
ASK AN
ASTROBIOLOGIST
EPISODE 59: JUNE 14, 2023
DR. LENA VINCENT
#AskAstrobio
NASA

1
00:00:25,410 --> 00:00:00,470
[Music]

2
00:00:39,549 --> 00:00:25,420
[Applause]

3
00:00:42,590 --> 00:00:39,559
[Music]

4
00:00:45,170 --> 00:00:42,600
friends fellow earthlings and explorers

5
00:00:47,450 --> 00:00:45,180
of the unknown and welcome to ask an

6
00:00:50,090 --> 00:00:47,460
astrobiologist the show that celebrates

7
00:00:52,190 --> 00:00:50,100
the science and the scientists involved

8
00:00:55,430 --> 00:00:52,200
in our quest to understand the nature of

9
00:00:57,529 --> 00:00:55,440
life I'm your host Dr Graham the cosmo

10
00:00:59,569 --> 00:00:57,539
biologist Lao and as always we're

11
00:01:02,750 --> 00:00:59,579
brought to you by the NASA astrobiology

12
00:01:05,210 --> 00:01:02,760
program and saigonet.org a huge thanks

13
00:01:07,730 --> 00:01:05,220

to all of you out there in the in the

14
00:01:10,070 --> 00:01:07,740
internet realm who share our Show online

15
00:01:11,929 --> 00:01:10,080
on Twitter and Instagram and Facebook

16
00:01:13,789 --> 00:01:11,939
and Linkedin and all of the other cool

17
00:01:16,310 --> 00:01:13,799
places where you can share about cool

18
00:01:18,469 --> 00:01:16,320
science online as always we want to give

19
00:01:20,630 --> 00:01:18,479
a shout out to one profile that's been

20
00:01:22,730 --> 00:01:20,640
very active in sharing about our show

21
00:01:25,010 --> 00:01:22,740
asking questions about our guests for

22
00:01:28,310 --> 00:01:25,020
this month's show this month we want to

23
00:01:30,469 --> 00:01:28,320
highlight the user are at astrobio buzz

24
00:01:32,270 --> 00:01:30,479
on Twitter this account's been fairly

25
00:01:35,210 --> 00:01:32,280
active lately and sharing and talking

26
00:01:37,670 --> 00:01:35,220
about astrobiology topics and so a huge

27
00:01:40,490 --> 00:01:37,680
thank you to Astro biobuzz on Twitter

28
00:01:43,069 --> 00:01:40,500
for sharing about ask an astrobiologists

29
00:01:44,630 --> 00:01:43,079
engaging with me with our guests it's a

30
00:01:47,270 --> 00:01:44,640
pleasure to have all of you tuning in

31
00:01:48,890 --> 00:01:47,280
for our show every month now today's

32
00:01:50,749 --> 00:01:48,900
episode is going to be pretty remarkable

33
00:01:52,730 --> 00:01:50,759
I've been wanting to have today's guest

34
00:01:54,170 --> 00:01:52,740
on the show for quite some time so I'm

35
00:01:55,910 --> 00:01:54,180
glad we can finally snag just a little

36
00:01:59,630 --> 00:01:55,920
bit of her time to have her chat with us

37
00:02:02,330 --> 00:01:59,640
today's guest is Dr Lena Vincent she is

38
00:02:05,149 --> 00:02:02,340

an experimental astrobiologist who

39
00:02:06,969 --> 00:02:05,159
earned her PhD in astrobiology at the

40
00:02:09,050 --> 00:02:06,979
University of Wisconsin Madison

41
00:02:10,910 --> 00:02:09,060
where she was studying the chemical

42
00:02:13,010 --> 00:02:10,920
origins of life

43
00:02:15,290 --> 00:02:13,020
she was also a fellow of the future

44
00:02:17,570 --> 00:02:15,300
investigators in NASA Earth and space

45
00:02:20,630 --> 00:02:17,580
science and technology or the finest

46
00:02:23,030 --> 00:02:20,640
program after finishing her PhD she then

47
00:02:24,770 --> 00:02:23,040
went on to become a NASA post-doctoral

48
00:02:27,229 --> 00:02:24,780
fellow at NASA's jet propulsion

49
00:02:30,290 --> 00:02:27,239
laboratory or JPL

50
00:02:32,930 --> 00:02:30,300
uh at JPL she studies how Signs of Life

51
00:02:35,089 --> 00:02:32,940
might be preserved in the icy ocean

52
00:02:37,030 --> 00:02:35,099
worlds of our solar system like Europa

53
00:02:39,770 --> 00:02:37,040
and Enceladus and how we can use

54
00:02:41,930 --> 00:02:39,780
instrumentation uh here on Earth and in

55
00:02:44,030 --> 00:02:41,940
the future on astrobiologically focused

56
00:02:46,610 --> 00:02:44,040
missions in space to look for those

57
00:02:48,949 --> 00:02:46,620
possible signs of life or bio signatures

58
00:02:51,949 --> 00:02:48,959
she's also an avid science communicator

59
00:02:54,410 --> 00:02:51,959
and has garnered over 500 000 followers

60
00:02:56,930 --> 00:02:54,420
across social media and sharing about

61
00:02:58,430 --> 00:02:56,940
her life her interests and a whole lot

62
00:03:00,110 --> 00:02:58,440
of astrobiology

63
00:03:01,910 --> 00:03:00,120

uh she's also into some really cool

64
00:03:03,470 --> 00:03:01,920
things like scuba diving and chasing

65
00:03:05,809 --> 00:03:03,480
aurorae and we'll talk about that in a

66
00:03:07,130 --> 00:03:05,819
little bit but first Elena Vincent thank

67
00:03:08,449 --> 00:03:07,140
you so much for joining us for asking

68
00:03:10,070 --> 00:03:08,459
astrobiologist

69
00:03:11,930 --> 00:03:10,080
well thanks so much for having me I'm

70
00:03:13,490 --> 00:03:11,940
really excited to chat with you awesome

71
00:03:15,470 --> 00:03:13,500
like I said I've been wanting you on the

72
00:03:17,210 --> 00:03:15,480
show for a long time uh we've been

73
00:03:19,850 --> 00:03:17,220
following each other in the internet

74
00:03:21,890 --> 00:03:19,860
realm for a while in social media it's

75
00:03:23,750 --> 00:03:21,900
been very cool to see your growth as a

76
00:03:26,210 --> 00:03:23,760
science Communicator as well as as a

77
00:03:28,729 --> 00:03:26,220
really great researcher in astrobiology

78
00:03:29,809 --> 00:03:28,739
before we jump into your research

79
00:03:32,030 --> 00:03:29,819
background though and what you're

80
00:03:34,309 --> 00:03:32,040
currently working on uh one thing I love

81
00:03:37,970 --> 00:03:34,319
to ask of our guests is what got you

82
00:03:39,470 --> 00:03:37,980
interested in science in astrobiology in

83
00:03:41,330 --> 00:03:39,480
the the realm that you've been pursuing

84
00:03:43,550 --> 00:03:41,340
in your life what was your science

85
00:03:46,670 --> 00:03:43,560
origin story

86
00:03:49,190 --> 00:03:46,680
well uh it actually is a little bit

87
00:03:51,589 --> 00:03:49,200
surprising I did not know that I wanted

88
00:03:54,110 --> 00:03:51,599

to be a scientist until a little bit

89
00:03:55,910 --> 00:03:54,120
later on uh in my childhood so I was not

90
00:03:57,110 --> 00:03:55,920
one of those kids that you looked at and

91
00:03:59,030 --> 00:03:57,120
went oh that's she's going to be a

92
00:04:00,410 --> 00:03:59,040
scientist for sure um in fact I went a

93
00:04:02,570 --> 00:04:00,420
lot of my childhood thinking I couldn't

94
00:04:04,910 --> 00:04:02,580
be a scientist because I wasn't very

95
00:04:06,530 --> 00:04:04,920
good at math so I was really struggled

96
00:04:07,910 --> 00:04:06,540
with math when I was in middle school

97
00:04:09,170 --> 00:04:07,920
and high school and because of that I

98
00:04:10,309 --> 00:04:09,180
was kind of deterred away from doing

99
00:04:13,149 --> 00:04:10,319
science

100
00:04:15,410 --> 00:04:13,159
unfortunately I didn't really listen

101
00:04:17,569 --> 00:04:15,420
I sort of fell in love with science

102
00:04:19,550 --> 00:04:17,579
through marine biology interestingly so

103
00:04:21,530 --> 00:04:19,560
I got to participate in an internship

104
00:04:24,890 --> 00:04:21,540
when I was in high school

105
00:04:26,570 --> 00:04:24,900
approaching college application time and

106
00:04:29,510 --> 00:04:26,580
I got to do some marine biology

107
00:04:31,610 --> 00:04:29,520
experiments with the Shedd Aquarium and

108
00:04:33,890 --> 00:04:31,620
that's what's sold me on doing science

109
00:04:35,689 --> 00:04:33,900
so I pursued a degree in initially

110
00:04:37,490 --> 00:04:35,699
marine biology at Cal State Long Beach

111
00:04:39,710 --> 00:04:37,500
and then I switched over to General

112
00:04:41,090 --> 00:04:39,720
biology because I I realized and through

113
00:04:43,310 --> 00:04:41,100

my coursework that I just love biology

114
00:04:46,430 --> 00:04:43,320
in general and I kind of stuck with that

115
00:04:48,770 --> 00:04:46,440
course until pretty late in my undergrad

116
00:04:50,749 --> 00:04:48,780
actually as a postback I was doing some

117
00:04:53,150 --> 00:04:50,759
research at City of Hope Medical Center

118
00:04:55,249 --> 00:04:53,160
I'm out here in California

119
00:04:57,409 --> 00:04:55,259
and thinking about grad school and what

120
00:04:58,730 --> 00:04:57,419
I wanted to do and realizing that there

121
00:05:00,650 --> 00:04:58,740
was a whole world out there of different

122
00:05:03,770 --> 00:05:00,660
things that I could study and I happened

123
00:05:07,249 --> 00:05:03,780
to cross the NASA astrobiology Institute

124
00:05:10,010 --> 00:05:07,259
website incidentally uh and my world was

125
00:05:11,749 --> 00:05:10,020
just brought uh I had no idea that

126
00:05:13,310 --> 00:05:11,759
astrobiology was a thing and there it

127
00:05:16,249 --> 00:05:13,320
was you know this website and not only

128
00:05:17,510 --> 00:05:16,259
did astrobiology exist NASA was excited

129
00:05:19,610 --> 00:05:17,520
about it

130
00:05:20,930 --> 00:05:19,620
um and so I haven't looked back since I

131
00:05:22,430 --> 00:05:20,940
decided right then and there that's what

132
00:05:24,050 --> 00:05:22,440
I wanted to do and that's how I

133
00:05:26,330 --> 00:05:24,060
discovered astrobiology kind of by

134
00:05:28,670 --> 00:05:26,340
accident through a Google search

135
00:05:31,189 --> 00:05:28,680
I love it so much and honestly marine

136
00:05:33,650 --> 00:05:31,199
biology is like a Gateway Science for so

137
00:05:34,909 --> 00:05:33,660
many people I also love marine biology I

138
00:05:37,310 --> 00:05:34,919

was an intern at The Graduate School of

139
00:05:39,050 --> 00:05:37,320
oceanography I off I often talk to other

140
00:05:41,270 --> 00:05:39,060
people who've pursued various Realms of

141
00:05:43,070 --> 00:05:41,280
astrobiology who started off in that

142
00:05:44,749 --> 00:05:43,080
realm and so maybe in some ways wanting

143
00:05:46,909 --> 00:05:44,759
to know what the alien life of our own

144
00:05:49,129 --> 00:05:46,919
oceans is like kind of leads us towards

145
00:05:50,870 --> 00:05:49,139
some of those ideas but then in your

146
00:05:53,090 --> 00:05:50,880
Graduate Studies you were studying more

147
00:05:55,430 --> 00:05:53,100
in the origins of Life the chemical

148
00:05:56,749 --> 00:05:55,440
origins of Life can you explain to us a

149
00:05:58,249 --> 00:05:56,759
bit more about your graduate research

150
00:06:00,710 --> 00:05:58,259
and what you were pursuing and trying to

151
00:06:04,070 --> 00:06:00,720
understand how life begins

152
00:06:05,689 --> 00:06:04,080
yeah so I was very lucky to be part of a

153
00:06:07,790 --> 00:06:05,699
super exciting project that started

154
00:06:09,469 --> 00:06:07,800
right when I started my PhD at the

155
00:06:12,110 --> 00:06:09,479
University of Wisconsin-Madison my

156
00:06:15,590 --> 00:06:12,120
advisor was a botanist named David Baum

157
00:06:18,650 --> 00:06:15,600
uh who had just secured funding from a

158
00:06:21,350 --> 00:06:18,660
program run by NASA and the NSF to do

159
00:06:23,090 --> 00:06:21,360
high-risk science uh for solving the

160
00:06:25,610 --> 00:06:23,100
origin of life or at least part of the

161
00:06:27,770 --> 00:06:25,620
mystery of the origin of life uh and so

162
00:06:30,770 --> 00:06:27,780
that was super exciting and basically my

163
00:06:33,710 --> 00:06:30,780

role in my PhD was uh

164
00:06:35,570 --> 00:06:33,720
testing out an experimental procedure to

165
00:06:37,249 --> 00:06:35,580
validate a model that they'd come up

166
00:06:39,170 --> 00:06:37,259
with for the origin of life and that

167
00:06:41,210 --> 00:06:39,180
model was pretty simple it was that you

168
00:06:42,770 --> 00:06:41,220
could get the processes of life on

169
00:06:45,409 --> 00:06:42,780
things like the ability to grow and

170
00:06:47,629 --> 00:06:45,419
reproduce and evolve in systems of

171
00:06:50,270 --> 00:06:47,639
chemicals in the absence of life

172
00:06:51,890 --> 00:06:50,280
and so we had a whole sort of scenario

173
00:06:53,930 --> 00:06:51,900
for how that might happen that involves

174
00:06:56,330 --> 00:06:53,940
mineral surfaces and mixing those with

175
00:06:58,670 --> 00:06:56,340
chemicals and then eventually getting

176
00:07:01,909 --> 00:06:58,680
these kind of self-perpetuating evolving

177
00:07:03,590 --> 00:07:01,919
chemical networks which is very cool and

178
00:07:04,850 --> 00:07:03,600
very risky um you know it's basically

179
00:07:06,409 --> 00:07:04,860
just mixing a whole bunch of stuff

180
00:07:08,870 --> 00:07:06,419
together in a test tube and then looking

181
00:07:11,029 --> 00:07:08,880
for these lifelike processes

182
00:07:13,249 --> 00:07:11,039
um and so that was the the bulk of my

183
00:07:14,930 --> 00:07:13,259
PhD it was was developing that procedure

184
00:07:17,570 --> 00:07:14,940
and then implementing it to look for

185
00:07:19,129 --> 00:07:17,580
signs of these lifelike chemical systems

186
00:07:20,930 --> 00:07:19,139
as we call them

187
00:07:22,909 --> 00:07:20,940
um to understand how life originated

188
00:07:23,930 --> 00:07:22,919

which we are still clueless about at

189
00:07:25,490 --> 00:07:23,940
this point

190
00:07:27,110 --> 00:07:25,500
yeah absolutely we don't know if life

191
00:07:29,089 --> 00:07:27,120
started on Earth or elsewhere and came

192
00:07:30,770 --> 00:07:29,099
here we don't know the process and maybe

193
00:07:32,689 --> 00:07:30,780
Evolution itself was just throwing a

194
00:07:33,650 --> 00:07:32,699
bunch of stuff together and seeing what

195
00:07:35,089 --> 00:07:33,660
happened

196
00:07:37,010 --> 00:07:35,099
um so that's really exciting I will say

197
00:07:39,710 --> 00:07:37,020
I don't know exactly when you and I

198
00:07:41,689 --> 00:07:39,720
first interacted online or in life but I

199
00:07:44,809 --> 00:07:41,699
do remember you kind of helping to put

200
00:07:46,610 --> 00:07:44,819
together and lead the ulala Symposium at

201
00:07:47,809 --> 00:07:46,620
UW-Madison

202
00:07:50,570 --> 00:07:47,819
um I wonder if you can explain for our

203
00:07:52,309 --> 00:07:50,580
audience what that was is uh and your

204
00:07:54,170 --> 00:07:52,319
role in developing that Symposium for

205
00:07:56,210 --> 00:07:54,180
bringing together astrobiologists to

206
00:07:58,909 --> 00:07:56,220
talk about their research

207
00:08:01,490 --> 00:07:58,919
yeah so uh while I was at UW-Madison I

208
00:08:03,890 --> 00:08:01,500
took advantage of a grant program that

209
00:08:05,629 --> 00:08:03,900
was at the University to fund Outreach

210
00:08:08,150 --> 00:08:05,639
programs and specifically to highlight

211
00:08:09,290 --> 00:08:08,160
women in stem and so I applied for the

212
00:08:11,270 --> 00:08:09,300
grant and I thought it would be a great

213
00:08:13,909 --> 00:08:11,280

opportunity not only to bring attention

214
00:08:16,370 --> 00:08:13,919
to astrobiology on the UW-Madison campus

215
00:08:18,110 --> 00:08:16,380
which was still relatively unknown at

216
00:08:20,450 --> 00:08:18,120
the time it was pretty small we only had

217
00:08:22,010 --> 00:08:20,460
I believe one or two

218
00:08:24,950 --> 00:08:22,020
um kind of research efforts at

219
00:08:27,110 --> 00:08:24,960
UW-Madison in astrobiology but also

220
00:08:28,070 --> 00:08:27,120
highlight um some some women in the

221
00:08:30,290 --> 00:08:28,080
field who I thought were doing

222
00:08:32,209 --> 00:08:30,300
absolutely incredible work so we got

223
00:08:34,010 --> 00:08:32,219
funding to bring four scientists to

224
00:08:36,469 --> 00:08:34,020
campus kind of across different

225
00:08:38,810 --> 00:08:36,479
disciplines Under the Umbrella of

226
00:08:40,670 --> 00:08:38,820
astrobiology who came to give talks to

227
00:08:43,250 --> 00:08:40,680
the public but then also interact with

228
00:08:46,070 --> 00:08:43,260
various departments at UW-Madison just

229
00:08:47,570 --> 00:08:46,080
to bring exposure to the field and you

230
00:08:49,370 --> 00:08:47,580
know let people know let students know

231
00:08:50,810 --> 00:08:49,380
in particular hey this is something you

232
00:08:52,370 --> 00:08:50,820
can do you know this is an area of

233
00:08:55,430 --> 00:08:52,380
science that a lot of people aren't

234
00:08:56,750 --> 00:08:55,440
aware of and it's really exciting and if

235
00:08:58,610 --> 00:08:56,760
it's something that interests you here

236
00:09:00,650 --> 00:08:58,620
are examples of scientists who are doing

237
00:09:02,750 --> 00:09:00,660
some really groundbreaking work in

238
00:09:05,210 --> 00:09:02,760

that area so that kind of launched the

239
00:09:07,610 --> 00:09:05,220
Oola initiative at UW-Madison which was

240
00:09:09,889 --> 00:09:07,620
an extension of that where we sort of

241
00:09:12,110 --> 00:09:09,899
Consolidated all the astrobiology

242
00:09:14,090 --> 00:09:12,120
research that was happening on the

243
00:09:17,150 --> 00:09:14,100
campus which was growing and as it

244
00:09:19,310 --> 00:09:17,160
continues to grow on the campus and also

245
00:09:21,230 --> 00:09:19,320
do Outreach and spread the word Beyond

246
00:09:23,630 --> 00:09:21,240
just the Wolves of UW-Madison about the

247
00:09:24,889 --> 00:09:23,640
work that's being done there I love that

248
00:09:26,930 --> 00:09:24,899
so much it's so important for

249
00:09:28,790 --> 00:09:26,940
representation for inclusion for people

250
00:09:30,170 --> 00:09:28,800
to see people who look like them from

251
00:09:31,910 --> 00:09:30,180
various Realms including lots of the

252
00:09:33,769 --> 00:09:31,920
amazing women who are doing incredible

253
00:09:35,690 --> 00:09:33,779
things throughout astrobiology and all

254
00:09:37,550 --> 00:09:35,700
the Sciences involved in our quest to

255
00:09:39,110 --> 00:09:37,560
understand life and I definitely want to

256
00:09:40,730 --> 00:09:39,120
come back to science Communication in

257
00:09:42,710 --> 00:09:40,740
just a minute and using social media for

258
00:09:44,210 --> 00:09:42,720
instance the share science but first I

259
00:09:47,210 --> 00:09:44,220
want to talk about your current research

260
00:09:49,190 --> 00:09:47,220
you are now at JPL which might be like

261
00:09:52,070 --> 00:09:49,200
the mecca of space exploration for a lot

262
00:09:53,090 --> 00:09:52,080
of people it's a pretty cool place

263
00:09:54,769 --> 00:09:53,100

um I wonder if you can just share with

264
00:09:56,509 --> 00:09:54,779
our audience your current research at

265
00:09:57,949 --> 00:09:56,519
JPL and what it's like being a NASA

266
00:09:59,750 --> 00:09:57,959
postdoc

267
00:10:01,970 --> 00:09:59,760
yeah it is super exciting it's always

268
00:10:03,470 --> 00:10:01,980
been my dream

269
00:10:05,509 --> 00:10:03,480
um so it's still kind of surreal for me

270
00:10:08,090 --> 00:10:05,519
to be there um but yeah I am part of a

271
00:10:10,490 --> 00:10:08,100
really amazing diverse team that in

272
00:10:12,290 --> 00:10:10,500
general our goal is you know if we

273
00:10:14,690 --> 00:10:12,300
imagine project into the future that

274
00:10:17,449 --> 00:10:14,700
we're able to send a spacecraft to the

275
00:10:18,470 --> 00:10:17,459
outer solar system uh to one of the icy

276
00:10:20,870 --> 00:10:18,480
moons

277
00:10:23,630 --> 00:10:20,880
um say Europa the moon of Jupiters or

278
00:10:26,030 --> 00:10:23,640
Enceladus the moon of Saturns and we can

279
00:10:28,850 --> 00:10:26,040
land there and reach the surface maybe

280
00:10:30,470 --> 00:10:28,860
go a little bit below the surface and

281
00:10:32,389 --> 00:10:30,480
look for signs of Life there how would

282
00:10:34,490 --> 00:10:32,399
we do that if there are signs of Life on

283
00:10:35,930 --> 00:10:34,500
these icy moons on the surface what

284
00:10:37,310 --> 00:10:35,940
kinds of instruments would we need to

285
00:10:38,829 --> 00:10:37,320
send up there and what would they need

286
00:10:41,449 --> 00:10:38,839
to do what would they need to look for

287
00:10:43,490 --> 00:10:41,459
as definitive Signs of Life

288
00:10:45,050 --> 00:10:43,500

and so that the way we're trying to

289
00:10:46,910 --> 00:10:45,060
answer that question is by simulating

290
00:10:48,710 --> 00:10:46,920
aspects of those environments so we know

291
00:10:51,050 --> 00:10:48,720
that they're very very harsh in a lot of

292
00:10:53,030 --> 00:10:51,060
ways so they're very cold first of all

293
00:10:55,430 --> 00:10:53,040
um but they also are exposed to various

294
00:10:57,590 --> 00:10:55,440
kinds of radiation and lots of it and we

295
00:10:59,930 --> 00:10:57,600
know that biology right the structures

296
00:11:01,250 --> 00:10:59,940
of biology really don't do well in those

297
00:11:03,170 --> 00:11:01,260
environments

298
00:11:05,690 --> 00:11:03,180
and so the question is you know if if

299
00:11:07,970 --> 00:11:05,700
those exist there would be would they be

300
00:11:09,410 --> 00:11:07,980
detectable uh will they be altered by

301
00:11:10,970 --> 00:11:09,420
the radiation and is that something we

302
00:11:12,769 --> 00:11:10,980
need to take into consideration when

303
00:11:14,870 --> 00:11:12,779
we're designing these missions

304
00:11:16,730 --> 00:11:14,880
and so you know recreating those aspects

305
00:11:19,370 --> 00:11:16,740
in a laboratory is super important so we

306
00:11:21,949 --> 00:11:19,380
have a variety of vacuum Chambers with

307
00:11:24,310 --> 00:11:21,959
electron or different radiation sources

308
00:11:26,990 --> 00:11:24,320
including electrons ultraviolet light

309
00:11:29,210 --> 00:11:27,000
and we basically blast various things

310
00:11:31,370 --> 00:11:29,220
including full cells with that radiation

311
00:11:32,870 --> 00:11:31,380
at various temperatures and look at what

312
00:11:35,090 --> 00:11:32,880
comes out the other end to make sure

313
00:11:36,530 --> 00:11:35,100

that we're able to detect them

314
00:11:38,630 --> 00:11:36,540
um and so yeah that's basically what we

315
00:11:39,829 --> 00:11:38,640
do we just Blast Off with radiation and

316
00:11:41,690 --> 00:11:39,839
then do a whole bunch of chemical

317
00:11:43,970 --> 00:11:41,700
analysis to figure out what kinds of

318
00:11:46,310 --> 00:11:43,980
biosignatures we should be targeting

319
00:11:47,990 --> 00:11:46,320
very cool and my own research in the

320
00:11:50,090 --> 00:11:48,000
past I had a chance to go to board Fjord

321
00:11:51,650 --> 00:11:50,100
pass in the high Arctic to a site where

322
00:11:53,509 --> 00:11:51,660
fluid is moving through a glacier and

323
00:11:55,569 --> 00:11:53,519
depositing material on the surface

324
00:11:57,470 --> 00:11:55,579
providing for us a way to see to see how

325
00:11:59,210 --> 00:11:57,480
biosignatures are preserved on the

326
00:12:01,069 --> 00:11:59,220
surface of a cold environment we have

327
00:12:03,350 --> 00:12:01,079
similar environments in Antarctica with

328
00:12:04,850 --> 00:12:03,360
blood falls in the Taylor Valley there's

329
00:12:06,769 --> 00:12:04,860
a lot of cool environments around the

330
00:12:07,790 --> 00:12:06,779
earth that we can look at but I wonder

331
00:12:09,949 --> 00:12:07,800
if you can just share with our audience

332
00:12:11,930 --> 00:12:09,959
how different the environments are at

333
00:12:13,550 --> 00:12:11,940
the near surface of Europa and Enceladus

334
00:12:14,690 --> 00:12:13,560
compared to the things that we find here

335
00:12:17,269 --> 00:12:14,700
on Earth

336
00:12:18,769 --> 00:12:17,279
yeah so those are great analog sites and

337
00:12:20,810 --> 00:12:18,779
there are lots of them but I think the

338
00:12:22,850 --> 00:12:20,820

big big difference probably I mean there

339
00:12:24,889 --> 00:12:22,860
are a lot of differences you know the

340
00:12:26,329 --> 00:12:24,899
Earth and these moons are different in

341
00:12:28,190 --> 00:12:26,339
other ways both in size and where they

342
00:12:29,690 --> 00:12:28,200
are in the solar system and all that um

343
00:12:32,930 --> 00:12:29,700
but I think the radiation is the big

344
00:12:35,750 --> 00:12:32,940
thing um you know Jupiter

345
00:12:37,970 --> 00:12:35,760
um you know that Europa orbits is

346
00:12:39,470 --> 00:12:37,980
producing a lot of ionizing radiation so

347
00:12:42,590 --> 00:12:39,480
these really high energy particles

348
00:12:44,389 --> 00:12:42,600
they're basically just punch through

349
00:12:45,650 --> 00:12:44,399
um biological molecules and create a lot

350
00:12:47,389 --> 00:12:45,660
of damage

351
00:12:49,310 --> 00:12:47,399
um there are there are some forms of

352
00:12:51,230 --> 00:12:49,320
ionizing radiation that affect us here

353
00:12:54,050 --> 00:12:51,240
on Earth but um the story is very

354
00:12:55,370 --> 00:12:54,060
different around Jupiter and so any life

355
00:12:57,290 --> 00:12:55,380
that exists that there would have to

356
00:12:58,910 --> 00:12:57,300
contend with this very aggressive very

357
00:13:01,009 --> 00:12:58,920
strong form of radiation

358
00:13:02,930 --> 00:13:01,019
so that's one one huge difference the

359
00:13:04,250 --> 00:13:02,940
other big difference that also plays

360
00:13:05,329 --> 00:13:04,260
into this is the presence of an

361
00:13:09,050 --> 00:13:05,339
atmosphere

362
00:13:11,509 --> 00:13:09,060
which among other things does protect us

363
00:13:12,829 --> 00:13:11,519

quite a bit from radiation

364
00:13:14,810 --> 00:13:12,839
um that is not the case on the surface

365
00:13:16,430 --> 00:13:14,820
of your open en solidus

366
00:13:18,410 --> 00:13:16,440
um it may have a very very thin what we

367
00:13:19,910 --> 00:13:18,420
call exosphere but it's very marginal

368
00:13:22,069 --> 00:13:19,920
and it doesn't do much in the way of

369
00:13:24,430 --> 00:13:22,079
protecting so um those are the big big

370
00:13:27,170 --> 00:13:24,440
differences and and they do matter a lot

371
00:13:28,610 --> 00:13:27,180
when we're thinking about biosignatures

372
00:13:29,810 --> 00:13:28,620
and how well they would be preserved in

373
00:13:31,310 --> 00:13:29,820
those environments when they're dealing

374
00:13:32,930 --> 00:13:31,320
with these really really aggressive

375
00:13:34,850 --> 00:13:32,940
forms of radiation

376
00:13:36,470 --> 00:13:34,860
absolutely and that's a great segue to

377
00:13:38,930 --> 00:13:36,480
the poll that we put out yesterday for

378
00:13:40,370 --> 00:13:38,940
our audience we asked people what might

379
00:13:42,949 --> 00:13:40,380
be the biggest challenge in their own

380
00:13:45,050 --> 00:13:42,959
view for finding Signs of Life at or

381
00:13:46,910 --> 00:13:45,060
near the surface of a world like Europa

382
00:13:49,490 --> 00:13:46,920
we gave them the options of freezing

383
00:13:51,410 --> 00:13:49,500
temperatures of the high radiation or a

384
00:13:54,350 --> 00:13:51,420
lot of salt in that environment the very

385
00:13:56,690 --> 00:13:54,360
low pressure or low water activity and

386
00:13:57,889 --> 00:13:56,700
more than half of the respondents did

387
00:13:59,870 --> 00:13:57,899
say that it was radiation that they

388
00:14:02,269 --> 00:13:59,880

thought would be the biggest issue the

389
00:14:04,129 --> 00:14:02,279
next largest uh almost 25 percent of

390
00:14:06,470 --> 00:14:04,139
those respondents said the freezing

391
00:14:08,389 --> 00:14:06,480
temperatures were an issue for finding

392
00:14:09,889 --> 00:14:08,399
possible signs of life and and maybe

393
00:14:10,970 --> 00:14:09,899
they were even talking about active life

394
00:14:11,870 --> 00:14:10,980
and I think we should you know

395
00:14:14,449 --> 00:14:11,880
differentiate we're not looking

396
00:14:16,670 --> 00:14:14,459
necessarily just for active cells at the

397
00:14:18,530 --> 00:14:16,680
surface of Europa but looking for signs

398
00:14:20,329 --> 00:14:18,540
of of life's activity

399
00:14:21,350 --> 00:14:20,339
um past or present

400
00:14:23,690 --> 00:14:21,360
um and so that's kind of interesting we

401
00:14:25,490 --> 00:14:23,700
did have one person respond to that they

402
00:14:27,530 --> 00:14:25,500
they weren't aware that these were

403
00:14:28,910 --> 00:14:27,540
possible issues and so it's really

404
00:14:30,710 --> 00:14:28,920
important I think to share that these

405
00:14:32,930 --> 00:14:30,720
are very different environments for us

406
00:14:35,210 --> 00:14:32,940
to explore now you've mentioned you're

407
00:14:36,949 --> 00:14:35,220
using these these test Chambers to kind

408
00:14:38,930 --> 00:14:36,959
of recreate the biology we create the

409
00:14:40,550 --> 00:14:38,940
biosignatures we could look for what

410
00:14:42,170 --> 00:14:40,560
kinds of biosignatures are you looking

411
00:14:43,970 --> 00:14:42,180
at right now or are you throwing in like

412
00:14:45,650 --> 00:14:43,980
active live organisms and then seeing

413
00:14:47,389 --> 00:14:45,660

how they might produce signatures in

414
00:14:49,430 --> 00:14:47,399
that environment

415
00:14:51,470 --> 00:14:49,440
and so the answer is all of the above so

416
00:14:52,790 --> 00:14:51,480
we're sort of casting a pretty wide net

417
00:14:54,710 --> 00:14:52,800
um so obviously one of the things we're

418
00:14:56,750 --> 00:14:54,720
looking for the the stuff of life right

419
00:14:59,269 --> 00:14:56,760
the molecules of life so what we call

420
00:15:01,009 --> 00:14:59,279
chemical biosignatures you know so you

421
00:15:03,110 --> 00:15:01,019
know if if there were an organism at the

422
00:15:04,910 --> 00:15:03,120
surface that's bombarded by radiation

423
00:15:07,129 --> 00:15:04,920
you know maybe it wouldn't be alive but

424
00:15:08,689 --> 00:15:07,139
it might leave behind traces of its

425
00:15:10,490 --> 00:15:08,699
presence that we can go in and detect

426
00:15:12,170 --> 00:15:10,500
after some time

427
00:15:13,370 --> 00:15:12,180
um so we are looking at those so we're

428
00:15:15,350 --> 00:15:13,380
looking at different types of

429
00:15:17,329 --> 00:15:15,360
macromolecules so for example amino

430
00:15:19,370 --> 00:15:17,339
acids lipids

431
00:15:21,110 --> 00:15:19,380
um nucleic acids so all the things that

432
00:15:24,110 --> 00:15:21,120
cells tend to be made of we are

433
00:15:26,389 --> 00:15:24,120
targeting we are also looking at cells

434
00:15:28,550 --> 00:15:26,399
themselves and that is a big part of the

435
00:15:30,110 --> 00:15:28,560
work that I'm doing right now is not

436
00:15:32,150 --> 00:15:30,120
just these chemical bio signatures but

437
00:15:34,490 --> 00:15:32,160
actually the cells themselves

438
00:15:36,530 --> 00:15:34,500

um do those provide a protective effect

439
00:15:38,329 --> 00:15:36,540
you know are we more likely to detect

440
00:15:40,129 --> 00:15:38,339
whole cells and we are these chemical

441
00:15:42,410 --> 00:15:40,139
biosignatures which might be much more

442
00:15:44,269 --> 00:15:42,420
sensitive by themselves

443
00:15:47,030 --> 00:15:44,279
um so yeah so we're kind of looking at

444
00:15:48,769 --> 00:15:47,040
both whole cells um and then also the

445
00:15:49,550 --> 00:15:48,779
the biochemical biosignatures they

446
00:15:52,250 --> 00:15:49,560
produce

447
00:15:54,230 --> 00:15:52,260
oh that's so cool uh I will say so a

448
00:15:56,689 --> 00:15:54,240
chemist uh Dr Ian Miller reached out to

449
00:15:58,490 --> 00:15:56,699
me on Facebook earlier today and he

450
00:16:00,769 --> 00:15:58,500
argued that it's not possible for life

451
00:16:02,569 --> 00:16:00,779
to start in Europa or Enceladus in Ocean

452
00:16:03,650 --> 00:16:02,579
worlds we've heard this argument from

453
00:16:04,730 --> 00:16:03,660
others

454
00:16:05,930 --> 00:16:04,740
um there are some who've been on the

455
00:16:08,090 --> 00:16:05,940
show even who have the hot spring

456
00:16:09,949 --> 00:16:08,100
hypothesis for instance

457
00:16:12,170 --> 00:16:09,959
um suggesting life had to start on a dry

458
00:16:14,269 --> 00:16:12,180
environment here on Earth one of the

459
00:16:16,850 --> 00:16:14,279
arguments for there not being potential

460
00:16:18,350 --> 00:16:16,860
life on Europa Enceladus has been a lack

461
00:16:20,509 --> 00:16:18,360
of phosphorus or at least what we

462
00:16:22,550 --> 00:16:20,519
thought was a lack of phosphorus a paper

463
00:16:25,370 --> 00:16:22,560

just came out today and was shared by

464
00:16:28,370 --> 00:16:25,380
the NASA astrobio Twitter account where

465
00:16:29,870 --> 00:16:28,380
they found signs of phosphorus salts in

466
00:16:32,210 --> 00:16:29,880
the e-ring around Saturn coming from

467
00:16:34,250 --> 00:16:32,220
Enceladus and so I guess just for a fun

468
00:16:36,410 --> 00:16:34,260
personal question for you do you think

469
00:16:38,689 --> 00:16:36,420
Europa or Enceladus is more likely the

470
00:16:40,009 --> 00:16:38,699
better Target to go to right now for us

471
00:16:41,329 --> 00:16:40,019
to look for possible signs of life

472
00:16:43,430 --> 00:16:41,339
especially now that we have evidence

473
00:16:47,150 --> 00:16:43,440
that there is phosphorus in the the

474
00:16:50,269 --> 00:16:47,160
encelada the the Saturn e-ring

475
00:16:51,410 --> 00:16:50,279
well so I I have an answer but it's not

476
00:16:54,410 --> 00:16:51,420
based on whether or not I think I think

477
00:16:56,329 --> 00:16:54,420
life is more likely to

478
00:16:58,009 --> 00:16:56,339
eat because my I have a blanket answer

479
00:17:00,769 --> 00:16:58,019
for that and then say we have no idea

480
00:17:02,389 --> 00:17:00,779
what life needs even here on Earth um

481
00:17:04,850 --> 00:17:02,399
it's impossible right now for us to

482
00:17:06,770 --> 00:17:04,860
disentangle that history uh and and say

483
00:17:08,569 --> 00:17:06,780
it with certainty you know life can only

484
00:17:10,669 --> 00:17:08,579
develop with this kind of environment

485
00:17:12,049 --> 00:17:10,679
with these specific things

486
00:17:13,250 --> 00:17:12,059
um that is just not we're just not in

487
00:17:15,890 --> 00:17:13,260
that place and there's good reason to

488
00:17:17,750 --> 00:17:15,900

think we'll never be in that position

489
00:17:19,370 --> 00:17:17,760
um on the other hand we can say you know

490
00:17:20,809 --> 00:17:19,380
maybe life can arise in lots of

491
00:17:22,130 --> 00:17:20,819
different places as long as long as it

492
00:17:23,929 --> 00:17:22,140
has a bare minimum so I'm going to be

493
00:17:25,250 --> 00:17:23,939
optimistic and say that life could arise

494
00:17:26,809 --> 00:17:25,260
anywhere

495
00:17:28,490 --> 00:17:26,819
um that has the right ingredients and

496
00:17:30,230 --> 00:17:28,500
right now it seems like both Europa and

497
00:17:31,850 --> 00:17:30,240
solidus do so let's say that that's even

498
00:17:33,710 --> 00:17:31,860
chances on both

499
00:17:36,289 --> 00:17:33,720
um I would put my money on Enceladus

500
00:17:38,450 --> 00:17:36,299
right now only because

501
00:17:40,310 --> 00:17:38,460
um looking at the structure of these

502
00:17:42,710 --> 00:17:40,320
moons and their Interiors we think that

503
00:17:44,090 --> 00:17:42,720
if life exists it probably does well

504
00:17:46,130 --> 00:17:44,100
below the surface

505
00:17:47,810 --> 00:17:46,140
far below where we're able to access

506
00:17:49,970 --> 00:17:47,820
right so we're talking about drilling

507
00:17:51,110 --> 00:17:49,980
through kilometers of ice and that's

508
00:17:52,970 --> 00:17:51,120
just not something we're able to do

509
00:17:54,710 --> 00:17:52,980
technologically right now

510
00:17:56,750 --> 00:17:54,720
um the nice thing within solidus we know

511
00:17:58,730 --> 00:17:56,760
sort of for sure is that there are

512
00:18:00,110 --> 00:17:58,740
mechanisms by which material from the

513
00:18:01,490 --> 00:18:00,120

subsurface come up to the surface

514
00:18:03,230 --> 00:18:01,500
through these kind of geyser-like

515
00:18:04,909 --> 00:18:03,240
mechanisms that may also be the case

516
00:18:06,650 --> 00:18:04,919
with Europa still figuring that out

517
00:18:08,990 --> 00:18:06,660
Clipper next year will have well in a

518
00:18:10,850 --> 00:18:09,000
few years will help us figure that out

519
00:18:12,470 --> 00:18:10,860
um but just because we know that there

520
00:18:14,450 --> 00:18:12,480
is this mechanism by which stuff from

521
00:18:16,130 --> 00:18:14,460
the subsurface comes up

522
00:18:17,570 --> 00:18:16,140
um we might have a better chance of

523
00:18:19,370 --> 00:18:17,580
sampling that material and therefore

524
00:18:20,690 --> 00:18:19,380
detecting signs of life if they exist so

525
00:18:22,010 --> 00:18:20,700
I'm going to put my money on Enceladus

526
00:18:24,289 --> 00:18:22,020
but not because I think it has a better

527
00:18:25,430 --> 00:18:24,299
chance of having life in Europa because

528
00:18:27,650 --> 00:18:25,440
I think we have a better chance of

529
00:18:29,870 --> 00:18:27,660
detecting it I love that yeah yeah

530
00:18:31,669 --> 00:18:29,880
Solace is just spewing possible

531
00:18:33,529 --> 00:18:31,679
biosignatures and the space for us to go

532
00:18:35,690 --> 00:18:33,539
fly through and look at we need another

533
00:18:37,430 --> 00:18:35,700
mission and soon I do want to change

534
00:18:39,409 --> 00:18:37,440
gears a little bit now to talk about

535
00:18:40,610 --> 00:18:39,419
your presence on social media and all of

536
00:18:42,890 --> 00:18:40,620
the communication that you've done

537
00:18:44,330 --> 00:18:42,900
you've grown a rather large following

538
00:18:46,789 --> 00:18:44,340

across many different social media

539
00:18:48,950 --> 00:18:46,799
platforms your user handles are at

540
00:18:51,350 --> 00:18:48,960
astrobiolina for those who want to

541
00:18:53,570 --> 00:18:51,360
follow you in various places

542
00:18:55,190 --> 00:18:53,580
um what was the the structure for you to

543
00:18:56,690 --> 00:18:55,200
kind of get engaged what drove you to

544
00:18:58,010 --> 00:18:56,700
share so much science through social

545
00:18:59,750 --> 00:18:58,020
media

546
00:19:01,909 --> 00:18:59,760
yeah so actually didn't start through

547
00:19:03,770 --> 00:19:01,919
social media so um you know the first

548
00:19:05,090 --> 00:19:03,780
few years of my PhD I did a lot of

549
00:19:06,650 --> 00:19:05,100
Outreach and science communication

550
00:19:09,470 --> 00:19:06,660
through what I would call more

551
00:19:12,830 --> 00:19:09,480
traditional platforms right so in person

552
00:19:15,890 --> 00:19:12,840
speaking to the public schools churches

553
00:19:18,529 --> 00:19:15,900
retirement homes uh and the jump to

554
00:19:21,049 --> 00:19:18,539
social media really didn't come until uh

555
00:19:23,049 --> 00:19:21,059
after the start of the pandemic when we

556
00:19:25,549 --> 00:19:23,059
saw some of these new platforms arise

557
00:19:27,950 --> 00:19:25,559
people were turning to social media for

558
00:19:30,890 --> 00:19:27,960
a lot of entertainment I was part of

559
00:19:32,990 --> 00:19:30,900
that group uh and actually you know a

560
00:19:36,289 --> 00:19:33,000
year or so into it so say in the summer

561
00:19:37,909 --> 00:19:36,299
of 2021 I kind of happened across this

562
00:19:40,250 --> 00:19:37,919
whole new realm of social media which

563
00:19:42,289 --> 00:19:40,260

was education right education on social

564
00:19:44,029 --> 00:19:42,299
media sharing educational content

565
00:19:46,850 --> 00:19:44,039
whether that's cycom or something else

566
00:19:49,370 --> 00:19:46,860
you know balancing a budget uh using a

567
00:19:51,350 --> 00:19:49,380
Lightroom or some kind of software

568
00:19:52,970 --> 00:19:51,360
and I it really hadn't clicked to me

569
00:19:55,909 --> 00:19:52,980
that social media could be used

570
00:19:58,850 --> 00:19:55,919
effectively for cycom until then and so

571
00:20:00,710 --> 00:19:58,860
I kind of on a whim through my hat in I

572
00:20:01,970 --> 00:20:00,720
created a video actually had nothing to

573
00:20:03,470 --> 00:20:01,980
do with science at the time it was how

574
00:20:06,710 --> 00:20:03,480
to use PowerPoint to make a good

575
00:20:08,870 --> 00:20:06,720
presentation and I kind of blew up and I

576
00:20:10,490 --> 00:20:08,880
rode that wave for a little bit and then

577
00:20:11,450 --> 00:20:10,500
when that sort of came to an end I was

578
00:20:13,510 --> 00:20:11,460
like I wonder if people would be

579
00:20:15,409 --> 00:20:13,520
interested in my science in astrobiology

580
00:20:18,289 --> 00:20:15,419
and I didn't know of a lot of people

581
00:20:19,970 --> 00:20:18,299
doing uh astrobiology cycom in that

582
00:20:21,710 --> 00:20:19,980
realm specifically on things like Tick

583
00:20:24,529 --> 00:20:21,720
Tock and Instagram reels

584
00:20:26,870 --> 00:20:24,539
uh and so um yeah I kind of capitalized

585
00:20:28,730 --> 00:20:26,880
on that made some videos and sort of

586
00:20:32,029 --> 00:20:28,740
took off from there so that was my entry

587
00:20:33,590 --> 00:20:32,039
into cycom on social media I love it so

588
00:20:35,750 --> 00:20:33,600

much now in the realm of science

589
00:20:37,610 --> 00:20:35,760
communication for those of us who have

590
00:20:40,190 --> 00:20:37,620
continued pursuing our research careers

591
00:20:41,570 --> 00:20:40,200
while also sharing science we do have

592
00:20:43,850 --> 00:20:41,580
that issue sometimes that we butt up

593
00:20:46,010 --> 00:20:43,860
against of especially amongst

594
00:20:47,510 --> 00:20:46,020
traditional academics is this idea that

595
00:20:48,830 --> 00:20:47,520
if you're sharing science actively and

596
00:20:50,930 --> 00:20:48,840
you're pursuing that role that you can't

597
00:20:52,190 --> 00:20:50,940
be a good researcher at the same time

598
00:20:53,930 --> 00:20:52,200
and sometimes it's referred to as the

599
00:20:55,669 --> 00:20:53,940
Sagan effect there were a lot of people

600
00:20:57,169 --> 00:20:55,679
who felt like Carl Sagan putting so much

601
00:20:59,450 --> 00:20:57,179
time into writing books and and

602
00:21:01,909 --> 00:20:59,460
producing Cosmos wasn't also doing

603
00:21:03,289 --> 00:21:01,919
effective and good research have you

604
00:21:04,909 --> 00:21:03,299
noticed that kind of that kind of

605
00:21:06,049 --> 00:21:04,919
dichotomy that some people have viewed

606
00:21:07,490 --> 00:21:06,059
that you're doing good science

607
00:21:09,650 --> 00:21:07,500
communication so you can't be a good

608
00:21:11,750 --> 00:21:09,660
researcher and if so how have you kind

609
00:21:13,669 --> 00:21:11,760
of dealt with that struggle

610
00:21:15,169 --> 00:21:13,679
I have and I also point out that there

611
00:21:16,970 --> 00:21:15,179
is the opposite problem so I am a

612
00:21:18,529 --> 00:21:16,980
Scientist but um you know I have a lot

613
00:21:20,390 --> 00:21:18,539

of colleagues and PSY Commerce who are

614
00:21:21,950 --> 00:21:20,400
not career scientists and they also

615
00:21:23,510 --> 00:21:21,960
receive a lot of criticism saying you

616
00:21:25,850 --> 00:21:23,520
know they're not scientists so how could

617
00:21:28,549 --> 00:21:25,860
they possibly you know be respected in

618
00:21:30,169 --> 00:21:28,559
in cycom and deliver effective cycom and

619
00:21:32,690 --> 00:21:30,179
I think all of that

620
00:21:34,549 --> 00:21:32,700
um is is not true right I think I do

621
00:21:35,630 --> 00:21:34,559
encounter the the opposite right the

622
00:21:37,250 --> 00:21:35,640
fact that

623
00:21:38,810 --> 00:21:37,260
um doing so much psychom and being so

624
00:21:40,970 --> 00:21:38,820
active with the public means that that's

625
00:21:42,710 --> 00:21:40,980
taking away somehow from my abilities as

626
00:21:44,390 --> 00:21:42,720
a career scientist

627
00:21:46,070 --> 00:21:44,400
and I've just not found that to be the

628
00:21:49,370 --> 00:21:46,080
case certainly in terms of time and

629
00:21:50,870 --> 00:21:49,380
effort right you have to make time there

630
00:21:52,430 --> 00:21:50,880
has to be time to do both of those

631
00:21:54,710 --> 00:21:52,440
things and that is a bit of a balancing

632
00:21:56,570 --> 00:21:54,720
act but I would argue that we have that

633
00:21:58,730 --> 00:21:56,580
Balancing Act regardless of whether or

634
00:22:00,830 --> 00:21:58,740
not we do cycom right balancing life and

635
00:22:02,630 --> 00:22:00,840
and the work is is a challenge that's

636
00:22:04,610 --> 00:22:02,640
pretty Universal

637
00:22:06,529 --> 00:22:04,620
um but yeah I think as long as as you

638
00:22:08,870 --> 00:22:06,539

can find the time and it's appropriate

639
00:22:10,549 --> 00:22:08,880
and it's and it's balanced I really

640
00:22:12,350 --> 00:22:10,559
don't see how they're mutually exclusive

641
00:22:14,930 --> 00:22:12,360
in fact I've found in my experience that

642
00:22:16,669 --> 00:22:14,940
both of those things right my

643
00:22:18,770 --> 00:22:16,679
um my career as a psy-commer and as a

644
00:22:20,029 --> 00:22:18,780
scientist have mutually benefited from

645
00:22:20,990 --> 00:22:20,039
each other and have really made me

646
00:22:23,750 --> 00:22:21,000
better

647
00:22:24,830 --> 00:22:23,760
in both of those cases so I do

648
00:22:26,390 --> 00:22:24,840
definitely encounter that but I think

649
00:22:28,850 --> 00:22:26,400
that's starting to wane a little bit as

650
00:22:31,070 --> 00:22:28,860
people really see the value of cycom

651
00:22:33,289 --> 00:22:31,080
and the value of having actual career

652
00:22:35,270 --> 00:22:33,299
scientists contribute

653
00:22:37,490 --> 00:22:35,280
um so yeah

654
00:22:38,870 --> 00:22:37,500
yeah absolutely and I I personally I've

655
00:22:40,490 --> 00:22:38,880
noticed a lot more amongst you know

656
00:22:42,529 --> 00:22:40,500
younger upcoming early career

657
00:22:44,450 --> 00:22:42,539
researchers tend to see more of the

658
00:22:46,549 --> 00:22:44,460
value than we traditionally have in

659
00:22:48,169 --> 00:22:46,559
sharing our science more openly and and

660
00:22:49,370 --> 00:22:48,179
doing more Community engagement and

661
00:22:50,990 --> 00:22:49,380
being part of their community and

662
00:22:52,430 --> 00:22:51,000
sharing and I love the idea of your

663
00:22:53,870 --> 00:22:52,440

science communication kind of improving

664
00:22:55,070 --> 00:22:53,880
your science it's just like you know

665
00:22:57,110 --> 00:22:55,080
reading a really good article and then

666
00:22:58,549 --> 00:22:57,120
talking about it with somebody else is a

667
00:23:00,110 --> 00:22:58,559
great way to understand that research

668
00:23:02,090 --> 00:23:00,120
and if you're talking about it with you

669
00:23:04,370 --> 00:23:02,100
know a half million people that's a much

670
00:23:05,570 --> 00:23:04,380
different way to talk about the research

671
00:23:07,370 --> 00:23:05,580
um I do want to jump into a few things

672
00:23:08,990 --> 00:23:07,380
you've been sharing lately

673
00:23:10,610 --> 00:23:09,000
um of your interests but before I get

674
00:23:12,649 --> 00:23:10,620
there just a reminder for our audience

675
00:23:15,529 --> 00:23:12,659
watching live you can ask your questions

676
00:23:16,730 --> 00:23:15,539
right now in the chat on YouTube for Dr

677
00:23:18,950 --> 00:23:16,740
Vincent and we will get to those

678
00:23:20,149 --> 00:23:18,960
questions very soon I promise but there

679
00:23:22,549 --> 00:23:20,159
are a few more things I want to know

680
00:23:24,110 --> 00:23:22,559
about uh first off of late Lena you've

681
00:23:26,510 --> 00:23:24,120
been sharing a lot of really cool stuff

682
00:23:28,310 --> 00:23:26,520
about scuba diving I've been kind of

683
00:23:30,230 --> 00:23:28,320
nerding out as a diver and someone who

684
00:23:32,810 --> 00:23:30,240
loves the ocean World especially marine

685
00:23:34,850 --> 00:23:32,820
life over all of these incredible videos

686
00:23:36,770 --> 00:23:34,860
uh I wonder if you can just share your

687
00:23:38,029 --> 00:23:36,780
journey as a diver and all these

688
00:23:38,990 --> 00:23:38,039

incredible things you've been doing with

689
00:23:41,210 --> 00:23:39,000
us

690
00:23:43,549 --> 00:23:41,220
yeah I'm I'm so excited to talk about it

691
00:23:45,230 --> 00:23:43,559
so it's a fairly new Venture for me um

692
00:23:47,029 --> 00:23:45,240
so it's funny it's also kind of coming

693
00:23:48,830 --> 00:23:47,039
full circle because as I mentioned I got

694
00:23:51,110 --> 00:23:48,840
my interest in science through the ocean

695
00:23:52,970 --> 00:23:51,120
to marine biology so it's been really

696
00:23:55,310 --> 00:23:52,980
fun to kind of close that Loop and come

697
00:23:57,350 --> 00:23:55,320
back to it so I scuba is always

698
00:23:59,210 --> 00:23:57,360
something I wanted to try but either

699
00:24:00,770 --> 00:23:59,220
just didn't have the time or was a

700
00:24:03,470 --> 00:24:00,780
little bit apprehensive about because it

701
00:24:05,270 --> 00:24:03,480
is kind of scary uh or just didn't have

702
00:24:08,029 --> 00:24:05,280
the funds because it is also a pretty

703
00:24:10,130 --> 00:24:08,039
expensive hobby it turns out

704
00:24:12,230 --> 00:24:10,140
um but last year in October I decided to

705
00:24:14,450 --> 00:24:12,240
go for it I'm here in California now

706
00:24:16,190 --> 00:24:14,460
there's great diving out here got

707
00:24:18,409 --> 00:24:16,200
certified kind of as a thing I thought

708
00:24:20,870 --> 00:24:18,419
I'd do as a as a hobby on vacation

709
00:24:24,470 --> 00:24:20,880
sometimes and yeah I was wrong about

710
00:24:26,390 --> 00:24:24,480
that I felt completely in love and um

711
00:24:28,789 --> 00:24:26,400
realized that there's a whole world of

712
00:24:30,770 --> 00:24:28,799
diving that incorporates science right

713
00:24:32,330 --> 00:24:30,780

so there's scientific diving this is

714
00:24:34,310 --> 00:24:32,340
something I was not aware of until

715
00:24:36,529 --> 00:24:34,320
fairly recently

716
00:24:38,750 --> 00:24:36,539
um so you can actually get certified to

717
00:24:41,810 --> 00:24:38,760
do science and contribute to research

718
00:24:43,370 --> 00:24:41,820
projects underwater with Scuba and so

719
00:24:45,529 --> 00:24:43,380
now that I know that that exists I'm

720
00:24:48,110 --> 00:24:45,539
looking for ways to kind of meld my

721
00:24:50,450 --> 00:24:48,120
skills as a scientist and as a diver and

722
00:24:52,130 --> 00:24:50,460
so I think diving is is very quickly

723
00:24:54,770 --> 00:24:52,140
become a big important part of my life

724
00:24:56,570 --> 00:24:54,780
but even just as a hobby uh you know I

725
00:24:57,470 --> 00:24:56,580
and now I look for any opportunities to

726
00:24:59,390 --> 00:24:57,480
dive

727
00:25:01,070 --> 00:24:59,400
um anywhere I travel uh is kind of right

728
00:25:03,169 --> 00:25:01,080
on my on the top of my list is look for

729
00:25:05,450 --> 00:25:03,179
a place to scuba uh and that's been

730
00:25:07,130 --> 00:25:05,460
super fun so yeah definitely if anyone's

731
00:25:09,409 --> 00:25:07,140
thought about trying it and isn't sure

732
00:25:11,210 --> 00:25:09,419
you should try it I love it yeah

733
00:25:12,890 --> 00:25:11,220
absolutely it's so incredible and there

734
00:25:14,990 --> 00:25:12,900
are different Pursuits in diving that

735
00:25:16,669 --> 00:25:15,000
people can go after like cave diving and

736
00:25:18,230 --> 00:25:16,679
other aspects of technical diving wreck

737
00:25:19,850 --> 00:25:18,240
diving all kinds of cool things that you

738
00:25:22,370 --> 00:25:19,860

can do if you're interested and you're

739
00:25:24,110 --> 00:25:22,380
okay with tight spaces for some of those

740
00:25:26,029 --> 00:25:24,120
um I will say so like you know many NASA

741
00:25:28,010 --> 00:25:26,039
astronauts to my knowledge all NASA

742
00:25:30,169 --> 00:25:28,020
astronauts have been certified to be

743
00:25:31,610 --> 00:25:30,179
divers that underwater environment is

744
00:25:34,490 --> 00:25:31,620
important for those who need to

745
00:25:36,470 --> 00:25:34,500
experience kind of neutral buoyancy but

746
00:25:37,789 --> 00:25:36,480
also kind of a more you know extreme

747
00:25:39,409 --> 00:25:37,799
environment you know where it's a little

748
00:25:42,049 --> 00:25:39,419
bit more scary kind of pushes the human

749
00:25:45,230 --> 00:25:42,059
body to a limit you are forced to rely

750
00:25:46,490 --> 00:25:45,240
on apparatus like scuba and I wonder for

751
00:25:48,289 --> 00:25:46,500
you uh in your own thinking of like

752
00:25:50,330 --> 00:25:48,299
training for astrobiology for the future

753
00:25:52,250 --> 00:25:50,340
do you think it'll be helpful for young

754
00:25:53,810 --> 00:25:52,260
people who want to be astrobiologists to

755
00:25:55,549 --> 00:25:53,820
experience the underwater environment

756
00:25:57,710 --> 00:25:55,559
will that help them think more about

757
00:25:59,810 --> 00:25:57,720
possible alien environments

758
00:26:00,890 --> 00:25:59,820
absolutely I mean one of the things that

759
00:26:02,630 --> 00:26:00,900
you mentioned right this neutral

760
00:26:05,149 --> 00:26:02,640
buoyancy first of all I think it's just

761
00:26:06,649 --> 00:26:05,159
such a a unique experience that you

762
00:26:08,149 --> 00:26:06,659
really don't get to do unless you go up

763
00:26:10,070 --> 00:26:08,159

into space right

764
00:26:12,049 --> 00:26:10,080
um and so I think just being down there

765
00:26:14,029 --> 00:26:12,059
and really kind of pushing the limits of

766
00:26:15,950 --> 00:26:14,039
where we can go as human beings right

767
00:26:18,590 --> 00:26:15,960
with the assistance of these kind of

768
00:26:20,930 --> 00:26:18,600
external gas sources uh I think

769
00:26:22,549 --> 00:26:20,940
absolutely puts things in perspective

770
00:26:24,110 --> 00:26:22,559
um and certainly for astrobiologists

771
00:26:25,970 --> 00:26:24,120
that are sort of exploring the limits of

772
00:26:27,710 --> 00:26:25,980
life and how weird it can get the

773
00:26:29,390 --> 00:26:27,720
underwater world is a perfect example of

774
00:26:31,130 --> 00:26:29,400
that and it's a perfect opportunity to

775
00:26:34,010 --> 00:26:31,140
reflect on that and really be inspired

776
00:26:35,690 --> 00:26:34,020
by the weirdness of underwater creatures

777
00:26:37,310 --> 00:26:35,700
so yeah I think there's absolutely

778
00:26:38,750 --> 00:26:37,320
benefits for people who are considering

779
00:26:41,390 --> 00:26:38,760
ashbiology but I think just in general

780
00:26:42,890 --> 00:26:41,400
as a person right as a human being

781
00:26:44,690 --> 00:26:42,900
um just kind of getting outside of our

782
00:26:47,450 --> 00:26:44,700
our comfort zone which tends to be on

783
00:26:49,730 --> 00:26:47,460
dry land uh can be super beneficial and

784
00:26:50,750 --> 00:26:49,740
I highly recommend it awesome I love it

785
00:26:52,430 --> 00:26:50,760
so much

786
00:26:54,049 --> 00:26:52,440
um one more question then for me before

787
00:26:56,570 --> 00:26:54,059
we go to our faster than life segment

788
00:26:58,850 --> 00:26:56,580

you also in your own social media your

789
00:27:00,529 --> 00:26:58,860
life you've been chasing aurorae you've

790
00:27:01,909 --> 00:27:00,539
been watching storms actually I know

791
00:27:03,049 --> 00:27:01,919
that if there is a solar storm there's a

792
00:27:04,730 --> 00:27:03,059
good chance you're gonna post about it

793
00:27:06,169 --> 00:27:04,740
on Twitter and I can follow along and

794
00:27:07,490 --> 00:27:06,179
see what's going on

795
00:27:09,110 --> 00:27:07,500
um I wonder if you can speak like what

796
00:27:10,430 --> 00:27:09,120
what is your your interest what's your

797
00:27:13,190 --> 00:27:10,440
fascination with space weather that's

798
00:27:14,870 --> 00:27:13,200
driven you to chase some aurorae

799
00:27:16,490 --> 00:27:14,880
yeah you know I actually don't really

800
00:27:18,110 --> 00:27:16,500
know where it started I think I've

801
00:27:20,570 --> 00:27:18,120
always been really interested in weather

802
00:27:21,830 --> 00:27:20,580
in general so severe weather so um you

803
00:27:23,810 --> 00:27:21,840
know I haven't lived in a lot of places

804
00:27:25,909 --> 00:27:23,820
where we have severe weather things like

805
00:27:27,110 --> 00:27:25,919
tornadoes and big fish severe

806
00:27:28,610 --> 00:27:27,120
thunderstorms but I've always been

807
00:27:31,070 --> 00:27:28,620
fascinated by them

808
00:27:32,870 --> 00:27:31,080
I love clouds I love the the kind of

809
00:27:35,029 --> 00:27:32,880
impending doom aspect of it I don't know

810
00:27:37,789 --> 00:27:35,039
what it is I love watching storm chasing

811
00:27:39,590 --> 00:27:37,799
shows uh so and I've kind of made a

812
00:27:40,909 --> 00:27:39,600
hobby out of tracking those severe

813
00:27:43,190 --> 00:27:40,919

weather systems even if they have

814
00:27:44,930 --> 00:27:43,200
nothing to do with me geographically

815
00:27:46,610 --> 00:27:44,940
and I think that sort of spiraled into

816
00:27:48,649 --> 00:27:46,620
just space weather

817
00:27:50,750 --> 00:27:48,659
um you know the this amazing phenomenon

818
00:27:52,010 --> 00:27:50,760
we have here on Earth at the Aurora

819
00:27:53,450 --> 00:27:52,020
um these beautiful light displays that

820
00:27:56,149 --> 00:27:53,460
we have and the fact that they originate

821
00:27:58,310 --> 00:27:56,159
from the Sun uh and interact with our

822
00:28:01,250 --> 00:27:58,320
magnetic field I think is so elegant and

823
00:28:03,950 --> 00:28:01,260
so cool and so beautiful and I've gotten

824
00:28:06,289 --> 00:28:03,960
to see the aurora now a few times uh I

825
00:28:09,649 --> 00:28:06,299
actually went to Alaska last year as a

826
00:28:10,970 --> 00:28:09,659
post-graduation trip uh for myself and

827
00:28:12,470 --> 00:28:10,980
got to experience them in a way it

828
00:28:14,029 --> 00:28:12,480
hadn't before and

829
00:28:15,470 --> 00:28:14,039
um again another thing I would recommend

830
00:28:17,149 --> 00:28:15,480
for people if they have the opportunity

831
00:28:19,070 --> 00:28:17,159
to go witness because it is really

832
00:28:20,390 --> 00:28:19,080
life-changing

833
00:28:22,730 --> 00:28:20,400
um but yeah that's that's where my

834
00:28:24,230 --> 00:28:22,740
interest in them came from I love it so

835
00:28:25,490 --> 00:28:24,240
much yeah it's so cool

836
00:28:26,870 --> 00:28:25,500
um just that connection I love that you

837
00:28:28,850 --> 00:28:26,880
pointed out this is connecting us to our

838
00:28:30,110 --> 00:28:28,860

star in our own solar system and it's

839
00:28:31,789 --> 00:28:30,120
always fun I think one of the best

840
00:28:33,890 --> 00:28:31,799
things of exploring astrobiology and

841
00:28:35,210 --> 00:28:33,900
space science is becoming of how they're

842
00:28:37,490 --> 00:28:35,220
becoming aware of how connected we

843
00:28:38,870 --> 00:28:37,500
really are to everything

844
00:28:40,070 --> 00:28:38,880
um and so thank you so much for sharing

845
00:28:42,669 --> 00:28:40,080
all of that I do want to get to our

846
00:28:45,110 --> 00:28:42,679
audience questions but first we have our

847
00:28:46,669 --> 00:28:45,120
faster than light segment so really

848
00:28:47,990 --> 00:28:46,679
short answers kind of just some fun

849
00:28:50,210 --> 00:28:48,000
questions that we like to ask of

850
00:28:52,549 --> 00:28:50,220
everyone the first one comes directly

851
00:28:54,110 --> 00:28:52,559
from me because I nerd out over it

852
00:28:56,690 --> 00:28:54,120
um with this idea of the Fermi question

853
00:28:58,909 --> 00:28:56,700
or Fermi Paradox so for you Dr Elena

854
00:29:01,850 --> 00:28:58,919
Vincent what is your favorite answer to

855
00:29:04,310 --> 00:29:01,860
fermi's question where are they

856
00:29:06,289 --> 00:29:04,320
oh well there are a lot of potential

857
00:29:07,850 --> 00:29:06,299
answers but the ones I tend to favor are

858
00:29:09,130 --> 00:29:07,860
the ones that really highlight how

859
00:29:12,169 --> 00:29:09,140
little we know

860
00:29:14,330 --> 00:29:12,179
and that oftentimes we might be looking

861
00:29:15,289 --> 00:29:14,340
for the wrong thing and in the wrong

862
00:29:17,029 --> 00:29:15,299
place

863
00:29:19,130 --> 00:29:17,039

so there are a number of different ideas

864
00:29:21,110 --> 00:29:19,140
about the fact that you know these these

865
00:29:22,970 --> 00:29:21,120
civilizations these alien civilizations

866
00:29:24,470 --> 00:29:22,980
that they exist might very well be

867
00:29:25,909 --> 00:29:24,480
transmitting they might exist they might

868
00:29:27,710 --> 00:29:25,919
be trying to make connections with us

869
00:29:29,210 --> 00:29:27,720
but we are not looking at the right

870
00:29:30,769 --> 00:29:29,220
thing we tend to be looking for radio

871
00:29:31,970 --> 00:29:30,779
signals

872
00:29:34,130 --> 00:29:31,980
um you know maybe they're using

873
00:29:35,930 --> 00:29:34,140
something else whether that's neutrinos

874
00:29:37,549 --> 00:29:35,940
lasers or something completely different

875
00:29:39,710 --> 00:29:37,559
that we just cannot conceptualize right

876
00:29:41,690 --> 00:29:39,720
now because we know so little about

877
00:29:43,430 --> 00:29:41,700
everything let alone other civilizations

878
00:29:45,110 --> 00:29:43,440
if they exist so that tends to be my

879
00:29:46,669 --> 00:29:45,120
favorite answers we have no idea what to

880
00:29:48,769 --> 00:29:46,679
look for I

881
00:29:50,210 --> 00:29:48,779
I love it so much that makes me think of

882
00:29:52,310 --> 00:29:50,220
like gravitational waves and like more

883
00:29:54,409 --> 00:29:52,320
kind of out there physics Concepts and

884
00:29:55,730 --> 00:29:54,419
cosmology and how aliens might be like

885
00:29:57,110 --> 00:29:55,740
shifting around neutron stars and

886
00:29:59,810 --> 00:29:57,120
sending messages there's so many things

887
00:30:01,490 --> 00:29:59,820
that could be happening out there and so

888
00:30:02,930 --> 00:30:01,500

for myself I'm a huge fan of Science

889
00:30:05,529 --> 00:30:02,940
Fiction I've always learned that over

890
00:30:08,149 --> 00:30:05,539
Star Trek Star Wars I wonder for you

891
00:30:09,769 --> 00:30:08,159
what stories have inspired you to want

892
00:30:11,269 --> 00:30:09,779
to know more about the nature of the

893
00:30:13,549 --> 00:30:11,279
universe

894
00:30:15,350 --> 00:30:13,559
so definitely science fiction I am a

895
00:30:16,789 --> 00:30:15,360
huge science fiction nerd if you can see

896
00:30:19,250 --> 00:30:16,799
the books in my bookcase you'd see about

897
00:30:20,389 --> 00:30:19,260
90 of them are sci-fi

898
00:30:21,950 --> 00:30:20,399
um so I definitely get a lot of

899
00:30:24,169 --> 00:30:21,960
inspiration there I think it's been such

900
00:30:26,630 --> 00:30:24,179
a powerful tool for imagining just how

901
00:30:28,370 --> 00:30:26,640
weird life can get that's really kind of

902
00:30:31,370 --> 00:30:28,380
the only tool that we have right now

903
00:30:34,430 --> 00:30:31,380
that allows us to kind of Envision fully

904
00:30:36,049 --> 00:30:34,440
what life might be like elsewhere

905
00:30:37,490 --> 00:30:36,059
um I had one that I just recently reread

906
00:30:39,649 --> 00:30:37,500
that's one of my favorites is a short

907
00:30:41,990 --> 00:30:39,659
story called story of your life by Ted

908
00:30:44,090 --> 00:30:42,000
Chung which inspired the movie arrival

909
00:30:45,769 --> 00:30:44,100
which is also a fantastic film it's an

910
00:30:47,750 --> 00:30:45,779
even better short story in my opinion so

911
00:30:49,430 --> 00:30:47,760
definitely sci-fi but also like we were

912
00:30:52,490 --> 00:30:49,440
talking about earlier

913
00:30:55,130 --> 00:30:52,500

um the ocean and how weird life can get

914
00:30:56,510 --> 00:30:55,140
um I think just just pushing the limits

915
00:30:59,269 --> 00:30:56,520
the boundaries what we think is possible

916
00:31:01,130 --> 00:30:59,279
in terms of shape and Physiology and how

917
00:31:02,810 --> 00:31:01,140
weird things can get really inspires me

918
00:31:03,950 --> 00:31:02,820
to think about how weird they could get

919
00:31:07,250 --> 00:31:03,960
elsewhere

920
00:31:08,510 --> 00:31:07,260
um so yeah life on Earth I love it I

921
00:31:09,769 --> 00:31:08,520
actually just finished stories of your

922
00:31:11,090 --> 00:31:09,779
life and others last night for the

923
00:31:13,010 --> 00:31:11,100
second time it's a great short Story

924
00:31:14,330 --> 00:31:13,020
collection he has a new short Story

925
00:31:15,830 --> 00:31:14,340
collection not that I have not read yet

926
00:31:17,090 --> 00:31:15,840
so I need to jump over to that next I

927
00:31:19,130 --> 00:31:17,100
think

928
00:31:20,690 --> 00:31:19,140
um so right now where you are in a

929
00:31:22,549 --> 00:31:20,700
career I mean you're very successful

930
00:31:24,049 --> 00:31:22,559
you're now a postdoc at JPL doing

931
00:31:25,730 --> 00:31:24,059
remarkable research you've had some

932
00:31:26,990 --> 00:31:25,740
different research along the way you

933
00:31:29,330 --> 00:31:27,000
mentioned that you started off kind of

934
00:31:31,669 --> 00:31:29,340
interested in Marine Biology but I

935
00:31:33,710 --> 00:31:31,679
wonder if you could go back to the

936
00:31:35,870 --> 00:31:33,720
beginning of your collegiate career your

937
00:31:38,870 --> 00:31:35,880
academic career and give yourself some

938
00:31:42,710 --> 00:31:38,880

advice what would you say

939
00:31:45,230 --> 00:31:42,720
I would say that being an expert in one

940
00:31:47,930 --> 00:31:45,240
specific thing is overrated

941
00:31:49,490 --> 00:31:47,940
uh you know obviously having experts and

942
00:31:50,930 --> 00:31:49,500
expertise is super important but at

943
00:31:53,029 --> 00:31:50,940
least in terms of being something to

944
00:31:54,350 --> 00:31:53,039
strive for I've really learned that

945
00:31:56,330 --> 00:31:54,360
there are much more important things you

946
00:31:58,430 --> 00:31:56,340
know I used to have this Vision that to

947
00:31:59,990 --> 00:31:58,440
be successful and to be valued by in the

948
00:32:01,430 --> 00:32:00,000
by the world was you know to be that

949
00:32:03,470 --> 00:32:01,440
expert in that one thing you know that

950
00:32:04,909 --> 00:32:03,480
people bring into a courtroom or you

951
00:32:06,649 --> 00:32:04,919
know like you're really the one person

952
00:32:08,450 --> 00:32:06,659
who can comment on something and I think

953
00:32:10,250 --> 00:32:08,460
that's great but I think for me

954
00:32:12,590 --> 00:32:10,260
personally I've found much more value in

955
00:32:14,810 --> 00:32:12,600
pursuing things like enjoying the work

956
00:32:17,330 --> 00:32:14,820
right having fun with it uh working with

957
00:32:18,769 --> 00:32:17,340
great people uh and also having the

958
00:32:20,450 --> 00:32:18,779
opportunity to change expertise

959
00:32:22,490 --> 00:32:20,460
sometimes and that's something I've done

960
00:32:23,930 --> 00:32:22,500
a lot in my career you know I've become

961
00:32:26,510 --> 00:32:23,940
an expert in one thing and then I move

962
00:32:28,250 --> 00:32:26,520
on to something else that interests me

963
00:32:29,870 --> 00:32:28,260

um while again having expertise in one

964
00:32:31,130 --> 00:32:29,880
specific thing super valuable and we

965
00:32:33,230 --> 00:32:31,140
need those people

966
00:32:36,110 --> 00:32:33,240
um it's also totally okay and important

967
00:32:37,490 --> 00:32:36,120
to recognize that interest shift

968
00:32:38,450 --> 00:32:37,500
um and you can do something else if you

969
00:32:40,310 --> 00:32:38,460
want to

970
00:32:41,870 --> 00:32:40,320
I love that and that's very much in the

971
00:32:43,190 --> 00:32:41,880
vein of this next question then of

972
00:32:45,710 --> 00:32:43,200
changing things if you want to or what

973
00:32:47,450 --> 00:32:45,720
could happen for any of us

974
00:32:49,730 --> 00:32:47,460
um what is something that excites you

975
00:32:52,370 --> 00:32:49,740
about the future

976
00:32:54,769 --> 00:32:52,380
oh I think pretty simple I'm just

977
00:32:56,510 --> 00:32:54,779
excited about learning more about the

978
00:32:58,190 --> 00:32:56,520
the place that we live in specifically

979
00:32:59,750 --> 00:32:58,200
the solar system right obviously there's

980
00:33:01,310 --> 00:32:59,760
so many discoveries and things we need

981
00:33:02,570 --> 00:33:01,320
to learn about Earth

982
00:33:04,430 --> 00:33:02,580
um and some of that might come through

983
00:33:06,529 --> 00:33:04,440
exploring other worlds so we have really

984
00:33:07,970 --> 00:33:06,539
exciting missions to places like Venus

985
00:33:09,590 --> 00:33:07,980
our other next door neighbor that we

986
00:33:11,690 --> 00:33:09,600
really know almost nothing about and I

987
00:33:13,850 --> 00:33:11,700
think it's pretty pretty shameful when

988
00:33:15,169 --> 00:33:13,860

you think about it uh so I'm really

989
00:33:17,330 --> 00:33:15,179
excited to see what we're going to learn

990
00:33:19,549 --> 00:33:17,340
from places like Venus and what they can

991
00:33:20,690 --> 00:33:19,559
tell us about our own history and where

992
00:33:22,730 --> 00:33:20,700
we're going

993
00:33:25,070 --> 00:33:22,740
um and then obviously just reaching

994
00:33:27,470 --> 00:33:25,080
further out into the solar system seeing

995
00:33:29,210 --> 00:33:27,480
what these other worlds are about um

996
00:33:31,070 --> 00:33:29,220
something about you know dragonfly to

997
00:33:32,990 --> 00:33:31,080
Titan Europa Clipper that's launching

998
00:33:35,450 --> 00:33:33,000
next year is being built right here at

999
00:33:36,889 --> 00:33:35,460
JPL so yeah I'm just really excited

1000
00:33:38,690 --> 00:33:36,899
about those

1001
00:33:40,070 --> 00:33:38,700
I love it so much yeah I'm excited for

1002
00:33:41,630 --> 00:33:40,080
those missions I'm excited for what the

1003
00:33:44,750 --> 00:33:41,640
future has for all of us to learn about

1004
00:33:46,490 --> 00:33:44,760
our place together as a civilization now

1005
00:33:48,590 --> 00:33:46,500
you're doing such remarkable work at JPL

1006
00:33:49,909 --> 00:33:48,600
you get to play with these mini icy

1007
00:33:51,529 --> 00:33:49,919
World Chambers you've developed and

1008
00:33:53,029 --> 00:33:51,539
you're putting stuff inside to see what

1009
00:33:55,789 --> 00:33:53,039
happens and testing the instrumentation

1010
00:33:58,250 --> 00:33:55,799
will take to space with us but what is

1011
00:34:01,909 --> 00:33:58,260
the best part of your job

1012
00:34:04,250 --> 00:34:01,919
oh um I would say probably the people I

1013
00:34:06,710 --> 00:34:04,260

get to work with I I think that's such

1014
00:34:08,329 --> 00:34:06,720
an important part of of every every job

1015
00:34:09,950 --> 00:34:08,339
right is not just the work that we're

1016
00:34:12,290 --> 00:34:09,960
doing the specific research that we get

1017
00:34:15,109 --> 00:34:12,300
to do and I'm very lucky in that both of

1018
00:34:16,550 --> 00:34:15,119
those things are are so great for me and

1019
00:34:17,990 --> 00:34:16,560
aligned very much with what I want to do

1020
00:34:20,270 --> 00:34:18,000
and I love my job and I love what I

1021
00:34:22,970 --> 00:34:20,280
research but I think without having a

1022
00:34:25,310 --> 00:34:22,980
really solid team of people that you can

1023
00:34:27,230 --> 00:34:25,320
that you trust and that you can interact

1024
00:34:28,849 --> 00:34:27,240
with on a daily basis and defer to right

1025
00:34:31,669 --> 00:34:28,859
tend to be experts in lots of different

1026
00:34:33,950 --> 00:34:31,679
things none of it really works right um

1027
00:34:36,290 --> 00:34:33,960
and so I think I'm very lucky that here

1028
00:34:38,329 --> 00:34:36,300
at JPL I work with an incredible team of

1029
00:34:40,310 --> 00:34:38,339
people who are all not only friendly and

1030
00:34:41,750 --> 00:34:40,320
kind and great human beings but also do

1031
00:34:43,970 --> 00:34:41,760
such cool science and are excited about

1032
00:34:45,230 --> 00:34:43,980
so many different things uh and so I

1033
00:34:47,329 --> 00:34:45,240
think that's the best part is just being

1034
00:34:50,450 --> 00:34:47,339
excited with really cool people about

1035
00:34:51,530 --> 00:34:50,460
really exciting things awesome I love it

1036
00:34:53,149 --> 00:34:51,540
so much

1037
00:34:54,589 --> 00:34:53,159
um so the last question from our faster

1038
00:34:56,089 --> 00:34:54,599

than light round and this is my favorite

1039
00:34:58,609 --> 00:34:56,099
of them all

1040
00:35:00,970 --> 00:34:58,619
what is an unbelievable science fact

1041
00:35:03,349 --> 00:35:00,980
that still blows your mind

1042
00:35:05,570 --> 00:35:03,359
okay and there are some obviously so

1043
00:35:07,970 --> 00:35:05,580
many but I think one that confronts me

1044
00:35:09,950 --> 00:35:07,980
pretty much every night at least every

1045
00:35:12,530 --> 00:35:09,960
clear night is

1046
00:35:14,210 --> 00:35:12,540
um the number of exoplanets out there uh

1047
00:35:15,770 --> 00:35:14,220
so you know you look at the night sky on

1048
00:35:17,690 --> 00:35:15,780
a clear night when you can see stars and

1049
00:35:19,609 --> 00:35:17,700
you and you you your mind is already

1050
00:35:21,829 --> 00:35:19,619
crumbling at the thought of how many

1051
00:35:23,810 --> 00:35:21,839
stars are out there but the fact that we

1052
00:35:25,910 --> 00:35:23,820
think that for at least every planet you

1053
00:35:27,410 --> 00:35:25,920
see there's at least one exoplanet so

1054
00:35:29,569 --> 00:35:27,420
for all the stars you're seeing there

1055
00:35:32,210 --> 00:35:29,579
might be this just flood of exoplanets

1056
00:35:34,069 --> 00:35:32,220
that you can't see is just not only is

1057
00:35:35,510 --> 00:35:34,079
it cool I like I can't wrap my brain

1058
00:35:38,030 --> 00:35:35,520
around it and every night I try to sit

1059
00:35:40,190 --> 00:35:38,040
up at the sky and say they're out there

1060
00:35:41,690 --> 00:35:40,200
and I just can't accept it because I

1061
00:35:44,329 --> 00:35:41,700
can't see them so not only is it

1062
00:35:45,650 --> 00:35:44,339
unbelievable it's also just hard to wrap

1063
00:35:48,290 --> 00:35:45,660

your head around

1064
00:35:50,210 --> 00:35:48,300
very cool I love it yeah there are so

1065
00:35:51,710 --> 00:35:50,220
many remarkable things to know about our

1066
00:35:53,270 --> 00:35:51,720
universe and our place in it and we're

1067
00:35:54,890 --> 00:35:53,280
still just barely touching the tip of an

1068
00:35:57,530 --> 00:35:54,900
iceberg of knowledge that's available

1069
00:35:58,849 --> 00:35:57,540
out there I will now jump to our

1070
00:36:00,470 --> 00:35:58,859
audience questions I see that we

1071
00:36:01,910 --> 00:36:00,480
actually have had a bunch of them come

1072
00:36:03,109 --> 00:36:01,920
in so thank you to all of you watching

1073
00:36:06,170 --> 00:36:03,119
live and those who've asked questions

1074
00:36:08,750 --> 00:36:06,180
online using the hashtag ask astrobio

1075
00:36:10,910 --> 00:36:08,760
the first question comes from Tom Caruso

1076
00:36:13,310 --> 00:36:10,920
who's user rendering reality 3D

1077
00:36:15,109 --> 00:36:13,320
animations on YouTube

1078
00:36:17,329 --> 00:36:15,119
um they want to know if you can discuss

1079
00:36:19,970 --> 00:36:17,339
changes in seawater chemistry on Earth

1080
00:36:22,190 --> 00:36:19,980
over time uh and how that compares to

1081
00:36:24,770 --> 00:36:22,200
what we currently know about the the icy

1082
00:36:27,109 --> 00:36:24,780
ocean worlds of our solar system

1083
00:36:28,790 --> 00:36:27,119
well uh it's maybe going to be sort of

1084
00:36:30,890 --> 00:36:28,800
an unsatisfying answer but we don't know

1085
00:36:32,630 --> 00:36:30,900
very much so we do know that the

1086
00:36:34,310 --> 00:36:32,640
chemistry of the ocean has changed

1087
00:36:36,349 --> 00:36:34,320
significantly over time in different

1088
00:36:37,670 --> 00:36:36,359

parameters you know both um its

1089
00:36:39,109 --> 00:36:37,680
oxygenation level which is super

1090
00:36:40,670 --> 00:36:39,119
important

1091
00:36:42,950 --> 00:36:40,680
um so you know do we know that deep in

1092
00:36:45,290 --> 00:36:42,960
its past there was little to no

1093
00:36:46,970 --> 00:36:45,300
atmospheric oxygen and that of course

1094
00:36:49,010 --> 00:36:46,980
affected the chemistry of the ocean

1095
00:36:50,210 --> 00:36:49,020
itself uh we know that the kinds of

1096
00:36:52,190 --> 00:36:50,220
things that were dissolved in the ocean

1097
00:36:53,750 --> 00:36:52,200
really different as well the types of

1098
00:36:55,190 --> 00:36:53,760
metals that were present it's

1099
00:36:56,990 --> 00:36:55,200
temperature it's pH so pretty much

1100
00:36:59,270 --> 00:36:57,000
everything about the ocean has changed

1101
00:37:01,910 --> 00:36:59,280
over time the specifics of that that

1102
00:37:04,069 --> 00:37:01,920
evolution is is still unclear the timing

1103
00:37:06,290 --> 00:37:04,079
of it and there's a lot of work being

1104
00:37:08,870 --> 00:37:06,300
done in astrobiology to figure that out

1105
00:37:10,670 --> 00:37:08,880
and also how that would affect biology

1106
00:37:13,310 --> 00:37:10,680
right obviously all of those things

1107
00:37:16,250 --> 00:37:13,320
really really influence what's possible

1108
00:37:18,530 --> 00:37:16,260
physiologically in terms of metabolism

1109
00:37:19,910 --> 00:37:18,540
um so that's being worked on there's

1110
00:37:21,950 --> 00:37:19,920
also a huge amount of uncertainty about

1111
00:37:23,690 --> 00:37:21,960
what the oceans of these ocean worlds

1112
00:37:25,849 --> 00:37:23,700
are like we have a tiny bit of

1113
00:37:27,530 --> 00:37:25,859

information and that is this the the

1114
00:37:29,210 --> 00:37:27,540
kind of the subject of some of these

1115
00:37:30,890 --> 00:37:29,220
upcoming missions is to try to get some

1116
00:37:32,630 --> 00:37:30,900
clarity on that but we really don't know

1117
00:37:33,890 --> 00:37:32,640
very much we know that they are mostly

1118
00:37:35,089 --> 00:37:33,900
liquid water

1119
00:37:36,650 --> 00:37:35,099
um they have stuff dissolved in them

1120
00:37:38,030 --> 00:37:36,660
they might be salty

1121
00:37:39,650 --> 00:37:38,040
um and again all those are things that

1122
00:37:41,810 --> 00:37:39,660
are important for biology but we are

1123
00:37:43,609 --> 00:37:41,820
still I would say very we have a lot of

1124
00:37:44,930 --> 00:37:43,619
work to do to figure out

1125
00:37:46,490 --> 00:37:44,940
um what the specifics of those

1126
00:37:48,109 --> 00:37:46,500
conditions are

1127
00:37:49,130 --> 00:37:48,119
yeah absolutely so much more to learn

1128
00:37:51,829 --> 00:37:49,140
yet

1129
00:37:55,609 --> 00:37:51,839
our next question comes from Jim pass on

1130
00:37:57,290 --> 00:37:55,619
Twitter at astrosociology and Jim is not

1131
00:37:59,930 --> 00:37:57,300
asking a sociology question this time

1132
00:38:02,329 --> 00:37:59,940
necessarily which is interesting so Jim

1133
00:38:04,010 --> 00:38:02,339
wants to know if or when the search for

1134
00:38:05,930 --> 00:38:04,020
intelligent extraterrestrial life is

1135
00:38:08,329 --> 00:38:05,940
successful do you think it'll be through

1136
00:38:10,970 --> 00:38:08,339
detection of Bio signatures techno

1137
00:38:13,609 --> 00:38:10,980
signatures or some combination of both

1138
00:38:15,230 --> 00:38:13,619

wow that's very hard to predict I would

1139
00:38:16,250 --> 00:38:15,240
say

1140
00:38:19,310 --> 00:38:16,260
um

1141
00:38:21,290 --> 00:38:19,320
no I think we still there's still so

1142
00:38:22,910 --> 00:38:21,300
much we don't understand in terms of you

1143
00:38:24,710 --> 00:38:22,920
know first of all the the distribution

1144
00:38:26,569 --> 00:38:24,720
of life in the universe whether it

1145
00:38:28,310 --> 00:38:26,579
exists elsewhere

1146
00:38:31,490 --> 00:38:28,320
um and what it will be like I think it's

1147
00:38:33,410 --> 00:38:31,500
very hard to make sort of probabilistic

1148
00:38:34,910 --> 00:38:33,420
um projections about where that

1149
00:38:36,650 --> 00:38:34,920
detection will come from without knowing

1150
00:38:37,970 --> 00:38:36,660
the specifics of what the life that is

1151
00:38:41,630 --> 00:38:37,980
producing those signatures is going to

1152
00:38:43,430 --> 00:38:41,640
be like however I would probably just

1153
00:38:45,470 --> 00:38:43,440
based on you know making assumptions

1154
00:38:47,270 --> 00:38:45,480
about the history of life on Earth

1155
00:38:48,829 --> 00:38:47,280
um and you know the fact that its

1156
00:38:50,690 --> 00:38:48,839
history really was dominated by

1157
00:38:52,370 --> 00:38:50,700
microbial life simpler life that wasn't

1158
00:38:54,589 --> 00:38:52,380
putting out for example sophisticated

1159
00:38:56,450 --> 00:38:54,599
radio signals out into space

1160
00:38:58,010 --> 00:38:56,460
um I'd probably focus on biosignatures

1161
00:38:59,210 --> 00:38:58,020
again just making very strong

1162
00:39:02,150 --> 00:38:59,220
assumptions you're making me pick

1163
00:39:03,650 --> 00:39:02,160

something so I would pick bio signatures

1164
00:39:05,810 --> 00:39:03,660
um just because of that just because you

1165
00:39:07,730 --> 00:39:05,820
know the the moment in history that the

1166
00:39:09,349 --> 00:39:07,740
kind of slice of history that we've been

1167
00:39:11,270 --> 00:39:09,359
broadcasting radio signals for is

1168
00:39:12,950 --> 00:39:11,280
relatively short

1169
00:39:15,109 --> 00:39:12,960
um you know compared to this history of

1170
00:39:18,230 --> 00:39:15,119
of Earth to begin with um so I would go

1171
00:39:21,650 --> 00:39:18,240
with that but it's a very very arm wavy

1172
00:39:23,810 --> 00:39:21,660
uh presumptuous answer yeah absolutely

1173
00:39:25,490 --> 00:39:23,820
you just don't know right

1174
00:39:26,690 --> 00:39:25,500
um I love it so I our next question

1175
00:39:28,430 --> 00:39:26,700
actually comes from one of our

1176
00:39:30,050 --> 00:39:28,440
production assistants

1177
00:39:31,430 --> 00:39:30,060
um who's been a visiting scholar with me

1178
00:39:33,710 --> 00:39:31,440
at Blue Marble space Institute of

1179
00:39:36,349 --> 00:39:33,720
science he was a past intern with me and

1180
00:39:38,150 --> 00:39:36,359
now he's starting his PhD work uh this

1181
00:39:40,490 --> 00:39:38,160
fall he's coming to the U.S in September

1182
00:39:42,890 --> 00:39:40,500
to begin his his PhD research at

1183
00:39:45,109 --> 00:39:42,900
Northwestern University in Chicago on a

1184
00:39:47,089 --> 00:39:45,119
root mohanti um who I'm a big fan of not

1185
00:39:48,950 --> 00:39:47,099
just because I'm in his advisor I have

1186
00:39:50,390 --> 00:39:48,960
been a colleague now of his I'm also

1187
00:39:52,970 --> 00:39:50,400
excited to see where he takes his career

1188
00:39:55,069 --> 00:39:52,980

however again he's starting his PhD so

1189
00:39:57,710 --> 00:39:55,079
he wants to know what advice you might

1190
00:39:59,210 --> 00:39:57,720
have for someone who's starting a PhD in

1191
00:40:01,250 --> 00:39:59,220
research but is also interested in

1192
00:40:03,650 --> 00:40:01,260
science communication how he might

1193
00:40:05,750 --> 00:40:03,660
manage his time and maybe what skills

1194
00:40:07,790 --> 00:40:05,760
you think could be essential for him to

1195
00:40:09,530 --> 00:40:07,800
excel as a researcher and science

1196
00:40:11,030 --> 00:40:09,540
communicator

1197
00:40:18,470 --> 00:40:11,040
that's a great question I think just

1198
00:40:22,069 --> 00:40:20,569
just know it's an interest that you have

1199
00:40:23,990 --> 00:40:22,079
um so obviously you know talking to your

1200
00:40:25,849 --> 00:40:24,000
advisor and and

1201
00:40:27,109 --> 00:40:25,859
not just to make sure that that's going

1202
00:40:28,790 --> 00:40:27,119
to be okay with them because that is a

1203
00:40:31,010 --> 00:40:28,800
big part of that right when you do a PhD

1204
00:40:32,390 --> 00:40:31,020
it's a big time commitment and you want

1205
00:40:35,210 --> 00:40:32,400
to make sure that that is something that

1206
00:40:37,250 --> 00:40:35,220
your advisor and your mentors uh know

1207
00:40:39,050 --> 00:40:37,260
about you and and are okay with I think

1208
00:40:40,609 --> 00:40:39,060
most advisors are and they recognize the

1209
00:40:42,589 --> 00:40:40,619
value of cycom

1210
00:40:44,150 --> 00:40:42,599
um but also they can they can put you in

1211
00:40:46,250 --> 00:40:44,160
front of opportunities to do that right

1212
00:40:48,290 --> 00:40:46,260
so I was very lucky with my PhD advisor

1213
00:40:49,670 --> 00:40:48,300

knew that I was very interested in cycom

1214
00:40:52,130 --> 00:40:49,680
and so it would kind of pass on

1215
00:40:55,730 --> 00:40:52,140
opportunities uh you know to go speak at

1216
00:40:57,770 --> 00:40:55,740
schools at seminars uh and so I think

1217
00:41:00,050 --> 00:40:57,780
that's another really great reason to

1218
00:41:01,849 --> 00:41:00,060
communicate that openly and then I think

1219
00:41:05,810 --> 00:41:01,859
you know really learning how to balance

1220
00:41:07,970 --> 00:41:05,820
both things making time uh to dedicate

1221
00:41:09,470 --> 00:41:07,980
to you know your your core skills your

1222
00:41:12,050 --> 00:41:09,480
core responsibilities as a grad student

1223
00:41:13,670 --> 00:41:12,060
but then also incorporating the cycom

1224
00:41:16,609 --> 00:41:13,680
aspects to really learning how to

1225
00:41:18,349 --> 00:41:16,619
balance the time that you have and then

1226
00:41:20,510 --> 00:41:18,359
trying if you can to incorporate the two

1227
00:41:22,430 --> 00:41:20,520
so one formatted video that really was

1228
00:41:24,530 --> 00:41:22,440
successful for me was actually bringing

1229
00:41:25,910 --> 00:41:24,540
people into my day-to-day right showing

1230
00:41:27,290 --> 00:41:25,920
them what it's like to be a grad student

1231
00:41:28,370 --> 00:41:27,300
because a lot of people don't know right

1232
00:41:29,390 --> 00:41:28,380
unless you're a grad student unless

1233
00:41:31,490 --> 00:41:29,400
you've been through a process that's

1234
00:41:33,109 --> 00:41:31,500
kind of a foreign thing and people love

1235
00:41:34,609 --> 00:41:33,119
that people love seeing not only what

1236
00:41:36,050 --> 00:41:34,619
it's like as a grad student but also if

1237
00:41:37,790 --> 00:41:36,060
you can take them into your lab and show

1238
00:41:39,770 --> 00:41:37,800

them stuff that you're doing even better

1239
00:41:41,030 --> 00:41:39,780
so I think those would be my big three

1240
00:41:43,190 --> 00:41:41,040
things

1241
00:41:44,329 --> 00:41:43,200
very cool yeah this balance is the most

1242
00:41:46,010 --> 00:41:44,339
important thing I think you said there

1243
00:41:47,450 --> 00:41:46,020
for me as well like it's gonna it can be

1244
00:41:49,550 --> 00:41:47,460
hard to find the appropriate balance for

1245
00:41:50,630 --> 00:41:49,560
all of us but balance is so crucial not

1246
00:41:52,010 --> 00:41:50,640
just for research and science

1247
00:41:54,349 --> 00:41:52,020
communication but all the things we do

1248
00:41:56,030 --> 00:41:54,359
in our lives so I love that so much

1249
00:41:59,210 --> 00:41:56,040
um we do have two very similar questions

1250
00:42:02,030 --> 00:41:59,220
now one from user uh a pachell on

1251
00:42:03,650 --> 00:42:02,040
YouTube who is doing some similar kinds

1252
00:42:05,329 --> 00:42:03,660
of research or at least interested in

1253
00:42:07,849 --> 00:42:05,339
similar research with viruses

1254
00:42:09,170 --> 00:42:07,859
hydrothermal vents origins of life and

1255
00:42:10,490 --> 00:42:09,180
they want to know about advice you might

1256
00:42:12,710 --> 00:42:10,500
have for people who want to share that

1257
00:42:14,510 --> 00:42:12,720
science but we also have a similar

1258
00:42:15,829 --> 00:42:14,520
question from another one of my interns

1259
00:42:18,650 --> 00:42:15,839
at Blue Marble space Institute of

1260
00:42:20,930 --> 00:42:18,660
science this summer of sibsungar palette

1261
00:42:23,030 --> 00:42:20,940
is working with me on biosignatures and

1262
00:42:24,849 --> 00:42:23,040
doing some research in biosignatures and

1263
00:42:27,410 --> 00:42:24,859

sip soccer kind of has the same question

1264
00:42:29,569 --> 00:42:27,420
if you have any tips for people who are

1265
00:42:31,370 --> 00:42:29,579
beginners and want to maybe improve

1266
00:42:33,170 --> 00:42:31,380
themselves in Sharing science especially

1267
00:42:34,190 --> 00:42:33,180
if doing so through social media and the

1268
00:42:37,490 --> 00:42:34,200
internet

1269
00:42:38,870 --> 00:42:37,500
oh yeah so I think yeah I think the

1270
00:42:40,490 --> 00:42:38,880
recommendations I have a pretty General

1271
00:42:41,870 --> 00:42:40,500
regardless of the specific subject that

1272
00:42:42,950 --> 00:42:41,880
you want

1273
00:42:44,210 --> 00:42:42,960
to go so if you're doing this through

1274
00:42:46,370 --> 00:42:44,220
social media usually it's going to be

1275
00:42:48,530 --> 00:42:46,380
very bite-sized very very very small

1276
00:42:50,569 --> 00:42:48,540
we're talking about 60 seconds maximum

1277
00:42:52,130 --> 00:42:50,579
if you're doing a video and so really

1278
00:42:54,710 --> 00:42:52,140
thinking about what you can deliver

1279
00:42:57,290 --> 00:42:54,720
effectively in that 60 seconds so it's

1280
00:42:59,750 --> 00:42:57,300
usually one point one main point

1281
00:43:01,550 --> 00:42:59,760
and really you know your if your goal is

1282
00:43:03,829 --> 00:43:01,560
to get as much reach as possible is to

1283
00:43:07,670 --> 00:43:03,839
make it as accessible as possible

1284
00:43:12,109 --> 00:43:10,309
dargan especially if it's not explained

1285
00:43:14,089 --> 00:43:12,119
um not assuming that people know about

1286
00:43:15,890 --> 00:43:14,099
certain things beforehand

1287
00:43:18,410 --> 00:43:15,900
but I think one thing that's helped me

1288
00:43:20,630 --> 00:43:18,420

is always thinking about why it matters

1289
00:43:22,730 --> 00:43:20,640
right why we care try to make make it

1290
00:43:24,770 --> 00:43:22,740
relatable and I think if you really go

1291
00:43:26,510 --> 00:43:24,780
with that you start with that

1292
00:43:28,550 --> 00:43:26,520
um you really can't go wrong so thinking

1293
00:43:30,230 --> 00:43:28,560
not just about the technical information

1294
00:43:31,730 --> 00:43:30,240
and making sure that's accurate and I

1295
00:43:33,050 --> 00:43:31,740
think as scientists we tend to do that

1296
00:43:35,270 --> 00:43:33,060
pretty well

1297
00:43:37,430 --> 00:43:35,280
um but also like why it matters why do

1298
00:43:39,290 --> 00:43:37,440
we care what does this mean

1299
00:43:40,370 --> 00:43:39,300
um if you can go with that not only will

1300
00:43:41,930 --> 00:43:40,380
it be really effective science

1301
00:43:43,849 --> 00:43:41,940
communication it'll also keep people

1302
00:43:45,410 --> 00:43:43,859
engaged and actually want to watch what

1303
00:43:47,270 --> 00:43:45,420
it is you produce which really is the

1304
00:43:49,790 --> 00:43:47,280
important thing so lead with that lead

1305
00:43:52,430 --> 00:43:49,800
with the relatability aspect

1306
00:43:54,109 --> 00:43:52,440
very cool yeah I love that so much uh

1307
00:43:56,990 --> 00:43:54,119
the next question I might take first and

1308
00:43:59,450 --> 00:43:57,000
then I'll share uh this is from user kzn

1309
00:44:01,190 --> 00:43:59,460
on YouTube they say they are a protein

1310
00:44:03,470 --> 00:44:01,200
biophysics researcher interested in

1311
00:44:04,849 --> 00:44:03,480
astrobiology and wanting to know how to

1312
00:44:07,010 --> 00:44:04,859
combine the two but not knowing where to

1313
00:44:08,450 --> 00:44:07,020

start and what advice we might offer I

1314
00:44:10,609 --> 00:44:08,460
think I'll start off that by doing

1315
00:44:11,930 --> 00:44:10,619
research in in the physics and the

1316
00:44:14,150 --> 00:44:11,940
biology of proteins you are doing

1317
00:44:16,550 --> 00:44:14,160
astrobiology already maybe you weren't

1318
00:44:19,130 --> 00:44:16,560
aware of it but astrobiology isn't a

1319
00:44:21,170 --> 00:44:19,140
discipline astrobiology is a field that

1320
00:44:23,690 --> 00:44:21,180
includes many disciplines it includes

1321
00:44:25,690 --> 00:44:23,700
chemistry physics biology geology

1322
00:44:28,190 --> 00:44:25,700
oceanography atmospheric chemistry

1323
00:44:30,950 --> 00:44:28,200
philosophy cultural studies sociology

1324
00:44:33,349 --> 00:44:30,960
all of these various Realms of learning

1325
00:44:35,630 --> 00:44:33,359
from a human study have come together to

1326
00:44:38,089 --> 00:44:35,640
help us understand how life might begin

1327
00:44:39,950 --> 00:44:38,099
where life might be out there The

1328
00:44:42,050 --> 00:44:39,960
evolutionary trajectories of life and

1329
00:44:44,809 --> 00:44:42,060
what the future of life might be and how

1330
00:44:46,069 --> 00:44:44,819
we search for other life there's so much

1331
00:44:47,870 --> 00:44:46,079
that we're learning with all these

1332
00:44:49,250 --> 00:44:47,880
studies together so I would argue that

1333
00:44:51,170 --> 00:44:49,260
you you actually are already doing

1334
00:44:53,210 --> 00:44:51,180
asterisk biology if you don't know it

1335
00:44:55,250 --> 00:44:53,220
but Dr Vincent maybe you could give them

1336
00:44:56,990 --> 00:44:55,260
some advice on ways they could take some

1337
00:44:59,450 --> 00:44:57,000
of their research in proteins and in

1338
00:45:01,910 --> 00:44:59,460

biology and maybe expand outward into

1339
00:45:04,670 --> 00:45:01,920
some more very directed astrobiology

1340
00:45:06,589 --> 00:45:04,680
work yeah well first I would agree with

1341
00:45:08,690 --> 00:45:06,599
you I think doing when you think about

1342
00:45:10,910 --> 00:45:08,700
it almost any kind of research in it

1343
00:45:12,410 --> 00:45:10,920
actually feeds into astrobiology somehow

1344
00:45:14,210 --> 00:45:12,420
and so and that's actually one of the

1345
00:45:15,770 --> 00:45:14,220
main pieces of advice I give to people

1346
00:45:19,190 --> 00:45:15,780
especially when they're very early on

1347
00:45:20,270 --> 00:45:19,200
like not even in college yet uh or

1348
00:45:22,309 --> 00:45:20,280
thinking about joining their first

1349
00:45:24,050 --> 00:45:22,319
research lab is to not sweat too hard

1350
00:45:26,510 --> 00:45:24,060
whether or not it calls itself an

1351
00:45:29,329 --> 00:45:26,520
astrobiology lab because really any

1352
00:45:31,490 --> 00:45:29,339
skill you gain in in research

1353
00:45:32,930 --> 00:45:31,500
um will be helpful and then it becomes a

1354
00:45:34,970 --> 00:45:32,940
matter of finding opportunities that

1355
00:45:36,530 --> 00:45:34,980
allow you to convert those skills

1356
00:45:38,270 --> 00:45:36,540
and start asking questions about

1357
00:45:40,309 --> 00:45:38,280
astrobiology whether that's in a

1358
00:45:42,170 --> 00:45:40,319
laboratory that again is self-proclaimed

1359
00:45:44,329 --> 00:45:42,180
as an astrobiology lab or has interest

1360
00:45:46,010 --> 00:45:44,339
right in exploring these things so if

1361
00:45:47,510 --> 00:45:46,020
you know if your current advisor has an

1362
00:45:49,849 --> 00:45:47,520
interest in figuring out how protein

1363
00:45:52,790 --> 00:45:49,859

biophysics in say early ancestral

1364
00:45:54,170 --> 00:45:52,800
proteins uh might have operated pitch

1365
00:45:56,390 --> 00:45:54,180
that to them see if you have little

1366
00:45:58,069 --> 00:45:56,400
grant opportunities locally or you know

1367
00:45:59,630 --> 00:45:58,079
higher at the at the national level

1368
00:46:01,790 --> 00:45:59,640
right with these bigger funding agencies

1369
00:46:03,829 --> 00:46:01,800
to fund some of that work or maybe find

1370
00:46:05,390 --> 00:46:03,839
collaborators who work in that space I

1371
00:46:07,670 --> 00:46:05,400
can tell you that those people exist

1372
00:46:09,349 --> 00:46:07,680
absolutely people are very interested in

1373
00:46:11,210 --> 00:46:09,359
kind of early proteins in the protein

1374
00:46:14,089 --> 00:46:11,220
Evolution and the biophysics of that

1375
00:46:15,770 --> 00:46:14,099
this definitely plays into it

1376
00:46:17,569 --> 00:46:15,780
um but yeah I think in general

1377
00:46:18,829 --> 00:46:17,579
you know thinking about next steps I

1378
00:46:20,569 --> 00:46:18,839
don't know where this the person who

1379
00:46:21,770 --> 00:46:20,579
asked this question is at in their

1380
00:46:22,849 --> 00:46:21,780
career but

1381
00:46:24,050 --> 00:46:22,859
um you know definitely you're in the

1382
00:46:26,270 --> 00:46:24,060
right place you're doing the right kind

1383
00:46:28,190 --> 00:46:26,280
of work um and maybe for your next Lab

1384
00:46:29,930 --> 00:46:28,200
start to think about uh whether that's

1385
00:46:31,370 --> 00:46:29,940
work you want to continue kind of in a

1386
00:46:33,170 --> 00:46:31,380
new context or look for a different

1387
00:46:35,030 --> 00:46:33,180
research lab that's doing something

1388
00:46:36,349 --> 00:46:35,040

different that caters to another aspect

1389
00:46:38,210 --> 00:46:36,359
of astrobiology that might be very

1390
00:46:40,309 --> 00:46:38,220
different than proteins

1391
00:46:42,109 --> 00:46:40,319
very cool I agree entirely

1392
00:46:44,750 --> 00:46:42,119
um our next question from user Haley

1393
00:46:46,550 --> 00:46:44,760
Monaco on YouTube they ask a rather fun

1394
00:46:48,589 --> 00:46:46,560
question they ask you if you expect to

1395
00:46:51,290 --> 00:46:48,599
find extraterrestrial comb jellies in

1396
00:46:52,190 --> 00:46:51,300
Ocean worlds or on Ocean moons I kind of

1397
00:46:54,470 --> 00:46:52,200
want to go a little bit further though

1398
00:46:56,270 --> 00:46:54,480
if I can Haley if that's okay with your

1399
00:46:58,490 --> 00:46:56,280
question I myself I'm working on an

1400
00:47:01,430 --> 00:46:58,500
article right now about convergent

1401
00:47:02,630 --> 00:47:01,440
evolution things like trees and crabs

1402
00:47:04,790 --> 00:47:02,640
and some other things that have

1403
00:47:06,829 --> 00:47:04,800
converged biologically and Metabolism

1404
00:47:08,690 --> 00:47:06,839
for microbes and things like that in

1405
00:47:11,569 --> 00:47:08,700
life are there any things that you

1406
00:47:13,790 --> 00:47:11,579
specifically think Dr Vincent life might

1407
00:47:15,650 --> 00:47:13,800
have converged to or is there something

1408
00:47:17,630 --> 00:47:15,660
that you really want to find in

1409
00:47:19,730 --> 00:47:17,640
extraterrestrial life out there

1410
00:47:21,050 --> 00:47:19,740
oh man that's a loaded question I think

1411
00:47:23,210 --> 00:47:21,060
as soon as you start to bring an

1412
00:47:24,950 --> 00:47:23,220
evolution things get real messy um and

1413
00:47:26,930 --> 00:47:24,960

actually that was a big part of my PhD

1414
00:47:29,750 --> 00:47:26,940
is understanding not just the origin of

1415
00:47:31,309 --> 00:47:29,760
evolution but what evolution even is

1416
00:47:33,170 --> 00:47:31,319
um and so as far as convergent evolution

1417
00:47:34,849 --> 00:47:33,180
right yes the The Hope or the

1418
00:47:37,430 --> 00:47:34,859
expectation that you know life elsewhere

1419
00:47:39,530 --> 00:47:37,440
might Converge on similar kinds of

1420
00:47:41,150 --> 00:47:39,540
adaptations or at least structures so

1421
00:47:43,370 --> 00:47:41,160
that we might be able to detect them I

1422
00:47:45,290 --> 00:47:43,380
think um is a big part of astrobiology

1423
00:47:46,790 --> 00:47:45,300
right we do make that assumption often

1424
00:47:48,770 --> 00:47:46,800
we have to right because we can't really

1425
00:47:50,150 --> 00:47:48,780
imagine something else it's really hard

1426
00:47:51,770 --> 00:47:50,160
to look for something you can't even

1427
00:47:54,050 --> 00:47:51,780
conceive of

1428
00:47:55,790 --> 00:47:54,060
um but I think really the only thing I

1429
00:47:57,309 --> 00:47:55,800
expect life to have converged on is the

1430
00:47:59,569 --> 00:47:57,319
ability to evolve in the first place

1431
00:48:01,309 --> 00:47:59,579
that's really when I think about it you

1432
00:48:02,809 --> 00:48:01,319
know I think that's really the only fair

1433
00:48:03,950 --> 00:48:02,819
assumption we can make at this point

1434
00:48:07,250 --> 00:48:03,960
because

1435
00:48:09,050 --> 00:48:07,260
Evolution at least even here on Earth is

1436
00:48:10,430 --> 00:48:09,060
it's not a predictable process right

1437
00:48:11,870 --> 00:48:10,440
it's not something we can press forward

1438
00:48:13,010 --> 00:48:11,880

even though we think we can't we really

1439
00:48:14,930 --> 00:48:13,020
can't

1440
00:48:17,750 --> 00:48:14,940
um it's a retrospective thing

1441
00:48:20,390 --> 00:48:17,760
um and so I think even predicting you

1442
00:48:22,010 --> 00:48:20,400
know convergences is is not really

1443
00:48:23,630 --> 00:48:22,020
possible and I think trying to do that

1444
00:48:25,130 --> 00:48:23,640
in other environments is also really

1445
00:48:27,770 --> 00:48:25,140
difficult and I think really the only

1446
00:48:30,230 --> 00:48:27,780
thing we we really know for sure

1447
00:48:31,190 --> 00:48:30,240
is that life elsewhere probably evolves

1448
00:48:33,230 --> 00:48:31,200
right because it's part of our

1449
00:48:35,510 --> 00:48:33,240
definition of life

1450
00:48:39,109 --> 00:48:35,520
um and so yeah I think that's that's

1451
00:48:43,309 --> 00:48:41,390
very cool yeah I mean there's so much we

1452
00:48:45,430 --> 00:48:43,319
don't know a user Dale Douglas on

1453
00:48:48,230 --> 00:48:45,440
YouTube wanted to know if there is a

1454
00:48:49,970 --> 00:48:48,240
consensus estimate amongst us in the

1455
00:48:52,130 --> 00:48:49,980
astrobiology community as if we're gonna

1456
00:48:54,230 --> 00:48:52,140
when we're gonna find alien life and the

1457
00:48:55,970 --> 00:48:54,240
true answer that is we don't know

1458
00:48:57,410 --> 00:48:55,980
um sometimes in my talks I'll share in

1459
00:48:58,790 --> 00:48:57,420
the past when certain people said you

1460
00:49:01,309 --> 00:48:58,800
know within this given time frame we'll

1461
00:49:03,950 --> 00:49:01,319
find alien life so far none of those

1462
00:49:05,990 --> 00:49:03,960
predictions have been correct however I

1463
00:49:08,089 --> 00:49:06,000

will say for myself it feels like if

1464
00:49:10,309 --> 00:49:08,099
we're not alone in our little corner of

1465
00:49:12,290 --> 00:49:10,319
the Galaxy given our detections of

1466
00:49:13,790 --> 00:49:12,300
exoplanets and now we're monitoring

1467
00:49:15,890 --> 00:49:13,800
their atmospheres with you know new

1468
00:49:17,630 --> 00:49:15,900
telescopes and kind of exploring more of

1469
00:49:19,609 --> 00:49:17,640
our own solar system it feels like we

1470
00:49:21,410 --> 00:49:19,619
might be close I wonder if you have a

1471
00:49:23,150 --> 00:49:21,420
feeling towards that at all Dr Vincent

1472
00:49:24,770 --> 00:49:23,160
whether or not we'd be close to finding

1473
00:49:26,690 --> 00:49:24,780
alien life

1474
00:49:28,130 --> 00:49:26,700
I I feel the same way we're certainly

1475
00:49:29,569 --> 00:49:28,140
getting closer right we're closer than

1476
00:49:31,010 --> 00:49:29,579
we've ever been which again it's a

1477
00:49:32,690 --> 00:49:31,020
little bit of an unsatisfying answer but

1478
00:49:34,250 --> 00:49:32,700
I certainly think you know to your point

1479
00:49:36,589 --> 00:49:34,260
with exoplanets but also some of the

1480
00:49:38,030 --> 00:49:36,599
missions that we have coming up

1481
00:49:39,710 --> 00:49:38,040
um are are starting to be really

1482
00:49:41,329 --> 00:49:39,720
astrobiology focused and it's I think

1483
00:49:42,890 --> 00:49:41,339
it's important to remember that many of

1484
00:49:44,329 --> 00:49:42,900
the exploration missions that we've sent

1485
00:49:46,370 --> 00:49:44,339
to space so far have not been

1486
00:49:47,870 --> 00:49:46,380
astrobiology focused right they're a

1487
00:49:49,550 --> 00:49:47,880
very small minority

1488
00:49:52,130 --> 00:49:49,560

and so in the grand scheme of things we

1489
00:49:53,630 --> 00:49:52,140
really haven't looked we really haven't

1490
00:49:55,309 --> 00:49:53,640
looked very hard and that's going to

1491
00:49:57,829 --> 00:49:55,319
change right we have actual missions

1492
00:49:59,930 --> 00:49:57,839
coming up that are astrobiology missions

1493
00:50:01,370 --> 00:49:59,940
and I think that's going to you know

1494
00:50:03,349 --> 00:50:01,380
that puts us in a really good spot if

1495
00:50:04,490 --> 00:50:03,359
life does exist say at the subsurface of

1496
00:50:06,589 --> 00:50:04,500
Mars

1497
00:50:08,870 --> 00:50:06,599
or on Titan I mean I think that's

1498
00:50:10,370 --> 00:50:08,880
unlikely but who knows you know it's a

1499
00:50:12,410 --> 00:50:10,380
stretch but

1500
00:50:13,849 --> 00:50:12,420
um I think we're getting closer um just

1501
00:50:15,530 --> 00:50:13,859
because we are actually putting more

1502
00:50:16,910 --> 00:50:15,540
effort into looking and I think that's

1503
00:50:19,010 --> 00:50:16,920
the first step and hopefully we're going

1504
00:50:20,630 --> 00:50:19,020
to continue to do that one more

1505
00:50:22,250 --> 00:50:20,640
um not only do I hope that's the case I

1506
00:50:24,230 --> 00:50:22,260
kind of know that's the case right like

1507
00:50:26,089 --> 00:50:24,240
we know that that is that's what's

1508
00:50:27,710 --> 00:50:26,099
driving a lot of the work that we're

1509
00:50:29,210 --> 00:50:27,720
doing as astrobiologists so I'm

1510
00:50:29,990 --> 00:50:29,220
optimistic as well

1511
00:50:32,690 --> 00:50:30,000
um

1512
00:50:35,150 --> 00:50:32,700
so yeah awesome I think we're gonna have

1513
00:50:36,589 --> 00:50:35,160

time maybe for one or two more questions

1514
00:50:38,329 --> 00:50:36,599
um honoru mahanti dropped in another

1515
00:50:39,710 --> 00:50:38,339
question I know that he's a huge fan of

1516
00:50:41,569 --> 00:50:39,720
yours and so I'm not surprised he wants

1517
00:50:43,309 --> 00:50:41,579
to know a lot of what you do he does

1518
00:50:45,290 --> 00:50:43,319
wonder how you stay on top of the

1519
00:50:47,690 --> 00:50:45,300
literature maybe more broadly how you

1520
00:50:49,430 --> 00:50:47,700
stay on top of your research

1521
00:50:50,990 --> 00:50:49,440
um and how in the past for social media

1522
00:50:52,910 --> 00:50:51,000
how you've selected topics for instance

1523
00:50:54,290 --> 00:50:52,920
is that from things you've been actively

1524
00:50:56,809 --> 00:50:54,300
reading or is that from things you think

1525
00:50:59,089 --> 00:50:56,819
your audience was interested in or both

1526
00:51:00,950 --> 00:50:59,099
yesterday on top of literature is really

1527
00:51:03,230 --> 00:51:00,960
hard um and especially I think for us

1528
00:51:04,910 --> 00:51:03,240
astrobiologists we usually are tracking

1529
00:51:06,290 --> 00:51:04,920
lots of different kinds of literature

1530
00:51:08,150 --> 00:51:06,300
right because

1531
00:51:09,650 --> 00:51:08,160
um we do have some astrobiology focused

1532
00:51:11,150 --> 00:51:09,660
journals but we're usually interested in

1533
00:51:13,790 --> 00:51:11,160
pulling pieces from from different

1534
00:51:15,589 --> 00:51:13,800
fields from other research areas and

1535
00:51:17,930 --> 00:51:15,599
that makes it really difficult

1536
00:51:19,309 --> 00:51:17,940
um and so you know I it's definitely

1537
00:51:20,089 --> 00:51:19,319
something I'm always striving to do

1538
00:51:22,190 --> 00:51:20,099

better

1539
00:51:23,930 --> 00:51:22,200
um but surprisingly I find social media

1540
00:51:25,910 --> 00:51:23,940
to be a very good way to do that um

1541
00:51:27,950 --> 00:51:25,920
Twitter in particular I feel like I've

1542
00:51:29,630 --> 00:51:27,960
come across papers that are super

1543
00:51:31,490 --> 00:51:29,640
relevant to my field but also just

1544
00:51:33,170 --> 00:51:31,500
general interest to me because people

1545
00:51:35,990 --> 00:51:33,180
have shared about them and written these

1546
00:51:37,010 --> 00:51:36,000
little digestible threads on them um so

1547
00:51:39,290 --> 00:51:37,020
I think that's been one kind of

1548
00:51:41,270 --> 00:51:39,300
surprising consequence of being on

1549
00:51:42,530 --> 00:51:41,280
science Twitter is that you get kind of

1550
00:51:43,910 --> 00:51:42,540
put in front of these papers that you

1551
00:51:45,230 --> 00:51:43,920
might not otherwise come across through

1552
00:51:46,910 --> 00:51:45,240
your own searches

1553
00:51:49,069 --> 00:51:46,920
and then also you know I'm a big fan of

1554
00:51:50,809 --> 00:51:49,079
the Google Scholar notifications I have

1555
00:51:52,069 --> 00:51:50,819
a lot of keywords put in there I get a

1556
00:51:53,390 --> 00:51:52,079
lot of

1557
00:51:54,890 --> 00:51:53,400
to me

1558
00:51:55,790 --> 00:51:54,900
um but then also yeah just scanning

1559
00:51:57,530 --> 00:51:55,800
around

1560
00:51:59,270 --> 00:51:57,540
um I I kind of I'm interested in other

1561
00:52:00,829 --> 00:51:59,280
things Beyond astrobiology and so like

1562
00:52:02,510 --> 00:52:00,839
kind of peruse

1563
00:52:04,490 --> 00:52:02,520

um different journals and and different

1564
00:52:06,290 --> 00:52:04,500
cycom channels who put me onto papers

1565
00:52:07,970 --> 00:52:06,300
that I might be interested in and also

1566
00:52:09,530 --> 00:52:07,980
people right people just send me papers

1567
00:52:11,690 --> 00:52:09,540
all the time whether that's colleagues

1568
00:52:12,950 --> 00:52:11,700
or people friends of mine who think Oh I

1569
00:52:14,690 --> 00:52:12,960
thought of you and I thought when I saw

1570
00:52:17,390 --> 00:52:14,700
this I think it's also a really great

1571
00:52:19,670 --> 00:52:17,400
way um to to Branch out and keep up with

1572
00:52:21,710 --> 00:52:19,680
the literature very cool I love it yeah

1573
00:52:23,569 --> 00:52:21,720
and the world of literature exploration

1574
00:52:25,190 --> 00:52:23,579
is growing with AI right now too people

1575
00:52:27,170 --> 00:52:25,200
are using AI now to help them sort

1576
00:52:28,370 --> 00:52:27,180
through literature and find pieces that

1577
00:52:30,170 --> 00:52:28,380
kind of fit a current realm they're

1578
00:52:31,370 --> 00:52:30,180
exploring so I personally see that

1579
00:52:32,630 --> 00:52:31,380
growing a lot

1580
00:52:34,130 --> 00:52:32,640
um we have a couple minutes left I want

1581
00:52:36,170 --> 00:52:34,140
to ask just kind of one fun quick

1582
00:52:38,569 --> 00:52:36,180
question of you so you're into chasing

1583
00:52:40,910 --> 00:52:38,579
storms you're into scuba diving

1584
00:52:42,770 --> 00:52:40,920
um top of your bucket list for both what

1585
00:52:44,870 --> 00:52:42,780
would be like the best coolest storm to

1586
00:52:45,770 --> 00:52:44,880
chase what would be the coolest place to

1587
00:52:47,030 --> 00:52:45,780
dive

1588
00:52:49,490 --> 00:52:47,040

okay

1589
00:52:50,750 --> 00:52:49,500
uh well I really have a dream of going

1590
00:52:55,069 --> 00:52:50,760
to chase

1591
00:52:58,549 --> 00:52:56,690
alley

1592
00:53:00,349 --> 00:52:58,559
um it's not something I'm Gonna Do by

1593
00:53:02,150 --> 00:53:00,359
myself like I definitely will defer to

1594
00:53:03,170 --> 00:53:02,160
experts it's very risky very dangerous

1595
00:53:04,670 --> 00:53:03,180
but

1596
00:53:07,670 --> 00:53:04,680
um yeah actually even just seeing a

1597
00:53:08,870 --> 00:53:07,680
tornado is top of my bucket list and um

1598
00:53:11,030 --> 00:53:08,880
I wouldn't try to make that happen

1599
00:53:13,190 --> 00:53:11,040
sometime in the next few years

1600
00:53:16,730 --> 00:53:13,200
um diving oh my gosh my list of diving

1601
00:53:18,730 --> 00:53:16,740
destinations is uh is huge but I really

1602
00:53:21,170 --> 00:53:18,740
want to get into ice diving eventually

1603
00:53:23,270 --> 00:53:21,180
and top of my list would be to do that

1604
00:53:24,710 --> 00:53:23,280
somewhere at the polls so probably

1605
00:53:26,150 --> 00:53:24,720
Antarctica

1606
00:53:27,710 --> 00:53:26,160
um deep below the ice whether that's the

1607
00:53:29,630 --> 00:53:27,720
actual Southern Ocean or some one of

1608
00:53:32,569 --> 00:53:29,640
these perennially frozen lakes

1609
00:53:34,970 --> 00:53:32,579
Big Life pool of mine so top of bucket

1610
00:53:37,069 --> 00:53:34,980
list I love it so for all of our viewers

1611
00:53:39,109 --> 00:53:37,079
watching right now live or in the

1612
00:53:41,569 --> 00:53:39,119
recorded version later keep an eye out

1613
00:53:44,390 --> 00:53:41,579

for Elena's work uh and her research as

1614
00:53:46,549 --> 00:53:44,400
well as on her social media at astrobio

1615
00:53:48,650 --> 00:53:46,559
Elena and maybe we'll see some videos of

1616
00:53:50,750 --> 00:53:48,660
her chasing a tornado and Diving under

1617
00:53:52,150 --> 00:53:50,760
the ice in the very near future you can

1618
00:53:54,470 --> 00:53:52,160
also learn more about her at

1619
00:53:56,630 --> 00:53:54,480
lanavincent.com on her personal website

1620
00:54:00,109 --> 00:53:56,640
uh Dr Vincent thank you so much for

1621
00:54:03,349 --> 00:54:01,910
like I said I wanted you on the show for

1622
00:54:04,549 --> 00:54:03,359
so long I've been nerding out over all

1623
00:54:06,770 --> 00:54:04,559
the cool things you've done in your

1624
00:54:08,150 --> 00:54:06,780
remarkable research for those who want

1625
00:54:10,430 --> 00:54:08,160
to stay in the loop who are watching

1626
00:54:12,890 --> 00:54:10,440
right now you can sign up for the NASA

1627
00:54:15,710 --> 00:54:12,900
astrobiology programs mailing list that

1628
00:54:17,750 --> 00:54:15,720
way you get awesome emails about uh our

1629
00:54:19,790 --> 00:54:17,760
show ask an astrobiologist or you can

1630
00:54:22,370 --> 00:54:19,800
learn more about programs opportunities

1631
00:54:24,470 --> 00:54:22,380
events research all the cool things that

1632
00:54:27,530 --> 00:54:24,480
are going on that are supported through

1633
00:54:29,930 --> 00:54:27,540
NASA astrobiology we loved having you on

1634
00:54:32,510 --> 00:54:29,940
the show Dr Vincent thank you so much to

1635
00:54:34,849 --> 00:54:32,520
her audience at home who are watching uh

1636
00:54:36,530 --> 00:54:34,859
on YouTube or out there in the interwebs

1637
00:54:40,190 --> 00:54:36,540
somewhere thank you so much for joining

1638
00:54:41,600 --> 00:54:40,200

us so as always we love you all and stay

1639
00:54:53,589 --> 00:54:41,610
curious

1640
00:54:55,290 --> 00:54:53,599
[Music]

1641
00:54:59,800 --> 00:54:55,300
thank you

1642
00:55:01,110 --> 00:54:59,810
[Music]

1643
00:55:09,589 --> 00:55:01,120
[Applause]

1644
00:55:11,960 --> 00:55:09,599
[Music]