



What are immune response
leading to unfavorable outcomes ?

History of The Greatest Pandemic in History

Purple Death



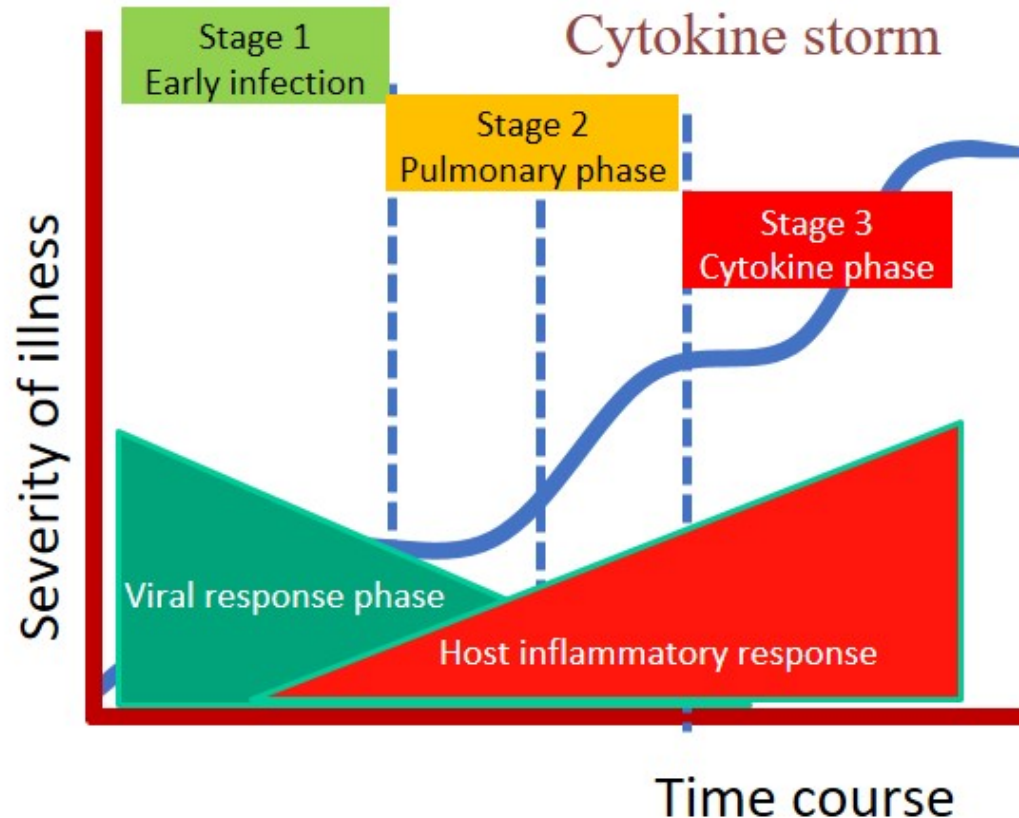
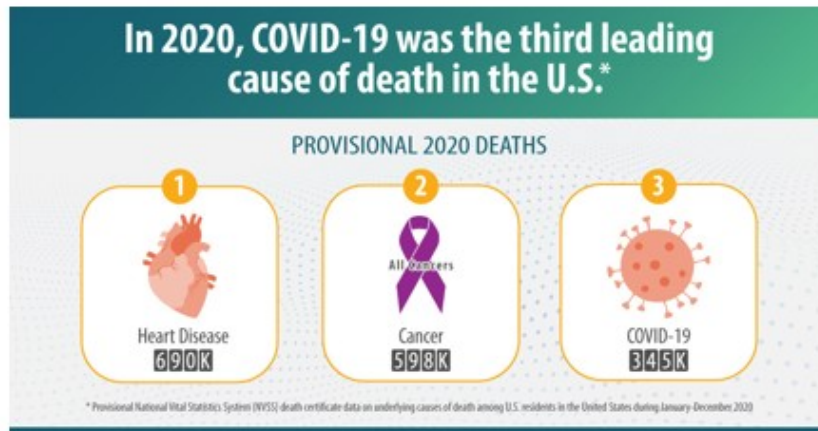
History of Pandemics



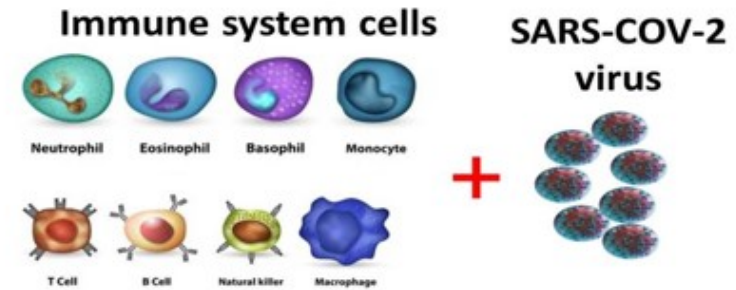
Main cause of Death

1918	Influenza pandemic	Cytokine storm
1981	HIV	Immune suppression
2003	SARS epidemic	Cytokine storm

Cause of Mortality in Pandemic



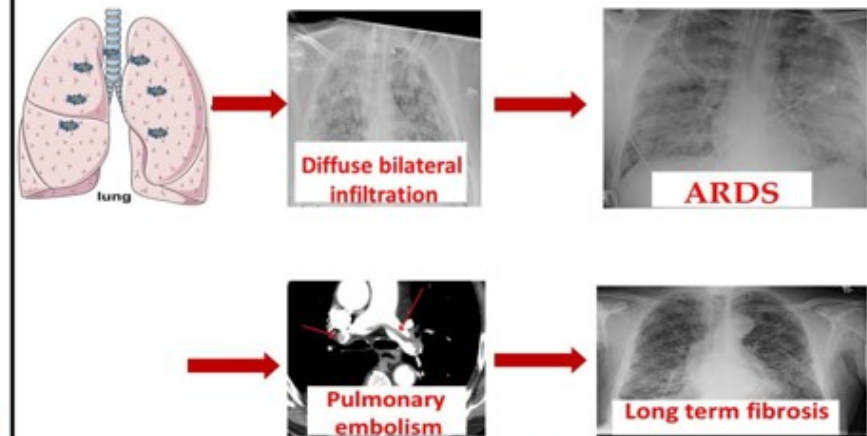
COVID-19: The Cytokine Storm Theory



Immune system cell activation

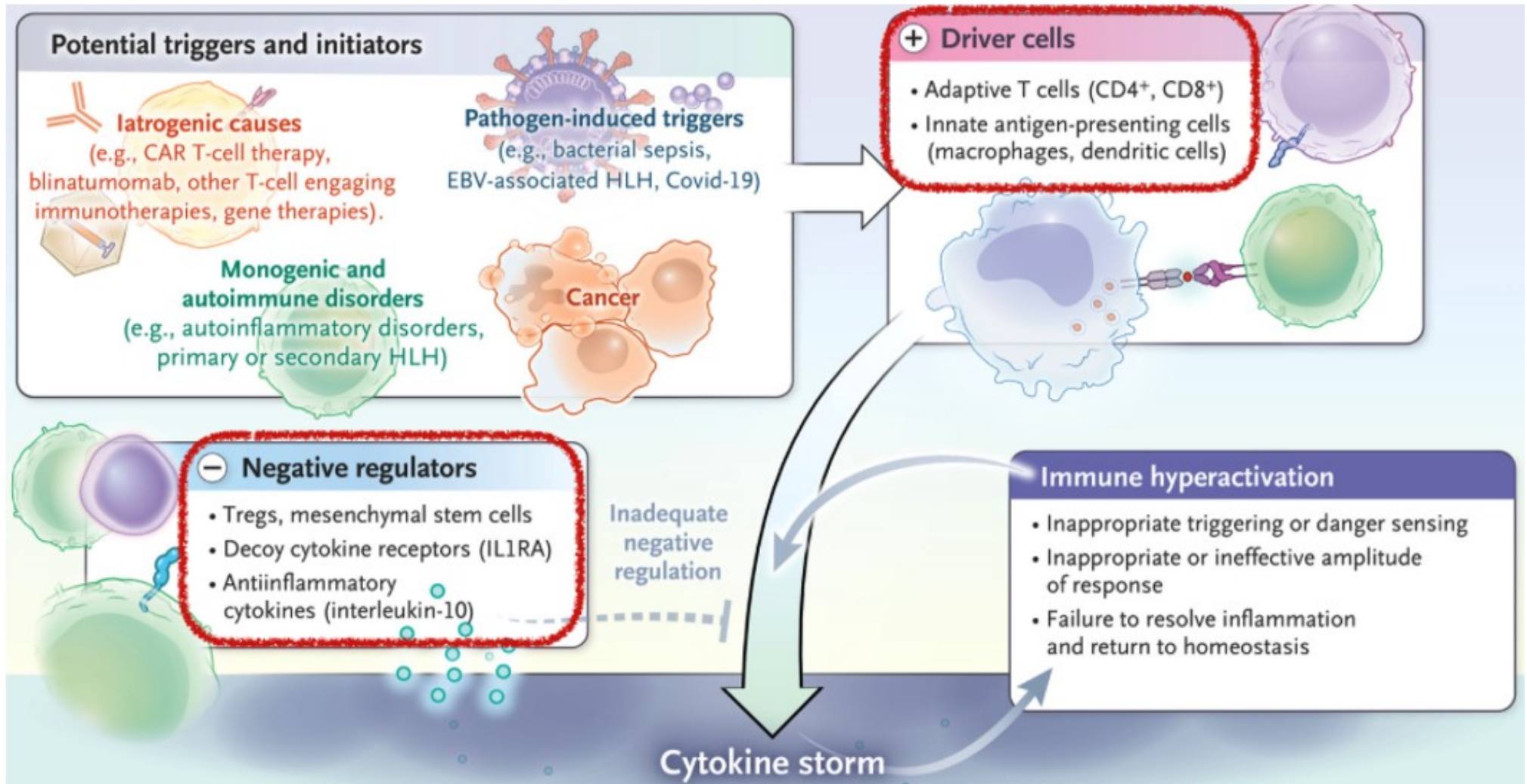
Cytokine storm:

Increased levels of: CCL-2, CCL-3, CXCL-10, GCSE, IFN- γ , IL-10, IL-2, IL-4, IL-6, IL-7, TNF α and TGF- β

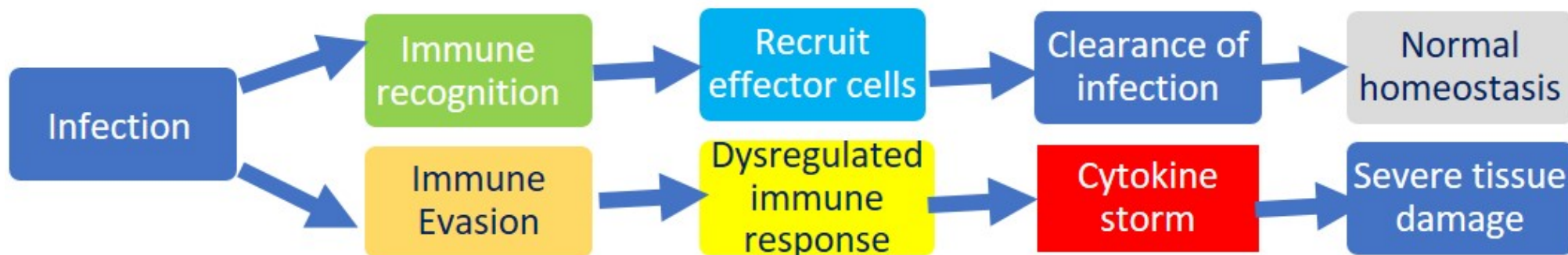


Lung damage due to the cytokine storm

Mechanisms of Cytokine storm



Dysregulated Response



New Sepsis Definition (Adults)

Infection

Dysregulated host response

Life threatening organ dysfunction

Clinical features

Lungs

- Pneumonitis
- Pulmonary edema
- Dyspnea, hypoxemia
- ARDS

Liver

- Hepatomegaly
- Elevated liver enzymes
- Increased hepcidin
- Hypoalbuminemia
- Liver injury
- Cholestasis
- Liver failure

Kidneys

- Acute renal dysfunction or injury
- Renal failure

Vascular and lymphatic systems

- Cytopenia, anemia, leukocytosis
- Coagulopathy
- Hyperferritinemia, increase in other acute-phase reactants (e.g., CRP, D-dimer)
- Elevated cytokines (e.g., interleukin-1, interleukin-6, interferon- γ) and growth factors (e.g., VEGF)
- Endothelial damage and vascular permeability
- Capillary leak syndrome
- Vasodilatory shock
- Spontaneous hemorrhage
- Lymphadenopathy

Nervous system

- Confusion
- Delirium
- Aphasia
- Seizures

Constitutional symptoms

- Fever
- Anorexia
- Fatigue

Heart

- Hypotension
- Tachycardia
- Cardiomyopathy

Rheumatologic system

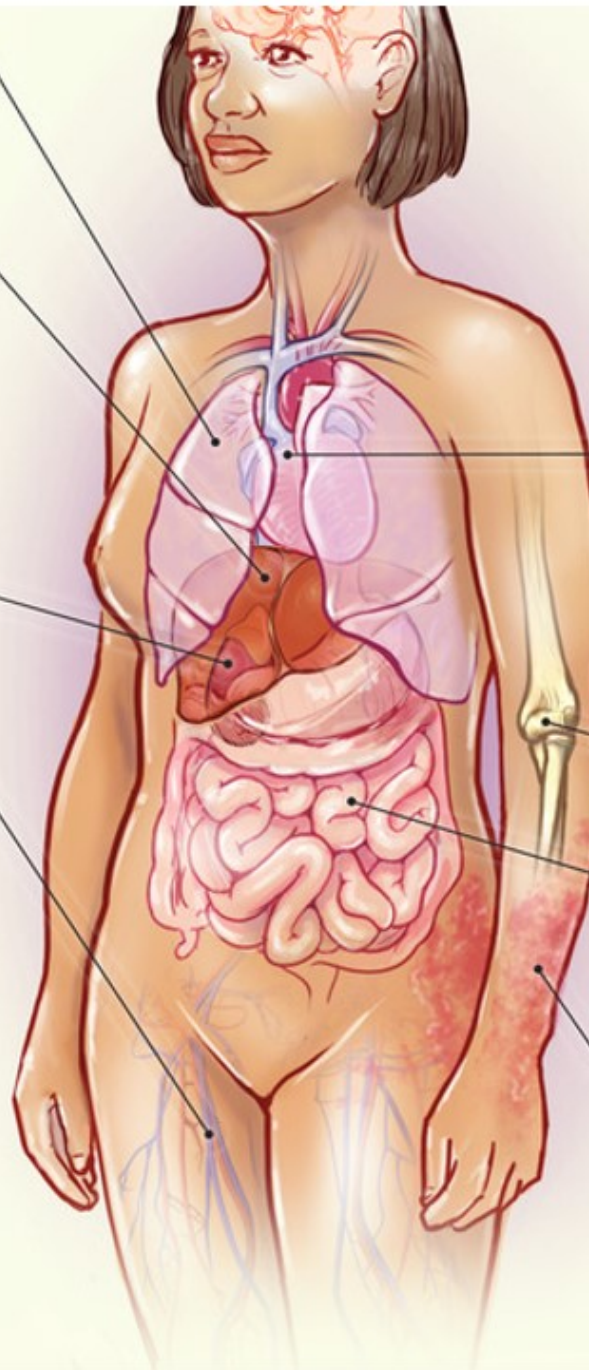
- Vasculitis
- Arthritis, arthralgia

Gastrointestinal system

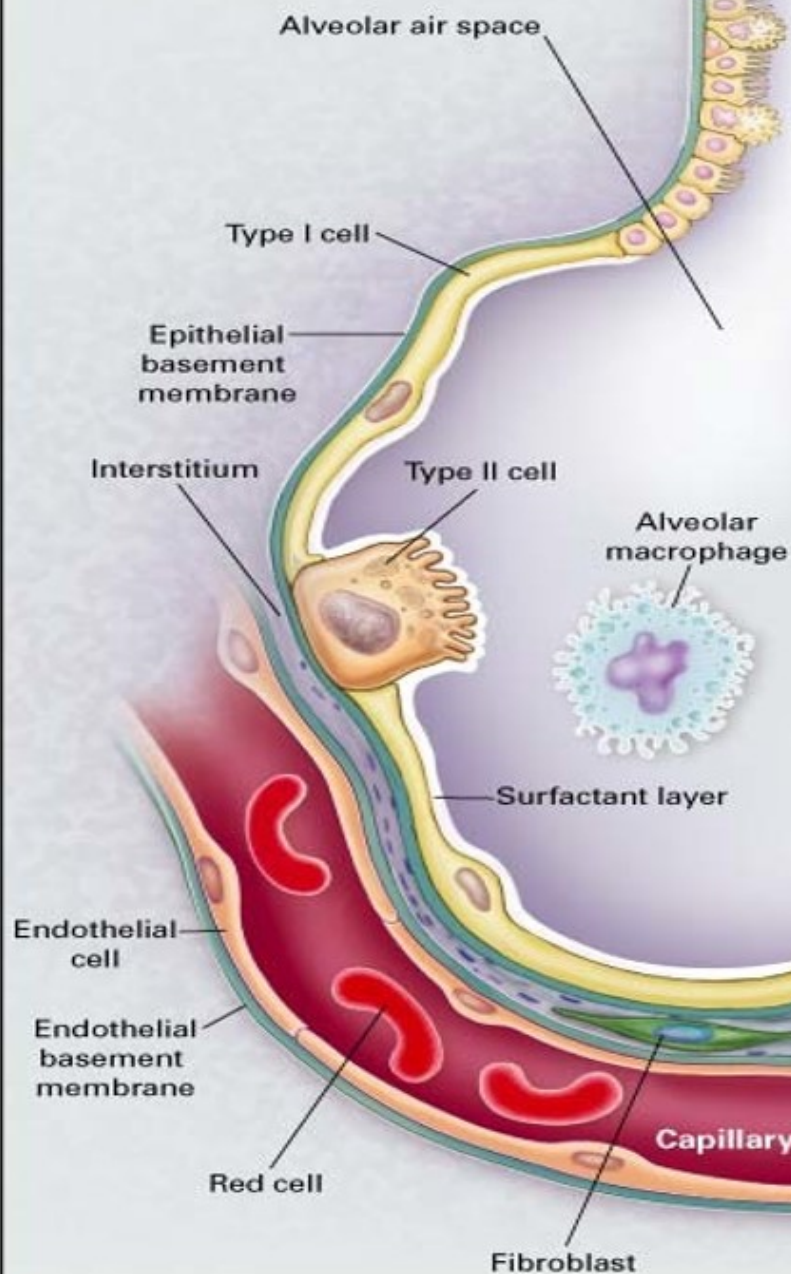
- Nausea
- Vomiting
- Diarrhea
- Ascites

Skin

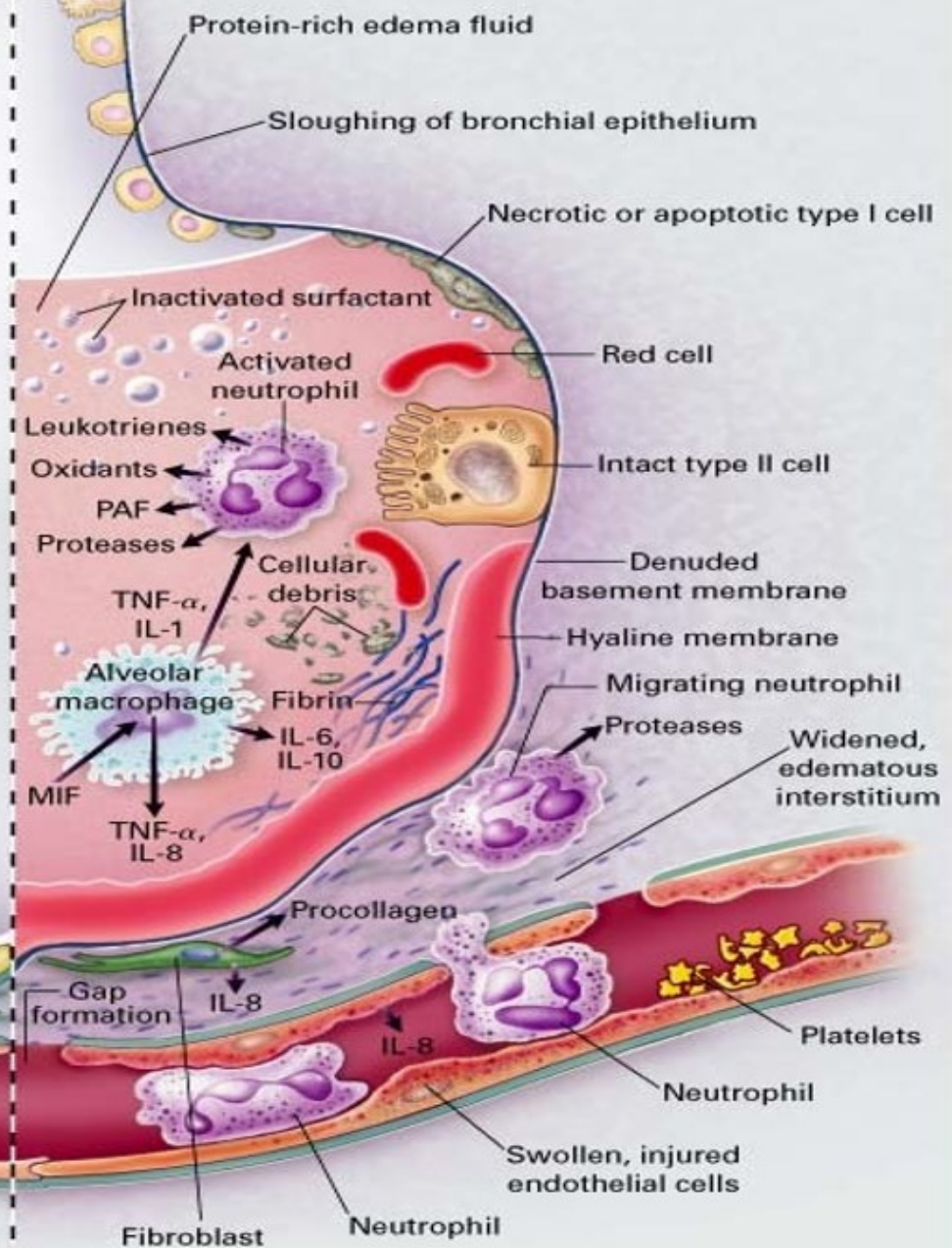
- Rash
- Edema



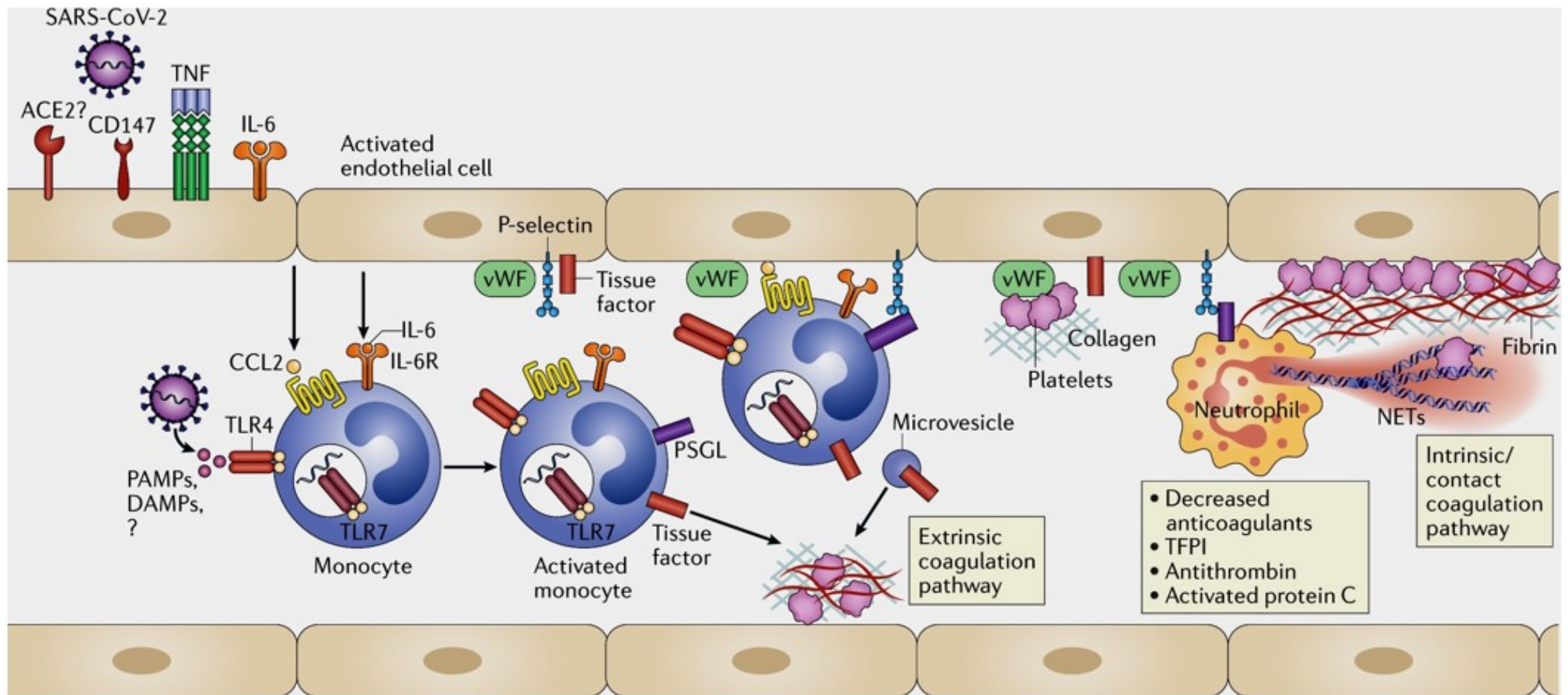
Normal Alveolus



Injured Alveolus during the Acute Phase



Immunocoagulopathy

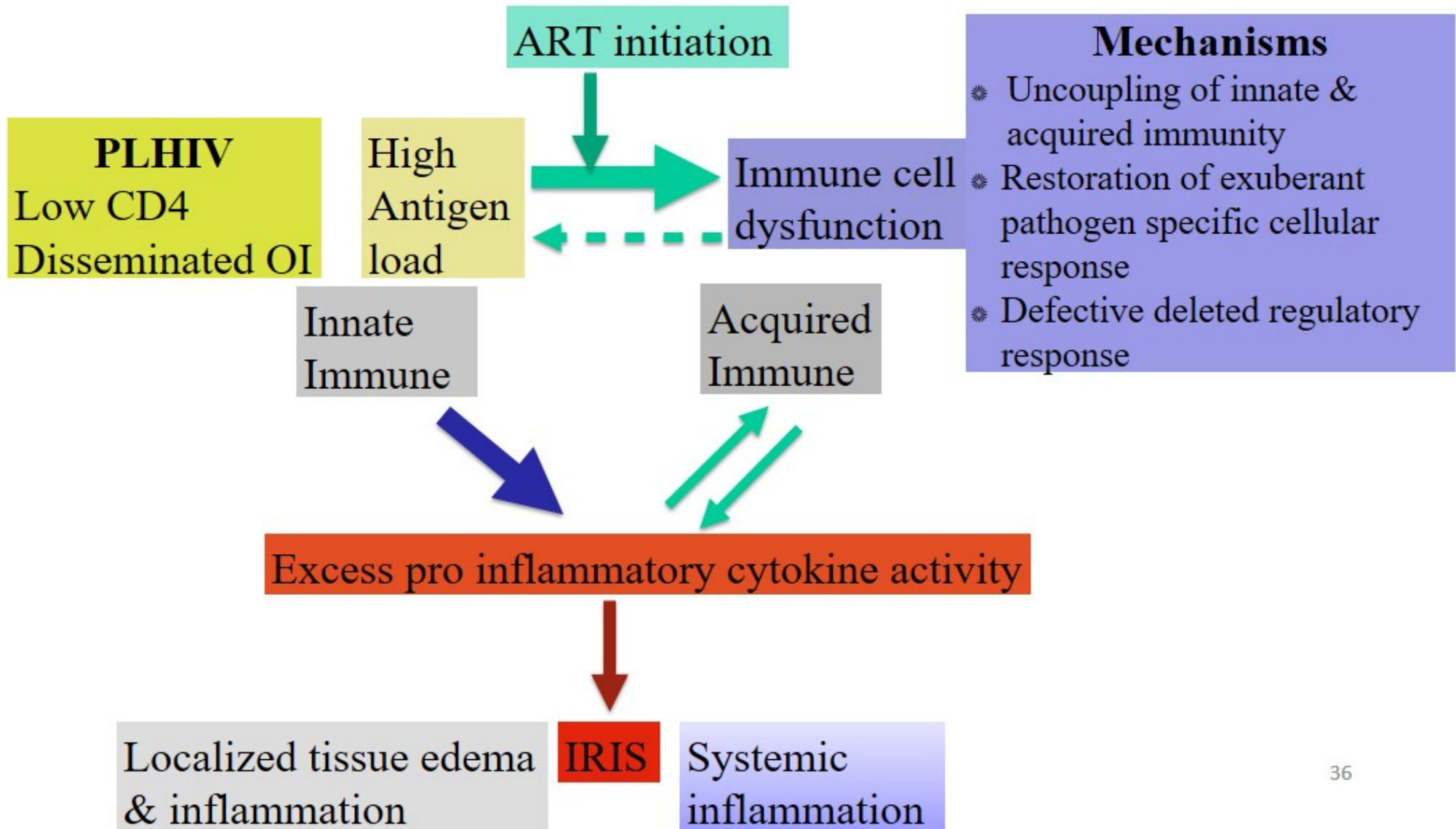


Immune Reconstitution Inhibition Syndrome

CD4 + T cells Presence

CD4 + T cells Absence

Mechanism of IRIS



Summary

"The power of the immune system
is a double-edged sword."

– Dr. William E. Paul

The 'immunologist's immunologist'



THANK
YOU