

Johns Hopkins Engineering

# Immunoengineering

Immune Response to Biomaterials: Transplantation



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# Transplant types

- Syngeneic
  - Genetically compatible (e.g. inbred strains of mice, homozygotic twins)
- Allogeneic
  - Obtained from a different individual of the same species but genes at one or more loci are not identical
- Xenogeneic
  - Obtained or derived from a different species

# Transplant Rejection is Immunological

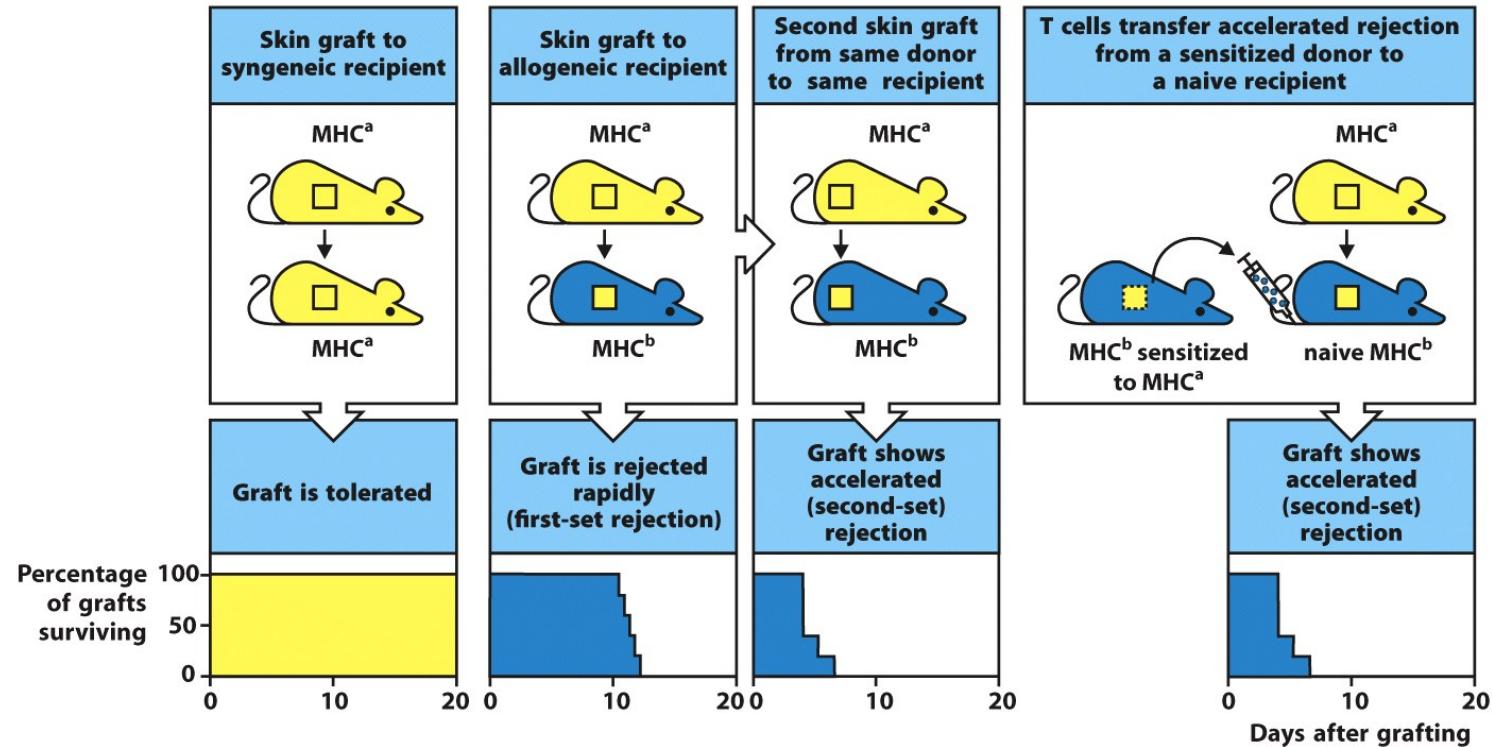
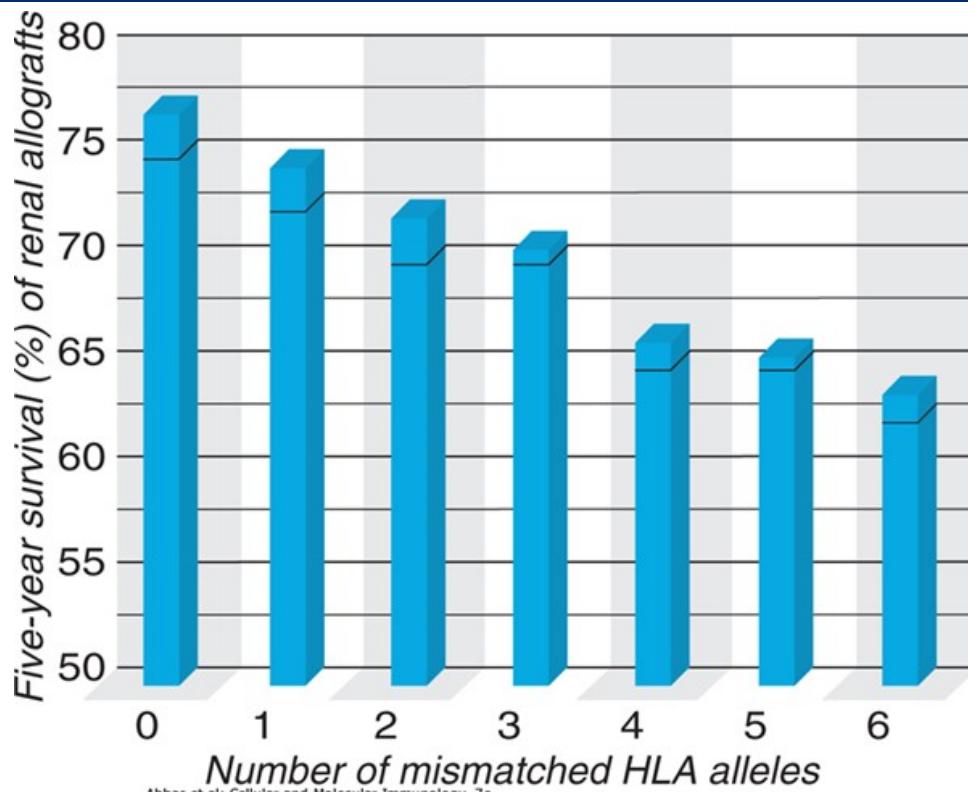


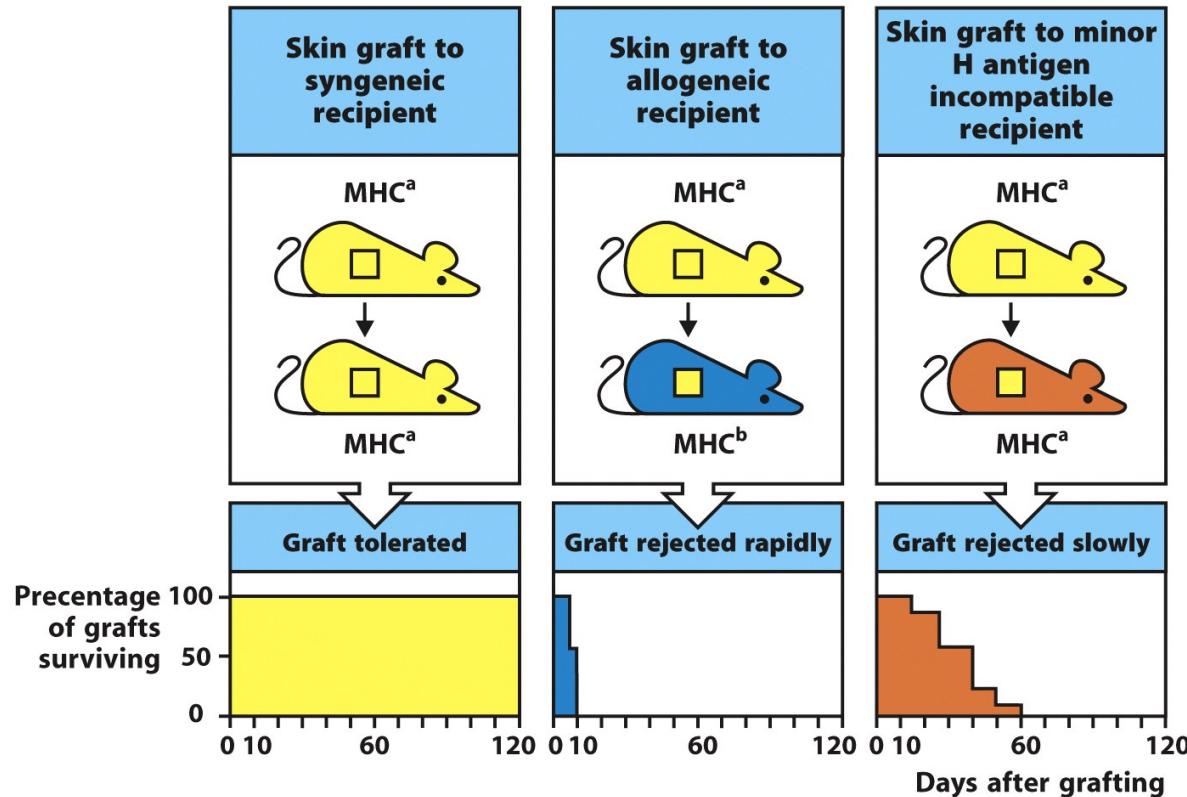
Figure 15.41 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

# HLA Matching



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# Genetics of Graft Rejection



# Minor Histocompatibility Antigens

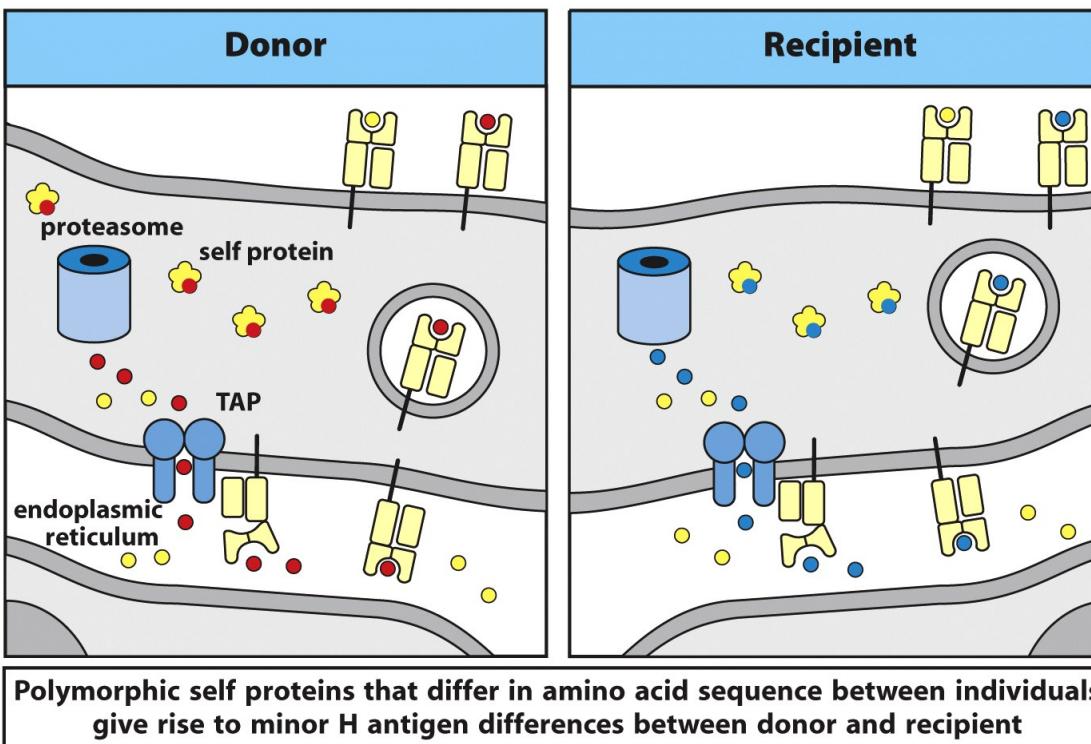
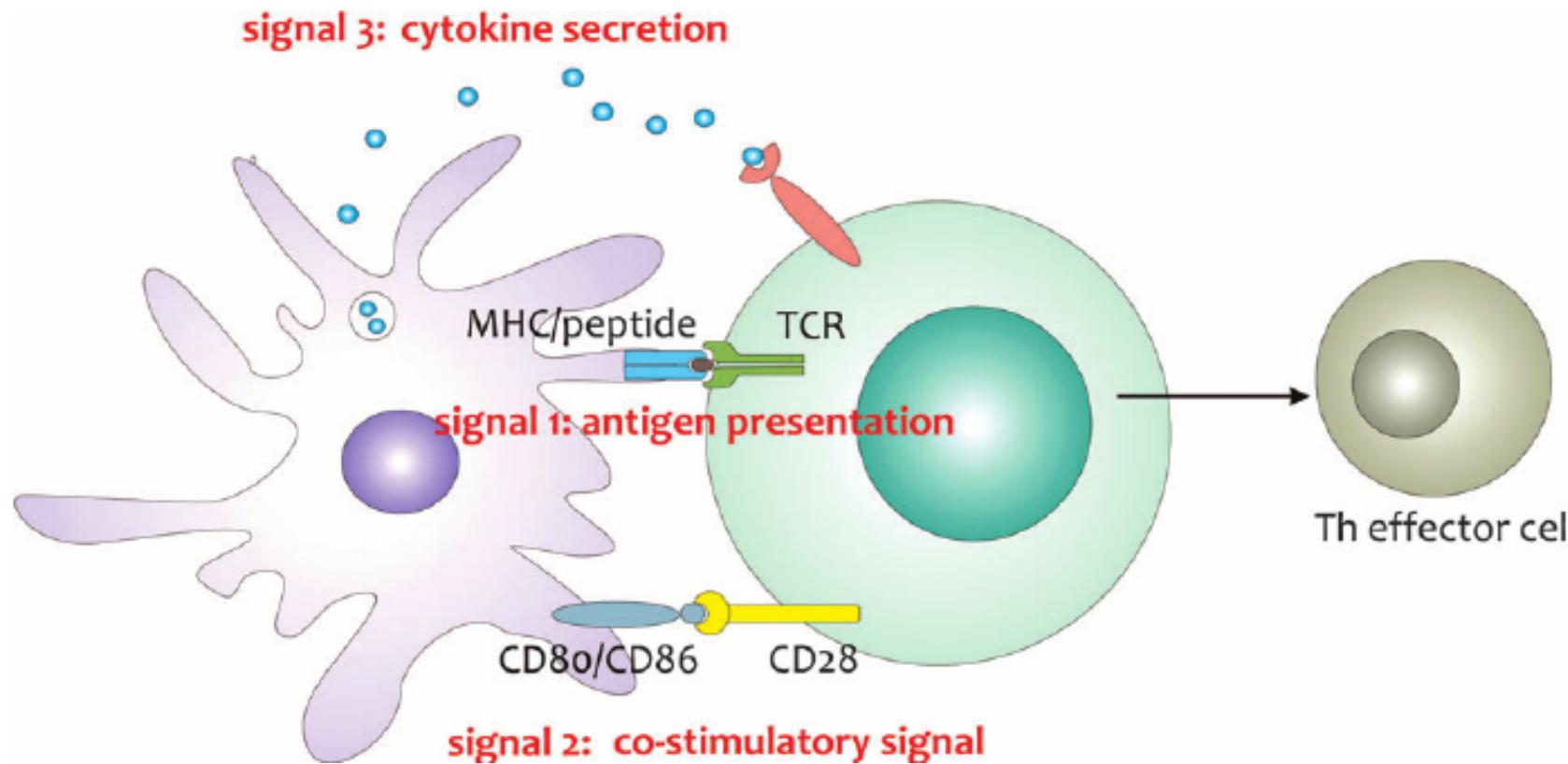


Figure 15.43 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

# Histocompatibility Genes

- 30-50 genes
  - Major histocompatibility genes (MHC)
    - H-2 genes in mice
    - HLA genes in humans
  - Minor histocompatibility genes
    - H-Y

# T Cell Activation



# Graft Rejection

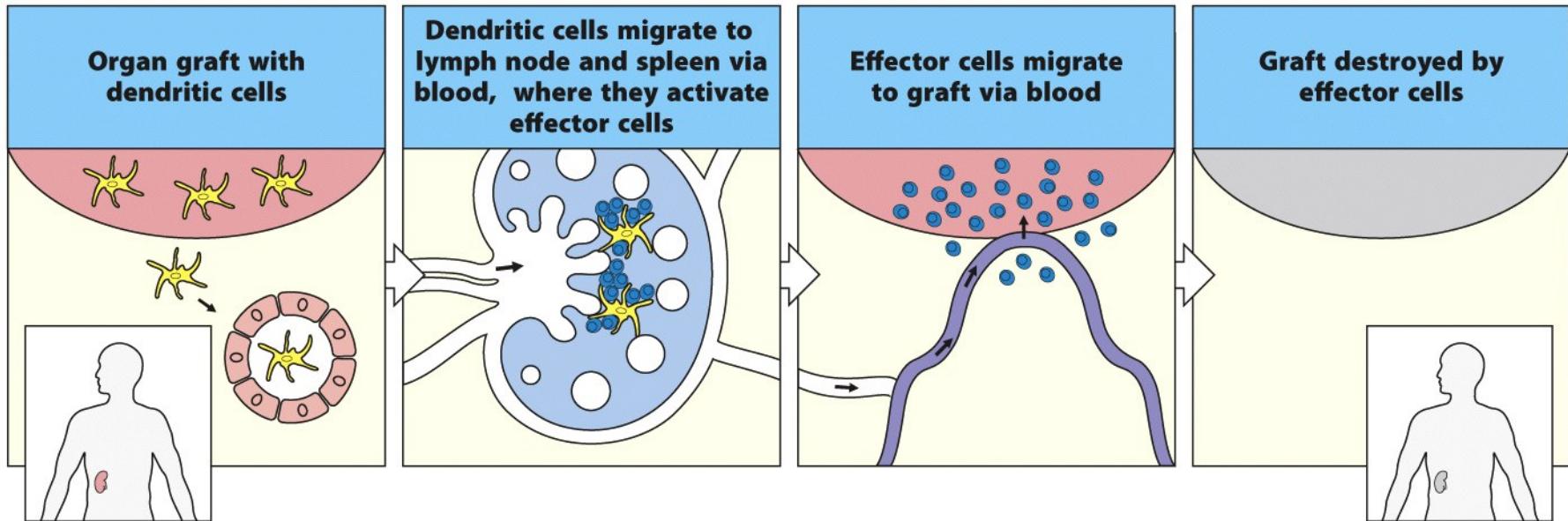


Figure 15.44 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

# Role of Donor and Host APCs

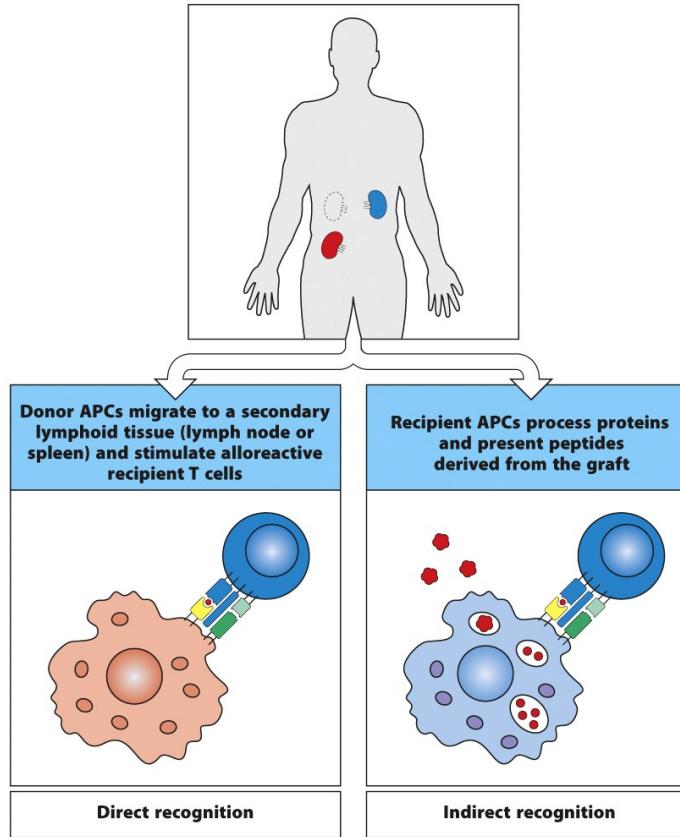
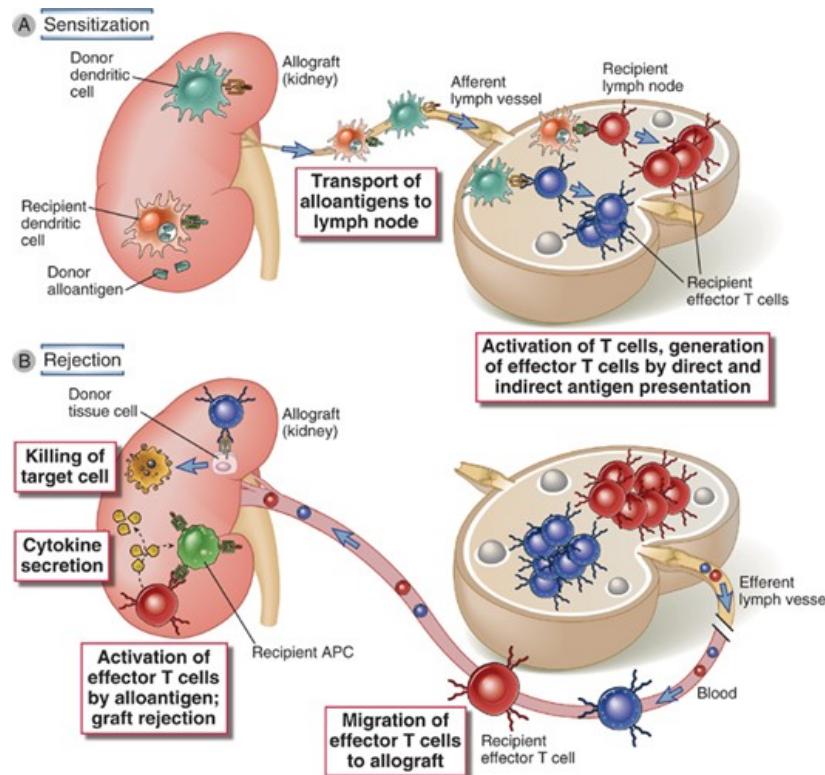


Figure 15.45 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

# Activation of Alloreactive T Cells

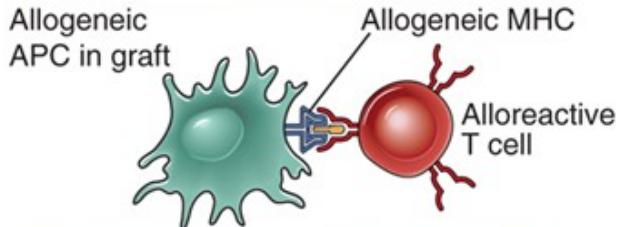


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Abbas, Lichtman, and Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999.

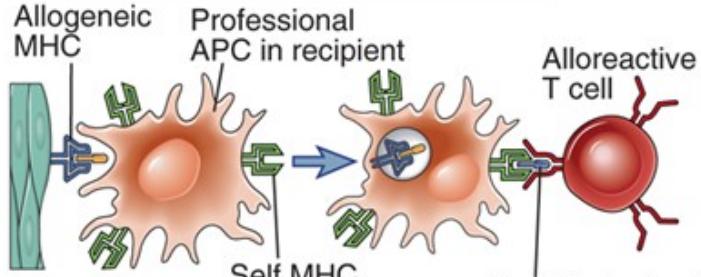
# Alloantigen Recognition

## A Direct alloantigen recognition



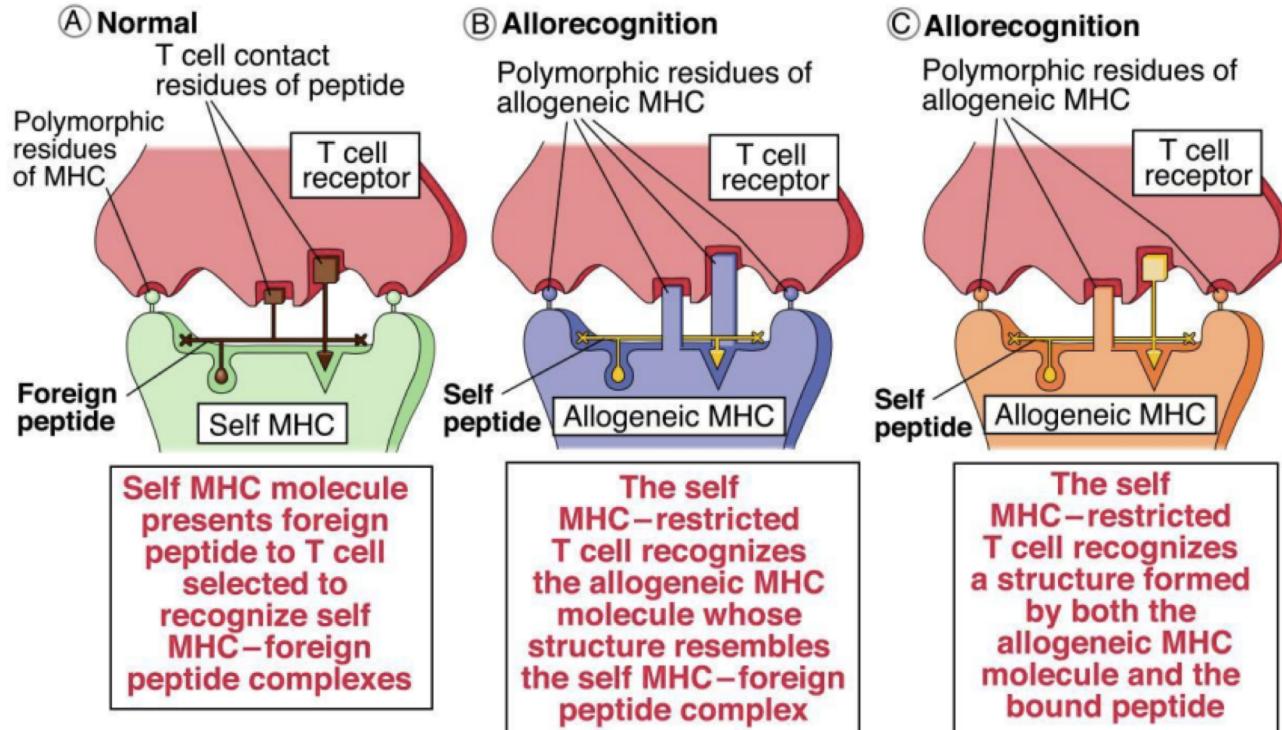
T cell recognizes unprocessed allogeneic MHC molecule on graft APC

## B Indirect alloantigen presentation



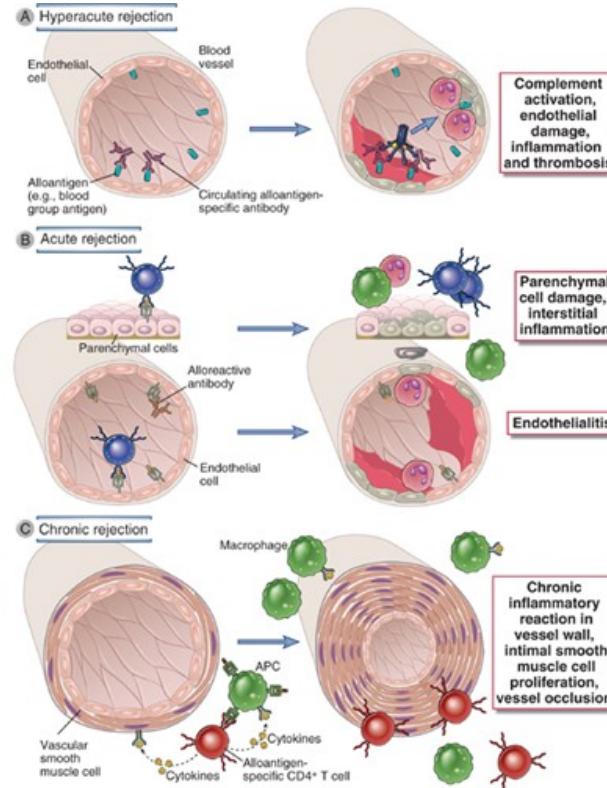
Presentation of processed peptide of allogeneic MHC molecule bound to self MHC molecule

# Direct Alloantigen Recognition



# Types of graft rejection

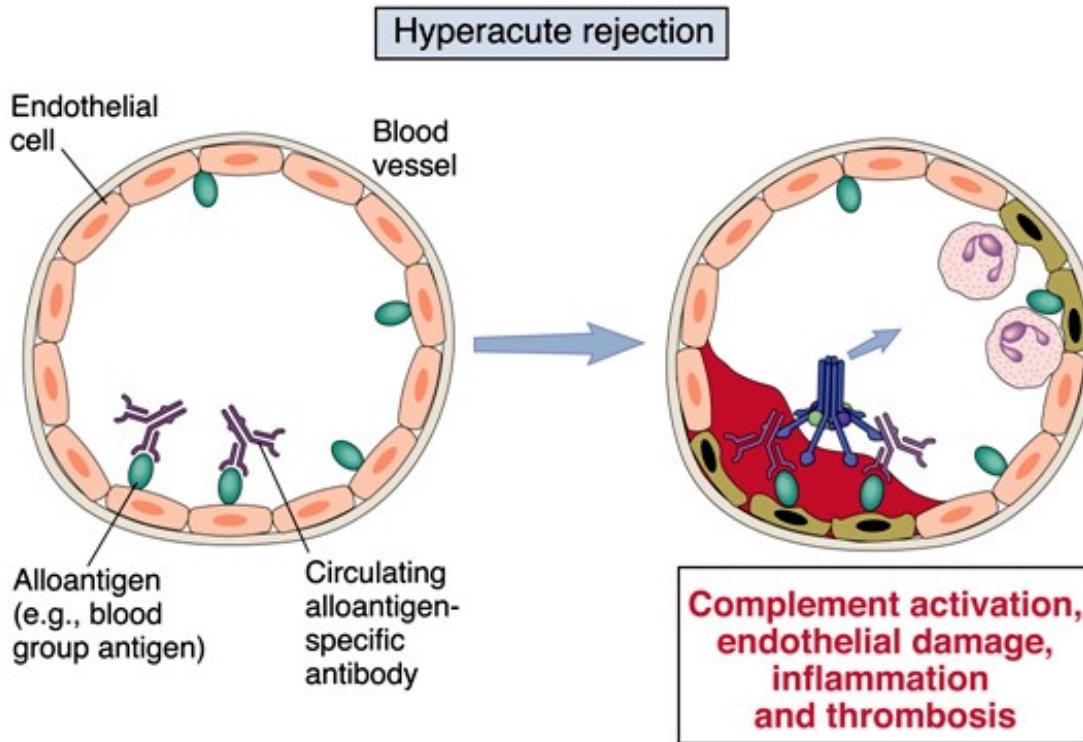
- Hyperacute
- Acute
- Chronic



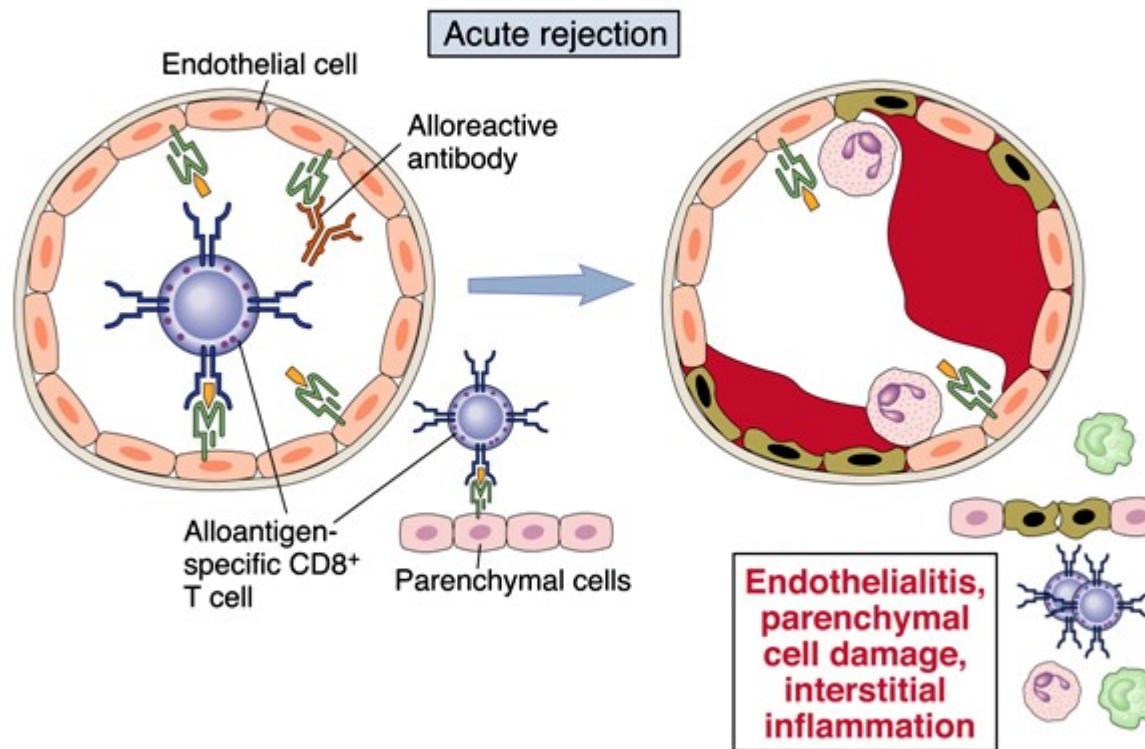
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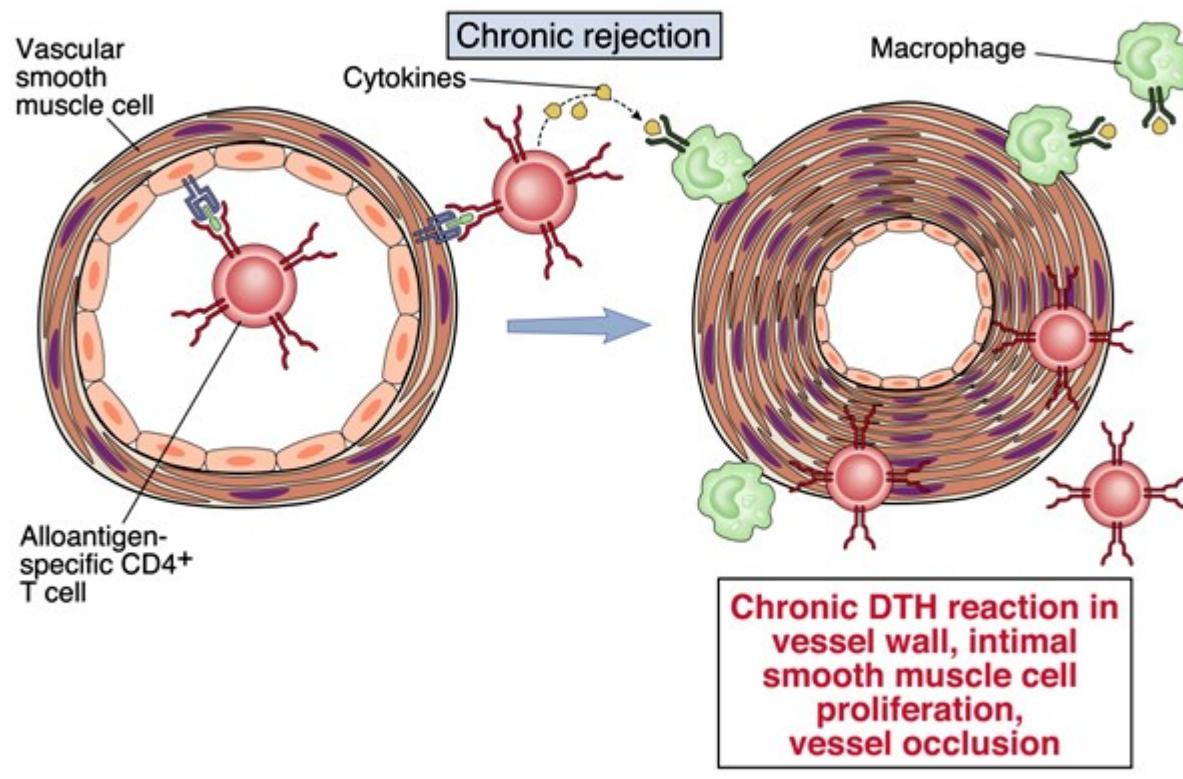
# Hyperacute Rejection



# Acute Rejection



# Chronic Rejection



# Types of graft rejection

	Hyperacute	Acute		Chronic
Duration	Minutes to hours	Days	Weeks	Months to years
Mediators	Pre-formed antibodies	Antibodies	Activated CD8+ T cells	Tissue Response
Incidence	Rare	Uncommon	Common	Universal
Pathology	Graft thrombosis	Vasculitis	Parenchymal injury	Vascular remodeling
Prevention	Cross matching	Avoid risk factors	Optimize HLA match	Decrease early injury



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