

# Lec1 summary. introduction to immunity

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## Immunology:

- The study of the components and function of the immune system.

## Immune System:

- Comprised of molecules, cells, tissues, and organs that provide non-specific and specific protection against microorganisms, microbial toxins, and tumor cells.
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## Antigens & Immunogens:

- **Immunogen**: A substance that induces a specific immune response, leading to the production of antibodies or immune lymphocytes.
- **Antigen**: Any molecule that binds to immune system components but doesn't necessarily induce an immune response.
- *Immunogens are always antigens, but not all antigens are immunogenic.*

## Factors Affecting Immunogenicity:

- **Nature of the Immunogen:**
    - **Foreignness**: Self-antigens typically do not induce an immune response.
    - **Molecular Weight**: A minimum molecular weight is necessary for immunogenicity:
      - <1000 daltons: Not immunogenic (e.g., penicillin).
      - 1000-6000 daltons: May or may not be immunogenic (e.g., insulin).
      - 6000 daltons: Immunogenic (e.g., albumin, tetanus toxin).
    - **Chemical Structure Complexity**: Heteropolymers are more immunogenic than homopolymers.
  - **Biological Factors:**
    - Dosage, route of administration (Subcutaneous > Intravenous > Intra-gastric), individual genetic differences, and the use of adjuvants.
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## Adjuvants:

- Substances that enhance immunogenicity without changing the chemical composition.
  - **Examples include** inorganic compounds (e.g., alum), mineral oils, bacterial products, and Freund's adjuvants.
  - **Mechanisms**: Extend antigen presence, aid absorption, activate macrophages and lymphocytes, support cytokine production.
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### Haptens:

- Low molecular weight nonantigenic molecules that cannot induce an immune response on their own but react with immune system products.
- Can become immunogenic when bound to a carrier molecule.
- **Examples:** Antibiotics, analgesics.
- Some haptens can form bonds with self-proteins, potentially leading to autoimmune diseases or drug allergies.

### Drug Allergy:

- Adverse immunological reactions to certain antigens (e.g., antibiotics).
  - **Mechanism:** Penicillin forms hapten-carrier conjugates, generating IgE antibodies that cause allergic reactions upon second exposure.
  - **IgE cross-reactivity** can occur with structurally similar antibiotics.
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### Epitopes:

- Sites on antigens where antibodies react, consisting of small amino acid or monosaccharide residues.
  - Polyvalent antigens have many epitopes of different specificities, while multivalent antigens have many epitopes of the same specificity.
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### Characteristics of the Immune Response:

- **Specificity:** Discrimination between different molecular entities.
  - **Discrimination:** Differentiation between "self" and "nonself" antigens.
  - **Memory:** Ability to recall previous foreign molecules and respond faster.
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## Types of Immunity:

- **Acquired Immunity:**
  - **Natural:**
    - **Active Immunity:** Antigens naturally enter the body, triggering long-term protection.
    - **Passive Immunity:** Antibodies are transferred from mother to fetus/infant, providing short-term protection.
  - **Artificial:**
    - **Active Immunity:** Antigens introduced via vaccination, providing long-term protection.
    - **Passive Immunity:** Transfer of antibodies from an immune individual for short-term protection.
- **Adoptive Immunity:** Transfer of immunity through immune cells.

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