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Change

Scary Viruses: Here Is Your Best Defense

The Battles Taking Place In Our Immune System

There has been so much in the news lately about the Zika virus. It sometimes feels that as soon as we are past one virus the next, worse virus comes along. Remember the Dengue fever? The Bird Flu? Or the Ebola virus? When I was in my residency training the big virus was HIV. As news of each new virus is presented to us they seem overwhelming and scary. The media makes it seem that the best we can do is to try and avoid contracting the virus, either by restricting travel to the area that the new virus is in or restricting contact with other people until scientists can create a vaccine to protect us against the new virus. We know from past experience, however, that the world is a small place, viruses spread easily, and it takes time to create vaccines in the laboratory. The whole notion that the body needs something to protect it from invading viruses and bacteria is a very western medical understanding – other medical traditions, for example traditional Chinese medicine and Ayuvedic medicine, believe the body is well-equipped to fight on its own. Metabolic and functional medicine practitioners also approach the body in this way. Our goal is to support the body's immune system in its ability to fend off diseases with the understanding that the body has an amazing immune system already. Our immune system is complex, sophisticated, and really nothing short of miraculous. If we can just support the immune system with nutrients that may be missing and clear out toxins that interfere with the immune system's ability to function properly, we would be able to avoid most illnesses.

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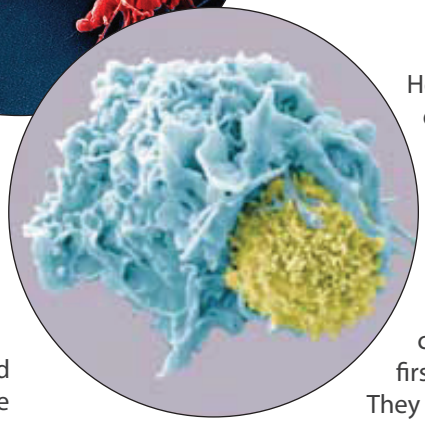
In this newsletter, I would like to take you on a journey into the immune system – to introduce you to the battle that is taking place daily inside your body to fight off invasion by viruses and bacteria, and to help you know what you can do to support the troops of your immune system.

Dendritic Cells

Let me first introduce you to one of the most fascinating types of cells of the immune system: the dendritic cell. Dendritic cells are found in tissues that are at the boundary between our bodies and the outside world. This include the skin, lungs, intestines, stomach, and nose. Dendritic cells are the front-line soldiers that first encounter foreign invaders and they really do engage in man-to-man combat with viruses and bacteria. Through the routine actions of eating and breathing, we are inhaling and ingesting bacteria and viruses all of the time. The majority of these microbes will never cause problems. However, there are always a few harmful microbes mixed in the lot, and several more microbes that can cause disease if the body's defenses are compromised. It is the job of the dendritic cell to constantly survey the borders of the body and decide which bacteria and viruses are okay to pass through and which ones need to be destroyed. The reason that they are called dendritic cells" is because they form dendrites, which are branch–like projections that can grow to reach out and swallow invading cells. Dendritic cells literally work by "eating up" foreign invaders.



How do dendritic cells know which cells are foreign and which cells are our own cells in the first place? They have to go to dendritic cell school to learn that. Dendritic cell school takes place in the thymus gland. This is a gland in the body that is located just below the breast bone. Immature dendritic cells are formed in the (our) bone marrow and then released into the blood stream where they travel to the thymus to learn how to recognize different kinds of cells in the body. Learning how to attack foreign cells and to not attack our own cells is called "tolerance,"

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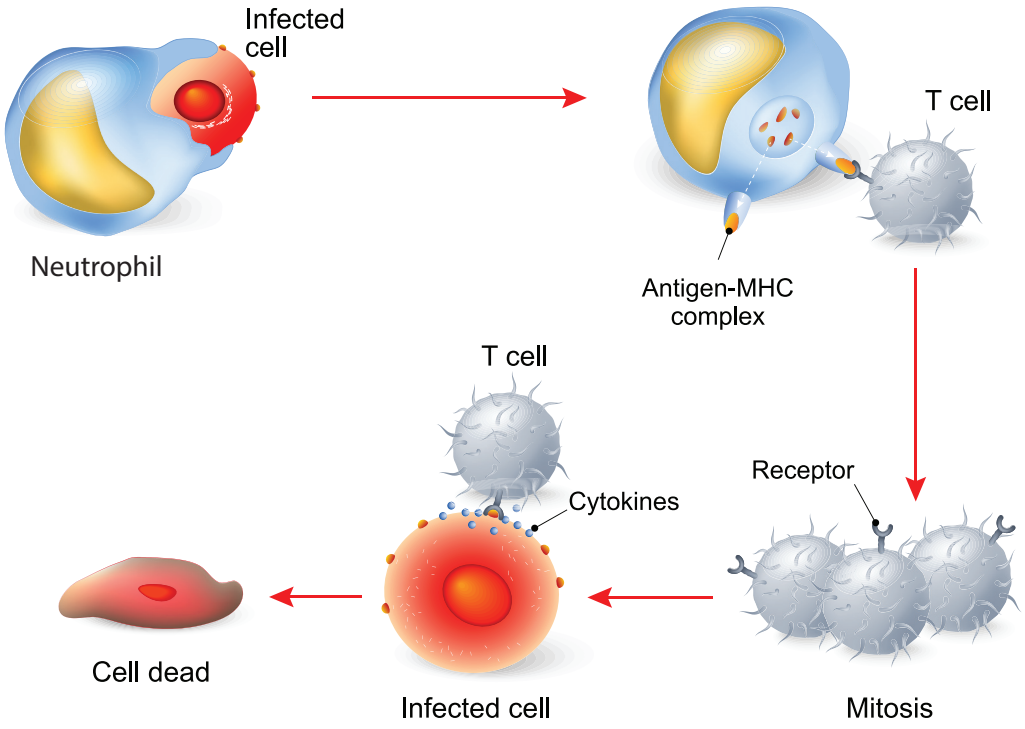

Chart above shows an immune response to an infected cell. Cyokines signal to the other cells in the immune system that they need help fighting the infection.

which is a concept that is hugely important in auto-immunity. There are several ways that dendritic cells learn tolerance for the body's cells and to attack foreign cells. The first way that mature dendritic cells educate newbie dendritic cells is by showing them antigens, or protein markers, from different kinds of cells – antigens from viral cells, antigens from bacterial cells, or antigens from our own cells.

Another, more recently discovered way to educate newbie dendritic cells is to teach them about PRR's and PAMPs. PRRs are pathogen-related receptors that dendrites acquire in their cell membranes, which are specifically designed to take up viruses and bacteria. The interesting twist is that some of these receptors also respond to the products of too much inflammation in the body. Yes, that's right. If we have too much inflammation – either from stress, or toxins, or foods – our immune system responds to that as if it were foreign. PAMPs are pathogen associated molecular patterns. These are molecular patterns that may be part of viruses, bacteria, and yeast, that are not part of our own cells. If the immature dendritic cell responds appropriately to antigens or molecular patterns from foreign cells by becoming activated and sending out inflammatory signals, it graduates from school and is released into the blood to be on the front lines of the constant, daily battle against foreign invaders. However, if the immature dendrite responds inappropriately by attacking antigens from our own cells, or eating up a healthy cell, it is destroyed. Pretty harsh, huh? It turns out that school for dendrites is extremely harsh, and fewer dendrites graduate (stay alive) than do not.

Once the dendritic cells are well-educated, they are off to protect us from invaders. Besides eating up viruses and bacteria, dendrites have several other functions as well. When dendritic cells encounter what they consider to be pathogens, they sound the alarm to the rest of the immune system by sending out cytokines, or immune messengers. These messengers act to increase inflammation and to activate other cells in the immune system to come to the site of the battle and start fighting. There are several different classes of cytokines. Some cytokines travel to the center of the cells in our body and speak to the command general of the immune system, nuclear factor kappa beta (NFKB). NFKB tells the immune system throughout the entire body how on alert, or how inflamed to be. Many new classes of drugs for autoimmune diseases and inflammation target NFKB, because if you can turn down NFKB, you can turn down inflammation.

Other cytokines signal to the other cells in the immune system, such as neutrophils, that they need help with man-to-man combat. Neutrophils migrate to the scene of the battle and when they come in contact with viruses or bacteria they spit out bleach bombs and hydrogen peroxide bombs at them to try and punch holes in their cell walls to destroy them. Some neutrophils act similarly to dendritic cells and engulf and then swallow up viruses and bacteria. This type of man-to-man warfare is called TH1 immunity. It occurs right where the invasion is and we can see this in the swelling, redness, and heat that occurs when we get a cut. These are all healthy signs that the body's immune system is actively fighting off a bacterial invasion at the scene of a breach in the skin, for example. The same thing happens wherever there is bacterial or viral invasion. Since we take in a large number

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of foreign cells through our digestive track, the intestines can also become red and inflamed in the battle to ward off pathogens. This is evident if we have an acute stomach bug but can also occur if we have a chronic, smoldering infection. For example, if the body has a large number of toxins, the immune system may not be able to function well enough to completely kill off and invasion of bacteria, so there ends up being lower-level "skirmishes" that occur chronically rather than a full-out battle that ends the war. For the person experiencing this, it can feel like heart burn or irritable bowel syndrome.

The Gut and Our Immune System

The gut, in fact, is integrally tied into our immune function. Remember how the dendritic cells go to school to learn about tolerance to self? Well, it turns out that we need to have a healthy amount of good bacteria in the gut in order to help the entire immune system know which bacteria are pathogens and which bacteria are friendly. The human intestinal tract contains two to three pounds of bacteria, most of which have not even been characterized yet. If you take into account all of the bacteria in the human body, the bacterial cells should exceed human cells by a ratio of two to one. Healthy bacteria perform functions for us that are essential for our survival. They help us to absorb nutrients such as fats and actually make other nutrients such as vitamin K. Depression has been linked to low levels of lactobacillus, and some recent reports are showing us that other healthy bacteria can help to prevent heart disease. As it turns out, it is essential that the dendritic cells learn to have tolerance of healthy, or commensal bacteria. The degree of tolerance that the dendritic cells have to healthy bacteria is directly linked to the degree of tolerance the dendrites will have for our own cells. There is constant communication occurring in the gut and elsewhere between the immune system and the healthy bacteria that live there.

If there are too many bad bacteria, or if there is already too much inflammation in the gut from food allergens or of toxins, the dialogue breaks down. Under these circumstances the dendritic cells do not become well-educated about tolerance to self, and a different kind of battle occurs. The dendritic cells become confused about what cells they should be attacking and may end up attacking the body's cells while not attacking the invading bacteria and viruses. Toxins can wreak particular havoc on the education of the immune system, because they can cause the dendritic cells to become enraged and over-reactive. For example, if the dendritic cell comes across a pathogen associated molecular pattern that belongs to a virus, but now there is a toxin molecule attached to it, the dendritic cell turns into a monster-killer and will be more likely to go on a killing-spree that may involve our own cells in addition to the virus.

One can see, then, that the ability of the immune system is dependent on many factors. When I first started in metabolic medicine eight years ago I would have said "just be sure to take your vitamin D and vitamin C to keep your immune system working well." Now, because of our increasing toxicity, inflammation, and the growing imbalance of bacteria in the gut, it appears that we may have to work harder to fight off the latest, greatest virus. So what should we be doing to support the body in its efforts to keep us healthy? How can we support our front-line soldier, the dendritic cell, in knowing which bacteria to kill and which bacteria to keep healthy? As you read above, much of our health starts in the gut, therefore we must start with food. Not that I think that we need to eat perfectly one-hundred percent of the time, but for a healthy gut and hence healthy immune system, we do need to have a diet is mostly whole foods with lots of green leafy vegetables and healthy fats such as nuts, seeds, avocado, coconut oil, etc. You know the drill. One can argue the benefits of paleo versus vegetarian, but the bottom line is whole foods, green leafy vegetables, and healthy fats. Of course we can get fancy and talk about the value of items such as fermented foods and bone broth, and certainly they are good for us, but I like to keep things simple: eat more veggies! Vegetables are full of vitamins and antioxidants that support a healthy immune function, whereas processed foods actually use up these nutrients just to be metabolized by the body.

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Supplements That Support the Immune System

In addition to this, there are a few supplements that I think are important for keeping a healthy immune system.

The first, of course, is vitamin D. Without adequate amounts of vitamin D, the immune system cannot function properly – as in, it will fail to protect us from viruses and bacteria. Adequate vitamin D means that your blood level is above 50 ng/mL. It is at this level that vitamin D helps the dendritic cells learn tolerance, helps to support proper inflammatory signaling, and activates neutrophils to come to the scene of the invasion and know which invaders to throw bleach bombs at. Who doesn't want that in their arsenal? Interestingly enough, since the human genome was completed, we have learned that many people have genetic abnormalities in their vitamin D receptors (VDR). As it turns out, people with VDR defects do have higher risk of infectious disease and often need to take higher doses of vitamin D to achieve the same immune function as people without these defects.

Vitamin D Dosage: I typically recommend between 4000IU and 7000IU daily for people living in the Western New York area where we don't have as much sun.

Next on the list is a probiotic. Due to the rampant use of insecticides and pesticides, poor diets, and toxin stress and psychological stress most of us are suffering from an imbalance of gut bacteria. Especially if you experience bloating, constipation or any of the symptoms of irritable bowel disease you know that you have an imbalance of gut bacteria. Adding a high-dose probiotic will not only help your gut function better but will support your immune system's ability to know self from non-self. Many authors feel that it is important to rotate your probiotic every six weeks to two months, so just find a different one on the shelf when you run out of the first.

Omega-3 Fatty Acids: Of course omega-3 fatty acids have to be included on this list. The research around omega-3 fatty acids and their effects on the health of the body is compelling. Omega-3 fatty acids help maintain an intact gut barrier, and we have learned that keeping a healthy gut helps to maintain a healthy immune system. Omega 3 fatty acids also help the immune system "turn on" and "turn off." They help to regulate immune signaling and so help the immune system both sound the alarm for an acute invasion and also help the immune system ramp down when the battle is over. Through this mechanism, they help to reduce chronic inflammation that can further disorder the immune system.
A dose of 2000mg per day is best.

B vitamins are next on the list. B vitamins are one of my absolute favorite supplements because they are so basic and yet do so much for the body. A good B complex of 50mg or 100mg per day plus extra B12 of 1000mcg to 5000mcg per day help all of the cells of the immune system function better. They also help the liver to clear toxins, and so can reduce the body's toxic burden which dysregulates the immune system. B vitamins are pretty much needed for every cellular process we have, so they pretty much help every cell function better, not just immune cells. This includes the gut as well. The intestines are a very active organ and require a lot of nutrients do their job, and B vitamins are some of the most fundamental of all.

Vitamin C: Last but not least is our old friend vitamin C. Most people understand that vitamin C is a powerful stimulant of the immune system, but now we know that vitamin C actually works as a genetic modulator of the immune system, meaning that vitamin C, along with many other antioxidants, actually can affect genetic expression of proteins in the immune system needed for healthy functioning. Vitamin C is also a powerful antioxidant and so helps the body recover from the damaging effects of toxins. Doses of vitamin C can vary from 1000mg per day at a minimum, to 4000m or 6000mg per day if you are trying to fight an infection.

There you have it. The next time news of a new virus comes to you, you will know that you have already done a great deal to protect yourself. A short list of supplements along with a healthy diet will potentially function better than a vaccine and are great for the body in so many ways. And the best part is that the benefits will help you live a long, healthy life for the future!