cancer was rare in

Uganda) ate very little meat or animal fat and ate mostly plant based unprocessed foods. The folks in London ate plenty of meat in addition to plant foods. They found increased amounts of bacteria that degrade bile in the Londoners and a reduced amount of these types of bacteria with higher counts of other bacteria in the Ugandans. They concluded that diet played a role in the types of bacteria in the colon and that the bacteria likely contributed to the development of colon cancer. The second study in 1973 [99] showed that the incidence of colon cancer correlated well with the incidence of breast cancer. The authors looked at a variety of factors that were more common in these cancer patients. "*Both cancers were highly correlated with indicators of affluence such as a high fat diet rich in animal protein and the availability of motor vehicles but the correlation with fat and animal protein was higher than for the other factors*." The high fat diet referred to high meat, egg and dairy product consumption.

Some more recent news about cancer:

1. **Summary from the publication:** Alcohol and Cancer Risk The U.S. Surgeon General's Advisory, HHS (January 2025)

This advisory highlights alcohol use as a leading preventable cause of cancer in the United States, contributing to nearly 100,000 cancer cases and about 20,000 cancer deaths each year [108].

2. **New Cancer Cases Increased To More Than Two Million In 2023, Report Says** [123]

The New York Times (1/17/2024, Gina Kolata) reports, "Cancer deaths in the United States are falling, with four million deaths prevented since 1991, according to the American Cancer Society's annual report." However, "the society reported that the number of new cancer cases had ticked up to more than two million in 2023, from 1.9 million in 2022."

The Hill (1/17/2024, Nazzaro) reports, "Cancer is the second leading cause of death in the United States overall and the leading cause among those younger than 85, researchers stated."

According to USA Today (1/17/2024, Alltucker), "The report said rates are increasing for six of the 10 most common cancers: breast, prostate, melanoma, kidney, pancreas and uterine." Meanwhile, "lung, colorectal and pancreas cancers cause the most deaths."

CNN (1/17/2024, Howard) reports, "Among adults younger than 50, colorectal cancer has become the leading cause of cancer death in men and the second-leading cause in women, behind breast cancer, the new report says." CNN adds, "In the late 1990s, it ranked fourth in both men and women younger than 50." The findings were published in CA: A Cancer Journal for Clinicians.

3. **Research reveals how fructose in diet enhances tumor growth** [128-129].
A study submitted to Nature in 2020 did not get published until 12/4/2024, a delay of more than 4 years which is unusual. This is a landmark study showing why lab animals which have implanted human tumors (breast, cervical cancers and melanoma) show unusually rapid tumor growth when the animal is fed fructose in the diet. Scientists working with the cancer implanted mice knew if they added fructose to the same cancer cells growing in a petri dish, the tumors did not get stimulated by fructose. Researchers at Washington University in St. Louis figured out why this was occurring. It turns out, when the liver gets exposed to fructose surges (these happen routinely in modern UPF diets), it over produces cell wall components called lysophophatidylcholines. When this happens, these are released into the circulation, so they are available to tumors. These components are not the main structural parts of new cell walls, but they are essential. It turns out tumor cells do not like making lysophosphatidylcholines. They prefer to snatch them from our circulation. Hence, when they get lots of lysophosphatidylcholines, they can make new cell walls much faster and this increases the growth of the cancers.

Cellular biology of Breast Cancer
Breast cancer cells, like other cancer cells, usually arise under a combination of circumstances. Most breast cancer cells arise from cells that line the ducts coming from the mammary glands. The ductal epithelial cells divide and migrate a lot during puberty and pregnancy branching out and creating more ducts. Otherwise, the cells do not divide very often. Carcinogens trigger mistakes in the DNA. Often this is associated with cell division and migration. If the cell does not correct this mistake or recognize it is there, the cell most likely will survive. This cell during future cell division can take on other mistakes in the DNA. In most cases these mistakes would be recognized and repaired quickly [102]. Our cells have several robust mechanisms of repairing damage to our DNA. This occurs several thousand times per day. If not reparable, the cell is supposed to self-destruct (apoptosis) which is what usually happens. But, if the mutation makes it hard for the cell to recognize the mutation(s) or makes it hard for natural killer cells to sense it, the mutated cell can undergo further change. For the tumor to grow, several things need to happen. One of those things is DNA changes that signal the cell to divide. Another is changes in the tumor cells that recruit nearby cells to support the growing tumor with increasing blood supply and structural support.

The current theory is that many (or even most) women get tiny microscopic tumors that become dormant often for years. After menopause, there is not much cell division going on in the ducts. If more changes happen to one of these tiny tumors that triggers it to grow, then a detectable tumor can form. Within these slightly bigger tumors other changes in the DNA can cause the tumor to not only continue to grow, but to spread to fatty tissue and invade blood vessels and lymph vessels. At this point the tumor has become cancerous. See the reference [101] for a much more detailed discussion. As you know, breast cancer can form anytime during a woman's life, but since the highest incidence of breast cancer is post-menopausal, we will focus on that scenario. The DNA changes that lead to invasive cancer can also occur in much younger women.

What triggers breaks in the DNA?

1. Elevated levels of estrogen [103, 104] stimulate transcription of DNA in epithelial cells that line the ducts. Under certain circumstances as RNA is being transcribed off DNA, mistakes can occur leading to mutations. Elevated levels of estrogen can attach to inactive epithelial tumor cells and stimulate them to divide and migrate and even take on invasive characteristics. What causes elevated levels of estrogen? Insulin resistance (due to eating or drinking too much UPF) is one well know cause. Insulin resistance reduces sex-hormone binding globulin (SHBG) levels, which increases estrogen bioavailability and can increase the risk of breast cancer. Elevated estrogen levels can also create an environment around an inactive tumor that can cause the inactive tumor to activate, grow, and invade. Many other environmental factors can elevate estrogen levels such as elevated body fat, liver disease, pesticides, heavy metals, and even the bacteria in the colon.
2. Estrogen mimickers such as Bisphenol A (BPA) and other BPA like chemicals [105] found in plastics and canned foods are used to coat the inside of water bottles and canned foods to prevent the taste of the container from getting into the food or drink. These can also trigger DNA abnormalities, replication and migration that can lead to cancer.
3. Cell nucleus rupture can occur during cell division or cell migration, both of which are common in ductal breast neoplasia. This can expose the DNA that is protected by being inside the nucleus to unfriendly molecules in the cell's cytoplasm. This can cause multiple mutations. Studies show this can lead to invasive phenotype in breast neoplastic cells [106].
4. Environmental carcinogens
   a) Polycyclic aromatic hydrocarbons (PAHs) from air pollution and smoked or grilled meat have been shown to increase the risk of breast cancer [111] .
   b) Heterocyclic amines (HCAs) [112-113]
   c) Nitrites and Nitrates
   d) Alcohol increases the risk and is dose related [107-109]. The more one drinks, the greater the chance of breast cancer. Alcohol can increase estrogen levels, damage DNA directly and reduce folate levels which are needed for DNA repair.
   e) Emulsifiers in UPF [110]
   f) Dozens of other environmental chemicals in our industrialized world

What circumstances make it more likely the abnormal mutated cells will survive?

1. Insulin resistance triggered by surges of fructose from UPF and/or from inflammatory metabolites such as LPS hinder killer cells that seek out and destroy wayward mutated cells. LPS and surging fructose levels can also increase the number of reactive oxygen molecules (called oxygen free radicals) that are inside the cell. Normally the cell has antioxidant molecules that quickly bind and neutralize these free radicals and no harm is done. If there are too many free radicals, then this can cause problems in the cell. It can cause more breaks or mistakes in the DNA. At the same time these radicals can hinder the cell's ability to fix these mistakes.

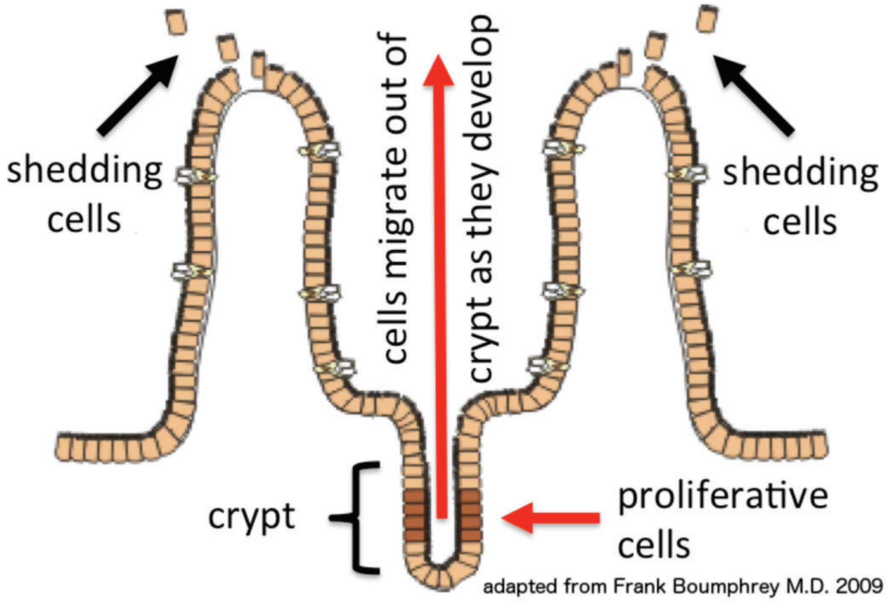
2. Fructose surges cause the liver to release lysophosphatidylcholines facilitating more rapid growth of cancer cells.
3. Elevated estrogen levels also favor the growth of these mutated cells by stimulating the growth of support cells such as blood vessels and fibrous tissue.

What role does nutrition play in preventing Breast Cancer?
A healthy whole plant diet keeps the duct and alveolar breast cells very healthy. Below is a list of the benefits of this healthy diet.

1. This diet does not have any significant fructose surges so it has plenty of neutralizing molecules that quickly take care of oxygen free radicals, can quickly repair breaks in the DNA, or, if not repairable, can trigger cell death (apoptosis).
2. It creates a very healthy mix of bacteria in the colon with little LPS or other unhealthy metabolites that can get into a woman's circulation and increase the free estrogen in her serum.
3. The fiber in the whole plant food creates lots of cell-nourishing SCFAs. This makes the colon cells strong and robust. They grow lots of strong bonds with the other epithelial cells and keep the LPS and other unhealthy metabolites from getting into our circulation. This allows the breast duct cells to carry out their duties of protecting and maintaining the DNA which prevents tumors from forming.
4. When the cell is not dysfunctional from an unhealthy UPF type diet, if a nucleus rupture occurs, the cell can quickly repair it before there is any DNA damage,
5. There are a lot fewer carcinogens coming in from our diet, so there is much less DNA damage going on.

In summary, minimally processed whole plant diets significantly reduce the formation of tiny tumors and activation of dormant breast tumor cells that can progress to become invasive cancerous tumors.

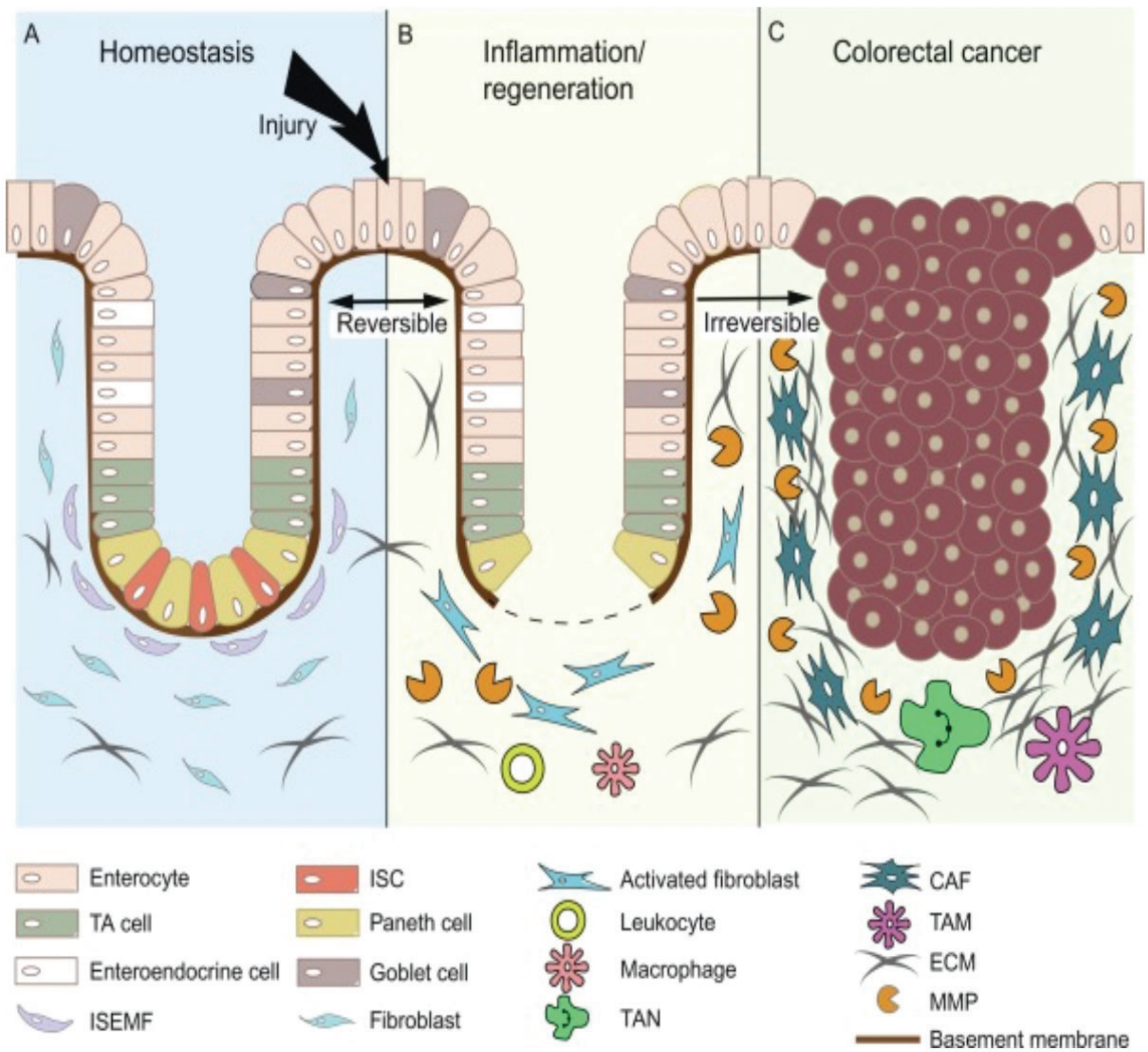
Cellular biology of Colon Cancer and Rectal Cancer
Colon tumors usually start in the crypts where rapid cell division is occurring. The colon cells mature as they migrate to the top of their villus and only live about 3-5 days. Many mutations need to occur before the cancer forms. This is why there is an element of chance involved. It is also why it usually takes months for the tumor to go from non-invasive to invasive.



Polyps and adenoma of the colon are benign but can progress to being malignant. Sometimes the tumor is very hard to see with the colonoscope as they can be very small. These tumors can become malignant before they get to the size of a visible polyp. These are usually more aggressive tumors. First, there can be an injury from hydrogen sulfide (H_2S) produced by unhealthy bacteria, lack of SCFA that keeps the cells robust, infection, diverticulitis, emulsifiers in the diet, antibiotics, opioids, ulcerative colitis, constipation, or spasm of the colon. After injury comes the repair process. If this person has too much LPS or too much fructose, it can cause the repair process to be too slow. If precancerous mutations happen in some of the proliferative cells, then a tumor may form. Most of these tumors are benign. Occasionally they quickly become malignant or later change with time from benign to malignant due to unhealthy bacteria inside the colon causing them to become cancerous.

How is the cause and maintenance of a colon tumor different from breast tumors?
Colon tumors are not hormone sensitive. Bacteria can play a direct role in attaching to the injured area and causing a delay in the repair process by shedding LPS [119] and producing H_2S [114-117]. The H_2S is produced by unhealthy bacteria (such as the LPS producing ones) when they metabolize cysteine and methionine amino acids. Meat, dairy, and eggs contain a lot of protein with these amino acids. The H_2S can then continue to enter cells and interfere with the cells ability to repair its DNA causing the mutated cells to evolve into tumor cells. If these cells get support from new blood vessels and fibroblasts, then a significant tumor can form.

The diagram below shows progression going from normal (homeostasis) to colon cancer. Notice that there are a lot of different cells around the tumor C and not so many around the normal colon A. B has more cells than A. Colon cancer requires support from a lot of modified cells. The cells around B are there to repair a break in the lining.



The lumen of the colon is at the top and below is part of the wall of the colon.
CAF, cancer-associated fibroblast (helps hold the tumor's shape)
ECM, extracellular matrix (tougher elastic collagen)
ISC, intestinal stem cell (healthy proliferative rapidly dividing cells)
ISEMF, intestinal subepithelial myofibroblast (support normal bowel surface and crypts)
MMP, matrix metalloproteinase (associated with tumor and repair support)
TA, Transit Amplifying cells that move up and mature into enterocytes
TAM, Tumor Associated Monocytes
TAN, Tumor Associated Neutrophil (type 2 immunosuppress, stimulate tumor growth, angiogenesis, & metastasis)

What role does nutrition play in the development of colon cancer?
Most Americans get a lot of protein and fat from UPF, cheese, and processed meats. High protein and fat diets cause an abnormal mix of bacteria in the colon [118]. These bacteria convert protein into H_2S which can penetrate the mucous protective layer and injure the stem

cells in the crypts between the microscopic villous protrusions. The mucous barrier can also be injured by elevated levels of LPS that occur with a UPF diet. During this injury, repair cycle mutations can occur and, if not repaired, can result in tumor cells forming. Repair is hampered by the fructose in the UPF and by LPS from the unhealthy bacteria cell walls. If the diet lacks whole plant food, not enough fiber is getting into the colon. With the subsequent lack of small chain fatty acids (SCFA), the cells lining the colon are weaker and may not repair the injury to the crypt before tumor cells are formed.

Alcohol use and Colorectal Cancer (CRC)

Recently published research shows an increased risk of colorectal cancer in people under 50 years of age. Alcohol use has been associated with increased risk of cancer for many years. This is especially true for breast, colon, esophageal, and pancreatic cancer. Over the last 8 years there has been strong epidemiologic evidence that alcohol increases the risk of getting colon cancer. A Korean study [120] was published in the Journal of Clinical Oncology in August of 2023 about the incidence of CRC in 20-49-year-olds. Using the South Korean population database of the National Health Insurance Service (NHIS), they identified 5.7 million young adults in this age group. In 2009 detailed questionnaires on drinking, smoking, and physical activity were added for all patients being seen. The data was taken from records from 2009 to 2019. The CRC group contained those patients who were diagnosed with CRC ages 20- 49 at the time of diagnosis. 8,314 cases of CRC were found. The dose-response association between drinking frequency and risk of CRC was very significant. Nondrinkers had the lowest rates of CRC. Those who drank alcohol 1-2 days a week had a 7% increase of getting CRC over nondrinkers. Those who drank 3-4 days a week had a 14% increase, and those who drank 5-7 days a week had a 27% increase.

Studies also have worked out several ways that alcohol use increases the risk of CRC:
1. Alcohol induces the growth of bacteria that utilized alcohol as an energy source, and this results in the overproduction of acetaldehyde. This has several cancer-causing effects:
a) Acetaldehyde causes DNA adducts (areas of epithelial DNA that have been chemically bonded to cancer-causing molecules and create mistakes in the transcription of DNA) [107, 121].
b) Acetaldehyde triggers the production of lipid peroxidases which are associated with increased risk of several cancers.
c) Acetaldehyde blocks the production of Retinoic Acid which helps prevent colon cancer by supporting normal cell development (as opposed to abnormal or dysplastic development)
2. Alcohol consumption is often associated with a poor diet increasing the risk of insulin resistance which is associated with increased cancer risk via the microbiome metabolites and too much fructose.
3. Poor diet and excessive alcohol use can lead to reduced folate levels which is critical in supporting the cell's mechanisms for repairing DNA damage.

With the current American diet, it is no wonder 40% of Americans over 50 have polyps in their colons. It is also no mystery why the number of people under 45 getting colon cancer is going up. This is nearly all preventable by changing one's diet and drinking habits.

A note on Emulsifiers
Emulsifiers are in about half of UPFs purchased in stores or coffee shops. The FDA has approved about 170 different emulsifiers. Over the last 15-20 years studies have implicated them in diseases related to inflammation. Approval of these additives is mostly by GRAS (Generally Regarded As Safe). This means they have not been proven to be safe, and the FDA allows them in foods without any major prospective studies. Dozens of studies show that they create an abnormal microbiome and increase the risk of insulin resistance and metabolic syndrome. In lab animals, normal doses of these chemicals cause inflammation in the colon and increase the risk of inflammatory bowel disease. In February of 2024 a large prospective French study [110] was published showing an increase incidence of breast and prostate cancer in adults who ate lots of food with emulsifiers compared with adults who did not. Examples of common emulsifiers: modified starches, lecithins, xanthan gum, pectins, mono- and diglycerides of fatty acids (FAs), carrageenan, celluloses, Xanthum gum, and guar gum.

Can Nutrition Help Those Diagnosed with Cancer?
The short answer is yes. Below is information about important topics for patients with cancer. Keep in mind that most healthy cells that can become neoplastic have insulin receptors. With insulin resistance, the cells are not getting the signals to tell them all is well, that there is plenty of food, and that they can carry out their specialized duties full steam ahead. This creates dysfunction inside the cells including reduced ability to prevent the cell from becoming cancerous or from recovering from chemo or radiation therapy.

What is well-being and where does it come from? Well-being simply is feeling well, content, or comfortable. Research on how our brains function has come a long way in the last 15-20 years. Using laboratory animal models, specialized functional MRI scans in humans and neurocognitive and psychological testing, we have a much better idea where in the brain certain important feelings come from. We also have a much better knowledge of what may influence these feelings in negative or positive ways. Here are some important feelings that people undergoing cancer treatment experience:

1. Fatigue verses feeling energetic [124]: Most of us have experienced days we are full of energy and enthusiasm or the opposite feeling of no energy or little enthusiasm which is called fatigue. Neurobiological studies implicate structures in the ascending arousal system, sleep executive control areas, and areas important in reward. In addition, the suprachiasmatic nucleus clearly plays an important role in homeostatic regulation of the neural network mediating fatigue. It is a network of cells and nerves that involve parts of the brain all the way up to the cortex. When you have a fever due to an infection, the fatigue or exhausted feeling you get comes from this network in the brain. Your brain wants you to rest, so it greatly reduces the activity in this “fatigue/energetic” network. This diverts your body’s energy toward the immune system that is fighting off the infection. It makes you feel like you have no energy and must lay down and rest. On the other hand, when this network is activated, you have energy to do things, and you get that get-up-and-go feeling.

Scientific studies show that this area is deactivated with a significant infection and causes us to rest more. It is revved up with exercise or in the morning after a good night's sleep (and maybe a cup of coffee). Of course, many other things influence this network. Scientific studies show that when there is an increase in chemicals that trigger inflammation such as what happens with an infection, this deactivates this fatigue/energetic network, and we feel fatigue. When those chemicals are no longer present, our energy comes back.

2. Loss of appetite verses feeling hungry: When a person has significant depression or anxiety, it is not unusual for them to lose their appetite. Any serious illness can cause our brain to quiet us down so we will rest and can divert our energy to fighting a serious illness. This often includes reducing our appetite. Many parts of our brain are involved in the loss of appetite. Most important for our day-to-day life is the hypothalamus.

3. Depression verses feeling good [126-127]: These powerful emotions come from the ventral striatum at the top of and to each side of the brain stem. It has millions of connections with the cerebral cortex. Inactivity in this network of brain cells and connections leads to depression. This is also where the reward center resides. When it is very active, we are in a good mood. It lights up when we accomplish a goal. Diets that trigger abnormalities in our cells can cause decreased activity in this area of the brain when it normally would be active. This can lead to diet induced depression and lack of feeling accomplishment when attaining a goal. Similar research on anxiety has been done.

4. Brain Fog (reduced memory, reduced fluency, reduced attention, reduced speed of information processing) verses feeling mentally sharp [125] : Brain fog is reported by some people undergoing certain treatments for cancer with radiation or chemotherapy. It is also seen after a COVID infection in some people. The areas of the brain most affected are parts of cerebral cortex grey and white matter that deal with math, recall, word processing and other cognitive processes. Another area in the brain stem, called the hippocampus, shows reduced regenerative activity following chemo or radiation therapy in some patients. These negative changes have been shown to at least be partially preventable in laboratory animals when feeding them whole food mostly plant-based diets.

How fructose worsens well-being in people living with cancer

The main sources of fructose in American's diet are sucrose, high fructose corn syrup, fruit juices, and whole fruit. Because our distant ancestors were not exposed to very much fructose, their cells did not have to worry about getting too much fructose at one time. Now with the American diet containing very large amounts of rapidly absorbing fructose in the form of sugar, high fructose corn syrup and fruit juice, the cells are unable to keep out the excess fructose. Too much fructose enters our cells and causes cellular dysfunction in important parts of the brain.

In some patients with cancer, the cancer itself and/or the treatment of the cancer can also cause some cellular dysfunction. By eliminating surges of fructose in our bodies, we can counteract some of the effects on the brain that worsen our feeling of well-being. The cellular dysfunction can lead to mood problems, poorer sleep, fatigue, reduced learning ability, and being less attentive.

How lack of fiber worsens well-being in cancer patients

When the fiber is digested by the healthy bacteria in our large intestine, this process gives energy to the bacteria to grow and divide and thrive. These healthy bacteria take in bits of the fiber and obtain energy as they break it into smaller molecules. The most important of these smaller molecules are short chain fatty acids (abbreviated SCFA). SCFA play a significant role in our health. They signal that full content feeling you get as you are digesting your food and help regulate your food consumption. The other very important role that SCFA have is nourishing the cells that line the inside of our large intestine. When these cell are healthy, unhealthy chemicals are kept from entering our circulation. On the typical American UPF diet the harmful metabolites like LPS significantly increase in our circulation. These cross the blood brain barrier and can trigger insulin resistance in many types of cells of the brain. The brain has lots of cells that respond to insulin. Insulin keeps the cells on tract to carry out their healthy routines to keep our brains functioning well and help with our well-being. Unhealthy metabolites like LPS also can increase the number of oxygen free radicals that can also reduce activation of parts of our brain that effect our well-being. Eating mostly a whole plant-based diet eliminates these detrimental metabolites and our brains get back to healthier feelings.

What happens when a person makes the transition from UPF to mostly a whole plant diet?

Let’s look at someone going through various treatments for cancer that decided weeks ago to get most of their calories in whole plant minimally processed foods. The current recommendation on changing your diet to more whole plant based is to do it gradually over 2-3 weeks if possible. However, many people do ok with making a faster transition depending on how much whole plant food they were eating before they made the change. If they were eating very little whole plant food and mostly UPF and make a quick transition, they may experience a mildly gassy distended stomach for a few days. Their intestines take several days and even up to 2 weeks to adapt.

Radiation for cancer in someone on healthy whole plant-based diet

Next, let’s assume this person (now mostly on a whole plant-based diet) is undergoing radiation treatment for their cancer. With this healthy diet, their immune system will be fully functional. They will be able to detect infections earlier and fight them off quicker. Inside their healthy cells, the machinery to repair cells that had been near the tumor is fully functional and less cells will die. Their white cells can more efficiently clean up the dead cells. This will cause less inflammation and less pain and weakness in the patient. Their natural killer cells that seek out cancer or damaged cells will work better and get rid of more cancer cells.

Chemotherapy in someone on a healthy whole plant-based diet
Someone undergoing chemotherapy will benefit like the person getting radiation with less chance of severe infection, less non-cancer cells dying, and better clean-up of dead and dying cancer cells. At least one study [122] showed that increased butyrate (one of the SCFA) levels improved response for certain chemotherapy drugs used for colorectal cancer. Butyrate goes up with high fiber whole plant-based diets. Natural killer cells can better seek out and destroy partially treated tumor cells as they will be more functional on this healthier diet. Another benefit noted above is improved well-being which makes it more likely they can complete their chemotherapy on schedule.

Major surgery for cancer in someone on healthy whole plant-based diet
If someone has surgery for a brain, colon, breast, kidney, or prostate cancer, there are several important issues to deal with. The surgery itself is traumatic to their body and there is an increased risk of clots in the lungs or the heart or the legs. On a healthy whole plant-based diet, clots are less common as the healthy cells that line the arteries and veins do not release clotting chemicals when they are not supposed to. On a much less healthy diet, clots are more likely. The risk of infection is less on whole plant-based diet. Wound healing is better on a whole plant-based diet.

Meat and Cancer
I have put meat in a separate category because there are healthy ways to eat it, but it has no fiber. To stay in good health, it is important to limit how much meat you eat. Red meat consumption and especially processed meat consumption have been associated with an increase of many cancers for a long time. Studies about breast and colon cancer dating back to the late 1960s and early 1970s show that red meat and processed meats significantly increase this risk. Studies since then in a wide variety of countries show the same thing. Over the last 15 years in addition to showing the increased risk of cancers with red meat, we have a lot better knowledge of why red meat and especially processed meats increase the risk of cancer.

How does red meat increase the risk of cancer?
The risk of getting cancer is a lot higher depending on how the meat is prepared. Grilled red meat is more carcinogenic for two reasons. Red meat that gets exposed to high temperatures such as grilled or broiled develops chemicals called heterocyclic amines (HCAs). The longer it's on the grill, the more HCAs are formed. These are carcinogens. Secondly the smoke from the drippings onto the grill gets into the meat and adds polycyclic aromatic hydrocarbons (PAHs). These are one of the many carcinogens in cigarette smoke. Red meat tends to be high in fat which triggers a very abnormal microbiome which sets off insulin resistance. This in turn reduces the cellular functions that prevent tumors from forming.

How does processed meat increase the risk of cancer?
Processed meat is more carcinogenic than red meat because, even though it has the same carcinogens as grilled red meat, the concentrations are significantly higher. Processed meat has more animal fat than red meat. Animal fat combined with red meat causes a significant increase

in the number of harmful bacteria in the large intestine. The harmful bacteria not only produce too much LPS, but, when breaking down proteins, they produce sulfur molecules that directly increase the risk of colon polyps and colon cancer.

Does eating chicken and fish increase the risk of cancer?
Both chicken and fish when processed increase the risk of cancer but less than red meat and processed red meat. For example, eating breaded and deep-fried chicken or fish makes these meats unhealthy. Deli poultry is processed and is considered processed meat. Rotisserie chickens purchased at the store are usually injected with a variety of chemicals before they get to the store to be cooked. These can include a lot of salt, phosphates, emulsifiers, flavors, modified food starch and added sugar. They are UPF or processed meat.

In summary, when someone is going through cancer treatment, eating a lot of meat increases the harmful bacteria in the large intestine and leads to cellular dysfunction in many organs which can reduce the effectiveness of cancer treatment. Processed meat and grilled meat do this more so than fish and poultry. The International Agency for Research on Cancer (IARC) rates processed meats as Group 1 cancer causing substances. This means it is well established they increase the risk of cancer. Red meat is Group 2A which means it is likely to cause cancer.

How can Cancer Patients Prevent a Recurrence of Cancer or a New Cancer?
We will review 3 articles regarding survival in cancer patients. Overall, it appears diet (as well as exercise) plays a very significant role in surviving cancer. Diets highest in plant food, coupled with regular exercise, consistently show benefit in surviving cancer. The typical American diet with lots of UPF and processed meat consistently shows reduced survival and higher recurrence rates.

I think the reason that there are <u>not</u> very many good studies that show folks who eat very little UPF and eat mostly whole plant foods do much better, is that there is not enough public education about eating a whole plant food diet. It is difficult to find cancer patients who adhere to a whole plant food diet. It also is clear there is a general reluctance to say anything negative about popular foods or to bluntly say that the healthiest diets contain a large amount of whole plant food. I see this a lot when I read the scientific literature regarding nutrition and cancer.

The guidelines given by cancer organizations seems to favor plant food but fail to do three important things: 1) to state why UPF is unhealthy and increases the risk of cancer 2) to warn that dairy products have been shown to worsen cancer survival 3) to recommend limiting meat intake and avoiding feed lot animal meat. Cancer organizations should be recommending a maximum of 4 oz servings, organic, free range meat or wild caught fish.

First Article: Lymphoma Recurrence and Survival
This article was published in 2010 and looked at information gathered from 600 adult women in Connecticut who were diagnosed with lymphoma (excluding Hodgkin Lymphoma). These women had filled out detailed questionnaires of about 120 different foods. They were followed for about 8 years. Women who ate recommended amounts of whole plant foods had lower

recurrence rates and better survival than women who ate much less than recommended. For example, if we took 100 women with lymphoma whose plant food intake was low, about 60 of them would have died during the study. But, if we look at 100 women who adhered to the guidelines about eating vegetables and fruits, only about 35 died. The numbers for recurrence were similar. This is about a 42% drop in the death and recurrence rates.

Reference: "Vegetable and fruit intake and non-Hodgkin lymphoma survival in Connecticut women" Published in 6/8/2010 in Leukemia Lymphoma. 2010 Jun;51(6):1047–1054. doi: 10.3109/10428191003690364"

Second Article: Breast Cancer Recurrence and Survival
This article was published in 2023. It involved 1340 women from cancer centers across the U.S. who were diagnosed between 2005 and 2011. They all had high risk breast cancer types and stages. They were all encouraged to adhere to recommendations about fruit and vegetable consumption, exercise, smoking, alcohol, avoiding sugar sweetened beverages and to avoid red and processed meat intake. Special questionnaires were filled out by participants before treatment started, when treatment ended, and twice more in the following 2-3 years. (This was usually about a 5-year period). A total score was based on each of their questionnaires with a higher score reflecting higher adherence to the recommendations. There was a significant drop in recurrence rates and improvement in survival rates in those who were best at adhering to the guidelines. Women, who were good at sticking to the guidelines compared to those who had poor adherence, had a 37% reduction in their recurrence rates. They also had a 58% reduction in their death rates. The guidelines were obtained from the American Institute for Cancer Research and the American Cancer Society.

Reference: "Adherence to Cancer Prevention Lifestyle Recommendations Before, During, and 2 Years After Treatment for High-risk Breast Cancer" Published 5/4/2023 in JAMA Network Open. 2023;6(5):e2311673. doi:10.1001/jamanetworkopen.2023.11673

Third Article: Colon Cancer Recurrence and Survival
This study, published in 2007, involved 1009 stage III colon cancer patients that were followed for an average of 5-6 years. They did multiple food questionnaires and looked at two types of diets. One was the typical American diet of a lot of UPF with meat and dairy products. The other diet pattern was one with much more plant-based foods and not much UPF. The group of patients who ate the typical American diet showed that those patients who ate the highest amounts of meat, UPF and dairy had 3 times the risk of death or recurrence than those who ate the least amount of UPF, meat and dairy products. This was quite significant.

Reference: "Association of dietary patterns with cancer recurrence and survival in patients with stage III colon cancer" published 8/15/2007 in JAMA, August 15, 2007—Vol 298, No. 7

Summary
These 3 studies suggest that in all 3 of these types of cancer (lymphoma, breast, and colon) a diet high in whole plant food and low in UPF, sugary beverages, meat and dairy will lead to less chance of the cancer coming back and less likelihood of the patient dying. We know that previous cultures (studied in the mid 1900s and before) who ate lots of whole plant food had very low rates of cancer. Those results are very consistent with these more modern results. From what we now know about how cancer develops easier in the face of lots of fructose or LPS (from lack of eating fiber foods), these studies make a lot of sense and are consistent with what science has learned about cancer.

It seems clear that adhering to a minimally processed whole plant base diet is best for cancer patients in many respects. It helps their feeling of well-being, helps with tolerating cancer treatment and it helps prevent recurrence of their cancer and early death.

The big challenge is how to change to a whole plant-based diet. By learning how to recognize the thousands of UPFs and drinks, knowing to keep meat portions to 4 oz or less, and learning how to buy healthy meat, we can be very successful. It is quite a rewarding journey to learn how to prepare plant-based food in a fun and enjoyable way.

<u>Two helpful web sites are: American Institute for Cancer Research, and Forks over Knives.</u>

How to buy, cook and prepare meat to make it part of a healthy diet.
Avoid processed meats. Red meat and poultry should be free range (not in a feed lot the last few months of their lives) and organic. Free range means the animals are choosing their own plants to eat rather than being fed factory manufactured soy and corn extracts to fatten them up. When the animals graze and choose what plants to eat, their meat has the healthy ratios of omega fatty acids. Feed lot meat has too much omega 6 fatty acids which can trigger inflammation increasing the risk of many chronic illnesses. Organic meat does not have steroid like growth stimulating chemicals in it and has no antibiotics in it. It is best to buy organic free-range meat. This is also true of fish. Farm raised fish are given antibiotics and corn and soy extracts designed to quickly fatten them. It is best to buy wild caught fish, organic free-range beef, pork or lamb, and free-range chickens that are not seasoned before you buy them. Turkey should be free-range and organic as well. Nearly all turkeys are pre-basted before getting to the store which makes them less healthy. It is best to ask for an unbasted free range organic turkey when turkey shopping. Free range and organic meats often are more expensive, but remember, we are trying to limit our daily meat consumption to 4 oz per day or less.

Healthier ways to cook meat: All meat should be in small portions (4 oz or less) and no more than once a day. It is ok to add spices, just not too much salt. It is best to cook it at lower temperatures such as in a crock pot, Instant Pot or microwave. Another good way to cook meat is to make chili or stew and add the meat raw or slightly browned. Avoid grilled meat or broiled meat. Most deli meats should be avoided as well.

What about Dairy products? Nearly all dairy products are significantly processed. Store bought ice cream, flavored yogurts, artificial whipping cream, butter like spreads, most cheese containing products, most chocolate drinks (including chocolate milk and chocolate flavored coffees) are all ultra-processed. Plain real butter, aged cheese, real whipped cream are considered group 3, processed foods (see NOVA PDF). Plain milk from the store is both pasteurized and homogenized but is not considered UPF. However, dairy products do not have fiber and drinking a lot of milk will alter the bacteria in the colon to make it more harmful. Drinking a lot of milk also causes constipation due to lack of fiber and the increase in harmful bacteria.

Please answer the questions for Session 2. In the second CME session we will go over some of these questions or questions you have before breaking into small groups to address another patient scenario.

Credits: Much thanks and praise to my wife Susie Rice who has been my faithful editor. And a big thankyou to her for putting up with my new avocation of teaching nutrition and chronic disease since I retired in 2021. Also thanks to all the folks who have attended my classes who have given me very helpful feedback.