

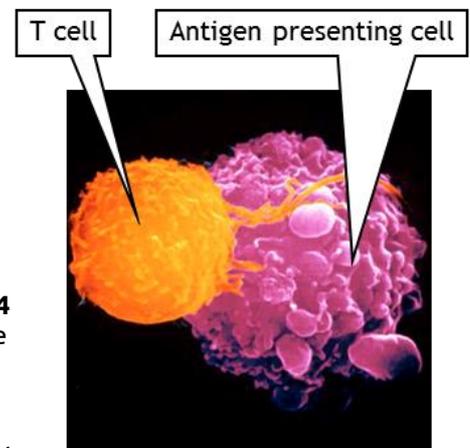
# Helper and Cytotoxic T cells



Original author: **Tracy Hussell, University of Manchester, UK**  
 Updated by: **Hannah Jeffery, University of Birmingham**

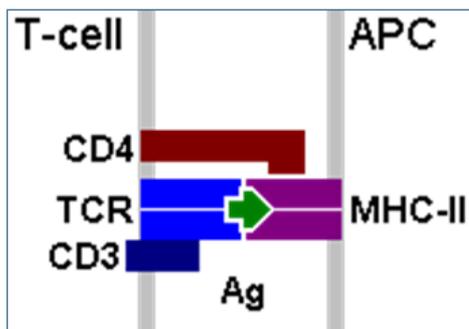
T cells are so called because they are predominantly produced in the **thymus**. They recognise foreign particles (**antigen**) by a surface expressed, highly variable, **T cell receptor (TCR)**. There are two major types of T cells: the **helper T cell** and the **cytotoxic T cell**. As the names suggest helper T cells 'help' other cells of the immune system, whilst cytotoxic T cells kill virally infected cells and tumours.

Unlike antibody, the TCR cannot bind antigen directly. Instead it needs to have broken-down peptides of the antigen 'presented' to it by an **antigen presenting cell (APC)**. The molecules on the APC that present the antigen are called **major histocompatibility complexes (MHC)**. There are two types of MHC: MHC class I and MHC class II. **MHC class I** presents to cytotoxic T cells; **MHC class II** presents to helper T cells.

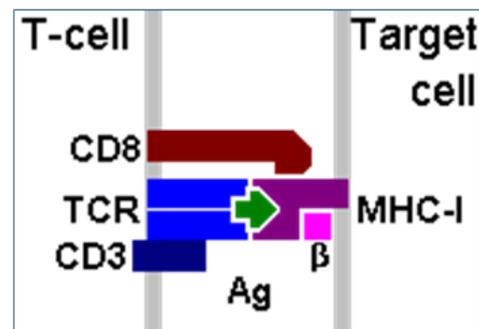


The binding of the TCR to the MHC molecule containing the antigen peptide is a little unstable and so **co-receptors** are required. The **CD4 co-receptor** (left image, below) is expressed by helper T cells and the **CD8 co-receptor** (right image, below) by cytotoxic T cells. Although most T cells express either CD4 or CD8, some express both and proportion do not express either ("double negative" (DN)). Most T cells are defined as CD4 or CD8 but some are classified into additional types such as invariant Natural Killer T cells (iNKT), and Mucosal Associated Invariant T cells (MAIT)

**Helper T cell**



**Cytotoxic T cell**



The TCR is made up of multiple chains to assist the **transmission** of the signal to the T cell. These chains are **alpha + beta**. The majority of T cells are alpha-beta T cells but alpha-alpha T cells do exist. There is also a special group of T cells with gamma and delta chains instead of alpha and beta called gamma-delta ( $\gamma\delta$ ) T cells. In order for the stimulus of antigen binding to the TCR to be relayed into the T cell, the TCR is associated with the protein complex CD3 which is made up of four types of chains including two **epsilon chains**, two **zeta chains**, one **delta** and one **gamma chain**.