Johns Hopkins Engineering

# Immunoengineering

## Immunoengineering: Modeling

## Cancer Antigen Modeling

JOHNS HOPKINS
WHITING SCHOOL
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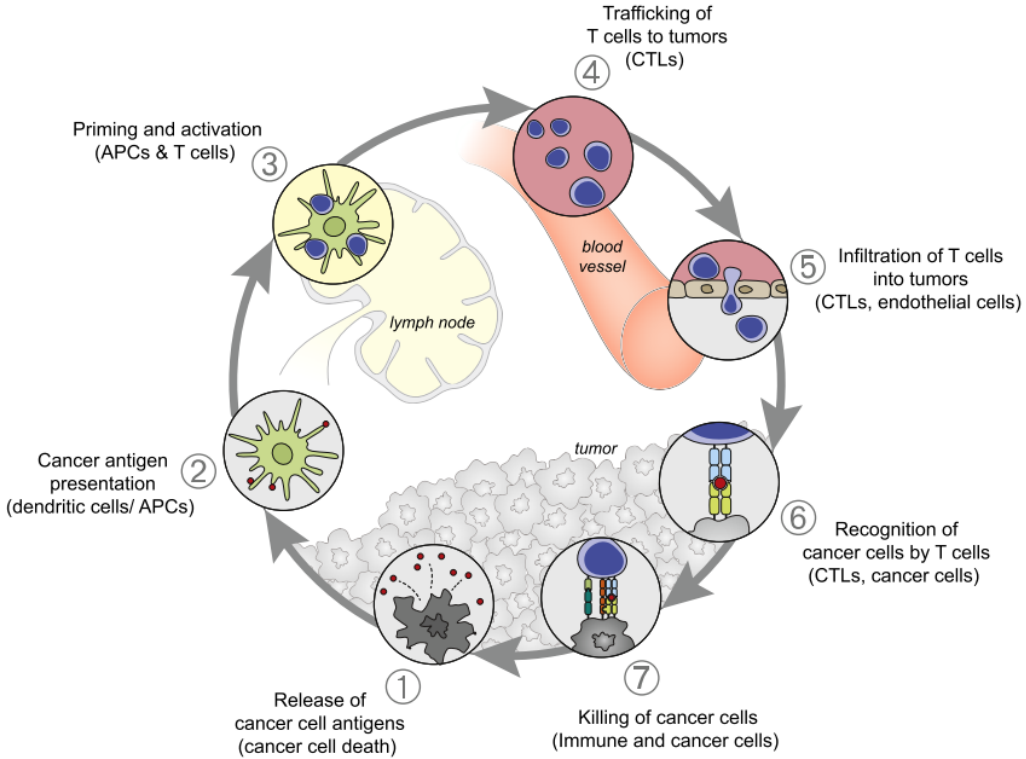
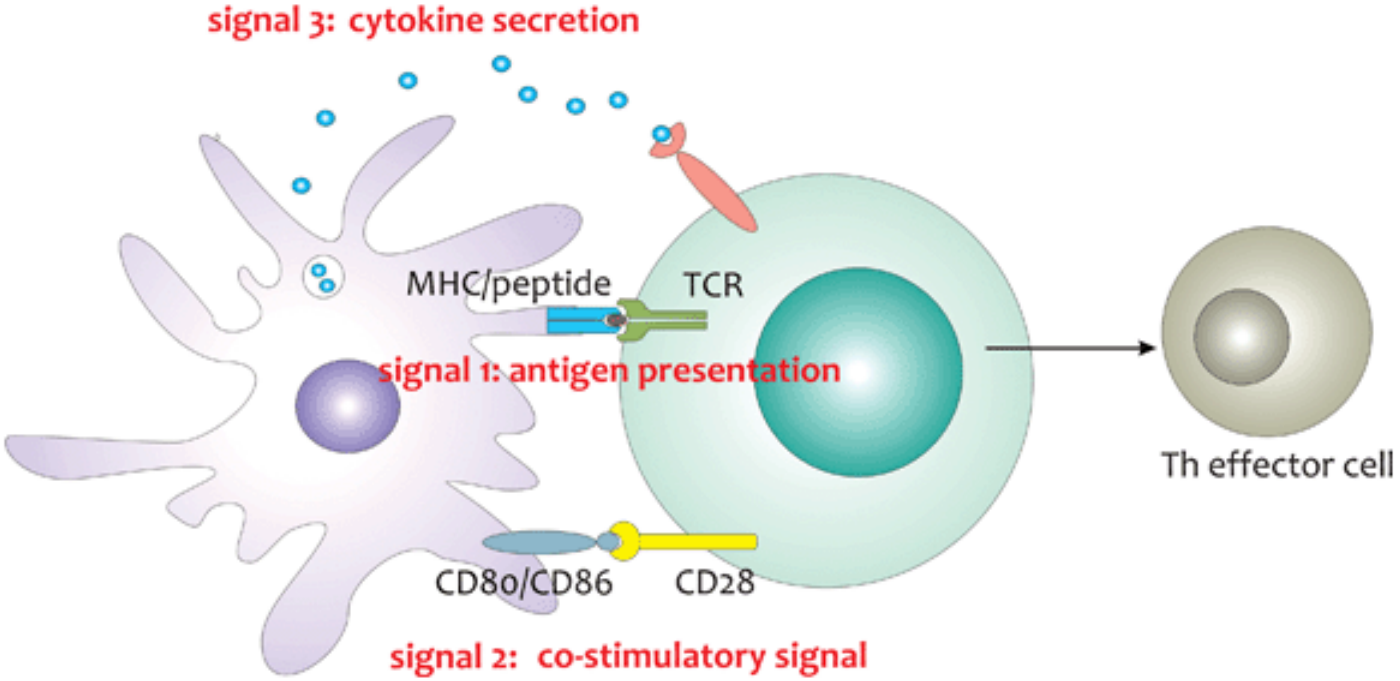
# Cancer Immunity Cycle






Chen et al. “Oncology Meets Immunology: The Cancer-Immunity Cycle”. *Immunity*, 39.1 (2013): 1-10.

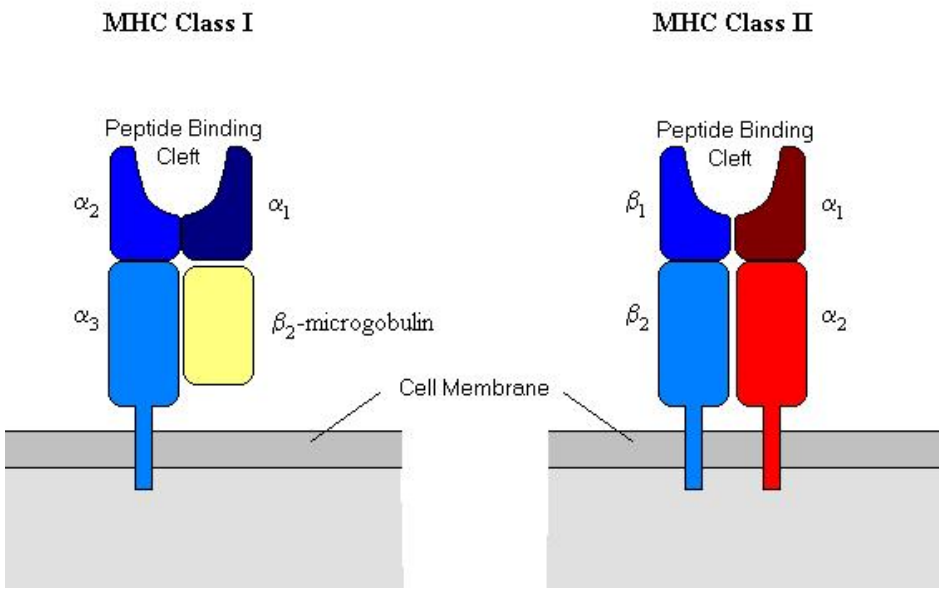
# Peptide-MHC complex acts as “signal 1” for T cell activation

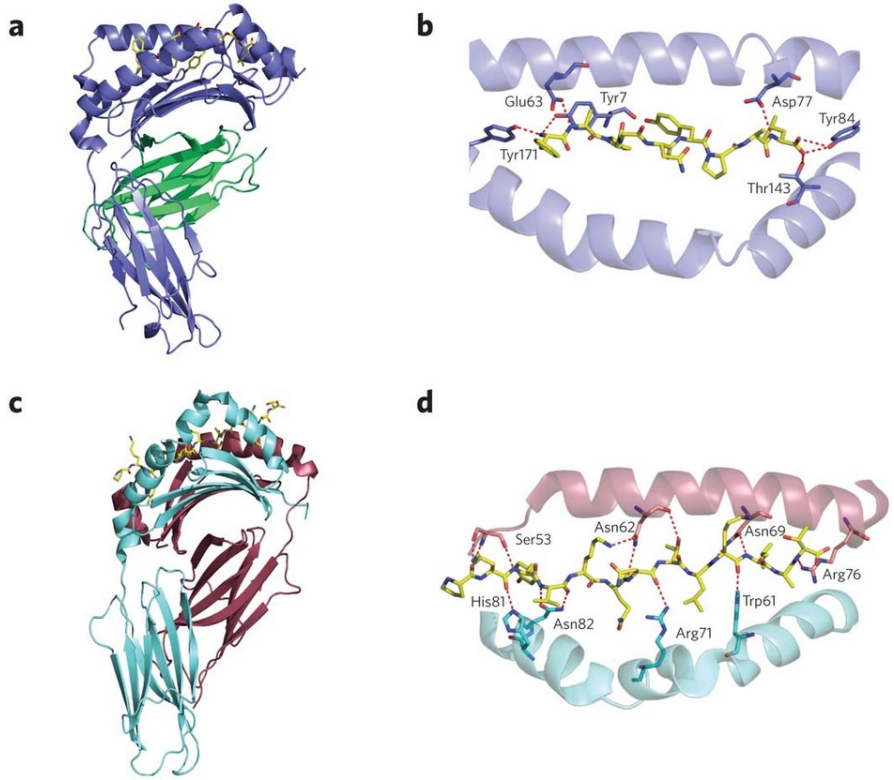





Koker et al. “Designing polymeric particles for antigen delivery” *Chem. Soc. Rev.* 40, (2011): 320-339.

# MHC



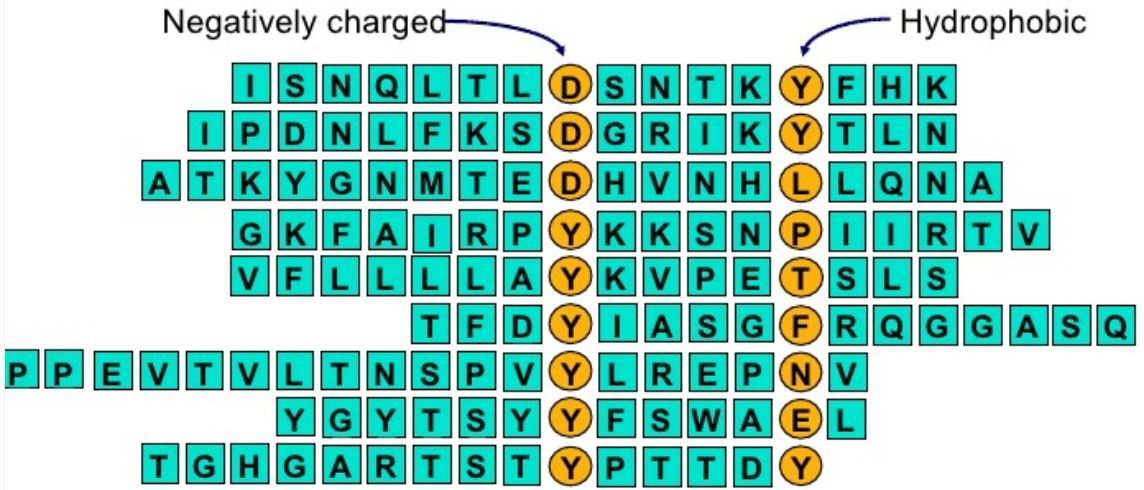

Janeway's Immunobiology (Garland Science 2012)

Neefjes et al. "A peptide's perspective on antigen presentation to the immune system" *Nature Chemical Biology* 9, (2013): 769-775.

# Anchor Residues

MHC I


MHC II

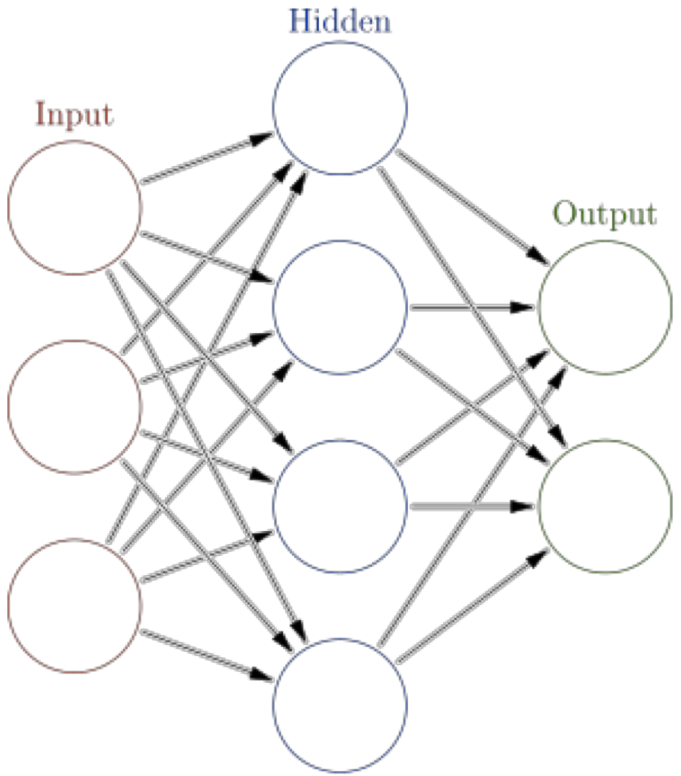





Janeway's Immunobiology (Garland Science 2012)

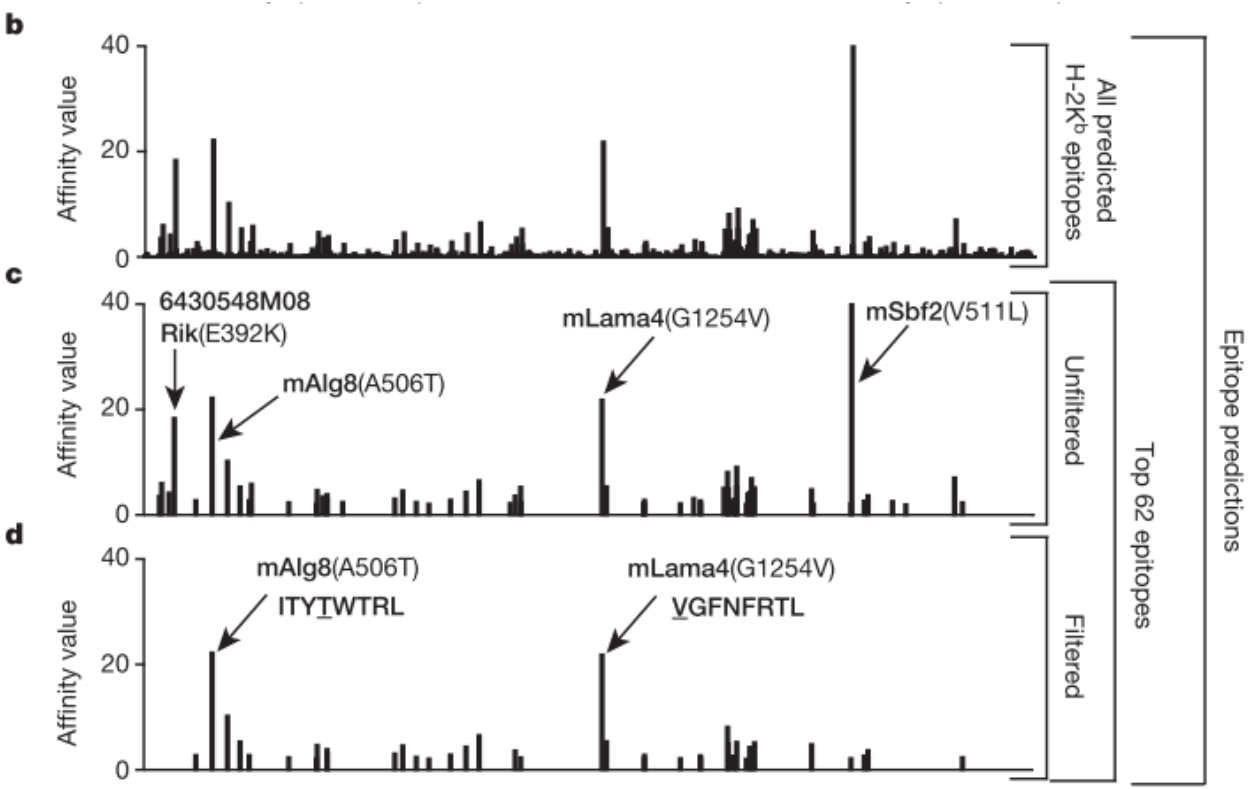
# NetMHC models peptide-MHC binding with artificial neural networks

- Input = peptides of interest
- Output = predicted binding strength to each MHC allele
- Artificial neural network is trained with known data of MHC-peptide binding




https://en.wikipedia.org/wiki/Artificial_neural_network
http://www.cbs.dtu.dk/services/NetMHC/

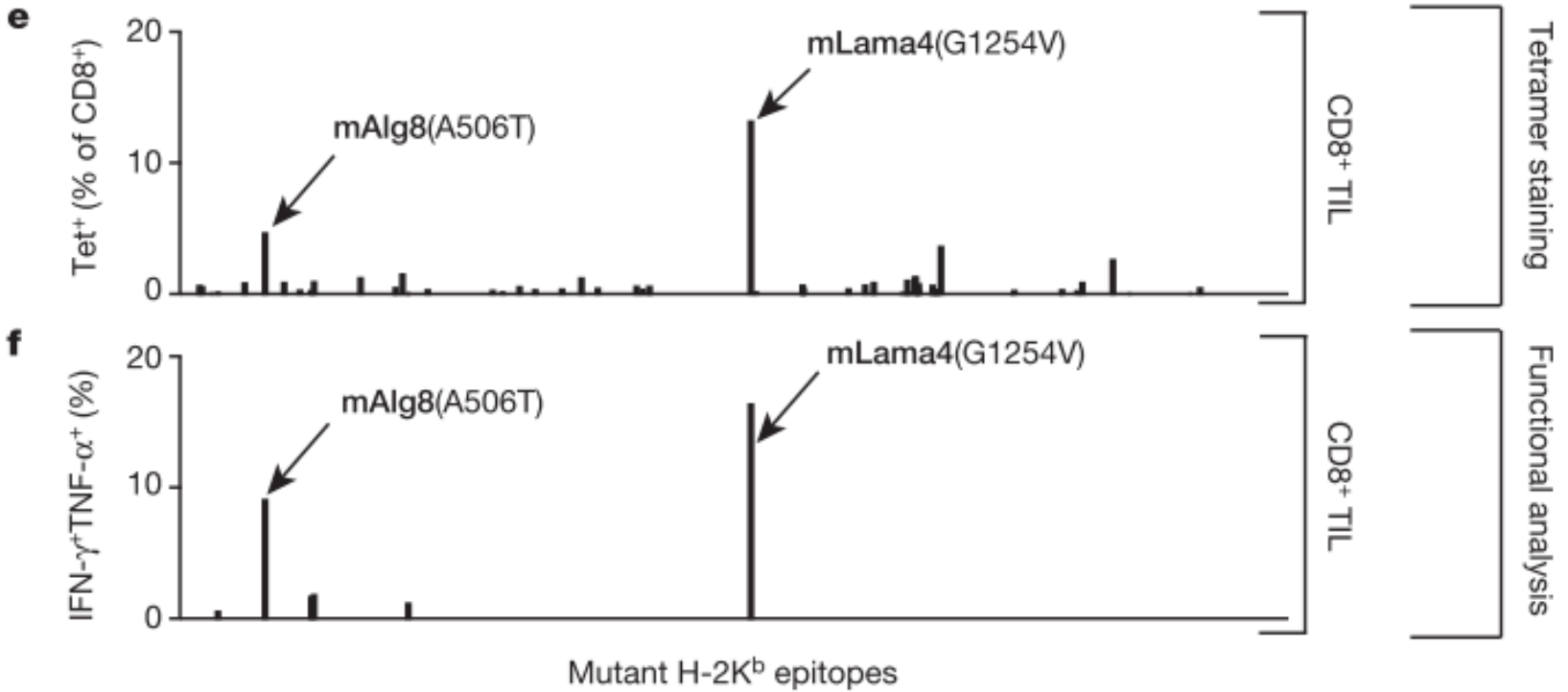
# NetMHC can predict cancer neoepitopes






Gubin et al. “Checkpoint blockade cancer immunotherapy targets tumour-specific mutant antigens” *Nature* 515, (2014): 577-581.

# Experimental assays can confirm MHC prediction algorithms






Gubin et al. “Checkpoint blockade cancer immunotherapy targets tumour-specific mutant antigens” *Nature* 515, (2014): 577-581.