
PAO

1
00:00:04,390 --> 00:00:02,230
good morning welcome to the space

2
00:00:06,070 --> 00:00:04,400
station flight control room i'm brandi

3
00:00:08,070 --> 00:00:06,080
dean with nasa public affairs office and

4
00:00:10,629 --> 00:00:08,080
i'm joined today by lisborne who is with

5
00:00:11,749 --> 00:00:10,639
the space station program science office

6
00:00:12,950 --> 00:00:11,759
and uh we are going to be joined

7
00:00:14,549 --> 00:00:12,960
remotely

8
00:00:16,230 --> 00:00:14,559
by students from fayette academy in

9
00:00:18,310 --> 00:00:16,240
somerville tennessee and i believe they

10
00:00:23,029 --> 00:00:18,320
have some questions for us can you all

11
00:00:25,830 --> 00:00:24,390
all right well tell us a little bit

12
00:00:30,550 --> 00:00:25,840
about you and then we'll get started on

13
00:00:34,950 --> 00:00:32,790

good morning i'm the principal research

14
00:00:37,270 --> 00:00:34,960
investigator for the student spaceflight

15
00:00:38,869 --> 00:00:37,280
experiments research project that was

16
00:00:41,190 --> 00:00:38,879
selected to go to the international

17
00:00:43,830 --> 00:00:41,200
space station in october

18
00:00:46,549 --> 00:00:43,840
our research project focuses on the

19
00:00:49,750 --> 00:00:46,559
reishi mushroom's effect on chronic

20
00:00:52,709 --> 00:00:49,760
myeloid leukemia's biological model

21
00:00:54,630 --> 00:00:52,719
e coli and microgravity

22
00:00:56,869 --> 00:00:54,640
my question is

23
00:00:58,950 --> 00:00:56,879
what type of research has been done in

24
00:01:00,950 --> 00:00:58,960
recent years on the international space

25
00:01:03,430 --> 00:01:00,960
station that will help to make it

26
00:01:05,910 --> 00:01:03,440
possible to keep people in space for

27
00:01:07,429 --> 00:01:05,920
prolonged periods of time with minimal

28
00:01:09,750 --> 00:01:07,439
negative effects

29
00:01:11,590 --> 00:01:09,760
on the space travelers

30
00:01:14,310 --> 00:01:11,600
well first of all i want to say hello

31
00:01:16,310 --> 00:01:14,320
and greetings uh brandon and i had a

32
00:01:17,749 --> 00:01:16,320
communication with butch wilmore who's

33
00:01:19,910 --> 00:01:17,759
going to be on orbit when your

34
00:01:21,350 --> 00:01:19,920
experiment gets there and he wasn't able

35
00:01:23,190 --> 00:01:21,360
to be here today he's actually on his

36
00:01:24,789 --> 00:01:23,200
way to russia but he did say that he's

37
00:01:27,030 --> 00:01:24,799
going to take real good care of your

38
00:01:28,710 --> 00:01:27,040

experiment so that's pretty cool i also

39
00:01:31,590 --> 00:01:28,720
think it's fantastic that you guys are

40
00:01:32,789 --> 00:01:31,600
participating in this space in the ssep

41
00:01:35,190 --> 00:01:32,799
program

42
00:01:37,030 --> 00:01:35,200
it's it's fantastic to see young people

43
00:01:39,270 --> 00:01:37,040
be interested in science and then

44
00:01:41,350 --> 00:01:39,280
propose an experiment and i'll tell you

45
00:01:43,429 --> 00:01:41,360
what if i was your age and i was able to

46
00:01:45,190 --> 00:01:43,439
have an experiment on the space station

47
00:01:46,870 --> 00:01:45,200
i would just i would be over the moon so

48
00:01:48,710 --> 00:01:46,880
i'm i'm proud of you guys thanks very

49
00:01:50,789 --> 00:01:48,720
much for participating and i hope you

50
00:01:52,550 --> 00:01:50,799
get excellent results

51
00:01:54,469 --> 00:01:52,560
now to answer your question

52
00:01:56,789 --> 00:01:54,479
so we've actually done a tremendous

53
00:01:58,789 --> 00:01:56,799
amount of work studying what happens to

54
00:02:00,310 --> 00:01:58,799
the human body in space and some of

55
00:02:03,109 --> 00:02:00,320
those changes that happen to the human

56
00:02:06,230 --> 00:02:03,119
body they're not very good for us

57
00:02:08,469 --> 00:02:06,240
so we try and mitigate those changes and

58
00:02:10,389 --> 00:02:08,479
some of those changes include some of

59
00:02:13,190 --> 00:02:10,399
them you may have heard of astronauts

60
00:02:16,070 --> 00:02:13,200
tend to lose bone or bone density while

61
00:02:18,710 --> 00:02:16,080
they're in space the lack of

62
00:02:20,710 --> 00:02:18,720
the loading of gravity is removed so

63
00:02:22,869 --> 00:02:20,720

microgravity is what we say the

64
00:02:24,869 --> 00:02:22,879
astronauts are living in in space and

65
00:02:27,270 --> 00:02:24,879
microgravity

66
00:02:29,589 --> 00:02:27,280
causes your bones to get weaker it's

67
00:02:31,750 --> 00:02:29,599
also true for your cardiovascular system

68
00:02:33,750 --> 00:02:31,760
and your muscles and even the immune

69
00:02:35,750 --> 00:02:33,760
system gets weaker so

70
00:02:38,309 --> 00:02:35,760
living in space isn't all that great for

71
00:02:40,550 --> 00:02:38,319
the human body fortunately we've learned

72
00:02:42,630 --> 00:02:40,560
a lot over the 50 some odd years that

73
00:02:44,309 --> 00:02:42,640
we've been doing space flight and we've

74
00:02:45,910 --> 00:02:44,319
learned to mitigate a lot of those

75
00:02:48,869 --> 00:02:45,920
changes so

76
00:02:51,990 --> 00:02:48,879
astronauts exercise a lot on orbit we

77
00:02:53,509 --> 00:02:52,000
allot them about two hours a day to

78
00:02:55,430 --> 00:02:53,519
to work out and that includes a little

79
00:02:56,710 --> 00:02:55,440
bit of time for hygiene and getting

80
00:02:58,710 --> 00:02:56,720
changed

81
00:03:01,270 --> 00:02:58,720
but that exercise helps them maintain

82
00:03:03,910 --> 00:03:01,280
bone strength and cardiovascular fitness

83
00:03:06,229 --> 00:03:03,920
and muscle strength and has some other

84
00:03:07,670 --> 00:03:06,239
beneficial effects for just improving

85
00:03:10,229 --> 00:03:07,680
their mood and it's kind of a stress

86
00:03:12,309 --> 00:03:10,239
relief as well so that's that's kind of

87
00:03:13,990 --> 00:03:12,319
a high level overview of of what we do

88
00:03:16,229 --> 00:03:14,000

to keep our astronauts safe while

89
00:03:20,550 --> 00:03:16,239
they're in space

90
00:03:20,560 --> 00:03:24,710
hi um

91
00:03:29,030 --> 00:03:25,830
i wanted to know if you've ever

92
00:03:31,110 --> 00:03:29,040
performed any uh research on metabolism

93
00:03:32,789 --> 00:03:31,120
if they had any effect with the

94
00:03:35,030 --> 00:03:32,799
anti-gravity

95
00:03:37,270 --> 00:03:35,040
and if you have what kind of research

96
00:03:39,910 --> 00:03:37,280
experiments have you done

97
00:03:41,670 --> 00:03:39,920
well when i was a university student and

98
00:03:44,710 --> 00:03:41,680
then in grad school i was really

99
00:03:46,630 --> 00:03:44,720
interested in metabolism and metabolism

100
00:03:49,589 --> 00:03:46,640
is sort of how your body controls how

101
00:03:52,710 --> 00:03:49,599
much energy it takes in through the form

102
00:03:55,030 --> 00:03:52,720
of calories so eating food how much

103
00:03:58,869 --> 00:03:55,040
energy you expend

104
00:04:01,350 --> 00:03:58,879
so daily metabolic rate and exercise and

105
00:04:03,750 --> 00:04:01,360
how those things balance out to maintain

106
00:04:05,910 --> 00:04:03,760
our body mass and i was interested if

107
00:04:08,630 --> 00:04:05,920
going to a different gravity level would

108
00:04:11,030 --> 00:04:08,640
affect metabolism different gravity all

109
00:04:13,110 --> 00:04:11,040
the way from maybe more gravity than is

110
00:04:16,069 --> 00:04:13,120
on earth to less gravity than is on

111
00:04:18,629 --> 00:04:16,079
earth and so i actually was able to

112
00:04:20,629 --> 00:04:18,639
perform some experiments

113
00:04:23,189 --> 00:04:20,639

here on earth using a centrifuge to

114
00:04:26,150 --> 00:04:23,199
expose my subjects to more than one

115
00:04:29,110 --> 00:04:26,160
gravity actually two times earth gravity

116
00:04:31,830 --> 00:04:29,120
and i found that not surprisingly that

117
00:04:34,469 --> 00:04:31,840
caused more energy expenditure so there

118
00:04:36,870 --> 00:04:34,479
was a little more uh intake requirement

119
00:04:39,030 --> 00:04:36,880
the more energy you expend the more food

120
00:04:41,110 --> 00:04:39,040
you have to eat to maintain

121
00:04:43,909 --> 00:04:41,120
normal energy balance

122
00:04:45,830 --> 00:04:43,919
and the reverse was true in space sort

123
00:04:48,469 --> 00:04:45,840
of it wasn't exactly what i wanted was

124
00:04:50,790 --> 00:04:48,479
hoping to find so my hypothesis was not

125
00:04:52,710 --> 00:04:50,800
exactly supported but that's kind of one

126
00:04:53,749 --> 00:04:52,720
of the cool things about science you ask

127
00:04:56,230 --> 00:04:53,759
a question

128
00:04:58,070 --> 00:04:56,240
you form a hypothesis what you think the

129
00:05:00,070 --> 00:04:58,080
answer is going to be then you perform

130
00:05:01,430 --> 00:05:00,080
the experiment and sometimes you're

131
00:05:03,909 --> 00:05:01,440
right and sometimes you're wrong but

132
00:05:05,990 --> 00:05:03,919
either way you have learned something

133
00:05:08,710 --> 00:05:06,000
and so i had that experience and that

134
00:05:11,270 --> 00:05:08,720
opportunity when i got to college and

135
00:05:13,749 --> 00:05:11,280
part of my um part of my experiment was

136
00:05:15,909 --> 00:05:13,759
done on a space shuttle mission it was

137
00:05:18,150 --> 00:05:15,919
sts-90

138
00:05:20,310 --> 00:05:18,160

it was a neurolab mission it was called

139
00:05:22,230 --> 00:05:20,320
neurolab mission and so that was a great

140
00:05:23,990 --> 00:05:22,240
opportunity for me you guys are getting

141
00:05:26,150 --> 00:05:24,000
to do the same thing now when you're in

142
00:05:27,749 --> 00:05:26,160
high school so you guys are you guys are

143
00:05:28,950 --> 00:05:27,759
well ahead of the game

144
00:05:30,469 --> 00:05:28,960
sounds like you're the perfect person to

145
00:05:33,830 --> 00:05:30,479
answer that question too

146
00:05:36,469 --> 00:05:33,840
good job so uh next question

147
00:05:38,629 --> 00:05:36,479
hi arch school was mentored by dr rafael

148
00:05:40,950 --> 00:05:38,639
collins underwood a researcher from

149
00:05:42,469 --> 00:05:40,960
saint jude children's research hospital

150
00:05:44,390 --> 00:05:42,479
during our student space flight

151
00:05:46,310 --> 00:05:44,400
experience program my research team

152
00:05:48,070 --> 00:05:46,320
designed a project that focused on what

153
00:05:50,150 --> 00:05:48,080
effect would microgravity have on the

154
00:05:51,749 --> 00:05:50,160
growth rate of chronic model of leukemia

155
00:05:53,110 --> 00:05:51,759
we were one of our school's finalists

156
00:05:55,110 --> 00:05:53,120
but our experiment will not be going to

157
00:05:56,309 --> 00:05:55,120
the international space station do you

158
00:05:58,230 --> 00:05:56,319
know that there has been research on the

159
00:05:59,670 --> 00:05:58,240
iss that focuses on the effect of

160
00:06:01,749 --> 00:05:59,680
microgravity on the growth rate of

161
00:06:04,230 --> 00:06:01,759
lithium cells

162
00:06:06,070 --> 00:06:04,240
so first of all let me say you know the

163
00:06:07,749 --> 00:06:06,080

fact that your exact experiment isn't

164
00:06:09,590 --> 00:06:07,759
going to make it to the space station

165
00:06:11,270 --> 00:06:09,600
don't let that discourage you the whole

166
00:06:13,270 --> 00:06:11,280
fact that you came up with an idea and

167
00:06:15,590 --> 00:06:13,280
proposed it to nasa

168
00:06:17,270 --> 00:06:15,600
is something to be very proud of

169
00:06:19,110 --> 00:06:17,280
it certainly doesn't preclude you from

170
00:06:21,189 --> 00:06:19,120
being involved in the future and i hope

171
00:06:23,189 --> 00:06:21,199
that you'll consider to do that

172
00:06:25,430 --> 00:06:23,199
research and science is something that

173
00:06:27,590 --> 00:06:25,440
is so much fun and i'm again i'm proud

174
00:06:30,070 --> 00:06:27,600
of you all of you for being involved and

175
00:06:32,710 --> 00:06:30,080
asking a question please don't ever lose

176
00:06:33,510 --> 00:06:32,720
that curiosity it it keeps it keeps us

177
00:06:36,230 --> 00:06:33,520
all

178
00:06:38,710 --> 00:06:36,240
scientist

179
00:06:42,070 --> 00:06:38,720
so to answer your question about

180
00:06:44,070 --> 00:06:42,080
leukemia cells in space i think a lot of

181
00:06:46,550 --> 00:06:44,080
examples have been flown a lot of cells

182
00:06:49,510 --> 00:06:46,560
have been flown in microgravity in space

183
00:06:52,230 --> 00:06:49,520
including leukemia cells and you asked

184
00:06:54,790 --> 00:06:52,240
specifically about growth rate

185
00:06:57,029 --> 00:06:54,800
from the literature that i'm aware of i

186
00:06:59,589 --> 00:06:57,039
think we've actually seen that growth

187
00:07:02,230 --> 00:06:59,599
rate of some leukemia cells is arrested

188
00:07:04,309 --> 00:07:02,240

or stopped in microgravity that doesn't

189
00:07:06,710 --> 00:07:04,319
mean it's always going to be true or

190
00:07:09,189 --> 00:07:06,720
it's going to be true for all cell lines

191
00:07:11,270 --> 00:07:09,199
so we still have a lot to learn but from

192
00:07:13,749 --> 00:07:11,280
what i'm familiar with we have seen

193
00:07:15,670 --> 00:07:13,759
microgravity affect

194
00:07:16,390 --> 00:07:15,680
multiple aspects of

195
00:07:19,830 --> 00:07:16,400
cell

196
00:07:22,230 --> 00:07:19,840
life growth cytoskeletal activity

197
00:07:25,029 --> 00:07:22,240
meiosis or separation and division of

198
00:07:28,070 --> 00:07:25,039
cells so we've seen a lot of changes

199
00:07:29,589 --> 00:07:28,080
but we still have a lot to learn so so i

200
00:07:31,110 --> 00:07:29,599
save that experiment and propose it

201
00:07:32,550 --> 00:07:31,120
another time

202
00:07:33,749 --> 00:07:32,560
that's fascinating y'all are asking

203
00:07:37,350 --> 00:07:33,759
great questions i think we're ready for

204
00:07:41,749 --> 00:07:39,270
hi my name is bowman

205
00:07:46,469 --> 00:07:41,759
i want to know would the lack of gravity

206
00:07:49,510 --> 00:07:48,390
so that's a fascinating question and

207
00:07:52,070 --> 00:07:49,520
it's been

208
00:07:54,309 --> 00:07:52,080
proposed and it's actually been flown on

209
00:07:56,309 --> 00:07:54,319
a several space flight experiments

210
00:07:59,110 --> 00:07:56,319
chicken eggs quail eggs and different

211
00:08:01,589 --> 00:07:59,120
kinds of bird eggs and

212
00:08:04,309 --> 00:08:01,599
i think that our findings have been a

213
00:08:06,710 --> 00:08:04,319

little bit inconclusive but for the most

214
00:08:09,350 --> 00:08:06,720
part we have actually seen that chicken

215
00:08:10,950 --> 00:08:09,360
eggs are able to develop

216
00:08:13,510 --> 00:08:10,960
when you launch them to space and

217
00:08:16,309 --> 00:08:13,520
incubate them and there's actually been

218
00:08:17,990 --> 00:08:16,319
some hatching of bird eggs

219
00:08:19,830 --> 00:08:18,000
on the mere space station which was the

220
00:08:22,150 --> 00:08:19,840
precursor to the international space

221
00:08:24,469 --> 00:08:22,160
station so we've had some success it

222
00:08:26,309 --> 00:08:24,479
hasn't been a perfect system

223
00:08:28,070 --> 00:08:26,319
the reason we ask questions like this

224
00:08:30,869 --> 00:08:28,080
and i assume this is why you're asking

225
00:08:33,750 --> 00:08:30,879
the question as well is it's un it's

226
00:08:37,190 --> 00:08:33,760
understanding is there a role of gravity

227
00:08:40,230 --> 00:08:37,200
in the development of an embryo

228
00:08:42,790 --> 00:08:40,240
and i think the jury is still out on on

229
00:08:43,990 --> 00:08:42,800
for sure knowing if gravity is important

230
00:08:45,670 --> 00:08:44,000
or not

231
00:08:47,670 --> 00:08:45,680
there's two schools of thoughts one of

232
00:08:48,550 --> 00:08:47,680
course is that gravity is

233
00:08:50,630 --> 00:08:48,560
um

234
00:08:52,630 --> 00:08:50,640
required and for you know early in

235
00:08:55,269 --> 00:08:52,640
gestation for development of like the

236
00:08:57,910 --> 00:08:55,279
neural tube of the organism

237
00:08:59,670 --> 00:08:57,920
but we've seen success without it so i

238
00:09:02,870 --> 00:08:59,680

think the jury's still out we've seen

239
00:09:05,350 --> 00:09:02,880
some success but it hasn't been perfect

240
00:09:06,710 --> 00:09:05,360
i think we still have a little bit to uh

241
00:09:09,430 --> 00:09:06,720
to understand maybe some more

242
00:09:14,389 --> 00:09:09,440
experiments to do

243
00:09:20,150 --> 00:09:16,790
um i was wondering what effect does

244
00:09:22,150 --> 00:09:20,160
micro gravity have on the human body

245
00:09:23,829 --> 00:09:22,160
well a little bit earlier i talked about

246
00:09:25,430 --> 00:09:23,839
um some of those effects and i'll go

247
00:09:27,110 --> 00:09:25,440
ahead and repeat them again because it's

248
00:09:29,509 --> 00:09:27,120
really what's very very interesting to

249
00:09:31,829 --> 00:09:29,519
me i am a physiologist and i'm

250
00:09:33,750 --> 00:09:31,839
interested in how the human body works

251
00:09:35,430 --> 00:09:33,760
which is fascinating itself but when you

252
00:09:37,590 --> 00:09:35,440
take the human body and you put it in an

253
00:09:40,710 --> 00:09:37,600
extreme environment like space or under

254
00:09:42,870 --> 00:09:40,720
the ocean those environmental changes

255
00:09:44,790 --> 00:09:42,880
cause a lot of cause a lot of problems

256
00:09:47,110 --> 00:09:44,800
for the human body in some cases but we

257
00:09:48,949 --> 00:09:47,120
are extremely adaptable it's one of the

258
00:09:50,550 --> 00:09:48,959
wonderful things about the human body we

259
00:09:52,790 --> 00:09:50,560
can live in a number

260
00:09:54,949 --> 00:09:52,800
of extreme environments and it's really

261
00:09:57,269 --> 00:09:54,959
fun to study what happens

262
00:09:59,430 --> 00:09:57,279
so when you go into space microgravity

263
00:10:01,750 --> 00:09:59,440

is one of the one of the largest

264
00:10:03,430 --> 00:10:01,760
environmental changes there's no gravity

265
00:10:05,430 --> 00:10:03,440
or no measurable gravity on the human

266
00:10:06,870 --> 00:10:05,440
body there's also radiation

267
00:10:09,430 --> 00:10:06,880
so the environment is pretty different

268
00:10:11,350 --> 00:10:09,440
than what we experience here on earth

269
00:10:13,590 --> 00:10:11,360
and the changes that the human body

270
00:10:16,150 --> 00:10:13,600
undergoes includes

271
00:10:19,750 --> 00:10:16,160
like i mentioned before some bone loss

272
00:10:21,590 --> 00:10:19,760
some muscle atrophy loss of muscle

273
00:10:23,430 --> 00:10:21,600
some cardiovascular deconditioning

274
00:10:25,110 --> 00:10:23,440
that's your heart and your lungs and

275
00:10:26,150 --> 00:10:25,120
your cardiovascular system getting

276
00:10:29,110 --> 00:10:26,160
weaker

277
00:10:30,790 --> 00:10:29,120
some immune system changes

278
00:10:32,550 --> 00:10:30,800
even some neurovestibular changes

279
00:10:34,790 --> 00:10:32,560
without normal gravity your inner ear

280
00:10:37,030 --> 00:10:34,800
gets a little bit confused usually that

281
00:10:38,550 --> 00:10:37,040
resolves itself pretty quickly but so

282
00:10:40,949 --> 00:10:38,560
there's a number of changes that the

283
00:10:43,030 --> 00:10:40,959
human body has to accommodate and adapt

284
00:10:45,670 --> 00:10:43,040
to but again because we're such an

285
00:10:48,310 --> 00:10:45,680
adaptable species within a couple days

286
00:10:50,230 --> 00:10:48,320
people get very used to living in space

287
00:10:52,310 --> 00:10:50,240
when they come back to earth

288
00:10:54,150 --> 00:10:52,320

they have to re-adapt to gravity as well

289
00:10:56,870 --> 00:10:54,160
but if if they've been

290
00:10:58,710 --> 00:10:56,880
exercising and eating right and and

291
00:11:00,230 --> 00:10:58,720
taking care of themselves that

292
00:11:02,310 --> 00:11:00,240
adaptation

293
00:11:03,509 --> 00:11:02,320
back to earth gravity isn't so bad and

294
00:11:05,269 --> 00:11:03,519
like i said we really want our

295
00:11:07,829 --> 00:11:05,279
astronauts to be healthy when they get

296
00:11:09,190 --> 00:11:07,839
back to earth or when we get to whatever

297
00:11:11,990 --> 00:11:09,200
terrestrial environment we're going to

298
00:11:14,069 --> 00:11:12,000
when we go to the moon or an asteroid or

299
00:11:15,590 --> 00:11:14,079
mars again we want our we want our

300
00:11:17,670 --> 00:11:15,600
astronauts to be healthy when they get

301
00:11:19,990 --> 00:11:17,680
to where they're going and so it's very

302
00:11:22,069 --> 00:11:20,000
important that they exercise eat right

303
00:11:23,990 --> 00:11:22,079
and take care of their bodies same thing

304
00:11:25,509 --> 00:11:24,000
for you and i eating and

305
00:11:27,990 --> 00:11:25,519
getting enough exercise is important for

306
00:11:29,030 --> 00:11:28,000
our our bodies as well it sounds like

307
00:11:30,630 --> 00:11:29,040
we're really starting to get a good

308
00:11:32,230 --> 00:11:30,640
handle on that right yeah i think you

309
00:11:33,910 --> 00:11:32,240
know we're really starting to get a good

310
00:11:35,670 --> 00:11:33,920
handle on it we're still learning a lot

311
00:11:38,870 --> 00:11:35,680
however um

312
00:11:40,550 --> 00:11:38,880
you may be aware that next march we

313
00:11:41,590 --> 00:11:40,560

are going to be launching two people

314
00:11:43,590 --> 00:11:41,600
that are going to live on the space

315
00:11:45,910 --> 00:11:43,600
station for an entire year a one year

316
00:11:47,829 --> 00:11:45,920
mission most of our experience is about

317
00:11:49,430 --> 00:11:47,839
six months the the people that are in

318
00:11:50,949 --> 00:11:49,440
space right now they're going to stay

319
00:11:52,550 --> 00:11:50,959
there for about six months on the

320
00:11:54,710 --> 00:11:52,560
international space station we've had a

321
00:11:55,910 --> 00:11:54,720
lot of experience many people have

322
00:11:58,389 --> 00:11:55,920
stayed on the international space

323
00:12:00,710 --> 00:11:58,399
station for six months we're going to

324
00:12:03,269 --> 00:12:00,720
learn some more when we go to one year

325
00:12:05,509 --> 00:12:03,279
it's twice as long so there's we're

326
00:12:07,509 --> 00:12:05,519
pretty excited to to do this and

327
00:12:09,190 --> 00:12:07,519
undertake this mission and learn about

328
00:12:11,670 --> 00:12:09,200
the changes in the human body that occur

329
00:12:13,590 --> 00:12:11,680
over a year and we we hope to learn a

330
00:12:15,350 --> 00:12:13,600
lot we also hope to find out that what

331
00:12:17,430 --> 00:12:15,360
we're doing for six months works for a

332
00:12:18,550 --> 00:12:17,440
year as well

333
00:12:20,389 --> 00:12:18,560
okay i think we're ready for the next

334
00:12:21,829 --> 00:12:20,399
question

335
00:12:24,150 --> 00:12:21,839
do you believe that there are planets

336
00:12:26,949 --> 00:12:24,160
similar to our past our galaxy and if so

337
00:12:29,590 --> 00:12:26,959
do you feel like there's intelligent on

338
00:12:31,910 --> 00:12:29,600

so nasa has a spacecraft it's a

339
00:12:33,910 --> 00:12:31,920
telescope called the kepler space

340
00:12:35,350 --> 00:12:33,920
telescope and its entire job is to

341
00:12:37,190 --> 00:12:35,360
search for

342
00:12:39,990 --> 00:12:37,200
planets that are maybe like earth

343
00:12:41,509 --> 00:12:40,000
outside of our galaxy and i think

344
00:12:44,550 --> 00:12:41,519
many have been found well over a

345
00:12:46,629 --> 00:12:44,560
thousand probably closer to 1500

346
00:12:50,069 --> 00:12:46,639
planets that are somewhat similar to

347
00:12:51,190 --> 00:12:50,079
earth in habitable zones near stars

348
00:12:53,430 --> 00:12:51,200
but

349
00:12:56,550 --> 00:12:53,440
do i believe intelligent life exists out

350
00:12:59,269 --> 00:12:56,560
there ah not really but i do believe

351
00:13:01,190 --> 00:12:59,279
that certainly even maybe in our solar

352
00:13:03,350 --> 00:13:01,200
our own solar system like on mars at

353
00:13:05,190 --> 00:13:03,360
some point may have supported some

354
00:13:07,670 --> 00:13:05,200
bacterial life or some kind of little

355
00:13:10,310 --> 00:13:07,680
cyanobacteria

356
00:13:12,310 --> 00:13:10,320
the conditions for life have to be

357
00:13:13,670 --> 00:13:12,320
pretty precise you have to

358
00:13:15,750 --> 00:13:13,680
as we know it you have to have some kind

359
00:13:17,110 --> 00:13:15,760
of water you have to have something for

360
00:13:18,629 --> 00:13:17,120
for the life to

361
00:13:20,870 --> 00:13:18,639
to consume and

362
00:13:23,190 --> 00:13:20,880
life has to produce waste and when you

363
00:13:25,829 --> 00:13:23,200

find water and you find moderate

364
00:13:27,990 --> 00:13:25,839
temperatures and you find minerals and

365
00:13:31,509 --> 00:13:28,000
resources i think there's a good chance

366
00:13:33,990 --> 00:13:31,519
that some type of life bacterial life

367
00:13:35,509 --> 00:13:34,000
could have existed or will exist and so

368
00:13:37,750 --> 00:13:35,519
i think i think it's only a matter of

369
00:13:39,350 --> 00:13:37,760
time before we find some other place in

370
00:13:40,389 --> 00:13:39,360
the universe

371
00:13:43,750 --> 00:13:40,399
where

372
00:13:46,389 --> 00:13:43,760
potentially life could be

373
00:13:48,389 --> 00:13:46,399
next question

374
00:13:50,150 --> 00:13:48,399
uh what type of training is required to

375
00:13:52,230 --> 00:13:50,160
be an astronaut and how long does it

376
00:13:53,509 --> 00:13:52,240
usually take

377
00:13:55,509 --> 00:13:53,519
brandy do you want to take that yeah i

378
00:13:57,030 --> 00:13:55,519
can take that one um so there's there's

379
00:14:00,069 --> 00:13:57,040
several different kind of layers i guess

380
00:14:02,790 --> 00:14:00,079
to that question uh first of all to even

381
00:14:06,389 --> 00:14:02,800
become an astronaut you have to have

382
00:14:09,110 --> 00:14:06,399
some experience in working in some um

383
00:14:11,110 --> 00:14:09,120
degrees and in math or science fields

384
00:14:12,710 --> 00:14:11,120
and really be pretty good at what you're

385
00:14:14,790 --> 00:14:12,720
already doing but then once you are

386
00:14:16,790 --> 00:14:14,800
selected to be an astronaut you've got a

387
00:14:17,990 --> 00:14:16,800
little ways to go from there you've got

388
00:14:19,670 --> 00:14:18,000

the initial training that all the

389
00:14:21,670 --> 00:14:19,680
astronauts go through that takes a

390
00:14:23,189 --> 00:14:21,680
couple of years um

391
00:14:25,509 --> 00:14:23,199
just getting them kind of caught up and

392
00:14:26,870 --> 00:14:25,519
up to speed on on what astronauts do and

393
00:14:28,629 --> 00:14:26,880
all the different kind of activities

394
00:14:30,230 --> 00:14:28,639
they might be called on and then once

395
00:14:32,310 --> 00:14:30,240
you actually get assigned to a mission

396
00:14:34,069 --> 00:14:32,320
you've got some more training to do so

397
00:14:35,990 --> 00:14:34,079
um you have to you have to learn a lot

398
00:14:38,790 --> 00:14:36,000
to be an astronaut it's not an easy job

399
00:14:40,150 --> 00:14:38,800
um but i think they would mostly

400
00:14:41,670 --> 00:14:40,160
probably all tell you that it's

401
00:14:43,110 --> 00:14:41,680
definitely worth the time that it takes

402
00:14:45,590 --> 00:14:43,120
they seem to have a lot of fun up in

403
00:14:47,110 --> 00:14:45,600
space so and there there are pilots who

404
00:14:49,030 --> 00:14:47,120
have become astronauts they're medical

405
00:14:51,910 --> 00:14:49,040
doctors who've become astronauts

406
00:14:53,030 --> 00:14:51,920
engineers um and lots of different types

407
00:14:55,990 --> 00:14:53,040
of scientists

408
00:14:57,590 --> 00:14:56,000
geologists and uh alex gerst an east

409
00:14:59,110 --> 00:14:57,600
astronaut in his face right now he's a

410
00:15:02,069 --> 00:14:59,120
volcanologist he's interested in

411
00:15:04,870 --> 00:15:02,079
volcanoes and so all kinds of different

412
00:15:06,629 --> 00:15:04,880
um backgrounds can be fields that

413
00:15:08,550 --> 00:15:06,639

contribute to the space program and

414
00:15:09,910 --> 00:15:08,560
being selected as an astronaut one of

415
00:15:12,230 --> 00:15:09,920
the things i've heard a lot of them say

416
00:15:13,670 --> 00:15:12,240
is pick a field that you really enjoy

417
00:15:15,750 --> 00:15:13,680
because if you enjoy what you're doing

418
00:15:17,030 --> 00:15:15,760
you'll be really good at it and being

419
00:15:18,710 --> 00:15:17,040
really good at all kind of raise you to

420
00:15:21,030 --> 00:15:18,720
the top of of your

421
00:15:22,470 --> 00:15:21,040
your class and and help you stand out

422
00:15:24,629 --> 00:15:22,480
when it comes time to actually apply to

423
00:15:26,230 --> 00:15:24,639
be an astronaut

424
00:15:28,069 --> 00:15:26,240
hope that answers your question uh next

425
00:15:30,310 --> 00:15:28,079
one

426
00:15:32,470 --> 00:15:30,320
hi i was wondering why time on earth was

427
00:15:34,710 --> 00:15:32,480
different from time and space

428
00:15:36,310 --> 00:15:34,720
okay that's a pretty complex question

429
00:15:39,350 --> 00:15:36,320
and i'm probably not the best person to

430
00:15:40,870 --> 00:15:39,360
answer it but i'll give it a shot um

431
00:15:43,910 --> 00:15:40,880
so the einstein

432
00:15:45,829 --> 00:15:43,920
uh in his theory of relative relativity

433
00:15:47,670 --> 00:15:45,839
stated that um

434
00:15:49,749 --> 00:15:47,680
gravity affects time

435
00:15:52,790 --> 00:15:49,759
and when you're close to a gravitational

436
00:15:53,990 --> 00:15:52,800
field time uh slows down a little bit so

437
00:15:56,710 --> 00:15:54,000
the further you are away from a

438
00:15:58,949 --> 00:15:56,720

gravitational field the faster time goes

439
00:16:01,749 --> 00:15:58,959
so we've actually measured this in

440
00:16:04,870 --> 00:16:01,759
spacecraft just in low earth orbit

441
00:16:07,910 --> 00:16:04,880
and so just a little bit away from earth

442
00:16:10,870 --> 00:16:07,920
there's just slightly less gravity and

443
00:16:12,550 --> 00:16:10,880
that actually affects time and so that

444
00:16:13,749 --> 00:16:12,560
somewhat answers your question and i

445
00:16:15,189 --> 00:16:13,759
know it's not perfect because i

446
00:16:17,670 --> 00:16:15,199
certainly don't have the best

447
00:16:20,230 --> 00:16:17,680
explanation but i will tell you that an

448
00:16:24,150 --> 00:16:20,240
astronaut living in space for six months

449
00:16:26,870 --> 00:16:24,160
will actually age .007

450
00:16:27,910 --> 00:16:26,880
seconds less than us here on earth and

451
00:16:29,110 --> 00:16:27,920
so

452
00:16:31,030 --> 00:16:29,120
i'll point out that one of the

453
00:16:33,110 --> 00:16:31,040
astronauts that is going to be living in

454
00:16:34,230 --> 00:16:33,120
space for one year on that one year

455
00:16:36,150 --> 00:16:34,240
mission

456
00:16:37,590 --> 00:16:36,160
he has a twin brother so scott kelly is

457
00:16:39,670 --> 00:16:37,600
the astronaut who will be living in

458
00:16:41,350 --> 00:16:39,680
space for a year he has a twin brother

459
00:16:44,150 --> 00:16:41,360
who's gonna stay here on earth his name

460
00:16:45,670 --> 00:16:44,160
is mark kelly and so they're twins so

461
00:16:47,670 --> 00:16:45,680
there's a slight age difference between

462
00:16:50,069 --> 00:16:47,680
them anyways just probably minutes i

463
00:16:52,550 --> 00:16:50,079

don't know exactly but when scott gets

464
00:16:54,550 --> 00:16:52,560
home he's going to be you know just a

465
00:16:57,670 --> 00:16:54,560
little bit younger

466
00:16:57,680 --> 00:17:03,030
all right next question

467
00:17:06,949 --> 00:17:05,189
we here on the news that mars and earth

468
00:17:08,870 --> 00:17:06,959
have similar environments even though

469
00:17:11,029 --> 00:17:08,880
there is no proof of life existing on

470
00:17:12,949 --> 00:17:11,039
mars today is there a possibility that

471
00:17:14,710 --> 00:17:12,959
humans might when they live there

472
00:17:16,150 --> 00:17:14,720
oh i sure hope so we're going to live on

473
00:17:17,750 --> 00:17:16,160
mars one day i think we're going to have

474
00:17:18,949 --> 00:17:17,760
a colony and there's people that are

475
00:17:20,710 --> 00:17:18,959
going to be staying there and living

476
00:17:23,189 --> 00:17:20,720
there it's a little ways off though

477
00:17:25,590 --> 00:17:23,199
because it's very challenging to do

478
00:17:27,669 --> 00:17:25,600
we're going to need to bring with us

479
00:17:29,830 --> 00:17:27,679
some pretty technologically advanced

480
00:17:31,350 --> 00:17:29,840
life support equipment

481
00:17:33,029 --> 00:17:31,360
we have some very technologically

482
00:17:35,110 --> 00:17:33,039
advanced life support equipment on the

483
00:17:37,190 --> 00:17:35,120
space station right now you can't live

484
00:17:39,510 --> 00:17:37,200
in space without bringing

485
00:17:41,510 --> 00:17:39,520
air and water in an environment and

486
00:17:43,029 --> 00:17:41,520
pressure and radiation protection you're

487
00:17:46,070 --> 00:17:43,039
going to need all of those things on

488
00:17:48,310 --> 00:17:46,080

mars too so mars is somewhat similar to

489
00:17:50,230 --> 00:17:48,320
earth and size and and the amount of

490
00:17:52,950 --> 00:17:50,240
sunlight it gets but there's more

491
00:17:54,150 --> 00:17:52,960
radiation more uv radiation it's really

492
00:17:57,669 --> 00:17:54,160
cold there

493
00:18:00,470 --> 00:17:57,679
the the atmosphere is very thin

494
00:18:02,470 --> 00:18:00,480
um and it's a lot of carbon dioxide we

495
00:18:04,950 --> 00:18:02,480
have mostly nitrogen in our atmosphere

496
00:18:06,710 --> 00:18:04,960
and they have mostly carbon dioxide and

497
00:18:08,870 --> 00:18:06,720
carbon dioxide is not really the most

498
00:18:10,950 --> 00:18:08,880
beneficial things for human to humans to

499
00:18:12,310 --> 00:18:10,960
breathe in high quantities

500
00:18:14,870 --> 00:18:12,320
so when we live on mars we're going to

501
00:18:17,750 --> 00:18:14,880
have to bring a lot of our own equipment

502
00:18:19,909 --> 00:18:17,760
um but that's part of the fun right it's

503
00:18:22,070 --> 00:18:19,919
part of the fun of exploration and

504
00:18:23,750 --> 00:18:22,080
and learning so yeah i think we're

505
00:18:24,950 --> 00:18:23,760
definitely gonna live on mars one day

506
00:18:28,070 --> 00:18:24,960
but we're just gonna have to bring a lot

507
00:18:29,350 --> 00:18:28,080
of uh a lot of comforts of home with us

508
00:18:30,950 --> 00:18:29,360
and you know we're we're building right

509
00:18:33,590 --> 00:18:30,960
now the spaceship that will take us

510
00:18:35,029 --> 00:18:33,600
there orion and it's getting ready um to

511
00:18:36,630 --> 00:18:35,039
go on its first test flight it won't go

512
00:18:38,870 --> 00:18:36,640
to mars the first time or even the

513
00:18:41,190 --> 00:18:38,880

second or third time um but we're gonna

514
00:18:43,270 --> 00:18:41,200
we're gonna send it 3 600 miles into

515
00:18:44,789 --> 00:18:43,280
space to test out a lot of its systems

516
00:18:46,310 --> 00:18:44,799
that we really want to make sure work

517
00:18:48,630 --> 00:18:46,320
before we put people on it and that test

518
00:18:50,549 --> 00:18:48,640
flight's coming up in december so

519
00:18:52,549 --> 00:18:50,559
we've just about got the spacecraft

520
00:18:54,230 --> 00:18:52,559
finished it's being built in florida at

521
00:18:56,390 --> 00:18:54,240
kennedy space center and it's supposed

522
00:18:57,909 --> 00:18:56,400
to launch on december 4th and we're also

523
00:19:00,470 --> 00:18:57,919
working on the rocket that would let us

524
00:19:04,470 --> 00:19:00,480
go to mars as well so that'll be

525
00:19:04,480 --> 00:19:09,510
next question

526
00:19:13,669 --> 00:19:12,070
hello and good morning my question for

527
00:19:15,669 --> 00:19:13,679
y'all is uh

528
00:19:17,750 --> 00:19:15,679
what changes do you see coming to

529
00:19:20,310 --> 00:19:17,760
research aboard the in-n-out space

530
00:19:21,510 --> 00:19:20,320
international space station

531
00:19:23,830 --> 00:19:21,520
so right now

532
00:19:26,150 --> 00:19:23,840
we've had about fifteen hundred and

533
00:19:28,549 --> 00:19:26,160
fifty different uh research

534
00:19:30,710 --> 00:19:28,559
investigations on the space station and

535
00:19:31,350 --> 00:19:30,720
uh come october we'll be counting you

536
00:19:33,029 --> 00:19:31,360
know

537
00:19:35,669 --> 00:19:33,039
your school as having one of those

538
00:19:37,669 --> 00:19:35,679

investigations so that's a lot and

539
00:19:39,590 --> 00:19:37,679
there's a lot coming and some of the

540
00:19:41,190 --> 00:19:39,600
changes that we see coming are we always

541
00:19:44,950 --> 00:19:41,200
have new facilities going to the space

542
00:19:46,950 --> 00:19:44,960
station that allow for new capabilities

543
00:19:48,390 --> 00:19:46,960
in fact one of those new capabilities is

544
00:19:50,549 --> 00:19:48,400
going to get there this fall where we're

545
00:19:52,390 --> 00:19:50,559
going to bring a 3d printer to the space

546
00:19:54,150 --> 00:19:52,400
station and that

547
00:19:56,310 --> 00:19:54,160
um we're actually doing research with it

548
00:19:57,909 --> 00:19:56,320
because we're not absolutely absolutely

549
00:19:58,870 --> 00:19:57,919
positive that it's going to work so

550
00:20:00,630 --> 00:19:58,880
we're going to bring it to the space

551
00:20:03,190 --> 00:20:00,640
station to test it out and once it's

552
00:20:05,430 --> 00:20:03,200
there um we're going to be able to

553
00:20:07,110 --> 00:20:05,440
perhaps build spare parts i know that

554
00:20:08,789 --> 00:20:07,120
that butch wilmore is pretty excited to

555
00:20:10,710 --> 00:20:08,799
get that 3d printer up there because

556
00:20:12,230 --> 00:20:10,720
he's a very handy guy he likes to build

557
00:20:14,149 --> 00:20:12,240
stuff and i think he's pretty excited to

558
00:20:16,789 --> 00:20:14,159
have that up there that's one example of

559
00:20:18,470 --> 00:20:16,799
a capability we also have a new habitat

560
00:20:20,070 --> 00:20:18,480
for fruit flies and we're going to be

561
00:20:23,430 --> 00:20:20,080
able to do a lot of genetics type of

562
00:20:25,110 --> 00:20:23,440
genomics experiments on them

563
00:20:27,110 --> 00:20:25,120

so we always have new equipment going to

564
00:20:28,870 --> 00:20:27,120
the space station new capabilities and

565
00:20:31,190 --> 00:20:28,880
new areas of research that we're looking

566
00:20:33,029 --> 00:20:31,200
forward to performing and that's that's

567
00:20:35,270 --> 00:20:33,039
just a quick highlight

568
00:20:38,549 --> 00:20:35,280
but if you go to our website which is

569
00:20:43,110 --> 00:20:41,110
iss hyphen science

570
00:20:44,870 --> 00:20:43,120
you can see there's we put out a lot of

571
00:20:46,390 --> 00:20:44,880
information there

572
00:20:48,070 --> 00:20:46,400
about the new facilities that are going

573
00:20:49,830 --> 00:20:48,080
to the space station the facilities that

574
00:20:51,669 --> 00:20:49,840
already exist there you know we have a

575
00:20:54,310 --> 00:20:51,679
centrifuge for spinning

576
00:20:56,630 --> 00:20:54,320
fluids down bodily fluids and otherwise

577
00:20:59,909 --> 00:20:56,640
we have some freezers really deep

578
00:21:02,149 --> 00:20:59,919
freezers minus 80 degrees celsius

579
00:21:04,470 --> 00:21:02,159
for storing samples

580
00:21:07,830 --> 00:21:04,480
we've got a combustion furnace for for

581
00:21:09,190 --> 00:21:07,840
doing combustion research we've got

582
00:21:12,149 --> 00:21:09,200
a fluids

583
00:21:14,070 --> 00:21:12,159
research rack for doing fluids research

584
00:21:15,430 --> 00:21:14,080
so we've got all types of equipment that

585
00:21:17,190 --> 00:21:15,440
is open for

586
00:21:19,510 --> 00:21:17,200
all kinds of scientists all over the

587
00:21:20,789 --> 00:21:19,520
world to propose their science and

588
00:21:22,390 --> 00:21:20,799

sometimes they have to have their own

589
00:21:23,830 --> 00:21:22,400
specialized equipment

590
00:21:27,190 --> 00:21:23,840
we have a lot of equipment mounted

591
00:21:28,310 --> 00:21:27,200
outside the space station as well

592
00:21:29,990 --> 00:21:28,320
so

593
00:21:31,430 --> 00:21:30,000
it's just more and more there's room for

594
00:21:32,630 --> 00:21:31,440
more science on the space station and

595
00:21:34,630 --> 00:21:32,640
that's something that we're interested

596
00:21:36,149 --> 00:21:34,640
in attracting and i'm glad that we're

597
00:21:37,830 --> 00:21:36,159
starting with students like yourselves

598
00:21:39,510 --> 00:21:37,840
we'd like we'd like for more people to

599
00:21:41,750 --> 00:21:39,520
propose experiments for the space

600
00:21:45,830 --> 00:21:41,760
station

601
00:21:49,830 --> 00:21:48,070
what kind of v-technology is being used

602
00:21:52,070 --> 00:21:49,840
to keep astronauts safe well in the

603
00:21:53,750 --> 00:21:52,080
international space station

604
00:21:56,149 --> 00:21:53,760
well um

605
00:21:57,990 --> 00:21:56,159
one type of new technology is is we're

606
00:21:59,669 --> 00:21:58,000
always trying to improve the amount and

607
00:22:01,029 --> 00:21:59,679
the types of exercise that the

608
00:22:03,110 --> 00:22:01,039
astronauts do

609
00:22:05,350 --> 00:22:03,120
we have three different devices up there

610
00:22:07,669 --> 00:22:05,360
we have a type of treadmill

611
00:22:09,669 --> 00:22:07,679
and we have a stationary bike

612
00:22:11,430 --> 00:22:09,679
and we have an advanced resistive

613
00:22:14,070 --> 00:22:11,440

exercise device which is kind of like a

614
00:22:15,990 --> 00:22:14,080
solo flex it's it's a it's like a

615
00:22:17,510 --> 00:22:16,000
modifiable gym equipment where you're

616
00:22:19,510 --> 00:22:17,520
not lifting weights but you're working

617
00:22:20,630 --> 00:22:19,520
against a resistive load

618
00:22:21,990 --> 00:22:20,640
and

619
00:22:23,750 --> 00:22:22,000
that's been up there for a little while

620
00:22:26,149 --> 00:22:23,760
but we're really kind of learning how

621
00:22:28,149 --> 00:22:26,159
best to use it by having really high

622
00:22:29,510 --> 00:22:28,159
intensity exercise and that's

623
00:22:33,190 --> 00:22:29,520
seeming to

624
00:22:35,029 --> 00:22:33,200
maintain astronaut bone very well

625
00:22:37,510 --> 00:22:35,039
and other technologies

626
00:22:39,190 --> 00:22:37,520
include better nutrition as well

627
00:22:40,950 --> 00:22:39,200
we've found that we have to reduce the

628
00:22:43,110 --> 00:22:40,960
amount of salt sodium intake that the

629
00:22:45,350 --> 00:22:43,120
astronauts are getting and that involves

630
00:22:47,350 --> 00:22:45,360
a whole team of food scientists here on

631
00:22:49,350 --> 00:22:47,360
the ground because the food has to taste

632
00:22:51,430 --> 00:22:49,360
good so it has to be palatable it has to

633
00:22:52,149 --> 00:22:51,440
have low salt but also has to have a

634
00:22:54,950 --> 00:22:52,159
good

635
00:22:56,789 --> 00:22:54,960
shelf life because once the food gets

636
00:22:58,630 --> 00:22:56,799
packaged and then launched to the space

637
00:23:00,710 --> 00:22:58,640
station we want it to be able to

638
00:23:02,310 --> 00:23:00,720

stay good and viable and all the

639
00:23:03,590 --> 00:23:02,320
nutrients are still available in the

640
00:23:04,870 --> 00:23:03,600
food for a while and so there's

641
00:23:06,789 --> 00:23:04,880
technologies that we're working on the

642
00:23:10,470 --> 00:23:06,799
ground as well to help

643
00:23:10,480 --> 00:23:15,510
okay next question

644
00:23:19,029 --> 00:23:16,549
what

645
00:23:23,110 --> 00:23:19,039
planets outside of this solar system

646
00:23:25,750 --> 00:23:23,120
would be able to sustain human life

647
00:23:28,070 --> 00:23:25,760
i don't think we have found any just yet

648
00:23:30,870 --> 00:23:28,080
but um i think we're you know we're

649
00:23:32,870 --> 00:23:30,880
searching we're looking um we've found

650
00:23:34,549 --> 00:23:32,880
planets that are similar in size to

651
00:23:37,350 --> 00:23:34,559
earth we've found planets that are

652
00:23:38,710 --> 00:23:37,360
similar in distance to a star

653
00:23:40,630 --> 00:23:38,720
as earth is

654
00:23:42,149 --> 00:23:40,640
so we're looking and you know i think

655
00:23:45,350 --> 00:23:42,159
one day we might find that we're not

656
00:23:47,029 --> 00:23:45,360
quite so unique there are there are

657
00:23:49,269 --> 00:23:47,039
billions and billions of stars and

658
00:23:51,430 --> 00:23:49,279
billions and billions of galaxies

659
00:23:53,909 --> 00:23:51,440
so i think you know the the longer we

660
00:23:57,909 --> 00:23:53,919
look the more we're going to find but uh

661
00:24:01,990 --> 00:23:59,990
and fayette academy this is nasa's

662
00:24:04,310 --> 00:24:02,000
digital learning network uh mike o'hare

663
00:24:05,750 --> 00:24:04,320

um just wanted to say that we're running

664
00:24:07,510 --> 00:24:05,760
out of time so i just wanted to see if

665
00:24:10,310 --> 00:24:07,520
you guys want to say any final words or

666
00:24:17,110 --> 00:24:10,320
thank you uh to dr warren and

667
00:24:21,029 --> 00:24:18,710
thank you sorry we didn't get a chance

668
00:24:23,029 --> 00:24:21,039
to get everybody's question but uh i'm

669
00:24:24,870 --> 00:24:23,039
sure glad you guys called today i'm glad

670
00:24:27,269 --> 00:24:24,880
we could answer some of your questions

671
00:24:28,870 --> 00:24:27,279
and uh good luck with your experiment

672
00:24:32,070 --> 00:24:28,880
i'm very excited to see it get up there

673
00:24:36,710 --> 00:24:32,080
i know butch is as well and stay curious