Health Condition: Cancers

"I was astonished to learn that in 1936, shortly before World War II broke out, the world's leading cancer scientists traveled to Brussels and agreed, at that time, that based on what was then known, coal tars (like those that lodge in the scrotum) were a cause of cancer (scrotal cancer) in chimney sweeps. They understood that cobalt and uranium mining caused cancer in workers. They knew that x-rays and solar radiation caused cancer, and if you painted hydrocarbons on the skin of animals and gave them solar radiation you could magnify the response. What was considered evidence of cancer in the 1930s was a combination of animal experiments and some human evidence. And what happened after the war was that epidemiology, as a discipline, became interpreted as the requirement before we could say something was causal. The effect of that was to make it necessary to wait until we had enough proof of human harm, in the form of dead or sick workers, or in the case of tobacco, people who clearly had been smoking for a long time. What that meant--because cancer has such a long latency, as you know--is that we were dooming one generation to be experimental subjects in order to decide whether we could try to protect the future generation. That is precisely what we did with tobacco epidemiology, so that not until the 1990s was government action started against tobacco, and when the War on Cancer was launched by President Nixon in 1971, it was completely silent about tobacco, although the hazards of tobacco were known in the scientific community in the 1930s and 1940s."

—Devra Lee Davis, PhD, MPH
Author of *The Secret History of the War on Cancer*
Founding Director, Center for Environmental Oncology, University of Pittsburgh Cancer Institute

Genes vs. Environment: Where Does Cancer Come From?

Where does cancer come from? Is it an inherited condition passed from parent to child, or does it occur as a consequence of uniquenesses in genes that react with environmental considerations and express themselves as malignancy? This is a very polarized question in the areas of cancer research and cancer therapies. Is cancer deterministic or modifiable based upon environment?

In 2000, a very significant study was published in the *New England Journal of Medicine* titled "Environmental and Heritable Factors in the Causation of Cancer--Analyses of Cohorts of Twins from Sweden, Denmark, and Finland."[1] This study used 44,788 pairs of twins listed in the Swedish, Danish, and Finnish twin registries to assess the risk of cancer at 28 anatomical sites for twins whose twin sibling had cancer. The researchers used statistical modeling to estimate the relative importance of heritable and environmental factors in causing cancer at 11 of those sites. The purpose of the study, which explored the genetics versus environment issue, was to determine whether the sibling whose twin has cancer is more likely to develop cancer than a member of the population as a whole.

This study was the largest of its type in twin cohort analysis. The conclusion was that inherited genetic factors make a minor contribution to susceptibility to most types of neoplasms. This finding indicates that environment plays the principal role in causing sporadic cancer. The relatively large effect of

heritability in cancer at a few sites (such as prostate and colorectal cancer) suggests major gaps in our knowledge of the genetics of cancer. The major forms of cancer, however, are more affected by diet, lifestyle, and environment. With the exception of uterine cancers, for which no evidence of heritability is found, 20-40% of cancer was found to be heritable, which implies that 60-80% is environmentally determined and is potentially modifiable.

For years cancer researchers and therapists did not generally accept that carcinogens, chemicals, or xenobiotic substances had a direct impact on producing cancer. If they acknowledged the effect of these substances at all, they believed their contribution to the cancer process was minor. Now we know cancer initiation and growth are tied to exposure to mutagens and carcinogens. This realization changed our thinking about cancer, moving from inside the body to environmental factors outside the body.

Gene/Environment Interaction and the Etiology of Cancer

It all starts at a molecular stage. Over the past decade, insights into the origins and behavior of human cancers have reshaped our understanding of these diseases. We now know that cancer is not singular, it is plural (cancers), and each cancer may have a different fingerprint based upon its genetic mutation that it has undergone within a specific cell. And that specific cell's regulatory change through a mutation either at the epigenetic or the genetic level can then result in certain dedifferentiated cell regulatory processes being obviated or exhibited, which then we ultimately see over time developing into a diagnosed cancer. What controls these personality characteristics of cells?

In 2002, an article was published in *Carcinogenesis* about gene-environment interaction in the etiology of cancer.[2] The author of this paper reviewed data on various genotypes that may have higher susceptibility to cancer and asked if one could define, using genotypic or SNPs evaluation, those individuals who might have a higher sensitivity to their environment or their diet relative to certain incidence of cancer. Of course, the factor that is most obvious is tobacco smoking.

In 2000, Peto et al. conducted a landmark epidemiological investigation on smoking and lung cancer incidence.[3] According to these investigators, if all associations between a condition and a disease were as clear as the link between smoking and lung cancer, the field of epidemiology and its relationship to medical therapy would be much less ambiguous. The relative correlation coefficient is so strong that it almost obviates the necessity for high-powered statistics.

We know, however, that certain genotypes are more likely to get lung cancer from smoking than others. Even in those cases, there is environmental modifiability. Dr. Mary Claire King, one of the discoverers of BRCA1, published an article in *Science* magazine discussing breast cancer and the BRCA1 and BRCA2 genes. She explained that even though 80 percent of women with the homozygous recessive BRCA1 mutations end up getting breast cancer, 20 percent with the same mutation do not.[4] What is different between the 20 to 30 percent who do not get breast cancer and the 70 to 80 percent who do? Dr. King indicates there are environmental modifiers, even for very significant hard-wired determinants for malignancy.

There are certain genotypes that may give rise to increasing risk to oncogenic hazard. In and of themselves, however, they do not predispose one to a certainty of getting cancer. It is when they are modified in their expression by various environmental factors that the risk increases. Included among those modifiers are oxidative stress, free radical pathology, and the interactions between carcinogens and DNA. These are primary factors in environment-related carcinogenic injury. Various cell-signaling messages cause cell proliferation and increase DNA turnover and mitogenesis. Increased angiogenic signals cause blood vessel formation and a greater feeding of small islet cells or islands of malignancy. Investigations have discovered ways that diet, lifestyle, and environment influence the progression of cancer, from its initiation all the way to becoming a palpable or diagnosable tumor.

Cancer at the Cellular Level

"By genomic instability, we really mean chromosomal and molecular events that are causing a continuous and major change in the genome of that particular cell. This hallmark of genomic instability is exactly what we see in cancer cells."

--Michael Fenech, PhD
Commonwealth Scientific and Industrial Research Organization (CSIRO), Adelaide, Australia
June 2008

The general theme today in cancer research is on genomics. Researchers are looking at the human genome, identifying marker genes that may be candidates for oncogene mutations that ultimately result in the cell's undergoing dedifferentiated replicate of growth. Genomic instability is not just connected to the potential risk to cancer, but also the potential risk to virtually every age-related chronic disease.

If you think of the cancer process, it is a process with a series of steps, starting with initiation. Sometimes this is called mutagenesis or the tumor initiation process. Then there are a series of cellular alterations of function that lead to propagation with cell replication and a dedifferentiated state (a

juvenile, embryonic-like state), rapidly dividing.. From there it goes into a state of having to feed itself--the process of angiogenesis. Once you get beyond about a three millimeter tumor mass, fixed tumors or solid tumors have to have their own blood supply--the angiogenic process. And then, obviously, the last step, and the most lethal part of cancer, is its tendency to break off certain cells and find sites of infiltration in other tissues. We call this metastasis.

Part of this relationship of how tumors get started relates to mutations of the genes as a consequence of injury by a chemical or a radiation event, but also by epigenetic effects, which mask and silence certain genes, or upregulate the expression of other genes. You would like--in theory--to silence your oncogenes and upregulate the expression of your tumor suppressor genes. The dysregulation of kinases, or the mutation of kinases-- a family of over 500 different enzymes whose role it is to selectively phosphorylate (or put a phosphate group at a specific region on a macromolecule)--has been, in the last 10 years, identified to be very closely associated with the process of cancer initiation and propagation.

We are starting to see how these concepts (the initiation, propagation, angiogenesis, and metastatic steps) actually translate into therapeutic potentials for prevention of cancer. We are really talking here about the molecular origins of cancer. There was an editorial on this in *The New England Journal of Medicine* in 2008 about how, over the last decade, insights into the origin and behavior of cancers have reshaped our understanding.[5] The seminal feature of all this research seems to be the focus on how these steps of initiation, propagation, angiogenesis, and metastasis can be modulated at the cellular level. Maybe the most important thing we have learned since President Nixon stared the "War on Cancer" is not necessarily how to treat cancer, but how better to prevent it based upon accessing the appropriate information to prevent initiation, propagation, angiogenesis, and metastasis.

Endocrine Disruptors and Cancer

The Committee on Environment and Natural Resources (CENR) identified endocrine disruptors as an initiative in November 1995. The CENR established a Working Group on endocrine disruptors that is chaired by the Environmental Protection Agency (EPA). According to a Fact Sheet available on the EPA website (www.epa.gov), the background that has warranted research into endocrine disruptors is this:

"There is evidence that domestic animals and wildlife have suffered adverse consequences from exposure to environmental chemicals that interact with the endocrine system. These problems have been identified primarily in species exposed to relatively high concentrations of organochlorine pesticides, PCBs, dioxins, as well as synthetic and plant-derived estrogens. Whether similar effects are occurring in the general human or wildlife populations from exposures to ambient environmental concentrations is unknown. For example, while there have been reports of declines in the quantity and quality of sperm production in humans over the last four decades, other studies show no decrease. Reported increases in incidences of certain cancers (breast, testes, prostate) may also be related to endocrine disruption. Because the endocrine system plays a critical role in normal growth, development,

and reproduction, even small disturbances in endocrine function may have profound and lasting effects. This is especially true during highly sensitive prenatal periods, such that small changes in endocrine status may have delayed consequences that are evident much later in adult life or in a subsequent generation. Furthermore, the potential for synergistic effects from multiple contaminants exists. The seriousness of the endocrine disruptor hypothesis and the many scientific uncertainties associated with the issue are sufficient to warrant a coordinated federal research effort."

The CENR has three established objective for developing an integrated research strategy across the federal agencies: (1) Develop a planning framework for federal research related to the human health and ecological effects of endocrine disrupting chemicals; (2) Conduct an inventory of on-going federally funded research on endocrine disruptors; and (3) Identify research gaps and facilitate a coordinated interagency research plan to address them.

In the case of endocrine disruption we are talking about subtle effects--not mutagenic effects, but subtle effects--on intercellular signal transduction signaling that relates ultimately to gene expression patterns that associate with cellular proliferation and the oncogenic process. We call this oncogenic potential or oncogenic burden. It is now recognized that environmental endocrine disrupting chemicals, including pesticides and industrial chemicals that have been released into the environment, have bioconcentrating effects on wildlife, get into our food supply, get concentrated up the food chain, and ultimately are delivered to humans. The effects that have been observed in animal models after exposure to these substances correlate positively with increased incidence of malformations of the male genital tract, with neoplasms, and with decreased sperm quality (observed in both the European and United States populations in independent studies). We now also see changes in the female reproductive system and changes in neuroendocrinology, including alterations in the phenotype of obesity, and thyroid and cardiovascular endocrinology. These are all unequivocal and multiple-study-documented cause-and-effect relationships. In fact, even things like plasticizers like bisphenol A, at very low levels, have been found to modulate signal transduction in such a way as to increase this endocrine-mediated pathway that increases the risk to obesity, type 2 diabetes, and other chronic diseases.

What is the impact of endocrine disruptors on endocrine targets? Do we have a specific ligand agonist understanding of how these things fit together? You have to get the signal from outside the cell inside the cell. There must be some antennae sitting on the cell that picks up that signal (that environmental disruptor signal), and that is now also starting to be well-understood. There was a paper published in *Hormone Metabolic Research* in 2010 that looked at endocrine disruptors in human health from this structure/function relationship: how these chemicals have mimic effects on modulating receptor sites for various hormones and influencing (through signal transduction, right to the genome) the production of messenger RNA, and altered proteins in the cells, and altered metabolism.[6]

There are a whole series of substances that are on the hit list of concern: phthalate esters; pesticides; dioxide; bisphenol A; diethylstilbestrol; heavy metals, including lead, cadmium and mercury; various types of polychlorinated biphenyls; even things that are benzene derivatives have been demonstrated to be xenohormones. We are starting to see heavy metals, persistent organic lipophilic toxins, secondary metabolites, and biocides all playing roles, as well as substances that are used in home products that may result in things like precocious puberty, delayed puberty, fertility-related problems, structural reproductive tract abnormalities, endometriosis, or mammary gland developmental problems that may be associated with increasing risk to breast cancer like proliferative breast problems. These are not insignificant issues.

What we are starting to recognize is the environmental connection to our function is symphonic rather than hard-hitting, single-agent toxicology. The neuroendocrine targets of endocrine disruptors, as pointed out by writer Andrea Gore in a 2010 review in *Hormones*, are the same receptor sites that modulate subtle function within the development of an organism from fetal development all the way up through adulthood, and maintain a homeostatic function in the organism.[7] The combination of all these chemicals put into our environment at low level, along with differing metabolic susceptibilities, genetic uniqueness, and detoxification abilities among people, makes this area very complicated to study, and to lockdown, and to demonstrate a clear cause-and-effect relationship.

Dietary Approaches to Chemoprevention

"Our research, as well as that of a couple of other groups (for example, Professor Bruce Ames' work is an inspiration with regards to this and the direction of our research), has indicated that a number of nutrients can have impact on the genome, either when they are deficient or in excess. I think this is actually very important because in the minds of many people, there is this idea that if a micronutrient or vitamin is good for you, the more the better. What we actually find is that is not the case. We know that with micronutrients, a U-shaped curve with regards to DNA damage is typical….It is essential to be able to exactly identify, for an individual, not only the dose of each micronutrient that is required to maintain the genome in the healthiest state possible, but also the combination of micronutrients and their doses. That is really where the field is going."

--Michael Fenech, PhD
Commonwealth Scientific and Industrial Research Organization (CSIRO), Adelaide, Australia
June 2008

Diet has been identified as one of the major determinants for the expression of the genome into the phenomenon called cancer. In 1983, Dr. Bruce Ames discussed this topic in a *Science* magazine paper titled "Dietary Carcinogens and Anticarcinogens: Oxygen Radicals and Degenerative Diseases."[8] Dr.

Ames, then chairman of the Department of Biochemistry at the University of California, Berkeley, explained that our diets have always contained cancer-producing substances, or carcinogens. They have also been rich in anticarcinogens in their natural, unprocessed form—agents that help defend against the injurious process of carcinogenesis. The implication in this article is that as our diets have changed over the years, they have tended to increase the potential for carcinogenic insult, with reduction of the density of the anticarcinogens as we have removed fiber, vitamins, minerals, and phytochemicals. By reducing the number of anticarcinogens and increasing the potential of carcinogenic exposure, Dr. Ames suggested we have tipped the balance into increased oncogenic risk. Our food is not completely benign with regard either to protection against or promotion of cancer. Deep-fat frying of fat-rich foods, for example, can result in metabolites or breakdown products—oxidation products of fatty acids that may be carcinogenic. Char broiling meat may produce pyrrolizidine alkaloid materials that are potential carcinogens from the charring activity on the meat protein. Many things we do to our foods and many things that are already in our foods could be viewed as potential carcinogens. Removing that carcinogenic potential and getting higher density of anticarcinogens in our diet, which means consuming a diet of color, texture, and variety, appears to be associated with the prevention of cancer.

Fish-eating populations have lower incidence of heart disease and many types of cancers, apparently as a result of increased intake of omega-3 fatty acids. Five to nine servings of fruits and vegetables daily provide antioxidants such as quercetin and isothiocyanates that are important chemoprevention agents. A high fiber intake, including bran and whole grains, is also very important. Polyphenols found in black and green tea are suggested to have protective effects against some cancers.

We are beginning to witness very strong support for the chemopreventive effect of complex dietary principles that may be as important in our understanding of cancer as any chemotherapeutic drug that has been developed over the past 20 or 30 years. We know that whole grains, in contrast to white flour products, contain phytochemicals that are potential anti-mutagenic and anti-carcinogenic agents. Antioxidants, phenolic compounds, and trace minerals can boost the immune and cellular repair systems and reduce inflammatory and oxidative stress reactions. Science is emerging related to the mechanisms by which these agents participate in cancer chemoprevention.

In 2008, Dr. Jeffrey Bland interviewed Michael Fenech, PhD, a geneticist and a health sciences and nutrition researcher at Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO), who said this about the direction of research:

"At this point in time we do not have enough knowledge to be able to say, based on genotype, what is the optimal nutritional combination to reduce DNA damage in an individual. Really, we can only rely on information we have from placebo-controlled trials that tell us this combination of nutrients or this other one could reduce DNA

damage and then test whether that actually works in an individual. That is really where we are. We are also building up a database to know what the genetic basis is for an individual's response to supplementation (for example, folate and B12, and why one individual differs from another). There could be a number of reasons. One reason could be, for example, a defect in the ability to absorb vitamin B12 or to metabolize it to the form that is actually active in the body. It is this information that we really need to build up to being able to provide targeted information to individuals."

We are beginning to look in much more detail at individual diets or dietary components and the way they influence specific genotypes in terms of nutrigenomic or nutrition expression patterns. We need to integrate this genomic concept into the education of healthcare providers so they can begin to look at patients as unique individuals rather than using the rule of averages.

Caring for those with Cancer

"I often describe my path here as having been drafted because I didn't volunteer to work in the field of cancer. I grew up with a large family history of cancer, and watched grandparents and my uncles pass away, and my mother and my sister are both survivors, so I knew as a fairly young person that I wanted to work with cancer patients. I started out doing that in psychology in my training and didn't feel right there and looked at some other ways of going. It was when a friend of mine developed a stage IV brain tumor that I decided. I was working in the field of nutrition and we couldn't find anyone to help her, and I decided, 'This is it. I have been drafted. This is my calling.' And I really turned the focus of my practice at that time toward a look at primary brain tumors and nutrition. I had been working with some other types of cancer for a couple of years. That really became my full focus at that time. And I'm happy to say she is still alive. It is 13 years later and she is a survivor both of primary brain tumor (a glioblastoma) as well as advanced breast cancer."

--Jeanne Wallace, PhD, CNC
October 2010

As we start to learn more about the etiology of cancers, and we learn more about how to put together a comprehensive care program, and as patients now start to survive through the primary therapy into years of life after, the question really becomes: What is the best management? How do we manage cancer on the front end, during, and after? How do you redifferentiate cells to their normal architecture? And how do you support, properly, whole organism immune function? These are all parts of different strategic thinking about cancer as a chronic disease and how one might design a program to manage it.

In 2010, Dr. Jeffrey Bland interviewed Jeanne Wallace, PhD, CNC, a specialist in nutritional oncology whose approach is grounded in understanding the interrelationship between nutritional and metabolic factors, which is a concept she calls "oncometabolic milieu." It is an approach that encompasses many of the factors involved in personalized lifestyle medicine. Dr. Wallace described her process:

“The clients come and they often don't have a sense of what we are going to do, so we do some orientation time and give them a sense. One thing that we like to do is we like to look at the environment of their body with a series of tests. We have them fill out extensive intake materials about their medical history, their medications, their diet, and their social life. We collect as much data as we can. Sometimes we don't use it until later when we get the ‘aha,’ but we do like to collect a lot data. And then we run some tests, because I want to get a sense of what's going on inside this person's body.

I want to come back to that term that I coined--oncometabolic milieu. I really have taken that from the idea in cardiovascular disease over the last 10 years that we have come to understand that metabolic syndrome is this antecedent or precursor of events going on in the body that foster and favor that cardiovascular disease process. I think the same thing can be said in cancer. We have had such a narrow focus on the cancer cell, as if it were an island existing in isolation. And what we really see now is that many events going on in the body, such as systemic inflammation, and hypercoagulability, and incompetence of the immune system and dysregulation in hormones, and also metabolic syndrome--these are factors that favor aggressive cancer growth, metastasis, invasion, angiogenesis, and cancer progression. So there is much we can do with nutrition, and also with many of the other complementary therapies, that address this oncometabolic milieu and give the client a way to really be a team member in the care of their cancer.

We, for example, will look at metabolic syndrome. We like to look at the A1c (glycated hemoglobin A1c). We'll run a high-sensitivity C-reactive protein, fibrinogen, vitamin D levels, sometime different hormone levels, and we'll look at these to get a sense of where should we put our focus in our counseling with this client. Each cancer patient has a different fingerprint of this syndrome. We might have some clients who have elevated inflammation and elevated fibrinogen, but the immune system actually looks fairly okay, and maybe their blood sugar regulation looks really okay. And for another client, perhaps with the same disease and diagnosis and other similar characteristics, the underlying terrain looks very different for them. They are maybe not in a state of hypercoagulability and inflammation, instead they have metabolic syndrome and deficiencies in vitamin D and other nutrients, elevated copper, for example. We do that testing and then we individually tailor our consulting for the client based on that testing.”

How did Dr. Wallace arrive at this approach to working with cancer patients? She explains:

“This is really 10 years of my research sort of coalesced into one theory. What I have done is surveyed the literature for different markers where modulating them, or reaching a certain threshold, can alter the progression of the cancer or alter response to treatment. I have maybe four dozen of these different markers, and I've really narrowed it down to five or six markers because they seem the most robust.

If fibrinogen is elevated, a couple of things happen. It increases the metastatic potential of the cancer. This probably happens through several different mechanisms. It may be that the fibrin is sticking to the cancer cells and helping them evade the immune response. It might be that the fiber in fibrinogen is enhancing metastasis directly. It might be that it decreases the circulation and the delivery of oxygen to the tumor site, and those hypoxic areas are then resistant to treatment. Or it may be that chemotherapy doesn't perfuse out to the tissue because the blood is sort of thick and sludgy because of the high fibrin.

There are multiple mechanisms of action, here. If you look at the literature, there are some different cut-off points. Some studies have suggested that, for example, in lung cancer patients, fibrinogen above 350 is associated with poor survival/poor response to treatment. Some studies have used 310. We use 310 as our cut-off, and so when we measure the fibrinogen, if a client is elevated quite a bit above that, we will advise them on diet and nutritional supplements/botanicals that lower their fibrinogen, do an intervention, say, for 3 months or 6 months, come back and repeat the test to ensure what we are doing in terms of dietary nutritional support is actually effective at altering that particular parameter.

Inflammation--and we use the C-reactive protein, here--and hypercoagulability go hand in hand. Often times when the fibrinogen is elevated, you also see high C-reactive protein. There is such a large body of data and research studies linking systemic inflammation to all types of events in the oncostatic process or oncogenic process. You have increased growth rates, and you have increased rates of infection, and increased weight loss during treatment, and increased metastases, and increased angiogenesis when there is systemic inflammation. The prostaglandins and leukotrienes that are inflammatory--those coming out of COX2 and 5--drive the active growth messengers and they drive the invasion, metastasis, and angiogenesis. When we have an elevated inflammation, we can get a direct benefit from decreasing the inflammatory state, so there is definitely nutritional things and botanical things (dietary things) that we do to try lower the C-reactive protein, and we look at those hand in hand (those two).

On the subject of hormonal levels, Dr. Wallace takes this approach:

“I'll test on just two here, those being cortisol and estrogen. We're very interested in normal pattern of cortisol regulation throughout the day, looking at the Spiegel and Sephton work out of Stanford.[9] They were looking at that pattern of normal cortisol secretion throughout the day and finding that dysregulation in that cortisol rhythm was associated with poor survival in breast cancer. We certainly see that in our clients. I think that is probably mediated by many different events in the body. Cortisol, of course, increasing blood sugar and blood sugar dysregulation, we find--in our clinic--a very important factor. So there is the cortisol blood sugar issue. There is probably also elevated cortisol immune suppression going on.

There is also a relationship when adrenal function is low; it can drive copper up. The adrenals are needed to stimulate the synthesis of ceruloplasmin, a copper-binding protein. Copper is a cofactor for many of the angiogenic enzymes, like VEGF, and basic fibroblastic growth factor, and HIF1. So when copper is low, it can slow the process of angiogenesis. When you have elevated cortisol or cortisol dysregulation, hypoadrenia, then what you see is copper is elevated and it favors angiogenesis. High glycemic response (metabolic syndrome) also favors angiogenic response. We're very interested in cortisol and because of that we do a lot of adaptogens and counseling about reducing stress to normalize that. That is one area where hormones are of great interest to us. Another is estrogens….Estrogen drives copper up, so often when we have elevated copper we work very hard to decrease the copper as an antiangiogenic strategy. When you are looking at your free copper (so you have measured a serum copper and a ceruloplasmin), you need both of those numbers to get a sense of the free copper (what will diffuse into the tissues and act on angiogenesis). You are using a simple formula where you take your ceruloplasmin and multiply that by 3 and subtract it from your serum copper to get a free or unbound copper. When you are looking at that, if your serum copper is elevated above 130, you are probably looking at somebody with the estrogen-dominant situation, and you're not going to be able to address the copper without addressing the hormone balance. On the other hand, if the ceruloplasmin is suppressed, especially below 22, you are probably looking at hypoadrenia and you're going to need to nourish the adrenals and use some adaptogens in order to successfully

get the copper down in your antiangiogenic strategy. In terms of hormones, those are two that are standouts. Sometimes we look at others, but those are probably the two most predominant places we are looking at."

And—as with so many (if not all) other health conditions, gut health is a crucial element. Dr. Wallace:

"Our clients are on all types of treatments that kill off the great majority of flora in the intestines, and obviously those [pro- and prebiotics] are so important in helping with immune competence. There are several other things that are important for that healthy eubiosis in the gut. Maybe key among those is when you have those healthy bacteria and you are eating a diet high in soluble fibers, your intestines become a butyrate-manufacturing facility. And butyrate is a histone deacetylase inhibitor. It is a differentiating agent. It is really important for cancer patients. We really want to ensure that our clients have those healthy bacteria at least for that reason, if not also to crowd out unfavorable bacteria, which would, for example, in a breast cancer patient, those bacteria would be using beta-glucuronidase enzyme to reassemble estrogens that had been broken down from the liver. There are several different pathways for which that is really important to do. It is definitely part of our protocols to do that."

What is on the horizon for supporting cancer patients during treatment and recovery? Dr. Wallace is optimistic:

"I feel like I've climbed a mountain, I'm standing at the peak, and I can see out over the field, and I'm actually very excited about where we are….I think one of the pearls of this particular approach is it really allows you to individualize the support for those cancer patients. Whereas often new clients come to me and they've seen four or five practitioners and they have the same little bag of 30 supplements that this practitioner gives to every cancer patient and how do I know which ones are actually useful for me and which ones might be doing me harm? This kind of exploration--using some testing to explore the terrain and then individualize the protocol--I'm hoping that the entire field of oncology will move more in that direction, not only the integrative/nutrition/holistic approach being individualized, but also I'm seeing with a lot of the mainstream and conventional treatments that we are moving in the direction of individualizing cancer treatments. I think we are just at the beginning of that, and that's what we will begin to see over the next five years. I'm excited about it."

Learn more about Dr. Wallace and her work by visiting her website, www.nutritional-solutions.net.

Please visit our Women's Health page to read more about breast cancer, and our Men's Health page to read about prostate cancer.

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