There is much advice on the internet on how to boost the immune system.

Below are some suggestions from medical authorities such as Harvard Health, WebMD, Center for Integrative Medicine at the Cleveland Clinic and Healthline.

- Don’t smoke
- Eat a balanced diet
- Exercise regularly
- Mediterranean-style diet plus fermented dairy
- Maintain a healthy weight
- If you drink alcohol, drink only in moderation
- Get adequate sleep.
- Washing your hands frequently
- Cook meat thoroughly
- Minimise stress
- Old fashioned chicken soup
- If you don’t like vegetables — taking a daily multivitamin and mineral supplement may bring other health benefits
- Maintain a healthy gut bacteria by eating a balanced diet
- Taking a probiotic or prebiotic

What exactly does a balanced diet, a Mediterranean-style diet plus fermented dairy or cook meat thoroughly mean?

Below is an alternative list that is much more helpful. The justification for diet-based choices are found in the article.

- Don’t smoke.
- Eat a balanced diet.
- Exercise regularly.
- Mediterranean-style diet plus fermented dairy.
- Maintain a healthy weight.
- Get adequate sleep.
- Washing your hands frequently.

- There is no benefit for eating any form of meat. Even a minuscule amount of meat is detrimental.
- Minimise stress.
- Chicken is the source of the majority of pathogens in the food supply. It is not beneficial. Vegetable broth is an alternative.
- Taking supplements instead of fruit and vegetables does not usually bring health benefits. Supplements may be useful and essential but only after an adequate diet is consumed.
- One single egg has a detrimental effect on gut bacteria as does a high-fat, animal-based meal. It is pointless consuming a diet that has a detrimental impact on gut bacteria and consuming probiotics or prebiotics and hoping to mitigate their effects.

White Blood Cells

The immune system is an incredibly complex series of inter-related systems that will be discussed very briefly.

White blood cells (leucocytes) are immune system cells that protect animals from disease and foreign invaders. They are produced in the bone marrow.

1. *Neutrophils* are the most abundant white blood cell. Their average lifespan is 5 days. They are the first responders to inflammation caused by invading bacteria. They engulf bacteria by and other foreign material. As a result, they become the main component of pus.

2. *Eosinophils* are much less prevalent consisting of 1-5% of the white blood cells. They are elevated in parasitic infections and respond to allergic conditions including asthma.

3. *Basophils* comprise of less than 0.5% of the white blood cells. They also have a role in parasitic infections and allergic conditions.

4. *Monocytes* circulate in the blood and move to the site of infection where the are transformed into macrophages. Like neutrophils, macrophages engulf and destroy

(phagocytise) foreign bacteria. *Macrophages* are long-lived, surviving for months or longer. The reside mostly in lymph tissue and the liver and are summoned to areas of infection.

5. *Lymphocytes* include *natural killer (NK) cells* which are a part of the innate immune system and *T-cells* and *B-cells* which are components of the adaptive immune system. Whilst T-cells are produced in the bone marrow, they mature in the thymus. The thymus is a gland located behind the sternum and in front of the heart.

Lymphocytes are much more common in the lymphatic system than the circulatory system. Lymph organs include lymph nodes, spleen and tonsils. These are the sites that trap foreign material such as infectious microorganisms (antigens). Unlike the circulatory system that relies on the heart to pump the blood, the lymphatic system relies on body movement to transport lymph.

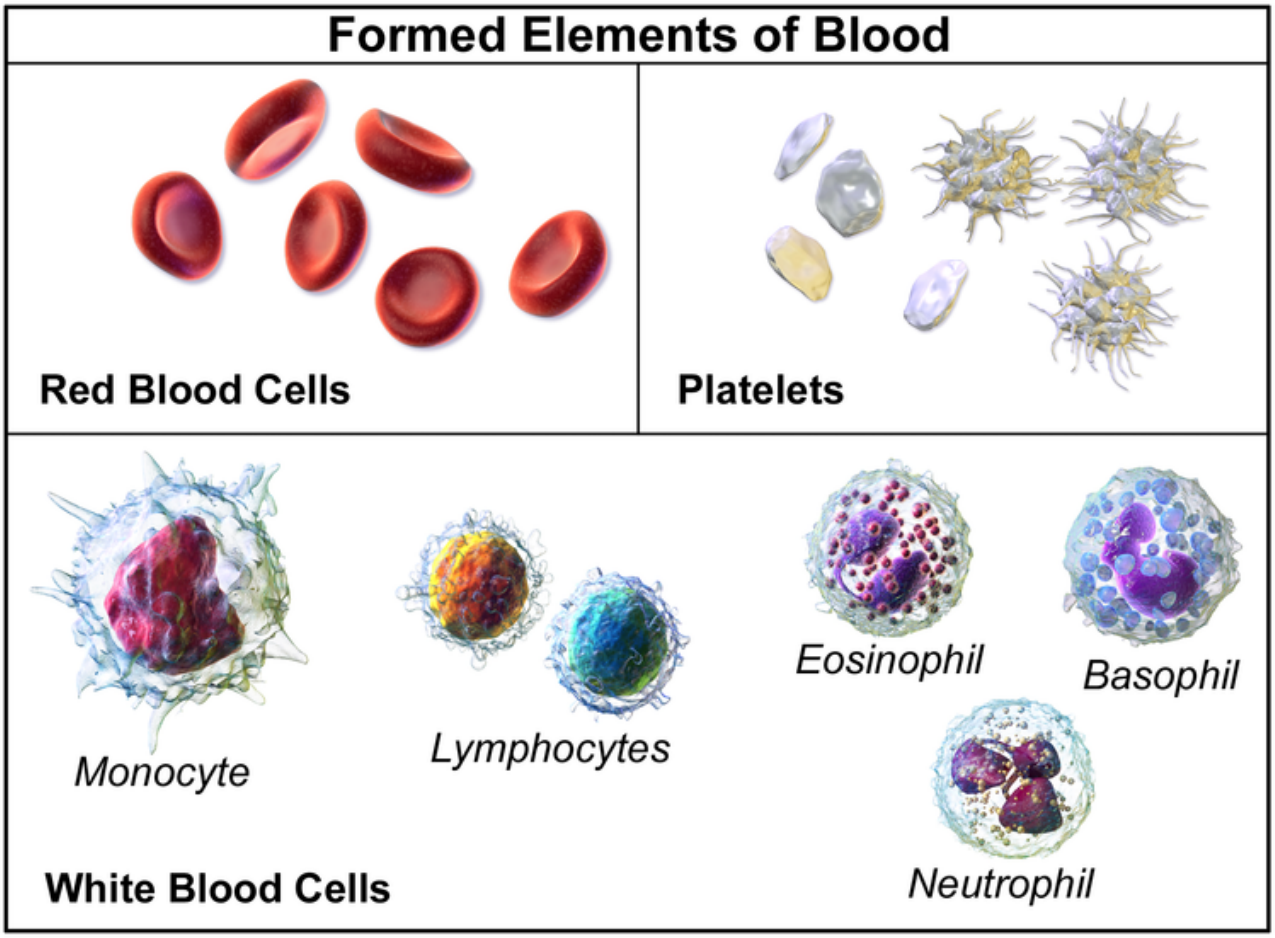
- Natural killer cells belong to the innate response system and provide rapid responses to virus-infected cells and cells that have become cancerous/li>
- Killer T-cells kill cells are also involved in virus-infected cells and cells that have become cancerous.
- Helper T-cells release cytokines and are involved with helping B-cells produce antibodies. Cytokines are small signalling proteins that modulate the immune response.
- Memory T-cells remember earlier invaders and are able to invoke a quicker response if the same pathogen is encountered later.
- B-cells are produced in the bone marrow. B-cells produce antibodies. Antibodies or immuno-globulins bind on to specific portions (epitope) of a foreign body (antigen). There are five classes of immunoglobulins (IgA, IgG, IgD, IgM, IgE). By binding on to the antigen, the invaders are marked for destruction by other white blood cells.

A protein (MHC Class 1 protein) displays protein fragments from within the cell on the cell's surface. This is detected by a T cell (a type of lymphocyte) that is hunting for cells infected by viruses. The T cell releases substances to kill the infected cell.

If the MHC proteins are prevented from displaying on the cell's surface because the virus is

inside the cell, then Natural Killer (NK) cells (another type of lymphocyte) , recognise these cells as virus-infected and initiates the destruction of the cell. Cells infected by viruses release interferons, a class of anti-viral proteins. Interferons also signal nearby infected cells to increase the number of MHC molecules on their surface.

Below are images of some common blood cells. [1]



Inflammatory Response

The inflammatory response is characterised by the following symptoms:

- Redness of the skin, due to locally increased blood circulation
- Heat, either increased local temperature, such as a warm feeling around a localied infection, or a systemic response that raises the body temperature
- Swelling of affected tissues
- Pain
- Loss of function

Inflammation enables white blood cells to be summoned to areas of need. Common causes of inflammation include:

- Infection by virus, bacteria, fungi
- Damage caused by injury, damage by chemicals, burns and foreign material
- Adaptive immune system response to disease

Inflammation can be either acute or chronic. Acute occurs in response to a particular event, chronic is when the event does not resolve and becomes long-standing in conditions such as rheumatoid arthritis.

The Immune System

For us to survive, our immune system needs to protect us from many sources such as:

- toxins
- viruses
- bacteria
- fungi
- protozoa – single cell organisms that have a nucleus enclosed in a membranes
- parasitic worms

Innate Immunity

The innate immune system is common to plants, fungi, insects as well as animals. It comprises of a number of passive and active mechanisms to provide defenses against invaders.

- Physical barriers such as skin, fur or bark.
- The acidic nature of the stomach destroys many micro-organisms.
- Epithelial cells line arteries, lymph vessels, intestines, urinary and other systems that act as a physical barrier.
- Anti-bacterial proteins and peptides are secreted on to epithelial surfaces.
- Tears and saliva also contain anti-bacterial proteins and peptides
- If organisms reach internal tissues, range of proteins bind to the invaders, called antigens, which damage their membranes and mark them for destruction.
- Cells such as marcophages and neutrophils engulf invading organisms.
- Killer cells kill damaged and cells that are infected by viruses.
- When cells detect microbes, cytokines are secreted which results in the inflammatory process to deal with the invaders.
- Usually bacteria live outside the cells of the infected host where viruses as can only survived inside the cells. This makes viruses much more difficult to be detected.

Adaptive Immunity

Adaptive immunity appeared 500 million years ago in the jawed fishes and occurs in all vertebrates. Adaptive responses are specific to a specific type of invader. It has developed a memory so previous exposures to one organism can lead to a better prepared response if the organism is encountered in the future.

Cytokines

Most cytokines have only a local, transient effect. However, tumour necrosis factor alpha (TNF-α), interleukin 1 (IL-1) and interleukin 6 (IL-6) are cytokines that reach sufficient levels in the blood to have systemic effects in the host, both in the acute phases and chronic phases.

They are involved in the inflammatory processes and are mainly produced by macrophages. TNF-α is also involved with programmed cell death (apoptosis) which includes cancer cells and it inhibits the formation of cancer cells.

Autoimmune Diseases and Biomimicry

Autoimmune diseases are a group of sinister diseases where the immune system attacks the body that it was designed to protect.

World-wide, the incidence of autoimmune diseases is increasing at the rate of 19% each and every year.[2]

In the US, the most prevalent diseases are Rheumatoid Arthritis (0.8%), Hashimoto's thyroiditis (0.7%), Celiac disease, (0.7%), Graves' disease (0.6%) and Type 1 Diabetes (0.5%) affecting millions of people. [3]

Disease	% US population	per 100,000
Rheumatoid Arthritis	0.806	860.00
Hashimoto's autoimmune thyroiditis	0.742	791.70
Celiac disease	0.703	750.00
Graves' disease	0.590	629.00
Diabetes mellitus, type 1	0.450	480.00
Vitiligo	0.375	400.20
Rheumatic fever	0.234	250.00
Pernicious anemia / atrophic gastritis	0.141	150.90
Alopecia areata	0.141	150.00
Immune thrombocytopenic purpura	0.068	72.00
Multiple sclerosis	0.055	58.30

Disease	% US population	per 100,000
Systematic Lupus Erythematosus	0.030	32.00
Temporal arteritis	0.028	30.00
Ulcerative colitis	0.028	30.00
Chron's disease	0.023	25.00
Scleroderma	0.023	24.00

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One mechanism that explains auto-immune conditions is *molecular biomimicry*. When intruders invade our bodies, the immune system creates antibodies that mark these intruders (antigens) as a foreign foe. The immune system then able to destroy the intruders.

During digestion, proteins from animal-based foods are broken down into their component amino acids. Some proteins may be absorbed from the intestine without being fully broken down into their amino acid components. Small chains of amino acids are called peptides. These peptides may be treated as a foreign invader by our immune system.

Rheumatoid Arthritis

Filaggrin is a protein that binds to keratin which is the main component of the outer layer of skin, hair, nails as well as horns, feathers, claws and hoofs. Anti-filaggrin antibodies are a strong indicator of rheumatoid arthritis. Two products that are derived from fibrin are deposited in the rheumatoid membranes that is a target for the anti-filaggrin antibodies. Fibrin is an insoluble protein that forms a network of fine fibres that assist clotting in the event of a cut. The presence of fibrin is greatly increased on an animal-based diet. [4] [5] [6]

An amino acid sequence in a protein in *Proteus* is similar to a sequence found in collagen. Collagen is the most abundant proteins found in mammals and is the main component of connective tissue. It is found in fibrous tissues such as tendons, ligaments, skin, cartilage and bones as well as other organs. It is cartilage and bones that are affected by rheumatoid arthritis.

There is evidence that *Proteus* bacteria is also involved with rheumatoid arthritis with the antibodies to the *Proteus* bacteria also attacking collagen.[7]

Rheumatoid arthritis and fibrin
Rheumatoid arthritis – an autoimmune condition

>Hashimoto's thyroiditis

There is a link between high levels of *Yersinia* antibodies and both Hashimoto's thyroiditis and Graves' disease . Antibodies to *Yersinia* were found in 66% of the Graves' disease patients and 100% of the Hashimoto's disease patients. [8]

Another paper showed that the prevalence of *Yersinia* antibodies was 14 times higher in people with Hashimoto's thyroiditis than in the two control groups. [9]

Yersinia infection is entirely derived from pork products.

Type 1 Diabetes

Antibodies to bovine serum albumin found in cow's milk attacks the cells on the surface of the pancreas that produce insulin. The immune system is unable to distinguish the cow's milk protein fragments from the pancreatic cells. It therefore destroys both which leads to the inability of the pancreas to produce insulin. [10]

Further information regarding type 1 diabetes and cows mil can be found at The problem with cow's file

What is incidence and prevalence? [11]

Get Bacteria – Balanced Diet

Microbes in the intestines are essential for the breakdown of complex carbohydrates, the production of short chain fatty acids and synthesis of vitamins. More than 1000 different species have been identified. Despite the vast number of bacteria species and people, there are only two types of bacteriological ecosystems in the gut (enterotypes) – those dominated by *Prevotella* genus bacteria and those by *Bacteroides* genera. Both *Bacteroides* and *Prevotella* belong to Bacteroidetes phylum. Enterotypes were strongly associated with long-term diets, particularly protein and animal fat (*Bacteroides*) versus carbohydrates (*Prevotella*). Microbiome composition changed within 24 hours of initiating a high-fat/low-fiber or low-fat/high-fiber diet. However, it takes a longer period of time to change the enterotype from one state to the other. [12]

Choline is converted by our gut bacteria into trimethylamine (TMA) which is then converted into trimethylamine N-oxide – $(CH_3)_3NO$ – in our liver. Trimethylamine N-oxide (TMAO) is implicated in a number of detrimental outcomes. [13] [14]

The choline in foods, such as eggs, can be turned by gut bacteria into TMA. However, it is only produced by the bacteria that are prevalent in high-fat, low-fibre animal-based diets.

The production of TMA is absent or greatly reduced in vegans. Feeding people steak or eggs can cause an increase in TMAO within a day.

Additional information regarding intestinal bacteria and diet is found at Eggs and the benefits of choline

Plant-based Immunity

The role of nutrition is often overlooked or reduced to such statements as “eat a balanced diet” or “increase fruits, vegetables, whole grains and healthy fats, found in foods such as fatty fish, nuts and olive oil”.

According to the Centers for Disease Control and Prevention (CDC),

> Vitamin A deficiency (serum retinol <20 µg/dL [<0.7 µmol/L] for subclinical Vitamin A deficiency can substantially increase the risk for childhood mortality from infectious and noninfectious causes. Vitamin A deficiency impairs the mobilization and transport of iron and is usually associated with anemia and reduced growth. Vitamin A deficiency is a major public health problem in parts of Africa, Asia, Latin America, and the Western Pacific. [15]

Whilst vitamin A is very important for a healthy immune system, it does not work in isolation. As Michael Zimmerman states in his *Pocket Guide to Micronutrients in Health and Disease*:

> The immune system is weakened by even marginal deficiencies of vitamins A, C, E, B6, B12, and folate, as well as lack of the minerals iron, zinc, manganese, copper, or selenium. Deficiencies of micronutrients can impair production of new white cells and their activation and activity against foreign substances and cells. Certain micro-nutrients (such as vitamins E, C, and B6, and selenium and zinc) can boost the immune system, enhance white cell activity and function, and increase resistance to infection. […] Diets high in refined carbohydrate and saturated fat can weaken the immune system. [16]

Many drugs and some nutritional substances such as conjugated linoleic acid (CLA) “enhance” the immune by provoking it. CLA is a group of fatty acids with that are found in dairy with the most common being rumenic acids. It is a trans-fatty acid that is found in dairy products and the fat of cows and other ruminants.

When the immune system recognises a foreign substance (an antigen), it produces an immune response such as in increase in white blood cells such as neutrophils and eosinophils. This results in the immune system being primed in the event of a subsequent attack.

Plant-based immunity results from a completely different mechanism.

Cytokine production (interleukins, TFN-), increase in Natural Killer cells and macrophages, tumour destruction and instigates an inflammatory response. The inflammatory stimulates

the innate immune system.

Brassicas, leafy greens, fruits and colourful vegetables contain a myriad of antioxidants, vitamins and minerals. Attempting to isolate the active ingredient is a vain exercise as the synergistic effects of these components far exceed the contribution of the individual items. [17] [18] [19] [20] [21]

- Leafy greens
- Whole grains
- Fruit
- Beans
- Complex carbohydrates
- Seeds and nuts
- Herbs and spices
- Mushrooms
- No added oils or sugars

Additional information regarding this list is found at When vegan diets do not work

Books

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Additional reading

Rheumatoid arthritis and fibrin
Rheumatoid arthritis – an autoimmune condition
When vegan diets do not work
Eggs and the benefits of choline

Footnotes

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people found to have the condition with the total number of people studied and is usually expressed as a fraction.

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