Episode 22: May 23rd, 2019

Dr. Yasuhito Sekine

NASA Astrobiology Program

1
00:00:29,230 --> 00:00:07,200
[Music]

2
00:00:34,150 --> 00:00:31,849
greetings and welcome to all of my

3
00:00:37,910 --> 00:00:34,160
fellow passengers on the spaceship earth

4
00:00:41,150 --> 00:00:37,920
this is the show ask an astrobiologist

5
00:00:43,729 --> 00:00:41,160
the NASA Astrobiology funded show where

6
00:00:46,279 --> 00:00:43,739
we talk to scientists from around the

7
00:00:48,380 --> 00:00:46,289
world who are doing advanced research in

8
00:00:51,290 --> 00:00:48,390
astrobiology and trying to figure out

9
00:00:54,170 --> 00:00:51,300
those big questions about are we alone

10
00:00:56,959 --> 00:00:54,180
what is life how do we find life on

11
00:00:59,150 --> 00:00:56,969
other worlds and how do we explore for

12
00:01:00,740 --> 00:00:59,160
life beyond our own solar system these

13
00:01:03,170 --> 00:01:00,750

are all very big questions and there's a

14
00:01:04,910 --> 00:01:03,180
lot of people who are trying to answer

15
00:01:07,910 --> 00:01:04,920
them right now along with us as we

16
00:01:09,800 --> 00:01:07,920
travel around our little star I am dr.

17
00:01:12,230 --> 00:01:09,810
Graham Lau one of your co-hosts of the

18
00:01:14,510 --> 00:01:12,240
show the other co-host is dr. Sanjay

19
00:01:17,270 --> 00:01:14,520
Psalm we take turns going back and forth

20
00:01:21,050 --> 00:01:17,280
once each month talking to another

21
00:01:23,300 --> 00:01:21,060
awesome guest astrobiologists our show

22
00:01:25,249 --> 00:01:23,310
is also sponsored by Sagan net org

23
00:01:27,499 --> 00:01:25,259
chances are most of you right now are

24
00:01:29,830 --> 00:01:27,509
watching this either on Sagan networks

25
00:01:33,260 --> 00:01:29,840
live stream or the NASA Astrobiology

26
00:01:35,510 --> 00:01:33,270
Facebook page before we get to today's

27
00:01:37,760 --> 00:01:35,520
special guests though and talk a lot

28
00:01:38,690 --> 00:01:37,770
about astrobiology we have some fun

29
00:01:41,690 --> 00:01:38,700
stuff to do first

30
00:01:43,730 --> 00:01:41,700
like our monthly background quiz so you

31
00:01:46,910 --> 00:01:43,740
might notice behind me right now is a

32
00:01:50,300 --> 00:01:46,920
cool picture of some Astro biologically

33
00:01:53,090 --> 00:01:50,310
relevant place on the planet and every

34
00:01:56,209 --> 00:01:53,100
month we ask you on the interwebs to

35
00:01:58,940 --> 00:01:56,219
tell us what this is a picture of and so

36
00:02:01,789 --> 00:01:58,950
the picture from last month was a pretty

37
00:02:05,359 --> 00:02:01,799
cool spot that actually occurs in the

38
00:02:08,749 --> 00:02:05,369

Olien Islands in Italy this is the Gran

39
00:02:12,260 --> 00:02:08,759
Cottier it is a volcanic island it's

40
00:02:13,440 --> 00:02:12,270
actually called volcano or Vulcan and

41
00:02:15,780 --> 00:02:13,450
this is where

42
00:02:18,449 --> 00:02:15,790
the name for volcano first originated

43
00:02:22,170 --> 00:02:18,459
from from this one volcano on this

44
00:02:25,110 --> 00:02:22,180
island and so the Roman god of fire both

45
00:02:28,559 --> 00:02:25,120
good and bad fire was Vulcan you might

46
00:02:30,720 --> 00:02:28,569
also know for the start that the planet

47
00:02:33,600 --> 00:02:30,730
Vulcan was in the show Star Trek where

48
00:02:35,339 --> 00:02:33,610
Spock came from there was actually a

49
00:02:37,650 --> 00:02:35,349
point in time in our own history where

50
00:02:40,440 --> 00:02:37,660
scientists thought a planet that they

51
00:02:42,960 --> 00:02:40,450
called Vulcan was very close to our Sun

52
00:02:44,759 --> 00:02:42,970
but it turns out on the reason that they

53
00:02:47,250 --> 00:02:44,769
hypothesized that is because the orbit

54
00:02:49,710 --> 00:02:47,260
of mercury seems very strange for our

55
00:02:51,270 --> 00:02:49,720
knowledge of physics at that time but it

56
00:02:52,979 --> 00:02:51,280
turns out we didn't need a planet name

57
00:02:53,819 --> 00:02:52,989
walking close to the Sun to explain

58
00:02:57,360 --> 00:02:53,829
Mercury's orbit

59
00:02:59,190 --> 00:02:57,370
what we really need was relativity but

60
00:03:01,589 --> 00:02:59,200
so thank you very much for everyone who

61
00:03:04,259 --> 00:03:01,599
went to Twitter and told us where that

62
00:03:07,380 --> 00:03:04,269
picture was located as usual we take a

63
00:03:09,960 --> 00:03:07,390

1st 2nd and 3rd place winner for those

64
00:03:13,319 --> 00:03:09,970
who got the answer right our third place

65
00:03:15,600 --> 00:03:13,329
winner this month is ismael a Costa who

66
00:03:17,250 --> 00:03:15,610
is now one of the new young scientist

67
00:03:19,559 --> 00:03:17,260
with the blue marble space Institute of

68
00:03:22,050 --> 00:03:19,569
Science Ismael will get some NASA

69
00:03:24,289 --> 00:03:22,060
stickers for taking third place our

70
00:03:26,910 --> 00:03:24,299
second place winner is Elizabeth Hutton

71
00:03:29,009 --> 00:03:26,920
Elizabeth will get our NASA stickers as

72
00:03:32,340 --> 00:03:29,019
well as some of the graphic histories

73
00:03:34,500 --> 00:03:32,350
from NASA Astrobiology and then our

74
00:03:37,770 --> 00:03:34,510
first place winner this month is Henry

75
00:03:39,420 --> 00:03:37,780
and a Lou Cox and Henrietta will get the

76
00:03:42,210 --> 00:03:39,430
stickers as well as the graphic

77
00:03:44,849 --> 00:03:42,220
histories and also a second net drinking

78
00:03:47,190 --> 00:03:44,859
glass so congratulations to all three of

79
00:03:49,410 --> 00:03:47,200
our winners we're also now doing

80
00:03:51,330 --> 00:03:49,420
something new where we nominate an

81
00:03:53,550 --> 00:03:51,340
ambassador of the month someone who's

82
00:03:56,099 --> 00:03:53,560
really worked hard to ask a lot of

83
00:03:57,780 --> 00:03:56,109
questions to share information about the

84
00:04:00,770 --> 00:03:57,790
upcoming episode and about our upcoming

85
00:04:03,479 --> 00:04:00,780
special guests and this month our

86
00:04:07,620 --> 00:04:03,489
ambassador of the month is astrobiology

87
00:04:09,270 --> 00:04:07,630
tweets at Astro bio times on Twitter so

88
00:04:10,770 --> 00:04:09,280

thank you very much for all of your

89
00:04:12,569 --> 00:04:10,780
support and sharing our show and the

90
00:04:15,599 --> 00:04:12,579
things that we're doing so without

91
00:04:18,870 --> 00:04:15,609
further ado let me introduce our special

92
00:04:20,699 --> 00:04:18,880
guests for this month our guest is a

93
00:04:24,890 --> 00:04:20,709
research scientist at the earth Life

94
00:04:27,420 --> 00:04:24,900
Science Institute in Tokyo he is dr.

95
00:04:29,850 --> 00:04:27,430
Yasuhito

96
00:04:31,740 --> 00:04:29,860
and he's joining us now from Tokyo so so

97
00:04:32,420 --> 00:04:31,750
dr. Simon a thank you very much for

98
00:04:35,760 --> 00:04:32,430
being here

99
00:04:39,090 --> 00:04:35,770
hi I mean yes this again yeah

100
00:04:41,730 --> 00:04:39,100
I'm very happy to be here nice to meet

101
00:04:43,470 --> 00:04:41,740
you great to have you on the show in ask

102
00:04:44,820 --> 00:04:43,480
an astrobiologist we have a lot of

103
00:04:47,340 --> 00:04:44,830
questions from the audience that we'll

104
00:04:48,870 --> 00:04:47,350
get to eventually so for our audience

105
00:04:50,909 --> 00:04:48,880
watching at home as we have our

106
00:04:52,470 --> 00:04:50,919
conversation if you'd like to ask some

107
00:04:55,560 --> 00:04:52,480
questions you can use the hashtag ask

108
00:04:58,260 --> 00:04:55,570
Astro bio on Twitter or ask directly on

109
00:05:00,480 --> 00:04:58,270
the live streams but first let's talk a

110
00:05:03,180 --> 00:05:00,490
bit about your research and what you do

111
00:05:07,379 --> 00:05:03,190
at LC what things really drive you right

112
00:05:11,219 --> 00:05:07,389
now in astrobiology yeah I'm currently

113
00:05:14,550 --> 00:05:11,229

doing the science about ocean wars in

114
00:05:18,360 --> 00:05:14,560
the solar system so also it's not the

115
00:05:21,450 --> 00:05:18,370
only planetary Valley that as look at

116
00:05:25,080 --> 00:05:21,460
water then we have multiple ocean wars

117
00:05:27,950 --> 00:05:25,090
in the outer solar system such as chief

118
00:05:31,830 --> 00:05:27,960
judgment new robber nganimate it and

119
00:05:35,580 --> 00:05:31,840
Saturn's moon Enceladus and item those

120
00:05:39,990 --> 00:05:35,590
actually supplies a mainly composed of a

121
00:05:43,440 --> 00:05:40,000
mixture of ice and rock and surface

122
00:05:46,320 --> 00:05:43,450
temperature is extremely cold less than

123
00:05:51,390 --> 00:05:46,330
minus hundred degrees Celsius but an

124
00:05:54,420 --> 00:05:51,400
interior can be warmed up by eating from

125
00:05:58,680 --> 00:05:54,430
the rock component so now we know that

126
00:06:02,550 --> 00:05:58,690
some of these ice moons Jupiter's moon

127
00:06:05,340 --> 00:06:02,560
Saturn's moon have such sampras ocean

128
00:06:08,370 --> 00:06:05,350
look at ocean beneath the icy crust so

129
00:06:09,990 --> 00:06:08,380
i'm now doing the research about the

130
00:06:13,620 --> 00:06:10,000
ocean world in the solar system

131
00:06:18,450 --> 00:06:13,630
especially focusing on the icy South

132
00:06:20,070 --> 00:06:18,460
whiteboard very interesting so what got

133
00:06:21,930 --> 00:06:20,080
you interested in that research in the

134
00:06:27,659 --> 00:06:21,940
first place in looking at these icy

135
00:06:31,110 --> 00:06:27,669
worlds up yeah so what was what what

136
00:06:35,130 --> 00:06:31,120
inspired you to do this research okay so

137
00:06:38,310 --> 00:06:35,140
the major reason is that those icy moon

138
00:06:40,200 --> 00:06:38,320

has like it what it the as you may know

139
00:06:41,730 --> 00:06:40,210
the wicked water is

140
00:06:44,969 --> 00:06:41,740
ingredient for life one of the

141
00:06:48,270 --> 00:06:44,979
ingredients for life the astrobiologists

142
00:06:51,230 --> 00:06:48,280
to consider that the there are three

143
00:06:54,629 --> 00:06:51,240
fundamental ingredient for life that

144
00:06:57,839 --> 00:06:54,639
wide-legged water the second one is

145
00:07:03,779 --> 00:06:57,849
organic materials and third one is

146
00:07:08,460 --> 00:07:03,789
energy for the driving the life activity

147
00:07:11,309 --> 00:07:08,470
so those icy moons have okay water so

148
00:07:14,400 --> 00:07:11,319
we're considering that one of the

149
00:07:18,560 --> 00:07:14,410
possible habitable price in a solar

150
00:07:25,620 --> 00:07:18,570
system so that's a my major motivation

151
00:07:28,140 --> 00:07:25,630
about icy el-shabazz that's very cool so

152
00:07:30,620 --> 00:07:28,150
if i can let's take a step back and

153
00:07:32,939 --> 00:07:30,630
consider so what was your career path

154
00:07:35,129 --> 00:07:32,949
where did you go to school and what did

155
00:07:37,170 --> 00:07:35,139
you study - now become a scientist that

156
00:07:41,610 --> 00:07:37,180
you are yeah

157
00:07:45,659 --> 00:07:41,620
the the first I when I was hindered

158
00:07:49,710 --> 00:07:45,669
heinous girl in school my father gave me

159
00:07:51,870 --> 00:07:49,720
a book of stir and book of life those

160
00:07:57,810 --> 00:07:51,880
are my favorite things

161
00:08:00,930 --> 00:07:57,820
so I since my childhood I had been very

162
00:08:06,050 --> 00:08:00,940
interested in both space and life so

163
00:08:09,420 --> 00:08:06,060

when I enter into the undergrad I

164
00:08:12,209 --> 00:08:09,430
noticed that there is a new research

165
00:08:16,770 --> 00:08:12,219
field of astrobiology in the university

166
00:08:21,270 --> 00:08:16,780
so I entered into the yeah

167
00:08:24,629 --> 00:08:21,280
astrobiology research good and yeah I

168
00:08:28,980 --> 00:08:24,639
get a PhD at University of Tokyo and

169
00:08:32,010 --> 00:08:28,990
you're in my graduate school I went to

170
00:08:38,790 --> 00:08:32,020
United States I worked in NASA Ames

171
00:08:42,930 --> 00:08:38,800
Research Center in 2004 to 2005 2005 so

172
00:08:46,440 --> 00:08:42,940
the timing is just overlapping with the

173
00:08:52,130 --> 00:08:46,450
cast the beginning of Cassini mission so

174
00:08:54,000 --> 00:08:52,140
just so that my state of the research of

175
00:08:56,550 --> 00:08:54,010
IC o---- Shores

176
00:09:00,360 --> 00:08:56,560
and also the mindset of international

177
00:09:03,030 --> 00:09:00,370
collaboration and it's awesome yeah I

178
00:09:08,220 --> 00:09:03,040
was an intern at NASA Ames in 2007 so

179
00:09:09,630 --> 00:09:08,230
close we're there so so what kinds of

180
00:09:12,210 --> 00:09:09,640
missions have you been involved with

181
00:09:13,740 --> 00:09:12,220
then if you're working at Ames and now

182
00:09:15,000 --> 00:09:13,750
you've been studying icy worlds have you

183
00:09:17,430 --> 00:09:15,010
have you been involved with various

184
00:09:22,320 --> 00:09:17,440
missions with NASA or the European Space

185
00:09:25,770 --> 00:09:22,330
Agency or even JAXA yeah the since 2004

186
00:09:28,740 --> 00:09:25,780
I was working with researchers who are

187
00:09:32,130 --> 00:09:28,750
involved in the Cassini mission the

188
00:09:36,780 --> 00:09:32,140

Cassini mission is the mission for

189
00:09:40,620 --> 00:09:36,790
Saturn and its icing moon and I'm also

190
00:09:45,210 --> 00:09:40,630
now involved in a Jax's mission I have

191
00:09:50,780 --> 00:09:45,220
two mission and also is as euros mission

192
00:09:59,430 --> 00:09:55,350
Jovian system and will be orbiting

193
00:10:03,000 --> 00:09:59,440
around animating one of the icy moon

194
00:10:06,390 --> 00:10:03,010
objective so now I'm involved in these

195
00:10:09,690 --> 00:10:06,400
two missions and also yeah I'm working

196
00:10:15,060 --> 00:10:09,700
with some researchers in US and Europe

197
00:10:19,950 --> 00:10:15,070
to consider a future mission to icy moon

198
00:10:21,090 --> 00:10:19,960
and also Mars and it's also sounds like

199
00:10:22,830 --> 00:10:21,100
you have a lot of international

200
00:10:24,810 --> 00:10:22,840
collaboration than having worked with

201
00:10:28,320 --> 00:10:24,820
other researchers from various nations

202
00:10:31,170 --> 00:10:28,330
and various space agencies what is that

203
00:10:34,200 --> 00:10:31,180
like is it difficult with language

204
00:10:35,910 --> 00:10:34,210
barriers and cultural barriers or do you

205
00:10:39,510 --> 00:10:35,920
have is it easy because you're

206
00:10:42,180 --> 00:10:39,520
discussing science with people yeah the

207
00:10:46,260 --> 00:10:42,190
language barrier is relatively yeah

208
00:10:50,970 --> 00:10:46,270
being for me but yeah if we have a same

209
00:10:54,510 --> 00:10:50,980
science background we can talk through

210
00:10:56,640 --> 00:10:54,520
the not only the words but also

211
00:11:00,060 --> 00:10:56,650
including the body language of something

212
00:11:01,910 --> 00:11:00,070
so I think that if we have same science

213
00:11:04,320 --> 00:11:01,920

background yeah we can do it

214
00:11:07,050 --> 00:11:04,330
international collaboration but the

215
00:11:10,830 --> 00:11:07,060
language value is still high for me so

216
00:11:13,530 --> 00:11:10,840
the in native native yes English

217
00:11:16,980 --> 00:11:13,540
speakers the two or three talk to each

218
00:11:20,580 --> 00:11:16,990
other I can understand only 70 percent

219
00:11:25,320 --> 00:11:20,590
of the one sentence so the if several

220
00:11:28,680 --> 00:11:25,330
conversations continues 70 percent times

221
00:11:31,880 --> 00:11:28,690
70 percent times 70 percent goes to

222
00:11:35,850 --> 00:11:31,890
almost zero so I sometime lost the

223
00:11:39,900 --> 00:11:35,860
discussion but yeah I try to catch them

224
00:11:44,750 --> 00:11:39,910
the by doing the I asking question then

225
00:11:46,470 --> 00:11:44,760
so then I I can follow their discussion

226
00:11:48,000 --> 00:11:46,480
interesting yeah that's awesome

227
00:11:50,820 --> 00:11:48,010
at least you can you can you know

228
00:11:52,950 --> 00:11:50,830
maintain the conversation then so you

229
00:11:54,870 --> 00:11:52,960
did you did mention Hayabusa boots or to

230
00:11:57,750 --> 00:11:54,880
which which I offer our audience is a

231
00:11:59,880 --> 00:11:57,760
right now visiting ryugu on asteroid in

232
00:12:02,070 --> 00:11:59,890
our solar system and you also mentioned

233
00:12:03,929 --> 00:12:02,080
Mars so it sounds like you're doing a

234
00:12:07,619 --> 00:12:03,939
lot of things in icy worlds and

235
00:12:09,899 --> 00:12:07,629
asteroids and Mars is that difficult to

236
00:12:14,159 --> 00:12:09,909
study so many different planetary

237
00:12:19,139 --> 00:12:14,169
processes not much because that my focus

238
00:12:23,299 --> 00:12:19,149

is water the water and its chemical

239
00:12:26,819 --> 00:12:23,309
reaction is my background so I I'm

240
00:12:29,509 --> 00:12:26,829
geochemist and doing the laboratory

241
00:12:34,619 --> 00:12:29,519
experiment or numerical modeling of

242
00:12:38,039 --> 00:12:34,629
water rock reaction or water the ribbon

243
00:12:41,449 --> 00:12:38,049
chemical reaction so this water or

244
00:12:44,129 --> 00:12:41,459
chemical reaction already ubiquitous

245
00:12:47,849 --> 00:12:44,139
among these point their body for example

246
00:12:50,909 --> 00:12:47,859
the you goo is just a small isolated but

247
00:12:53,699 --> 00:12:50,919
if we consider that the you was one of

248
00:12:57,629 --> 00:12:53,709
the first of the relatively large parent

249
00:13:01,739 --> 00:12:57,639
body which called the prime decimal the

250
00:13:04,819 --> 00:13:01,749
front interpretation of the scientist

251
00:13:08,460 --> 00:13:04,829
believes at the liquid water world

252
00:13:11,669 --> 00:13:08,470
active within the parent is Uma and

253
00:13:14,429 --> 00:13:11,679
causes a chemical reaction between water

254
00:13:18,179 --> 00:13:14,439
taking water and rock those chemical

255
00:13:21,119 --> 00:13:18,189
reaction the drop the look at water into

256
00:13:24,599 --> 00:13:21,129
the rock and we can now see the water

257
00:13:28,679 --> 00:13:24,609
bearing minerals criminal called

258
00:13:31,319 --> 00:13:28,689
criminals on the surface of a selected

259
00:13:36,529 --> 00:13:31,329
YouTube so those are really similar on

260
00:13:37,979 --> 00:13:36,539
Mars were icy words or even on our

261
00:13:40,829 --> 00:13:37,989
planet Earth

262
00:13:43,849 --> 00:13:40,839
those chemistry is really ubiquitous so

263
00:13:47,939 --> 00:13:43,859

it's not so difficult to the different

264
00:13:50,399 --> 00:13:47,949
planetary object so yeah I think one

265
00:13:52,699 --> 00:13:50,409
important message to the junior high

266
00:13:56,549 --> 00:13:52,709
school or high school student if they

267
00:13:58,739 --> 00:13:56,559
listen to this program I dress to

268
00:14:01,909 --> 00:13:58,749
suggest that that the very basic

269
00:14:05,489 --> 00:14:01,919
chemistry very basic physics is really

270
00:14:09,059 --> 00:14:05,499
important because if you understand

271
00:14:11,699 --> 00:14:09,069
those very common basic chemistry

272
00:14:15,649 --> 00:14:11,709
physics so sorry liddie ubiquitous and

273
00:14:17,880 --> 00:14:15,659
you can do the many signs using the

274
00:14:21,569 --> 00:14:17,890
those fundamental

275
00:14:23,910 --> 00:14:21,579
things so yeah that's a message to high

276
00:14:27,569 --> 00:14:23,920
school students or junior high student

277
00:14:29,880 --> 00:14:27,579
but yeah like asking to your question

278
00:14:33,329 --> 00:14:29,890
yeah yeah it's not so bit very difficult

279
00:14:37,410 --> 00:14:33,339
for me to do the different primary

280
00:14:39,660 --> 00:14:37,420
object research it that's incredible

281
00:14:43,440 --> 00:14:39,670
yeah it's a pretty awesome message for

282
00:14:45,150 --> 00:14:43,450
young people learn the basics so can I

283
00:14:48,240 --> 00:14:45,160
can I ask then so a lot of

284
00:14:50,430 --> 00:14:48,250
astrobiologists kind of study you know

285
00:14:52,710 --> 00:14:50,440
extraterrestrial worlds or you know

286
00:14:55,500 --> 00:14:52,720
exoplanets or they do research on earth

287
00:14:57,660 --> 00:14:55,510
but I understand that you besides

288
00:14:59,730 --> 00:14:57,670

studying icy worlds and Mars and Smith

289
00:15:02,460 --> 00:14:59,740
other places that you've also done some

290
00:15:03,990 --> 00:15:02,470
field research on earth I'm wondering if

291
00:15:06,449 --> 00:15:04,000
you can tell us a bit about the places

292
00:15:09,360 --> 00:15:06,459
that you've gone and what kind of

293
00:15:11,630 --> 00:15:09,370
research you do on earth to better

294
00:15:15,420 --> 00:15:11,640
understand what's going on out there

295
00:15:17,190 --> 00:15:15,430
yeah I have been doing a field research

296
00:15:21,329 --> 00:15:17,200
on ours

297
00:15:26,180 --> 00:15:21,339
the it's included including the field

298
00:15:30,949 --> 00:15:26,190
research to US Canada Australia

299
00:15:36,090 --> 00:15:30,959
Scandinavians in gear and Central Asia

300
00:15:39,269 --> 00:15:36,100
moon Korea so those are very I mean

301
00:15:43,680 --> 00:15:39,279
different direction of research but I'm

302
00:15:46,980 --> 00:15:43,690
not proceeding the research project of

303
00:15:50,490 --> 00:15:46,990
field research in Moon Warrior because

304
00:15:55,380 --> 00:15:50,500
we consider that the current primates

305
00:15:58,800 --> 00:15:55,390
and hydrological water cycle in moon

306
00:16:00,720 --> 00:15:58,810
warrior may be very similar similar to

307
00:16:03,449 --> 00:16:00,730
being Moors or even current Moore's

308
00:16:06,269 --> 00:16:03,459
condition because as you know that the

309
00:16:09,900 --> 00:16:06,279
moon warrior is really Highland and very

310
00:16:13,199 --> 00:16:09,910
dry and also the memorial mountains have

311
00:16:15,210 --> 00:16:13,209
some permafrost the upon the recent

312
00:16:18,509 --> 00:16:15,220
growth a warming those permafrost is

313
00:16:20,340 --> 00:16:18,519

starting to melting and we're the the

314
00:16:23,550 --> 00:16:20,350
memorial people are worrying about the

315
00:16:25,889 --> 00:16:23,560
Palmer frost melting but I'm considering

316
00:16:30,230 --> 00:16:25,899
that those situation melting of

317
00:16:38,119 --> 00:16:34,249
here maybe very similar to our amorous

318
00:16:38,840 --> 00:16:38,129
condition so now we're doing the field

319
00:16:41,900 --> 00:16:38,850
of research

320
00:16:45,710 --> 00:16:41,910
what kind of the hydrological water

321
00:16:50,030 --> 00:16:45,720
cycle is going on on Mars and what kind

322
00:16:54,559 --> 00:16:50,040
of microbial life can survive or related

323
00:16:57,530 --> 00:16:54,569
living there so yeah that's a current

324
00:17:01,239 --> 00:16:57,540
ongoing research projects of the field

325
00:17:04,120 --> 00:17:01,249
of research on our planet

326
00:17:05,689 --> 00:17:04,130
interesting so do you think though the

327
00:17:08,199 --> 00:17:05,699
microorganisms that you're looking at

328
00:17:10,279 --> 00:17:08,209
then are there things that they're doing

329
00:17:11,919 --> 00:17:10,289
creating minerals or creating

330
00:17:14,870 --> 00:17:11,929
biomolecules things that we can then

331
00:17:17,000 --> 00:17:14,880
maybe with Mars 2020 or an upcoming

332
00:17:19,309 --> 00:17:17,010
Rover could read that directly look for

333
00:17:22,309 --> 00:17:19,319
some of those signs if there are things

334
00:17:24,500 --> 00:17:22,319
like that on Mars is that possible yeah

335
00:17:26,659 --> 00:17:24,510
I think so because the that we observe

336
00:17:30,649 --> 00:17:26,669
the melting of permafrost and the

337
00:17:33,620 --> 00:17:30,659
permafrost trapped methane gas so

338
00:17:35,990 --> 00:17:33,630

there's a methane crust layer trap

339
00:17:38,450 --> 00:17:36,000
I mean preserving beneath the surface

340
00:17:41,659 --> 00:17:38,460
and upon the melting of permafrost

341
00:17:45,470 --> 00:17:41,669
the methane a bubbling into the toughest

342
00:17:50,419 --> 00:17:45,480
region so that we found some methane

343
00:17:53,750 --> 00:17:50,429
eating bacteria near the surface of the

344
00:17:57,409 --> 00:17:53,760
I mean the in the region where the

345
00:18:00,169 --> 00:17:57,419
permafrost melting occurred so the on

346
00:18:04,279 --> 00:18:00,179
current Mars the there is an argument

347
00:18:08,930 --> 00:18:04,289
that the methane spikes recording on

348
00:18:13,430 --> 00:18:08,940
Mars not but we consider that the such a

349
00:18:16,519 --> 00:18:13,440
really small spikes of methane is very

350
00:18:20,060 --> 00:18:16,529
important to the microbial life because

351
00:18:23,750 --> 00:18:20,070
for some micro by Allah Michael by a

352
00:18:27,490 --> 00:18:23,760
life the methane can be a food or energy

353
00:18:31,490 --> 00:18:27,500
for them so I think yeah the the

354
00:18:39,639 --> 00:18:31,500
memorials the permafrost ecosystem could

355
00:18:47,320 --> 00:18:43,039
yeah understanding the ecosystem on such

356
00:18:50,570 --> 00:18:47,330
a dry and cold area is very important

357
00:18:54,019 --> 00:18:50,580
not only for the finding life on Mars

358
00:18:56,419 --> 00:18:54,029
but also to protect Mars wrong

359
00:19:01,129 --> 00:18:56,429
the Earth's contamination it's called

360
00:19:04,129 --> 00:19:01,139
the planting protection if the yeah

361
00:19:06,590 --> 00:19:04,139
bacteria are out here or sound life from

362
00:19:10,220 --> 00:19:06,600
ours to Mars it gonna be a contamination

363
00:19:13,399 --> 00:19:10,230

so we need to avoid such a contamination

364
00:19:15,879 --> 00:19:13,409
we need to protect not only ours but

365
00:19:18,980 --> 00:19:15,889
also we need to protect Mars so

366
00:19:22,010 --> 00:19:18,990
understanding the possible ecosystem of

367
00:19:25,730 --> 00:19:22,020
a hydrological cycle it's very critical

368
00:19:29,750 --> 00:19:25,740
not only to find in the Martian life but

369
00:19:33,289 --> 00:19:29,760
also to protect Mars from Earth or the

370
00:19:34,700 --> 00:19:33,299
contamination mm-hmm interesting yeah

371
00:19:36,560 --> 00:19:34,710
there yeah I do know that there's

372
00:19:38,360 --> 00:19:36,570
someone whose actual title is planetary

373
00:19:41,629 --> 00:19:38,370
protection detection off and that's a

374
00:19:43,909 --> 00:19:41,639
pretty cool title to have can I ask

375
00:19:46,760 --> 00:19:43,919
though since you were in Mongolia doing

376
00:19:48,440 --> 00:19:46,770
research you know some of us are lucky

377
00:19:52,010 --> 00:19:48,450
enough to travel to these remote places

378
00:19:54,590 --> 00:19:52,020
on the planet to study you know the

379
00:19:56,810 --> 00:19:54,600
field geology and the microbiology and

380
00:19:59,690 --> 00:19:56,820
to try to understand more about life

381
00:20:02,480 --> 00:19:59,700
here to look for life out there

382
00:20:05,299 --> 00:20:02,490
so what was it like in Mongolia what was

383
00:20:08,409 --> 00:20:05,309
the field research like how remote it

384
00:20:12,500 --> 00:20:08,419
was it how far away from civilization

385
00:20:18,080 --> 00:20:12,510
how long were you there yeah we usually

386
00:20:21,200 --> 00:20:18,090
stayed in the fields one we could to the

387
00:20:22,970 --> 00:20:21,210
the location is very far from the simple

388
00:20:27,529 --> 00:20:22,980

oh man warriors and welcome warriors

389
00:20:30,350 --> 00:20:27,539
lambatos the remoter is yeah the center

390
00:20:32,480 --> 00:20:30,360
of man warrior and almost one third of

391
00:20:34,250 --> 00:20:32,490
the people all over the world were

392
00:20:37,610 --> 00:20:34,260
living in Roboto

393
00:20:41,060 --> 00:20:37,620
and to reach to the research field from

394
00:20:45,860 --> 00:20:41,070
the rum bottle it takes three days at

395
00:20:50,230 --> 00:20:45,870
four and we stayed in Gale

396
00:20:53,270 --> 00:20:50,240
do you know Gale it at the kind of camp

397
00:20:57,019 --> 00:20:53,280
tent of the local people the local

398
00:21:01,700 --> 00:20:57,029
camper having tea or

399
00:21:06,889 --> 00:21:01,710
Gold hauls and then they move with them

400
00:21:12,289 --> 00:21:06,899
so we stayed in the girl to the research

401
00:21:13,969 --> 00:21:12,299
and yeah it's a really fantastic

402
00:21:21,820 --> 00:21:13,979
experience

403
00:21:26,239 --> 00:21:21,830
yeah we're now interested in motion

404
00:21:30,560 --> 00:21:26,249
recording not linear which is the dark

405
00:21:34,070 --> 00:21:30,570
story creatures appeared in summer of

406
00:21:38,839 --> 00:21:34,080
Moore's on the steep slope the it's a

407
00:21:41,930 --> 00:21:38,849
nail and dark streaks appeared on the

408
00:21:44,599 --> 00:21:41,940
surface of Mars only during the Sun so

409
00:21:47,859 --> 00:21:44,609
some researchers consider that those are

410
00:21:52,580 --> 00:21:47,869
produced by the melting of permafrost

411
00:21:56,869 --> 00:21:52,590
melting of underground ice during summer

412
00:22:00,109 --> 00:21:56,879
but other research it suggested to that

413
00:22:03,859 --> 00:22:00,119

formed by the dry process so we found

414
00:22:09,589 --> 00:22:03,869
the very similar dark streak feature in

415
00:22:14,180 --> 00:22:09,599
Mongolia and we need to go there to see

416
00:22:17,239 --> 00:22:14,190
how the staff features formed and yeah

417
00:22:22,930 --> 00:22:17,249
what kind of mechanism driving to do to

418
00:22:28,520 --> 00:22:22,940
create such a geological features yeah I

419
00:22:33,860 --> 00:22:30,799
you know we have earth atmosphere and

420
00:22:36,770 --> 00:22:33,870
one bar of pressure at the surface where

421
00:22:38,600 --> 00:22:36,780
those are forming is it hard to make

422
00:22:40,640 --> 00:22:38,610
that analogy to what's happening on Mars

423
00:22:44,060 --> 00:22:40,650
to say that these things are similar or

424
00:22:45,470 --> 00:22:44,070
is it really a good analog for what we

425
00:22:48,740 --> 00:22:45,480
might see on Mars with these recurring

426
00:22:51,890 --> 00:22:48,750
slope lineae mm-hmm yeah I think the

427
00:22:56,779 --> 00:22:51,900
major difference is the gravity the

428
00:23:00,409 --> 00:22:56,789
gravity change the velocity of Luckett

429
00:23:02,990 --> 00:23:00,419
draw on the surface so if the velocity

430
00:23:05,659 --> 00:23:03,000
is different the formed geological

431
00:23:08,299 --> 00:23:05,669
features may be totally different so we

432
00:23:12,590 --> 00:23:08,309
need to we need to do the theoretical

433
00:23:17,529 --> 00:23:12,600
work to scale the the whether we can

434
00:23:21,260 --> 00:23:17,539
scale the geological feature on wars 2

435
00:23:24,380 --> 00:23:21,270
euros coefficient on oars to Mars so the

436
00:23:26,990 --> 00:23:24,390
scaling is very important but I think

437
00:23:29,960 --> 00:23:27,000
the major physics or chemistry occurring

438
00:23:32,330 --> 00:23:29,970

on the the permafrost melting air here

439
00:23:35,149 --> 00:23:32,340
would be common between these two

440
00:23:36,919 --> 00:23:35,159
planets interesting that's really

441
00:23:39,289 --> 00:23:36,929
awesome I do want to interrupt real

442
00:23:41,600 --> 00:23:39,299
quick and remind the audience you can

443
00:23:44,930 --> 00:23:41,610
ask questions right now for Yasuhito

444
00:23:46,940 --> 00:23:44,940
second hang on our live streams on Sagan

445
00:23:48,740 --> 00:23:46,950
net org on the NASA Astrobiology

446
00:23:51,020 --> 00:23:48,750
Facebook page or you can go over to

447
00:23:53,539 --> 00:23:51,030
Twitter and use ask Esther bio as a

448
00:23:55,370 --> 00:23:53,549
hashtag to ask any questions you have I

449
00:23:57,380 --> 00:23:55,380
see that we already have a whole bunch

450
00:23:59,549 --> 00:23:57,390
coming in so we'll just chat a little

451
00:24:03,240 --> 00:23:59,559
bit longer and

452
00:24:06,480 --> 00:24:03,250
audience questions so dr. second a if I

453
00:24:09,629 --> 00:24:06,490
may I want to change now a little bit to

454
00:24:10,919 --> 00:24:09,639
talk more about you as a person about

455
00:24:13,769 --> 00:24:10,929
the things that you know you do in your

456
00:24:15,749 --> 00:24:13,779
life your hobbies your interests that

457
00:24:19,919 --> 00:24:15,759
help you to make all the science worth

458
00:24:24,269 --> 00:24:19,929
it what things make you happy to go to

459
00:24:28,049 --> 00:24:24,279
show up every day yeah my yeah

460
00:24:31,560 --> 00:24:28,059
major hobbies the do hinder research but

461
00:24:34,919 --> 00:24:31,570
yeah my second hobby is baseball

462
00:24:37,169 --> 00:24:34,929
yeah when I was yeah junior high and the

463
00:24:39,990 --> 00:24:37,179

high school student I prayed baseball

464
00:24:46,019 --> 00:24:40,000
every day and I did not study very much

465
00:24:48,590 --> 00:24:46,029
and currently I do not the baseball very

466
00:24:53,129 --> 00:24:48,600
much but just watching the baseball game

467
00:24:57,060 --> 00:24:53,139
and a TV show with some video beer and

468
00:25:00,330 --> 00:24:57,070
snacks yeah that doesn't my favorite

469
00:25:02,580 --> 00:25:00,340
time in the weekend so for our audience

470
00:25:05,490 --> 00:25:02,590
at home can you tell us how popular is

471
00:25:06,899 --> 00:25:05,500
baseball in Japan and are there is there

472
00:25:10,830 --> 00:25:06,909
a specific team that you think is the

473
00:25:14,600 --> 00:25:10,840
best yeah and in Japan the baseball is

474
00:25:20,119 --> 00:25:14,610
very one of the most popular sports and

475
00:25:23,850 --> 00:25:20,129
I'm very fond of Hiroshima cork which is

476
00:25:28,889 --> 00:25:23,860
yeah the Hiroshima Carp won three times

477
00:25:31,259 --> 00:25:28,899
in a recent year and uh yeah season so

478
00:25:34,860 --> 00:25:31,269
currently the Hiroshima copy is one of

479
00:25:39,480 --> 00:25:34,870
the best team in Japan and also I'm a

480
00:25:43,830 --> 00:25:39,490
fan of San Francisco Giants and Oakland

481
00:25:47,909 --> 00:25:43,840
eight because I stayed in us from 2004

482
00:25:51,899 --> 00:25:47,919
to 2005 and in Bay Area NASA Ames is

483
00:25:56,369 --> 00:25:51,909
located in a bay area so I frequently

484
00:26:00,409 --> 00:25:56,379
went to the baseball park to see the

485
00:26:04,769 --> 00:26:00,419
games of San Francisco Giants and AIDS

486
00:26:05,460 --> 00:26:04,779
that's a really good my memory yeah no

487
00:26:07,710 --> 00:26:05,470
that's awesome

488
00:26:09,600 --> 00:26:07,720

I was I was fortunate I just saw our

489
00:26:12,480 --> 00:26:09,610
walk past at least at the San Francisco

490
00:26:13,110 --> 00:26:12,490
Giants Stadium while visiting my co-host

491
00:26:15,269 --> 00:26:13,120
on Joyce

492
00:26:18,419 --> 00:26:15,279
out in San Francisco it looked like a

493
00:26:21,239 --> 00:26:18,429
very beautiful place so before we open

494
00:26:22,470 --> 00:26:21,249
it up to the audience questions let's

495
00:26:25,739 --> 00:26:22,480
let's just talk a little bit about some

496
00:26:28,560 --> 00:26:25,749
hypotheticals what do you think is the

497
00:26:30,509 --> 00:26:28,570
most likely place outside of Earth in

498
00:26:35,700 --> 00:26:30,519
our solar system where we might find

499
00:26:39,899 --> 00:26:35,710
alien life so you mean that the living

500
00:26:43,350 --> 00:26:39,909
life or fall sale of life with which it

501
00:26:44,730 --> 00:26:43,360
um let's say either do you think there's

502
00:26:48,629 --> 00:26:44,740
another world in our solar system that

503
00:26:53,220 --> 00:26:48,639
likely had or has life hmm yeah I think

504
00:26:57,060 --> 00:26:53,230
the there are multiple locations that

505
00:26:59,519 --> 00:26:57,070
can hover like for example the Saturn's

506
00:27:03,090 --> 00:26:59,529
moon Enceladus and you can see from your

507
00:27:06,509 --> 00:27:03,100
offer those these two icy moons would be

508
00:27:11,669 --> 00:27:06,519
the best place to look for living life

509
00:27:15,269 --> 00:27:11,679
because these two moons are having look

510
00:27:17,399 --> 00:27:15,279
at water and possibly organics and the

511
00:27:20,909 --> 00:27:17,409
energy that these three things are

512
00:27:25,259 --> 00:27:20,919
really important for habitability alive

513
00:27:27,570 --> 00:27:25,269

and answered it meets these ingredient

514
00:27:31,619 --> 00:27:27,580
three ingredients for life so I think

515
00:27:39,210 --> 00:27:31,629
the n sodas and Europa will be the best

516
00:27:42,960 --> 00:27:39,220
price to find the living the the country

517
00:27:46,350 --> 00:27:42,970
to finding life is that those far from

518
00:27:49,710 --> 00:27:46,360
our planet so we need to send a large

519
00:27:52,830 --> 00:27:49,720
spacecraft and it if we want to confirm

520
00:27:58,080 --> 00:27:52,840
the living life we need some sample

521
00:28:02,039 --> 00:27:58,090
return from those icy wars so the sample

522
00:28:04,080 --> 00:28:02,049
return would be really technically high

523
00:28:08,669 --> 00:28:04,090
barrier and then also high cost

524
00:28:11,940 --> 00:28:08,679
so yeah the the one of the main issue

525
00:28:15,239 --> 00:28:11,950
and if we talk about the the fossil of

526
00:28:19,049 --> 00:28:15,249
life the we should go to Mars the mores

527
00:28:22,730 --> 00:28:19,059
worse habitable forests the many lines

528
00:28:26,090 --> 00:28:22,740
of geological your chemical evidence

529
00:28:27,180 --> 00:28:26,100
strongly suggests that the most worse

530
00:28:30,420 --> 00:28:27,190
one

531
00:28:34,860 --> 00:28:30,430
habitable which means this promit had

532
00:28:38,040 --> 00:28:34,870
liquid water organics and also energy so

533
00:28:43,020 --> 00:28:38,050
if the contrary count mercey it's very

534
00:28:47,670 --> 00:28:43,030
dry and very cold but if we try to find

535
00:28:52,520 --> 00:28:47,680
the fossil of life we should go to Mars

536
00:28:59,520 --> 00:28:52,530
so Mars could provide very fundamental

537
00:29:02,520 --> 00:28:59,530
information on on the the how light beam

538
00:29:04,890 --> 00:29:02,530

on the planetary body it would be very

539
00:29:07,320 --> 00:29:04,900
essential to understand the origin of

540
00:29:11,460 --> 00:29:07,330
life on Earth because the currently

541
00:29:14,670 --> 00:29:11,470
there are almost no evidence of what

542
00:29:18,900 --> 00:29:14,680
kind of environment supports the bars

543
00:29:21,360 --> 00:29:18,910
and our evolution of life on Earth but

544
00:29:25,050 --> 00:29:21,370
those evidence can be found on Mars so

545
00:29:27,480 --> 00:29:25,060
most very important prize to know not

546
00:29:30,890 --> 00:29:27,490
only the extraterrestrial life but also

547
00:29:34,500 --> 00:29:30,900
the origin of life on Earth

548
00:29:38,130 --> 00:29:34,510
interesting yeah so maybe along those

549
00:29:41,850 --> 00:29:38,140
lines if someone gave you unlimited

550
00:29:48,210 --> 00:29:41,860
money to send a mission anywhere you

551
00:29:50,790 --> 00:29:48,220
wanted to where would you send it yeah I

552
00:29:54,750 --> 00:29:50,800
want to send a spacecraft to Enceladus

553
00:29:58,200 --> 00:29:54,760
and also Titan Titan is my favorite

554
00:30:01,680 --> 00:29:58,210
place because yeah the Titan has a look

555
00:30:04,620 --> 00:30:01,690
at methane on the surface like if

556
00:30:06,960 --> 00:30:04,630
methane break maintained ocean on the

557
00:30:09,120 --> 00:30:06,970
southwest those are really exotic phrase

558
00:30:12,090 --> 00:30:09,130
I don't know whether those kind of

559
00:30:15,180 --> 00:30:12,100
conditions suitable for life but if the

560
00:30:18,180 --> 00:30:15,190
Titans really exotic phrase weather yeah

561
00:30:21,300 --> 00:30:18,190
and answered us is really good price to

562
00:30:25,740 --> 00:30:21,310
find life so I want to do the sample

563
00:30:29,580 --> 00:30:25,750

eight emission from Enceladus awesome

564
00:30:31,260 --> 00:30:29,590
thank you so yes I am up not to our

565
00:30:33,510 --> 00:30:31,270
audience to ask questions

566
00:30:35,700 --> 00:30:33,520
just a reminder use hash tag ask Astro

567
00:30:37,890 --> 00:30:35,710
bio on Twitter or ask the questions

568
00:30:39,780 --> 00:30:37,900
directly in the chat from Sagan net org

569
00:30:41,080 --> 00:30:39,790
or in the NASA Astrobiology Facebook

570
00:30:42,700 --> 00:30:41,090
page

571
00:30:45,160 --> 00:30:42,710
but let's just start seeing what the

572
00:30:47,890 --> 00:30:45,170
audience wants to know so our first

573
00:30:50,770 --> 00:30:47,900
question comes from user Astra bio times

574
00:30:53,980 --> 00:30:50,780
who was our ambassador of this month and

575
00:30:57,760 --> 00:30:53,990
they asked what career path would you

576
00:31:00,670 --> 00:30:57,770
suggest to young people from from other

577
00:31:02,860 --> 00:31:00,680
places in the world maybe specifically

578
00:31:04,740 --> 00:31:02,870
to those places where astrobiology isn't

579
00:31:06,550 --> 00:31:04,750
really a well-developed field of study

580
00:31:08,650 --> 00:31:06,560
so there are some countries where

581
00:31:11,160 --> 00:31:08,660
astrobiology isn't available as a course

582
00:31:14,050 --> 00:31:11,170
in college maybe there aren't as many

583
00:31:16,060 --> 00:31:14,060
astrobiologists working what would you

584
00:31:19,660 --> 00:31:16,070
suggest for young people who want to

585
00:31:23,200 --> 00:31:19,670
study astrobiology from those places hmm

586
00:31:30,580 --> 00:31:23,210
yeah that's a really good question yeah

587
00:31:33,940 --> 00:31:30,590
I have no clear answer but it even today

588
00:31:39,550 --> 00:31:33,950

I have been receiving the email or

589
00:31:44,530 --> 00:31:39,560
letter from the other countries the food

590
00:31:50,020 --> 00:31:44,540
won't land astrobiology in Japan or yeah

591
00:31:52,540 --> 00:31:50,030
in LC LC is my appellation but so those

592
00:31:57,310 --> 00:31:52,550
are kind of keeping the contacting with

593
00:32:03,340 --> 00:31:57,320
the researcher is I think very important

594
00:32:07,510 --> 00:32:03,350
and yeah okay awesome yeah sounds like a

595
00:32:16,120 --> 00:32:07,520
good starting advice show I would just

596
00:32:20,980 --> 00:32:17,560
so we have another question from

597
00:32:24,970 --> 00:32:20,990
Elizabeth Tasker and Elizabeth wants to

598
00:32:29,740 --> 00:32:24,980
know if we find life on one of these icy

599
00:32:33,700 --> 00:32:29,750
moons how close would that life be to

600
00:32:36,010 --> 00:32:33,710
life here on earth say compared with

601
00:32:38,290 --> 00:32:36,020
finding life on Mars or somewhere closer

602
00:32:42,430 --> 00:32:38,300
but specifically a place like Enceladus

603
00:32:45,100 --> 00:32:42,440
or Europa how similar would it be hmm

604
00:32:48,940 --> 00:32:45,110
that's a really interesting question and

605
00:32:51,190 --> 00:32:48,950
I want to know the answer so that's a

606
00:32:53,039 --> 00:32:51,200
reason why I need to sample it down

607
00:32:58,229 --> 00:32:53,049
better I

608
00:33:00,350 --> 00:32:58,239
the availability of the bio essential

609
00:33:05,180 --> 00:33:00,360
elements such as carbon nitrogen

610
00:33:09,840 --> 00:33:05,190
phosphorus sulfur and oxygen doesn't

611
00:33:14,519 --> 00:33:09,850
deflate between the ours and icy moons

612
00:33:18,930 --> 00:33:14,529
so I think the especially the transports

613
00:33:19,499 --> 00:33:18,940

may be depleted in icy body compared

614
00:33:22,080 --> 00:33:19,509
with ours

615
00:33:25,619 --> 00:33:22,090
the ours Rock contained a laboratory

616
00:33:30,810 --> 00:33:25,629
high abundance of phosphorous compared

617
00:33:33,210 --> 00:33:30,820
with the rock in icy moons so that we

618
00:33:37,320 --> 00:33:33,220
can use phosphorus so DNA contained a

619
00:33:42,619 --> 00:33:37,330
phosphorus or yeah we need phosphorous

620
00:33:49,080 --> 00:33:42,629
every day but on life on Enceladus or

621
00:33:51,060 --> 00:33:49,090
Europa may not be healing the phosphorus

622
00:33:58,129 --> 00:33:51,070
because the phosphorous may be depleted

623
00:34:03,239 --> 00:33:58,139
in those products so they may not use

624
00:34:06,560 --> 00:34:03,249
DNA or RNA because of the depletion of

625
00:34:10,399 --> 00:34:06,570
phosphorus so that

626
00:34:13,159 --> 00:34:10,409
a large difference between us live

627
00:34:15,559 --> 00:34:13,169
structure and I see monster oxygen

628
00:34:19,460 --> 00:34:15,569
that's my opening about it yeah we need

629
00:34:23,409 --> 00:34:19,470
to check this possibility interesting so

630
00:34:30,589 --> 00:34:23,419
the sample attend and yeah if there is

631
00:34:33,500 --> 00:34:30,599
no life or lifeless satellite it gonna

632
00:34:36,559 --> 00:34:33,510
be very it's really very interesting to

633
00:34:37,819 --> 00:34:36,569
me so Enceladus is a habitable place

634
00:34:41,240 --> 00:34:37,829
yeah

635
00:34:44,089 --> 00:34:41,250
the it contain delicate water organics

636
00:34:47,329 --> 00:34:44,099
and energy so it's habitable but if we

637
00:34:51,500 --> 00:34:47,339
find in the future the answer does it's

638
00:34:53,780 --> 00:34:51,510

lifeless satellite it's really important

639
00:34:58,309 --> 00:34:53,790
and interesting so we need to think

640
00:35:03,550 --> 00:34:58,319
about why the top of the Enceladus is

641
00:35:08,030 --> 00:35:03,560
lifeless despite of it habitable so it

642
00:35:12,559 --> 00:35:08,040
could tell us about some insight into it

643
00:35:17,000 --> 00:35:12,569
worried the real requirement for the

644
00:35:19,700 --> 00:35:17,010
origin of life so we need to find many

645
00:35:22,309 --> 00:35:19,710
habitable phrases in the solar system

646
00:35:25,760 --> 00:35:22,319
and we need to check whether diesel

647
00:35:29,569 --> 00:35:25,770
really like or they're all lifeless

648
00:35:33,980 --> 00:35:29,579
planet so that would provide the what

649
00:35:38,089 --> 00:35:33,990
kind of the factors or a component

650
00:35:43,460 --> 00:35:38,099
necessary to emerge life on the plot a

651
00:35:47,390 --> 00:35:43,470
body hmm very interesting so the next

652
00:35:49,430 --> 00:35:47,400
question comes from vol dr Chara from

653
00:35:50,870 --> 00:35:49,440
Twitter and it's kind of a similar

654
00:35:54,290 --> 00:35:50,880
question which is why we have it here I

655
00:35:58,550 --> 00:35:54,300
suppose if there is a chemo autotrophic

656
00:36:00,290 --> 00:35:58,560
life in Enceladus is ocean is it

657
00:36:03,859 --> 00:36:00,300
possible that there might also then be

658
00:36:06,950 --> 00:36:03,869
larger trophic chains or food webs of

659
00:36:12,050 --> 00:36:06,960
organisms an ecology or that we should

660
00:36:15,319 --> 00:36:12,060
look at or look for hmm yeah within the

661
00:36:17,480 --> 00:36:15,329
answer this the energy can be formed by

662
00:36:19,040 --> 00:36:17,490
the hydrothermal reaction the

663
00:36:20,329 --> 00:36:19,050

hydrothermal reaction is a high

664
00:36:23,660 --> 00:36:20,339
temperature

665
00:36:30,680 --> 00:36:23,670
water of reactions that produce the

666
00:36:35,900 --> 00:36:30,690
hydrogen hydrogen hydrogen h2 is food

667
00:36:40,700 --> 00:36:35,910
for microbial life to produce methane or

668
00:36:44,690 --> 00:36:40,710
to produce hydrogen sulfide but to make

669
00:36:46,339 --> 00:36:44,700
a large ecosystem or complex life the we

670
00:36:50,779 --> 00:36:46,349
need more oxidant

671
00:36:55,099 --> 00:36:50,789
the hot hydrogen eats reductant and the

672
00:36:58,009 --> 00:36:55,109
we need oxygen so these two difference

673
00:37:01,999 --> 00:36:58,019
in a chemical difference in ER having

674
00:37:05,420 --> 00:37:02,009
chemical potential provide and control

675
00:37:07,759 --> 00:37:05,430
the sides of life so we have hydrogen

676
00:37:12,109 --> 00:37:07,769
with an answer this which is the

677
00:37:16,099 --> 00:37:12,119
strongest reduction within answer this

678
00:37:20,170 --> 00:37:16,109
so if we have strong oxidants such as

679
00:37:23,719 --> 00:37:20,180
oxygen ozone or hydrogen peroxide

680
00:37:27,079 --> 00:37:23,729
there's going to be a large potential so

681
00:37:31,759 --> 00:37:27,089
if we have these two extreme slip strong

682
00:37:37,789 --> 00:37:31,769
oxidant and reductant that can maintain

683
00:37:40,069 --> 00:37:37,799
the complex life or a complex system so

684
00:37:43,039 --> 00:37:40,079
but we still don't know that we have

685
00:37:46,759 --> 00:37:43,049
hydrogen with ena answer this better we

686
00:37:50,359 --> 00:37:46,769
have almost no idea about the what kind

687
00:37:54,979 --> 00:37:50,369
of oxidants are available in Solace so

688
00:37:58,099 --> 00:37:54,989

country we found co2 carbon dioxide so

689
00:38:00,920 --> 00:37:58,109
those potential it's not so large so

690
00:38:06,410 --> 00:38:00,930
currently we I consider that the complex

691
00:38:09,920 --> 00:38:06,420
life or complex ecosystem cannot be I

692
00:38:12,529 --> 00:38:09,930
mean maintained with an N so this but if

693
00:38:16,339 --> 00:38:12,539
we can find it strong oxidants within

694
00:38:20,509 --> 00:38:16,349
Enceladus the kind of complex life or

695
00:38:25,609 --> 00:38:20,519
complex X system could be yeah could

696
00:38:27,170 --> 00:38:25,619
could have a birth interesting so what

697
00:38:30,769 --> 00:38:27,180
would we need to do to figure out what

698
00:38:33,890 --> 00:38:30,779
other oxidants might be present for that

699
00:38:35,390 --> 00:38:33,900
to occur in Enceladus um is the

700
00:38:39,470 --> 00:38:35,400
specific instrument that would be best

701
00:38:43,310 --> 00:38:39,480
to send there yeah the the oxidants are

702
00:38:46,880 --> 00:38:43,320
usually formed on the surface of icy

703
00:38:50,630 --> 00:38:46,890
body through the solar UV radiation the

704
00:38:54,290 --> 00:38:50,640
solar UV radiation associated h2o ice

705
00:38:58,040 --> 00:38:54,300
and hydrogen escaped to the space and

706
00:39:02,600 --> 00:38:58,050
oxygen living on the surface so if we

707
00:39:06,670 --> 00:39:02,610
can find you or awesome or hydrogen

708
00:39:09,170 --> 00:39:06,680
peroxide h2o2 on the surface and those

709
00:39:13,850 --> 00:39:09,180
oxidant on the surface could be

710
00:39:16,490 --> 00:39:13,860
eventually I mean entered into the

711
00:39:21,670 --> 00:39:16,500
subsurface ocean so that the recycling

712
00:39:26,510 --> 00:39:21,680
of the surface icy surface so the key

713
00:39:28,580 --> 00:39:26,520

measurement is the ya keep key

714
00:39:34,370 --> 00:39:28,590
measurement is the analysis of the

715
00:39:39,140 --> 00:39:34,380
surface icy materials on Enceladus that

716
00:39:41,510 --> 00:39:39,150
is same for Europa that seems very

717
00:39:47,600 --> 00:39:41,520
promising then since it's much easier to

718
00:39:48,110 --> 00:39:47,610
access the outside yeah the inside so to

719
00:39:50,000 --> 00:39:48,120
move it along

720
00:39:53,060 --> 00:39:50,010
our next question actually comes from my

721
00:39:55,280 --> 00:39:53,070
co-host from dr. Sanjoy Psalm and this

722
00:39:57,290 --> 00:39:55,290
kind of go back goes back to when you

723
00:39:59,270 --> 00:39:57,300
were discussing whether or not we could

724
00:40:01,010 --> 00:39:59,280
learn more about the origin of life that

725
00:40:02,990 --> 00:40:01,020
the necessary ingredients for the origin

726
00:40:06,380 --> 00:40:03,000
of life and instead us

727
00:40:08,180 --> 00:40:06,390
so dr. Psalm asks do you think that all

728
00:40:11,270 --> 00:40:08,190
the or do you think that all the Indians

729
00:40:15,170 --> 00:40:11,280
for the origin of life stem from one

730
00:40:16,730 --> 00:40:15,180
specific kind of environment or is the

731
00:40:20,870 --> 00:40:16,740
origin of life possible from ingredients

732
00:40:23,930 --> 00:40:20,880
from from many environments hmm yeah

733
00:40:30,920 --> 00:40:23,940
that's a really yeah interesting and a

734
00:40:34,040 --> 00:40:30,930
good question I think the mmm

735
00:40:37,550 --> 00:40:34,050
the cycle of materials is very important

736
00:40:41,930 --> 00:40:37,560
the only in the one part we cannot make

737
00:40:46,150 --> 00:40:41,940
life because the in a one part that the

738
00:40:47,770 --> 00:40:46,160

materials always within this environment

739
00:40:57,520 --> 00:40:47,780
so

740
00:41:03,660 --> 00:40:57,530
example oxidant from the atmosphere to

741
00:41:09,190 --> 00:41:03,670
this region and Redux tax from the thief

742
00:41:12,190 --> 00:41:09,200
class or the deep-sea area to one price

743
00:41:16,750 --> 00:41:12,200
so the saturation is very important so

744
00:41:19,480 --> 00:41:16,760
yeah I think we need to consider the

745
00:41:24,550 --> 00:41:19,490
what kind of hydrological cycle material

746
00:41:27,940 --> 00:41:24,560
cycles or occurring on re ours it could

747
00:41:31,930 --> 00:41:27,950
provide the some yeah chemical product

748
00:41:36,910 --> 00:41:31,940
to unfreeze where the life can be formed

749
00:41:39,640 --> 00:41:36,920
so yeah I think the mmm the multiple

750
00:41:42,970 --> 00:41:39,650
environment would be boring but the more

751
00:41:47,820 --> 00:41:42,980
important thing is how connect those the

752
00:41:50,860 --> 00:41:47,830
multiple environments on re ours

753
00:41:52,390 --> 00:41:50,870
interesting and so there was a very cool

754
00:41:54,780 --> 00:41:52,400
take on it

755
00:41:58,090 --> 00:41:54,790
our next question comes from Tony Jia

756
00:42:00,220 --> 00:41:58,100
and Tony asks since you have been to so

757
00:42:03,430 --> 00:42:00,230
many interesting and extreme

758
00:42:07,320 --> 00:42:03,440
environments on earth what was the most

759
00:42:11,400 --> 00:42:07,330
interesting place that you've been to a

760
00:42:14,770 --> 00:42:11,410
mic barrier and in a path yeah yeah yeah

761
00:42:16,270 --> 00:42:14,780
yeah let's open up the whole way and say

762
00:42:19,960 --> 00:42:16,280
say in general what's the most

763
00:42:24,580 --> 00:42:19,970

interesting place I want to go to

764
00:42:28,180 --> 00:42:24,590
Antarctica yeah that's my one dream and

765
00:42:32,890 --> 00:42:28,190
yeah those conditions are also same -

766
00:42:37,060 --> 00:42:32,900
also very similar to re more current

767
00:42:40,920 --> 00:42:37,070
mode so yeah I want to go to the extreme

768
00:42:45,580 --> 00:42:40,930
environments yeah very cold in the arm

769
00:42:50,160 --> 00:42:45,590
yeah yeah I'd love to yeah more is

770
00:42:54,430 --> 00:42:50,170
really cool - right yeah especially in

771
00:42:58,680 --> 00:42:54,440
summer the immemorial the basically very

772
00:43:01,720 --> 00:42:58,690
dry throughout the year but only August

773
00:43:05,830 --> 00:43:01,730
July rainy season due to

774
00:43:08,890 --> 00:43:05,840
Arjun Muslim that when I went to Moorea

775
00:43:12,460 --> 00:43:08,900
in this season the ground really

776
00:43:21,499 --> 00:43:16,779
October or September the the grandeur

777
00:43:26,480 --> 00:43:21,509
very Brown dark and really alley but if

778
00:43:30,400 --> 00:43:26,490
only in the summer the clean the ground

779
00:43:33,819 --> 00:43:30,410
are everywhere and yeah just a really

780
00:43:37,339 --> 00:43:33,829
yeah beautiful place and I believe that

781
00:43:39,079 --> 00:43:37,349
yeah you can yeah if you go to Memorial

782
00:43:41,359 --> 00:43:39,089
in the summer season you can see the

783
00:43:44,150 --> 00:43:41,369
horror of the crane or over the year

784
00:43:48,559 --> 00:43:44,160
Butte and I think the memorial is a one

785
00:43:51,319 --> 00:43:48,569
of the brace closest to the heaven it's

786
00:43:56,269 --> 00:43:51,329
a high price and that I can see only sky

787
00:43:59,059 --> 00:43:56,279
blue and the green ground so yeah I like

788
00:44:01,400 --> 00:43:59,069

that yeah it's awesome

789
00:44:05,180 --> 00:44:01,410
yeah but my dream is go to the

790
00:44:08,210 --> 00:44:05,190
Antarctica and very cool yeah you sold

791
00:44:11,299 --> 00:44:08,220
me a Mongolia I have to go now our next

792
00:44:12,620 --> 00:44:11,309
question comes from Elizabeth Hutton one

793
00:44:17,210 --> 00:44:12,630
of our winners from this week for our

794
00:44:19,400 --> 00:44:17,220
background quiz and Elizabeth asked how

795
00:44:22,609 --> 00:44:19,410
would you respond if somebody were to

796
00:44:27,339 --> 00:44:22,619
come up to you and ask what are you

797
00:44:30,819 --> 00:44:27,349
doing to help the future of Earth Oh

798
00:44:37,220 --> 00:44:30,829
help the future arse

799
00:44:40,390 --> 00:44:37,230
hmm in terms of astrobiology or a my um

800
00:44:41,630 --> 00:44:40,400
she didn't say so let's just say yes

801
00:44:44,660 --> 00:44:41,640
okay

802
00:44:46,999 --> 00:44:44,670
I think the mmm

803
00:44:51,279 --> 00:44:47,009
the important thing is that if we find

804
00:44:55,279 --> 00:44:51,289
life in the solar system or beyond

805
00:44:59,120 --> 00:44:55,289
whichever is the very tiny of the year

806
00:45:01,640 --> 00:44:59,130
or complex life it could tell us that

807
00:45:04,430 --> 00:45:01,650
that we are not alone in the universe

808
00:45:07,849 --> 00:45:04,440
and we are not special in the universe

809
00:45:11,410 --> 00:45:07,859
also the way we mean that the Earth's

810
00:45:15,700 --> 00:45:11,420
life is at one of one one big family

811
00:45:22,640 --> 00:45:15,710
those kind of concept is very important

812
00:45:24,980 --> 00:45:22,650
to in a upcoming very difficult age of

813
00:45:28,490 --> 00:45:24,990

ours that if we

814
00:45:31,370 --> 00:45:28,500
can really understand the odds life is

815
00:45:36,440 --> 00:45:31,380
one become family it gonna change our

816
00:45:39,980 --> 00:45:36,450
words so I think the the yeah body of

817
00:45:44,960 --> 00:45:39,990
the astrobiology may be to realize

818
00:45:51,200 --> 00:45:44,970
ourselves as a one family so yeah that's

819
00:45:54,800 --> 00:45:51,210
it that only yeah yeah that's a yes sir

820
00:45:56,900 --> 00:45:54,810
biology can do this but other science

821
00:46:00,770 --> 00:45:56,910
for example I don't know that the

822
00:46:01,640 --> 00:46:00,780
chemistry or mathematics may not be able

823
00:46:04,190 --> 00:46:01,650
to do this

824
00:46:07,520 --> 00:46:04,200
the astrobiology only can tell us its

825
00:46:11,780 --> 00:46:07,530
new console I mean provided us this

826
00:46:14,540 --> 00:46:11,790
concept so I think that the survivors

827
00:46:17,420 --> 00:46:14,550
you may not be able to really support

828
00:46:21,890 --> 00:46:17,430
our life in the future but it can change

829
00:46:26,660 --> 00:46:21,900
your concept or out view that's a I

830
00:46:31,579 --> 00:46:26,670
think the more important down the some

831
00:46:33,800 --> 00:46:31,589
technique or technology it's awesome

832
00:46:36,109 --> 00:46:33,810
yeah so I'm not sure if you've heard of

833
00:46:37,730 --> 00:46:36,119
the overview effect this is what

834
00:46:39,920 --> 00:46:37,740
astronauts feel when they go to space

835
00:46:41,960 --> 00:46:39,930
and they look back down and they see the

836
00:46:44,930 --> 00:46:41,970
earth and they they feel this this

837
00:46:47,530 --> 00:46:44,940
awareness of us as a family on earth as

838
00:46:50,510 --> 00:46:47,540

you mentioned so I have a fun question

839
00:46:53,810 --> 00:46:50,520
if you had the chance to go to space

840
00:46:55,339 --> 00:46:53,820
would you take it and and what do you

841
00:47:01,300 --> 00:46:55,349
think you would feel looking back at the

842
00:47:04,370 --> 00:47:01,310
earth I mean if I go to the spice and

843
00:47:05,870 --> 00:47:04,380
yeah in the back how do you how do you

844
00:47:10,640 --> 00:47:05,880
think you would feel looking back at the

845
00:47:13,280 --> 00:47:10,650
earth I have no idea about it yeah I

846
00:47:19,940 --> 00:47:13,290
want to go to space that's a my out of

847
00:47:23,290 --> 00:47:19,950
the dream but yeah I I think yeah yeah I

848
00:47:27,410 --> 00:47:23,300
also feel that the arse is the one

849
00:47:32,730 --> 00:47:27,420
planet and we are living one price so

850
00:47:34,410 --> 00:47:32,740
yeah we're well family yeah awesome

851
00:47:37,050 --> 00:47:34,420
that's kind of fitting with with the

852
00:47:39,359 --> 00:47:37,060
person who asked our next question dr.

853
00:47:42,780 --> 00:47:39,369
Jim Pass who runs the Astra sociological

854
00:47:47,280 --> 00:47:42,790
research institute and dr. Paz quants to

855
00:47:49,740 --> 00:47:47,290
know what does the ubiquity of life on

856
00:47:52,260 --> 00:47:49,750
Earth tell us about the possibility

857
00:47:55,200 --> 00:47:52,270
bility for life elsewhere in the solar

858
00:47:57,270 --> 00:47:55,210
system and maybe more specifically what

859
00:48:04,500 --> 00:47:57,280
are your thoughts about the idea of

860
00:48:06,839 --> 00:48:04,510
panspermia hmm yeah I'm supportive of

861
00:48:09,680 --> 00:48:06,849
pants Bill Maher especially from ours

862
00:48:13,589 --> 00:48:09,690
and the malls we have we have already

863
00:48:15,780 --> 00:48:13,599

many multimedia light and if we

864
00:48:17,640 --> 00:48:15,790
investigate the Martian metal like the

865
00:48:22,890 --> 00:48:17,650
interior of Martian meteorite is not so

866
00:48:26,940 --> 00:48:22,900
very I mean it does not experience I can

867
00:48:29,700 --> 00:48:26,950
pursue over high pressure so them the

868
00:48:34,770 --> 00:48:29,710
exchange of materials between Earth and

869
00:48:39,329 --> 00:48:34,780
Mars possibly occurs even today and also

870
00:48:42,589 --> 00:48:39,339
more frequently in re stages of the

871
00:48:51,270 --> 00:48:42,599
solar system so I think the ORS and Mars

872
00:48:57,329 --> 00:48:51,280
may be yeah may have similar a lifetime

873
00:49:01,820 --> 00:48:57,339
so yeah I think the weekend yeah I mean

874
00:49:06,720 --> 00:49:01,830
consider the Earth's life type as a

875
00:49:10,950 --> 00:49:06,730
standard to look for the life on Mars

876
00:49:13,290 --> 00:49:10,960
but icy moons such as Europa Enceladus

877
00:49:17,490 --> 00:49:13,300
it's really difficult to exchange

878
00:49:20,280 --> 00:49:17,500
material between our planets and those

879
00:49:23,579 --> 00:49:20,290
icy bodies so that we need to think

880
00:49:29,790 --> 00:49:23,589
about the wide range of possibility to

881
00:49:30,960 --> 00:49:29,800
find life for these icy moons the devil

882
00:49:33,900 --> 00:49:30,970
didn't answer the question

883
00:49:36,359 --> 00:49:33,910
yes I believe so let's ask another

884
00:49:39,810 --> 00:49:36,369
question this one is from Facebook from

885
00:49:41,880 --> 00:49:39,820
user Steven Weber and Steven so the

886
00:49:44,970 --> 00:49:41,890
question was what are American PhD

887
00:49:46,260 --> 00:49:44,980
student prospects for study in Japan but

888
00:49:49,380 --> 00:49:46,270

I'd like to bra

889
00:49:52,650 --> 00:49:49,390
the question a little bit and ask what

890
00:49:55,800 --> 00:49:52,660
are the opportunities for students PhD

891
00:49:59,040 --> 00:49:55,810
students and and Beyond from other

892
00:50:03,420 --> 00:49:59,050
countries to come and work in Japan for

893
00:50:06,750 --> 00:50:03,430
LC or just in Japan in general yeah I

894
00:50:10,590 --> 00:50:06,760
think yeah conducting the people are

895
00:50:14,310 --> 00:50:10,600
really important and to do this we need

896
00:50:15,030 --> 00:50:14,320
to first know the for doing what kind of

897
00:50:19,620 --> 00:50:15,040
research

898
00:50:22,980 --> 00:50:19,630
so if yeah the students are interested

899
00:50:27,720 --> 00:50:22,990
know some research topic they may read a

900
00:50:33,090 --> 00:50:27,730
newspaper magazine or web then they can

901
00:50:36,720 --> 00:50:33,100
go more deep in today the what kind of

902
00:50:38,790 --> 00:50:36,730
research are those researcher doing

903
00:50:41,400 --> 00:50:38,800
through the web or through the magazine

904
00:50:43,980 --> 00:50:41,410
and then they can gather information

905
00:50:47,160 --> 00:50:43,990
through not only through the web but

906
00:50:49,260 --> 00:50:47,170
also from paper something so yeah I

907
00:50:52,730 --> 00:50:49,270
think the the communication is very

908
00:50:57,620 --> 00:50:52,740
important and country the we can have a

909
00:51:02,490 --> 00:50:57,630
communication much more easier than the

910
00:51:06,600 --> 00:51:02,500
than the past so yeah I think they're

911
00:51:09,540 --> 00:51:06,610
sending the email or calling in the

912
00:51:12,470 --> 00:51:09,550
office already yeah a good way to

913
00:51:14,900 --> 00:51:12,480

communicate with the researchers and

914
00:51:19,170 --> 00:51:14,910
here doing the research in other

915
00:51:20,730 --> 00:51:19,180
countries mm-hmm awesome yeah we really

916
00:51:23,190 --> 00:51:20,740
are very connected this day these days

917
00:51:24,450 --> 00:51:23,200
on our planet I mean our show has

918
00:51:26,850 --> 00:51:24,460
audience members from around the world

919
00:51:30,120 --> 00:51:26,860
who watch and tune in and it's great for

920
00:51:31,770 --> 00:51:30,130
us to be able to connect in this way so

921
00:51:34,980 --> 00:51:31,780
let's go to another Facebook question

922
00:51:37,440 --> 00:51:34,990
here this one from Tom Caruso so Tom

923
00:51:40,890 --> 00:51:37,450
wants to know if you think that cold

924
00:51:44,550 --> 00:51:40,900
ocean waters favored life formation over

925
00:51:48,060 --> 00:51:44,560
warm ocean waters so like the ability to

926
00:51:51,140 --> 00:51:48,070
hold gases changes in pH the

927
00:51:53,250 --> 00:51:51,150
availability of minerals and iron so

928
00:51:54,660 --> 00:51:53,260
what does that what kind of implication

929
00:51:56,650 --> 00:51:54,670
does that have then for places like

930
00:51:58,210 --> 00:51:56,660
Enceladus and Europa

931
00:52:02,020 --> 00:51:58,220
on the temperature of the fluids

932
00:52:05,020 --> 00:52:02,030
themselves hmm the low low temperature

933
00:52:09,390 --> 00:52:05,030
is for the stability of some organic

934
00:52:12,400 --> 00:52:09,400
materials so in terms of the life

935
00:52:14,440 --> 00:52:12,410
lifetime survivability of complex

936
00:52:15,549 --> 00:52:14,450
organic materials the low temperature

937
00:52:18,099 --> 00:52:15,559
will be with it

938
00:52:21,279 --> 00:52:18,109

but in a low temperature the chemical

939
00:52:24,490 --> 00:52:21,289
reactions are also slow so it may be a

940
00:52:27,370 --> 00:52:24,500
trade-off between the life required

941
00:52:29,770 --> 00:52:27,380
conference organic materials but those

942
00:52:32,549 --> 00:52:29,780
are in a high temperature

943
00:52:35,680 --> 00:52:32,559
those are relatively easy easily

944
00:52:37,839 --> 00:52:35,690
destroyed but if we can get the more

945
00:52:42,549 --> 00:52:37,849
energy at the high temperature so we can

946
00:52:44,890 --> 00:52:42,559
fix the compressed organic materials but

947
00:52:47,349 --> 00:52:44,900
in a low temperature this already

948
00:52:50,020 --> 00:52:47,359
I mean complex organics are really

949
00:52:54,690 --> 00:52:50,030
stable but we can get only small amount

950
00:52:58,289 --> 00:52:54,700
of energy so it may be a trade-off so I

951
00:53:01,180 --> 00:52:58,299
do not have clear answer whether the the

952
00:53:04,779 --> 00:53:01,190
very low temperature such as del degree

953
00:53:07,720 --> 00:53:04,789
Celsius would be good for the the origin

954
00:53:10,870 --> 00:53:07,730
of life or the evolution of life whether

955
00:53:17,900 --> 00:53:10,880
the the one thing I can say the low

956
00:53:23,700 --> 00:53:20,790
okay um so so you're involved with the

957
00:53:25,080 --> 00:53:23,710
the juice mission we also have Europa

958
00:53:27,990 --> 00:53:25,090
clipper that will launch here before

959
00:53:30,000 --> 00:53:28,000
long and go out to Europa with these

960
00:53:32,430 --> 00:53:30,010
missions give us the ability to better

961
00:53:33,800 --> 00:53:32,440
understand the temperature of Europa's

962
00:53:35,850 --> 00:53:33,810
ocean and maybe have a better

963
00:53:40,230 --> 00:53:35,860

understanding of if it's cold or if it's

964
00:53:42,060 --> 00:53:40,240
hot yeah I think so the yeah I just said

965
00:53:46,490 --> 00:53:42,070
I'm involved in the juice

966
00:53:51,470 --> 00:53:46,500
juicy icy moon Explorer led by ISA and

967
00:53:55,950 --> 00:53:51,480
also yeah Europa clipper is a very yeah

968
00:53:58,710 --> 00:53:55,960
nice mission to Europa and if we see the

969
00:54:01,830 --> 00:53:58,720
surface salt material or surface

970
00:54:04,170 --> 00:54:01,840
materials it could tell us about the

971
00:54:09,780 --> 00:54:04,180
what kind of the chemical composition of

972
00:54:12,350 --> 00:54:09,790
ocean of Europa or animated so the

973
00:54:15,960 --> 00:54:12,360
chemical composition of ocean is

974
00:54:18,990 --> 00:54:15,970
determined by the interaction with the

975
00:54:21,710 --> 00:54:19,000
rocky core on the seafloor

976
00:54:26,550 --> 00:54:21,720
so the chemical composition water

977
00:54:29,940 --> 00:54:26,560
reflects the interaction with the rocky

978
00:54:37,110 --> 00:54:29,950
ports so we can understand what kind of

979
00:54:40,220 --> 00:54:37,120
temperature at the deep sea floor it's

980
00:54:48,840 --> 00:54:45,540
tea-things so if we put if we have a tea

981
00:54:53,090 --> 00:54:48,850
leaves and we put very high temperature

982
00:54:57,750 --> 00:54:53,100
100 degrees hot water the we can get a

983
00:54:59,520 --> 00:54:57,760
tea but if we put the gel degree Celsius

984
00:55:02,700 --> 00:54:59,530
very low temperature low temperature

985
00:55:07,830 --> 00:55:02,710
water we can get a different type of T

986
00:55:09,780 --> 00:55:07,840
so if we taste this tea we can get some

987
00:55:12,750 --> 00:55:09,790
information of the what kind of

988
00:55:16,980 --> 00:55:12,760

temperature and how long the chemical

989
00:55:21,330 --> 00:55:16,990
reaction was going on in the ball of the

990
00:55:25,500 --> 00:55:21,340
sea so the exploration of the Europa's

991
00:55:28,700 --> 00:55:25,510
ocean composition is very I think very

992
00:55:31,180 --> 00:55:28,710
similar to the tasting tea and

993
00:55:34,339 --> 00:55:31,190
different types of teeth and we can

994
00:55:39,349 --> 00:55:34,349
understand what kind of the leaf tea

995
00:55:44,200 --> 00:55:39,359
leaves and what which temperatures those

996
00:55:46,250 --> 00:55:44,210
tear is brand yeah so I mean yeah

997
00:55:49,849 --> 00:55:46,260
understanding the chemical composition

998
00:55:53,569 --> 00:55:49,859
of the Southwest and the ocean is very

999
00:55:58,490 --> 00:55:53,579
critical to constraint the water of

1000
00:56:00,349 --> 00:55:58,500
reaction I have to admit the tea analogy

1001
00:56:02,839 --> 00:56:00,359
is now my favorite analogy for

1002
00:56:05,660 --> 00:56:02,849
understanding the composition of oceans

1003
00:56:08,299 --> 00:56:05,670
of these icy worlds so let's move to

1004
00:56:12,109 --> 00:56:08,309
another question this one comes from Jay

1005
00:56:16,670 --> 00:56:12,119
Weezy on Facebook and gay wants to now

1006
00:56:19,040 --> 00:56:16,680
go to our Moon and J wonders if our Moon

1007
00:56:22,370 --> 00:56:19,050
offers anything beneficial for your

1008
00:56:24,260 --> 00:56:22,380
research especially since there's

1009
00:56:26,240 --> 00:56:24,270
there's talk now of this tentative

1010
00:56:29,240 --> 00:56:26,250
return date for getting humans back to

1011
00:56:32,750 --> 00:56:29,250
the moon how does the moon fit into the

1012
00:56:36,170 --> 00:56:32,760
research that you're doing yeah moon is

1013
00:56:40,490 --> 00:56:36,180

very important price to test some

1014
00:56:44,089 --> 00:56:40,500
technology for example the landing and

1015
00:56:46,930 --> 00:56:44,099
also going back to this space happening

1016
00:56:52,460 --> 00:56:46,940
and also the lowering technique is

1017
00:56:56,569 --> 00:56:52,470
required to test so I think the moon our

1018
00:56:59,210 --> 00:56:56,579
moon is a really good place to test such

1019
00:57:05,059 --> 00:56:59,220
kind of the space exploration technology

1020
00:57:08,870 --> 00:57:05,069
so if we yeah did not have our moon it's

1021
00:57:12,530 --> 00:57:08,880
very difficult to do the technological

1022
00:57:18,430 --> 00:57:12,540
test so we are very lucky to have a moon

1023
00:57:21,470 --> 00:57:18,440
to have our room nice it's very cool

1024
00:57:22,970 --> 00:57:21,480
wrapping up now on time we only have a

1025
00:57:25,490 --> 00:57:22,980
couple of minutes left so before we

1026
00:57:27,319 --> 00:57:25,500
finish the episode I do want to know

1027
00:57:29,900 --> 00:57:27,329
what what are the next big steps in your

1028
00:57:32,349 --> 00:57:29,910
research what's the next big question

1029
00:57:37,130 --> 00:57:32,359
that you're trying to answer right now

1030
00:57:41,940 --> 00:57:37,140
yeah I want to answer the whether the

1031
00:57:44,430 --> 00:57:41,950
current Mars is habitable and you'll be

1032
00:57:47,010 --> 00:57:44,440
that the past Mars is habitable but we

1033
00:57:51,720 --> 00:57:47,020
have almost no idea whether the current

1034
00:57:56,400 --> 00:57:51,730
Mars has liquid water or a keep flying

1035
00:57:59,970 --> 00:57:56,410
and whether there's sufficient to

1036
00:58:04,310 --> 00:57:59,980
support life so I'm yeah I want to know

1037
00:58:08,970 --> 00:58:04,320
the what kind of the environment are

1038
00:58:13,140 --> 00:58:08,980

there are on current Mars and whether

1039
00:58:16,800 --> 00:58:13,150
they they're habitable suitable for life

1040
00:58:20,790 --> 00:58:16,810
so I want to investigate those things

1041
00:58:23,450 --> 00:58:20,800
through the space mission so I'm one of

1042
00:58:26,670 --> 00:58:23,460
the member of Jackson's next Mars

1043
00:58:31,130 --> 00:58:26,680
mission so in the next Mars mission by

1044
00:58:34,380 --> 00:58:31,140
JAXA I want to investigate the chemical

1045
00:58:37,230 --> 00:58:34,390
environment on current month you know

1046
00:58:39,569 --> 00:58:37,240
it's so cool I look forward to reading

1047
00:58:41,670 --> 00:58:39,579
about it in the future and for any young

1048
00:58:44,160 --> 00:58:41,680
people who are watching as dr. second

1049
00:58:45,990 --> 00:58:44,170
name is Ted reach out send them an email

1050
00:58:47,609 --> 00:58:46,000
send researchers emails who are doing

1051
00:58:50,490 --> 00:58:47,619
this stuff if that sounds interesting to

1052
00:58:52,530 --> 00:58:50,500
you so for all of our audience who are

1053
00:58:55,260 --> 00:58:52,540
watching we're gonna try something new

1054
00:58:57,510 --> 00:58:55,270
this month and start asking people at

1055
00:59:00,030 --> 00:58:57,520
the end of every of every episode to

1056
00:59:02,490 --> 00:59:00,040
answer a fun question about the

1057
00:59:13,280 --> 00:59:02,500
conversation we just had so that's going

1058
00:59:17,220 --> 00:59:15,540
Astrobiology heat the second thing thank

1059
00:59:19,680 --> 00:59:17,230
you very much for joining us for ask and

1060
00:59:20,520 --> 00:59:19,690
astrobiologists thank you has been a

1061
00:59:22,500 --> 00:59:20,530
pleasure having you

1062
00:59:23,520 --> 00:59:22,510
yeah I mean then to our audience at home

1063
00:59:24,690 --> 00:59:23,530

thank you very much