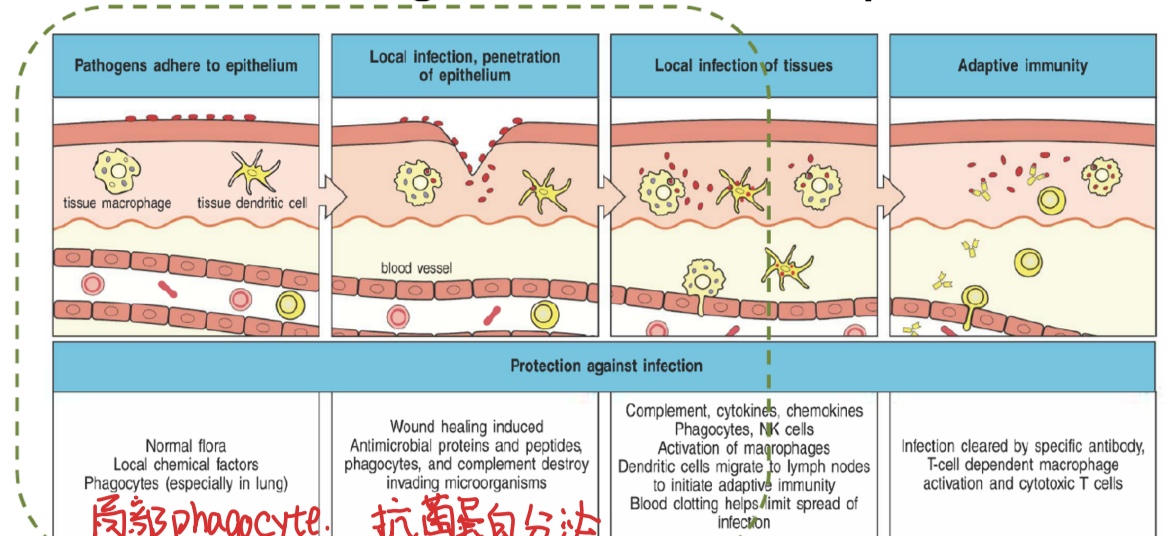


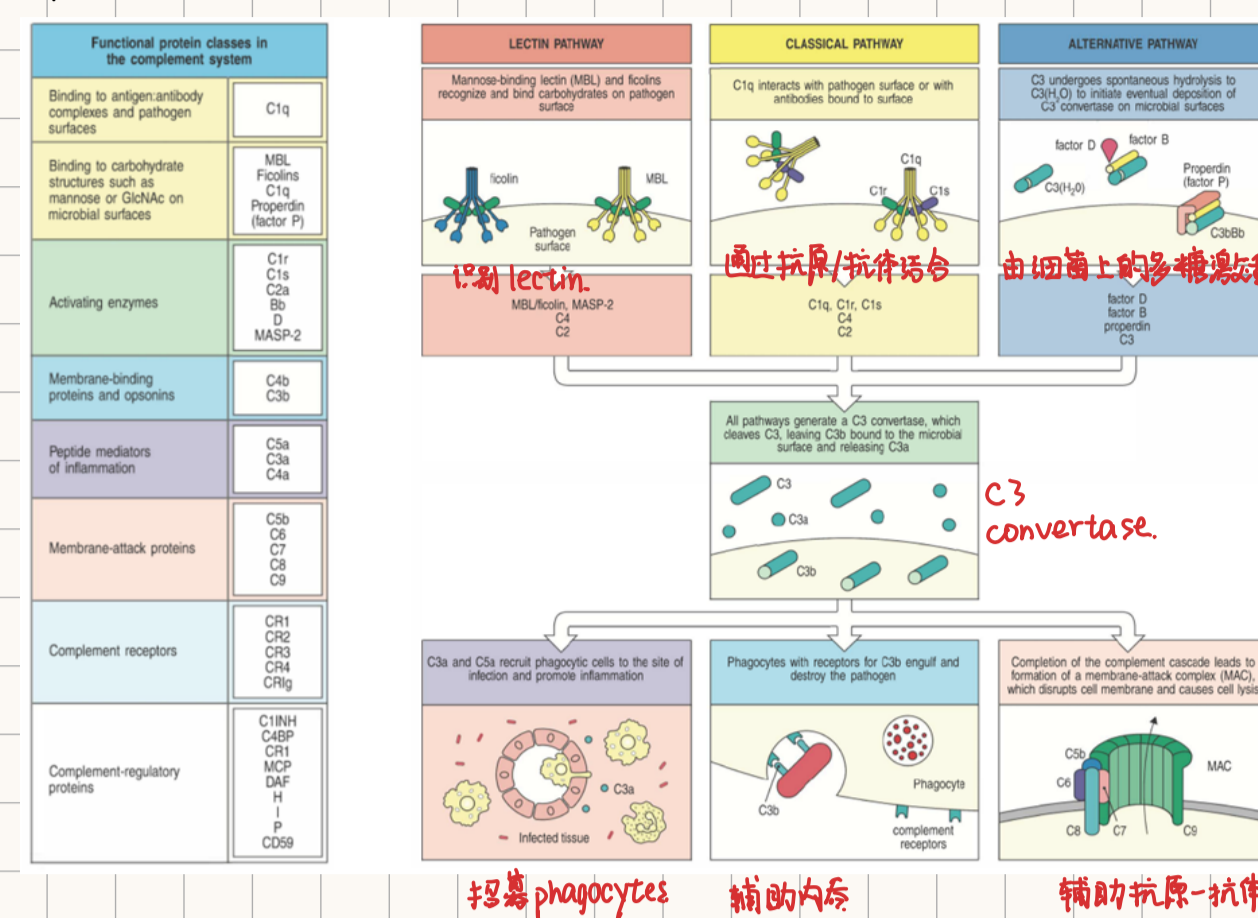
# 基础免疫

## Innate immunity

### Different stages of the infectious response

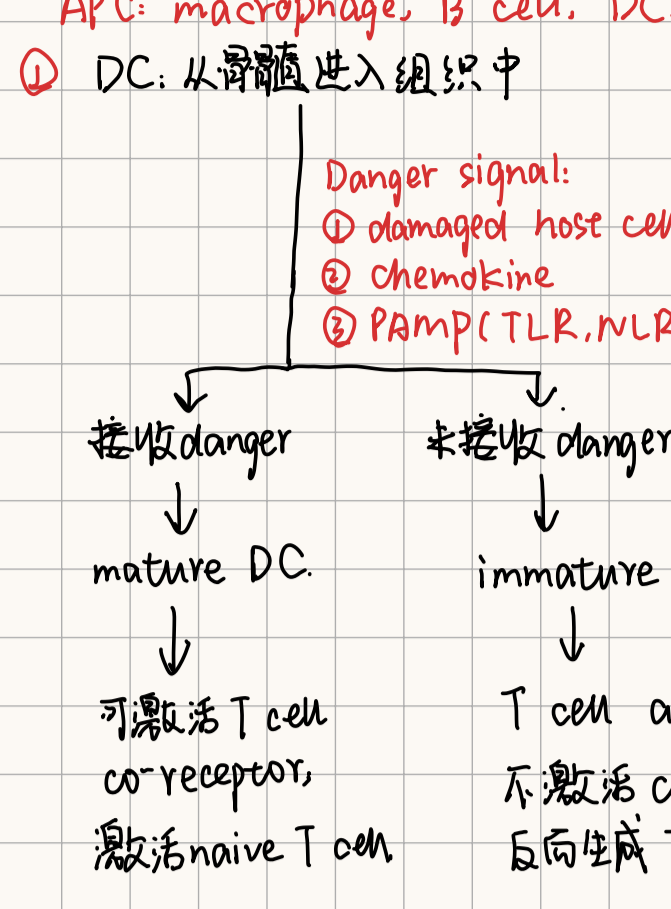


## 补体系统



## Adaptive immunity

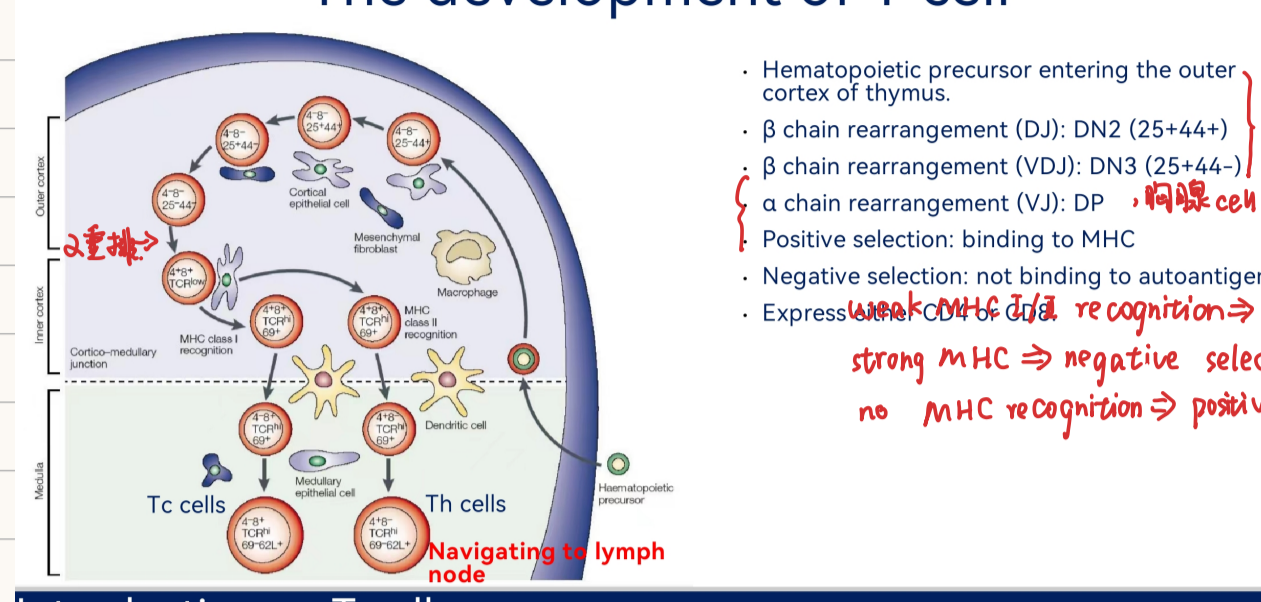
APC: macrophage, B cell, DC



## T cell

发育

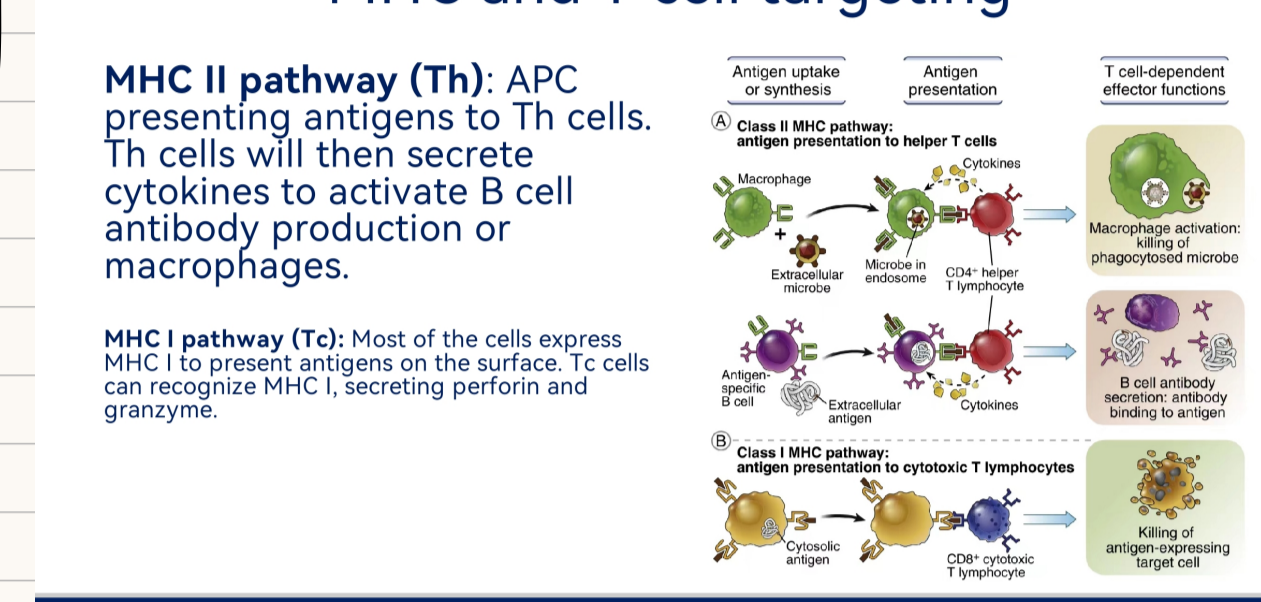
### The development of T cell



## 工作流程

- Antigen recognition: Naive T cell: 在淋巴器官内被激活 (DC); Effector T cell: 在 infection site 进行

### MHC and T cell targeting



2. Activation, proliferation, differentiation

Three signals:

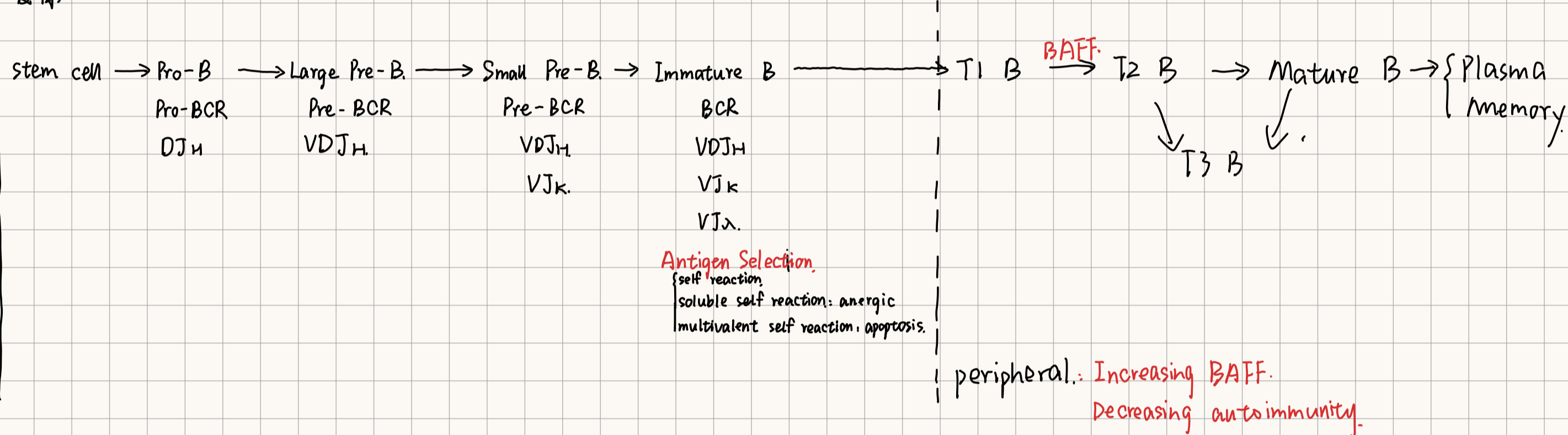
- TCR
- co-stimulation: 缺乏会导致 anergic
- cytokine: IL-12 等, 足分化 → CD4 分化为 Th1, Th2, Th17, CD8+ DC 未被感染, 受 Th 激活, DC 被感染: Th independent

## 3. Effect

- CD4: Th1: IFN-γ, 激活 macrophage, 作用于胞内感染细菌; Th2: 作用于 B cell, 调控炎症; Th17: 激活 neutrophil; Treg (CD4+ CD25+ Foxp3): 接触抑制, 分泌 IL-10 等
- CD8: 杀伤方式: ① necrosis: contact → secrete (granzyme, perforin) → lysis; ② apoptosis: granzyme, Fas

## B cell

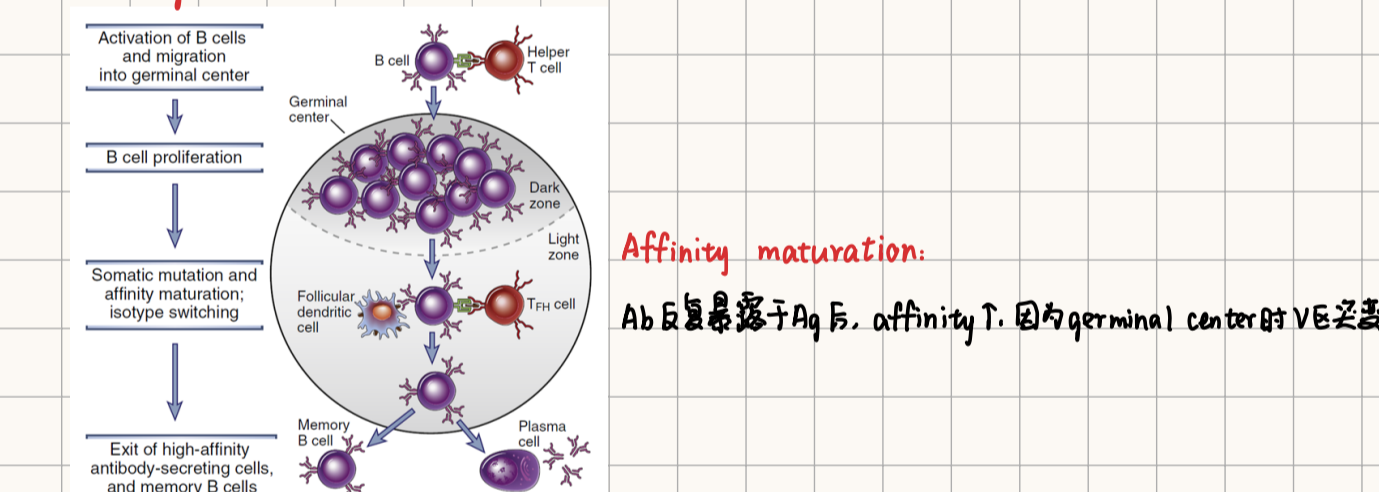
发育



## 作用

- BCR识别: BCR + co-receptor (CD19, TLR) + Th 帮助 (MHC 识别, 释放 cytokine)
- 信号传导

## 迁入 germinal center



## 抗体

- Neutralization: blocking binding of microbe of the cell and adjacent cell; blocking toxin binding
- Opsonization and phagocytosis: 便于杀菌; Killing the Ab-coated cell: NK cell 会处理有 Ab 的 cell
- Complement activation: killing bacteria, inflammation 炎症
- IgE and mast cell activation

# 免疫相关现象, 疾病

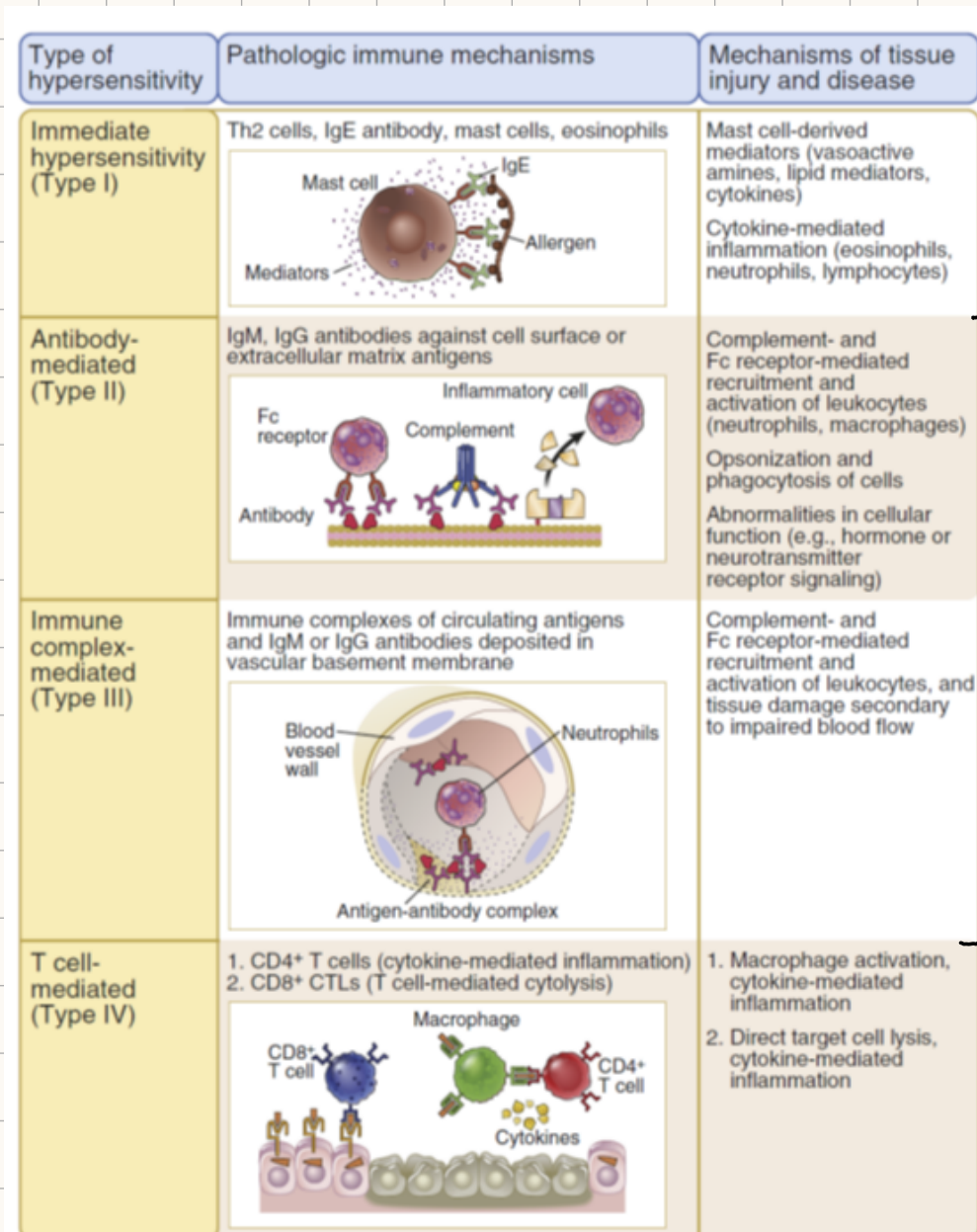
## Immune tolerance



## 相关疾病

- ① autoimmune: Antibody (surface), immune-complex (circulating antigen), T-cell-mediated; Cause: Failure in self-tolerance → altered antigen or antigen presentation (Release of sequestered Ag, High MHC); Infection: Molecular mimicry, Bystander: 激活 TLR 引起炎症, epitope spreading

## ② hypersensitivity



allergen → B cell ← Th2  
IgE (吸附在肥大细胞上)  
作用: 引起炎症  
mast cell, histamine, cytokine, enzyme → vasodilation, vascular leak, eosinophil, granulocyte → cell killing, tissue damage, bronchospasm

Opsonization and phagocytosis → phagocytosis, tissue injury  
Complement → antibody activate/block receptor

Infection → sensitive Th1

## ③ Immunodeficiency

技术: 疫苗, immunotherapy