Treg cells play a crucial role in suppressing physiological immune responses and preventing sustained or exaggerated responses. They are important for maintaining self-tolerance and suppressing autoreactive T cell responses, which is essential for preventing autoimmune diseases. Treg cells secrete cytokines that inhibit the activities of effector T cells and prevent the development of chronic inflammation.

**Regulatory T (Treg) Cells**

- **CD4+ Treg cells** are a subset of CD4+ T cells that express the transcription factor FoxP3 and the surface marker CD25.
- Treg cells are essential for maintaining immune tolerance by suppressing the activation and proliferation of autoreactive T cells.

**Secreted Factors**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL-10</td>
<td>Promotes suppression of immune responses</td>
</tr>
<tr>
<td>IFN-γ</td>
<td>Suppressed in Treg cells</td>
</tr>
<tr>
<td>IL-4</td>
<td>Essential for the development of Treg cells</td>
</tr>
</tbody>
</table>

**Surface Markers**

- **CD25** (interleukin-2 receptor α chain)
- **FoxP3**
- **CTLA-4**
- **CD127**

**Cell Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD39**

**Transcription Factors**

- **FoxP3**
- **CTLA-4**
- **Tac**
- **CD40L** (CD154)
- **IFN-γR1**

**Cellular Activities**

- Treg cells are involved in the regulation of immune responses through the secretion of cytokines and cell contact-dependent mechanisms.
- They can inhibit the proliferation of effector T cells and diminish the production of pro-inflammatory cytokines.

**Cytotoxic T Lymphocytes (CTL)**

- **CD8+ T cells** express the T cell receptor (TCR) that recognizes peptide antigens presented by MHC class I molecules.
- Upon activation, CTLs become activated and can directly kill infected cells or target cells expressing specific antigens.

**Secreted Factors**

- **IFN-γ**
- **TNF-α**
- **Granzyme B**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161** (NKG2D ligand)

**Transcription Factors**

- **T-bet**
- **Eomes**
- **Stat1**
- **Stat4**

**Cellular Activities**

- CTLs are responsible for the destruction of infected cells and the prevention of viral replication.
- They can also indirectly target cancer cells by inducing cell death through the release of cytotoxic granules.

**Helper T Cells**

- **Th1 cells** are activated by CD4+ T cells and secrete cytokines like IFN-γ, which are involved in the activation of macrophages and the elimination of intracellular pathogens.
- **Th2 cells** are activated by CD4+ T cells and secrete cytokines like IL-4, IL-5, and IL-13, which are involved in the activation of B cells and the generation of antibodies.

**Secreted Factors**

- **IFN-γ**
- **IL-4**
- **IL-13**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Transcription Factors**

- **Oct-2**
- **Stat1**
- **IFN-γR1**

**Cellular Activities**

- Th1 cells are important in the fight against intracellular pathogens like viruses and bacteria.
- Th2 cells are important in the fight against extracellular pathogens and play a role in the regulation of allergic responses.

**Th17 Cells**

- **Th17 cells** are activated by CD4+ T cells and secrete cytokines like IL-17, which are involved in the activation of neutrophils and the recruitment of other immune cells to sites of infection.

**Secreted Factors**

- **IL-17**
- **IL-6**
- **TNF-α**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Transcription Factors**

- **Batf**
- **Rorc**
- **Il17a**

**Cellular Activities**

- Th17 cells are important in the fight against extracellular pathogens and play a role in the regulation of autoimmune responses.

**Th9 Cells**

- **Th9 cells** are activated by CD4+ T cells and secrete cytokines like IL-4, which are involved in the regulation of B cell differentiation.

**Secreted Factors**

- **IL-4**
- **IL-5**
- **IL-13**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Transcription Factors**

- **Oct-2**
- **Stat1**
- **IFN-γR1**

**Cellular Activities**

- Th9 cells have a putative physiological role in host defense against extracellular pathogens.

**Tfh Cells**

- **Tfh cells** are activated by CD4+ T cells and secrete cytokines like IL-21, which are involved in the differentiation of B cells into plasma cells.

**Secreted Factors**

- **IL-21**
- **IL-6**
- **TNF-α**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Transcription Factors**

- **Oct-2**
- **Stat1**
- **IFN-γR1**

**Cellular Activities**

- Tfh cells regulate the development of antigen-specific B cell immunity.

**NKT Cells**

- **NKT cells** are activated by CD4+ T cells and secrete cytokines like IL-13, which are involved in the regulation of immune responses.

**Secreted Factors**

- **IL-13**
- **IL-6**
- **TNF-α**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Transcription Factors**

- **Oct-2**
- **Stat1**
- **IFN-γR1**

**Cellular Activities**

- NKT cells are involved in the regulation of immune responses and can differentiate into Th1 or Th2 cells.

**TCR Subsets**

- **αβ TCR** is expressed on the majority of T cells and is involved in the recognition of protein antigens presented by MHC class I or II molecules.
- **δε TCR** is expressed on γδ T cells and is involved in the recognition of glycolipid antigens presented by the MHC I-like molecule CD1d.
- **γδ TCR** is expressed on γδ T cells and is involved in the recognition of glycolipid antigens presented by the MHC I-like molecule CD1d.

**Cell Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Cellular Activities**

- The TCR recognizes different types of antigens depending on the T cell subset, allowing for a diverse range of immune responses.

**Adaptive Immunity**

- T cells play a central role in the adaptive immune response, coordinating the activation and differentiation of other immune cells.
- They are responsible for the destruction of infected cells and the regulation of immune responses.

**Secreted Factors**

- **IFN-γ**
- **IL-2**
- **TNF-α**

**Surface Markers**

- **CD3**
- **CD4**
- **CD8**
- **CD28**
- **CD161**

**Transcription Factors**

- **Oct-2**
- **Stat1**
- **IFN-γR1**

**Cellular Activities**

- T cells are involved in a wide range of immune responses, including the elimination of infected cells, the regulation of immune responses, and the activation of other immune cells.

**Innate Immunity**

- T cells play a crucial role in the innate immune response by activating and regulating other immune cells.
- They are essential for the maintenance of immune homeostasis and the prevention of infections.