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Cardiovascular: Vascular System & Portal Circulation

Printable Flashcards — Pre-Med Biology

Arteries, veins, capillaries, vessel wall layers, hemodynamics, resistance vessels, capillary exchange pressures, hepatic and hypothalamic-pituitary portal systems, kidney microcirculation, and venous return.

176 cards — Print double-sided, flip on long edge, then cut along dashed lines.

176 cards — Printable Flashcards

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1

In one line: what is the vascular (blood vessel) system for?

2

Blood vessels are basically the body's...

3

Name the 3 main vessel types (high yield).

4

The rule that never lies: arteries carry blood... and veins carry blood...

5

Trap: arteries always carry oxygenated blood. True or false?

6

Which vessel carries deoxygenated blood but is still an artery?

7

Which vessel carries oxygenated blood but is still a vein?

8

Systemic circulation =

2

Pipes for a closed-loop transport system.

1

Move blood so cells get O2/nutrients and dump CO2/waste.

4

Arteries carry blood away from the heart; veins carry blood toward the heart.

3

Arteries, capillaries, veins.

6

Pulmonary artery.

5

False.

8

Left heart -> body tissues -> right heart.

7

Pulmonary vein.

9

Pulmonary circulation =

10

Why do we have capillaries at all?
Why not artery straight to vein?

11

Big trap: 'capillaries are just tiny arteries'. True or false?

12

Order of blood flow (typical):

13

Definition rule: arteries carry blood {{c1::away}} from the heart; veins carry blood {{c2::toward}} the heart.

14

Small vessel that directly feeds a capillary bed:

15

Blood vessel walls have 3 layers (tunics). Name them.

16

Tunica intima is mainly...

10

Capillaries give a huge surface area + thin wall so exchange can happen.

9

Right heart -> lungs -> left heart.

12

Artery -> arteriole -> capillary -> venule -> vein.

11

False.

14

Arteriole

13

Definition rule: arteries carry blood away from the heart; veins carry blood toward the heart.

16

Endothelium (plus a thin layer under it).

15

Tunica intima, tunica media, tunica externa (adventitia).

17

Tunica media is mainly...

18

Tunica externa (adventitia) is mainly...

19

Why are arteries 'thicker' than veins?

20

Big structural difference: arteries vs veins - which has the thicker tunica media?

21

Big structural difference: arteries vs veins - which is more of a 'blood reservoir'?

22

Compliance (simple) means...

23

Endothelium is not just 'wallpaper'. It also...

24

Capillaries have which tunics?

18

Connective tissue for support/anchoring.

17

Smooth muscle (and elastic fibers, especially in arteries).

20

Arteries.

19

They handle higher pressure, so they need more muscle/elastic tissue.

22

How easily a vessel stretches when pressure changes.

21

Veins.

24

Mostly just tunica intima (endothelium) + basement membrane.

23

Releases signals that control vessel tone (like nitric oxide).

25

Trap: capillaries have thick smooth muscle to control flow. True or false?

26

Vessel wall layers: tunica {{c1::intima}} (endothelium), tunica {{c2::media}} (smooth muscle), tunica {{c3::externa}} (connective tissue).

27

Vessel wall layer mainly made of smooth muscle:

28

Arteries are built for...

29

Elastic arteries (like the aorta) help because they...

30

Arterioles are the main... vessels.

31

Where is the biggest drop in blood pressure across the circulation?

32

Trap: blood pressure drops most in capillaries because they're tiny. True or false?

26

Vessel wall layers: tunica intima (endothelium), tunica media (smooth muscle), tunica externa (connective tissue).

25

False.

28

High pressure blood leaving the heart.

27

Tunica media

30

Resistance vessels.

29

Stretch during systole and recoil during diastole to smooth blood flow.

32

False.

31

Across arterioles.

33

If you constrict arterioles (vasoconstriction), what happens to resistance and blood pressure (general)?

34

If you dilate arterioles (vasodilation), what happens to resistance?

35

The vessel size change that has the biggest effect on flow is...

36

Exam-friendly Poiseuille idea: if radius halves, resistance changes by about...

37

Arteries usually have... (relative to veins)

38

Biggest pressure drop happens across {{c1::arterioles}} because they are the main {{c2::resistance}} vessels.

39

Main resistance vessels that control blood flow into capillary beds:

40

Veins are built for...

34

Resistance decreases.

33

Resistance increases, and upstream arterial pressure tends to increase.

36

16x higher (because $R \sim 1/r^4$).

35

Radius (tiny changes matter a lot).

38

Biggest pressure drop happens across arterioles because they are the main resistance vessels.

37

Thicker walls, smaller lumen, no valves, and higher pressure.

40

Low pressure blood returning to the heart.

39

Arterioles

41

Veins are called capacitance vessels because they...

42

Why do many veins have valves?

43

Trap: arteries have valves like veins. True or false?

44

Varicose veins happen mainly when...

45

How does the 'muscle pump' help venous return?

46

How does breathing help venous return? (high-level)

47

Why can standing still for a long time make you feel dizzy?

48

Veins vs arteries: which one has higher pressure?

42

To prevent backflow (especially in limbs where blood must fight gravity).

41

Store a large volume of blood.

44

Vein valves fail and blood pools.

43

False (generally).

46

Pressure changes in chest/abdomen pull blood toward the heart.

45

Muscle contractions squeeze veins and push blood toward the heart (valves stop backflow).

48

Arteries.

47

Blood pools in leg veins -> less venous return -> less cardiac output -> lower brain perfusion.

49

Veins vs arteries: which one carries most of the blood volume at rest?

50

If sympathetic nervous system constricts veins, what happens to venous return?

51

Veins often have {{c1::valves}} to prevent {{c2::backflow}}, especially in the legs.

52

Main reason veins can act as a blood reservoir:

53

Capillaries are built for one main job:

54

Capillaries are about how thick?

55

Why is blood flow slowest in capillaries?

56

Trap: blood velocity is highest in capillaries because they're narrow. True or false?

50

It increases (more blood pushed back toward the heart).

49

Veins.

52

They are highly compliant (stretchy) and low pressure.

51

Veins often have valves to prevent backflow, especially in the legs.

54

One cell layer of endothelium (plus basement membrane).

53

Exchange (O_2, CO_2, nutrients, waste, fluids).

56

False.

55

Because total cross-sectional area is HUGE (many capillaries in parallel).

57

Blood velocity is highest in which vessels (general)?

58

What does slow capillary flow help with?

59

Capillaries usually don't have smooth muscle. So who controls how much blood enters the capillaries?

60

Precapillary sphincters are basically...

61

If a tissue needs more oxygen (like exercising muscle), local arterioles usually...

62

Capillary exchange happens mainly by... (top 2)

63

Easy high-yield: O_2 and CO_2 cross capillaries mainly by...

64

Blood velocity is {{c1::slowest}} in capillaries because total cross-sectional area is {{c2::largest}} there.

58

More time for exchange by diffusion/filtration.

57

Aorta/large arteries.

60

Tiny smooth muscle rings that can shut/open capillary entrances.

59

Arterioles + precapillary sphincters (upstream).

62

Diffusion and bulk flow (filtration/reabsorption).

61

Dilate to increase blood flow to that tissue.

64

Blood velocity is slowest in capillaries because total cross-sectional area is largest there.

63

Diffusion.

65

Main vessel type where gas/nutrient exchange happens:

66

Two big forces in capillary fluid movement are basically:

67

Hydrostatic pressure in capillaries tends to...

68

Oncotic (colloid osmotic) pressure is mostly due to...

69

Oncotic pressure tends to...

70

Classic pattern along a capillary (basic version):

71

Trap: oncotic pressure is caused by sodium. True or false?

72

Edema (swelling) can happen if... (one simple cause)

66

Hydrostatic pressure (pushes fluid out) and oncotic pressure (pulls fluid in).

65

Capillaries

68

Plasma proteins (especially albumin).

67

Push fluid OUT of the capillary into tissues (filtration).

70

More filtration near the arterial end, more reabsorption near the venous end.

69

Pull fluid INTO the capillary (reabsorption).

72

More fluid leaves capillaries than returns (filtration $>$ reabsorption/lymph drainage).

71

False.

73

Low albumin (low plasma protein) tends to cause...

74

The lymphatic system is important here because it...

75

Capillary fluid movement basics: hydrostatic pressure pushes fluid {{c1::out}}; oncotic pressure pulls fluid {{c2::in}}.

76

Plasma protein pressure that pulls water into capillaries is called:

77

One equation that explains most blood flow questions:

78

If DeltaP stays the same but resistance increases, flow...

79

If resistance stays the same but DeltaP increases, flow...

80

In the body, what usually changes resistance the most: vessel length, viscosity, or radius?

74

Returns excess filtered fluid back to the bloodstream.

73

Less oncotic pull -> more edema.

76

Oncotic (colloid osmotic) pressure

75

Capillary fluid movement basics: hydrostatic pressure pushes fluid out; oncotic pressure pulls fluid in.

78

Decreases.

77

Flow = DeltaP / Resistance.

80

Radius.

79

Increases.

81

Flow through a tissue increases most when arterioles...

82

Blood pressure is highest in...

83

Blood pressure is lowest in...

84

Pulse pressure (the pulse you feel) is strongest in...

85

Trap: capillaries have a strong pulse. True or false?

86

Why is it good that capillaries don't get a strong pulse?

87

Parallel vs series (blood vessel networks): tissues are mostly in...

88

Series network example in humans that matters:

82

Large arteries (like the aorta).

81

Dilate (increase radius).

84

Arteries, not capillaries.

83

Large veins near the right atrium.

86

Steady flow protects fragile capillaries and improves exchange.

85

False.

88

Portal system (two capillary beds in series).

87

Parallel.

89

Hemodynamics: Flow = {{c1::DeltaP}} / {{c2::Resistance}}.

90

Main vessel type that changes resistance the most in the body:

91

In a generic tissue capillary bed: the vessel bringing blood IN is the...

92

In a generic tissue capillary bed: the vessel taking blood OUT is the...

93

Trap: 'afferent' always means artery and 'efferent' always means vein. True or false?

94

Kidney special: what enters the glomerulus?

95

Kidney special: what leaves the glomerulus?

96

Why is it weird that kidney has an efferent arteriole after a capillary bed?

90

Arterioles

89

Hemodynamics: Flow = DeltaP / Resistance.

92

Venule (efferent from the bed).

91

Arteriole (afferent to the bed).

94

Afferent arteriole.

93

False.

96

Because usually capillaries drain into venules, not another arteriole.

95

Efferent arteriole (still an arteriole!).

97

Kidney has basically... capillary beds in series.

98

If the afferent arteriole constricts, glomerular filtration tends to... (high-level)

99

If the efferent arteriole constricts (mildly), glomerular pressure tends to... (high-level)

100

Generic bed: arteriole (afferent) -> {{c1::capillaries}} -> venule (efferent).

101

Kidney trap: glomerulus is fed by the {{c1::afferent arteriole}} and drained by the {{c2::efferent arteriole}} (still an arteriole).

102

In the kidney, the vessel that LEAVES the glomerulus is the:

103

Portal system = what's the key idea?

104

Quick definition you can use in an MCQ: portal system =

98

Decrease (less blood enters the glomerulus).

97

Two: glomerular capillaries then peritubular capillaries (or vasa recta).

100

Generic bed: arteriole (afferent) -> capillaries -> venule (efferent).

99

Increase (blood backs up in glomerulus).

102

Efferent arteriole

101

Kidney trap: glomerulus is fed by the afferent arteriole and drained by the efferent arteriole (still an arteriole).

104

A vessel system that links two capillary beds (usually via a portal vein).

103

Blood goes through TWO capillary beds in a row before returning to the heart.

105

The most famous portal system in humans is the...

106

Hepatic portal system path (super simple):

107

Why does the liver need portal blood from the gut?

108

Trap: portal vein carries oxygen-rich blood like an artery. True or false?

109

If portal vein is not oxygen-rich, how does liver get a lot of its oxygen?

110

Second portal example you should know:

111

Why does the hypothalamic-pituitary portal system exist?

112

Portal system is basically a 'shortcut' to send signals/substances from... to ...

106

Gut capillaries -> portal vein -> liver sinusoids (capillaries).

105

Hepatic portal system.

108

False (mostly).

107

To process nutrients, drugs, and toxins first (first-pass processing).

110

Hypothalamic-pituitary portal system.

109

From the hepatic artery.

112

One organ straight to another organ.

111

So tiny amounts of releasing hormones can hit the anterior pituitary directly (no dilution).

113

Trap: a portal system must always involve an artery. True or false?

114

If you see 'two capillary beds in series' in a question, the answer is probably...

115

Portal system = {{c1::two capillary beds}} connected in series (capillary -> {{c2::portal vein}} -> capillary).

116

Most famous human portal system:

117

Capillary types (basic list):

118

Continuous capillaries are...

119

Fenestrated capillaries are...

120

Sinusoidal capillaries (discontinuous) are...

114

Portal system.

113

False.

116

Hepatic portal system

115

Portal system = two capillary beds connected in series (capillary -> portal vein -> capillary).

118

Least leaky; tight, continuous endothelium.

117

Continuous, fenestrated, and sinusoidal (discontinuous).

120

Very leaky; big gaps, slow flow, allow large molecules/cells through.

119

More leaky; have pores (fenestrations) for filtration/absorption.

121

Brain blood vessels are less leaky because...

122

Trap: kidney glomerulus has continuous capillaries like brain. True or false?

123

Capillary leakiness (rough): {{c1::continuous}} < {{c2::fenestrated}} < {{c3::sinusoidal}}.

124

Capillary type most associated with filtration in the kidney:

125

Pulmonary arteries carry... blood to the lungs.

126

Pulmonary veins carry... blood to the heart.

127

Systemic arteries usually carry... blood.

128

Systemic veins usually carry... blood.

122

False.

121

They have tight junctions (blood-brain barrier idea).

124

Fenestrated

123

Capillary leakiness (rough): continuous $<$ fenestrated $<$ sinusoidal.

126

Oxygenated blood.

125

Deoxygenated blood.

128

Deoxygenated blood.

127

Oxygenated blood.

129

Pulmonary circulation is overall a... pressure system compared to systemic.

130

Trap: pulmonary circulation has higher pressure because it goes to the lungs first. True or false?

131

Pulmonary artery carries {{c1::deoxygenated}} blood; pulmonary vein carries {{c2::oxygenated}} blood.

132

Arteriovenous (AV) shunt/anastomosis is...

133

Why is bypassing capillaries useful in skin?

134

Trap: all blood must pass through capillaries before reaching veins. True or false?

135

A vessel with thick smooth muscle + high pressure + no valves is most likely a(n)...

136

A vessel with thin wall + large lumen + valves is most likely a(n)...

130

False.

129

Lower pressure.

132

A direct connection between arteriole and venule that bypasses capillaries.

131

Pulmonary artery carries deoxygenated blood; pulmonary vein carries oxygenated blood.

134

False.

133

It lets you quickly change heat loss: send blood to skin capillaries (lose heat) or bypass (save heat).

136

Vein.

135

Artery.

137

A one-cell thick vessel where RBCs go single-file is most likely a(n)...

138

A small vessel that heavily controls resistance is most likely a(n)...

139

A small vessel that drains a capillary bed is most likely a(n)...

140

If you see a diagram with two capillary beds connected by a vein, it screams...

141

If a question says 'nutrient-rich blood from intestines goes to liver first', what vessel is key?

142

If a question says 'blood supply to the liver is dual', the two sources are...

143

Vessel type that has valves to prevent backflow (especially in legs):

144

Portal system vs 'normal' system: what's the key difference?

138

Arteriole.

137

Capillary.

140

Portal system.

139

Venule.

142

Portal vein + hepatic artery.

141

Hepatic portal vein.

144

Portal has capillary bed -> portal vein -> capillary bed (two beds in a row). Normal is one capillary bed then back to heart.

143

Veins

145

Trap: portal vein goes straight to the heart. True or false?

146

Why is the hepatic portal system medically important (concept, not details)?

147

If a drug is taken orally, why might the dose need to be higher than injection? (concept)

148

Hypothalamic-pituitary portal system connects hypothalamus to which pituitary part?

149

Trap: posterior pituitary hormones travel through a portal system. True or false?

150

Hepatic portal idea: gut capillaries -> {{c1::portal vein}} -> liver {{c2::sinusoids}} (capillaries).

151

Trap: veins have thicker walls because they have more blood. True or false?

152

Trap: capillaries have the highest total cross-sectional area. True or false?

146

Because substances absorbed in the gut hit the liver before entering general circulation (first-pass).

145

False.

148

Anterior pituitary.

147

Because the liver can metabolize it during first-pass through the portal system.

150

Hepatic portal idea: gut capillaries -> portal vein -> liver sinusoids (capillaries).

149

False.

152

True.

151

False.

153

Trap: higher cross-sectional area means higher velocity. True or false?

154

If the question asks 'where does exchange happen?', don't overthink it:

155

If the question asks 'which vessel controls BP the most?', don't overthink it:

156

If an answer choice says 'capillaries control blood pressure with smooth muscle', it's...

157

If an answer choice says 'veins have a pulse wave like arteries', it's...

158

Arteries near the heart are elastic to smooth flow. So if those arteries become stiff, what changes (concept)?

159

Most tissues are arranged in {{c1::parallel}} (not series) so the body can control blood flow to each organ independently.

160

Why do arterioles have so much smooth muscle compared to capillaries?

154

Capillaries.

153

False.

156

Wrong.

155

Arterioles.

158

Pulse pressure tends to increase (less cushioning).

157

Mostly wrong in basic physiology.

160

Because they're meant to change diameter and control flow/pressure.

159

Most tissues are arranged in parallel (not series) so the body can control blood flow to each organ independently.

161

Vasoconstriction means...

162

Vasodilation means...

163

Local control: active tissue produces metabolites (CO_2, H^+, heat). That usually causes...

164

Capillary recruitment means...

165

Trap: more capillaries open means blood speed goes up. True or false?

166

If tissue blood flow increases a lot, what happens to capillary exchange generally?

167

Venules are important in inflammation because... (basic)

168

Microcirculation control: arterioles are the main {{c1::resistance}} vessels; capillaries are the main {{c2::exchange}} vessels; veins are the main {{c3::reservoir}}.

162

Vessel radius increases.

161

Vessel radius decreases.

164

Opening more capillaries to increase exchange surface area.

163

Vasodilation to increase blood flow.

166

It can increase because delivery increases and more capillaries can be recruited.

165

False.

168

Microcirculation control: arterioles are the main resistance vessels; capillaries are the main exchange vessels; veins are the main reservoir.

167

They can become leaky and allow immune cells to exit into tissues.

169

Afferent means... (word meaning)

170

Efferent means... (word meaning)

171

Kidney MCQ trap: efferent arteriole is called 'efferent' because it...

172

Afferent = {{c1::toward}} a structure;
efferent = {{c2::away}} from a structure.

173

Vessels where blood pressure is highest:

174

Vessel type that is the main site of exchange:

175

Vessel type that contains valves to prevent backflow:

176

System where blood goes through 2 capillary beds in a row before returning to heart:

170

Going away from a structure.

169

Going toward a structure.

172

Afferent = toward a structure;
efferent = away from a structure.

171

Leaves the glomerulus.

174

Capillaries

173

Arteries (especially large arteries like the aorta)

176

Portal system

175

Veins