Topics

- Type III hypersensitivity
- Type IV hypersensitivity

Type III hypersensitivity

- Immune complex – mediated
- Activates complement
- Inflammation
Figure 18.5 Immune complex - mediated

Figure 22.7 Glomerulonephritis
### TABLE 18.3 Pathogenesis of Immune Complex Disease

1. Antibody combines with excess soluble antigen.
2. The antibody-antigen combination reacts with complement.
3. Complexes are deposited in sites such as skin, kidney, and joints.
4. Fragments of complement cause release of histamine and other mediator substances from mast cells or basophils and also attract neutrophils.
5. Release of the mediators causes increased permeability of blood vessel walls.
6. Immune complexes penetrate or form in blood vessel walls.
7. Neutrophils enter the vessel walls chemotactically.
8. Neutrophils release lysosomal enzymes, especially proteases, that induce tissue injury.

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**Type III hypersensitivity and disease**

**Excess antigen**
- farmer’s lung
- bacterial endocarditis
- malaria

**Streptococcus pyogenes skin and throat infections**
- acute glomerulonephritis

**Rubella (German measles), early symptoms**
- rash, painful joints, fever

**Disseminated intravascular coagulation**
- clots form in small blood vessels; organ failure

**Arthus reaction – local reaction in response to injected antigen**

**Serum sickness – passive immunization with animal serum**
- antisera against diphtheria, tetanus

**Antigens in foreign serum induce immune response**
Type IV hypersensitivity

- Delayed cell – mediated
- Tuberculin skin test
- Contact hypersensitivities (*contact dermatitis*)

Type IV hypersensitivity

- Delayed cell – mediated
- Tuberculin skin test
- Contact hypersensitivities
- Infectious diseases
Delayed cell-mediated

- Delayed hypersensitivity
- Sensitized T lymphocytes

Figure 18.6 Tuberculin skin test

Redness, induration due to sensitized T cells reacting with antigen, followed by release of cytokines and influx of macrophages.

PPD – purified protein derivative
Figure 18.7 Contact hypersensitivities

Figure 18.8 Severe contact hypersensitivity
Common examples of contact hypersensitivity

- poison ivy, poison oak
- nickel in metal jewelry
- chromium salts in leather products
- cosmetics
- latex products (IgE-mediated Type I reactions also)
- plant protein induces sensitization
- use vinyl gloves
- potential allergens detected with patch test

Infectious disease

- Protective function cause tissue damage
- Ex. Leprosy (damaged sensory nerves; Mycobacterium leprae)
- Tuberculosis (granulomas form – tubercules; persistent Mycobacterium tuberculosis infection)
- Leishmaniasis (Leishmania species survive within macrophages)
- Herpes simplex (HSV-1, HSV-2 infects nerve cells emerges as cold sores, genital herpes)
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type I hypersensitivity</th>
<th>Type II hypersensitivity</th>
<th>Type III hypersensitivity</th>
<th>Type IV hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Immediate; IgE-mediated</td>
<td>Cytotoxic</td>
<td>Immune complex-mediated</td>
<td>Delayed cell-mediated</td>
</tr>
<tr>
<td>Cell type responsible</td>
<td>B cells</td>
<td>B cells</td>
<td>B cells</td>
<td>T cells</td>
</tr>
<tr>
<td>Type of antigen</td>
<td>Soluble</td>
<td>Cell-bound</td>
<td>Soluble</td>
<td>Soluble or cell-bound</td>
</tr>
<tr>
<td>Type of antibody</td>
<td>IgE</td>
<td>IgG, IgM</td>
<td>IgG</td>
<td>None</td>
</tr>
<tr>
<td>Other cells involved</td>
<td>Basophils, mast cells</td>
<td>Red blood cells, white blood cells, platelets</td>
<td>Various host cells</td>
<td>Various host cells</td>
</tr>
<tr>
<td>Mediators</td>
<td>Histamine, serotonin, leukotrienes</td>
<td>Complement, ADCC</td>
<td>Complement, neutrophil proteases</td>
<td>Complement, neutrophil proteases</td>
</tr>
<tr>
<td>Transfer of hypersensitivity</td>
<td>By serum</td>
<td>By serum</td>
<td>By serum</td>
<td>By T cells</td>
</tr>
<tr>
<td>Time of reaction after challenge with antigen</td>
<td>Immediate, up to 30 minutes</td>
<td>Hours to days</td>
<td>Hours to days</td>
<td>Peaks at 48 to 72 hours</td>
</tr>
<tr>
<td>Skin reaction</td>
<td>Urticarial rash</td>
<td>None</td>
<td>Arthus</td>
<td>Induration, necrosis</td>
</tr>
<tr>
<td>Examples</td>
<td>Anaphylactic shock, hay fever, hives</td>
<td>Transfusion reaction, hemolytic disease of newborns</td>
<td>Serum sickness, farmer's lung, malarial kidney damage</td>
<td>Tuberculin reaction, contact dermatitis, tissue transplant rejection</td>
</tr>
</tbody>
</table>