THE IMMUNE SYSTEM

How Does Your Immune System Work?

READING 2 · HOW DOES YOUR IMMUNE SYSTEM WORK?

Task 1 · Matching headings | Skim the text and match a heading (1–10) to each paragraph (A–H). Two headings are not needed.

1 Defence that has to be learned
2 Where immune cells are made and matured
3 Barriers that keep almost everything out
4 Why antibiotic resistance is increasing
5 Fast, powerful, but not selective
6 Telling self from non-self
7 Protection borrowed from another organism
8 Preparing the body in advance
9 When the judgement fails
10 What the system is and what it does

A	B	C	D	E	F	G	H
____	____	____	____	____	____	____	____

Now read the text.

A Every day your body meets an enormous number of microorganisms. Most of them are harmless; a small minority are pathogens — bacteria, viruses, fungi or parasites able to cause disease in a host. The immune system is the collection of organs, cells and proteins whose job is to keep those pathogens under control. It has three main tasks: to identify and destroy invading microorganisms, to neutralise harmful substances from the environment, and to remove the body's own cells when they become damaged or abnormal. When the system is working well, you notice nothing at all. You become aware of it only when it fails, or when it overreacts.

B The first line of defence never distinguishes one invader from another; it simply tries to keep everything out. Intact skin forms a tough physical barrier that very few microorganisms can cross. The airways are lined with sticky mucus, which traps particles, and with cilia — microscopic hairs that beat upwards in order to move the trapped material away from the lungs. Tears and saliva contain enzymes that break down bacterial cell walls, and the stomach produces acid strong enough to destroy most of what we swallow. None of this is "immunity" in the strict sense, but without it the rest of the system would be overwhelmed within hours.

C If a pathogen does get through, the innate immune system responds within minutes. Damaged tissue releases chemical signals; blood vessels widen so that more blood can reach the site; and the area becomes red, warm, swollen and painful. This reaction is called inflammation, and although it is uncomfortable, its purpose is to bring defensive cells and proteins exactly where they are needed. Phagocytes — literally "eating cells" — follow the chemical trail, attach to the invader, surround it and digest it inside the cell. The innate response is fast and it works against almost anything, but it is not precise, and it learns nothing.

D Precision comes from recognition. On the surface of every cell there are molecules that act as identity markers. The immune system is trained to tolerate the markers of the body's own cells; any marker it does not recognise is treated as an antigen — something foreign that must be dealt with. Immune receptors do not read the whole antigen: each one binds to a small, precisely shaped region called an epitope, rather in the way a key fits one particular lock. This is why the adaptive response is so specific, and also why a pathogen that changes the shape of its surface can escape recognition altogether.

E The adaptive immune system is built around lymphocytes. B lymphocytes respond to an antigen by multiplying rapidly and differentiating into plasma cells, which secrete large quantities of antibody. Antibodies do not usually kill anything themselves: they bind to antigens in order to block the pathogen's entry into host cells, to clump free particles together, and to mark the invader so that phagocytes can clear it more easily. T lymphocytes take a different route. Helper T cells release cytokines to activate and coordinate the rest of the response, while cytotoxic T cells destroy the body's own cells once those cells have been infected from within. The adaptive response takes days rather than minutes — but it is targeted.

F These cells have to be produced, matured and stored somewhere. Bone marrow, the soft tissue inside long bones, generates all blood cells, including every lymphocyte. Immature T cells then travel to the thymus, a small organ behind the breastbone, in order to be tested: those that would attack the body's own tissue are eliminated there. Mature cells circulate in the blood and in the lymphatic system, a network of thin vessels that drains fluid from the tissues. Along these vessels sit the lymph nodes, where antigens are concentrated and where lymphocytes are most likely to meet the invader they were made for. The spleen performs a similar filtering role for the blood itself.

G The most useful feature of adaptive immunity is that it does not forget. After an infection has been cleared, a small population of memory cells survives, sometimes for decades. If the same antigen appears again, these cells reactivate almost immediately, and antibody levels rise far higher and far faster than the first time. Vaccination exists in order to create this memory without the risk of the disease itself: a weakened, killed or partial form of the pathogen is introduced, the adaptive system responds as it would to a real infection, and memory cells are formed. When the real pathogen is encountered later, the response is already prepared.

H A system this powerful can also go wrong, and it does so in three broad ways. In autoimmune disease the immune system loses tolerance and attacks healthy tissue: rheumatoid arthritis, type 1 diabetes and multiple sclerosis are examples, and roughly eighty per cent of patients are women. In allergy — or hypersensitivity — the system mounts a full response against a substance that is in fact harmless, such as pollen or a food protein. In immunodeficiency the response is too weak; this may be congenital, or acquired through infection or medical treatment. In each case the problem is not the strength of the immune system but the accuracy of its judgement.

Task 2 · True / False / Not Given | Write T, F or NG.

#	STATEMENT	T / F / NG
1	The immune system also removes the body's own cells when they become abnormal.	____
2	Most of the microorganisms we meet every day cause disease.	____
3	Cilia move trapped material downwards, towards the lungs.	____
4	According to the text, inflammation is an unnecessary reaction that should always be suppressed.	____
5	One antibody binds to the entire surface of an antigen.	____
6	Antibodies normally destroy pathogens by breaking them apart themselves.	____
7	Immature T lymphocytes complete their development in the thymus.	____
8	Vaccines always contain a live, fully active pathogen.	____
9	About four out of five autoimmune-disease patients are women.	____
10	Antibody tests are the cheapest way of diagnosing an autoimmune disease.	____

Task 3 · Vocabulary in context | Find a word or phrase in the paragraph shown that means:

1. (B) whole, unbroken, not damaged — adjective _____
2. (B) completely defeated by something too large to cope with — verb _____
3. (C) to become wider — verb _____
4. (D) to accept something without reacting against it — verb _____
5. (E) to stick together in a mass — phrasal verb _____
6. (F) to remove or destroy completely — verb _____
7. (G) made less strong or less dangerous — adjective _____
8. (H) present from birth — adjective _____

Task 4 · Summary gap-fill | Complete with ONE word from the box. There are two extra words.

adaptive · antigen · barriers · congenital · cytokines · epitope · inflammation · innate · memory · phagocytes · tolerance · virulence

Human defence begins with physical and chemical (1) _____, which stop most microorganisms from entering at all. If one gets through, the (2) _____ system reacts within minutes, producing (3) _____ — redness, heat and swelling — so that defensive cells can reach the site. (4) _____ then engulf and digest the invader. A slower but far more precise response follows. Any surface molecule the body does not recognise is treated as an (5) _____, and each receptor binds only to one small region of it, known as an (6) _____. Helper T cells release (7) _____ in order to coordinate the response, while B cells differentiate into plasma cells and secrete antibody. Once the infection is over, (8) _____ cells remain, which is why the second response is faster. The system can also fail: it may lose (9) _____ and attack the body itself, overreact to a harmless substance, or — if the deficiency is (10) _____ — be too weak from birth.

Task 5 · Sequencing | Put events A–G in chronological order on the timeline.

A Lymphocytes produce antibodies that match the pathogen's antigen.

B Phagocytes engulf and digest the marked pathogens.

C A pathogen enters the body through a cut, the mouth or the airways.

D The antibodies bind to the antigens and mark the pathogens for destruction.

E The pathogen multiplies and the person begins to feel unwell.

F The pathogens are destroyed and memory cells remain in the body.

G White blood cells recognise the antigens on the surface as foreign.

Write the letters in the correct order:

1	2	3	4	5	6	7
_____	_____	_____	_____	_____	_____	_____