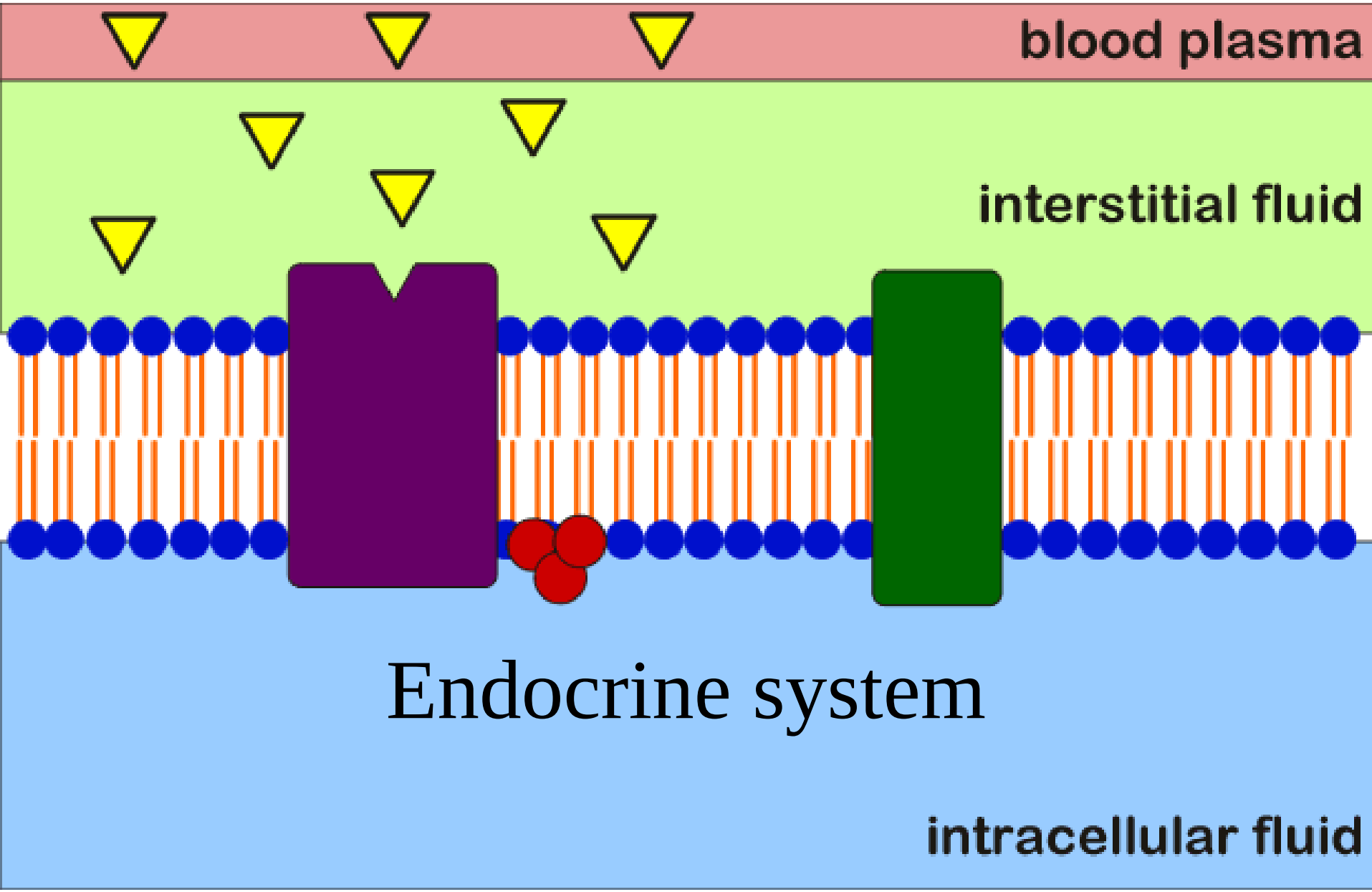


Endocrine system

Functions of the endocrine system

- Production & release of hormones into the cardiovascular system
- Long-term regulation (minutes/weeks) of the other systems of the body
  - Hormones effect the function of cells

Endocrine Glands

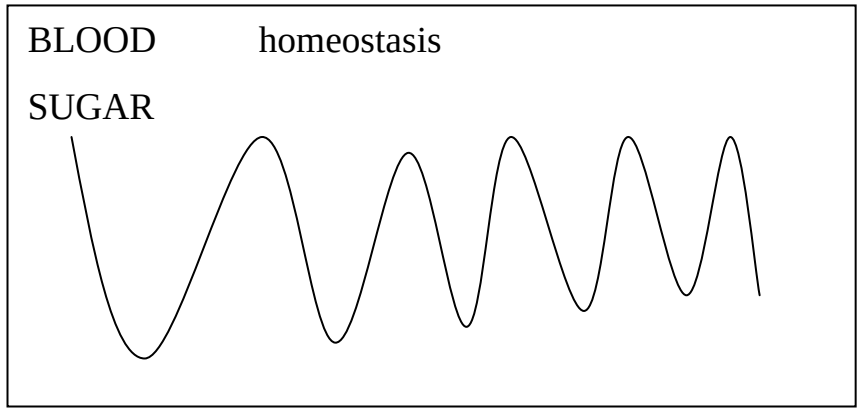
- Ductless; secrete their product (hormones) directly into the interstitial fluid, bound for blood

- Not 2 b confused with, Exocrine Glands
  - Secrete their product (oil, mucous, sweat, etc) into ducts.

Homeostasis

- Maintenance of a relatively stable internal environment
- Physiological variables stay within a set range
- Regulated by hormones

Blood glucose example



- high blood glucose
- release of insulin into blood
- cells detect insulin
- cells take in glucose
- lowering of blood glucose
- low blood glucose
- inhibit release of insulin, release of glucagon into blood
- cells detect glucagon
- cells release glucose to blood
- raising of blood glucose
- inhibit release of glucagon, release of insulin into blood

Feedback

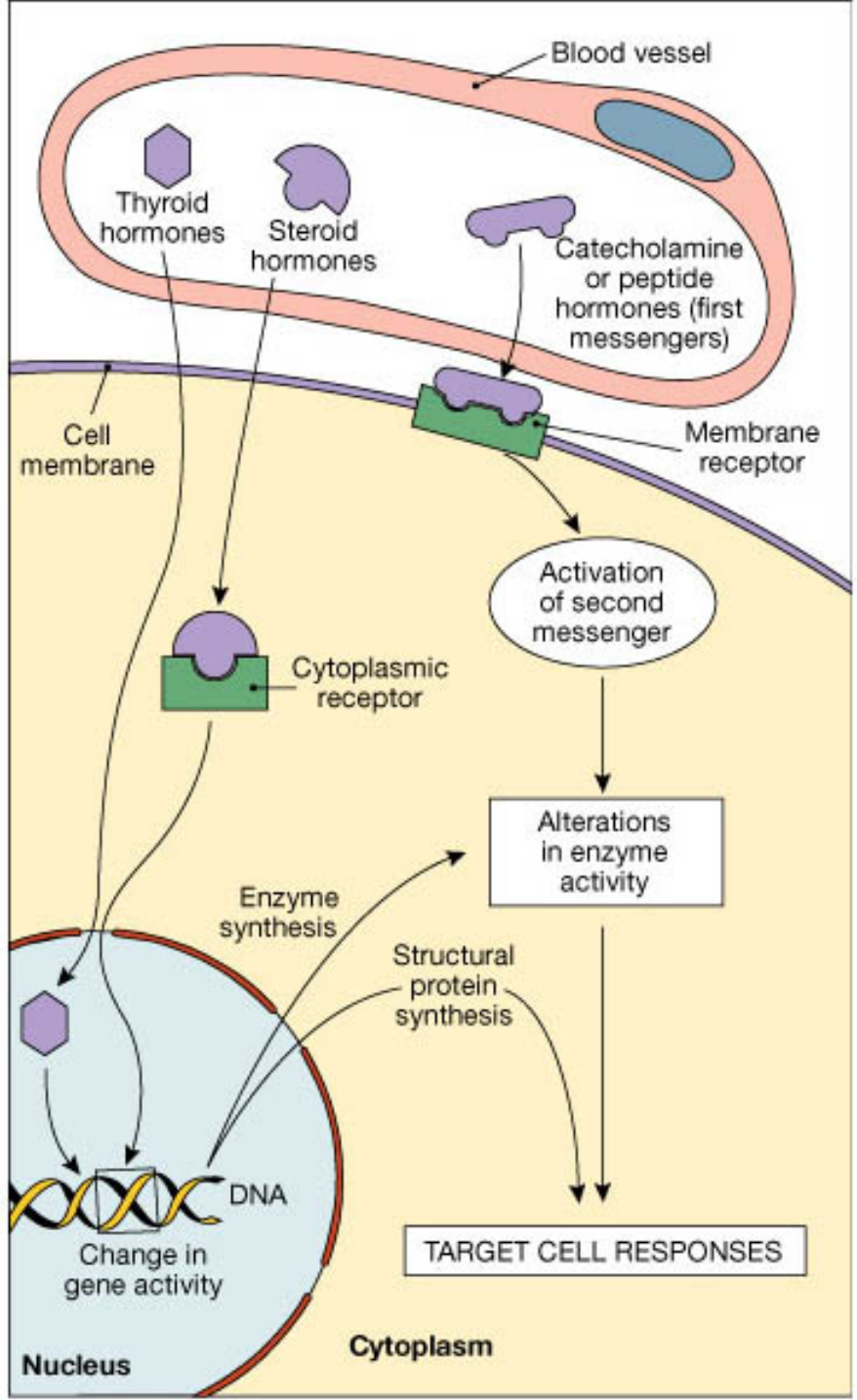
- **Negative Feedback**
- Secretion of insulin➔ blood sugar level decline➔ normal blood sugar levels➔ inhibit secretion of insulin

- **Positive Feedback**
- Secretion of oxytocin➔ uterine wall contracts➔ uterine wall stretches➔ secretion of oxytocin

Types of hormones

19.2

- Steroid hormones-made from cholesterol
- Peptide hormones-made from chains of amino acids
- Amino acid derivatives-made from a single amino acid



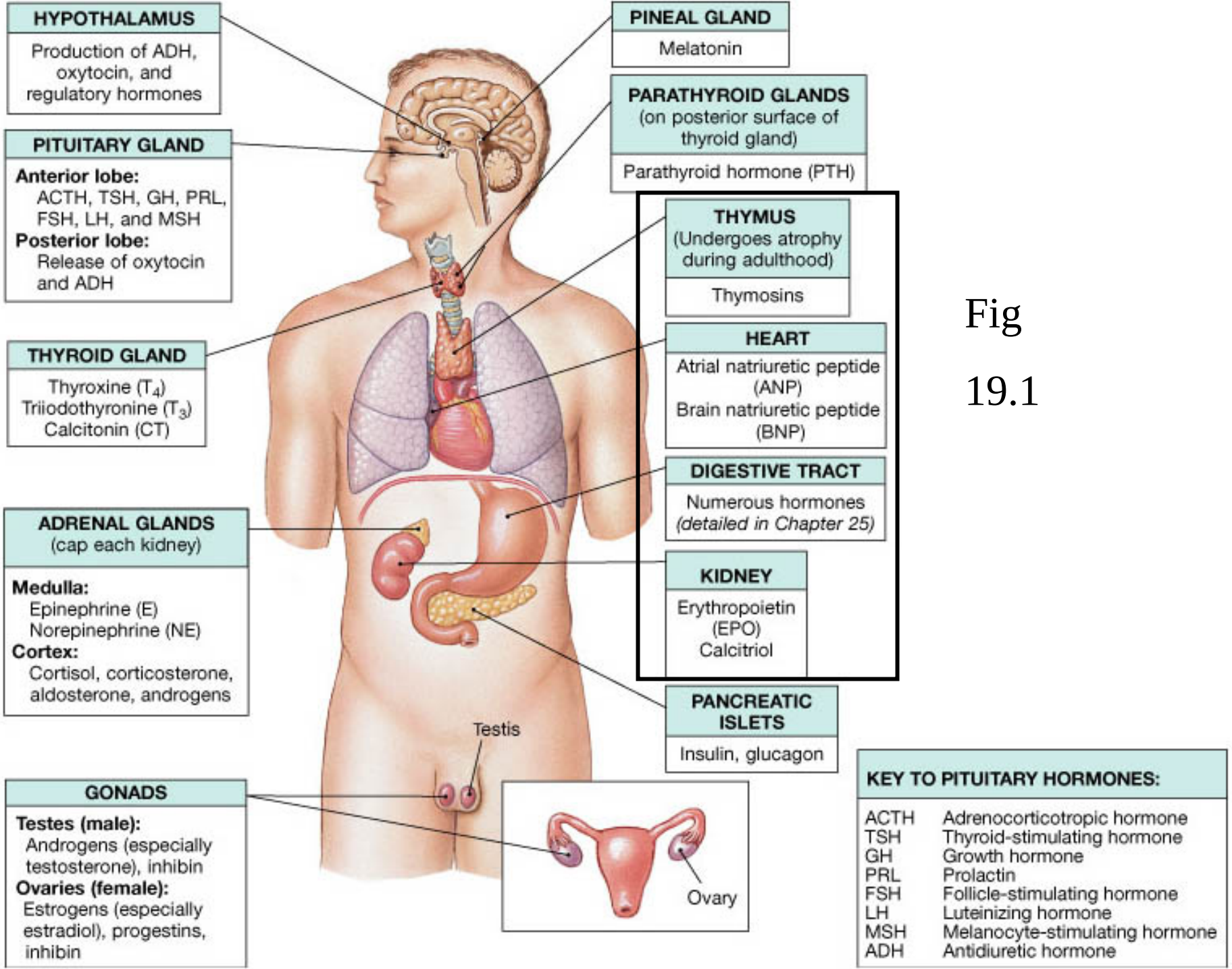

HYPOTHALAMUS
Production of ADH, oxytocin, and regulatory hormones
PINEAL GLAND
Melatonin
PARATHYROID GLANDS (on posterior surface of thyroid gland)
Parathyroid hormone (PTH)
PITUITARY GLAND
Anterior lobe:
ACTH, TSH, GH, PRL, FSH, LH, and MSH
Posterior lobe:
Release of oxytocin and ADH
THYMUS (Undergoes atrophy during adulthood)
Thymosins
THYROID GLAND
Thyroxine (T_4)
Triiodothyronine (T_3)
Calcitonin (CT)
HEART
Atrial natriuretic peptide (ANP)
Brain natriuretic peptide (BNP)
DIGESTIVE TRACT
Numerous hormones (detailed in Chapter 25)
ADRENAL GLANDS (cap each kidney)
Medulla:
Epinephrine (E)
Norepinephrine (NE)
Cortex:
Cortisol, corticosterone, aldosterone, androgens
KIDNEY
Erythropoietin (EPO)
Calcitriol
PANCREATIC ISLETS
Insulin, glucagon
Testis
GONADS
Testes (male):
Androgens (especially testosterone), inhibin
Ovaries (female):
Estrogens (especially estradiol), progestins, inhibin
Ovary
KEY TO PITUITARY HORMONES:
ACTH Adrenocorticotropic hormone
TSH Thyroid-stimulating hormone
GH Growth hormone
PRL Prolactin
FSH Follicle-stimulating hormone
LH Luteinizing hormone
MSH Melanocyte-stimulating hormone
ADH Antidiuretic hormone

Fig 19.1

Hypothalamus

- 1. Control center of the autonomic nervous system (nervous system)
  - Controls release of hormones from the adrenal gland (adrenal medulla)
- 2. Produces two hormones: ADH & Oxytocin (endocrine system)
- 3. Secretes Regulatory hormones that stimulate the anterior pituitary (endocrine system)

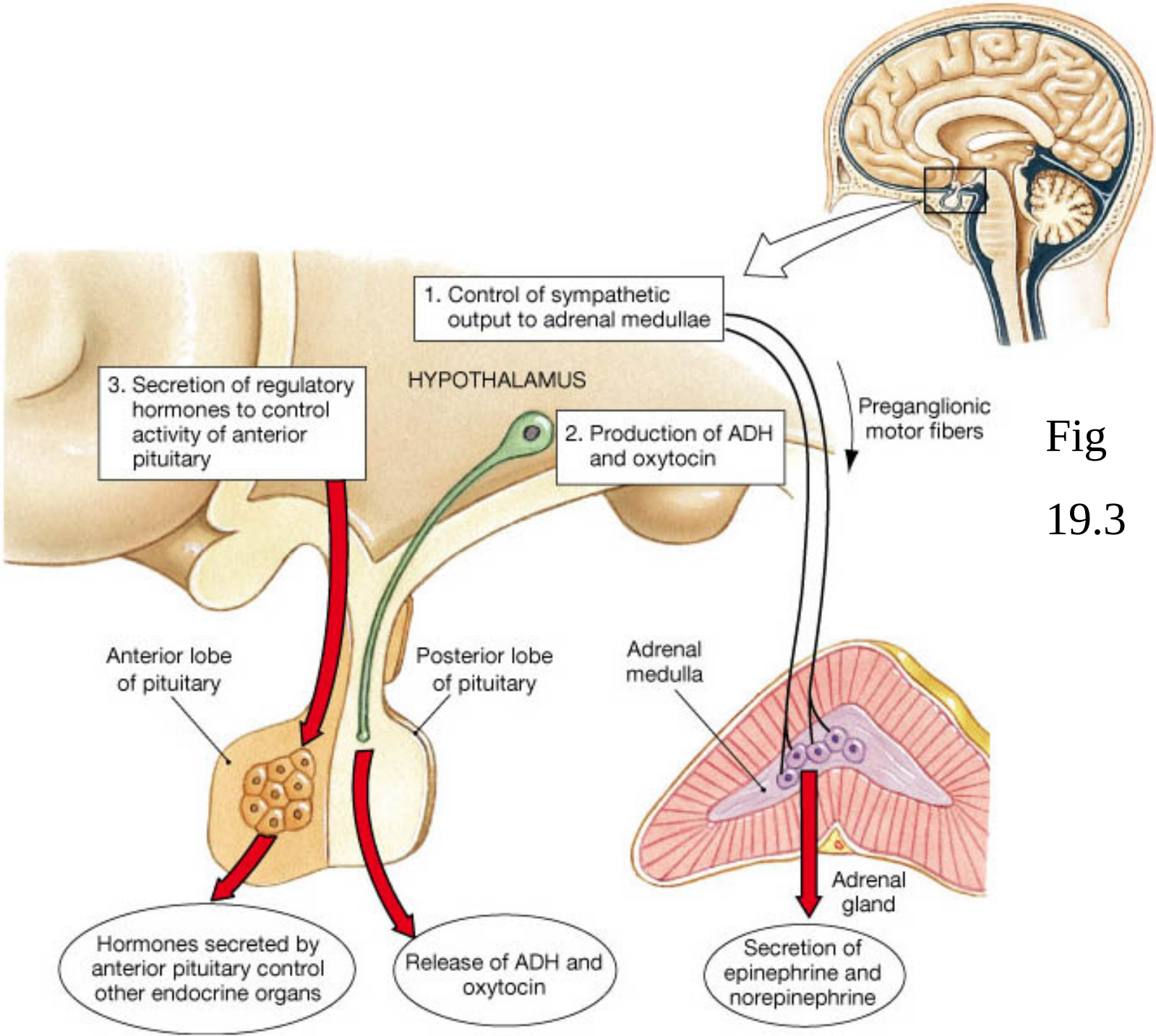
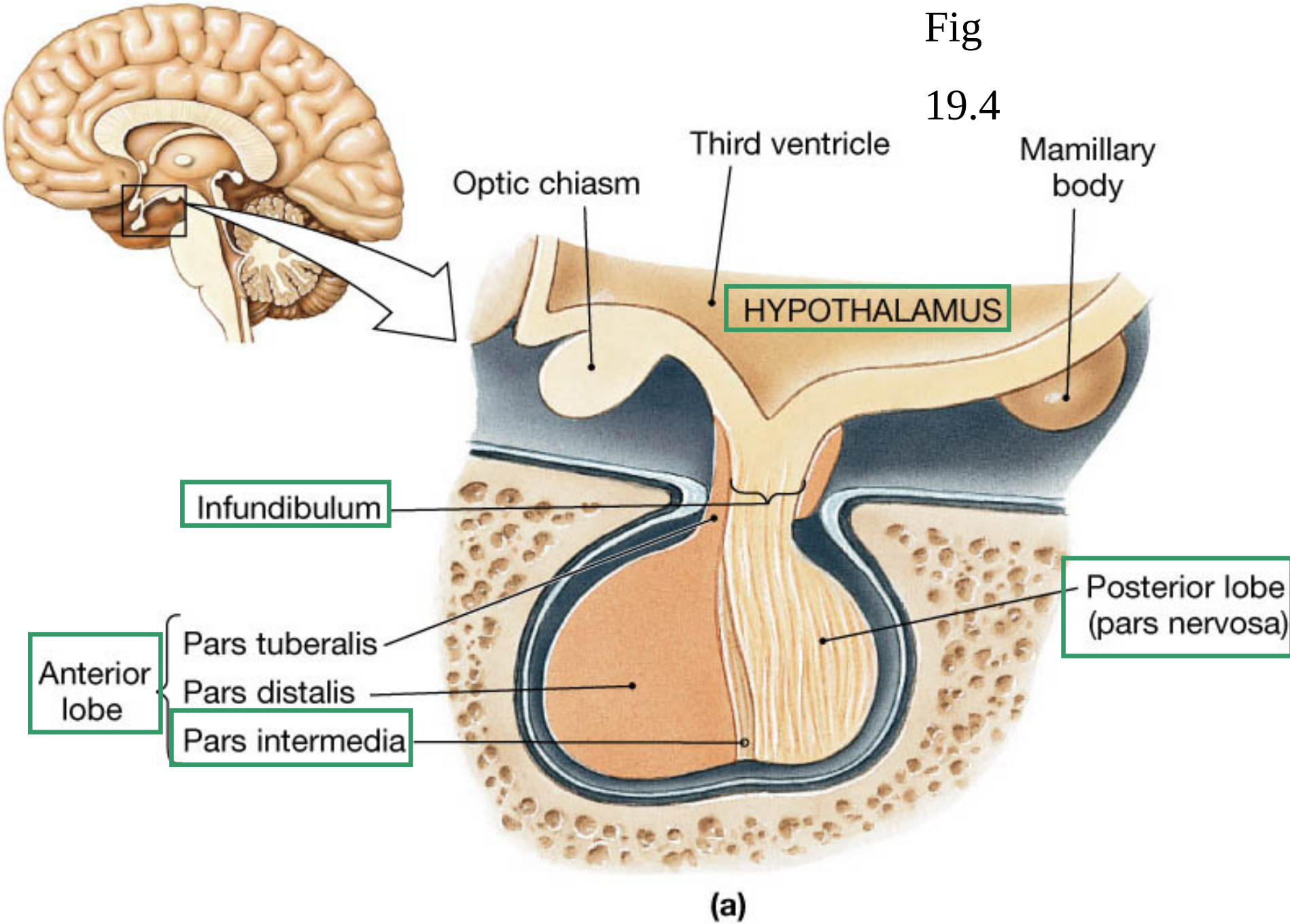

1. Control of sympathetic output to adrenal medullae
HYPOTHALAMUS
3. Secretion of regulatory hormones to control activity of anterior pituitary
2. Production of ADH and oxytocin
Preganglionic motor fibers
Anterior lobe of pituitary
Posterior lobe of pituitary
Adrenal medulla
Adrenal gland
Hormones secreted by anterior pituitary control other endocrine organs
Release of ADH and oxytocin
Secretion of epinephrine and norepinephrine

Fig 19.3

Pituitary gland

- Anterior & Posterior lobes
- neurons from hypothalamus bring hormones to posterior lobe (nervous system)
- Posterior lobe releases ADH & Oxytocin (endocrine system)
- Anterior lobe is stimulated by hypothalamic hormones
- In sella turcica of sphenoid

Fig 19.4


Optic chiasm
Third ventricle
Mamillary body
HYPOTHALAMUS
Infundibulum
Posterior lobe (pars nervosa)
Anterior lobe
Pars tuberalis
Pars distalis
Pars intermedia
(a)

Portal system

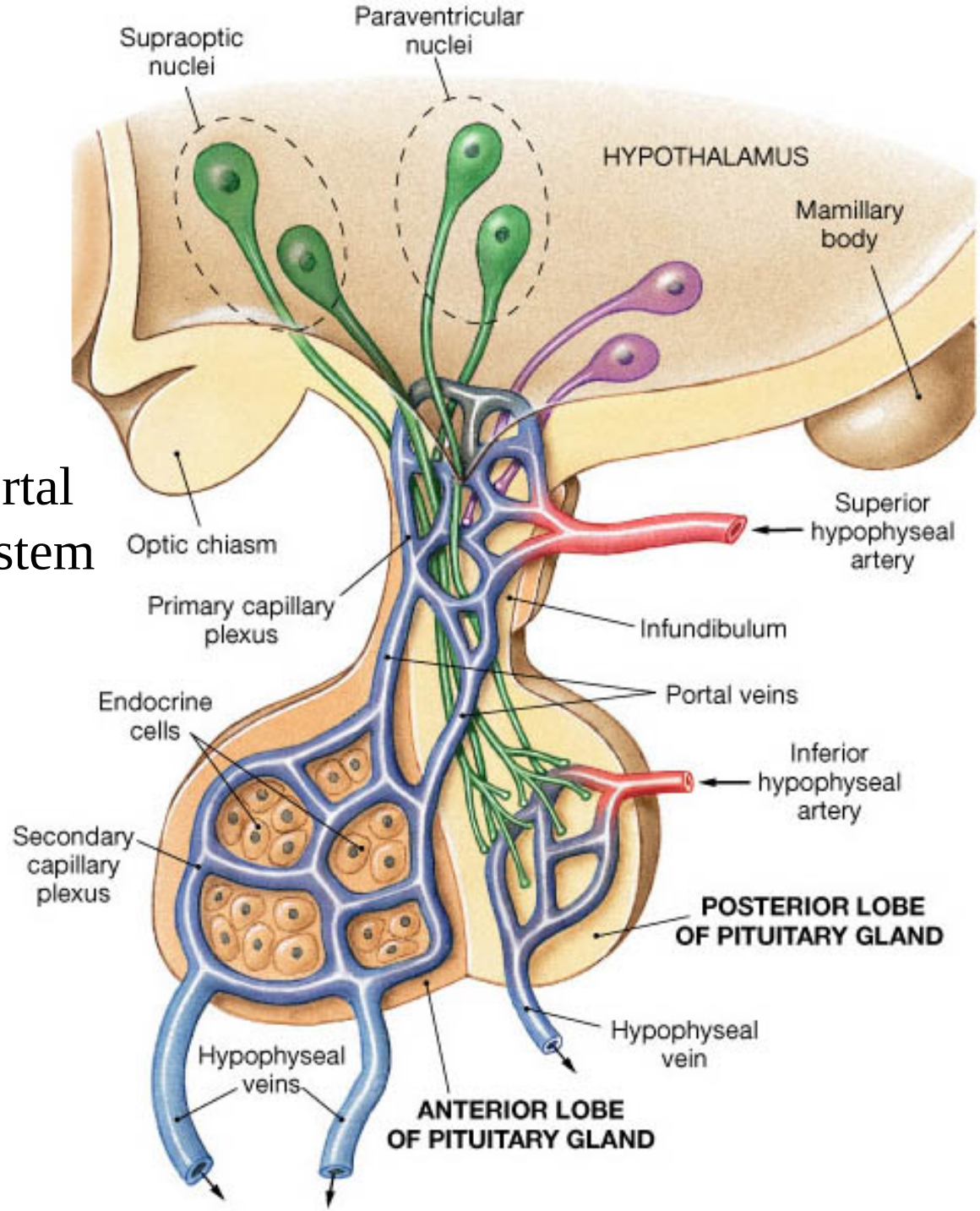
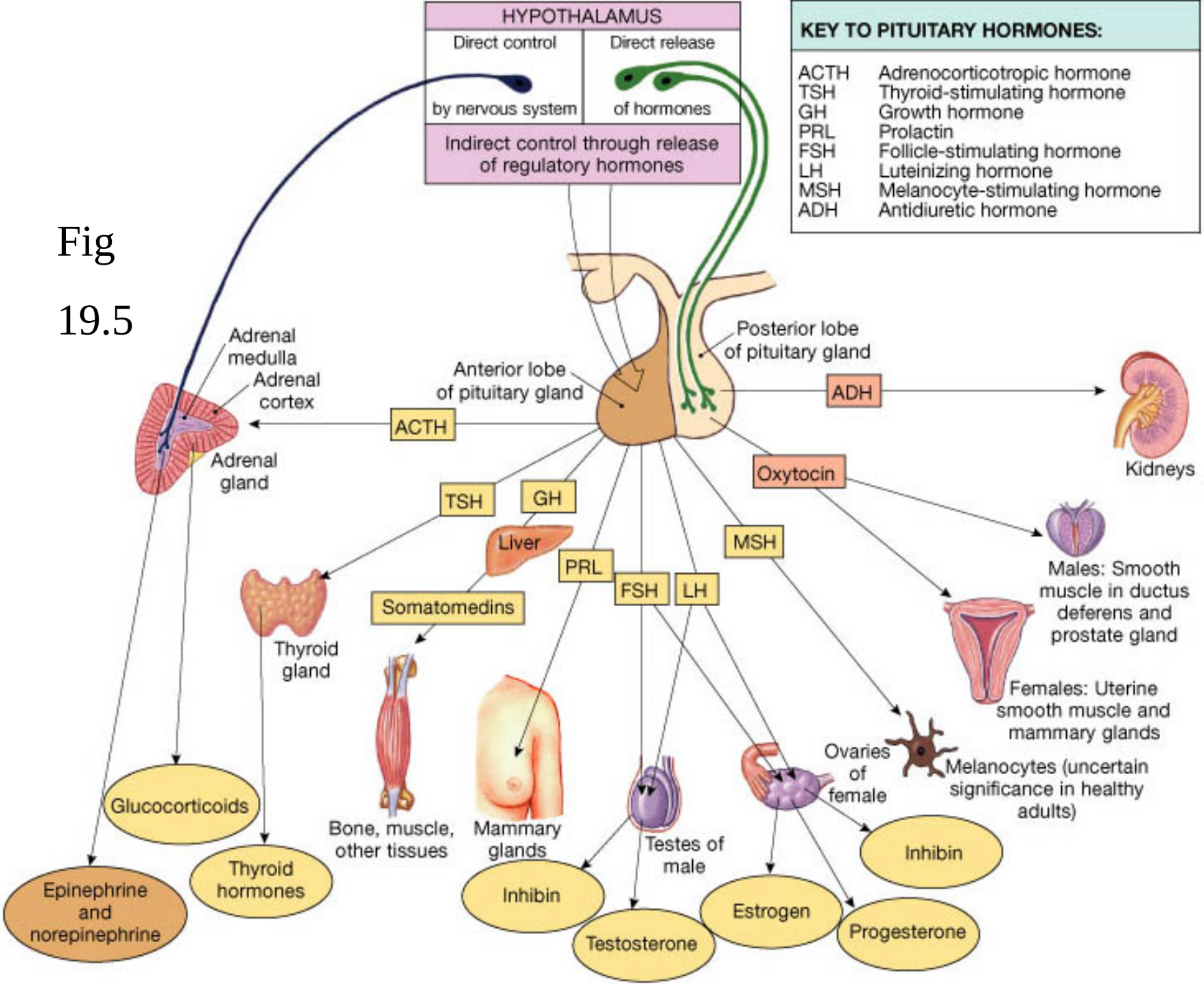


Fig 19.6

Fig

19.5


HYPOTHALAMUS
Direct control
by nervous system
Direct release
of hormones
Indirect control through release of regulatory hormones
KEY TO PITUITARY HORMONES:
ACTH Adrenocorticotropic hormone
TSH Thyroid-stimulating hormone
GH Growth hormone
PRL Prolactin
FSH Follicle-stimulating hormone
LH Luteinizing hormone
MSH Melanocyte-stimulating hormone
ADH Antidiuretic hormone
Adrenal medulla
Adrenal cortex
Adrenal gland
Anterior lobe of pituitary gland
Posterior lobe of pituitary gland
ACTH
ADH
Kidneys
Oxytocin
TSH
GH
Liver
MSH
PRL
FSH
LH
Somatomedins
Thyroid gland
Males: Smooth muscle in ductus deferens and prostate gland
Females: Uterine smooth muscle and mammary glands
Ovaries of female
Melanocytes (uncertain significance in healthy adults)
Glucocorticoids
Bone, muscle, other tissues
Mammary glands
Testes of male
Inhibin
Epinephrine and norepinephrine
Thyroid hormones
Inhibin
Estrogen
Testosterone
Progesterone

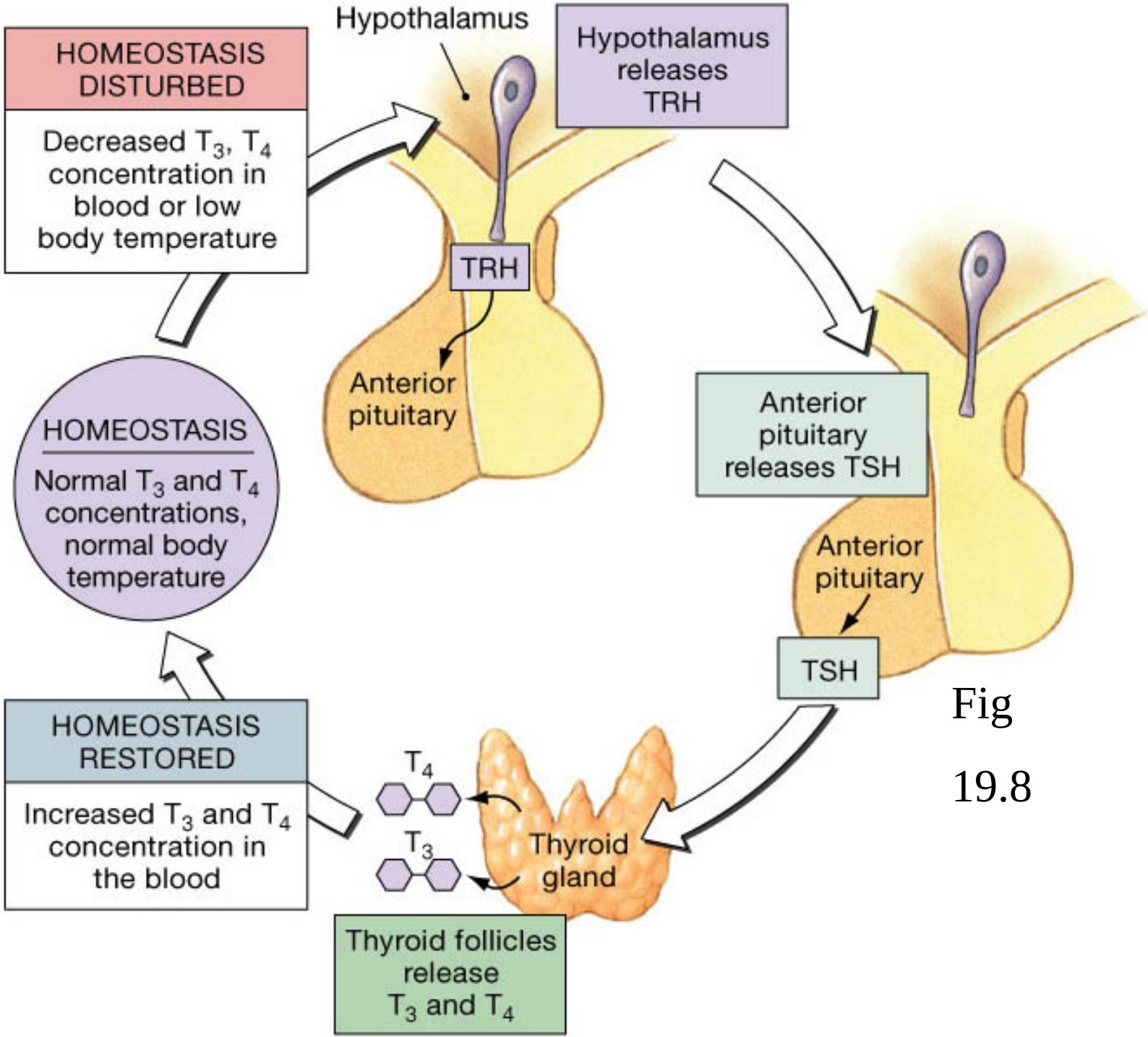
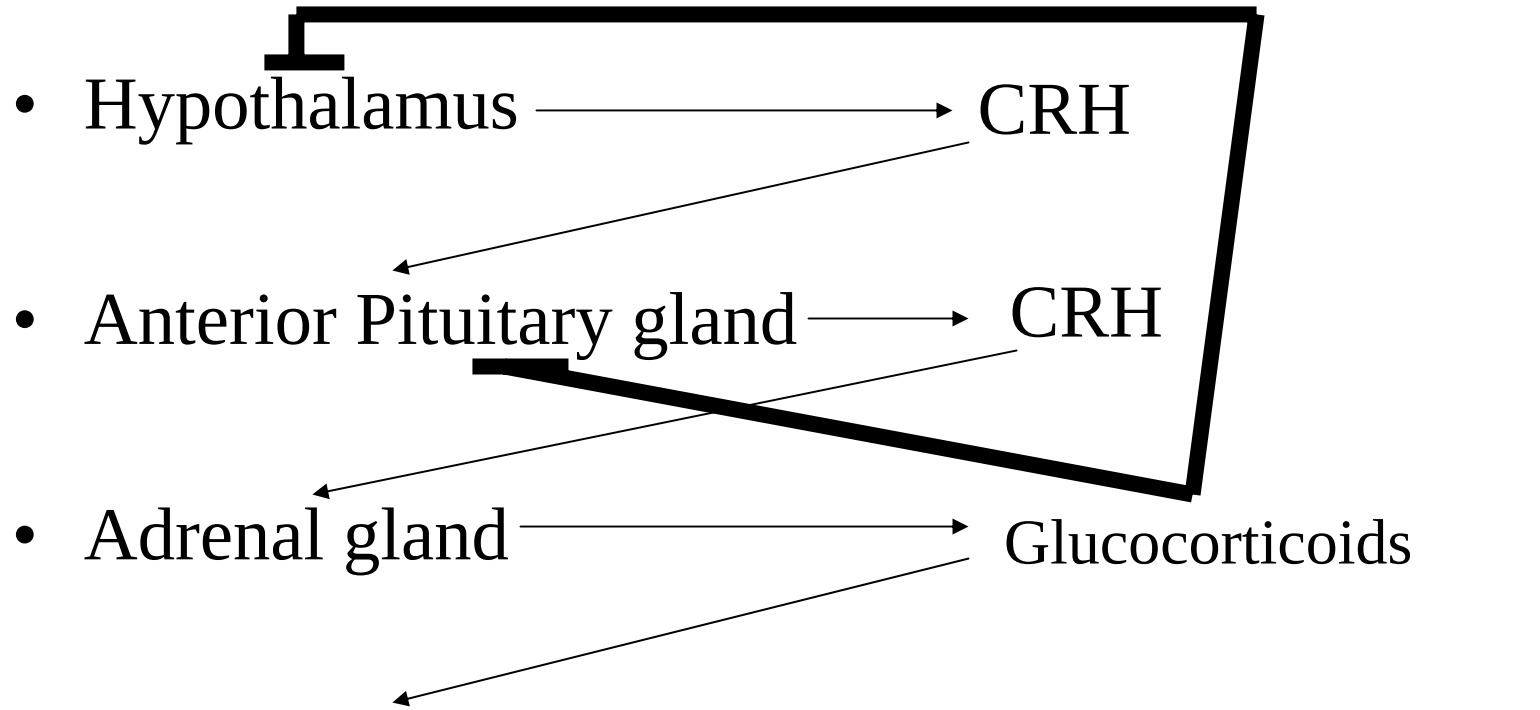
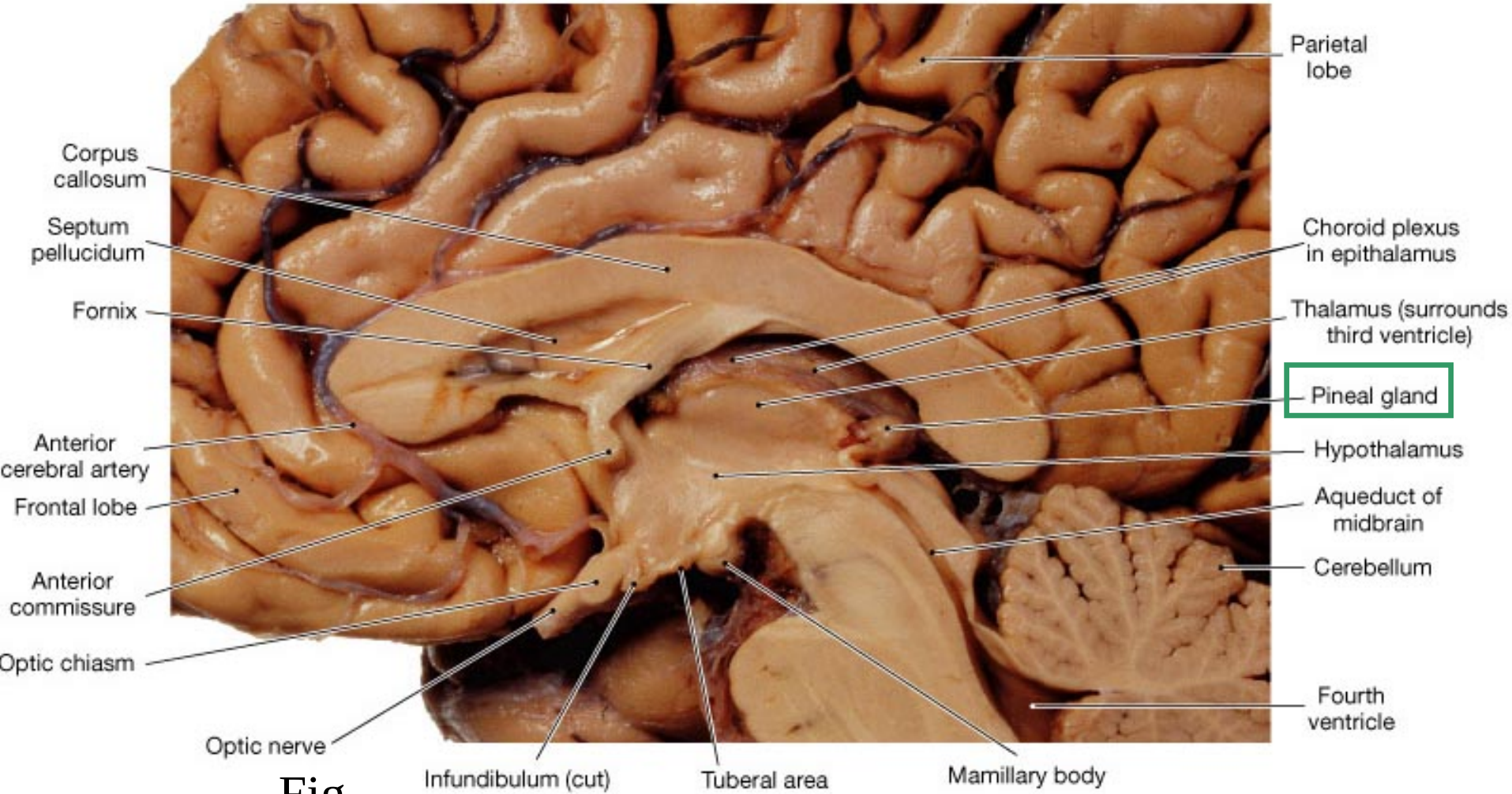

HOMEOSTASIS DISTURBED
Decreased T_3, T_4 concentration in blood or low body temperature
Hypothalamus
Hypothalamus releases TRH
TRH
Anterior pituitary
Anterior pituitary releases TSH
Anterior pituitary
TSH
HOMEOSTASIS
Normal T_3 and T_4 concentrations, normal body temperature
HOMEOSTASIS RESTORED
Increased T_3 and T_4 concentration in the blood
T_4
T_3
Thyroid gland
Thyroid follicles release T_3 and T_4

Fig 19.8

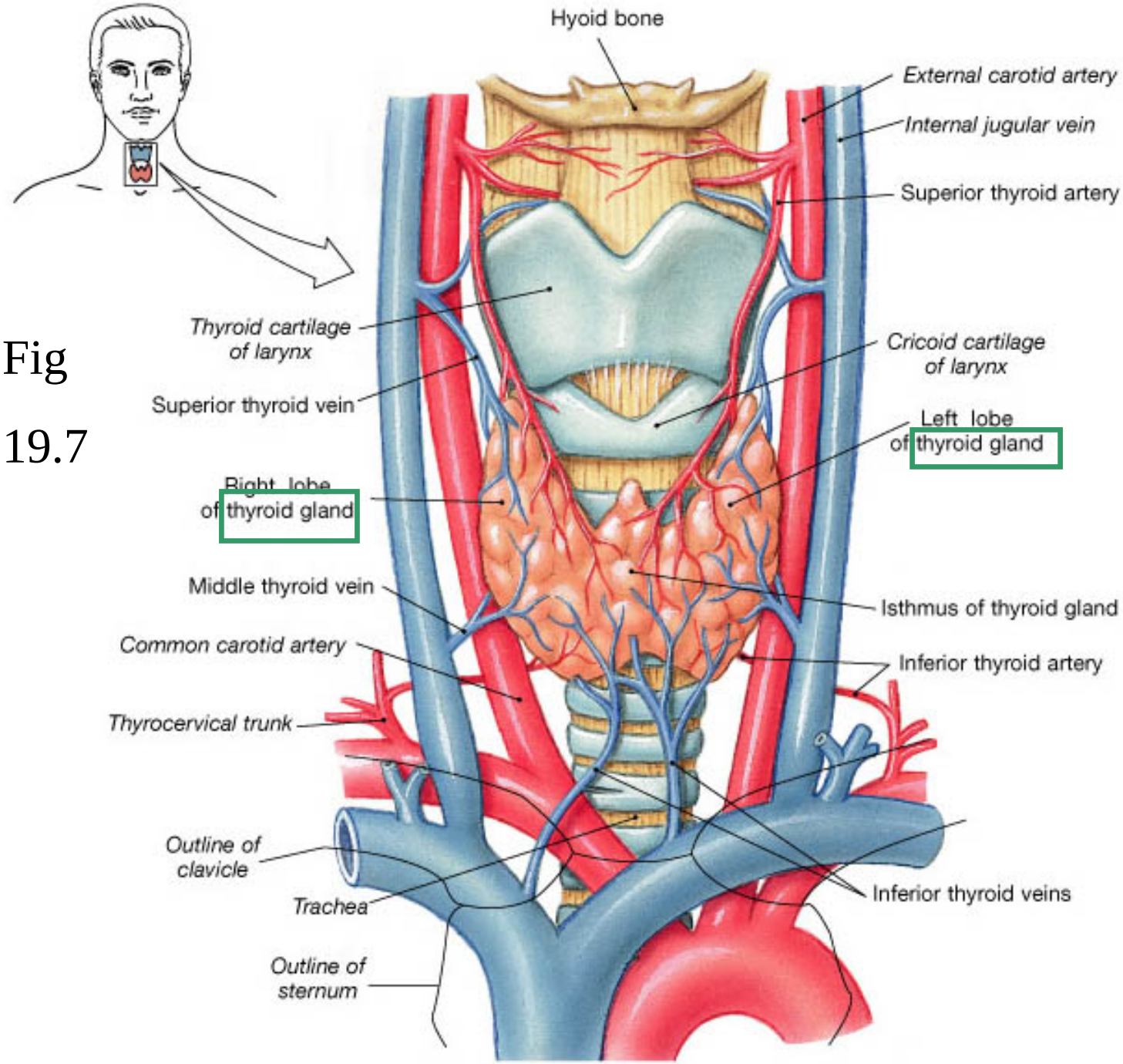

Hypothalamus
CRH
Anterior Pituitary gland
CRH
Adrenal gland
Glucocorticoids
Most cells of the body break down stored energy



(a) Midsagittal section

Fig 15.15

Fig 19.7



(a) Location of thyroid gland, anterior view

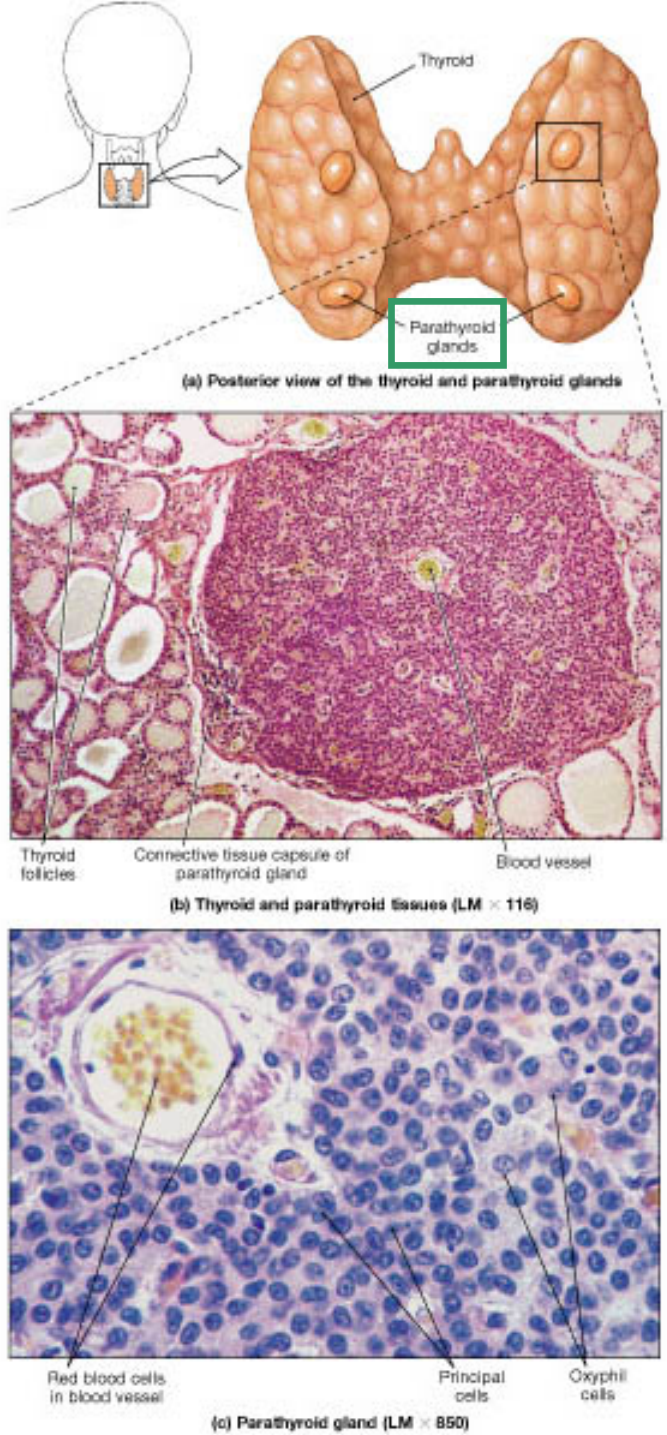

Thyroid
Parathyroid glands
(a) Posterior view of the thyroid and parathyroid glands
Thyroid follicles
Connective tissue capsule of parathyroid gland
Blood vessel
(b) Thyroid and parathyroid tissues (LM × 116)
Red blood cells in blood vessel
Principal cells
Oxyphil cells
(c) Parathyroid gland (LM × 850)

Fig 19.9

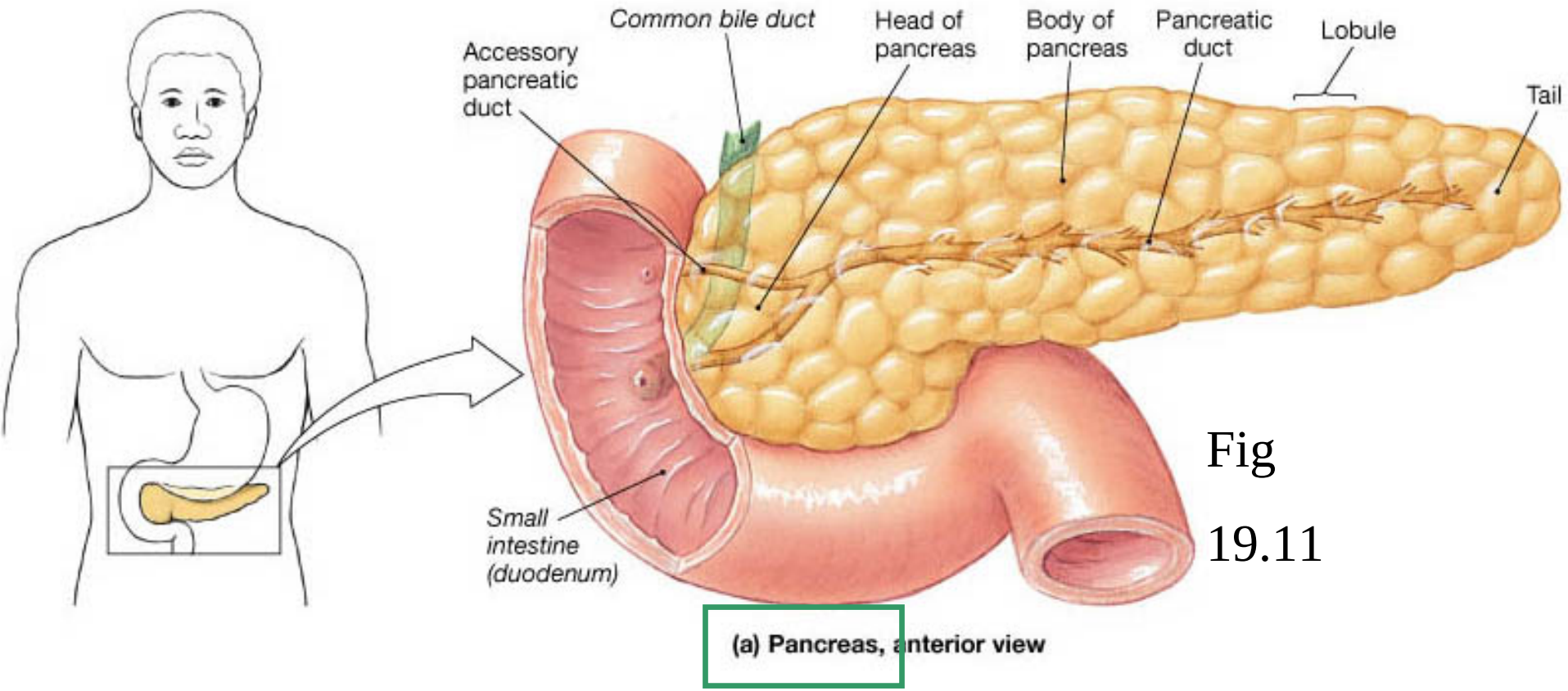
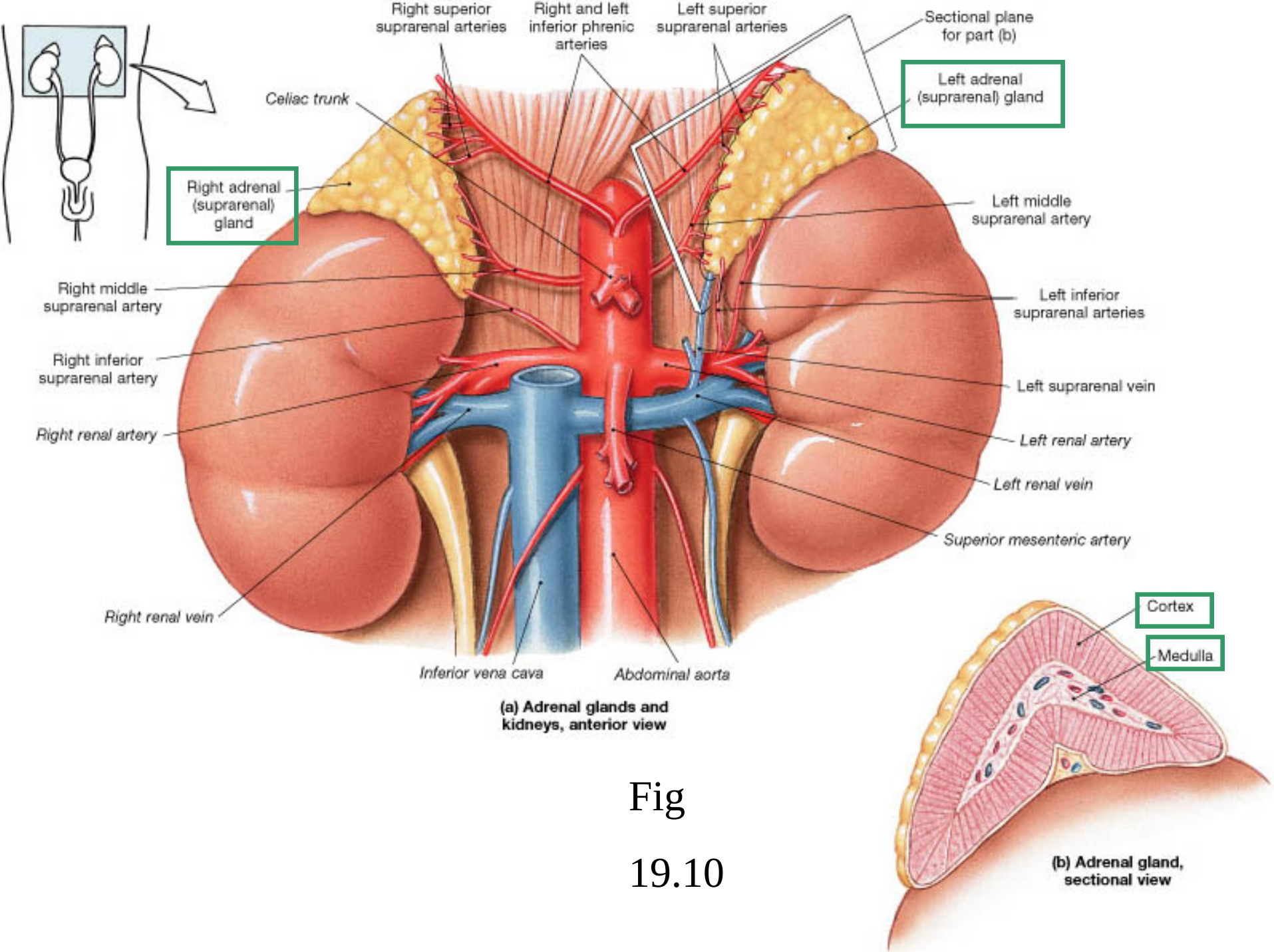

Common bile duct
Head of pancreas
Body of pancreas
Pancreatic duct
Lobule
Accessory pancreatic duct
Tail
Small intestine (duodenum)
(a) Pancreas, anterior view

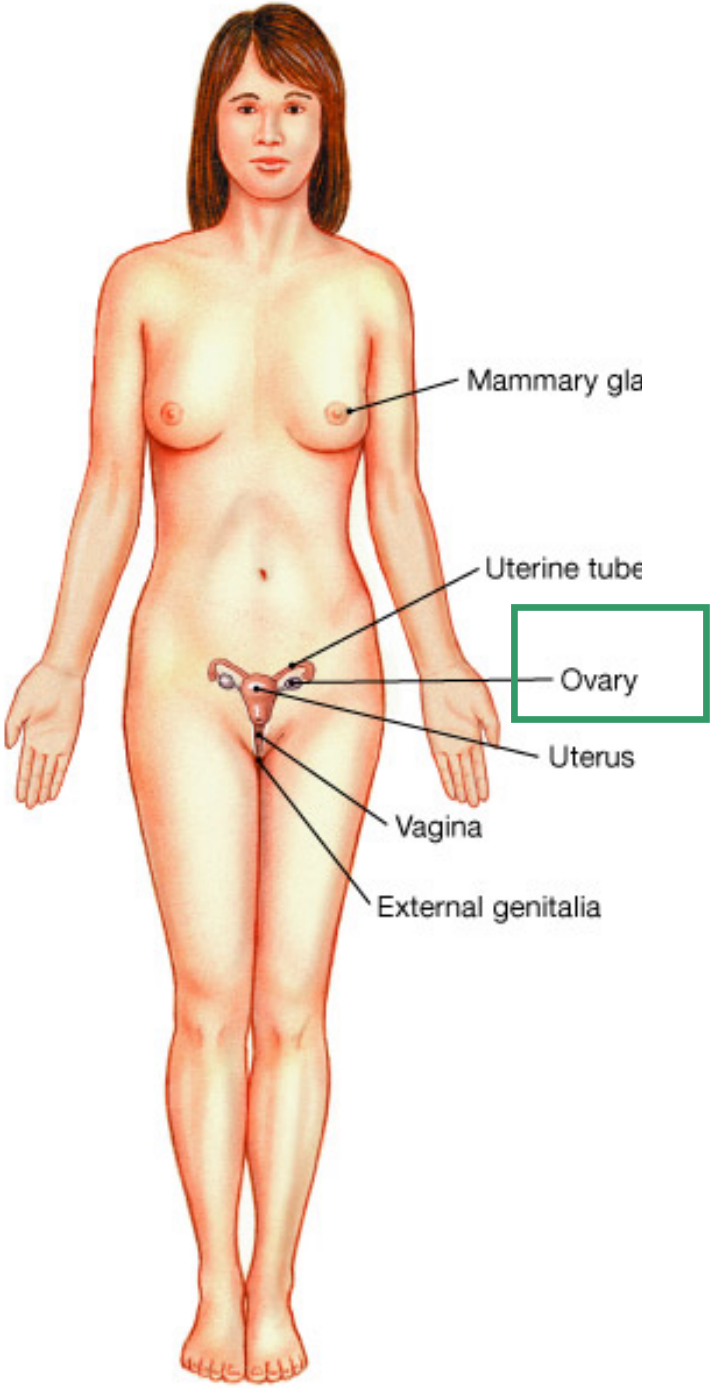
Fig 19.11

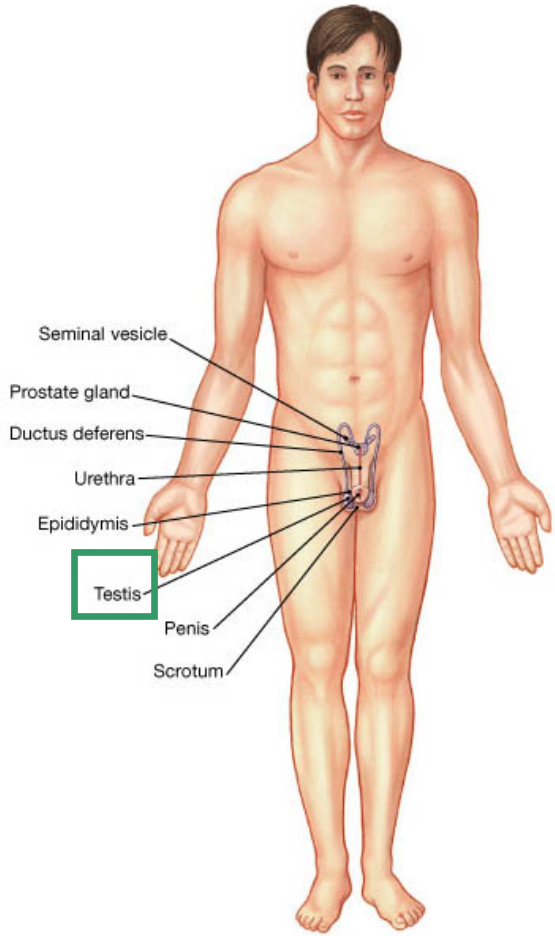

Right superior suprarenal arteries
Right and left inferior phrenic arteries
Left superior suprarenal arteries
Sectional plane for part (b)
Left adrenal (suprarenal) gland
Celiac trunk
Right adrenal (suprarenal) gland
Left middle suprarenal artery
Right middle suprarenal artery
Left inferior suprarenal arteries
Right inferior suprarenal artery
Left suprarenal vein
Right renal artery
Left renal artery
Left renal vein
Superior mesenteric artery
Right renal vein
Inferior vena cava
Abdominal aorta
(a) Adrenal glands and kidneys, anterior view
Cortex
Medulla
(b) Adrenal gland, sectional view

Fig

19.10

- As an endocrine gland
  - produces hormones (both cortex and medulla)
- As a neuronal structure (medulla only)
  - sympathetic neuron stimulate release of neurotransmitters/hormones
  - releases neurotransmitters/hormones


Mammary gla
Uterine tube
Ovary
Uterus
Vagina
External genitalia


Seminal vesicle
Prostate gland
Ductus deferens
Urethra
Epididymis
Testis
Penis
Scrotum

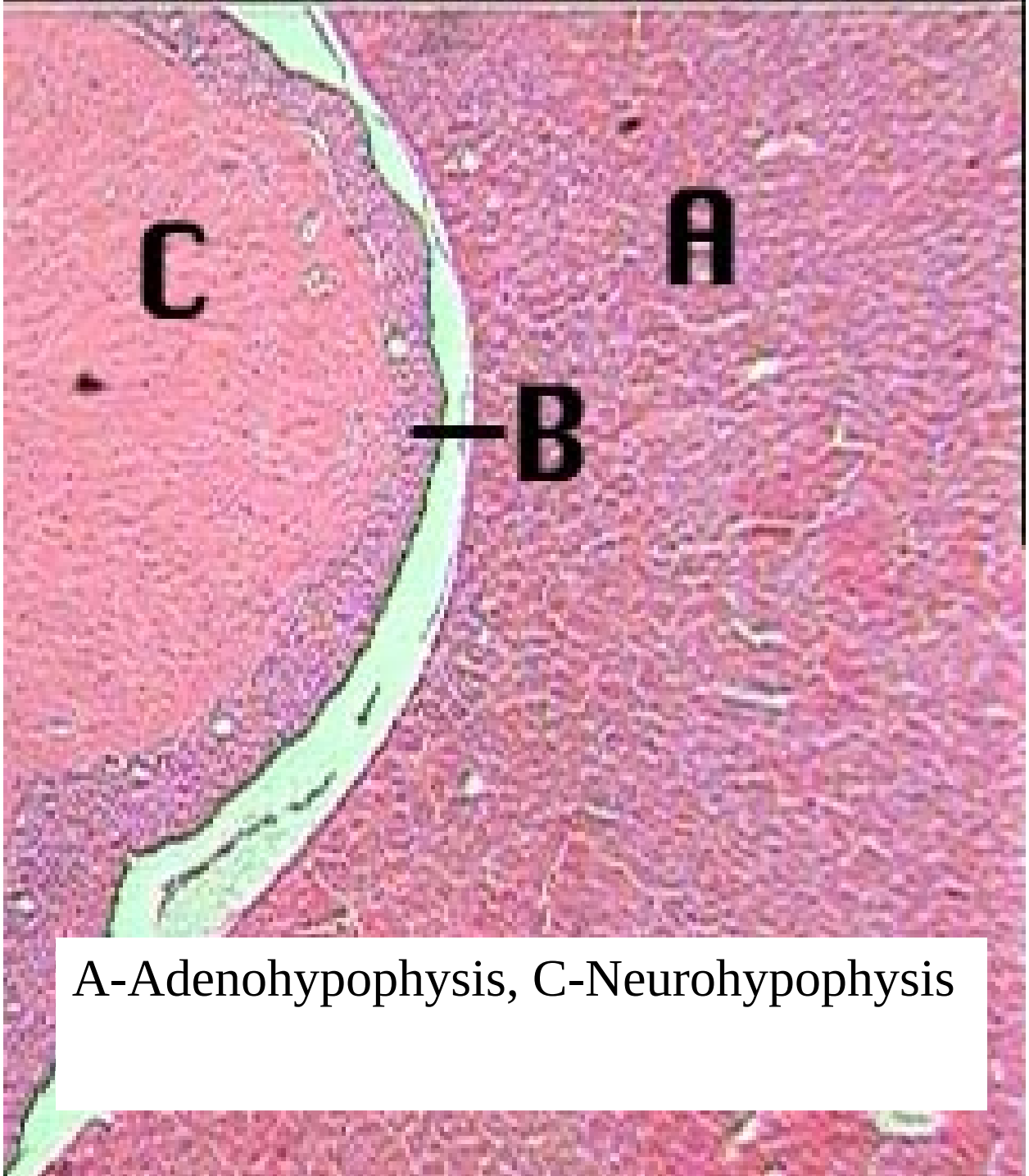
Neuroendocrine System

- Nervous System
- Length of effect: short-term (until impulse stops)
- Target type: specific target (must form synapse)
- Chemical Used: neurotransmitter
- Recovery Time: immediate (when impulse stops)
- Response time: immediate (when impulse starts)

- Endocrine system
- Length of Effect: longer-term (until hormone is broken down)
- Target Type: general target (must have receptors)
- Chemical Used: hormone
- Recovery Time: slow (hours to weeks)
- Response Time: slow (minutes to weeks)

break

- Histology CD



A-Adenohypophysis, C-Neurohypophysis