The Search for Life in the Universe with your Students!

1
00:00:05,430 --> 00:00:03,030
welcome to the search for life in the

2
00:00:08,070 --> 00:00:05,440
universe with your students

3
00:00:10,390 --> 00:00:08,080
my name is martha grover and i'll be

4
00:00:12,390 --> 00:00:10,400
moderating the session today i'm a

5
00:00:15,110 --> 00:00:12,400
professor at georgia tech and we're

6
00:00:17,269 --> 00:00:15,120
happy to be hosting the ab cycon

7
00:00:19,429 --> 00:00:17,279
conference in atlanta

8
00:00:21,189 --> 00:00:19,439
and to have have this event also

9
00:00:23,269 --> 00:00:21,199
together together with the conference so

10
00:00:24,470 --> 00:00:23,279
at the end of this of the session we can

11
00:00:26,710 --> 00:00:24,480
also tell you about some of the other

12
00:00:29,029 --> 00:00:26,720
events that you might be interested in

13
00:00:31,669 --> 00:00:29,039

around this astrobiology science

14
00:00:33,510 --> 00:00:31,679
conference today we're here for the

15
00:00:49,510 --> 00:00:33,520
search for life in the universe with

16
00:00:54,150 --> 00:00:51,910
so i'm happy to introduce our three

17
00:00:56,630 --> 00:00:54,160
presenters this evening

18
00:00:59,110 --> 00:00:56,640
the first presenter is graham lau who's

19
00:01:01,670 --> 00:00:59,120
an astrobiologist and communicator of

20
00:01:03,990 --> 00:01:01,680
science uh his academic background

21
00:01:05,270 --> 00:01:04,000
includes biology astrophysics and

22
00:01:07,190 --> 00:01:05,280
geology

23
00:01:08,950 --> 00:01:07,200
um and he's an expert on how living

24
00:01:11,350 --> 00:01:08,960
things affect the environment around

25
00:01:12,950 --> 00:01:11,360
them and how we search for alien life

26
00:01:15,030 --> 00:01:12,960
beyond earth

27
00:01:17,910 --> 00:01:15,040
he's also the host of the nasa funded

28
00:01:20,310 --> 00:01:17,920
show ask an astrobiologist

29
00:01:21,830 --> 00:01:20,320
and he serves as a

30
00:01:23,270 --> 00:01:21,840
meditation instructor and public

31
00:01:24,870 --> 00:01:23,280
speaking coach

32
00:01:27,429 --> 00:01:24,880
so graham will start off and tell us

33
00:01:31,910 --> 00:01:27,439
about what is astrobiology

34
00:01:36,230 --> 00:01:33,910
aaron's an astrobiologist artist and

35
00:01:38,710 --> 00:01:36,240
communication specialist with the nasa

36
00:01:41,510 --> 00:01:38,720
astrobiology program and he's the author

37
00:01:43,350 --> 00:01:41,520
and illustrator of nasa astrobiology

38
00:01:45,670 --> 00:01:43,360

graphic history series so he'll be

39
00:01:47,670 --> 00:01:45,680
talking in particular about the graphic

40
00:01:50,630 --> 00:01:47,680
novels um

41
00:01:53,749 --> 00:01:50,640
and uh as a as a scientist his work has

42
00:01:56,069 --> 00:01:53,759
centered around microbial ecology and

43
00:02:00,550 --> 00:01:56,079
has spent time in field campaigns and

44
00:02:06,149 --> 00:02:02,870
he also has a bachelor's in theatre and

45
00:02:09,029 --> 00:02:06,159
performing arts and a phd in geo

46
00:02:11,670 --> 00:02:09,039
microbiology and astrobiology

47
00:02:13,510 --> 00:02:11,680
and our third presenter is danny leach

48
00:02:16,390 --> 00:02:13,520
who's a middle and high school teacher

49
00:02:18,470 --> 00:02:16,400
of 25 years she has a masters of science

50
00:02:19,350 --> 00:02:18,480
in space studies and she created the

51
00:02:21,589 --> 00:02:19,360
first

52
00:02:23,270 --> 00:02:21,599
full year high school astrobiology

53
00:02:25,670 --> 00:02:23,280
course

54
00:02:28,309 --> 00:02:25,680
in washington state she's a strong

55
00:02:30,869 --> 00:02:28,319
proponent of using astrobiology content

56
00:02:33,030 --> 00:02:30,879
across k-12 grades and disciplines and

57
00:02:36,390 --> 00:02:33,040
has been an active collaborator in the

58
00:02:38,229 --> 00:02:36,400
development of the nasa astrobiology

59
00:02:39,509 --> 00:02:38,239
learning progressions

60
00:02:42,229 --> 00:02:39,519
which is what she's going to be telling

61
00:02:44,949 --> 00:02:42,239
you about in in the workshop today

62
00:02:46,309 --> 00:02:44,959
so thank you all for coming um and uh i

63
00:02:48,790 --> 00:02:46,319

look forward to hearing from our three

64
00:02:53,270 --> 00:02:48,800
speakers today as well so first of all

65
00:02:55,830 --> 00:02:54,710
thank you very much martha and if the

66
00:02:58,070 --> 00:02:55,840
audience is wondering we're going to be

67
00:02:59,990 --> 00:02:58,080
doing a little shuffling here uh in one

68
00:03:01,670 --> 00:03:00,000
chair in the room that we're sharing i

69
00:03:03,830 --> 00:03:01,680
do have the chat box open so if

70
00:03:05,990 --> 00:03:03,840
questions come up at all we can also

71
00:03:07,670 --> 00:03:06,000
address those if needed while we're

72
00:03:09,190 --> 00:03:07,680
speaking

73
00:03:12,710 --> 00:03:09,200
but i just wanted to give kind of a

74
00:03:14,470 --> 00:03:12,720
rough background of what astrobiology is

75
00:03:16,149 --> 00:03:14,480
if you go online and you look up

76
00:03:16,830 --> 00:03:16,159
astrobiology you might find something

77
00:03:19,430 --> 00:03:16,840
that

78
00:03:21,910 --> 00:03:19,440
astrobiology is the study of the origins

79
00:03:23,910 --> 00:03:21,920
and evolution the distribution of life

80
00:03:27,030 --> 00:03:23,920
in the universe but more than that

81
00:03:28,390 --> 00:03:27,040
astrobiology is our quest to understand

82
00:03:30,550 --> 00:03:28,400
what life is

83
00:03:32,630 --> 00:03:30,560
it's a very broad human quest that we've

84
00:03:34,550 --> 00:03:32,640
been undertaking for a very long time

85
00:03:36,710 --> 00:03:34,560
and in my own life i've kind of just

86
00:03:39,030 --> 00:03:36,720
always wanted to know what would aliens

87
00:03:40,789 --> 00:03:39,040
be like would they be like the creatures

88
00:03:42,470 --> 00:03:40,799

that we've dreamed of in our science

89
00:03:44,550 --> 00:03:42,480
fiction and our films and comic books

90
00:03:46,229 --> 00:03:44,560
and that kind of stuff or could they be

91
00:03:47,750 --> 00:03:46,239
something way different than what we've

92
00:03:49,990 --> 00:03:47,760
imagined they could be

93
00:03:51,589 --> 00:03:50,000
and so astrobiology is a way for us to

94
00:03:53,429 --> 00:03:51,599
try to understand what we can find out

95
00:03:55,270 --> 00:03:53,439
there we can look at things that we have

96
00:03:56,390 --> 00:03:55,280
here on earth that maybe seem a little

97
00:03:57,830 --> 00:03:56,400
alien

98
00:03:59,589 --> 00:03:57,840
i really love kind of studying some of

99
00:04:01,110 --> 00:03:59,599
those weird bizarre creatures from

100
00:04:03,190 --> 00:04:01,120
around our planet things like the

101
00:04:06,550 --> 00:04:03,200
portuguese man-o-war the deep-sea giant

102
00:04:08,390 --> 00:04:06,560
isopod they look fairly alien to me

103
00:04:10,869 --> 00:04:08,400
and yet they very much are part of this

104
00:04:12,470 --> 00:04:10,879
large diverse biosphere in which we live

105
00:04:15,030 --> 00:04:12,480
here in our planet

106
00:04:17,749 --> 00:04:15,040
life on earth is extremely diverse and

107
00:04:20,150 --> 00:04:17,759
has come to fill so many different

108
00:04:23,670 --> 00:04:20,160
environments uh finding different ways

109
00:04:24,870 --> 00:04:23,680
to move different ways to get food uh

110
00:04:27,189 --> 00:04:24,880
you know there's so many different ways

111
00:04:29,270 --> 00:04:27,199
that creatures have adapted to living

112
00:04:30,710 --> 00:04:29,280
here on the earth over the past four

113
00:04:31,830 --> 00:04:30,720

billion years

114
00:04:34,390 --> 00:04:31,840
and a lot of the things we want to know

115
00:04:36,550 --> 00:04:34,400
in astrobiology is how did that start

116
00:04:38,469 --> 00:04:36,560
how did life begin here on earth did it

117
00:04:41,350 --> 00:04:38,479
come to us from space

118
00:04:43,830 --> 00:04:41,360
maybe being born on meteorites

119
00:04:46,790 --> 00:04:43,840
coming to us from comets and asteroids

120
00:04:49,590 --> 00:04:46,800
or did life start in place here on the

121
00:04:51,590 --> 00:04:49,600
earth were there some chemical reactions

122
00:04:53,670 --> 00:04:51,600
in you know charles darwin's warm little

123
00:04:57,629 --> 00:04:53,680
ponds perhaps that could have allowed

124
00:04:59,990 --> 00:04:57,639
for life to begin here on our planet

125
00:05:02,469 --> 00:05:00,000
astrobiologists want to know how life

126
00:05:05,350 --> 00:05:02,479
changed through time with the earth how

127
00:05:07,590 --> 00:05:05,360
did our world and life evolve and adapt

128
00:05:09,189 --> 00:05:07,600
together you know life isn't just that

129
00:05:12,070 --> 00:05:09,199
happens on a planet it's something that

130
00:05:13,670 --> 00:05:12,080
happens to a planet and as life has

131
00:05:15,590 --> 00:05:13,680
evolved along with our planet it's

132
00:05:17,749 --> 00:05:15,600
changed a lot of the features of our

133
00:05:20,070 --> 00:05:17,759
world as well perhaps for instance

134
00:05:23,189 --> 00:05:20,080
you've heard that the oxygen in our

135
00:05:26,070 --> 00:05:23,199
atmosphere is being driven by life that

136
00:05:28,629 --> 00:05:26,080
the oxygen that we have is itself a sign

137
00:05:29,749 --> 00:05:28,639
of life being here and being active in

138
00:05:31,510 --> 00:05:29,759

our world

139
00:05:33,430 --> 00:05:31,520
there's astrobiologists who are also

140
00:05:35,670 --> 00:05:33,440
studying things like life in extreme

141
00:05:37,749 --> 00:05:35,680
environments this is my favorite places

142
00:05:39,430 --> 00:05:37,759
on the planet if you haven't been here

143
00:05:40,950 --> 00:05:39,440
it's in yellowstone national park this

144
00:05:43,350 --> 00:05:40,960
is called grand prix

145
00:05:45,350 --> 00:05:43,360
spring there's a boardwalk down there in

146
00:05:46,629 --> 00:05:45,360
the lower right hand side of this

147
00:05:48,950 --> 00:05:46,639
picture and you can see some people

148
00:05:51,430 --> 00:05:48,960
walking around it's a really beautiful

149
00:05:53,029 --> 00:05:51,440
hot spring feature to visit and as you

150
00:05:54,790 --> 00:05:53,039
look at this feature in the middle of

151
00:05:56,710 --> 00:05:54,800
this this hot spring you see some dark

152
00:05:58,870 --> 00:05:56,720
blue colors but as you go towards the

153
00:06:02,469 --> 00:05:58,880
outside of the spring you start seeing

154
00:06:04,469 --> 00:06:02,479
some greens and yellows oranges and reds

155
00:06:06,790 --> 00:06:04,479
and those are all caused by living

156
00:06:09,430 --> 00:06:06,800
things that thrive in this high

157
00:06:11,909 --> 00:06:09,440
temperature and very acidic environment

158
00:06:13,590 --> 00:06:11,919
and so by studying some of those extreme

159
00:06:15,990 --> 00:06:13,600
places on our earth by studying what

160
00:06:18,469 --> 00:06:16,000
life does on our earth we can better

161
00:06:21,110 --> 00:06:18,479
know what to look for when we go

162
00:06:24,870 --> 00:06:21,120
explore out there looking at worlds like

163
00:06:26,950 --> 00:06:24,880

venus and mars titan europa enceladus

164
00:06:29,830 --> 00:06:26,960
the worlds of our solar system to figure

165
00:06:31,510 --> 00:06:29,840
out if life happened somewhere else in

166
00:06:33,350 --> 00:06:31,520
our solar system or maybe life happened

167
00:06:34,629 --> 00:06:33,360
here and went somewhere else in our

168
00:06:37,830 --> 00:06:34,639
solar system

169
00:06:40,309 --> 00:06:37,840
uh mars has been highly studied of late

170
00:06:42,150 --> 00:06:40,319
with lots of robotic missions uh

171
00:06:44,309 --> 00:06:42,160
including perseverance and the ingenuity

172
00:06:47,029 --> 00:06:44,319
drone which have been flying around um

173
00:06:49,270 --> 00:06:47,039
on the surface of mars this past year

174
00:06:51,189 --> 00:06:49,280
venus is now a very interesting target

175
00:06:52,629 --> 00:06:51,199
for the potential for life to be in its

176
00:06:54,070 --> 00:06:52,639
atmosphere

177
00:06:56,309 --> 00:06:54,080
but there's also other targets in our

178
00:06:58,550 --> 00:06:56,319
solar system one of my favorites is

179
00:07:01,270 --> 00:06:58,560
europa one of the moons of jupiter that

180
00:07:04,469 --> 00:07:01,280
has a thick icy crust but down below

181
00:07:06,070 --> 00:07:04,479
that crust is a very deep ocean and so a

182
00:07:08,309 --> 00:07:06,080
lot of us want to know could there be

183
00:07:10,150 --> 00:07:08,319
life inside of that ocean could there be

184
00:07:12,150 --> 00:07:10,160
things like hydrothermal vents like what

185
00:07:14,469 --> 00:07:12,160
we have here on the earth things called

186
00:07:16,710 --> 00:07:14,479
black smokers where we find these oases

187
00:07:19,029 --> 00:07:16,720
of life where things are thriving in

188
00:07:20,870 --> 00:07:19,039

these deep ocean systems

189
00:07:22,790 --> 00:07:20,880
allowing for life to potentially have

190
00:07:24,710 --> 00:07:22,800
originated and evolved in these systems

191
00:07:26,390 --> 00:07:24,720
as well

192
00:07:27,589 --> 00:07:26,400
those of us studying astrobiology are

193
00:07:28,710 --> 00:07:27,599
also involved in a lot of mission

194
00:07:30,790 --> 00:07:28,720
development

195
00:07:32,629 --> 00:07:30,800
in 2024 we're going to launch the europa

196
00:07:34,710 --> 00:07:32,639
clipper mission it's going to go in

197
00:07:37,110 --> 00:07:34,720
orbit around jupiter and europa together

198
00:07:38,790 --> 00:07:37,120
and study the surface and give us more

199
00:07:41,270 --> 00:07:38,800
knowledge of what that ocean is really

200
00:07:42,950 --> 00:07:41,280
like uh the european space agency also

201
00:07:44,469 --> 00:07:42,960
has the jupiter icy moon explorer

202
00:07:45,909 --> 00:07:44,479
mission or juice

203
00:07:47,510 --> 00:07:45,919
which will soon be going out to the

204
00:07:49,670 --> 00:07:47,520
jovian system as well and studying

205
00:07:51,270 --> 00:07:49,680
europa and other worlds

206
00:07:52,469 --> 00:07:51,280
we also have a world in our solar system

207
00:07:54,629 --> 00:07:52,479
which actively

208
00:07:56,550 --> 00:07:54,639
leaks water out into space there are

209
00:07:59,029 --> 00:07:56,560
plumes of water erupting from the

210
00:08:01,830 --> 00:07:59,039
southern hemisphere of enceladus a moon

211
00:08:05,029 --> 00:08:01,840
of jupiter that's also become a very uh

212
00:08:07,510 --> 00:08:05,039
prioritized target for astrobiology

213
00:08:09,430 --> 00:08:07,520

we also have a world like titan a moon

214
00:08:12,230 --> 00:08:09,440
in our solar system orbiting around

215
00:08:14,710 --> 00:08:12,240
saturn that has a very thick and dense

216
00:08:17,029 --> 00:08:14,720
atmosphere and presents a unique place

217
00:08:19,270 --> 00:08:17,039
for us to study the chemistry of a

218
00:08:21,830 --> 00:08:19,280
different world that has hydrocarbon

219
00:08:25,430 --> 00:08:21,840
lakes on its surface and where it rains

220
00:08:27,029 --> 00:08:25,440
ethane and methane rather than water

221
00:08:28,550 --> 00:08:27,039
and so in the not too distant future

222
00:08:30,950 --> 00:08:28,560
we're going to launch the dragonfly

223
00:08:33,029 --> 00:08:30,960
mission a large car sized drone that

224
00:08:34,389 --> 00:08:33,039
will fly around the surface of titan and

225
00:08:36,550 --> 00:08:34,399
help us to better understand the

226
00:08:38,709 --> 00:08:36,560
chemical history of that world

227
00:08:39,509 --> 00:08:38,719
and then of course you know when i was a

228
00:08:41,110 --> 00:08:39,519
kid

229
00:08:43,269 --> 00:08:41,120
in school we didn't know of any

230
00:08:46,630 --> 00:08:43,279
exoplanets existing and now we know of

231
00:08:48,870 --> 00:08:46,640
over 5 000 worlds that exist around

232
00:08:50,790 --> 00:08:48,880
other stars and that has really changed

233
00:08:52,870 --> 00:08:50,800
the game in our exploration for what

234
00:08:54,790 --> 00:08:52,880
could be possible out there for life and

235
00:08:56,310 --> 00:08:54,800
looking for signs of life in some of

236
00:08:58,310 --> 00:08:56,320
these other worlds

237
00:09:01,030 --> 00:08:58,320
and then in astrobiology we also want to

238
00:09:03,590 --> 00:09:01,040

know what is the future of life what's

239
00:09:05,590 --> 00:09:03,600
the future for our species here on this

240
00:09:07,670 --> 00:09:05,600
planet and could it teach us more of

241
00:09:08,470 --> 00:09:07,680
what to look for in looking for life out

242
00:09:10,230 --> 00:09:08,480
there

243
00:09:12,870 --> 00:09:10,240
perhaps you've heard before of the drake

244
00:09:16,470 --> 00:09:12,880
equation uh sculpted by the astronomer

245
00:09:18,230 --> 00:09:16,480
frank drake in 1960 it was basically a a

246
00:09:20,150 --> 00:09:18,240
conference proceedings for for

247
00:09:22,949 --> 00:09:20,160
organizing sessions of a meeting but

248
00:09:24,630 --> 00:09:22,959
it's become rather famous for uh this

249
00:09:27,110 --> 00:09:24,640
equation that helps us figure out based

250
00:09:29,350 --> 00:09:27,120
on a few factors that we know or could

251
00:09:31,910 --> 00:09:29,360
know about the potential for life in in

252
00:09:33,190 --> 00:09:31,920
our galaxy how many civilizations might

253
00:09:35,750 --> 00:09:33,200
be out there right now who can

254
00:09:37,509 --> 00:09:35,760
communicate with us via radio and my

255
00:09:40,389 --> 00:09:37,519
favorite part of this equation is the

256
00:09:42,550 --> 00:09:40,399
very last factor the l factor it's the

257
00:09:45,670 --> 00:09:42,560
average time span for a civilization to

258
00:09:47,910 --> 00:09:45,680
exist uh astrobiology very much helps us

259
00:09:49,030 --> 00:09:47,920
to frame our understanding of what it

260
00:09:51,590 --> 00:09:49,040
means to be

261
00:09:53,509 --> 00:09:51,600
a species in a biosphere where we're now

262
00:09:56,870 --> 00:09:53,519
coming to understand our place in the

263
00:09:58,230 --> 00:09:56,880

universe and our own fragile place in

264
00:10:00,630 --> 00:09:58,240
the cosmos

265
00:10:03,030 --> 00:10:00,640
and so astrobiology has so very much to

266
00:10:06,230 --> 00:10:03,040
offer as a field in understanding our

267
00:10:08,150 --> 00:10:06,240
origins and how life thrives and evolves

268
00:10:10,310 --> 00:10:08,160
with the world and how we can look for

269
00:10:12,710 --> 00:10:10,320
life out there as well

270
00:10:15,670 --> 00:10:12,720
and so that's just kind of a very broad

271
00:10:17,430 --> 00:10:15,680
general idea of what astrobiology is and

272
00:10:19,350 --> 00:10:17,440
some of the things that we're doing and

273
00:10:22,069 --> 00:10:19,360
so now i'm going to pass it off to aaron

274
00:10:24,870 --> 00:10:22,079
gronstal who will share with you some of

275
00:10:32,069 --> 00:10:24,880
the resources that we have for teachers

276
00:10:38,310 --> 00:10:35,350
everyone my name is aaron gronstal and i

277
00:10:40,470 --> 00:10:38,320
am actually just going to

278
00:10:43,190 --> 00:10:40,480
kind of do a little tour of the

279
00:10:44,790 --> 00:10:43,200
astrobiology program website here

280
00:10:47,430 --> 00:10:44,800
um to start

281
00:10:49,190 --> 00:10:47,440
so this is the the astrobiology site at

282
00:10:50,150 --> 00:10:49,200
nasa um

283
00:10:52,230 --> 00:10:50,160
and

284
00:10:53,269 --> 00:10:52,240
we have a whole bunch of resources here

285
00:10:55,590 --> 00:10:53,279
for

286
00:10:59,670 --> 00:10:55,600
to

287
00:11:01,110 --> 00:10:59,680
things

288
00:11:02,310 --> 00:11:01,120

most stuff is right up here at the very

289
00:11:05,269 --> 00:11:02,320
top bar

290
00:11:08,069 --> 00:11:05,279
the first thing ask an astrobiologist

291
00:11:09,670 --> 00:11:08,079
this is an excellent series where graham

292
00:11:10,630 --> 00:11:09,680
does a lot of wonderful interviews with

293
00:11:12,069 --> 00:11:10,640
with

294
00:11:13,590 --> 00:11:12,079
scientists and

295
00:11:15,670 --> 00:11:13,600
and people in the astrobiology field

296
00:11:17,350 --> 00:11:15,680
talking about their specialties and

297
00:11:19,350 --> 00:11:17,360
and how they got into astrobiology and

298
00:11:20,790 --> 00:11:19,360
their kind of educational and career

299
00:11:22,710 --> 00:11:20,800
paths and things it's a really really

300
00:11:24,710 --> 00:11:22,720
wonderful resource if you have

301
00:11:25,910 --> 00:11:24,720
kind of specific things that

302
00:11:29,430 --> 00:11:25,920
that you want to talk to your class

303
00:11:31,590 --> 00:11:29,440
about or have you know have them watch

304
00:11:33,190 --> 00:11:31,600
and things are organized by the episodes

305
00:11:34,550 --> 00:11:33,200
down here

306
00:11:36,870 --> 00:11:34,560
you can find you can find kind of

307
00:11:38,630 --> 00:11:36,880
episodes based on certain topics

308
00:11:40,550 --> 00:11:38,640
and then the second thing up here

309
00:11:42,069 --> 00:11:40,560
is just the education page that we have

310
00:11:43,829 --> 00:11:42,079
and this is sort of a landing page for

311
00:11:45,030 --> 00:11:43,839
all things education at the astrobiology

312
00:11:46,069 --> 00:11:45,040
program

313
00:11:48,710 --> 00:11:46,079

um

314
00:11:50,949 --> 00:11:48,720
going kind of slow right now there we go

315
00:11:52,230 --> 00:11:50,959
um and this talks about there's there's

316
00:11:53,430 --> 00:11:52,240
some features up here at the top but

317
00:11:55,030 --> 00:11:53,440
some of the big programs we've been

318
00:11:58,150 --> 00:11:55,040
doing this is astrobiology for the

319
00:11:59,590 --> 00:11:58,160
incarcerated um where daniela scalise

320
00:12:01,590 --> 00:11:59,600
who's the

321
00:12:03,590 --> 00:12:01,600
blurry person in the back back here uh

322
00:12:05,670 --> 00:12:03,600
she she's kind of the communications

323
00:12:07,269 --> 00:12:05,680
lead for astrobiology at nasa

324
00:12:08,150 --> 00:12:07,279
and she's worked really hard on this

325
00:12:09,670 --> 00:12:08,160
program

326
00:12:12,069 --> 00:12:09,680
using astrobiology

327
00:12:13,670 --> 00:12:12,079
as an educational tool in in in

328
00:12:15,990 --> 00:12:13,680
in prisons

329
00:12:17,590 --> 00:12:16,000
um and the nasa in the navajo nation um

330
00:12:18,710 --> 00:12:17,600
she's also done a lot of work with with

331
00:12:21,269 --> 00:12:18,720
indigenous

332
00:12:23,110 --> 00:12:21,279
kind of uh tribal governments and things

333
00:12:24,470 --> 00:12:23,120
throughout the united states

334
00:12:26,230 --> 00:12:24,480
and this is the astrobiology graphic

335
00:12:28,069 --> 00:12:26,240
histories uh i'll talk a little bit more

336
00:12:29,030 --> 00:12:28,079
about that that later

337
00:12:30,629 --> 00:12:29,040
and

338
00:12:31,670 --> 00:12:30,639

if you keep kind of keep scrolling down

339
00:12:33,750 --> 00:12:31,680
here there's a whole bunch of other

340
00:12:35,750 --> 00:12:33,760
stuff to get into um this learning

341
00:12:38,550 --> 00:12:35,760
materials page here

342
00:12:40,470 --> 00:12:38,560
is just kind of a long list of different

343
00:12:42,310 --> 00:12:40,480
types of learning materials that we we

344
00:12:45,110 --> 00:12:42,320
have some some of which were sort of

345
00:12:46,710 --> 00:12:45,120
created in-house at astrobiology

346
00:12:48,710 --> 00:12:46,720
the astrology program funds a lot of

347
00:12:50,230 --> 00:12:48,720
teams at universities and

348
00:12:51,750 --> 00:12:50,240
and things like that so these are these

349
00:12:53,750 --> 00:12:51,760
are resources that those university

350
00:12:56,069 --> 00:12:53,760
teams have developed over the years

351
00:12:57,910 --> 00:12:56,079
and some other kind of things we brought

352
00:12:59,590 --> 00:12:57,920
in from around nasa

353
00:13:01,670 --> 00:12:59,600
and also

354
00:13:03,430 --> 00:13:01,680
you know some maybe former pis on some

355
00:13:04,870 --> 00:13:03,440
research projects that have developed

356
00:13:06,629 --> 00:13:04,880
some things

357
00:13:07,990 --> 00:13:06,639
and so you can i mean scroll down this

358
00:13:10,310 --> 00:13:08,000
and this list goes on and on and it's

359
00:13:13,030 --> 00:13:10,320
sort of organized by things that are

360
00:13:16,710 --> 00:13:13,040
you know classroom materials um this is

361
00:13:18,310 --> 00:13:16,720
this is a project in k-12 classrooms uh

362
00:13:21,430 --> 00:13:18,320
developed by one of our teams that we

363
00:13:22,949 --> 00:13:21,440

fund at albion college uh

364
00:13:24,389 --> 00:13:22,959
but yeah so this

365
00:13:25,910 --> 00:13:24,399
wonderful place to go kind of run around

366
00:13:27,509 --> 00:13:25,920
and check things out

367
00:13:29,110 --> 00:13:27,519
um the other the other good thing at

368
00:13:31,350 --> 00:13:29,120
this top bar so there's asp mascara

369
00:13:33,590 --> 00:13:31,360
biologist education and then at the end

370
00:13:35,670 --> 00:13:33,600
here there's resources and this is sort

371
00:13:37,269 --> 00:13:35,680
of a direct link to some of the

372
00:13:39,990 --> 00:13:37,279
the main things that we've developed

373
00:13:42,150 --> 00:13:40,000
in-house at the astrobiology program

374
00:13:44,150 --> 00:13:42,160
we have sort of digital backgrounds if

375
00:13:46,470 --> 00:13:44,160
some of if any of you are still doing

376
00:13:47,910 --> 00:13:46,480
classes over zoom and things and

377
00:13:50,230 --> 00:13:47,920
and your students want to have some cool

378
00:13:52,150 --> 00:13:50,240
backgrounds of mars or

379
00:13:54,629 --> 00:13:52,160
europa the one that i was sitting in

380
00:13:56,310 --> 00:13:54,639
front of before is is um from the from

381
00:13:57,110 --> 00:13:56,320
the graphic histories and it's a europa

382
00:14:00,310 --> 00:13:57,120
one

383
00:14:01,670 --> 00:14:00,320
so there's the arecibo telescope there's

384
00:14:02,550 --> 00:14:01,680
kind of fun fun things to play around in

385
00:14:03,590 --> 00:14:02,560
there

386
00:14:05,750 --> 00:14:03,600
um

387
00:14:08,230 --> 00:14:05,760
there's this extremophile trading card

388
00:14:10,470 --> 00:14:08,240

uh series that was done

389
00:14:13,030 --> 00:14:10,480
by the within in i think the university

390
00:14:14,710 --> 00:14:13,040
of wisconsin um so these are this when

391
00:14:16,470 --> 00:14:14,720
graham was talking about the kind of the

392
00:14:17,750 --> 00:14:16,480
microbes that live in the prismatic

393
00:14:19,670 --> 00:14:17,760
spring and things

394
00:14:21,110 --> 00:14:19,680
uh this is a series of trading cards

395
00:14:22,790 --> 00:14:21,120
that kind of describe

396
00:14:24,389 --> 00:14:22,800
all these different kinds of microbes

397
00:14:25,990 --> 00:14:24,399
that live in these crazy environments

398
00:14:29,030 --> 00:14:26,000
are crazy to us

399
00:14:30,470 --> 00:14:29,040
but but what they call home

400
00:14:31,430 --> 00:14:30,480
and

401
00:14:32,949 --> 00:14:31,440
um

402
00:14:34,710 --> 00:14:32,959
there's also these kind of

403
00:14:36,069 --> 00:14:34,720
hero posters that are we're taking sort

404
00:14:37,269 --> 00:14:36,079
of from the graphic novels we took some

405
00:14:39,269 --> 00:14:37,279
of the main

406
00:14:41,590 --> 00:14:39,279
kind of missions and things and we made

407
00:14:43,350 --> 00:14:41,600
these posters that kind of describe what

408
00:14:47,670 --> 00:14:43,360
the missions are and and why they're why

409
00:14:51,110 --> 00:14:49,189
and also there's stuff so there's

410
00:14:52,470 --> 00:14:51,120
coloring pages as well um if you're if

411
00:14:54,230 --> 00:14:52,480
you're with some younger students and

412
00:14:56,150 --> 00:14:54,240
things and these are some of these are

413
00:14:59,189 --> 00:14:56,160

kind of coloring pages with activities

414
00:15:00,790 --> 00:14:59,199
sort of built in like uh this one's the

415
00:15:01,750 --> 00:15:00,800
the perseverance rover and the clean

416
00:15:03,030 --> 00:15:01,760
room and

417
00:15:04,710 --> 00:15:03,040
you know the suggestion is to draw the

418
00:15:06,550 --> 00:15:04,720
microbes that they're finding you know

419
00:15:09,430 --> 00:15:06,560
as they're making sure it's clean before

420
00:15:13,590 --> 00:15:11,110
okay and so the main but the main thing

421
00:15:15,750 --> 00:15:13,600
that i'm kind of my my big project that

422
00:15:18,470 --> 00:15:15,760
i work on part of the time is uh the

423
00:15:20,550 --> 00:15:18,480
graphic history series and this was a

424
00:15:22,949 --> 00:15:20,560
a series of comic books basically that

425
00:15:24,389 --> 00:15:22,959
that we started developing

426
00:15:26,150 --> 00:15:24,399
um

427
00:15:28,870 --> 00:15:26,160
to celebrate the 50th anniversary of

428
00:15:30,389 --> 00:15:28,880
exobiology uh at nasa so exobiology is

429
00:15:32,150 --> 00:15:30,399
actually it's been around for a long

430
00:15:34,310 --> 00:15:32,160
time the first grant was

431
00:15:35,990 --> 00:15:34,320
uh given for the wolf trap instrument

432
00:15:37,110 --> 00:15:36,000
that was being developed for the viking

433
00:15:38,949 --> 00:15:37,120
mission it didn't actually make it on

434
00:15:41,030 --> 00:15:38,959
the mission but that was what the what

435
00:15:42,150 --> 00:15:41,040
it was for and so

436
00:15:43,829 --> 00:15:42,160
uh

437
00:15:45,749 --> 00:15:43,839
i got into this i was already working at

438
00:15:47,910 --> 00:15:45,759

the astrology program office

439
00:15:49,749 --> 00:15:47,920
but uh mary wojtek who's the program

440
00:15:52,069 --> 00:15:49,759
scientist knew that i i

441
00:15:54,710 --> 00:15:52,079
grew up drawing comic books and

442
00:15:57,509 --> 00:15:54,720
i always have always will uh my mother

443
00:15:59,749 --> 00:15:57,519
always an artist is a visual artist but

444
00:16:00,389 --> 00:15:59,759
mostly paint and kind of abstract inks

445
00:16:02,629 --> 00:16:00,399
and

446
00:16:04,949 --> 00:16:02,639
my father's a musician so i grew up in a

447
00:16:06,949 --> 00:16:04,959
very artsy household so art has always

448
00:16:08,629 --> 00:16:06,959
been a big part of my life and um when

449
00:16:09,829 --> 00:16:08,639
the 50th anniversary came around she was

450
00:16:10,870 --> 00:16:09,839
like well let's let's make use of that

451
00:16:12,310 --> 00:16:10,880
let's make a

452
00:16:14,710 --> 00:16:12,320
comic to celebrate that we can hand out

453
00:16:16,230 --> 00:16:14,720
at the at the 50th anniversary events

454
00:16:17,749 --> 00:16:16,240
and it turned out that people really

455
00:16:18,470 --> 00:16:17,759
liked it and

456
00:16:20,470 --> 00:16:18,480
so

457
00:16:22,550 --> 00:16:20,480
they kind of we just decided to keep

458
00:16:25,269 --> 00:16:22,560
doing it as long as as long as we

459
00:16:27,269 --> 00:16:25,279
can keep thinking up new things to

460
00:16:28,870 --> 00:16:27,279
to make an issue about and and as long

461
00:16:30,470 --> 00:16:28,880
as people are still interested and and

462
00:16:32,949 --> 00:16:30,480
now they're being used in a number of

463
00:16:35,990 --> 00:16:32,959

classrooms um we've had a lot of sort of

464
00:16:37,189 --> 00:16:36,000
museums that we'll use them in

465
00:16:38,550 --> 00:16:37,199
you know programs for kids that come

466
00:16:40,230 --> 00:16:38,560
into the museum and that sort of stuff

467
00:16:42,310 --> 00:16:40,240
and some of my favorite stuff has been

468
00:16:43,910 --> 00:16:42,320
art museums using it or art classrooms

469
00:16:46,710 --> 00:16:43,920
using it because it's a

470
00:16:47,829 --> 00:16:46,720
it's a great way to get students who

471
00:16:49,430 --> 00:16:47,839
maybe don't even know that they're

472
00:16:52,150 --> 00:16:49,440
interested in science kind of thinking

473
00:16:53,910 --> 00:16:52,160
about the science and things and these

474
00:16:55,350 --> 00:16:53,920
each issue is sort of organized around a

475
00:16:56,550 --> 00:16:55,360
different topic this one the first one

476
00:16:58,949 --> 00:16:56,560
is just sort of an introduction to like

477
00:17:01,030 --> 00:16:58,959
what is astrobiology and and the history

478
00:17:02,069 --> 00:17:01,040
of how it began at nasa and

479
00:17:03,910 --> 00:17:02,079
and

480
00:17:05,429 --> 00:17:03,920
you know actually began even before nasa

481
00:17:07,110 --> 00:17:05,439
like because it's

482
00:17:09,189 --> 00:17:07,120
the question of life beyond our planet

483
00:17:11,029 --> 00:17:09,199
is a pretty old question and and the

484
00:17:12,549 --> 00:17:11,039
origin of life on our planet so it goes

485
00:17:14,309 --> 00:17:12,559
through some of like the main

486
00:17:15,909 --> 00:17:14,319
scientific findings over the years some

487
00:17:16,549 --> 00:17:15,919
of the big scientists and things that

488
00:17:21,110 --> 00:17:16,559

have

489
00:17:22,710 --> 00:17:21,120
and all the scientists that are

490
00:17:25,110 --> 00:17:22,720
in the issues are

491
00:17:26,870 --> 00:17:25,120
actual people and

492
00:17:28,390 --> 00:17:26,880
actual discoveries that were made and if

493
00:17:29,990 --> 00:17:28,400
you if you kind of go to the final pages

494
00:17:31,669 --> 00:17:30,000
of the issues there's actually a list of

495
00:17:33,110 --> 00:17:31,679
references

496
00:17:35,190 --> 00:17:33,120
so you can you can find further

497
00:17:36,150 --> 00:17:35,200
information and everything is referenced

498
00:17:39,909 --> 00:17:36,160
if you need

499
00:17:41,510 --> 00:17:39,919
students need to dig in a bit deeper to

500
00:17:45,029 --> 00:17:41,520
things

501
00:17:45,039 --> 00:17:50,549
where's your back button graham

502
00:17:54,950 --> 00:17:53,029
i just opened a new window

503
00:17:59,430 --> 00:17:54,960
where's the old window where are your

504
00:18:03,190 --> 00:18:01,830
it's hidden by the zoom bar um grab that

505
00:18:05,669 --> 00:18:03,200
pull down

506
00:18:07,270 --> 00:18:05,679
there you go say control w or command w

507
00:18:08,630 --> 00:18:07,280
all right about that

508
00:18:09,909 --> 00:18:08,640
okay so there's there's a bunch of

509
00:18:11,350 --> 00:18:09,919
different issues there's this origin

510
00:18:13,190 --> 00:18:11,360
issue oh and some of them have been

511
00:18:14,710 --> 00:18:13,200
translated into other languages um

512
00:18:16,549 --> 00:18:14,720
there's some korean editions and there's

513
00:18:18,549 --> 00:18:16,559

a japanese edition

514
00:18:20,950 --> 00:18:18,559
of some of the issues

515
00:18:22,390 --> 00:18:20,960
the second one is all missions to mars

516
00:18:24,150 --> 00:18:22,400
the third one was sort of missions to

517
00:18:25,830 --> 00:18:24,160
the inner solar system

518
00:18:26,870 --> 00:18:25,840
fourth was missions to the outer solar

519
00:18:29,830 --> 00:18:26,880
system

520
00:18:30,710 --> 00:18:29,840
we've got stuff about earth exoplanets

521
00:18:32,390 --> 00:18:30,720
um

522
00:18:34,390 --> 00:18:32,400
and prebiotic chemistry and the origin

523
00:18:36,310 --> 00:18:34,400
of life and then this is the brand new

524
00:18:38,470 --> 00:18:36,320
issue that was just released yesterday

525
00:18:39,750 --> 00:18:38,480
on biosignatures and so that kind of

526
00:18:41,830 --> 00:18:39,760
talks about

527
00:18:43,830 --> 00:18:41,840
when we're looking for life beyond earth

528
00:18:45,029 --> 00:18:43,840
what are we looking for and why are we

529
00:18:47,430 --> 00:18:45,039
looking for it

530
00:18:48,789 --> 00:18:47,440
and how how do we look for it so all the

531
00:18:50,789 --> 00:18:48,799
kind of different things that the

532
00:18:51,669 --> 00:18:50,799
scientists are looking for

533
00:18:52,549 --> 00:18:51,679
and

534
00:18:53,990 --> 00:18:52,559
yeah so that's that's kind of the

535
00:18:55,669 --> 00:18:54,000
graphic histories i can talk about that

536
00:18:57,350 --> 00:18:55,679
more if you have questions about how you

537
00:18:58,950 --> 00:18:57,360
know the actual process of making them

538
00:19:00,150 --> 00:18:58,960

um they're all done

539
00:19:02,470 --> 00:19:00,160
pencil and

540
00:19:03,830 --> 00:19:02,480
ink by hand and then scan them and do

541
00:19:05,190 --> 00:19:03,840
the colors and the layouts and

542
00:19:08,070 --> 00:19:05,200
everything digitally

543
00:19:09,909 --> 00:19:08,080
um but then kind of the other really

544
00:19:11,270 --> 00:19:09,919
amazing thing that we have that i think

545
00:19:13,990 --> 00:19:11,280
is probably the most

546
00:19:16,310 --> 00:19:14,000
probably the most important thing um

547
00:19:18,470 --> 00:19:16,320
is this the learning progressions that

548
00:19:20,390 --> 00:19:18,480
uh danny is going to talk about so to

549
00:19:24,070 --> 00:19:20,400
get to those um if you go back to this

550
00:19:29,270 --> 00:19:27,110
go where is it danny

551
00:19:30,789 --> 00:19:29,280
it is on here there we go the astrology

552
00:19:32,390 --> 00:19:30,799
learning project predictions so this is

553
00:19:34,630 --> 00:19:32,400
how this is how you get to the learning

554
00:19:37,270 --> 00:19:34,640
progressions on the astrobiology website

555
00:19:38,150 --> 00:19:37,280
it's on that major education page and

556
00:19:39,510 --> 00:19:38,160
i'm going to i'm going to hand things

557
00:19:40,950 --> 00:19:39,520
off to danny and

558
00:19:47,510 --> 00:19:40,960
let her explain exactly what the what

559
00:19:53,669 --> 00:19:50,070
great thank you so much

560
00:19:55,510 --> 00:19:53,679
yes actually everything that graham and

561
00:19:56,710 --> 00:19:55,520
aaron have talked about i've used in my

562
00:19:59,510 --> 00:19:56,720
classes

563
00:20:01,029 --> 00:19:59,520

literally every single thing um

564
00:20:03,270 --> 00:20:01,039
and i'll be able to screen share once

565
00:20:06,310 --> 00:20:03,280
you guys are out of that but it's okay

566
00:20:08,870 --> 00:20:07,669
hey got it

567
00:20:11,430 --> 00:20:08,880
perfect

568
00:20:12,789 --> 00:20:11,440
um so hi everybody i'm danny leech i

569
00:20:16,630 --> 00:20:12,799
have um

570
00:20:18,950 --> 00:20:16,640
been um like my intro been teaching um

571
00:20:21,350 --> 00:20:18,960
science and astrobiology and math and

572
00:20:22,870 --> 00:20:21,360
all sorts of things for a long time 26

573
00:20:25,190 --> 00:20:22,880
years and

574
00:20:26,710 --> 00:20:25,200
my background today is

575
00:20:28,390 --> 00:20:26,720
the hubble deep filled image and this

576
00:20:29,750 --> 00:20:28,400
was one of the things that blew my mind

577
00:20:31,350 --> 00:20:29,760
when i first

578
00:20:34,310 --> 00:20:31,360
learned about astrobiology and just

579
00:20:36,789 --> 00:20:34,320
started to get into it as this is from

580
00:20:38,549 --> 00:20:36,799
like i said the hubble and it was a an

581
00:20:41,909 --> 00:20:38,559
image taken over a really long period of

582
00:20:43,669 --> 00:20:41,919
time and in fact every single

583
00:20:45,510 --> 00:20:43,679
dot that's there

584
00:20:47,590 --> 00:20:45,520
well first i'll tell you it's only

585
00:20:50,549 --> 00:20:47,600
covering a really boring part of the sky

586
00:20:53,430 --> 00:20:50,559
and it only is covering a section of sky

587
00:20:55,830 --> 00:20:53,440
about the size of

588
00:20:57,430 --> 00:20:55,840

a pencil eraser held at arm's length up

589
00:21:00,070 --> 00:20:57,440
in the sky and that's how much coverage

590
00:21:03,110 --> 00:21:00,080
it was but in just that tiny little bit

591
00:21:05,669 --> 00:21:03,120
in the sky each one of these um dots

592
00:21:08,230 --> 00:21:05,679
that are behind me are actually from an

593
00:21:09,669 --> 00:21:08,240
entire galaxy of hundreds of millions of

594
00:21:10,630 --> 00:21:09,679
stars each

595
00:21:12,630 --> 00:21:10,640
and

596
00:21:14,310 --> 00:21:12,640
of course we we don't know but we're

597
00:21:17,510 --> 00:21:14,320
assuming there's lots of planets around

598
00:21:19,590 --> 00:21:17,520
each of or many of them and um that just

599
00:21:22,310 --> 00:21:19,600
blew my mind and and once that was one

600
00:21:24,630 --> 00:21:22,320
of the ideas that jumped um for me when

601
00:21:26,950 --> 00:21:24,640
i started to dig into this and i share

602
00:21:34,870 --> 00:21:26,960
that with students and they

603
00:21:39,350 --> 00:21:37,190
there we go so there's a qr code there

604
00:21:40,950 --> 00:21:39,360
to jump right where um aaron was saying

605
00:21:42,070 --> 00:21:40,960
to get into the astrobiology learning

606
00:21:43,270 --> 00:21:42,080
progressions

607
00:21:45,909 --> 00:21:43,280
but i'm going to show you that in a

608
00:21:47,110 --> 00:21:45,919
little bit as well so um not you don't

609
00:21:48,710 --> 00:21:47,120
have to worry about grabbing it right

610
00:21:49,990 --> 00:21:48,720
there i'm going to get it to you in a

611
00:21:51,830 --> 00:21:50,000
little bit too

612
00:21:54,630 --> 00:21:51,840
um so one of the things that i wanted to

613
00:21:57,350 --> 00:21:54,640

share with you today is just why or how

614
00:21:59,350 --> 00:21:57,360
both of those you can get um

615
00:22:00,950 --> 00:21:59,360
astrobiology concepts this idea of

616
00:22:03,430 --> 00:22:00,960
searching for life in the universe why

617
00:22:05,990 --> 00:22:03,440
is it here where is it elsewhere and how

618
00:22:08,070 --> 00:22:06,000
do we find out um why this would be good

619
00:22:10,870 --> 00:22:08,080
in your classroom and how can you you

620
00:22:13,990 --> 00:22:10,880
know make that happen um and so giving

621
00:22:15,750 --> 00:22:14,000
you support in that so first off um it's

622
00:22:17,029 --> 00:22:15,760
wonderful with your classrooms because

623
00:22:19,270 --> 00:22:17,039
students are

624
00:22:21,590 --> 00:22:19,280
super interested in it i would say that

625
00:22:23,510 --> 00:22:21,600
it's not just students i think humans

626
00:22:25,750 --> 00:22:23,520
are super interested these are questions

627
00:22:27,270 --> 00:22:25,760
that people are interested in for a very

628
00:22:29,669 --> 00:22:27,280
long period of time

629
00:22:32,230 --> 00:22:29,679
and um almost every science news that

630
00:22:35,029 --> 00:22:32,240
you hear about is actually you can it

631
00:22:36,710 --> 00:22:35,039
comes back to a lot of times

632
00:22:38,870 --> 00:22:36,720
is there life there could there be life

633
00:22:41,590 --> 00:22:38,880
there and how are we going to find out

634
00:22:43,750 --> 00:22:41,600
so these types of questions like

635
00:22:45,590 --> 00:22:43,760
is there life on mars

636
00:22:47,750 --> 00:22:45,600
can we use technology to search for life

637
00:22:49,990 --> 00:22:47,760
how are we going to do that

638
00:22:52,870 --> 00:22:50,000

brings in students and gets them really

639
00:22:54,549 --> 00:22:52,880
excited and that can be as you well know

640
00:22:56,950 --> 00:22:54,559
i'm sure you know

641
00:22:59,430 --> 00:22:56,960
one of our biggest obstacles

642
00:23:03,590 --> 00:22:59,440
it's also awesome for teachers

643
00:23:06,149 --> 00:23:03,600
we have huge demands placed on us

644
00:23:08,950 --> 00:23:06,159
it is not what many think where you just

645
00:23:10,630 --> 00:23:08,960
have these lists of

646
00:23:12,630 --> 00:23:10,640
small number of standards that you have

647
00:23:14,390 --> 00:23:12,640
to hit each year no the demands on

648
00:23:16,549 --> 00:23:14,400
teachers are we not only have to cover

649
00:23:18,789 --> 00:23:16,559
all the standards for our content but we

650
00:23:19,750 --> 00:23:18,799
also need to support the standards in

651
00:23:22,149 --> 00:23:19,760
the math

652
00:23:23,750 --> 00:23:22,159
and also engineering and also the

653
00:23:25,750 --> 00:23:23,760
writing and

654
00:23:26,789 --> 00:23:25,760
21st century skills and there's so much

655
00:23:29,430 --> 00:23:26,799
that

656
00:23:33,110 --> 00:23:29,440
are demanded of this so astrobiology is

657
00:23:35,190 --> 00:23:33,120
great because it inherently uses science

658
00:23:36,470 --> 00:23:35,200
concepts from

659
00:23:38,950 --> 00:23:36,480
all sciences

660
00:23:40,470 --> 00:23:38,960
so you don't have to be teaching biology

661
00:23:42,149 --> 00:23:40,480
you could be teaching a concept in

662
00:23:45,350 --> 00:23:42,159
chemistry or physics or geology or

663
00:23:47,590 --> 00:23:45,360

astronomy and oceanography climatology

664
00:23:49,510 --> 00:23:47,600
meteorology and you could bring some

665
00:23:51,750 --> 00:23:49,520
aspect of astrobiology could help you

666
00:23:55,830 --> 00:23:51,760
bring that to life for them

667
00:23:57,590 --> 00:23:55,840
also it's easy to build into areas

668
00:23:58,870 --> 00:23:57,600
such as creative writing

669
00:24:00,390 --> 00:23:58,880
math

670
00:24:02,789 --> 00:24:00,400
technology

671
00:24:05,029 --> 00:24:02,799
reading comprehension writing

672
00:24:06,390 --> 00:24:05,039
it's it can do all of those things very

673
00:24:08,230 --> 00:24:06,400
well

674
00:24:10,470 --> 00:24:08,240
and the biggest thing is it's engaging

675
00:24:11,909 --> 00:24:10,480
and it's relevant so they students are

676
00:24:13,990 --> 00:24:11,919
excited about

677
00:24:15,590 --> 00:24:14,000
these ideas and they're willing to spend

678
00:24:17,269 --> 00:24:15,600
time thinking of them

679
00:24:19,750 --> 00:24:17,279
and it's also bringing in things that

680
00:24:21,990 --> 00:24:19,760
are happening right now so the questions

681
00:24:24,070 --> 00:24:22,000
that students ask are the same questions

682
00:24:26,470 --> 00:24:24,080
that scientists are out there trying to

683
00:24:29,190 --> 00:24:26,480
answer and new discoveries will be

684
00:24:31,029 --> 00:24:29,200
learned along the way so not only will

685
00:24:33,669 --> 00:24:31,039
you be teaching something about

686
00:24:36,870 --> 00:24:33,679
astrobiology but throughout the year

687
00:24:38,549 --> 00:24:36,880
something in that topic will be

688
00:24:40,549 --> 00:24:38,559

announced on

689
00:24:42,070 --> 00:24:40,559
uh whatever news or article that it

690
00:24:44,149 --> 00:24:42,080
might be

691
00:24:45,430 --> 00:24:44,159
so it's um

692
00:24:47,669 --> 00:24:45,440
both of those things it's also really

693
00:24:51,029 --> 00:24:47,679
like i said it's also timely because it

694
00:24:53,190 --> 00:24:51,039
is going to keep changing for us um and

695
00:24:55,190 --> 00:24:53,200
when we can figure out a way to help

696
00:24:57,750 --> 00:24:55,200
kids be curious then we're setting

697
00:25:01,190 --> 00:24:57,760
ourselves up to have the best

698
00:25:03,350 --> 00:25:01,200
learning opportunities that we can

699
00:25:05,430 --> 00:25:03,360
so this little guy who looks huge right

700
00:25:07,669 --> 00:25:05,440
now but is actually microscopic is one

701
00:25:09,990 --> 00:25:07,679
of our friends in

702
00:25:12,789 --> 00:25:10,000
astrobiology and it's the tardigrade

703
00:25:15,510 --> 00:25:12,799
also known as the moss piglet or the

704
00:25:17,269 --> 00:25:15,520
water bear and you know it just gives

705
00:25:18,870 --> 00:25:17,279
you these this is a

706
00:25:20,710 --> 00:25:18,880
an organism that's an animal in a

707
00:25:22,070 --> 00:25:20,720
complex life form however it's a

708
00:25:24,470 --> 00:25:22,080
microscopic

709
00:25:25,909 --> 00:25:24,480
so when i'm thinking about how i might

710
00:25:27,510 --> 00:25:25,919
have to teach

711
00:25:30,149 --> 00:25:27,520
kingdoms of life you know what are the

712
00:25:31,510 --> 00:25:30,159
different categories um you can actually

713
00:25:34,470 --> 00:25:31,520

bring these little guys into your

714
00:25:36,149 --> 00:25:34,480
classroom um order them online and

715
00:25:38,390 --> 00:25:36,159
there's a variety of ways to do that put

716
00:25:41,029 --> 00:25:38,400
them under microscopes and find them and

717
00:25:42,950 --> 00:25:41,039
watch them and then you can learn about

718
00:25:44,870 --> 00:25:42,960
where do they fit

719
00:25:46,950 --> 00:25:44,880
this is a topic this these little guys

720
00:25:49,029 --> 00:25:46,960
are interested in astrobiology because

721
00:25:50,630 --> 00:25:49,039
um even on

722
00:25:53,269 --> 00:25:50,640
the international space station they

723
00:25:56,149 --> 00:25:53,279
were put out on the outside of it and

724
00:25:57,430 --> 00:25:56,159
they didn't die they came back in and

725
00:25:58,710 --> 00:25:57,440
they were brought back

726
00:26:01,430 --> 00:25:58,720
brought back to life is a little harsh

727
00:26:03,350 --> 00:26:01,440
but anyway they were able to um

728
00:26:05,190 --> 00:26:03,360
continue living

729
00:26:07,029 --> 00:26:05,200
and because of that

730
00:26:08,470 --> 00:26:07,039
those kind of increasing interesting

731
00:26:10,630 --> 00:26:08,480
qualities

732
00:26:12,789 --> 00:26:10,640
some questions about could life go from

733
00:26:14,070 --> 00:26:12,799
one place to another in the solar system

734
00:26:16,230 --> 00:26:14,080
or beyond

735
00:26:18,149 --> 00:26:16,240
um so i can think of maybe taking

736
00:26:20,070 --> 00:26:18,159
something in a lesson or a unit that

737
00:26:22,470 --> 00:26:20,080
maybe needs some

738
00:26:24,470 --> 00:26:22,480

some up some revving up and you could

739
00:26:26,390 --> 00:26:24,480
think about some ways and explore with

740
00:26:30,710 --> 00:26:26,400
you i'll explore with you on how we

741
00:26:34,310 --> 00:26:32,070
graham showed you a picture of the grand

742
00:26:35,750 --> 00:26:34,320
prismatic spring and it is just one of

743
00:26:38,149 --> 00:26:35,760
those really cool places that

744
00:26:40,470 --> 00:26:38,159
astrobiology looked at but anybody who

745
00:26:42,390 --> 00:26:40,480
goes there um everybody who's lined up

746
00:26:44,310 --> 00:26:42,400
there are an astrobiologist they're all

747
00:26:47,590 --> 00:26:44,320
they're enjoying themselves because it

748
00:26:48,870 --> 00:26:47,600
is just interesting all by itself so um

749
00:26:50,390 --> 00:26:48,880
and then you know just kind of thinking

750
00:26:52,549 --> 00:26:50,400
of other topics you might be thinking

751
00:26:55,110 --> 00:26:52,559
about in your classes you know

752
00:26:56,630 --> 00:26:55,120
photosynthesis big bang

753
00:26:58,070 --> 00:26:56,640
trying to do that claim evidence

754
00:26:59,269 --> 00:26:58,080
reasoning that we're doing across the

755
00:27:00,789 --> 00:26:59,279
board

756
00:27:03,990 --> 00:27:00,799
all of those things have ways that we

757
00:27:06,470 --> 00:27:04,000
can come up with a question or an angle

758
00:27:09,029 --> 00:27:06,480
that could help you in bringing some

759
00:27:11,269 --> 00:27:09,039
energy and life to it and capturing the

760
00:27:14,549 --> 00:27:11,279
attention and then teaching the piece

761
00:27:16,950 --> 00:27:14,559
that you want to make sure they get

762
00:27:18,789 --> 00:27:16,960
so some of the ways that um have been

763
00:27:21,029 --> 00:27:18,799

mentioned already that i also want to

764
00:27:22,789 --> 00:27:21,039
mention a few others um nasa wavelength

765
00:27:24,950 --> 00:27:22,799
has a ton of lessons

766
00:27:26,630 --> 00:27:24,960
um stem engagement and we can put these

767
00:27:29,510 --> 00:27:26,640
in the chat at the end as well

768
00:27:31,029 --> 00:27:29,520
um nasa express is sent to you i think

769
00:27:32,310 --> 00:27:31,039
it's pretty much weekly and they have

770
00:27:33,669 --> 00:27:32,320
great ideas

771
00:27:35,110 --> 00:27:33,679
and then what i wanted to share with you

772
00:27:38,710 --> 00:27:35,120
today is the astrobiology of learning

773
00:27:42,389 --> 00:27:40,389
so this is right from the website about

774
00:27:44,549 --> 00:27:42,399
why we had this but the the creation of

775
00:27:47,430 --> 00:27:44,559
the astrobiology learning progressions

776
00:27:49,510 --> 00:27:47,440
mainly was twofold one we wanted to help

777
00:27:53,029 --> 00:27:49,520
teachers feel really comfortable

778
00:27:54,549 --> 00:27:53,039
in providing um and creating units for

779
00:27:56,950 --> 00:27:54,559
their students

780
00:27:59,669 --> 00:27:56,960
in an area that they have probably not a

781
00:28:01,909 --> 00:27:59,679
lot of experience you know i went to

782
00:28:04,470 --> 00:28:01,919
college we took classes a variety of

783
00:28:06,789 --> 00:28:04,480
science classes so did you

784
00:28:09,510 --> 00:28:06,799
but very few of us took an astrobiology

785
00:28:10,870 --> 00:28:09,520
course and so because of that

786
00:28:13,269 --> 00:28:10,880
we're going to have to kind of put out

787
00:28:15,110 --> 00:28:13,279
some some time into learning something

788
00:28:16,389 --> 00:28:15,120

brand new to bring to our students i

789
00:28:18,310 --> 00:28:16,399
don't think you have to know it all to

790
00:28:20,389 --> 00:28:18,320
be able to teach at all but i do think

791
00:28:22,230 --> 00:28:20,399
we need to feel comfortable enough to be

792
00:28:23,510 --> 00:28:22,240
able to do that and so

793
00:28:25,590 --> 00:28:23,520
that was one of the reasons for the

794
00:28:27,029 --> 00:28:25,600
development of the learning progressions

795
00:28:29,830 --> 00:28:27,039
the other one is actually to help

796
00:28:32,070 --> 00:28:29,840
scientists be able to communicate their

797
00:28:34,310 --> 00:28:32,080
work to students of different

798
00:28:36,389 --> 00:28:34,320
cognitive levels and so i'm going to

799
00:28:38,870 --> 00:28:36,399
show you how those are worked out and

800
00:28:42,230 --> 00:28:38,880
just run through something that i hope

801
00:28:44,470 --> 00:28:42,240
would be something you can use

802
00:28:46,389 --> 00:28:44,480
as we move forward and it's not just a

803
00:28:48,630 --> 00:28:46,399
one and done just something that you can

804
00:28:50,310 --> 00:28:48,640
use on and off um

805
00:28:53,830 --> 00:28:50,320
throughout your career

806
00:28:55,909 --> 00:28:53,840
so all of astrobiology we tried to take

807
00:28:57,750 --> 00:28:55,919
every question that

808
00:28:59,909 --> 00:28:57,760
people are looking into about life in

809
00:29:00,710 --> 00:28:59,919
the universe where is it how did it get

810
00:29:05,909 --> 00:29:00,720
here

811
00:29:07,669 --> 00:29:05,919
and put it into seven core learning

812
00:29:09,750 --> 00:29:07,679
progression questions

813
00:29:11,510 --> 00:29:09,760

and this helps with trying to narrow

814
00:29:13,430 --> 00:29:11,520
down the amount of information that

815
00:29:15,430 --> 00:29:13,440
you're going to need to

816
00:29:17,190 --> 00:29:15,440
understand and feel comfortable with so

817
00:29:18,470 --> 00:29:17,200
that you're not reading an entire book

818
00:29:20,710 --> 00:29:18,480
or taking an entire class on

819
00:29:23,269 --> 00:29:20,720
astrobiology we're just going to get you

820
00:29:26,070 --> 00:29:23,279
comfortable in in one area and then

821
00:29:28,630 --> 00:29:26,080
you'll take it from there

822
00:29:32,070 --> 00:29:28,640
but because that was even too much um

823
00:29:34,389 --> 00:29:32,080
potentially we also broke it down to sub

824
00:29:38,149 --> 00:29:34,399
questions so every core question is then

825
00:29:41,110 --> 00:29:38,159
broken down into several um core um sub

826
00:29:43,590 --> 00:29:41,120
questions and this you may not know at

827
00:29:45,590 --> 00:29:43,600
first where you're going with a question

828
00:29:48,389 --> 00:29:45,600
that you want to work on or a unit or an

829
00:29:50,789 --> 00:29:48,399
idea that you want to search out but by

830
00:29:53,269 --> 00:29:50,799
clicking around for a little bit

831
00:29:54,950 --> 00:29:53,279
and seeing what it looks like i think

832
00:29:57,430 --> 00:29:54,960
that you will become comfortable really

833
00:29:58,950 --> 00:29:57,440
quickly so the the fact that right now

834
00:30:01,909 --> 00:29:58,960
it's a long list

835
00:30:04,389 --> 00:30:01,919
um i don't want that to be um you know

836
00:30:05,909 --> 00:30:04,399
inaccessible i think it's really gonna

837
00:30:07,909 --> 00:30:05,919
you're gonna jump into a couple things

838
00:30:12,070 --> 00:30:07,919

quickly and be able to understand what's

839
00:30:16,149 --> 00:30:14,470
so the um the breakdown of the

840
00:30:17,430 --> 00:30:16,159
progression so

841
00:30:20,389 --> 00:30:17,440
like aaron was saying it's on the

842
00:30:22,470 --> 00:30:20,399
website and i'll get you a qr code in

843
00:30:24,310 --> 00:30:22,480
the website at the end as well but what

844
00:30:26,230 --> 00:30:24,320
it looks like is

845
00:30:27,430 --> 00:30:26,240
it's broken down by the core learning

846
00:30:31,590 --> 00:30:27,440
questions

847
00:30:34,230 --> 00:30:31,600
and then there is this

848
00:30:36,310 --> 00:30:34,240
what we're calling progress storyline

849
00:30:38,070 --> 00:30:36,320
and then there's some different tabs um

850
00:30:39,909 --> 00:30:38,080
ngss connections for teachers so we're

851
00:30:41,750 --> 00:30:39,919
going to talk about some standards

852
00:30:43,029 --> 00:30:41,760
concept boundaries for scientists so

853
00:30:44,070 --> 00:30:43,039
when you work with scientists you can

854
00:30:46,389 --> 00:30:44,080
make good

855
00:30:48,470 --> 00:30:46,399
positive moments with them

856
00:30:49,909 --> 00:30:48,480
and then resources that are those will

857
00:30:52,230 --> 00:30:49,919
be lessons and things that you could use

858
00:30:54,470 --> 00:30:52,240
right away and occasionally some of the

859
00:30:56,310 --> 00:30:54,480
questions do have storyline extensions

860
00:30:59,190 --> 00:30:56,320
meaning that this might be a little

861
00:31:01,269 --> 00:30:59,200
beyond k12 but we wanted to put it in

862
00:31:04,070 --> 00:31:01,279
anyway so

863
00:31:07,110 --> 00:31:04,080

and this is kind of in a grid if you

864
00:31:08,710 --> 00:31:07,120
want to think of it that way with

865
00:31:12,549 --> 00:31:08,720
different grade bands

866
00:31:15,509 --> 00:31:12,559
so we're going to take a look at that

867
00:31:20,230 --> 00:31:15,519
okay so we've created uh four grade

868
00:31:22,389 --> 00:31:20,240
bands k2 3-5 6-8 9-12

869
00:31:24,310 --> 00:31:22,399
as a guide for for everybody and and

870
00:31:26,389 --> 00:31:24,320
when you click on the left or the right

871
00:31:27,750 --> 00:31:26,399
you'll be able to change from one to the

872
00:31:30,549 --> 00:31:27,760
next but stay

873
00:31:32,549 --> 00:31:30,559
in the same core learning question

874
00:31:34,789 --> 00:31:32,559
okay so what how why does that help you

875
00:31:36,789 --> 00:31:34,799
is it helps you zero in on the

876
00:31:38,630 --> 00:31:36,799
information that you exactly need for

877
00:31:42,230 --> 00:31:38,640
the grade that you you have

878
00:31:44,710 --> 00:31:42,240
so the progress um the progress

879
00:31:48,070 --> 00:31:44,720
information here the the story lines

880
00:31:49,990 --> 00:31:48,080
what those basically are is a way of

881
00:31:52,470 --> 00:31:50,000
taking this concept this question that

882
00:31:54,389 --> 00:31:52,480
they're looking at and then saying well

883
00:31:56,389 --> 00:31:54,399
okay how did we get here what are the

884
00:31:58,710 --> 00:31:56,399
main ideas what are the what's the

885
00:31:59,669 --> 00:31:58,720
research being done how are they forming

886
00:32:02,230 --> 00:31:59,679
questions

887
00:32:05,110 --> 00:32:02,240
and then thinking of it in terms of what

888
00:32:06,710 --> 00:32:05,120

would be appropriate for that grade band

889
00:32:08,070 --> 00:32:06,720
so i mean appropriate as in like

890
00:32:09,350 --> 00:32:08,080
cognitive level

891
00:32:12,870 --> 00:32:09,360
and so

892
00:32:15,350 --> 00:32:12,880
as you getting used to a certain topic

893
00:32:18,470 --> 00:32:15,360
i would suggest that if you are like a

894
00:32:20,870 --> 00:32:18,480
k2 or 35 or 68 whatever you are teacher

895
00:32:21,909 --> 00:32:20,880
i would also look at the higher grade

896
00:32:24,070 --> 00:32:21,919
bands

897
00:32:26,710 --> 00:32:24,080
um as well and read that because that

898
00:32:29,669 --> 00:32:26,720
will give you more of a a feel and

899
00:32:30,710 --> 00:32:29,679
information about where it's headed

900
00:32:33,190 --> 00:32:30,720
towards

901
00:32:34,630 --> 00:32:33,200
um and that'll help you know make it

902
00:32:37,269 --> 00:32:34,640
easier for you to bring it to your

903
00:32:38,310 --> 00:32:37,279
students in their cognitive level range

904
00:32:41,029 --> 00:32:38,320
so

905
00:32:41,990 --> 00:32:41,039
all the time

906
00:32:43,590 --> 00:32:42,000
but

907
00:32:46,950 --> 00:32:43,600
it's here for you by being able to go

908
00:32:51,190 --> 00:32:49,269
so if you are um i'm just gonna run an

909
00:32:52,710 --> 00:32:51,200
example and and think about you know if

910
00:32:54,389 --> 00:32:52,720
this works for you and of course there's

911
00:32:57,430 --> 00:32:54,399
lots of different um questions that are

912
00:33:00,070 --> 00:32:57,440
there but um so let's say we have an

913
00:33:01,909 --> 00:33:00,080

eighth grade teacher planning a unit

914
00:33:03,990 --> 00:33:01,919
definitely wants to hit something about

915
00:33:04,870 --> 00:33:04,000
adam creation about atoms about the big

916
00:33:06,549 --> 00:33:04,880
bang

917
00:33:08,950 --> 00:33:06,559
after clicking around on the core

918
00:33:11,110 --> 00:33:08,960
learning questions then it would become

919
00:33:13,350 --> 00:33:11,120
pretty obvious pretty quick that we

920
00:33:16,149 --> 00:33:13,360
really want to be in 1.1 which is are we

921
00:33:17,990 --> 00:33:16,159
really made of star stuff

922
00:33:20,149 --> 00:33:18,000
um if it's an 8th grade teacher zooming

923
00:33:21,669 --> 00:33:20,159
into the 8th grade 6 8th grade band

924
00:33:23,430 --> 00:33:21,679
would be great and also like i said

925
00:33:25,190 --> 00:33:23,440
would be awesome to take a look at the

926
00:33:26,549 --> 00:33:25,200
912

927
00:33:27,990 --> 00:33:26,559
and then

928
00:33:30,789 --> 00:33:28,000
additionally we have this ngss

929
00:33:31,990 --> 00:33:30,799
connections for teachers and what that

930
00:33:39,110 --> 00:33:32,000
is

931
00:33:41,669 --> 00:33:39,120
as well as the cross-cutting

932
00:33:44,310 --> 00:33:41,679
concepts and put them

933
00:33:47,830 --> 00:33:44,320
into information that you could easily

934
00:33:50,389 --> 00:33:47,840
get quickly so if you want to do

935
00:33:52,470 --> 00:33:50,399
something around this topic if you click

936
00:33:54,789 --> 00:33:52,480
on that you would then see all of the

937
00:33:57,750 --> 00:33:54,799
standards that we think could be

938
00:33:59,830 --> 00:33:57,760

addressed by this topic and some and the

939
00:34:01,669 --> 00:33:59,840
resources that are here so as the

940
00:34:03,669 --> 00:34:01,679
teacher it's your job to as you well

941
00:34:05,430 --> 00:34:03,679
know you'll be in charge of making sure

942
00:34:06,870 --> 00:34:05,440
that you do hit it to the depth that you

943
00:34:09,669 --> 00:34:06,880
need to

944
00:34:12,069 --> 00:34:09,679
but we've kind of went through and

945
00:34:14,069 --> 00:34:12,079
looked at all the ngss dcis and said

946
00:34:16,710 --> 00:34:14,079
okay these are the things that could fit

947
00:34:18,230 --> 00:34:16,720
for this particular question

948
00:34:20,069 --> 00:34:18,240
we also did that with the cross-cutting

949
00:34:21,030 --> 00:34:20,079
concepts

950
00:34:23,190 --> 00:34:21,040
and

951
00:34:24,869 --> 00:34:23,200
i think that you could even go further

952
00:34:26,869 --> 00:34:24,879
with the cross-cutting concepts and

953
00:34:28,389 --> 00:34:26,879
potentially add some more

954
00:34:31,669 --> 00:34:28,399
but definitely the ones that are there

955
00:34:33,909 --> 00:34:31,679
are ones that you'll you would

956
00:34:36,230 --> 00:34:33,919
feel confident that you could hit during

957
00:34:38,230 --> 00:34:36,240
this type of unit and

958
00:34:40,550 --> 00:34:38,240
i also will mention that we didn't put

959
00:34:42,950 --> 00:34:40,560
in the science and

960
00:34:45,669 --> 00:34:42,960
engineering practices because things

961
00:34:48,389 --> 00:34:45,679
like developing models and interpreting

962
00:34:51,510 --> 00:34:48,399
data and asking questions we're

963
00:34:53,589 --> 00:34:51,520

literally in every single one of the sub

964
00:34:55,430 --> 00:34:53,599
questions and so instead of writing it

965
00:34:58,550 --> 00:34:55,440
each time i just want to announce that

966
00:35:01,589 --> 00:34:58,560
is that you can by the choices you make

967
00:35:03,589 --> 00:35:01,599
on how you set up your units or lessons

968
00:35:05,190 --> 00:35:03,599
and the types of questions

969
00:35:07,030 --> 00:35:05,200
types of lessons that you're doing

970
00:35:08,790 --> 00:35:07,040
you'll make sure that

971
00:35:13,430 --> 00:35:08,800
it

972
00:35:15,510 --> 00:35:13,440
practice that you want to

973
00:35:16,790 --> 00:35:15,520
i'm not saying that any one lesson would

974
00:35:18,630 --> 00:35:16,800
therefore hit them all i'm saying

975
00:35:19,990 --> 00:35:18,640
they're all available to be hit with

976
00:35:22,950 --> 00:35:20,000
that

977
00:35:26,470 --> 00:35:22,960
and then the resources

978
00:35:28,069 --> 00:35:26,480
are here as well so the resources um are

979
00:35:29,510 --> 00:35:28,079
all from

980
00:35:31,589 --> 00:35:29,520
well what i did was i went through all

981
00:35:32,950 --> 00:35:31,599
of a massive wavelength and took a look

982
00:35:35,109 --> 00:35:32,960
at all of the

983
00:35:36,470 --> 00:35:35,119
um

984
00:35:38,470 --> 00:35:36,480
actually i should move this on a little

985
00:35:39,910 --> 00:35:38,480
bit hold on there's our disciplinary

986
00:35:41,270 --> 00:35:39,920
core ideas

987
00:35:45,430 --> 00:35:41,280
i'll just pause for a second since i

988
00:35:45,440 --> 00:35:50,230

and the cross-cutting concepts

989
00:35:55,990 --> 00:35:52,470
and here's the resources so what i had

990
00:35:58,710 --> 00:35:56,000
done is i took the lessons that were in

991
00:36:00,150 --> 00:35:58,720
nasa wavelength and deciphered whether

992
00:36:01,670 --> 00:36:00,160
or not they were

993
00:36:04,710 --> 00:36:01,680
astrobiology because sometimes they're

994
00:36:07,270 --> 00:36:04,720
just astronomy or physics and took all

995
00:36:10,150 --> 00:36:07,280
of those and then broke them down into

996
00:36:12,390 --> 00:36:10,160
what category for what um

997
00:36:14,550 --> 00:36:12,400
sub sub question for every single

998
00:36:18,150 --> 00:36:14,560
question and put them into a list for

999
00:36:20,069 --> 00:36:18,160
you so if you are on a page for 1.1 we

1000
00:36:20,870 --> 00:36:20,079
are all made are we really made of star

1001
00:36:23,510 --> 00:36:20,880
stuff

1002
00:36:26,630 --> 00:36:23,520
then you click on the resources page

1003
00:36:29,430 --> 00:36:26,640
this will be all things for that topic

1004
00:36:30,550 --> 00:36:29,440
and then they're also by grade band as

1005
00:36:32,470 --> 00:36:30,560
well

1006
00:36:34,710 --> 00:36:32,480
so there should be a lot of things there

1007
00:36:36,950 --> 00:36:34,720
that you can then quickly with the p

1008
00:36:40,390 --> 00:36:36,960
with the

1009
00:36:42,069 --> 00:36:40,400
things and

1010
00:36:45,109 --> 00:36:42,079
um that's the plan is to help you

1011
00:36:47,190 --> 00:36:45,119
quickly get comfortable

1012
00:36:48,950 --> 00:36:47,200
know that you hit your standards

1013
00:36:51,829 --> 00:36:48,960

while you're while you're creating these

1014
00:36:52,550 --> 00:36:51,839
units and give you lessons that can help

1015
00:36:56,069 --> 00:36:52,560
you

1016
00:36:57,670 --> 00:36:56,079
in that supporting as area as well

1017
00:37:00,230 --> 00:36:57,680
um

1018
00:37:01,829 --> 00:37:00,240
so the point of being able to do that is

1019
00:37:03,750 --> 00:37:01,839
certainly to just help you try to be

1020
00:37:05,670 --> 00:37:03,760
more comfortable and confident so that

1021
00:37:07,910 --> 00:37:05,680
you can bring these in together and

1022
00:37:10,630 --> 00:37:07,920
honor and respect the time that it takes

1023
00:37:12,550 --> 00:37:10,640
to create these units i would also

1024
00:37:15,030 --> 00:37:12,560
mention that you definitely we all have

1025
00:37:17,349 --> 00:37:15,040
to consider that the lessons and units

1026
00:37:19,109 --> 00:37:17,359
that we are doing now in a few years are

1027
00:37:21,589 --> 00:37:19,119
going to need to be revamped because

1028
00:37:23,910 --> 00:37:21,599
that's part of what um

1029
00:37:25,750 --> 00:37:23,920
what we need to do to stay more to stay

1030
00:37:27,910 --> 00:37:25,760
relevant so i'm hoping that you'll be

1031
00:37:30,470 --> 00:37:27,920
able to come back to the astrobiology

1032
00:37:32,870 --> 00:37:30,480
learning progressions more than once and

1033
00:37:34,550 --> 00:37:32,880
keep building and and and changing up

1034
00:37:36,470 --> 00:37:34,560
things as you as new things are being

1035
00:37:38,150 --> 00:37:36,480
discovered

1036
00:37:39,589 --> 00:37:38,160
and and that are out in the news and

1037
00:37:41,349 --> 00:37:39,599
keeping things relevant and motivating

1038
00:37:43,829 --> 00:37:41,359

for students

1039
00:37:45,910 --> 00:37:43,839
so um i also wanted to mention that

1040
00:37:46,630 --> 00:37:45,920
sometimes we do work with scientists and

1041
00:37:48,470 --> 00:37:46,640
the

1042
00:37:50,870 --> 00:37:48,480
astrobiology learning progressions do

1043
00:37:53,349 --> 00:37:50,880
help scientists with their communication

1044
00:37:54,870 --> 00:37:53,359
and as well and and

1045
00:37:56,790 --> 00:37:54,880
really what the problem was and it

1046
00:37:59,030 --> 00:37:56,800
happened in my class too is that i

1047
00:38:00,550 --> 00:37:59,040
thought i had this great setup for my

1048
00:38:03,270 --> 00:38:00,560
students to learn something really

1049
00:38:04,790 --> 00:38:03,280
important from a scientist and then

1050
00:38:07,829 --> 00:38:04,800
my scientist

1051
00:38:09,750 --> 00:38:07,839
who loves precise language like

1052
00:38:13,750 --> 00:38:09,760
cork and adam

1053
00:38:15,670 --> 00:38:13,760
lost my kids and as you probably know

1054
00:38:17,670 --> 00:38:15,680
just as much as i do is that students

1055
00:38:19,270 --> 00:38:17,680
don't always ask the questions that they

1056
00:38:20,870 --> 00:38:19,280
need to have answered if they get

1057
00:38:23,349 --> 00:38:20,880
confused sometimes they just check out

1058
00:38:25,430 --> 00:38:23,359
or disengage and so what could have been

1059
00:38:29,030 --> 00:38:25,440
this home run lesson

1060
00:38:31,510 --> 00:38:29,040
kind of just wasn't there and

1061
00:38:33,990 --> 00:38:31,520
the plan is then that scientists can

1062
00:38:34,950 --> 00:38:34,000
also take a look at this the

1063
00:38:36,310 --> 00:38:34,960

um

1064
00:38:38,470 --> 00:38:36,320
learning progressions and get some

1065
00:38:40,470 --> 00:38:38,480
information about how to talk to and

1066
00:38:42,310 --> 00:38:40,480
work with your students so certainly

1067
00:38:43,670 --> 00:38:42,320
they know what their their content is

1068
00:38:45,670 --> 00:38:43,680
quite well

1069
00:38:47,589 --> 00:38:45,680
but what they don't know is what are

1070
00:38:49,670 --> 00:38:47,599
some boundaries what are some things

1071
00:38:51,670 --> 00:38:49,680
that you probably shouldn't bring up and

1072
00:38:53,510 --> 00:38:51,680
given them permission to use other sets

1073
00:38:54,950 --> 00:38:53,520
of words and examples

1074
00:38:57,430 --> 00:38:54,960
so um

1075
00:38:59,510 --> 00:38:57,440
for like my example for adam we don't

1076
00:39:01,430 --> 00:38:59,520
bring up the word adam is really not

1077
00:39:03,910 --> 00:39:01,440
taught until middle school but if you're

1078
00:39:06,550 --> 00:39:03,920
talking with a third grade class

1079
00:39:09,030 --> 00:39:06,560
you might be able to use the word stuff

1080
00:39:10,710 --> 00:39:09,040
or super tiny particles

1081
00:39:12,550 --> 00:39:10,720
or matter

1082
00:39:14,470 --> 00:39:12,560
and so those are the kinds of things

1083
00:39:16,710 --> 00:39:14,480
that scientists can find

1084
00:39:32,950 --> 00:39:16,720
in

1085
00:39:34,550 --> 00:39:32,960
boundaries for scientists and let me

1086
00:39:36,310 --> 00:39:34,560
know if you want to talk some more about

1087
00:39:38,230 --> 00:39:36,320
how to help our kids

1088
00:39:40,230 --> 00:39:38,240

you know in this in this great make it

1089
00:39:42,069 --> 00:39:40,240
fantastic

1090
00:39:43,829 --> 00:39:42,079
we've been presenting this to uh

1091
00:39:45,589 --> 00:39:43,839
scientists as well and the feedback

1092
00:39:48,390 --> 00:39:45,599
we're getting from them is that it's

1093
00:39:50,390 --> 00:39:48,400
working for them and that they like the

1094
00:39:52,950 --> 00:39:50,400
ability to go study something to learn

1095
00:39:54,710 --> 00:39:52,960
about how to to approach students and

1096
00:39:59,190 --> 00:39:54,720
and kind of word choices and idea

1097
00:40:02,390 --> 00:40:01,430
and within this as well they will also

1098
00:40:04,230 --> 00:40:02,400
have

1099
00:40:05,990 --> 00:40:04,240
the resources because that might come in

1100
00:40:07,510 --> 00:40:06,000
handy too that way that nobody has to

1101
00:40:08,870 --> 00:40:07,520
come up with a brand new lesson

1102
00:40:12,630 --> 00:40:08,880
necessarily they might use something

1103
00:40:18,230 --> 00:40:15,190
so that's some of my information

1104
00:40:19,910 --> 00:40:18,240
here we have a couple of other

1105
00:40:21,990 --> 00:40:19,920
like i said i was going to have

1106
00:40:24,230 --> 00:40:22,000
everything here at the end

1107
00:40:26,710 --> 00:40:24,240
so here on the left hand side that's how

1108
00:40:28,309 --> 00:40:26,720
you you can use that qr code or the link

1109
00:40:29,670 --> 00:40:28,319
there and you can go to the astrobiology

1110
00:40:32,309 --> 00:40:29,680
learning progressions

1111
00:40:33,910 --> 00:40:32,319
um here's the stuff all about at ask and

1112
00:40:35,910 --> 00:40:33,920
astrobiologists

1113
00:40:37,910 --> 00:40:35,920

the graphic histories

1114
00:40:42,710 --> 00:40:37,920
and also

1115
00:40:46,870 --> 00:40:44,150
education

1116
00:40:48,870 --> 00:40:46,880
public event coming up this week

1117
00:40:49,990 --> 00:40:48,880
and so i want to invite you to that as

1118
00:40:52,790 --> 00:40:50,000
well

1119
00:40:54,710 --> 00:40:52,800
that is going to be the jovian safari

1120
00:40:57,109 --> 00:40:54,720
and what um

1121
00:40:58,390 --> 00:40:57,119
what that is implying is that you're

1122
00:41:00,870 --> 00:40:58,400
going to be getting all the up-to-date

1123
00:41:03,430 --> 00:41:00,880
images and information and discoveries

1124
00:41:05,190 --> 00:41:03,440
about jupiter and its moons and so we

1125
00:41:06,390 --> 00:41:05,200
really hope that you

1126
00:41:07,750 --> 00:41:06,400
would feel

1127
00:41:09,510 --> 00:41:07,760
like this is a good talk we're going to

1128
00:41:11,349 --> 00:41:09,520
add to it we're going to keep get things

1129
00:41:13,910 --> 00:41:11,359
rolling and

1130
00:41:15,190 --> 00:41:13,920
i'm going to move it back over to

1131
00:41:17,829 --> 00:41:15,200
martha now

1132
00:41:19,349 --> 00:41:17,839
and i do want to before i completely do

1133
00:41:21,030 --> 00:41:19,359
that i'll just say that i would love

1134
00:41:22,790 --> 00:41:21,040
that if you guys since i'm gonna leave

1135
00:41:24,470 --> 00:41:22,800
the screen up here for a little bit if

1136
00:41:26,150 --> 00:41:24,480
you guys have your own

1137
00:41:28,069 --> 00:41:26,160
devices

1138
00:41:31,510 --> 00:41:28,079

use those qr codes go ahead right now

1139
00:41:33,829 --> 00:41:31,520
even and get things bookmarked or listed

1140
00:41:35,589 --> 00:41:33,839
so that you can use these open another

1141
00:41:37,190 --> 00:41:35,599
tab and take care of that but don't

1142
00:41:39,190 --> 00:41:37,200
leave us yet because we have we have

1143
00:41:41,829 --> 00:41:39,200
more time for questions

1144
00:41:44,069 --> 00:41:41,839
and for everybody that's here

1145
00:41:45,910 --> 00:41:44,079
so thank you so much and really i really

1146
00:41:46,950 --> 00:41:45,920
appreciate that you guys have all come

1147
00:41:50,710 --> 00:41:46,960
out here

1148
00:41:52,390 --> 00:41:50,720
on a number year three of a really hard

1149
00:41:54,309 --> 00:41:52,400
time

1150
00:41:55,910 --> 00:41:54,319
from years before that were that weren't

1151
00:41:58,150 --> 00:41:55,920
that easy either

1152
00:41:59,829 --> 00:41:58,160
and the time that you took today to come

1153
00:42:01,430 --> 00:41:59,839
out to something like this after a long

1154
00:42:03,670 --> 00:42:01,440
day of work i really appreciate your

1155
00:42:09,430 --> 00:42:03,680
time and the work that you're doing

1156
00:42:13,990 --> 00:42:12,230
thank you danny and erin

1157
00:42:17,430 --> 00:42:14,000
and graham

1158
00:42:20,550 --> 00:42:17,440
and thank you all for coming

1159
00:42:23,510 --> 00:42:20,560
and we have time now for questions

1160
00:42:25,670 --> 00:42:23,520
uh so um

1161
00:42:29,190 --> 00:42:25,680
feel free if you'd like to unmute and

1162
00:42:33,190 --> 00:42:29,200
ask a question all 36 are still here

1163
00:42:35,349 --> 00:42:33,200

from from the beginning and um feel free

1164
00:42:37,109 --> 00:42:35,359
to unmute or if you prefer uh you can

1165
00:42:38,069 --> 00:42:37,119
just type in the chat

1166
00:42:40,710 --> 00:42:38,079
um

1167
00:42:43,589 --> 00:42:40,720
but but any of us would just be happy to

1168
00:42:44,390 --> 00:42:43,599
to take any of your questions

1169
00:42:48,150 --> 00:42:44,400
okay

1170
00:42:50,630 --> 00:42:48,160
have all exoplanets found

1171
00:42:53,190 --> 00:42:50,640
to be located in a certain part of the

1172
00:42:55,430 --> 00:42:53,200
galaxy

1173
00:42:57,430 --> 00:42:55,440
exoplanets

1174
00:42:59,430 --> 00:42:57,440
you go ahead no

1175
00:43:02,710 --> 00:42:59,440
so

1176
00:43:05,349 --> 00:43:02,720
exoplanets i mean for us to discover

1177
00:43:06,950 --> 00:43:05,359
exoplanets um it takes

1178
00:43:08,630 --> 00:43:06,960
takes a lot of kind of hard work with

1179
00:43:10,150 --> 00:43:08,640
the telescopes and

1180
00:43:11,990 --> 00:43:10,160
a lot of luck actually that the planets

1181
00:43:13,829 --> 00:43:12,000
in the right place to kind of pass it in

1182
00:43:15,670 --> 00:43:13,839
front of its stars so that we can see it

1183
00:43:17,990 --> 00:43:15,680
and or the other kind of gravitational

1184
00:43:19,430 --> 00:43:18,000
waves that they discover them but so far

1185
00:43:21,430 --> 00:43:19,440
most of the planets that we found are in

1186
00:43:23,910 --> 00:43:21,440
the milky way um

1187
00:43:24,790 --> 00:43:23,920
things that our own galaxy that we're in

1188
00:43:27,829 --> 00:43:24,800

um

1189
00:43:30,150 --> 00:43:27,839
there are a couple i think maybe two

1190
00:43:32,230 --> 00:43:30,160
there's a handful that have been found

1191
00:43:33,829 --> 00:43:32,240
and identified outside of our galaxy and

1192
00:43:35,990 --> 00:43:33,839
other galaxies but

1193
00:43:38,150 --> 00:43:36,000
um part of that's probably a limitation

1194
00:43:38,870 --> 00:43:38,160
of the technology that we have right now

1195
00:43:49,750 --> 00:43:38,880
and

1196
00:43:52,150 --> 00:43:49,760
bit as well

1197
00:43:53,990 --> 00:43:52,160
um the the most of the exoplanets we

1198
00:43:56,230 --> 00:43:54,000
have found we have we have found some

1199
00:43:58,150 --> 00:43:56,240
close to the center of our galaxy

1200
00:43:59,910 --> 00:43:58,160
uh the milky way is a big disc and in

1201
00:44:02,069 --> 00:43:59,920
the middle there's a nice big bulge of

1202
00:44:03,349 --> 00:44:02,079
stars and and so we've seen some around

1203
00:44:04,950 --> 00:44:03,359
some of these really big highly

1204
00:44:08,069 --> 00:44:04,960
energetic stars towards the center of

1205
00:44:10,550 --> 00:44:08,079
our galaxy but most of the exoplanets

1206
00:44:12,550 --> 00:44:10,560
we've seen so far are within just a few

1207
00:44:15,109 --> 00:44:12,560
thousand light years of our own solar

1208
00:44:17,670 --> 00:44:15,119
system and so of our galaxy which is

1209
00:44:20,069 --> 00:44:17,680
roughly 100 000 light years wide the

1210
00:44:22,870 --> 00:44:20,079
ones that we found are in a small circle

1211
00:44:24,470 --> 00:44:22,880
kind of around our own solar system

1212
00:44:26,550 --> 00:44:24,480
and most of them are towards the

1213
00:44:28,550 --> 00:44:26,560

constellation cygnus

1214
00:44:31,190 --> 00:44:28,560
that's the swan that we see in the sky

1215
00:44:33,109 --> 00:44:31,200
overhead of it's one of the the 88

1216
00:44:36,069 --> 00:44:33,119
accepted constellations from the

1217
00:44:37,910 --> 00:44:36,079
international astronautical union um the

1218
00:44:39,190 --> 00:44:37,920
reason that we found most of them there

1219
00:44:41,510 --> 00:44:39,200
so far is actually because of the

1220
00:44:44,550 --> 00:44:41,520
mission kepler which was looking towards

1221
00:44:46,630 --> 00:44:44,560
a little swath of space in that area and

1222
00:44:48,309 --> 00:44:46,640
so there's like a little cone kind of

1223
00:44:49,670 --> 00:44:48,319
going out that that telescope was

1224
00:44:50,550 --> 00:44:49,680
looking at for several years and that's

1225
00:44:52,390 --> 00:44:50,560
where

1226
00:44:57,430 --> 00:44:52,400
most of the exoplanets we've found we

1227
00:45:01,430 --> 00:44:59,510
well this is a fun one um probably aaron

1228
00:45:02,790 --> 00:45:01,440
be the best for this uh can you tell us

1229
00:45:05,589 --> 00:45:02,800
more about projects with incarcerated

1230
00:45:07,990 --> 00:45:05,599
individuals

1231
00:45:09,990 --> 00:45:08,000
yeah i can so

1232
00:45:11,750 --> 00:45:10,000
i mean the

1233
00:45:13,190 --> 00:45:11,760
the best person to speak about this is

1234
00:45:14,550 --> 00:45:13,200
daniella this was this was really a

1235
00:45:16,950 --> 00:45:14,560
project that she worked with and she

1236
00:45:20,069 --> 00:45:18,230
oh she partnered with some other

1237
00:45:21,670 --> 00:45:20,079
organizations that were working inside

1238
00:45:23,270 --> 00:45:21,680

prisons and

1239
00:45:25,670 --> 00:45:23,280
sort of

1240
00:45:27,030 --> 00:45:25,680
just it was the um let's see i think it

1241
00:45:28,630 --> 00:45:27,040
started in washington state was the

1242
00:45:29,910 --> 00:45:28,640
first one they've they've worked in

1243
00:45:32,710 --> 00:45:29,920
florida

1244
00:45:33,910 --> 00:45:32,720
um i think it's about five states or so

1245
00:45:36,230 --> 00:45:33,920
that she's worked in prisons and

1246
00:45:39,109 --> 00:45:36,240
actually brought um astrobiologists into

1247
00:45:39,910 --> 00:45:39,119
the prison to give give lectures and

1248
00:45:42,230 --> 00:45:39,920
um

1249
00:45:43,589 --> 00:45:42,240
most most of them were were adults were

1250
00:45:44,870 --> 00:45:43,599
incarcerated but there was there was one

1251
00:45:47,430 --> 00:45:44,880
sort of youth

1252
00:45:48,710 --> 00:45:47,440
um

1253
00:45:50,309 --> 00:45:48,720
i hate saying the word prisoner but you

1254
00:45:52,309 --> 00:45:50,319
know like i i

1255
00:45:54,309 --> 00:45:52,319
kind of of incarcerated youth that she

1256
00:45:55,589 --> 00:45:54,319
was working with uh there is

1257
00:45:56,630 --> 00:45:55,599
some information on the website if you

1258
00:45:57,910 --> 00:45:56,640
look at that there's there's a pretty

1259
00:45:59,670 --> 00:45:57,920
in-depth article kind of talking about

1260
00:46:01,670 --> 00:45:59,680
what the project is and

1261
00:46:05,829 --> 00:46:01,680
and how hopefully they'll be they'll be

1262
00:46:11,109 --> 00:46:07,910
i would also just add that

1263
00:46:13,990 --> 00:46:11,119

there is a there is a slice of um of the

1264
00:46:15,990 --> 00:46:14,000
astrobiology that you can use to help

1265
00:46:18,230 --> 00:46:16,000
students with actually being able to get

1266
00:46:20,069 --> 00:46:18,240
along with each other and make

1267
00:46:21,750 --> 00:46:20,079
group decisions and also seeing

1268
00:46:24,230 --> 00:46:21,760
themselves kind of in a different

1269
00:46:25,910 --> 00:46:24,240
location and that's part of the idea of

1270
00:46:27,990 --> 00:46:25,920
the work that the

1271
00:46:29,270 --> 00:46:28,000
incarcerated is that you may not be able

1272
00:46:31,990 --> 00:46:29,280
to talk about

1273
00:46:33,750 --> 00:46:32,000
easily what's going on with you and and

1274
00:46:37,190 --> 00:46:33,760
what has happened with you but you can

1275
00:46:38,550 --> 00:46:37,200
talk about um an enclosed space on mars

1276
00:46:40,309 --> 00:46:38,560
and how that would be really hard to get

1277
00:46:42,309 --> 00:46:40,319
along with everybody and how would you

1278
00:46:44,790 --> 00:46:42,319
set that up and and what sorts of

1279
00:46:46,950 --> 00:46:44,800
challenges would you face and that can

1280
00:46:48,630 --> 00:46:46,960
bring out some um

1281
00:46:50,710 --> 00:46:48,640
some some interesting and wonderful

1282
00:46:53,510 --> 00:46:50,720
things and that's true with um with

1283
00:46:55,829 --> 00:46:53,520
everybody including kids at school who

1284
00:46:57,190 --> 00:46:55,839
might have maybe a harder time to

1285
00:46:59,109 --> 00:46:57,200
explain

1286
00:47:03,030 --> 00:46:59,119
you know how they're doing and having

1287
00:47:07,670 --> 00:47:05,030
um jeffrey there was a question you had

1288
00:47:20,150 --> 00:47:07,680

a hand up did you want to unmute and

1289
00:47:22,870 --> 00:47:21,360
he said that was an accident

1290
00:47:26,630 --> 00:47:22,880
[Laughter]

1291
00:47:30,230 --> 00:47:28,230
another question about what are some

1292
00:47:31,670 --> 00:47:30,240
internships that may be available to

1293
00:47:33,750 --> 00:47:31,680
high schools

1294
00:47:35,270 --> 00:47:33,760
um interest in astrobiology and wanting

1295
00:47:36,549 --> 00:47:35,280
to major in this uh there's there's some

1296
00:47:38,470 --> 00:47:36,559
information on the astrobiology program

1297
00:47:41,109 --> 00:47:38,480
website about that as well there's

1298
00:47:43,030 --> 00:47:41,119
um some resources for for early career

1299
00:47:44,069 --> 00:47:43,040
um high school is

1300
00:47:46,069 --> 00:47:44,079
is is

1301
00:47:47,589 --> 00:47:46,079
younger than that but um there's also a

1302
00:47:49,910 --> 00:47:47,599
lot of the

1303
00:47:51,510 --> 00:47:49,920
so so we as a funding body we fund you

1304
00:47:53,750 --> 00:47:51,520
know researchers at universities and

1305
00:47:54,950 --> 00:47:53,760
things and they have often have

1306
00:47:56,390 --> 00:47:54,960
um

1307
00:47:58,069 --> 00:47:56,400
programs that they run themselves with

1308
00:47:59,430 --> 00:47:58,079
their own teams that that work with kind

1309
00:48:00,630 --> 00:47:59,440
of local high schools and that that sort

1310
00:48:01,990 --> 00:48:00,640
of thing so

1311
00:48:03,109 --> 00:48:02,000
always feel free to contact us if you

1312
00:48:05,030 --> 00:48:03,119
have any questions or if you're if

1313
00:48:06,549 --> 00:48:05,040

you're you know you have a student that

1314
00:48:08,549 --> 00:48:06,559
is looking for a placement or something

1315
00:48:10,150 --> 00:48:08,559
maybe we can help um there's also we

1316
00:48:11,349 --> 00:48:10,160
have the astrobiology communication

1317
00:48:12,790 --> 00:48:11,359
skill that we can reach out to a lot of

1318
00:48:15,190 --> 00:48:12,800
people involved in astrobiology that

1319
00:48:17,109 --> 00:48:15,200
might have some some good ideas on

1320
00:48:19,190 --> 00:48:17,119
on how to

1321
00:48:20,390 --> 00:48:19,200
find good places for your students to

1322
00:48:21,750 --> 00:48:20,400
get involved

1323
00:48:23,910 --> 00:48:21,760
um

1324
00:48:25,349 --> 00:48:23,920
yeah

1325
00:48:26,870 --> 00:48:25,359
and what colleges have astrobiology

1326
00:48:28,069 --> 00:48:26,880
programs uh i mean

1327
00:48:29,750 --> 00:48:28,079
there's some

1328
00:48:32,230 --> 00:48:29,760
there's like too many for me to remember

1329
00:48:33,670 --> 00:48:32,240
off the top of my head now um

1330
00:48:35,270 --> 00:48:33,680
i do think there is an undergraduate

1331
00:48:37,430 --> 00:48:35,280
program now somewhere

1332
00:48:38,870 --> 00:48:37,440
you know yeah there's a couple there is

1333
00:48:40,470 --> 00:48:38,880
a list on the web on the astrobiology

1334
00:48:42,549 --> 00:48:40,480
program website too that we try to keep

1335
00:48:44,309 --> 00:48:42,559
up to date of what colleges and

1336
00:48:45,670 --> 00:48:44,319
universities have actual kind of degree

1337
00:48:47,349 --> 00:48:45,680
programs in astrobiology there's a

1338
00:48:49,589 --> 00:48:47,359

number that have like a class

1339
00:48:51,270 --> 00:48:49,599
a class or two but there's also

1340
00:48:53,829 --> 00:48:51,280
um there's a lot of astrobiologists that

1341
00:48:56,069 --> 00:48:53,839
get into the field going you know

1342
00:48:57,510 --> 00:48:56,079
via another form you know another area

1343
00:49:00,309 --> 00:48:57,520
of science like maybe they're studying

1344
00:49:01,750 --> 00:49:00,319
geology or astronomy and then and kind

1345
00:49:03,349 --> 00:49:01,760
of as they move through their career

1346
00:49:05,510 --> 00:49:03,359
sort of

1347
00:49:07,270 --> 00:49:05,520
involved in astrobiology and different

1348
00:49:12,630 --> 00:49:07,280
in different kind of facets of the

1349
00:49:24,710 --> 00:49:14,230
so question about

1350
00:49:27,990 --> 00:49:26,230
are there some gas giants like hot

1351
00:49:29,109 --> 00:49:28,000
jupiters that might sustain some form of

1352
00:49:31,190 --> 00:49:29,119
life

1353
00:49:32,549 --> 00:49:31,200
so while hot jupiters are are a little

1354
00:49:33,670 --> 00:49:32,559
bit different than than some of the

1355
00:49:36,309 --> 00:49:33,680
things we talk about being in the

1356
00:49:38,230 --> 00:49:36,319
habitable zone um you know we we had

1357
00:49:40,390 --> 00:49:38,240
this vision for what planets were and

1358
00:49:43,589 --> 00:49:40,400
how they formed and then that all

1359
00:49:46,230 --> 00:49:43,599
changed after 1995. uh so the very first

1360
00:49:48,069 --> 00:49:46,240
exoplanet detections were in 1992 but

1361
00:49:49,589 --> 00:49:48,079
the very first detections of worlds

1362
00:49:51,910 --> 00:49:49,599
around other stars that are kind of

1363
00:49:53,510 --> 00:49:51,920

similar to our sun uh they fall in what

1364
00:49:55,750 --> 00:49:53,520
we call the main sequence it's kind of

1365
00:49:57,750 --> 00:49:55,760
the main the main band of where most

1366
00:50:00,230 --> 00:49:57,760
stars are they're not like super giant

1367
00:50:02,790 --> 00:50:00,240
stars or neutron stars or white dwarfs

1368
00:50:05,109 --> 00:50:02,800
uh so in 1995 we started discovering

1369
00:50:08,549 --> 00:50:05,119
these worlds around stars and the ones

1370
00:50:11,030 --> 00:50:08,559
that were the easiest to find right away

1371
00:50:13,670 --> 00:50:11,040
were really big and really close to

1372
00:50:16,309 --> 00:50:13,680
their stars so the the hot jupiters uh

1373
00:50:18,950 --> 00:50:16,319
they're large gas giants like jupiter or

1374
00:50:21,109 --> 00:50:18,960
saturn or even bigger uh and they they

1375
00:50:23,270 --> 00:50:21,119
orbit their stars sometimes the period

1376
00:50:24,950 --> 00:50:23,280
as short as just a couple of days so

1377
00:50:26,390 --> 00:50:24,960
they're whizzing around their stars

1378
00:50:28,630 --> 00:50:26,400
super fast

1379
00:50:31,910 --> 00:50:28,640
um they made us have to rethink how

1380
00:50:34,790 --> 00:50:31,920
planets form and we had to have to

1381
00:50:36,710 --> 00:50:34,800
probably move uh after they form and can

1382
00:50:38,230 --> 00:50:36,720
move around in the solar system and our

1383
00:50:41,270 --> 00:50:38,240
own solar system probably had some

1384
00:50:43,589 --> 00:50:41,280
movement of jupiter and saturn

1385
00:50:45,829 --> 00:50:43,599
but those hot jupiters are very much

1386
00:50:48,390 --> 00:50:45,839
large gaseous worlds just like jupiter

1387
00:50:50,630 --> 00:50:48,400
and saturn um now i would personally say

1388
00:50:52,069 --> 00:50:50,640

that there could be life in those kinds

1389
00:50:54,630 --> 00:50:52,079
of worlds even carl sagan in the

1390
00:50:57,109 --> 00:50:54,640
original cosmos envisioned a world like

1391
00:50:59,910 --> 00:50:57,119
jupiter having its own biosphere of what

1392
00:51:01,430 --> 00:50:59,920
he called floaters and sinkers um inside

1393
00:51:02,790 --> 00:51:01,440
of this gas giant which is really cool

1394
00:51:04,230 --> 00:51:02,800
to think about

1395
00:51:05,750 --> 00:51:04,240
but in our own solar system we don't

1396
00:51:08,150 --> 00:51:05,760
think jupiter and saturn have life at

1397
00:51:09,349 --> 00:51:08,160
least not life as we know it uh and so

1398
00:51:11,510 --> 00:51:09,359
we're not really looking to those hot

1399
00:51:13,190 --> 00:51:11,520
jupiters right now for potential signs

1400
00:51:15,030 --> 00:51:13,200
of life at least we haven't had good

1401
00:51:16,710 --> 00:51:15,040
reason to yet but when it comes to

1402
00:51:18,790 --> 00:51:16,720
thinking about what's what's habitable

1403
00:51:21,510 --> 00:51:18,800
out there there's this region around

1404
00:51:23,109 --> 00:51:21,520
stars we call the goldilocks zone

1405
00:51:24,390 --> 00:51:23,119
technically it's the goldilocks zone for

1406
00:51:26,710 --> 00:51:24,400
liquid water

1407
00:51:28,790 --> 00:51:26,720
if you recall the the fairy tale of

1408
00:51:30,309 --> 00:51:28,800
goldilocks and three bears you know that

1409
00:51:31,829 --> 00:51:30,319
there's the porridge is too hot the

1410
00:51:32,950 --> 00:51:31,839
porridge is too cold the porridge is

1411
00:51:34,870 --> 00:51:32,960
just right

1412
00:51:37,670 --> 00:51:34,880
so in the goldilocks zone for liquid

1413
00:51:39,750 --> 00:51:37,680

water it's the region around a star

1414
00:51:42,309 --> 00:51:39,760
where the temperature could be just

1415
00:51:44,950 --> 00:51:42,319
right at the surface of that world

1416
00:51:47,109 --> 00:51:44,960
for liquid oceans to exist

1417
00:51:49,270 --> 00:51:47,119
now that's based only on its orbit

1418
00:51:51,349 --> 00:51:49,280
around its star it doesn't take into

1419
00:51:53,430 --> 00:51:51,359
consideration the actual composition of

1420
00:51:56,470 --> 00:51:53,440
the world or whether or not it has an

1421
00:51:58,870 --> 00:51:56,480
atmosphere um worlds like venus could

1422
00:52:00,549 --> 00:51:58,880
very much be in the same position as

1423
00:52:02,549 --> 00:52:00,559
earth is around their star and still

1424
00:52:04,790 --> 00:52:02,559
have surfaces that are hundreds of

1425
00:52:07,750 --> 00:52:04,800
degrees celsius many hundreds of degrees

1426
00:52:10,069 --> 00:52:07,760
fahrenheit um and so be totally

1427
00:52:12,069 --> 00:52:10,079
uninhabitable for life as we know it

1428
00:52:14,230 --> 00:52:12,079
but it is a very good place for us to

1429
00:52:16,309 --> 00:52:14,240
start looking for signs of life on some

1430
00:52:18,790 --> 00:52:16,319
of these exoplanets that are out there

1431
00:52:20,309 --> 00:52:18,800
and trying to find life and so a lot of

1432
00:52:22,150 --> 00:52:20,319
our current work and looking for

1433
00:52:24,710 --> 00:52:22,160
biosignatures signs of life on

1434
00:52:26,390 --> 00:52:24,720
exoplanets is very much targeting those

1435
00:52:28,309 --> 00:52:26,400
worlds that are kind of in that region

1436
00:52:33,430 --> 00:52:28,319
the goldilocks zone for liquid water

1437
00:52:37,349 --> 00:52:35,109
well this is a fun question from jeffrey

1438
00:52:39,349 --> 00:52:37,359

bergen uh is there any search for

1439
00:52:41,190 --> 00:52:39,359
non-carbon or water dependent life forms

1440
00:52:42,870 --> 00:52:41,200
being looked at uh it's a very good

1441
00:52:45,030 --> 00:52:42,880
question jeffrey

1442
00:52:47,910 --> 00:52:45,040
um i teach a class uh an intro

1443
00:52:49,670 --> 00:52:47,920
astrobiology course that i teach where i

1444
00:52:50,549 --> 00:52:49,680
basically go through some chemistry of

1445
00:52:53,349 --> 00:52:50,559
why

1446
00:52:55,109 --> 00:52:53,359
carbon is probably the best element for

1447
00:52:58,150 --> 00:52:55,119
a backbone for life

1448
00:53:00,470 --> 00:52:58,160
way better than silicon uh and why water

1449
00:53:02,950 --> 00:53:00,480
is probably the best solvent for life at

1450
00:53:04,309 --> 00:53:02,960
least life as we know it um however

1451
00:53:06,230 --> 00:53:04,319
that's not to say that that there

1452
00:53:09,030 --> 00:53:06,240
couldn't be silicon-based life out there

1453
00:53:11,109 --> 00:53:09,040
or life based on some other molecule um

1454
00:53:12,790 --> 00:53:11,119
or some other element for its backbone

1455
00:53:14,950 --> 00:53:12,800
there's also quite a potential that

1456
00:53:17,589 --> 00:53:14,960
there could be life that thrives in

1457
00:53:19,510 --> 00:53:17,599
supercritical carbon dioxide or that

1458
00:53:21,430 --> 00:53:19,520
thrives in hydrocarbon lakes like the

1459
00:53:23,349 --> 00:53:21,440
ones that we find on titan

1460
00:53:25,270 --> 00:53:23,359
so there certainly could be

1461
00:53:27,430 --> 00:53:25,280
other forms of life out there

1462
00:53:29,510 --> 00:53:27,440
that said most of what we're looking for

1463
00:53:31,349 --> 00:53:29,520

right now is very reliant on the life

1464
00:53:33,670 --> 00:53:31,359
that we do know the life that we have

1465
00:53:35,910 --> 00:53:33,680
here on earth um because we don't quite

1466
00:53:37,990 --> 00:53:35,920
know yet what kinds of bio signatures to

1467
00:53:44,309 --> 00:53:38,000
look at for silicon based life or other

1468
00:53:48,309 --> 00:53:46,630
i will so i will say though that the um

1469
00:53:49,430 --> 00:53:48,319
like what grav graham said is absolutely

1470
00:53:51,910 --> 00:53:49,440
right but

1471
00:53:53,910 --> 00:53:51,920
we are looking at ways of identifying

1472
00:53:56,150 --> 00:53:53,920
life that um

1473
00:53:58,630 --> 00:53:56,160
what we call agnostic biosignatures um

1474
00:53:59,990 --> 00:53:58,640
so looking for life in ways that

1475
00:54:01,510 --> 00:54:00,000
we can find something even we don't

1476
00:54:03,589 --> 00:54:01,520
really know what we're looking for and

1477
00:54:05,750 --> 00:54:03,599
one kind of cool example that's come out

1478
00:54:07,190 --> 00:54:05,760
recently in the past year is um

1479
00:54:09,589 --> 00:54:07,200
looking at probably like looking at

1480
00:54:11,829 --> 00:54:09,599
probability as a way to detect life and

1481
00:54:13,510 --> 00:54:11,839
sort of thinking about it as

1482
00:54:15,109 --> 00:54:13,520
if you have a system

1483
00:54:16,150 --> 00:54:15,119
and you have

1484
00:54:18,069 --> 00:54:16,160
sort of

1485
00:54:20,470 --> 00:54:18,079
a level of complexity that you can reach

1486
00:54:21,829 --> 00:54:20,480
in that system based on physics and

1487
00:54:23,430 --> 00:54:21,839
chemistry

1488
00:54:26,230 --> 00:54:23,440

but you find something that's more

1489
00:54:28,390 --> 00:54:26,240
complex than that system can produce

1490
00:54:30,549 --> 00:54:28,400
then there was some sort of extra push

1491
00:54:32,390 --> 00:54:30,559
to get to that level of complexity so

1492
00:54:33,829 --> 00:54:32,400
it's sort of like if you landed on mars

1493
00:54:34,950 --> 00:54:33,839
and there was an iphone laying there on

1494
00:54:37,670 --> 00:54:34,960
the ground

1495
00:54:38,789 --> 00:54:37,680
like the iphone's not alive

1496
00:54:40,470 --> 00:54:38,799
but

1497
00:54:41,829 --> 00:54:40,480
you know that it was made by something

1498
00:54:43,510 --> 00:54:41,839
because it's way too like you don't just

1499
00:54:45,190 --> 00:54:43,520
get an iphone being made from rocks on

1500
00:54:46,710 --> 00:54:45,200
mars out of you know out of nothing you

1501
00:54:48,309 --> 00:54:46,720
know so you know that there was some

1502
00:54:49,829 --> 00:54:48,319
step involved in there and and so

1503
00:54:51,670 --> 00:54:49,839
there's there's a team

1504
00:54:53,349 --> 00:54:51,680
um with what they call the laboratory

1505
00:54:55,829 --> 00:54:53,359
diagnostic biosignatures that look

1506
00:54:57,670 --> 00:54:55,839
that's looking at ways of identifying

1507
00:54:59,510 --> 00:54:57,680
sort of life as that little extra push

1508
00:55:00,390 --> 00:54:59,520
of energy you need in the system to get

1509
00:55:02,069 --> 00:55:00,400
to

1510
00:55:03,349 --> 00:55:02,079
a certain level of complexity if it

1511
00:55:04,630 --> 00:55:03,359
makes sense

1512
00:55:07,270 --> 00:55:04,640
so there are people that are thinking

1513
00:55:08,069 --> 00:55:07,280

about ways of identifying life that that

1514
00:55:10,150 --> 00:55:08,079
aren't

1515
00:55:25,510 --> 00:55:10,160
dependent on exactly on what we know is

1516
00:55:29,990 --> 00:55:27,990
cool are there other questions

1517
00:55:46,470 --> 00:55:30,000
i should say like that's that's also

1518
00:55:46,480 --> 00:55:53,430
seven

1519
00:55:56,630 --> 00:55:55,430
here's one from beyond could life

1520
00:55:58,870 --> 00:55:56,640
express your life exist in other

1521
00:55:59,990 --> 00:55:58,880
dimensions um the true answer is we

1522
00:56:02,549 --> 00:56:00,000
don't know because we don't even know if

1523
00:56:03,750 --> 00:56:02,559
other dimensions are existing out there

1524
00:56:05,349 --> 00:56:03,760
i imagine you're thinking of things like

1525
00:56:06,710 --> 00:56:05,359
the multiverse

1526
00:56:08,230 --> 00:56:06,720
it's interesting to think about but it's

1527
00:56:09,750 --> 00:56:08,240
definitely beyond the realm of current

1528
00:56:13,270 --> 00:56:09,760
science and our current paradigms of

1529
00:56:17,829 --> 00:56:15,750
oh from abdullah you use the iphone as

1530
00:56:20,309 --> 00:56:17,839
an example what are they looking for as

1531
00:56:21,829 --> 00:56:20,319
a part of process up there

1532
00:56:23,670 --> 00:56:21,839
um i'm assuming that you mean like what

1533
00:56:26,710 --> 00:56:23,680
are we looking for for signs of life out

1534
00:56:28,390 --> 00:56:26,720
there um like aaron mentioned um there

1535
00:56:30,069 --> 00:56:28,400
is a team the laboratory for agnostic

1536
00:56:32,390 --> 00:56:30,079
biosignatures who are thinking about

1537
00:56:33,750 --> 00:56:32,400
what kinds of signs of life could there

1538
00:56:35,510 --> 00:56:33,760

could exist out there for us to find

1539
00:56:37,750 --> 00:56:35,520
that aren't aren't necessarily

1540
00:56:39,670 --> 00:56:37,760
terrestrial signs of life that don't

1541
00:56:41,990 --> 00:56:39,680
require the same biochemistry that we

1542
00:56:43,430 --> 00:56:42,000
have uh the same evolutionary history of

1543
00:56:45,030 --> 00:56:43,440
life as we have

1544
00:56:46,870 --> 00:56:45,040
but we're also very much looking for for

1545
00:56:49,750 --> 00:56:46,880
signs of life that we do know

1546
00:56:52,870 --> 00:56:49,760
the production of biosignature gases

1547
00:56:54,230 --> 00:56:52,880
the production of techno signatures um a

1548
00:57:00,549 --> 00:56:54,240
lot of things that life does that we can

1549
00:57:03,910 --> 00:57:01,990
here's one um how likely is

1550
00:57:05,910 --> 00:57:03,920
extraterrestrial life for intelligence

1551
00:57:08,630 --> 00:57:05,920
um that's also one that we really can't

1552
00:57:11,109 --> 00:57:08,640
answer we don't know how likely life is

1553
00:57:13,670 --> 00:57:11,119
out there i will say that sometimes

1554
00:57:16,390 --> 00:57:13,680
people say that i i tend to be that

1555
00:57:18,789 --> 00:57:16,400
that person who can be a bummer

1556
00:57:20,950 --> 00:57:18,799
for some others i will say so based on

1557
00:57:22,789 --> 00:57:20,960
logic and our knowledge of science we

1558
00:57:25,190 --> 00:57:22,799
have to admit that with our given

1559
00:57:28,150 --> 00:57:25,200
evidence we could be alone

1560
00:57:30,710 --> 00:57:28,160
but it doesn't feel likely when you

1561
00:57:33,030 --> 00:57:30,720
start thinking of the sheer number of

1562
00:57:35,270 --> 00:57:33,040
stars and the number of planets that

1563
00:57:37,109 --> 00:57:35,280

were now certain exist out there biggest

1564
00:57:38,470 --> 00:57:37,119
number we've found already

1565
00:57:40,150 --> 00:57:38,480
and we start thinking of all the

1566
00:57:43,270 --> 00:57:40,160
potential environments that are out

1567
00:57:45,109 --> 00:57:43,280
there it doesn't feel like we're alone

1568
00:57:45,990 --> 00:57:45,119
it feels like there must be something

1569
00:57:48,710 --> 00:57:46,000
else

1570
00:57:51,030 --> 00:57:48,720
um you know there's that famous phrase

1571
00:57:53,109 --> 00:57:51,040
um that if it really is just us what a

1572
00:57:54,390 --> 00:57:53,119
tremendous waste of space

1573
00:57:56,069 --> 00:57:54,400
because it really feels like you know

1574
00:57:57,990 --> 00:57:56,079
just given all the potential that there

1575
00:57:59,750 --> 00:57:58,000
really should be life out there and

1576
00:58:01,910 --> 00:57:59,760
honestly like right now is a very

1577
00:58:04,309 --> 00:58:01,920
incredible time to be alive in the

1578
00:58:06,630 --> 00:58:04,319
history of astrobiology because we are

1579
00:58:09,670 --> 00:58:06,640
just now developing

1580
00:58:12,069 --> 00:58:09,680
space flight to explore our solar system

1581
00:58:14,309 --> 00:58:12,079
and developing telescopes to orbit our

1582
00:58:17,589 --> 00:58:14,319
world to look at other worlds so far

1583
00:58:20,069 --> 00:58:17,599
away i mean it's only been six decades

1584
00:58:22,390 --> 00:58:20,079
plus just a little bit since we've we've

1585
00:58:25,030 --> 00:58:22,400
traveled into space ourselves

1586
00:58:27,430 --> 00:58:25,040
and yet we are so very potentially close

1587
00:58:29,510 --> 00:58:27,440
to seeing signs of life on another world

1588
00:58:39,910 --> 00:58:29,520

if it's out there to be found and that's

1589
00:58:43,430 --> 00:58:42,150
that's good to know um for my side of it

1590
00:58:47,589 --> 00:58:43,440
um it's been a pleasure speaking with

1591
00:58:50,870 --> 00:58:49,030
yeah martha do you want to finish us off

1592
00:58:53,349 --> 00:58:50,880
here well i'd just like to you know

1593
00:58:55,030 --> 00:58:53,359
thank everyone um

1594
00:58:56,789 --> 00:58:55,040
thank you all for coming and you know

1595
00:58:59,270 --> 00:58:56,799
we've shared our contact information in

1596
00:59:01,750 --> 00:58:59,280
the chat um and lots of other links

1597
00:59:04,630 --> 00:59:01,760
we've had an active chat going on um in

1598
00:59:06,549 --> 00:59:04,640
parallel to the discussion here so um

1599
00:59:08,549 --> 00:59:06,559
you know just really encourage you uh to

1600
00:59:11,190 --> 00:59:08,559
to check out some of these uh resources

1601
00:59:13,349 --> 00:59:11,200
i also posted some of my own um from

1602
00:59:15,829 --> 00:59:13,359
georgia tech in the in the chat so there

1603
00:59:17,349 --> 00:59:15,839
are a lot of resources out there but um

1604
00:59:19,510 --> 00:59:17,359
uh you know

1605
00:59:21,829 --> 00:59:19,520
uh uh please continue exploring with

1606
00:59:23,270 --> 00:59:21,839
your students and um and just feel free

1607
00:59:24,870 --> 00:59:23,280
to reach out there will be a recording

1608
00:59:27,670 --> 00:59:24,880
available right there will be a

1609
00:59:29,109 --> 00:59:27,680
recording available yeah so um yeah

1610
00:59:30,230 --> 00:59:29,119
definitely uh we'll send out the

1611
00:59:31,910 --> 00:59:30,240
recording

1612
00:59:33,829 --> 00:59:31,920
and uh if there's anything you know you

1613
00:59:38,549 --> 00:59:33,839

really that you want to refer back to or