



EnterMedSchool.org

Physiology: Hemoglobin & O₂ Transport

Printable Flashcards — Pre-Med Biology

Oxygen-hemoglobin binding, cooperativity, Bohr effect, fetal hemoglobin, myoglobin, and CO poisoning.

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

110 cards — Printable Flashcards

Free & Open-Source

Licensed under Creative Commons — Attribution required when sharing

Generated February 20, 2026

Scan to visit online



1

Hemoglobin: where is it found?

2

Hemoglobin's job (one sentence)?

3

How many O₂ molecules can one hemoglobin carry max?

4

What part of hemoglobin actually binds oxygen?

5

What ion in heme binds oxygen?

6

Does hemoglobin bind O₂ permanently?

7

Hemoglobin carries most oxygen in blood. True or false?

8

Oxygen saturation means...

2

Pick up O₂ in the lungs and deliver it to tissues.

entermedschool.org

1

Inside red blood cells (RBCs).

entermedschool.org

4

The heme group (iron).

entermedschool.org

3

4.

entermedschool.org

6

No. It binds reversibly.

entermedschool.org

5

Iron (Fe²⁺).

entermedschool.org

8

The % of hemoglobin binding sites that have O₂.

entermedschool.org

7

True.

entermedschool.org

9

Oxygen partial pressure (pO₂) is basically...

10

If pO₂ is high (like in lungs), hemoglobin tends to...

11

If pO₂ is low (like in tissues),
hemoglobin tends to...

12

Hemoglobin O₂ dissociation curve shape:
straight line, hyperbola, or S-shape?

13

Why is the hemoglobin curve S-shaped?

14

Cooperativity in one line:

15

Cooperativity trap: does myoglobin
show cooperative binding?

16

Myoglobin O₂ curve shape?

10

Bind more oxygen (higher saturation).

entermedschool.org

9

A measure of how much O₂ is available
(driving force for diffusion/binding).

entermedschool.org

12

S-shape (sigmoidal).

entermedschool.org

11

Release oxygen (lower saturation).

entermedschool.org

14

Each O₂ that binds increases
hemoglobin's affinity for the next O₂.

entermedschool.org

13

Cooperativity: binding one O₂
makes binding the next O₂ easier.

entermedschool.org

16

Hyperbola (not S-shaped).

entermedschool.org

15

No.

entermedschool.org

17

Myoglobin usually has higher or lower O₂ affinity than hemoglobin?

18

P₅₀ means...

19

If P₅₀ increases, hemoglobin affinity goes up or down?

20

If P₅₀ decreases, hemoglobin affinity goes up or down?

21

Right shift of the curve means...

22

Left shift of the curve means...

23

At a given pO₂, which shift gives higher saturation?

24

At a given pO₂, which shift gives more O₂ release to tissues?

18

The pO₂ where hemoglobin is 50% saturated.

entermedschool.org

17

Higher.

entermedschool.org

20

Up.

entermedschool.org

19

Down.

entermedschool.org

22

Hemoglobin has HIGHER affinity for O₂ -> it holds onto O₂ more.

entermedschool.org

21

Hemoglobin has LOWER affinity for O₂ -> it releases O₂ more easily.

entermedschool.org

24

Right shift.

entermedschool.org

23

Left shift.

entermedschool.org

25

Quick memory: right shift happens in active tissues because...

26

Bohr effect: what is it in one line?

27

Bohr effect happens mainly in the lungs or tissues?

28

In the lungs, CO₂ is lower and pH is higher. What happens to Hb-O₂ affinity?

29

Low pH means...

30

High pH means...

31

Does lower pH make hemoglobin hold oxygen tighter or release it?

32

Does higher CO₂ make hemoglobin hold oxygen tighter or release it?

26

More CO₂ / lower pH -> hemoglobin releases O₂ more (right shift).

entermedschool.org

25

Active tissues make CO₂, acid, and heat -> hemoglobin lets go of O₂.

entermedschool.org

28

It increases (left shift) -> easier loading.

entermedschool.org

27

Tissues.

entermedschool.org

30

Less H⁺ (more basic).

entermedschool.org

29

More H⁺ (more acidic).

entermedschool.org

32

Release it (right shift).

entermedschool.org

31

Release it (right shift).

entermedschool.org

33

Bohr effect: why is it actually useful?

34

If CO₂ rises in a tissue, what happens to pH locally?

35

Bohr effect: curve shifts right. What happens to P₅₀?

36

Bohr effect: curve shifts right. At the same tissue pO₂, Hb saturation is...

37

Bohr effect: $\{\{c1::CO_2 \text{ up}\}\}$ or $\{\{c2::pH \text{ down}\}\}$ shifts the O₂ curve $\{\{c3::right\}\}$ (more O₂ release).

38

In lungs (low CO₂, higher pH), hemoglobin shifts $\{\{c1::left\}\}$ and loads $\{\{c2::O_2\}\}$.

39

Temperature effect: higher temperature shifts the curve which way?

40

Cold temperature shifts the curve which way?

34

It drops (more acidic).

entermedschool.org

33

It sends more O₂ to the tissues that are producing lots of CO₂ and acid (the ones that need it most).

entermedschool.org

36

Lower.

entermedschool.org

35

It increases.

entermedschool.org

38

In lungs (low CO₂, higher pH), hemoglobin shifts left and loads O₂.

entermedschool.org

37

Bohr effect: CO₂ up or pH down shifts the O₂ curve right (more O₂ release).

entermedschool.org

40

Left (holds O₂ tighter).

entermedschool.org

39

Right (more O₂ release).

entermedschool.org

41

During intense exercise, what happens to the curve in the working muscle?

42

2,3-BPG (2,3-DPG) does what to hemoglobin O₂ affinity?

43

Why is 2,3-BPG useful at high altitude?

44

2,3-BPG increases or decreases P₅₀?

45

Fetal hemoglobin (HbF) has higher or lower O₂ affinity than adult Hb?

46

If HbF has higher affinity, does it help loading in the placenta or unloading?

47

Why is HbF left-shifted (simple pre-med explanation)?

48

Most CO₂ in blood is carried as...

42

Decreases it (right shift) -> helps unload O₂.

entermedschool.org

41

Right shift.

entermedschool.org

44

Increases P₅₀.

entermedschool.org

43

It helps unload O₂ to tissues when oxygen is scarce (right shift).

entermedschool.org

46

Loading (it grabs O₂).

entermedschool.org

45

Higher (left-shifted).

entermedschool.org

48

Bicarbonate (HCO₃⁻).

entermedschool.org

47

It interacts less with 2,3-BPG, so it holds O₂ tighter.

entermedschool.org

49

Some CO₂ does bind to hemoglobin.
Does it bind to the heme iron?

50

Does CO₂ compete with O₂ for the
same binding site on hemoglobin?

51

Bohr effect vs Haldane effect
(super short): what's Bohr about?

52

Haldane effect (one line, if they mention it):

53

Carbon monoxide (CO) binds hemoglobin
with... higher or lower affinity than O₂?

54

CO poisoning: does the O₂ curve
shift left or right (for remaining sites)?

55

CO poisoning trap: can oxygen saturation look
'okay' on paper while tissues are hypoxic?

56

Methemoglobin: what's the simple problem?

50

No.

entermedschool.org

49

No, it binds to the globin part (not the heme site).

entermedschool.org

52

Oxygenation of Hb in lungs helps unload CO₂; deoxygenated Hb carries CO₂/H⁺ better in tissues.

entermedschool.org

51

CO₂/H⁺ affecting O₂ binding (O₂ release in tissues).

entermedschool.org

54

Left shift (higher affinity) even though total O₂ carrying capacity drops.

entermedschool.org

53

Much higher.

entermedschool.org

56

Hemoglobin iron is in the wrong oxidation state so it can't bind O₂ properly.

entermedschool.org

55

Yes.

entermedschool.org

57

When hemoglobin has no O₂ bound (deoxy), it is in the...

58

When hemoglobin is fully oxygenated, it tends toward the...

59

Cooperativity means the FIRST O₂ binds...

60

Cooperativity is useful because it gives Hb a steep part of the curve at tissue pO₂. Why is that good?

61

If tissue pH drops from 7.4 to 7.2, what shift do you expect?

62

If blood becomes more basic (pH increases), Hb affinity goes up or down?

63

If CO₂ decreases in the lungs, Hb curve shifts...

64

If CO₂ increases in a tissue, Hb curve shifts...

58

R (relaxed) state = higher affinity.

entermedschool.org

57

T (tense) state = lower affinity.

entermedschool.org

60

Small drops in tissue pO₂ cause big O₂ unloading.

entermedschool.org

59

Harder than the later ones.

entermedschool.org

62

Up (left shift).

entermedschool.org

61

Right shift (more O₂ release).

entermedschool.org

64

Right.

entermedschool.org

63

Left.

entermedschool.org

65

Trap wording: 'right shift increases hemoglobin saturation' - true or false?

66

Trap wording: 'left shift helps tissues get more oxygen' - true or false?

67

Trap wording: 'Bohr effect helps oxygen loading in tissues' - true or false?

68

Trap wording: 'Bohr effect happens because oxygen binds to CO₂' - true or false?

69

If a question says 'more O₂ delivered at same pO₂', which shift is that?

70

If a question says 'Hb holds O₂ more tightly', which shift is that?

71

Blood O₂ content depends on... just saturation?

72

Anemia: can you have normal O₂ saturation but still low O₂ delivery?

66

False (left shift means Hb holds O₂ tighter).

entermedschool.org

65

False (at the same pO₂, saturation is lower).

entermedschool.org

68

False.

entermedschool.org

67

False. Bohr effect helps oxygen unloading in tissues.

entermedschool.org

70

Left shift.

entermedschool.org

69

Right shift.

entermedschool.org

72

Yes.

entermedschool.org

71

No. It depends on saturation AND how much hemoglobin you have.

entermedschool.org

73

If hemoglobin concentration drops, what happens to the maximum O₂ carrying capacity?

74

If a question shows a normal dissociation curve but low oxygen content, what should you suspect?

75

Hemoglobin vs myoglobin: who is for transport and who is for storage?

76

Which protein is better at grabbing O₂ at low pO₂ in muscle?

77

Max number of O₂ molecules per hemoglobin:

78

Name of the effect: CO₂/H⁺ increase → Hb releases O₂ more:

79

Curve shape of hemoglobin O₂ binding:

80

Protein in muscle that stores O₂:

74

Low hemoglobin amount (anemia).

entermedschool.org

73

It decreases.

entermedschool.org

76

Myoglobin.

entermedschool.org

75

Hemoglobin = transport in blood.
Myoglobin = storage in muscle.

entermedschool.org

78

Bohr effect

entermedschool.org

77

4

entermedschool.org

80

Myoglobin

entermedschool.org

79

Sigmoidal (S-shaped)

entermedschool.org

81

Shift that makes hemoglobin release O₂ more easily:

82

Shift that makes hemoglobin hold O₂ tighter:

83

pO₂ at which Hb is 50% saturated is called:

84

Hemoglobin shows **positive cooperativity**, giving an **S-shaped** O₂ dissociation curve.

85

Right shift = **lower** O₂ affinity and **more** O₂ release to tissues.

86

Left shift = **higher** O₂ affinity and **less** O₂ release to tissues.

87

Lower pH (more **H⁺**) shifts the curve **right**.

88

Higher CO₂ shifts the curve **right**; lower CO₂ shifts it **left**.

82

Left shift

entermedschool.org

81

Right shift

entermedschool.org

84

Hemoglobin shows positive cooperativity, giving an S-shaped O₂ dissociation curve.

entermedschool.org

83

P₅₀

entermedschool.org

86

Left shift = higher O₂ affinity and less O₂ release to tissues.

entermedschool.org

85

Right shift = lower O₂ affinity and more O₂ release to tissues.

entermedschool.org

88

Higher CO₂ shifts the curve right; lower CO₂ shifts it left.

entermedschool.org

87

Lower pH (more H⁺) shifts the curve right.

entermedschool.org

89

Mini boss: a muscle is working hard. CO₂ up, pH down, temperature up. Shift?

90

Mini boss: in the lungs, CO₂ is being removed. What happens to Hb affinity?

91

Mini boss: a patient has alkalosis (blood pH high). Do you expect easier unloading or harder unloading in tissues?

92

Mini boss: a patient has acidosis (blood pH low). Do you expect easier unloading or harder unloading?

93

Mini boss: Which shift helps a fetus get oxygen from the mother?

94

Mini boss: high altitude adaptation often increases 2,3-BPG. Shift?

95

Mini boss: CO poisoning. What 2 problems happen at once?

96

Student says: 'Right shift means Hb loads more oxygen.' Correct them.

90

It increases (left shift).

entermedschool.org

89

Right shift.

entermedschool.org

92

Easier unloading (right shift).

entermedschool.org

91

Harder unloading (left shift).

entermedschool.org

94

Right shift (better unloading).

entermedschool.org

93

Left shift (HbF has higher affinity).

entermedschool.org

96

Right shift means Hb releases oxygen more easily (lower affinity).

entermedschool.org

95

Less O₂ carrying capacity AND Hb holds onto remaining O₂ too tightly (left shift).

entermedschool.org

97

Student says: 'Lower pH makes Hb bind O₂ tighter.' Correct them.

98

Student says: 'CO₂ binds to the same place as O₂ on Hb.' Correct them.

99

Student says: 'Cooperativity means Hb binds the first O₂ easiest.' Correct them.

100

Student says: 'Saturation = oxygen content.' Correct them.

101

Which shift: CO₂ up?

102

Which shift: pH down (acidic)?

103

Which shift: temperature up?

104

Which shift: 2,3-BPG up?



98

CO₂ binds to globin (not heme). O₂ binds to heme iron.

entermedschool.org

97

Lower pH makes Hb release O₂ (Bohr effect -> right shift).

entermedschool.org

100

Saturation is a %, content depends on saturation AND hemoglobin amount.

entermedschool.org

99

First O₂ binding is hardest; it gets easier as more O₂ bind.

entermedschool.org

102

Right.

entermedschool.org

101

Right.

entermedschool.org

104

Right.

entermedschool.org

103

Right.

entermedschool.org

105

Which shift: fetal hemoglobin?

106

Which shift: CO binding to Hb?

107

If you only remember one Bohr rule, remember this:

108

If you only remember one cooperativity rule, remember this:

109

Why is an S-shaped curve better than a straight one for oxygen delivery?

110

Last check: active tissues get a right shift.
What does that do to oxygen delivery?

106

Left shift for remaining sites
(plus lower O₂ capacity overall).

entermedschool.org

105

Left.

entermedschool.org

108

First O₂ is hardest; each next O₂
binds easier -> S-shaped curve.

entermedschool.org

107

CO₂ up / pH down -> O₂ off (right shift).

entermedschool.org

110

Increases delivery (more unloading).

entermedschool.org

109

It loads well in lungs but unloads a
lot in tissues over a small pO₂ drop.

entermedschool.org