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Metabolism: Glucose & Hormonal Control

Printable Flashcards — Pre-Med Biology

Glycolysis, pyruvate fates, lactate fermentation, and blood glucose regulation by insulin and glucagon.

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

120 cards — Printable Flashcards

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1

Glycolysis: what's the one-line job?

2

Where does glycolysis happen?

3

Does glycolysis require oxygen?

4

Net ATP from glycolysis per 1 glucose (high school answer)?

5

How many pyruvate molecules come from 1 glucose?

6

Glycolysis makes NADH too. How many NADH per glucose?

7

Glycolysis makes CO_2: true or false?

8

What kind of phosphorylation makes ATP directly in glycolysis?

2

In the cytosol (cytoplasm).

1

Turn glucose into pyruvate and grab some ATP, fast.

4

2 ATP (net).

3

No.

6

2 NADH (net).

5

2 pyruvate.

8

Substrate-level phosphorylation.

7

False.

9

Why is glycolysis so important even if you have oxygen?

10

If a cell has no mitochondria, can it still make ATP from glucose?

11

Which human cells famously depend 100% on glycolysis for ATP?

12

Quick pre-med trap: 'glycolysis happens in mitochondria' - what's the fix?

13

Why does glycolysis spend ATP at the start?

14

Glycolysis has two phases. Name the idea.

15

ATP accounting trap: glycolysis produces 4 ATP. So why is net only 2?

16

Rate-limiting / committed step of glycolysis (the classic answer)?

10

Yes, via glycolysis.

9

It's fast, happens in all cells, and it's the entry point for glucose.

12

Glycolysis is in the cytosol; mitochondria handle aerobic steps after pyruvate.

11

Mature red blood cells (RBCs).

14

Investment phase (spend ATP) then payoff phase (make ATP + NADH).

13

To 'prime' glucose: trap it in the cell and make it reactive enough to split.

16

Phosphofructokinase-1 (PFK-1).

15

Because it uses 2 ATP early.

17

The key 'committed step' enzyme of glycolysis:

18

PFK-1 speeds up when the cell is low on energy: true or false?

19

If ATP is high, glycolysis should speed up or slow down?

20

After glycolysis, pyruvate has 2 main fates in humans. Name them.

21

If oxygen is available, pyruvate usually goes where?

22

Pyruvate -> acetyl-CoA happens in the...

23

When oxygen is low, why convert pyruvate to lactate?

24

Anaerobic metabolism trap: does lactate formation create extra ATP?

18

True.

17

PFK-1

20

Aerobic: -> acetyl-CoA (mitochondria). Anaerobic: -> lactate.

19

Slow down.

22

Mitochondrial matrix (eukaryotes).

21

Into the mitochondria to become acetyl-CoA, then into the Krebs cycle.

24

No. The ATP comes from glycolysis (2 net). Lactate just regenerates NAD^+.

23

To regenerate NAD^+ so glycolysis can keep running.

25

Where does lactate formation usually happen in humans?

26

Yeast pyruvate fate (not humans): what do they make anaerobically?

27

Quick distinction: lactate fermentation vs ethanol fermentation - what's different?

28

If a cell has functioning mitochondria AND oxygen, does it still do glycolysis?

29

Aerobic vs anaerobic: which one extracts more energy per glucose?

30

Common trap: 'lactate is a useless waste product' - fair or not?

31

NAD^+ is needed in glycolysis because it...

32

If NAD^+ runs out, what happens to glycolysis?

26

Ethanol + CO2 (alcohol fermentation).

25

In cells/tissues with low oxygen or no mitochondria (e.g., intense muscle, RBCs).

28

Yes.

27

Lactate fermentation makes lactate (no CO2). Ethanol fermentation makes ethanol + CO2.

30

Not really. It's a temporary form; it can be converted back and used later.

29

Aerobic.

32

It stops.

31

Accepts electrons (gets reduced to NADH) during one step, allowing the pathway to continue.

33

In aerobic conditions, NADH is mainly re-oxidized to NAD^+ by...

34

In anaerobic conditions, NADH is recycled back to NAD^+ by...

35

In anaerobic conditions, pyruvate -> lactate regenerates {{c1::NAD^+}} so glycolysis can keep making {{c2::ATP}}.

36

First step of glycolysis: why phosphorylate glucose immediately?

37

If a question says 'committed step', it's usually asking about...

38

Glycolysis is a pathway. Is it a single reaction?

39

Which type of molecules are used to store/transfer energy in glycolysis?

40

Glycolysis uses glucose. Can it also run on glycogen-derived glucose?

34

Fermentation (e.g., lactate formation in humans).

33

The electron transport chain in mitochondria.

36

It traps glucose in the cell (charged molecules don't cross membranes easily).

35

In anaerobic conditions, pyruvate -> lactate regenerates NAD^+ so glycolysis can keep making ATP.

38

No, it's a sequence of reactions.

37

PFK-1 (phosphofructokinase-1).

40

Yes (glycogen can be broken down to feed glycolysis).

39

ATP and NAD^+/NADH.

41

Insulin vs glucagon: who lowers blood glucose?

42

Insulin vs glucagon: who raises blood glucose?

43

Insulin is released when blood glucose is...

44

Glucagon is released when blood glucose is...

45

Pancreas cells that release insulin:

46

Pancreas cells that release glucagon:

47

The quickest 'food vs fasting' memory:
insulin is for ____, glucagon is for ____.

48

{{c1::Insulin}} is high after eating;
{{c2::glucagon}} is high when fasting.

42

Glucagon.

41

Insulin.

44

Low (fasting/between meals).

43

High (after a meal).

46

Alpha cells

45

Beta cells

48

Insulin is high after eating;
glucagon is high when fasting.

47

Insulin = fed state (store).
Glucagon = fasting state (release).

49

Insulin's big message to the body (one sentence)?

50

Insulin makes cells (especially muscle/fat) take up glucose using what idea?

51

GLUT4 is important because it's insulin-dependent in which tissues?

52

Insulin promotes glycogen... synthesis or breakdown?

53

Insulin promotes fat storage or fat breakdown (lipolysis)?

54

Insulin promotes gluconeogenesis (making new glucose) or inhibits it?

55

If a question says 'anabolic hormone after eating', which one is it?

56

Glucagon's big message (one sentence)?

50

More glucose transporters move to the cell membrane (GLUT4 concept).

49

Glucose is available -> take it up and store energy.

52

Synthesis.

51

Muscle and adipose (fat) tissue.

54

Inhibits it.

53

Fat storage.

56

Glucose is low -> release glucose into the blood.

55

Insulin.

57

Glucagon promotes glycogen breakdown (glycogenolysis) mainly in the...

58

Why is liver glycogen special compared to muscle glycogen?

59

Glucagon promotes gluconeogenesis mainly in the...

60

Glucagon promotes fat breakdown (lipolysis) or fat storage?

61

If a stem says 'fasting, between meals, blood glucose dropping', which hormone is up?

62

If you answered 'glucagon makes muscle cells release glucose into the blood', what's wrong?

63

After a sprint (low oxygen in muscle), pyruvate mostly becomes...

64

After a meal (blood glucose high), what's happening overall?

58

Liver can release glucose into blood; muscle uses its glycogen for itself.

57

Liver.

60

Fat breakdown (overall fasting signal).

59

Liver.

62

Skeletal muscle doesn't release free glucose into the blood like the liver does.

61

Glucagon.

64

Insulin rises: cells take up glucose and store it as glycogen/fat.

63

Lactate.

65

During an overnight fast, what's happening overall?

66

Glycogen is basically...

67

If blood glucose is low, do you want glycogen synthesis or glycogen breakdown?

68

If blood glucose is high, do you want glycogen synthesis or glycogen breakdown?

69

Insulin pushes which direction: glucose -> storage OR storage -> glucose?

70

Glucagon pushes which direction: glucose -> storage OR storage -> glucose?

71

If a question uses the word 'catabolic' for a fasting hormone, which one fits best?

72

If a question uses the word 'anabolic' for a fed hormone, which one fits best?

66

Stored glucose (a glucose polymer).

65

Glucagon rises: liver releases glucose (breaks down glycogen, makes new glucose).

68

Glycogen synthesis.

67

Glycogen breakdown.

70

Storage -> glucose.

69

Glucose -> storage.

72

Insulin.

71

Glucagon.

73

Diabetes basic idea (no drama): what's going wrong?

74

Type 1 vs Type 2 diabetes (high school version)?

75

If insulin isn't working, do cells take up glucose easily?

76

Mini boss: oxygen suddenly becomes available after exercise. What can happen to lactate?

77

Mini boss: a cell has plenty of glucose but no NAD^+. What's the problem?

78

Mini boss: you block the conversion of pyruvate to lactate in low oxygen. What happens fast?

79

Mini boss: you block PFK-1. Does glycolysis speed up or slow down?

80

Mini boss: after eating, which hormone should be high and what does it do to blood glucose?

74

Type 1: little/no insulin (beta cells damaged). Type 2: insulin resistance (often with some insulin still made).

73

Glucose stays high in the blood because insulin is missing or not working properly.

76

It can be converted back and used (lactate -> pyruvate -> aerobic metabolism).

75

Less easily (especially muscle/fat).

78

Glycolysis slows/stops because NAD^+ can't be regenerated.

77

Glycolysis stalls because NAD^+ is required for one step.

80

Insulin; it lowers blood glucose by promoting uptake/storage.

79

Slow down hard.

81

Mini boss: after a long fast, which hormone should be high and what does it do?

82

If you answered 'glycolysis needs oxygen', what did you mix up?

83

If you answered 'glycolysis makes CO2', what did you mix up?

84

If you answered 'lactate production is aerobic', what's the fix?

85

If you answered 'glucagon lowers blood glucose', what's the fix?

86

If you answered 'insulin is high during fasting', what's the fix?

87

Net ATP from glycolysis (per glucose):

88

Location of glycolysis in eukaryotic cells:

82

You mixed glycolysis with aerobic metabolism after glycolysis.

81

Glucagon; it raises blood glucose mainly via liver release/production.

84

Lactate is mainly an anaerobic pathway (low oxygen) to recycle NAD^+.

83

You mixed glycolysis with pyruvate processing/Krebs cycle.

86

Fasting -> glucagon high. Eating -> insulin high.

85

Glucagon raises blood glucose. Insulin lowers it.

88

Cytosol

87

2

89

Main product of glycolysis (besides ATP/NADH):

90

Anaerobic fate of pyruvate in human muscle:

91

Hormone released by pancreatic beta cells:

92

Hormone released by pancreatic alpha cells:

93

Rate-limiting enzyme of glycolysis:

94

Glycolysis occurs in the {{c1::cytosol}} and does {{c2::not}} require oxygen.

95

Net yield of glycolysis per glucose: {{c1::2 ATP}} and {{c2::2 NADH}}.

96

With oxygen: pyruvate -> {{c1::acetyl-CoA}} -> {{c2::Krebs cycle}}.

90

Lactate

89

Pyruvate

92

Glucagon

91

Insulin

94

Glycolysis occurs in the cytosol and does not require oxygen.

93

PFK-1

96

With oxygen: pyruvate -> acetyl-CoA -> Krebs cycle.

95

Net yield of glycolysis per glucose: 2 ATP and 2 NADH.

97

Low oxygen: pyruvate -> {{c1::lactate}}
to regenerate {{c2::NAD^+}}.

98

{{c1::Insulin}} lowers blood glucose;
{{c2::glucagon}} raises blood glucose.

99

Why is the liver the main 'blood glucose manager'?

100

Why doesn't muscle just 'share' its glycogen as blood glucose (exam logic)?

101

Insulin helps glucose enter cells. Why doesn't glucose just diffuse through the membrane?

102

If insulin increases glucose uptake in muscle/fat, does that tend to raise or lower blood glucose?

103

If a stem says 'ATP low, AMP high' what should happen to glycolysis?

104

If a stem says 'cell has plenty of ATP' what should happen to glycolysis?

98

Insulin lowers blood glucose;
glucagon raises blood glucose.

97

Low oxygen: pyruvate ->
lactate to regenerate NAD^+.

100

Because muscle glycogen is mainly for muscle energy; blood glucose regulation is the liver's job.

99

Because it can store glucose as glycogen and later release glucose back into the blood.

102

Lower it.

101

Glucose is polar and relatively
big, so it needs transport proteins.

104

It should slow down.

103

It should speed up.

105

If a question says 'fast ATP without oxygen', what's the pathway?

106

If a question says 'slow but high ATP yield', what metabolic style is that?

107

Exam trap: do you need to memorize exact 'total ATP per glucose' from aerobic respiration?

108

Besides acetyl-CoA and lactate, pyruvate can be used to make what amino acid (basic idea)?

109

Don't panic: are you expected to memorize every possible pyruvate fate?

110

Glycolysis vs Krebs: which needs mitochondria?

111

Glycolysis vs fermentation: are they the same thing?

112

Insulin vs glucagon: are they usually 'on' at the same time at high levels?

106

Aerobic metabolism (mitochondria-based).

105

Glycolysis (with fermentation if needed).

108

Alanine (via transamination).

107

Usually no. Know that aerobic >> anaerobic, and glycolysis gives net 2 ATP.

110

Krebs needs mitochondria (in eukaryotes). Glycolysis doesn't.

109

No. Nail the main two (acetyl-CoA vs lactate) and recognize fermentation in yeast.

112

Not typically. One dominates depending on fed vs fasting state.

111

No. Glycolysis makes ATP + pyruvate. Fermentation is what you do with pyruvate/NADH to recycle NAD^+ without oxygen.

113

A cell is producing lactate. What does that strongly suggest?

114

A student says: 'Lactate forms because the body wants to make energy.' What's the correction?

115

A student says: 'Glucagon tells cells to take up glucose.' What's the correction?

116

A stem says: 'after a meal, glycogen stores increase.' Which hormone fits?

117

A stem says: 'during fasting, liver breaks down glycogen.' Which hormone fits?

118

A stem says: 'cells are low on energy, need ATP now.' Which pathway kicks in fast?

119

A stem says: 'cell wants max ATP per glucose.' Which condition helps?

120

Final trap check: glycolysis makes ATP in mitochondria: true or false?

114

Lactate forms mainly to regenerate NAD^+ so glycolysis can keep making ATP.

113

Oxygen is limited OR the cell lacks mitochondria.

116

Insulin.

115

That's insulin. Glucagon mainly tells the liver to release/make glucose.

118

Glycolysis.

117

Glucagon.

120

False.

119

Aerobic conditions (oxygen available) with functioning mitochondria.