
AB
GRAD
CON23

1
00:00:04,230 --> 00:00:11,650
[Music]

2
00:00:16,609 --> 00:00:13,549
hi everyone

3
00:00:19,010 --> 00:00:16,619
um I'm Claire and so I'm going to talk a

4
00:00:20,330 --> 00:00:19,020
little bit about respiration oxygen

5
00:00:22,910 --> 00:00:20,340
sensing

6
00:00:25,250 --> 00:00:22,920
um and this idea that there might be a

7
00:00:28,189 --> 00:00:25,260
really close relative to the ancestor of

8
00:00:31,130 --> 00:00:28,199
Proto mitochondria in modern oxygen

9
00:00:35,389 --> 00:00:33,290
um so I think a lot of people here are

10
00:00:38,330 --> 00:00:35,399
familiar with eukaryogenesis it's this

11
00:00:40,130 --> 00:00:38,340
idea that an archaea and a bacteria a

12
00:00:43,069 --> 00:00:40,140
very long time ago decided to be best

13
00:00:44,110 --> 00:00:43,079

friends forever and now we're here

14
00:00:46,850 --> 00:00:44,120
um so there's lots of different

15
00:00:47,990 --> 00:00:46,860
hypotheses over how this might have

16
00:00:50,569 --> 00:00:48,000
happened

17
00:00:52,970 --> 00:00:50,579
um and kind of the main point I want to

18
00:00:55,729 --> 00:00:52,980
make here is that one there's always a

19
00:00:58,209 --> 00:00:55,739
bacterial host and that's generally

20
00:01:02,090 --> 00:00:58,219
thought of as an alpha proteobacteria

21
00:01:04,750 --> 00:01:02,100
and there's also a lot of or has been a

22
00:01:07,310 --> 00:01:04,760
lot of talk historically about is this

23
00:01:10,010 --> 00:01:07,320
obligately aerobic does it have to have

24
00:01:13,190 --> 00:01:10,020
oxygen is it facultatively aerobic where

25
00:01:14,030 --> 00:01:13,200
it could use oxygen or not or is it kind

26
00:01:16,310 --> 00:01:14,040
of

27
00:01:20,210 --> 00:01:16,320
um an anaerobic partnership that turned

28
00:01:25,670 --> 00:01:23,390
so a lot of more quantitative Recent

29
00:01:28,910 --> 00:01:25,680
research so kind of this triangulation

30
00:01:31,789 --> 00:01:28,920
method suggests that this new clade of

31
00:01:33,770 --> 00:01:31,799
marine Alpha proteobacteria from marine

32
00:01:37,130 --> 00:01:33,780
oxiclines and these are really related

33
00:01:40,670 --> 00:01:37,140
to a group called iodidemonus This is an

34
00:01:42,109 --> 00:01:40,680
iodide using bacteria might be the

35
00:01:44,749 --> 00:01:42,119
closest living relative to

36
00:01:46,630 --> 00:01:44,759
protomitochondria

37
00:01:48,770 --> 00:01:46,640
um and so like I said Alpha

38
00:01:50,630 --> 00:01:48,780

proteobacteria for a while have been

39
00:01:53,569 --> 00:01:50,640
thought of as that sort of bacterial

40
00:01:55,670 --> 00:01:53,579
component of eukaryogenesis and what I'm

41
00:01:58,550 --> 00:01:55,680
going to showing you really quick right

42
00:02:01,190 --> 00:01:58,560
here is that these are some anaerobic

43
00:02:02,749 --> 00:02:01,200
traits that are thought of really

44
00:02:06,590 --> 00:02:02,759
essential when you're looking at the

45
00:02:09,050 --> 00:02:06,600
criteria for this ancestor and so most

46
00:02:10,969 --> 00:02:09,060
of these are alpha proteobacteria and

47
00:02:13,490 --> 00:02:10,979
when we're looking at the heat map what

48
00:02:15,350 --> 00:02:13,500
we want to focus on is this green

49
00:02:18,290 --> 00:02:15,360
highlighted here that's this new clade

50
00:02:20,570 --> 00:02:18,300
so they hit all of these criteria for

51
00:02:24,410 --> 00:02:20,580
anaerobic traits when we're thinking

52
00:02:28,309 --> 00:02:26,210
and then when we're thinking more about

53
00:02:30,170 --> 00:02:28,319
the aerobic side of this these

54
00:02:32,750 --> 00:02:30,180
facultative aerobics we want to think

55
00:02:34,670 --> 00:02:32,760
about the terminal electron chain so

56
00:02:37,729 --> 00:02:34,680
what's interesting is that this is

57
00:02:40,369 --> 00:02:37,739
comprised of four complexes and these

58
00:02:42,949 --> 00:02:40,379
complexes actually have this really

59
00:02:45,290 --> 00:02:42,959
phenomenal history of the evolution of

60
00:02:48,410 --> 00:02:45,300
respiration inside of it so from complex

61
00:02:53,030 --> 00:02:48,420
one to complex four we can kind of track

62
00:02:55,309 --> 00:02:53,040
as the Earth went from anoxic to the

63
00:02:58,009 --> 00:02:55,319

great oxidation event to kind of what we

64
00:03:01,190 --> 00:02:58,019
experience now and so I'm really looking

65
00:03:04,729 --> 00:03:01,200
more at complex four because

66
00:03:07,970 --> 00:03:04,739
um within it um this is that last step

67
00:03:10,009 --> 00:03:07,980
that important uh reduction step so if

68
00:03:13,070 --> 00:03:10,019
we're thinking about proto-mitochondria

69
00:03:15,350 --> 00:03:13,080
they would need to have this complex for

70
00:03:18,350 --> 00:03:15,360
um so that can be divided up even more

71
00:03:21,170 --> 00:03:18,360
into this a to c family we have an

72
00:03:24,110 --> 00:03:21,180
a-type lots of oxygen we don't have to

73
00:03:26,509 --> 00:03:24,120
bind it super well it's there but the

74
00:03:29,869 --> 00:03:26,519
sea family is thought of these as the

75
00:03:31,369 --> 00:03:29,879
oldest terminal or complex four of the

76
00:03:33,470 --> 00:03:31,379
terminal electron chain and that's

77
00:03:37,790 --> 00:03:33,480
because it's capable of binding oxygen

78
00:03:42,710 --> 00:03:40,130
so for this new clade I had two main

79
00:03:44,509 --> 00:03:42,720
questions looking at sort of data mining

80
00:03:47,030 --> 00:03:44,519
which is what kind of genes do they have

81
00:03:49,009 --> 00:03:47,040
for respiration is it

82
00:03:51,289 --> 00:03:49,019
um entirely aerobic or is there

83
00:03:53,210 --> 00:03:51,299
anaerobic as well are they able to sense

84
00:03:55,729 --> 00:03:53,220
oxygen and are they moving along

85
00:03:57,890 --> 00:03:55,739
gradients in response to that and then

86
00:04:01,309 --> 00:03:57,900
on top of that are these genes actually

87
00:04:06,649 --> 00:04:03,770
um so I did a lot of data mining in the

88
00:04:08,089 --> 00:04:06,659

uh with this nice big data set from the

89
00:04:12,110 --> 00:04:08,099
sandwich Inlet that's in British

90
00:04:14,509 --> 00:04:12,120
Columbia it's a seasonally hypoxic area

91
00:04:17,509 --> 00:04:14,519
but it's an oxygen minimum Zone and that

92
00:04:20,530 --> 00:04:17,519
just means that very quickly we'll lose

93
00:04:23,570 --> 00:04:20,540
oxygen very high up in the water column

94
00:04:26,030 --> 00:04:23,580
and it's you can see how like seasonally

95
00:04:29,810 --> 00:04:26,040
variable it is but overall there's a

96
00:04:36,469 --> 00:04:32,930
and so the two really interesting points

97
00:04:38,930 --> 00:04:36,479
I saw was one there are c-type aerobic

98
00:04:42,170 --> 00:04:38,940
oxidases associated with this Alpha Pro

99
00:04:43,909 --> 00:04:42,180
newclate Alpha proteobacteria and its

100
00:04:46,430 --> 00:04:43,919
transcription or the amount that it was

101
00:04:49,249 --> 00:04:46,440
being used potentially increased Into

102
00:04:51,230 --> 00:04:49,259
the anoxic Depths and that there are two

103
00:04:53,090 --> 00:04:51,240
chemotaxis proteins so that's an

104
00:04:55,730 --> 00:04:53,100
aerotaxis protein

105
00:04:57,170 --> 00:04:55,740
maybe maybe not it might be responding

106
00:04:58,670 --> 00:04:57,180
to something else

107
00:05:02,629 --> 00:04:58,680
um they were both being transcribed

108
00:05:05,150 --> 00:05:02,639
really highly into these anoxic depths

109
00:05:06,710 --> 00:05:05,160
um so my main takeaway is we should look

110
00:05:08,390 --> 00:05:06,720
at omz's more we're thinking about

111
00:05:09,530 --> 00:05:08,400
protomitochondria

112
00:05:11,930 --> 00:05:09,540
um because there are some really

113
00:05:14,090 --> 00:05:11,940

interesting Alphas there that only exist

114
00:05:15,230 --> 00:05:14,100
right now as metagenomic assembled

115
00:05:17,330 --> 00:05:15,240
genomes

116
00:05:19,550 --> 00:05:17,340
um and it would be really interesting to

117
00:05:22,430 --> 00:05:19,560
really look at the full genomic uh

118
00:05:24,529 --> 00:05:22,440
capabilities of them

119
00:05:26,210 --> 00:05:24,539
um so I'd like to thank the glass Lab at

120
00:05:29,570 --> 00:05:26,220
Georgia Tech

121
00:05:38,780 --> 00:05:29,580
um my funding the NSF grad and then the