Immunity for infinity and beyond

Constantly swallowing to check your throat isn't sore? Worried you're heating up with a fever? Discover the role your immune system plays when foreign cells like Coronavirus enter the body and what you can do to improve your immune defence.

Words Josh Reed

Your body, including your gut, skin and other mucosal environments, is colonised by a significant number of microbes. Collectively, they are referred to as your microbiota. Bacteria dominate your gut, yet archaea, fungi, viruses and parasites also exist in smaller numbers.

Your gut microbes deliver multiple functions that your body cannot live without, including production of nutrients, detoxication, regulation of your immune system, and protection against pathogens. Due to advances in technology, it is well understood that your gut microbiota plays a fundamental role in the induction, education and function of your immune system.

What is your immune system?

Your immune system refers to a collection of cells, chemicals and processes that function to protect your skin, intestinal tract, respiratory passages and other areas from foreign antigens including pathogenic microbes, cancer, toxins and alien cells.

In a nutshell, you have human cells that your body recognises as "self" and foreign antigens that your body recognises as "non-self". If "non-self" antigens or foreign cells enter your body, such as Coronavirus, your immune system is activated. This activation can be simplified into two major lines of defence: innate immunity and adaptive immunity.

Innate immunity

This is an immediate (within minutes to hours) defence mechanism that is non-specific, meaning it does not rely on a specific antigen to cause an immune response. This type of immunity has no memory and therefore is unable to recognise or memorise the same pathogens should it be exposed to it again.

It comprises four types of barriers: anatomic (skin and mucous membranes); physiologic (chemical mediators, low pH and temperature); phagocytic and endocytic; and inflammation. More specifically, your skin acts as a mechanical barrier that retards microbes entering, as

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well as creating an acidic environment that is undesirable for microbe growth.

Your mucous membranes contain millions of good microbes that compete with bad microbes for attachment sites. The mucus produced on your membranes also entraps foreign microbes and the tiny cilia that line the membranes propel them through coughing. Further to this, your body can spark a fever which inhibits the growth of some pathogens. Your stomach's strong acid content kills most undigested microbes and your immune cells (such as macrophages) attack foreign materials.

Adaptive immunity

This type of immunity is antigen-specific, requiring your immune system to adapt defences specific to a particular antigen such as the novel Coronavirus — with novel meaning new virus with no previous exposure. This system takes a little while to kick into gear because your body is developing a response before launching a major attack. The hallmark of this type of immunity is that it has memory, meaning it has the ability to learn or record its experiences with specific pathogens, leading to effective and rapid immune responses upon subsequent exposure. Chickenpox is a good example of this.

T cells and B calls are the major components of your adaptive immune system. T cells directly kill infected cells, store memories for subsequent responses, activate other immune cells, produce cytokines, plus regulate your immune response. B cells produce antibodies, present antigens to your T cells as well as differentiate into memory B cells for any subsequent infections.

Both your innate and adaptive immune systems are vital. They work in synergy and if either system is defected, it can lead to autoimmune diseases (e.g. coeliac disease), immunodeficiencies (e.g. AIDS), hypersensitivity reactions (e.g. food allergies) or ongoing and life-threatening infections.

Microbe mates

From the moment you were born, you have co-evolved with the microbes living in your gut. Under normal conditions, the foetal gastrointestinal tract (GIT) is believed to be sterile, with the first exposure to commensal (good) microbes occurring during the passage through the birth canal. These early interactions are fundamental and considered to set the tone of your mucosal and systemic immune system for the long term. Research shows that babies born via the vaginal passage have an increased gut microbiota diversity.

Further to this, breastfeeding and breast milk play another pivotal role in shaping the infant's gut microbiota. Colostrum and breast milk contain live microbes, immune cells, cytokines and many other important metabolites, including oligosaccharides that promote the growth and vitality of an infant's gut microbiota. A baby also receives microbes from the surface of the breast during breastfeeding. Studies show that these commensal microbes contribute to the fortification of an infant's intestinal barrier. Breastfed infants have also been shown to have higher levels of beneficial bifidobacteria. These are well known for their health-promoting probiotic properties. Leading on, infants weaned into consuming a large variety of wholefoods are additionally set up for a greater diversity of good gut microbes.

It's important to note that a healthy gut microbiota is characterised by a great diversity of bacterial species. On top of this, an infant's environment, siblings or lack of, pets or animal contact, and stress levels also significantly impact the health of their gut microbiota. For instance, studies show that growing up in microbe-rich environments, such as on traditional farms, increases the health and diversity of an individual's gut microbiota.

Crucial for your survival

Your gut microbes are critical in regulating your local intestinal immune system as well as having a profound influence on your systemic immune responses. In a nutshell, your gut microbiota immune functions include: educating the naïve infant immune system; producing immune stimulators throughout life to active your systemic immune response; claiming your gut lining property to prevent bad bugs finding gaps to harness; fighting off and detoxifying foreign pathogens that enter your gut; producing short-chain-fatty-acids (SCFAs) that feed and strengthen the barrier lining of your gut cells; lowering the pH of your large intestine (via SCFAs), making it undesirable for opportunistic pathogens to grow; and regulating your mucosal immune system. They also likely mitigate immune system hypersensitivity, for example preventing the development of food allergies.

Your unique gut microbiota is shaped in your first year of life and by about the age of three its true character is ultimately cemented. However, your present-day diet and lifestyle behaviours still have a profound influence on both maintaining and improving your gut microbiota and associated immune defence.

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5 ways to improve your gut microbiota and associated immune defence

1. Eat a variety of wholefoods such as grains, fruits, legumes, veggies, nuts and seeds. Aim to eat 30 or more different wholefoods per week.
2. Eat prebiotic foods often, such as onions, garlic, cabbage, chickpeas, lentils, oats, barley, cashews and cold potatoes.
3. Minimise gut irritants such as greasy foods, highly processed foods and nasty additives like emulsifiers.
4. Move your body daily, ideally outdoors in the natural environment.
5. Get seven to eight hours of good-quality sleep each night.

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