Pathophysiology II

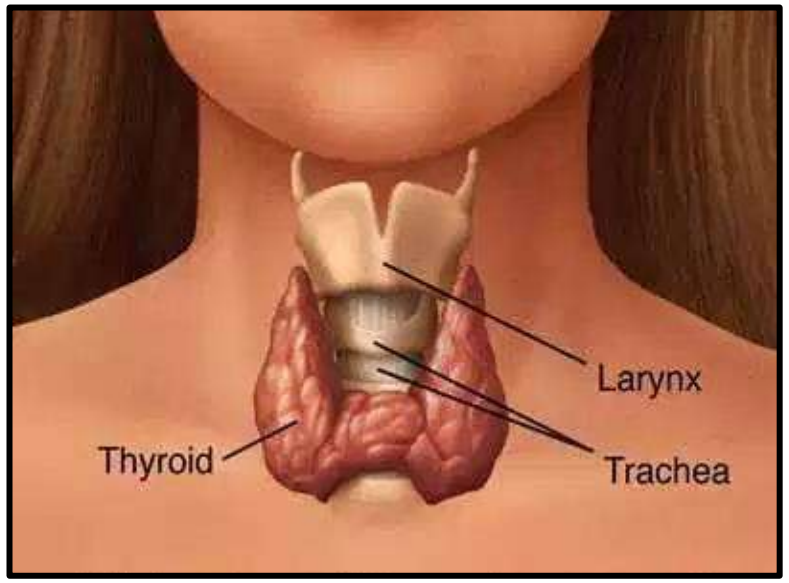
Chapter (3): Endocrine diseases

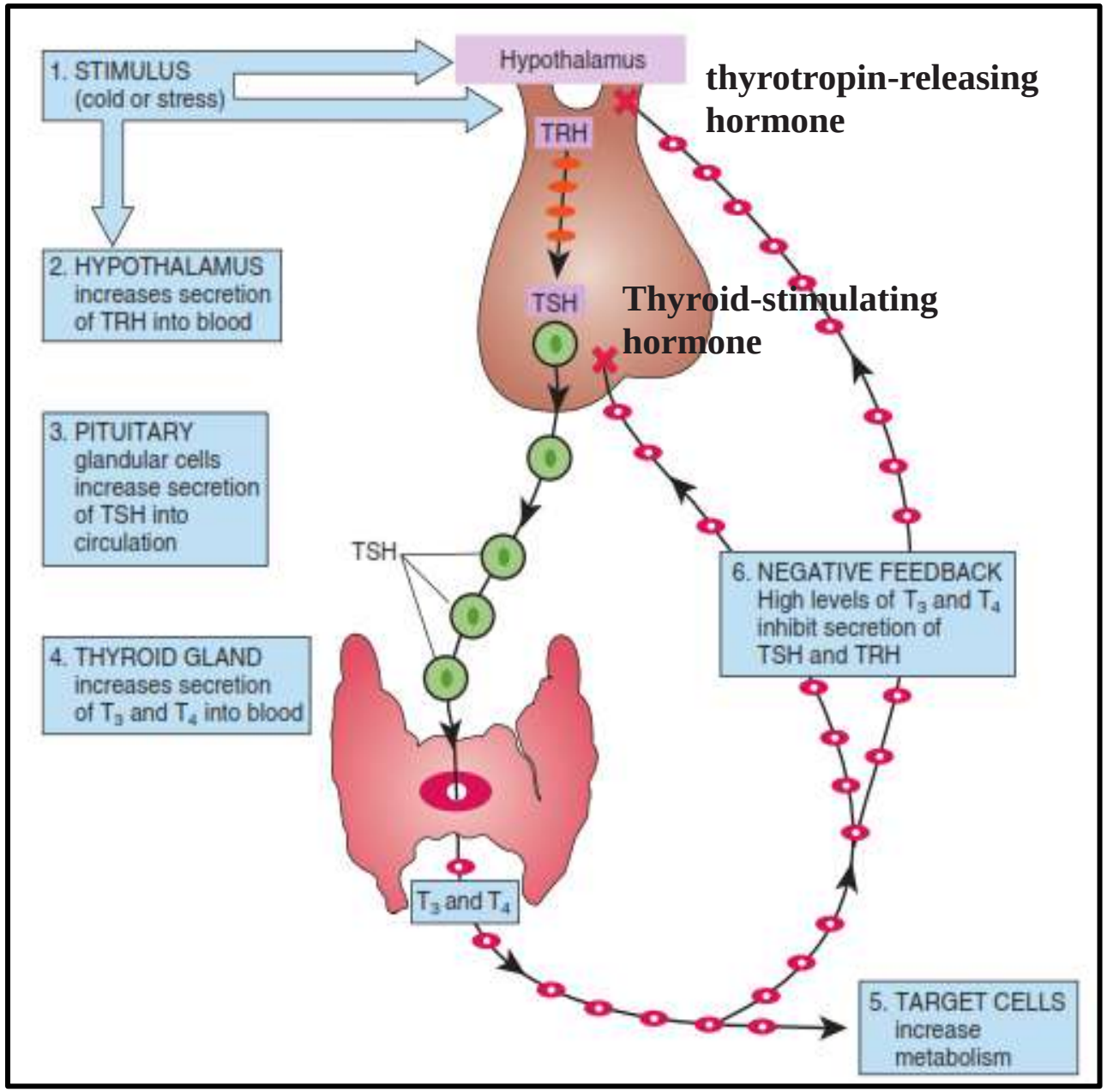
- Thyroid gland disorders
- Adrenal gland (cortex) disorders
- Diabetes Mellitus

Thyroid Disorders

Thyroid gland

- **It is a butterfly-shaped organ located in the neck.**
  - **Thyroxine T4: 90%**
  - **Triiodothyronine T3: 10%**





Thyroid Disorders

Physiologic effects of thyroid hormones

- **Metabolism**
  - increases glucose absorption from gut
  - increases gluconeogenesis
  - increases lipolysis
  - Increases proteolysis

- **Cardiovascular system**
  - T_3 increases cardiac output
  - T_3 is chronotropic and inotropic
  - T_3 reduces vascular resistance

- **Sympathetic Nervous System**
  - increased synthesis of β adrenergic receptors in cardiac/skeletal muscles and adipocytes (Heterologous up-regulation)

Thyroid disorders

- Goiter is an increase in the size of the thyroid gland which can occur in hypothyroid and hyperthyroid states.

1. Hypothyroidism

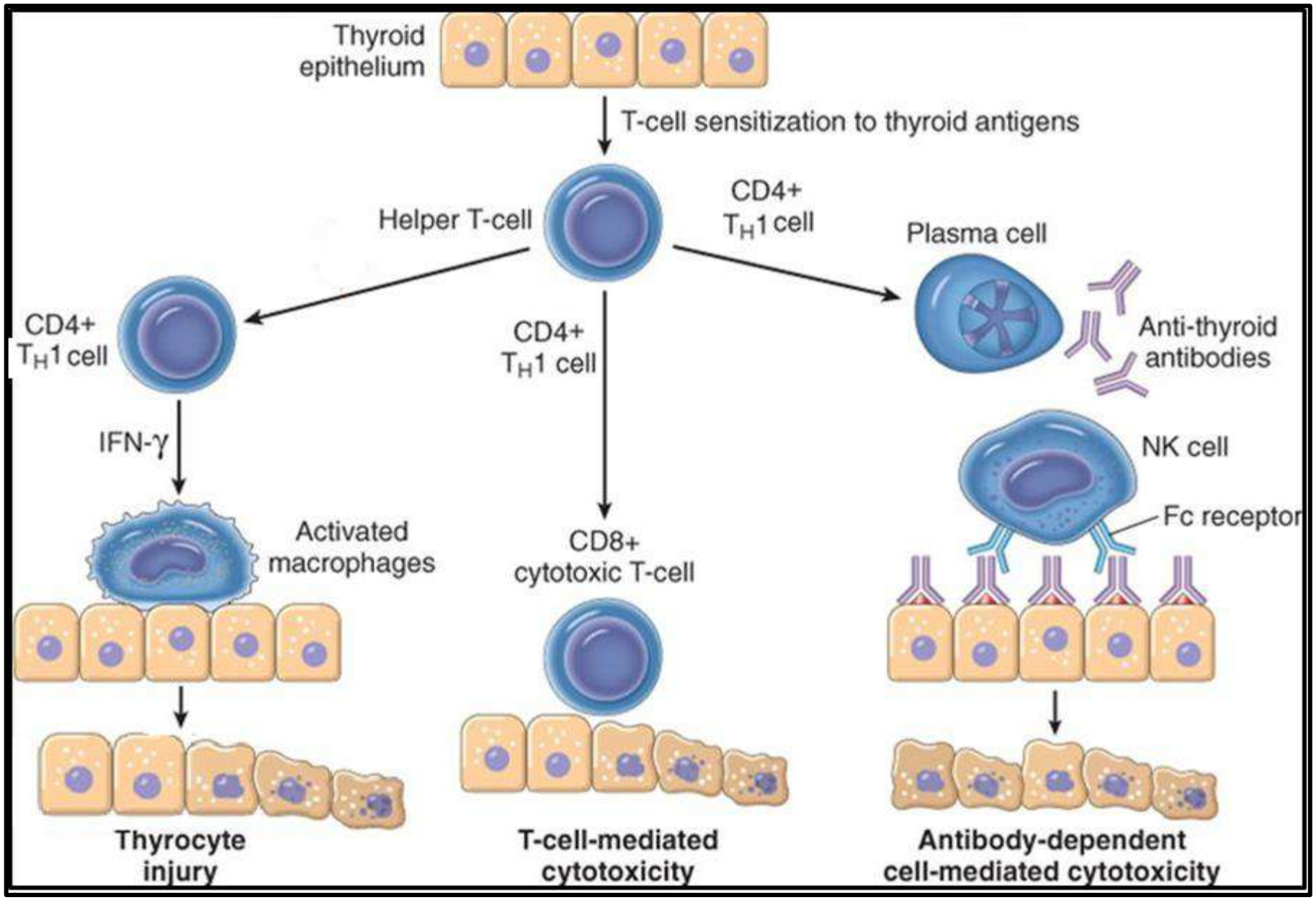
- It is a condition in which the thyroid gland does not produce enough thyroid hormones.

- Causes
  - Congenital defect: cretinism, impaired physical and mental development
  - Acquired defect: Primary, Secondary, Tertiary
  - Autoimmune disease: Hashimoto's thyroiditis

Thyroid Disorders

Thyroid disorders

1. **Hypothyroidism**
   - **Hashimoto thyroiditis**
   - **Pathogenesis**



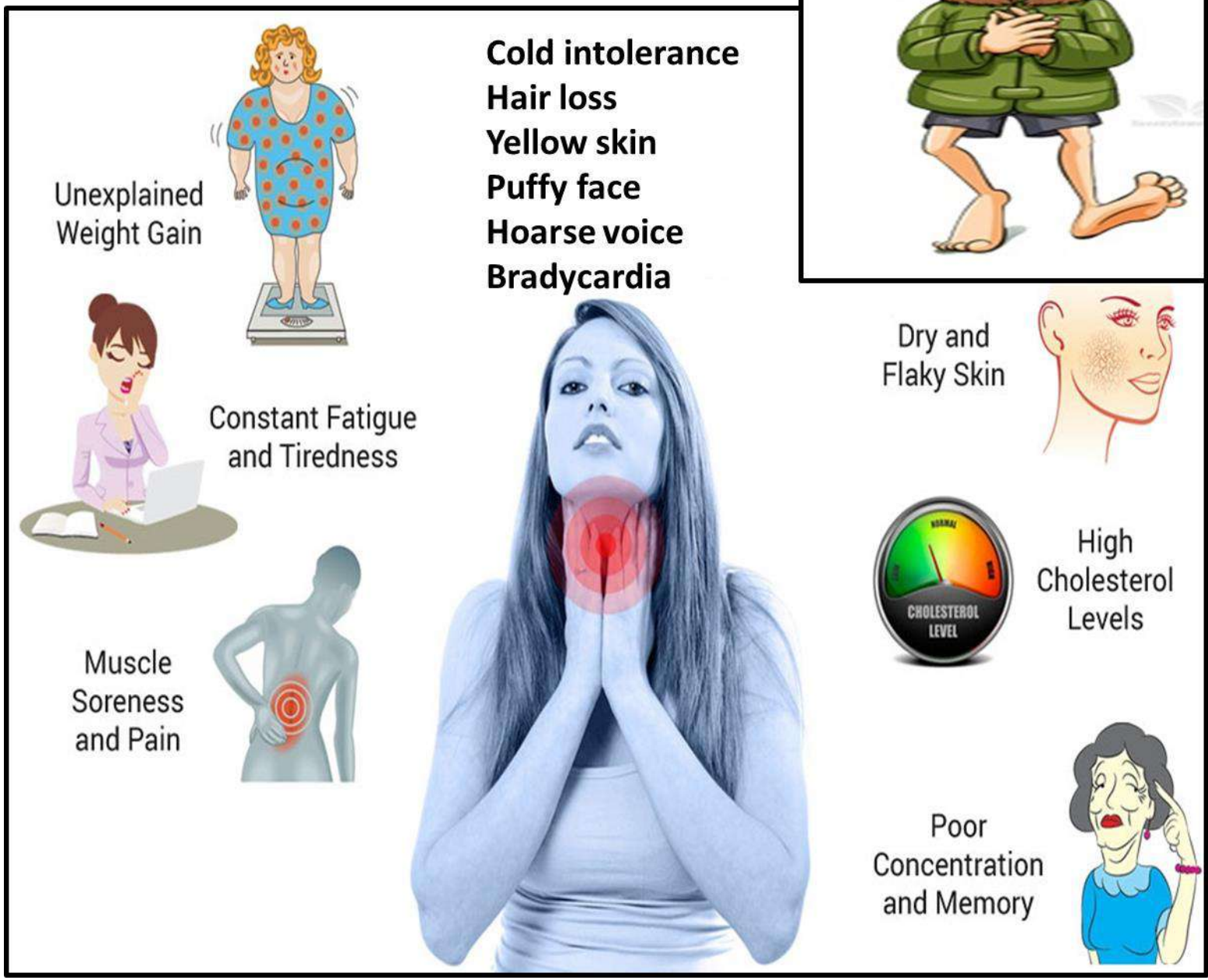
Thyroid disorders

1. Hypothyroidism

- Symptoms

Congenital hypothyroidism, causes mental retardation and impaired growth (Cretinism).

Myxedema (glycosaminoglycans deposition)



Thyroid disorders

1. **Hypothyroidism**

- **Diagnosis: Symptoms, T3/T4 blood test, TSH blood test**

- **Treatment**
  - **T3 or T4 replacement therapy**

Thyroid disorders

2. Hyperthyroidism (Thyrotoxicosis)

- **It is a condition characterized by excessive production and secretion of thyroid hormones.**

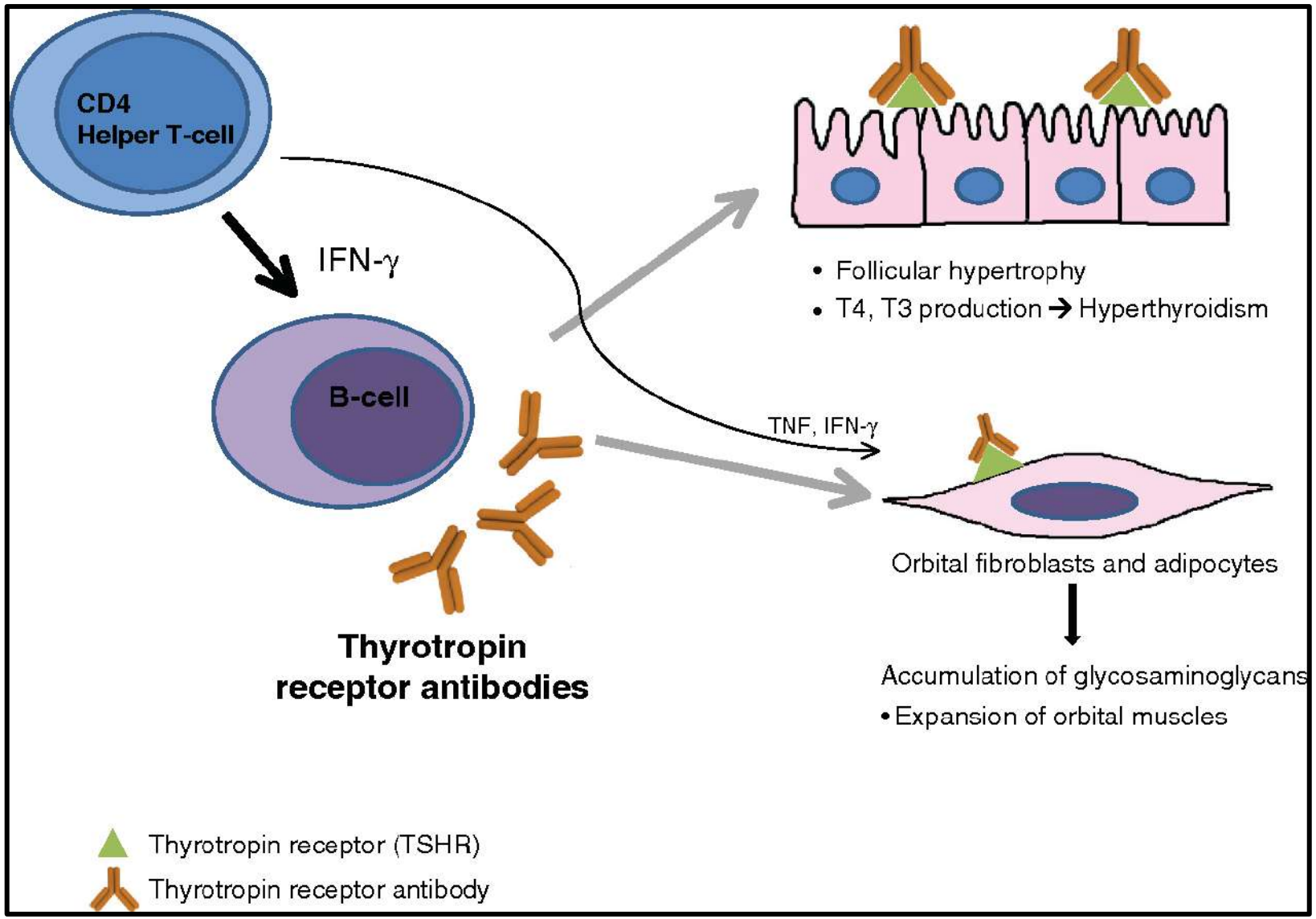
- **Causes**

  - **Graves' disease**
  - **Iodine containing agents**
  - **Thyroid adenoma**
  - **Thyroiditis (acute)**

Thyroid disorders

2. Hyperthyroidism (Thyrotoxicosis)

- **Causes**
  - **Graves' disease**
    - **Pathogenesis**

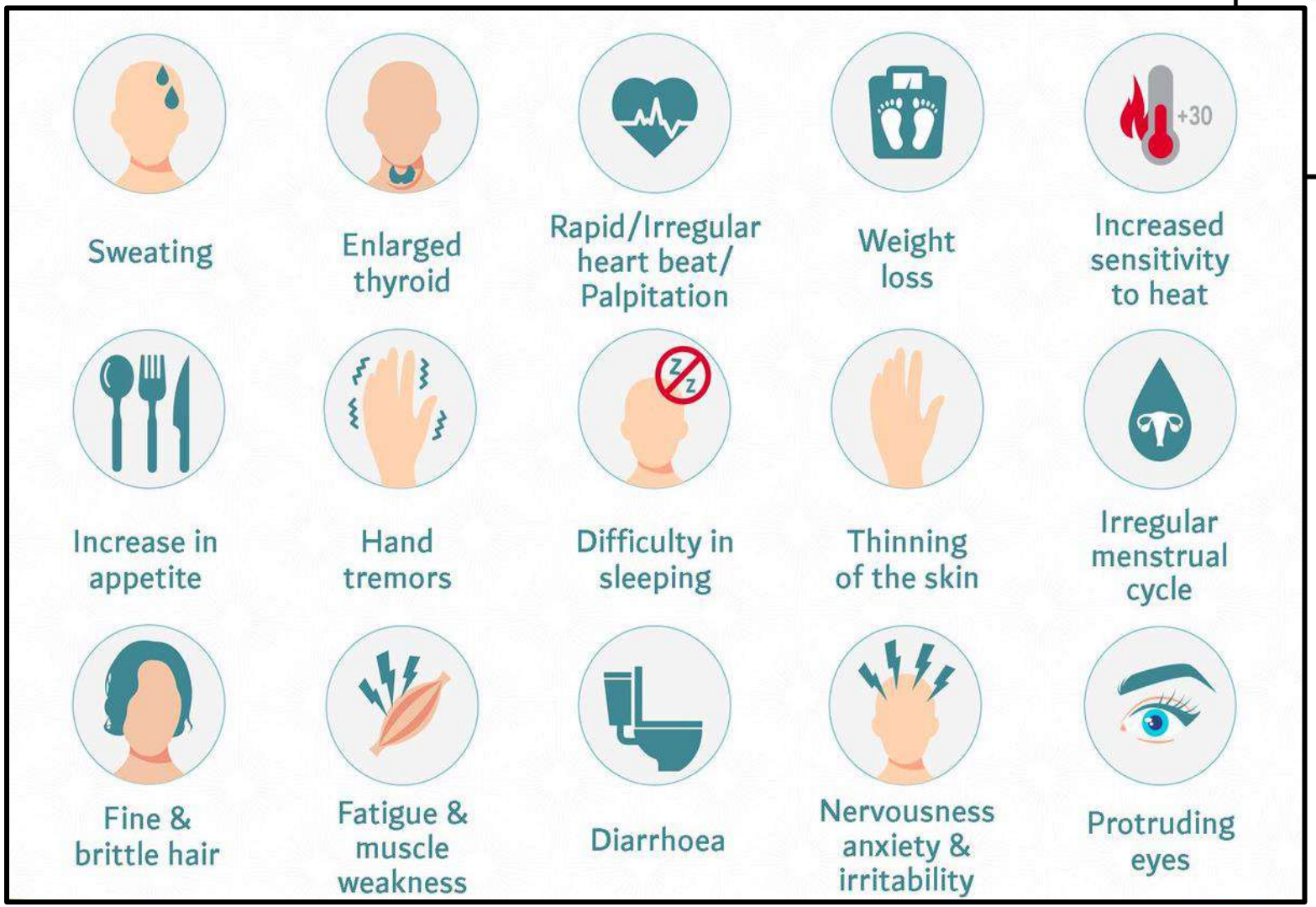


Thyroid Disorders

Thyroid disorders

2. **Hyperthyroidism**

- **Symptoms**



Exophthalmos

Thyroid disorders

2. Hyperthyroidism

- **Diagnosis: Symptoms, T3/T4 blood test, TSH blood test**

- **Treatment**

  - Eradication of the thyroid gland with radioactive iodine (iodine-131)
  - Surgical therapy
  - ß-adrenergic blocking drugs
  - Antithyroid drugs (propylthiouracil and methimazole)

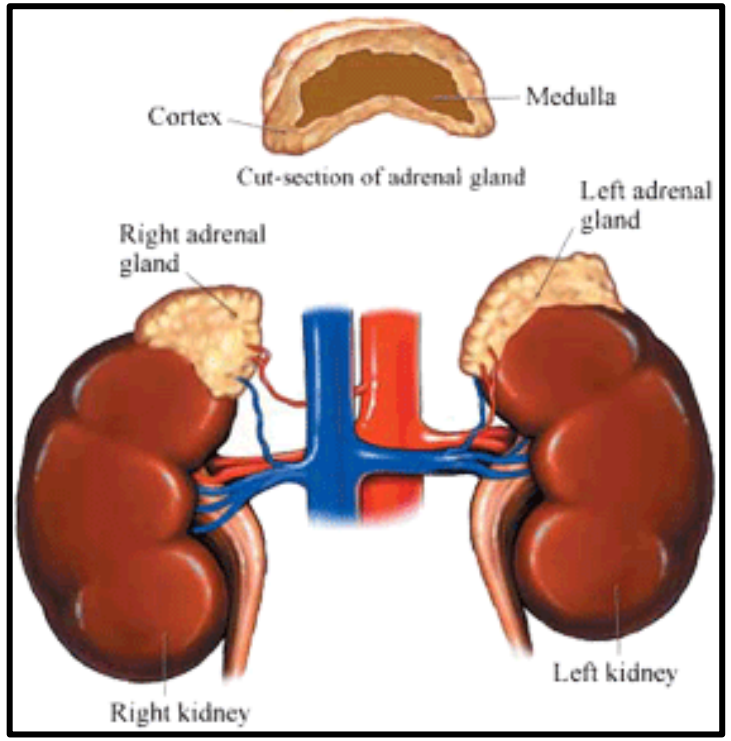
Thyroid storm (crisis)

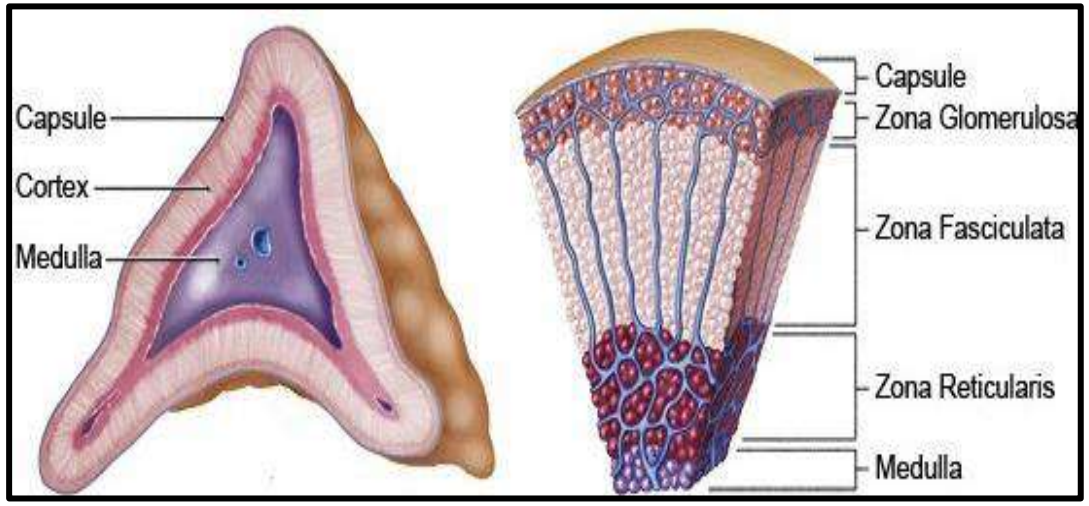
- **Extreme heat production: cooling**
- **Avoid Aspirin**

Adrenal cortical hormone disorders

Adrenal glands

- **The adrenal glands are small structures found at the apex of each kidney**
  - **Medulla (20%): Adrenaline**
  - **Cortex (80%): glucocorticoids (cortisol), mineralocorticoids (aldosterone), and adrenal androgens (dehydroepiandrosterone).**

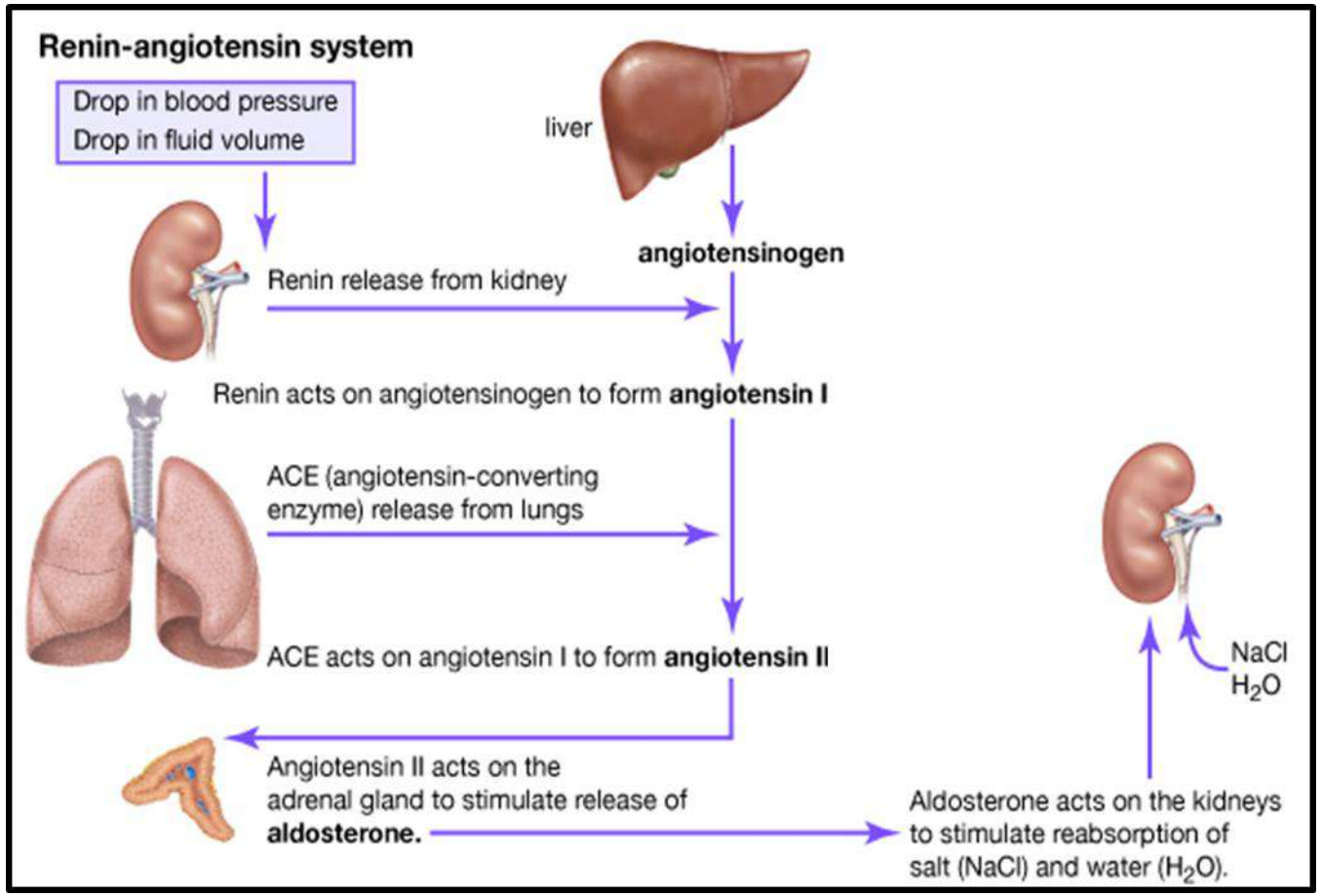


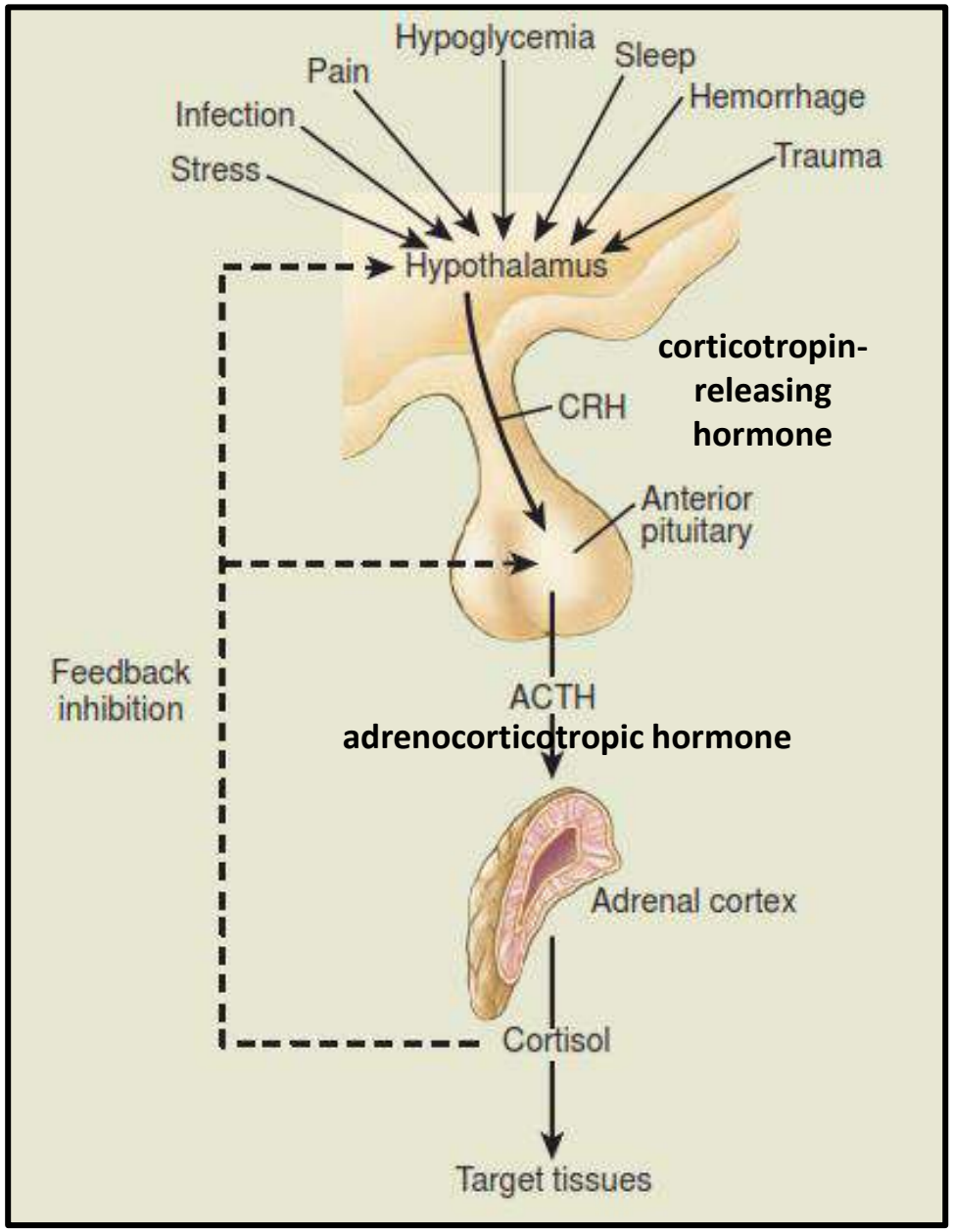


Adrenal cortical hormone disorders

Adrenal glands

- **Cortex (80%): glucocorticoids, mineralocorticoids, and adrenal androgens.**



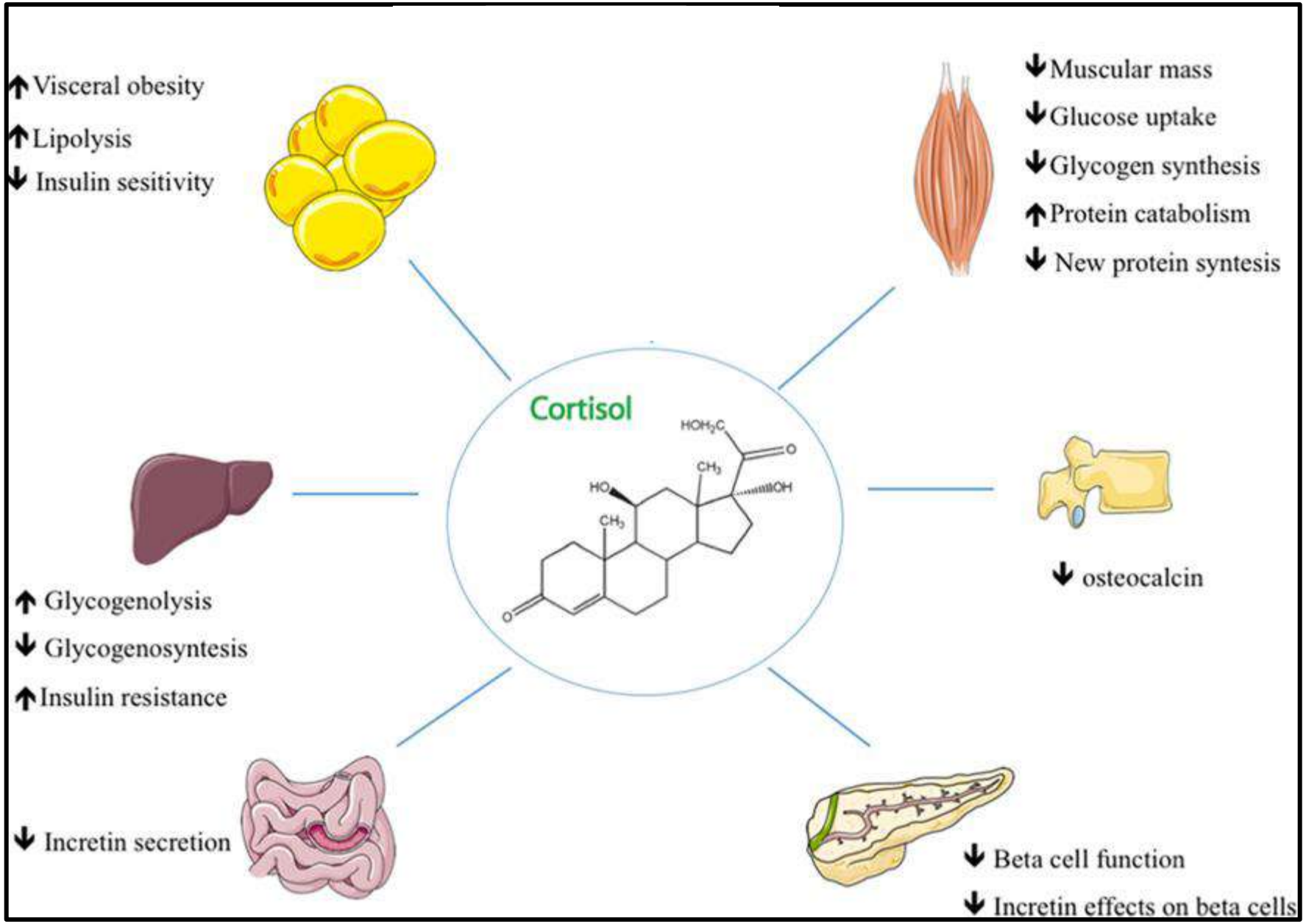


Adrenal cortical hormone disorders

Adrenal glands

- **Physiological effects of cortisol**

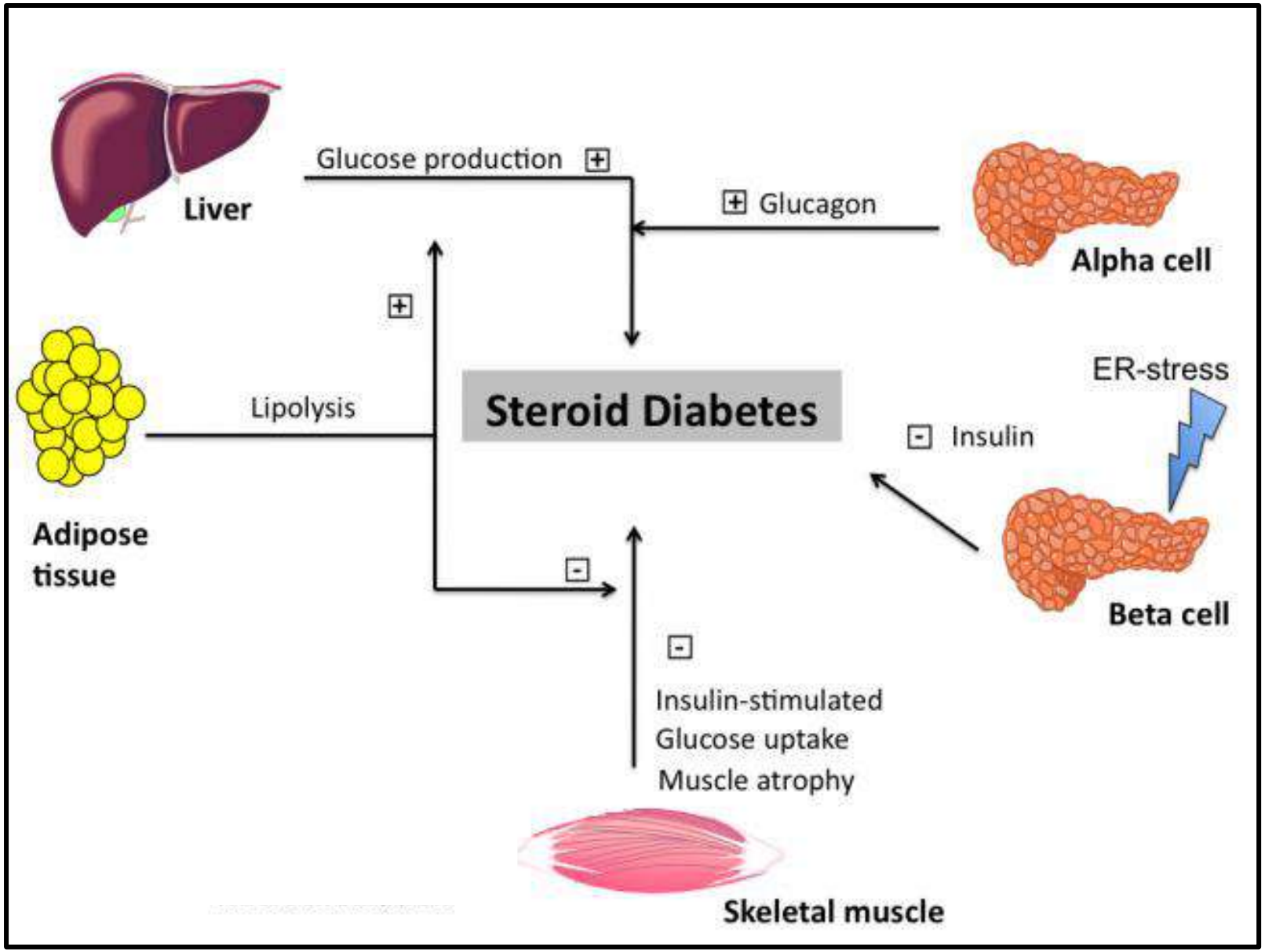
Inflammation



Adrenal cortical hormone disorders

Adrenal glands

cortisol

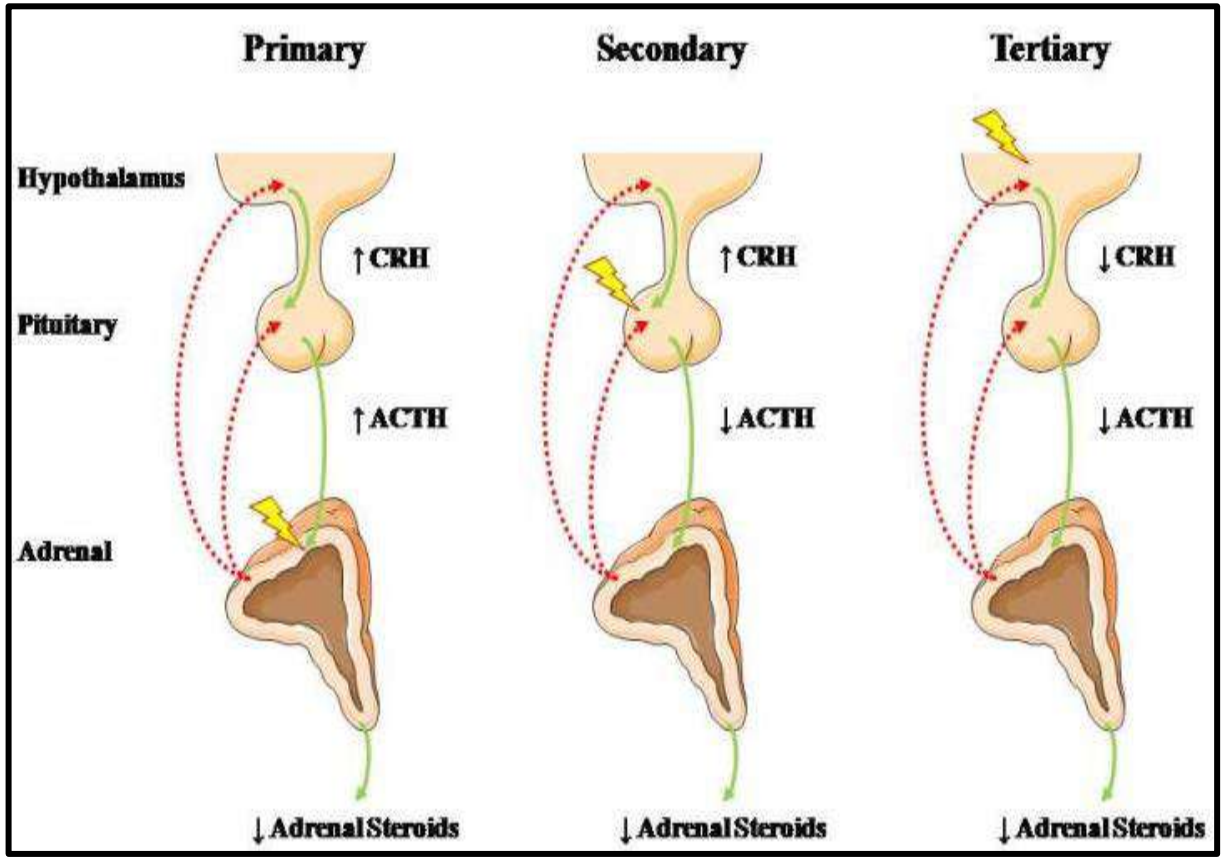


Adrenal cortical hormone disorders

1. Adrenocortical Insufficiency

- **It is a condition characterized by decreased production of glucocorticoids and mineralocorticoids.**

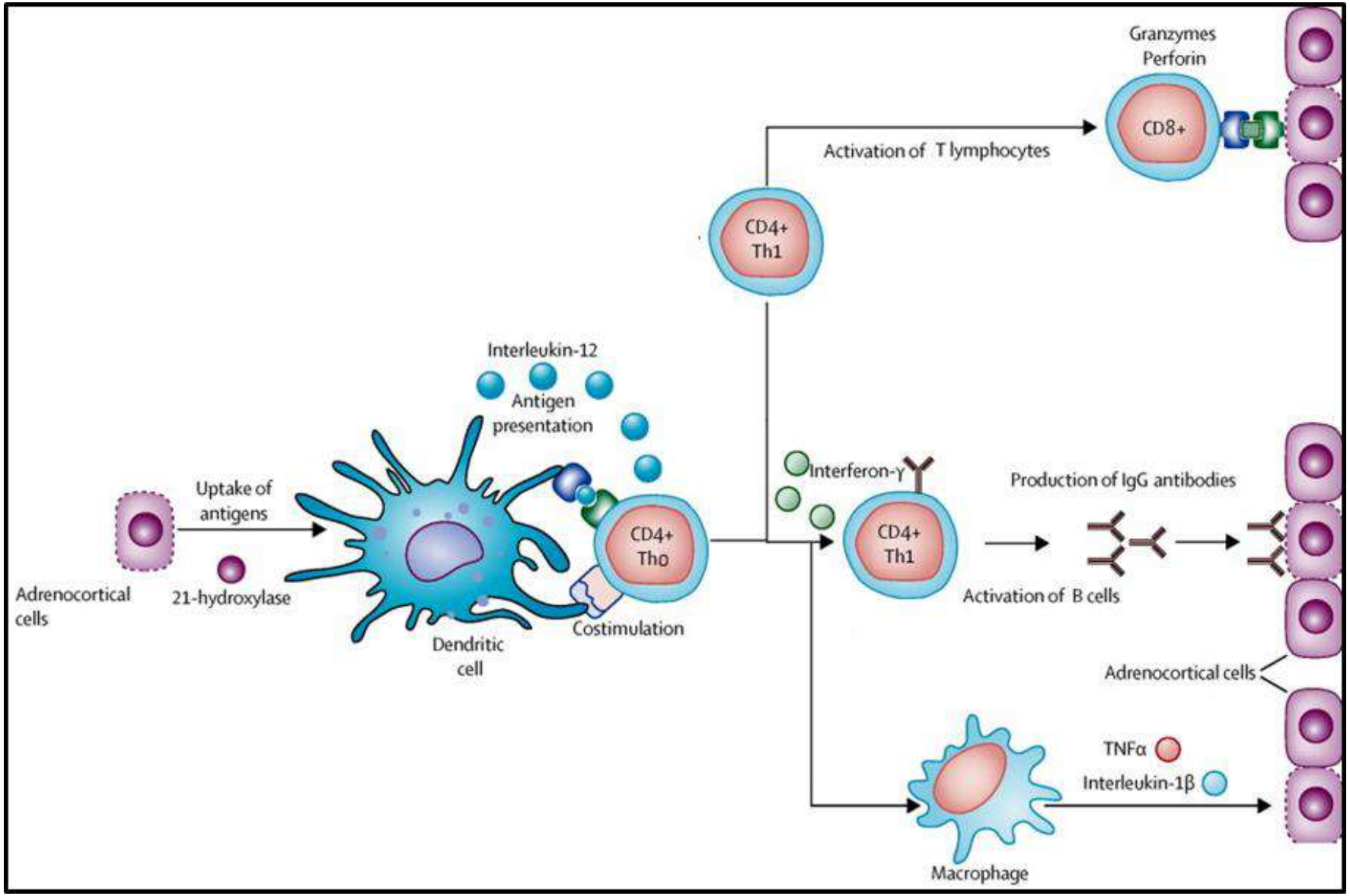
  - **Primary:**
  - **Causes**
    - ✓ **Addison's disease (hypocortisolism)**
  - **Secondary**
  - **Tertiary**



Adrenal cortical hormone disorders

1. Adrenocortical Insufficiency

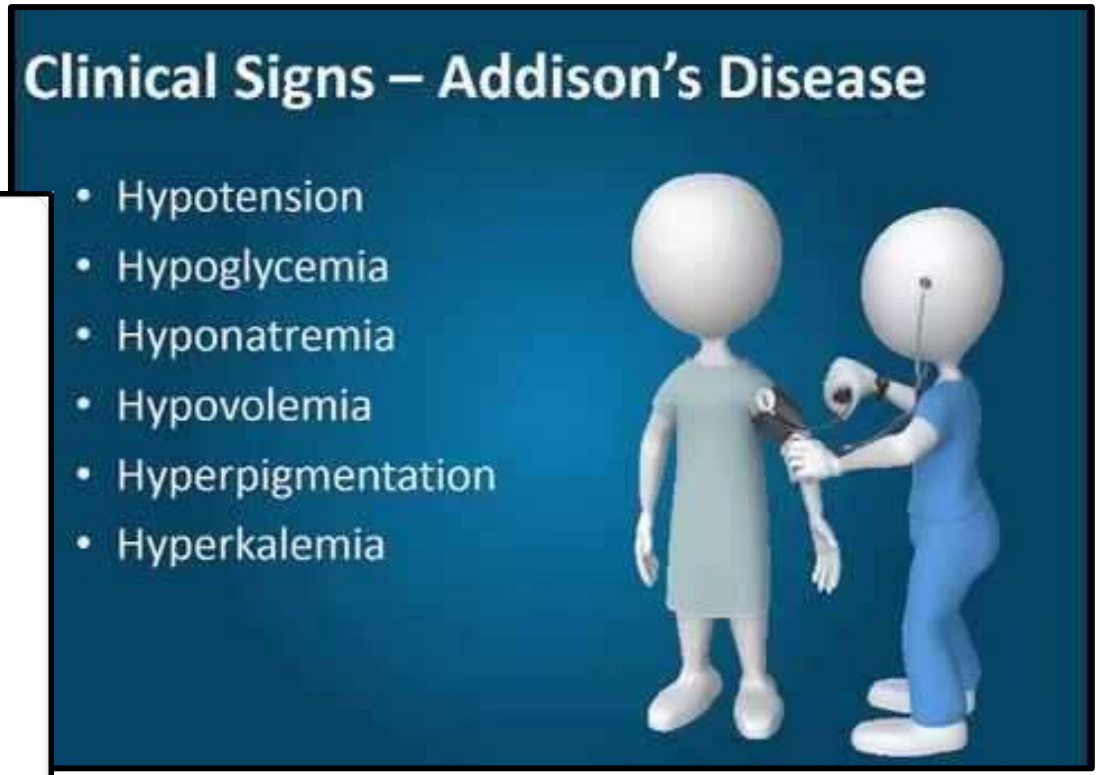
- **Addison's disease**
- **Pathogenesis**

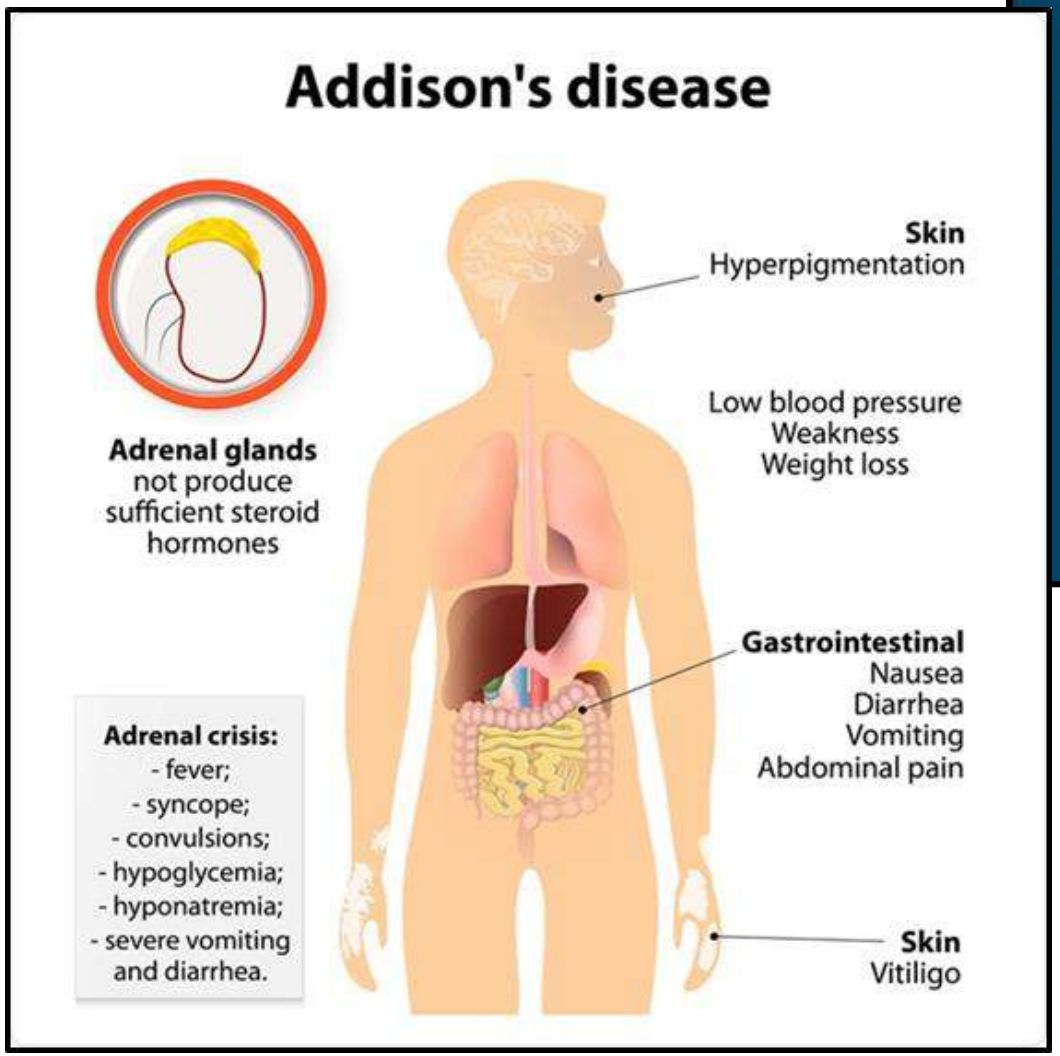


Adrenal cortical hormone disorders

1. Adrenocortical Insufficiency

- **Symptoms**



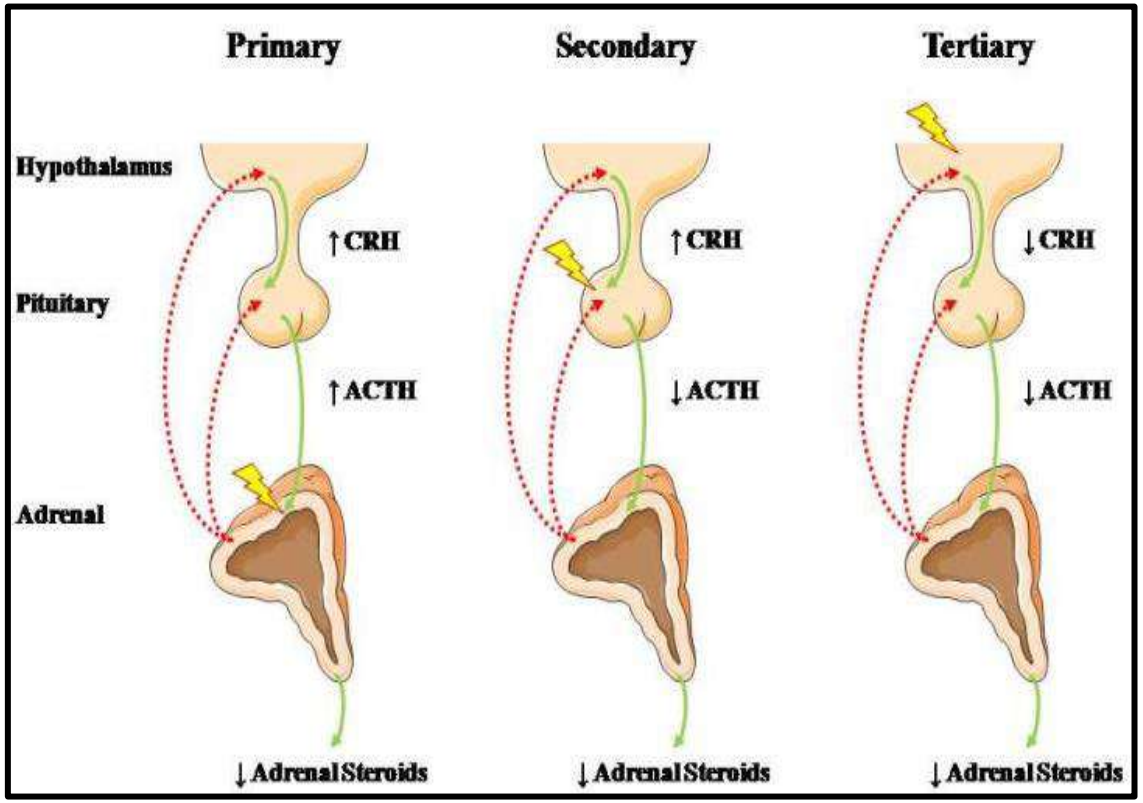


Adrenal cortical hormone disorders

Adrenocortical Insufficiency

- Diagnosis
  - ➢ Symptoms
  - ➢ Blood level of cortisol, aldosterone and ACTH
  - ➢ Stimulation test

- Treatment
  - ➢ Hormone replacement therapy



Adrenal cortical hormone disorders

2. Cushing syndrome

- **It is a condition caused by either excessive production of cortisol by the adrenal glands or excessive cortisol-like medication.**

- **Hypercortisolism for any cause**

- **Causes:**

  - **Cushing disease**
  - **Adrenal form Cushing**
  - **Ectopic Cushing syndrome**
  - **Iatrogenic Cushing syndrome**

Adrenal cortical hormone disorders

2. Cushing syndrome

- **Symptoms:**

Puffalo hump

Purple straie (stretch markers)

Hyperpigmentation

Adrenal cortical hormone disorders

2. Cushing syndrome

- **Diagnosis**

  - **Symptoms**
  - **Blood level of cortisol and ACTH**
  - **Suppression test**

- **Treatment**

  - **Surgery**
  - **Radiation**
  - **Drugs inhibit cortisol synthesis: ketoconazole**

Diabetes Mellitus (DM)

- **It is a chronic metabolic disorder characterized by chronic hyperglycemia due to multiple causes including:**
  - **Absolute insulin deficiency**
  - **Impaired insulin secretion**
  - **Insulin resistance, or**
  - **Increased glucose production**

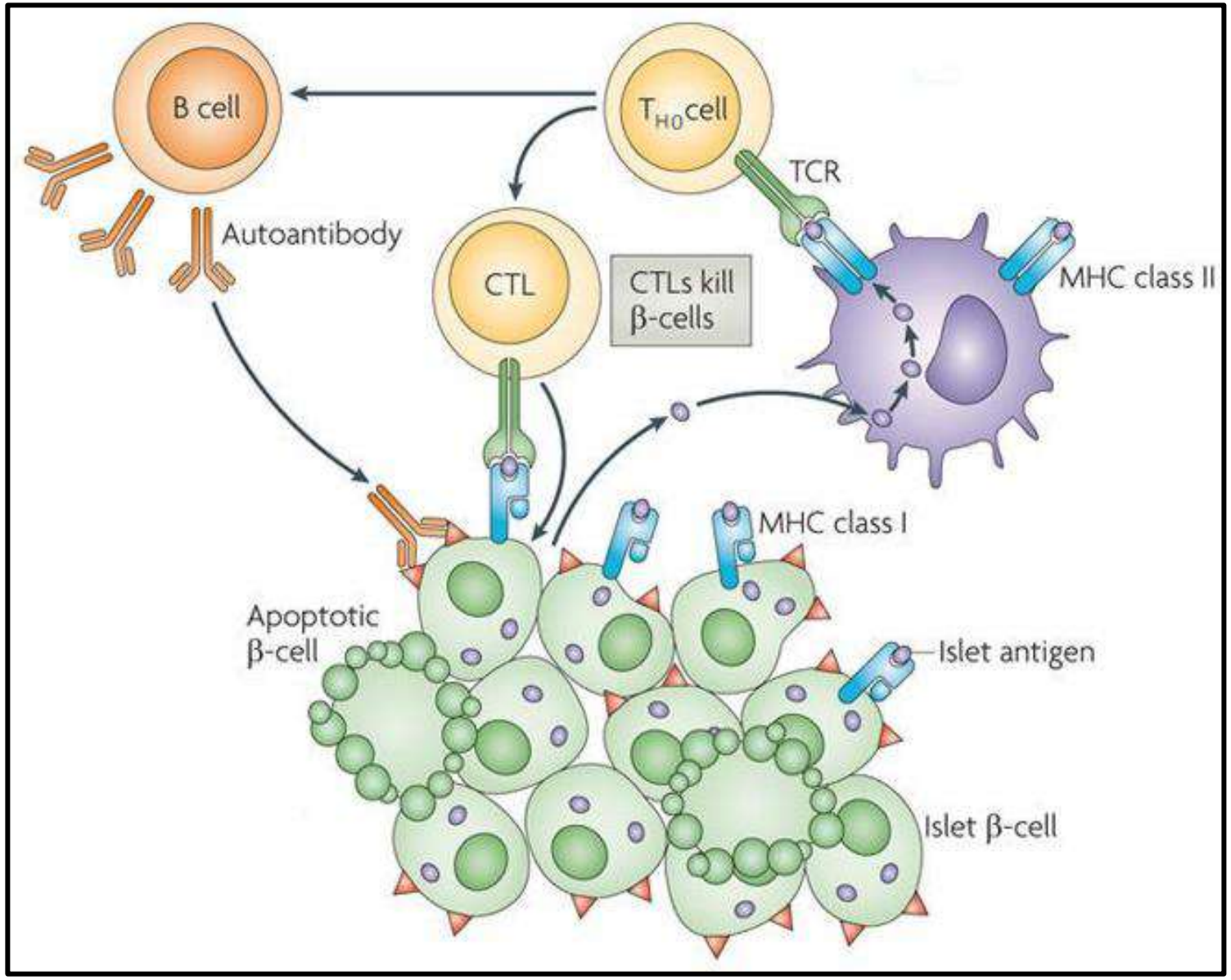
Diabetes Mellitus (DM)

Classification of DM

1. **Type 1 DM: 5-10% (type A: Juvenile diabetes, and type B)**
2. **Type 2 DM: 90-95%**
3. **Secondary DM**
4. **Gestational DM: 7% of all pregnancies**

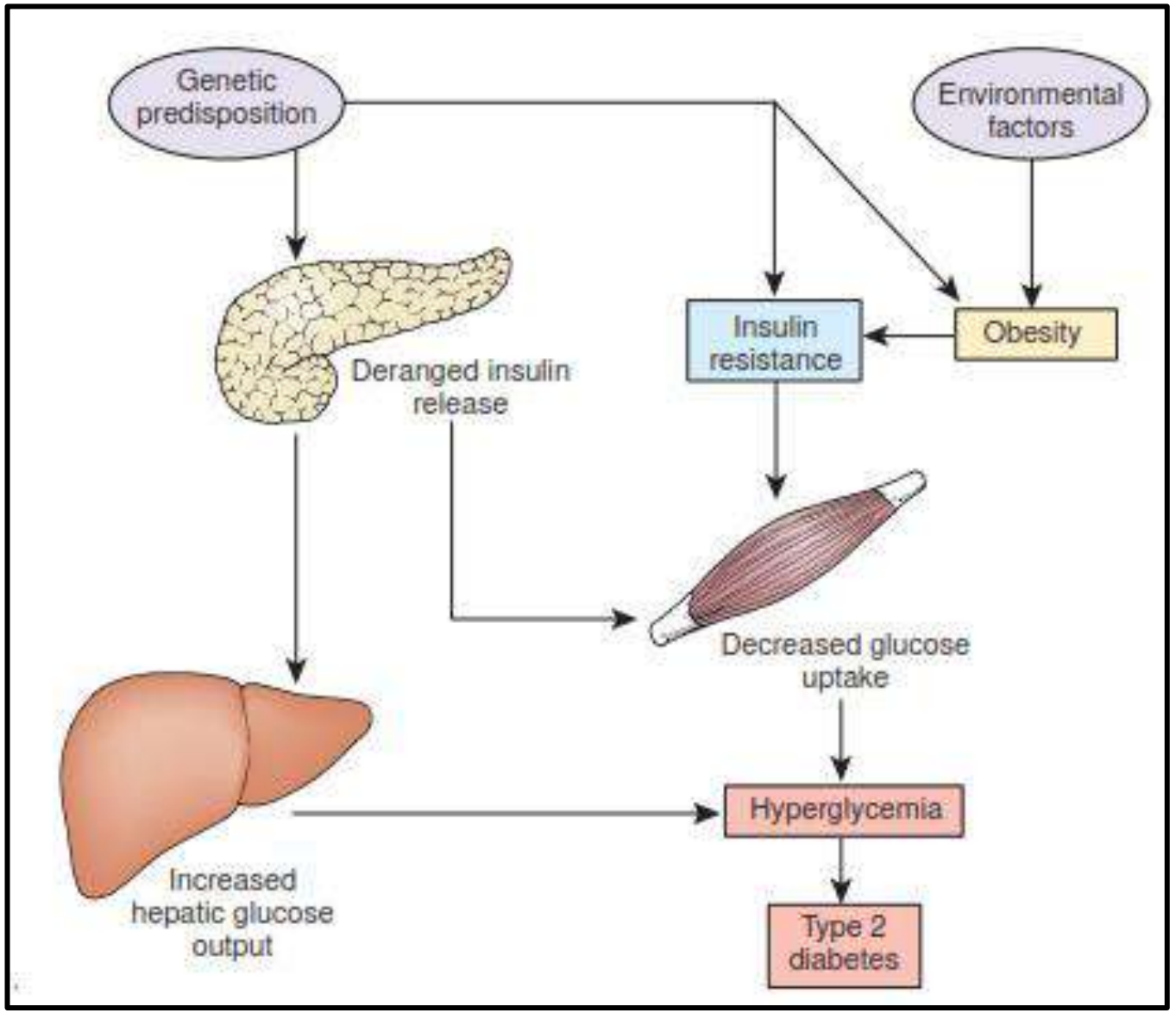
Diabetes Mellitus

- **Pathogenesis of Type 1A DM**



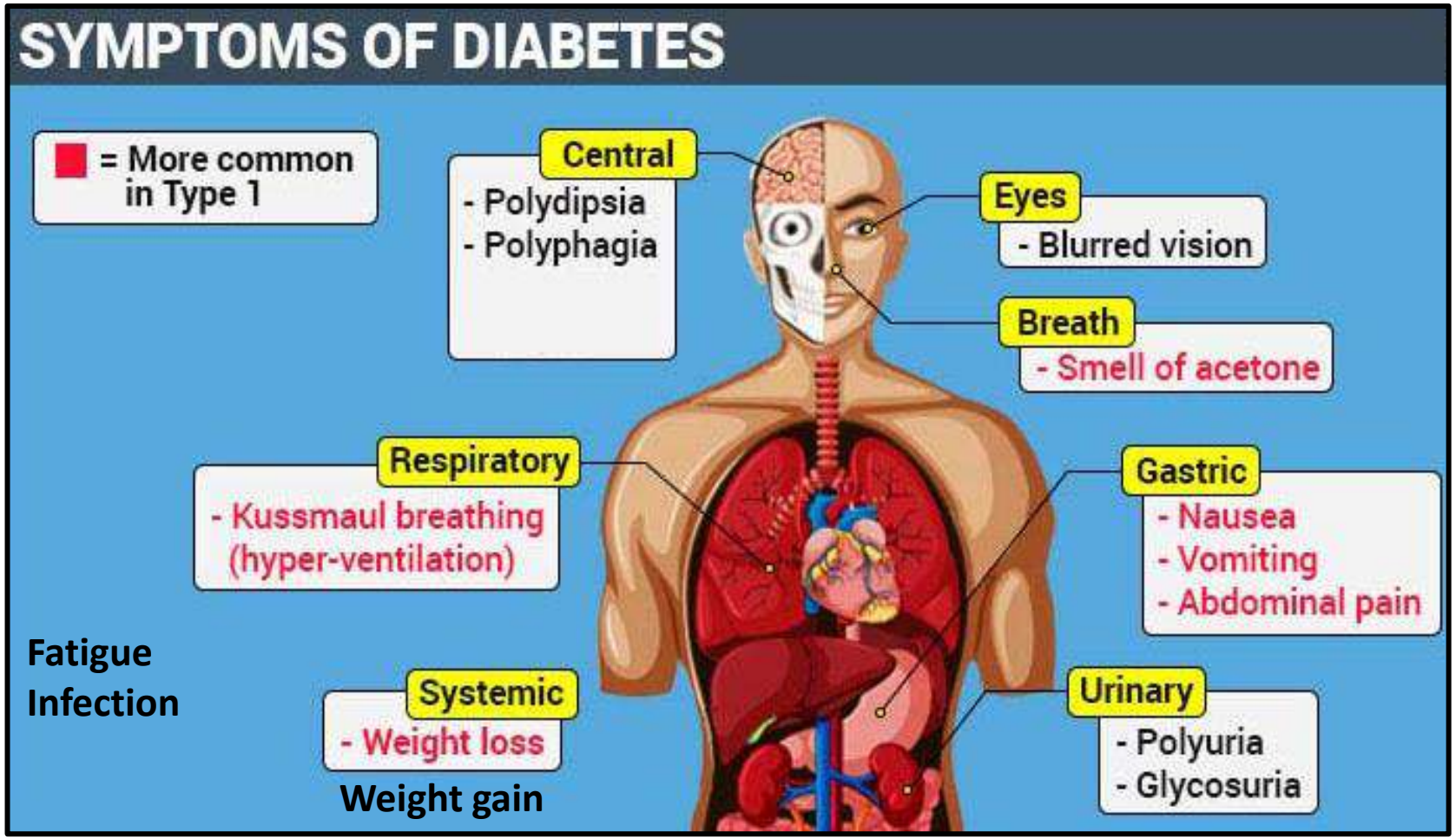
Diabetes Mellitus

- **Pathogenesis of Type 2 DM**



Diabetes Mellitus (DM)

- **Symptoms: 3 polys**

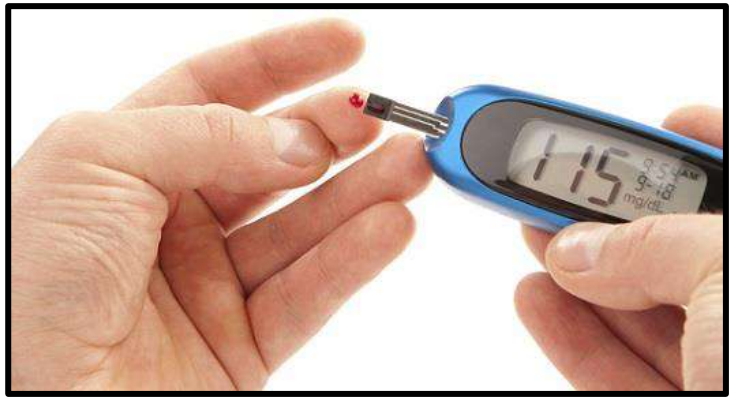


Diabetes Mellitus (DM)

Diagnosis

a. Blood tests

- FPG
- Casual Blood Glucose Test
- OGTT
- Glycated Hemoglobin Test (HbA1C or A1C)



Capillary Blood Glucose Monitoring

b. Urine tests

- Urine glucose
- Urine ketone

CHART 50.2 CRITERIA FOR DIAGNOSIS OF DM

1. HbA_{1c}* ≥ 6.5%

OR

2. FPG ≥ 126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 hours.

OR

3. 2-hour plasma glucose ≥ 200 mg/dL (11.1 mmol/L) during and OGTT.

OR

4. In a person with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose of ≥200 mg/dL (11.1 mmol/L)

TABLE 50.4 DIAGNOSIS OF GESTATIONAL DM WITH A 75-g GLUCOSE LOAD

BASELINE AND TIME AFTER ADMINISTRATION OF 75-g GLUCOSE LOAD	PLASMA GLUCOSE LEVEL, mg/dL (mmol/L)
Fasting	92 (5.1)
1 hour	180 (10.0)
2 hours	153 (8.5)

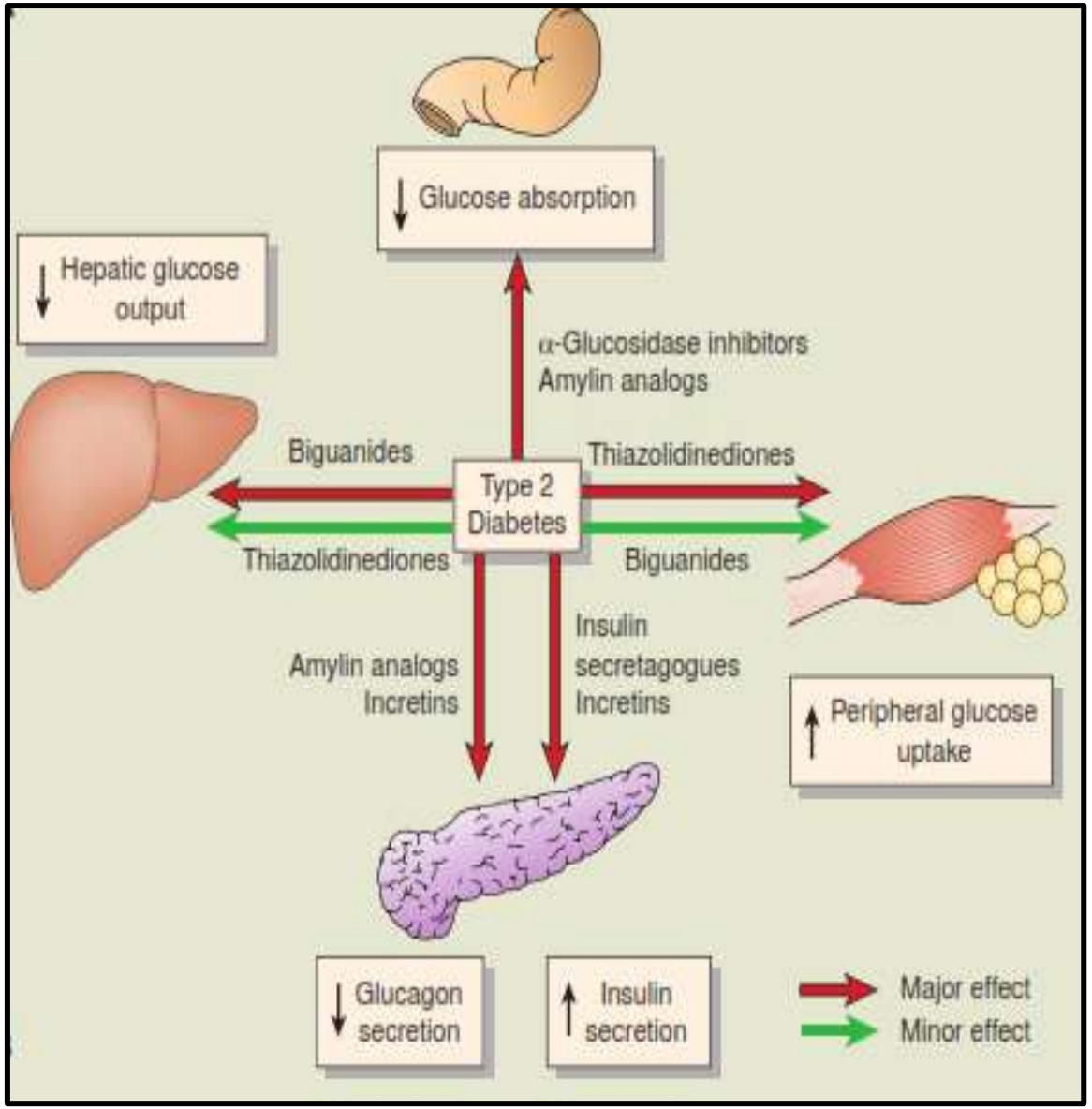
TABLE 50.2 CLASSIFICATION OF DIABETES USING FASTING* PLASMA GLUCOSE AND OGTTS

TEST	NORMOGLYCEMIC	IFG†	IGT†	DM‡
FPG	<100 mg/dL (5.6 mmol/L)	100–125 mg/dL (5.6–6.9 mmol/L)		≥126 mg/dL (7.0 mmol/L)
2-hour OGTT§	<140 mg/dL (7.8 mmol/L)		140–199 mg/dL (7.8–11.0 mmol/L)	≥200 mg/dL (11.1 mmol/L)
Other				Symptoms of DM and casual plasma glucose ≥200 mg/dL (11.1 mmol/L)

Diabetes Mellitus (DM)

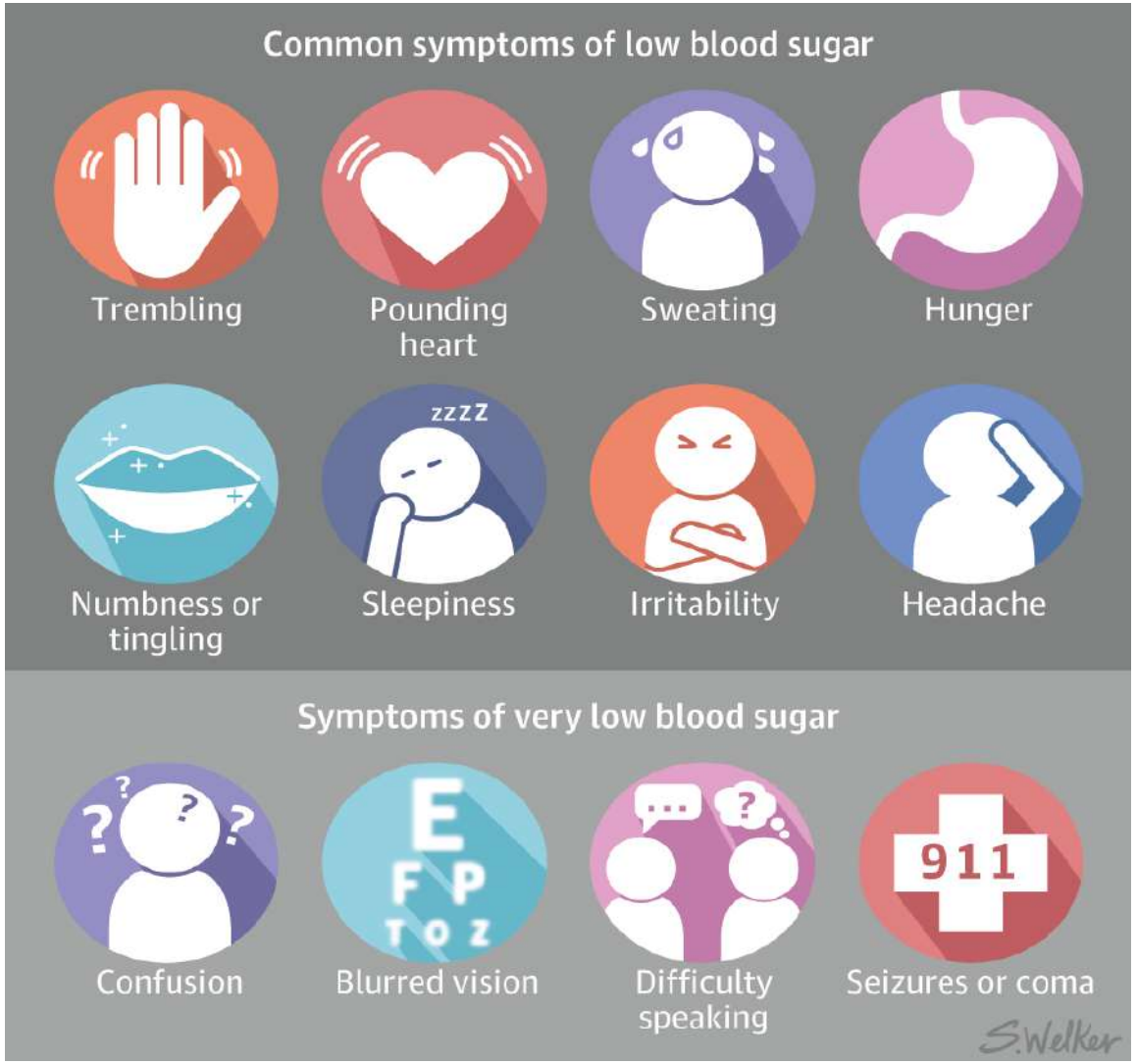
Treatment

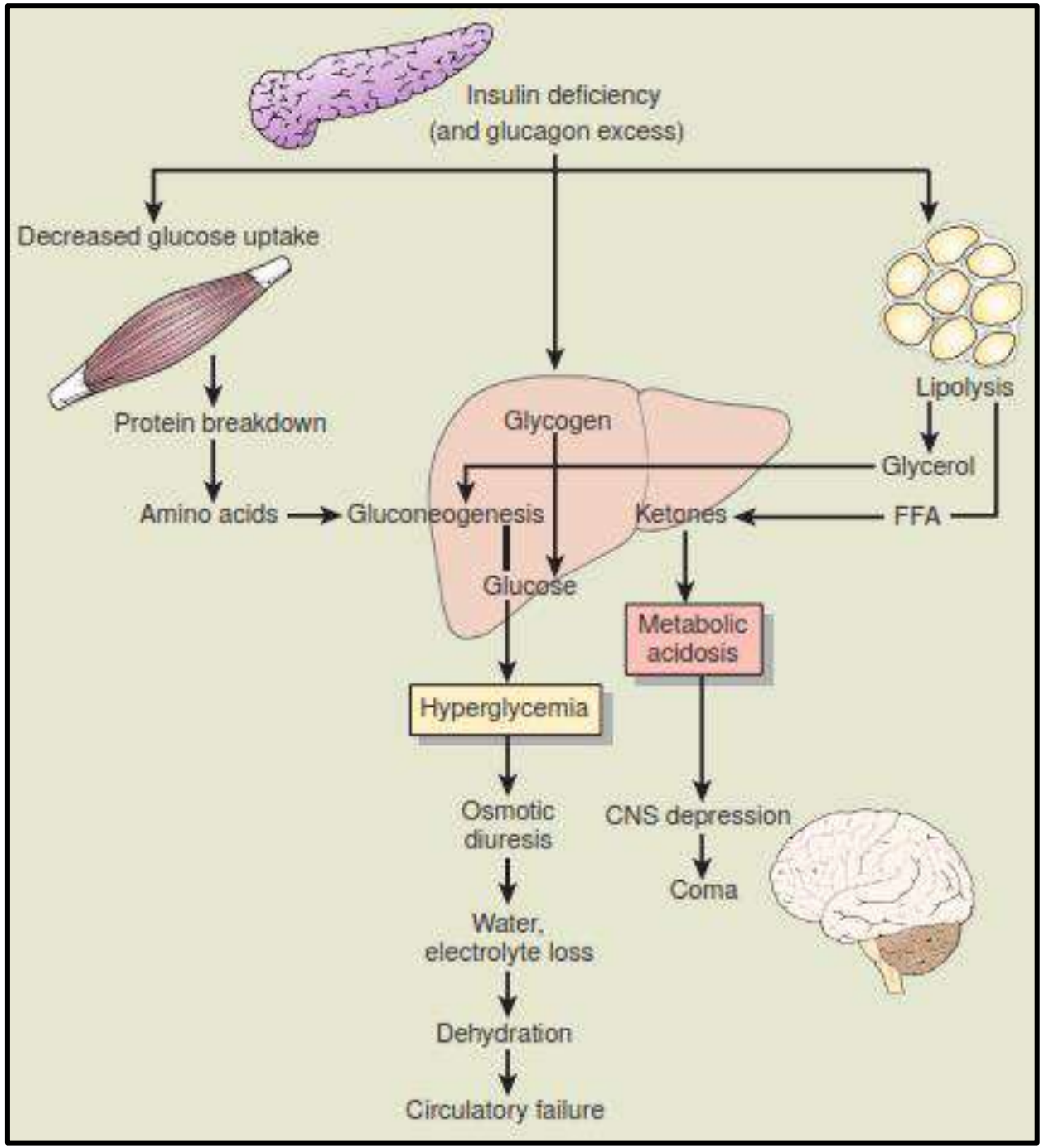
- **Life style management: medical nutrition therapy and exercise**
- **Insulin therapy**
- **Hypoglycemic drugs**
- **Pancreas cell transplantation**



Diabetes Mellitus (DM)

Acute Diabetic Complications





Diabetes Mellitus

4 causes

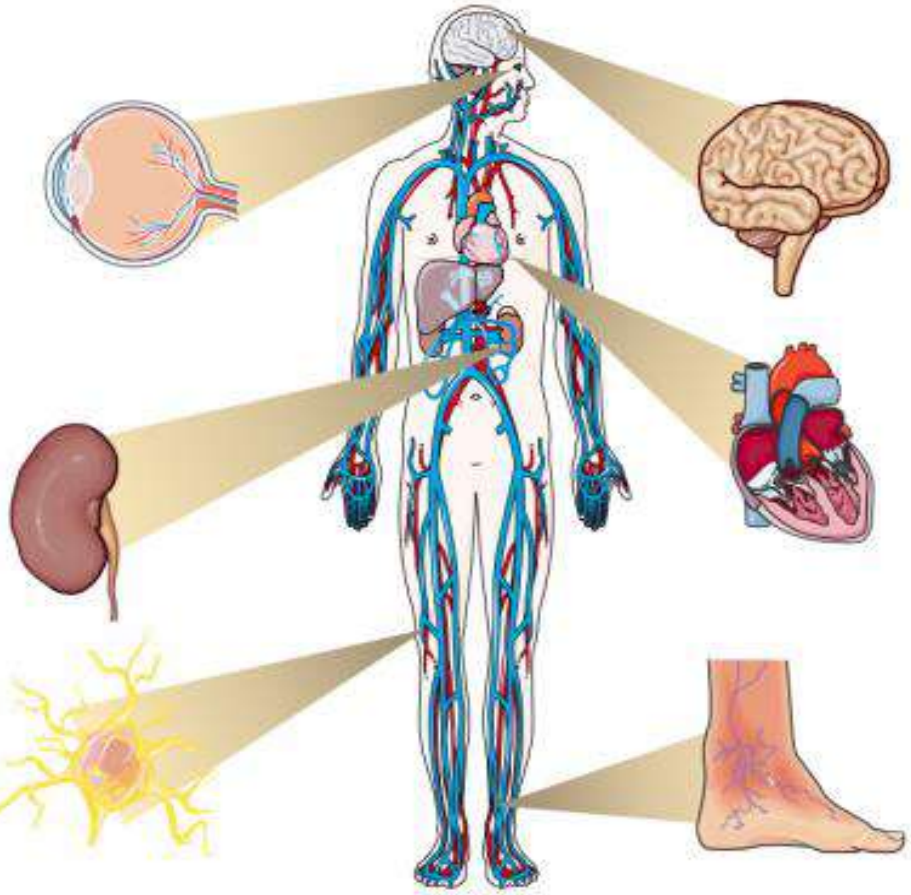
Major Complications of Diabetes

Microvascular

Eye
High blood glucose and high blood pressure can damage eye blood vessels, causing retinopathy, cataracts and glaucoma

Kidney
High blood pressure damages small blood vessels and excess blood glucose overworks the kidneys, resulting in nephropathy.

Neuropathy
Hyperglycemia damages nerves in the peripheral nervous system. This may result in pain and/or numbness. Feet wounds may go undetected, get infected and lead to gangrene.



Macrovascular

Brain
Increased risk of stroke and cerebrovascular disease, including transient ischemic attack, cognitive impairment, etc.

Heart
High blood pressure and insulin resistance increase risk of coronary heart disease

Extremities
Peripheral vascular disease results from narrowing of blood vessels increasing the risk for reduced or lack of blood flow in legs. Feet wounds are likely to heal slowly contributing to gangrene and other complications.

Infections
GIT disorders