WEBVTT

1

00:00:13.280 --> 00:00:21.049

Olivia Schuitema: Alrighty, hi everybody. Tonight we're going to be going over,

sorry, Chapter 7, Energy for Cells.

2

00:00:23.130 --> 00:00:28.630

Olivia Schuitema: So, first we'll talk about cellular respiration. That's basically

what this whole chapter is about.

3

00:00:29.080 --> 00:00:32.930

Olivia Schuitema: So, cellular respiration is kind of the reverse

4

00:00:33.370 --> 00:00:38.430

Olivia Schuitema: equation to photosynthesis. So, it's kind of the opposite

process.

5

00:00:38.660 --> 00:00:47.120

Olivia Schuitema: With cellular respiration, you can take this lady here. She is

breathing in oxygen. Everyone take a deep breath in.

6

00:00:48.770 --> 00:00:50.140

Olivia Schuitema: And let it out.

7

00:00:50.510 --> 00:00:56.059

Olivia Schuitema: Breathing in is bringing in all of that oxygen, and what we

release is carbon dioxide.

8

00:00:56.160 --> 00:01:12.360

Olivia Schuitema: So, she is breathing in oxygen into her cells, and she's eating

this carrot

here. That's a form of glucose, so those are going into her cells, and

we have water coming out as a byproduct, and carbon dioxide being released when we

breathe.

9

00:01:13.010 --> 00:01:22.280

Olivia Schuitema: So, this happens... cellular respiration happens in the

mitochondria, which is here on the bottom left. I'll go over that anatomy of that

in just a little bit.

10

00:01:22.930 --> 00:01:30.479

Olivia Schuitema: But all cells' activities are powered by ATP. Remember, ATP is

the currency for the cells.

11

00:01:30.810 --> 00:01:45.380

Olivia Schuitema: And it is, produced during cellular respiration in the

mitochondria. So if you guys have heard, the mitochondria is the powerhouse of the

cell. It is

the powerhouse because it produces so much ATP

12

00:01:48.310 --> 00:01:55.990

Olivia Schuitema: so much ETP for the cell and for the body, so it produces a lot.

We'll talk about what's a little bit later.

13

00:01:56.830 --> 00:02:08.380

Olivia Schuitema: Cellular respiration is also a redox reaction. This makes sense

because it is, opposite of photosynthesis, and we know photosynthesis is a redox

reaction.

14

00:02:09.449 --> 00:02:14.980

Olivia Schuitema: So here is the chemical equation for source... sorry, for cellular

respiration.

15

00:02:15.020 --> 00:02:29.929

Olivia Schuitema: We have glucose getting added with oxygen, which yields carbon

dioxide, water, and energy. Okay, so one thing is added, we have energy here, but

here is the

redox part. But first off,

16

00:02:30.040 --> 00:02:36.590

Olivia Schuitema: Does this equation look familiar? If you reverse it, what is it?

It's the equation for photosynthesis, like I said before.

17

00:02:37.060 --> 00:02:51.679

Olivia Schuitema: So, we're gonna see here glucose, that's gonna be oxidized to

carbon dioxide. If we remember from the last chapter, oil rig. O-I-L-R-I-G. So, O-

I-L, oxidation is loss.

18

00:02:51.960 --> 00:02:58.409

Olivia Schuitema: So, if glucose is being oxidized, it is losing electrons, it is

losing the hydrogens, so...

19

00:02:58.610 --> 00:03:07.369

Olivia Schuitema: We go from glucose C6H12O6 to 6CO2, so we've lost the hydrogen.

20

00:03:07.790 --> 00:03:18.469

Olivia Schuitema: Also want to note that the numbers are larger here, they're a

little bit different than that of photosynthesis, but they mean the same thing,

there's just more of them here, basically.

21

00:03:18.540 --> 00:03:34.340

Olivia Schuitema: So, glucose is oxidized to carbon dioxide. And reduction...

reduction is gain, so we are gaining electrons and we are gaining the hydrogen. So,

the oxygen here is being reduced to water. It is gaining that hydrogen there.

22

00:03:36.550 --> 00:03:52.380

Olivia Schuitema: So, basically, the process of cellular respiration breaks down

the glucose, okay? That is one of the main, phases of cellular respiration, and in

order to release the energy, it has to break down that glucose.

23

00:03:52.580 --> 00:04:08.359

Olivia Schuitema: So, it happens in a series of chemical reactions, and it happens

both in the

cytoplasm and also in the mitochondria of eukaryotic cells. Again, this

doesn't happen in prokaryotic cells, this only happens in eukaryotic cells.

24

00:04:08.480 --> 00:04:27.380

Olivia Schuitema: So, cellular respiration happens in the mitochondria for 3 of the

4 steps, and then the first step, it actually happens in the cytoplasm. If we

remember, the cytoplasm is the jelly-like soup that is holding all of the

organelles together in the cell, okay?

25

00:04:28.050 --> 00:04:44.599

Olivia Schuitema: So here, first off, let's go over the anatomy of this

mitochondria here. So here's the mitochondria. It has an outer kind of brown

membrane, and it has this inner yellow membrane with the purple inside. So it's

double membraned, and here we have the matrix.

26

00:04:44.620 --> 00:04:50.870

Olivia Schuitema: Matric is the inside of, it's kind of the inner space inside the

mitochondria.

27

00:04:51.650 --> 00:04:54.370

Olivia Schuitema: Excuse me, and then we have the Cristae.

28

00:04:56.770 --> 00:05:11.480

Olivia Schuitema: Excuse me. Then we have the cristae. The cristae is, are the

folds here,

the inner folds inside the mitochondria, okay? So there's four

different phases. The first is glycolysis.

29

00:05:11.500 --> 00:05:17.149

Olivia Schuitema: And when you think of glycolysis, I want you to think of glyco,

that means glucose.

30

00:05:17.860 --> 00:05:28.849

Olivia Schuitema: And lysis means to slice, or to break, okay? So we are breaking

down, or cutting up that, glucose molecule.

31

00:05:29.080 --> 00:05:35.649

Olivia Schuitema: Glycolysis happens in the cytoplasm. It's the first step. It

happens outside of the mitochondria.

32

00:05:36.320 --> 00:05:39.289

Olivia Schuitema: And it involves the breakdown of glucose.

33

00:05:39.590 --> 00:05:50.159

Olivia Schuitema: into two different molecules of pyruvate, okay? This is a new

guy, pyruvate. So, glucose is broken down into two molecules of pyruvate.

34

00:05:50.820 --> 00:06:03.200

Olivia Schuitema: Near the end of this, 2 ATP are gonna be gained, and also NADH is

produced. Hopefully you guys remember NADH from the last chapter. Again, that is

just another energy, molecule.

35

00:06:04.670 --> 00:06:14.319

Olivia Schuitema: Next, we have the PrEP reaction. So now is when we move into the

mitochondria, and we go specifically into the matrix. That's this inner space here.

36

00:06:15.010 --> 00:06:28.670

Olivia Schuitema: So, the pyruvate that was produced in glycolysis is now going to

be broken down into a 2-carbon acetyl group, okay? And this acetyl group is going

to be carried by coenzyme A.

37

00:06:28.890 --> 00:06:42.870

Olivia Schuitema: Together, if you look down here at the last bullet, those are

going to form acetyl-CoA. The 2-carbon acetyl group is going to be carried by the

coenzyme A,

and they become acetyl-CoA.

38

00:06:43.110 --> 00:06:44.000

Olivia Schuitema: Okay?

39

00:06:44.360 --> 00:06:51.450

Olivia Schuitema: Also in this prep reaction, oxidation is going to yield the NADH

and the carbon dioxide.

40

00:06:52.570 --> 00:07:05.699

Olivia Schuitema: Carbon dioxide occurs in, the production of carbon dioxide occurs

in two different steps in glycolysis. The first, or excuse me, in cellular

respiration. The first is here in the PrEP reaction.

41

00:07:06.890 --> 00:07:16.200

Olivia Schuitema: The second will be in the citric acid cycle. So the citric acid

cycle happens still in the mitochondria... in the matrix of the mitochondria, it's

that inner space.

42

00:07:16.440 --> 00:07:31.230

Olivia Schuitema: And here, a bunch of different chemical reactions occur, I'll get

into them later, but they result in NADH, FADH2, there's that second carbon

dioxide, and two ATP molecules, for glucose.

43

00:07:31.300 --> 00:07:44.169

Olivia Schuitema: FADH2 is just another energy molecule, it's similar to NADH. And,

I will note

that you guys don't have to remember the number of ATP that are being

produced.

44

00:07:44.460 --> 00:07:57.930

Olivia Schuitema: The, number can vary depending on what the cell needs, so

sometimes, in total, there's a range, expanding from, like, 32 to, like, 38 or 40,

45

00:07:58.150 --> 00:08:00.650

Olivia Schuitema: ATP molecules that are produced, so...

46

00:08:01.260 --> 00:08:03.929

Olivia Schuitema: Don't worry about memorizing the numbers.

47

00:08:04.550 --> 00:08:15.370

Olivia Schuitema: And then lastly, we have the electron transport chain, which we

saw something similar in photosynthesis, where all of the kind of electron energy

goes to to accumulate like a bank.

48

00:08:15.470 --> 00:08:22.549

Olivia Schuitema: And this happens in the cristae of the mitochondria, so now we're

here in these inner membrane folds.

49

00:08:23.190 --> 00:08:27.759

Olivia Schuitema: And here is where a series of electron carriers,

50

00:08:27.930 --> 00:08:35.529

Olivia Schuitema: that are able to release energy, and it's also able to capture

energy to create it in the form of ATP.

51

00:08:36.850 --> 00:08:52.109

Olivia Schuitema: like I said, ATP is produced. This is actually the step where

most of the

ATP is going to be produced, we'll talk about that later. And oxygen is

going to combine with some of those hydrogen ions that have been free and released

within the electron transport chain.

52

00:08:52.110 --> 00:08:59.159

Olivia Schuitema: And it's going to combine, to produce water. So that is water as

a byproduct

that is being released.

53

00:09:00.690 --> 00:09:14.590

Olivia Schuitema: So this is a really great figure, to summarize cellular

respiration. It's similar to that of the photosynthetic, the photosynthesis image

that I showed you guys last time.

54

00:09:14.670 --> 00:09:23.450

Olivia Schuitema: you will have to remember the photosynthesis image for the exam,

and you'll have to remember this one, okay? Memorize everything.

55

00:09:23.550 --> 00:09:39.980

Olivia Schuitema: I might block out the word glycolysis, I might block out NADH2,

FADH2, I might block out carbon dioxide, whatever it might be, I might block it

out, so you

have to remember all of these things here. And this is a great figure

because it tells you what goes in and what goes out.

56

00:09:40.370 --> 00:09:54.620

Olivia Schuitema: And let's go through it really quick. So here we have the

cytoplasm. Again, we're outside of the mitochondria. This is the mitochondria, this

big bean thing. But remember, all of this, this entire slide, is happening inside a

eukaryotic cell.

57

00:09:55.230 --> 00:10:11.610

Olivia Schuitema: So here in the cytoplasm, we have glycolysis. We are breaking

down that glucose into that pyruvate molecule, and we are releasing some NADH that

gets pushed

up and out over to the electron transport chain. Remember that energy

bank that's

at the end.

58

00:10:11.920 --> 00:10:14.690

Olivia Schuitema: We also have some ATP that's being produced.

59

00:10:16.270 --> 00:10:34.819

Olivia Schuitema: Next in the prep reaction, this pyruvate goes into the prep

reaction, and remember, acetyl-CoA is produced. However, acetyl-CoA is not shown in

this image,

okay? So don't worry about that for this, specific image, but I do want

you to know

that, it does

60

00:10:34.970 --> 00:10:38.169

Olivia Schuitema: happen in the PrEP reaction. It is, produced there.

61

00:10:38.600 --> 00:10:48.209

Olivia Schuitema: carbon dioxide is released, and then more NADH is headed over to

the electron transport chain. See these orange bars? They're heading that way.

62

00:10:48.760 --> 00:10:58.239

Olivia Schuitema: Then we have the citric acid cycle, where we have NADH and FADH2

that's being produced. We have carbon dioxide being produced, and also ATP.

63

00:10:58.690 --> 00:11:12.079

Olivia Schuitema: And then finally, we have the electron transport chain that has

taken all of the energy molecules from every single step, and it is producing a

massive amount of ATP. You see that there's 34 molecules here, that's a lot.

64

00:11:12.300 --> 00:11:16.749

Olivia Schuitema: And water is being, produce as a byproduct.

65

00:11:18.610 --> 00:11:26.779

Olivia Schuitema: So now let's look at each of the steps individually with a little

bit of a caveat after this glycolysis, okay?

66

00:11:26.950 --> 00:11:32.949

Olivia Schuitema: So, glycolysis, again, I just want you guys to know pretty much

the,

67

00:11:33.180 --> 00:11:48.349

Olivia Schuitema: the summary slides that I've been over here. You can see them

here. The summary slides are important to know. I'm gonna go through each of them

more in depth, but you, you know, don't have to know the super details, but just

kind of know what's going on, know the inputs and the outputs.

68

00:11:48.530 --> 00:11:50.019

Olivia Schuitema: Of each set.

69

00:11:50.170 --> 00:11:54.400

Olivia Schuitema: So... Glycolysis, we know, is breaking down

70

00:11:55.370 --> 00:12:00.469

Olivia Schuitema: Excuse me. Breaking down the glucose, and glucose is a 6-carbon

molecule.

71

00:12:00.980 --> 00:12:06.600

Olivia Schuitema: Which turns into 2 separate 3-carbon molecules, and each of those

are called pyruvate.

72

00:12:07.070 --> 00:12:11.220

Olivia Schuitema: So we have glucose as an input, and pyruvate as output.

73

00:12:12.410 --> 00:12:23.170

Olivia Schuitema: NAD+, remember, oil rig, oxidation is loss, reduction is gain.

NAD plus is

being reduced to turn into NADH.

74

00:12:23.310 --> 00:12:31.559

Olivia Schuitema: ATP is being used to help break up that glucose into the

pyruvate, and then we have some more ATP that's being,

75

00:12:31.960 --> 00:12:43.099

Olivia Schuitema: produced from the ATP and the phosphate. So, we have a net of 2

ATP. 2 is being used, and 4 is being produced, so we have 2 left over, but again,

don't worry

about the numbers.

76

00:12:44.760 --> 00:13:07.460

Olivia Schuitema: Okay, so there's certain situations... we're gonna step away from

cellular respiration for a second, but there's a couple situations in which, the,

cellular respiration process cannot move past glycolysis because of certain

conditions,

and that's when they undergo fermentation instead of going into the

prep reaction.

77

00:13:07.460 --> 00:13:18.920

Olivia Schuitema: So, fermentation happens when oxygen is limited or absent, okay?

Remember, we need oxygen to go into the...

78

00:13:19.800 --> 00:13:27.639

Olivia Schuitema: the cellular respiration process, it's one of the reactants, and

if we don't

have it temporarily or,

79

00:13:28.570 --> 00:13:43.139

Olivia Schuitema: Yeah, if we don't have it temporarily, then, we can't go through

with the rest of cellular respiration. So, these pyruvate molecules are going to

accumulate when we don't have that oxygen to move the process forward.

80

00:13:44.360 --> 00:14:02.340

Olivia Schuitema: So in order to correct for this, cells may enter anaerobic, which

means without oxygen, anaerobic pathways after glycolysis. And there's two types of

fermentation. There's lactic acid fermentation, and there's alcohol fermentation.

And we're going to go through each type.

81

00:14:03.380 --> 00:14:11.949

Olivia Schuitema: Lactic acid fermentation, is where pyruvate is formed from

glycolysis.

It's gonna accept two hydrogen atoms and

82

00:14:12.160 --> 00:14:29.489

Olivia Schuitema: excuse me, it's going to reduce to lactate, okay? Lactate, if you

put it into

highly, watery conditions, like our bodies, our bodies are 70% water,

right? Water plus the lactate forms lactic acid.

83

00:14:29.600 --> 00:14:30.560

Olivia Schuitema: Okay.

84

00:14:31.170 --> 00:14:45.410

Olivia Schuitema: So, we're gonna regenerate NAD plus to form ATP, and this is a

way to produce ATP when, the oxygen intake in our body is temporarily limited.

85

00:14:45.410 --> 00:14:53.929

Olivia Schuitema: Okay? So this allows for ATP to be, created, regenerating NAD+.

86

00:14:56.010 --> 00:15:14.219

Olivia Schuitema: from this lactic acid in order to, keep our bodies going in times

where we don't have oxygen. So, instead of just shutting down and not working

because we don't have oxygen, we can temporarily make energy from other things. So,

reasons that this could happen...

87

00:15:14.290 --> 00:15:26.650

Olivia Schuitema: This happens in animals and bacteria. You can think about when

you're going to the gym, or when you're working out, or when you're playing a

sport. You're breathing really hard, right? You're working hard, you're putting in

a lot of effort.

88

00:15:27.030 --> 00:15:33.140

Olivia Schuitema: And your body... it's hard for your body to keep up, to get enough

oxygen into

your...

89

00:15:33.140 --> 00:15:52.180

Olivia Schuitema: Into your lungs. So you're breathing really hard, and you're

using up more energy than you can bring in oxygen. So that is how oxygen is

temporarily

limited, but we do still have ATP being produced. You can still, you

know, continue to keep moving and keep going, despite having low oxygen levels.

90

00:15:52.540 --> 00:16:08.870

Olivia Schuitema: this lactic acid can build up in your body and in your muscles.

If you guys

have ever heard of lactic acid buildup, that's one of the things that

contributes

to making you sore after you, you know, did a workout or you were

active, you

played a sport, or did something. So...

91

00:16:08.990 --> 00:16:16.239

Olivia Schuitema: This lactic acid buildup starts happening in our bodies when we

don't get enough oxygen, and

92

00:16:16.640 --> 00:16:19.490

Olivia Schuitema: And that's the lactic acid fermentation.

93

00:16:20.010 --> 00:16:20.750

Olivia Schuitema: Okay.

94

00:16:22.410 --> 00:16:37.280

Olivia Schuitema: Okay, now for alcohol fermentation, instead of lactate, the

pyruvate is

going to be reduced into alcohol, okay? And the NAD plus regeneration

happens, however.

95

00:16:37.280 --> 00:16:49.370

Olivia Schuitema: alcohol fermentation releases a little bit of CO2. So this

doesn't happen in lactic acid fermentation, but when NAD plus is being regenerated

to help form ATP,

96

00:16:49.430 --> 00:16:52.850

Olivia Schuitema: alcohol fermentation releases a little bit of CO2.

97

00:16:53.680 --> 00:17:05.440

Olivia Schuitema: A good example of this is bread. So, yeast in bread, uses

alcoholic fermentation to generate alcohol and also carbon dioxide, and

98

00:17:05.569 --> 00:17:16.160

Olivia Schuitema: depending on what type of bread you make, if it has yeast in it,

sometimes you need to let the bread rise, right? You knead it out, you mix it, do

whatever you have to do, and then you have to let it rise.

99

00:17:16.160 --> 00:17:26.669

Olivia Schuitema: What makes it rise is the yeast eating that flour, eating the

glucose in the flour, and creating CO2, and that creates an alcoholic fermentation

100

00:17:26.670 --> 00:17:30.629

Olivia Schuitema: kind of process, so that carbon dioxide is what makes the bread

rise.

101

00:17:30.980 --> 00:17:36.550

Olivia Schuitema: Similarly, this can happen, in wine or beer making.

102

00:17:36.820 --> 00:17:45.229

Olivia Schuitema: when the yeast is eating, the grape sugar and alcohol is formed.

So that's another kind of concept, or example, excuse me.

103

00:17:45.370 --> 00:17:47.830

Olivia Schuitema: And this happens in bacteria and fungi.

104

00:17:48.960 --> 00:17:50.029

Olivia Schuitema: Like, yeast.

105

00:17:51.430 --> 00:18:14.510

Olivia Schuitema: Okay, so now that we took that detour, we looked at glycolysis,

and we looked at a special condition after glycolysis, if there's no oxygen. But if

there is oxygen and everything's normal, we go straight from glycolysis into the

next step of the cellular respiration, which is the PrEP reaction. And now we move

into the mitochondria.

106

00:18:14.810 --> 00:18:28.360

Olivia Schuitema: So the purpose of the preparatory reaction is to prepare the

outputs of glycolysis, which we know is the pyruvate molecules, for use in the

citric acid

cycle. So, the...

107

00:18:28.360 --> 00:18:36.510

Olivia Schuitema: The prep reaction is kind of like a pre-step for all of the

chemical reactions that are going to happen in the citric acid cycle.

108

00:18:36.990 --> 00:18:52.040

Olivia Schuitema: So here's a little summary of it. Pyruvate is going to be

oxidized, and a carbon dioxide molecule is going to be given off. Fun fact, this is

the carbon dioxide that we breathe out. So everyone take a deep breath in.

109

00:18:53.230 --> 00:18:54.710

Olivia Schuitema: Take a deep breath out.

110

00:18:55.520 --> 00:18:58.480

Olivia Schuitema: Whatever we just released.

111

00:18:58.800 --> 00:19:06.029

Olivia Schuitema: That is carbon dioxide. The air that we just released is carbon

dioxide, and that comes from this preparatory reaction.

112

00:19:07.480 --> 00:19:13.649

Olivia Schuitema: NAD plus is gonna accept some electrons and hydrogen ions, and

it's gonna form NADH.

113

00:19:13.960 --> 00:19:31.239

Olivia Schuitema: And then the product, which is called, the 2-carbon acetyl group,

remember we

talked about that earlier, that's gonna attach to this coenzyme A,

which is the CoA part. And together, they're gonna form acetyl-CoA.

114

00:19:31.240 --> 00:19:47.010

Olivia Schuitema: Okay, so the pyruvate is going to be oxidized, we have NADH

that's going to be formed, and when pyruvate's oxidized, it produces a 2-carbon

acetyl group that will attach to coenzyme A and form this acetyl-CoA.

115

00:19:47.010 --> 00:19:56.649

Olivia Schuitema: Remember, this acetyl-CoA is not in the big figure that I showed

you guys, that I want you to memorize, but I do want you to take note that this is

what's produced,

116

00:19:56.650 --> 00:19:59.399

Olivia Schuitema: or used in the PrEP reaction, okay?

117

00:20:00.890 --> 00:20:10.199

Olivia Schuitema: So, the outputs are 2 carbon dioxides, we have NADH, and we also

have acetyl-CoA. Again, you don't have to remember the numbers of any of these.

118

00:20:11.750 --> 00:20:29.650

Olivia Schuitema: Next, we have the citric acid cycle, so a little summary of that.

The acetyl group, which we saw from the previous, slide in the prep reaction, that

acetyl group that was carried by coenzyme A, it's gonna become oxidized, and it's

gonna form CO2, okay?

119

00:20:29.900 --> 00:20:39.810

Olivia Schuitema: Both of the NAD plus and also the FAD are gonna accept electrons

and hydrogen ions. Again, reduction is gain if they're being reduced.

120

00:20:40.010 --> 00:20:43.670

Olivia Schuitema: And they're becoming NADH and FADH2.

121

00:20:43.790 --> 00:20:47.450

Olivia Schuitema: Reminder, these are just both energy molecules.

122

00:20:50.610 --> 00:21:06.630

Olivia Schuitema: ATP synthesis is gonna happen, and it's gonna produce an ATP. We

know what ATP synthesis is, because it's creation of an ATP. Basically, if you look

where my cursor is, this ADP plus the phosphate groups, those phosphate groups are

gonna

123

00:21:06.630 --> 00:21:11.999

Olivia Schuitema: pop back onto ADP to form ATP, okay?

124

00:21:13.840 --> 00:21:17.710

Olivia Schuitema: And all of this is gonna happen twice for each of those,

125

00:21:18.170 --> 00:21:21.610

Olivia Schuitema: Pyruvate molecules that were formed from the glucose.

126

00:21:24.780 --> 00:21:30.990

Olivia Schuitema: I might have an image of the citric acid cycle, I'll see a little

bit later, but anyway.

127

00:21:31.170 --> 00:21:47.610

Olivia Schuitema: These are the inputs, and these are the outputs, just like I

explained it here. 2-acetyl-CoA turns into 4-CO2, NAD plus turns into NADH, FAD

turns into FADH2, and ADP plus P equals, the ATP.

128

00:21:49.410 --> 00:22:07.729

Olivia Schuitema: Now we finally go to the electron transport chain, which is a

series of carriers that passes electrons from one another. Basically, it's like a

bank that receives all of the high-energy electrons, and it can use all of that

energy to create a bunch of ATP for the cell.

129

00:22:08.320 --> 00:22:25.629

Olivia Schuitema: So, it receives the NADH and the FADH2. Remember, those are high-

energy electrons, and it receives those from all of this... all of the phases of

cellular respiration, including glycolysis, the PrEP reaction, and the citric acid

cycle.

130

00:22:27.100 --> 00:22:30.640

Olivia Schuitema: Water is going to be produced, that's a byproduct.

131

00:22:31.020 --> 00:22:35.380

Olivia Schuitema: And please, if there's one thing you need to know about the

electron transport chain.

132

00:22:36.510 --> 00:22:44.079

Olivia Schuitema: It's that the majority of ATP production occurs here, okay? It

produces a lot of ATP,

133

00:22:44.240 --> 00:22:48.399

Olivia Schuitema: Sorry. It produces a lot of ATP, and...

134

00:22:48.850 --> 00:22:58.919

Olivia Schuitema: It is very, very highly productive because it's so energized from

all of those electrons that have come from the previous phases.

135

00:23:00.480 --> 00:23:15.949

Olivia Schuitema: Here is a figure. You do not have to memorize this, okay? Don't

worry about

this, but this is just another way to visualize all of the cycles in a

little bit more complex way, if you're interested. So, here, the

136

00:23:15.950 --> 00:23:25.240

Olivia Schuitema: colored boxes in the background show where these cycles are

happening. So, cytoplasm, here we have glycolysis that's happening.

137

00:23:25.300 --> 00:23:29.269

Olivia Schuitema: And then here we enter the mitochondrion, or the mitochondria.

138

00:23:29.480 --> 00:23:36.759

Olivia Schuitema: With this, like, dark pink bubble. So, here we have glucose, and

we have...

139

00:23:37.080 --> 00:23:42.999

Olivia Schuitema: it gets turned into two pyruvate molecules, and we have ATP

that's being produced.

140

00:23:43.310 --> 00:23:52.370

Olivia Schuitema: Here, it's not really outlined in this figure, but we have the

PrEP reaction that turns the 2-pyruvate into the acetyl-CoA.

141

00:23:53.130 --> 00:23:59.859

Olivia Schuitema: And also releases the carbon dioxide. Okay, so this phase right

here is the

prep reaction.

142

00:24:00.450 --> 00:24:07.850

Olivia Schuitema: The 2-acetyl-CoA go into the citric acid cycle, where ATP is

produced, and also CO2 is produced.

143

00:24:07.980 --> 00:24:27.540

Olivia Schuitema: I also forgot to mention, if you look at these red arrows, at

every single step, there's some form of, electron energy being produced. So,

glycolysis produces NADH and the hydrogen ions, the prep reaction releases the

same, and the citric acid cycle releases the same, and also FADH2.

144

00:24:27.870 --> 00:24:35.780

Olivia Schuitema: So, this just shows how all of those go to this electron

transport chain at the end, and those,

145

00:24:37.000 --> 00:24:44.790

Olivia Schuitema: what you call it? Those, contributions get transported or

converted into ATP.

146

00:24:45.480 --> 00:24:55.980

Olivia Schuitema: And also in the electron transport chain, the oxygen is being,

turned into

the hydrogen, or excuse me, the water, and that's what's being,

released.

147

00:24:56.360 --> 00:24:57.240

Olivia Schuitema: Okay?

148

00:24:57.950 --> 00:25:03.640

Olivia Schuitema: So this is, again, a good overview, but you don't have to

memorize this, you only have to remember the other figure.

149

00:25:05.580 --> 00:25:08.139