

## Properties of B and T Cell Antigen/Immunogens

- Overview of B and T cell Receptor structures
- Differences in B and T cell epitopes
- Properties of B and T cell epitopes
- Haptens

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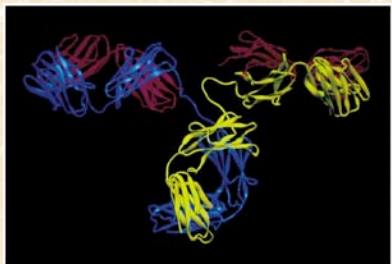
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## Immunoglobulin Structure



← -Variable Domain  
-Binds Antigen

← -Constant Domain  
-No Antigen Binding

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## Some definitions...

- EPITOPES are the ANTIGENIC DETERMINANTS which are recognized by immunoglobulin/antibody or by the T cell receptors
- these are the "business" end of the antigen, where specificity takes place

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### B cell Epitopes

- B cells recognize 3-dimensional "epitopes" on unprocessed antigens
  - No other molecules are required for binding.
- Generally, good B cell epitopes are external (accessible), hydrophilic (charged) peptides which may contain sequential or non-sequential amino acids

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### Antigen-Antibody Interactions

- Regulated by weak non-covalent interactions
- The ANTIGEN may be much larger than the antibody binding site, however the EPITOPE must fit into the antigen-binding groove of the antibody.

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### Antigen-Antibody interactions

- Behave like a "lock-and key" between antibody and epitope.
- Binding occurs through MULTIPLE interactions between antibody and antigen.

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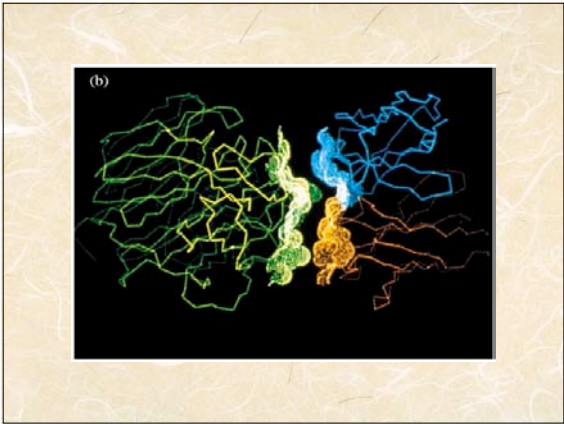
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**Antibody Binding Sites / Epitopes**

- Generally accessible, not buried
- Hydrophilic (charged)
- Interact via weak forces:
  - E.g. Hydrogen bonding, van der Waals forces
- While each antibody clone is unique, interaction always occurs with a defined region or antigen-binding domain.

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**B cell Epitopes**

**B CELL EPITOPES, UNLIKE T CELL EPITOPES, MAY BE SEQUENTIAL OR NON-SEQUENTIAL, AND ARE 3-DIMENSIONAL STRUCTURES**

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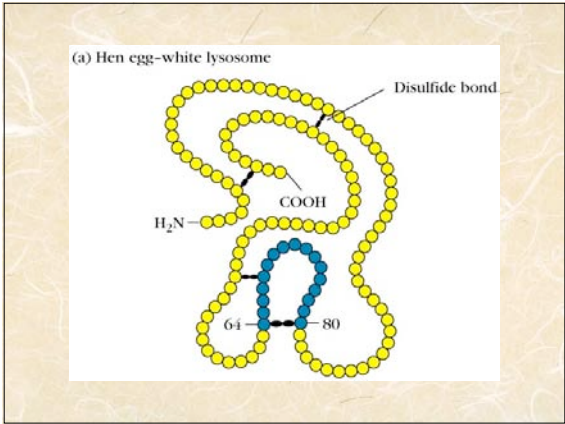
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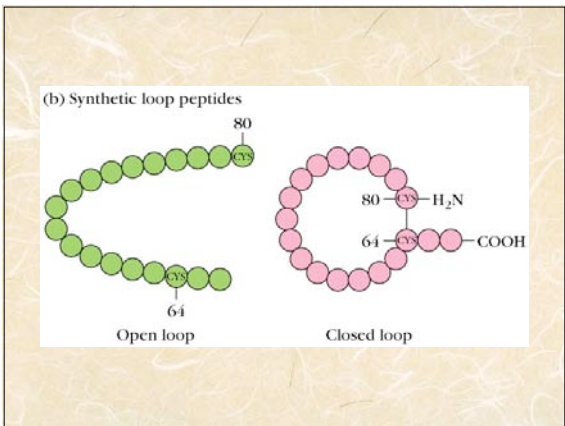
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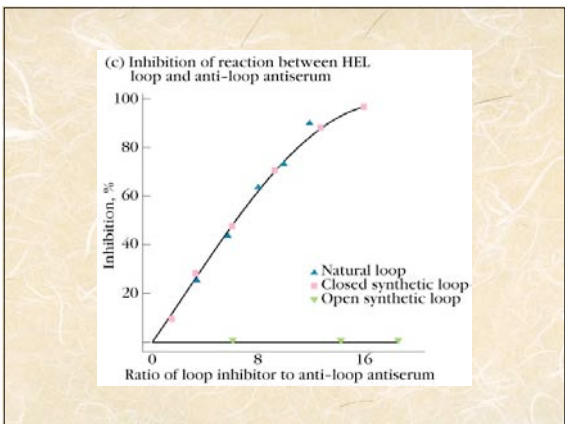
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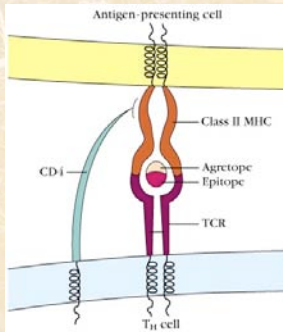
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## T cell Interactions



-Processed Antigen  
presented on MHC to T  
Cells  
-CD8+ T cells recognize  
Class I MHC  
-CD4+ T cells recognize  
Class II MHC

-TcR consists of 2  
chains, either  $\alpha\beta$  or  $\gamma\delta$   
- $\alpha\beta$  T cells are the  
"traditional" T cells

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For T cell interactions to take place,  
processed peptide antigens must bind  
**BOTH** the MHC-molecule, and the T  
cell Receptor

Binding to the peptide-binding cleft of  
MHC is explained by the "barbeque"  
model

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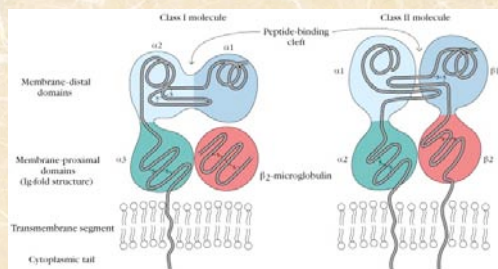
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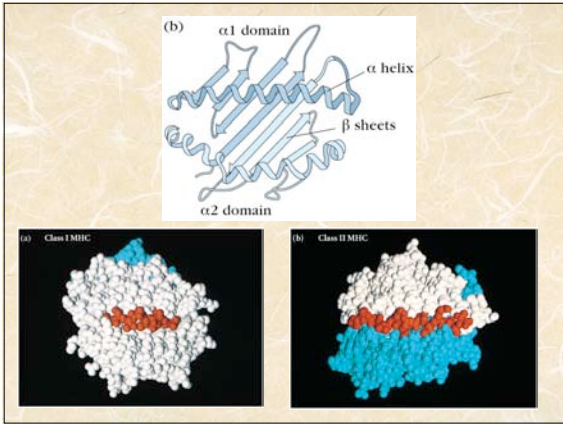
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### T cell Epitopes

- T cell antigens are processed, linear, peptides with no 3-D structure.
- They bind via weak intermolecular forces (similar to Abs) to BOTH the MHC heterodimer and the TcR heterodimer.
- The EPITOPE interacts with the TcR, the AGRETOPE interacts with the MHC.

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### Binding to MHC

- MHC binds MANY different peptides (note that the MHC molecule is NOT antigen-specific).
- For any given MHC, certain "immunodominant" peptides will be produced by antigen processing (immunodominance is the focus of vaccine development)

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## T cell Epitopes

- Recognition occurs through selective interaction of several amino-acids on the peptide with the TcR
- Peptides often represent internal peptides from complex proteins.

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## Haptens

- Haptens are small molecules, which are by themselves antigenic but not immunogenic
- The study of haptens is largely responsible for our understanding of antibody binding, specificity, and diversity.

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Carrier Hapten  
Immunize rabbit  
Hapten-carrier conjugate

Antibodies to hapten  
Antibodies to carrier  
Antibodies to conjugate of hapten and carrier

Injection with:	Antibodies formed:
Hapten (DNP)	None
Protein carrier (BSA)	Anti-BSA
Hapten-carrier conjugate (DNP-BSA)	Anti-DNP (major) Anti-BSA (minor) Anti-DNP/BSA (minor)

Notes: In general, a T cell response will only be evident to the CARRIER. It is the addition of the carrier which allows T cells to respond and provokes the formation of antibodies to the hapten.

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## Allergies

- Anything capable of cross-linking to a protein may be a hapten
  - This INCLUDES normal hormones, drugs, etc., which may provoke allergic responses to non-immunogenic proteins

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## Next Lecture

- Pattern-Recognition Receptors
- Review
- NOTE: Term Test 1 will be Friday during lecture!

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