

Influenza and Diabetes

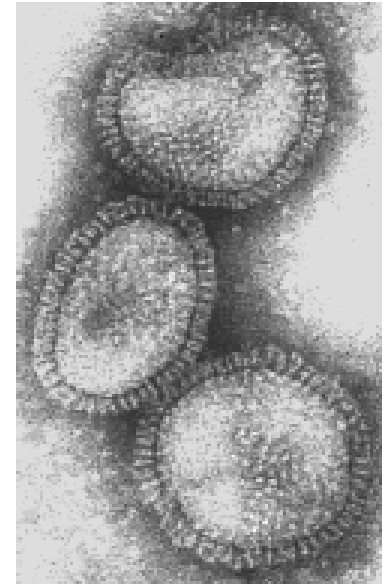


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Diabetes and Influenza



1918 - 1919 pandemic

- This killed between 20 – 40 million people
- Face masks were worn but provided little protection against infection



What is the current Issue?

THE ISSUE

415 MILLION PEOPLE WITH DIABETES
OVER **640 MILLION** BY 2040
MOST OF THESE CASES ARE TYPE 2 DIABETES

THE ISSUE

199 MILLION WOMEN WITH DIABETES
313 MILLION BY 2040



- Diabetes was responsible for **12% of healthcare spending in 2015** and is expected to reach **USD 802 billion by 2040**

Vaccine recommendations

- CDC has come up with recommendations of vaccines for diabetes patients
 - Influenza vaccine
 - Pneumococcal vaccine
 - Hepatitis B vaccine
 - Tdap vaccine- against whooping cough and tetanus
 - Zoster vaccine
 - HPV vaccine
 - MMR vaccine
 - Varicella vaccine
- The same are also recommended by
 - American Diabetes Association
 - Advisory Committee on Immunization Practices
 - World Health Organization

Classification

RNA virus

Family:

ORTHOMYXOVIRIDAE

Genus:

Influenza virus

Influenza C virus

Types:

Type A

Type B

Type C

INFLUENZA

PREVALENCE



5-10% adults
infected each year



20-30% children
infected each year¹



COMPLICATION



up to **5 million**
cases of severe illness¹

DEATHS



up to **500,000 deaths** each year¹

Risk of complications with Influenza

x3 Risk of hospitalization⁵

x5 Risk of experiencing a Heart Attack after systemic respiratory infections⁶

x3 Risk of experiencing a Stroke after systemic respiratory infections⁶

N°1 at Risk group for Influenza mortality⁷



DIABETES



HEART DISEASES



STROKE



LUNG DISEASES

- 28% deaths⁸

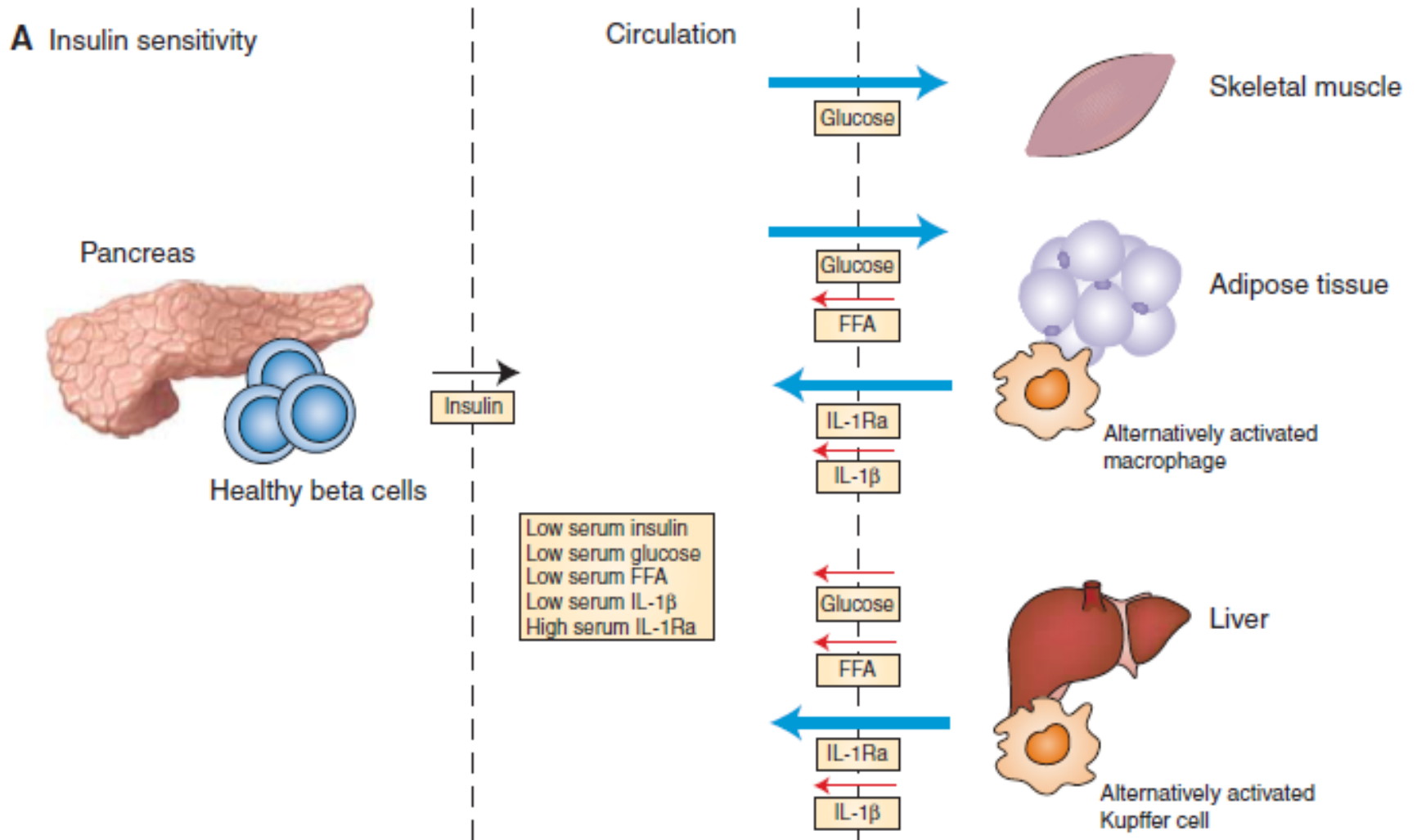
- 79% hospital admission⁹

- 50% heart attack occurrence¹⁰

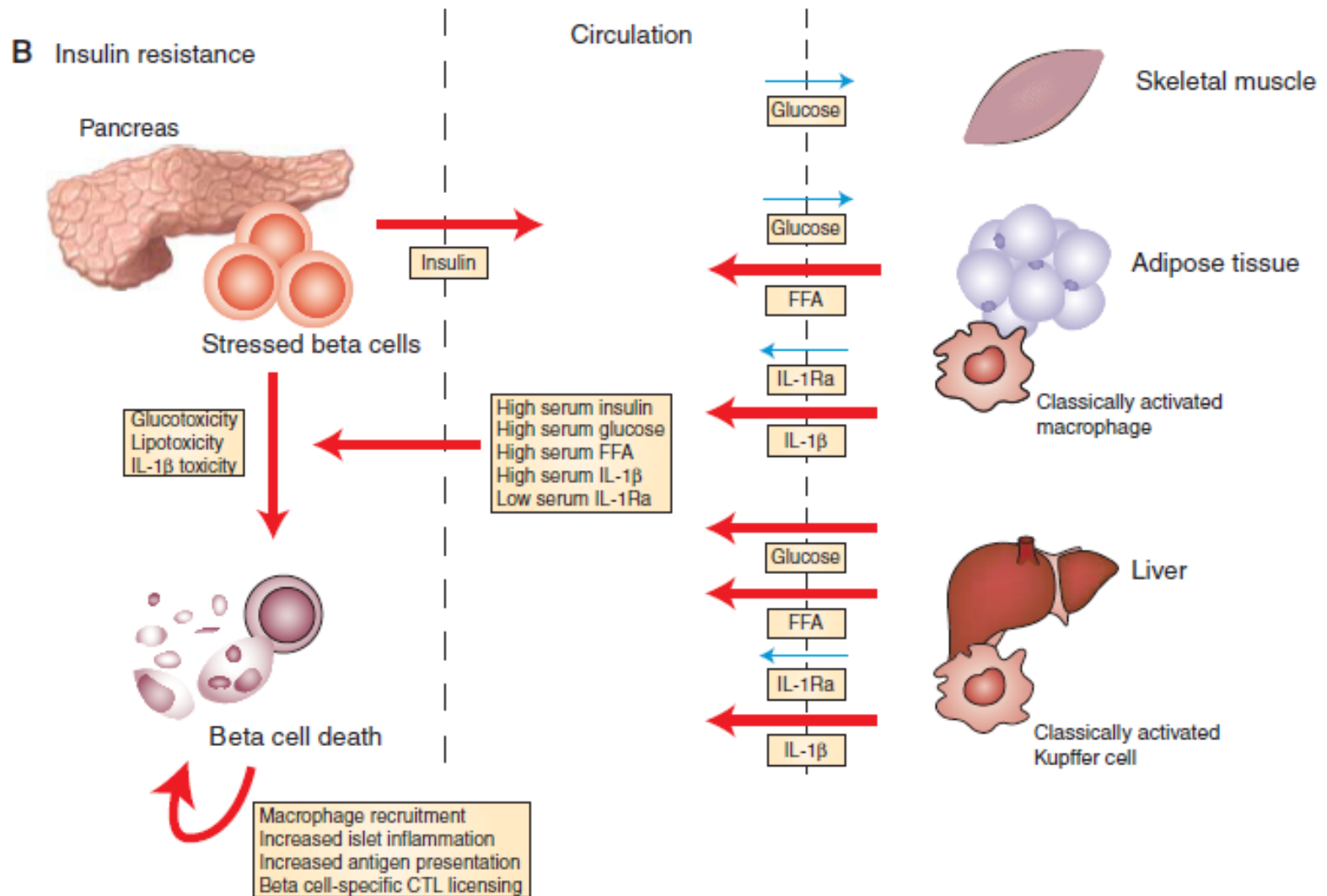
- 24% occurrence¹¹

significant reduction of exacerbation.

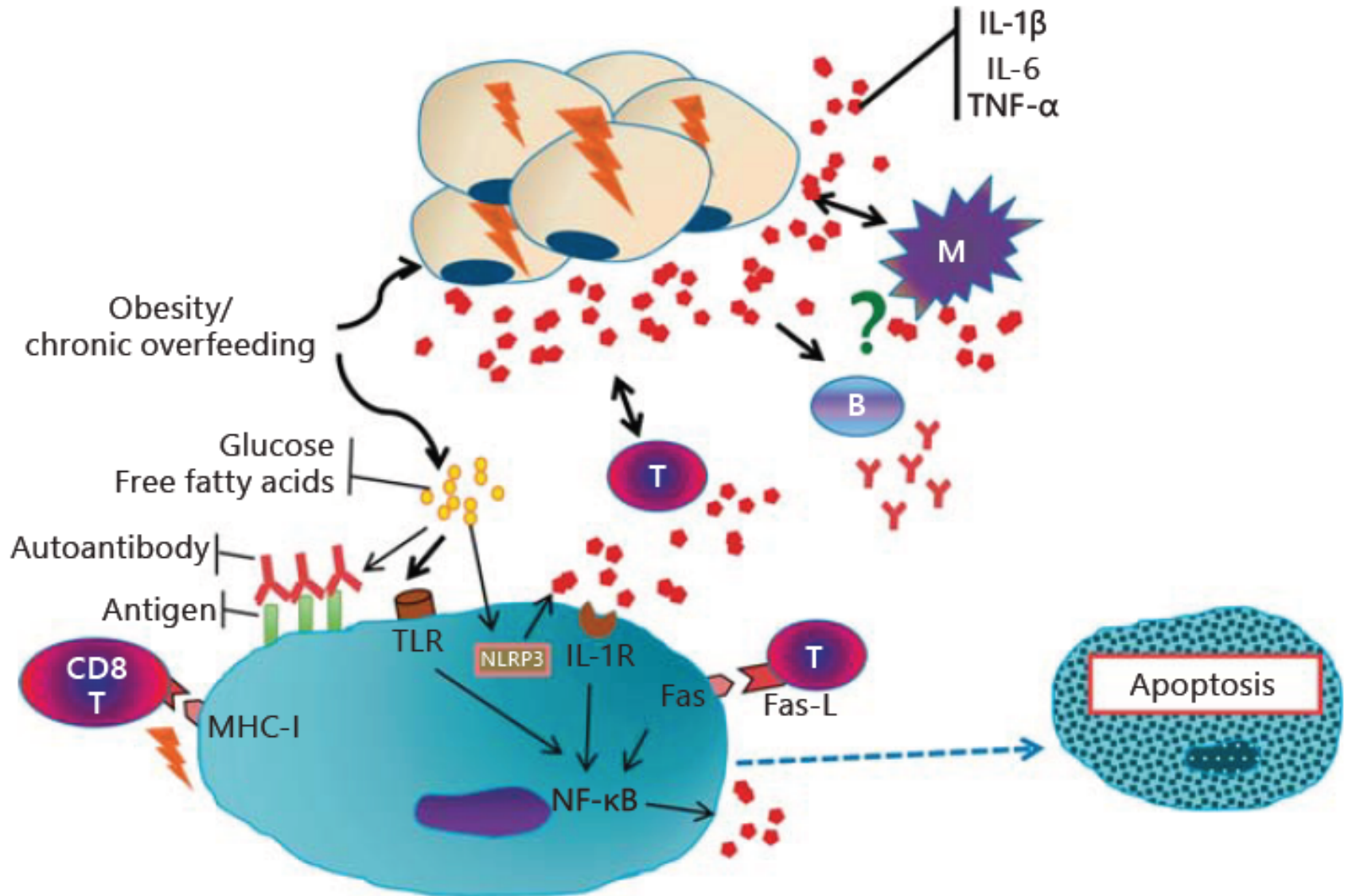
Insulin resistance damages beta-cells and leads to autoimmune insulinitis



Insulin resistance damages b-cells and leads to autoimmune insulinitis



Autoimmune Activation in T2DM



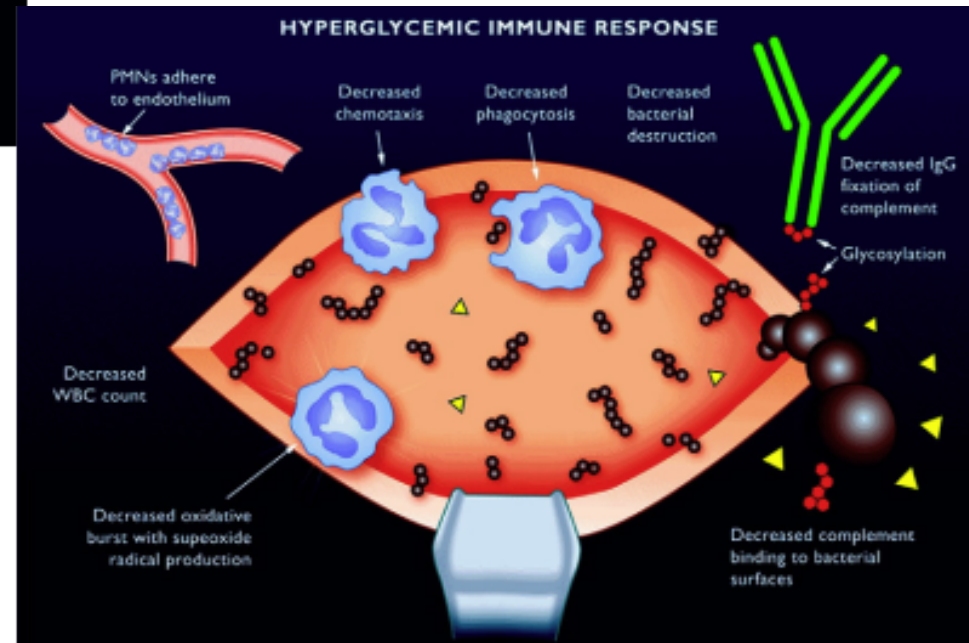
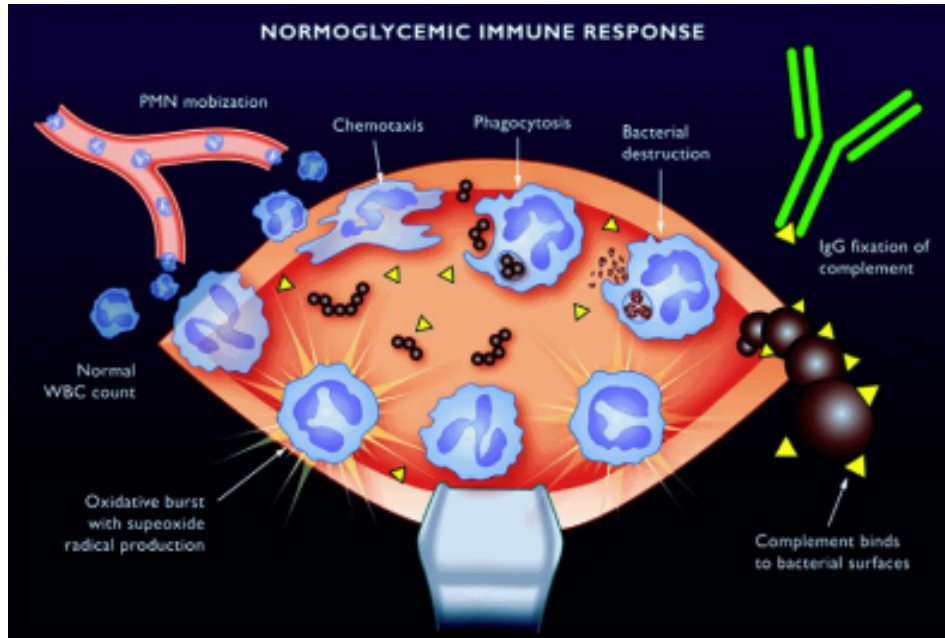
Suppressed Immunity in DM Patients

- **PMN functions** ↓ (particular when acidosis is present):
 - Leukocyte adherence ↓
 - Chemotaxis ↓
 - Phagocytosis ↓
 - Antioxidant activities ↓
- But **response to vaccines** appear to be normal
- Improving glycemic control might improve immune function

Diabetes and Influenza

- Diabetes is associated with several immunological changes
- Cell-mediated immunity appears to be the most affected, with alterations in immune cells including polymorphonuclear leukocytes, monocytes, and lymphocytes
- Diabetes patients are more common and serious because of several pathological changes in diabetes patients including;
 - ✓ Reduced T lymphocyte response
 - ✓ Reduced neutrophil function
 - ✓ Changes in humoral immunity
 - ✓ Reduced antioxidant defense
 - ✓ Lower secretion of inflammatory cytokines
 - ✓ Hyperglycemia

The effects of hyperglycemia on the immune system



Pathophysiology of infections associated with diabetes mellitus

