

# Advances

In Orthomolecular Research

# VIRUSES

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Canada Volume 6 | Issue 1





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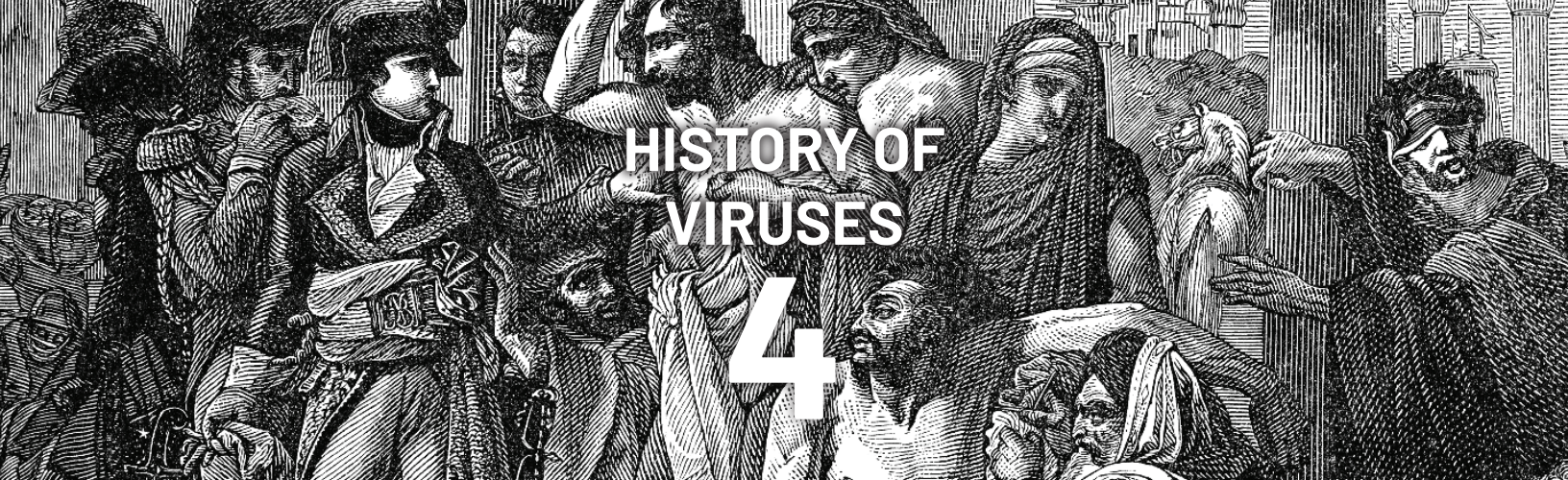
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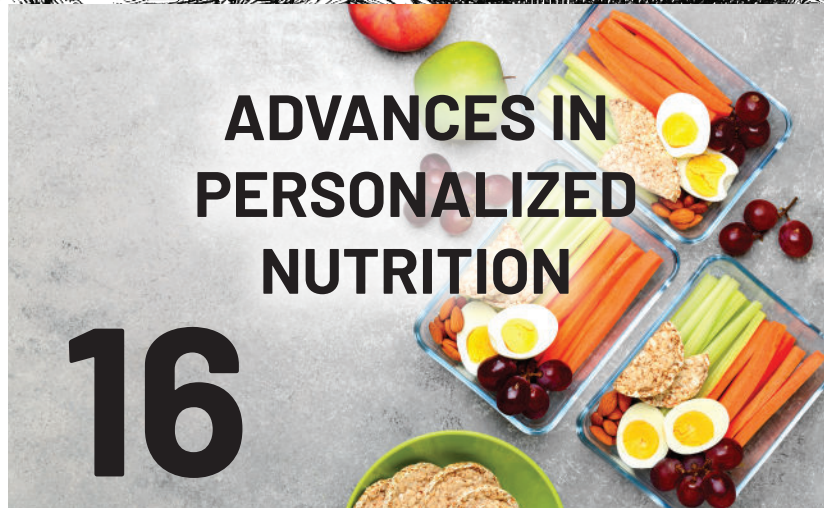
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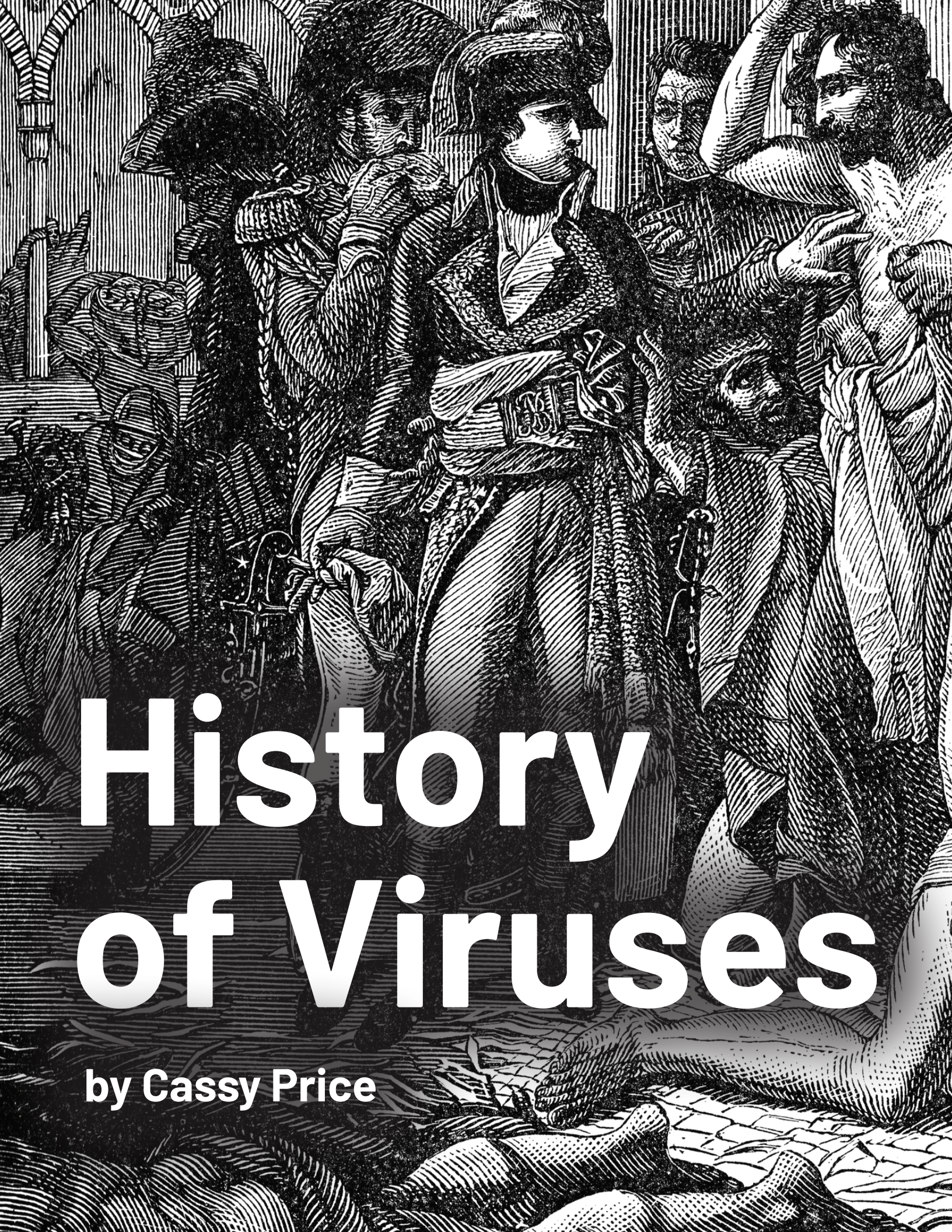
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# History of Viruses

by Cassy Price





## The human race has been battling viruses since the Neolithic period.

Through the ages with scientific research and developments, people have been able to develop vaccines and antiviral drugs to keep some infections from spreading. These preventative measures and treatments have helped sick people recover from, and in rare cases, even eradicate a virus.

A virus is an infectious agent that replicates inside the living cells of an organism. They can infect all types of life forms, including animals, plants and microorganisms. Viruses undergo the same evolution and natural selection we see in all cell-based life. However, a virus can evolve much more rapidly than larger organisms. When two viruses infect a cell at the same time, they may swap genetic material to make new viruses with unique properties.

Throughout the history of viruses, we have seen many situations where a virus evolves with new mutations that lead to epidemics worldwide, leading to new research and new developments. Here are some examples of the better-known or deadliest viral epidemics.



## Smallpox

Prior to its eradication in 1980, humans battled smallpox for thousands of years. The disease, caused by the variola virus, killed about 33% of those it infected. The first symptoms of smallpox usually appear 10 to 14 days after infection and present with a sudden onset of flu-like signs and symptoms including fever, headache, severe fatigue, back pain, and possible vomiting.

Smallpox is transmitted from person to person by infected aerosols and air droplets spread in face-to-face contact with an infected person or by contaminated clothes and bedding. The mortality rate of smallpox is 30% according to WHO and survivors are often marked with deep-pitted scars, most prominent on the face.

## Marburg

Discovered in Germany in 1967, Marburg is a rare but severe hemorrhagic fever, which affects both humans and non-human primates. It presents with fever, chills, headache, and myalgia after a five to 10 day incubation period. Transmission occurs through person-to-person contact via bodily fluids of those who are infected. People who have close contact with African fruit bats, human patients, or non-human primates infected with Marburg virus are at risk.

The mortality rate in the first outbreak in Germany was 25%, but it was more than 80% in the 1998–2000 outbreak in the Democratic Republic of Congo, as well as in the 2005 outbreak in Angola, according to the World Health Organization (WHO).

Marburg virus is an RNA virus of the filovirus family. The five species of Ebola virus are the only other known members of the filovirus family.

## Ebola

Ebola, one of the deadliest viral diseases, had its first known human outbreaks simultaneously in the Republic of the Sudan and the Democratic Republic of Congo in 1976. Primary signs and symptoms of Ebola often include fever, aches and pains, weakness and fatigue, gastrointestinal symptoms including diarrhea, vomiting and stomach pain. Symptoms usually present themselves after a two to 21 day incubation period. Scientists believe people initially become infected with the virus through contact with an infected animal, such as a fruit bat or non-human primate, and then it travels from person to person through bodily fluids.

The average Ebola case fatality rate is around 50%, however, case fatality rates have varied from 25% to 90% in past outbreaks according to WHO. Vaccines to protect against Ebola are under development and have been used to help control the spread of Ebola outbreaks in Guinea and the Democratic Republic of the Congo.



## Human Immunodeficiency Virus (HIV)

Human Immunodeficiency Virus (HIV), the virus that causes Acquired Immune Deficiency Syndrome (AIDS), is a highly genetically variable virus. It reproduces much more rapidly than most other viruses and can produce billions of copies of itself each day. Through this rapid-fire replication, there are often a number of mutations that occur leading to new strains of the virus.

First detected in a blood sample collected in 1959 from a man in Kinshasa, Democratic Republic of the Congo, HIV weakens a person's immune system by destroying important cells that fight disease and infection. The age-adjusted death rate for HIV disease, according to Medscape, peaked in 1995 at 0.000163%, decreased 69.9% through 1998, and then further decreased 30.2% from 1999 through 2007, to 0.000037%.

## Influenza

Influenza, or the flu, is a contagious respiratory illness caused by influenza viruses. It can cause mild to severe illness with serious cases resulting in hospitalization or death. There are four types of seasonal influenza viruses, types A, B, C and D. Influenza A and B viruses circulate and cause seasonal epidemics of the flu.

Influenza A viruses are further classified into subtypes according to the combinations of the hemagglutinin (HA) and the neuraminidase (NA), the proteins on the surface of the virus. Only influenza type A viruses are known to have caused pandemics. Influenza B viruses are not classified into subtypes, but can be broken down into lineages.

Seasonal influenza is characterized by a sudden onset of fever, cough (usually dry), headache, muscle and joint pain, sore throat and a runny nose. The incubation period for influenza is 24 to 72 hours. Most experts believe that flu viruses spread mainly by tiny droplets made when people with flu cough, sneeze or talk. It is believed that people infected with the flu may be contagious before they are aware they're sick, as well as while sick. People with flu are most contagious in the first 3–4 days after their illness begins.

Mortality rates for seasonal influenza are usually quite low (<1%) however, certain populations such as the elderly are at a higher risk of death if they become infected.

## SARS-CoV

Severe acute respiratory syndrome (SARS) is a viral respiratory illness caused by a coronavirus. Coronaviruses are a large family of viruses that can cause diseases ranging from the common cold to severe acute respiratory syndrome. SARS was first reported in Asia in November 2002, and then spread to more than two dozen countries in North America, South America, Europe, and Asia in 2003. According to WHO, 8,098 people worldwide became sick with SARS during the 2003 outbreak, 774 of whom died.

The incubation period ranges between three and 10 days and presents with a high fever, a headache, and body aches. Some people also have mild respiratory symptoms at the outset with the majority of patients developing a dry cough after two to seven days that eventually develops into pneumonia. About 10 to 20% of patients have diarrhea.

Transmission of SARS-CoV is primarily from person to person by close contact, through respiratory droplets produced when an infected person coughs or sneezes.





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Transmission of SARS-CoV is primarily from person to person by close contact, through respiratory droplets produced when an infected person coughs or sneezes.

## MERS-CoV

Like SARS-CoV, Middle East respiratory syndrome (MERS) is a viral respiratory disease caused by a coronavirus. It was first identified in Saudi Arabia in 2012. MERS-CoV is thought to spread from an infected person's respiratory secretions, through means such as coughing. Symptoms can include fever, cough, shortness of breath, kidney failure and gastrointestinal issues, however, not all those infected are symptomatic. The mortality rate for reported cases of MERS-CoV is about 35%.

## Conclusion

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Possible  
smallpox  
outbreak in  
Italy

Second possible  
smallpox outbreak  
in Rome, Italy

Smallpox and  
measles plagued  
Native Americans,  
passed along by the  
Europeans

Smallpox epidemic  
in India

Measles outbreak  
in Cuba

Whooping cough  
epidemic in  
Paris, France

Diphtheria  
epidemic  
in Spain

165 A.D.

251 A.D.

1492

1525

1529

1575

1613

# Virus Discovery

1878

1889

1918

1957

1967

1968

1981

Yellow Fever  
outbreak in  
Tennessee

The Russian Flu  
(H2N2) pandemic;  
started in Siberia and  
Kazakhstan, traveled  
to Moscow, and made  
its way into Finland  
and then Poland,  
where it moved into  
the rest of Europe

The Spanish  
Flu (H1N1)  
pandemic

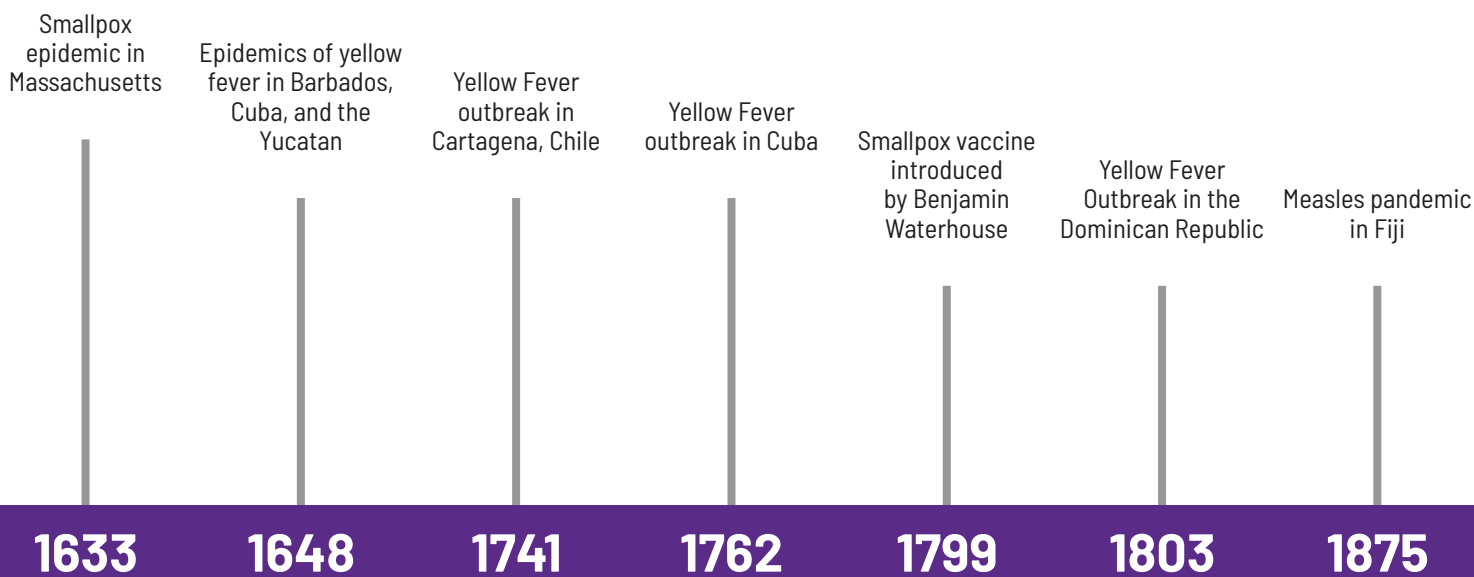
The Asian Flu  
(H2N2) pandemic;  
started in Hong  
Kong, spread  
throughout China  
and then into the  
United States,  
and England

Marburg epidemic  
in Germany

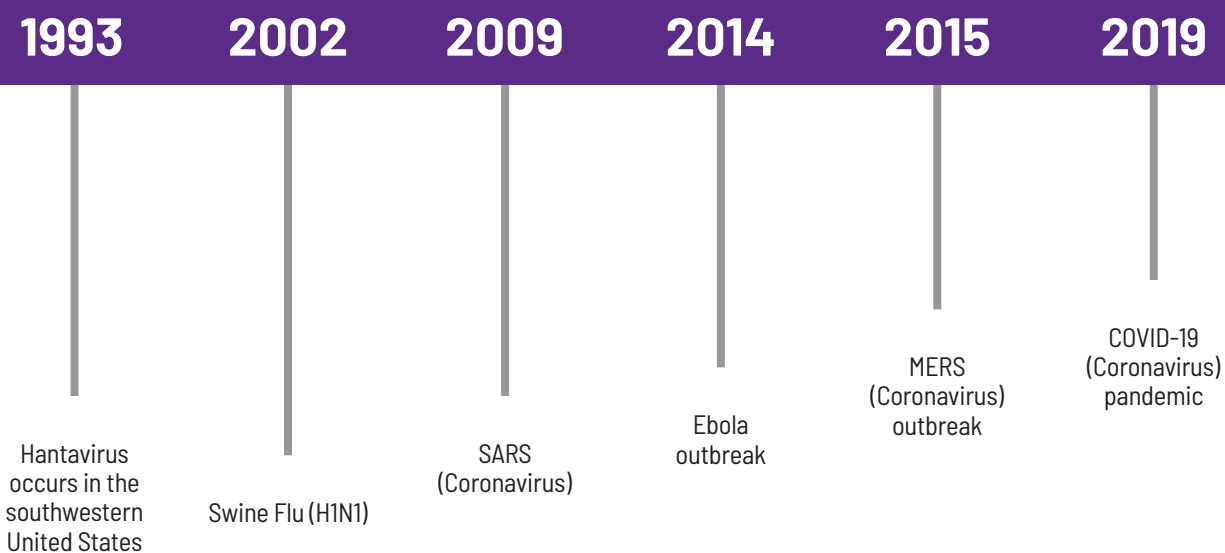
The Hong Kong Flu  
(H3N2) pandemic;  
started in Hong  
Kong, spread  
through Vietnam  
and Singapore

Human  
Immunodeficiency  
Virus (HIV) becomes  
an epidemic





# Timeline











# Improving the Health of Your Workspace

By Darianna Berbenetz

**Work** profoundly impacts our lives. Many of us will spend nearly half of our waking hours each day, and an average of 90,000 hours in a lifetime at work. This is equivalent to 10 years! To ensure our work life positively influences our health, wellness, workplace productivity, and enjoyment, it is imperative for both employers and employees to look for effective and impactful ways to create healthy workspaces. Whether you work for yourself, a fortune 500 company, or anything in between, exploring ways in which to better your workplace health will improve your productivity and performance, overall health and well-being, and create a greater sense of community.



The concept of a healthy workplace has evolved over the past several decades beyond the traditional meaning of occupational health and safety for employees in the physical work environment – free from potentially life-threatening physical, chemical, biological hazards, occupational injury and physical disease. The definition of a healthy workplace has now broadened to include a more wholistic understanding; one that values employee physical health, mental well-being, and psychosocial factors related to the workplace- workplace culture and community. The modern workplace evolved to not only be a place where we stress the importance of health protection, but one in which we can develop programming and build environments that encourage health promotion. Through systematic review, the World Health Organization (WHO) has proposed the following to define a healthy workplace: a healthy workplace should be a place where staff and management work together collectively to create an environment that continuously strives to improve processes that protect employee safety, and promote their health and well-being. The WHO also stressed

the value of empowering managers and employees to become their own health stewards and advocates; to seek ways to improve their own health, become more energetic, positive and contented in their workplace.

Despite this comforting, empowering and inspiring definition of a healthy workplace, many of us experience significant amounts of stress at work, sit for prolonged periods of time at our workspace, and do not feel that work positively influences health. Your health and the health of your workplace are intimately connected. A healthy work environment positively contributes to employee health. Unfortunately, the converse is also true: an unhealthy environment can lead to negative physical and mental health outcomes. Cultivating a healthy workspace that inspires, enhances productivity, minimizes stress, and promotes a healthy work environment is essential to enhancing employee health. In the sections that follow, we will explore eight ways in which to create a healthy work environment.



# Create and sustain a clean, organized workspace

Maintaining a clean, and organized workspace is more than simply keeping a tidy desk at work. From a health perspective, the careful cleaning and disinfection of frequently handled environmental surfaces is essential for effective infection prevention in the workplace. It is worthwhile to discern the difference between cleaning and disinfecting. Cleaning any surface can be accomplished with water and scrubbing. Cleaning does not kill viruses, bacteria, or fungi living on workplace surfaces. It removes dirt, dust, and food particles from workplace surfaces. The use of an antimicrobial disinfectant or sanitizer kills germs. Disinfection should be routinely practiced during cold and flu seasons, or when deemed necessary. The use of scent-free cleaning products is ideal for children or adults with work-related asthma, allergies, and those sensitive to artificial perfumes.

Remember, clean does not have a scent!

A clean workspace is also one that is visually free from clutter, and is well organized. Regardless of the nature of your work, organizing and reorganizing your workspace are essential parts of daily activities. Considering the amount of information that may come across our desks daily, it is imperative that we develop a successful organization system. This includes physical papers and documents, and electronic files. Your system for organization should be intuitive, and work best for you. The key is to be able to successfully maintain this system, so that you can stay current, focused, maximize your productivity and minimize stress.



## Minimize exposure to indoor air pollutants.

The quality of indoor air in the workplace is an area of growing health and safety concern. This is not only a concern for those that work in environments that have direct exposure to chemicals, dusts, or other indoor air contaminants. To improve the quality of air at your personal workspace, consider opening a window periodically during the day, inquiring if you can move your work space to a nearby window for direct access to fresh air, or keeping a portable HEPA-filter by your workspace.

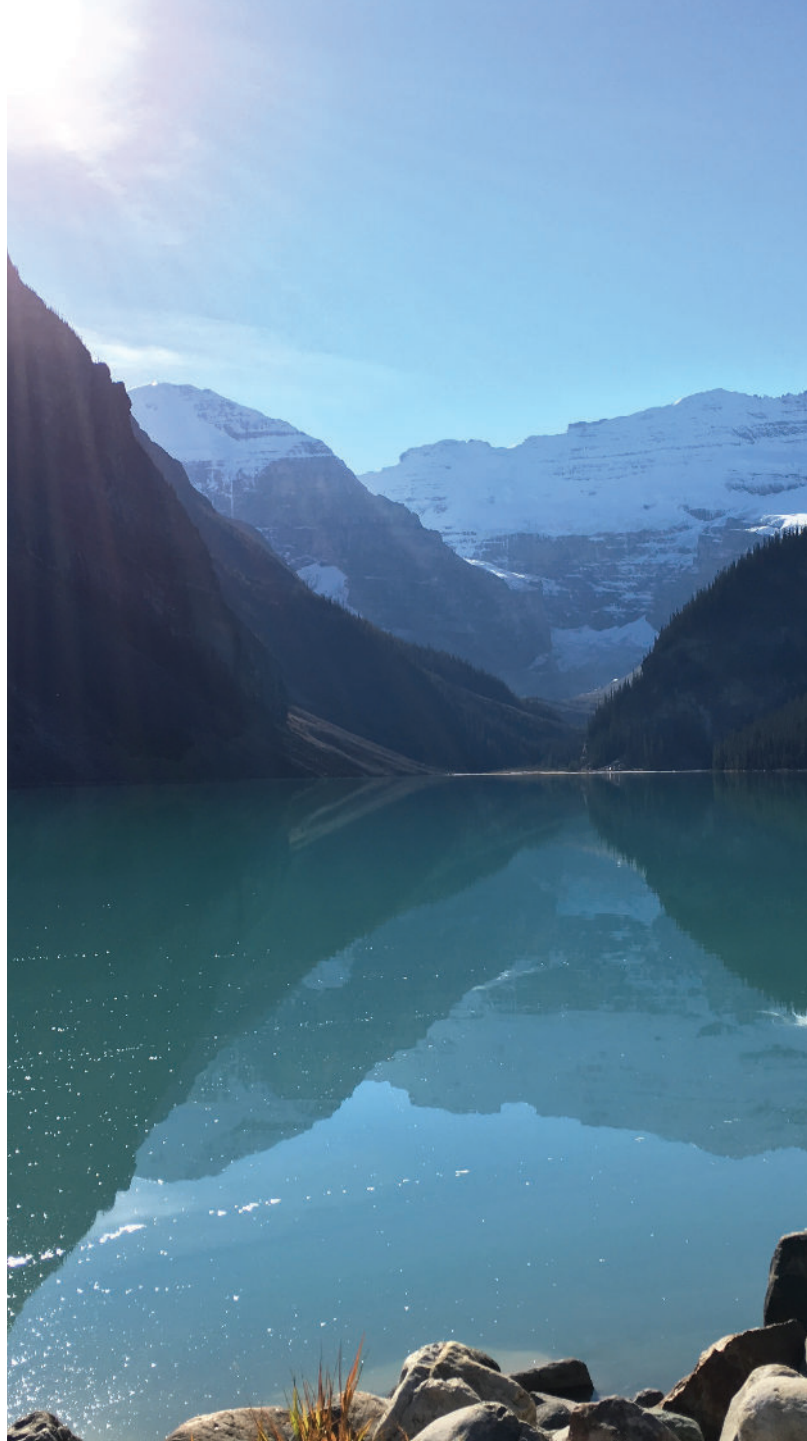
## Ensure there are healthy food choices or options available at work

What you eat during your workday can have a profound impact on your productivity, sense of well-being, and performance. This not only includes the foods you prepare and bring for lunch and snacks during the workday; but, also avoiding excessive snacking on cafeteria/lunchroom junk food and pastries. Embracing healthier eating habits in the workplace is a great way to foster a sense of community. As an example, discuss with your colleagues how you can all collectively make healthier snacking choices at work. Brainstorm fun and creative ways to share and make healthier alternatives to lunch room favourites that are high in protein, fibre and free from refined sugars and carbohydrates.

## Mindfulness, brain and gut health at work

What you eat during your workday can have a profound impact on your productivity, sense of well-being, and performance. This not only includes the foods you prepare and bring for lunch and snacks during the workday; but, also avoiding excessive snacking on cafeteria/lunchroom junk food and pastries. Embracing healthier eating habits in the workplace is a great way to foster a sense of community. Work can be a stressful environment. Stress experienced in the workplace can have a negative impact on health, causing symptoms ranging from digestive complaints and other physical illnesses to anxiety. Understanding the gut-brain connection via the enteric nervous system, and the relationship between our gut, digestion and mood can greatly help when tackling your next workplace deadline. The enteric nervous system is better known as the nervous system of the gastrointestinal tract, or “second brain.” It is an information highway relaying information about the state of the digestive system back up to the central nervous system (CNS)/brain.

Feeding your gut healthy food while at work, will not only improve gastrointestinal health, but will also subsequently improve your mental health. The incorporation of a healthy, balanced lunch and snacks to eat during work can improve gastrointestinal health, mood and performance. Not only does the quality of the food at work impact your overall health, so does its location. Stepping away from your workspace, and finding a quiet place to eat your meal in a relaxed state is key to optimal digestion and nutrient absorption. It may also be a good idea to consider taking a series of deep breaths prior to having your lunch, to encourage a parasympathetic state that facilitates resting and digestion.



## Increase nature contact

One way to positively promote health at work is to increase our contact with nature. At work, increasing your exposure to nature can be achieved by adding indoor plants by your desk or a common work space, having a desk with a view to the outdoors, taking breaks to work outdoors, or spending time on your lunch hour outside. Several studies have found that indoor exposure to plants, natural lighting, fish tanks, and a view to the outdoors are associated with less stress in the workplace. Sensory experiences that connect us to nature can also elicit this effect. For example, recorded nature sounds, art work and photographs of natural landscapes. Need another reason to bring indoor plants into your workplace? Plant leaves, stems and branches assist in reducing office noise, by absorbing sound, and deflecting sound waves.





## Noise Control

Noise at work can be a direct contributor to physiological stress experienced during work (causing our blood pressure to rise, and our heart rate to elevate), and result in a lack of productivity and decreased performance. The ability to multi-task in a noisy environment can seem like an impossible feat, making it difficult to juggle the many tasks at hand in priority sequence. A recent publication in the *Journal of Applied Psychology* found that noise in open-workspaces can also negatively impact our ergonomics at work – encouraging more postural changes and slouching than a quiet environment. Your ability to control the amount of noise pollution in your environment may seem challenging, but if you are able to set a quiet zone for yourself away from common spaces, bring indoor plants into your work place, and speak to your employer about acoustic solutions, you will be able to improve your productivity, posture, and reduce stress while at work.

## Move!

As our workforce transitions to low activity occupations such as office work, more and more research is being conducted to evaluate the health effects of being sedentary, and its relationship with premature mortality. Increases in sedentary behavior have been linked to poor health, and is positively correlated with sedentary activities outside of work. Changing sedentary behavior in the workplace is an excellent opportunity to improve physical activity and health outcomes. Ways in which employers and employees alike can improve their physical activity at work, is to encourage exercise during work hours, stretching breaks, and create workspaces that accommodate sit-stand desks.

## Build a community

One of the most positive influences on workplace health and mental wellbeing is through community. With our coworkers, we can create a shared environment in which we feel valued, respected, and contributors to a common goal. Working with our colleagues, we build a greater sense of purpose- improving moral, mental health, and performance in the workplace. We can also lean on this community to help us achieve our healthy workplace goals, that will not only better our own productivity, but the organization as a whole. Healthy employees mirror the health and future successes of a company. Therefore, investing in the health of employees is good business.

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Advances in

# Personalized Nutrition





By Antonina Bureacenco, BA, CNP

**Personalized nutrition is based on the concept that no one diet is suitable for everyone, and that humans have considerable diversity in genetics, metabolism, lifestyle, and environment. Nutritional needs vary by age, gender, genetic background and other factors. All of these account for individual differences in response to nutrient status, dietary patterns, and exposure to toxins.**

American biochemist Rogers Williams, PhD, may be credited for the earliest conception of personalized nutrition with his emphasis on 'biochemical individuality' as it relates to metabolic makeup and micronutrient requirements. (1)

Linus Pauling, PhD, further established this movement in coining the term orthomolecular medicine, first used in his seminal article, *Orthomolecular Psychiatry*, published in the journal *Science*, April 19, 1968. (2) Orthomolecular medicine, as conceptualized by Pauling, aims to restore the optimum environment of the body by correcting molecular imbalances on the basis of individual biochemistry.

The term 'personalized nutrition' is often thought to be synonymous with 'precision nutrition' and 'nutrigenomics'. Nutritional genomics is a specific area of research exploring the interaction between genes, nutritional components, and individual health outcomes. Data from this rapidly emerging scientific field is being used to prevent, effectively manage, and treat disease. Most of the available evidence in support of personalized nutrition has come from observational studies.

An individual's health status is not simply the presence or absence of a diagnosable disease, but rather an interplay of inherited factors

and the environment. Genetic variations influence metabolism and specific nutrient requirements, food sensitivities, hormonal balance, detoxification, and disease risk. Depending on genetics, some individuals may have a predisposition to being sensitive or intolerant to certain foods and environmental substances. Genetics also play a large role in determining how alcohol, caffeine, and other stimulants are metabolized.

In collecting and understanding data that reflects the entirety of an individual's unique circumstances, health history, and functional imbalances, we can better determine an optimal diet and targeted nutraceuticals.

Lifestyle factors such as exercise, sleep, and stress management; and food-related behaviours such as selection, preparation, and meal timing are also informed via individual assessment. Specific risk factors for nutritional deficiencies and enhanced nutrient needs can be identified, along with genetic variants (SNPs) which affect nutrient metabolism. Genes play a key role in determining the efficiency of detoxification pathways, and depending on variants, there are some minor nutritional and lifestyle adjustments that can make a major difference in helping to achieve improved health.

As personalized nutrition technology advances, data collection has



become increasingly affordable and more accessible. Awareness of, and access to, information about gene variants that may play a role in health and disease is now available to the consumer. Wearable devices and mobile apps enable users to collect real-time information on physical activity, diet and fluid intake, and other measures of health.

Personal nutritional genetic profiles, including risks and strengths, will allow individuals to adjust their nutritional approach to health.

AOR's MyBlueprint focuses mainly on genetic variants (polymorphisms or SNP's) which have been determined in research to have a significant impact on the body's metabolic pathways. In other words, they participate in the absorption and metabolism of nutrients, detoxification mechanisms, and the functioning of muscles. They also reveal a tendency toward some modern disease risk factors, such as cardiovascular disease, obesity and type II diabetes.

Knowing your genetic predispositions changes everything as it gives you the inside information you have been seeking to understand your body better, it's exciting, empowering and motivating! Your report provides an incentive for making practical dietary and lifestyle changes that allow you to maximize your own individual health potential.

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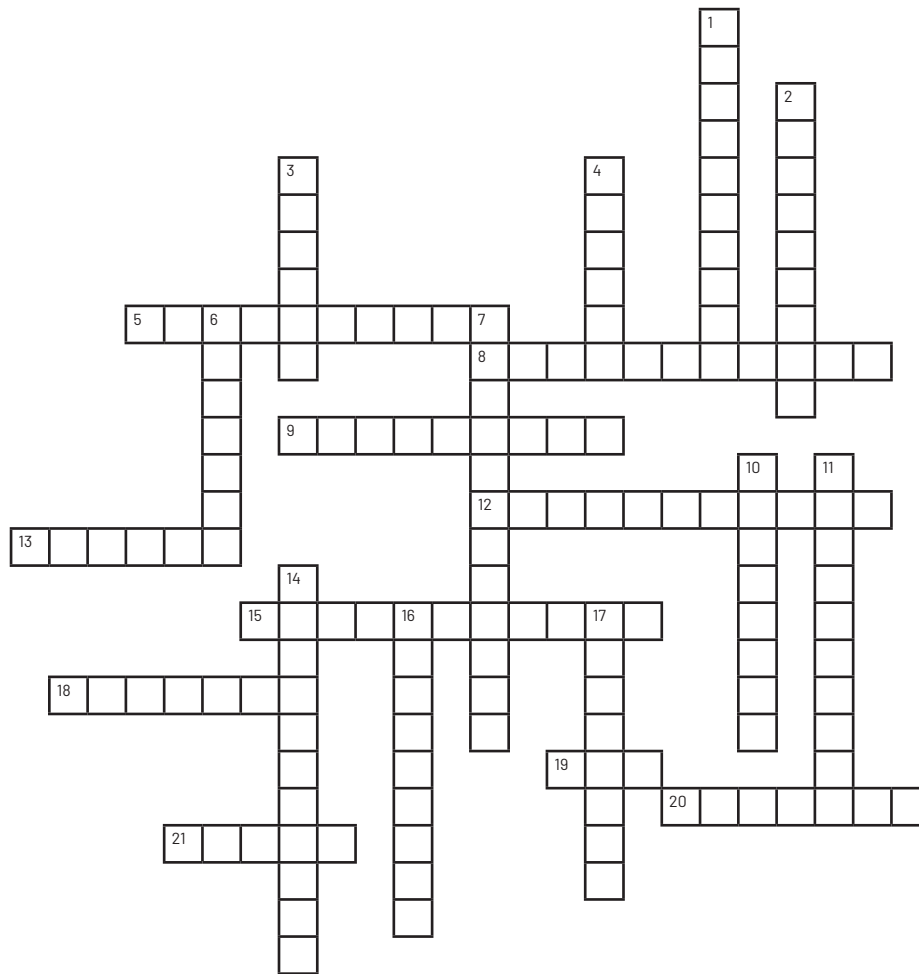
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## Advance your virus knowledge with this crossword challenge!

Find the answers to complete the puzzle. If you get stuck, find the answer key on page 30.



### Across

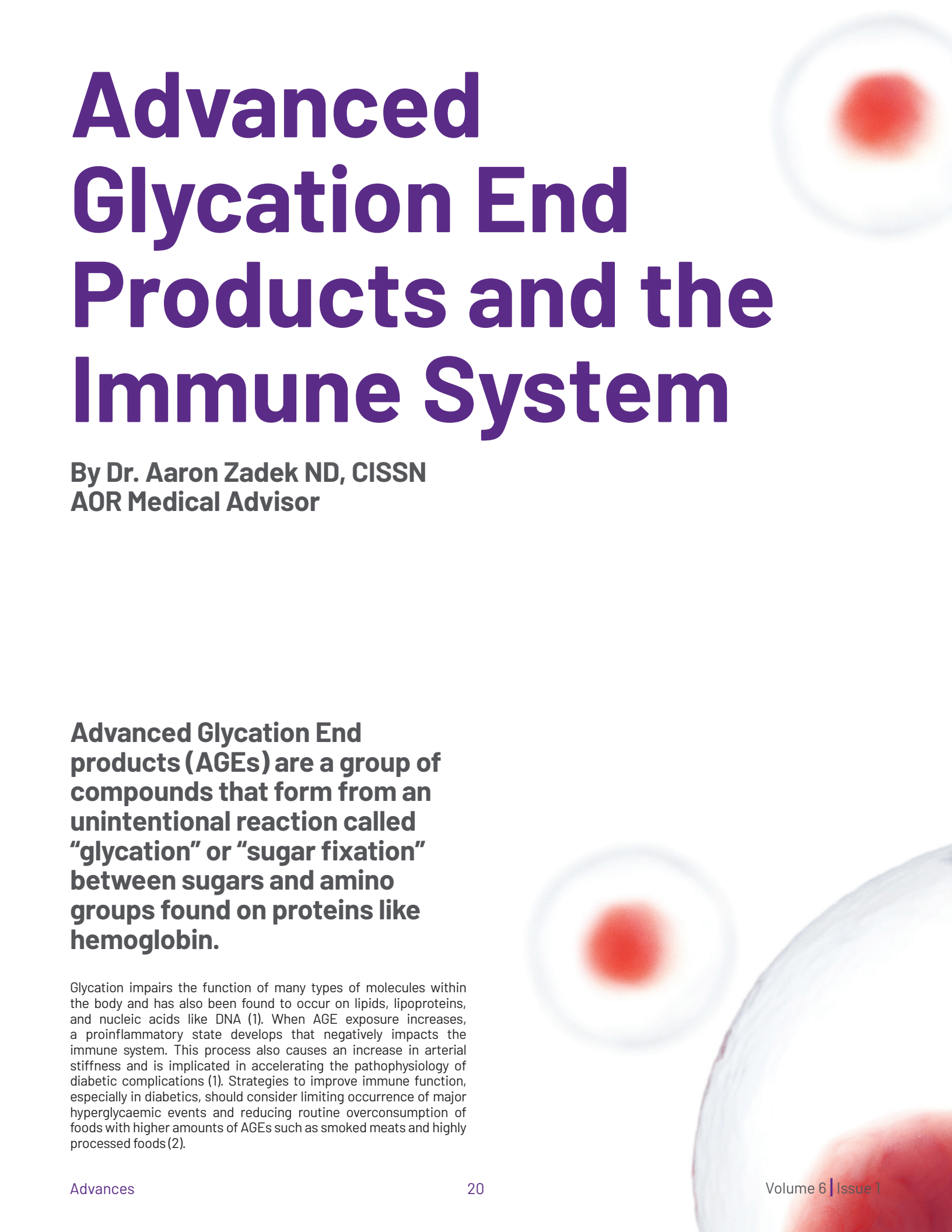
5. A virus that contains RNA instead of DNA is sometimes called a \_\_\_\_\_
8. Helps to stop the spread of viruses
9. Viruses survive by \_\_\_\_\_ living hosts
12. The infectious part of a virus
13. The largest virus is the \_\_\_\_\_ fever virus
15. All viruses share six basic steps in their \_\_\_\_\_ cycles
18. Capsid shapes have two main categories: \_\_\_\_\_ and icosahedral
19. Double-stranded \_\_\_\_\_ is found in the Small Pox virus
20. Viruses have no cell \_\_\_\_\_
21. This helps to strengthen your immune system to fight off viruses

### Down

1. The common cold is caused by this
2. The two main types of reproductive cycles of viruses: the lytic cycle and the \_\_\_\_\_ cycle
3. Virus comes from the Latin word for this
4. Viruses are covered in a protective coat of protein called the \_\_\_\_\_
6. The smallest virus is the \_\_\_\_\_ necrosis virus
7. Viruses can be passed from one person to another by doing this
10. \_\_\_\_\_ help our bodies to build up immunity to specific viruses
11. Most viruses are so small they cannot be seen by an optical \_\_\_\_\_
14. The first human virus discovered was \_\_\_\_\_
16. This is one of the most common viruses
17. Most viruses are very well adapted to their host \_\_\_\_\_



# Advanced Glycation End Products and the Immune System

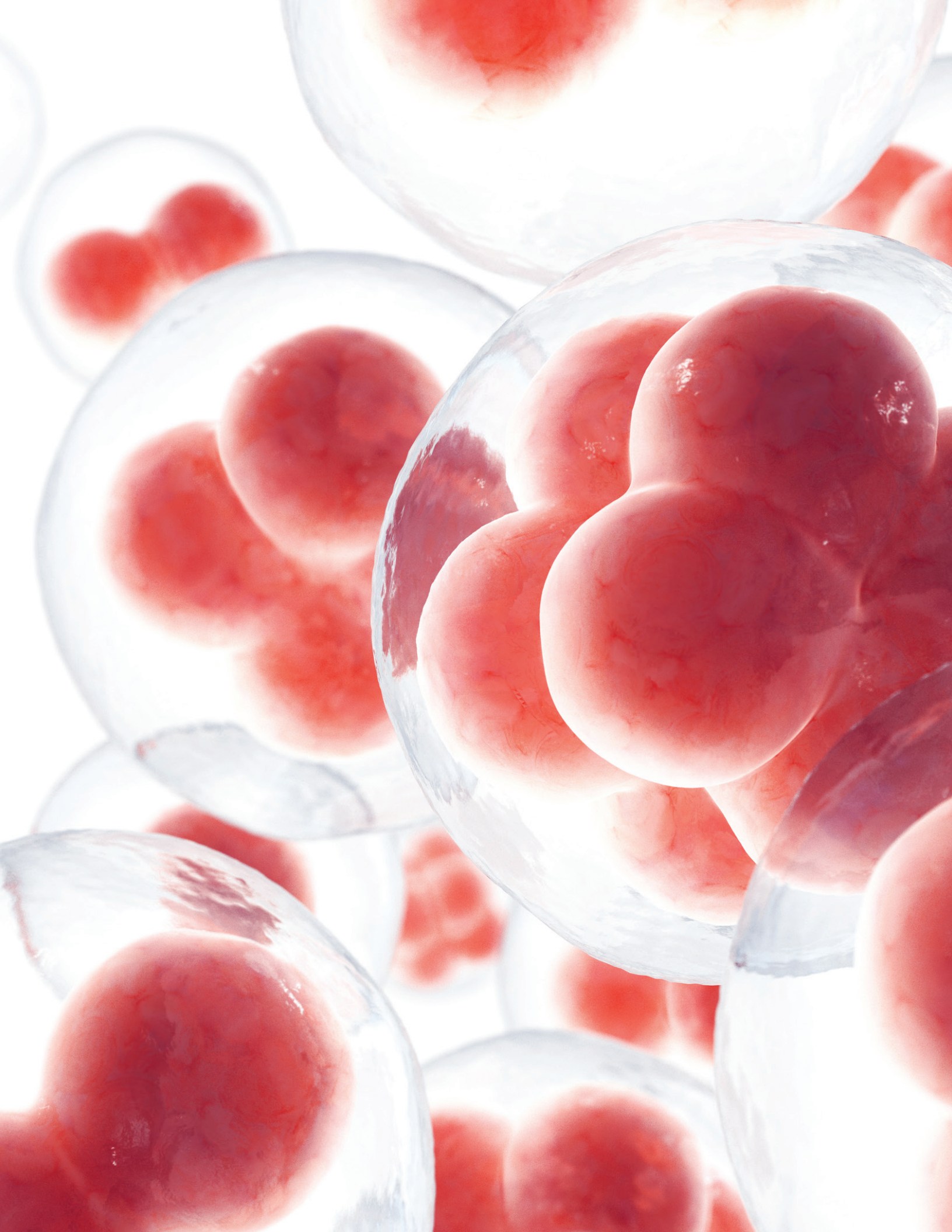


By Dr. Aaron Zadek ND, CISSN  
AOR Medical Advisor

**Advanced Glycation End products (AGEs) are a group of compounds that form from an unintentional reaction called “glycation” or “sugar fixation” between sugars and amino groups found on proteins like hemoglobin.**

Glycation impairs the function of many types of molecules within the body and has also been found to occur on lipids, lipoproteins, and nucleic acids like DNA (1). When AGE exposure increases, a proinflammatory state develops that negatively impacts the immune system. This process also causes an increase in arterial stiffness and is implicated in accelerating the pathophysiology of diabetic complications (1). Strategies to improve immune function, especially in diabetics, should consider limiting occurrence of major hyperglycaemic events and reducing routine overconsumption of foods with higher amounts of AGEs such as smoked meats and highly processed foods (2).







## So how does the innate immune system recognize invaders?

Our body's initial response against microbial infections is known as the innate immune system. This system helps to form protective barriers to infections and is the first line of defence tasked with recognition and, if possible, destruction of the invading microorganism. In fact, most microorganism invaders are recognized by the innate immune system and destroyed within minutes to hours (3). Pathogens that cannot be destroyed by this first line defence are transported to lymphoid organs where the adaptive immune process can recruit and train specialized immune cells to better target and eliminate the infection.

The key to this system's effectiveness is in its ability to quickly mobilize once a pathogen is discovered; this is heavily dependent on inflammatory processes. Inflammation is critical to ensuring a proper immune response and fighting infection. It is the reason why you might notice pain, redness, heat and swelling around an infection site (3). The body has a number of different pro-inflammatory mediators that can be released in time of need but it is about the right response at the right time at the right magnitude. These mediators serve several functions; 1) act as a signal fire to increase the number of immune specific cells in the area to seek out any other invaders, 2) increase small blood vessel coagulation to prevent infection from easily spreading via the blood, and 3) promote repair of injured tissues (3).

## What are advanced glycation end products?

Advanced Glycation End products (AGEs) are reduced sugar compounds that form on proteins that alter their function. Exposure to AGEs can occur through dietary intake of foods rich in AGEs as well as persistent exposure to increased blood sugar leading to glycation of internal proteins including LDL, albumin, hemoglobin etc. (1). Many normal tissues are disrupted by AGEs including the nervous system, blood vessels and immune specific cells such as neutrophils and macrophages (4). Increased AGE exposure is implicated in a variety of human diseases including diabetes and diabetic related complications, obesity, Alzheimer's disease, and other age related pathologies such as erectile dysfunction, glaucoma, cataracts, atherosclerosis and pulmonary fibrosis (5). These AGE products can form very rapidly; interfering with tissue function and modulating cellular process by cross-linking directly to extracellular proteins or binding to an appropriately named surface receptor called "RAGE" - Receptor for Advanced Glycation End Products (6). When AGEs bind to RAGE there is notable increase in the body's oxidative stress and inflammation signalling that has been linked to arterial stiffening, microvascular complications and diabetic complications resulting in damage to the eye, kidney and nervous system (1)(7).

## Is there a connection between AGEs and immune function?

Yes, AGEs have been implicated as a disruptor of several immune responses. Not only do they bind directly to the cells of the innate immune system, they suppress production of signal molecules to recruit additional immune support (8). Additionally diminished is the ability of certain white blood cells to release key activators against influenza and other RNA viral infections resulting in a higher vulnerability to infection (4). In the presence of microbial and viral infections, the immune cells will produce inflammasomes, an important intercellular process that amplifies the immune response in time of need (9). This process is less responsive in the presence of AGEs and its assembly mechanism is impeded leading to a higher susceptibility of infection and diminished response.

Research is ongoing but it is clear that there are many mechanisms by which AGEs interfere with immune response. AGEs are able to bind LDL cholesterol and circulating immune complexes in type 1 diabetics, this process is now considered to be associated with thicker carotid artery muscle leading to increased risk of cardiovascular events (10). It is clear that AGE levels and chronic inflammation are associated, with a strong connection between AGEs levels and atherosclerosis and cardiovascular pathologies becoming more supported in literature. While a majority of this literature is done in diabetics due to increased blood sugar events, this does not mean that only diabetics are at risk of increased AGE exposure.

## Conclusion:

Effort should be placed on reducing dietary consumption of advanced glycation end products that promote inflammation and oxidative stress. When these compounds build up in excessive amounts, are correlated to decreased immune function and increases in diabetic progression, cardiovascular risk and chronic disease pathology. While detailed research on AGE containing foods is still a work in progress, certain trends are becoming clear. Cooking techniques on animal proteins such as frying, smoking, broiling, grilling and roasting result in elevated dietary AGE consumption compared to boiling, poaching, stewing, and steaming (2). Red meat, high fat containing animal proteins, full fat dairy products and highly processed foods also appear to increase risk but the take home message is that of moderation. AGEs are a part of a normal metabolism, it would be extremely difficult to avoid them completely, but continued elevated exposure is not healthy long term. For those who are at increased risk due to pre-existing conditions or depleted immune systems there is rational to consider increased consumption lower AGE containing foods such as fish, legumes, and vegetables while integrating cooking techniques that limit additional AGE formation.

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# Anti-Viral Remedies

By Pamela Ovadje, PhD

## Complementary & Alternative Options for Viral Infections

Despite all the progress made in vaccine and antiviral drug development, many viruses are still lacking preventative vaccines and efficient antivirals. This lack of effective vaccination and antiviral treatment is also made worse by the fact that viruses are prone to rapid mutations. Moreover, due to increased global travel and urbanization, epidemic outbreaks represents a critical threat to public health, particularly when there is a lack of appropriate vaccines and antiviral drugs. This suggests that the identification of novel antiviral therapies is of critical importance, and herbal products have represented a great source for new drug discoveries for many decades.

Many plants have been used as natural treatments for various illnesses, including viral infections and there are many anecdotal reports of the use of natural herbs and their safety and effectiveness in many health conditions are available. Recent research (mostly pre-clinical research) has encouraged the use of natural products and herbs for their benefits, however, more suitably planned and properly executed clinical studies are needed to validate the clinical applicability of natural products, especially in the development of appropriate antiviral therapies.

Alternative natural medications are an urgent requirement to fill the gap of unavailability of conventional therapies or vaccines.

Below is a summary of some natural products that have been evaluated for their potential benefits in targeting viral infections.



## Zinc

Zinc helps improve and maintain barrier defenses and its deficiency impairs barrier defense. This mineral is required for the production of the thymus hormone thymuline, which is necessary for the maintainance of immune function, therefore it has been noted that zinc deficiency increases the risk for infectious diseases, via immunosuppression through thymulin insufficiency. One of the consequences of zinc supplementation is the reduction in the efficiency in the absorption of copper in the gastrointestinal tract. This effect is generally observed when supplementing with over 30 mg of zinc per day. Copper deficiency is also a risk factor for immune impairment, so zinc supplementation should be accompanied by copper supplementation as well.

## Sage (*Salvia officinalis*)

Sage has a long standing use in traditional medicine for the treatment of viral infections. Research suggests that the antiviral properties of sage are attributed to safficinolide and sage one, which are prevalent in the leaves and stems of the plant. Sage has specifically been shown to combat herpes simplex virus (HSV-1).

## Garlic (*Allium Sativum*)

Garlic is a member of the onion genus, with close relatives including the onion, shallot, leeks and chives. Garlic is native to Central Asia and northeastern Iran and has a wide use worldwide in both diets and supplementation. Garlic has been purported to have many health benefits, including against viral infections, however, more clinical research is needed to properly validate the effectiveness of this popular herb in antiviral medicine development. Studies suggest that garlic may have antiviral activity against several other viruses, including influenza A and B, herpes simplex virus (HSV-1), viral pneumonia and rhinovirus, which causes the common cold.

Outside of the potential direct antiviral effects, garlic has also been shown to enhance the iummune system by stimulating the production of immune cells, which could also be useful in preventing and helping fight against viral infections.

## Licorice (*Glycyrrhiza glabra*)

Licorice has been used in traditional Chinese medicine (TCM) and for other natural practices for centuries and although licorice does have medicinal effects, the current scientific research only supports some of its uses and its safety in specific populations. Therefore health care practitioner oversight should not be discounted and more research is needed to validate the safety of this herb.

Research has identified more than 300 different compounds in licorice, some of which are attributed to have antiviral and antimicrobial properties. Glycyrrhizic acid present in the plant inhibits virus growth and inactivates virus particles. Glycyrrhizic acid from *Glycyrrhiza glabra* increase virus-specific antibodies in the infected individual.

## Astragalus (*Astragalus membranaceus*)

Astragalus is a flowering herb popular in traditional Chinese medicine. It boasts Astragalus polysaccharide (APS), which has significant immune-enhancing and antiviral qualities. Studies suggest that Astragalus can drastically reduce the proliferation of the H9N2 virus, increase the expression of several interleukins involved in immunity and may promote a rapid humoral response. These results, along with evidence from Health Canada, suggests the use of astragalus in maintaining a healthy immune system, especially in the face of viral infections.







## Ginger (*Salvia officinalis*)

Ginger is used to add flavour to food and has been used for its benefits in gastrointestinal irritation, as well as muscle pain and inflammation. A few of the bioactive components that are attributed to have beneficial health benefits, including gingerols, sulfur containing compounds (allicin, alliin, and ajoene), as well as enzymes (allinase, peroxidase and myrosinase). The gingerols and zingerone compounds in ginger have been found to inhibit viral replication and viral-host fusion, while preventing viral entry into the host cells. In-vitro studies of ginger, in combination with other herbs, including cloves, fenugreek and garlic, could possess very strong antiviral activity.

## Holy Basil (*Ocimum sanctum*)

Holy basil is native to Southeast Asia and has been used in various traditional medicine practices, especially Ayurveda, as an expectorant to help relieve cough, cold symptoms and respiratory mucus buildup. Some of the constituents of holy basil includes oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, and  $\beta$ -caryophyllene and the antiviral activity of this plant is attributed to one or more combinations of these components.

Clinical studies show that an average dose of 300 mg daily can significantly increase the levels of helper T cells and natural killer cells, both of which are able to protect and defend the body against viral infections.

## Phyllanthus emblica (*Emblica officinalis*)

Also known as emblic, emblic myrobalan, myrobalan, Indian gooseberry, Malacca tree, or amla from Sanskrit amalaki, this is an important medicinal plant in Ayurvedic medicine. The plant is commonly used both as a medicine and as a tonic to build up lost vitality and vigor. Phyllanthus emblica is highly nutritious and could be an important dietary source of vitamin C, amino acids, and minerals. Phyllanthus emblica also contains phenolic compounds, tannins, phyllembelic acid, phyllembelin, rutin, curcuminoids, and emblicol, which are proposed to contribute to the many health benefits attributed to this plant. Generally, all parts of the plant are used for medicinal purposes, especially the fruit, which has been used in traditional medicine for the treatment of diarrhea, jaundice, and inflammation. The antiviral activity of this plant suggest that kaempferol, a component of emblica and many other plants, possesses significant antiviral activity via its ability to solubilize the outer viral lipoproteins.

## Peppermint (*Mentha piperita*)

Peppermint is a widely used plant, both in medicine and food. This is a natural hybrid plant between spearmint and water mint and although it is native to the mediterranean region, it is now cultivated all over the world, for its flavour, fragrance and medicinal applications. The volatile peppermint oil is composed of menthol and menthone, along with other minor components like limonene, depending on the growing conditions and locations. The antiviral activity of menthol has been widely reported.

## Green Tea (*Camellia sinensis*)

The benefits attributed to green tea are vast. It has been researched for its many health benefits, including cognitive health, cardiovascular health, aging and cancer and the research is still ongoing. In fact, typing "green tea" into pubmed yields over 32,000 peer reviewed publication results.

Recent research has included the role in green tea catechins in fighting off viral infections. These catechins are proposed to work by inhibiting the adsorption of viruses onto red blood cells, preventing their transportation with a host and reducing attachment to host cells.



## Echinacea (*Echinacea angustifolia* and *Echinacea purpurea*)

Zinc helps improve and maintain barrier defenses and its deficiency Although the term “echinacea” refers to a group of nine species of flowering plants in the daisy family, only three species are actually used in herbal medicine. It is widely recognized by practitioners and regulatory officials for its benefits against the common cold and the relief of symptoms of upper respiratory tract infections.

Echinacea can help patients recover faster and reduce their symptoms while they are sick. Additionally, echinacea has been shown to reverse the stimulation of pro-inflammatory cytokines caused by viral infections, thereby reducing the symptoms of viral infections.

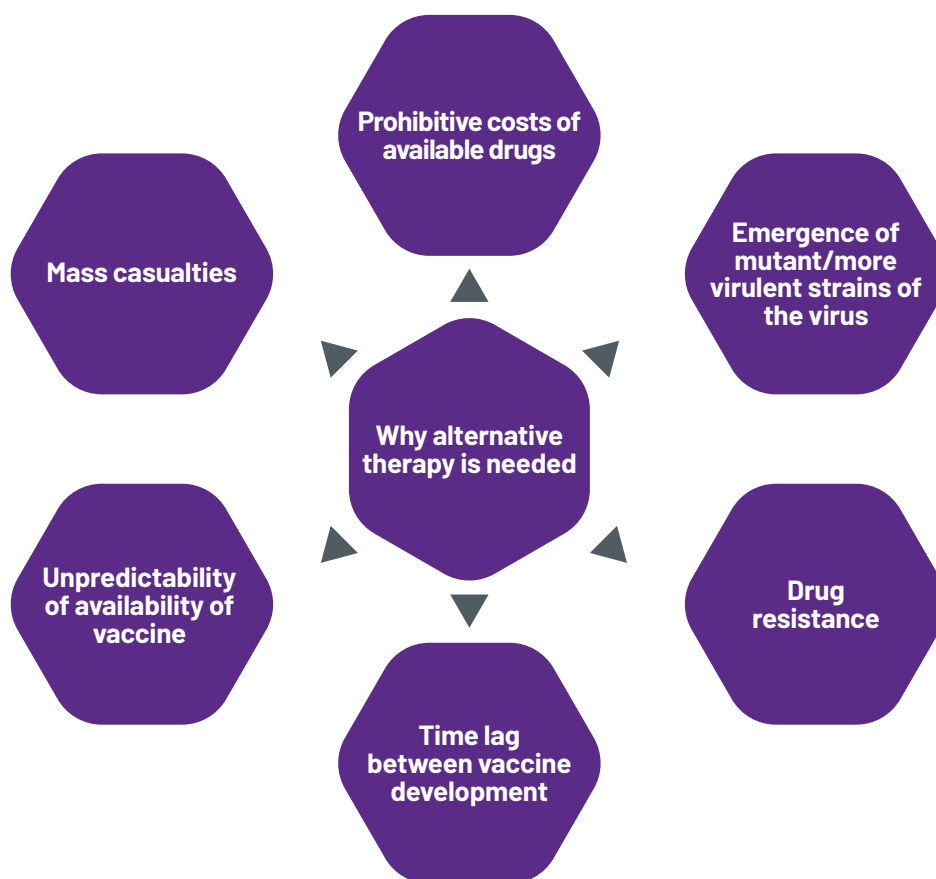
## Andrographis (*Andrographis paniculata*)

Andrographis is an herb with a long history of use in traditional Chinese and Indian medicines. It is commonly referred to as the “Indian Echinacea” and is a bitter herb, rich in bioactive compounds commonly referred to as andrographolides. These compounds are believed to possess anti-inflammatory, antiviral and antioxidant properties and the herbal extract is used traditionally in diseases including cancer, diabetes, cardiovascular issues, bronchitis, influenza and malaria etc. in Asian, American and African traditional medicine practices.

Apart from the direct activity of andrographolides against specific viral entities, these compounds are also able to stimulate the immune system to help combat viral (and other pathogenic) infections. Studies confirm the immune supporting and antiviral effects of this very helpful herb.

## Conclusion

There are many reasons why natural products and plants should be used as a resource for the development of antiviral preventatives and treatments. Figure 5 (obtained from the work published by Arora and colleagues in 2011) summarizes the benefits of looking to alternative sources for antiviral options.



In the current times, it is of utmost importance to protect ourselves and loved ones from infections. Where possible, preventative actions must be taken to combat the spread of viral infections. Our immune system is our army against invasion of pathogens and must be supported at all costs and when needed, supplementation with natural health products can be of great benefit in supporting the fight against viral and other pathogenic infections.





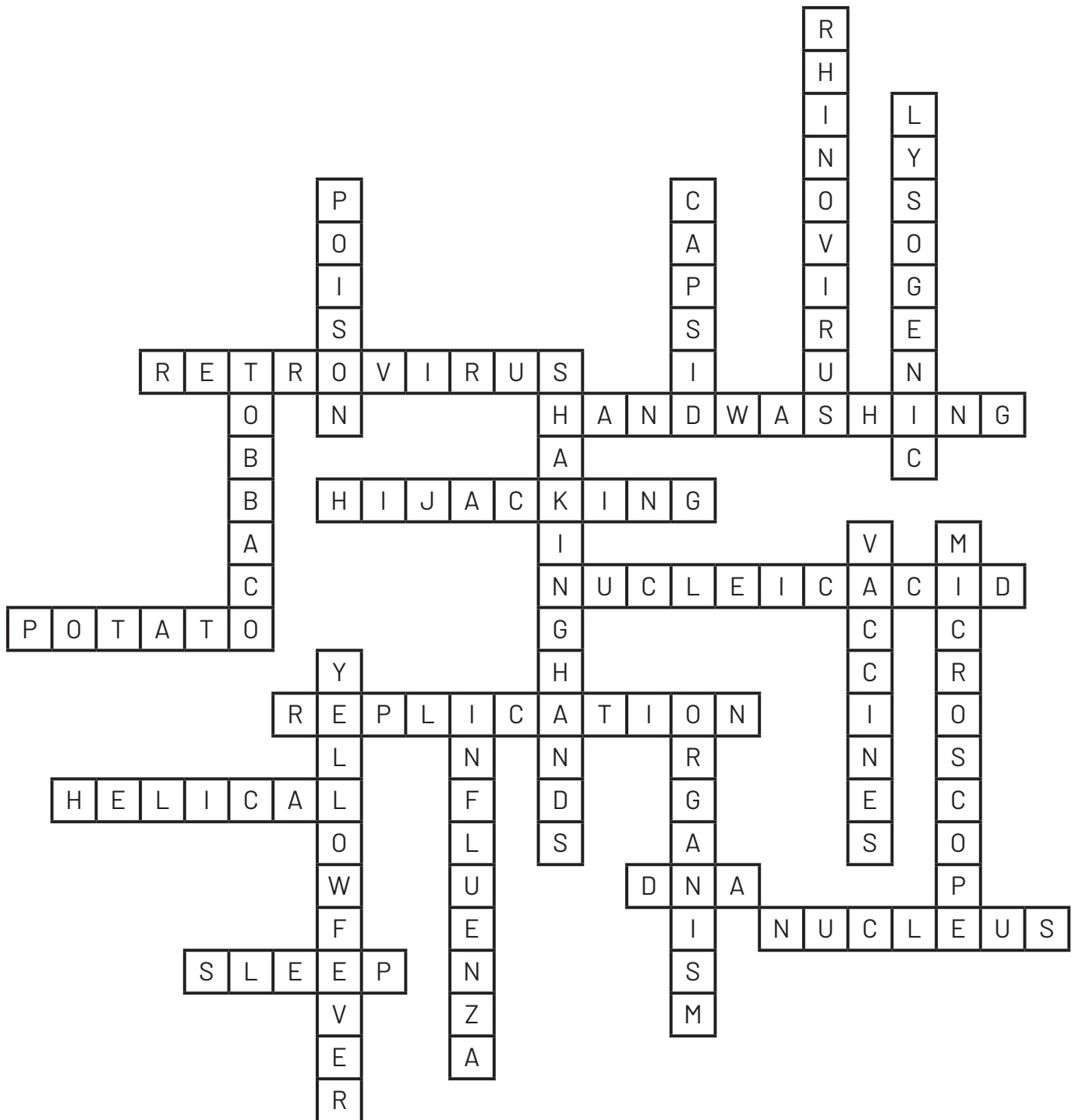
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