Exercise walk-through

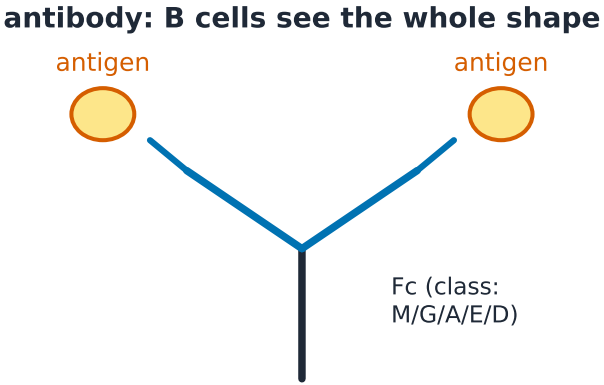
7.2
Antigen recognition: antibodies, receptors and MHC

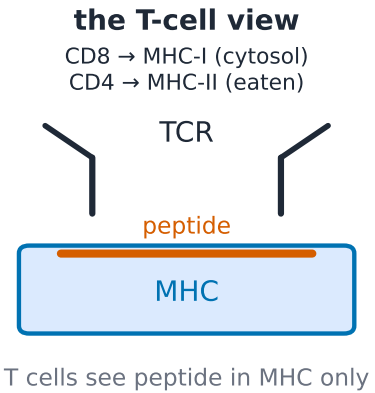
University Medicine

Antigen recognition: two chemistries

1. **Antibody** Ig (M first, G memory/transfer, A mucosa, E allergy) binds FREE antigen, whole shape; Fc region sets the class job.
2. **TCR + MHC** T cells see ONLY peptide in MHC: MHC-I (all cells, cytosol $\rightarrow$ CD8); MHC-II (professionals, eaten $\rightarrow$ CD4).
3. **Diversity** V(D)J recombination + junctional diversity $\rightarrow$ 10^6–10^8 specificities; class switch + **affinity maturation** 10–100$\times$.

Antigen recognition - figure





Antibody binding antigen beside MHC-peptide-TCR.

Exercises 2.1·2.3

2.1 Which Ig class crosses the placenta? [3]

2.2 What does MHC-I display and to which T-cell subset? [3]

2.3 Compute the chance two siblings share both HLA haplotypes. [3]

Exercises 2.1·2.3

2.1 Which Ig class crosses the placenta? [3]

2.1

- IgG ✓.

2.2 What does MHC-I display and to which T-cell subset? [3]

2.2

- Cytosolic (self-made) samples to CD8 cells ✓.

2.3 Compute the chance two siblings share both HLA haplotypes. [3]

2.3

- $1/2 \times 1/2 = 1/4$ ✓.

Exercise 3.1

3.1 A laboratory reports a new antibody titre 40× baseline at day 14 (fictional serology).

Explain the class-switch and affinity-maturation events behind the rise (germinal centre). Predict the dominant Ig class and its affinity change. State what the same sample at day 4 would likely have shown. [7]

Exercise 3.1

3.1 A laboratory reports a new antibody titre 40× baseline at day 14 (fictional serology).

Explain the class-switch and affinity-maturation events behind the rise (germinal centre). Predict the dominant Ig class and its affinity change. State what the same sample at day 4 would likely have shown. [7]

3.1

- In germinal centres B cells proliferate, switch IgM→IgG (CD40L–CD40 – cytokines) and hypermutate V regions; higher-affinity mutants are selected.
- Dominant IgG at 10–100× affinity ✓.
- Day 4: IgM only (or nothing) – primary-response lag ✓.

Exercise 3.2

3.2 A kidney transplant candidate has three siblings (fictional).

Compute the probability that at least one sibling is a full 2-haplotype match (each sibling 1/4). Explain why HLA-DR matching matters most for outcome. State what ABO mismatch would cause and when. [8]

Exercise 3.2

3.2 A kidney transplant candidate has three siblings (fictional).

Compute the probability that at least one sibling is a full 2-haplotype match (each sibling 1/4). Explain why HLA-DR matching matters most for outcome. State what ABO mismatch would cause and when. [8]

3.2

- P(at least one full match of three) $= 1 - (3/4)^3 = 1 - 0.422 = 0.578 \approx 58\ \%$ ✓.
- HLA-DR drives the direct T-cell alloresponse strongest (DR presents the broadest peptide repertoire to CD4 help).
- ABO mismatch → pre-formed anti-A/B antibody → hyperacute rejection, minutes after reperfusion ✓.