Hemolytic disease of the newborn is caused primarily by clearance of fetal Rh+ red blood cells that have bound maternal Rh IgG.

Cytotoxic clearance of the IgG bound fetal blood cells occurs primarily via destruction by macrophages in the fetal spleen.

In contrast, RBCs bound by recipient IgM in transfusion reactions are agglutinated, then eliminated primarily by complement activation and hemolysis of the transfused RBCs.

Important terms:

Hypersensitivity – immune responses that causes tissue damage

Autoimmune disease – immune responses to self-antigens

Immunodeficiency – insufficient immune response
Topics

- Transplantation immunity
- Autoimmune diseases
- Immunodeficiency disorders

Transplantation immunity
Transplantation immunity

- Allografts
- Xenografts
- Genetically non–identical grafts cause rejections
- Type IV reaction – delayed cell-mediated
  Immunological rejection of transplant
    - Killing of graft by sensitized cytotoxic T cells
    - Natural killer cells (ADCC)
    - MHC antigens major cause of rejection
      - abundant on leukocytes = HLAs
      - tissue typing minimizes incompatibility

Requires immunosuppression for successful transplants

- minor antigens cause rejection
- immunosuppressants may be needed indefinitely
Transplantation immunity

- Allografts
- Xenografts
- Genetically non–identical grafts cause rejections
- Type IV reaction – delayed cell-mediated

Immunological rejection of transplant

- Killing of graft by sensitized cytotoxic T cells
- Natural killer cells (ADCC)
- MHC antigens major cause of rejection

Requires immunosuppression for successful transplants

- Cyclosporin A, tacrolimus
- Interfere with cell signaling
- Inhibit clonal expansion of T cells
- Specificity leads to fewer side effects than radiation and cytotoxicity inhibitors

The fetus as allograft (Perspective 18.1 – page 452)

half the fetus’ antigens are foreign (father’s)

fetus is thus an allograft, but is not rejected. Why?

mother makes anti-Rh, anti-MHC antibodies

mother in fact has small number of fetal cells in circulation

therefore not due to lack of exposure to fetal antigen

trophoblast forms barrier as outer layer of placenta

no MHC molecules expressed

NK cells suppressed

“immunologically privileged” sites; do not drain via lymph

avoid APCs and immune stimulation

also produce immunosuppressive cytokines

pregnancy also causes immunosuppression in mother
Autoimmune disease

Negative selection eliminates self reactive lymphocytes
Autoimmune diseases caused by body responding to self antigens
MHC genes involved; genetically based

Autoimmune disease

• Spectrum of autoimmune reactions
• Treatment of autoimmune diseases
Type III Hypersensitivity

- Treatment of autoimmune diseases
  - Immunosuppressants (eg cyclosporins)
  - Anti – inflammatory drugs (eg steroids)
  - Replacement therapy (eg insulin, thyroid hormone)

  *including transplantation of pancreatic insulin-producing cells for insulin-dependent diabetes*
Treatment of autoimmune diseases

- Immunosuppressants (eg cyclosporins)
- Anti-inflammatory drugs (eg steroids)
- Replacement therapy (eg insulin, thyroid hormone)
- Feeding or oral tolerance (induce tolerance to antigen)
  - Feed insulin for diabetes
  - Collagen for rheumatoid arthritis
  - Cause local intestinal immune response, down regulation of antigen receptors, deletion of immune cells

Immunodeficiency disorders

- Primary immunodeficiencies (genetic, inborn)
- Secondary immunodeficiencies (acquired, disease)
Primary immunodeficiencies

- Lack of B-cell function
- Lack of the different T-cell functions
- Lack of both T and B cell functions
- Defective phagocytes

Table 18.6 Some Primary Immunodeficiency Diseases for Which Genetic Defects Are Known

<table>
<thead>
<tr>
<th>Severe combined immunodeficiency (SCID)</th>
<th>X-linked hyper-IgM syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-linked SCID</td>
<td>Wiscott-Aldrich syndrome</td>
</tr>
<tr>
<td>MHC class II deficiency *</td>
<td>Ataxia telangiectasia</td>
</tr>
<tr>
<td>CD3 deficiency</td>
<td>* Chronic granulomatous disease</td>
</tr>
<tr>
<td>CD8 deficiency</td>
<td>* Leukocyte adhesion deficiency</td>
</tr>
<tr>
<td>X-linked agammaglobulinemia no Ig</td>
<td>* Many complement deficiencies</td>
</tr>
</tbody>
</table>
Treatments for primary immunodeficiencies

eg SCID children

bone marrow transplants
repair faulty genes

adenosine deaminase needed for B, T cell proliferation
replacement therapy with enzyme
collect T cells, introduce deaminase gene

Secondary immunodeficiencies

- Malnutrition
- Immunosuppressive agents
- Infections (measles, AIDS, SARS, promote secondary infections)
- Malignancies (multiple myeloma – from one B cell)
  consumes immune resources
can’t mount normal responses