

MATERI 1 (FA 1604)

KONSEP DASAR IMUNOLOGI

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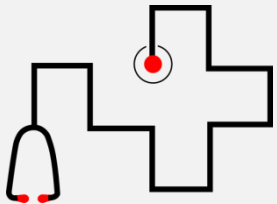
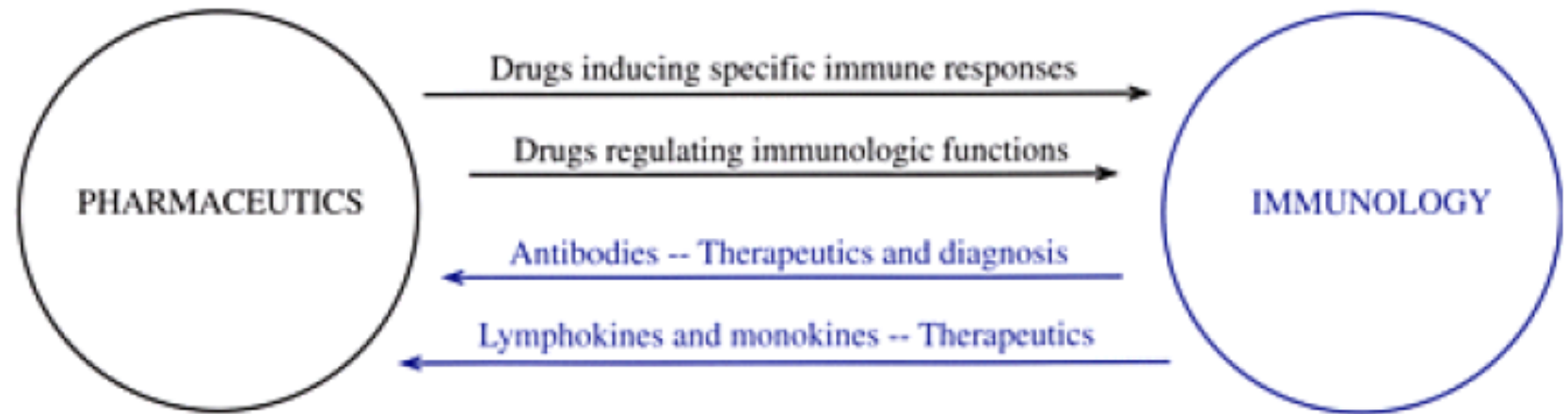


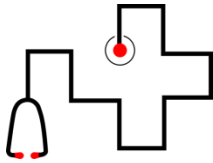
DEFINISI



- **Imunologi** → Studi mengenai pertahanan tubuh dalam melawan infeksi
- **Sistem imun** → Sistem yang terdiri dari Molekuler, Seluler, Jaringan dan Organ yang berperan dalam proteksi/ kekebalan tubuh
- **Respon imun** → Reaksi yang dikoordinasi oleh sel-sel, molekul-molekul dan bahan lainnya terhadap infeksi dari makromolekul asing atau serangan organisme
- **Imunitas** → Kemampuan tubuh untuk bertahan atau mengeliminasi materi asing yang berpotensi berbahaya atau sel abnormal

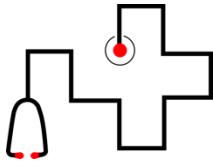
IMUNOLOGI & FARMASI





- <https://www.youtube.com/watch?v=zQGOcOUBi6s>

SEJARAH IMUNOLOGI



Edward Jenner (1798)



Inokulasi cairan cowpox
sehingga terhindar dari
penyakit Smallpox



Figure 1-1 Immunobiology, 7th ed. (© Garland Science 2008)



Louis Pasteur (1881)



Pengembangan penelitian
mengenai vaksin dari
Bacillus anthracis yang
dilemahkan untuk melawan
antraks dan rabies

SEJARAH IMUNOLOGI

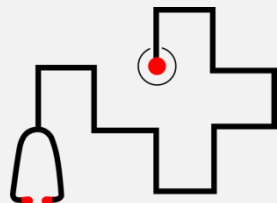
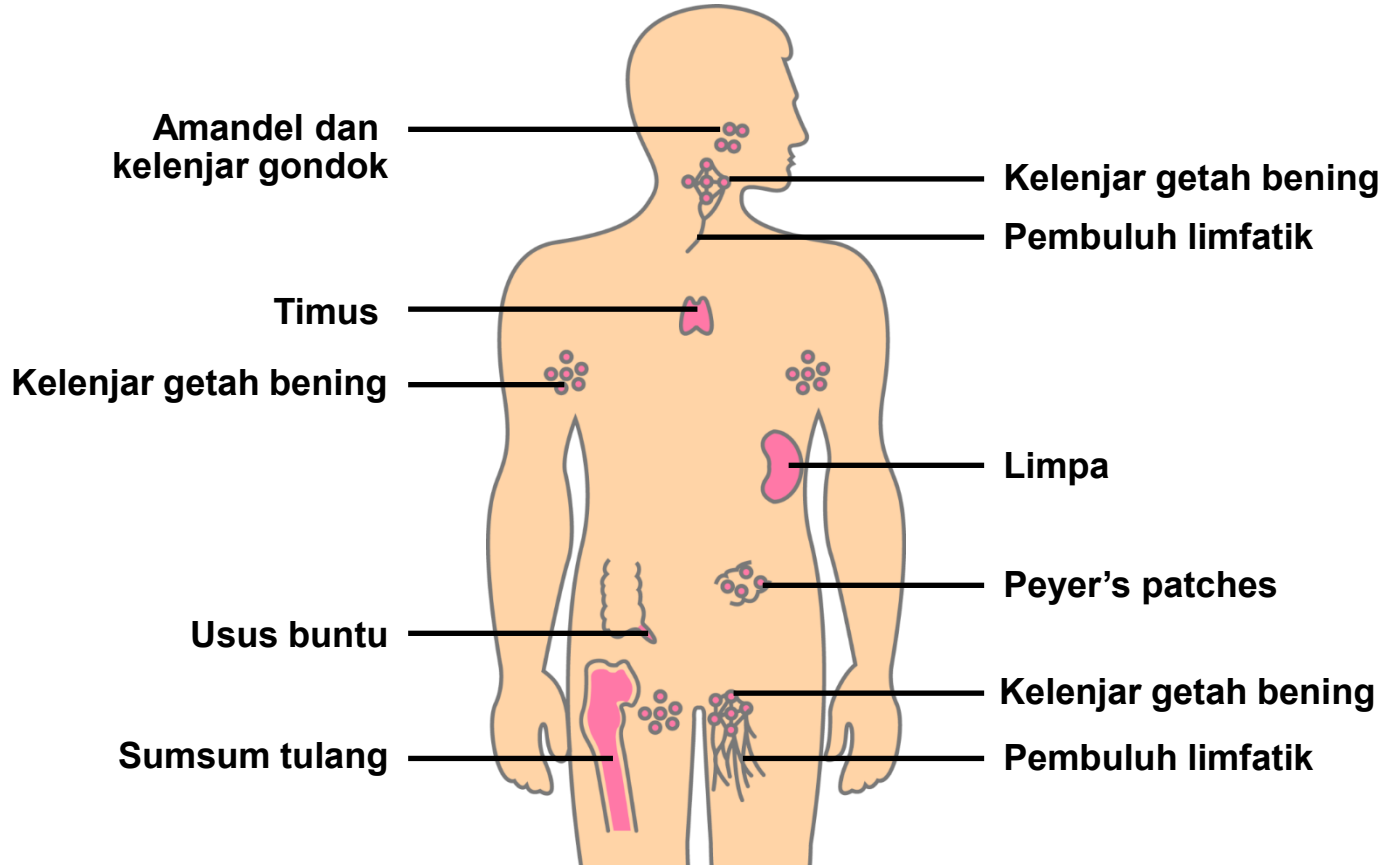


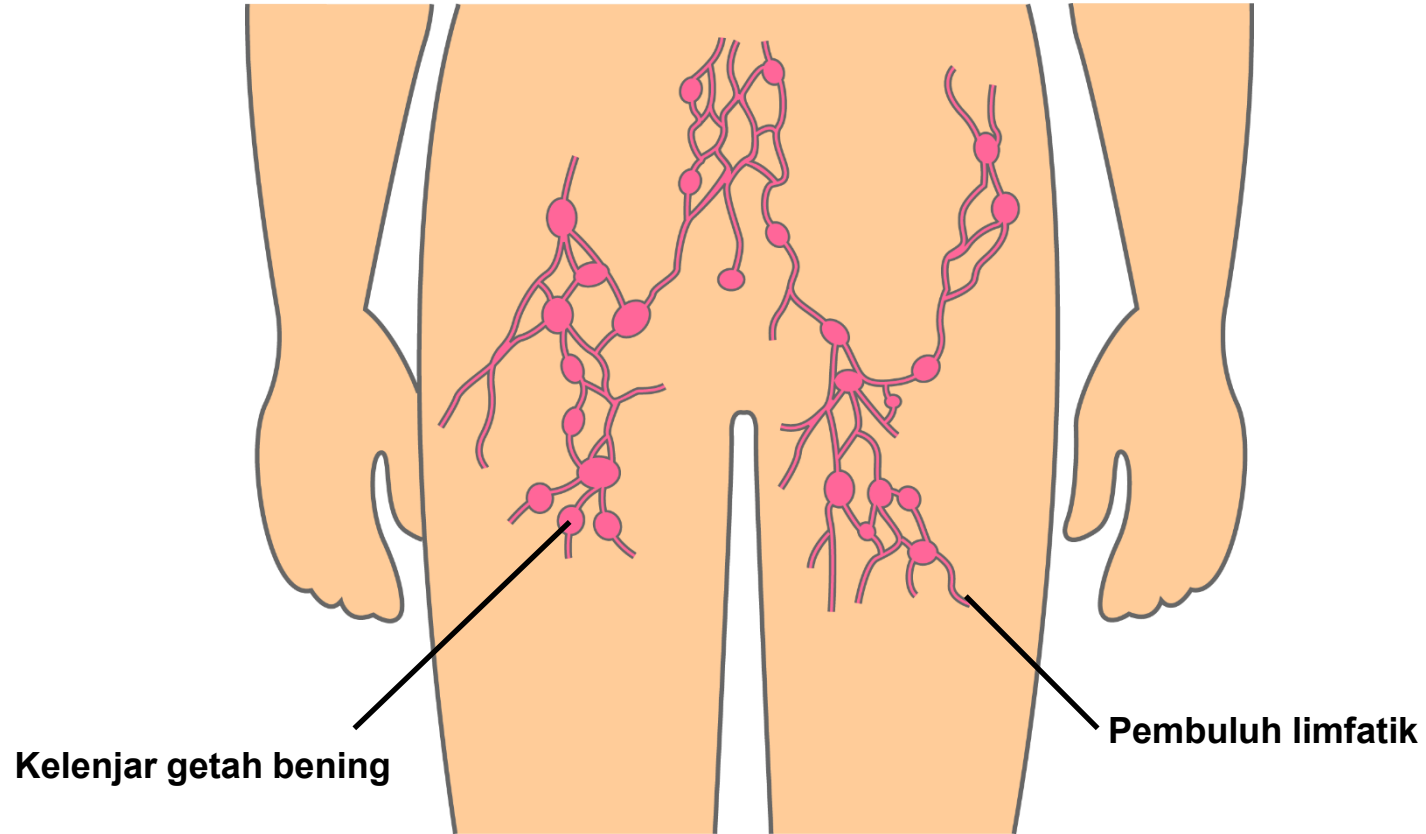
TABLE 1-2 Nobel Prizes for Immunologic research

Year	Recipient	Country	Research
1901	Emil von Behring	Germany	Serum antitoxins
1905	Robert Koch	Germany	Cellular Immunity to tuberculosis
1908	Elie Metchnikoff Paul Ehrlich	Russia Germany	Role of phagocytosis (Metchnikoff) and antitoxins (Ehrlich) in Immunity
1913	Charles Richet	France	Anaphylaxis
1919	Jules Bordet	Belgium	Complement-mediated bacteriolysis
1930	Karl Landsteiner	United States	Discovery of human blood groups
1951	Max Theiler	South Africa	Development of yellow fever vaccine
1957	Daniel Bovet	Switzerland	Antihistamines
1960	F. Macfarlane Burnet Peter Medawar	Australia Great Britain	Discovery of acquired immunological tolerance
1972	Rodney R. Porter Gerald M. Edelman	Great Britain United States	Chemical structure of antibodies
1977	Rosalyn R. Yalow	United States	Development of radioimmunoassay
1980	George Snell Jean Dausset Baruj Benacerraf	United States France United States	Major histocompatibility complex
1984	Niels K. Jerne Cesar Milstein Georges E. Köhler	Denmark Great Britain Germany	Immune regulatory theories (Jerne) and technological advances in the development of monoclonal antibodies (Milstein and Köhler)
1987	Susumu Tonegawa	Japan	Gene rearrangement in antibody production
1991	E. Donnall Thomas Joseph Murray	United States United States	Transplantation Immunology
1996	Peter C. Doherty Rolf M. Zinkernagel	Australia Switzerland	Role of major histocompatibility complex in antigen recognition by T cells
2002	Sydney Brenner H. Robert Horvitz J. E. Sulston	South Africa United States Great Britain	Genetic regulation of organ development and cell death (apoptosis)
2008	Harald zur Hausen Françoise Barré-Sinoussi Luc Montagnier	Germany France France	Role of HPV in causing cervical cancer (Hausen) and the discovery of HIV (Barré-Sinoussi and Montagnier)
2011	Jules Hoffman Bruce Beutler Ralph Steinman	France United States United States	Discovery of activating principles of Innate Immunity (Hoffman and Beutler) and role of dendritic cells in adaptive Immunity (Steinman)

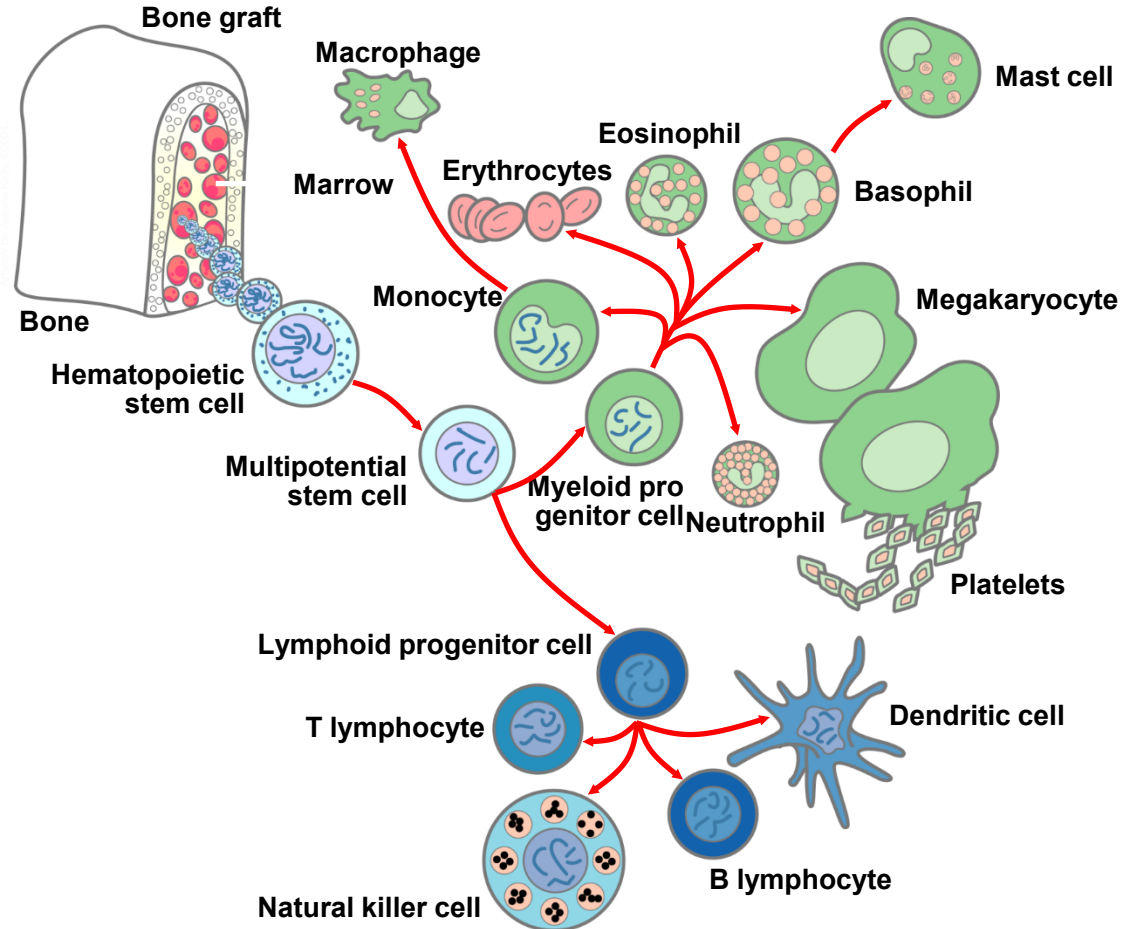
Organ Sistem Imun

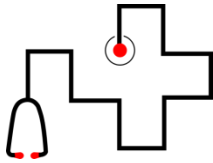


Sistem Limfatik



Sel-Sel Imun





Gambar 1. Sistem imun

Nonspecific Lines of Defense

Physical and chemical barriers to pathogens

•1st Line of Defense

Skin – most important

Hair – eyelashes, nose hairs

Cilia – in nose and throat; push pathogens away from lungs

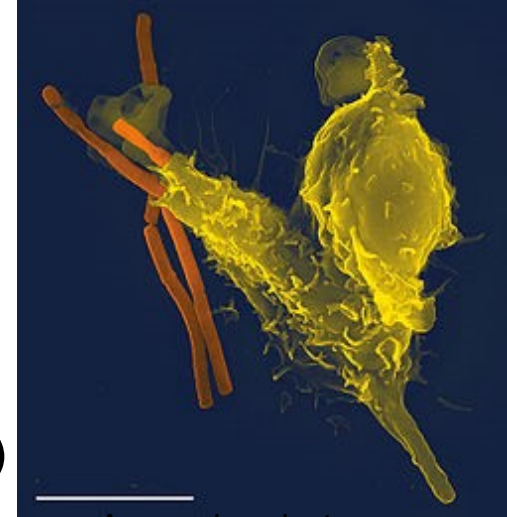
Secretions – mucous, stomach acid, sweat, tears, saliva, oil



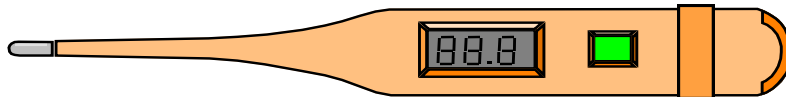
Nonspecific Lines of Defense

2nd Lines of Defense

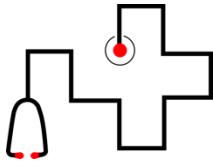
- Inflammation (swelling)
 - **Vasodilation** – blood vessels open up and allow white blood cells easier access the affected area
- Temperature response (fever)
- **Phagocytes** “eating cells” – engulf and destroy pathogens



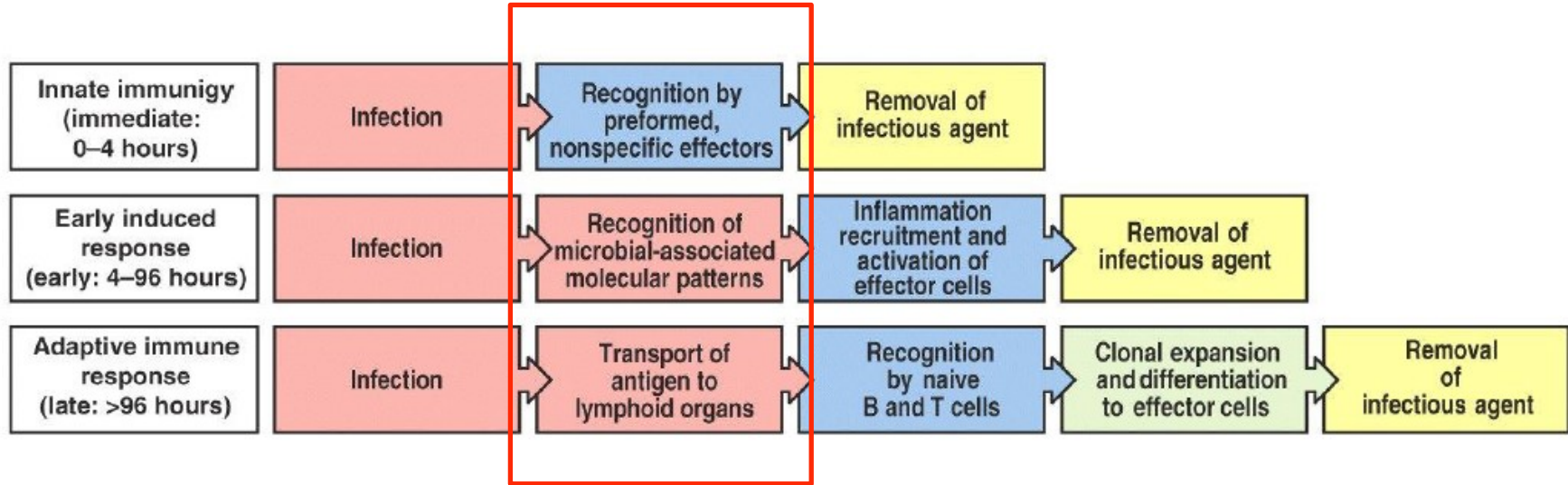
A scanning electron microscope image of a single neutrophil (yellow), engulfing anthrax bacteria (orange).



RESPON IMUN

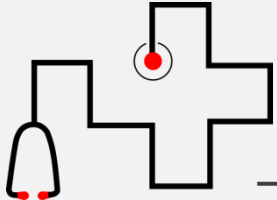


Reaksi tubuh terhadap keberadaan patogen, terjadi secara bertahap .



INNATE Vs ADAPTIVE

Sistem imun bawaan dapat mengaktifkan imun dan membantu mengeliminasi patogen



INNATE/BAWAAN/ NON-SPESTIFIK

- Respon tidak bergantung pada keberadaan antigen
- Respon berlangsung segera
- Tidak ada antigen spesifik
- Tidak memiliki memori imunologi

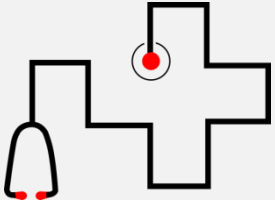
ADAPTIVE/ SPESTIFIK

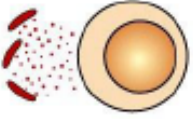


- Respon bergantung pada **antigen**
- Membutuhkan **waktu** antara paparan dan respon yang maksimal
- Terdapat **antigen spesifik**
- Menghasilkan **memori imunologi**

PATOGEN

The immune system protects against four classes of pathogens

Type of pathogen	Examples	Diseases
Extracellular bacteria, parasites, fungi	<i>Streptococcus pneumoniae</i> <i>Clostridium tetani</i> <i>Trypanosoma brucei</i> <i>Pneumocystis carinii</i>	Pneumonia Tetanus Sleeping sickness <i>Pneumocystis pneumonia</i>
Intracellular bacteria, parasites	<i>Mycobacterium leprae</i> <i>Leishmania donovani</i> <i>Plasmodium falciparum</i>	Leprosy Leishmaniasis Malaria
Viruses (intracellular)	Variola Influenza Varicella	Smallpox Flu Chickenpox
Parasitic worms (extracellular)	<i>Ascaris</i> <i>Schistosoma</i>	Ascariasis Schistosomiasis



	Direct mechanisms of tissue damage by pathogens		
	Exotoxin production	Endotoxin	Direct cytopathic effect
Pathogenic mechanism			
Infectious agent	<i>Streptococcus pyogenes</i> <i>Staphylococcus aureus</i> <i>Corynebacterium diphtheriae</i> <i>Clostridium tetani</i> <i>Vibrio cholerae</i>	<i>Escherichia coli</i> <i>Haemophilus influenzae</i> <i>Salmonella typhi</i> <i>Shigella</i> <i>Pseudomonas aeruginosa</i> <i>Yersinia pestis</i>	Variola Varicella-zoster Hepatitis B virus Polio virus Measles virus Influenza virus Herpes simplex virus Human herpes virus 8 (HHV8)
Disease	Tonsillitis, scarlet fever Boils, toxic shock syndrome, food poisoning Diphtheria Tetanus Cholera	Gram-negative sepsis Meningitis, pneumonia Typhoid fever Bacillary dysentery Wound infection Plague	Smallpox Chickenpox, shingles Hepatitis Poliomyelitis Measles, subacute sclerosing panencephalitis Influenza Cold sores Kaposi's sarcoma

TIPE KERUSAKAN OLEH PATOGEN

KERUSAKAN LANGSUNG

EKSOTOKSIN

Menyebabkan efek keracunan dan toksin yang dikeluarkan



ENDOTOKSIN

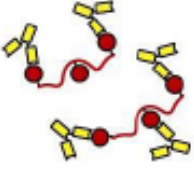

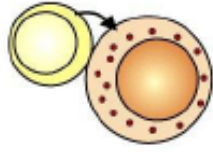
Kerusakan di tempat infeksi akibat adanya pertahanan patogen yang mengandung toksin



DIRECT CYTOPATHIC EFFECT

Adanya perubahan sel patogen yang berdampak pada kerusakan di tempat infeksi



	Indirect mechanisms of tissue damage by pathogens		
	Immune complexes	Anti-host antibody	Cell-mediated immunity
Pathogenic mechanism			
Infectious agent	Hepatitis B virus Malaria <i>Streptococcus pyogenes</i> <i>Treponema pallidum</i> Most acute infections	<i>Streptococcus pyogenes</i> <i>Mycoplasma pneumoniae</i>	<i>Mycobacterium tuberculosis</i> <i>Mycobacterium leprae</i> Lymphocytic choriomeningitis virus <i>Borrelia burgdorferi</i> <i>Schistosoma mansoni</i> Herpes simplex virus
Disease	Kidney disease Vascular deposits Glomerulonephritis Kidney damage in secondary syphilis Transient renal deposits	Rheumatic fever Hemolytic anemia	Tuberculosis Tuberculoid leprosy Aseptic meningitis Lyme arthritis Schistosomiasis Herpes stromal keratitis

TIPE KERUSAKAN OLEH PATOGEN

KERUSAKAN TIDAK LANGSUNG

PEMBENTUKAN IMUN KOMPLEKS

Kompleks imun mengendap dan menyebabkan berbagai kerusakan ginjal



ANTIBODI BEREAKSI SILANG DENGAN "SELF"

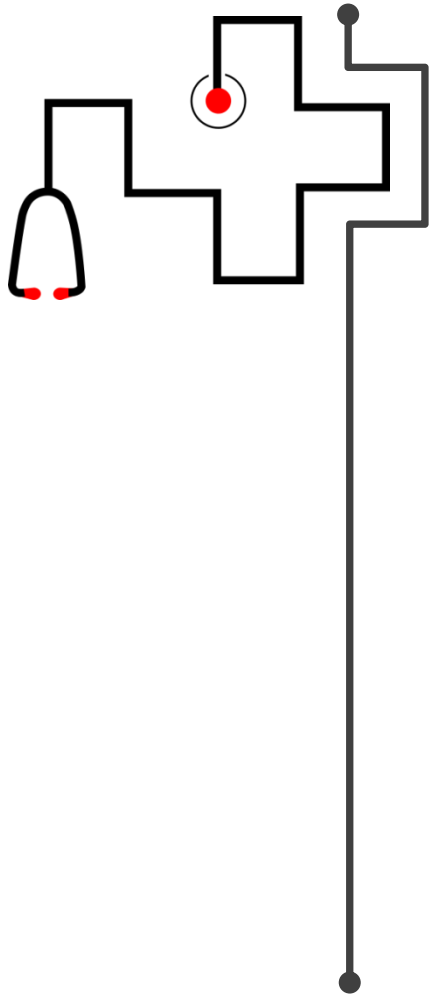
Menyebabkan kesalahan respon sehingga terjadi kerusakan sel



IMUNITAS YANG DIPERANTARAI SEL

Kerusakan sel terjadi sebagai akibat dari mekanisme imunitas seluler

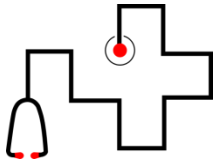




FUNGSI RESPON IMUN

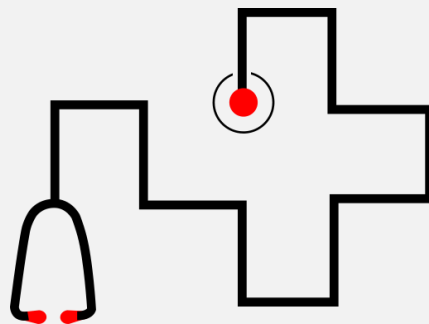
- 01 Pengenalan imunologi (self-nonself)
- 02 Efektor imun (mengeliminasi) : sistem komplemen, antibodi, sel T sitotoksik
- 03 Regulasi imun (keseimbangan) : membedakan self dan non-self → kegagalan (autoimunitas)
- 04 Memori imunologi (re-infeksi) : respon yang bersifat segera dan lebih cepat

AKTIVITAS IMUNITAS



- Pertahanan terhadap patogen yang masuk
- Penghilangan sel rusak (sel darah merah rusak) dan jaringan hancur (dari luka atau penyakit)
- Identifikasi dan penghancuran sel abnormal atau mutan (terutama terhadap kanker)
- Penolakan sel asing (transplantasi organ)
- Respons yang salah:
 - Alergi: respons terhadap senyawa yang tidak berbahaya
 - Penyakit autoimun

Antigen	Effect of response to antigen	
	Normal response	Deficient response
Infectious agent	Protective immunity	Recurrent infection
Innocuous substance	Allergy	No response
Grafted organ	Rejection	Acceptance
Self organ	Autoimmunity	Self tolerance
Tumor	Tumor immunity	Cancer



Thank you