

Anatomy of Thyroid Gland

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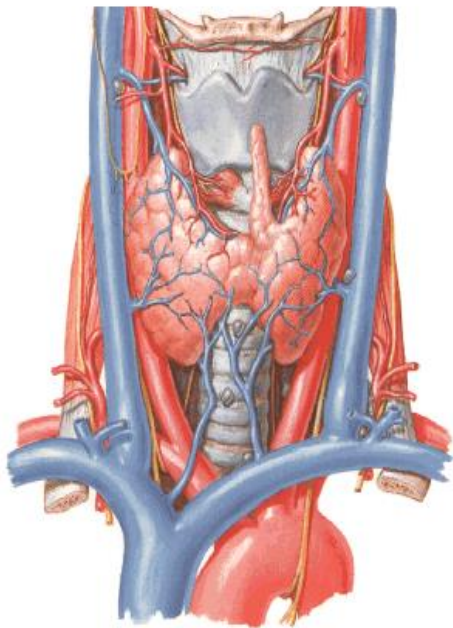
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Anatomy of Thyroid Gland

- Normal Thyroid gland weights – 20-25 Gms.
- 15 gm at birth – 16 yrs. maximum: 17 + 7 gms
- Weighs more in Female than male,
- More in summer than in winter
- More during pregnancy lactation than Otherwise
- More in Kulu- Manali than in Delhi.

Thyroid Gland
Anterior View



- Butterfly shaped gland..
- Connected by isthmus
- Pyramidal lobe as long narrow projection of thyroid tissue extending from isthmus upwards laying on surface of thyroid cartilage
- Rt. lobe bigger than left
- Convex anteriorly and concave posteriorly as it has to accommodate of anterolateral portion of trachea and Larynx.
- Firmly fixed to them by fibrous tissue.
- Bed between medially Larynx and Trachea
Laterally
Sternomastoid and Carotid sheath

● **Capsule:**

- Enveloped by thick fibrous capsule, which sends septa into gland substance to produce pseudolobulation.
- **No true capsule exists.**
- Pretracheal fascia divides into anterior and posterior layer to invest the gland - producing false capsule.

● **Blood Supply:**

- **Superior Thyroid Inferior Thyroid and some times Thyroid Ima artery**
- Abundant 5ml / gm / minute.

● **Innervation :**

- Sympathetic – cervical ganglion and enters through blood vessel.
- Parasympathetic – Vagus via branches from laryngeal nerves.

Deep fascia of Neck

(a) Investing Layer

External
occipital
protuberances
Superior Nuchal line
Base of mastoid process
Zygomatic arch
Lower border of mandible



Spine of scapula and
acromion process
Clavicle
Manubrium sterni.

Splits to close -
2 muscles Trapezius, Sternomastoid
2 Salivary gland - Submandibular, Parotid.
Roof of two triangles Post & Anterior
Space of Burn

Gives slip to form
Carotid Sheath
One slip each from

Investing layer ,
Pretracheal layer
Prevertebral layer

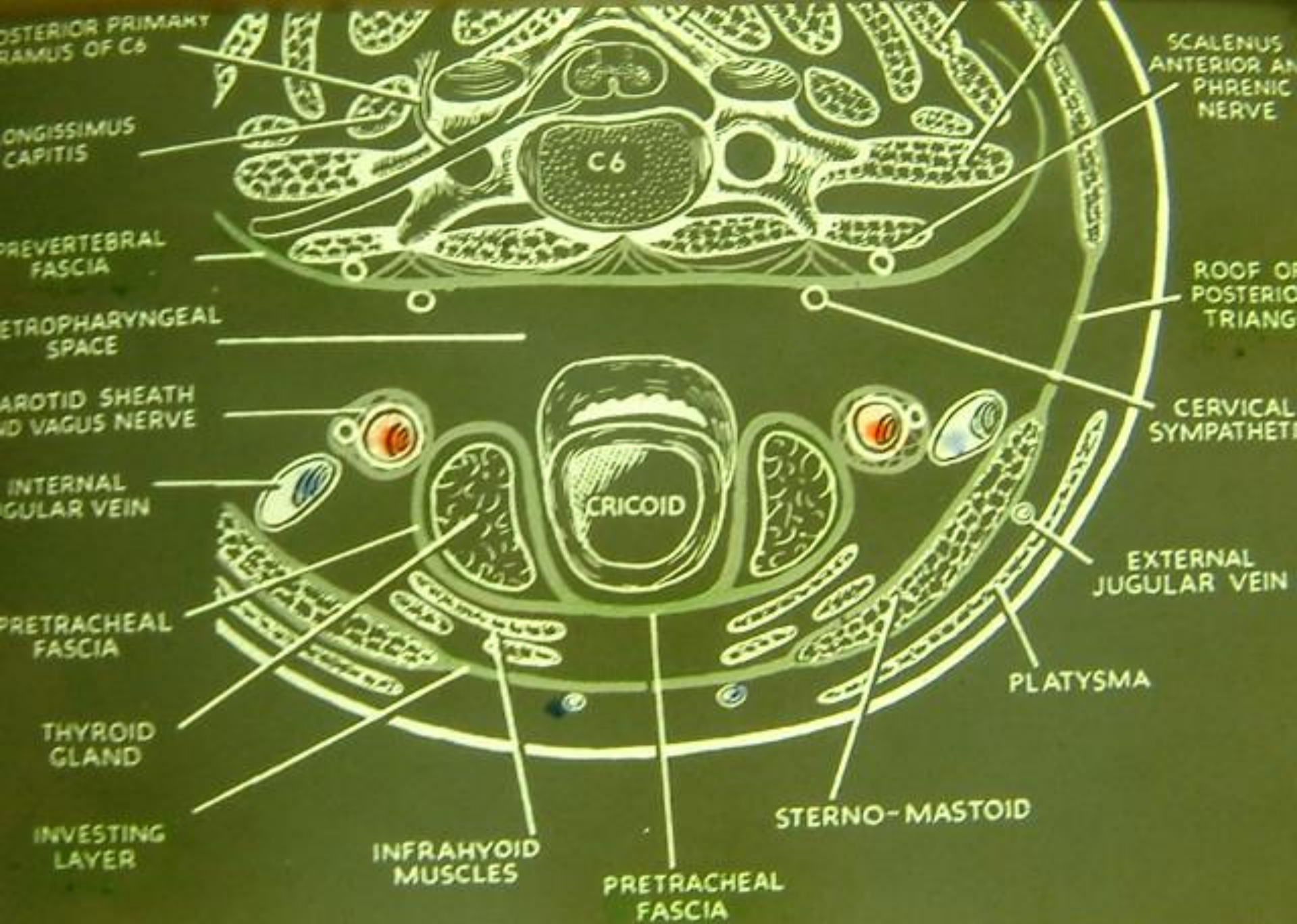
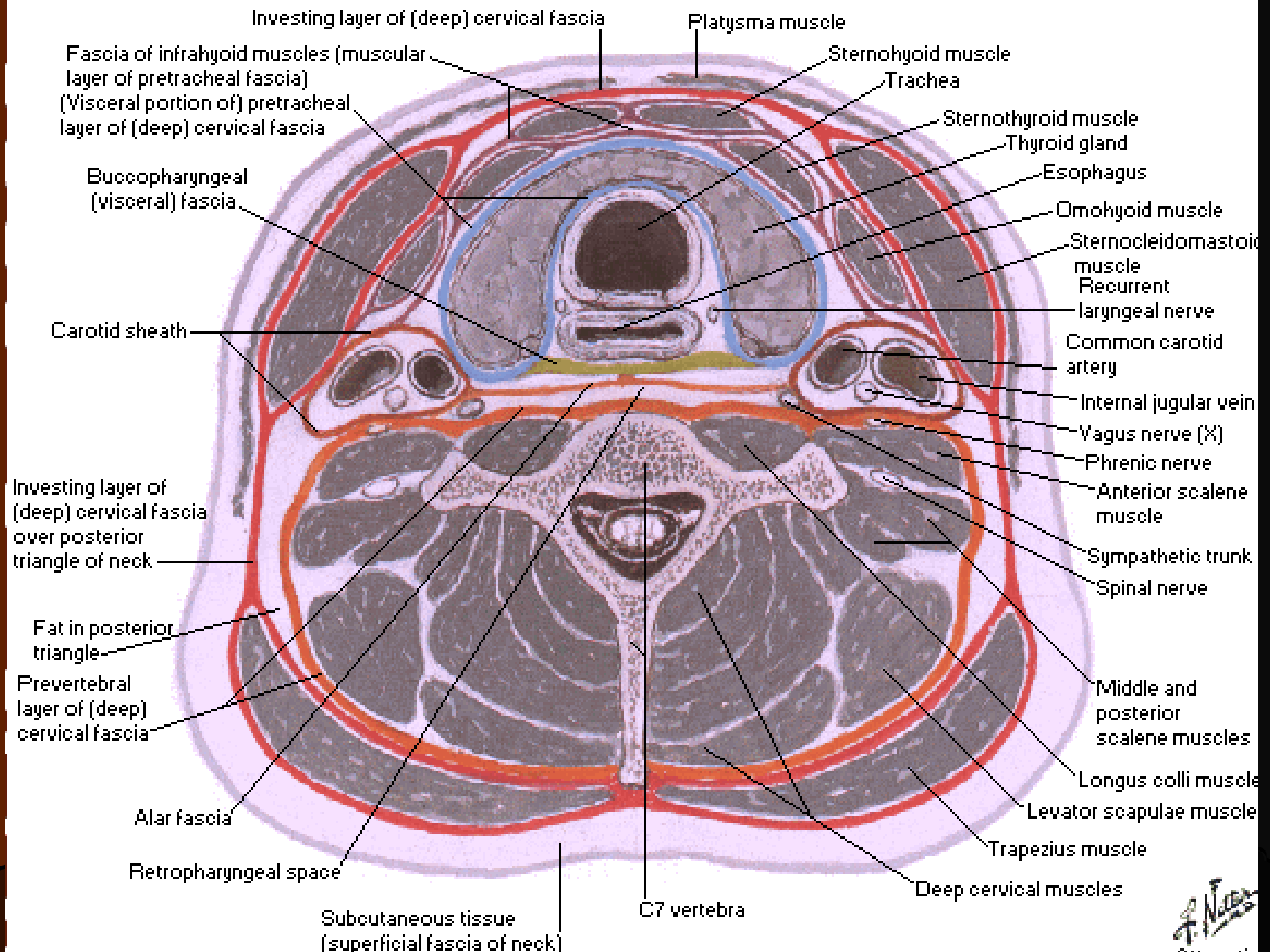


FIG. 289. THE FASCIAL PLANES AND TISSUE SPACES OF THE NECK, IN HORIZONTAL SECTION.

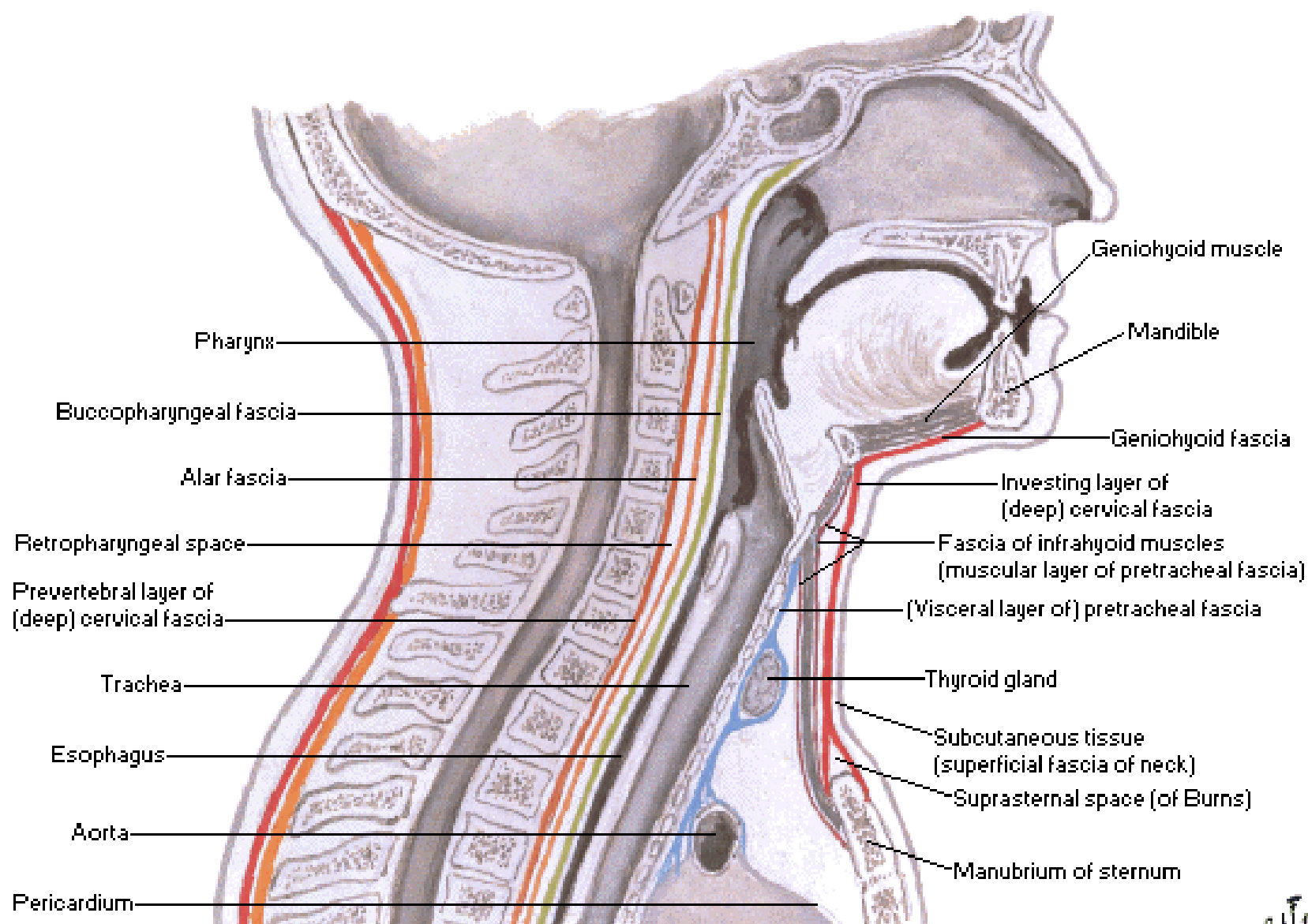
Fascial Layers of Neck

Cross Section



Fascial Layers of Neck

Sagittal Section



Pretracheal Layer

Hyoid bone
Cricoid and Thyroid Cartilage



Ligament of Berry :
condensation of both layers
above the Thyroid gland
Then invests the Thyroid gland

From, inner and back
part of gland, it goes to
Cricoid Cartilage.
Rt. & Left anchors the
gland preventing the
taking away from Larynx.
Oesophagus

Postly, the fascia has attachment to Laryngeal
Postly it is weakest Cartilage
Enlargement of gland therefore occurs postly



Blends up with
fibrous pericardium over
the great vessels
sup. Mediastinum.

It gives of one fascial process
to Prevertebral fascia.
This process in front of sternohyoid,
sternothyroid and omohyoid muscles.
Binds down with intermediate tendon
of Omohyoid.



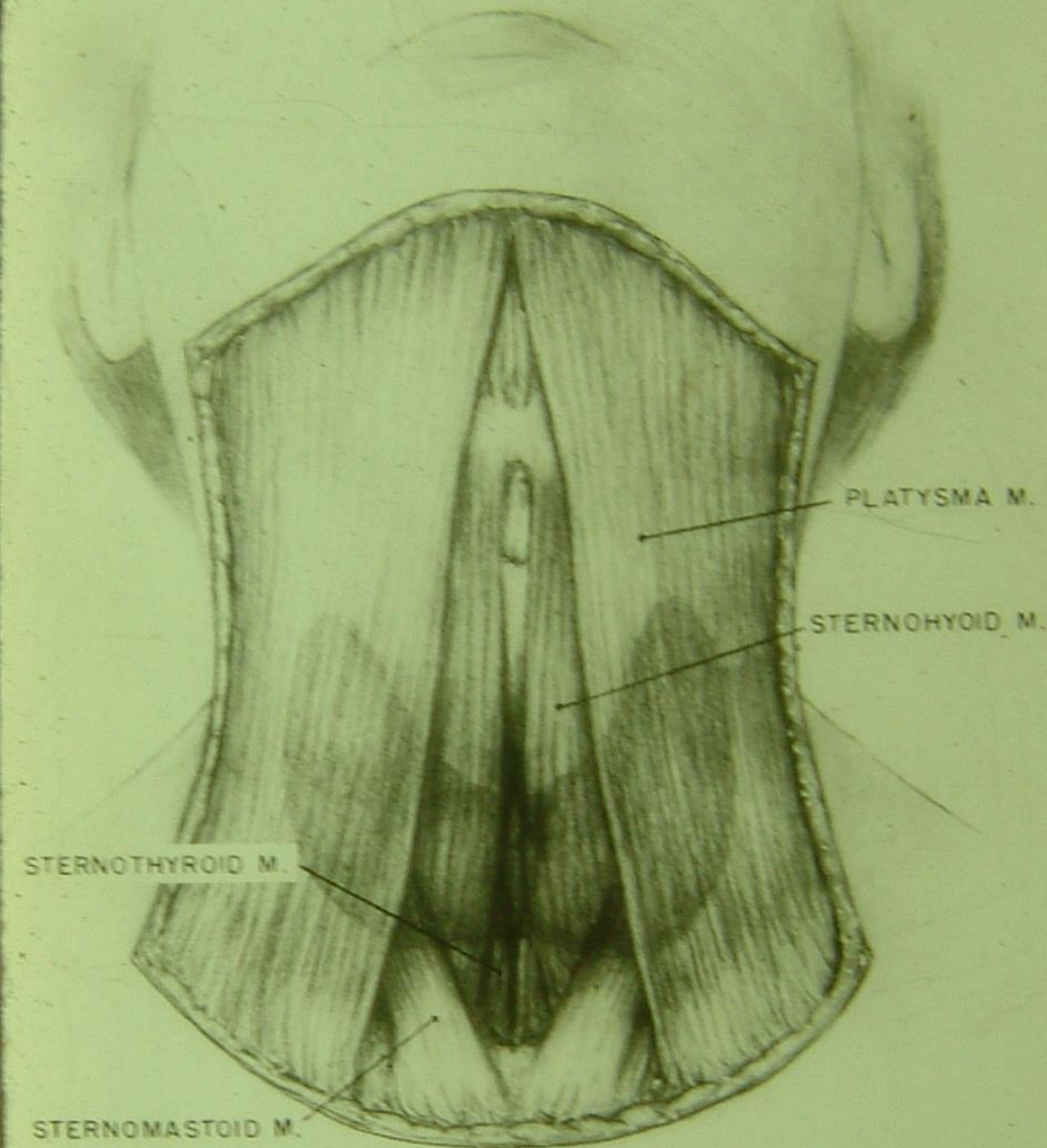
Skin in Neck

- **Several Transverse folds,**
- **Deciding factor for incision**
- **Group of folds just above sternum, clavicle**
- **Collar incision.**



Platysma :

subcutaneous, sheet like muscle
fan like, clavicle---- mandible.
Leaving space in midline.



Fascial plane between
Platysma and pre
Thyroid –
Avascular
i.e. Skin, subcutaneous
fat, Platysma
Reflected in one plane.

Muscles of Facial Expression

Lateral View



Muscles in front of Thyroid

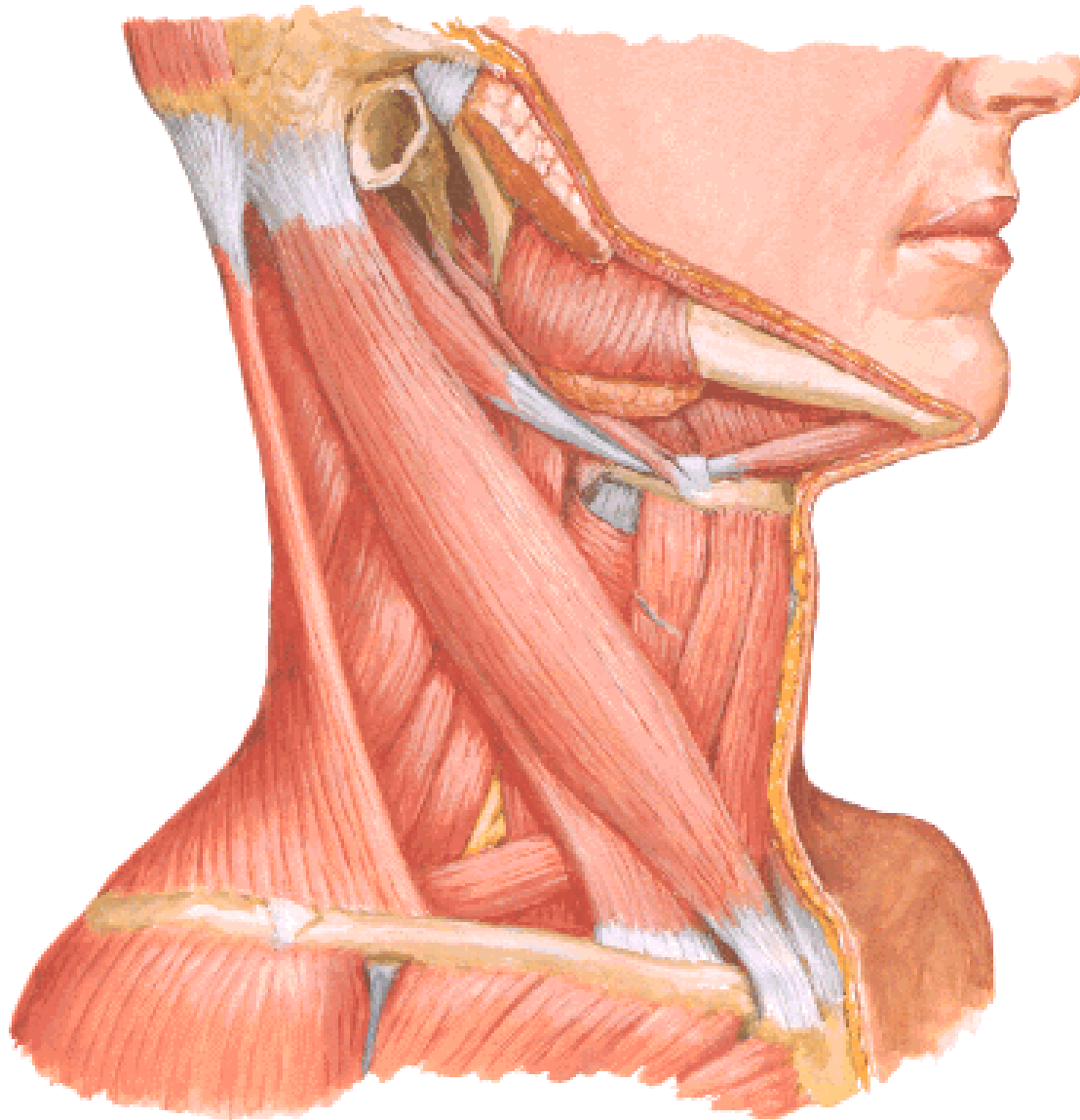
- **Sternomastoid - 2 form lateral boundaries.**
- **Strap muscles**
 - **Sternohyoid – anteriorly**
 - **Sternothyroid - Post. covers Thyroid capsule.**
 - **Omohyoid laterally**
- **Fascia of Sternomastoid along antero-medial border fuses with lateral border of Sternohyoid.**

- *Nerve supply – Areas hypoglossi – enters low in neck.*
- *If strap muscles are to be cut – High transaction advised.*

● *Sternomastoid muscle covers one third of Strap muscle so it has to be retracted laterally*

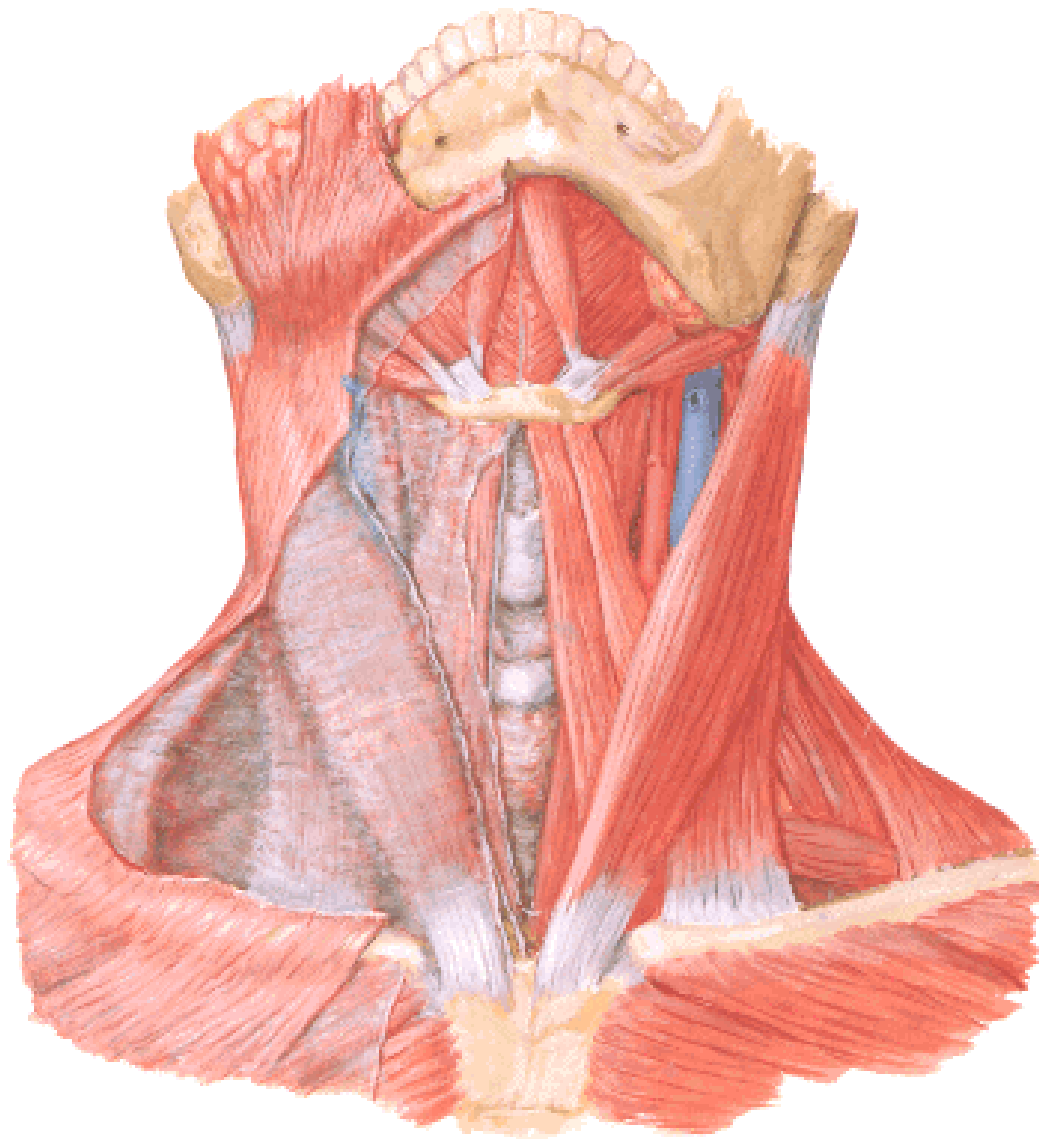
Muscles of Neck

Lateral View

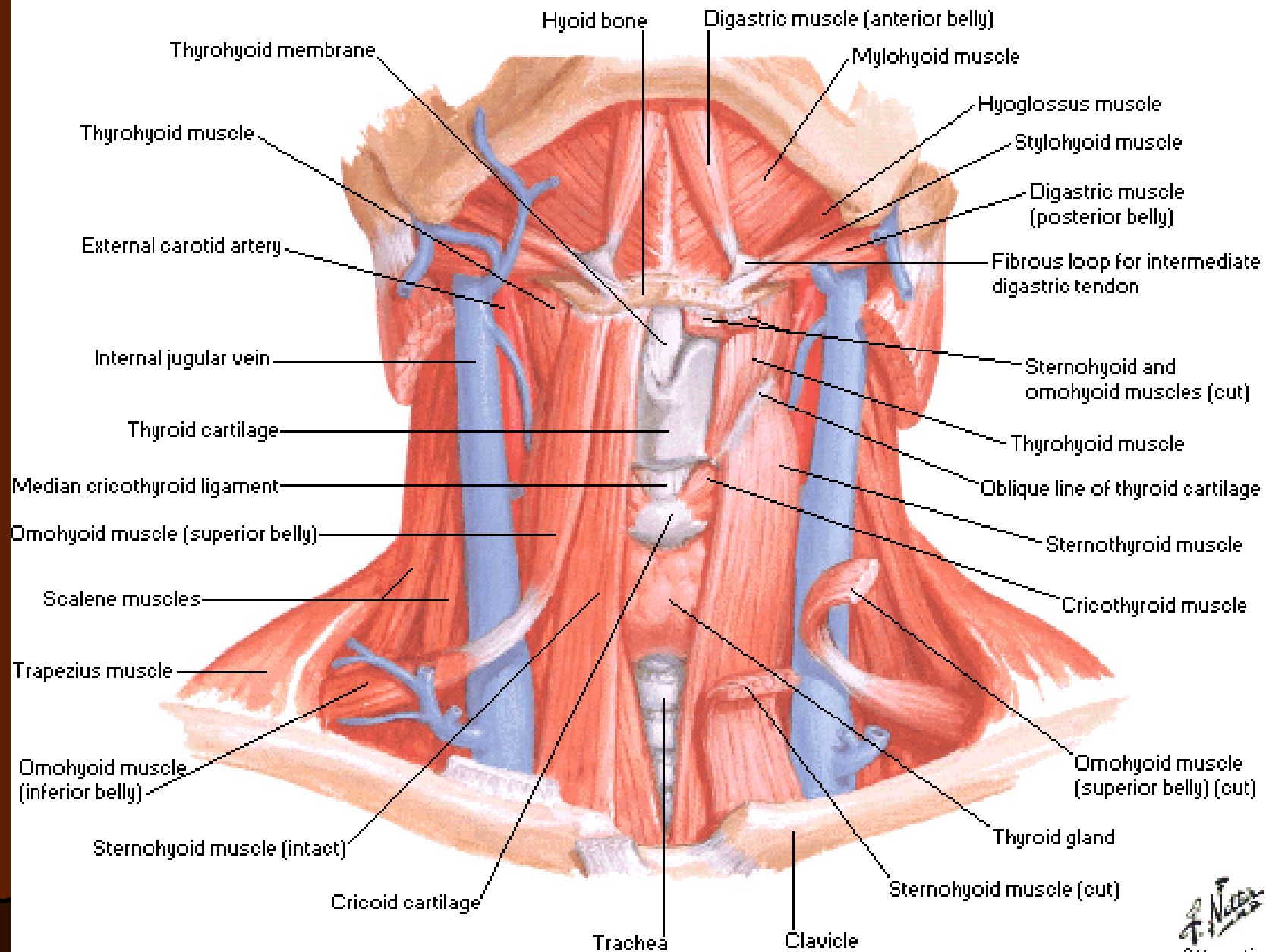


Muscles of Neck

Anterior View

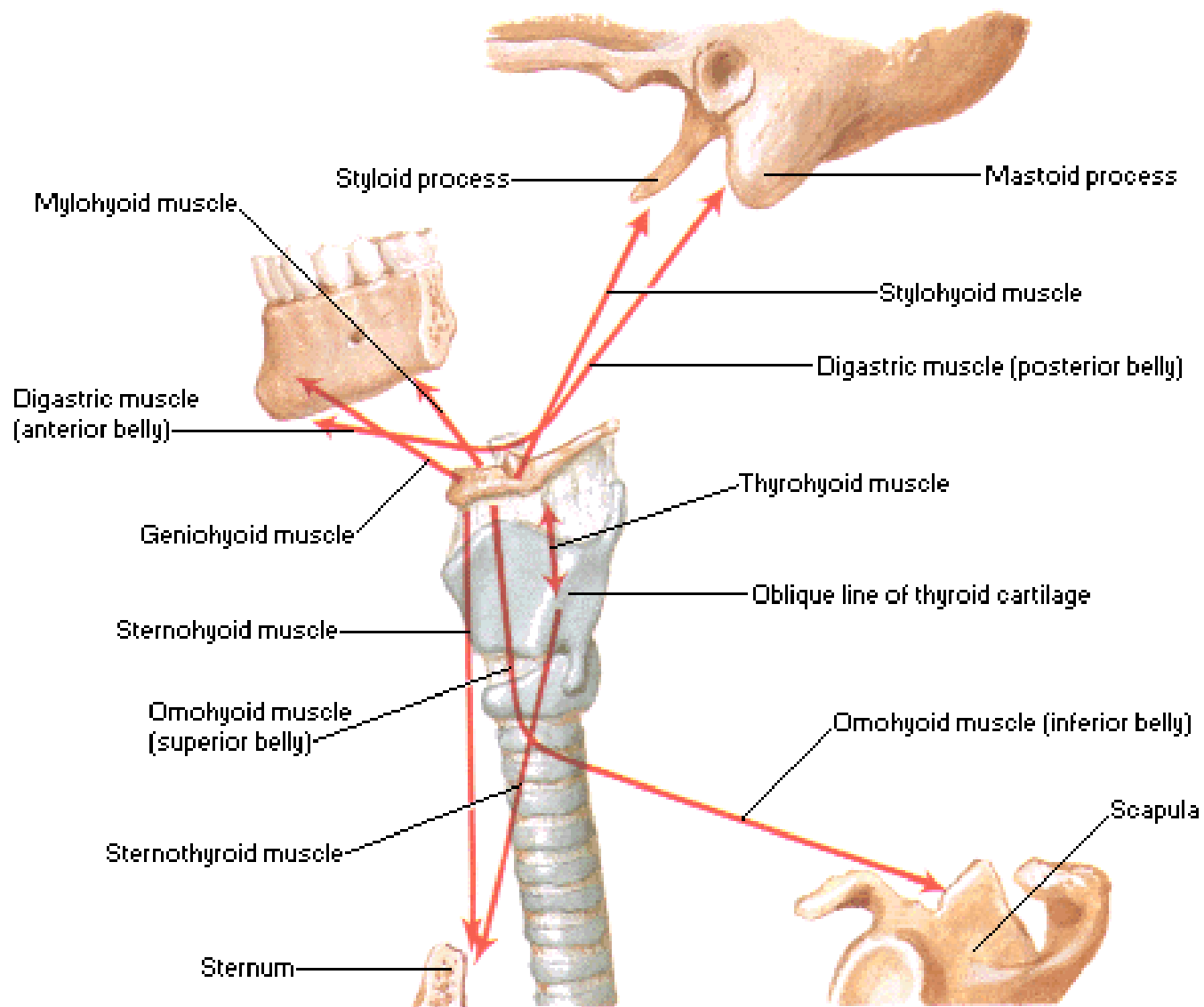


Infrahyoid and Suprahyoid Muscles



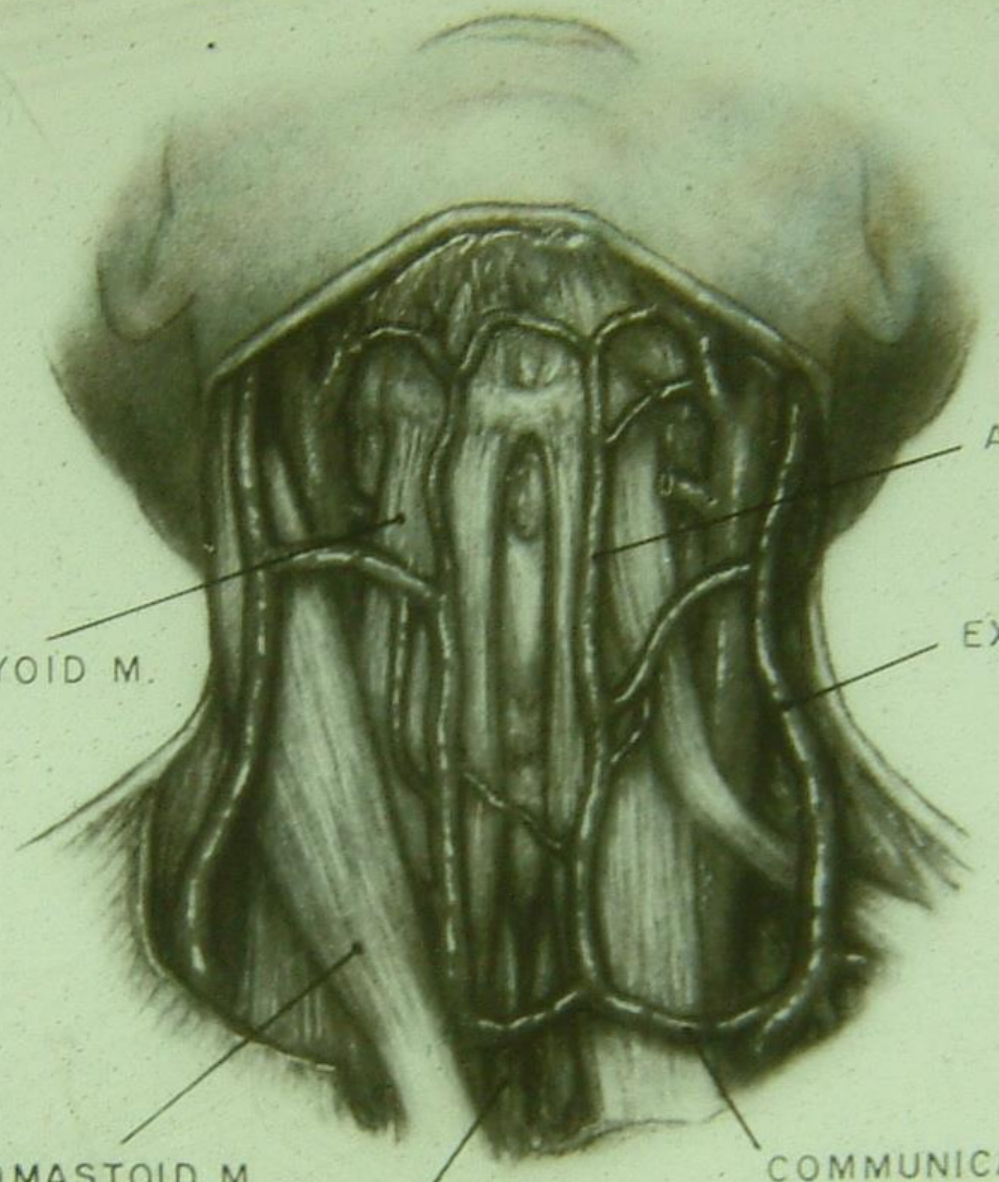
Infrahyoid and Suprahyoid Muscles and their Action

Schema



Superficial Veins of Thyroid

- Just below the Platysma
- External Jugular Vein :
 - Lateral, cross over the belly of Sternomastoid and penetrates deep fascia to enter subclavian vein
- Anterior Jugular Vein :
 - Lie on Sternohyoid
- Communicating plexus of these veins present.
- If it is Goitre : These veins are Large.
- **Applied Anatomy**
- Fascia between Stern mastoid and Sterno hyoid, if has to cut Comm. vein will need to be cut. External jugular vein to be refracted laterally. In order to reduce bleeding both the veins should be ligated at Highest point and lowest point of flap



STERNOHYOID M.

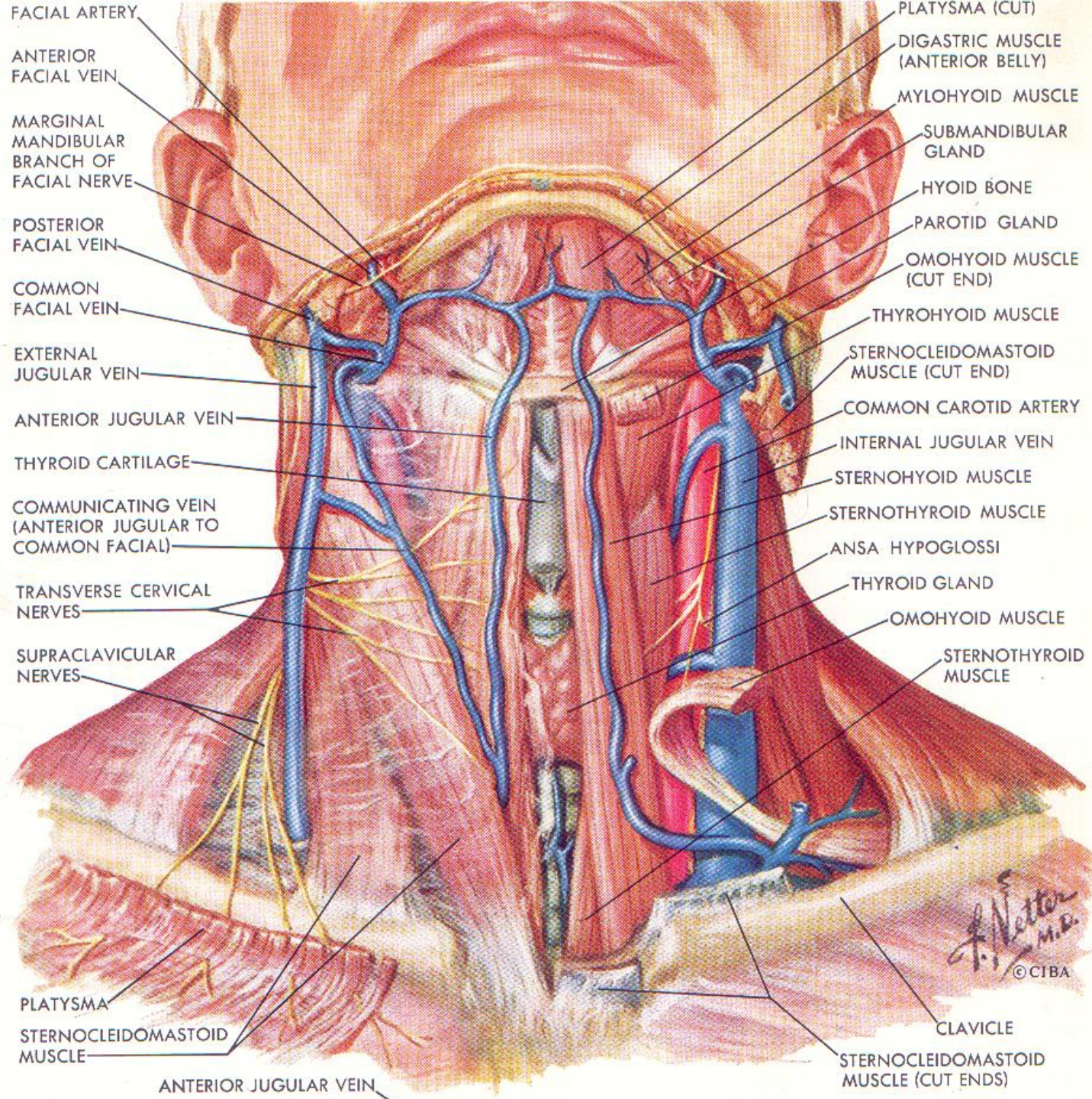
ANT. JUG. V.

EXT. JUG. V.

STERNOMASTOID M.

COMMUNICATING V.

STERNOTHYROID M.



Deep Veins :

Superior, Middle, Inferior, thyroid vein and Thyroid ima vein..

- **Superior Thyroid vein :**

- Accompany artery but less constant in number ,position and size: Leaves the gland at sup. Pole ant. And lat. to artery – joins Cricothyroid tributary of internal jugular vein.

- **Inferior Thyroid vein**

- One or more trunks, frequently plexus.
- Not accompanied by artery
- Ends in Internal Jugular vein or directly in to Innominate vein

- **Middle Thyroid Vein**

- From lateral border directly pass in to IJV. 25% times present
- Large glands it is difficult.
- Confirm the presence first before handling the gland
- Otherwise likely to get avulsed leading to hemorrhage

SUP. THYR. V.

INT. JUG. V.

MID.
LAT. THYR. V.

INF. THYR. V.

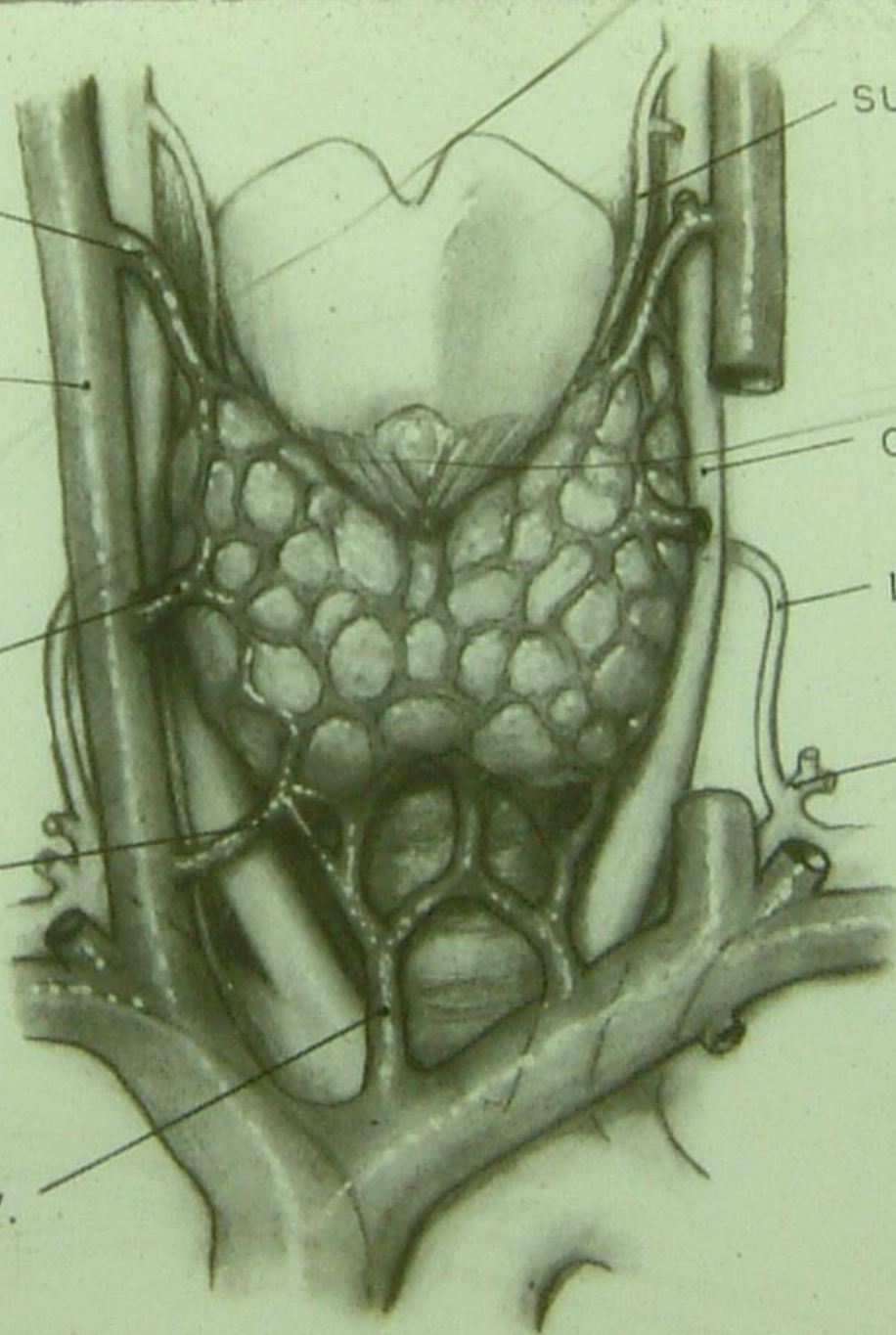
THYROIDEA IMA V.

SUP. THYR. A.

COM. CAR. A.

INF. THYR. A.

THYROCERVICAL
TRUNK



Arteries of Thyroid

1. Sup. Thyroid Artery :

- 1st branch of Ext. carotid. After bifurcation of CCA
- Runs downward and medially on the surface of Middle Constrictor of Pharynx
- Enters upper pole at antero sup. Surface
- Downward Course: It is just inferior and lateral to Sup. Laryngeal nerve. 1cm above superior pole.

The artery to be ligated close to gland parenchyma

High ligation – Injury to nerve.

Enlarged gland – lingula of thyroid – above and lateral to anterior of artery- Mistaken as sup. Pole. Artery in that case enters from medial side

SUPERIOR VENA CAVA

EXTERNAL CAROTID ARTERY

SUPERIOR THYROID ARTERY

COMMON CAROTID ARTERY

INTERNAL JUGULAR VEIN

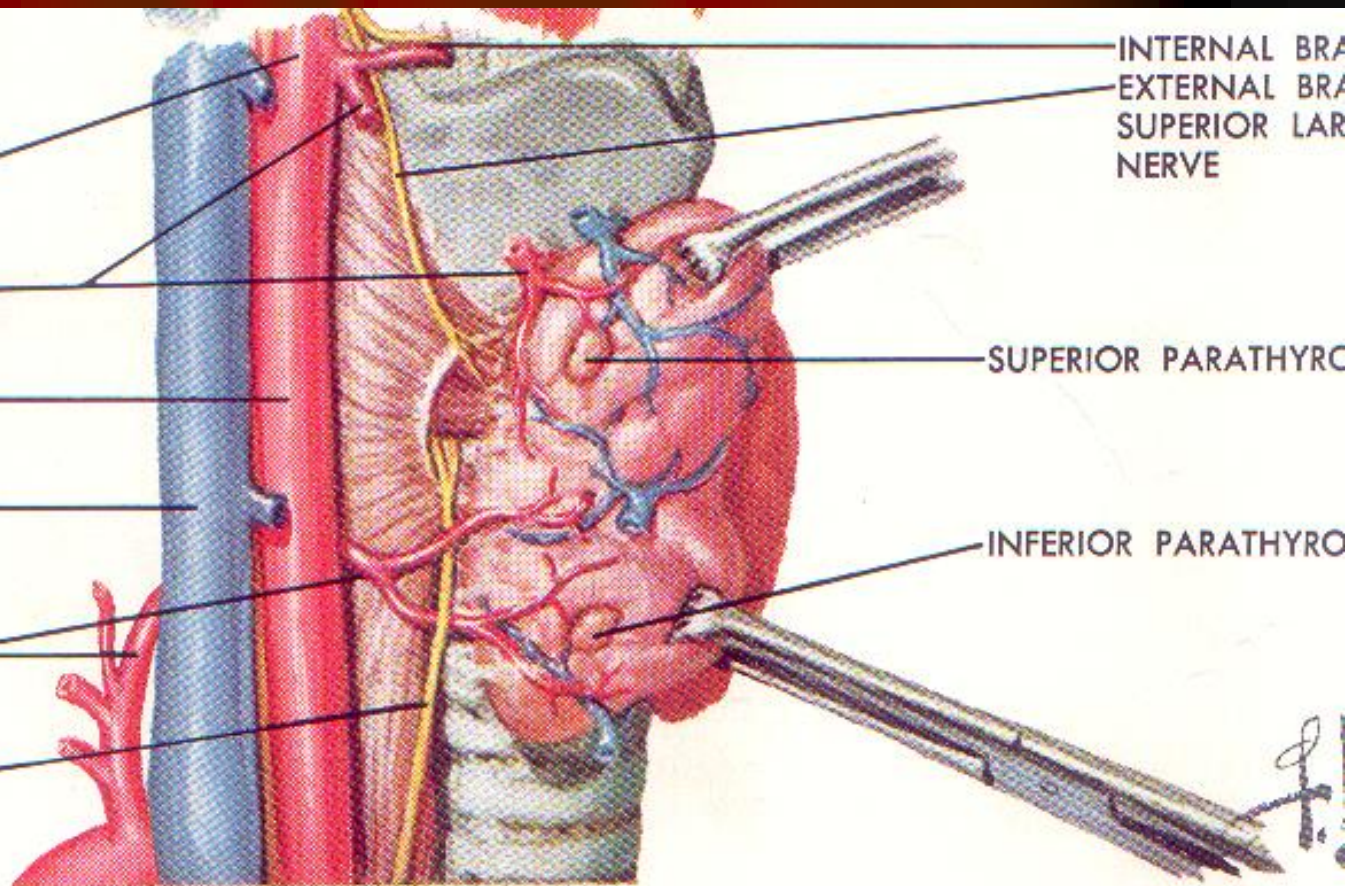
INFERIOR
THYROID ARTERY

RECURRENT (INFERIOR)
LARYNGEAL NERVE

INTERNAL BRANCH
EXTERNAL BRANCH
SUPERIOR LARYNGEAL
NERVE

SUPERIOR PARATHYROID

INFERIOR PARATHYROID



2. Inf. Thyroid Artery:

- Arises from Thyro-cervical Trunk:
- Just after origin from subclavian ascends up behind carotid and jugular vein
- Changes the course perpendicularly at the level of middle thyroid.
- Loop downward and medially enters the gland at mid portion

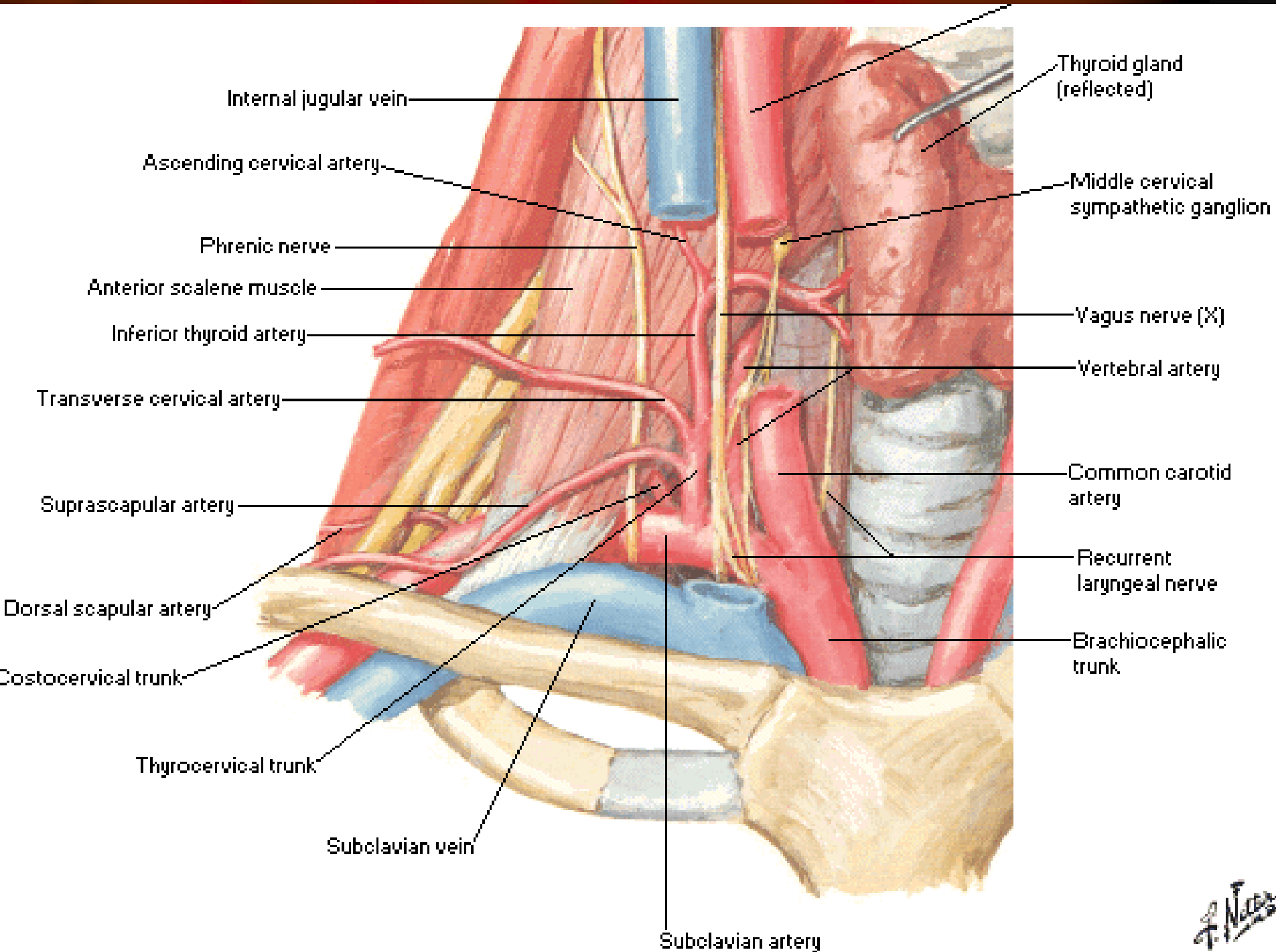
Applied anatomy

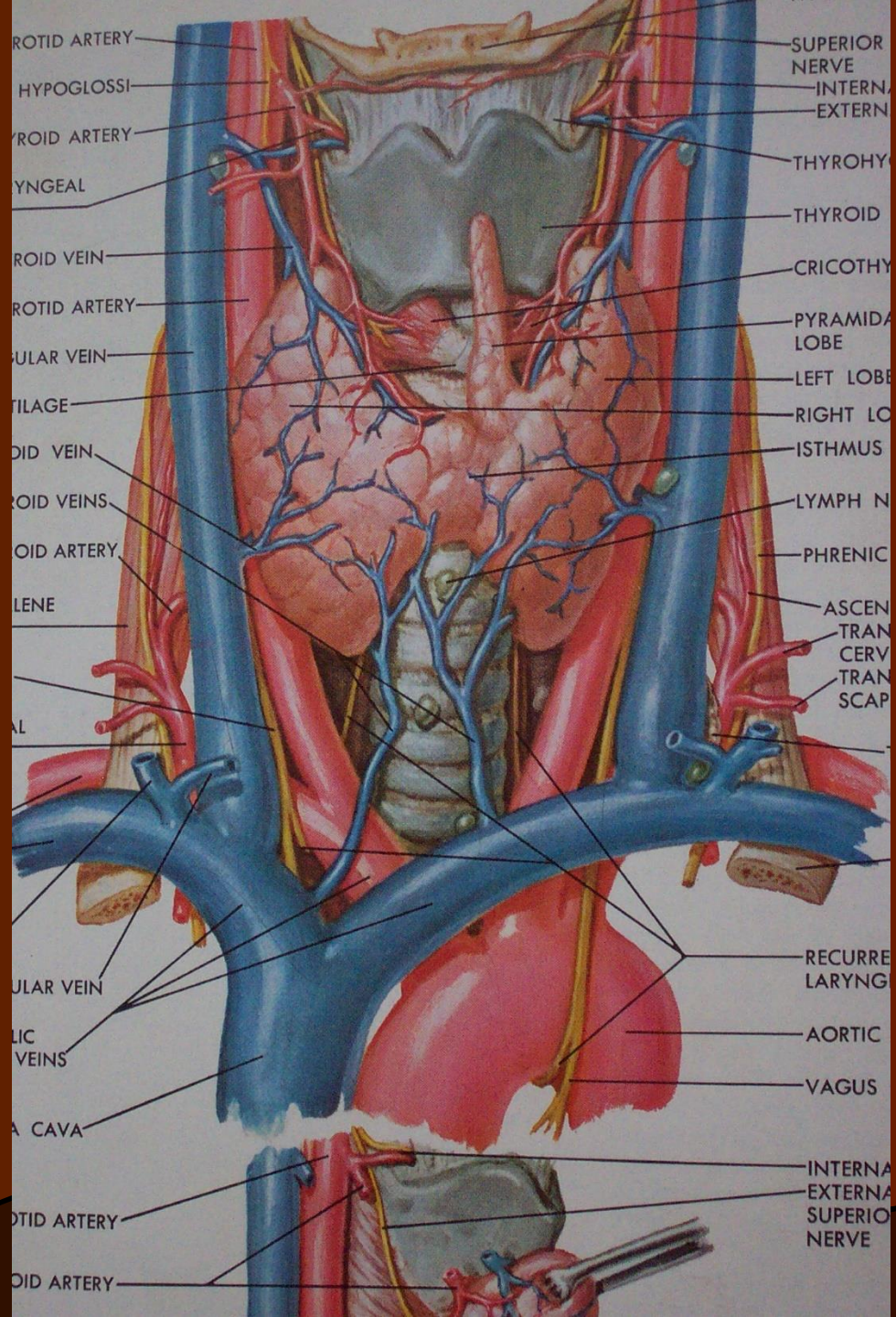
Closely Related to recurrent Laryngeal Nerve.

Ligated as away as as possible.

(3) Thyroid ima

Unusual, arises from aorta, Innominate artery.
Passes directly upwards in front of Trachea.
Enters Lower border of Isthmus.





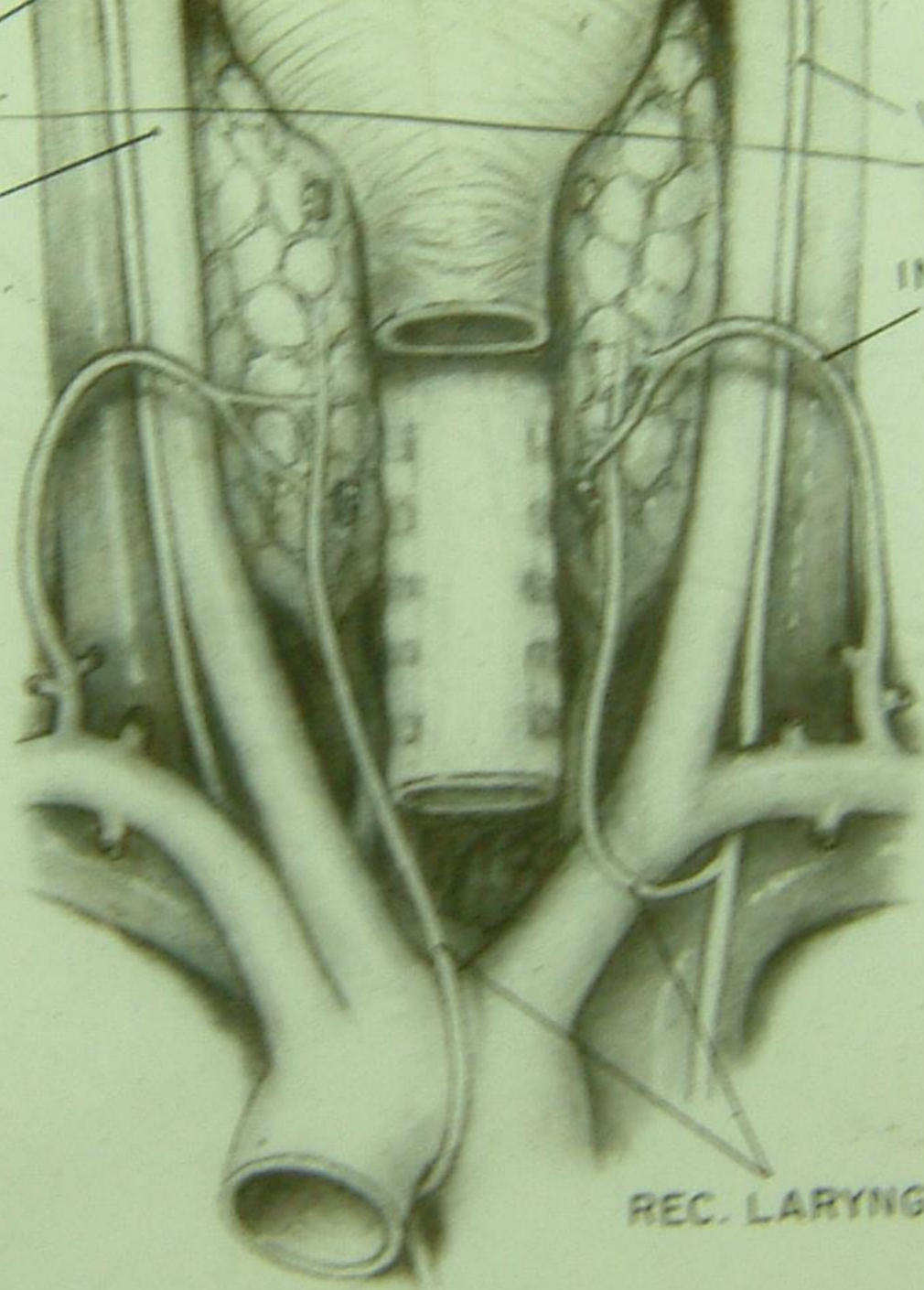
INT. JUG. V.

VAGUS N.

COM. CAR. A.

INF. THYROID A.

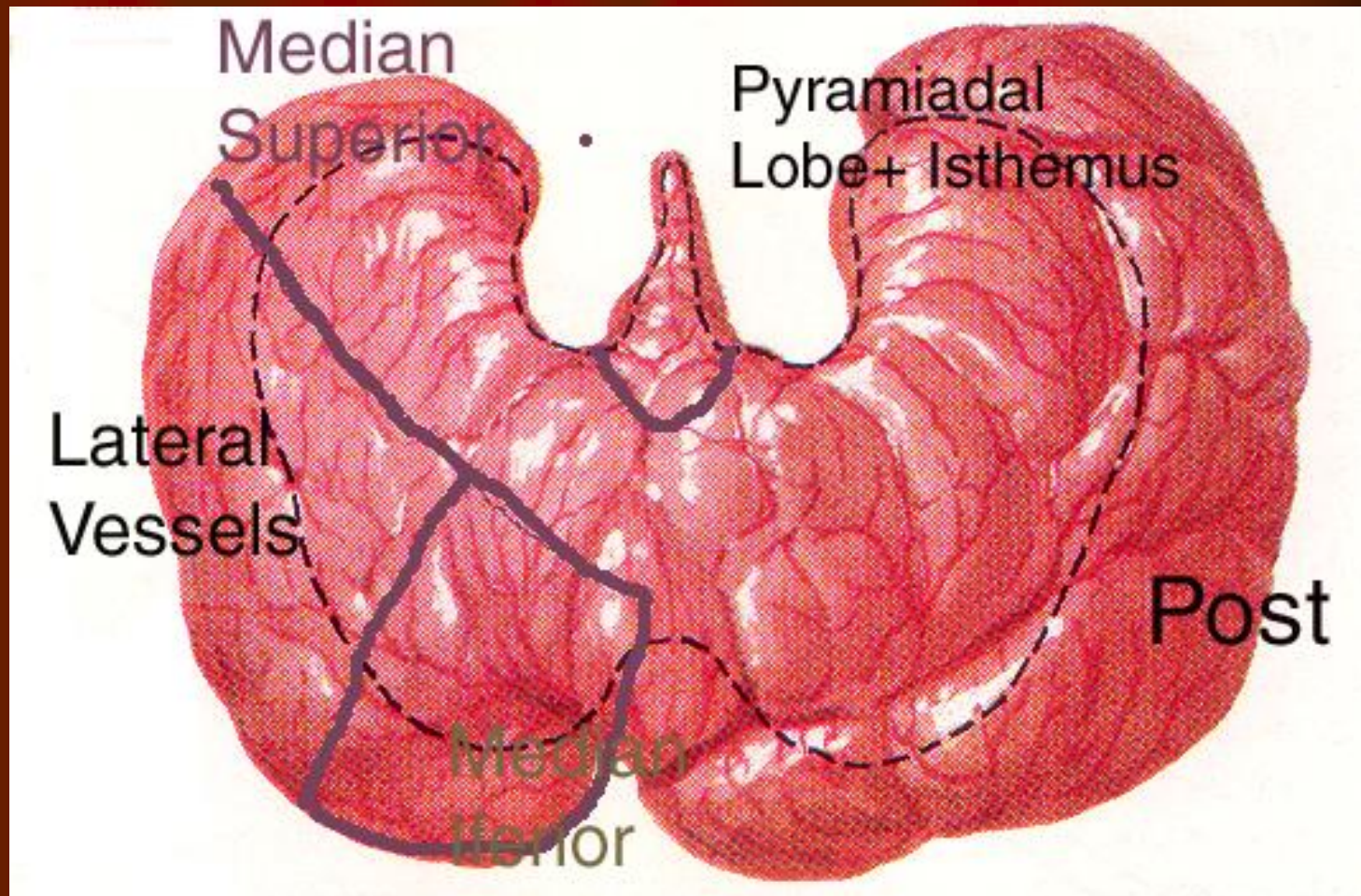
REC. LARYNG. N.



Lymphatics Drainage of Thyroid

- **Lymphatics Accompany Veins**
- **Collecting Lymph channels**
- **Draining intraglandular capillaries**
- **Beneath Thyroid capsule –**
- **Drain in to channels of capsule-**
- **Communicate with isthmus and opposite . Lobe.**

Lymphatics Drainage of Thyroid



Sup. Lymph Vessels
(Isthmus, medial sup. Portion)

Sub diaphragic Lymph nodes

Median Inf. Vessels
: Descend with Inf. Thyroid vein;

Pre Tracheal Nodes.
: Ant. sup. Mediastinal nodes

Lateral Vessels

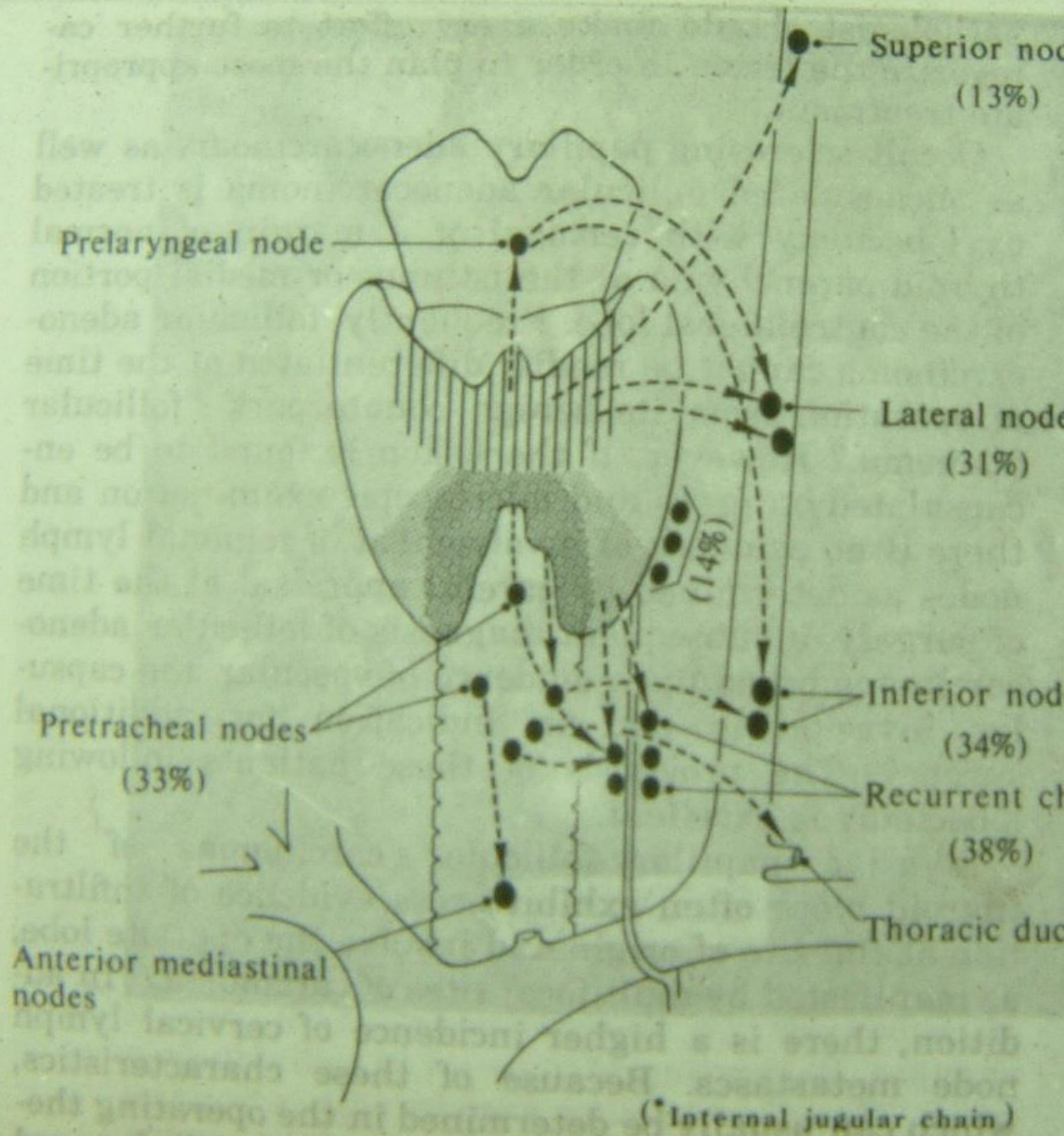
Ant. Sup. Nodes of Int. Jugular Chain
: Recurrent laryngeal Nodes
: Ant. sup. Mediastinal nodes
(Beyond Radical Neck Dissection.)

Post superior vessels

Leave post capsule : Retropharyngeal nodes, Rouviere found in 1/5th dissection – Beyond RND

**Pyramidal Lobe or
the upper part of Isthmus**

Pre laryngeal, Inferior & Anterior group



Lymph
node
Metastasis
in
Papillary
carcinoma
of
Thyroid

Physiology of Thyroid Gland

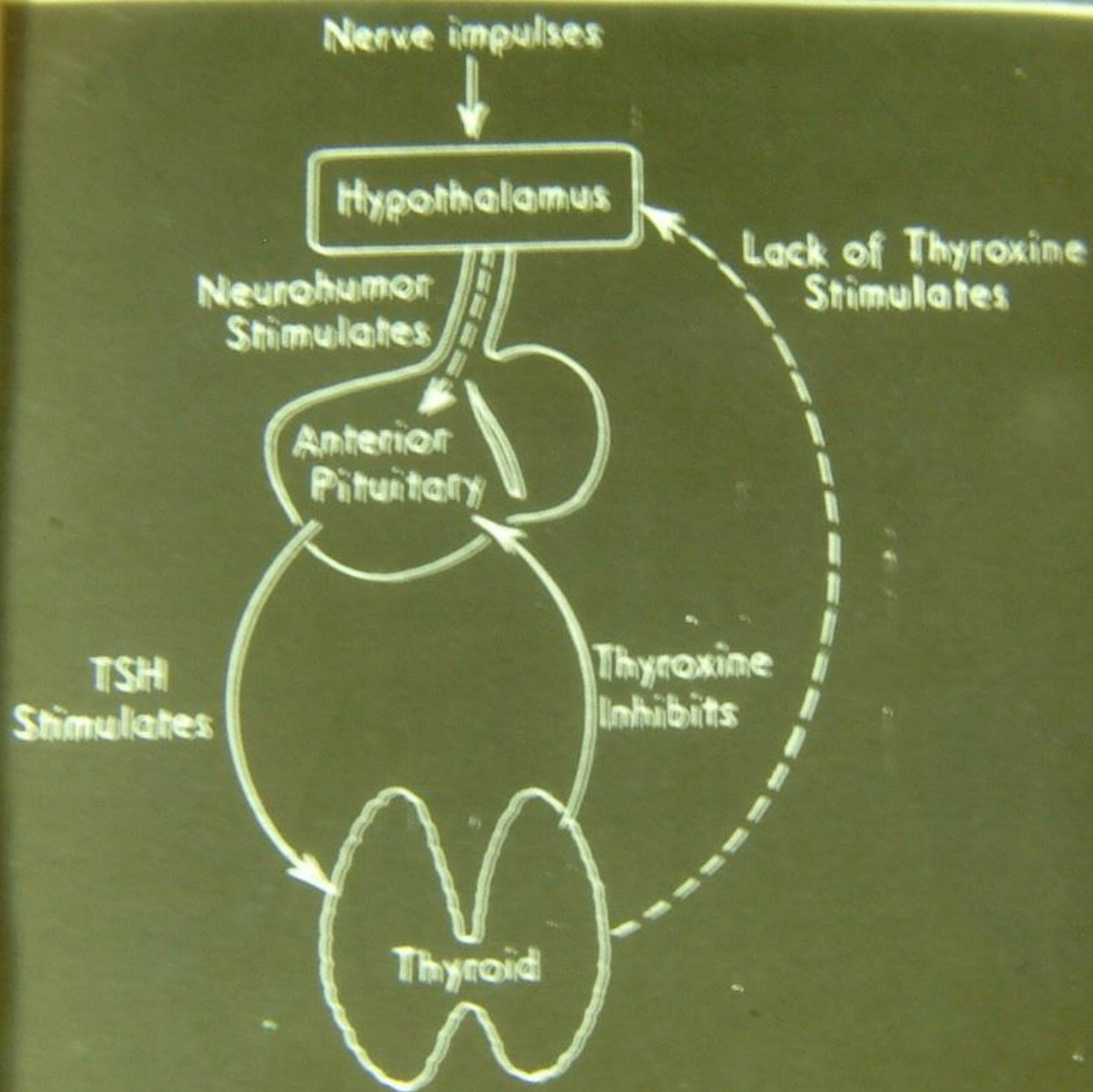
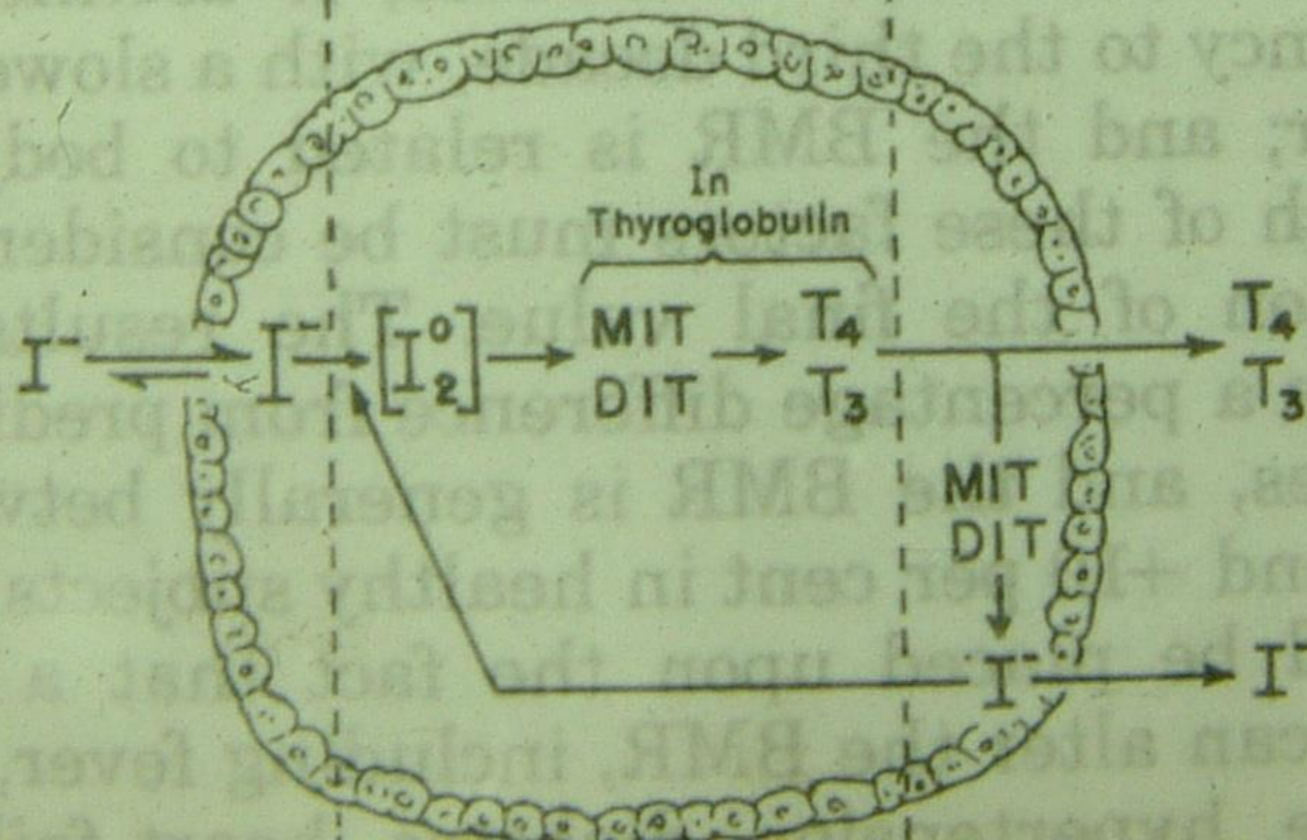


FIG. 58

Diagram of relationships between hypothalamus, anterior pituitary, and thyroid.

SCN^- ClO_4^- 	THIOURYLENES PAS DIETARY GOITROGENS SULFONAMIDES 	IODIDE 
IODIDE TRANSPORT	OXIDATION, ORGANIC BINDING & COUPLING	PROTEOLYSIS, RELEASE & DEHALOGENATION



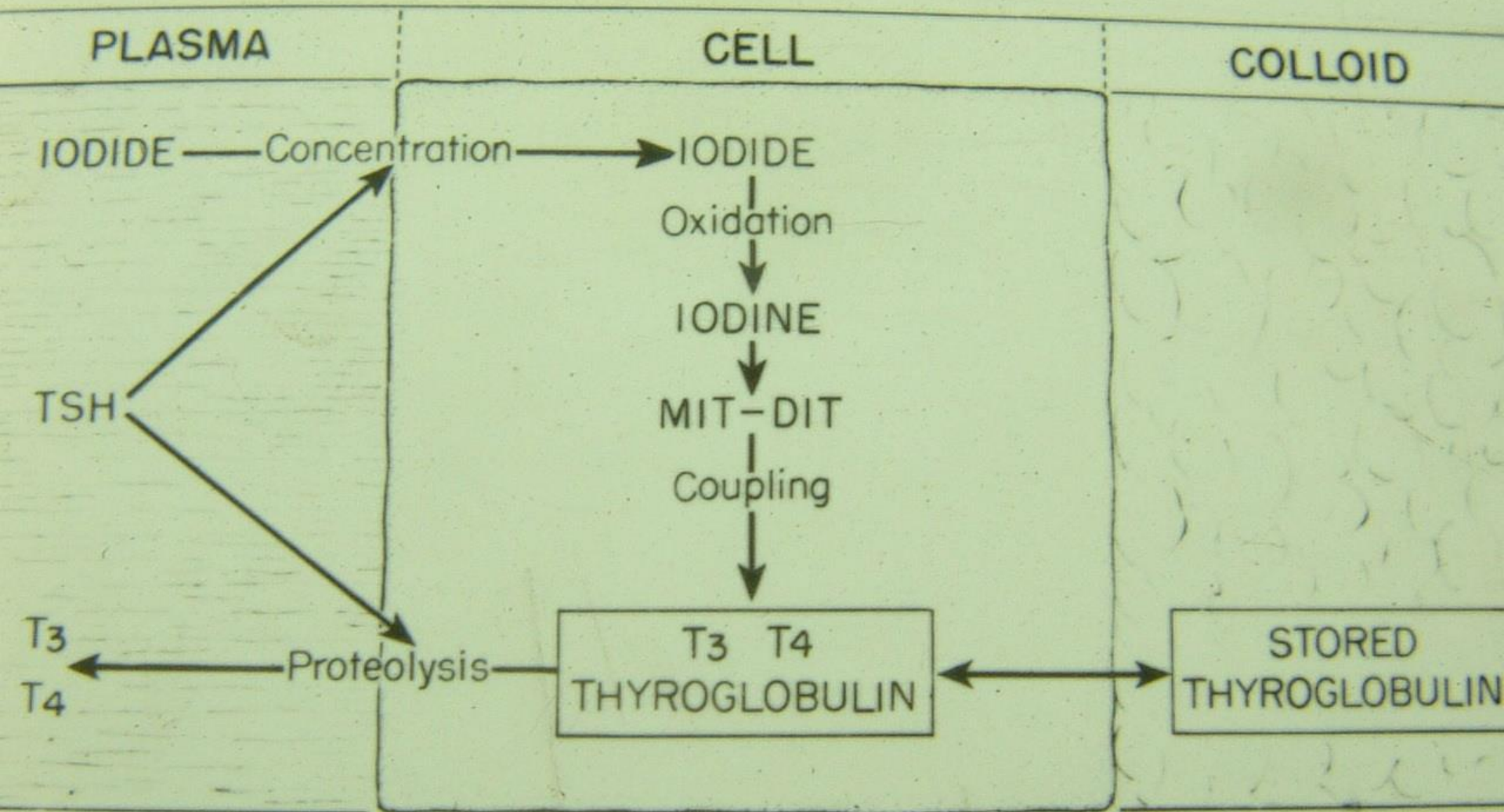
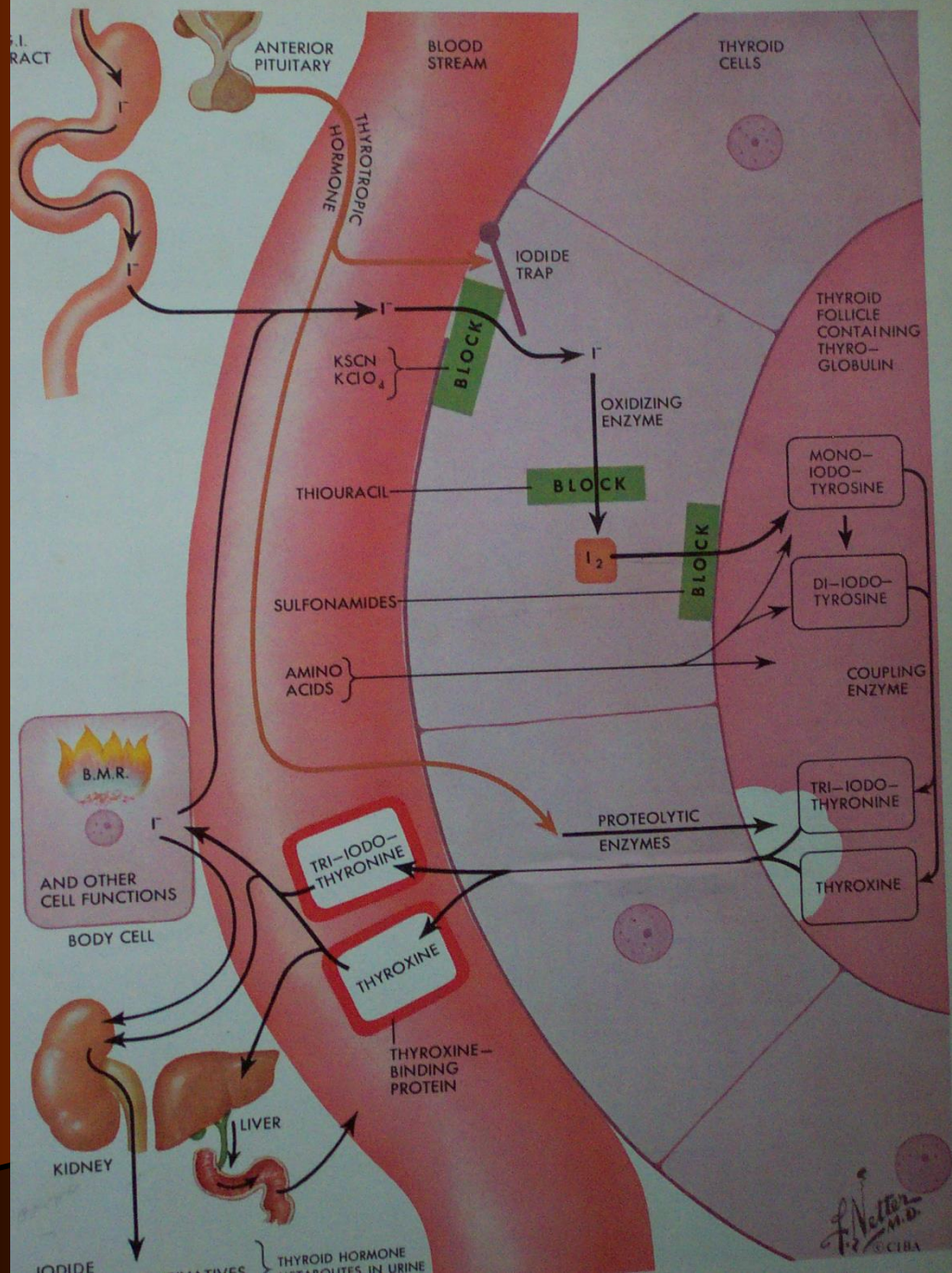
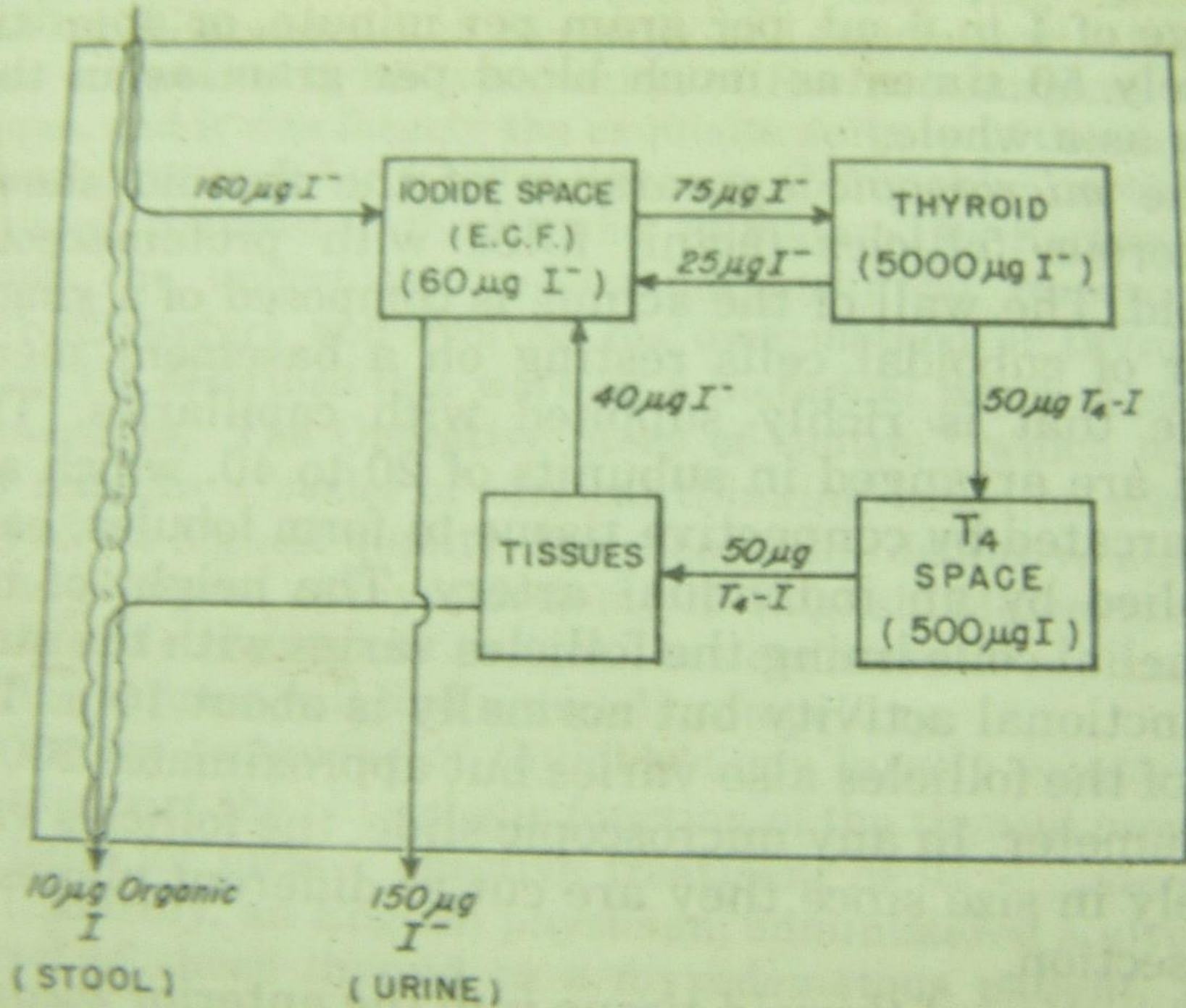


Figure 5-2. Synthesis and secretion of thyroid hormones.





Salient Features about Physiology of Thyroid gland

● Physiological actions of Active T3 and T4

*1) Increase tissue metabolism
(by increasing the respiratory
Enzymes in mitochondria)*

Increased appetite

Decreased weight

*Increased heat production and
Oxygen consumption.*

*2.) Increased sensitivity of
Beta Adrenergic receptor*

Tachycardia

Lid Lag

Tremors

Nervousness

*3.) Increase tissue growth
(By increasing metabolism and
Secretion of growth hormone)*

*Increased growth
and tissue maturation*

- Unique feature of Thyroid Metabolism is storage of Hormone in extra cellular location ie colloid anchored to molecule of Thyroid.
- Thyroxin is manufactured in a cell by Exocytosis it goes out of cell in Acinar space to bind with thyroglobulin
- Thyroglobulin which is also product of acini-mucoprotein of high molecular weight.
- By means of proteolytic enzyme which hydrolyses peptide bond, T3 and T4 are released into capillary network which surrounds the acini

Regulation of Thyroid hormone by Intra Thyroidal Iodide cocentration

- Inversely influences to T.S.H.
- Small dose ---- increase the T4
- Large doses ----- Biphasic response
First increasing Blockade of Org. binding.
- Then decreasing. The blockade so it stimulates

● This is called as Wolf –Chekoff Effect

Foetal thyroid Physiology

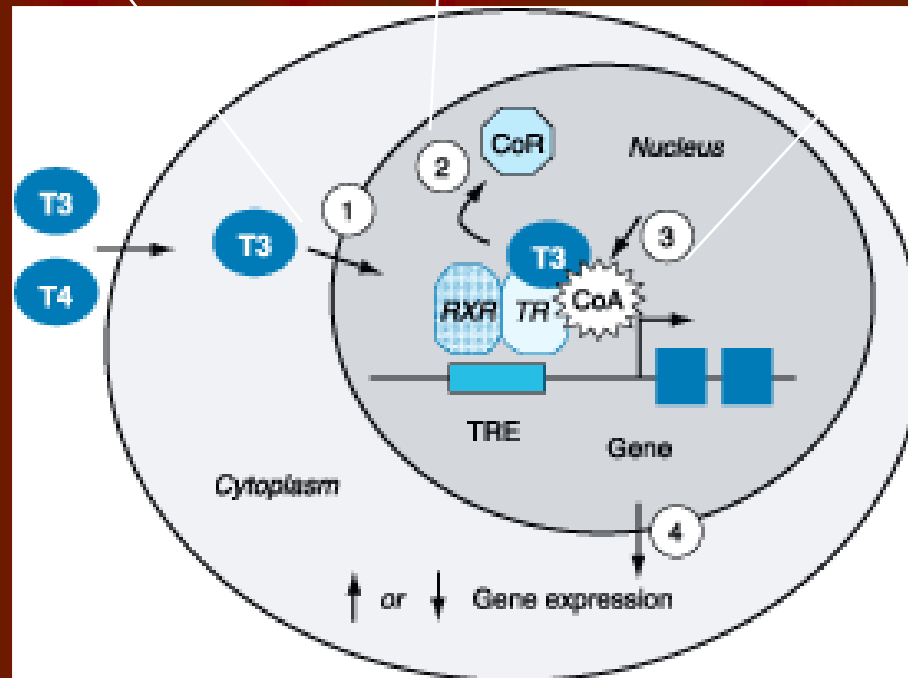
- Foetal Thyroid - can concentrate Iodine at 10 weeks
- T4, TSH -detectable in second Trimester
- Foetal Hypothalamus starts secreting TRH then TBG appears and T4 goes up
- Till then it is dependent upon Maternal TRH
- Foetal T 3 is low but reverse T3 is high
- Foetal axis is different than maternal axis

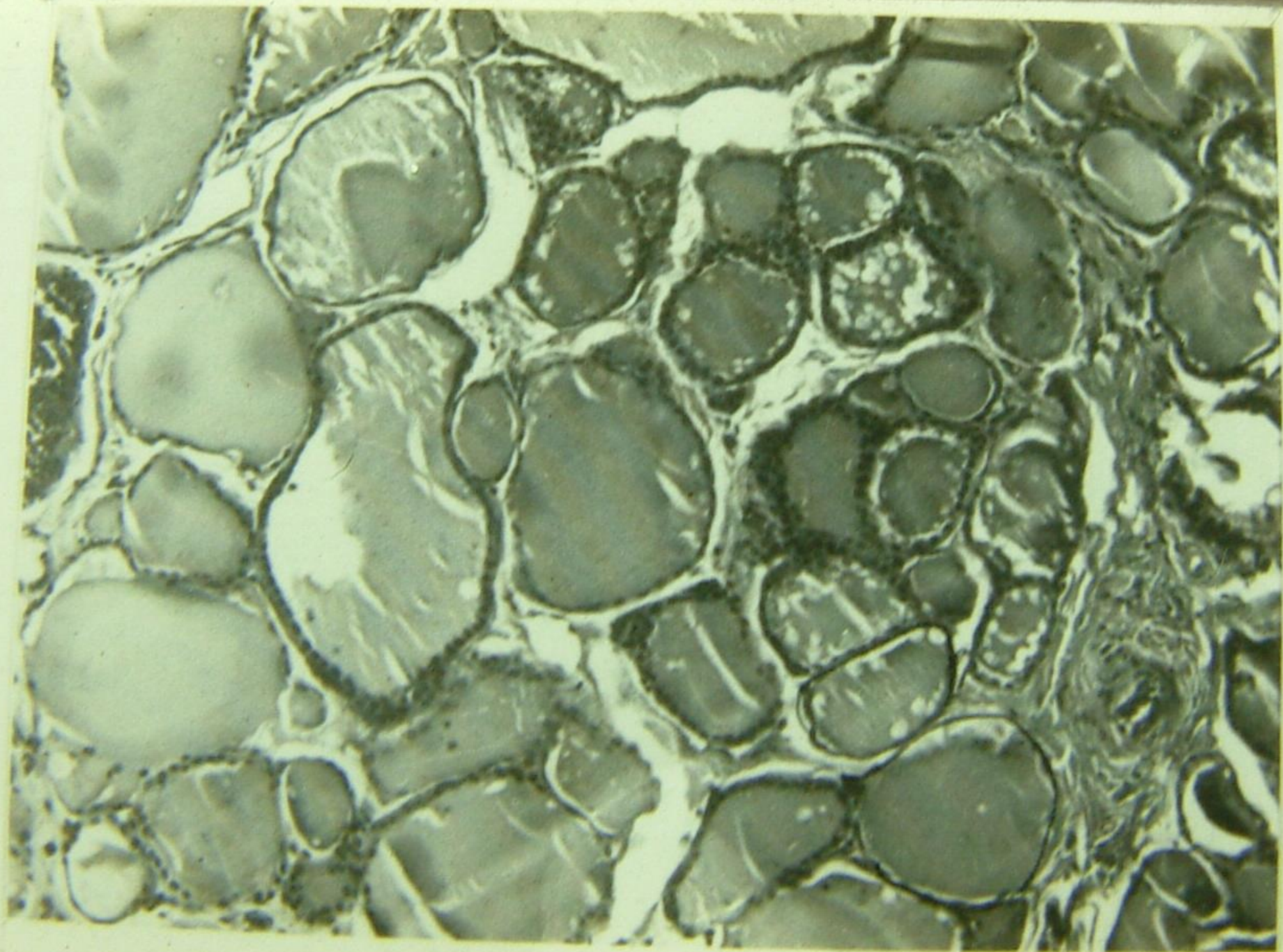
Mechanism of **thyroid** hormone receptor action. The **thyroid** hormone receptor (TR) and retinoid X receptor (RXR) form heterodimers that bind specifically to **thyroid** hormone response elements (TRE) in the promoter regions of target genes. In the absence of hormone, TR binds corepressor (CoR) proteins that silence gene expression. The numbers refer to a series of ordered reactions that occur in response to **thyroid** hormone: (1) T₄ or T₃ enters the nucleus; (2) T₃ binding dissociates CoR from TR; (3) Coactivators (CoA) are recruited to the T₃-bound receptor; (4) gene expression is altered.

T₄ or T₃ enters the nucleus

T₃ binding dissociates CoR from TR

Coactivators (CoA) are recruited to the T₃-bound receptor





Normal Histology of Thyroid



Thyroid Function Test

PHYSIOLOGIC LEVEL OF THYROID FUNCTION TESTS

TESTS

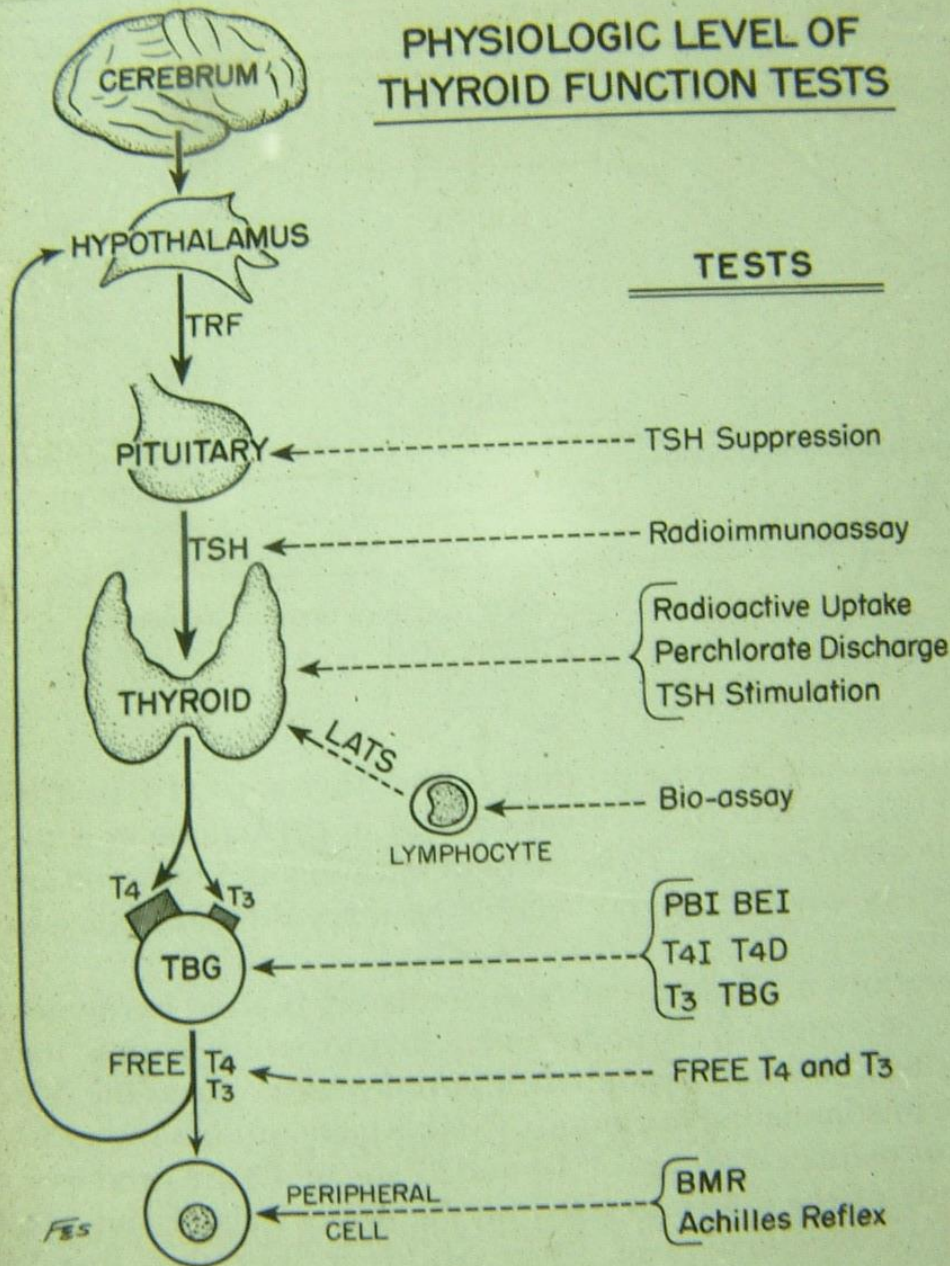


Figure 5-3. Physiological level of thyroid function tests.

Thyroid Function Test

1. Tests on Serum:

- a. Direct estimation iodine content: PBI, BET, T4I, T3I.
- b. Estimation of thyroxin binding: T3 uptake test, T4 displacement test.

2. In vivo test:

I131uptake test, T3 suppression test, scanning.

3. Misc: BMR, Ach. Reflex, ECG, serum cholesterol, Creatinine.

24-HOUR ^{131}I UPTAKE

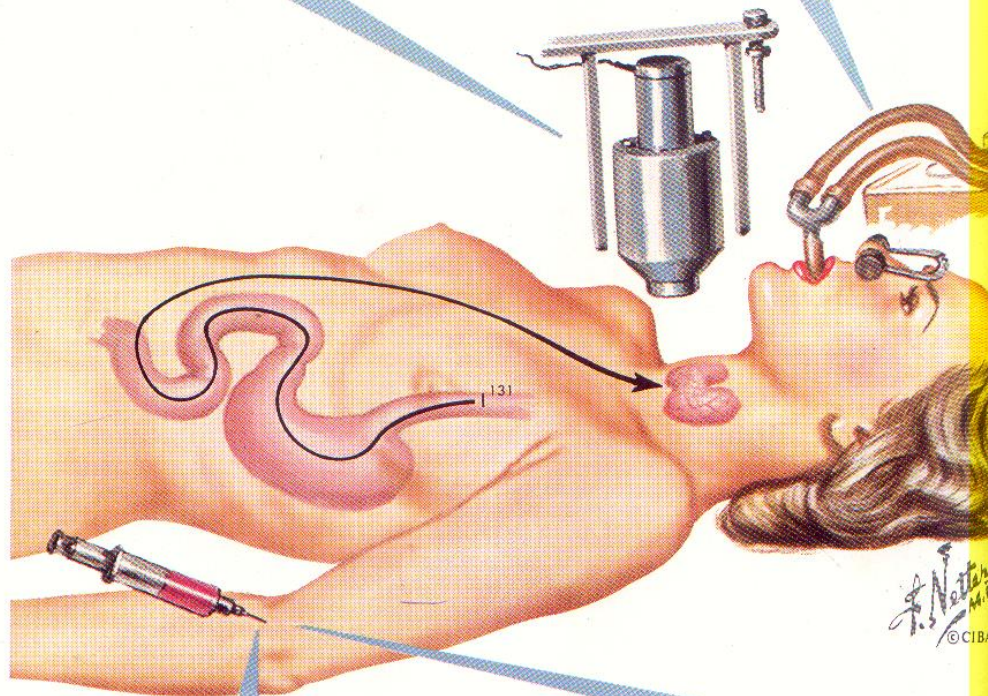
MEASURES AVIDITY OF THYROID GLAND FOR IODINE	
NORMAL	20 to 45% (SUPPRESSED BY T_3)
HYPOTHYROIDISM	0 to 20%
GRAVES' DISEASE	45 to 90% (NOT SUPPRESSED BY T_3)
HYPERFUNCTIONING ADENOMA	40 to 45% (LOCALIZED IN TUMOR; NOT SUPPRESSED BY T_3)
IODINE DEFICIENCY GOITER	50 to 90%
UNDER THIOURACIL, KSCN OR LARGE DOSES OF IODINE	0 to 20%

BASAL METABOLIC RATE (B.M.R.)

MEASURES EFFECT OF CIRCULATING THYROID HORMONE ON OXYGEN CONSUMPTION

NORMAL	-10% to +10%
HYPOTHYROIDISM	-15% to -40%
GRAVES' DISEASE	+35% to +60%
HYPERFUNCTIONING ADENOMA	+20% to +30%

ELEVATED IN PATIENTS NOT RELAXED, IN ACROMEGALY, ESSENTIAL HYPERTENSION, PHEOCHROMOCYTOMA, HEART FAILURE, LEUKEMIA
LOW IN ADDISON'S DISEASE AND PANHYPOPITUITARISM



P.B.I. AND B.E.I.

MEASURES LEVEL OF CIRCULATING THYROID HORMONE

	P.B.I.	B.E.I.
NORMAL	3.5 to 8.5 $\mu\text{g}/100\text{ ml}$	3.2 to 6.5 $\mu\text{g}/100\text{ ml}$
HYPOTHYROIDISM	0.5 to 3.0 $\mu\text{g}/100\text{ ml}$	0.5 to 3.0 $\mu\text{g}/100\text{ ml}$
GRAVES' DISEASE	9.0 to 20.0 $\mu\text{g}/100\text{ ml}$	7.0 UP $\mu\text{g}/100\text{ ml}$
HYPERFUNCTIONING ADENOMA	8.0 to 10.0 $\mu\text{g}/100\text{ ml}$	7.0 to 10.0 $\mu\text{g}/100\text{ ml}$

FALSE HIGH AFTER IODIDE INGESTION, RADIOPAQUE MEDIA (GALLBLADDER DYE MAY LAST MONTHS; RENAL DYE, A FEW DAYS)
FALSE LOW AFTER MERCURIAL DIURETICS (LASTS A FEW DAYS)

SERUM CHOLESTEROL

MEASURES ONE PERIPHERAL ACTION OF THYROID HORMONE

NORMAL	150 to 250 $\text{mg}/100\text{ ml}$
HYPOTHYROIDISM	ELEVATED (IF ON NORMAL DIET)
HYPERTHYROIDISM	NORMAL TO LOW

Embryology Of Thyroid

Congenital Anomalies
Of
Thyroid Gland

- *Embryologically Thyroid is off shoot of Primitive Alimentary tract*

Takes origin from Epithelium of Pharynx in Midline



Median Thyroid Diverticulum



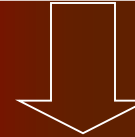
Lateral Component
Para Follicular C cells



Diverticulum Grows
Downwards as
**Thyroglossal
Duct**



At The Level of Thyroid Cartilage
It grows laterally as **Lateral Lobes**



Pyramidal Lobe: Growth at the distal
End

Failure
Of
Descent

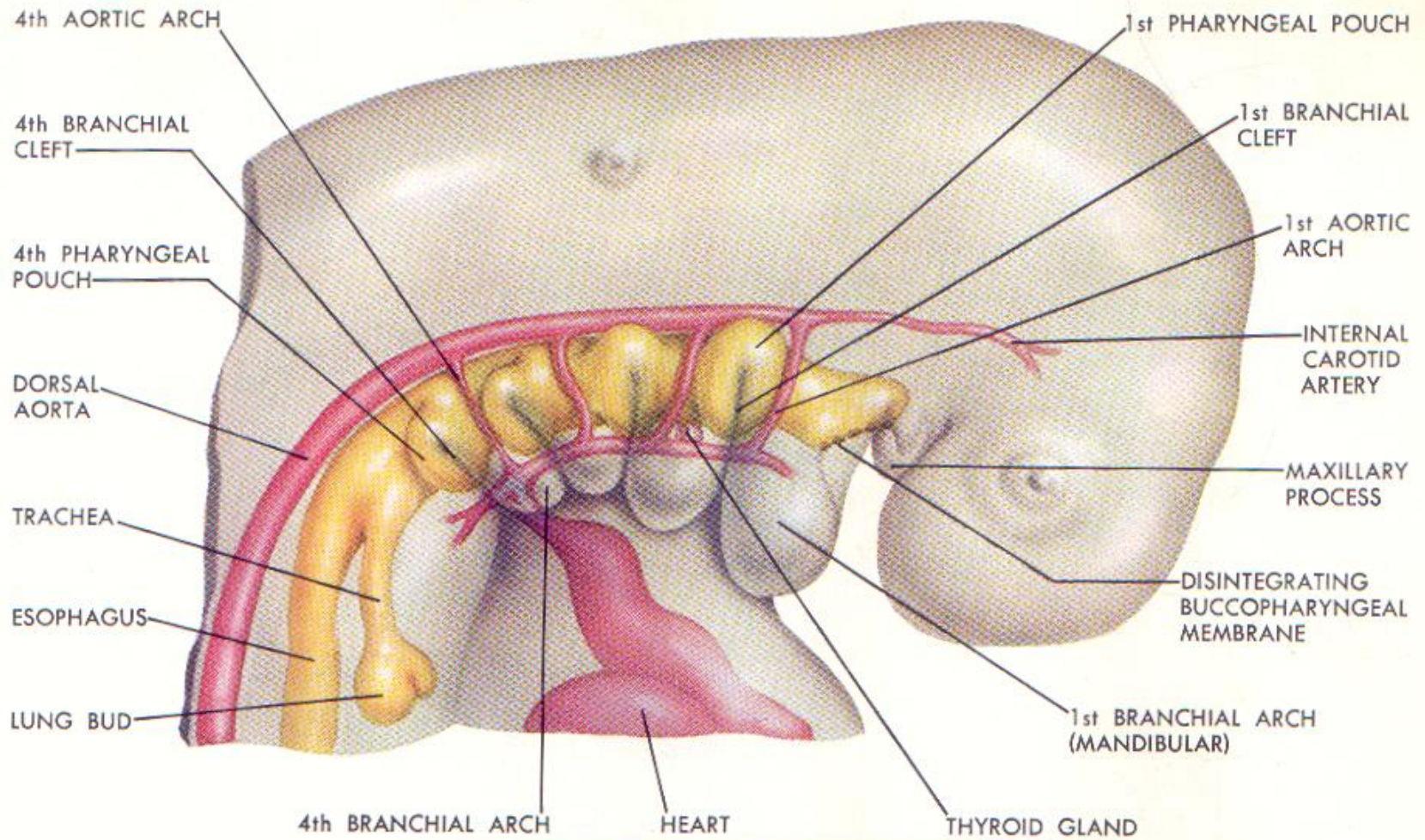


Ectopic
Thyroid

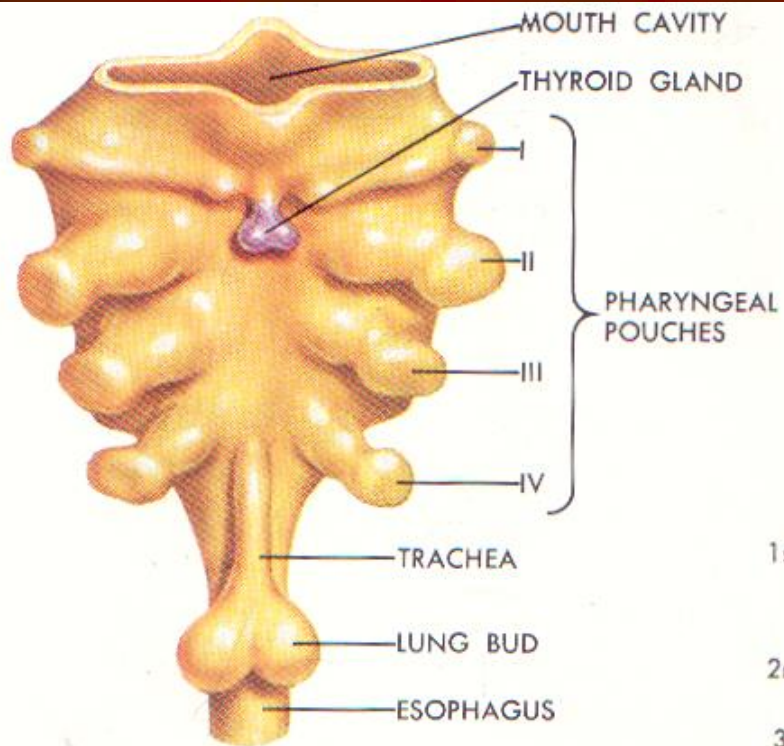


Thyro
glossal
Tract
Ectopic

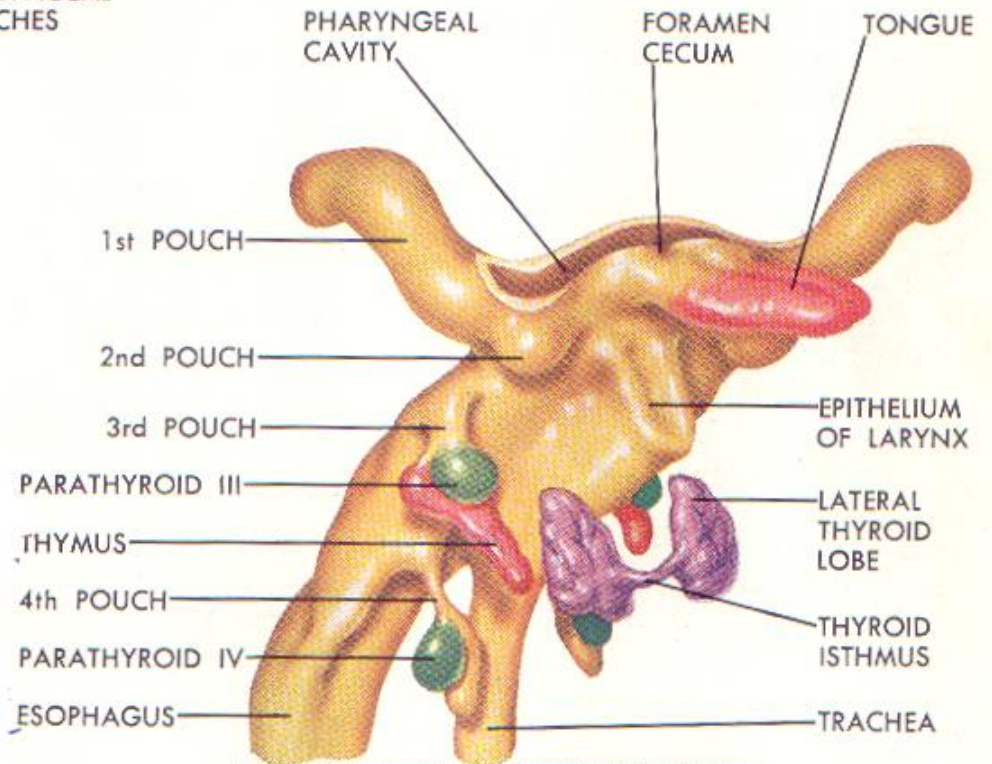
Thyroglossal Duct Anomaly :
Cyst , Fistula Sinus



A: PHARYNX AND RELATED STRUCTURES—4th WEEK



B: PHARYNX (VENTRAL VIEW)
4th WEEK



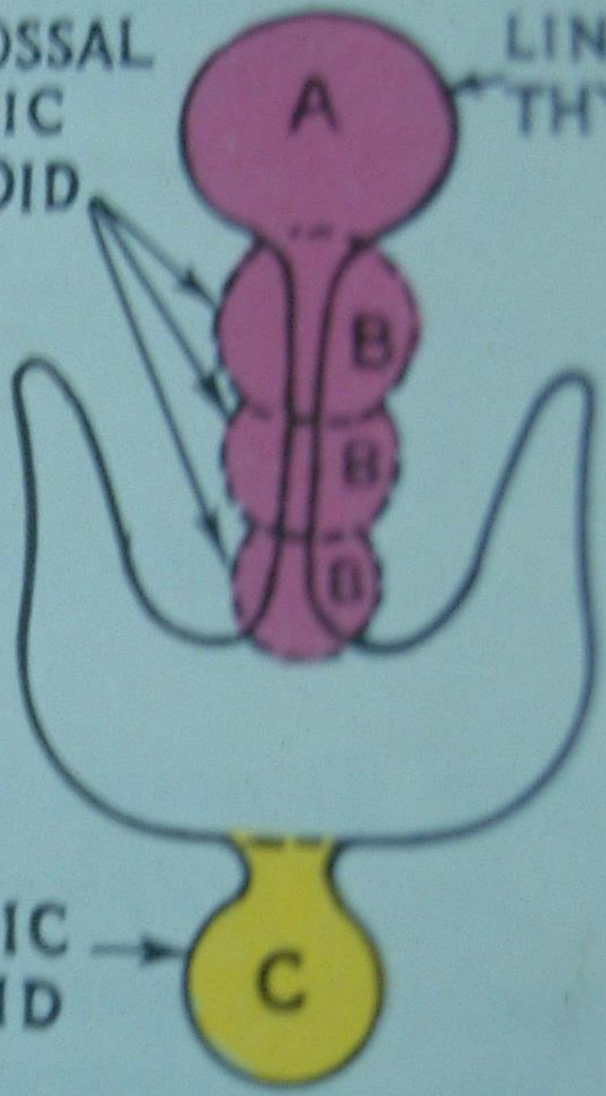
C: PHARYNX AND DERIVATIVES
(BETWEEN 6th AND 7th WEEKS)

Lingual Thyroid

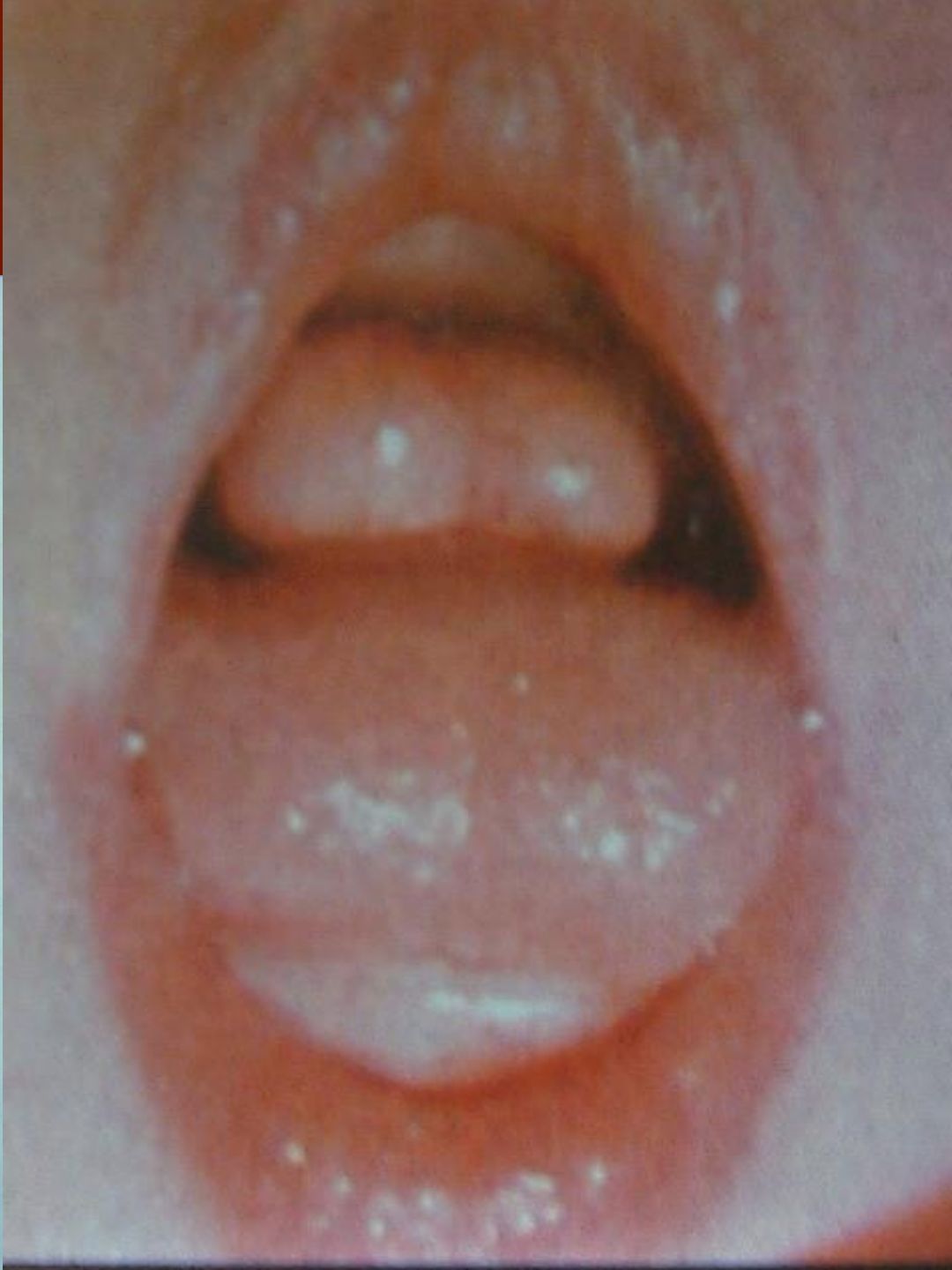
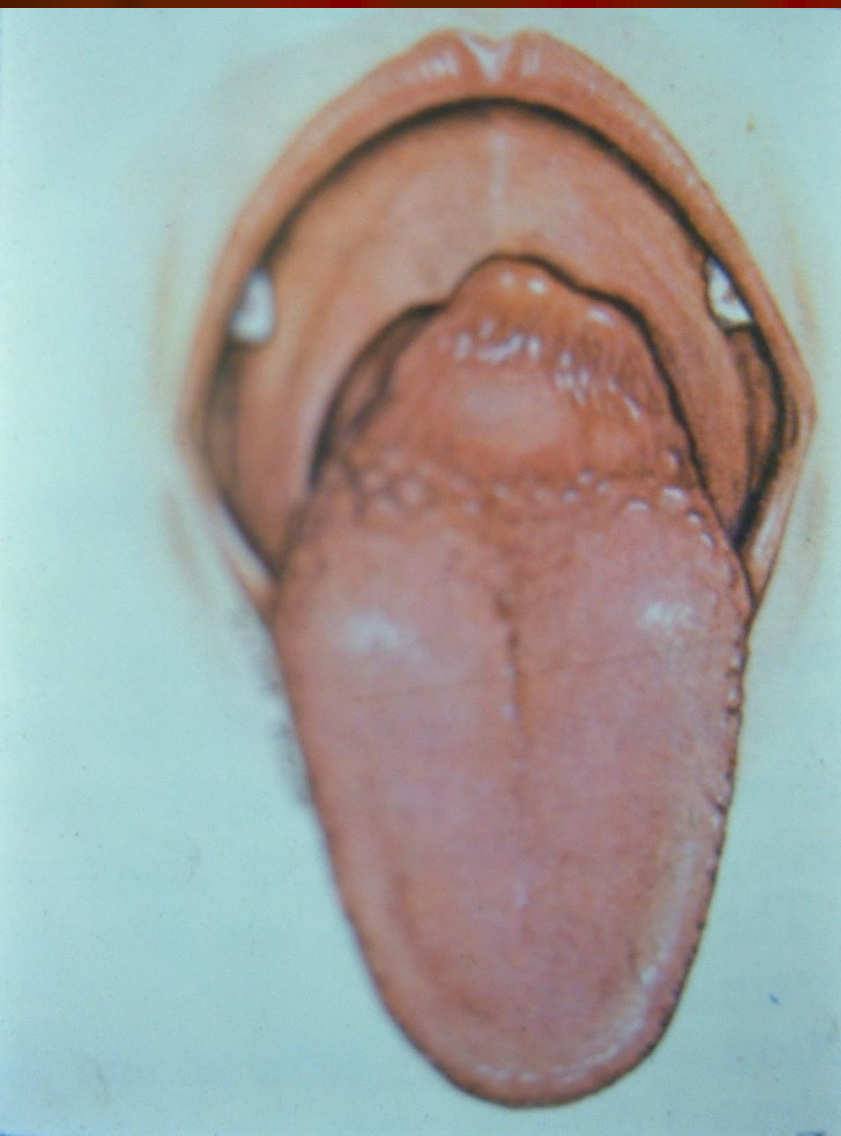
- Rounded swelling at the base of tongue
- Dysphagia
- Impairment of Speech
- Respiratory Obstruction
- Dysphonia.

THYROGLOSSAL
ECTOPIC
THYROID

LINGUAL
THYROID



INTRA-
THORACIC
THYROID

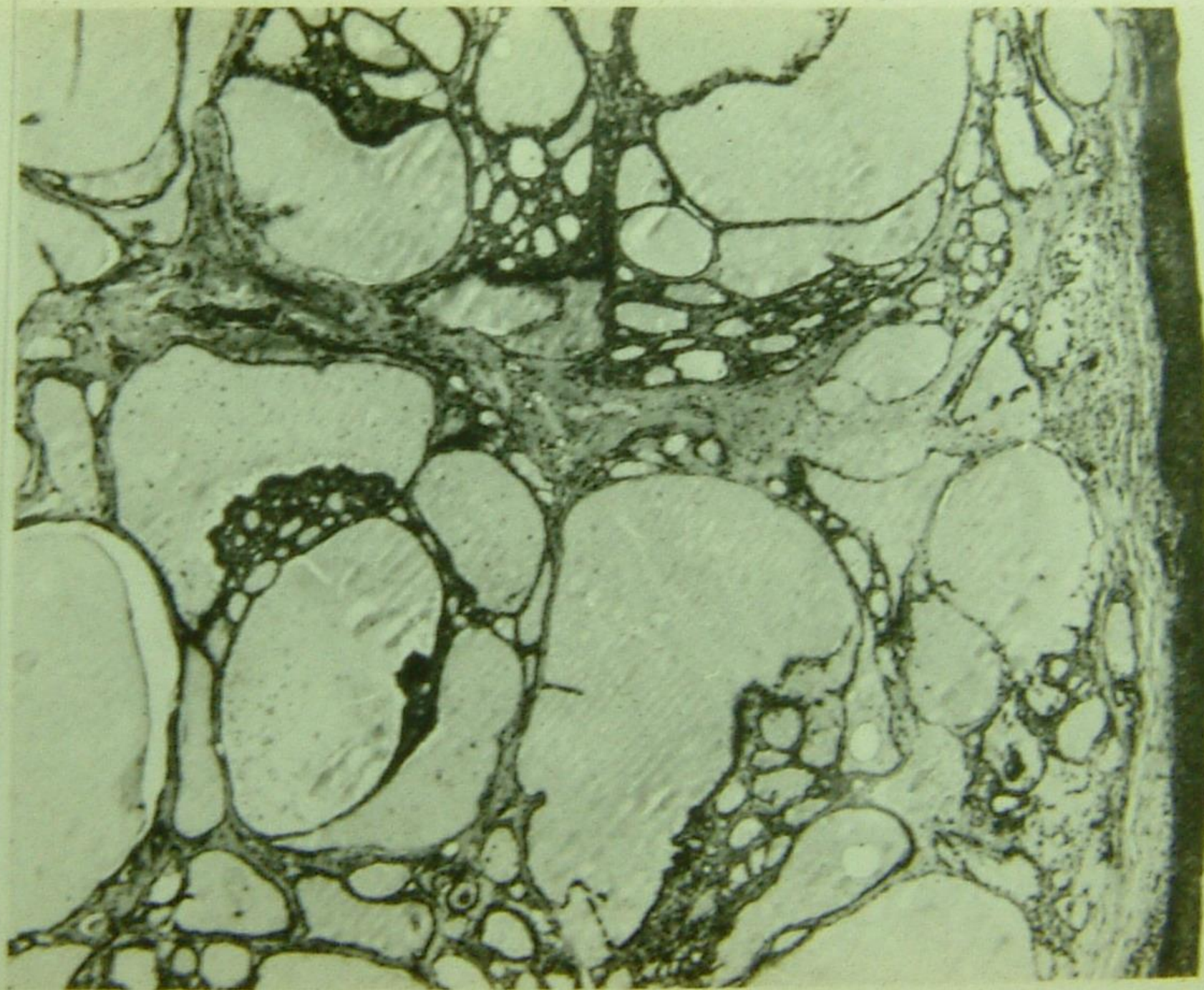


Lingual Thyroid

- Investigations: I 131 Scan
- Indications for Surgery:
 - Dysphagia
 - Dysphonia
 - Degeneration
 - Uncontrolled Hyperthyroidism
 - Dyspnoea
 - Haemorrhage
 - Necrosis
 - Suspicion of malignancy

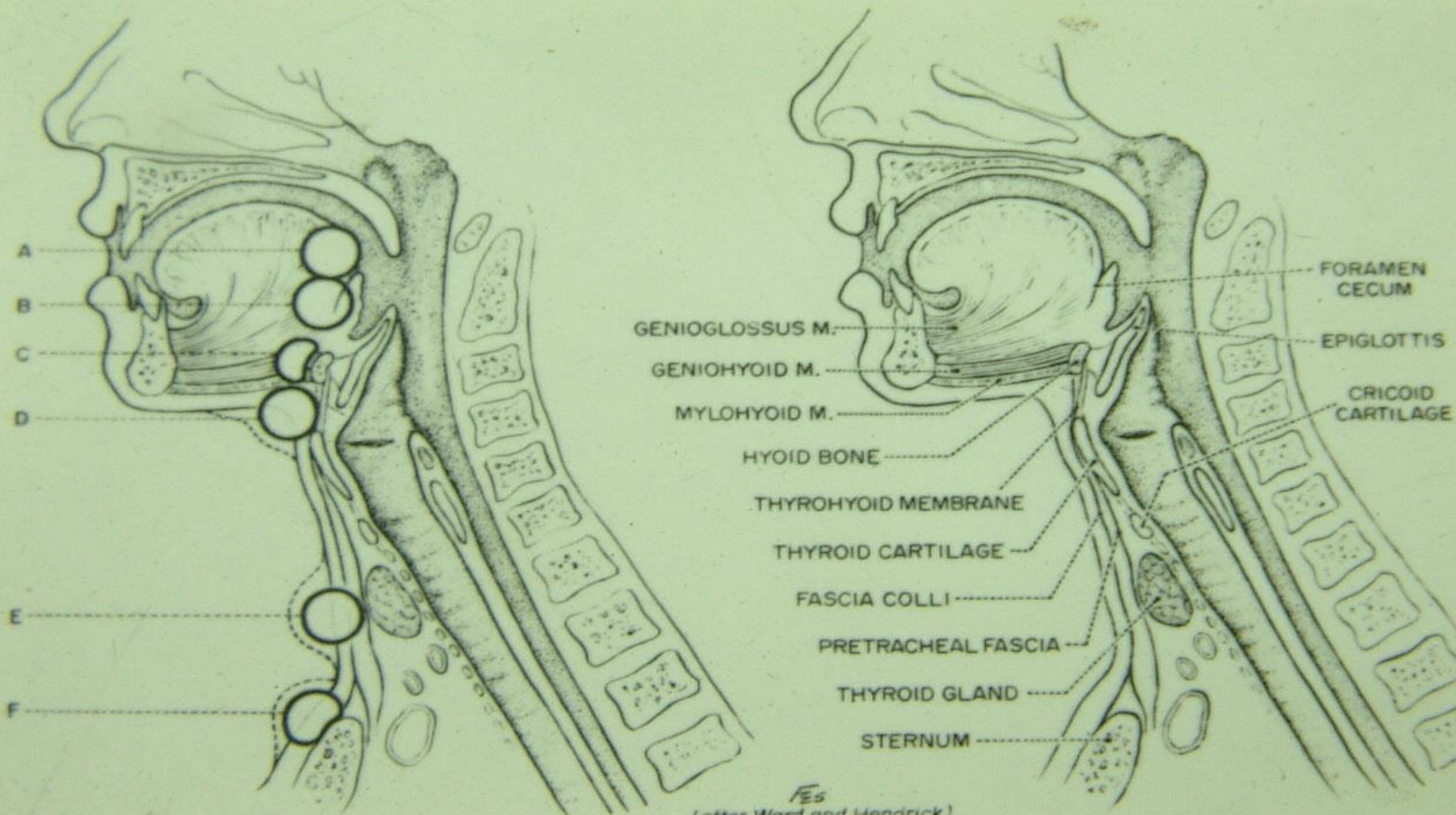
Lingual Thyroid

- Pre-operative Preparation:
Thyroxine/ I 131 to reduce the size
- Operation: Excision of the lingual thyroid with auto transplantation in thigh.
- Approaches for lingual thyroid:
1. Intra-oral with tongue pull-through
 2. Lateral pharyngotomy



Thyroglossal Cyst

- Sites:
 1. In front of foramen caccum
 2. At foramen caccum
 3. Beneath foramen caccum
 4. In the floor of mouth
 5. Suprathyroid
 6. Subthyroid
 7. In the area of thyroid
 8. In the level of cricoid cartilage
 9. Suprasternal.



FES
(after Ward and Hendrick)



Clinical Presentation

1. Swelling: Prone to infection- abscess
Spontaneous drainage
Spontaneous fistula
Sinus formation
2. Dysphagia and occasionally other pressure symptoms.
3. Occasionally, pressure on cyst when the duct is potent above might push fluid in oral cavity.

THYROGLOSSAL CYST GETS ELEVATED ON
SWALLOWING AS WELL AS ON PROTRUSION
OF THE TONGUE.

