What is an antigen?

An antigen is a substance specifically recognised by antibodies or lymphocyte receptors. Recognition of a foreign antigen can stimulate a specific immune response.

1. MOLECULES THAT CAN BE RECOGNISED

Many antigens are proteins, glycoproteins or polysaccharides. They may occur on cell or pathogen surfaces, but can also be soluble molecules such as toxins. Antigens are not restricted to living microbes.

2. KEEP THREE IDEAS SEPARATE

Pathogen	The disease-causing organism or agent, such as a bacterium.
Antigen	A molecular feature that can be recognised, such as a bacterial surface protein.
Antibody	A specific binding protein secreted by plasma cells; it binds a complementary region on an antigen.

3. ONE PATHOGEN, MANY ANTIGENS

A bacterium can carry many different antigenic molecules. Even one large antigen may have several recognition sites, called epitopes. Different antibodies can therefore recognise different parts of the same microbe.

Useful distinction: an antigen is recognised; an antibody recognises and binds. Neither word is another name for the whole pathogen.

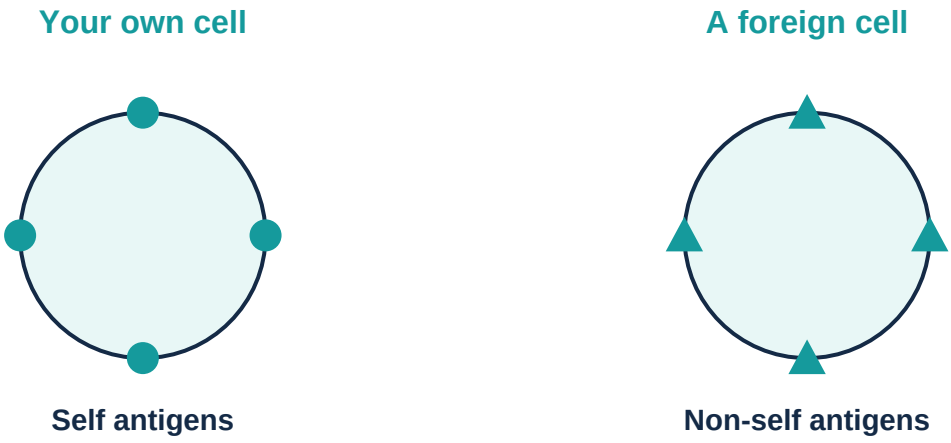
Antigen definition and examples: National Cancer Institute, Dictionary of Cancer Terms.
Specificity, epitopes and antibodies: OpenStax, Microbiology 18.1.

Scope: Cambridge Biology 9700 syllabus, section 11.1, outcome 2, p. 31.

Self and non-self

The distinction is relative to the individual. The immune system normally tolerates the body's own antigens while remaining able to respond to foreign ones.

1. SURFACE MARKERS: A SIMPLE MODEL



Shapes represent different molecular markers, not literal antigen shapes. Cells have many markers; the diagram highlights only the self/non-self comparison.

2. SELF ANTIGENS AND TOLERANCE

Self antigens belong to the individual's own cells and molecules. Immune tolerance normally prevents a damaging response to them. Self-reactive lymphocytes can be removed, inactivated or controlled; self does not mean "no antigens".

3. NON-SELF ANTIGENS

Non-self antigens are foreign to that individual, for example microbial molecules or some donor-cell markers. They can provoke a specific response. Recognition does not mean every foreign substance is automatically attacked: immune regulation and context matter.

Self-tolerance: OpenStax, Microbiology 19.2, Autoimmune Disorders.
Foreign donor markers: British Society for Immunology, Transplant Immunology.

Scope: Cambridge Biology 9700 syllabus, section 11.1, outcome 2, p. 31.

Apply the distinction

Ask two questions: what molecule is being recognised, and whose immune system is recognising it? This prevents common mix-ups about antigens.

1. A BACTERIAL SURFACE MOLECULE

A bacterial surface antigen is non-self to a human host. A matching antibody can bind it. The antigen is a molecular target on the bacterium, not the whole bacterium or the antibody.

2. A TRANSPLANTED ORGAN

Donor cells are human cells, yet their surface markers can differ from the recipient's. Some donor antigens are non-self to the recipient and may trigger rejection. The same markers are self to the donor.

3. AN AUTOIMMUNE RESPONSE

If self-tolerance fails, immune responses can damage the body's own tissues. The recognised molecules remain self antigens; they do not become foreign just because the immune system attacks them.

4. SPECIFIC RECOGNITION

Antibody binding depends on a complementary binding site and antigenic region. Different lymphocytes carry different receptors. This diversity lets the adaptive immune system recognise many targets while normal tolerance limits responses against self.

Take-home idea: antigen describes a recognised molecule; self or non-self describes its relationship to a particular individual.

Self-tolerance and autoimmunity: OpenStax, Microbiology 19.2.
Donor versus recipient: BSI, Transplant Immunology; specificity: page 1.

Scope: Cambridge Biology 9700 syllabus, section 11.1, outcome 2, p. 31.