

DISCUSSION SESSION: GROSS ANATOMY

ONN BLOCK

**Discuss Spinal Reflexes, Cranial Nerve
Reflexes (including testing),
Autonomics (including Horner's
syndrome)**

SPINAL AND CRANIAL NERVE REFLEXES

Review reflexes as clinical tools

Three basic Spinal Reflexes –

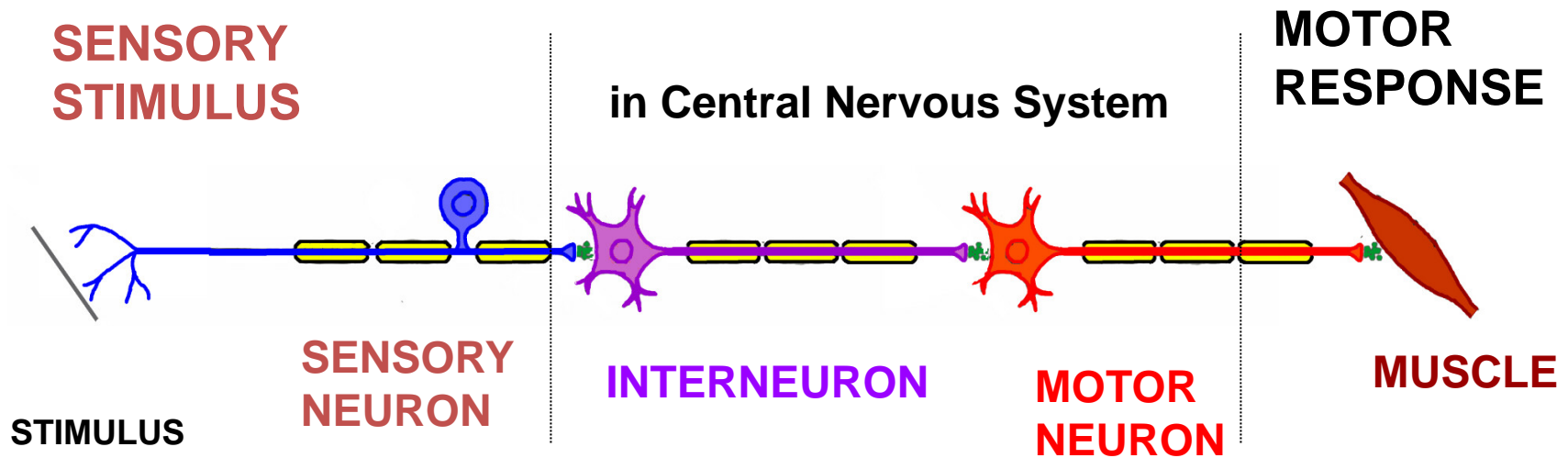
Stretch reflex – tap on tendon causes muscle to contract

Flexor reflex – aversive stimulus (ex. strong tactile stimulation of sole of foot) causes flexor muscles to contract

Autogenic inhibition – Large forces cause muscle to relax

Cranial nerve reflexes

TYPICAL REFLEX



Reflexes are clinical tools. For reflex to occur, all elements (sensory neuron, interneuron, muscle) must be functional:

If absent, diagnose where pathway is interrupted.

If abnormal, diagnose where pathway is compromised.

**REFLEXES CAN BE USED TO TEST NERVOUS SYSTEM
FUNCTION, LOCATE SITE OF LESION**

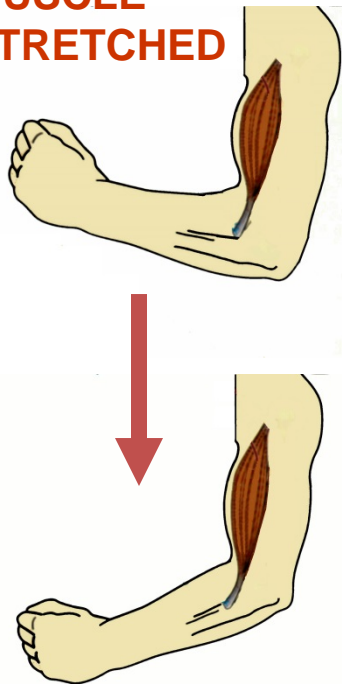
SPINAL REFLEXES

SPINAL REFLEXES AND DISORDERS

REFLEX	STIMULUS/SENSE ORGAN(S) EXCITED	NORMAL RESPONSE	UPPER MOTOR NEURON DISORDERS
Stretch (Myotatic, Deep Tendon) Reflex – Compensatory maintain position (ex. riding on moving bus)	Rapid Stretch of muscle (test: tap on muscle tendon) Excites Muscle Spindle Primary (Ia) and Secondary (II) sensory neurons (NOT Golgi Tendon Organ)	Stretched muscle contracts rapidly (monosynaptic connection); also Excite synergist and Inhibit antagonist Note: Gamma motor neurons can enhance stretch reflexes, tell patient to relax before test	<u>Hyperreflexia</u> - (increase) - characteristic of Upper Motor Neuron lesions (ex. spinal cord injury, damage Corticospinal tract); note: <u>Clonus</u> = hyperreflexia with repetitive or sustained contractions to single stimulus
Autogenic Inhibition - Limits Muscle Tension	Large force on tendon excites Golgi Tendon Organ Ib (test: pull on muscle when resisted)	Muscle tension decreases; Also inhibit synergist muscles; excite antagonist muscles	<u>Clasped Knife Reflex</u> - occurs in Upper Motor Neuron lesions - forceful stretch of muscle is first resisted then collapses
Flexor Reflex - Protective avoidance reflex	Sharp, painful stimulus, as in stepping on nail; Excites - Cutaneous and pain receptors (test: stroke foot with pointed object)	Limb is rapidly withdrawn from stimulus; protective reflex; also inhibit extensors of same limb and excite extensors of opposite limb (Crossed Extensor Reflex)	<u>Babinski sign</u> - toes extend (dorsiflex) to cutaneous stimulus of sole of foot (normally plantar flex); characteristic of Upper Motor Neuron lesion

STIMULUS

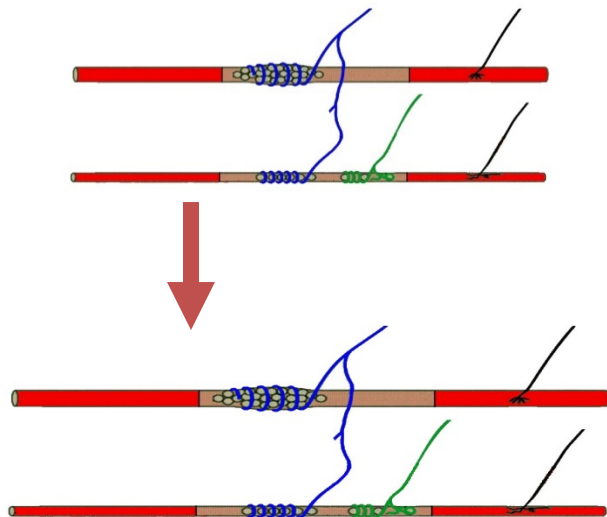
**BICEPS
MUSCLE
STRETCHED**



**1) Stimulus -
fast stretch
of muscle**

STRETCH REFLEX

BICEPS MUSCLE SPINDLE

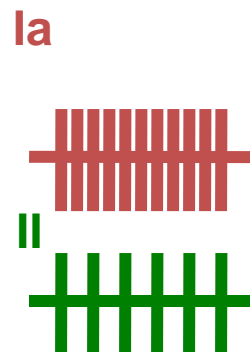


**2) Sense organ
excited - Muscle
spindle Ia and II
sensory neurons**

RESPONSE



**BICEPS
MUSCLE
CONTRACTS**



**3) Primary
response -
muscle that is
stretched
contracts rapidly**

OTHER COMPONENTS OF STRETCH REFLEX

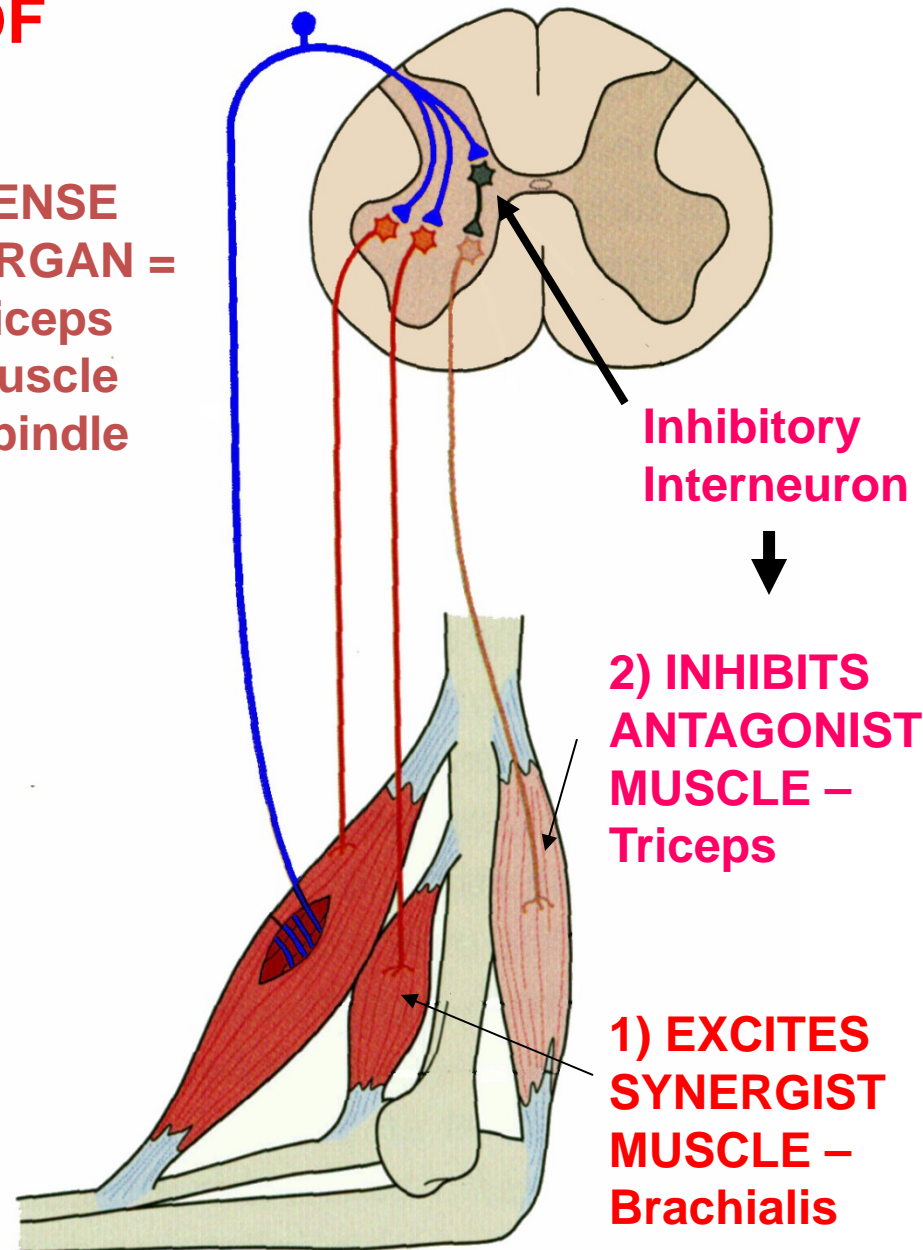


1) Excite synergist muscles - spindle afferents also make excitatory **monosynaptic** connections with synergist muscles

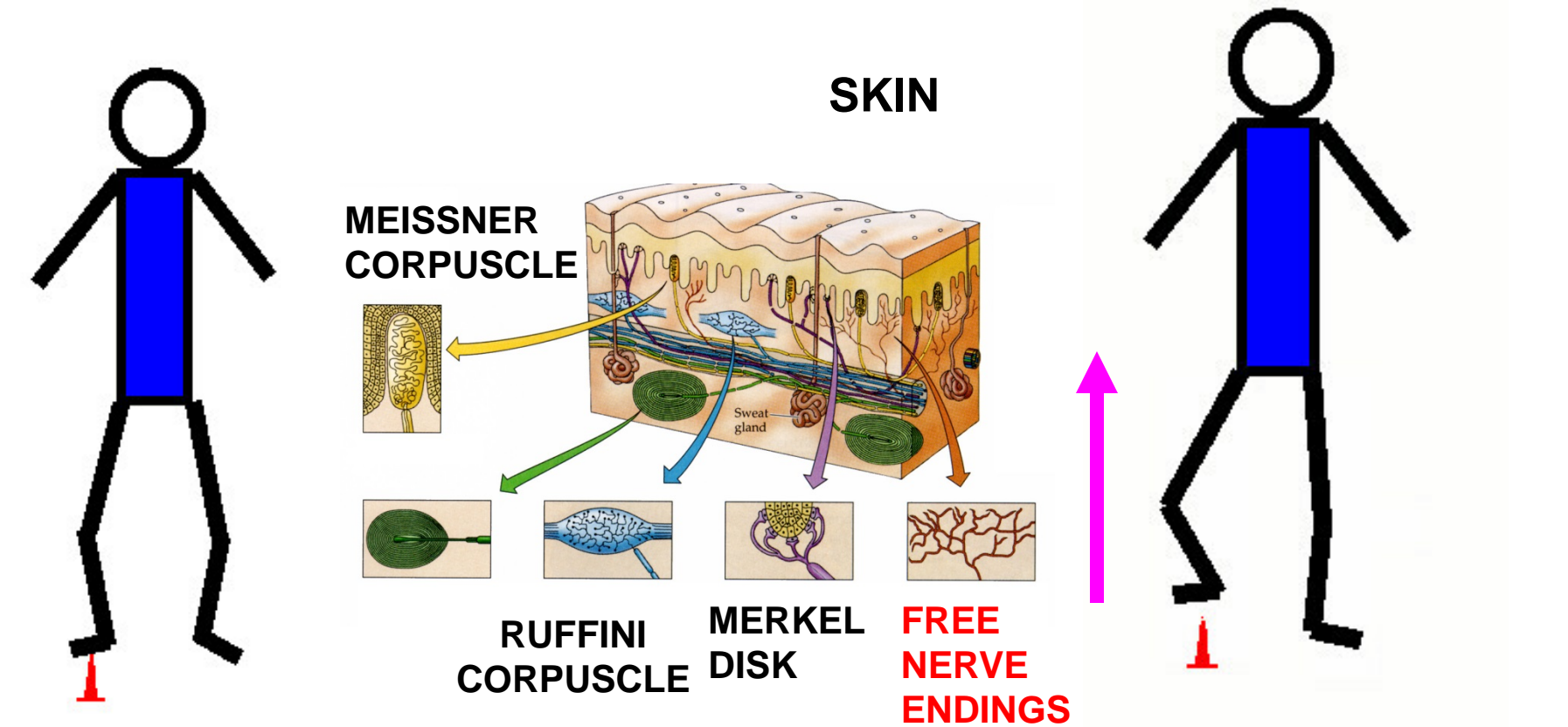


2) Inhibit antagonist muscles - **RECIPROCAL INHIBITION** - Spindle activity also excites **interneurons** that make **inhibitory synapses** on motor neurons to antagonist muscles (**polysynaptic**)

SENSE ORGAN =
Biceps
Muscle
Spindle



FLEXOR REFLEX

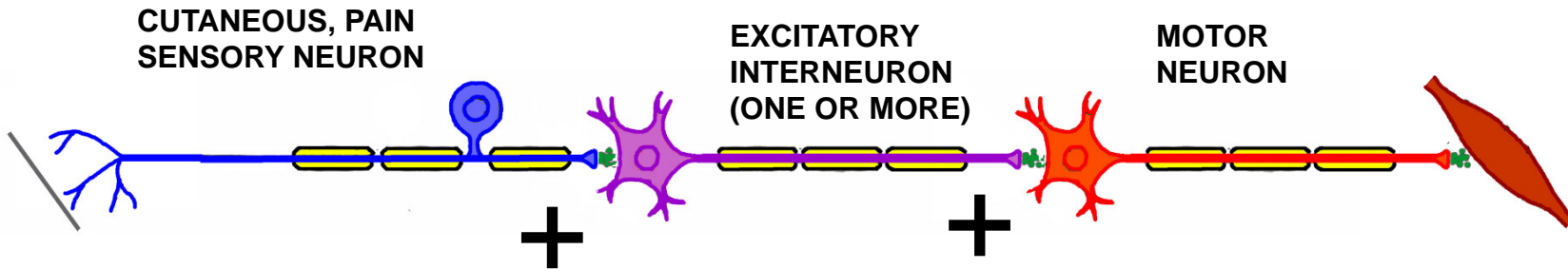


1) Stimulus - painful or noxious stimulus (stepping on nail)

2) Sense organ excited - Cutaneous receptors, Pain receptors (nociceptors)

3) Primary response - Protective withdrawal of limb

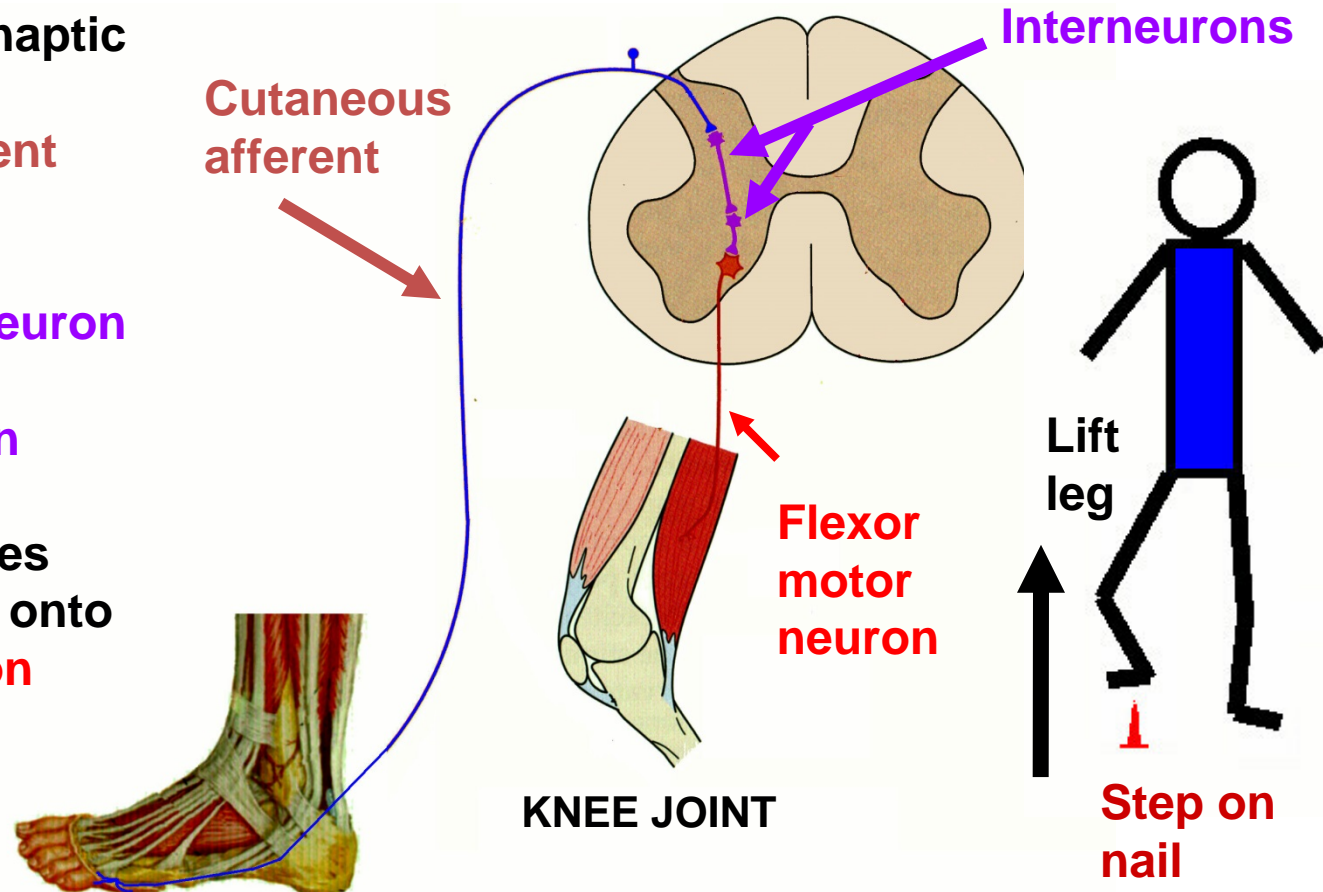
FLEXOR REFLEX: PATHWAYS



Synapses - Polysynaptic

1) **Cutaneous afferent** makes excitatory synapse onto **Interneuron**; **Interneuron** can synapse upon another interneuron

2) **Interneuron** makes excitatory synapse onto **Flexor motor neuron**

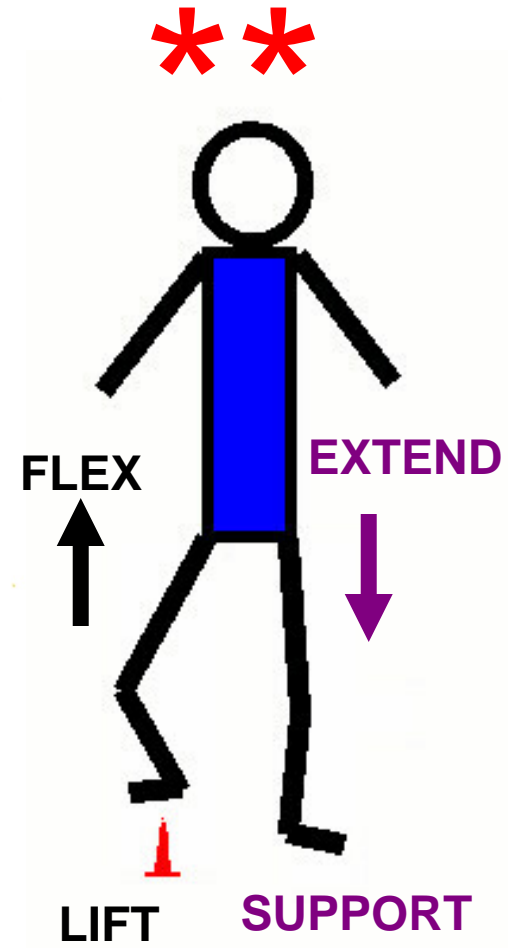
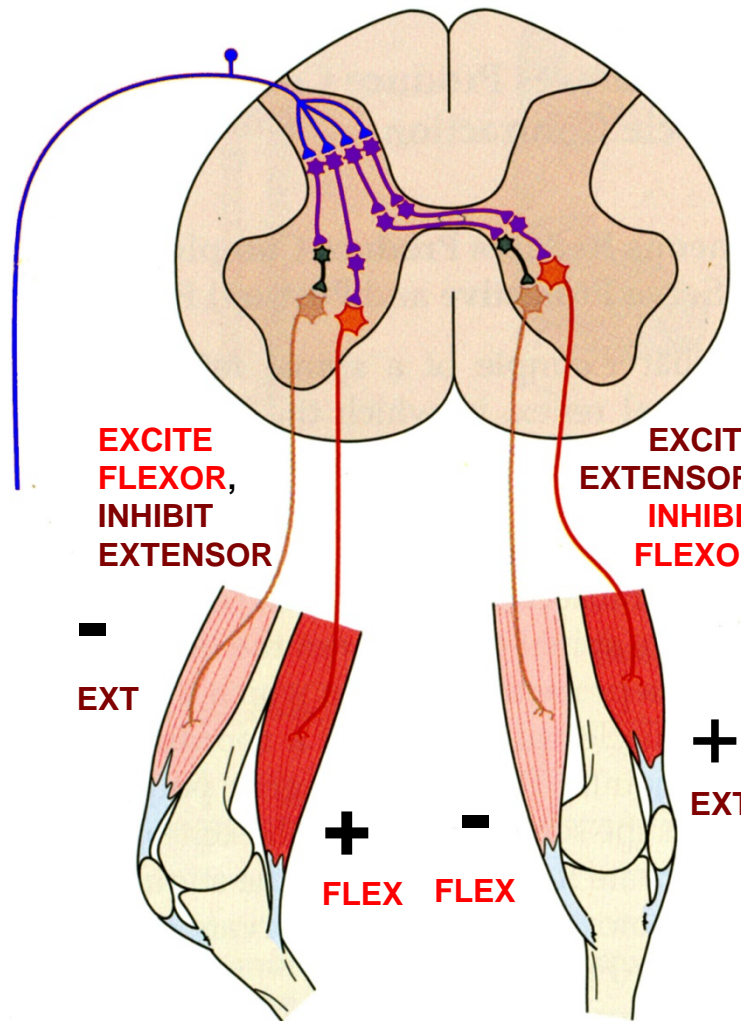


FLEXOR REFLEX: OTHER EFFECTS ALL ARE POLYSYNPAPTIC BY INTERNEURONS

1) Excite synergist muscles - **excite other flexors in same leg** (other joints)

2) Inhibit antagonist muscles - **inhibit Extensors in same leg**

3) **CROSSED EXTENSION REFLEX - EXCITE EXTENSORS AND INHIBIT FLEXORS IN OPPOSITE LEG**

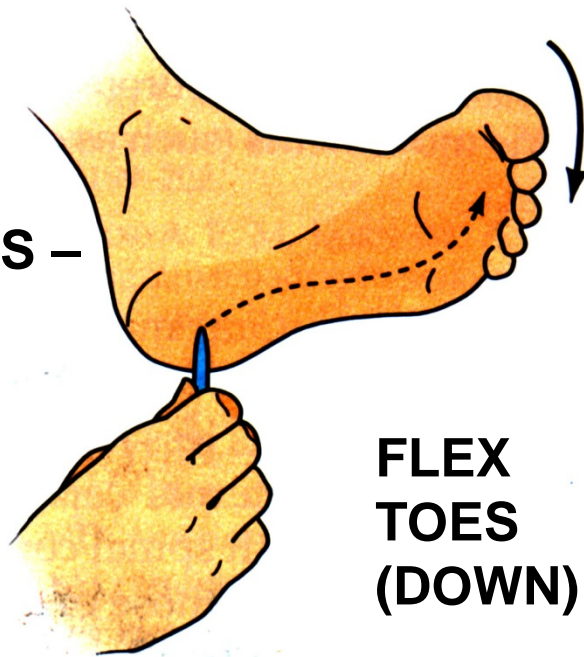


FUNCTION: OTHER LEG PROVIDES SUPPORT WHEN FIRST LEG IS LIFTED

FLEXOR REFLEXES CAN CHANGE AFTER LESIONS, DISEASE PROCESSES

NORMAL RESPONSE

**STIMULUS –
TO SKIN
OF SOLE
OF FOOT**



**FLEX
TOES
(DOWN)**

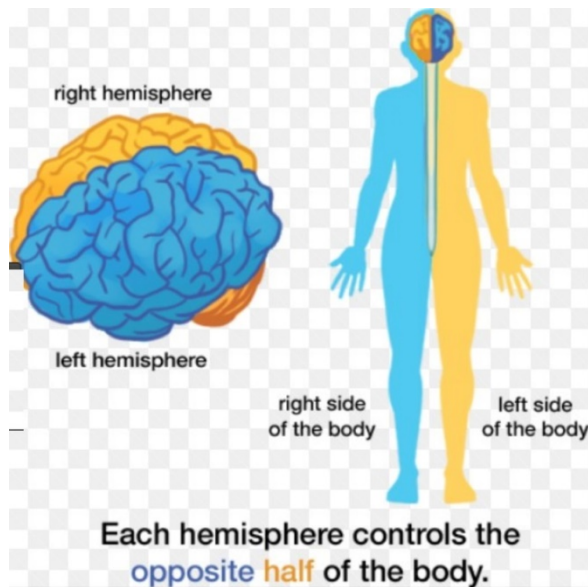
**BABINSKI SIGN –
(EXTENSOR PLANTAR
RESPONSE)**



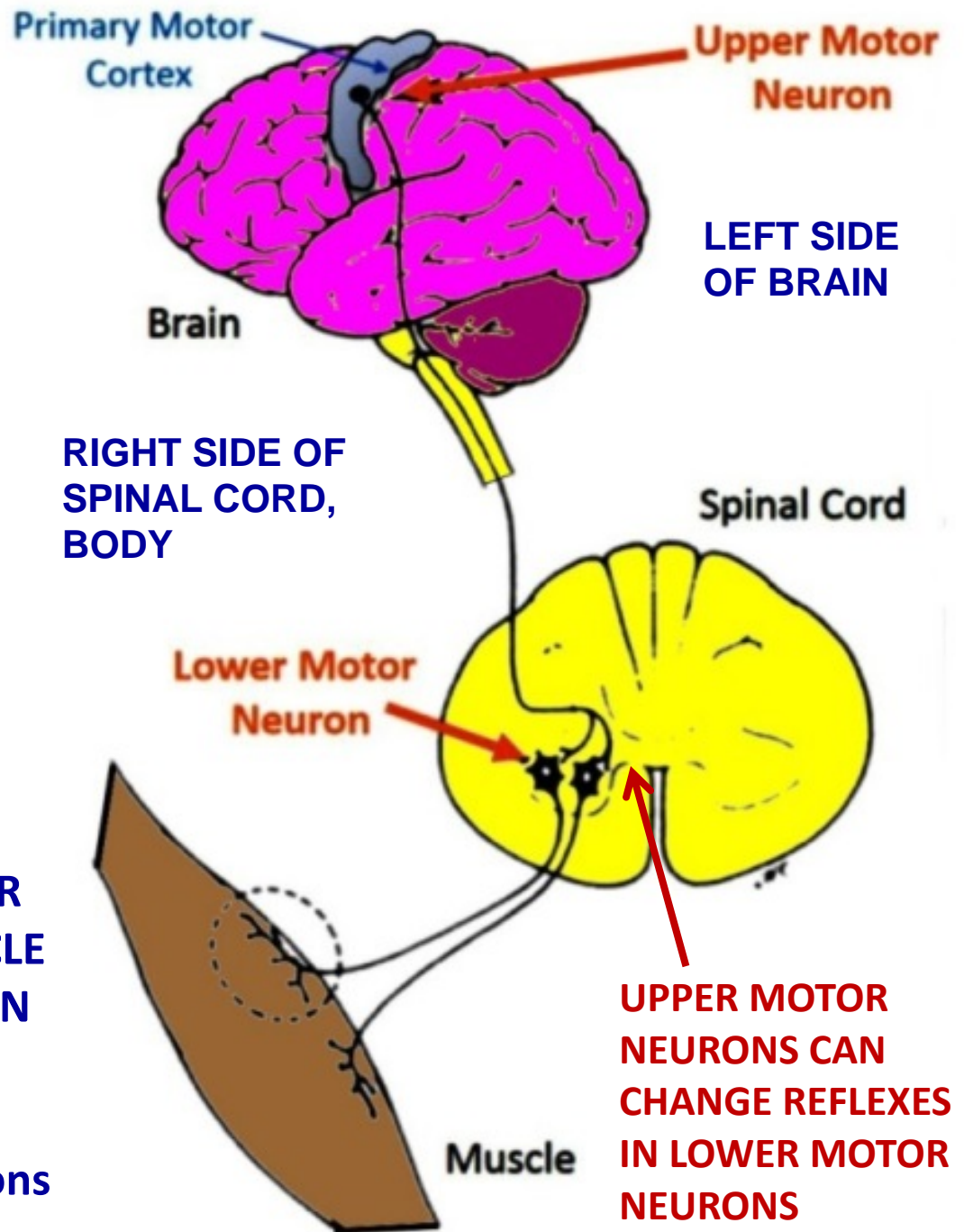
**EXTEND BIG
TOE, FANNING
(ABDUCTION)
OF OTHER
TOES**

Babinski sign - seen after **Upper Motor neuron lesion**
-direction of movement **changes from flexing toes to
extending and fanning (abducting) toes**

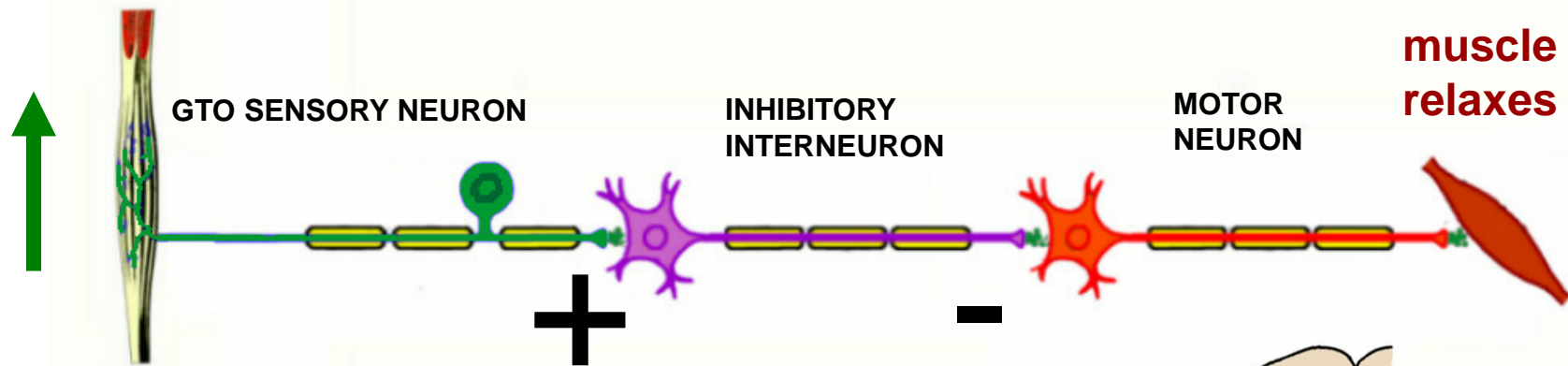
UPPER VS LOWER MOTOR NEURON



LOWER MOTOR NEURON = MOTOR NEURON THAT INNERVATES MUSCLE
UPPER MOTOR NEURON – NEURON IN CNS THAT CAN ACTIVATE OR INFLUENCE LOWER MOTOR NEURONS (ex. Corticospinal neurons in brain)



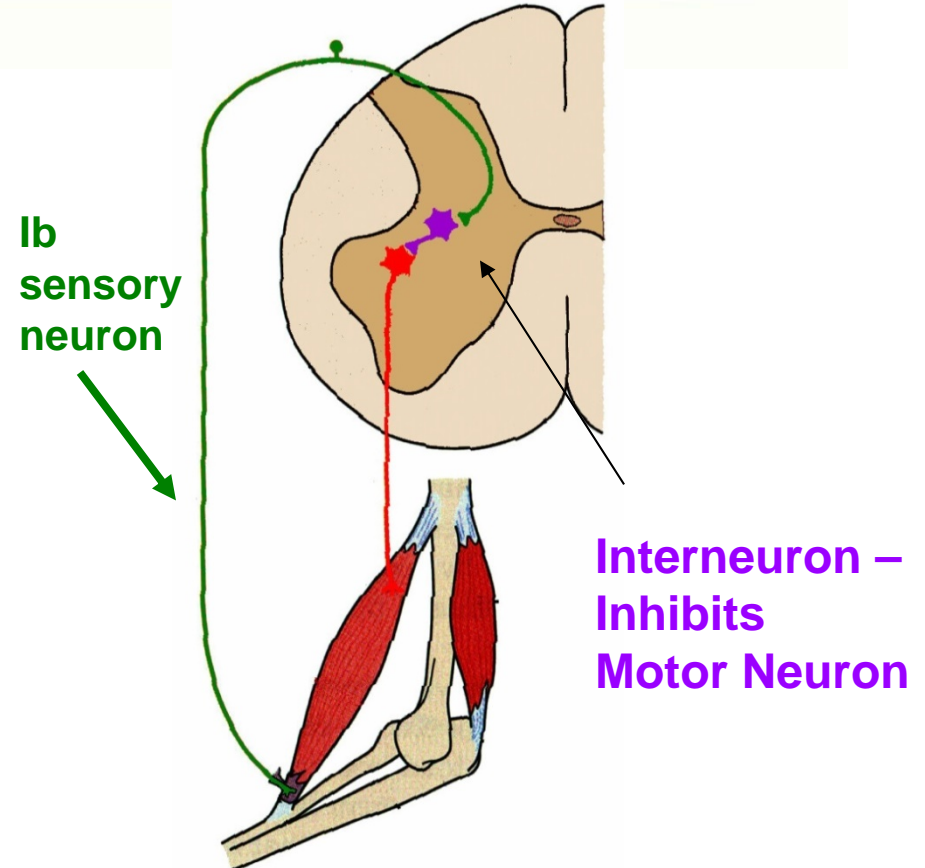
AUTOGENIC INHIBITION REFLEX: GOLGI TENDON ORGANS



PRIMARY RESPONSE
Synapses - polysynaptic

- 1) Ib sensory neuron (GTO) makes excitatory synapse onto interneuron
- 2) Interneuron makes inhibitory synapse onto motor neuron; Motor neuron decreases firing

Function of Autogenic inhibition -
Regulating muscle tensions
(protective, prevent damage to tendon)

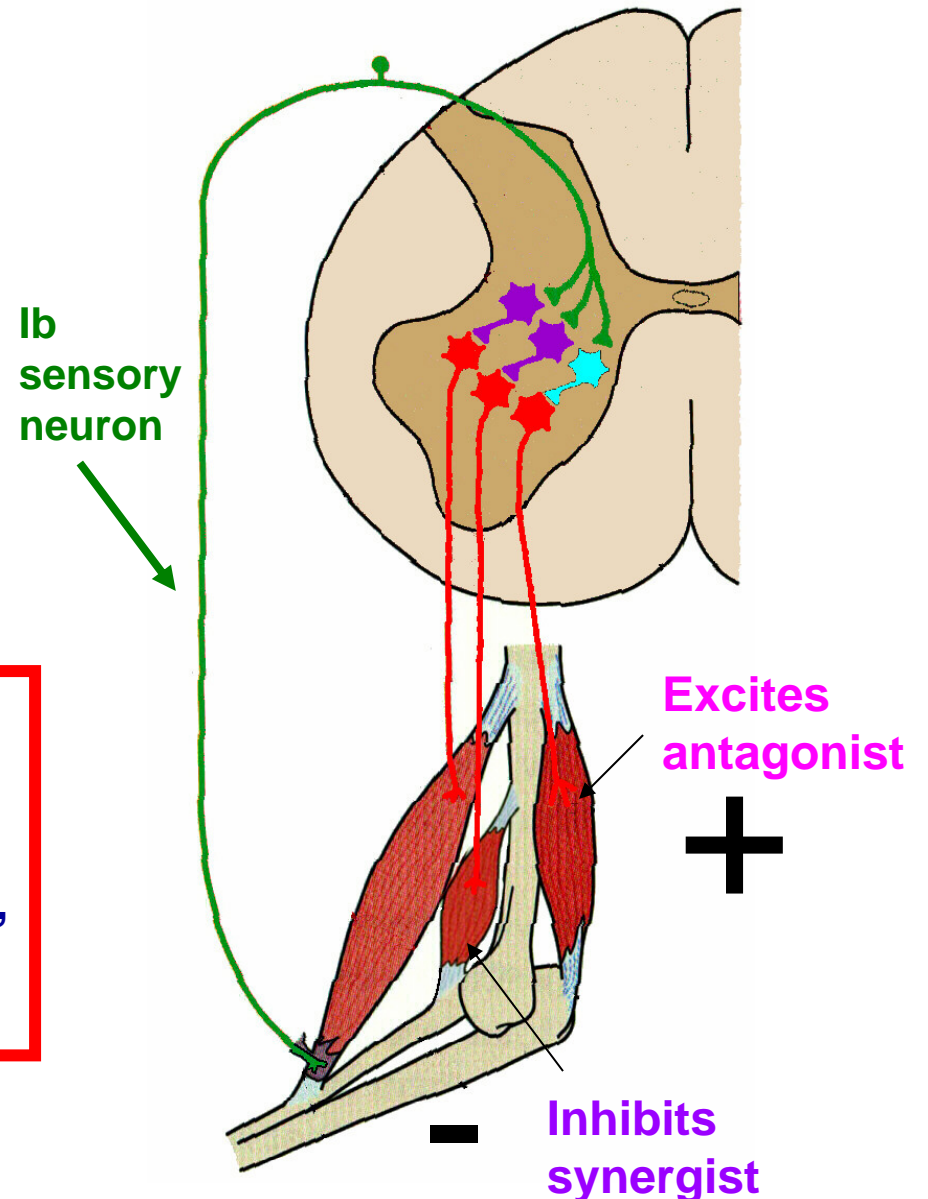


AUTOGENIC INHIBITION

Other effects

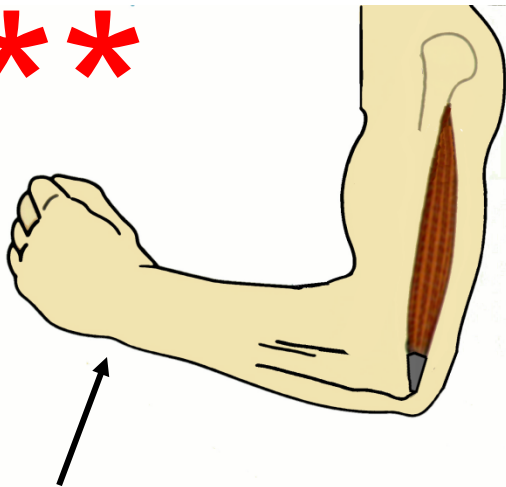
- a. Inhibit synergist muscles
- b. Excites antagonist muscles -

CLASPED KNIFE REFLEX: in Upper motor neuron lesions, tonus increases, resistance to stretch increases; if sufficient force is applied, limb resistance suddenly decreases (like pocket knife snapping shut)

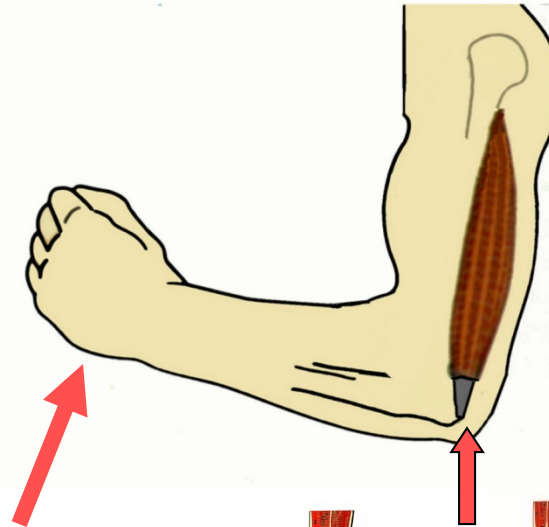


CLASPED KNIFE REFLEX: is an example of Autogenic inhibition. It is elicited in patients with UMN lesions due to high tonus in muscle.

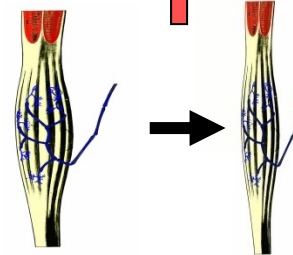
1) PHYSICIAN TRIES TO FLEX ELBOW JOINT OF PATIENT WITH UPPER MOTOR NEURON LESION



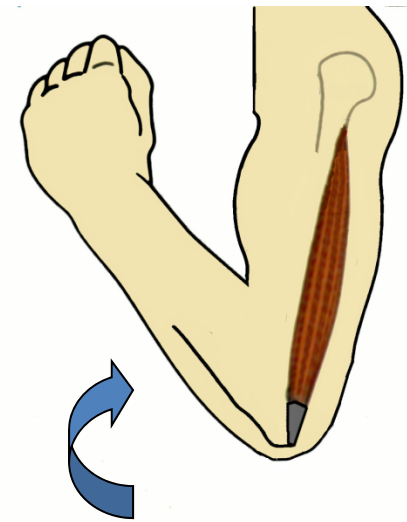
2) KEEP TRYING AND TENSION ON TRICEPS TENDON EXCITES GOLGI TENDON ORGANS



HIGH IMPOSED FORCE EXCITES GOLGI TENDON ORGANS IN TRICEPS TENDON WHICH INHIBITS MOTOR NEURONS TO TRICEPS MUSCLE



3) TRICEPS RELAXES AND RESISTANCE SUDDENLY DECREASES: ELBOW JOINT FLEXES



ELBOW JOINT SNAPS SHUT LIKE A POCKET KNIFE = CLASPED KNIFE REFLEX

REFLEXES OF CRANIAL NERVES

REFLEXES OF CRANIAL NERVES

REFLEX	STIMULUS	SENSORY	RESPONSE	CLINICAL
Pupillary Light Reflex (II to III)	Test: Shine light in eye	Light detected by Optic Nerve	Excite Constrictor of pupil of eye (III Short Ciliary nerves (Ciliary Ganglion, parasympathetic))	Extensively used to check CN II; Absence of Pupillary Light Reflex can indicate catastrophe (brain herniation)
Corneal Reflex (V to VII)	Touch cornea of eye with cotton	Touch detected by Long Ciliary nerves (V1), Somatic sensory	Close eye (VII to Orbicularis Oculi muscle) Branchiomotor	Absence of Corneal Reflex; Test for damage to V1 sensory, VII motor
Gag Reflex (IX to X)	Test: Touch posterior tongue, oropharynx;	Excites Visceral Sensory endings in Glossopharyngeal N. (IX)	Excite muscles of pharynx, palate; Vagus N. (X), Branchiomotor	Other symptoms of Vagus damage (X); Patient Say's Ahh: soft palate not elevated on ipsilateral side (paralyze Levator Palati); uvula deviated away from side of lesion
Jaw Jerk Reflex Stretch (Deep Tendon) Reflex (V to V)	Test: tap down on mandible; Stretch muscles of mastication (ex. Masseter)	Excites Muscle Spindle sensory neurons in Trigeminal nerve (V)	Contract muscles that elevate mandible Motor - V3	<u>Hyporeflexia</u> - indicates Trigeminal nerve damage

1. PUPILLARY LIGHT REFLEX - II TO III

AFFERENT ARM OF REFLEX

**SENSORY
STIMULUS**

**LIGHT IN
EYE**

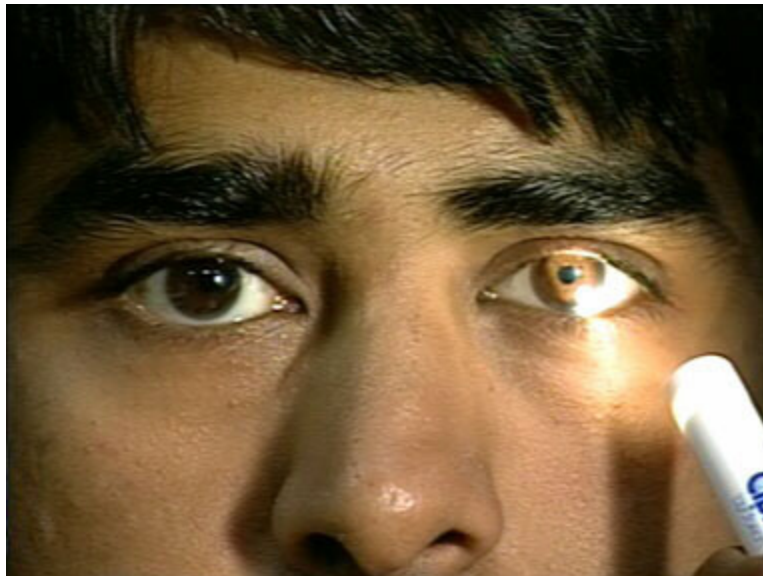


EFFERENT ARM OF REFLEX

**MOTOR
RESPONSE**

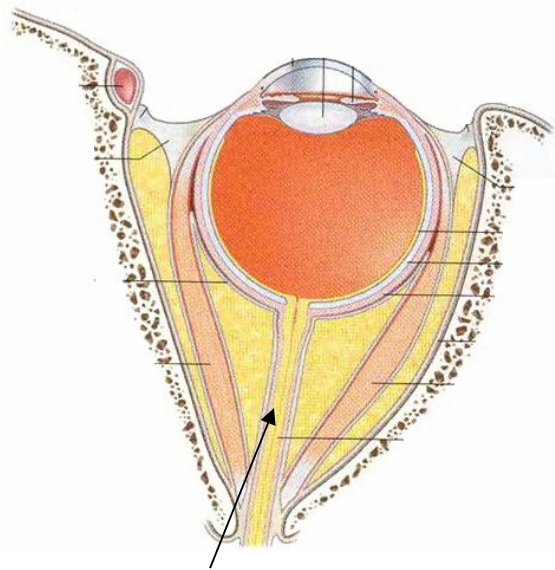
**CONSTRICT
PUPIL**

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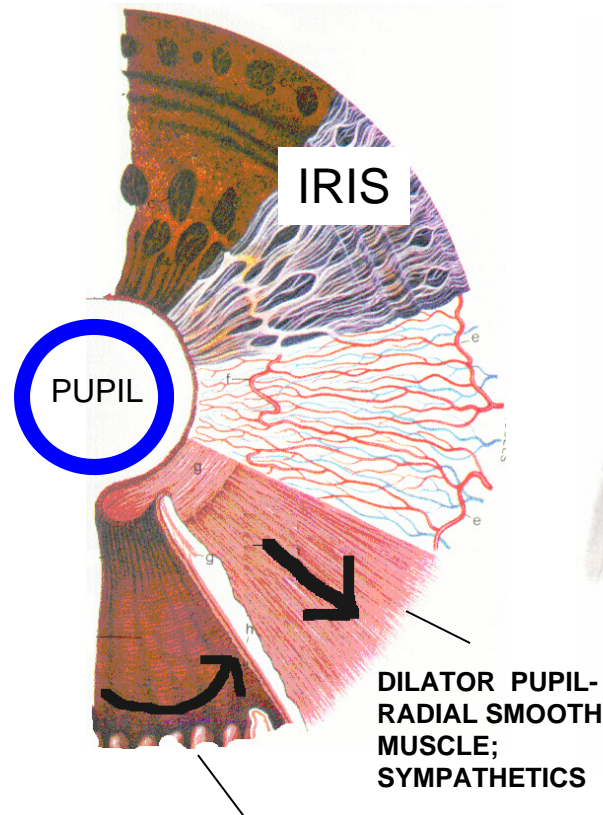
PUPILLARY LIGHT REFLEX

**CN II - OPTIC NERVE -
DETECTS LIGHT**

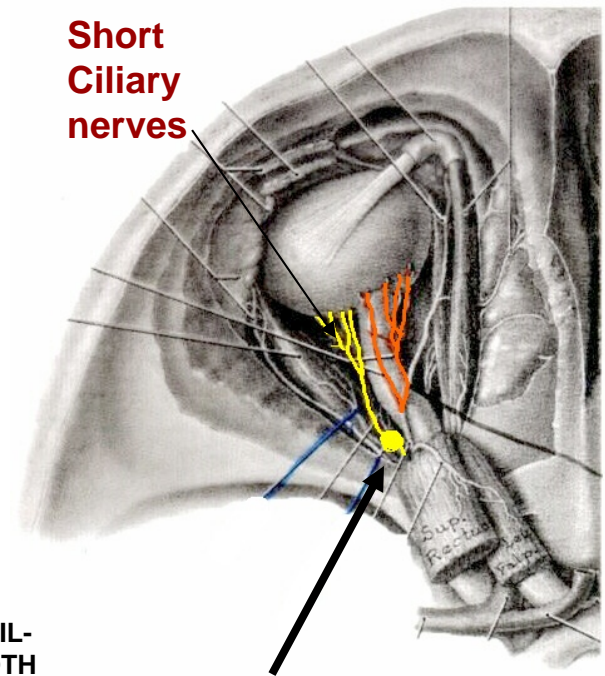


**OPTIC NERVE -
CN II VISION**

**CN III - OCULOMOTOR - parasympathetics
from Ciliary Ganglion in Short Ciliary nerves**



**CONSTRICTOR PUPIL-
CIRCULAR SMOOTH MUSCLE;
PARASYMPATHETICS - CN III**



Ciliary Ganglion of CN III

PUPILLARY LIGHT REFLEX

CN II - OPTIC NERVE - DETECTS LIGHT

CN III - OCULOMOTOR - parasympathetics from Ciliary Ganglion in Short Ciliary nerves

CN III - OCULOMOTOR

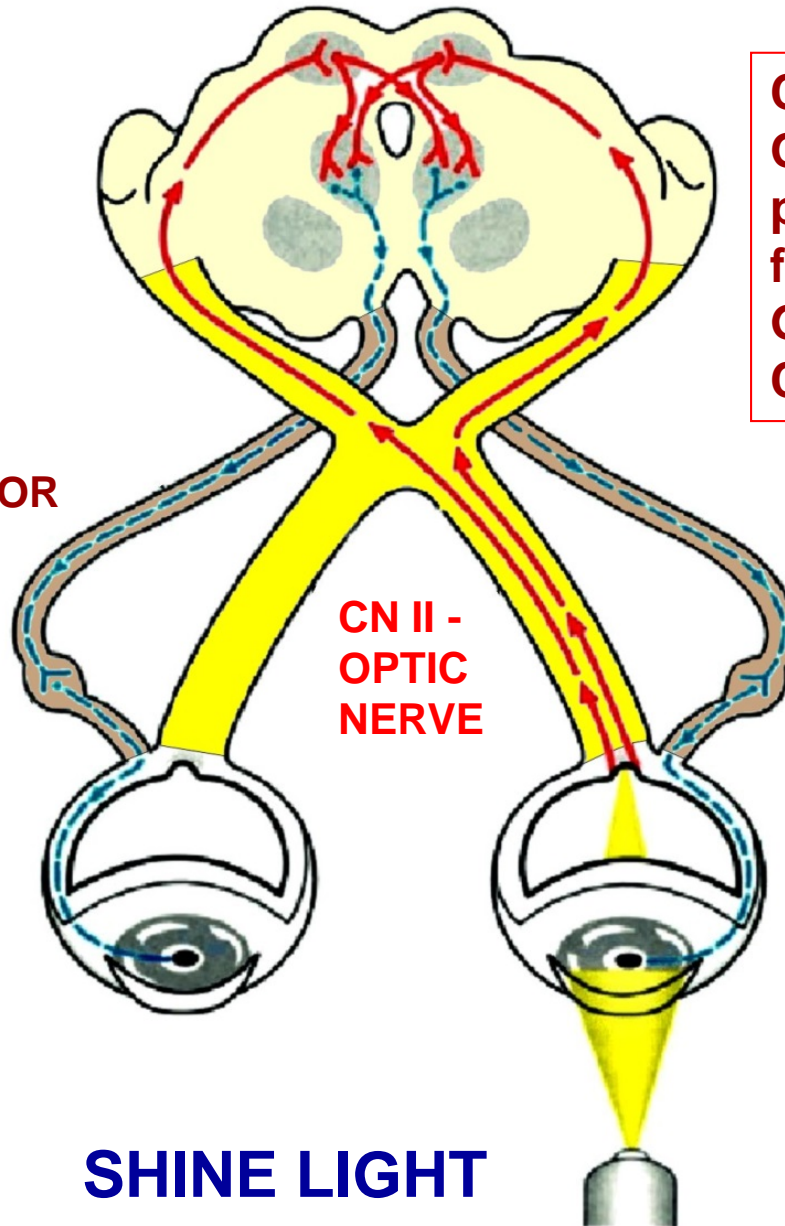
CN III - OCULOMOTOR

CN II - OPTIC NERVE

CONSENSUAL REFLEX – PUPIL CONSTRICTS IN OPPOSITE EYE

DIRECT REFLEX – PUPIL CONSTRICTS IN SAME EYE

SHINE LIGHT



2. CORNEAL REFLEX - V TO VII

AFFERENT ARM OF REFLEX

**SENSORY
STIMULUS**

**TOUCH
CORNEA**

**TRIGEMINAL -
V1 - LONG
CILIARY NERVES
TO CORNEA**



EFFERENT ARM OF REFLEX

**MOTOR
RESPONSE**

**CLOSE
EYELID**

**FACIAL -
VII - MOTOR TO
ORBICULARIS
OCULI (SVE)**

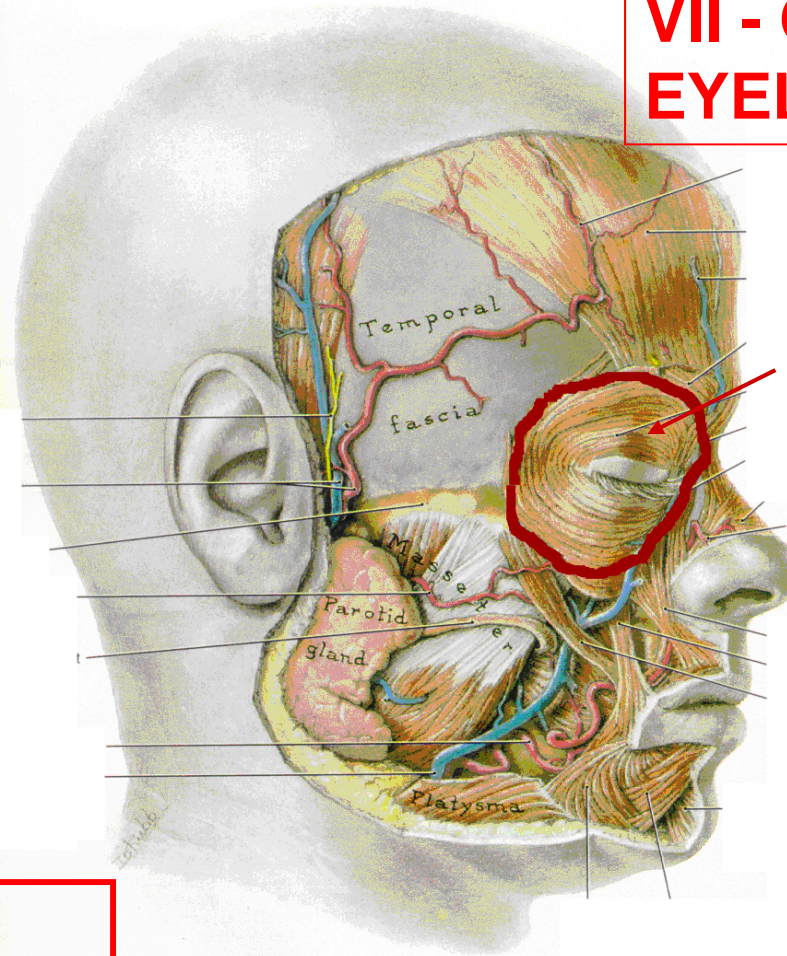
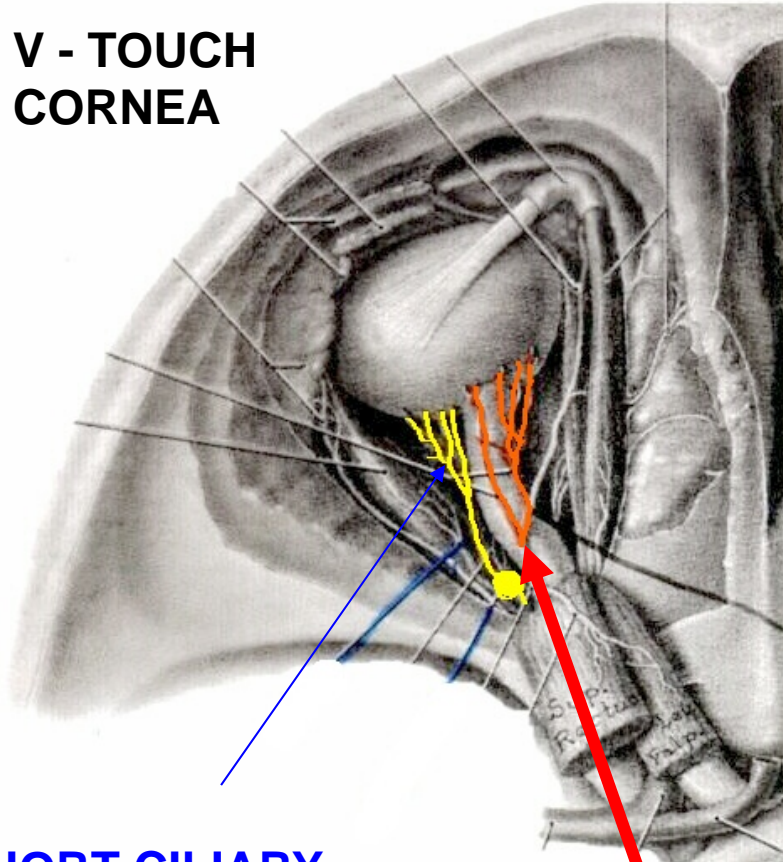


CORNEAL REFLEX - V to VII



VII - CLOSE EYELID

V - TOUCH CORNEA



ORBITALIS OCULI M.

SHORT CILIARY NERVES (III), CILIARY GANGLION PARASYMPATHETIC

LONG CILIARY NERVES (V1) - SOMATIC SENSORY TO CORNEA

- Palpebral part - Close eyelids
 - Orbital part - Buries eyelids, Ex. sandstorm
- BRANCHIOMOTOR - VII**

GAG REFLEX - IX to X

GO OVER NEXT BLOCK

AFFERENT ARM OF REFLEX

EFFERENT ARM OF REFLEX

**SENSORY
STIMULUS**

**MOTOR
RESPONSE**

**TOUCH
ORO-
PHARYNX**



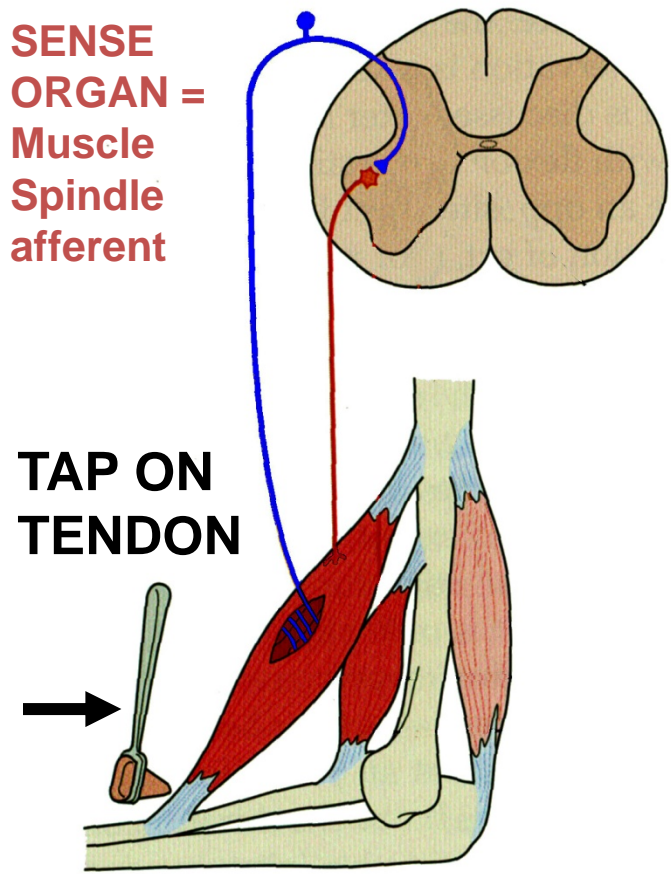
**PATIENT GAGS -
CONTRACT
PHARYNGEAL
MUSCLES**



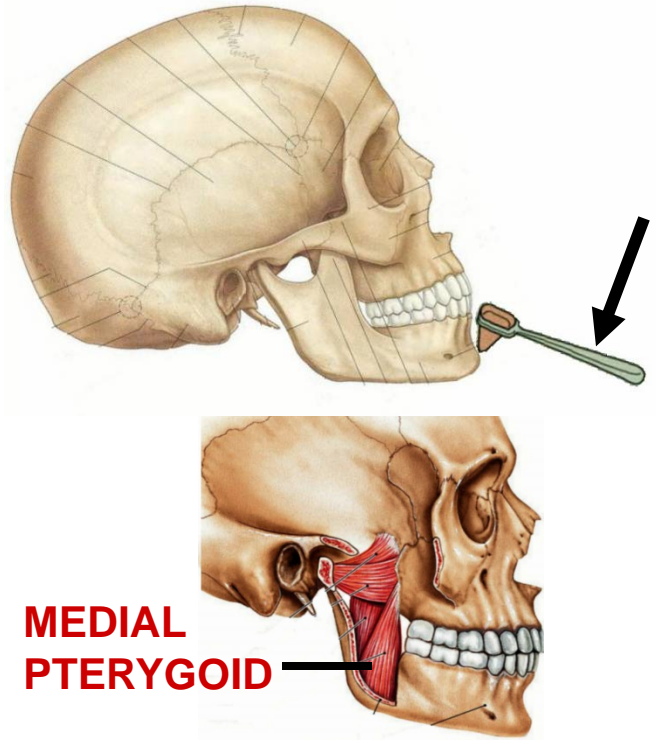
STRETCH REFLEX OF MUSCLES OF MASTICATION - JAW JERK REFLEX - sensory and motor in Trigeminal V3

GO OVER NEXT BLOCK

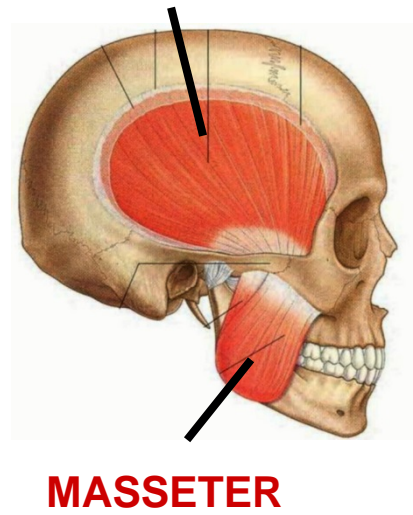
STRETCH REFLEX



TAP DOWN ON CHIN



STRETCH MUSCLES THAT CLOSE MOUTH (ELEVATE MANDIBLE) TEMPORALIS



DISCUSSION SESSION: GROSS ANATOMY

ONN BLOCK

Discuss Nasal Cavity

**Note: Nasal Cavity part 2 will be
discussed later in the ONN block**

NASAL CAVITY

Bones and fractures

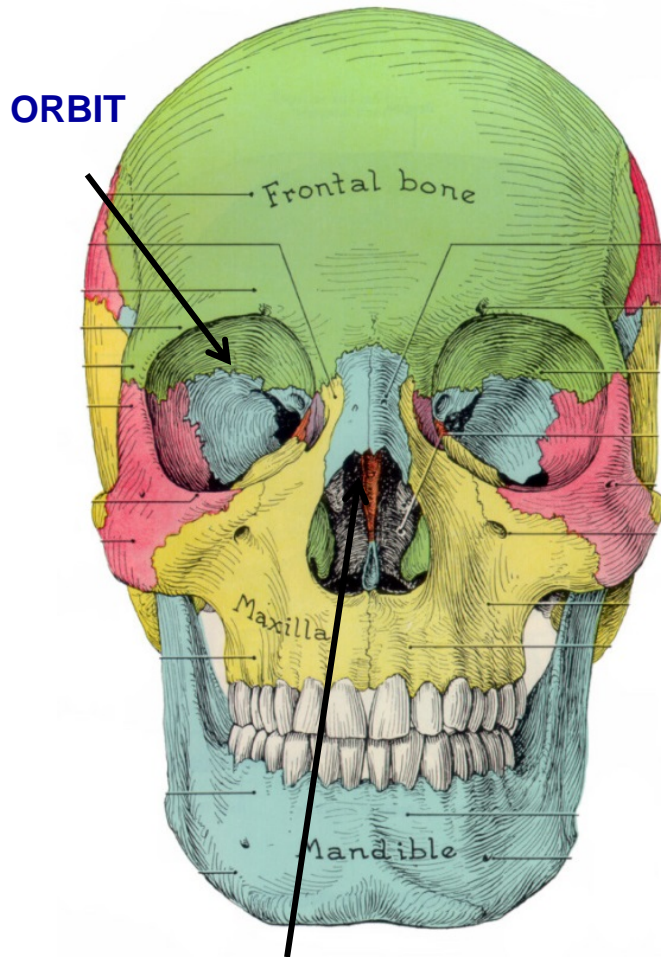
Identification of sinuses CT projections

Nerves in sinuses

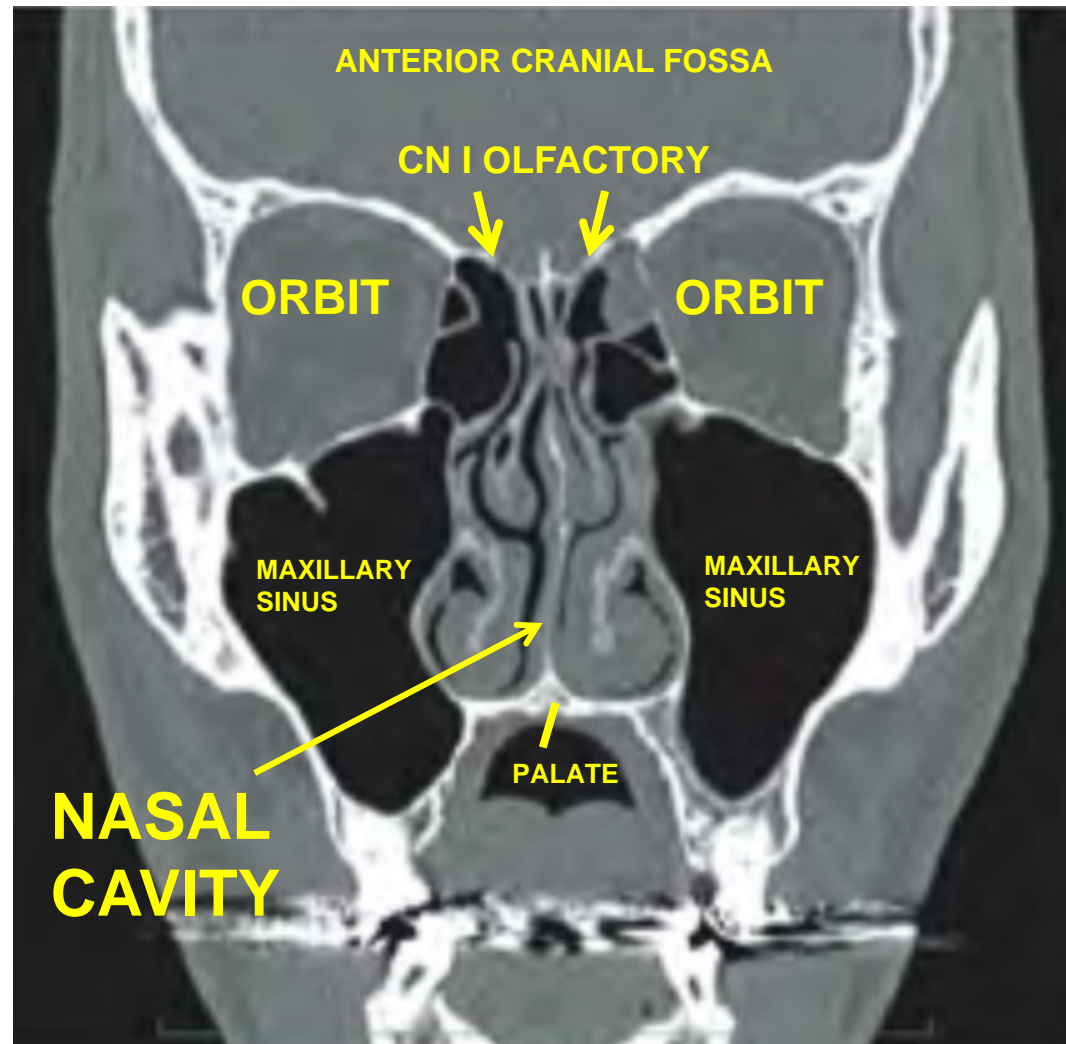
Innervation/Blood Supply to Nasal Cavity

Palatine tonsils (nerves/blood supply)

NASAL CAVITY – STRUCTURE COMPLEX – AIR SINUSES OPEN TO NASAL CAVITY, NERVES , ARTERIES FROM DIVERSE SOURCES (EX. ORBIT, CRANIAL CAVITY (ANTERIOR CRANIAL FOSSA))



NASAL CAVITY



CT – bones are white; air is black

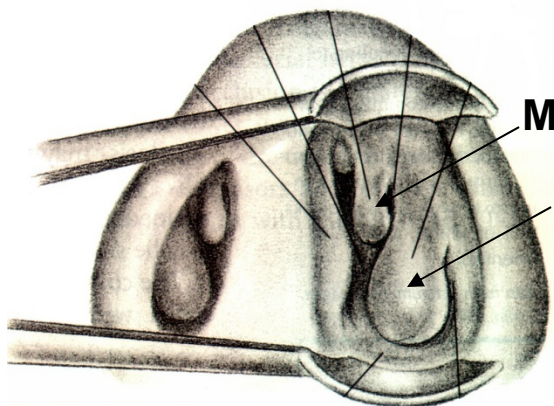
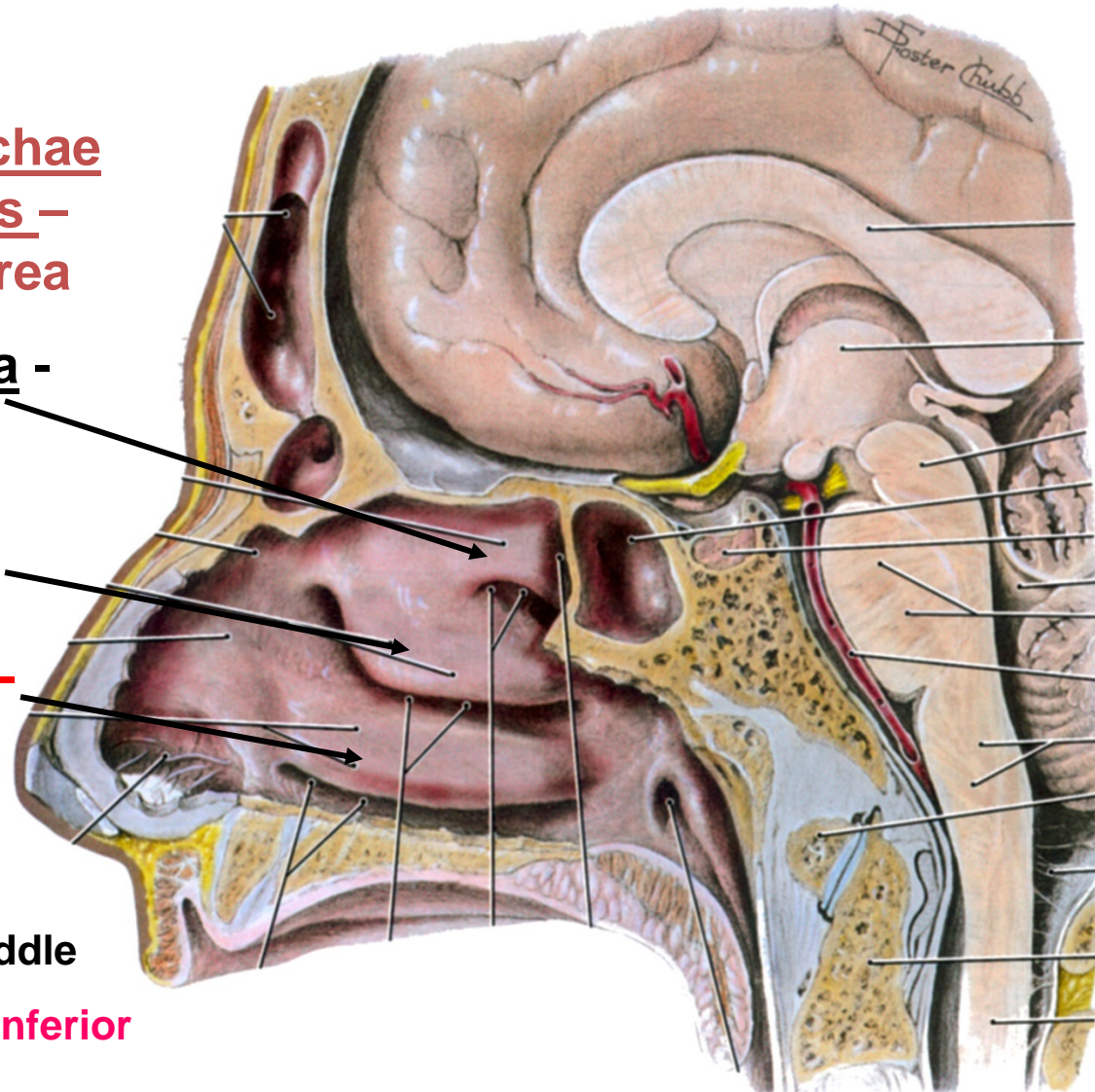
LATERAL WALL OF NASAL CAVITY

Projections = Conchae (shell) or turbinates – increase surface area

1) Superior Concha - Ethmoid

2) Middle Concha - Ethmoid

3) Inferior Concha - separate bone



In nasal speculum view,
See only Middle and Inferior Conchae (Turbinates)

PRACTICE QUESTION CLINICAL VIGNETTE

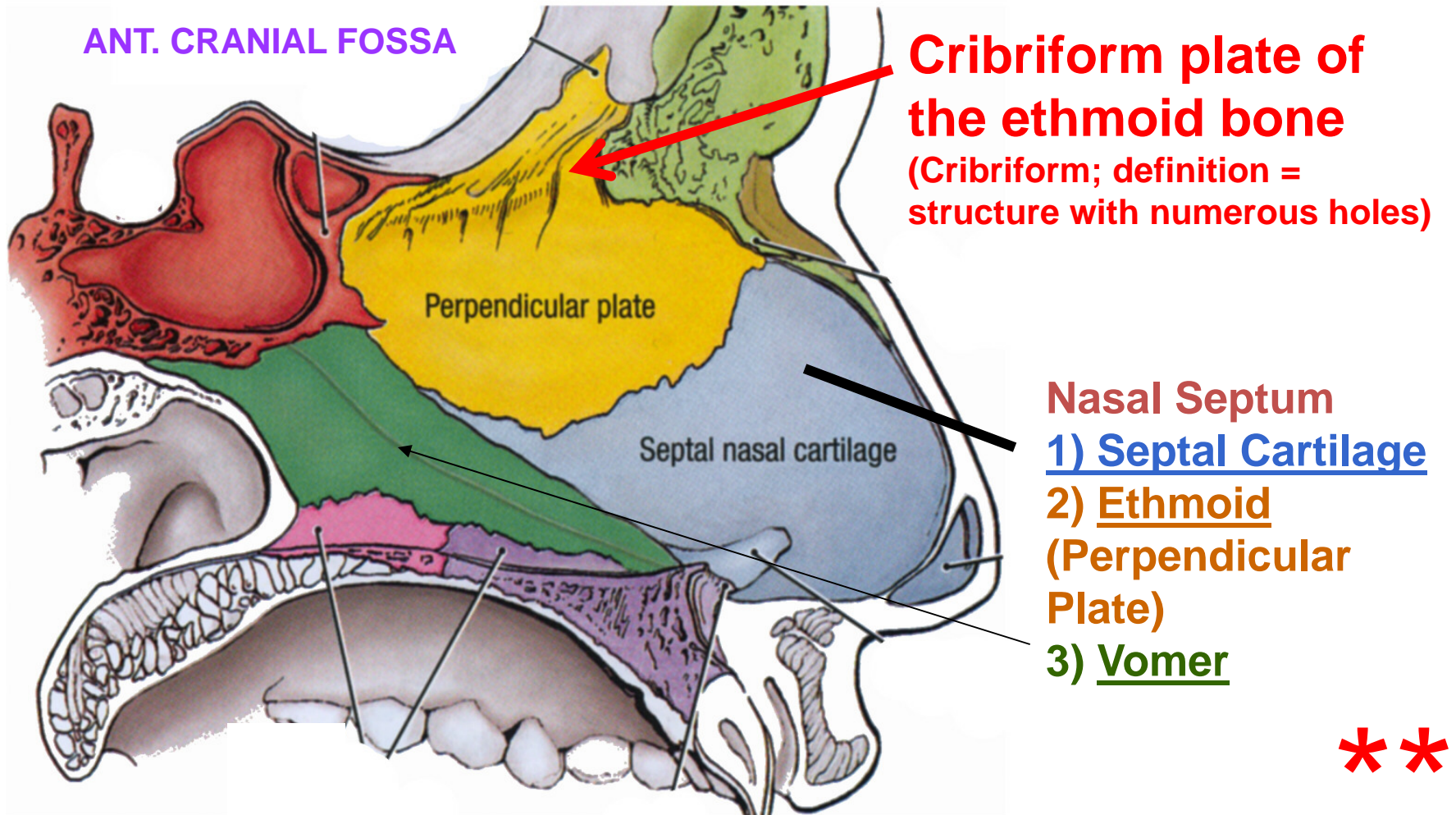


A 19 year old suffers a violent blow to the nose during a fist fight. Over the following week, the person notices that **a clear fluid persists in dripping from the nose** and goes to the local hospital emergency room. The physician orders a CT scan and finds a defect (arrow in image) in the floor of anterior cranial fossa. This **defect is likely a fracture of which of the following bones?**

- A. Maxillary bone
- B. Vomer
- C. Horizontal process of the frontal bone
- D. Greater wing of the sphenoid bone
- E. Cribriform plate of the ethmoid bone

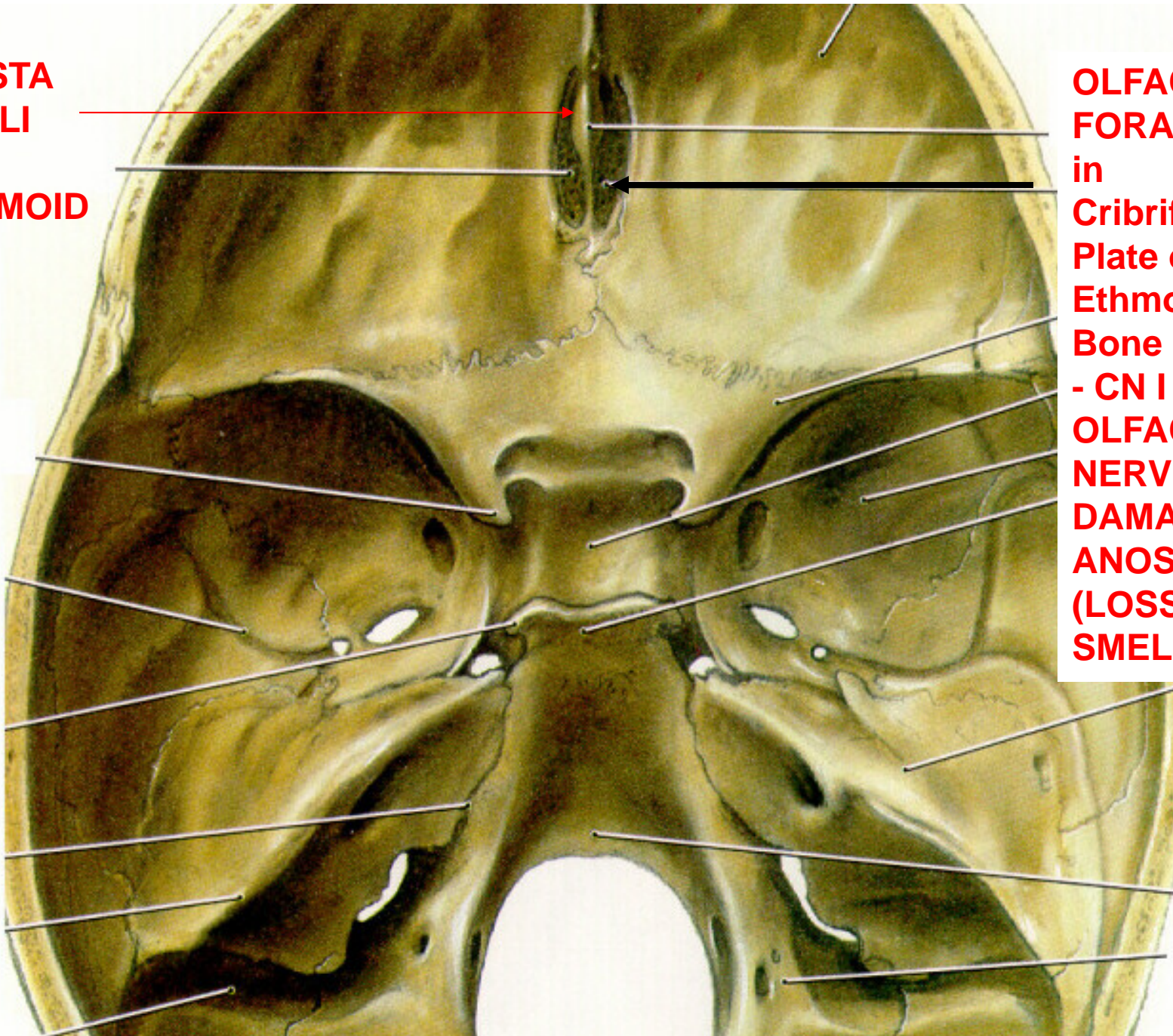
WHAT IS THE CLEAR FLUID?

MEDIAL WALL OF NASAL CAVITY = NASAL SEPTUM



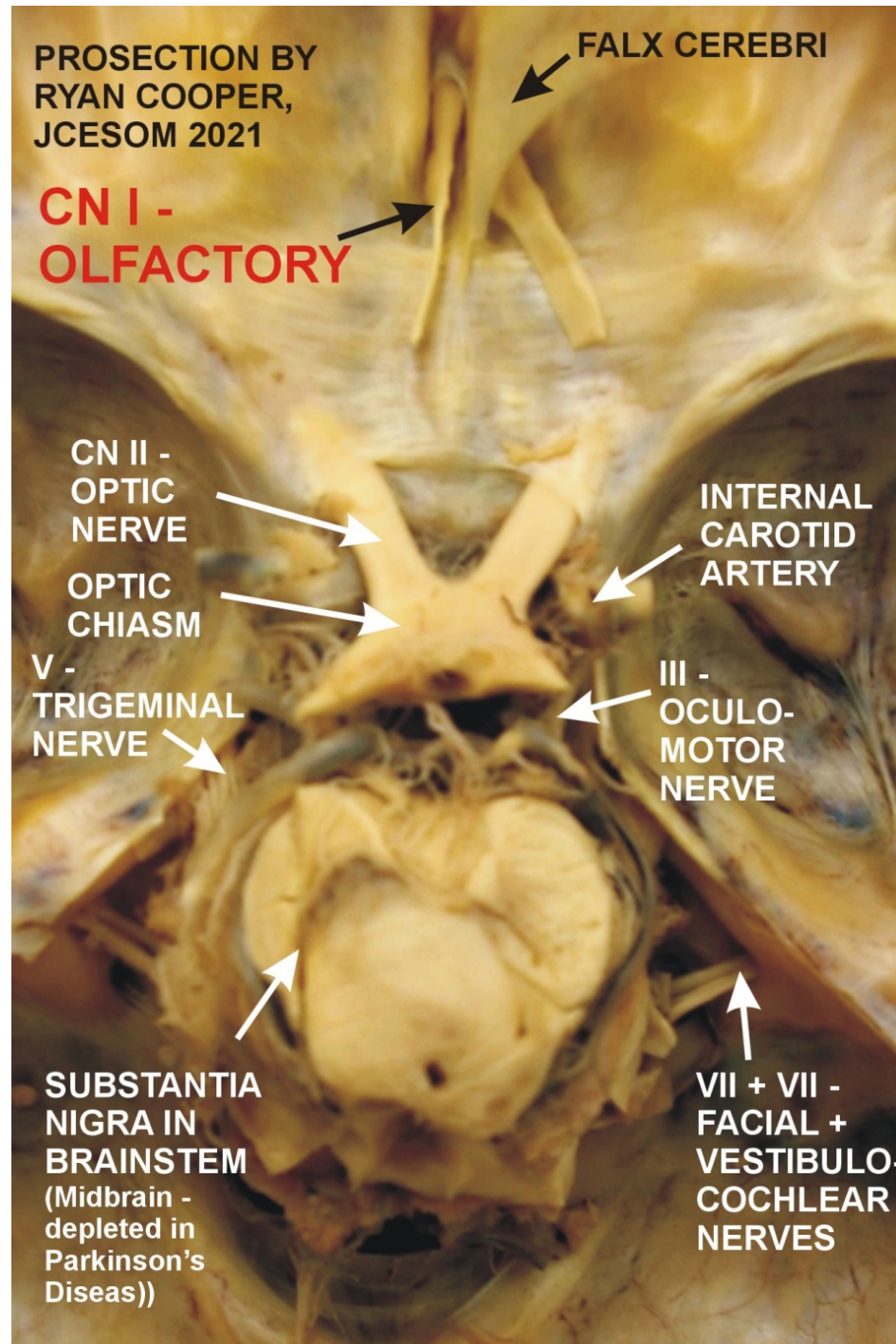
CLINICAL – Fracture of nose can break Cribriform plate, floor of Ant. Cranial fossa - **leak CSF from nose**; can result in Meningitis

**CRISTA
GALLI
OF
ETHMOID**



**OLFACTORY
FORAMINA –
in
Cribriform
Plate of
Ethmoid
Bone
- CN I
OLFACTORY
NERVE
DAMAGE -
ANOSMIA
(LOSS OF
SMELL)**

PROSECTIONS 77 - BRAINSTEM IN CRANIAL CAVITY



NERVES of NASAL CAVITY

Nerves

1. Olfactory N. - SMELL

Olfactory Area

2. General Sensation -

**ALL SOMATIC
SENSORY** touch,
pain, etc.

V1 + V2 *

- V1 Anterior Ethmoidal
N.

- V2 Nasal Branches

- V2 Nasopalatine N.

3. Mucous Glands of

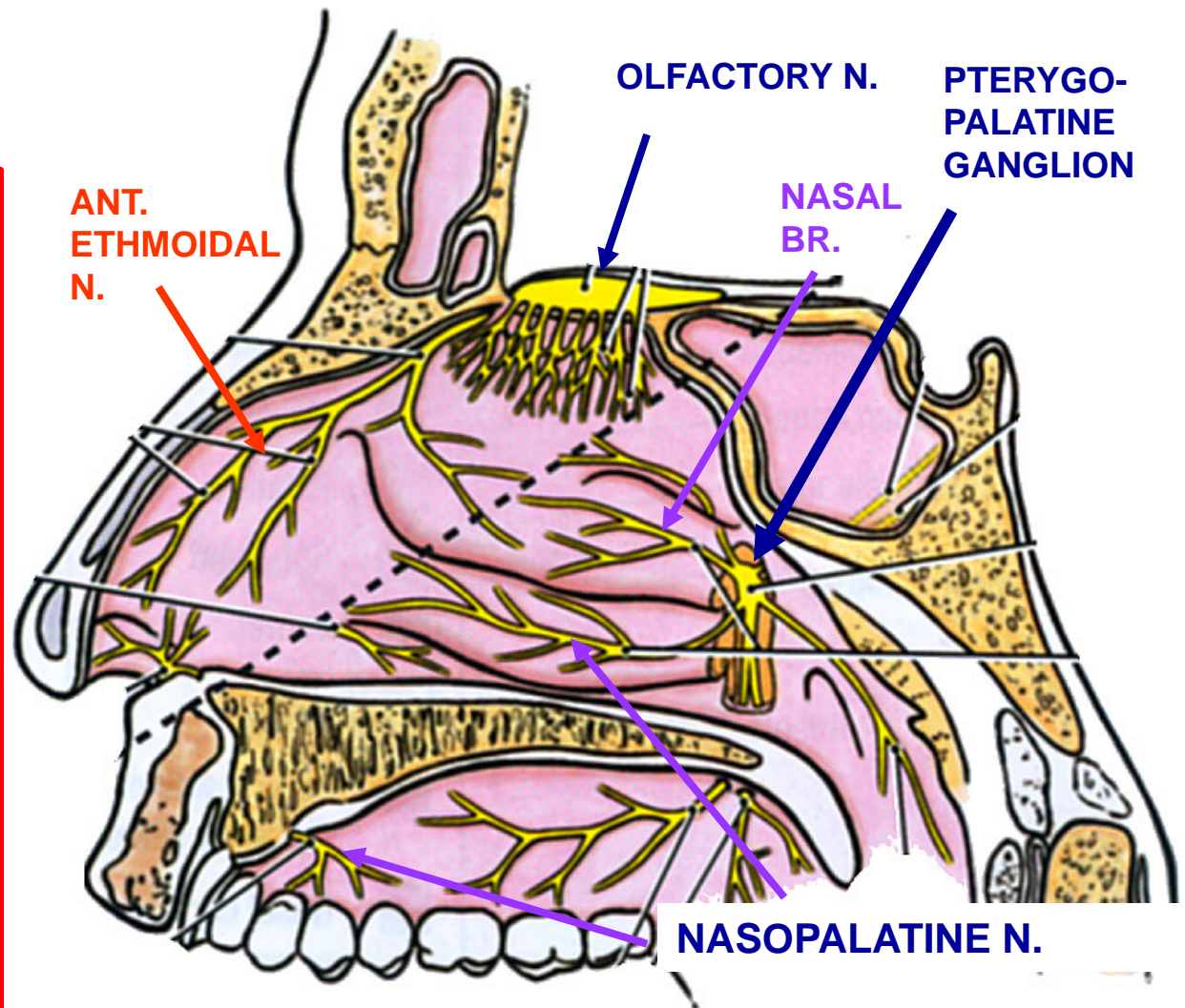
nose - VISCERAL

MOTOR PARASYMP. -

VII - Facial N. by

Pterygopalatine

Ganglion *



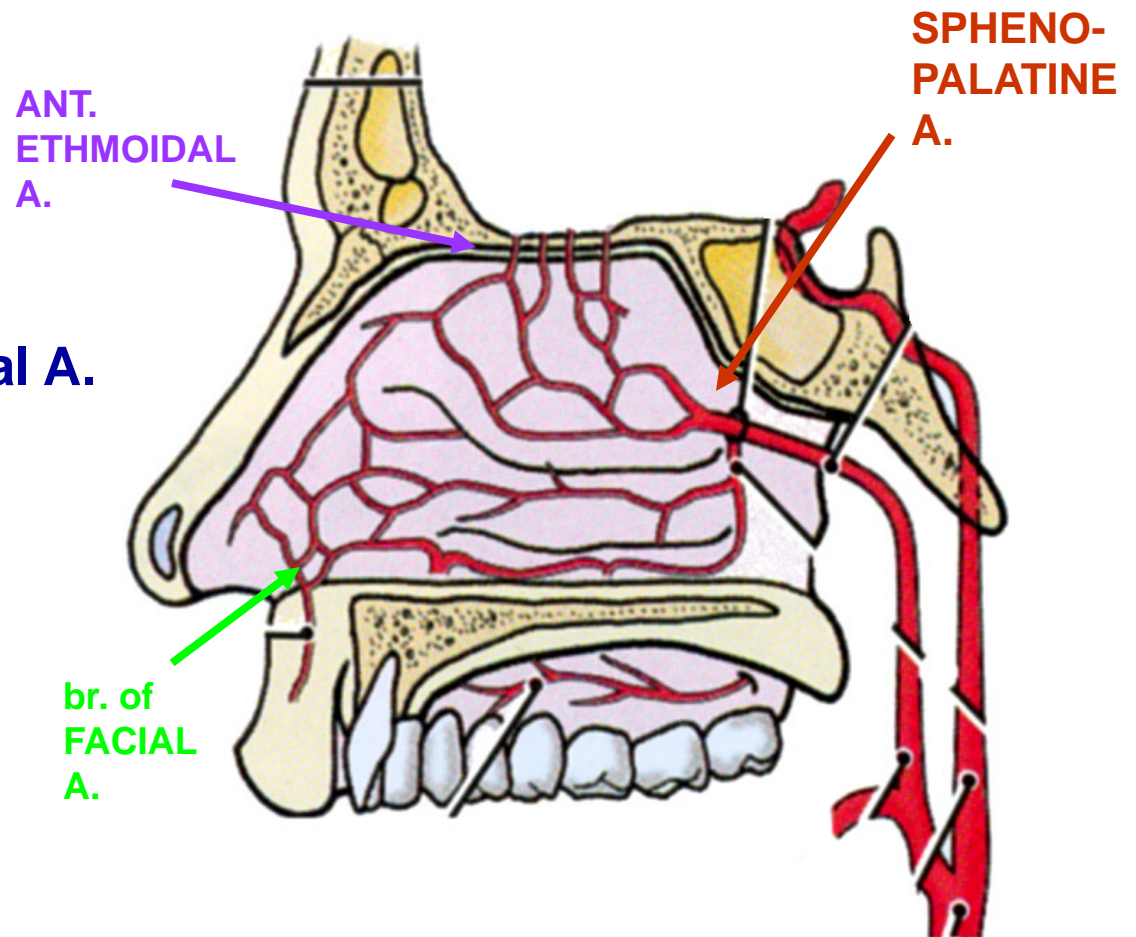
ARTERIES/VEINS OF NASAL CAVITY

1. Arteries

- a. Sphenopalatine Artery
- from Maxillary A.
- b. Ant. and Post Ethmoidal A.
- from Ophthalmic A.
- c. Branches of Facial A.

2. Veins

- a. Ethmoidal vein
drain to Ophthalmic v.
- b. Other branches to
Pterygoid Venous Plexus
- c. Facial Vein



Note: Epistaxis (nosebleed) can be extensive due to Anastomoses – Spurting if arterial

PARANASAL AIR SINUSES

VIEW: FLOOR OF
ANT. CRAN. FOSSA
WITH BONE
REMOVED

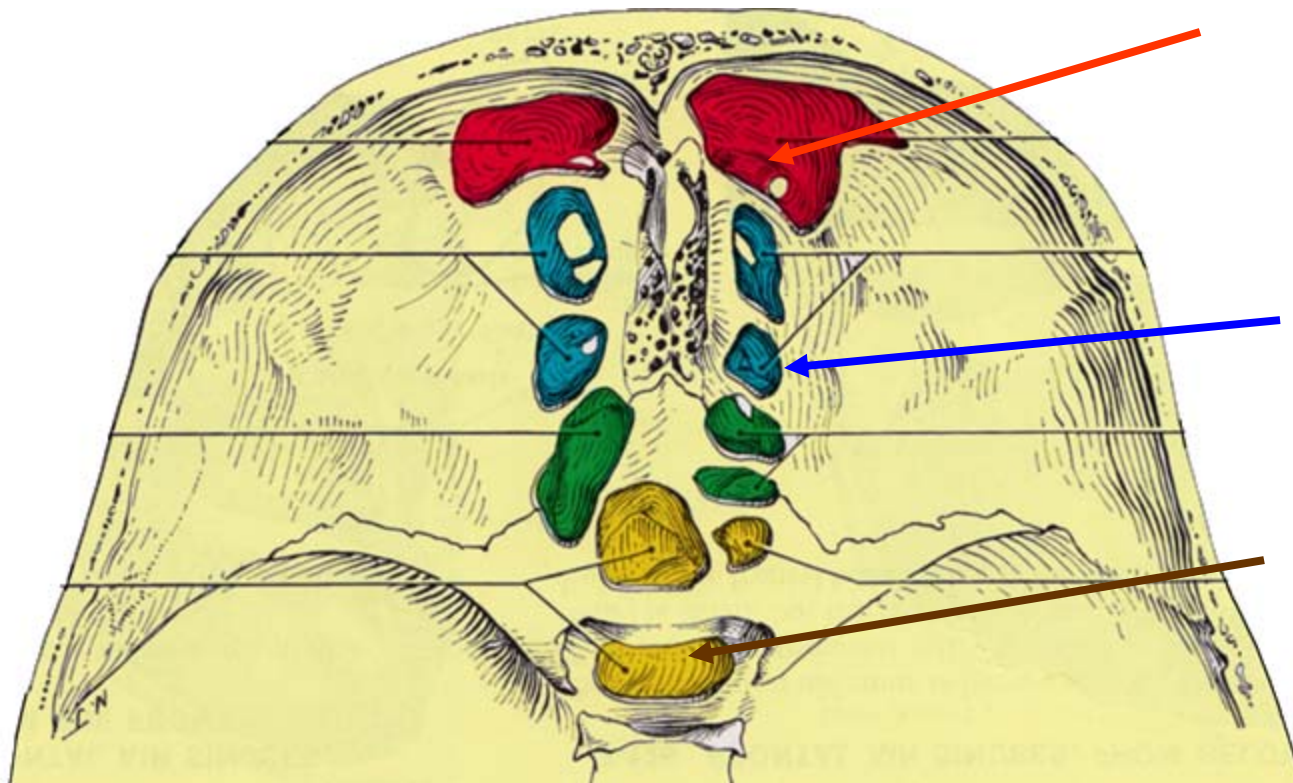
All usually paired

NOSE

A. Frontal - separate
by septum, variable
size

C. Ethmoid- also
called air cells (Ant.,
Mid., Post.)

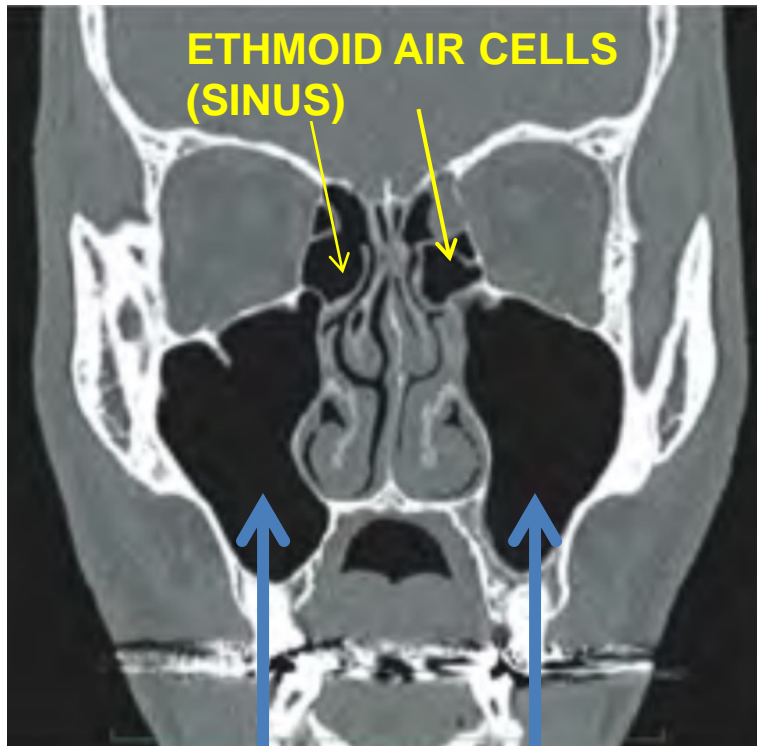
B. Sphenoid - in
body of Sphenoid
bone



Ethmoid - Blocked Sinus Infection Can Spread to Orbit

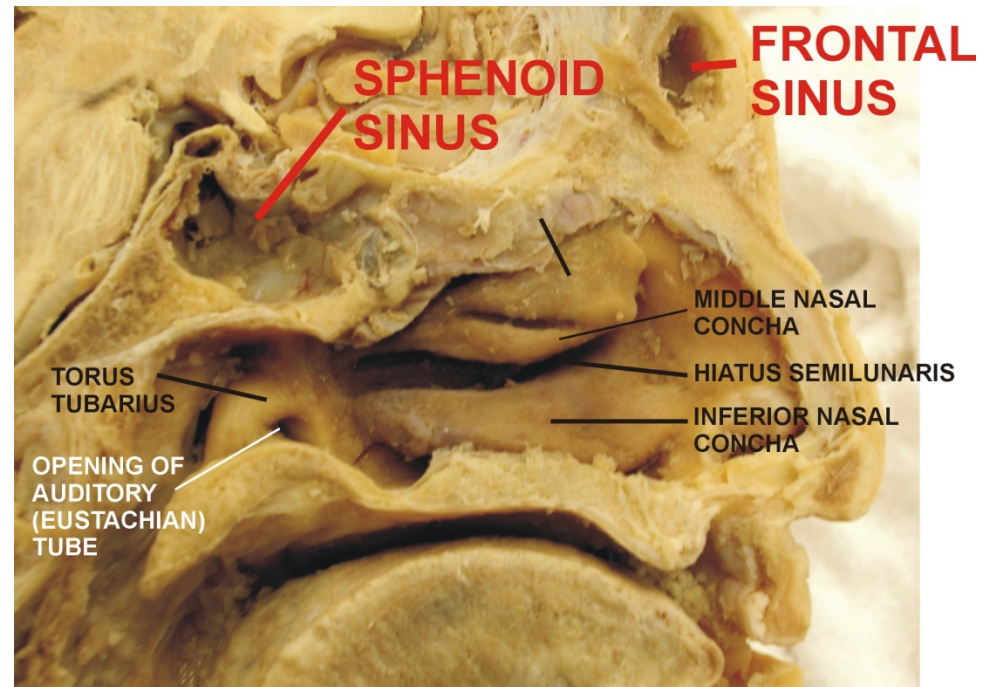
SINUSES ON CT AND PROSECTION PICTURES

CT IN CORONAL PLANE

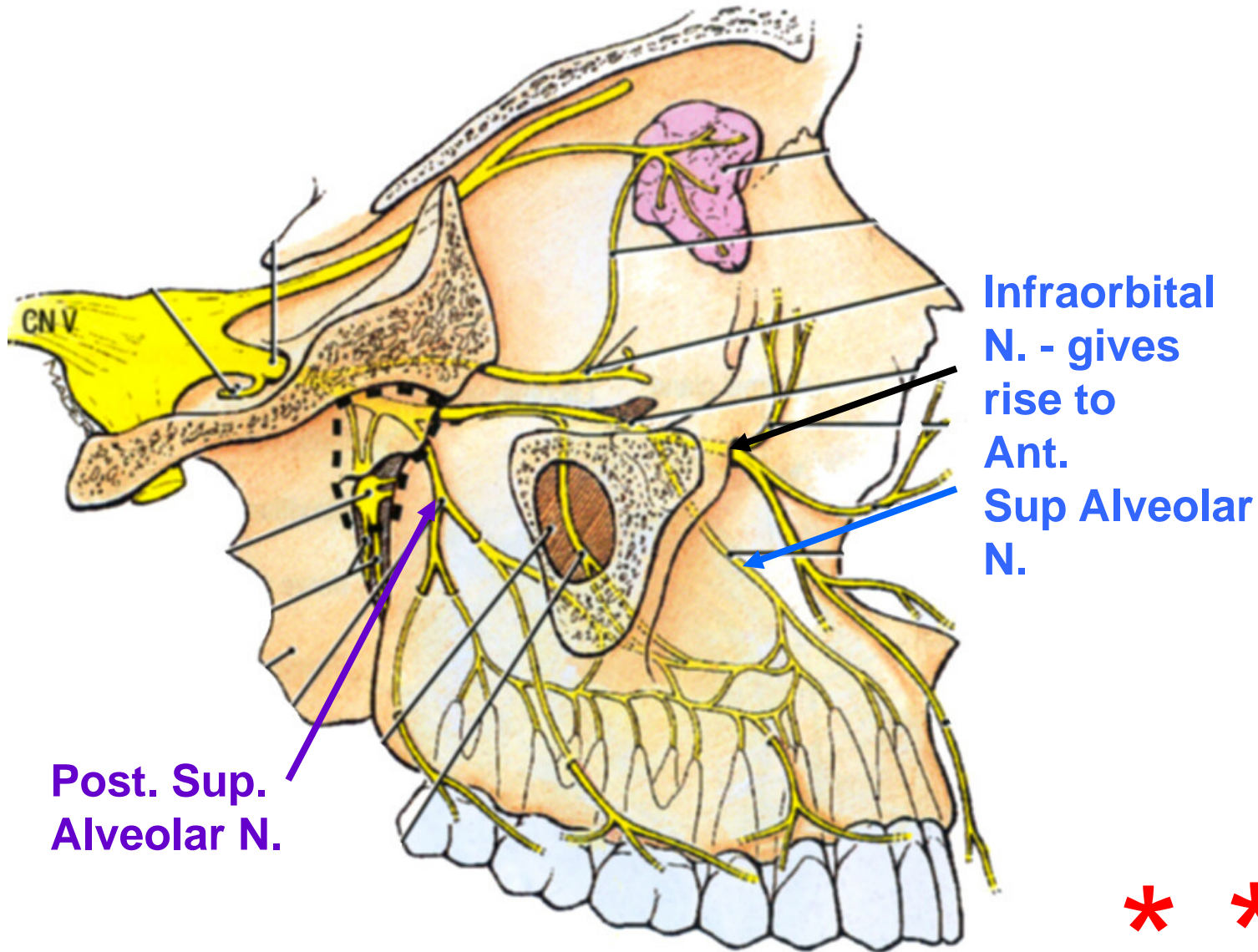


MAXILLARY SINUS

PROSECTION 75 – NASAL CAVITY



PARANASAL AIR SINUSES: NERVES



V2 - Ant. & Post. Sup. Alveolar N. supply Max Sinus & Teeth;
(Infected MAXILLARY sinus can feel like a tooth ache)

PRACTICE QUESTION CLINICAL VIGNETTE

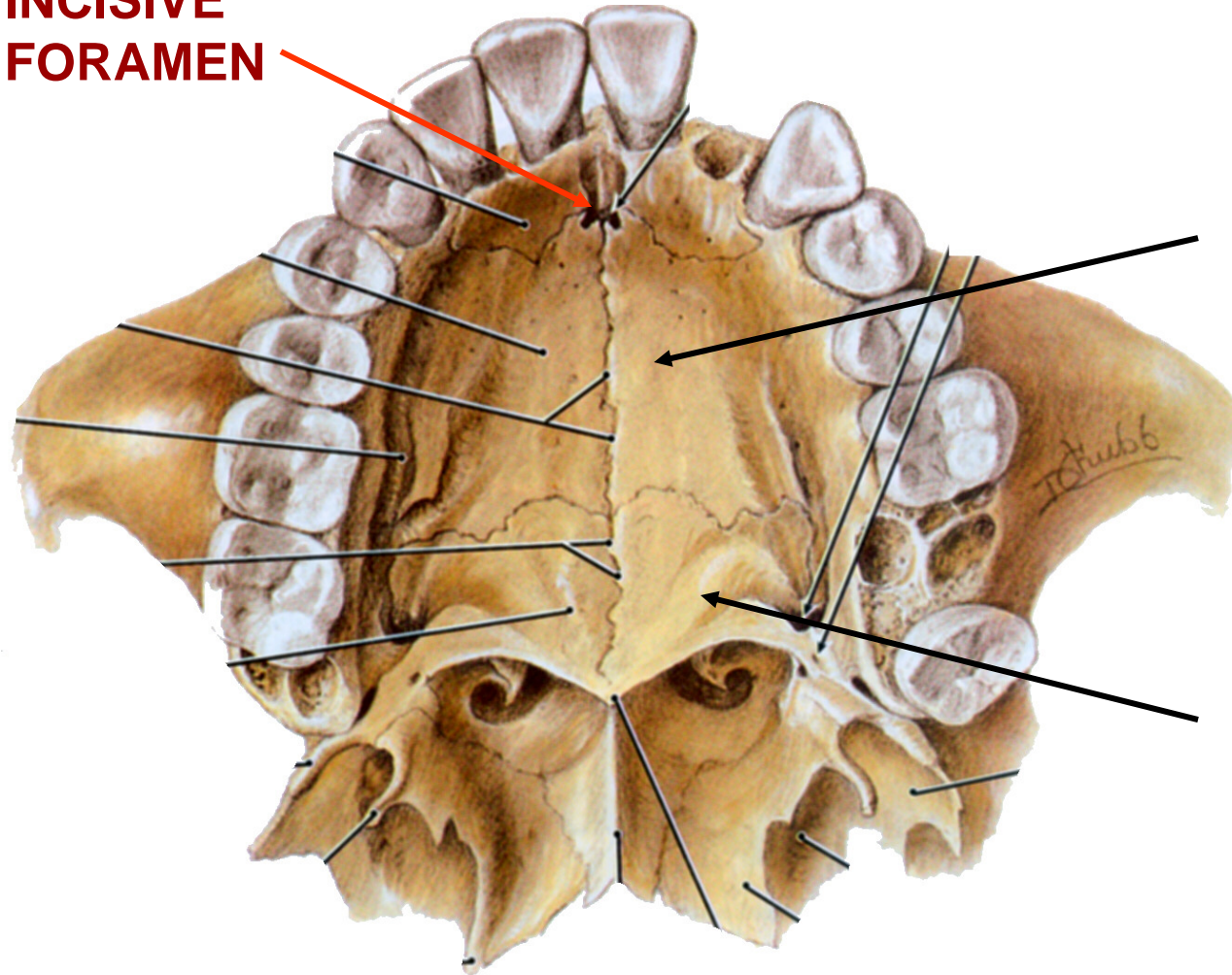


A young boy is brought to a physician working in a field hospital. The mother of the boy says he has difficulty swallowing and that food is expelled through the nasal cavity. Upon examination, the physician finds a large defect in the hard and soft palates (photo above) and suspects that the child developed with a Posterior Cleft palate. **Failure of fusion of which of the following structures produces a Posterior Cleft Palate?**

- a) medial nasal and maxillary process
- b) maxillary processes of each side
- c) lateral nasal process and maxillary processes
- d) medial and lateral nasal processes
- e) lateral nasal process of each side

PALATE ANATOMY

INCISIVE FORAMEN



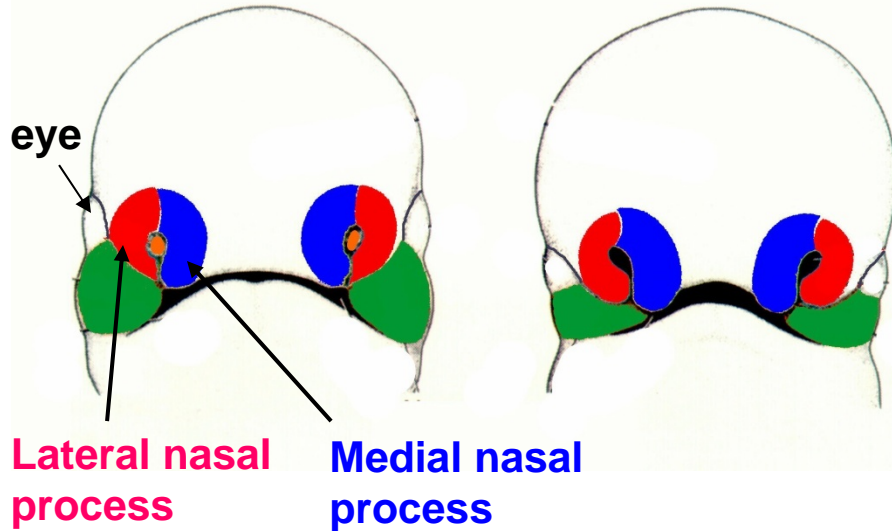
B. Anatomy

**Hard Palate
a. Maxillary
Bones
(palatine
process)**

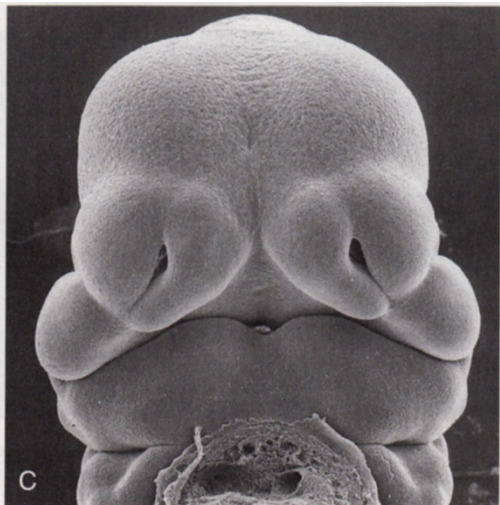
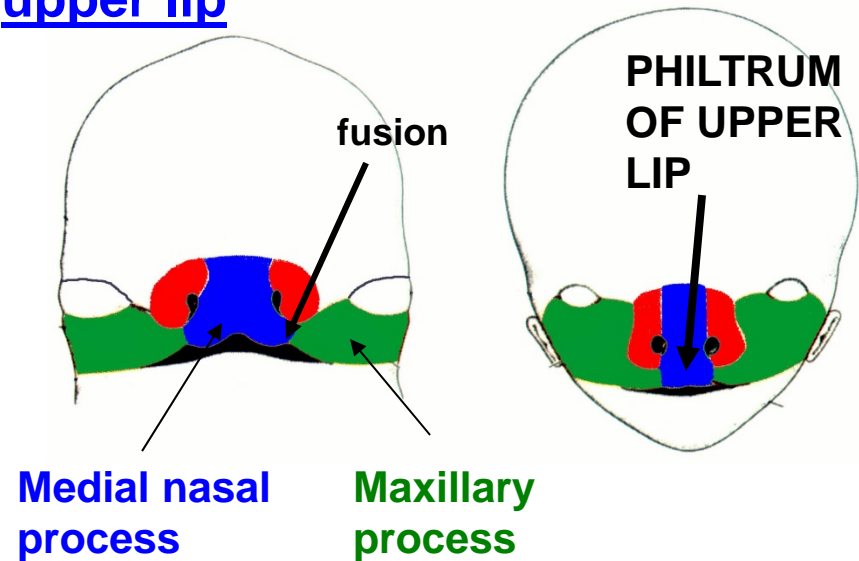
**b. Palatine
bones
(horizontal
plate)**

DEVELOPMENT OF FACE

2. Medial and **Lateral** Nasal Processes – form at margins of nasal placodes

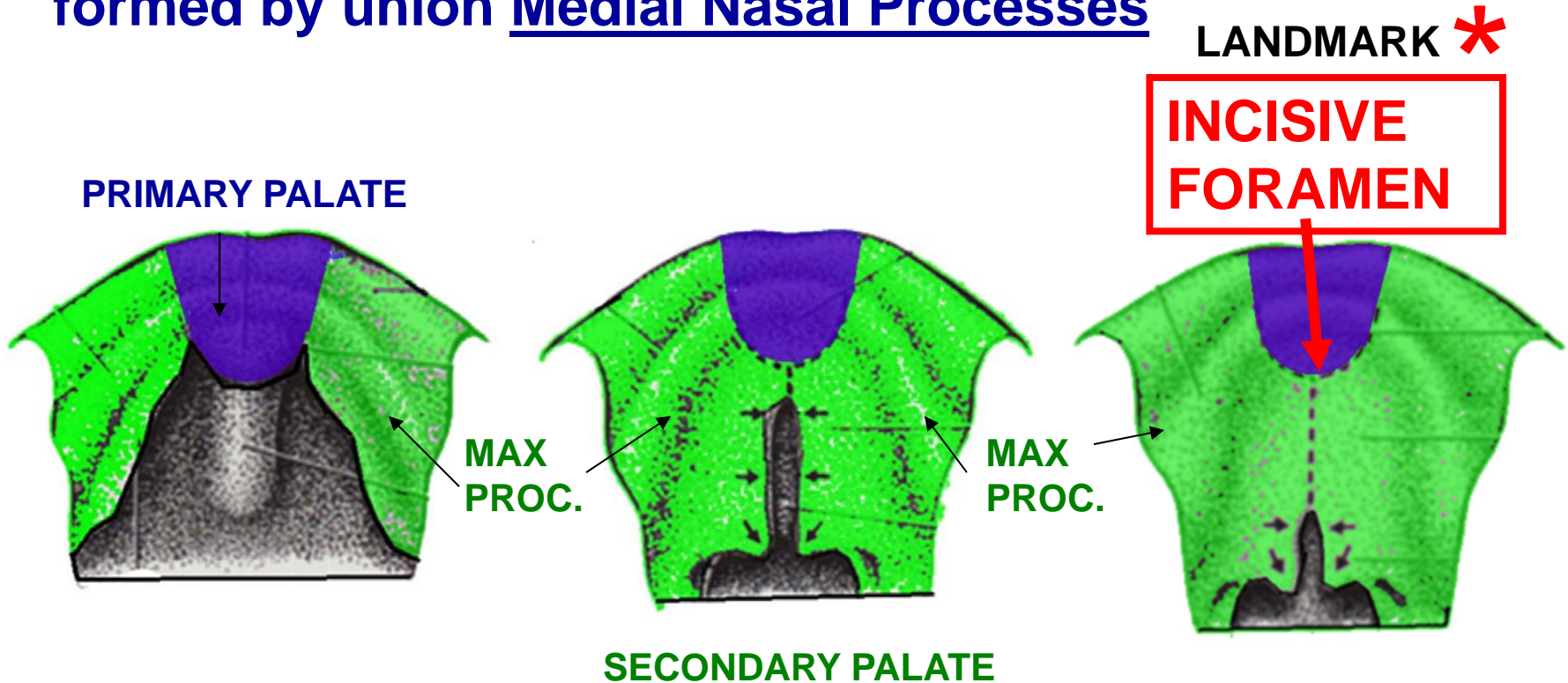


3. Medial nasal process and Maxillary Process – fuse to form upper lip



PALATE DEVELOPMENT

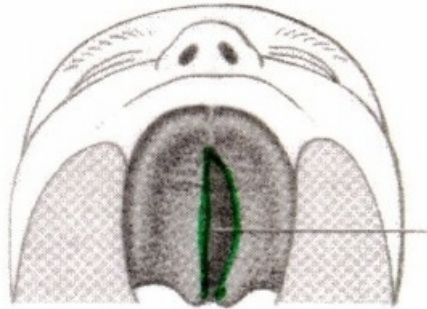
a. Primary Palate – Anterior to Incisive Foramen formed by union Medial Nasal Processes



b. Secondary Palate – Posterior to Incisive Foramen formed by fusion of Maxillary processes

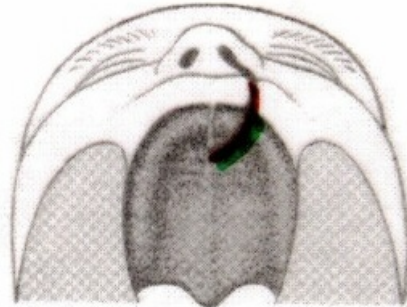
MALFORMATIONS: CLEFT PALATE

2) Posterior Cleft Palate - Not fuse *****
Secondary palate
(not fuse Maxillary Processes each side)



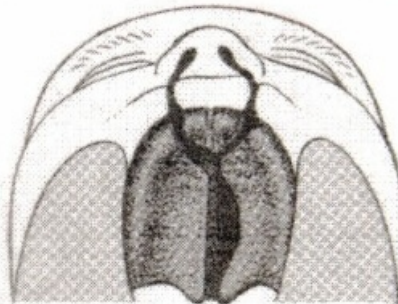
1:2500
births

1) Anterior Cleft Palate - Not fuse *****
Medial Nasal Process
and
Maxillary Process



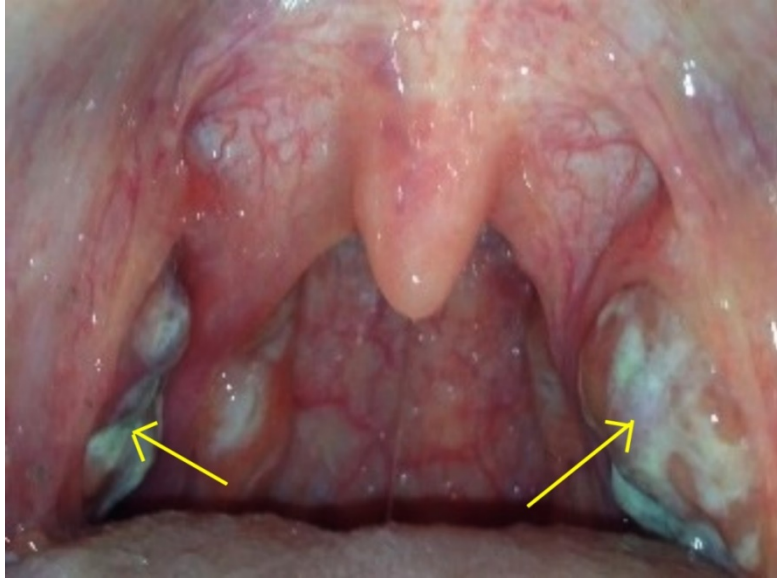
1:1000
Births

Can be unilateral
or bilateral



Note: Ant. Cleft Palate is same as Cleft Lip

PRACTICE QUESTION CLINICAL VIGNETTE

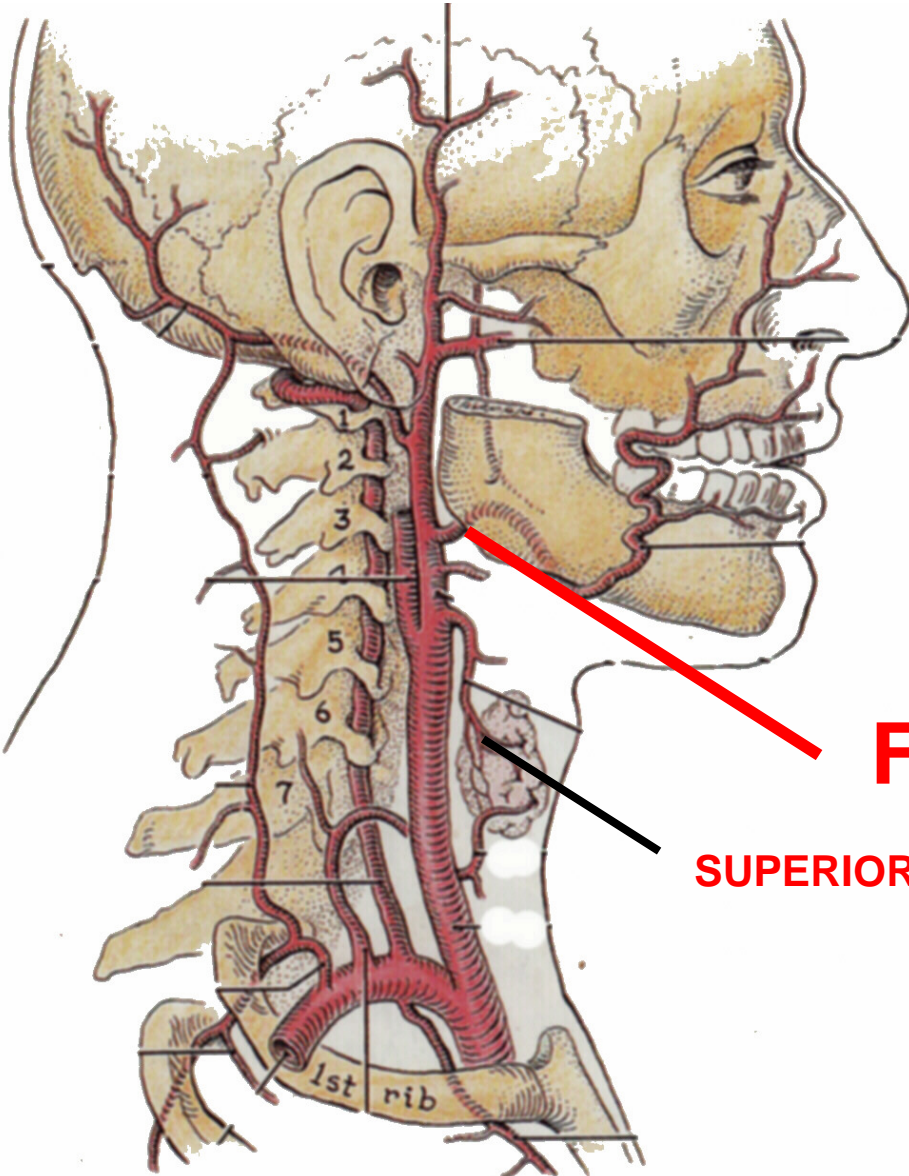


A patient is seen because of a very 'sore throat' Inspection of the soft palate (image above) shows enlarged masses in the lateral wall of the oropharynx. The masses are surgically removed and the patient returns home. However, that evening, there is extensive arterial hemorrhage in the oropharynx. This is most likely due to injury to a branch of which of the following arteries?

- A. Superior Thyroid artery
- B. Lingual artery
- C. Facial artery
- D. Posterior Auricular artery
- E. Ophthalmic artery

ADDITIONAL QUESTION: WHAT CRANIAL NERVE CAN BE DAMAGED DURING TONSILLECTOMY?

FACIAL ARTERY



NOSE →

FACIAL A.

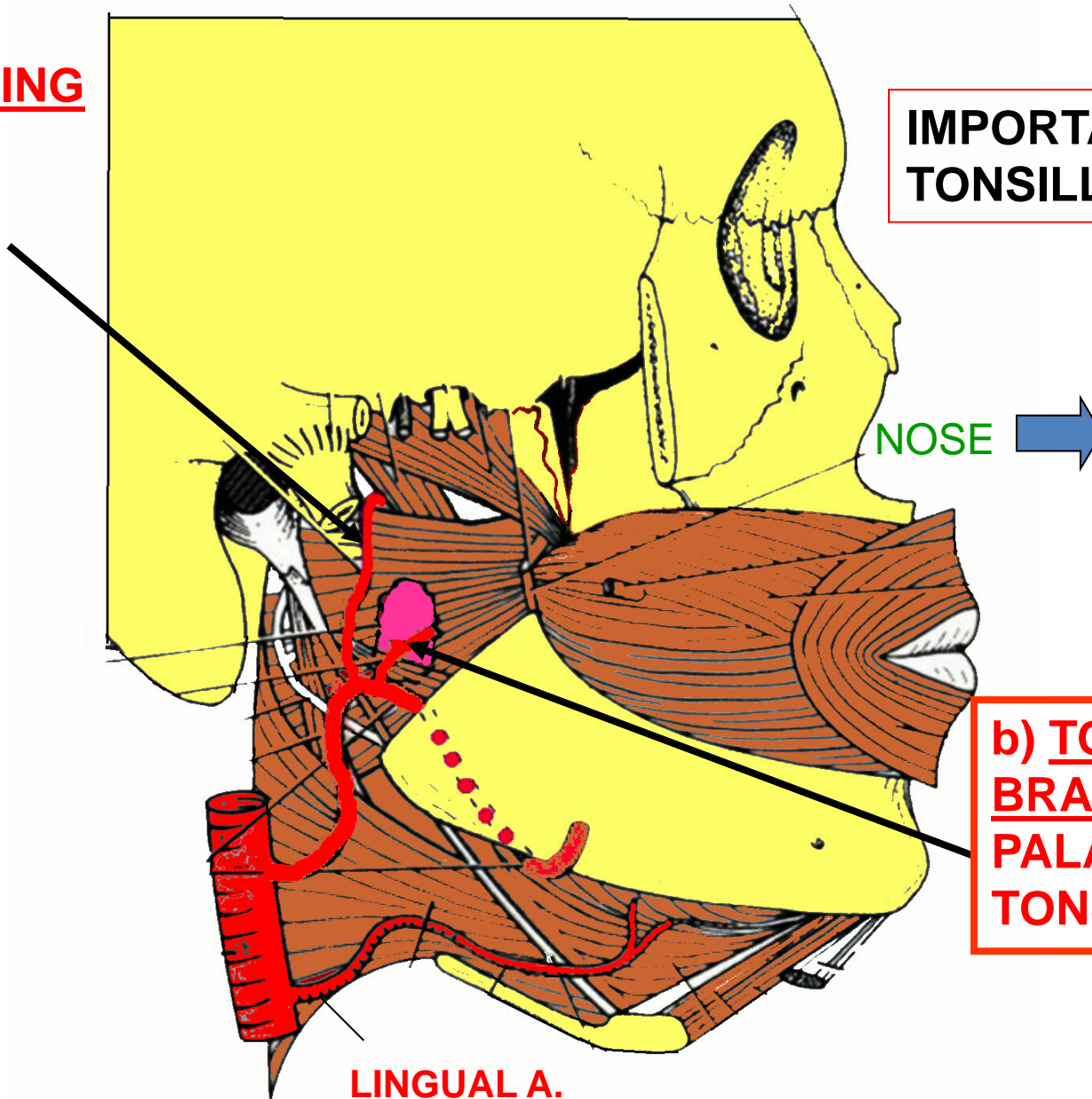
**COURSE =
'WIGGLE' X 3**

SUPERIOR THYROID A.

FACIAL ARTERY- BRANCHES MEDIAL TO MANDIBLE

a) ASCENDING PALATINE ARTERY - PALATE

IMPORTANT IN TONSILLECTOMY

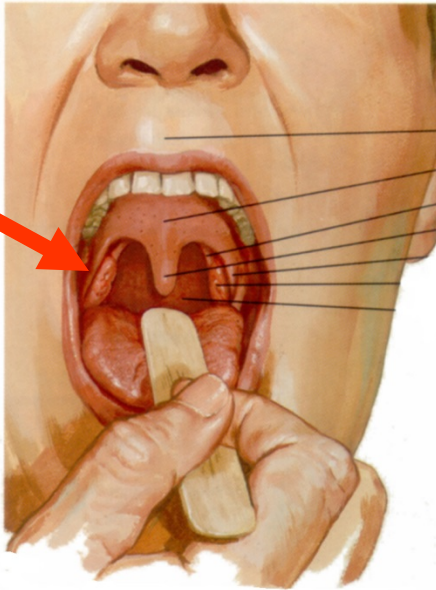


b) TONSILLAR BRANCH - PALATINE TONSIL

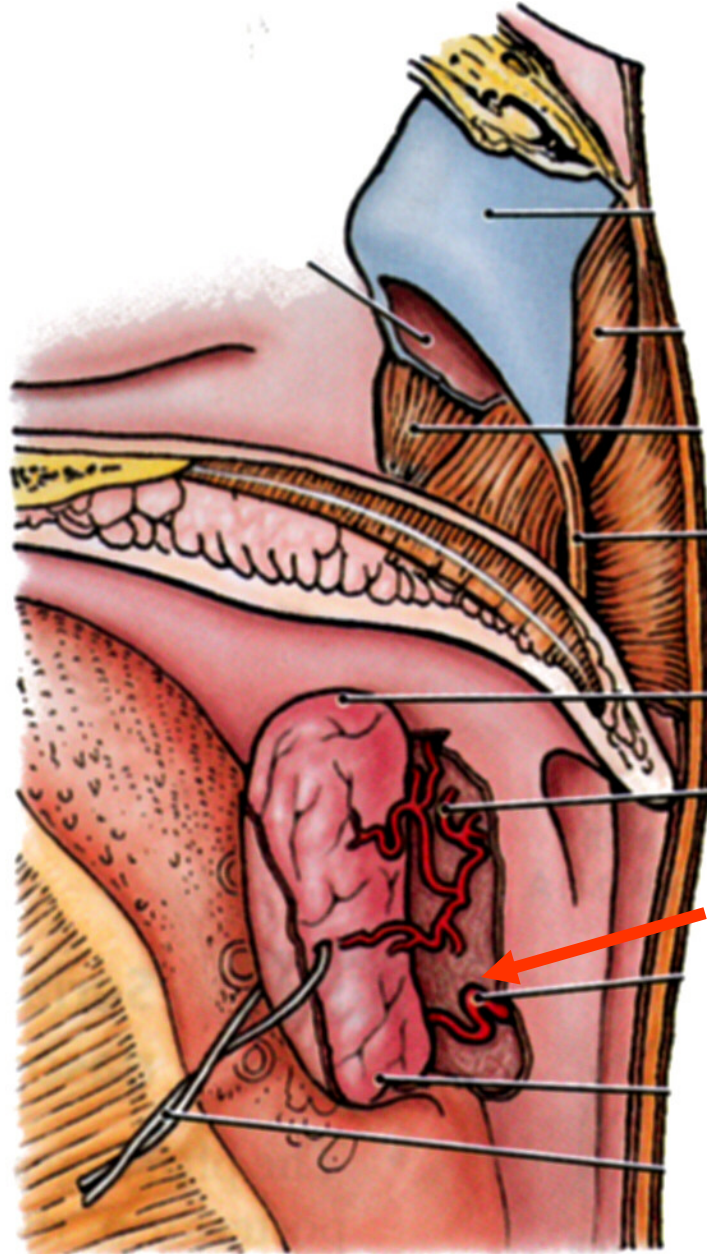
LINGUAL A.

FACIAL ARTERY- BRANCHES MEDIAL TO MANDIBLE

PALATINE
TONSIL



**NOTE: TONSILLECTOMY -
Post-operative bleeding
of Tonsillar branch of
Facial artery is * *
complication of
removal of palatine
tonsils; also damage IX**



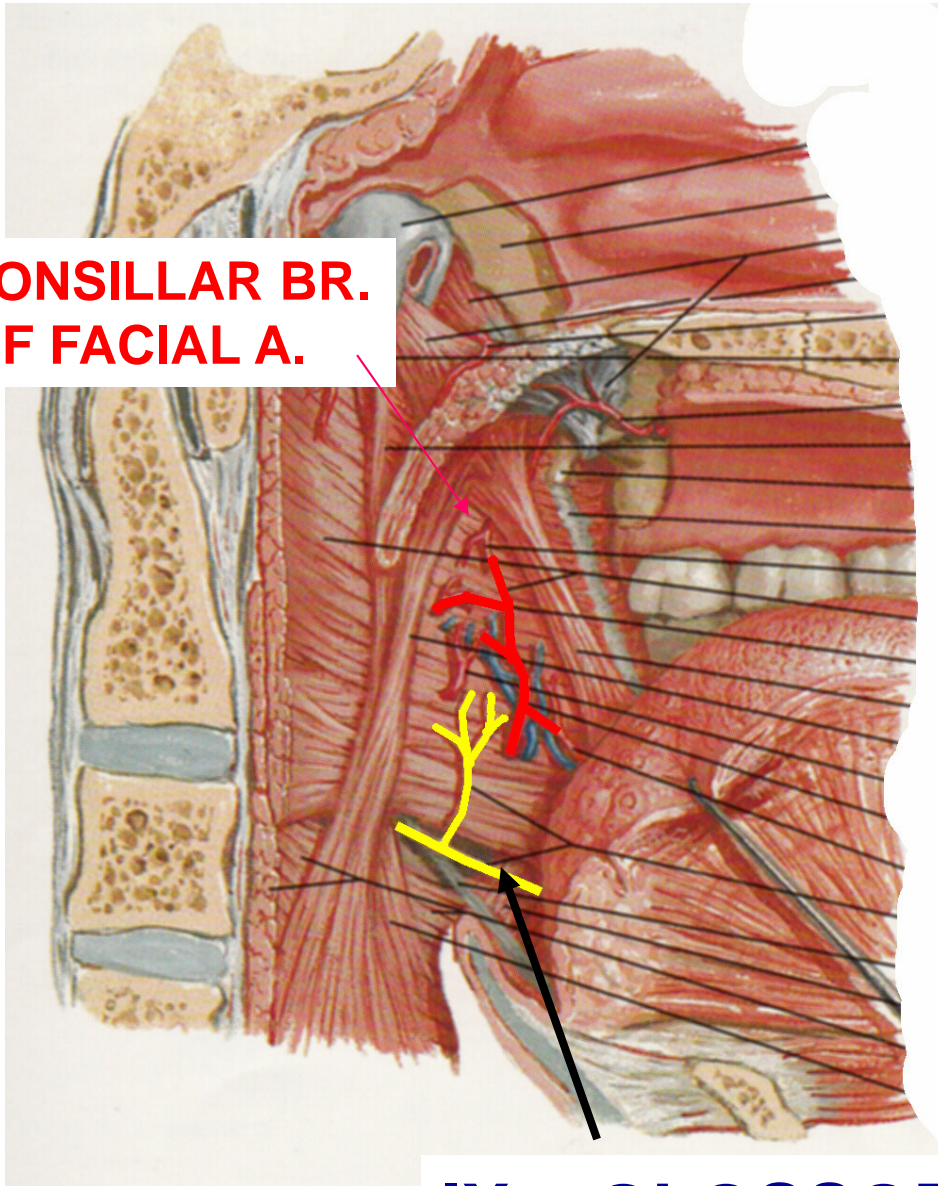
**b) TONSILLAR
BRANCH -
PALATINE
TONSIL**

▶ PALATINE TONSILS

Arteries-

From Tonsillar branch of Facial Artery - can be large
Extensive bleeding after tonsillectomy

**TONSILLAR BR.
OF FACIAL A.**

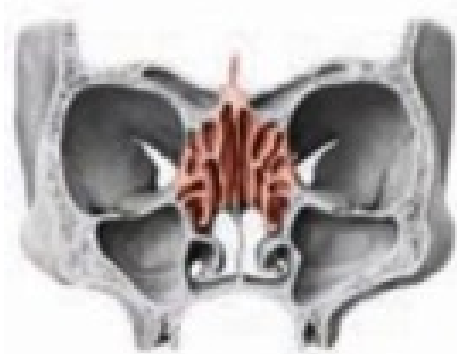


Note:

1) Glossopharyngeal Nerve
only covered by Fascia; can
be damaged in tonsillectomy

IX – GLOSSOPHARYNGEAL NERVE

FYI: ETHMOID BONE (anterior view)



**ETHMOID AIR
CELLS (SINUS)**



CRISTA GALLI



**CRIBRIFORM
PLATE**



PERPENDICULAR PLATE



**MIDDLE
CONCHA**



ETHMOID - Gk. for sieve or strainer

CRIBRIFORM - structure with many holes

NO QUESTIONS ON THIS SLIDE