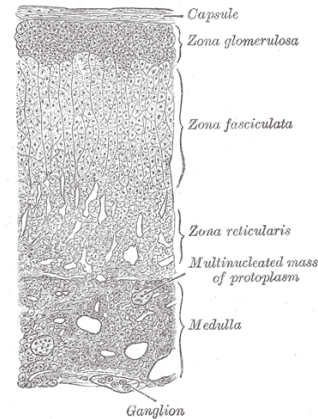


ADRENAL MEDULLA (AM)

I. **Chromaffin** Gr. Chroma (color); L. affinis (affinity) pheochromocytes

→ brown color exposed to oxidizing agent chromate
(especially NE secreting cells)



1) secretes catecholamines

- A. epinephrine (E)
- B. norepinephrine (NE)
- C. enkephalins (endorphins)

2) intimate association with sympathetic nervous system **sympathoadrenal system**

3) AM located interiorly

- A. blood flows from exterior (cortex) of adrenal gland to AM
- B. blood titer \uparrow glucocorticoids influence hormone synthesis in AM

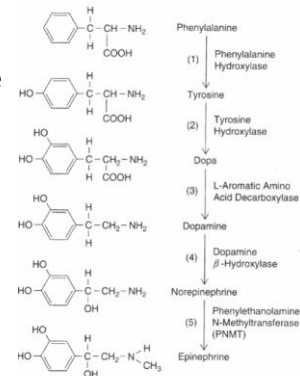
4) Anatomy

A. chromaffin cells -stained histologically with chromium

1. pheochromoblasts = derived from neural crest
2. functions as neuroendocrine cells
3. similar structurally to postganglionic fibers of sympathetic nervous system
4. preganglionic fibers to medulla
directly innervate (no synaptic cleft) chromaffin cells
5. stimulation → chromaffin cells secrete hormone E into blood
6. affects variety of effector organs throughout body
7. NE secreted in small titers
8. NE an intermediate in synthesis of E

B. Synthesis/Secretion of E

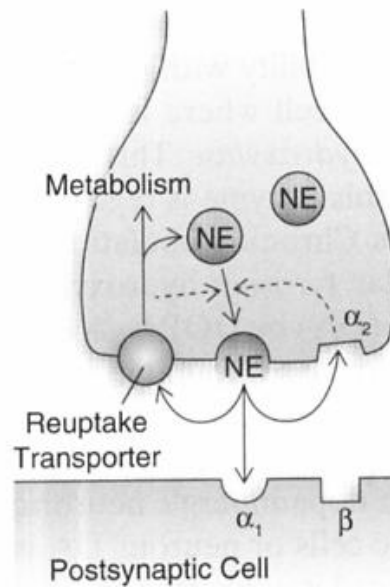
1. tyrosine
2. dihydroxyphenylalanine (DOPA)
 - a. enzyme tyrosine hydroxylase (TH) converts tyrosine to DOPA
 - b. rate limiting step in E synthesis
 - c. nerve stimuli ↓ enzymatic activity of TH
 - d. subsequent steps proceed rapidly
3. NE
4. E
 - a. enzyme phenylethanolamine-N-methyl transferase (PNMT) converts NE to E
 - b. PNMT stimulated by cortisol
 - c. E packaged into vesicles=chromaffin granule
 - d. stimulation of chromaffin cell --> release of E from granules



5. Metabolism: ↑blood glucose (glucogenesis)*
 - a. ↑ glycogenolysis in liver: ↑ glucose release into blood
 - b. ↑ glycogenolysis in muscles:
 - 1) glucose--> lactate which released into blood
 - 2) lactate uptake by liver to conversion to glucose
 - c. ↑ lipolysis in adipose tissue
 - 1) fat source for metabolism of heart/muscles
 - 2) glycerol released from lipolysis uptake by liver to convert into glucose
 - 3) "sparing effect" to offer fatty acids as fuel source to spare glucose utilization
 - d. ↓ insulin secretion
 - e. ↑ glucagon secretion

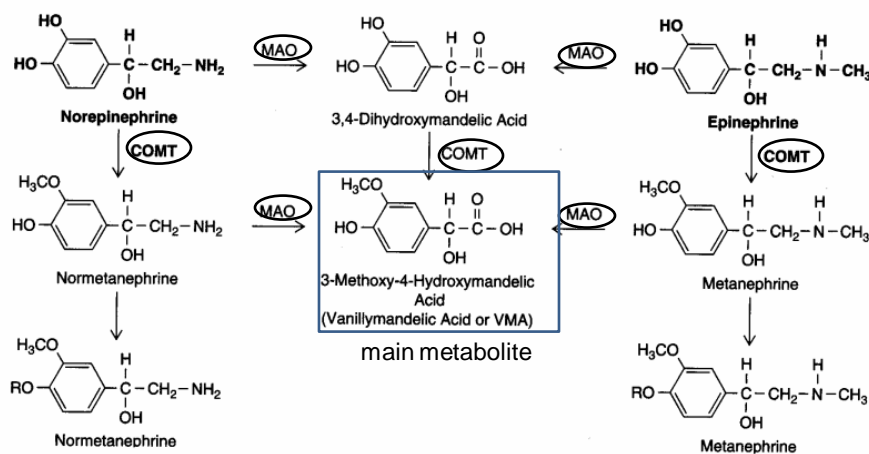
*glucogenesis: generation of glucose from carbon substrates:

- 1) pyruvate
- 2) lactate
- 3) glycerol
- 4) amino acids (primarily alanine & glutamine)



sympathetic: – **feedback mechanism**: inhibition of sympathetic neuron secretion

Pathways of Catecholamine Metabolism



MAO = monoamine oxidase

COMT = catecholamine-O-methyltransferase

F. Action of E & NE

1. **fight-or-flight response: ↑capability of body to perform**
vigorous muscular activity for survival
2. cardiovascular
 - a) ↑cardiac output: ↑amount blood pumped/minute
 - 1) ↑heart rate
 - 2) ↑strength of cardiac contractions
 - b) vasodilation in skeletal muscle: ↑blood flow
 - c) vasoconstriction in internal organ & skin: ↓blood flow
3. other tissues
 - a) relaxation of smooth muscles
 - 1) gastrointestinal tract
 - 2) urinary bladder
 - 3) lung airways: ↑O₂ transport
 - b) contraction of spleen
 - ↑circulating blood volume & red blood cells: ↑O₂ transport
 - c) central nervous system: ↑mental alertness

ADRENAL MEDULLA (AM)

II. Medulla & cortex regions

- 1) overlap in birds & mammals ↑E : ↓NE
- 2) variable in reptiles & amphibians: frogs: 55-70% NE
- 3) highly separated in elasmobranchs & teleosts
dogfish shark: NE

III. Human

- 1) **A**-storing cells (adrenaline) → E
- 2) **N**-storing cells (noradrenaline) → NE
- 3) glycoproteins in **A** cells
- 4) fetus: ↑extra-adrenal chromaffin tissue ↑NE → ? fetal circulation
fetal: humoral control (NE); postnatal: sympathetic neural (NE)

IV. A/N ratio high in humans & guinea pigs: **A** & **N** cells found in

- 1) birds
- 2) reptiles
- 3) amphibians
- 4) elasmobranchs