
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:11,949 --> 00:00:08,709
[Applause]

3
00:00:14,320 --> 00:00:11,959
I am ready my name is Hannah Dawson and

4
00:00:16,060 --> 00:00:14,330
I'm a graduate student at University of

5
00:00:17,290 --> 00:00:16,070
Washington in the School of Oceanography

6
00:00:19,359 --> 00:00:17,300
and today I want to talk to you about

7
00:00:21,310 --> 00:00:19,369
using metabolomics as a method to probe

8
00:00:24,760 --> 00:00:21,320
the physiological adaptations of sea ice

9
00:00:27,339 --> 00:00:24,770
algae so just to orient us to this

10
00:00:29,740 --> 00:00:27,349
extreme environment this is a video

11
00:00:32,589 --> 00:00:29,750
showing you the sea ice extent in the

12
00:00:34,600 --> 00:00:32,599
Arctic over one season so sea ice is an

13
00:00:36,880 --> 00:00:34,610

extreme and dynamic environment here on

14
00:00:39,040 --> 00:00:36,890
earth with four to six percent of the

15
00:00:40,420 --> 00:00:39,050
global ocean area being covered by sea

16
00:00:44,139 --> 00:00:40,430
ice depending on the time of the year

17
00:00:45,819 --> 00:00:44,149
and despite being a relatively harsh

18
00:00:47,799 --> 00:00:45,829
environment a number of organisms have

19
00:00:49,959 --> 00:00:47,809
been able to exploit this habitat and

20
00:00:51,849 --> 00:00:49,969
one of these organisms are sea ice algae

21
00:00:53,829 --> 00:00:51,859
which are single-celled eukaryotic

22
00:00:56,169 --> 00:00:53,839
photosynthetic organisms that can live

23
00:00:57,639 --> 00:00:56,179
within the liquid brine channels formed

24
00:01:00,069 --> 00:00:57,649
in sea ice surrounded by a freshwater

25
00:01:03,579 --> 00:01:00,079
ice matrix so here I'm just showing you

26
00:01:05,530 --> 00:01:03,589
an example of sea ice diatoms inside of

27
00:01:07,600 --> 00:01:05,540
a brine channel but these organisms

28
00:01:08,890 --> 00:01:07,610
contend with a number of challenging

29
00:01:11,050 --> 00:01:08,900
features in this environment and

30
00:01:12,610 --> 00:01:11,060
temperature is one of the largest

31
00:01:14,020 --> 00:01:12,620
challenges in this environment where

32
00:01:16,210 --> 00:01:14,030
throughout the sea ice column

33
00:01:19,240 --> 00:01:16,220
temperature varies greatly on a spatial

34
00:01:21,670 --> 00:01:19,250
and seasonal scale so temperature at the

35
00:01:23,320 --> 00:01:21,680
top of the ice column is much colder and

36
00:01:24,670 --> 00:01:23,330
in contact with the atmosphere while

37
00:01:26,560 --> 00:01:24,680
temperatures at the bottom are much

38
00:01:28,720 --> 00:01:26,570

warmer and closer to sea water

39
00:01:30,610 --> 00:01:28,730
conditions and like I mentioned there's

40
00:01:32,800 --> 00:01:30,620
a liquid brine volume left behind when

41
00:01:35,280 --> 00:01:32,810
seawater freezes and the fat volume also

42
00:01:37,480 --> 00:01:35,290
scales with temperature and lastly

43
00:01:39,460 --> 00:01:37,490
salinity varies throughout the ice

44
00:01:41,530 --> 00:01:39,470
column also with temperature with

45
00:01:43,090 --> 00:01:41,540
salinities of that Bryan being very high

46
00:01:45,580 --> 00:01:43,100
at the top of the ice where it's very

47
00:01:48,040 --> 00:01:45,590
cold and closer to seawater salinities

48
00:01:50,050 --> 00:01:48,050
towards the bottom of the ice and this

49
00:01:52,480 --> 00:01:50,060
is also a variable environment on a

50
00:01:54,460 --> 00:01:52,490
seasonal scale with the melting of sea

51
00:01:56,500 --> 00:01:54,470
ice in the spring and reformation in the

52
00:01:58,060 --> 00:01:56,510
autumn and winter bringing along large

53
00:02:00,700 --> 00:01:58,070
swings and temperature and salinity

54
00:02:04,180 --> 00:02:00,710
reaching near freshwater conditions in

55
00:02:09,430 --> 00:02:04,190
melt season and conditions temperatures

56
00:02:11,140 --> 00:02:09,440
above zero but despite this sea ice

57
00:02:13,270 --> 00:02:11,150
algae have been able to survive and

58
00:02:16,240 --> 00:02:13,280
thrive in this environment and here I'm

59
00:02:17,880 --> 00:02:16,250
showing you a video of what it looks

60
00:02:20,870 --> 00:02:17,890
like underneath the sea ice in the

61
00:02:22,730 --> 00:02:20,880
Arctic in Nootka Davich Alaska and here

62
00:02:24,590 --> 00:02:22,740
stuck a gopro down through a core hole

63
00:02:26,300 --> 00:02:24,600

in the ice and I think this is a really

64
00:02:28,610 --> 00:02:26,310
cool video it just gives us a glimpse at

65
00:02:30,980 --> 00:02:28,620
this otherworldly environment where

66
00:02:32,150 --> 00:02:30,990
these organisms are you can see a brown

67
00:02:34,370 --> 00:02:32,160
layer on the bottom of that ice and

68
00:02:36,410 --> 00:02:34,380
those are all sea ice algae mostly

69
00:02:37,700 --> 00:02:36,420
dominated by diatoms and in this

70
00:02:39,500 --> 00:02:37,710
environment they can reach these high

71
00:02:41,810 --> 00:02:39,510
abundances like we're seeing here high

72
00:02:43,340 --> 00:02:41,820
rates of primary production and serve as

73
00:02:45,380 --> 00:02:43,350
an important food source for a number of

74
00:02:47,720 --> 00:02:45,390
organisms and play largely into

75
00:02:48,800 --> 00:02:47,730
biogeochemical cycling and climate

76
00:02:52,040 --> 00:02:48,810
active gas production in this

77
00:02:53,900 --> 00:02:52,050
environment but we still don't have a

78
00:02:57,200 --> 00:02:53,910
very good understanding of how they're

79
00:02:58,940 --> 00:02:57,210
adapted to do this so I'm interested in

80
00:03:01,160 --> 00:02:58,950
how sea ice algae are physiologically

81
00:03:03,020 --> 00:03:01,170
adapted to survive and thrive in the

82
00:03:04,820 --> 00:03:03,030
extreme and variable conditions found in

83
00:03:08,780 --> 00:03:04,830
sea ice and how we can probe those

84
00:03:10,460 --> 00:03:08,790
adaptations so one way we can do this is

85
00:03:12,320 --> 00:03:10,470
by better understanding the metabolic

86
00:03:14,150 --> 00:03:12,330
reactions going on inside of the cell or

87
00:03:16,760 --> 00:03:14,160
the suite of biochemical reactions that

88
00:03:19,010 --> 00:03:16,770

allow a cell to be alive and this is

89
00:03:20,630 --> 00:03:19,020
just a glimpse at how complicated these

90
00:03:23,330 --> 00:03:20,640
systems can be these are all the

91
00:03:25,340 --> 00:03:23,340
metabolic pathways in a and example

92
00:03:27,530 --> 00:03:25,350
diatoms cell where each line in this

93
00:03:30,560 --> 00:03:27,540
diagram is a metabolic reaction mediated

94
00:03:32,090 --> 00:03:30,570
by enzymes and along each of these lines

95
00:03:34,160 --> 00:03:32,100
there are a lot of precursors

96
00:03:35,600 --> 00:03:34,170
intermediates and products of these

97
00:03:38,390 --> 00:03:35,610
reactions which I'll refer to as

98
00:03:40,790 --> 00:03:38,400
metabolites and one way that we can get

99
00:03:42,380 --> 00:03:40,800
a better idea of what in tablets are

100
00:03:45,310 --> 00:03:42,390
inside of a cell how they're regulated

101
00:03:49,120 --> 00:03:45,320
is by using a method called metabolomics

102
00:03:51,770 --> 00:03:49,130
so metabolomics we take this entire

103
00:03:55,070 --> 00:03:51,780
intracellular pool of metabolites inside

104
00:03:56,540 --> 00:03:55,080
of a cell extract them and then use a

105
00:03:58,940 --> 00:03:56,550
tandem liquid chromatography mass

106
00:04:00,920 --> 00:03:58,950
spectrometry approach in order to get

107
00:04:04,400 --> 00:04:00,930
the entire pool of detectable

108
00:04:06,140 --> 00:04:04,410
metabolites and in this each compound is

109
00:04:07,940 --> 00:04:06,150
represented by a peak on the mass spec

110
00:04:10,820 --> 00:04:07,950
and the area underneath of that peak is

111
00:04:12,470 --> 00:04:10,830
correlated with the relative abundance

112
00:04:14,570 --> 00:04:12,480
of that compound and to give you an idea

113
00:04:16,280 --> 00:04:14,580

of scale of how many compounds we can

114
00:04:20,090 --> 00:04:16,290
look at simultaneously with this method

115
00:04:22,310 --> 00:04:20,100
we end up with in my sample type around

116
00:04:23,870 --> 00:04:22,320
19,000 mass features or Peaks which

117
00:04:27,050 --> 00:04:23,880
could be potential compounds but to try

118
00:04:30,020 --> 00:04:27,060
to identify but another approach is to

119
00:04:32,060 --> 00:04:30,030
look at a pared down list of compounds

120
00:04:33,860 --> 00:04:32,070
that were interested in going into a

121
00:04:35,980 --> 00:04:33,870
study and I'm going to

122
00:04:38,300 --> 00:04:35,990
to those as targeted metabolites and

123
00:04:40,129 --> 00:04:38,310
again for scale this is around

124
00:04:43,250 --> 00:04:40,139
eighty-eight compounds in my sample type

125
00:04:45,050 --> 00:04:43,260
and specifically today I'm going to be

126
00:04:46,879 --> 00:04:45,060
talking about a group of compounds

127
00:04:50,090 --> 00:04:46,889
referred to as compatible solutes and

128
00:04:52,040 --> 00:04:50,100
I'm interested here in how altering

129
00:04:54,350 --> 00:04:52,050
temperature and salinity conditions

130
00:04:58,340 --> 00:04:54,360
changed the compatible solute pools and

131
00:04:59,870 --> 00:04:58,350
sea ice algae and I'm interested in this

132
00:05:01,640 --> 00:04:59,880
because compatible solutes are these

133
00:05:03,260 --> 00:05:01,650
small organic molecules that can be

134
00:05:05,330 --> 00:05:03,270
maintained at very high intracellular

135
00:05:08,659 --> 00:05:05,340
concentrations serve a number of roles

136
00:05:09,500 --> 00:05:08,669
inside a wide variety of cells and two

137
00:05:10,850 --> 00:05:09,510
of the roles that can serve as

138
00:05:13,520 --> 00:05:10,860

mitigating salinity and temperature

139
00:05:15,620 --> 00:05:13,530
stress and they can respond very rapidly

140
00:05:17,719 --> 00:05:15,630
to environmental change so if we start

141
00:05:19,490 --> 00:05:17,729
with an algal cell out in the

142
00:05:20,600 --> 00:05:19,500
environment in a marine environment we

143
00:05:22,490 --> 00:05:20,610
would expect them to have a baseline

144
00:05:25,520 --> 00:05:22,500
concentration of compatible solutes in

145
00:05:27,110 --> 00:05:25,530
order to mitigate osmotic stress between

146
00:05:30,379 --> 00:05:27,120
the interior of the cell and their

147
00:05:31,700 --> 00:05:30,389
saline environment surrounding them but

148
00:05:34,250 --> 00:05:31,710
if they're in colder or saltier

149
00:05:35,450 --> 00:05:34,260
conditions like in sea ice brines we

150
00:05:36,920 --> 00:05:35,460
would expect them to have higher

151
00:05:38,719 --> 00:05:36,930
concentrations of these compatible

152
00:05:41,930 --> 00:05:38,729
solutes to prevent water loss our

153
00:05:44,240 --> 00:05:41,940
freezing and if they're introduced into

154
00:05:46,279 --> 00:05:44,250
warmer and fresher conditions algal

155
00:05:47,570 --> 00:05:46,289
cells can rapidly dump these compatible

156
00:05:50,330 --> 00:05:47,580
solutes out into the surrounding

157
00:05:52,070 --> 00:05:50,340
environment and once they're in the

158
00:05:53,810 --> 00:05:52,080
environment they can be taken up and

159
00:05:55,969 --> 00:05:53,820
used as compatible solutes again by

160
00:05:57,710 --> 00:05:55,979
other organisms used as a carbon

161
00:05:59,600 --> 00:05:57,720
nitrogen or an energy source by

162
00:06:01,909 --> 00:05:59,610
heterotrophic bacteria in the sea ice or

163
00:06:04,520 --> 00:06:01,919

serve as climate active gas precursors

164
00:06:06,770 --> 00:06:04,530
and here are just three examples of

165
00:06:08,719 --> 00:06:06,780
compatible solutes that have been found

166
00:06:11,089 --> 00:06:08,729
to be abundant in sea ice algae in

167
00:06:13,520 --> 00:06:11,099
particular including DM SP the climate

168
00:06:17,450 --> 00:06:13,530
active gas precursor glycine betaine and

169
00:06:20,000 --> 00:06:17,460
prolene so to get at this question of

170
00:06:21,260 --> 00:06:20,010
how CSL G used compatible solutes in

171
00:06:21,770 --> 00:06:21,270
response to changes in temperature and

172
00:06:24,290 --> 00:06:21,780
salinity

173
00:06:26,629 --> 00:06:24,300
we used a lab study of the Antarctic sea

174
00:06:28,040 --> 00:06:26,639
ice diatom mitchell Laconte grown at two

175
00:06:30,020 --> 00:06:28,050
different temperatures and two different

176
00:06:32,900 --> 00:06:30,030
salinities minus 1 and plus 4 degrees

177
00:06:34,969 --> 00:06:32,910
Celsius and solemnities of 32 and 41 and

178
00:06:37,190 --> 00:06:34,979
then compared this to environmental

179
00:06:40,279 --> 00:06:37,200
samples collected in the Arctic in new

180
00:06:42,440 --> 00:06:40,289
geographic in a mixed sea ice community

181
00:06:44,480 --> 00:06:42,450
dominated by a niches species and this

182
00:06:46,540 --> 00:06:44,490
was at similar conditions around minus 1

183
00:06:50,710 --> 00:06:46,550
degrees Celsius and a salinity

184
00:06:53,080 --> 00:06:50,720
32 and first off we could see from

185
00:06:54,340 --> 00:06:53,090
looking at the general physiology of the

186
00:06:56,560 --> 00:06:54,350
cells growing these different treatments

187
00:06:57,910 --> 00:06:56,570
there were relatively small changes in

188
00:07:00,220 --> 00:06:57,920

something like growth rates so we saw

189
00:07:02,110 --> 00:07:00,230
less than 10% changes in growth rate

190
00:07:04,270 --> 00:07:02,120
which is in stark contrast to a lot of

191
00:07:06,010 --> 00:07:04,280
studies of compatible solutes that use

192
00:07:08,050 --> 00:07:06,020
large shock treatments with bigger

193
00:07:10,900 --> 00:07:08,060
temperature and salinity changes where

194
00:07:12,160 --> 00:07:10,910
growth often is reduced or stopped so

195
00:07:14,260 --> 00:07:12,170
we're assuming that these cells are

196
00:07:16,000 --> 00:07:14,270
generally well adapted to the conditions

197
00:07:18,070 --> 00:07:16,010
we grew them under but we still saw

198
00:07:19,660 --> 00:07:18,080
large changes in metabolite abundances

199
00:07:23,080 --> 00:07:19,670
including those compatible solutes we're

200
00:07:24,970 --> 00:07:23,090
interested in so just to give you a

201
00:07:26,680 --> 00:07:24,980
broad idea of the power of this

202
00:07:29,080 --> 00:07:26,690
metabolomics method we wanted to first

203
00:07:30,490 --> 00:07:29,090
look at a suite of potential compatible

204
00:07:32,140 --> 00:07:30,500
solutes that we've seen evidence in

205
00:07:34,660 --> 00:07:32,150
other organisms that they could be

206
00:07:37,690 --> 00:07:34,670
compatible solutes and here this is

207
00:07:40,390 --> 00:07:37,700
again just this matrix of cold vs warm

208
00:07:43,210 --> 00:07:40,400
and salty versus fresh and when we

209
00:07:45,850 --> 00:07:43,220
looked at this potential broad suite we

210
00:07:48,250 --> 00:07:45,860
saw a number of reactions we would

211
00:07:50,440 --> 00:07:48,260
expect compatible solutes to fall mainly

212
00:07:53,130 --> 00:07:50,450
up here higher in abundance in the cold

213
00:07:56,500 --> 00:07:53,140

and salty treatment but we saw some

214
00:07:58,720 --> 00:07:56,510
respond that way and some respond only

215
00:08:01,560 --> 00:07:58,730
in higher abundance in just the cold

216
00:08:03,760 --> 00:08:01,570
treatment or just the salty treatment

217
00:08:05,650 --> 00:08:03,770
another group that responded either

218
00:08:07,240 --> 00:08:05,660
oppositely or had mixed reactions to

219
00:08:09,550 --> 00:08:07,250
what we'd expect for compatible solute

220
00:08:11,590 --> 00:08:09,560
action and another group that were not

221
00:08:12,820 --> 00:08:11,600
significantly changed in response to any

222
00:08:14,800 --> 00:08:12,830
of the temperature or salinity

223
00:08:17,380 --> 00:08:14,810
treatments we used here so we're seeing

224
00:08:19,600 --> 00:08:17,390
a really broad reaction to these

225
00:08:21,310 --> 00:08:19,610
conditions and today I'm just going to

226
00:08:24,510 --> 00:08:21,320
talk a little bit more about a few of

227
00:08:26,380 --> 00:08:24,520
these compounds in particular so those 3

228
00:08:29,440 --> 00:08:26,390
compatible solutes I mentioned that are

229
00:08:30,400 --> 00:08:29,450
common in ice algae in particular here

230
00:08:33,250 --> 00:08:30,410
I'm showing you prolene

231
00:08:34,660 --> 00:08:33,260
DM SP and attained for prolene we saw

232
00:08:36,520 --> 00:08:34,670
that even though we were getting those

233
00:08:38,530 --> 00:08:36,530
less than 10 percent growth rate changes

234
00:08:40,390 --> 00:08:38,540
really large magnitude changes in the

235
00:08:42,790 --> 00:08:40,400
concentration of prolene both in

236
00:08:44,080 --> 00:08:42,800
response to cold temperature and in

237
00:08:45,640 --> 00:08:44,090
response to higher salinity with an

238
00:08:47,890 --> 00:08:45,650

additive effect up to a four-fold

239
00:08:50,530 --> 00:08:47,900
increase in pearling concentrations and

240
00:08:53,530 --> 00:08:50,540
reaching high concentrations around 50

241
00:08:56,230 --> 00:08:53,540
milli molar and here I have this as

242
00:08:57,970 --> 00:08:56,240
normalized peak area which is like

243
00:08:59,630 --> 00:08:57,980
relative abundance but we do have

244
00:09:03,130 --> 00:08:59,640
estimates for absolute concentration

245
00:09:05,750 --> 00:09:03,140
well which is that fifty mili molar and

246
00:09:06,950 --> 00:09:05,760
then if we look at DMS P again we're

247
00:09:08,450 --> 00:09:06,960
looking at the normalized peak area

248
00:09:09,890 --> 00:09:08,460
against the salinities and the two

249
00:09:12,020 --> 00:09:09,900
different temperature treatments minus

250
00:09:13,640 --> 00:09:12,030
one and plus for DMS P increased in

251
00:09:16,040 --> 00:09:13,650
response to cold temperature and higher

252
00:09:17,570 --> 00:09:16,050
salinity around twofold but did not show

253
00:09:19,370 --> 00:09:17,580
the additive effect we saw four prolene

254
00:09:21,200 --> 00:09:19,380
and we don't have absolute

255
00:09:23,300 --> 00:09:21,210
concentrations for DMS P using this

256
00:09:25,610 --> 00:09:23,310
method but we can assume from previous

257
00:09:28,400 --> 00:09:25,620
work they're similarly high and for

258
00:09:31,370 --> 00:09:28,410
glycine betaine there are at pretty high

259
00:09:33,620 --> 00:09:31,380
concentration still between 27 and 60 1

260
00:09:34,910 --> 00:09:33,630
millimolar but showed a more complicated

261
00:09:36,620 --> 00:09:34,920
response than what we're seeing for

262
00:09:38,060 --> 00:09:36,630
these other candidates with a general

263
00:09:41,230 --> 00:09:38,070

increase in response to higher salinity

264
00:09:44,270 --> 00:09:41,240
but a more complicated temperature story

265
00:09:46,700 --> 00:09:44,280
and one of the cool things that this

266
00:09:48,650 --> 00:09:46,710
method can do is not only look at those

267
00:09:50,630 --> 00:09:48,660
compatible solutes we already know

268
00:09:52,730 --> 00:09:50,640
exists and important in ice algal cells

269
00:09:54,920 --> 00:09:52,740
but to find new potential candidates

270
00:09:56,690 --> 00:09:54,930
that is compatible solutes and one of

271
00:09:59,450 --> 00:09:56,700
these that came out of the study was d

272
00:10:02,630 --> 00:09:59,460
HPS which is dihydroxy propane sulfonate

273
00:10:04,490 --> 00:10:02,640
and this is a relatively newly studied

274
00:10:06,170 --> 00:10:04,500
metabolite in the oceans in general and

275
00:10:08,690 --> 00:10:06,180
we don't have a great idea what it's

276
00:10:11,270 --> 00:10:08,700
doing in any ocean environment let alone

277
00:10:13,760 --> 00:10:11,280
in sea ice but it has shown potential as

278
00:10:16,730 --> 00:10:13,770
a compatible solute and we are seeing

279
00:10:19,310 --> 00:10:16,740
similar results here where a thps was

280
00:10:21,590 --> 00:10:19,320
increased around twofold in response to

281
00:10:23,540 --> 00:10:21,600
cold temperature and to higher salinity

282
00:10:26,180 --> 00:10:23,550
but again not the additive effect we saw

283
00:10:28,700 --> 00:10:26,190
with prolene but reaching really high

284
00:10:31,370 --> 00:10:28,710
intracellular concentrations up to 91

285
00:10:34,100 --> 00:10:31,380
milli molar and just to give you an

286
00:10:36,670 --> 00:10:34,110
example to ground that in a temperate

287
00:10:39,200 --> 00:10:36,680
diatom species celesia cyrus sudan ana

288
00:10:41,330 --> 00:10:39,210

DHS has only found around seven

289
00:10:43,250 --> 00:10:41,340
millimolar this is potentially a really

290
00:10:46,610 --> 00:10:43,260
potent compatible solute in the sea ice

291
00:10:49,190 --> 00:10:46,620
environment in particular and the next

292
00:10:51,710 --> 00:10:49,200
thing so CH the CI sarà Tom Mitchell

293
00:10:53,630 --> 00:10:51,720
Laconte maintains and regulates a

294
00:10:55,580 --> 00:10:53,640
diverse suite of compatible solutes with

295
00:10:57,290 --> 00:10:55,590
variable sensitivities to temperature

296
00:10:58,700 --> 00:10:57,300
and salinity even when growth is not

297
00:11:00,550 --> 00:10:58,710
large virtually change but the next

298
00:11:02,960 --> 00:11:00,560
thing we wanted to look at is if the

299
00:11:05,390 --> 00:11:02,970
metabolize diatom culture was similar to

300
00:11:06,500 --> 00:11:05,400
that of a mixed he ate sea ice community

301
00:11:09,650 --> 00:11:06,510
and what's actually going on in the

302
00:11:12,200 --> 00:11:09,660
environment so here I'm just showing you

303
00:11:13,290 --> 00:11:12,210
the overall number of detected targeted

304
00:11:14,850 --> 00:11:13,300
metabolites from that

305
00:11:17,490 --> 00:11:14,860
smaller list I mentioned earlier and

306
00:11:19,440 --> 00:11:17,500
this is for the field samples which were

307
00:11:21,120 --> 00:11:19,450
a mixed community but dominated by a

308
00:11:23,519 --> 00:11:21,130
niche Agenor as well nature for Geetha

309
00:11:26,100 --> 00:11:23,529
and comparing that to our niche Allah

310
00:11:27,720 --> 00:11:26,110
can take culture and we conceded the

311
00:11:29,819 --> 00:11:27,730
majority of metabolites in this targeted

312
00:11:31,949 --> 00:11:29,829
pool were shared but there were unique

313
00:11:33,389 --> 00:11:31,959

compounds found in both sample types

314
00:11:37,050 --> 00:11:33,399
with more unique compounds found in the

315
00:11:38,730 --> 00:11:37,060
field and the next thing I wanted to

316
00:11:40,410 --> 00:11:38,740
look at is how the concentrations of the

317
00:11:43,949 --> 00:11:40,420
compatible solutes in particular compare

318
00:11:45,329 --> 00:11:43,959
between these sample types and here I'm

319
00:11:47,340 --> 00:11:45,339
just showing you for a select number of

320
00:11:49,079 --> 00:11:47,350
compatible solutes the absolute

321
00:11:50,670 --> 00:11:49,089
concentrations for both the field and

322
00:11:52,440 --> 00:11:50,680
the culture and the first thing I want

323
00:11:55,019 --> 00:11:52,450
to point out is the difference in y axis

324
00:11:56,610 --> 00:11:55,029
where the right axis in green is the

325
00:11:58,560 --> 00:11:56,620
millimoles of metabolites per mole

326
00:12:01,500 --> 00:11:58,570
carbon in the culture and the right in

327
00:12:02,699 --> 00:12:01,510
blue is in the field and you might

328
00:12:04,170 --> 00:12:02,709
notice that there is about a tenfold

329
00:12:05,220 --> 00:12:04,180
difference in concentration between

330
00:12:06,449 --> 00:12:05,230
these two sample types with

331
00:12:08,790 --> 00:12:06,459
concentrations being higher in the

332
00:12:10,410 --> 00:12:08,800
culture which we would expect and

333
00:12:12,810 --> 00:12:10,420
comparing a pure exponentially growing

334
00:12:14,190 --> 00:12:12,820
culture to a mixed field community where

335
00:12:16,800 --> 00:12:14,200
all the organic matter might not

336
00:12:19,410 --> 00:12:16,810
necessarily be living and growing but

337
00:12:21,000 --> 00:12:19,420
overall we saw that DHBs was the most

338
00:12:23,010 --> 00:12:21,010

abundant of the compatible solutes we

339
00:12:25,230 --> 00:12:23,020
quantified in both sample types with

340
00:12:28,530 --> 00:12:25,240
beteen and prolene scaling down in a

341
00:12:30,180 --> 00:12:28,540
similar pattern from that but there were

342
00:12:32,010 --> 00:12:30,190
also a number of compatible solute

343
00:12:33,810 --> 00:12:32,020
candidates that were in relatively high

344
00:12:35,970 --> 00:12:33,820
concentrations in the field like home

345
00:12:38,819 --> 00:12:35,980
marine and ECT onic acid that were not

346
00:12:41,460 --> 00:12:38,829
found in high levels within our culture

347
00:12:42,900 --> 00:12:41,470
samples and another group of compatible

348
00:12:45,060 --> 00:12:42,910
solute candidates that were strictly

349
00:12:46,980 --> 00:12:45,070
unique to the field not detected at all

350
00:12:48,480 --> 00:12:46,990
in our culture's but at relatively low

351
00:12:50,490 --> 00:12:48,490
concentrations hinting at some

352
00:12:53,449 --> 00:12:50,500
interesting possible species specific

353
00:12:56,340 --> 00:12:53,459
differences in compatible solute use and

354
00:12:57,870 --> 00:12:56,350
just to give you an idea of the scale of

355
00:12:58,889 --> 00:12:57,880
the concentrations of these compounds

356
00:13:01,500 --> 00:12:58,899
out in the environment and their

357
00:13:03,269 --> 00:13:01,510
potential to impact the environment I

358
00:13:05,550 --> 00:13:03,279
want to remind you that these are highly

359
00:13:08,310 --> 00:13:05,560
mobile compounds that can be rapidly

360
00:13:09,900 --> 00:13:08,320
dumped from cells such as during the

361
00:13:12,199 --> 00:13:09,910
spring melt when they're introduced into

362
00:13:15,120 --> 00:13:12,209
those warmer and fresher conditions and

363
00:13:15,990 --> 00:13:15,130

they can dump up to 80% of their

364
00:13:18,810 --> 00:13:16,000
compatible sawyou

365
00:13:21,240 --> 00:13:18,820
inventory in less than an hour so if we

366
00:13:23,880 --> 00:13:21,250
just take the nitrogen containing

367
00:13:26,310 --> 00:13:23,890
compounds I have quantified here and

368
00:13:27,030 --> 00:13:26,320
pull them together this is equivalent to

369
00:13:29,129 --> 00:13:27,040
around

370
00:13:30,870 --> 00:13:29,139
point two micro molar concentration of

371
00:13:32,430 --> 00:13:30,880
organic nitrogen that's capable of

372
00:13:34,560 --> 00:13:32,440
rapidly flux into the surrounding

373
00:13:37,379 --> 00:13:34,570
environment and this is on a comparable

374
00:13:39,900 --> 00:13:37,389
scale to the inorganic nature

375
00:13:42,060 --> 00:13:39,910
concentrations in Batam sea ice during

376
00:13:45,120 --> 00:13:42,070
the spring which are around 0.5 to 10

377
00:13:48,120 --> 00:13:45,130
micromolar nitrate so this is a

378
00:13:54,050 --> 00:13:48,130
potential large source of nitrogen for

379
00:13:56,999 --> 00:13:54,060
this environment so to wrap up I want to

380
00:13:59,040 --> 00:13:57,009
conclude that metabolomic is a powerful

381
00:14:01,230 --> 00:13:59,050
tool that can detect a wide range of

382
00:14:03,360 --> 00:14:01,240
intracellular metabolites simultaneously

383
00:14:04,800 --> 00:14:03,370
in microbial organisms and quantify

384
00:14:07,559 --> 00:14:04,810
their response to varying environmental

385
00:14:09,480 --> 00:14:07,569
conditions here we saw that CAS algae

386
00:14:11,430 --> 00:14:09,490
maintained and tightly regulated complex

387
00:14:12,960 --> 00:14:11,440
suite of compatible solutes with

388
00:14:16,290 --> 00:14:12,970

variable sensitivities to temperature

389
00:14:17,490 --> 00:14:16,300
and salinity and to follow up on this we

390
00:14:19,920 --> 00:14:17,500
want to do continued work on

391
00:14:22,829 --> 00:14:19,930
environmental metabolomics of sea ice

392
00:14:25,139 --> 00:14:22,839
and compatible solute use in sea ice and

393
00:14:27,389 --> 00:14:25,149
we're doing that with an NSF funded

394
00:14:29,040 --> 00:14:27,399
project studying the spring melt season

395
00:14:31,860 --> 00:14:29,050
in Antarctica and seeing how that can be

396
00:14:35,730 --> 00:14:31,870
the sea ice community response to melt

397
00:14:37,559 --> 00:14:35,740
conditions so I'd like to thank everyone

398
00:14:39,329 --> 00:14:37,569
who is involved in this project everyone

399
00:14:41,610 --> 00:14:39,339
who helped generate the data it's

400
00:14:44,069 --> 00:14:41,620
particularly the young angles and Deming

401
00:14:46,270 --> 00:14:44,079
labs at u-dub and I'll take any

402
00:14:51,930 --> 00:14:48,829
[Music]

403
00:14:54,420 --> 00:14:51,940
thank you very much Hannah we have time

404
00:14:56,970 --> 00:14:54,430
for one question so there's a microphone

405
00:14:58,530 --> 00:14:56,980
up front and center please identify

406
00:15:02,519 --> 00:14:58,540
yourself when you ask your question

407
00:15:08,480 --> 00:15:02,529
state your name and institution anybody

408
00:15:11,100 --> 00:15:08,490
have any questions for Hannah thank you

409
00:15:13,199 --> 00:15:11,110
hi my name is joy I'm at Carnegie

410
00:15:15,420 --> 00:15:13,209
Institute in Washington DC really great

411
00:15:16,949 --> 00:15:15,430
thank you for sharing your work um so

412
00:15:19,110 --> 00:15:16,959
you talked about the eat flux of these

413
00:15:21,059 --> 00:15:19,120

metabolites containing nitrogen is there

414
00:15:23,879 --> 00:15:21,069
a way for you to understand the

415
00:15:26,069 --> 00:15:23,889
partitioning of extracellular versus

416
00:15:27,990 --> 00:15:26,079
intracellular metabolites with this

417
00:15:30,480 --> 00:15:28,000
method currently it's a little difficult

418
00:15:32,249 --> 00:15:30,490
to look at the dissolved pool of

419
00:15:34,050 --> 00:15:32,259
compatible solutes but that is something

420
00:15:35,460 --> 00:15:34,060
that the Ingalls lab is currently

421
00:15:36,629 --> 00:15:35,470
working on adjusting and that's

422
00:15:38,160 --> 00:15:36,639
something that hopefully in the future

423
00:15:39,809 --> 00:15:38,170
we'll be able to quantify a little bit

424
00:15:40,030 --> 00:15:39,819
better but currently we're just looking

425
00:15:46,860 --> 00:15:40,040
at the