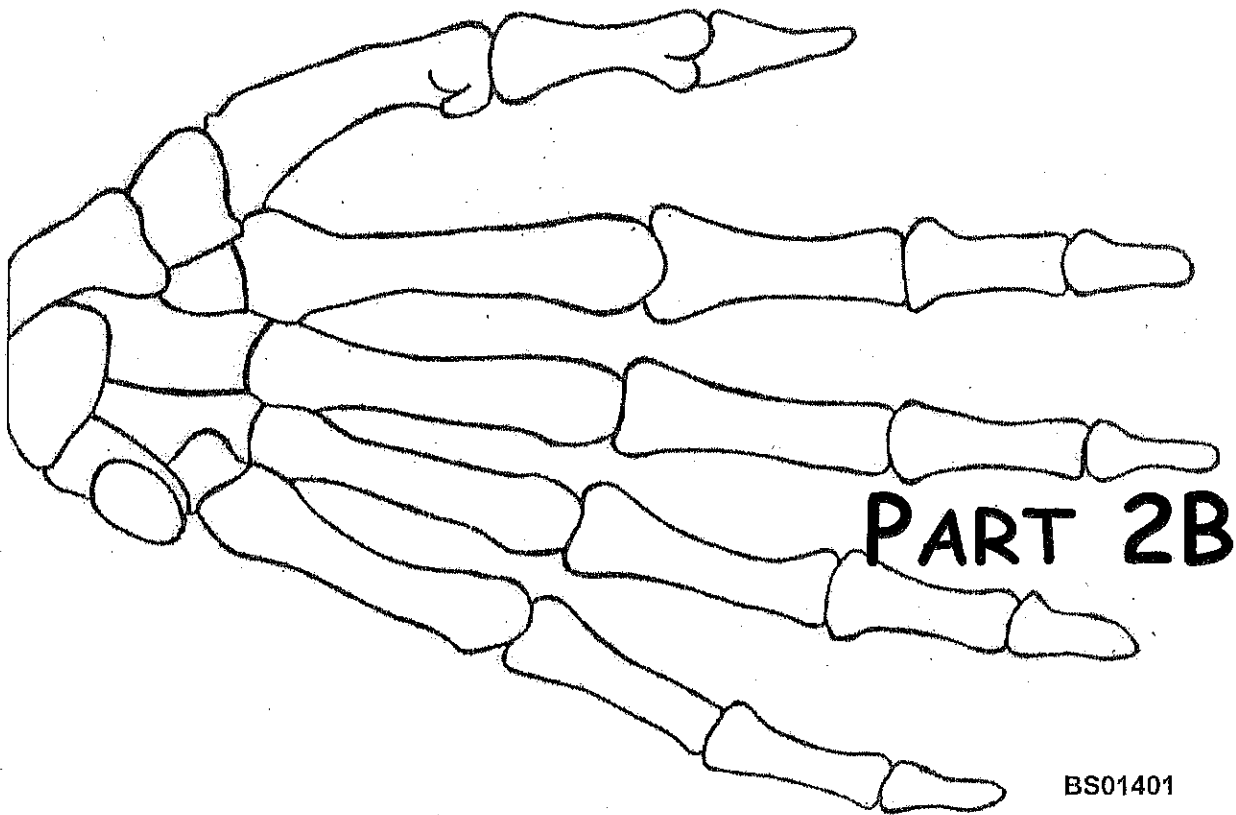


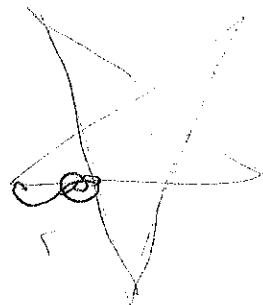
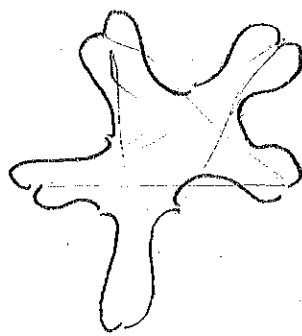
GROSS ANATOMY I

STUDY AIDS



PART 2B

BS01401
January 2008
Ted Lane



CHECKLIST OF STRUCTURES FOR IDENTIFICATION

POSTERIOR FOREARM and HAND

radius and ulna

dorsal tubercle of radius

anatomical snuff box

forearm – superficial layer

brachioradialis

extensor carpi radialis longus

extensor carpi radialis brevis

extensor digitorum

extensor digiti minimi

extensor carpi ulnaris

anconeus

forearm – deep layer

supinator

abductor pollicis longus

extensor pollicis brevis

extensor pollicis longus

extensor indicis

posterior interosseous artery

interosseous recurrent artery

posterior branch of anterior interosseous artery

extensor retinaculum – 6 compartments and their tendon contents

radial artery

dorsal digital arteries

deep and superficial radial nerves

dorsal branch of ulnar nerve

POSTERIOR FOREARM and HAND

brachioradialis

origin: lateral supracondylar ridge of humerus

insertion: lateral side of distal radius

action: flex elbow

innervation: radial nerve (C6)

major blood supply: radial artery

extensor carpi radialis longus

origin: lateral supracondylar ridge of humerus

insertion: base of 2nd metacarpal

action: extends wrist, abducts hand

innervation: radial nerve (C6, C7)

major blood supply: radial artery

extensor carpi radialis brevis

origin: lateral supracondylar ridge of humerus by common extensor tendon

insertion: base of 3rd metacarpal

action: extends wrist, abducts hand

innervation: deep branch of radial nerve (C7)

major blood supply: radial and posterior interosseous arteries

extensor digitorum

origin: lateral supracondylar ridge of humerus by common extensor tendon

insertion: extensor expansions of digits 2-5

action: extends MP & IP joints, extends wrist

innervation: posterior interosseous nerve (C7)

major blood supply: posterior interosseous and branch of anterior interosseous artery

extensor digiti minimi

origin: lat supracondylar ridge of humerus by common extensor tendon

insertion: extensor expansion of 5th digit

action: extends MP, proximal IP & distal IP

innervation: posterior interosseous nerve (C7)

major blood supply: posterior interosseous and branch of anterior interosseous artery

extensor carpi ulnaris

origins: lat supracondylar ridge of humerus by common extensor tendon and posterior ulna

insertion: base of 5th metacarpal

action: extend wrist, adduct hand

innervation: posterior interosseous nerve (C7)

major blood supply: posterior interosseous and branch of anterior interosseous artery

Opp. 1st dig.

Flexor Retinaculum
forms Carpal Tunnel
contains 9 tendons +
one nerve

Thenar
Compartment

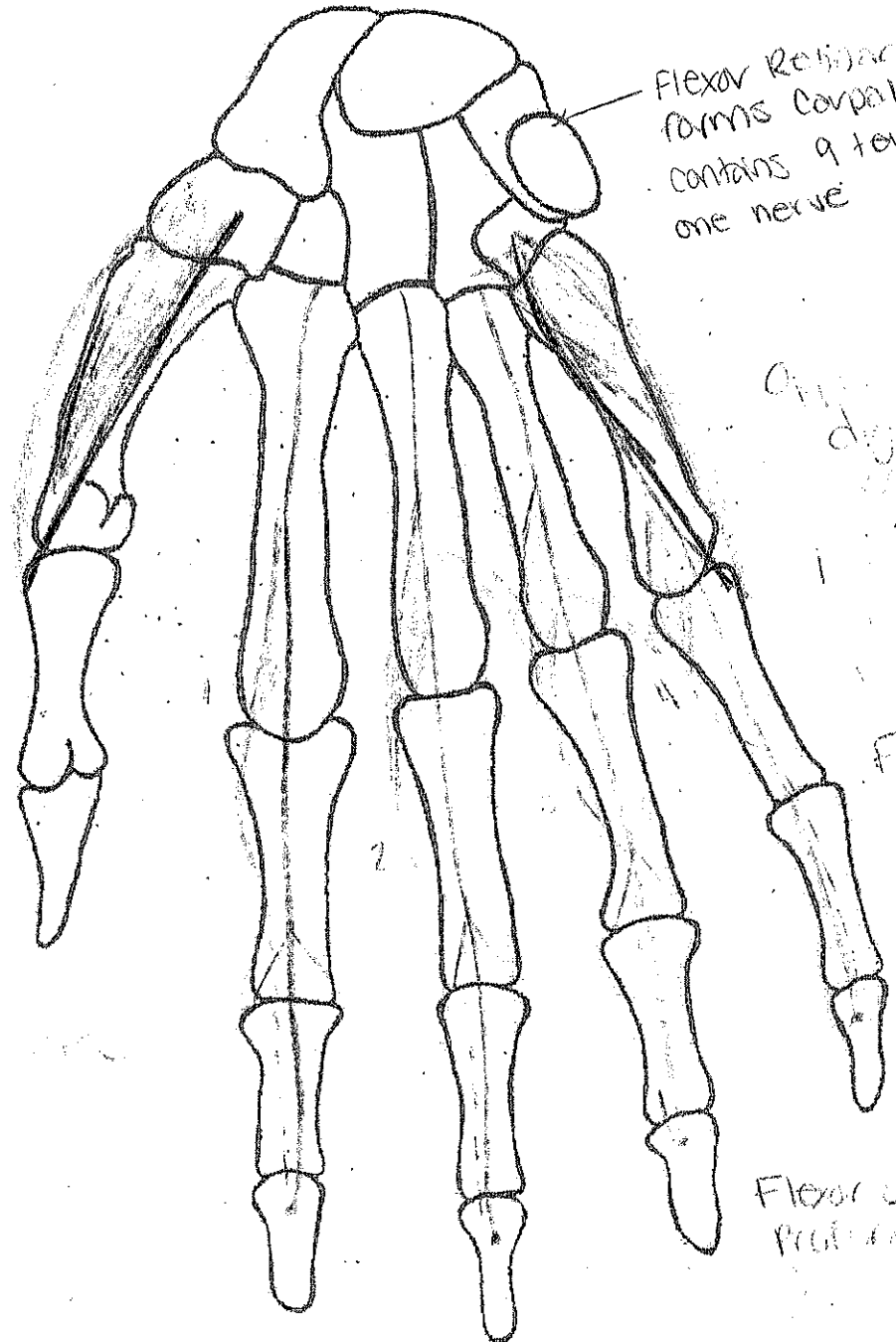
Opp. 2nd dig.

Flexor
Pollicis
Recurvus

Flexor
digiti
minimi

Opp. 3rd dig.

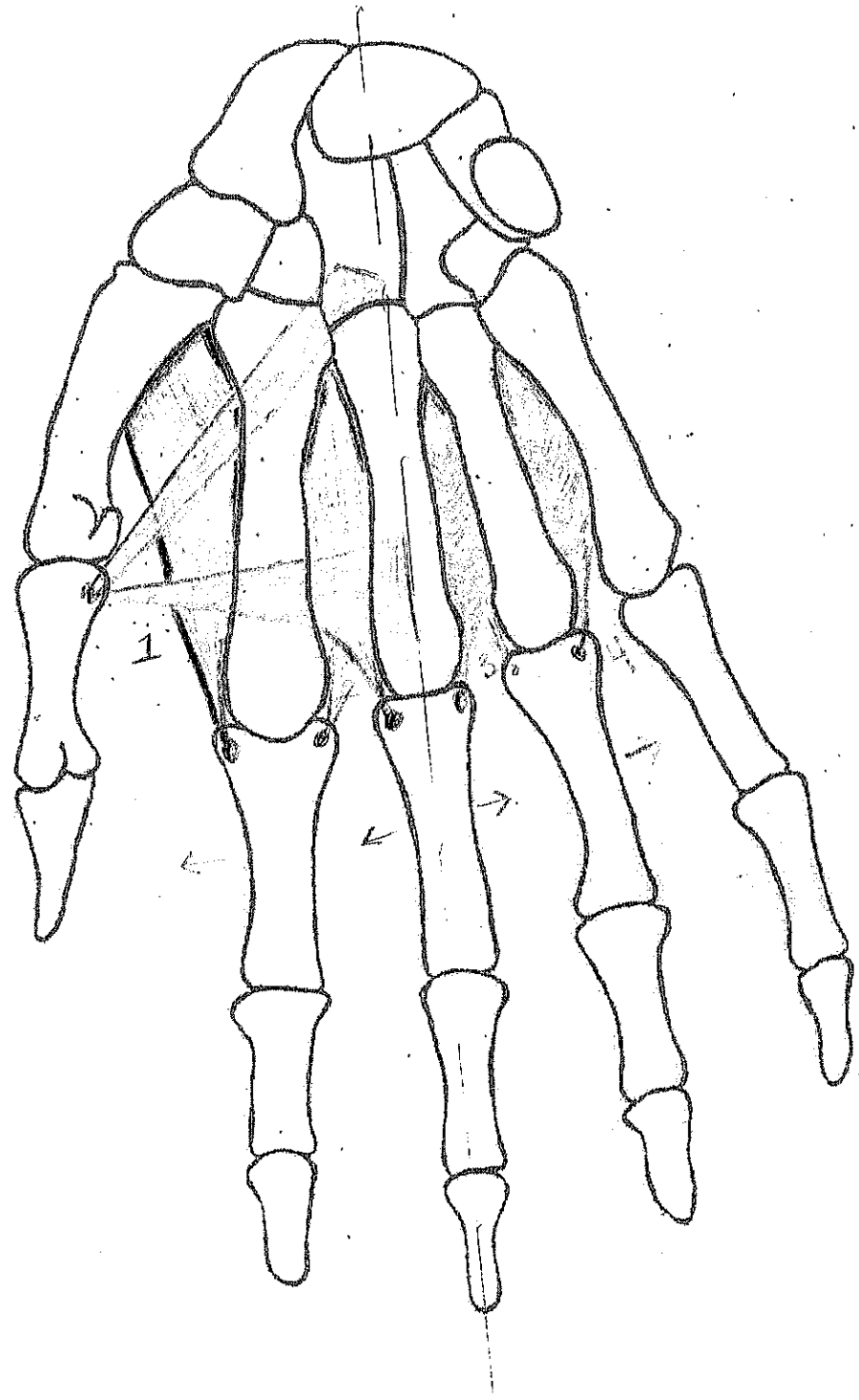
Flexor digitorum,
profundus



imaginary center-line

local
muscles
(muscle mass)

flexion
extension



ANTERIOR HAND

flexor retinaculum

lateral attachments: crest of scaphoid, tubercle of trapezium

medial attachments: pisiform and hook of hamate

carpal tunnel

boundaries: lateral – scaphoid and trapezium

medial – pisiform and hamate

floor – capitate, hamate, lunate, _____, _____

contents: tendons flexor pollicis longus

flexor digitorum superficialis

flexor digitorum profundus

nerve median nerve

abductor pollicis brevis most lateral

origin: lateral flexor retinaculum and scaphoid

insertion: lateral base of proximal phalanx of thumb

action: abduct thumb

innervation: recurrent branch of median nerve (C8)

major blood supply: radial artery

flexor pollicis brevis * 2 heads *

origin: flexor retinaculum and capitate superficial head, trapezium deep head

insertion: lateral base of proximal phalanx of thumb

action: flex thumb

innervation: superficial head – recurrent branch of median nerve (C8)

deep head – deep branch of ulnar nerve (C8)

major blood supply: radial artery

opponens pollicis

origin: lateral flexor retinaculum tubercle of trapezium

insertion: lateral surface of first metacarpal

action: oppose thumb (pulls medially)

innervation: recurrent branch of median nerve (C8)

major blood supply: radial artery

abductor digiti minimi

origin: medial flexor retinaculum and pisiform

insertion: medial base of proximal phalanx of 5th digit

action: abduct 5th digit

innervation: deep branch of ulnar nerve (T1)

major blood supply: ulnar artery

CHECKLIST OF STRUCTURES FOR IDENTIFICATION ANTERIOR HAND

carpal bones (all 8 by name)
metacarpals (1-5)
phalanges (proximal, middle, distal)
flexor retinaculum and carpal tunnel
palmar aponeurosis
palmaris brevis

thenar compartment *thumb*
abductor pollicis brevis
flexor pollicis brevis
opponens pollicis
recurrent branch of median nerve
superficial palmar branch of radial artery
tendon of *flexor pollicis longus* (deep)

hypothenar compartment
abductor digiti minimi
flexor digiti minimi brevis
opponens digiti minimi
superficial and deep branches of ulnar artery and nerve

central compartment
8 flexor tendons
lumbrical muscles (1-4)
superficial palmar arterial arch
common digital arteries (branches of superficial palmar arch)
common digital nerves (branches of median and ulnar nerves)

adductor-interosseous compartment
adductor pollicis
3 palmar interosseous muscles
4 dorsal interosseous muscles
deep palmar arterial arch
palmar metacarpal arteries (branches of deep palmar arch)
deep branch of ulnar nerve

fingers
proper digital arteries and nerves
princeps pollicis
radialis indicis

flexor digiti minimi

origin: medial flexor retinaculum

insertion: medial side of base of proximal phalanx of 5th finger

action: Flex 5th digit

innervation: ulnar nerve (T1)

major blood supply: ulnar artery

opponens digiti minimi

origin: medial flexor retinaculum and hook of the hamate

insertion: medial side of 5th metacarpal

action: opposes 5th digit

innervation: ulnar nerve (T1)

major blood supply: ulnar artery

palmaris brevis

origin: medial border of palmar aponeurosis

insertion: medial hypothenar skin

action: draws the skin into the palm

innervation: ulnar nerve (T1)

major blood supply: ulnar artery

adductor pollicis

origins: Capitate and 3rd Metacarpal

insertion: medial side of base of proximal phalanx of thumb

action: adduct thumb

innervation: deep branch of ulnar nerve (T1)

major blood supply: deep branch of ulnar artery

1st and 2nd *lumbricales* (unipennate)

origins: lateral sides of 1st and 2nd tendons of flexor digitorum profundus

insertion: extensor expansion of 2nd and 3rd fingers

action: flex metacarpophalangeal, extend interphalangeal

innervation: Median nerve (T1)

major blood supply: common digital arteries

3rd and 4th *lumbricales* (bipennate)

origins: adjacent sides of 2nd/3rd and 3rd/4th tendons of flexor digitorum profundus

insertion: extensor expansions of 4th and 5th fingers proximal + distal

action: flex metacarpophalangeal, extend interphalangeal

innervation: deep branch of ulnar nerve (T1)

major blood supply: common digital arteries

PAD

palmar interossei (1 - 3) (unipennate)

origins: medial surface of _____, lateral surfaces of _____

insertions: medial side of base of proximal phalanx of 2nd finger,
lateral sides of bases of 4th and 5th fingers,
all 3 to extensor expansions

actions: flexes MP, extends IP + adducts

innervation: deep branch of ulnar nerve (T1)

major blood supply: palmar metacarpal arteries

DAB

dorsal interossei (1 - 4) (bipennate)

origins: adjacent sides of 1st/2nd, 2nd/3rd, 3rd/4th, 4th/5th metacarpals

insertion: lateral side of base of proximal phalanx of 2nd finger,
lateral side of base of proximal phalanx of 3rd finger,
medial side of base of proximal phalanx of 3rd finger,
medial side of base of proximal phalanx of 4th finger,
all 4 to extensor expansion

action: abduct fingers 2-4

innervation: deep branch of ulnar nerve (T1)

major blood supply: palmar and dorsal digital arteries
metacarpal

PHYSICAL RELATIONSHIPS

ANTERIOR HAND

in thenar compartment,

abductor pollicis brevis is lateral and superficial,

flexor pollicis brevis is medial, and has 2 heads (one superficial and one deep)

opponens pollicis is deep, under abductor

in hypothenar compartment,

abductor digiti minimi is superficial,

flexor digiti minimi is deeper

opponens digiti minimi is deepest

tendons of *flexor digitorum superficialis* split distally,

and insert on 2 sides of bases of middle phalanges of 2nd through 5th fingers

tendons of deep flexor (*flexor digitorum profundus*) pass through splits in superficial tendons, to insert on bases of distal phalanges of 2nd through 5th fingers

4 lumbrical muscles originate from tendons of *flexor digitorum profundus*

1st and 2nd lumbricals are unipinnate, originating only from lateral side of deep tendons

3rd and 4th lumbricals are bipinnate,

originating from adjacent sides of 2nd/3rd and 3rd/4th tendons, respectively

lumbrical tendons pass dorsally on lateral side of each MP joint

to insert into extensor expansions

ulnar artery passes deep to palmar carpal ligament, but superficial to flexor retinaculum, forms most of superficial palmar arch

superficial palmar br. of radial artery may join ulnar artery to form superficial palmar arch

common palmar digital arteries branch off superficial arch,

then branch into proper palmar digital arteries, each to one side of each finger

radial artery passes dorsal to 1st metacarpal, pierces through 1st dorsal interosseous, then branches to form:

major contribution to deep palmar arch,

princeps pollicis artery to thumb,

radialis indicis artery to lateral side of index finger

deep palmar branch of ulnar artery joins radial artery to form deep palmar arch

deep palmar arterial arch usually located just distal to bases of metacarpals

superficial palmar arterial arch usually located about halfway along length of metacarpals

median nerve innervates 4½ muscles and skin of lateral 3½ fingers

ulnar nerve innervates 14½ muscles including *palmaris brevis* and skin of medial 1½ fingers

palmar branch of median nerve leaves median nerve proximal to flexor retinaculum,

passing on superficial surface of palmar carpal ligament into palm,

to innervate skin in middle of palm

palmar branch of ulnar nerve also passes on superficial surface of palmar carpal ligament,

to innervate *palmaris brevis* muscle and skin over hypothenar compartment

PHYSICAL RELATIONSHIPS

PALM of HAND *continued*

median nerve enters palm through carpal tunnel, gives off recurrent branch to thenar muscles, then branches into:

- 2 proper digital nerves to skin of thumb,
- 1 proper digital nerve to skin of lateral index finger
(giving branch to 1st lumbrical muscle along the way),
- 2 common digital nerves in the 2nd and 3rd inter-metacarpal spaces
(lateral one gives branch to 2nd lumbrical muscle)
- common digital nerves branch into proper digital nerves
to skin of medial 2nd finger, third finger, and lateral 4th finger

ulnar nerve:

enters palm with ulnar artery, just medial to artery
passes deep to palmar carpal ligament, but superficial to flexor retinaculum
cuts groove in lateral side of pisiform bone, as it passes
divides into superficial and deep branches, as it enters palm
superficial branch of ulnar nerve gives off proper digital nerve to skin of medial 5th finger,
and common digital nerve between 4th and 5th metacarpals,
which divides to form proper nerves to skin of lateral 5th and medial 4th fingers
deep branch of ulnar nerve innervates hypothenar muscles, then goes deep into palm,
innervating medial 2 lumbricals, *adductor pollicis*, all 7 interossei,
and deep head of *flexor pollicis brevis*
common and proper digital nerves accompany common and proper digital arteries
adductor pollicis

distal fibers run transversely, from 3rd metacarpal,
proximal fibers run obliquely, from capitate,
all insert on medial base of proximal phalanx of thumb

deep palmar arterial arch is deep to *adductor pollicis*

deep transverse metacarpal ligament (between heads of metacarpals 2 through 5)
separates palmar and dorsal interosseous muscles

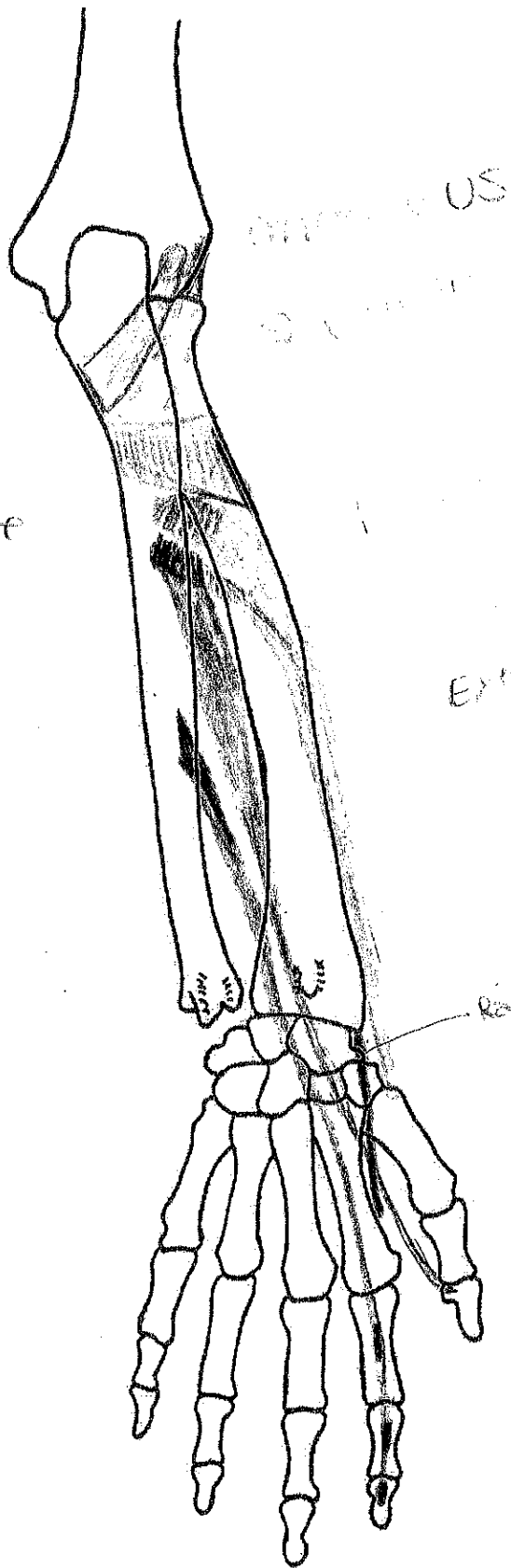
3 palmar interossei (adductors) are unipinnate,

arising from medial side of metacarpal 1 and lateral sides of metacarpals 4 and 5

4 dorsal interossei (abductors) are bipinnate,

arising from adjacent sides of 1st/2nd, 2nd/3rd, 3rd/4th, and 4th/5th metacarpals

deep branch
of radial nerve
pierces the
supinator



Extensor Pollicaris Longus

Extensor Pollicaris Longus

Radial Artery

Extensor Pollicaris Longus

4th Comp
 | Extensor digitorum
 | Extensor indicis

3rd Compartment
 | Ext Pol. longus

2nd Compartment
 | Extensor carp rad brevis
 | Extensor carpi rad longus

5th Comp
 | Extensor digiti minimi

1st compartment
 | Ext. Pol. Brev
 | Abd. Pol. longus

6th Comp
 | Extensor carpi
 | Ulnaris



Innervation
 of Dorsal Hand
 Skin
 Medial 1.5 digits = ulnar nerve

lateral 3.5 digits = radial nerve
 1st web space = radial nerve
 2nd web space = radial nerve
 3rd web space = radial nerve
 4th web space = radial nerve
 5th web space = radial nerve
 1st web space = radial nerve
 2nd web space = radial nerve
 3rd web space = radial nerve
 4th web space = radial nerve
 5th web space = radial nerve

PHYSICAL RELATIONSHIPS

POSTERIOR FOREARM and DORSUM of HAND

4 muscles originate by common extensor tendon from lateral epicondyle of humerus

extensor carpi radialis brevis

extensor digitorum

extensor digiti minimi

extensor carpi ulnaris

extensor carpi ulnaris also takes partial origin from ulna

anconeus also originates from lateral epicondyle (posterior surface)

2 muscles originate **above** lateral epicondyle

extensor carpi radialis longus from lower third of supracondylar line

brachioradialis from upper two-thirds of supracondylar line

deep branch of radial nerve pierces superior margin of *supinator* muscle, emerges from inferior margin and branches to remaining extensor muscles, then continues as small posterior interosseous nerve

2 “outcropping” muscles, *abductor pollicis longus* and *extensor pollicis brevis* appear on lateral side of distal forearm, out from under *extensor digitorum*, crossing tendons of *extensor carpi radialis longus* and *brevis*

”anatomical snuffbox” formed by 3 tendons:

abductor pollicis longus and *extensor pollicis brevis*, together, lateral border, and *extensor pollicis longus*, medial border

radial artery lies deep in snuffbox, then dives between 1st and 2nd metacarpals to palm

extensor pollicis longus passes in groove on medial side dorsal tubercle of radius, which acts like a pulley, providing leverage, as tendon changes direction and heads toward thumb

extensor retinaculum has 6 compartments for tendons:

1 - *abductor pollicis longus* and *extensor pollicis brevis*

2 - *extensor carpi radialis longus* and *brevis*

3 - *extensor pollicis longus*

4 - *extensor digitorum* (4 tendons) and *extensor indicis* (1 tendon, deep)

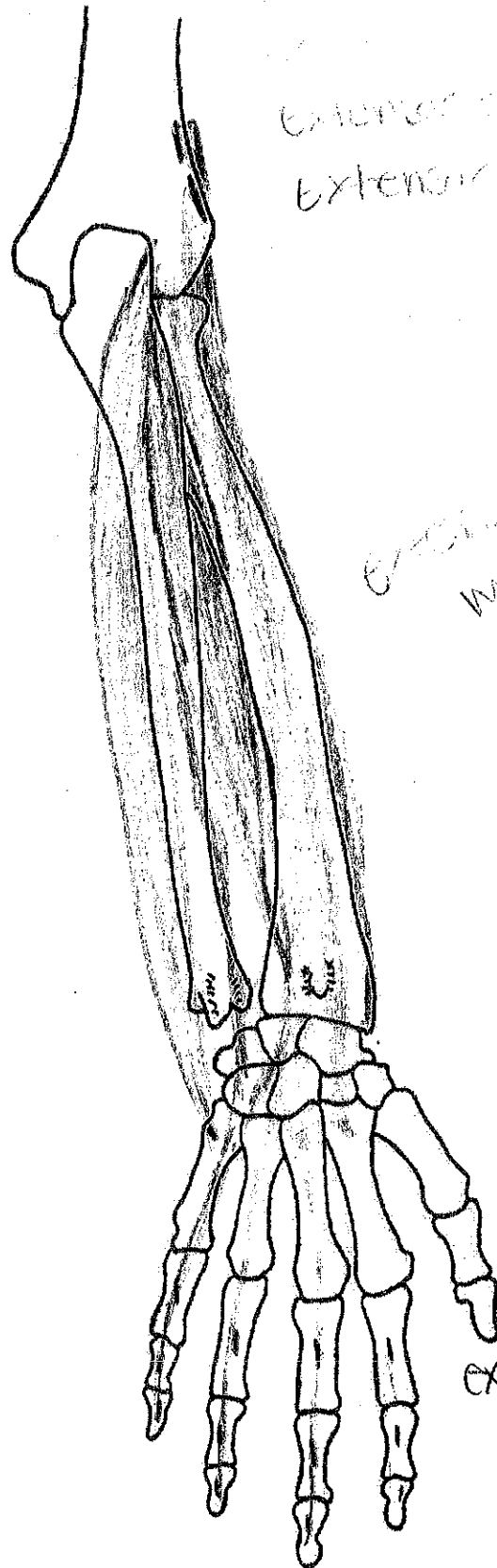
5 - *extensor digiti minimi*

6 - *extensor carpi ulnaris*

dorsal carpal arch formed from dorsal carpal branches of radial and ulnar arteries

dorsal metacarpal arteries, off dorsal carpal arch, run between *dorsal interossei*, then branch to form dorsal (proper) digital arteries, accompanying dorsal digital nerves (branches of radial and ulnar nerves)

Brachioradialis
Extensor digitorum
Extensor carpi ulnaris



Extensor digitorum
ulnaris

extensor expansion

anconeus

origin: lateral epicondyle of humerus
insertion: lateral surface olecranon process and proximal ulna ^{forearm}
action: unlocks elbow, rotates ulnar radial, *Extend elbow*
innervation: radial nerve (C7, C8, T1)
major blood supply: radial and radial recurrent arteries

supinator

origins: crest of ulna and lateral epicondyle of humerus
insertion: lateral surface of proximal 2/3 of radius
action: laterally rotate radius = supinate
innervation: deep branch of radial nerve (C6)
major blood supply: radial recurrent and posterior interosseous arteries

abductor pollicis longus

origins: posterior proximal radius, interosseous membrane, and ulna
insertion: base of 1st metacarpal
action: abduct thumb
innervation: deep branch of radial nerve (C8)
major blood supply: posterior interosseous and branch of anterior interosseous artery

extensor pollicis brevis

origins: posterior radius and interosseous membrane
insertion: base of proximal phalanx of thumb
action: extends thumb @ MP joint
innervation: deep radial nerve (C8)
major blood supply: posterior interosseous and branch of anterior interosseous artery

extensor pollicis longus

origins: posterior interosseous membrane and ulna
insertion: base of distal phalanx of thumb
action: extends thumb @ I.P. joint
innervation: deep radial nerve (C8)
major blood supply: posterior interosseous and branch of anterior interosseous artery

extensor indicis

origins: posterior interosseous membrane and ulna
insertion: extensor expansion of 1st digit
action: extends 1st digit MP + IP joints
innervation: deep radial nerve (C8)
major blood supply: posterior interosseous and branch of anterior interosseous artery

extensor retinaculum

attachments: distal radius and ulna

compartments and contents:

- 1 - tendons of _____
- 2 - tendons of _____
- 3 - tendon of _____
- 4 - tendons of _____
- 5 - tendon of _____
- 6 - tendon of _____

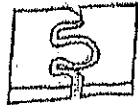
KNOW!
See compartments

CLASSIFICATION of JOINTS

I. FIBROUS JOINTS (synarthroses – immovable)

fibrous connective tissue between bones

a. SUTURES (thin layer of connective tissue)



dentate

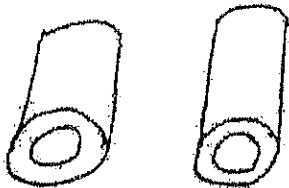


serrate



plane

b. SYNDESMOSES (wider separation between bones)



c. GOMPHOSES (between tooth and bone)

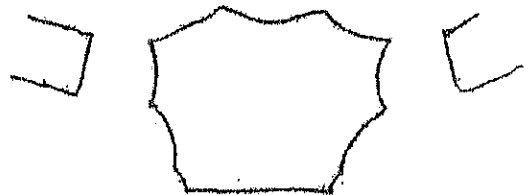


II. CARTILAGINOUS JOINTS (amphiarthroses – slightly movable)

fibrous connective tissue and cartilage between bones

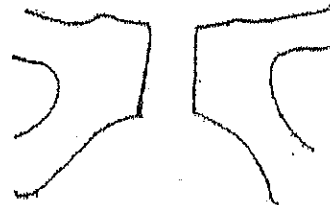
a. SYNCHONDROSES (primary)

both bones from same embryological model



b. SYMPHYSES (secondary)

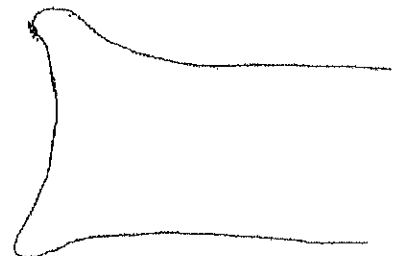
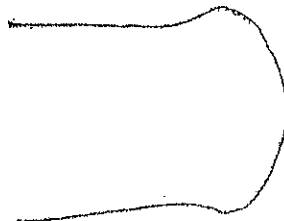
2 bones from different embryological models



III. SYNOVIAL JOINTS (diarthroses – freely movable)

fibrous connective tissue, cartilage, and space between bones

- a. HINGE
- b. PIVOT
- c. CONDYLOID
- d. SADDLE
- e. BALL AND SOCKET
- f. PLANE (GLIDING)



CHECKLIST OF STRUCTURES for identification
JOINTS OF THE UPPER LIMB

sternoclavicular joint

- interclavicular ligament
- anterior sternoclavicular ligament
- posterior sternoclavicular ligament
- costoclavicular ligament

shoulder joint

- coracoclavicular ligament
- 2 parts \ conoid ligament medial
- trapezoid ligament lateral
- articular capsule
- superior glenohumeral ligament
- inferior glenohumeral ligament
- glenoid labrum
- transverse ligament
- coracohumeral ligament
- tendon of long head of *biceps brachii*
- rotator cuff tendons fused to capsule
 - above – *supraspinatus*
 - posterior – *infraspinatus* and *teres minor*
 - anterior – *subscapularis*

acromioclavicular
and coracromial ligament

elbow joint

- articular capsule
- ulnar collateral ligament (3 parts)
- radial collateral ligament

no ligament
no 2 → 3 parts

proximal radioulnar articulation

- annular ligament in elbow

middle radioulnar articulation

- oblique cord
- interosseous membrane

distal radioulnar articulation

- palmar radioulnar ligament
- dorsal radioulnar ligament



go to next page

wrist (radiocarpal) joint

- dorsal radiocarpal ligaments
- palmar radiocarpal ligaments
- dorsal ulno-carpal ligaments
- palmar ulno-carpal ligaments
- ulno-carpal articular disc
- ulnar collateral ligament
- radial collateral ligament
- pisohamate ligament *
- pisometacarpal ligament *

radiocarpal - more specific
 ulnocarpal - more specific

metacarpophalangeal joints

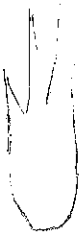
- deep transverse metacarpal ligament

interphalangeal joints

- collateral ligaments

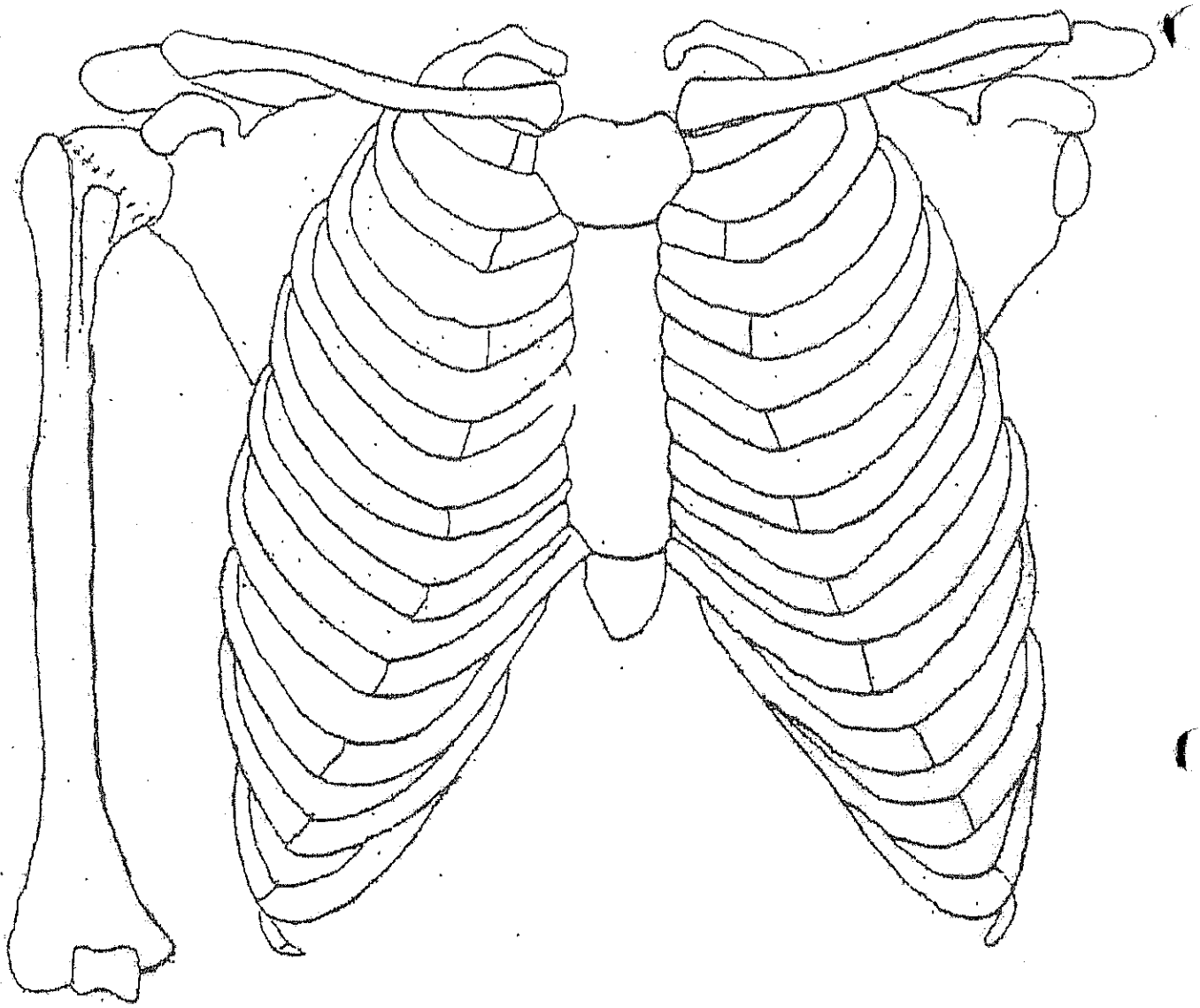
*** Cutaneous Innervation**

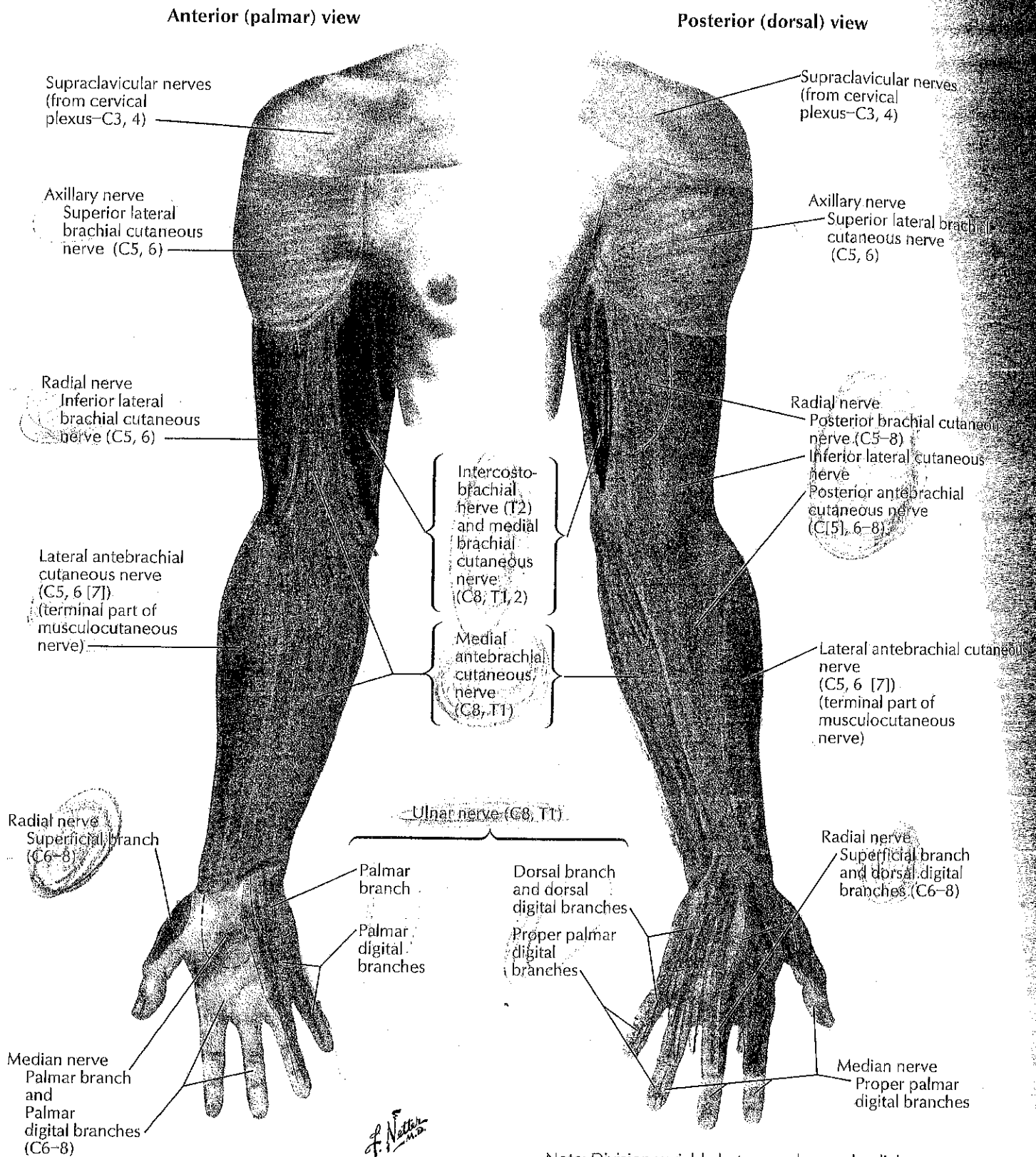
- Lateral Arm - Upper - Superior lateral brachial cutaneous (branches of axillary n.)
 Lower - Inferior lateral brachial cutaneous (branches of radial n.)
- Posterior Arm - posterior brachial cutaneous nerve (branches of radial n.)
 Post. forearm - posterior antebrachial cutaneous nerve (branches of radial n.)
- Medial arm - medial brachial cutaneous (branches off medial cord)
- Med. forearm - medial antebrachial cutaneous (branches of musculospiral cutaneous)
- Lat. forearm - lateral antebrachial cutaneous (branches of musculospiral cutaneous)



*** Dermatomes ***

region of skin innervated by one spinal nerve
 (ie: C7 reg innervated by C7 sp. n. axons)



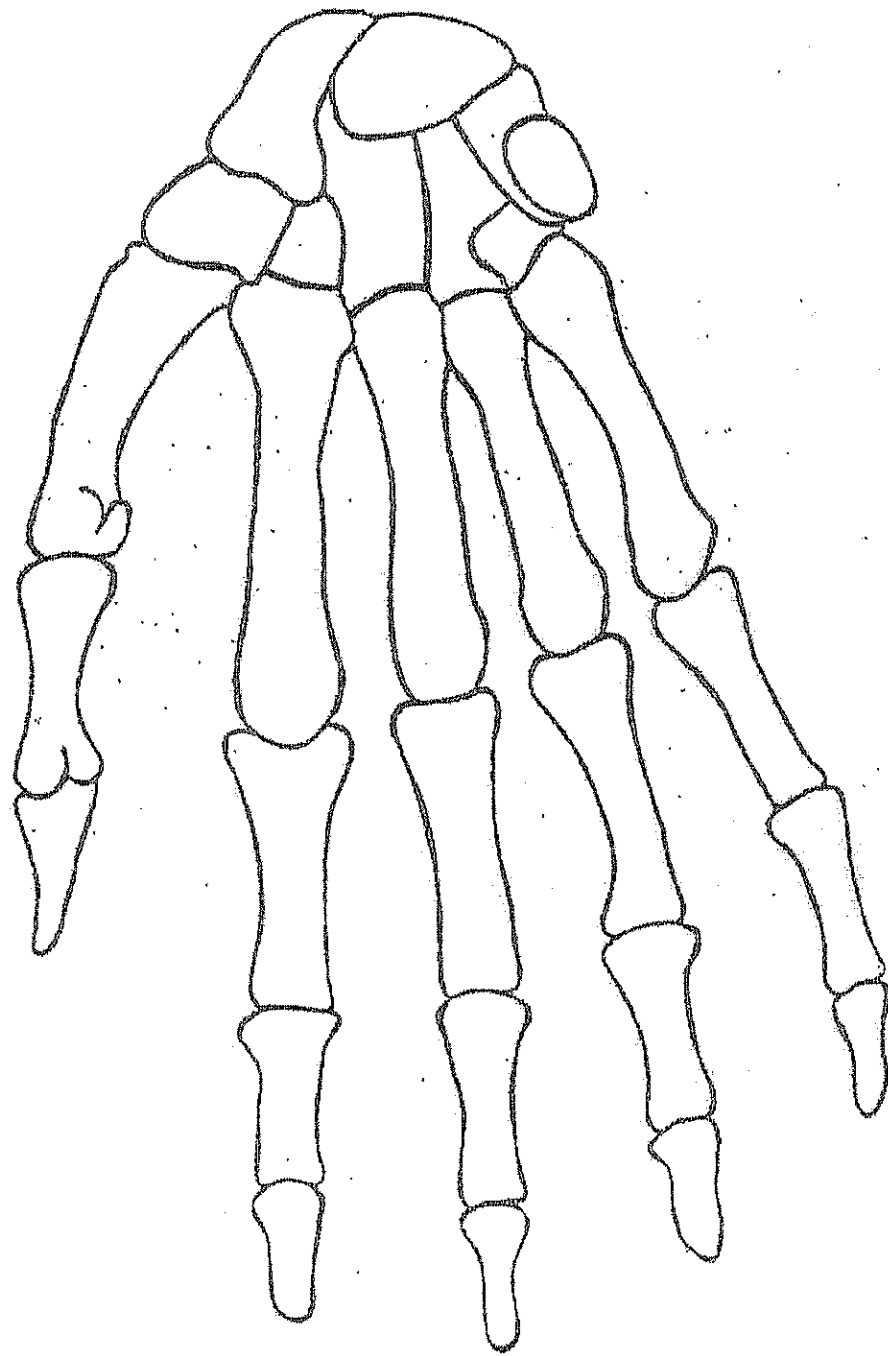


Note: Division variable between ulnar and radial innervation on dorsum of hand and often aligns with middle of 3rd digit instead of 4th digit as shown

C

C

C



AUTONOMIC NERVOUS SYSTEM

pre-ganglionic fibers
post-ganglionic fibers

SYMPATHETIC DIVISION (thoraco-lumbar) *short term*

thoracic and lumbar spinal nerves
sympathetic chain ganglia (paravertebral ganglia)
cervical, thoracic, lumbar ganglia
gray *rami communicantes*
white *rami communicantes*

adrenaline
epinephrine

post-ganglionic fibers from superior cervical ganglia

functions _____

post-ganglionic fibers from T1 through T5 spinal nerves *maybe L5*

functions _____

post-ganglionic fibers from all thoracic and lumbar spinal nerves

functions _____

greater splanchnic nerves

celiac ganglia

functions _____

lesser splanchnic nerves

superior mesenteric ganglia

functions _____

least splanchnic nerves

inferior mesenteric ganglia

functions _____

PARASYMPATHETIC DIVISION (cranio-sacral)

cranial nerves

CN III (oculomotor)

functions _____

CN VII (facial)

functions _____

CN IX (glossopharyngeal)

functions _____

CN X (vagus)

functions _____

Auerbach's (myenteric) plexus

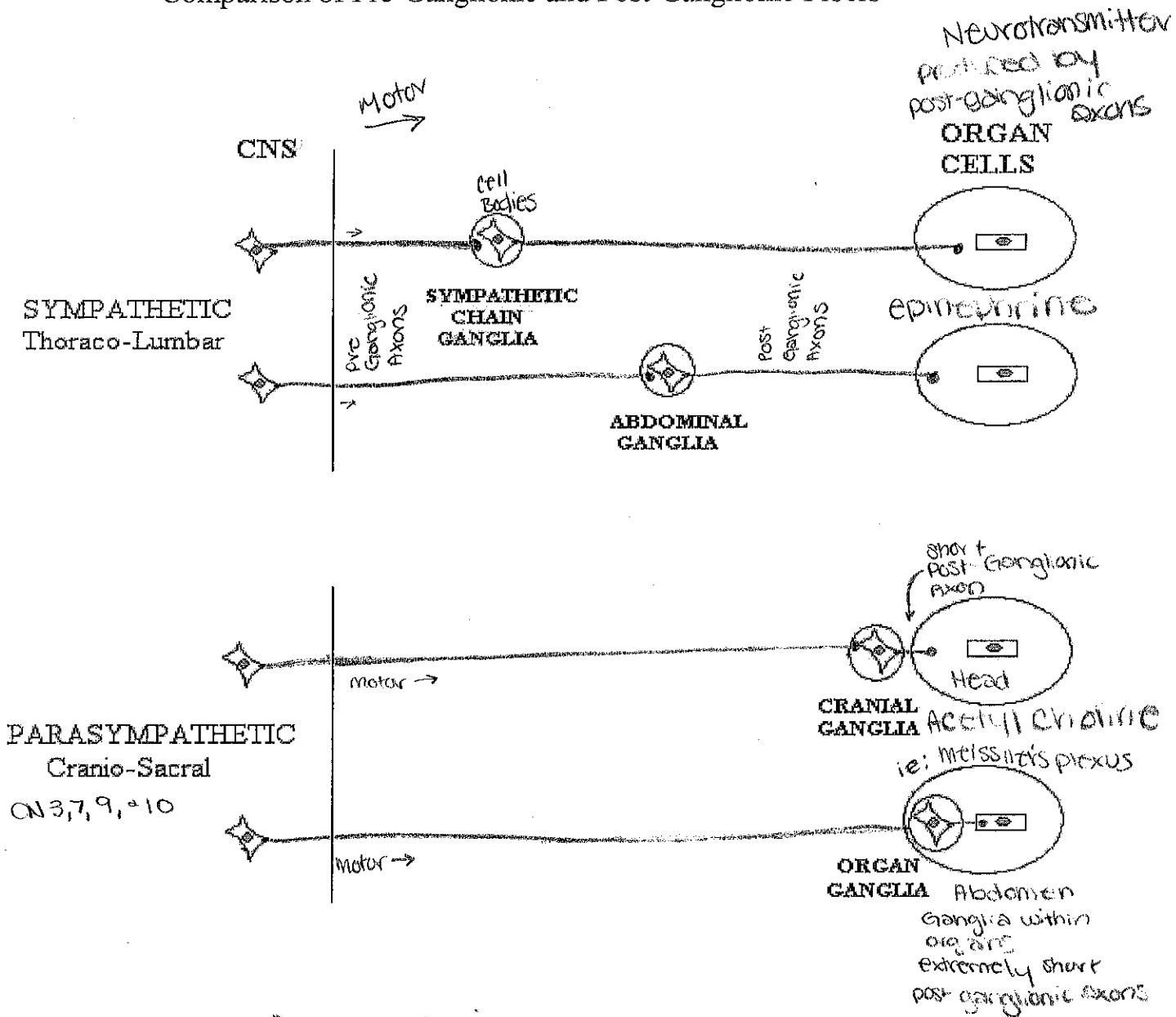
Meissner's (submucosal) plexus

sacral spinal nerves (S2, S3, S4)

functions _____

AUTONOMIC NERVOUS SYSTEM

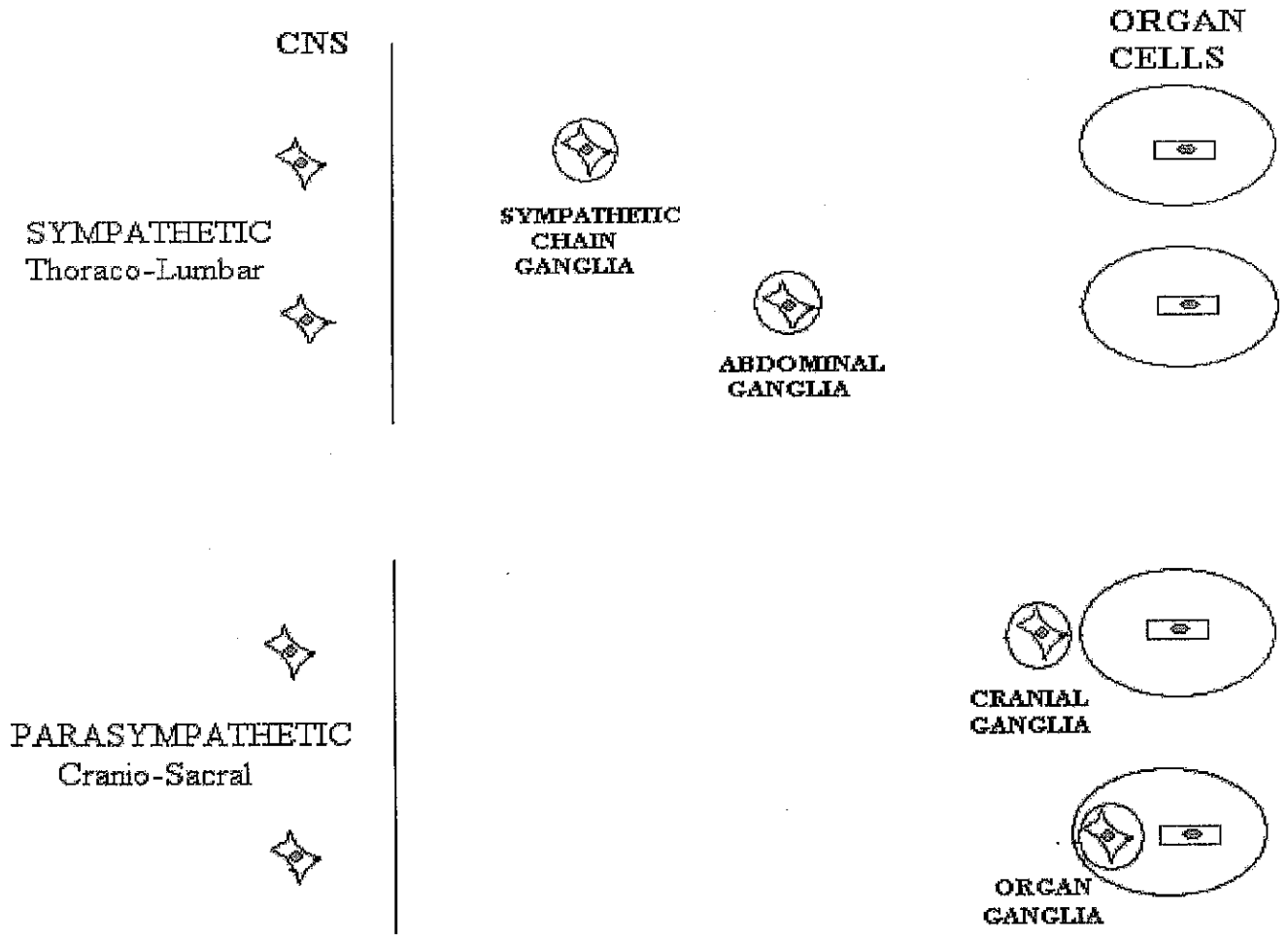
Comparison of Pre-Ganglionic and Post-Ganglionic Fibers



(nor)epinephrine
 almost interchangeable
 in brain/synapse = neurotransmitters
 in blood/body = hormones

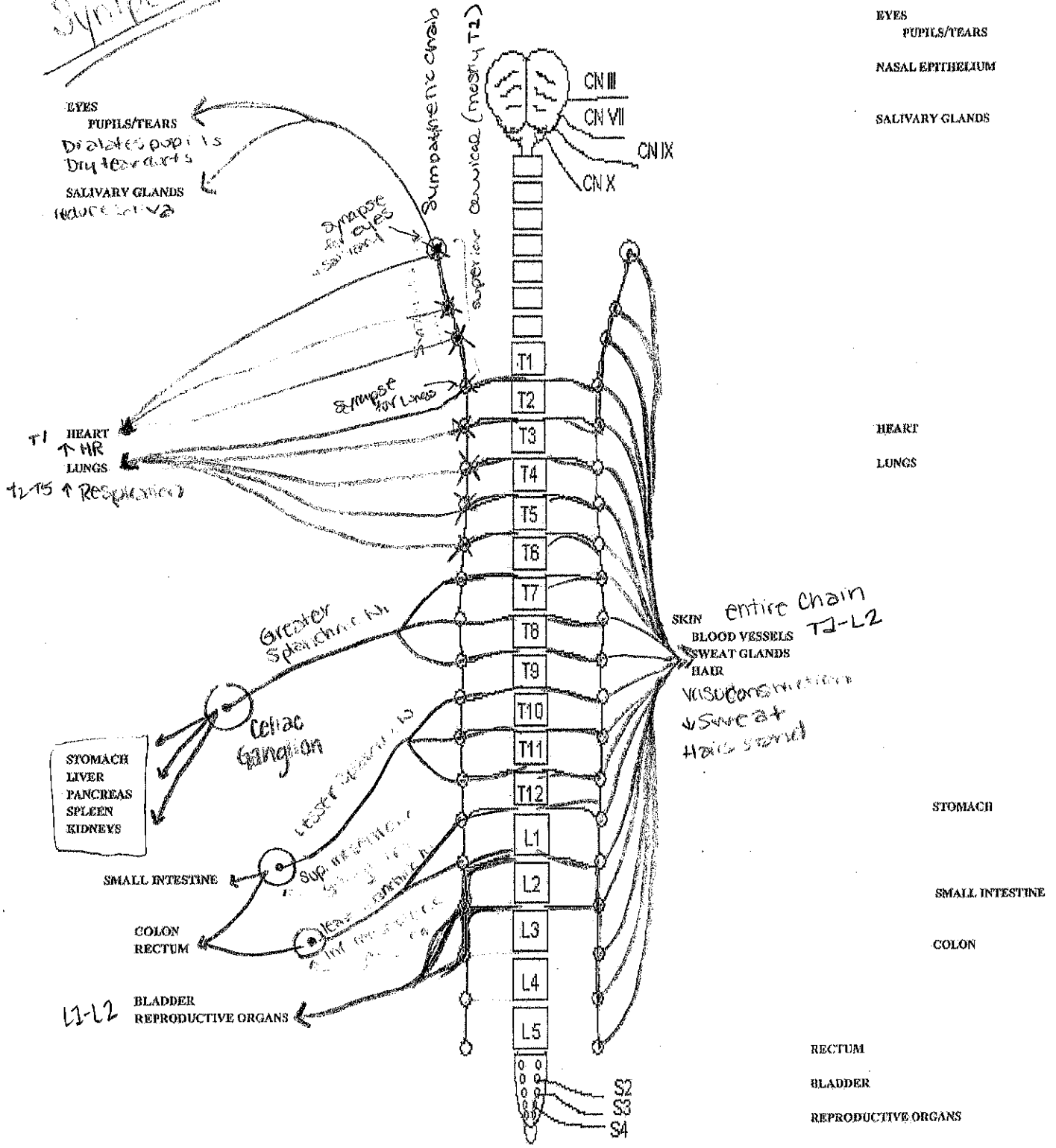
AUTONOMIC NERVOUS SYSTEM

Comparison of Pre-Ganglionic and Post-Ganglionic Fibers



AUTONOMIC NERVOUS SYSTEM

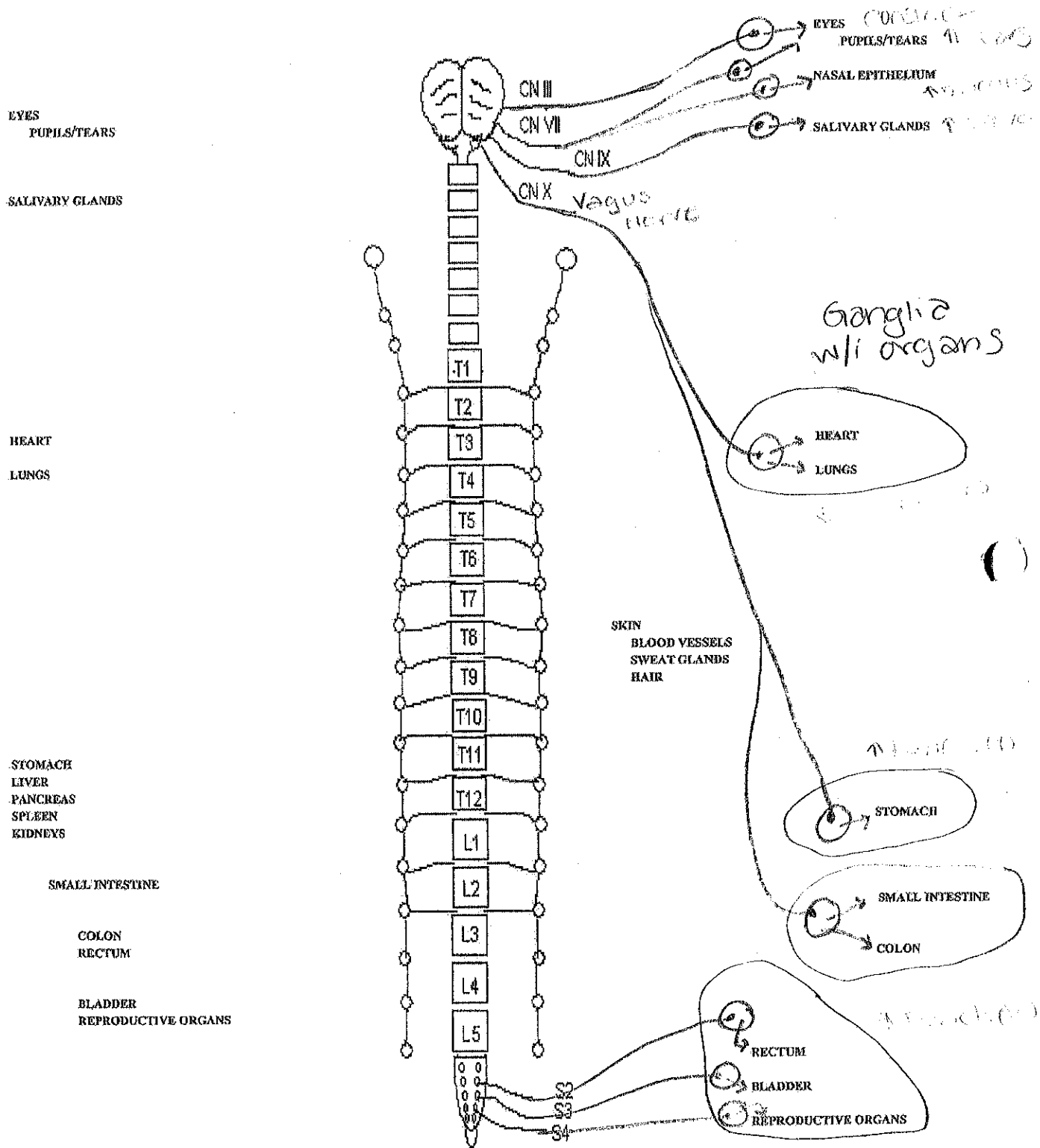
Sympathetic



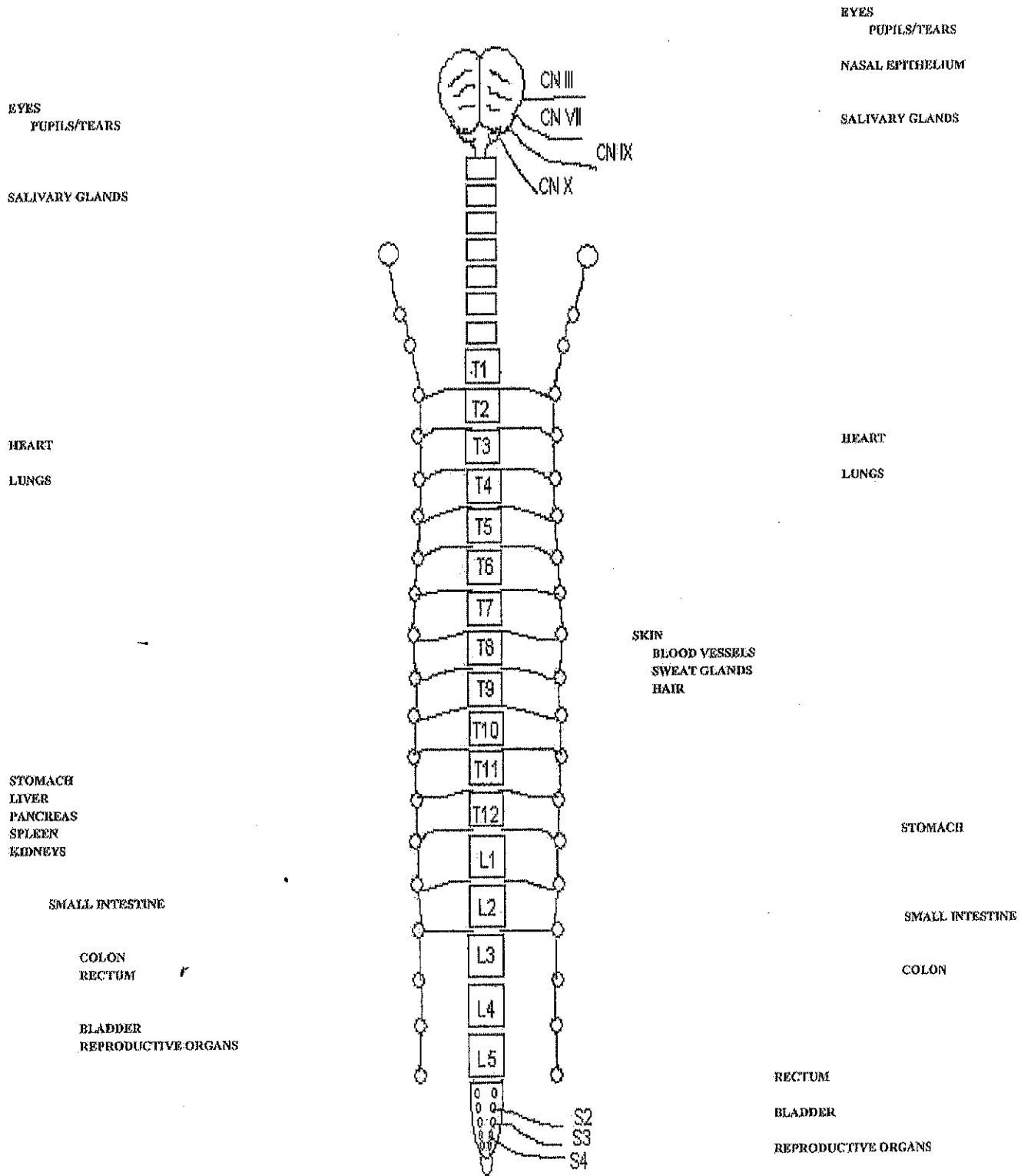
Part 1 of 2

Post-Brain/Brain

AUTONOMIC NERVOUS SYSTEM



AUTONOMIC NERVOUS SYSTEM



THE SYMPATHETIC CHAIN

