The Immune System

We are surrounded by millions of bacteria, viruses and other germs (microbes) that have the potential to enter our bodies and cause harm. The Immune System is the body's defence against disease-causing microbes (pathogens).

Germs live everywhere. You can find germs (microbes) in the air; on food, plants and animals; in soil and water — and on just about every other surface, including your body. Most won't harm you. Your Immune System protects you against infectious agents. However, some germs are difficult enemies because they're constantly mutating to breach your Immune System's defences. Knowing how germs work can increase your chances of avoiding infection.

This is slightly 'science', but can explain the glories and pitfalls of our Immune Systems; it describes the downside of over-working and how, through diet, knowing what is needed to fuel 100%.

Bacteria

Bacteria are one-celled organisms that can be seen only with a microscope. They're so small that if you lined up a thousand of them end to end, they could fit across the end of a pencil eraser.

Not all bacteria are harmful, and some bacteria that live in your body are helpful. For instance, Lactobacillus acidophilus — a harmless bacterium that resides in your intestines — helps you digest food, destroys some disease-causing organisms and provides nutrients.

Viruses

Viruses are much smaller than cells. In fact, viruses are basically just capsules that contain genetic material. To reproduce, viruses invade cells in your body, hijacking the machinery that makes cells work. Host cells are often eventually destroyed during this process.

Viruses are responsible for causing many diseases, including: AIDS, Common cold, Ebola virus, Influenza, Measles, Chickenpox and shingles

Antibiotics designed for bacteria have no effect on viruses.

Anti-biotics over prescribed

Antibiotics are important medications. The benefits of penicillin and other antibiotics in treating bacterial infections, preventing the spread of disease and reducing serious complications of disease cannot be overstated.

But some medications that used to be standard treatments for bacterial infections are now less effective or don't work at all. When an antibiotic no longer has an effect on a certain strain of bacteria, those bacteria become 'antibiotic resistant'. This is now one of the world's most pressing health problems.

The overuse and misuse of antibiotics are key factors contributing to antibiotic resistance. The general public, doctors and hospitals all play a role in ensuring proper use of the medications and minimizing the development of antibiotic resistance.

In 2009, headlines reported that GPs were being urged to stop prescribing antibiotics for coughs and colds as overuse increased resistance to them, making it more difficult to tackle serious infections like hospital bugs.

The overuse of antibiotics in recent years, prescribed for minor infections such as the common cold and mild flu, means they're becoming less effective; this has led to the emergence of "superbugs". These are strains of bacteria that have developed resistance to many different types of antibiotics, including:

- MRSA (methicillin-resistant Staphylococcus aureus)
- Clostridium difficile (C. diff)
- the bacteria that cause multi-drug-resistant tuberculosis

These types of infections can be serious and challenging to treat, and are becoming an increasing cause of disability and death across the world.

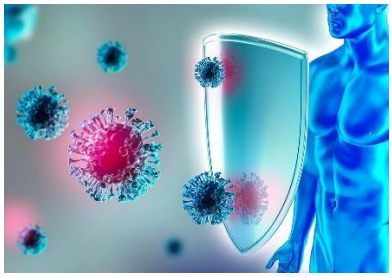
The biggest worry is that new strains of bacteria may emerge that cannot be treated by any existing antibiotics.

According to the Centres for Disease Control and Prevention, up to one-third to one-half of antibiotic use in humans is unnecessary or inappropriate.

Antibiotics treat bacterial infections but not viral infections. For example, an antibiotic is an appropriate treatment for strep throat, which is caused by the bacterium Streptococcus pyogenes. But it's not the right treatment for most sore throats, which are caused by viruses.

Other common viral infections that don't benefit from antibiotic treatment include:

- Cold
- Flu (influenza)
- Bronchitis
- Most coughs
- Some ear infections
- Some sinus infections
- Stomach flu



The Immune System is made up of non-specialised defences such as your skin (acting as a barrier) and strong acid stomach juices. However it also has some highly specialised defences which give you resistance to particular pathogens. Another name for this resistance is immunity. These defences are special white blood cells called lymphocytes. Other types of white blood cells play an important part in defending your body against infection.

The Immune System consists of two parts, the innate and adaptive responses, each having different functions.

We are born with the innate system; it jumps into action, trying to control an invading pathogen from spreading, this gives the adaptive immune response time to activate and react against it.

The innate response is what causes a high temperature, vomiting, mucus production and a streaming nose, as the body tries to quickly rid itself of the invader.

The adaptive immune response is more specific. In your infant years you're generating millions of random, adaptive immune cells. These cells might be specific for dangerous challenges such as infection, or non-dangerous ones like food or body components such as insulin or joint tissues; it takes a while for your Immune System to screen all these specifications and find the one that fits the infection you're faced with.

In most cases, once the Immune System has found the specific fit that will eliminate the virus or bacteria, it will generate memory cells providing you with lifelong immunity to that particular infection.

When rhinoviruses (the virus that causes colds) replicate they rarely produce exact copies of themselves, which is part of their strategy for survival, and why we don't yet have a vaccine for the common cold.

Another classic example is HIV. That's why an HIV vaccine is so difficult to develop, because, as with colds, there is so much variation in the virus."

Balance vs boost

Supplements and products that claim to boost the Immune System are commonplace, but the popular concept of 'boosting' the Immune System is largely misunderstood.

"It is usually inappropriate to boost the Immune System," cautions the Chair of Immunology at Imperial College London. If someone is healthy and well-nourished, the Immune System is balanced between its ability to recognise toxins, viruses and bacteria on the one hand, and making an inappropriate attack on the host's own tissues, i.e. an autoimmune response on the other.

The danger is that boosting the power of the immune response in a broad sense might increase the risk of autoimmune or allergic reactions. A more beneficial approach would be to support the Immune System to remain in balance.

When we talk about boosting the Immune System it only makes sense if you boost it very specifically the way vaccines do, meaning they are boosting a specific immune response to a particular infection."

Immune support - what works and what doesn't

From echinacea to nasal sprays and good old vitamin C, everyone has something they swear by to stave off colds, but many of these products are not supported by robust scientific evidence. So what has been proven actually to work?

As with everything else to do with our bodies, diet plays an essential part in normal immune function, by ensuring that we have the necessary nutrients to allow the immune cells to work normally. Vitamins can be helpful, but only if the person has an obvious deficiency, and probiotics might be helpful to restore a normal population of bacteria in the gut if the population has been altered by antibiotics. It seems clear that exercise, stress, a healthy sex life and adequate sleep also affect the efficiency of the immune response.

When we're stressed, the hormone corticosteroid is released: this can suppress the effectiveness of the Immune System by lowering the number of lymphocytes. Lack of sleep has also been proven to affect the Immune System - research shows that someone sleeping five to six hours a night has a far greater risk of catching a cold than someone who sleeps for seven hours.

Sleep is an area of considerable interest in immunology. There's an increasing number of papers looking at circadian rhythms - the Immune System seems to tune to what time of day it is. There was an interesting study a while back showing that if you vaccinated in the

morning you would get better immune responses than later in the day, and suggesting that your Immune System is heightened in the morning and starts to wane later on.

The tests to have if you're frequently ill

Indicators of serious immunodeficiency can include recurrent bouts of bronchitis and pneumonia, ear and sinus infections, meningitis, skin infections, blood disorders and infection of internal organs.

There's no hard and fast National Institute for Health and Care Excellence (NICE) guidance for GPs regarding how to manage recurrent viral infections in patients, though the cause of reduced immune response in adults is likely to be due to another disease or deficiency that has an effect on the Immune System, such as low thyroid hormone levels (hypothyroidism), type 2 diabetes, anaemia, or undiagnosed coeliac disease.

These conditions can be easily checked for by blood testing, but adults who present with recurrent infections can often pose a dilemma for GPs if no obvious immune deficiency can be established; factors include lifestyle influences such as obesity, smoking, lack of exercise, excess alcohol and poor diet. Asthma and allergies may also increase the frequency of recurrent mild infections, although they do not indicate an underlying impaired immune response.

Medication such as anti-autoimmune drugs and chemotherapy (during cancer treatment) can also impact upon immunity.

Children naturally suffer more mild self-limiting viral infections than adults and the frequency reduces with age (though in old age the Immune System becomes less effective).

At school, children will have around six or seven viral infections per year. "If they have more frequent infections, especially if these are complicated by a bacterial infection requiring antibiotics, they should be investigated. And it is crucial that children are fully immunised against common diseases."

It is also important for the elderly and those who may be immune-suppressed to get the flu vaccine each year.

The answer may lie in your genes

If you're prone to frequent bugs and sniffles, yet all tests prove normal and you're living a healthy lifestyle, it might be down to your genes.

It’s very hard to analyse in detail why some people get ill more often than others, as so many factors are involved, but undoubtedly your genome influences your adaptive immune response.

It has been agreed that: "Inheritance plays a strong part in determining the type and power of the immune response. The particular genes that you carry determine how efficiently you will recognise each virus or bacterium, and your risk of autoimmunity and allergic diseases. It is now known that variation between people in these genes is the main reason why some become ill with a certain infectious agent, while others don't."