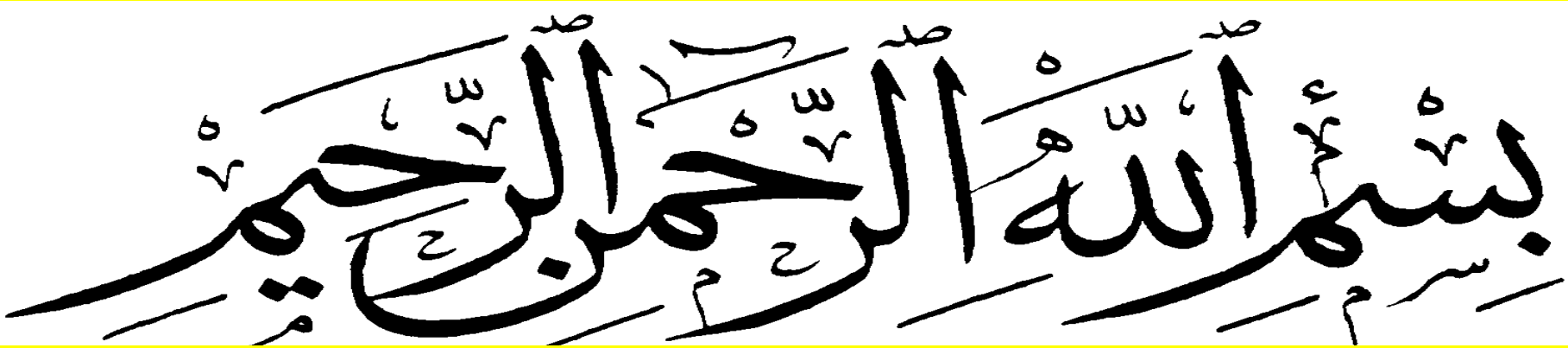

بسم الله الرحمن الرحيم

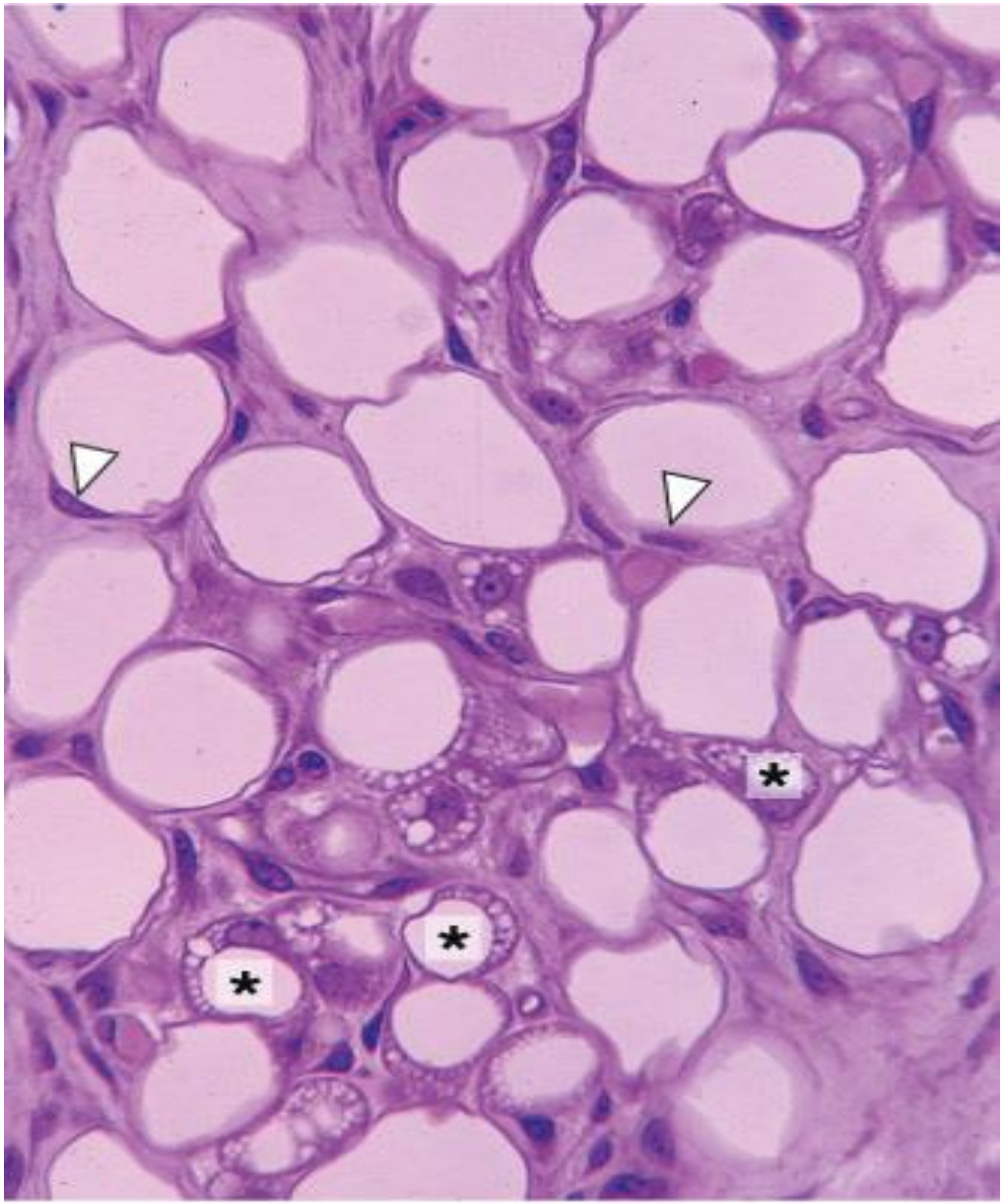
ADIPOSE TISSUE(20%)

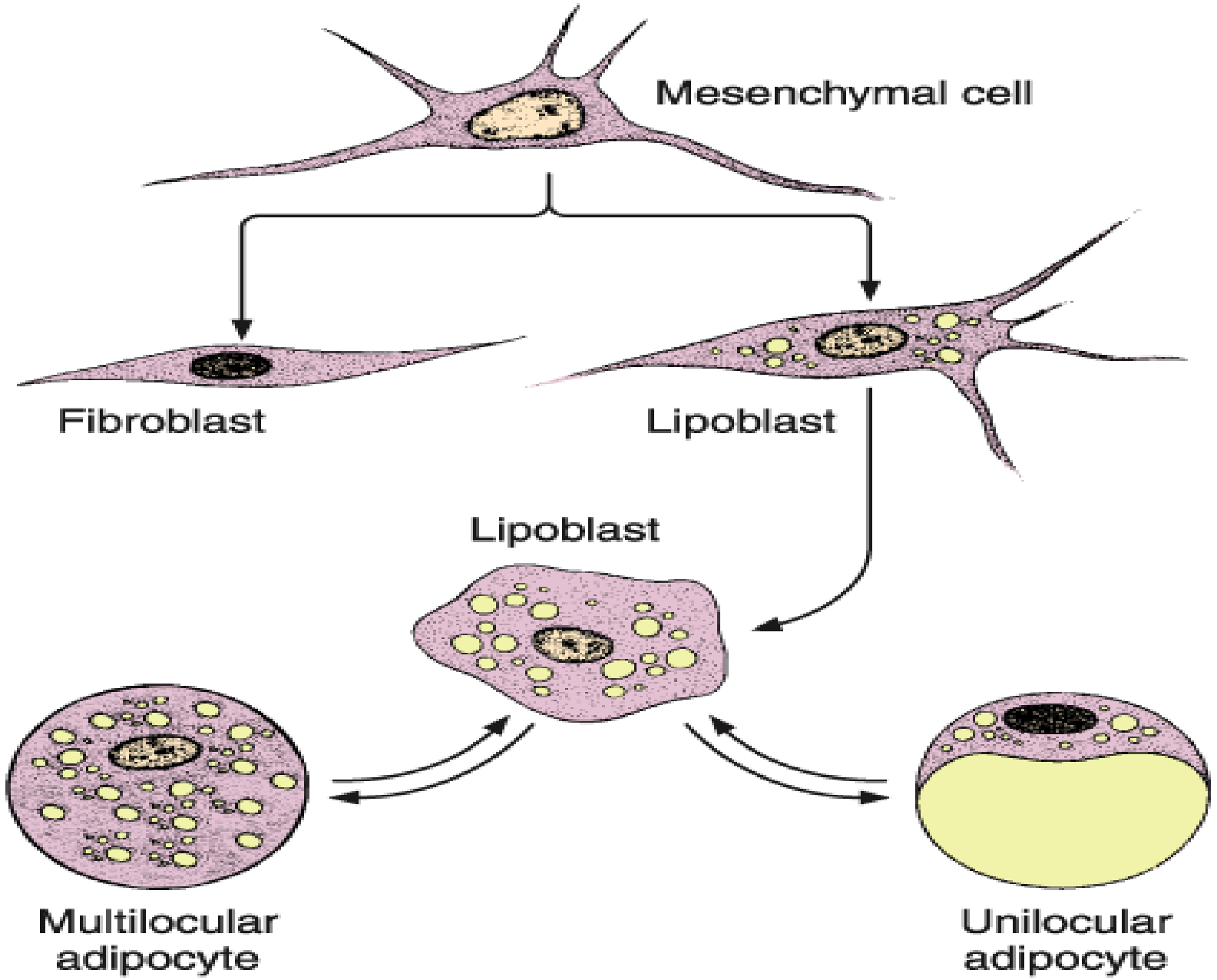
Adipose tissue is a special type of connective tissue in which adipose **adipocytes** predominate.

Unilocular adipose tissue

Arrowheads show nuclei of adipocytes compressed

against the cell membrane. Note that although most cells are unilocular, there are several cells (asterisks) with small lipid droplets in their cytoplasm, an indication that their differentiation is not yet complete.





- Adipose tissue is the largest repository of energy (in the form of triglycerides) in the body.

- **It is in a state of continuous turnover and is sensitive to both nervous and hormonal stimuli**.

- Subcutaneous layers of adipose tissue help to shape the surface of the body, whereas deposits in the form of pads act as shock absorbers, chiefly in the soles and palms.

- It contributes to the thermal insulation of the body.
- **It helps to keep some organs in place. Recently, it was observed that adipose tissue secretes various types of molecules that may be carried by the blood to influence distant organs.**
- The two known types

1. **Unilocular** (**common,** or **yellow**) **adipose tissue** is composed of cells that, when completely developed, contain one large central droplet of yellow fat in their cytoplasm. The **signet ring cells.**

   LIPOMAS

Multilocular (or **brown**) adipose tissue is composed of cells that contain numerous lipid droplets and **ABUNDANT BROWN MITOCHONDRIA**.

Rich blood supply. The ratio of blood volume to cytoplasm volume is greater in adipose tissue than in striated muscle. Multilocular adipose tissue is also Called **brown fat** due to both the large number of blood capillaries in this tissue and the numerous mitochondria in the cells.

Important in postnatal life to produces heat in newborn.

Reduced in adulthood.

Insulin stimulates the uptake of glucose into the adipose cells and increases the synthesis of lipoprotein lipase.

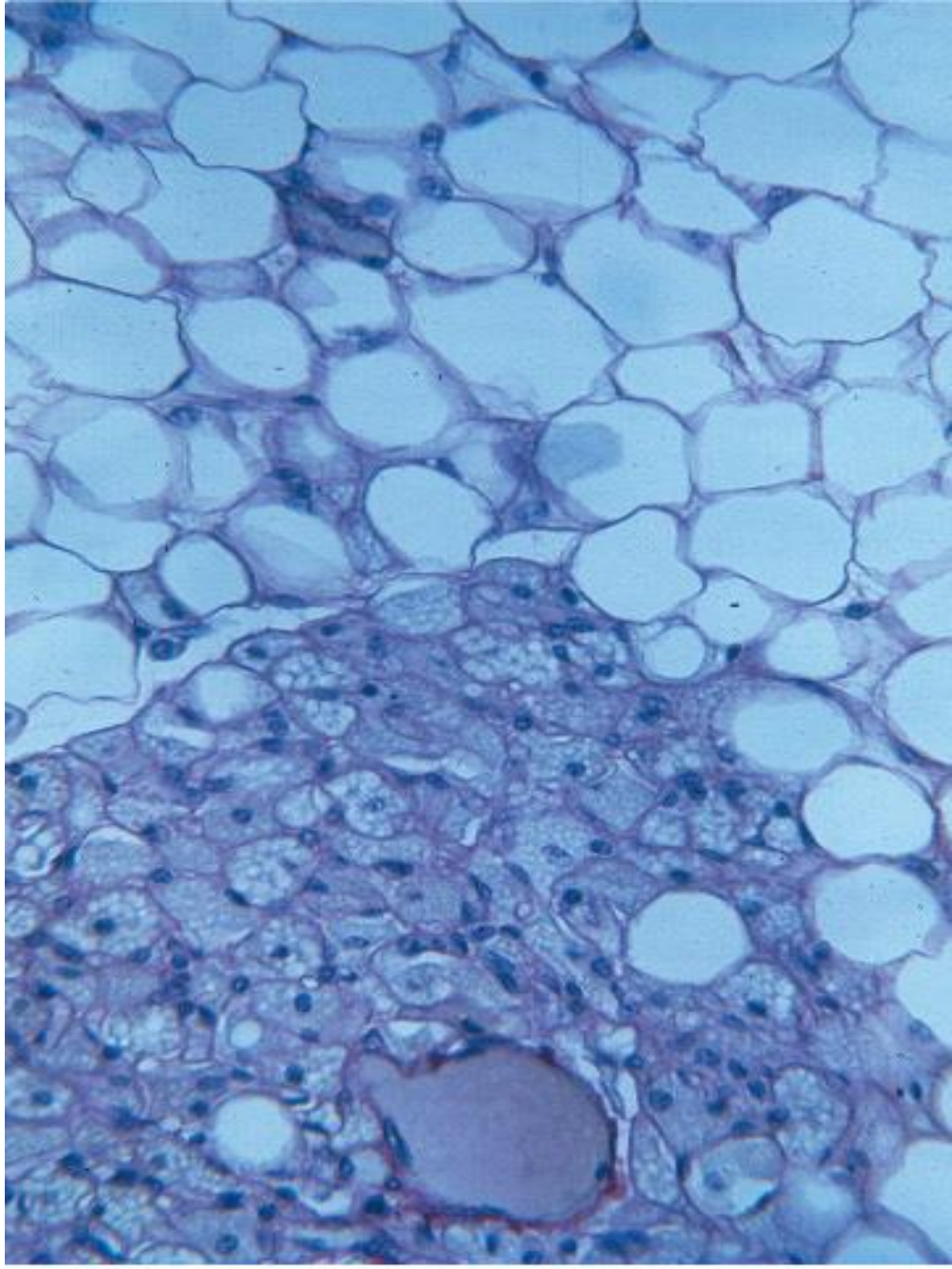
Norepinephrine is liberated at the endings of the postganglionic sympathetic nerves present in adipose tissue activates the hormone-sensitive lipase. This innervation plays an important role in the mobilization of fats from body.

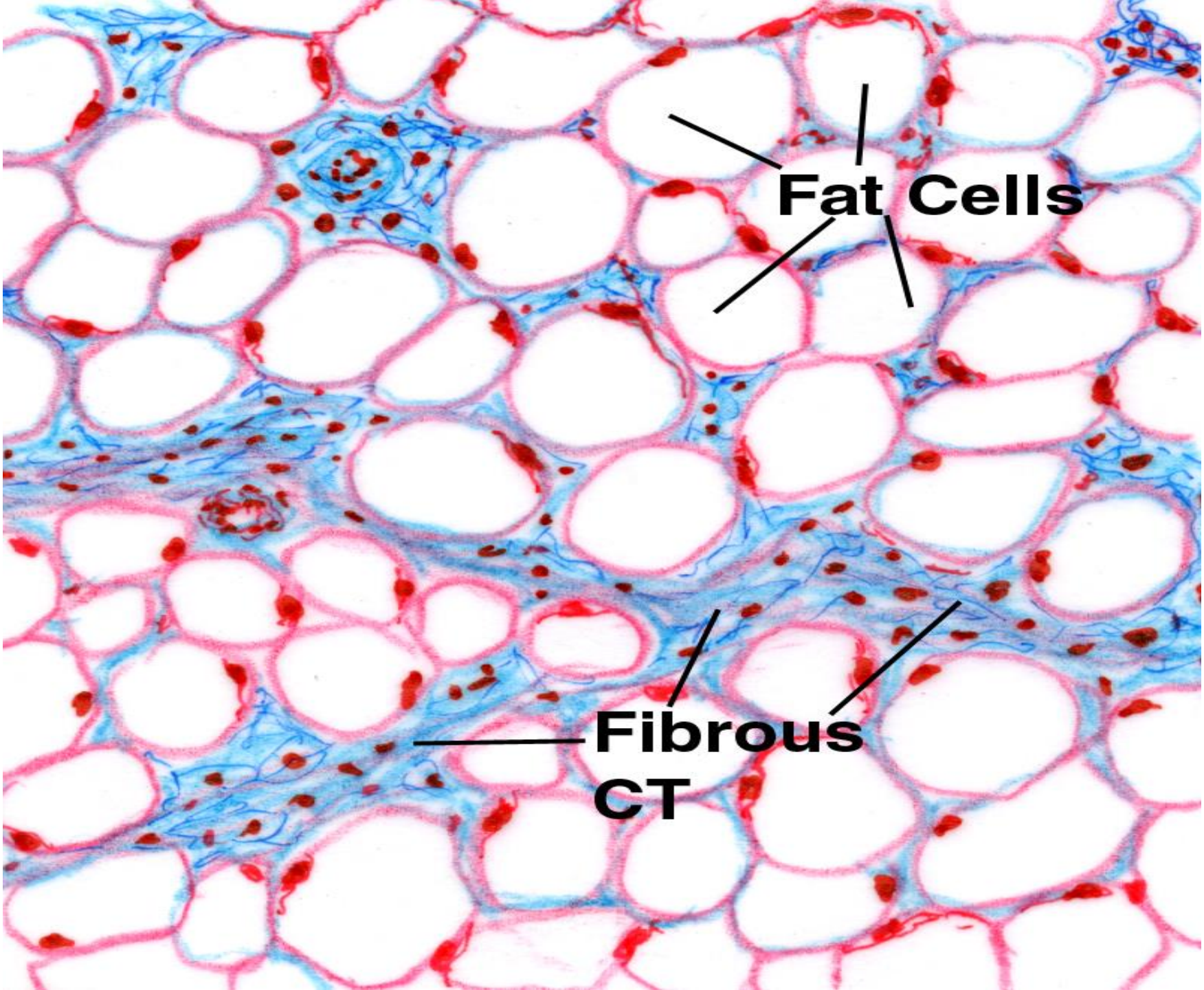
OBESITY in adults may result from an excessive accumulation of fat in unilocular tissue cells that have become larger than usual

1. **Hypertrophic obesity**.
2. **Hyperplastic obesity .** An increase in the number of adipocytes.

Multilocular adipose tissue (lower portion) with its characteristic cells containing central spherical nuclei and multiple lipid droplets.

For comparison, the upper part of the photomicrograph shows unilocular tissue.




Fat Cells
Fibrous
CT

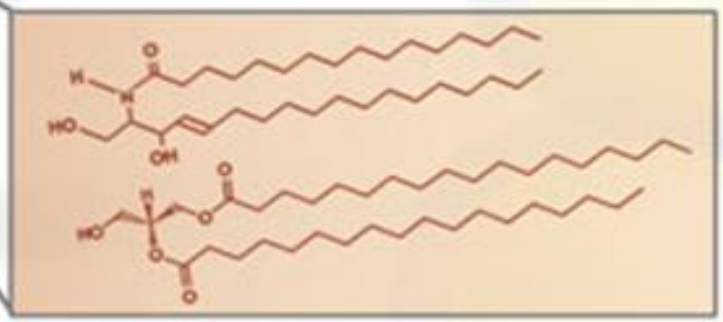
Best Wishes from
Punxsatawney Phil!

Not all fat cells are alike

In upper body subcutaneous fat, cells increase in size with weight gain.

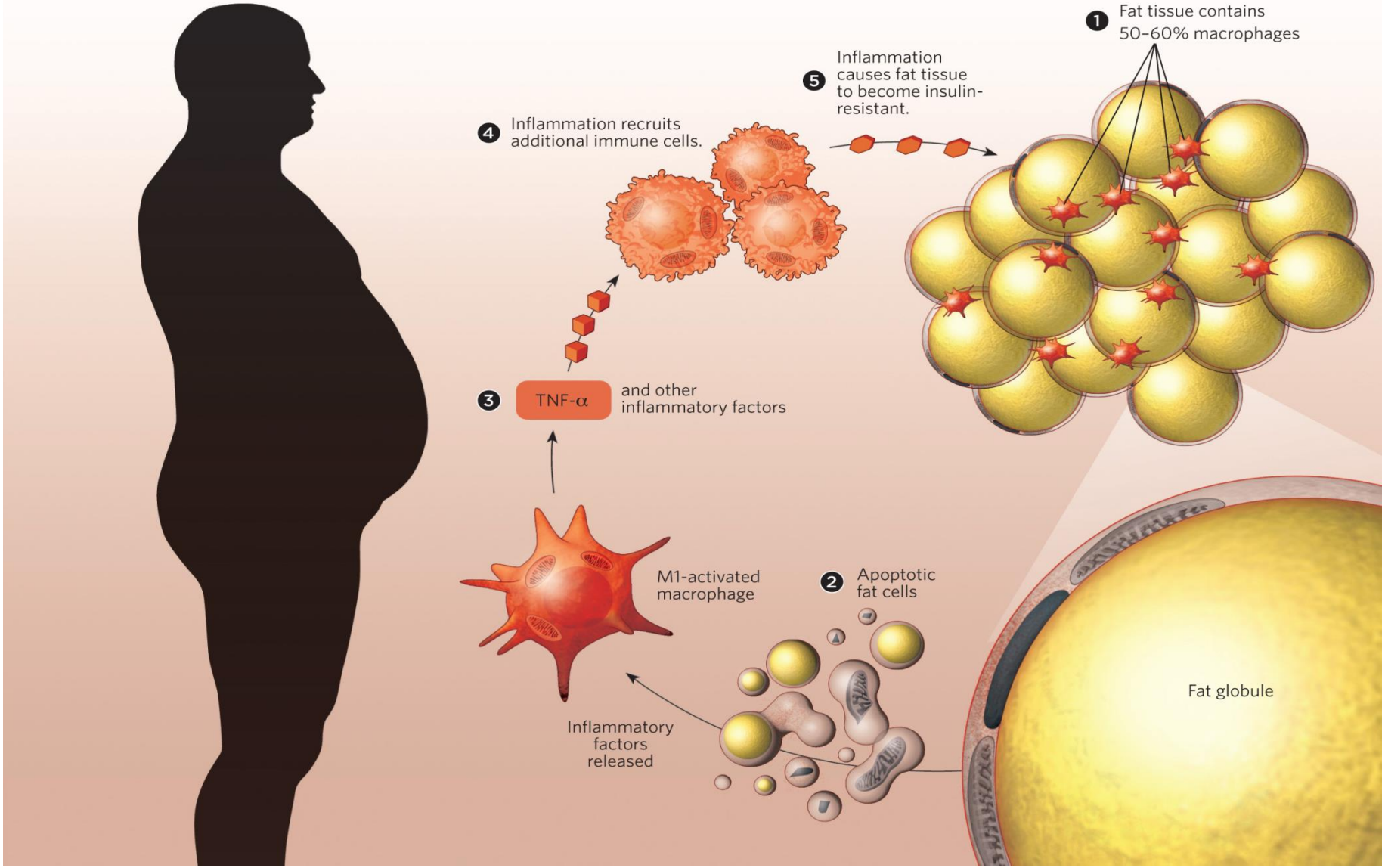
When they become overly large and surrounded by inflammatory cells, they release too many free fatty acids.

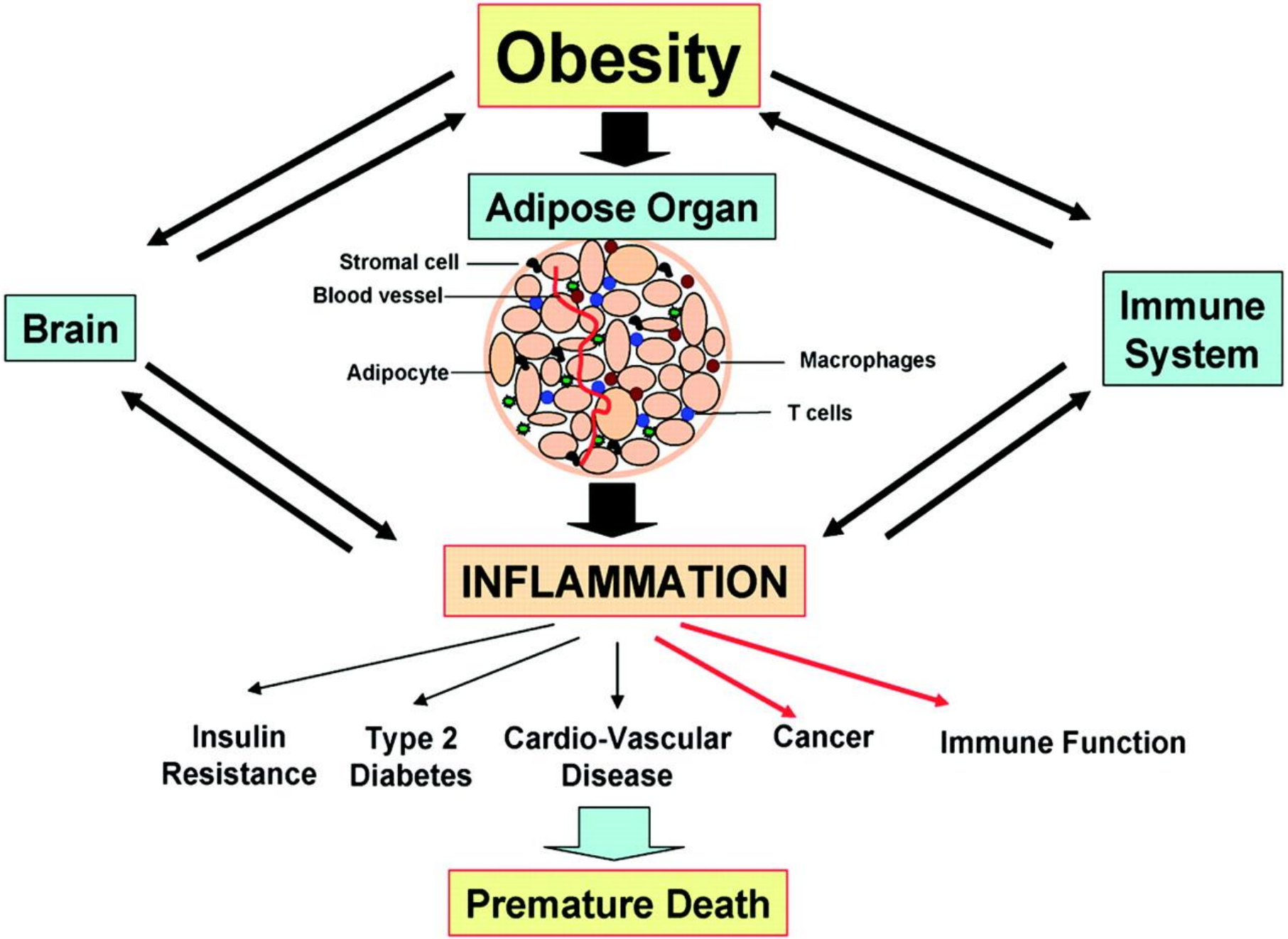
Fatty acids build up in muscle, liver, and pancreatic islet cells, where they form diglycerides and ceramides that can lead to metabolic dysfunction.

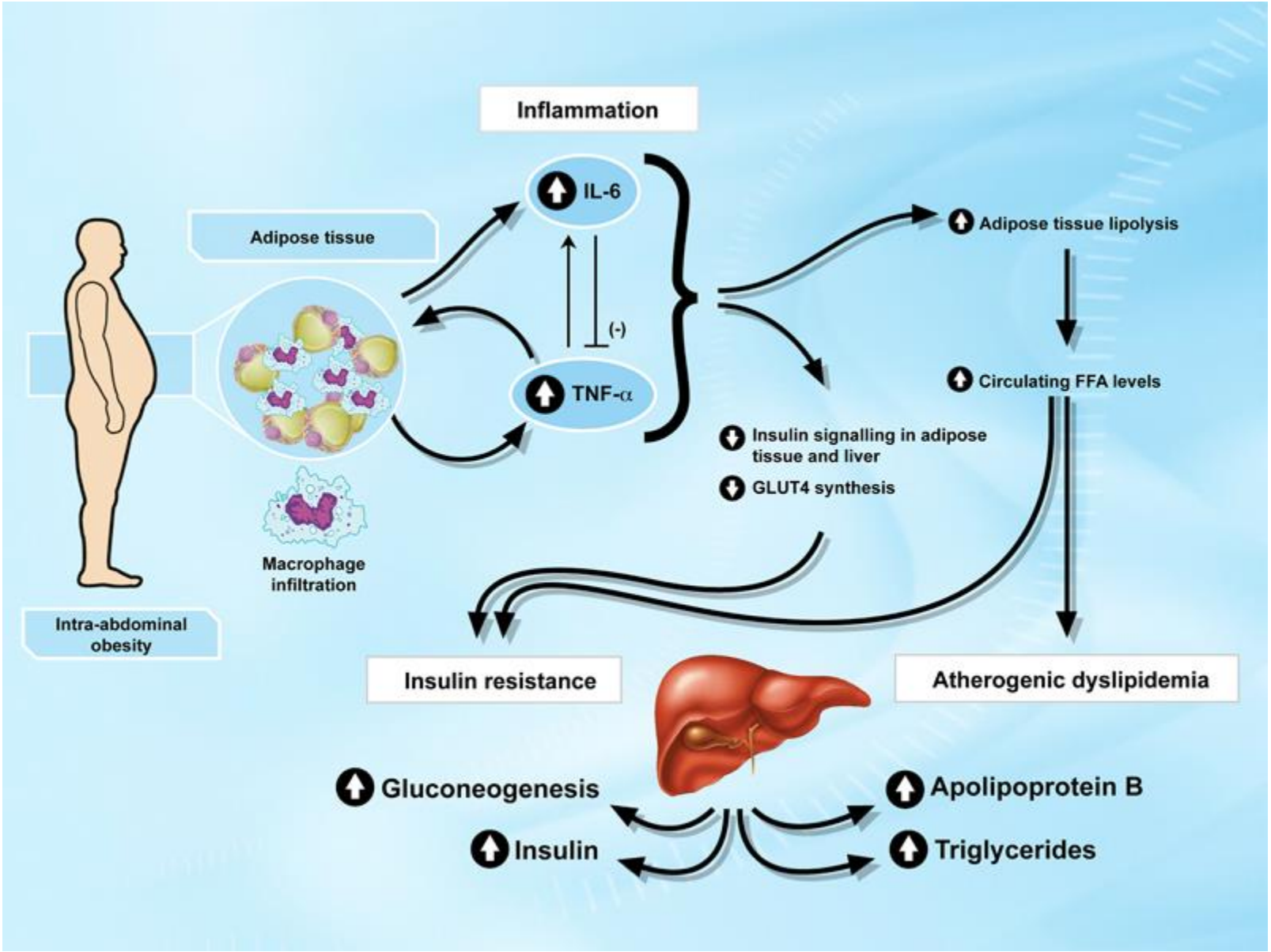


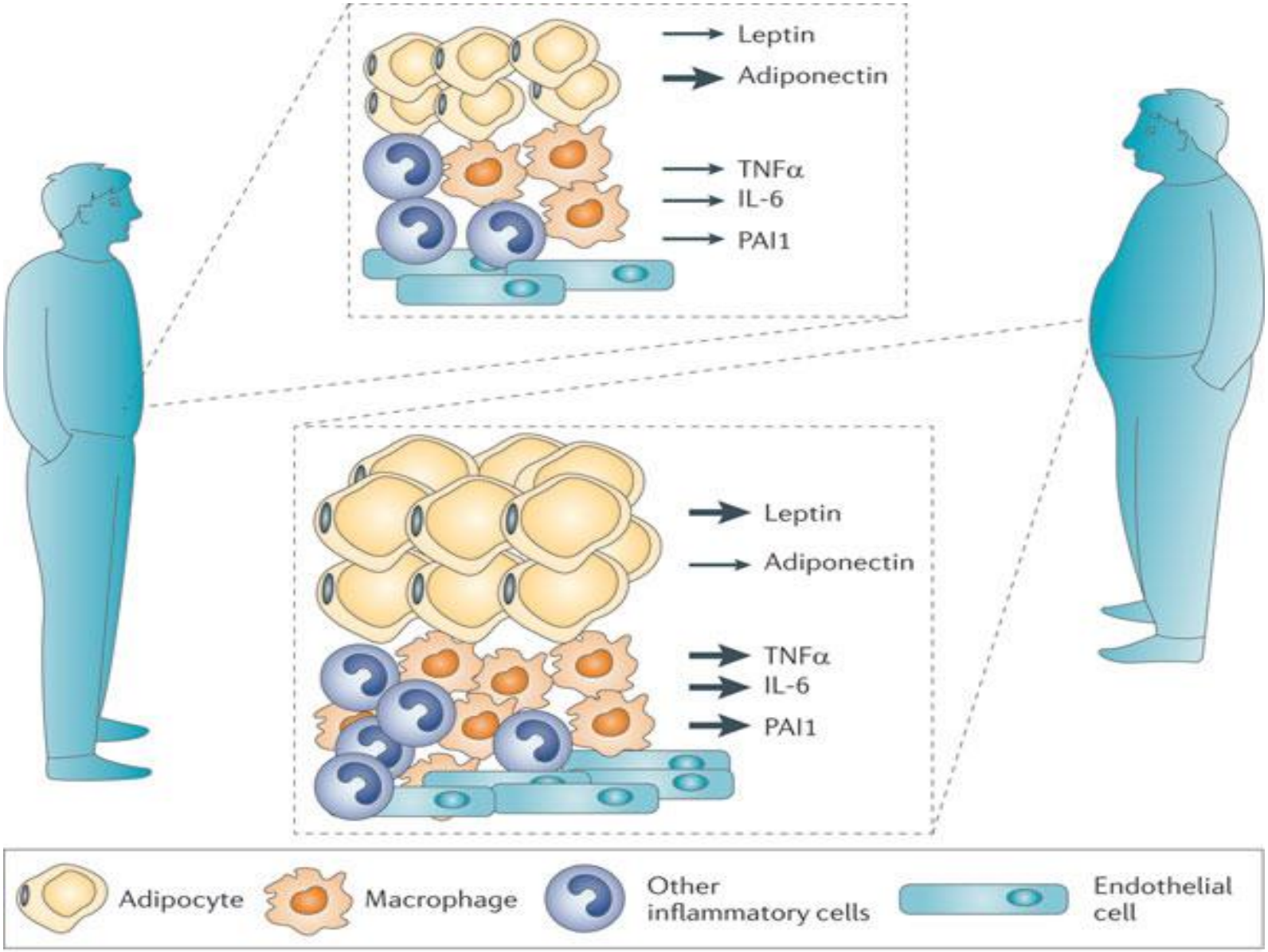
ADIPOSE TISSUE METABOLISM IN OBESE INDIVIDUALS

The adipose cells in obese individuals are both greater in number and size than in lean individuals, and the tissue contains a much higher percentage of macrophages ❶. As a result of storing excessive amounts of fat, the stressed adipose cells release inflammation-inducing factors and undergo apoptosis ❷. Both outcomes activate macrophages in a traditional M1 inflammatory state ❸ in which they release tumor necrosis factor-α (TNF-α), which recruits and activates additional immune cells to the site ❹. This low level sustained inflammation causes tissues to become resistant to insulin ❺, the first step in developing diabetes.




Obesity
Adipose Organ
Stromal cell
Blood vessel
Adipocyte
Macrophages
T cells
Brain
Immune System
INFLAMMATION
Insulin Resistance
Type 2 Diabetes
Cardio-Vascular Disease
Cancer
Immune Function
Premature Death


Inflammation
IL-6
Adipose tissue
Adipose tissue lipolysis
(-)
TNF-α
Circulating FFA levels
Insulin signalling in adipose tissue and liver
GLUT4 synthesis
Macrophage infiltration
Intra-abdominal obesity
Insulin resistance
Atherogenic dyslipidemia
Gluconeogenesis
Apolipoprotein B
Insulin
Triglycerides


Leptin
Adiponectin
TNFα
IL-6
PAI1
Leptin
Adiponectin
TNFα
IL-6
PAI1
Adipocyte
Macrophage
Other inflammatory cells
Endothelial cell

Adipose tissue can be fractionated into lipid-containing adipocytes and into the stromal-vascular fraction, which contains pre-adipocytes, macrophages, other inflammatory cells and endothelial cells.

In the obese state, there is an increase in the size and number of adipocytes, as well as increases in the inflammatory and endothelial compartments of the stromal-vascular fraction.

This change in the composition of the adipose tissue results in the increased secretion of leptin and inflammatory cytokines, with a decrease in the secretion of adiponectin. IL-6, interleukin-6; PAI1, plasminogen activator inhibitor 1; TNFα, tumour necrosis factor-α

THANKS