



- * heart 3 parts:
- 1- Pump part (يضخ الدم)
 - 2- Conductive part
 - 3- Macro circulation (دائري يعبر فيه تيارات الفارتان وال nutrient وال waste Products)

* pulmonary و systemic في غنا circulation

* portal system: 2 Capillary systems موجود
في ال portal vein التي خاص بال GIT و liver و يوصل بين ال circulation
ال موجود في GIT و الموجود في ال liver

* heart 4 chambers (2 atrial + 2 ventricular)

* fibrous skeleton: four rings of fibrous tissue
وصول يحوط بالأربع فتحات الرئيسية (2 atrial + 2 ventricular) في ال
atrioventricular valves و كالب واحد حول ال Valve of aorta و واحد حول ال

* 2 fibers trigons (Value of pulmonary artery)
1) Connecting the rings to each other
2) dense connective tissue تكونه

* fibrous skeleton + fibers trigons → attachment site of valves

* The bulk of heart mass is Cardiac muscle

Contraction ال
باصطلاح ال
Conducting system في غنا (مصدر لإنتاج ال signals و توصيلها)

Conducting system → Modified muscle cells أصله
يعني ال muscle cells حار منها تغيرات عن ال تارة على شكل Pulse

ولا ال fibers ال اسر وهو pyrrkinge fibers



Aorta rise from left ventricular and give branches (left coronary artery and right coronary artery).
وصدرى يعمل على كفاءة القلب

* Conducing system:

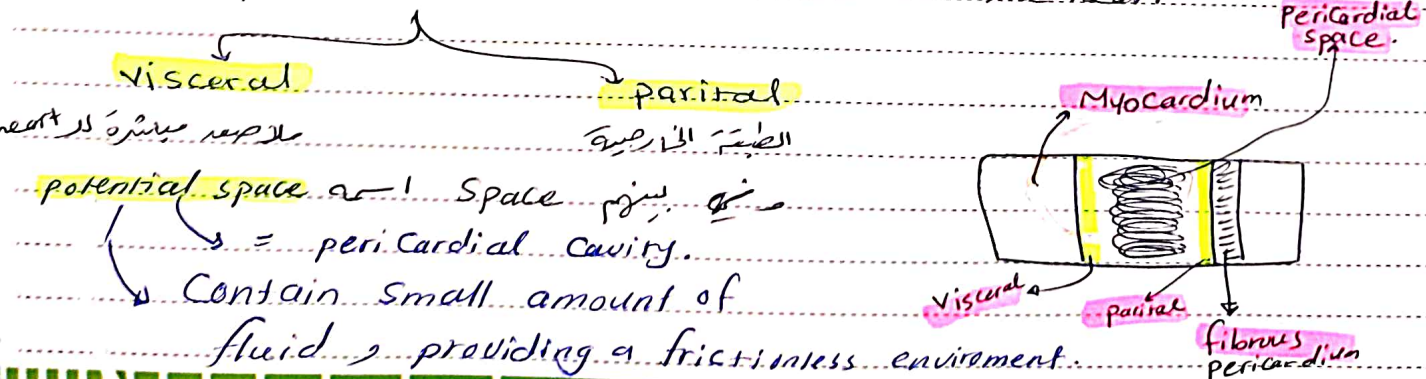
- 1 - SA node: أول مكان يتولد منه الإشارة
- 2 - AV node
وفي 3 pathways بين SA و AV
- 3 - bundle of His (AV bundle)
يتفرع لفرعين واحد يربط right و left

* Cardiac muscle (الجزء الأساسي أو الأكبر من القلب) MyoCardium

القلب مقسم من 3 طبقات أحدهم MyoCardium

heart Chambers lined by endoCardium
والسطح الخارجي يغطيه من الخارج Fibrous Connective tissue و يربطه
مع المحيط الذي هو (diaphragm + sternum) - pericardium

pericardium: Sac Surrounds the heart





Potential space contain 15-50 cc of
serous fluid in pericardium cavity

Histology of Myocardium: for muscles

Myocardium = Cardiac muscle

Smooth Striated

- Atrium muscle thin
- RV thick
- LV more thick than RV

- arrangement of يُرتب
Contractile protein inside
the muscle cell

Striated skeletal
Cardiac

CT = Connective
tissue

لو أخذت مقطع من heart و كبره :-
في الخارج خلاص عيزي Adipose tissue و ال pericardium (fibrous tissue dense) و اللي
one layer of Mesothelial cells lined by المبط

Note Mesothelial cells: تغيب البقيع الجوفاء
(Pericardium + pleural + Peritoneum) في

• pericardium visceral + parital
علاص طبقة اللي في الخارج

pericardium parital Potential space epiCardium
(Fibrous layer) Pericardium that lined by

Lined internally Myocardium Layer of fatty tissue visceral layer of pericardium
(by endocardium)



بواظ
Coronary
arteries



Endocardium :

الطبقة الداخلية للقلب تتكون من endothelium وهو نوع خاص من epithelium (Simple squamous epithelium) الذي هو

- lining of internal Part of heart → endocardium
- lining layer of blood vessels → endothelium
- lining of body cavity → mesothelium

تحت endothelial C.T يوجد Sub endothelial C.T وهو طبقة عميقة deep layer of C.T (Subendocardial layer continuous with C.T of the myocardium) Middle layer of C.T and smooth muscle cells.

و هذا النظام Conducting system الذي يوجد فيه ال

(left Atrium) Well developed Thick Myoepithelium LA Transverse section of heart ال septum RA و LA thin Right septum

Interatrial septum RA و LA Interventricular septum RV و LV

heart valves: start from fibrous rings (fibrous skeleton)

①. (valve core connective tissue) fibrosa في طبقة اسفلية

ال valve يتكون من اجزاء (ring ثابتة و ring و جبهة لتقليل رجلا على انفسه و يمنع رجوع الدم لعين الرجلا (one uni directional)

②. (loose C.T. rich in proteoglycans) Spongiosa

Proteins with polysaccharide GAGs = glucose amine glyCans.. (Chondroitin sulfate)

التي تحتوي على sulfate (-charge) و rich in sulfate group اجزاء بيضاء صلبة



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يوجد جزيئات الـ GAGs في الماء
جذب كبر من جزيئات الماء
فيسر فيه رابط بينه - charge - وال

Partial Charge فيسر فيه كمية من GAGs بداخل الـ Structure

فلو صار mechanical pressure محاول يخلي جزيئات الـ H_2O

تتمدد ولكن وجود GAGs يخليه يجذب رطل resistance

موجود هذه الجزيئات

مبجل زي absorpant بكمية عن (Shock absorpant) زي مثلا الـ Cartilages

الـ Joints في شكل كبر الـ proteoglycans على صيا ستر

يعرض انه يسر عليه pressure

وجود الـ proteoglycans في الـ Valve من مثلا لو valve به نغلم

الضغط يوصل الـ 120 mmHg فيسر Mechanical force به يسر منشاء

صرك طينة الـ Spongiosa في حتمين الاستجاع أو الـ Mechanical pressure

وصار الـ هينظم انسياب وحركة الدم وحولها طبيعة أكثر

• Semi-lunar valves are Avascular Valves. الـ blood في

بسيطة عند طرفي وحيثما هن الـ nutrition من الـ blood بالي حولها

الـ ring عند طرفه الـ diffusion

Blood vessels:

Arteries and veins or Integral blood vessels contain

3 layers → 1- The most inner Tunica intima

2- Tunica Media

3- Tunica adventitia

Tunica intima: contain one single layer of simple squamous epithelium called endothelium

and inf. it bind to basement membrane

(basal Lamina) and below it there's the

Subendothelial Layer (loose c.t. and smooth

muscle cells: if the blood vessel is artery

there's an elastic Lamina (elastic membrane)



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وصار هو في artery

عنا يعرض لسطح كبير فلازم يكون فيه
درج من الليونة عناه تسوي الـ Pressure



Tunica Media: Circular Layer of smooth muscle cells

ليف شريطي حلقية منتظمة حول الـ

Lumen of blood vessels

و لكنه في بعض الأوعية حلقية أطول (غير منتظمة وغير مكملة)
Middle Large veins في الـ

internal elastic Tunica media في الـ Tunica intima
Membrane.

External elastic Circular Layer of smooth muscle
Lamina of smooth muscle
arteries في معظم الـ

Tunica adventitia: 1) The outer layer

2) is a collagenous tissue and elastic fibers.

③ بعد قطر جدار الـ blood vessel يتغير بارتفاع الضغط و O_2 و يتلقى من Weast
diffusion الـ thickness جدار الـ diffusion الـ
أنه يتغير كل الخلايا أو الـ material الـ blood vessel
blood vessel الـ blood vessel

Vasa Vasora:

Signals الـ nerve من جدار بعض الـ
nerve Vasa (الـ nerve في بعض الـ)
الـ vessels



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Arteries

① Large or elastic Arteries :

أول arteries يتفرع من ال LV أو من ال Arch
شعاع / Their branches + Aorta + pulmonary artery

لأنه في طبقات متفرقة بعد كبر ال membranes
elastic Membrane
internal + External elastic

عدم بقاء ال Thickness تابع ال blood vessel

في ال artery العادي في بسى طرية (internal + external) كية
elastic Membrane

في ال elastic artery في كى طبقات قد تصل ال عشرة حسب ال Thickness
هذا حيث تغطي ال blood vessel درج عالية من المرونة

أهمية المرونة

• بسى ضغط الدم 120/80؟ عبارة عا ينقبض القلب
بوصل 120 و يصل ينقبض لحد ما يصل 80 (Relaxation)

نقص ال Contraction حبيب 120 و يرجع يتزل ل 80 و يرجع لطلع 120--

+ هو الخوض حسب الميكانيكا من صلب؟ لو كان ال ال rigid يعني بال
Contraction حبيب 120 و لا يلقى يرجع 0 "Zero" وضع ال Contraction

الثاني حبيب 120 بسى ضغط الدم 120/0 و طبياً ينقبض يصير
0 . فالمرونة صاوي هو ال حباب على حل الموضع يعني طما

الدم يدخل ال aorta (elastic) حبيب و يأخذ 120 و حبيب يرجع حبيب
سوى (بدون) فما يلقى ضغط الدم يصل 80 شى صفر راي أنه
يصل ال Contraction الثاني .



- ② Medium arteries & muscular
- ③ small arteries and arterioles

elastic artery function: ① Convey blood from the heart to the peripheral part

- ② facilitate the continuous and uniform movement of blood

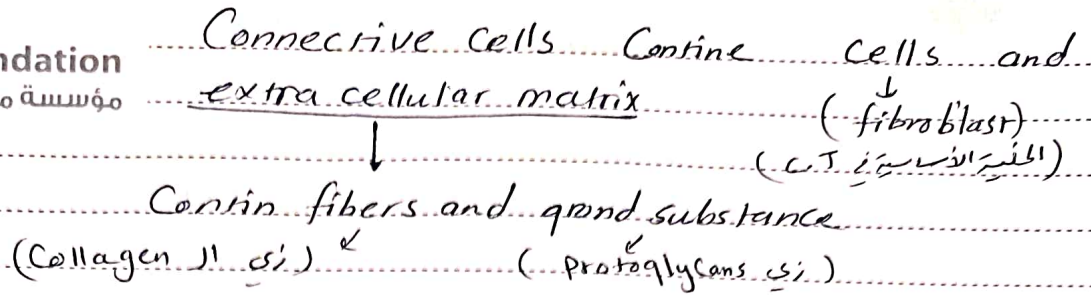
Endothelial cells: Tight Junction

- ↳ special structure or special protein
- ↳ on the surface of the cell
- ↳ there's grooves and ridges
- ↳ The other cell has the complete part of the other cell and bind to gether by those Tight Junctions (Zonula occludens)

Tight Junctions → material لا يمر من هنا
ما بين الـ blood lumen و الـ surrounded tissue
موصلة ولكن لا يمر بها ذلك

- Endothelial cells have relations between them by Gap Junctions

Endothelial → Weibel palade bodies
تسمى به Microscope
① VWF
② P-selectin + Coagulation factors
cell adhesion molecule
P-selectin
Leucocyte
Leucocyte
Leucocyte



- extracellular matrix synthesised by fibroblast

Large
In arteries: extracellular matrix and ground substance
Medium synthesised by muscular smooth muscle
cells (fibroblast في الشرايين)

- No fibroblast in Tunica Media. (In large artery)

Medium (muscular) : More muscle (Thicker than muscles
in elastic Artery)

- less elastic membranes
(internal and external elastic membrane)

Contain

- 1- Prominent internal elastic membrane.
- 2- Thinner intima than large Arteries.
- 3- has external elastic membrane
- 4- No fibroblast in the Tunica Media. (في الشرايين)
- 5- Thick Tunica adventitia.



Small arteries And arterioles:-

1- In Tunica Media One or 2 Smooth muscle layer
(لا أكثر من 2 بطانة صغيرة)

Small artery } 3 to 8 Smooth muscle layer
 } has internal elastic membrane

Arterioles : internal elastic membrane
(مرء موجود مرء لا)

Gap Junctions between endothelial and smooth muscle cells.

مصدر تنظيمها الأساسية توصيل أو تسمى وصل
أو small molecule tissue . و يتواجد في الـ tissue
That should act together. (Should have a relation)
(مثل / وظيفة البطانة بغيرها مكنة توصيل Signal و ينقبض و يوسع ليتمكّن
الـ Signal نظام ثانوي مكنة Signal + Signal من توصيل بين الـ tissue لكل
الأنسجة و تنقبض عن طريق وصل في Gap Junction)
يتأثر وصل الـ Signal في
التوصيل المناسب و أنه ليس

Contraction together.

In Small Arteries : Tunica adventitia Thin
In Arterioles : " " "

بعد الـ Arterioles في Capillary system & فضاء الـ Arterioles في البوابات إلى
post Capillary Venues و يوسع و يتوسع

In Arterioles : muscle cell control the amount of blood
that enter the Capillary system

(لا يوسع) كل Contraction من مدخول دم في Capillary system



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(شي مطون في مفرقة)

Arteriovenous shunt

نفاصة

عودة ال arteries موازية لل veins فوائداً ال Arteriovenous بجانبه في ال venial

أحياناً يكون وصلة مباشرة بين ال Arterial و ال venial اسمها

ال (Arteriovenous) shunt لشي مثلاً ال Arterial على ال Contraction كامل فكله تفتح

ال الدم عبر ال Capillary و بالتالي الدم يروح لل venial مباشرة

بدون ما يدعى ال system يتبادل للغذاء أو ال waste

صادره في ال skin في حوامله الفاظ على درجة الحرارة

(الدم طالع يمر عبر ال Capillary حوامله فكله حرارة بس طالع يروح

al Venuals مباشرة شي حوامله نقده للحرارة)

الضغط
الحرارة
في الجسم

Capillaries:-

1- Gas exchange done in it

+ Metabolite exchange

2- There's 500,000 miles of Capillary in human body

3- Contain one layer of endothelial cells and its basement membrane

4- Lumen of Capillary Diameter is smaller than RBCs (مقارناً أصغر من قطر ال RBCs بس مش كثير)

"عنايه يكون مرور الدم بطيء نسبياً فيعطى فرصة لل RBCs

أنة تدل كمية ال O_2 متأخذ ال CO_2 "Gas exchange" تكملة مثله"

Capillary Classification :

1- Continuous

2- Fenestrated

3- Discontinuous



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arteries

القلب يخلق pump لتضخ الدم وال Veins + ال
كوسيلة توصيل للدم وأهم مكان هو Capillaries
عشائر هو مكان ال Gas exchange

Capillaries is an endothelial cell layer and its basement membrane



(Muscular layer) Tonica Media

• Capillaries lumen → RBCs يمررون
وأصلاً ال RBCs يتحلل وتضيق لحالة عشائر

عندما يمرر قطر ال RBCs يتضيق ويصادف عشائر
Slacage passage (مرور بطيء وبالمشي فحصة أكبر لك لدخول ال
والخلاص من CO_2 + waste products

Continuous Capillary:

متكونة من basement membrane + single layer of endothelial cells

Tight Junctions (الخلاصة) ال endothelial cells
كامل في ال intercellular space (وبالمشي ال basement membrane
Continuous بدون فتحات

②

① Luminal surface & microvilli

Numerous pinocytotic vesicles of transcytosis

لأنه ال intracellular space مثل ال مرور يتكون من

خلال ال cytoplasm من خلال حشوف ملية كبيرة كحشوف
of endocytosis [أو كنتاج ال endocytosis
vesicles كثيرة داخل ال cytoplasm

يستوفون في أماله كثيرة (معظم أجزاء الجسم)



Fenestrated Capillaries:

بُنى شباك أو فتحة

Endothelial cytoplasm contact openings allow the passage of materials.

- Openings $\leftarrow$ ثقب كامل $\rightarrow$ Openings from 70 - 80 nm
منها عابضة
الـ diaphragm (حاجز بين أنواع مختلفة من البروتينات)

* In: Endocrine glands, gallbladder, kidney, pancreas and GIT.

* have continuous basal lamina (like continuous capillaries)

* Contain numerous pinocytotic vesicles

* In kidney, opening increases filtration in glomerulus

Discontinuous Capillaries

* In sinusoids

* More dilated than other capillaries + elongated and sometimes it is branched called sinusoids

* In: liver, spleen and bone marrow
(الأنسجة التي تتكون فيها خلايا الدم - Haematopoietic system)

* Irregular in shape

* Endothelial cells $\rightarrow$ Large cytoplasmic openings
 $\rightarrow$ There's an intracellular spaces (No Tight Junctions)
 $\rightarrow$ Discontinuous basal lamina



Sinusoidal vessels

المسامية هي تسمى بكبد الكبد
تسمى جزيئات الجسم أكثر من المعتاد

In liver: Sinusoidal vessels have cells of monocyte phagocytic system

monocyte from blood stream to tissue and become Macrophage or histocyte or ...

In some organs they have special name as Kupffer cell in liver

Pericytes:

repair or Stem cells new generation

من بين هذه الخلايا endothelial cells (كبد الكبد)
fibroblast و muscle cell
differentiation في الخلايا مختلف

So

pericyte = undifferentiated mesenchymal stem cell and usually associated with Capillaries

تسمى تسمى موجود حول
Post Capillary Venules

wrapping Capillary and share the endothelial basal

Lamina

Contractile proteins (قوى) Contraction (خاصية انقباض)
Contraction (قوة انقباض) و Contraction (قوة انقباض) (hemodynamic)
Controlled by Nitric Oxide



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• Av Shunt → surrounded by Capsule
Connective tissue

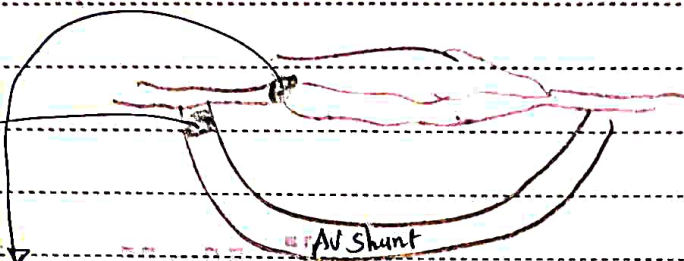
كسوي
nerve endings

Arterial system ends by arterioles branched to
made capillary system and convert to made
post capillary venules

صبيك لين



ليس في اجزاء الاضياء على يدك في
وصلة مباشرة ما بين الarterial والvenous



Av Shunt in
nose lips penis
Clitoris and finger
tips.

Sphincter (well developed smooth muscle cells)

تتألم في مرور الدم من الarterial الى الcapillary
في contraction يمنع مرور الدم في الcapillary
كيسه ويحيطه قفص من الدم كله

Av Shunt also have sphincter (smooth muscle cells)

Sphincter contraction يمنع مرور الدم عبر طريق الshunt
والتاليه الدم يمر بطريق الcapillaries

heat regulation (عادة هذه structures موجودة في skin)

بدخله حرارة الجسم مفروض اضافة على فيمنع مرور الدم في الcapillaries
في الshunt (shunt sphincter not contracted)

الدم في الcapillaries ليس فقط بكميات كبيرة من الحرارة
contracted



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Veins:

- Contain 3 layers (Tunica media, Tunica intima and Tunica adventitia) but not distinct as in arteries.

- Same size Arteries and veins travel together.
- Thinner wall and larger lumen.
- Valves (ميزة عن الartery) ليس في الartery

عند الartery يتم الدفع للم ب force كافية
ليغطي احتياجه للطاقة ويتنفس لكن ال veins لا
أي مصدر للثقة ويعتمد على contraction في ال muscles
التي تخلق فيه negative pressure الموجب في
Thorax space هو الذي يفرغ الدم في اتجاه القلب
فال valves يمنع الدم من عكس اتجاهه

① Venules: 2 types → ① post Capillary (جدارة بس ال Capillary)
→ ② Muscular venules

② Small Veins: less than 1 mm

③ Medium veins: up to 10 mm

usually accompanied by arteries

④ Large veins: Larger than 10 mm (1 cm)
like (Vena Cava)

post Capillary Venules contain endothelial cells and basal
lamina and There's no muscle layer also there's pericytes
(ليس الarterial فيه muscle layer)



Contain pericyte
• Post Capillary Venules Site of inflammatory reaction (site of dilation and edema) (مرور الخلايا المناعية الموجودة داخل الدم)
and allergic

Special post Capillary Venules in lymph node called High endothelial Venules.

circulating lymphocytes pass across it to lymph node (homing).
its endothelial cells are Ocubodical rather than Squamous (high) (مرور الخلايا المناعية الموجودة داخل الدم)

• Muscular Venules: 2 or 3 post Capillary venules
Convex together and made it
Contain one or two
Layer of smooth muscle cells (Tunica Media)
No pericyte
Thin Tunica adventitia.

Small veins:-

- قَصَبَاتُ الْقَيْصِلِ Venules
• Continuation of muscular
• Contain 3 Tunica layers
• T. Media Contain 2 or 3 layer of smooth muscle cells.
• T. adventitia Thick (More developed)



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Medium veins:

- Most deep veins are in this category.
- Valves are characteristic in lower limb.
- T.intima is endothelium and its basal lamina and Thin subendothelial Layer (loose C.T and smooth muscle cells).

artery الشريان
vein الوريد

elastic membrane الغشاء المرن
artery الشريان
vein الوريد

- In some cases a thin internal elastic membrane may present, but is a discontinuous and ~~imperfect~~ Not well developed as in arteries.

T. media: ① Circular smooth muscle cell.

② Thinner than of Medium arteries than

③ Longitudinal smooth muscle cells

الشريان في الوريد والوريد في الشريان
Large

T. Adventitia: Thicker than the T. media.

Contia ↓ bundle of longitudinal muscle cell.

Large veins:

↓
more than 1 cm.

Tunica intima: Endothelium and basal lamina
Subendothelia C.T. and some
Smooth muscle cells.

T. media: Relatively Thin
Circumferential muscle layer.



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T. Adventitia: ① The Thickest.

② well developed layer of longitudinal smooth muscle cell

Lymphatic vessels:

- pressures → تتحكم في مرور السوائل
1. Oncotic pressure [osmotic pressure associated with blood protein]
 2. hydrostatic pressure (جاء و برا ال circulation)

صاد يخرج ال سائل عن طريق ال Capillary system من ال circulation
 ال tissue و ليس يوصل ال Venules يبدأ يرجع السائل
 ال قفصه و يحايه صا رقتة للسائل حينئذ ال oncotic pressure
 و يرجع سبب ال سائل مرة أخرى و دائمة من صفة العجلة صلاته في
 residual of fluid يرجع من خلال ال lymphatic system

blind tube ↓
 يبدأ من سبب ال Capillary system ال سائل يتحرك نحو ال heart

Lymphatic Capillaries ① blind tubes

② Numerous in loose C.T beneath the epithelia

③ More permeable

(في loss connection بين ال endothelial cells) سائل تساقط
 مرور السائل

④ Lack continuous basal lamina



- Lymphatic vessels contain valves
(عشان تمنع عودة الدم اللي منه بيتأثر
بالضغط المجاور له)

Capillary converge into lymphatic vessels.

- Lymphatic vessels contain Tight Junctions between endothelial cells and continuous basal lamina surrounded by smooth muscle cells

C.T
Smooth muscle cell
كل ما اتجوزا نحو القلب جند ال Thickness
C.T
Smooth muscle cell

- 2 main channels في هالمنقوص كنه في
1. Thoracic duct
 2. right lymphatic trunk

Enters the blood at the Junction of internal Jugular and subclavian Vein

also passes through lymph nodes.

lymph nodes في lower limb
inguinal و popliteal fossa
area
ممكننا في
vessel ال

• منو صار اي event (infection) ال lymphatic vessels
microorganisms او ال products
Cancer ال lymph node
و هناك بيتم الشال منه
vessel ال lymph node

heart layers: epiCardium, MyoCardium, EndoCardium

epiCardium : = visceral serous periCardium

1. Mesothelial cell layer underlying C.T and adipose.

Myocardium → The bulk of heart
= Cardiac Muscle

Endocardium - inner layer.

- epithelium (endothelial layer)
- + subendothelial layer and deeper layer of C.T (subendocardial layer)
- contain cells of conducting system of the heart.

Fibrous skeleton: ① for attachment of valves and separation of atrial and ventricular musculature.

↳ ② Consists of 4 fibrous ring surrounding the valve orifice

→ ③ Consists of 2 fibrous trigones. Connecting the rings and the membranous part of interventricular and interatrial septa.

pericardium:

- serous
 - visceral
 - parietal
- fibrous

} between them there's pericardial fluid (15-50 cc)

Heart valves:-

- Composed of C.T with overlying endocardium
- Heart valves attached to dense irregular C.T that forms the fibrous ring and surrounds the orifices.

Value

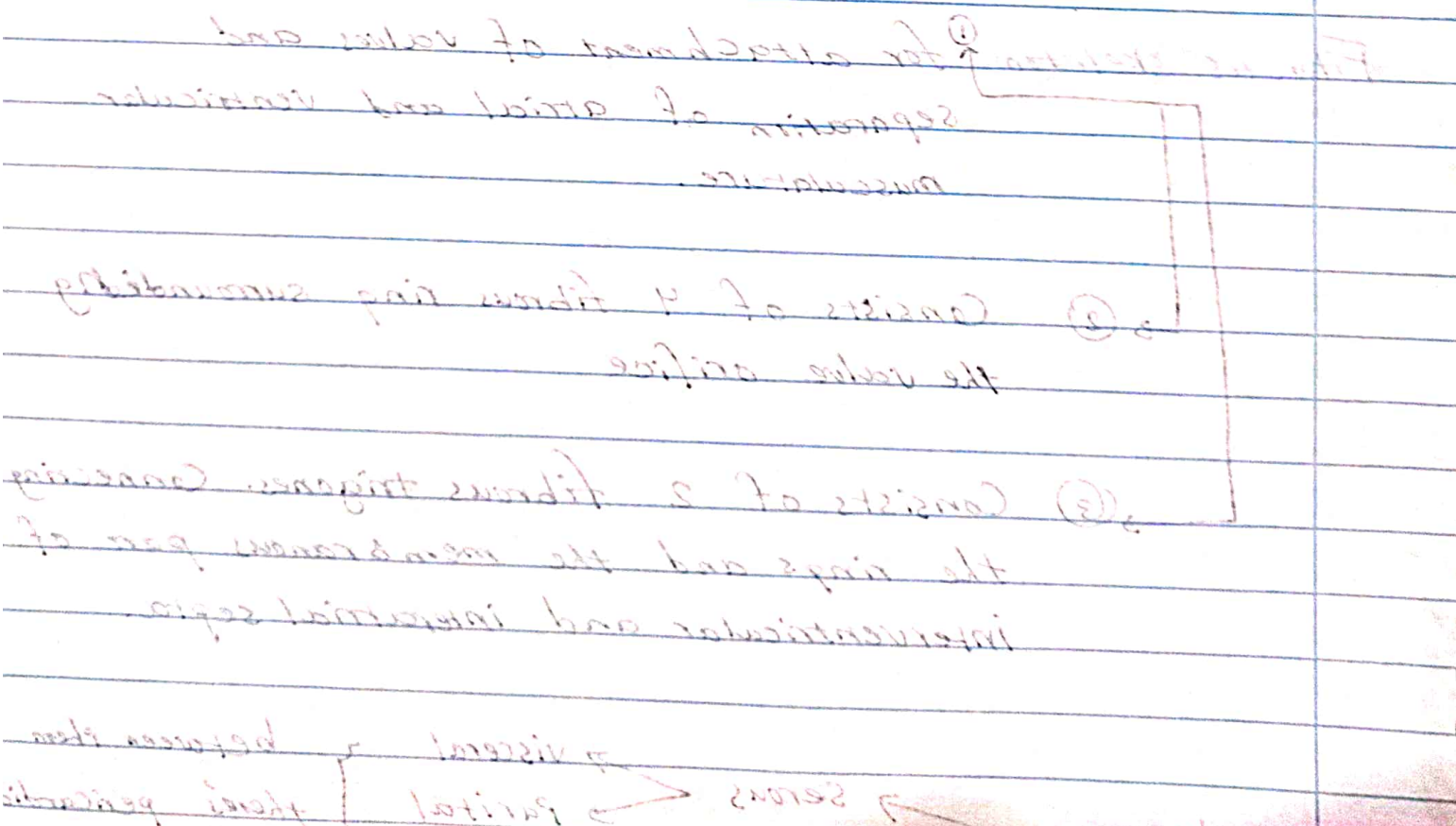
Spongiosa

- loose C.T
- Composed of collagen and elastic fibers with large number of proteoglycans.

Fibrosa

form the core of the valve and contains fibrous extensions from dense C.T of the skeletal ring.

- Act as shock absorber and confers flexibility and plasticity to valve cups.



Blood vessels: +ve spiral.

3 layer.

(T.M) (T.I) (T.A)

Tunica Media / Tunica Intima / Tunica adventitia.

Tunica Intima: inner most layer

Composed of: Endothelial and its

Subendothelial (loose C.T.) and smooth muscle cell

Simple Squamous epithelium.

NOTE

In arteries: it

Contains internal elastic membrane

Tunica Media: Middle layer

Composed of circumferentially arranged

Layer of vascular smooth muscle cell

Thick layer extend from internal elastic membrane to external elastic membrane

(Separates T.M from T.A)

Tunica adventitia: Outermost C.T layer

Composed of collagenous and few elastic fibers.

Contains Vasa vasorum and nervi vasorum

Supply blood to vascular wall themselves

Control contraction of the smooth muscle in the vessels wall

• Large arteries (elastic Arteries)

- function
1. Conduction tubes (C.T.)
 2. facilitate the continuous and uniform movement of blood along the tube.

A. Tunica Intima

- ① endothelial lining with its basal lamina.
- ② The cells are joint by gap Junction and Tight Junctions.
- ③ sub endothelial layer of C.T with Collagen and elastic fibers.
- ④ Internal elastic lamina Membrane (one of the many IEM) + (innermost elastic layer)

B. Tunica Media

thickens with numerous Internal elastic Membrane and Smooth muscles.

C. Tunica Adventitia

Thin C.T. and external elastic Membrane

- Medium Arteries (Muscular arteries)
- More muscle, less elastic Membrane.
- prominent internal elastic membrane.
- Has external elastic membrane.

Tunica intima thinner than in Elastic arteries.

Tunica Media

muscle cells and little elastic Material
No fibroblast.

Tunica adventa

Thicker than in elastic Arteries.

There's External elastic membrane.

Small arteries and arterioles:
distinguished from one another by the number
of smooth muscle cell layers in Tunica media.

Arterioles (one or two layers)
Small artery (8 layers of smooth muscle)

T. intima

has internal elastic membrane

in small arteries but it may or may not
present in arteriole.

gap Junction between endothelial cells
and smooth muscle of the Tunica media.

Tunica adventa

Thin sheath of C.T.

There's gap Junction between endothelial cells.

Basal lamina. May have disorganized collagen fibrillations and there's a continuous layer of endothelial cells contain openings called fenestrations.

Pericytes
Pericytic
Nervous
Contain x

Pancreas and GIT (sites of absorption)
In endocrine glands and blood kidney
Capillaries

Capillaries

Gas exchange
3 Types:-
500 000 miles.
Human capillary diameter
Small than RBCs.

1. Continuous
 2. Fenestrated
 3. Discontinuous.
(sinusoidal)
- Contain one layer of endothelial cells and its membrane.
basement.

Continuous:-

- In all body typically (lung skin C.T
Cardiac + skeletal +
Smooth muscle)

• They are uninterrupted vascular endothelium and continuous basal lamina.

Process that transport large molecule between lumen and C.T

Contain microvilli on their luminal surface. + Nervous pinocytotic vesicles of transcytosis.

There's gap Junction between endothelial cells.

Fenestrated Capillaries.

- * Contain Nervous Pinocytotic vesicles
- * In endocrine glands gallbladder Kidney Pancreas and GIT (sites of absorption)
- * Its endothelial cells contain openings called fenestrations. and there's a continuous basal lamina. May have diaphragm

• Discontinuous (sinusoidal)

- In liver spleen bone marrow
- Larger and more irregular than other capillaries.
- Endothelial cell lining have large openings in their cytoplasm and separated by wide irregular intercellular gaps. + Discontinuous basal Lamina.

- Features vary from one organ to another with specialized cells like Kupfer cells.

(sinusoidal vessels have Macrophages

in liver)

Pericytes:

• Undifferentiated mesenchymal stem cell

• In capillaries and post capillary venules.

• Wrap around vascular endothelial cell

• They are contractile and controlled by

(Not) produced by endothelial cells.

Veins

The tunics of veins are not as distinct as Tunics of arteries.

1. Large

2. Medium

3. Small

4. Venules

Post Capillary

Muscular.

Venules and Small veins:-

Site of inflammation and allergic responses.

Post Capillary Venules:

endothelial lining with

its basal lamina and pericyte

No muscular layer

In lymphatic system they called High endothelial Venules.

"because of prominent cuboidal appearance of endothelial cells and ovoid nuclei"

Muscular Venules:



1 mm in diameter

2 or 3 Post Capillary Venules

One or 2 layers of T.M

Thin Tunica adventitia.

No pericyte.

Small veins:

Continuation of Muscular Venules

Diameter from 1 to 1 mm

Thicker T. adventitia.

2 or 3 layers T. Media

Medium veins:

Diameter as much as 10 mm.

Most deep veins that accompany arteries.

• valves are a characteristic feature. (inf. portion of the body)

Tunica intima

Endothelial cells with their basal lamina.

A thin subendothelial layer.

In some cases there's a discontinuous internal elastic membrane.

Tunica Media

Circular smooth muscle cell with collagen and elastic fibers.

also longitudinally arranged smooth muscle may be present. Just beneath the T. Adventitia

Tunica Adventitia

Thicker than T. Media.

Contain collagen and elastic fibers.

Large veins (from tissue)

T. intima

endothelial and basal lamina.

more

Subendothelial c.t. and some

permeable

smooth muscle

present

epithelium

T. Media

Relatively thin

Circumferentially smooth muscle cells + collagen + fibroblast.

increased large collecting vessels called

T. Adventitia

Thickest layer of the vessel wall

longitudinal smooth muscle cell with collagen elastic and fibroblast.

Arteriovenous Shunt

Allow blood to bypass capillaries by providing direct route between arteries and veins.

Commonly found in skin nose lips fingertips and penis and clitoris.

Contraction of the arteriole smooth muscle of (AV shunt) sends blood to a capillary bed, relaxation of muscle sends blood to a venule bypassing capillary bed.

