## Disorders Associated with the Immune System

- Hypersensitivity
- over-reaction of immune system resulting in host tissue damage or death
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  - Transplant rejection
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### Hypersensitivity Reactions

- Response to antigens (allergens) leading to damage.
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- 4 (or 5) types

### Type I (Anaphylactic) Reactions

- Type I (Immediate-type) hypersensitivity (anaphylactic)
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- IgE bound to mast cells and basophils
- mast cells especially contain granules of histamines
- upon exposure to allergen (antigen causing allergy), mast cell "degranulation" occurs

- histamines released → itching, edema (increased capillary permeability), vascular dilation (erythema), smooth muscle contraction (ex. bronchial constriction-- not asthma) = allergy symptoms
- asthma mediated by leukotrienes and prostaglandins (synthesized by activated mast cells )

- location of symptoms depends on location of mast cells
- respiratory tract →
- itchy and watery eyes, noses, increased mucous secretion
- intestinal tract → food allergy symptoms often not manifested in GI tract (ex. hives, systemic anaphylaxis)
- skin → local inflammation (ex. _____)
- Generally speaking, these represent localized anaphylaxis

- Type I systemic anaphylactic shock
- exposure to antigen (usually injected somehow) triggering peripheral blood vessel dilation throughout entire body ↓ blood pressure →
- massive histamine and other mediator (leukotrienes, prostoglandins) release → edema, respiratory constriction →
- immediate treatment with adrenalin (_____) required

- 1st exposure to allergen =
- 2nd exposure = shocking dose, significant to massive allergic response

### Allergy Desensitization

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- Desensitization
  - process of exposing allergic host to controlled doses of allergen(s)

- induces formation of IgG's to allergen
- IgG's do not induce mast cell degranulation
- IgG' compete with IgE's for binding antigen =
- if allergens bound to IgG's, they can't bind to IgE mast cells

- effectiveness variable, may be as high as 75% effective for inhaled antigens and up to 97% effective for insect venoms

**Type II (_____) Reactions**

- Involve IgG or IgM antibodies and complement.
- Complement activation causes cell lysis or damage by macrophages.
- target cell lysis mediated by Ab's (IgG, IgM), complement, killer cells
- associated with incompatible blood transfusions and hemolytic disease of newborns

**Type III (_____) Reactions**

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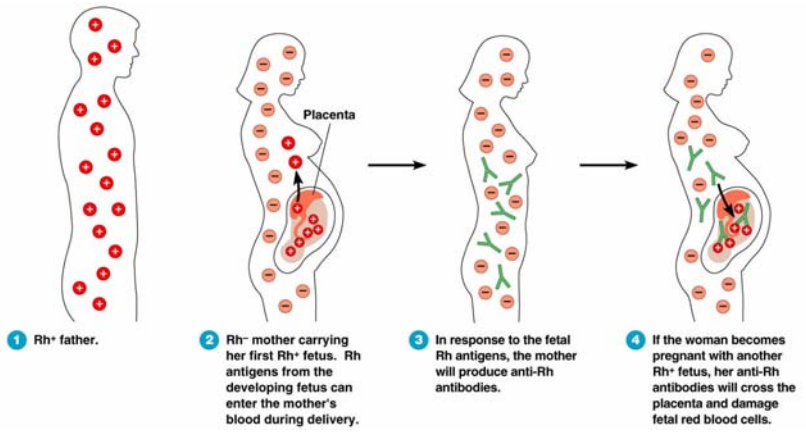
- An-Ab complexes get deposited on membranes in various tissues (ex. kidney, joints, lungs) → inflammation and complement activation → local destruction of host tissue (ex. glomerulonephritis)




**Type IV (_____) Reactions**

- cell mediated response
- 24-48 hrs after contact with antigen
- most common =
- 1st exposure =
- 2nd exposure →
- skin inflammation and destruction of epidermal cells (blistering)
- urushiol oils (poison ivy), cosmetics, soaps, drugs (ex. penicillin), metals (ex. nickel), iodine
- most are haptens requiring tissue proteins →

Which hypersensitivities are humoral?

**Autoimmune Diseases**

- Clonal deletion during fetal development ensures self-tolerance.
  - self recognizing T and B cells normally destroyed or suppressed during fetal development
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- Abs (_____) and T cells attack host cells

- Type I — Due to antibodies against pathogens.
- Type II — Antibodies react with cell-surface antigens.
- Type III (Immune Complex) — IgM, IgG, complement immune complexes deposit in tissues.
- Type IV —
- Type V (_____) – similar to Type II but antibodies bind specifically to cell surface receptors

| Type | Example | Target Tissue |
|---|---|---|
| Type II – Cytotoxic<br>(Type V – Stimulatory) | Grave's disease | thyroid→ stimulation |
| Type III - Immune complex | Lupus | systemic, Abs against cell components, kidneys |
| | Rheumatoid arthritis | joints, chronic inflammation caused by immune complexes and complement deposition |
| Type IV - T cell mediated | insulin-dependent diabetes | insulin secreting cell of pancreas |

**Reactions to Transplantation**

- Transplants may be attacked by T cells, macrophages, and complement-fixing antibodies.
- privileged site - region not exposed to immune surveillance (ex. brain, region of cornea, testes)
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- privileged tissue - does not stimulate immune system (ex. heart valves, Achilles tendon [after freezing], fetus)

**Grafts**

- Autograft:
- Isograft: Use of identical twin's tissue.
- Allograft: Use of tissue from another person.
- Xenograft:
- Graft-versus-host disease can result from transplanted bone marrow that contains immunocompetent cells.

**Immunosuppression Prevents an Immune Response to Transplanted Tissues**

- In order to prevent transplant rejection, the immune response must be partially suppressed.
- A variety of drugs exist. (e.g., )

- patients become more prone to cancer and infections

**Study Objectives**

1. Describe each of the 4 main types of hypersensitivities including: mediators, allergens/antigens, etc. and give examples.

2. Compare and contrast local anaphylaxis with systemic anaphylaxis.

3. Describe hemolytic disease of newborns and how it can be prevented.

4. Describe autoimmune disease and give examples.

5. Define: privileged site/tissue, auto-, iso-, allo-, xenografts, graft vs. host disease.

6. Why is immunosuppression required for transplant patients? What are some of the consequences?