

Lizethe Pendleton
*Session 3 Warm-Up Talk:
Biology*

1
00:00:00,240 --> 00:00:10,869

[Music]

2
00:00:14,869 --> 00:00:13,249

where we get started I just wanted to

3
00:00:16,730 --> 00:00:14,879

say a quick thank you to everyone who

4
00:00:19,580 --> 00:00:16,740

showed up for the event last night to

5
00:00:21,500 --> 00:00:19,590

volunteer hang out eat pizza I think it

6
00:00:23,090 --> 00:00:21,510

was a really great turnout I had a lot

7
00:00:24,470 --> 00:00:23,100

of positive reviews from the public and

8
00:00:26,210 --> 00:00:24,480

everyone said they had a ton of fun so

9
00:00:27,290 --> 00:00:26,220

thank you you guys made the event and it

10
00:00:31,460 --> 00:00:27,300

really means a lot to me for your

11
00:00:32,959 --> 00:00:31,470

participation second I know this has

12
00:00:35,180 --> 00:00:32,969

been talked about a lot a lot already

13
00:00:36,799 --> 00:00:35,190

but I've literally been tweeting my

14

00:00:39,889 --> 00:00:36,809

thumbs off for this trying to capture a

15

00:00:41,389 --> 00:00:39,899

lot from the event going on so if you

16

00:00:43,189 --> 00:00:41,399

guys follow the account or follow the

17

00:00:47,299 --> 00:00:43,199

Instagram account I will tag you in

18

00:00:49,790 --> 00:00:47,309

anything that I know you're in so please

19

00:00:52,700 --> 00:00:49,800

follow this is the hashtag to have grad

20

00:00:54,559 --> 00:00:52,710

con for just like anything related to

21

00:00:56,840 --> 00:00:54,569

the conference and yesterday during our

22

00:00:59,809 --> 00:00:56,850

sicom panel I tagged everything with the

23

00:01:00,979 --> 00:00:59,819

AGC sicom so if you guys had any quotes

24

00:01:02,180 --> 00:01:00,989

or anything that you really love your

25

00:01:03,979 --> 00:01:02,190

thought was cool that you want to share

26

00:01:08,090 --> 00:01:03,989

I would appreciate it if you'd use these

27

00:01:10,280 --> 00:01:08,100

hashtags okay so as Julia already

28

00:01:12,170 --> 00:01:10,290

outlined we will have the first half of

29

00:01:13,370 --> 00:01:12,180

our talks up until about 10:05 and then

30

00:01:17,060 --> 00:01:13,380

we'll take a quick break and then we'll

31

00:01:18,740 --> 00:01:17,070

have the rest of our speakers so I'm

32

00:01:22,340 --> 00:01:18,750

going to start off today with the three

33

00:01:23,900 --> 00:01:22,350

domains of life so a very simple

34

00:01:25,880 --> 00:01:23,910

breakdown of the three domains which are

35

00:01:28,460 --> 00:01:25,890

bacteria archaea and eukaryotes

36

00:01:30,830 --> 00:01:28,470

that bacteria has no membrane bound

37

00:01:33,110 --> 00:01:30,840

organelles archaea are typically known

38

00:01:34,670 --> 00:01:33,120

for being extremely files and eukaryota

39

00:01:36,770 --> 00:01:34,680

house membrane bound organelles within

40

00:01:40,910 --> 00:01:36,780

their cells and here is my favorite

41

00:01:42,410 --> 00:01:40,920

eukaryote my cat so this is an example

42

00:01:44,330 --> 00:01:42,420

of the Tree of Life this is a

43

00:01:48,350 --> 00:01:44,340

phylogenetic tree which is based on

44

00:01:49,760 --> 00:01:48,360

sequencing of the 16s rRNA gene so again

45

00:01:53,090 --> 00:01:49,770

we have the three domains act Iria

46

00:01:54,560 --> 00:01:53,100

archaea and Eukarya and here's really

47

00:01:56,150 --> 00:01:54,570

quick the central dogma for those of you

48

00:01:59,270 --> 00:01:56,160

who might not be familiar with biology

49

00:02:01,630 --> 00:01:59,280

we have DNA which is the library DNA

50

00:02:06,620 --> 00:02:01,640

holds all of the genetic information

51
00:02:10,100 --> 00:02:06,630
then DNA transcribed into RNA which kind

52
00:02:11,210 --> 00:02:10,110
of relays the message and then RNA makes

53
00:02:12,560 --> 00:02:11,220
you know acids and proteins and

54
00:02:14,750 --> 00:02:12,570
everything which does kind of a lot of

55
00:02:17,300 --> 00:02:14,760
the heavy lifting in our bodies so as I

56
00:02:20,960 --> 00:02:17,310
said the phylogenetic tree is based on

57
00:02:23,480 --> 00:02:20,970
the sequencing of the 16s rRNA gene it's

58
00:02:26,180 --> 00:02:23,490
rooted with Luca which stands for the

59
00:02:27,830 --> 00:02:26,190
last Universal common ancestor something

60
00:02:30,470 --> 00:02:27,840
important to keep in mind about Luca is

61
00:02:34,070 --> 00:02:30,480
that it is not necessarily the first

62
00:02:35,900 --> 00:02:34,080
organism on earth but the organism that

63
00:02:37,820 --> 00:02:35,910

persisted and didn't become extinct so

64

00:02:43,150 --> 00:02:37,830

it's the idea that every living organism

65

00:02:46,550 --> 00:02:43,160

can tie back to a single living thing so

66

00:02:49,610 --> 00:02:46,560

16s rRNA sequencing is this sequencing

67

00:02:52,280 --> 00:02:49,620

of the 16s ribosomal RNA RNA gene and

68

00:02:56,410 --> 00:02:52,290

this is also known as deep sequencing so

69

00:02:59,449 --> 00:02:56,420

it kind of gives us a very accurate

70

00:03:01,910 --> 00:02:59,459

profile it's almost like the passport or

71

00:03:04,340 --> 00:03:01,920

the license of the microbes living there

72

00:03:07,550 --> 00:03:04,350

it tells us okay this guy's here this is

73

00:03:11,330 --> 00:03:07,560

here this is here and it can tell us who

74

00:03:13,010 --> 00:03:11,340

is in an environment so this is the same

75

00:03:15,170 --> 00:03:13,020

tree that was shown earlier but as you

76

00:03:17,060 --> 00:03:15,180

can see with the colors this might not

77

00:03:20,870 --> 00:03:17,070

be clear but this shows the maximum

78

00:03:23,570 --> 00:03:20,880

growth temperature so Green is up to 60

79

00:03:26,210 --> 00:03:23,580

degrees Celsius yellow is up to 75

80

00:03:28,940 --> 00:03:26,220

orange is up to 90 and anything that's

81

00:03:30,770 --> 00:03:28,950

red is 90 degrees Celsius and above so

82

00:03:32,720 --> 00:03:30,780

as you can see within the Eukarya domain

83

00:03:34,820 --> 00:03:32,730

it's mostly green there's a little bit

84

00:03:36,440 --> 00:03:34,830

of color but for the most part you carry

85

00:03:39,729 --> 00:03:36,450

our Musa files which means that they

86

00:03:42,170 --> 00:03:39,739

prefer more mild growing temperatures

87

00:03:43,850 --> 00:03:42,180

over here in bacteria we have a little

88

00:03:45,830 --> 00:03:43,860

bit more color diversity so there are a

89

00:03:47,300 --> 00:03:45,840

little more thermo tolerance and over

90

00:03:49,190 --> 00:03:47,310

here as I mentioned archaea are

91

00:03:51,320 --> 00:03:49,200

typically extremophiles and as you can

92

00:03:55,100 --> 00:03:51,330

see there are a lot of bugs in here that

93

00:03:57,620 --> 00:03:55,110

like hot temperatures so as I was saying

94

00:03:59,210 --> 00:03:57,630

thermo files have our organisms with a

95

00:04:02,330 --> 00:03:59,220

preference of high temperatures ranging

96

00:04:04,850 --> 00:04:02,340

from 41 degrees to 122 degrees Celsius

97

00:04:07,100 --> 00:04:04,860

and acidophiles are organisms that

98

00:04:09,140 --> 00:04:07,110

prefer highly acidic environments so

99

00:04:11,840 --> 00:04:09,150

this is an example of the Yellowstone

100

00:04:14,600 --> 00:04:11,850

National Park hot spring which is both

101
00:04:16,520 --> 00:04:14,610
very hot and very acidic and really

102
00:04:20,360 --> 00:04:16,530
quick this is the pH scale which ranges

103
00:04:23,580 --> 00:04:20,370
from 0 to 6 for acidic 7 is neutral and

104
00:04:25,320 --> 00:04:23,590
then 8 to 14 is alkaline and

105
00:04:28,620 --> 00:04:25,330
settle files are over in this region

106
00:04:30,840 --> 00:04:28,630
preferring high acidity psychrow files

107
00:04:32,760 --> 00:04:30,850
are organisms with a preference of very

108
00:04:35,129 --> 00:04:32,770
low temperatures ranging from negative

109
00:04:37,469 --> 00:04:35,139
20 to positive 10 degrees Celsius this

110
00:04:39,600 --> 00:04:37,479
can be found in like polar icecaps the

111
00:04:41,280 --> 00:04:39,610
frozen tundra the bottom of the ocean

112
00:04:44,280 --> 00:04:41,290
where there are cold seeps anyway that's

113
00:04:46,020 --> 00:04:44,290

just really cold pale files are

114

00:04:48,420 --> 00:04:46,030

organisms with a preference of high

115

00:04:50,040 --> 00:04:48,430

salinity conditions and within the Halo

116

00:04:52,080 --> 00:04:50,050

file designation there are slight

117

00:04:53,400 --> 00:04:52,090

moderate and extreme preferences and

118

00:04:55,980 --> 00:04:53,410

this just depends on the salt

119

00:04:57,870 --> 00:04:55,990

concentration a local example is the

120

00:05:00,360 --> 00:04:57,880

Great Salt Lake which is five times

121

00:05:02,340 --> 00:05:00,370

saltier than the ocean and this pink

122

00:05:08,640 --> 00:05:02,350

color is actually a bunch of halophiles

123

00:05:10,170 --> 00:05:08,650

and the Archaean domain another example

124

00:05:12,030 --> 00:05:10,180

of an external file are alkyl files

125

00:05:14,550 --> 00:05:12,040

which are organisms that prefer alkaline

126

00:05:16,620 --> 00:05:14,560

environments this is an image from the

127

00:05:19,950 --> 00:05:16,630

lost city cruise that the browses in lab

128

00:05:21,330 --> 00:05:19,960

and a few others went on last fall if

129

00:05:22,950 --> 00:05:21,340

you were here for the opening ceremonies

130

00:05:25,710 --> 00:05:22,960

dr. Brazelton showed some videos and

131

00:05:28,050 --> 00:05:25,720

pictures of this place so they're on the

132

00:05:29,850 --> 00:05:28,060

opposite end of the pH scale from the

133

00:05:34,290 --> 00:05:29,860

acidophiles and they're over here in an

134

00:05:36,719 --> 00:05:34,300

environment from nine to eleven so there

135

00:05:39,629 --> 00:05:36,729

are different kinds of extremophiles

136

00:05:41,250 --> 00:05:39,639

there are organisms that don't love

137

00:05:44,610 --> 00:05:41,260

oxygen so they're found in anoxic

138

00:05:48,029 --> 00:05:44,620

conditions there are organisms that live

139

00:05:49,350 --> 00:05:48,039

in low nutrient environments and one

140

00:05:51,960 --> 00:05:49,360

thing that's important to remember is

141

00:05:55,379 --> 00:05:51,970

while these environments are extreme to

142

00:05:56,670 --> 00:05:55,389

us these guys are completely happy here

143

00:05:58,680 --> 00:05:56,680

like this is their happy place they're

144

00:06:01,290 --> 00:05:58,690

on vacation this is what they were made

145

00:06:03,779 --> 00:06:01,300

for so while these appear and then

146

00:06:05,700 --> 00:06:03,789

habitable or uncomfortable to us they

147

00:06:09,600 --> 00:06:05,710

are just having the time of their life

148

00:06:11,339 --> 00:06:09,610

wherever they are so there are some

149

00:06:12,900 --> 00:06:11,349

heavy words within the microbiology

150

00:06:15,060 --> 00:06:12,910

field when it comes to the organisms

151
00:06:17,040 --> 00:06:15,070
like this word keema with no heterotroph

152
00:06:19,379 --> 00:06:17,050
sounds like a mouthful but it can give

153
00:06:21,800 --> 00:06:19,389
you a lot of information about the

154
00:06:24,120 --> 00:06:21,810
organism where it lives and what it does

155
00:06:27,450 --> 00:06:24,130
so a quick breakdown of some of the

156
00:06:30,000 --> 00:06:27,460
terms troph it means nourish litho

157
00:06:31,860 --> 00:06:30,010
literally means eater of rock Auto means

158
00:06:33,779 --> 00:06:31,870
self or self producing and in this

159
00:06:34,999 --> 00:06:33,789
context it's an organism that can

160
00:06:37,790 --> 00:06:35,009
produce their own organ

161
00:06:40,279 --> 00:06:37,800
compounds hetero cannot produce its own

162
00:06:42,649 --> 00:06:40,289
food chemos oxidation of chemical

163
00:06:44,989 --> 00:06:42,659

whether organic or inorganic compounds

164

00:06:46,760 --> 00:06:44,999

an oligo means few so earlier I

165

00:06:49,549 --> 00:06:46,770

mentioned that there are organisms that

166

00:06:52,089 --> 00:06:49,559

can live in low nutrient vironment so

167

00:06:54,260 --> 00:06:52,099

they would be classified as oligo trove

168

00:06:56,689 --> 00:06:54,270

back to that word chemo little

169

00:06:59,480 --> 00:06:56,699

heterotroph chemo oxidation of chemicals

170

00:07:01,399 --> 00:06:59,490

litho eaters of rock hetero cannot make

171

00:07:03,230 --> 00:07:01,409

its own food troph nourish so

172

00:07:04,730 --> 00:07:03,240

chemoautotrophs are organisms that

173

00:07:07,629 --> 00:07:04,740

derive their energy from inorganic

174

00:07:10,040 --> 00:07:07,639

minerals or other geological processes

175

00:07:12,589 --> 00:07:10,050

so here is kind of another little

176

00:07:15,049 --> 00:07:12,599

breakdown of that flowchart so if you

177

00:07:17,600 --> 00:07:15,059

know the energy source and the carbon

178

00:07:20,149 --> 00:07:17,610

source then you can almost designate

179

00:07:22,249 --> 00:07:20,159

where if that organism would be and the

180

00:07:24,499 --> 00:07:22,259

kind of environment that it lives in so

181

00:07:26,809 --> 00:07:24,509

autotrophs make food from carbon dioxide

182

00:07:30,619 --> 00:07:26,819

and heterotrophs cannot make their own

183

00:07:33,170 --> 00:07:30,629

food so earlier I mentioned sequencing

184

00:07:34,820 --> 00:07:33,180

of the 16s rRNA gene another type of

185

00:07:37,459 --> 00:07:34,830

sequencing that's very common for

186

00:07:39,529 --> 00:07:37,469

environmental microbiologist is called

187

00:07:41,299 --> 00:07:39,539

metagenomics it's the study of genetic

188

00:07:43,790 --> 00:07:41,309

material directly from environmental

189

00:07:45,709 --> 00:07:43,800

samples so when it comes to metagenomics

190

00:07:47,600 --> 00:07:45,719

you're taking an environmental sample

191

00:07:50,809 --> 00:07:47,610

and you extract the DNA and you're

192

00:07:52,999 --> 00:07:50,819

sequencing everything so this gives you

193

00:07:54,739 --> 00:07:53,009

kind of a big picture idea of everything

194

00:07:57,619 --> 00:07:54,749

that can possibly go on in this

195

00:08:00,379 --> 00:07:57,629

environment it's an analogy that our lab

196

00:08:01,759 --> 00:08:00,389

uses commonly is that it's like taking a

197

00:08:03,409 --> 00:08:01,769

bunch of puzzle pieces together from

198

00:08:05,959 --> 00:08:03,419

different puzzles throwing them in a

199

00:08:07,820 --> 00:08:05,969

pile throwing the boxes away so you

200

00:08:08,959 --> 00:08:07,830

don't know if the puzzle is complete you

201
00:08:10,489 --> 00:08:08,969
don't know what it looks like and you

202
00:08:11,809 --> 00:08:10,499
don't know how many puzzles or pieces

203
00:08:12,679 --> 00:08:11,819
there are and then trying to piece

204
00:08:16,309 --> 00:08:12,689
everything together

205
00:08:18,469 --> 00:08:16,319
so while 16s is deep meta genomic

206
00:08:20,029 --> 00:08:18,479
sequencing is wide and like I said this

207
00:08:21,980 --> 00:08:20,039
gives you at a Baalak potential of

208
00:08:25,549 --> 00:08:21,990
everything that could be going on an

209
00:08:27,259 --> 00:08:25,559
environment meta transcriptomics on the

210
00:08:31,579 --> 00:08:27,269
other hand is a study of gene expression

211
00:08:33,620 --> 00:08:31,589
which is RNA based and this can tell you

212
00:08:35,689 --> 00:08:33,630
exactly what's going on so right now

213
00:08:37,939 --> 00:08:35,699

we're all alive we're all breathing we

214

00:08:39,889 --> 00:08:37,949

could be skydiving we could be reading a

215

00:08:42,170 --> 00:08:39,899

book we could be taking a nap you could

216

00:08:43,850 --> 00:08:42,180

be getting a root canal or you could be

217

00:08:45,319 --> 00:08:43,860

listening to this talk which I'm hoping

218

00:08:46,890 --> 00:08:45,329

is a little less painful than a root

219

00:08:50,140 --> 00:08:46,900

canal

220

00:08:52,690 --> 00:08:50,150

so again the overview is 16's tells us

221

00:08:54,730 --> 00:08:52,700

who is their metagenomics tells us what

222

00:08:57,070 --> 00:08:54,740

they can do and that a transcriptomics

223

00:08:59,940 --> 00:08:57,080

tells us what they are doing and how

224

00:09:03,610 --> 00:08:59,950

they are doing it right in the moment so

225

00:09:05,200 --> 00:09:03,620

o RP or oxidation reduction potential is

226

00:09:06,910 --> 00:09:05,210

a measurement within an environment so

227

00:09:08,800 --> 00:09:06,920

earlier I mentioned the pH scale which

228

00:09:11,890 --> 00:09:08,810

is a measurement of the hydrogen ions

229

00:09:13,840 --> 00:09:11,900

present in the environment or P is kind

230

00:09:16,360 --> 00:09:13,850

of similar as it's a measurement of

231

00:09:18,640 --> 00:09:16,370

what's going on but instead of what's

232

00:09:20,470 --> 00:09:18,650

going on in the environment it's telling

233

00:09:23,440 --> 00:09:20,480

you how easily electrons are transferred

234

00:09:25,600 --> 00:09:23,450

from one species to another so in case

235

00:09:27,010 --> 00:09:25,610

any you guys remember oil rig oxidation

236

00:09:30,400 --> 00:09:27,020

is lost reduction is gain

237

00:09:32,230 --> 00:09:30,410

we have electron donors which donate to

238

00:09:34,090 --> 00:09:32,240

the electron acceptor and that means

239

00:09:36,640 --> 00:09:34,100

that they become oxidized they're losing

240

00:09:40,060 --> 00:09:36,650

that electron on the other hand electron

241

00:09:42,010 --> 00:09:40,070

acceptors who accept the electron become

242

00:09:46,900 --> 00:09:42,020

reduced when they gain that electron

243

00:09:49,150 --> 00:09:46,910

from the donor so this is really where

244

00:09:52,060 --> 00:09:49,160

di realize that but all I wanted to take

245

00:09:55,420 --> 00:09:52,070

away from this is that the more positive

246

00:09:57,100 --> 00:09:55,430

value the stronger oxidizing agent and

247

00:09:59,380 --> 00:09:57,110

at the same time the weaker reducing

248

00:10:01,660 --> 00:09:59,390

agent and on the other end where there's

249

00:10:03,910 --> 00:10:01,670

a higher negative value it's a stronger

250

00:10:08,310 --> 00:10:03,920

reducing agent and a weaker oxidizing

251
00:10:12,100 --> 00:10:08,320
agent so this is the electron power and

252
00:10:14,230 --> 00:10:12,110
this is kind of the same idea where the

253
00:10:17,080 --> 00:10:14,240
better reductants electron donors are up

254
00:10:19,510 --> 00:10:17,090
here and the better oxidizers better

255
00:10:20,950 --> 00:10:19,520
electron acceptors are down here and all

256
00:10:23,740 --> 00:10:20,960
we really need to get from this is that

257
00:10:27,400 --> 00:10:23,750
the longer the arrow the more energy is

258
00:10:29,410 --> 00:10:27,410
obtained so glucose to oxygen that's

259
00:10:31,210 --> 00:10:29,420
from the top to the bottom so there's a

260
00:10:33,730 --> 00:10:31,220
ton of art of energy to be gained there

261
00:10:35,770 --> 00:10:33,740
whereas with hydrogen gas to carbon

262
00:10:37,930 --> 00:10:35,780
dioxide there's not much going on there

263
00:10:42,030 --> 00:10:37,940

is energy available and present but it's

264

00:10:48,340 --> 00:10:45,580

relating also relating to ORP our oxygen

265

00:10:50,140 --> 00:10:48,350

levels so there are different ranges of

266

00:10:54,040 --> 00:10:50,150

oxygen concentration or dissolved oxygen

267

00:10:56,560 --> 00:10:54,050

within water so there's oxic hypoxic and

268

00:10:58,910 --> 00:10:56,570

a toxic toxic is classified as like a

269

00:11:00,949 --> 00:10:58,920

healthy dissolved oxygen content

270

00:11:03,160 --> 00:11:00,959

means macro organisms can live there

271

00:11:05,420 --> 00:11:03,170

like fish and other aquatic animals

272

00:11:07,550 --> 00:11:05,430

hypoxic is kind of on the range of like

273

00:11:09,829 --> 00:11:07,560

well something could be living here but

274

00:11:12,769 --> 00:11:09,839

probably nothing big would be mostly

275

00:11:15,530 --> 00:11:12,779

bacteria or other organisms and then

276

00:11:18,620 --> 00:11:15,540

anoxic is pretty much nothing going on

277

00:11:21,670 --> 00:11:18,630

there's if there's anything living there

278

00:11:24,319 --> 00:11:21,680

it's definitely going to be microbial

279

00:11:27,470 --> 00:11:24,329

ORP has a positive correlation with

280

00:11:29,329 --> 00:11:27,480

oxygen levels so the higher the oxygen

281

00:11:31,970 --> 00:11:29,339

levels the more positive the ORP value

282

00:11:34,100 --> 00:11:31,980

and then down here it's the same the

283

00:11:36,590 --> 00:11:34,110

lower the oxygen levels the more

284

00:11:38,900 --> 00:11:36,600

negative ORP values and down here are

285

00:11:43,220 --> 00:11:38,910

going to be like a lot of heavy metals

286

00:11:44,660 --> 00:11:43,230

and kind of the more extremophiles and

287

00:11:46,310 --> 00:11:44,670

with that that's all I have for you

288

00:11:48,319 --> 00:11:46,320

today thank you so much so our next

289

00:11:50,660 --> 00:11:48,329

speaker will be Nicole Wagner talking

290

00:11:52,960 --> 00:11:50,670

about meta genomic profiling of the

291

00:11:55,759 --> 00:11:52,970

methane-rich anoxic basin of Lake

292

00:11:57,290 --> 00:11:55,769

Untersee and of ocean world thank you so