

M U N I
M E D

Endocrine function of selected organs and tissues

Hormones synthesized and secreted by dedicated endocrine glands

□ Pituitary Gland

- Growth hormone (GH)
- Prolactin
- Adrenocorticotrophic hormone (ACTH)
- Thyroid-stimulating hormone (TSH)
- Follicle-stimulating hormone (FSH)
- Luteinizing hormone (LH)

□ Thyroid Gland

- Tetraiodothyronine (T4; thyroxine)
- Triiodothyronine (T3)
- Calcitonin

□ Parathyroid Glands

- Parathyroid hormone (PTH)

□ Pancreas (Islets of Langerhans)

- Insulin
- Glucagon
- Somatostatin

□ Adrenal Gland

- Epinephrine
- Norepinephrine
- Cortisol
- Aldosterone
- Dehydroepiandrosterone sulfate (DHEAS)

□ Hormones Synthesized by Gonads

- **Ovaries**
- Estradiol-17 β
- Progesterone
- Inhibin
- **Testes**
- Testosterone
- Antimüllerian hormone (AMH)
- Inhibin

Hormones synthesized in organs with a primary function other than endocrine

□ Brain (Hypothalamus)

- Antidiuretic hormone (ADH)
- Oxytocin
- Corticotropin-releasing hormone (CRH)
- Thyrotropin-releasing hormone
- Gonadotropin-releasing hormone (GnRH)
- Growth hormone–releasing hormone (GHRH)
- Somatostatin
- Dopamine

□ Brain (Pineal Gland)

- Melatonin

□ Heart

- Atrial natriuretic peptide (ANP)

□ Kidney

- Erythropoietin

□ Adipose Tissue

- Leptin
- Adiponectin

□ Stomach

- Gastrin
- Somatostatin
- Ghrelin
- Intestines
- Secretin
- Cholecystokinin
- Glucagon-like peptide-1 (GLP-1)
- Glucagon-like peptide-2 (GLP-2)
- Glucose-dependent insulinotropic peptide (GIP; gastrin inhibitory peptide)
- Motilin

□ Liver

- Insulin-like growth factor-I (IGF-I)

Hormones Produced to a Significant Degree by Peripheral Conversion

□ Lungs

- Angiotensin II

□ Kidney

- $1\alpha,25$ -dihydroxyvitamin D

□ Adipose, Mammary Glands

- Estradiol- 17β

□ Liver

- Testosterone

□ Genital Skin, Prostate, Sebaceous Gland

- 5-Dihydrotestosterone (DHT)

□ Many Organs

- T3

Cardiovascular endocrinology

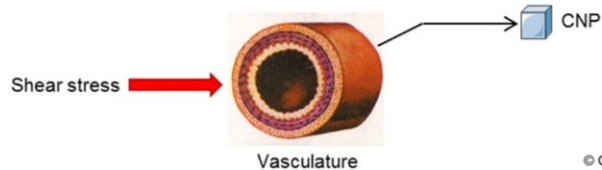
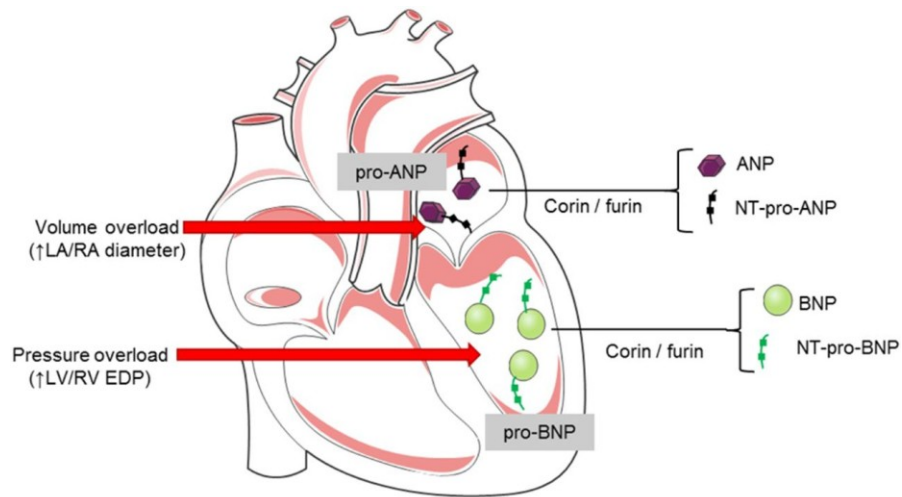
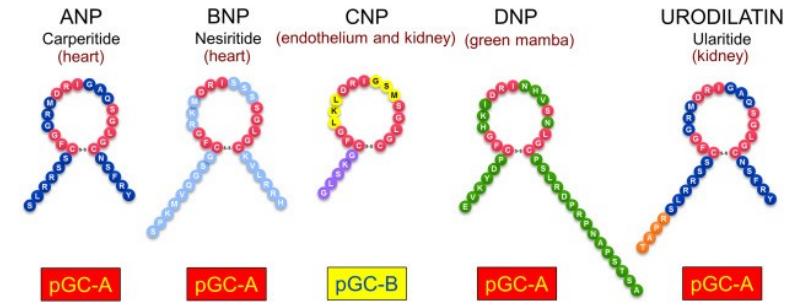
Endocrine hormones	ANP	Natriuresis and vasodilation
	BNP	Natriuresis and vasodilation
	GDF-15	Inhibiting body growth
	Myostatin	Reducing skeletal muscle mass
Autocrine/paracrine factors	CNP	Vasodilation
	Activin A	Protecting cardiomyocyte
	ET-1	Promoting cardiomyocyte survival
	IL-33	Antihypertrophic and antifibrosis

ANP = atrial natriuretic peptide; BNP = brain natriuretic peptide; CNP = C-type natriuretic peptide; ET = endothelin; GDF = growth differentiation factor; IL = interleukin;

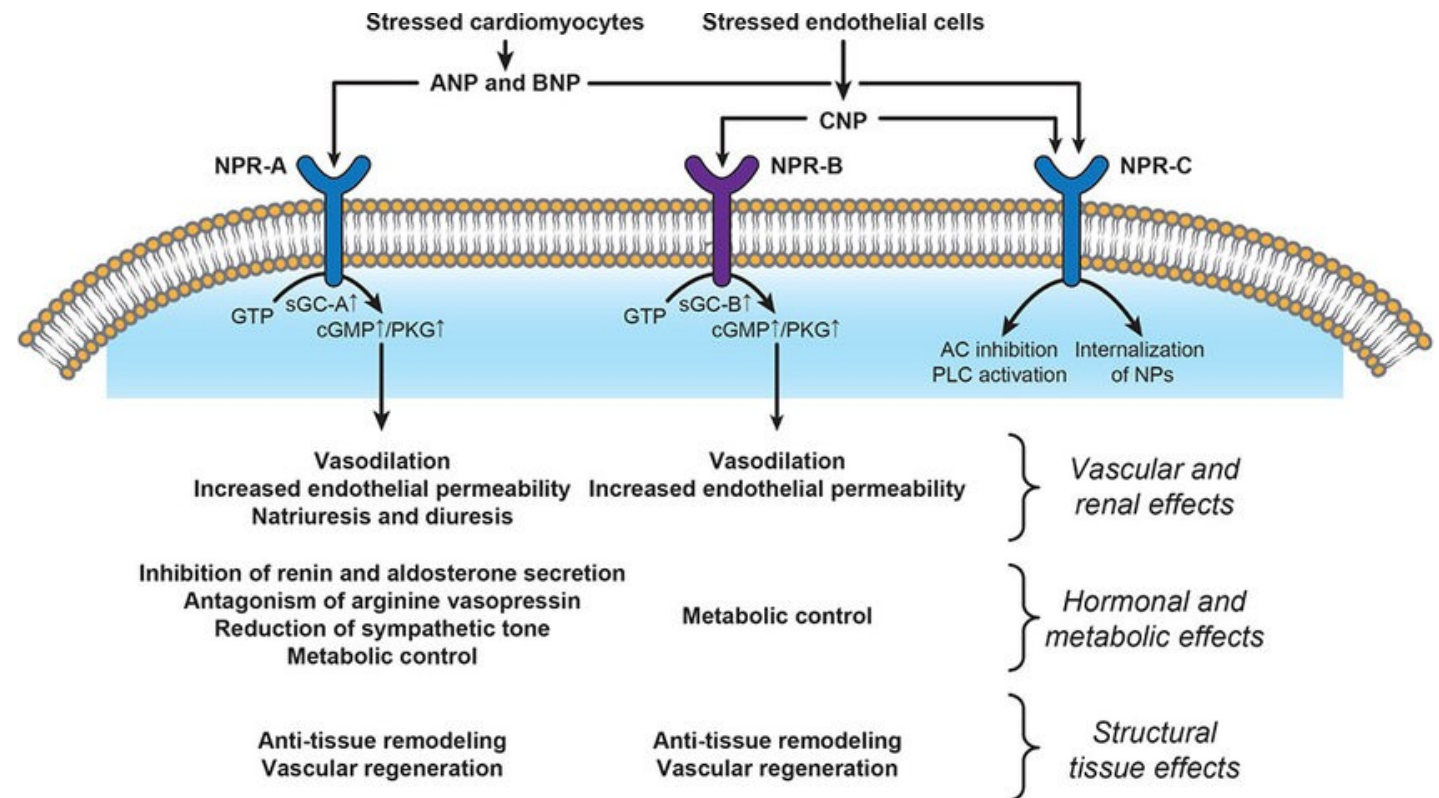
*Myostatin:
produced and released by myocytes
acts on muscle cells to inhibit muscle growth
require relatively large amounts of E/nutrients

Natriuretic peptides

- atrial natriuretic peptide (ANP)
- B-type natriuretic peptide (BNP)
- C-type natriuretic peptide (CNP)
- dendroaspis-type natriuretic peptide (DNP)
- urodilatin

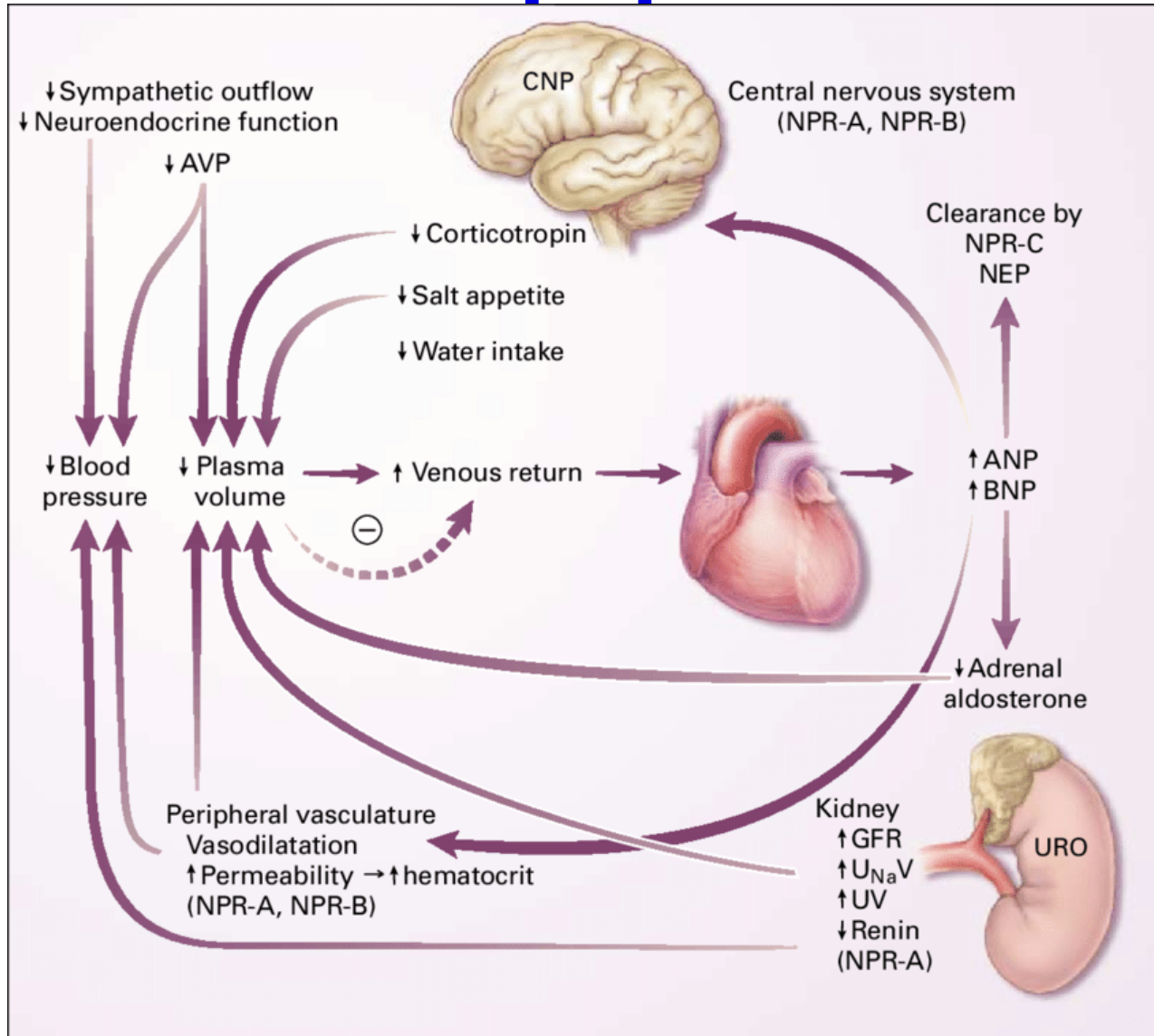


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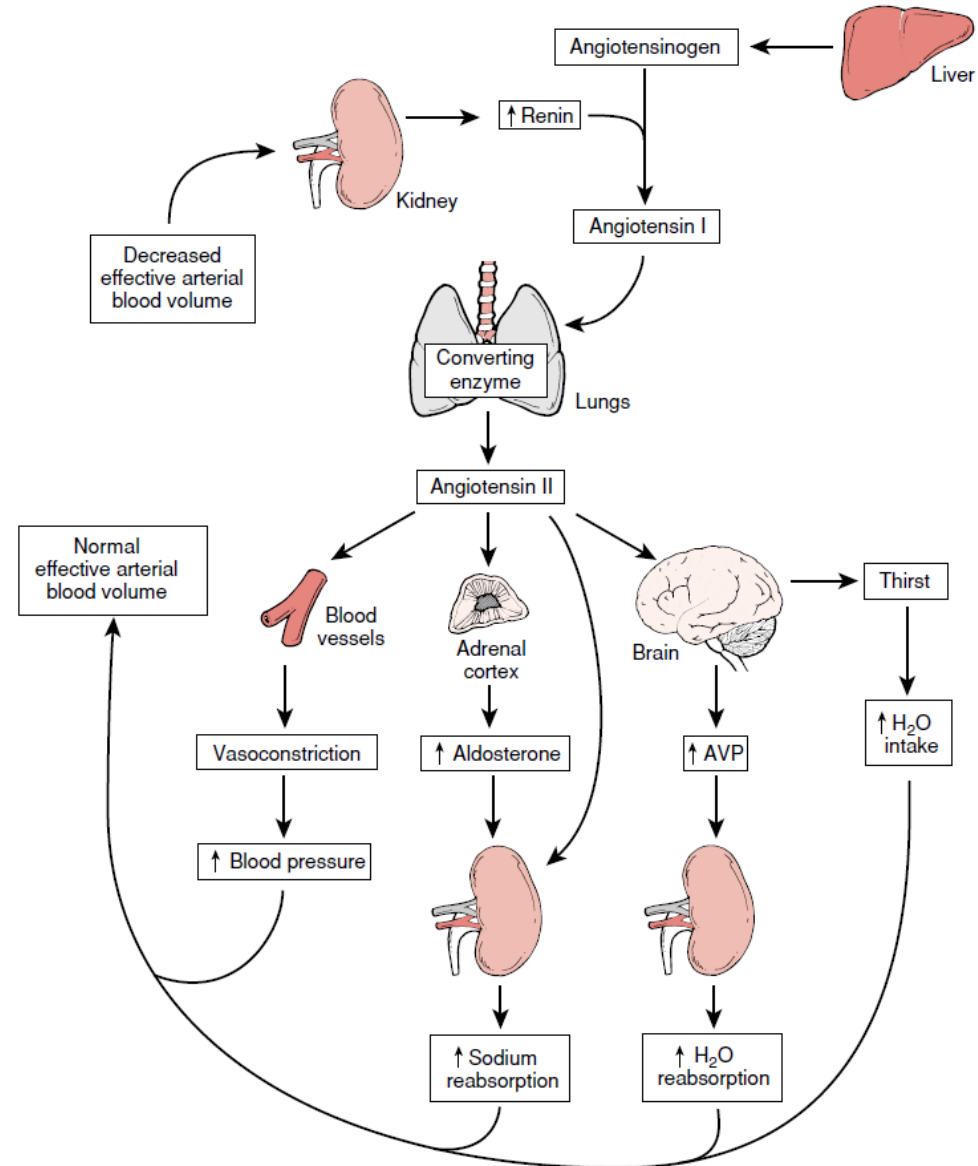


Natriuretic peptides

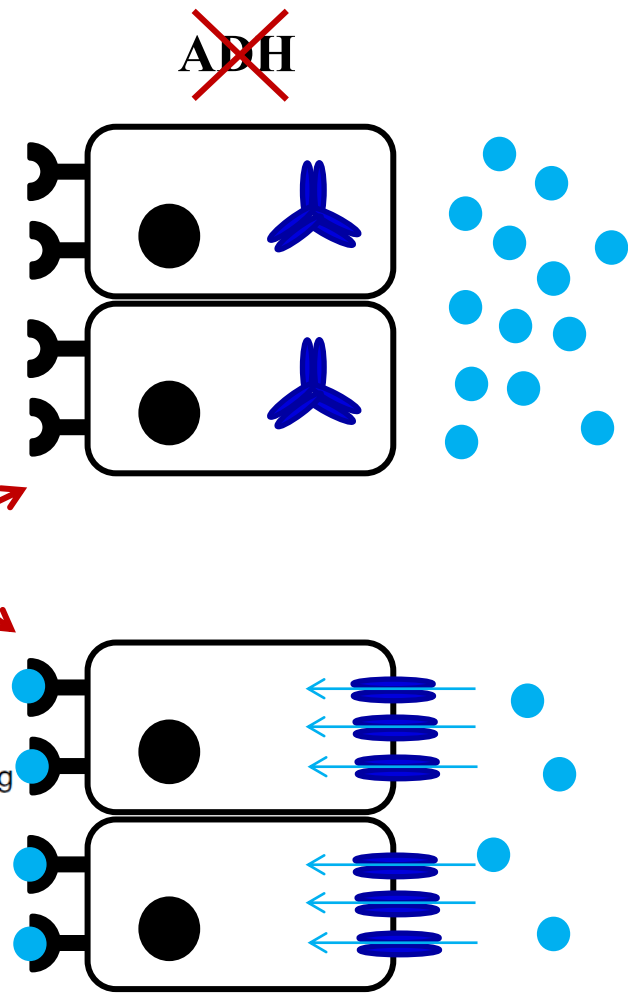
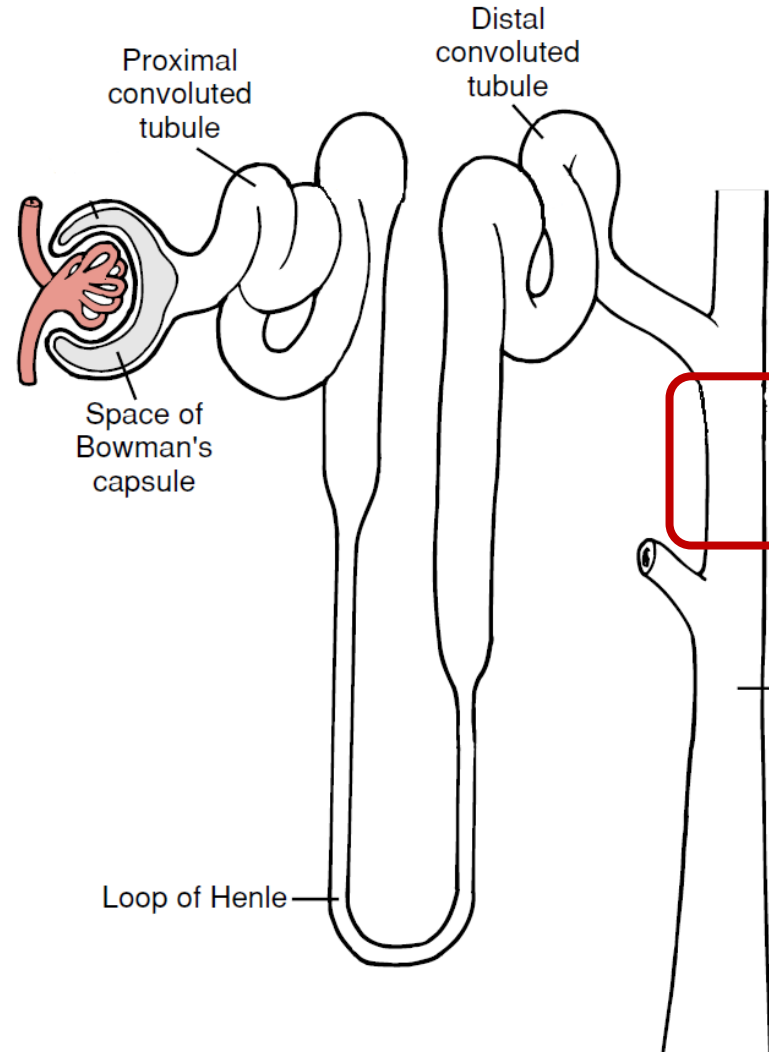
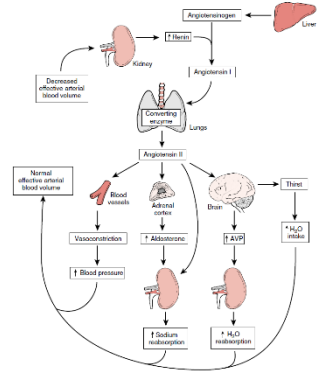
$$BP = HR \times SV \times TPR$$



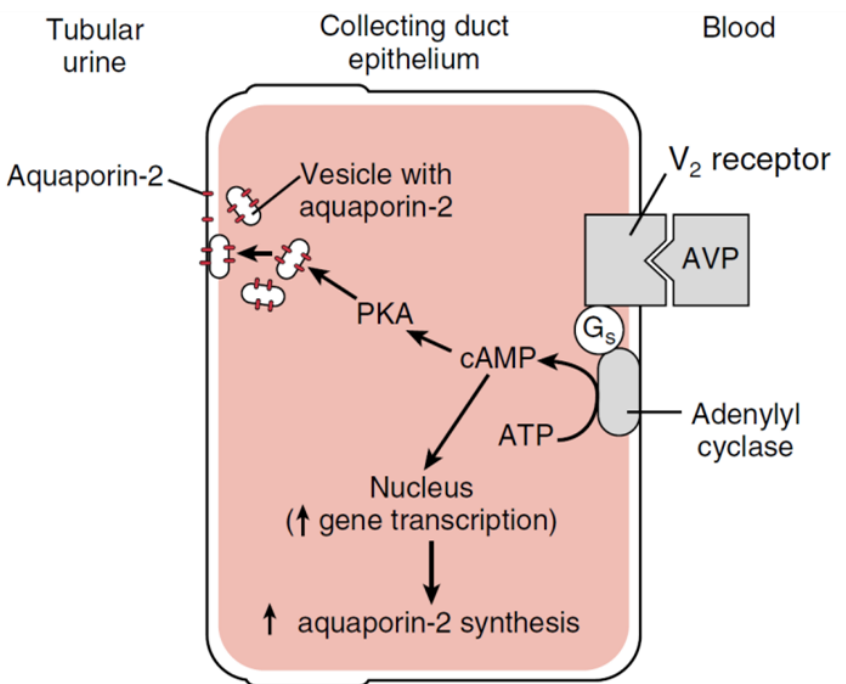
RAAS



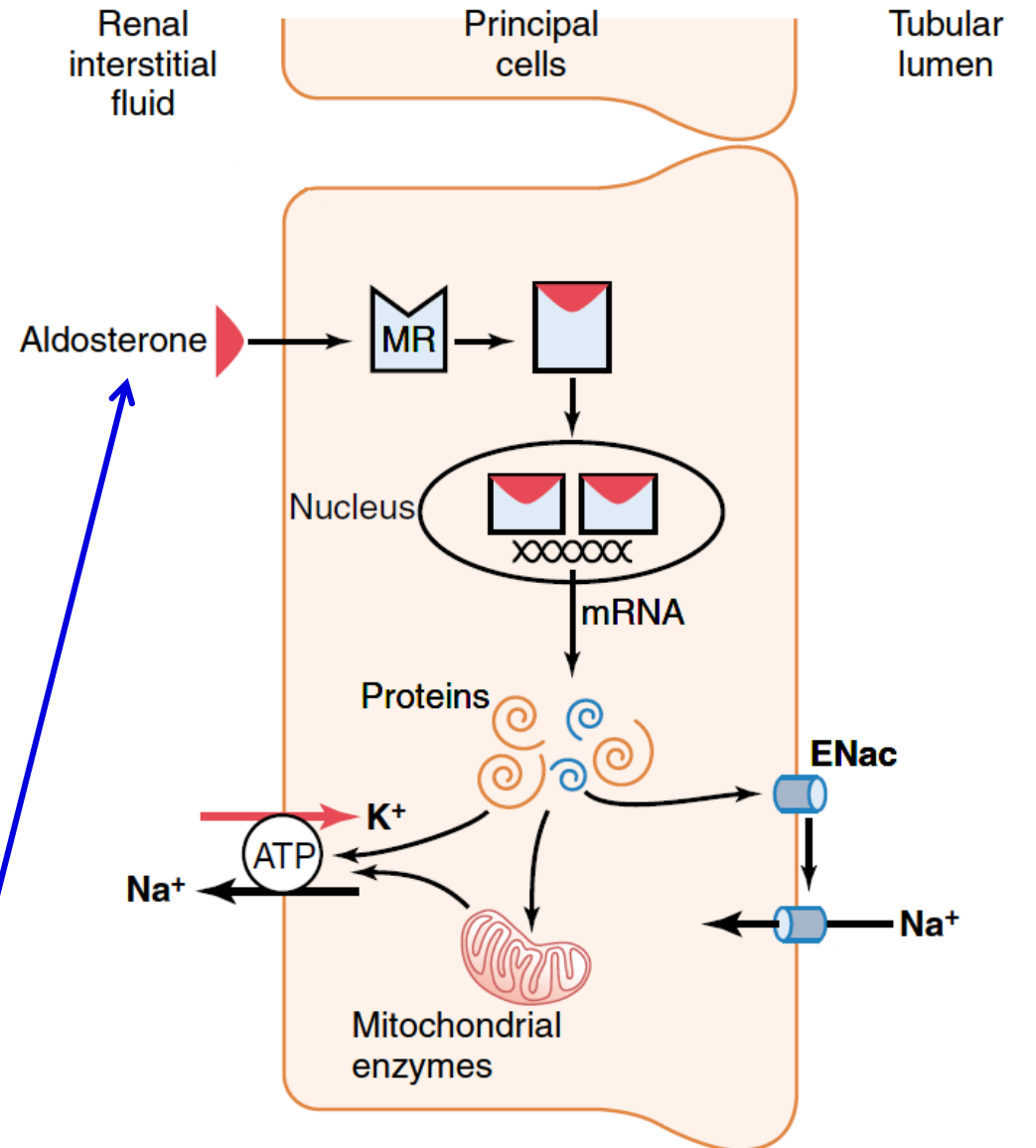
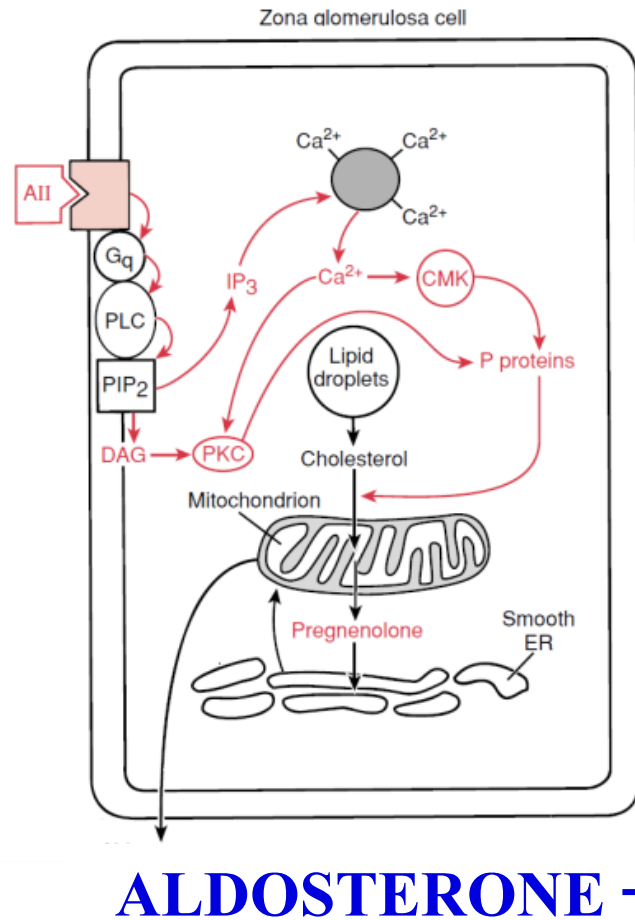
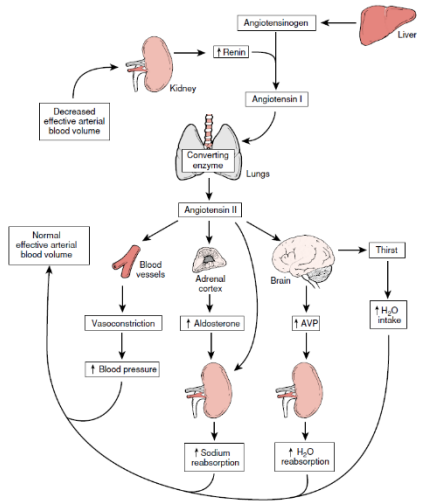
ADH



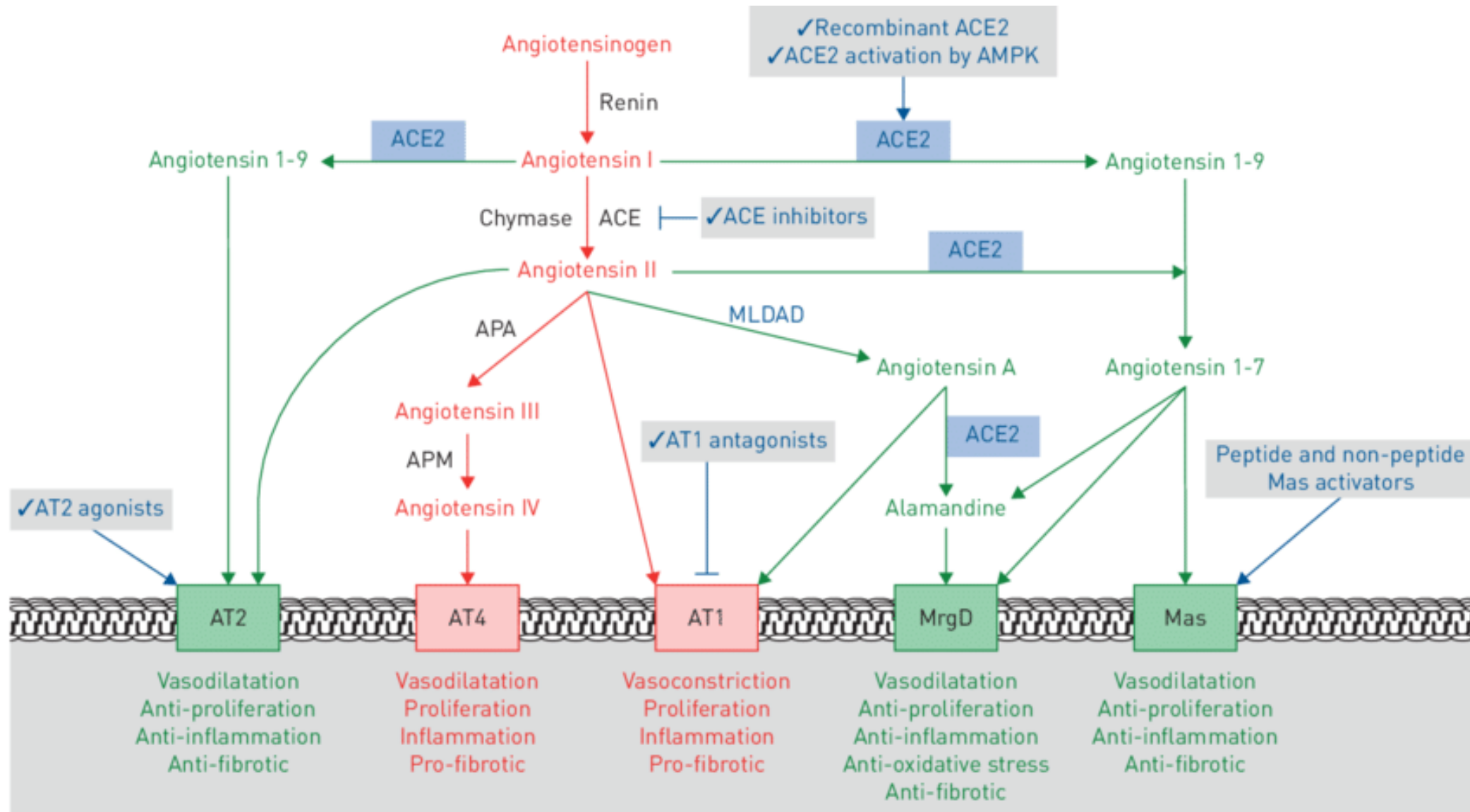
ADH
MUNI
MED



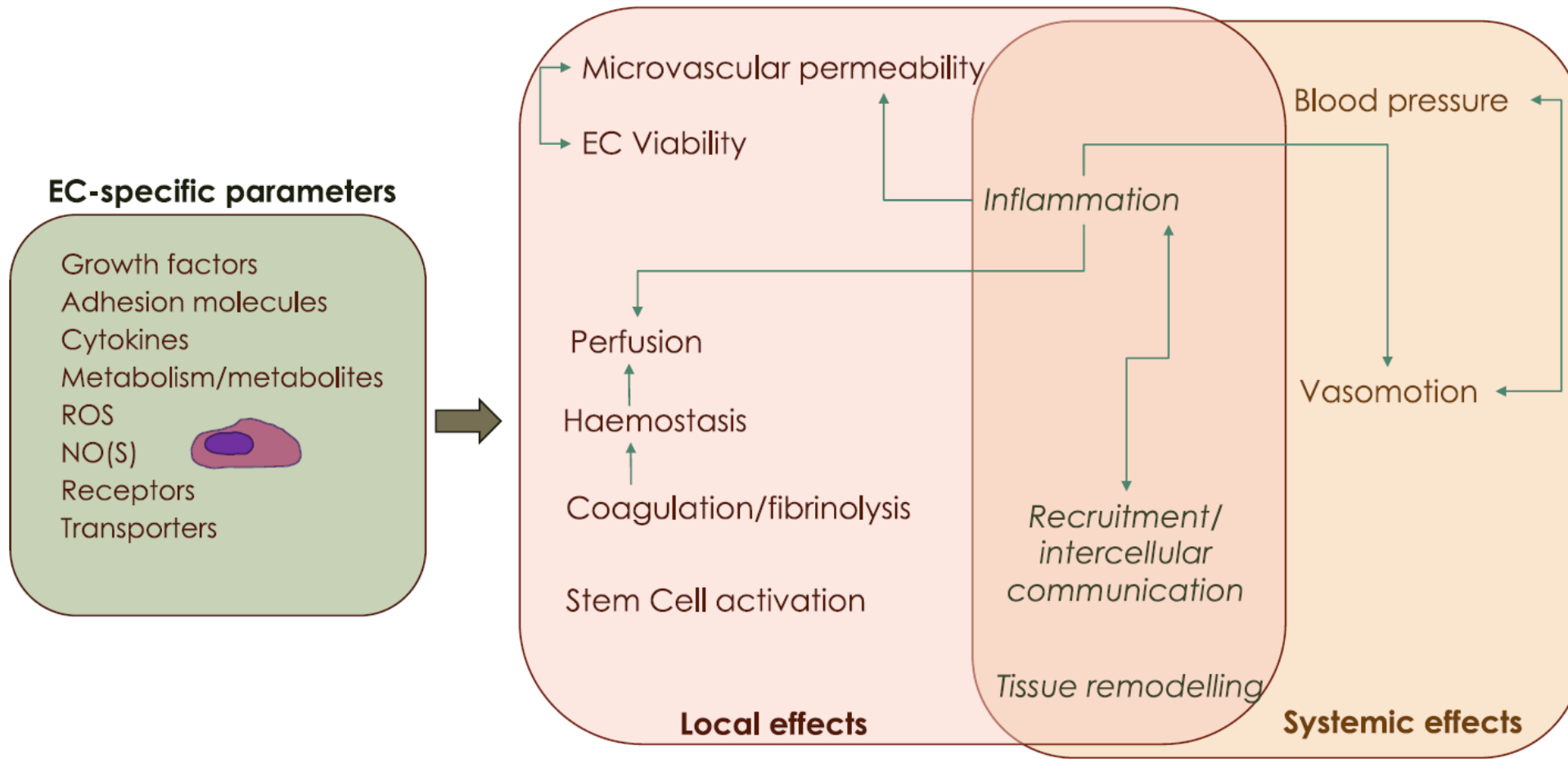
Aldosterone



RAAS



Endothelial cells



Endothelial cells

Matrix products

fibronectin
laminin
collagen
proteoglycans
proteases

Antithrombotic factors

prostacyclin
thrombomodulin
antithrombin
plasminogen activator
heparin

Procoagulant factors

von Willebrand factor
thromboxane A2
thromboplastin
factor V
platelet activating factor
plasminogen activator inhibitor

Growth factors

insulin like growth factor
transforming growth factor
colony stimulating factor

Endothelial cell

Inflammatory mediators

interleukins 1, 6, 8
leukotrienes
MHC II

Vasodilator factors

nitric oxide
prostacyclin

Vasoconstricting factors

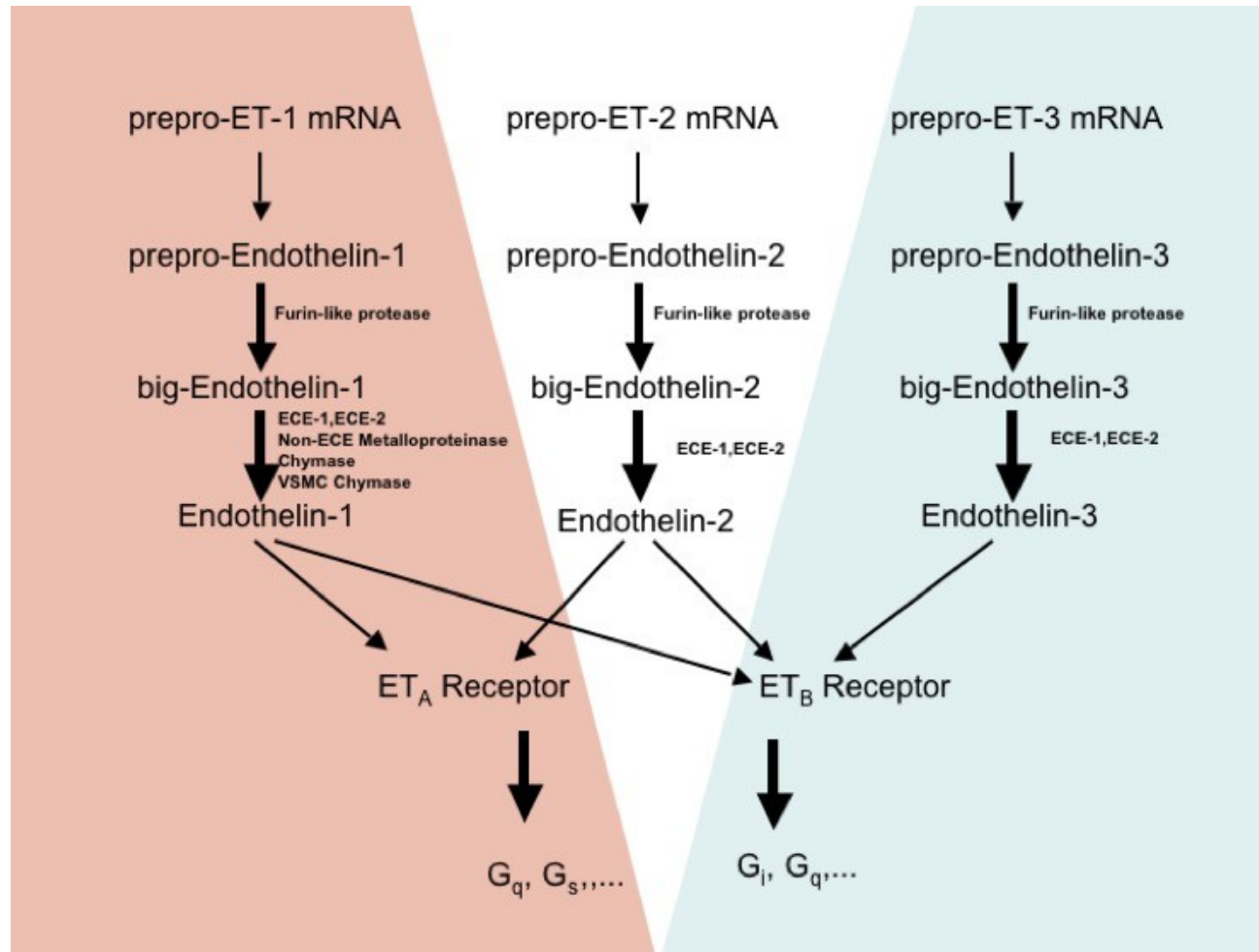
angiotensin converting enzyme
thromboxane A2
leukotrienes
free radicals
endothelin

EC:

metabolic functions

synthetic functions

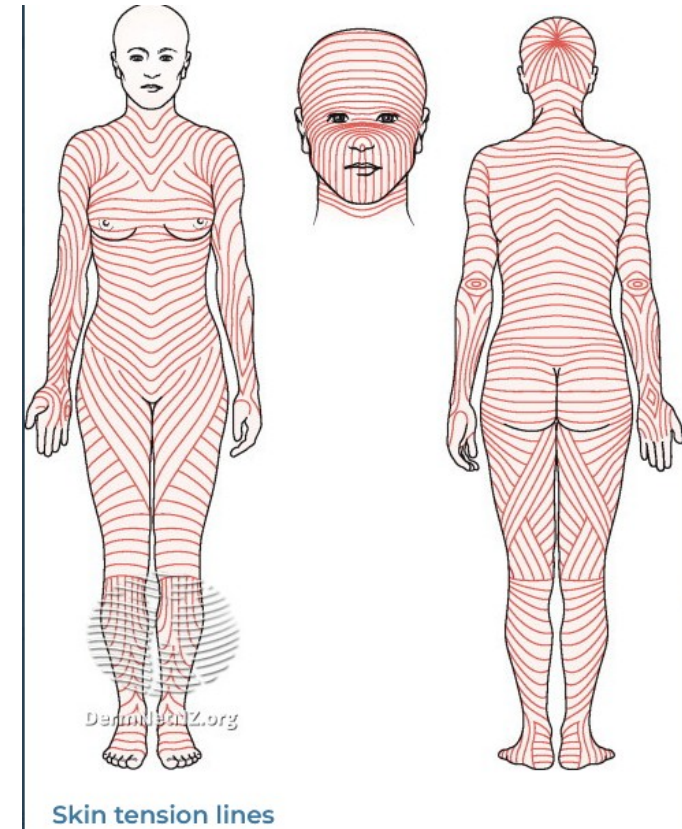
Endothelins and their receptors



- ET_AR – vasoconstriction
- ET_BR – vasodilation

Skin physiology

- skin pH and skin integrity
 - 4.1–5.8
 - pigmentation, age, localization and skin layer
- microbiome
- mechanical barrier
 - collagen
 - elastin
 - filaggrin
- immune barrier
 - Langerhans cells, T lymphocytes, granulocytes, keratinocytes, fibroblasts and melanocytes, skin associated lymphoid tissue
- thermoregulation
- photoprotection
- endocrine function

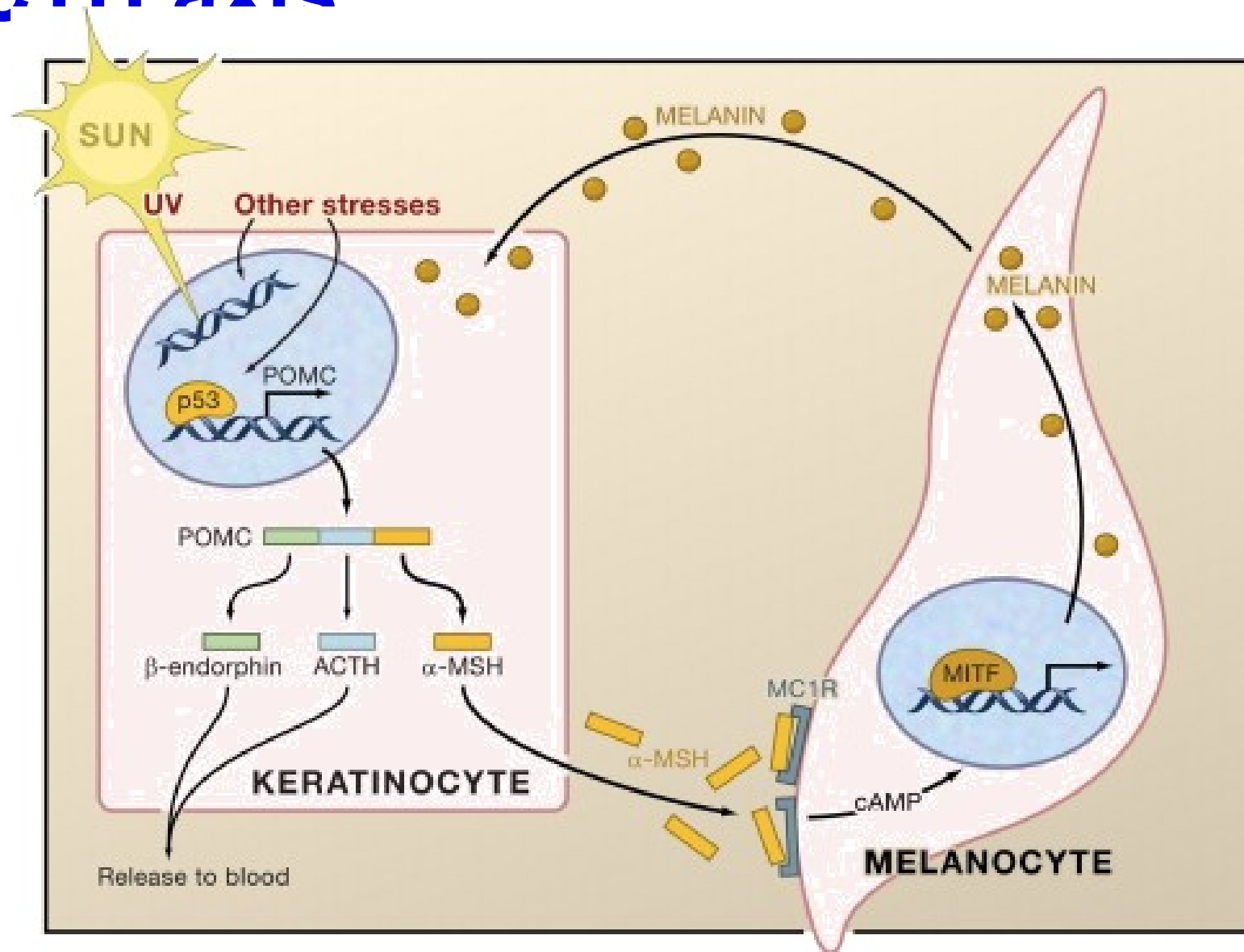


Endocrine function of skin

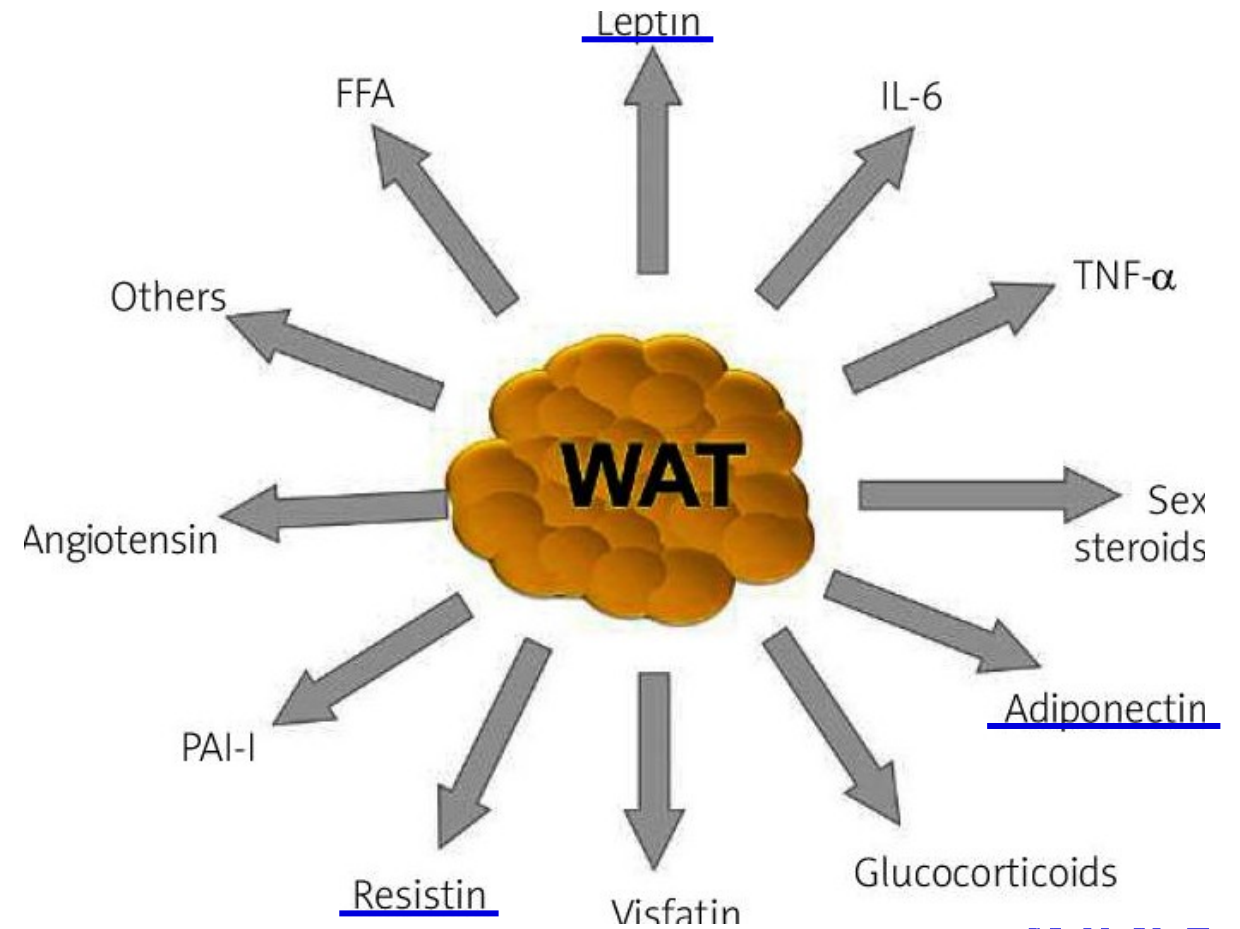
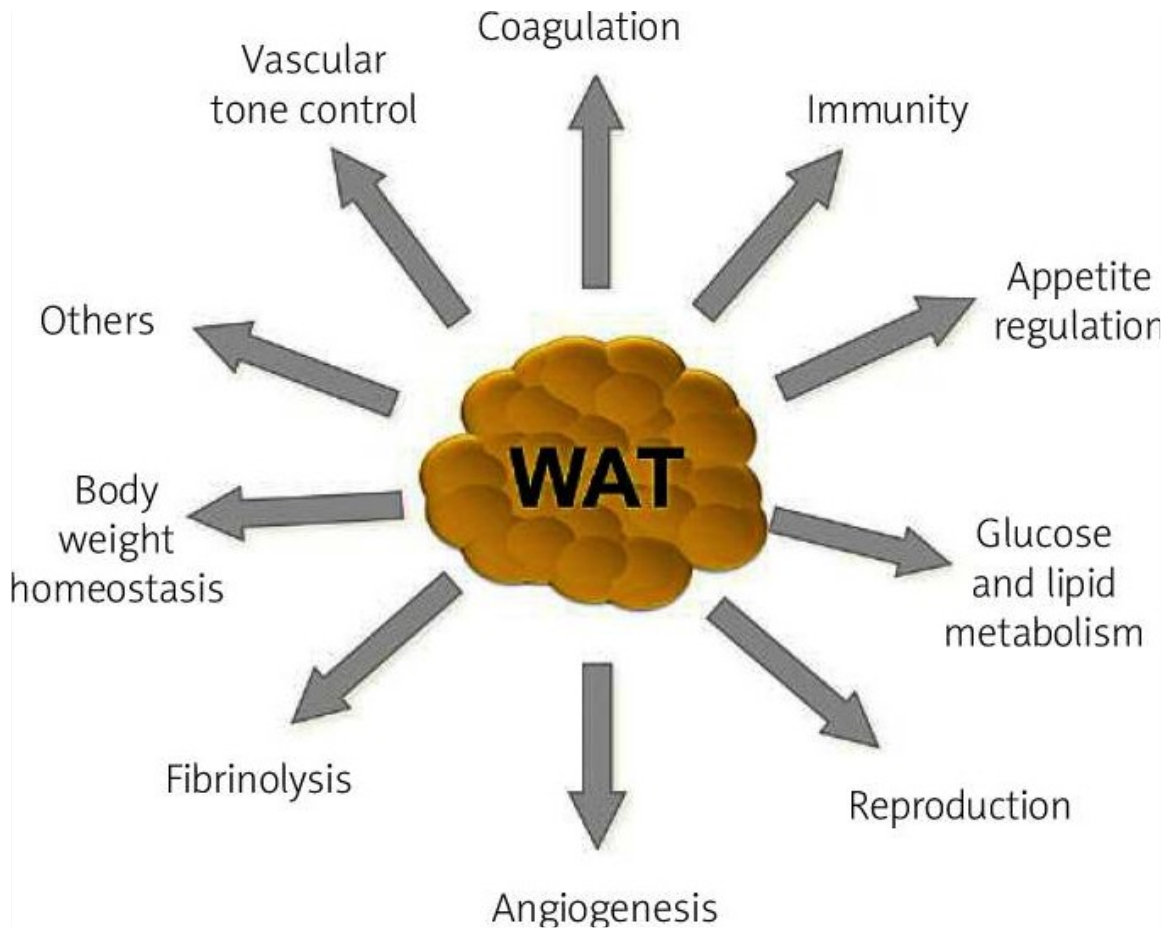
Parathyroid hormone-related peptide		Keratinocytes
Corticotrophin-releasing hormone		Sebocytes, follicular keratinocytes, endothelial cells, dermal nerves
Urocortin		Epidermal and follicular keratinocytes, sweat glands, epidermal melanocytes, dermal smooth muscle cells and fibroblasts, endothelial cells
Pro-opiomelanocortin peptides	Adrenocorticotrophic hormone	Epidermal keratinocytes, melanocytes, outer root sheath of anagen follicles, dermal fibroblasts, endothelial cells
	Alpha-melanocyte-stimulating hormone	
	β -Endorphin	Outer root sheath of anagen follicles, dermal fibroblasts
PRL		Dermal fibroblasts
Catecholamines (epinephrine and norepinephrine)		Keratinocytes
Insulin-like growth factor-I		Dermal fibroblasts, melanocytes, keratinocytes of stratum granulosum
Sex steroids		Sebaceous and sweat glands with intracellular activation depending on expression of enzymes
Retinoids (all-transretinoic acid)		Low amounts in keratinocytes
Vitamin D		Keratinocytes
Eicosanoids (prostaglandins, prostacyclins and leukotriene)		Keratinocytes, sebocytes

Skin and CRH-ACTH axis

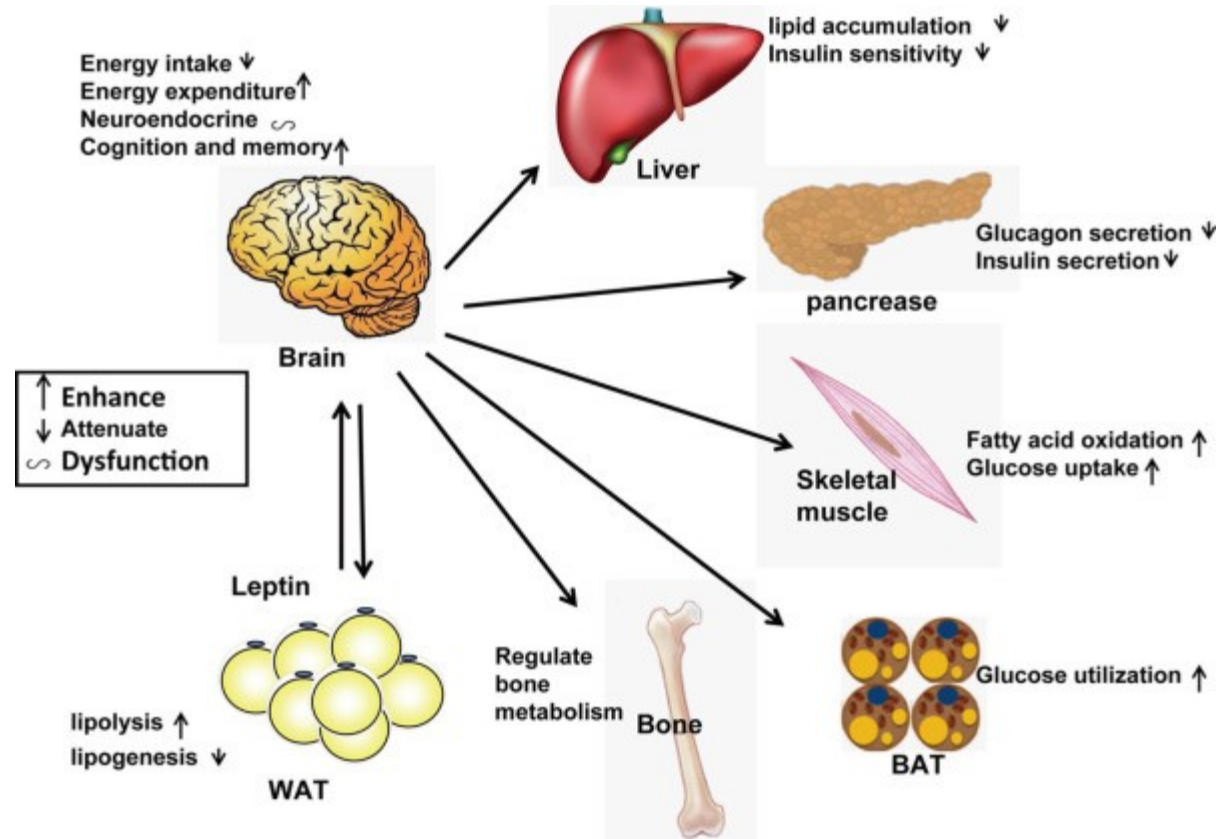
POMC
↓
Pro-ACTH
↓
ACTH



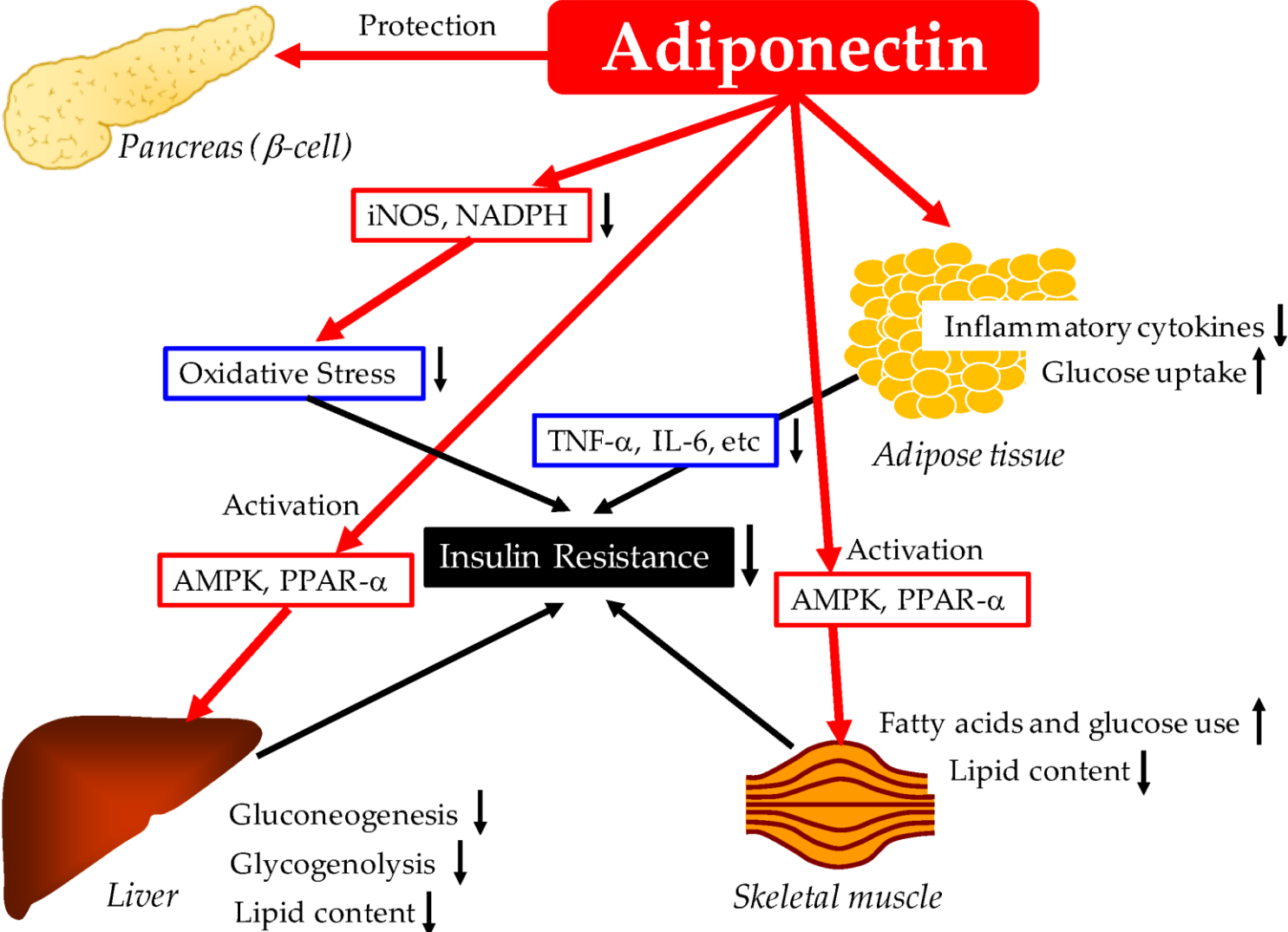
Endocrine function of adipose tissue



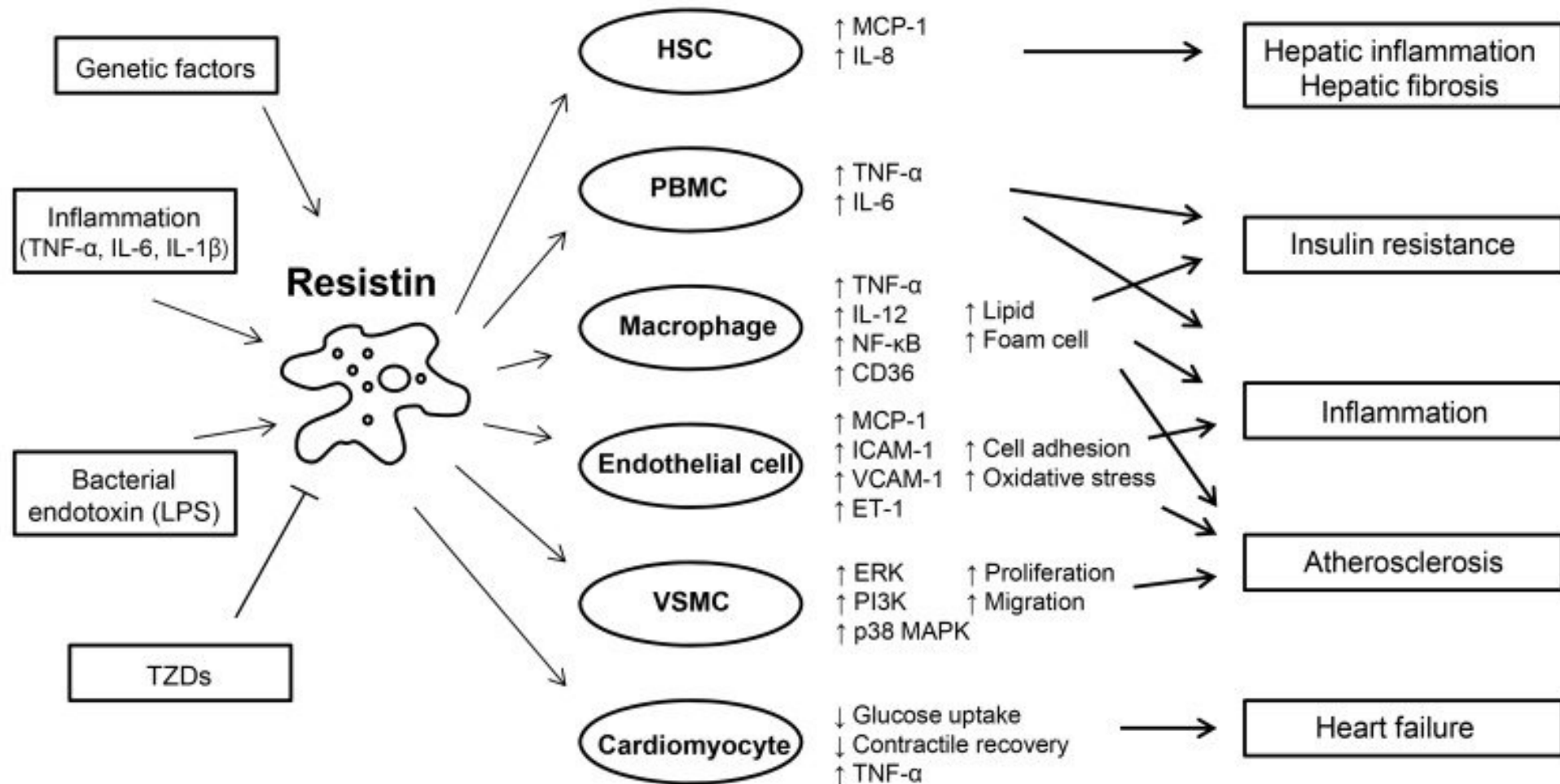
Leptin - functions



Adiponectin



Resistin



Thank you for your attention