
SPACEX CRS-4
NASA

1
00:00:07,909 --> 00:00:05,329
good morning I'm Stephanie shareholds

2
00:00:09,620 --> 00:00:07,919
from NASA's Office of Communications we

3
00:00:11,240 --> 00:00:09,630
are here at the Kennedy Space Center

4
00:00:13,759 --> 00:00:11,250
today to talk with scientists and

5
00:00:15,400 --> 00:00:13,769
researchers about the important studies

6
00:00:17,870 --> 00:00:15,410
they will be conducting in microgravity

7
00:00:19,730 --> 00:00:17,880
this weekend's launch of the SpaceX

8
00:00:22,040 --> 00:00:19,740
Dragon spacecraft on its fourth

9
00:00:24,019 --> 00:00:22,050
commercial resupply services mission to

10
00:00:26,599 --> 00:00:24,029
the international space station will

11
00:00:29,390 --> 00:00:26,609
deliver these studies here to talk with

12
00:00:32,150 --> 00:00:29,400
us today are to my left dr. Marshall

13
00:00:34,490 --> 00:00:32,160

porterfield division director space life

14
00:00:36,380 --> 00:00:34,500
and physical sciences at NASA's human

15
00:00:39,530 --> 00:00:36,390
exploration and operations Mission

16
00:00:42,020 --> 00:00:39,540
Directorate at NASA headquarters dr.

17
00:00:44,569 --> 00:00:42,030
Sheila Nielsen principal investigator

18
00:00:49,160 --> 00:00:44,579
micro eight from Montana State

19
00:00:52,010 --> 00:00:49,170
University dr. sharmila Bhattacharya

20
00:00:54,529 --> 00:00:52,020
principal investigator Ames student

21
00:00:58,069 --> 00:00:54,539
fruit fly experiment from NASA's Ames

22
00:01:00,830 --> 00:00:58,079
Research Center in California and dr.

23
00:01:03,680 --> 00:01:00,840
Ruth Globus project scientist for the

24
00:01:07,700 --> 00:01:03,690
rodent habitat rodent research one also

25
00:01:09,410 --> 00:01:07,710
from NASA Ames our intent today is to

26
00:01:10,940 --> 00:01:09,420
enable discussion so we'll take

27
00:01:13,870 --> 00:01:10,950
questions throughout if you would like

28
00:01:16,789 --> 00:01:13,880
to ask a question please raise your hand

29
00:01:19,340 --> 00:01:16,799
dr. Porter field our panel focuses on

30
00:01:21,950 --> 00:01:19,350
model organisms can you please tell us

31
00:01:24,560 --> 00:01:21,960
what a model organism is and why we're

32
00:01:26,060 --> 00:01:24,570
interested in studying them in space so

33
00:01:28,340 --> 00:01:26,070
there's really two ways I can answer

34
00:01:30,200 --> 00:01:28,350
that question one is to make reference

35
00:01:32,929 --> 00:01:30,210
to the fact that certain research

36
00:01:36,200 --> 00:01:32,939
organisms have been adopted as central

37
00:01:41,090 --> 00:01:36,210
reference systems to do research in

38
00:01:43,069 --> 00:01:41,100

order to enable the leak science and

39
00:01:46,429 --> 00:01:43,079
expand the impact and one example is a

40
00:01:48,080 --> 00:01:46,439
rabbit opsys taliana which is the

41
00:01:50,060 --> 00:01:48,090
organism is being using the seedling

42
00:01:51,889 --> 00:01:50,070
growth experiment is a model organism

43
00:01:55,190 --> 00:01:51,899
that's adopted by the plant science

44
00:01:57,200 --> 00:01:55,200
community in order to promote an

45
00:01:58,969 --> 00:01:57,210
advanced agricultural research a lot of

46
00:02:01,399 --> 00:01:58,979
agricultural research plant stress

47
00:02:03,530 --> 00:02:01,409
physiology research is done using that

48
00:02:05,450 --> 00:02:03,540
as a model organism another way to look

49
00:02:07,100 --> 00:02:05,460
at the term model organism is in terms

50
00:02:09,139 --> 00:02:07,110
of human medicine we talked about

51
00:02:12,619 --> 00:02:09,149
biomedical research what about

52
00:02:13,320 --> 00:02:12,629
biomedical model organisms and systems

53
00:02:15,690 --> 00:02:13,330
whether this

54
00:02:18,060 --> 00:02:15,700
biology systems or whole organism

55
00:02:22,740 --> 00:02:18,070
systems like the rodents which will be

56
00:02:24,840 --> 00:02:22,750
launching in this next basics mission so

57
00:02:27,290 --> 00:02:24,850
why did NASA space life in Physical

58
00:02:31,290 --> 00:02:27,300
Sciences Division select these studies

59
00:02:33,600 --> 00:02:31,300
so we have a very rigorous selection

60
00:02:37,020 --> 00:02:33,610
process when we are developing our

61
00:02:40,350 --> 00:02:37,030
science program one of the key documents

62
00:02:43,740 --> 00:02:40,360
that we we refer to and the scientific

63
00:02:45,240 --> 00:02:43,750

community refers to is the de kado

64
00:02:47,700 --> 00:02:45,250
survey that came out of the national

65
00:02:49,470 --> 00:02:47,710
academies and not only do they define

66
00:02:52,260 --> 00:02:49,480
the types of model organisms we should

67
00:02:53,970 --> 00:02:52,270
be doing but they have hype that they

68
00:02:55,680 --> 00:02:53,980
provide us with the guidelines in terms

69
00:02:57,900 --> 00:02:55,690
of the types of science that we should

70
00:03:00,660 --> 00:02:57,910
be selecting so when we put out an NRA

71
00:03:02,790 --> 00:03:00,670
for competitive selection all of our

72
00:03:04,350 --> 00:03:02,800
investigations are selective

73
00:03:08,550 --> 00:03:04,360
competitively through a peer-review

74
00:03:11,480 --> 00:03:08,560
process that process includes evaluation

75
00:03:14,670 --> 00:03:11,490
of how these projects map back to this

76
00:03:21,240 --> 00:03:14,680
National Academies report which is put

77
00:03:23,699 --> 00:03:21,250
together to in to enhance the scientific

78
00:03:25,380 --> 00:03:23,709
outcomes and our ability to develop the

79
00:03:27,840 --> 00:03:25,390
science that's needed to develop human

80
00:03:29,190 --> 00:03:27,850
exploration out beyond low-earth orbit

81
00:03:30,840 --> 00:03:29,200
and that's our main focus of our

82
00:03:33,150 --> 00:03:30,850
utilization of the International Space

83
00:03:34,650 --> 00:03:33,160
Station is high quality science that

84
00:03:38,729 --> 00:03:34,660
road maps to the National Academies

85
00:03:40,199 --> 00:03:38,739
report that is has recommendations of

86
00:03:43,860 --> 00:03:40,209
what we need to do in order to advance

87
00:03:45,390 --> 00:03:43,870
human exploration great and and what is

88
00:03:48,090 --> 00:03:45,400

the connection among all these studies

89
00:03:49,290 --> 00:03:48,100
we have micro eight and we don't have

90
00:03:51,030 --> 00:03:49,300
the scientists here for seedling growth

91
00:03:53,340 --> 00:03:51,040
too but you can talk to that a little

92
00:03:54,990 --> 00:03:53,350
bit the aim student fruit fly experiment

93
00:03:56,850 --> 00:03:55,000
and the rodent research what is the

94
00:03:58,680 --> 00:03:56,860
connection that draws them all together

95
00:04:01,530 --> 00:03:58,690
really the connection is a national

96
00:04:04,590 --> 00:04:01,540
academies report and the fact that these

97
00:04:07,199 --> 00:04:04,600
are all model organisms that have where

98
00:04:10,140 --> 00:04:07,209
the data has impact back to human

99
00:04:14,430 --> 00:04:10,150
medicine fruit flies are a great model

100
00:04:16,650 --> 00:04:14,440
organism over 700 or the of the 900

101
00:04:19,440 --> 00:04:16,660
known genes to cause disease in humans

102
00:04:21,330 --> 00:04:19,450
also occur in the fruit fly system so we

103
00:04:23,520 --> 00:04:21,340
look and learn a lot from the fruit fly

104
00:04:26,260 --> 00:04:23,530
system as it relates to fundamental

105
00:04:28,240 --> 00:04:26,270
biology as it relates to

106
00:04:31,089 --> 00:04:28,250
human medicine and our ability to

107
00:04:34,659 --> 00:04:31,099
protect astronaut and crew health in

108
00:04:35,680 --> 00:04:34,669
future missions okay great and dr.

109
00:04:38,170 --> 00:04:35,690
Nielsen you're the principal

110
00:04:39,430 --> 00:04:38,180
investigator for micro eight can you

111
00:04:42,189 --> 00:04:39,440
please tell us a little bit about your

112
00:04:43,510 --> 00:04:42,199
study yeah thanks Stephanie so our lab

113
00:04:45,460 --> 00:04:43,520

is particularly interested in an

114
00:04:48,010 --> 00:04:45,470
opportunistic pathogenic yeast called

115
00:04:50,860 --> 00:04:48,020
Canada albicans this is a fairly common

116
00:04:52,059 --> 00:04:50,870
organism most of us will encounter it at

117
00:04:54,309 --> 00:04:52,069
some point in our life and it really

118
00:04:56,350 --> 00:04:54,319
won't faze us at all but it can cause

119
00:04:58,809 --> 00:04:56,360
superficial and fairly easily treatable

120
00:05:01,870 --> 00:04:58,819
infections such as fungal nails and

121
00:05:03,610 --> 00:05:01,880
thrush and athlete's foot it also has

122
00:05:05,170 --> 00:05:03,620
the potential of causing more severe and

123
00:05:08,800 --> 00:05:05,180
systemic diseases so we do think that

124
00:05:11,080 --> 00:05:08,810
that it's a it's a potential concern and

125
00:05:13,719 --> 00:05:11,090
our our goal really now is to better

126
00:05:16,390 --> 00:05:13,729
understand how it behaves in the extreme

127
00:05:18,540 --> 00:05:16,400
environment of microgravity so micro ate

128
00:05:21,399 --> 00:05:18,550
the microwave payload is our opportunity

129
00:05:23,950 --> 00:05:21,409
to look at the behavior of Canada

130
00:05:28,059 --> 00:05:23,960
albicans in this extreme environment it

131
00:05:29,409 --> 00:05:28,069
will fly on SpaceX for it will will grow

132
00:05:30,730 --> 00:05:29,419
for about four days while on the

133
00:05:32,860 --> 00:05:30,740
International Space Station at which

134
00:05:34,420 --> 00:05:32,870
time the crew will preserve the

135
00:05:36,730 --> 00:05:34,430
experiment it will come back at the end

136
00:05:38,800 --> 00:05:36,740
of this mission and will bring all the

137
00:05:40,990 --> 00:05:38,810
organisms back to the labs who basically

138
00:05:43,420 --> 00:05:41,000

study them at that point this research

139
00:05:46,480 --> 00:05:43,430
is an extension of our first mission

140
00:05:48,070 --> 00:05:46,490
which was micro six on SpaceX one and

141
00:05:50,050 --> 00:05:48,080
we've basically taken what we learned

142
00:05:51,790 --> 00:05:50,060
from that experiment and included it

143
00:05:54,249 --> 00:05:51,800
into this one and in extent are

144
00:05:55,629 --> 00:05:54,259
extending those studies so it looks like

145
00:05:57,999 --> 00:05:55,639
you brought some show-and-tell can you

146
00:06:00,249 --> 00:05:58,009
tell us what you have sure and this this

147
00:06:03,159 --> 00:06:00,259
is just the hardware that is actually

148
00:06:06,820 --> 00:06:03,169
provided by the bio serve company in

149
00:06:09,730 --> 00:06:06,830
Boulder Colorado and we build each of

150
00:06:11,680 --> 00:06:09,740
the experiments on site here we bring we

151
00:06:13,390 --> 00:06:11,690
bring all of our reagents there either

152
00:06:15,749 --> 00:06:13,400
provided here for us or we bring them

153
00:06:18,189 --> 00:06:15,759
and build each experiment in two

154
00:06:19,899 --> 00:06:18,199
chambers within these glass barrels

155
00:06:21,820 --> 00:06:19,909
they're called fluid processing

156
00:06:23,980 --> 00:06:21,830
apparatus I call them a tricked-out test

157
00:06:26,050 --> 00:06:23,990
tube and basically we can

158
00:06:28,450 --> 00:06:26,060
compartmentalize the experiment to to

159
00:06:30,189 --> 00:06:28,460
keep it in a sort of hold status until

160
00:06:32,230 --> 00:06:30,199
it gets on station and the crew can

161
00:06:35,829 --> 00:06:32,240
activate it and so what the crew will do

162
00:06:39,189 --> 00:06:35,839
is they'll have the opportunity to at an

163
00:06:39,970 --> 00:06:39,199

indicated time they'll do turn a crank

164
00:06:42,150 --> 00:06:39,980
on this

165
00:06:45,100 --> 00:06:42,160
gap which is a secondary enclosure and

166
00:06:47,770 --> 00:06:45,110
push Pistons down on these 8 fluid

167
00:06:49,510 --> 00:06:47,780
processing apparatus to activate the

168
00:06:51,520 --> 00:06:49,520
experiment those cells will grow for

169
00:06:53,380 --> 00:06:51,530
about a hundred hours at the end of that

170
00:06:56,380 --> 00:06:53,390
hundred hours the crew member will again

171
00:06:58,840 --> 00:06:56,390
turn the crank mix the next chamber into

172
00:07:01,240 --> 00:06:58,850
the first two which preserves the sample

173
00:07:03,310 --> 00:07:01,250
they put it in a storage temperature and

174
00:07:07,060 --> 00:07:03,320
then it will be brought back to our lab

175
00:07:09,250 --> 00:07:07,070
to to analyze so you mentioned that you

176
00:07:11,950 --> 00:07:09,260
made some changes to this one based on

177
00:07:13,720 --> 00:07:11,960
what you learned from the first mission

178
00:07:15,640 --> 00:07:13,730
that you flew on on the first SpaceX

179
00:07:18,580 --> 00:07:15,650
launch can you tell us some of the

180
00:07:20,800 --> 00:07:18,590
things that changed some of the things

181
00:07:22,570 --> 00:07:20,810
that we found from the first launch it

182
00:07:27,010 --> 00:07:22,580
that was our first opportunity so we

183
00:07:28,450 --> 00:07:27,020
learned a lot but the we compared and I

184
00:07:29,770 --> 00:07:28,460
what I didn't mention is that we will be

185
00:07:31,720 --> 00:07:29,780
doing these same experiments on the

186
00:07:33,700 --> 00:07:31,730
ground with a one-hour delay those will

187
00:07:35,200 --> 00:07:33,710
be our ground controls and we're

188
00:07:38,020 --> 00:07:35,210

comparing everything that we find in

189
00:07:39,640 --> 00:07:38,030
flight to those ground controls we we

190
00:07:41,320 --> 00:07:39,650
were able to analyze the cell growth of

191
00:07:42,580 --> 00:07:41,330
these organisms both on ground and in

192
00:07:45,070 --> 00:07:42,590
flight and found them to be pretty

193
00:07:47,320 --> 00:07:45,080
comparable one of the interesting

194
00:07:48,640 --> 00:07:47,330
features was the the organisms in flight

195
00:07:50,620 --> 00:07:48,650
were a little bit more resistant to

196
00:07:52,720 --> 00:07:50,630
antifungal agents that was actually

197
00:07:55,240 --> 00:07:52,730
predicted based on our ground studies as

198
00:07:57,910 --> 00:07:55,250
well as flights of other organisms in

199
00:08:00,580 --> 00:07:57,920
space and so this time we're adding a

200
00:08:03,850 --> 00:08:00,590
second antifungal agent this time we're

201
00:08:05,680 --> 00:08:03,860
also adding a host for the organisms

202
00:08:08,290 --> 00:08:05,690
we're adding a human monocyte component

203
00:08:10,870 --> 00:08:08,300
of this to see how the monocytes will be

204
00:08:13,030 --> 00:08:10,880
able to count combat the organisms or

205
00:08:14,530 --> 00:08:13,040
counteract the organisms so I think

206
00:08:19,870 --> 00:08:14,540
those are the two biggest changes we've

207
00:08:22,450 --> 00:08:19,880
made and why did you select yeast the

208
00:08:25,210 --> 00:08:22,460
shortened version like dr. porterfield

209
00:08:26,980 --> 00:08:25,220
said it's a great model organism there's

210
00:08:28,360 --> 00:08:26,990
a lot known about it and we can there

211
00:08:31,540 --> 00:08:28,370
are a lot of different types of analyses

212
00:08:35,320 --> 00:08:31,550
that we can do with the east I think as

213
00:08:37,750 --> 00:08:35,330

a broad scientific investigation ee

214
00:08:39,310 --> 00:08:37,760
cells perhaps surprisingly aren't that

215
00:08:41,200 --> 00:08:39,320
much different from our own cells so the

216
00:08:43,330 --> 00:08:41,210
more we learn about them I think we can

217
00:08:48,370 --> 00:08:43,340
extrapolate how our own cells might

218
00:08:50,500 --> 00:08:48,380
behave in space that is also again as

219
00:08:53,080 --> 00:08:50,510
dr. porterfield mentioned this is a

220
00:08:53,620 --> 00:08:53,090
pathogenic East so I think among the

221
00:08:55,720 --> 00:08:53,630
yeast did

222
00:08:57,730 --> 00:08:55,730
has its own interest because it can

223
00:08:59,860 --> 00:08:57,740
cause infections and we'd like to be

224
00:09:01,480 --> 00:08:59,870
able to predict those infections

225
00:09:04,480 --> 00:09:01,490
understand them better and treat them

226
00:09:06,010 --> 00:09:04,490
better in to protect the crew and then

227
00:09:07,510 --> 00:09:06,020
there are also implications for the more

228
00:09:09,760 --> 00:09:07,520
we understand how they behave in in

229
00:09:13,000 --> 00:09:09,770
extreme environments we can learn a lot

230
00:09:14,470 --> 00:09:13,010
about how they behave in in spaces

231
00:09:17,140 --> 00:09:14,480
within the human body that are not so

232
00:09:21,250 --> 00:09:17,150
accessible to study okay does anybody

233
00:09:23,740 --> 00:09:21,260
have questions for dr. Nielsen okay

234
00:09:26,500 --> 00:09:23,750
we'll keep going then and so the the

235
00:09:28,330 --> 00:09:26,510
moving up and complexity it we have the

236
00:09:29,710 --> 00:09:28,340
seedling growth to study which dr.

237
00:09:31,660 --> 00:09:29,720
porterfield will tell us a little bit

238
00:09:34,870 --> 00:09:31,670

about and can you touch us a little bit

239
00:09:39,040 --> 00:09:34,880
about the study so this is an experiment

240
00:09:41,380 --> 00:09:39,050
is this second in series but it has a

241
00:09:43,510 --> 00:09:41,390
long lineage the principal investigators

242
00:09:46,630 --> 00:09:43,520
dr. John kiss who's Dean and professor

243
00:09:48,780 --> 00:09:46,640
at University of Mississippi he's a

244
00:09:52,680 --> 00:09:48,790
really a preeminent researcher in the

245
00:09:55,090 --> 00:09:52,690
field of plant sciences he's been

246
00:09:57,940 --> 00:09:55,100
studying the interactions from gravity

247
00:10:01,510 --> 00:09:57,950
and light sensing and the key his

248
00:10:03,520 --> 00:10:01,520
experiment is that if you remove gravity

249
00:10:04,900 --> 00:10:03,530
you can understand the light responses

250
00:10:06,520 --> 00:10:04,910
better because plants are always

251
00:10:08,380 --> 00:10:06,530
integrating these responses on the

252
00:10:10,660 --> 00:10:08,390
ground so if you can completely remove

253
00:10:13,030 --> 00:10:10,670
gravity or partially remove revit II

254
00:10:15,310 --> 00:10:13,040
using the hardware that they're using is

255
00:10:18,070 --> 00:10:15,320
a European modular cultivation system

256
00:10:19,930 --> 00:10:18,080
that actually allows you to centrifuge

257
00:10:21,520 --> 00:10:19,940
some samples so they're going the

258
00:10:23,980 --> 00:10:21,530
experiment is using a rabbit office

259
00:10:26,680 --> 00:10:23,990
italiana which again is a model organism

260
00:10:29,410 --> 00:10:26,690
it's the number one model organism in

261
00:10:30,820 --> 00:10:29,420
the plant sciences area the plants are

262
00:10:33,790 --> 00:10:30,830
going to be mounted on a petri dish and

263
00:10:36,340 --> 00:10:33,800

you can expose the plants to different

264
00:10:38,410 --> 00:10:36,350
colors of light and different angles and

265
00:10:41,350 --> 00:10:38,420
look at those interactions and then also

266
00:10:44,140 --> 00:10:41,360
look at how they respond in partial G is

267
00:10:46,810 --> 00:10:44,150
part of a dose response curve to look at

268
00:10:50,470 --> 00:10:46,820
gravity and light interactions but also

269
00:10:52,720 --> 00:10:50,480
to you can look at lunar G and Mars G

270
00:10:56,050 --> 00:10:52,730
responses to understand how plants may

271
00:10:57,520 --> 00:10:56,060
grow on in the context of human

272
00:11:01,240 --> 00:10:57,530
exploration to these other planetary

273
00:11:03,880 --> 00:11:01,250
bodies after the samples are analyzed

274
00:11:06,430 --> 00:11:03,890
they're going to be frozen in the minus

275
00:11:06,980 --> 00:11:06,440
eighty-degree freezer and then return to

276
00:11:10,090 --> 00:11:06,990
earth for

277
00:11:12,610 --> 00:11:10,100
analysis on the ground for different

278
00:11:15,829 --> 00:11:12,620
biomolecular and biochemical markers

279
00:11:18,560 --> 00:11:15,839
okay and and what might we learn about

280
00:11:21,440 --> 00:11:18,570
plants on earth from these experiments

281
00:11:24,769 --> 00:11:21,450
on plants in space anytime you can

282
00:11:26,930 --> 00:11:24,779
dissect out these signaling pathways to

283
00:11:29,990 --> 00:11:26,940
better understand them it creates an

284
00:11:34,010 --> 00:11:30,000
opportunity to improve agricultural

285
00:11:36,470 --> 00:11:34,020
systems here on the ground a lot of I

286
00:11:39,110 --> 00:11:36,480
know in in modern agriculture a lot of

287
00:11:41,510 --> 00:11:39,120
automation is dependent upon a certain

288
00:11:43,639 --> 00:11:41,520

type of plant architecture in the field

289
00:11:46,730 --> 00:11:43,649
and if the plants are responding to

290
00:11:48,949 --> 00:11:46,740
stress or change in light in some way

291
00:11:50,690 --> 00:11:48,959
then the automated systems can't really

292
00:11:53,410 --> 00:11:50,700
interact with the plants so as we're

293
00:11:56,990 --> 00:11:53,420
moving more to the more to that type of

294
00:11:58,430 --> 00:11:57,000
agricultural production capability we

295
00:11:59,990 --> 00:11:58,440
are going to be able to need to control

296
00:12:02,510 --> 00:12:00,000
plant growth at a higher level

297
00:12:04,010 --> 00:12:02,520
resolution and so what about plant

298
00:12:06,470 --> 00:12:04,020
growth in space does this have any

299
00:12:09,380 --> 00:12:06,480
implications for astronauts for oxygen

300
00:12:11,600 --> 00:12:09,390
or food yeah one of the main reasons

301
00:12:14,269 --> 00:12:11,610
that NASA is interested in plant growth

302
00:12:17,350 --> 00:12:14,279
on not only microgravity but on Mars and

303
00:12:20,780 --> 00:12:17,360
moon is to be able to develop systems to

304
00:12:22,699 --> 00:12:20,790
recycle water really help replenish the

305
00:12:25,519 --> 00:12:22,709
atmosphere and provide fresh food for

306
00:12:27,470 --> 00:12:25,529
the astronauts on orbit the last SpaceX

307
00:12:29,510 --> 00:12:27,480
launch delivered to the International

308
00:12:33,199 --> 00:12:29,520
Space Station the veggie plant growth

309
00:12:34,490 --> 00:12:33,209
unit swanee harvested a small crop of

310
00:12:36,139 --> 00:12:34,500
lettuce and it's actually going to be

311
00:12:39,800 --> 00:12:36,149
returning those letter samples are going

312
00:12:41,660 --> 00:12:39,810
to be returning on on this next SpaceX

313
00:12:43,670 --> 00:12:41,670

and we're going to analyze those samples

314
00:12:46,400 --> 00:12:43,680
to determine that they're safe they

315
00:12:48,500 --> 00:12:46,410
don't have any pathogens or bacteria so

316
00:12:50,360 --> 00:12:48,510
that would be safe and allow astronauts

317
00:12:53,210 --> 00:12:50,370
to actually eat those crops in the

318
00:12:55,850 --> 00:12:53,220
future future International Space

319
00:12:57,800 --> 00:12:55,860
Station missions hopefully too so r is

320
00:12:59,690 --> 00:12:57,810
he gonna get get a chance to test that

321
00:13:01,310 --> 00:12:59,700
let us down here on the ground I think

322
00:13:04,040 --> 00:13:01,320
its effort gets frozen the minus

323
00:13:08,630 --> 00:13:04,050
eighty-degree freezer it's it's not too

324
00:13:10,040 --> 00:13:08,640
palatable okay thank you so um dr.

325
00:13:12,079 --> 00:13:10,050
Bhattacharya as the principal

326
00:13:13,910 --> 00:13:12,089
investigator for the Ames student fruit

327
00:13:17,269 --> 00:13:13,920
fly experiment can you tell us a little

328
00:13:19,790 --> 00:13:17,279
bit about the study yes Stephanie so

329
00:13:20,340 --> 00:13:19,800
we're very interested in using the fruit

330
00:13:22,410 --> 00:13:20,350
fly mode

331
00:13:24,390 --> 00:13:22,420
the latin name is just awfully

332
00:13:26,880 --> 00:13:24,400
melanogaster but it's simply the fruit

333
00:13:29,160 --> 00:13:26,890
fly that you'll see buzzing around in

334
00:13:33,750 --> 00:13:29,170
your kitchens near fruit but we of

335
00:13:36,240 --> 00:13:33,760
course have a separate cohort that we

336
00:13:38,220 --> 00:13:36,250
grow in the lab because we have to have

337
00:13:39,960 --> 00:13:38,230
it very well controlled we have to make

338
00:13:43,290 --> 00:13:39,970

sure they're not getting contaminated by

339
00:13:45,420 --> 00:13:43,300
any other genetic stock of flies and so

340
00:13:49,950 --> 00:13:45,430
what we're interested in this experiment

341
00:13:52,920 --> 00:13:49,960
is to ask the question of how does an

342
00:13:56,130 --> 00:13:52,930
organism a biological system respond to

343
00:13:57,900 --> 00:13:56,140
the space environment and you can

344
00:14:00,300 --> 00:13:57,910
imagine that in a space environment it's

345
00:14:03,090 --> 00:14:00,310
a very unique environment there's very

346
00:14:05,910 --> 00:14:03,100
low to no gravity there are other

347
00:14:07,980 --> 00:14:05,920
changes that an astronaut or any other

348
00:14:11,280 --> 00:14:07,990
biological system experiences when going

349
00:14:13,860 --> 00:14:11,290
to space and coming back and what we

350
00:14:16,230 --> 00:14:13,870
want to do is actually use this fruit

351
00:14:18,660 --> 00:14:16,240
fly as a model to ask that question of

352
00:14:21,450 --> 00:14:18,670
what are the changes that we expect to

353
00:14:24,420 --> 00:14:21,460
see how does an organism respond to that

354
00:14:26,820 --> 00:14:24,430
environment and as dr. Porter Phil

355
00:14:29,850 --> 00:14:26,830
mentioned you know you may be asking why

356
00:14:32,820 --> 00:14:29,860
the fruit fly so the food fly is a very

357
00:14:34,830 --> 00:14:32,830
powerful organism in science people

358
00:14:38,550 --> 00:14:34,840
scientists have been using it for over a

359
00:14:40,980 --> 00:14:38,560
hundred years to understand the basic

360
00:14:45,450 --> 00:14:40,990
molecular biology and the genetics of

361
00:14:48,200 --> 00:14:45,460
how things work and as several of the

362
00:14:50,880 --> 00:14:48,210
panel members have and will speak to you

363
00:14:53,790 --> 00:14:50,890

all of these organisms actually have a

364
00:14:56,580 --> 00:14:53,800
lot of the DNA sequence in common so

365
00:15:00,000 --> 00:14:56,590
what you learn from a from a simple

366
00:15:01,500 --> 00:15:00,010
model like this and in flight you can

367
00:15:04,380 --> 00:15:01,510
imagine with the fruit fly which is a

368
00:15:07,200 --> 00:15:04,390
small organism you can grow thousands of

369
00:15:09,120 --> 00:15:07,210
them in a small space so you don't need

370
00:15:11,190 --> 00:15:09,130
a lot of mass you don't need a lot of

371
00:15:13,380 --> 00:15:11,200
volume to fly it you don't need a lot of

372
00:15:17,060 --> 00:15:13,390
resources and in a short period of time

373
00:15:20,100 --> 00:15:17,070
you can do multi-generational studies so

374
00:15:21,870 --> 00:15:20,110
with this organism then and and I should

375
00:15:26,960 --> 00:15:21,880
actually preface this by saying that

376
00:15:30,510 --> 00:15:26,970
this experiment was built tested

377
00:15:33,020 --> 00:15:30,520
developed everything by a group of 12

378
00:15:35,730 --> 00:15:33,030
students whom I men

379
00:15:39,420 --> 00:15:35,740
in my laboratory over the last two years

380
00:15:41,280 --> 00:15:39,430
and it was actually sponsored by the

381
00:15:43,880 --> 00:15:41,290
American Society for gravitational space

382
00:15:46,440 --> 00:15:43,890
research as well as by NanoRacks and STC

383
00:15:48,300 --> 00:15:46,450
but what's really neat is that these

384
00:15:51,150 --> 00:15:48,310
students have actually built this

385
00:15:54,570 --> 00:15:51,160
hardware which will look at a population

386
00:15:57,600 --> 00:15:54,580
of mutant flies and a population of its

387
00:16:00,480 --> 00:15:57,610
comparable wall type flies now what

388
00:16:02,280 --> 00:16:00,490

mutants am I talking about so in the

389
00:16:05,130 --> 00:16:02,290
space environment again as I mentioned

390
00:16:07,320 --> 00:16:05,140
there are a lot of stressors so there

391
00:16:10,050 --> 00:16:07,330
are actually fly meetings that are

392
00:16:12,990 --> 00:16:10,060
particularly resistant on earth to

393
00:16:14,640 --> 00:16:13,000
stressors these stress resistant mutants

394
00:16:16,560 --> 00:16:14,650
for example on earth have been found to

395
00:16:20,490 --> 00:16:16,570
be resistant to things like starvation

396
00:16:24,450 --> 00:16:20,500
dehydration they live twice as long as

397
00:16:25,800 --> 00:16:24,460
their wall type cohort so we are very

398
00:16:28,590 --> 00:16:25,810
interested in what the students are

399
00:16:31,500 --> 00:16:28,600
going to do is to fly a population of

400
00:16:35,460 --> 00:16:31,510
the stress resistant mutants compare

401
00:16:37,230 --> 00:16:35,470
them with the wild-type version in space

402
00:16:39,360 --> 00:16:37,240
and how they respond in space and then

403
00:16:41,760 --> 00:16:39,370
compare them with how they're responding

404
00:16:44,130 --> 00:16:41,770
on the earth and so there'll be those

405
00:16:46,980 --> 00:16:44,140
for comparisons that the students will

406
00:16:48,900 --> 00:16:46,990
make in terms of behavior so looking at

407
00:16:51,960 --> 00:16:48,910
how the Flies respond to this

408
00:16:55,500 --> 00:16:51,970
environment as well as doing molecular

409
00:16:56,820 --> 00:16:55,510
biology analyses on the ground to look

410
00:16:59,330 --> 00:16:56,830
at some of the things that the others

411
00:17:02,160 --> 00:16:59,340
are talking about like DNA changes

412
00:17:04,470 --> 00:17:02,170
signal signaling pathway what gene is

413
00:17:06,870 --> 00:17:04,480

talking to what gene what proteins are

414
00:17:09,210 --> 00:17:06,880
being expressed and how the organism is

415
00:17:11,040 --> 00:17:09,220
responding to this environment so in a

416
00:17:13,800 --> 00:17:11,050
nutshell that's what the experiment is

417
00:17:20,460 --> 00:17:13,810
about excellent Thank You Marcia Dunn

418
00:17:23,160 --> 00:17:20,470
has a question yeah into space and you

419
00:17:26,910 --> 00:17:23,170
know are they young old male female how

420
00:17:28,860 --> 00:17:26,920
do you yes so we're flying of the two

421
00:17:33,090 --> 00:17:28,870
populations for each of the population

422
00:17:36,630 --> 00:17:33,100
we're sending up 15 flies so 10 females

423
00:17:38,910 --> 00:17:36,640
and five males in each of the of the

424
00:17:40,130 --> 00:17:38,920
compartments we call them the fly condo

425
00:17:42,660 --> 00:17:40,140
because it's like a two-story

426
00:17:45,240 --> 00:17:42,670
condominium and the mutant and the

427
00:17:46,250 --> 00:17:45,250
wild-type on the two floors so we sent

428
00:17:48,260 --> 00:17:46,260
up 15

429
00:17:49,910 --> 00:17:48,270
each but at the end of the one month

430
00:17:52,760 --> 00:17:49,920
experiment because it goes up on space

431
00:17:55,550 --> 00:17:52,770
explore comes down on SpaceX for we

432
00:17:58,250 --> 00:17:55,560
anticipate having hundreds of each of

433
00:18:01,520 --> 00:17:58,260
those and you know on mush Marsha from

434
00:18:03,620 --> 00:18:01,530
our past missions you know and I know

435
00:18:06,740 --> 00:18:03,630
we've discussed this before we get you

436
00:18:09,410 --> 00:18:06,750
know the Flies do reproduce in space and

437
00:18:12,860 --> 00:18:09,420
the last time we flew 60 flies and we

438
00:18:14,900 --> 00:18:12,870

got 3,000 back so they will actually

439
00:18:16,850 --> 00:18:14,910
reproduce in space and so we definitely

440
00:18:20,420 --> 00:18:16,860
have numbers on our side with this

441
00:18:23,630 --> 00:18:20,430
experiment three all together yeah

442
00:18:25,460 --> 00:18:23,640
correct and um there was one other

443
00:18:27,800 --> 00:18:25,470
question and now I forget so I'll get

444
00:18:32,120 --> 00:18:27,810
you under so I don't we do have a

445
00:18:33,890 --> 00:18:32,130
question over here though actually if

446
00:18:37,100 --> 00:18:33,900
possible I have a question for dr.

447
00:18:39,020 --> 00:18:37,110
porterfield these are my name is Chu

448
00:18:42,170 --> 00:18:39,030
revilla from social media the question

449
00:18:45,920 --> 00:18:42,180
is I understand that we are still idea

450
00:18:48,470 --> 00:18:45,930
baby step stage in the studies of plants

451
00:18:51,020 --> 00:18:48,480
life and they're you know they're

452
00:18:54,650 --> 00:18:51,030
possible applications in space but if

453
00:18:57,370 --> 00:18:54,660
but is there any potential application

454
00:19:00,650 --> 00:18:57,380
of these sort of studies for future

455
00:19:03,740 --> 00:19:00,660
terraforming on Mars for example you

456
00:19:05,990 --> 00:19:03,750
know be able to grow planes in a extra

457
00:19:08,600 --> 00:19:06,000
terrestrial environment to create

458
00:19:13,340 --> 00:19:08,610
artificial you know artificial plant

459
00:19:16,850 --> 00:19:13,350
ecosystems actually at this point we're

460
00:19:19,580 --> 00:19:16,860
probably just in the initial stages of

461
00:19:21,260 --> 00:19:19,590
restarting our plant sciences program in

462
00:19:23,360 --> 00:19:21,270
the context of International Space

463
00:19:26,510 --> 00:19:23,370

Station utilization there's a long

464
00:19:29,690 --> 00:19:26,520
history of plant research has been

465
00:19:33,530 --> 00:19:29,700
conducted by NASA or in the 80's 90's

466
00:19:34,880 --> 00:19:33,540
and also the Soviets and Russians also

467
00:19:37,130 --> 00:19:34,890
did a lot of research in this area in

468
00:19:39,740 --> 00:19:37,140
terms of bio regenerative life support

469
00:19:41,330 --> 00:19:39,750
and closed-loop bio regenerative systems

470
00:19:44,270 --> 00:19:41,340
where plants are really the foundation

471
00:19:48,740 --> 00:19:44,280
for water recycling atmospheric

472
00:19:50,480 --> 00:19:48,750
recycling and food production so there

473
00:19:53,240 --> 00:19:50,490
is great interest in and developing

474
00:19:56,750 --> 00:19:53,250
these systems for interplanetary support

475
00:19:57,230 --> 00:19:56,760
or for long-duration habitation weather

476
00:19:59,840 --> 00:19:57,240
on the

477
00:20:02,380 --> 00:19:59,850
or on Mars I've seen results of studies

478
00:20:04,220 --> 00:20:02,390
where we looked at reduced pressure and

479
00:20:05,510 --> 00:20:04,230
plant growth and reduced pressure

480
00:20:08,870 --> 00:20:05,520
because you imagine operating a

481
00:20:11,000 --> 00:20:08,880
greenhouse on Mars we let would be less

482
00:20:12,860 --> 00:20:11,010
expensive less complicated if you could

483
00:20:15,800 --> 00:20:12,870
reduce the pressure people looked at

484
00:20:18,590 --> 00:20:15,810
lunar soil lunar soil simulants and

485
00:20:22,880 --> 00:20:18,600
looking at how plants might grow and

486
00:20:24,470 --> 00:20:22,890
respond in lunar regolith but the

487
00:20:28,910 --> 00:20:24,480
interesting thing about about a lot of

488
00:20:29,870 --> 00:20:28,920

that research it was done is that a lot

489
00:20:33,410 --> 00:20:29,880
of the technology was developed

490
00:20:35,270 --> 00:20:33,420
airponics and the advanced use of LEDs

491
00:20:37,880 --> 00:20:35,280
for plant growth are now the foundation

492
00:20:39,770 --> 00:20:37,890
for urban and vertical farming

493
00:20:41,570 --> 00:20:39,780
industries that are springing up around

494
00:20:44,360 --> 00:20:41,580
the world and in various cities Chicago

495
00:20:46,820 --> 00:20:44,370
has a fledgling industry right now

496
00:20:49,130 --> 00:20:46,830
Singapore is producing ten percent of

497
00:20:52,190 --> 00:20:49,140
their crop their fresh vegetable crops

498
00:20:53,710 --> 00:20:52,200
in the city using a controlled

499
00:20:56,540 --> 00:20:53,720
environment agriculture that relies on

500
00:21:00,860 --> 00:20:56,550
these advanced technologies that NASA

501
00:21:03,110 --> 00:21:00,870
pioneered and developed excellent thank

502
00:21:05,900 --> 00:21:03,120
you I have a question about the fruit

503
00:21:09,680 --> 00:21:05,910
flies so obviously there flies Marsha

504
00:21:11,420 --> 00:21:09,690
alluded to that and you are intending to

505
00:21:14,420 --> 00:21:11,430
study the genetics but do you study

506
00:21:17,150 --> 00:21:14,430
their flight patterns or how they handle

507
00:21:18,890 --> 00:21:17,160
microgravity yes indeed so yes I'm glad

508
00:21:21,320 --> 00:21:18,900
you bring this up Stephanie because the

509
00:21:22,940 --> 00:21:21,330
one of the main components of the

510
00:21:27,320 --> 00:21:22,950
hardware that the students have built is

511
00:21:29,120 --> 00:21:27,330
actually a high-definition camera so to

512
00:21:31,210 --> 00:21:29,130
look in fact it exactly the questions

513
00:21:35,120 --> 00:21:31,220

definitely brought up that is look at

514
00:21:36,590 --> 00:21:35,130
behaviorally how these flies respond

515
00:21:38,390 --> 00:21:36,600
because they were flying organism

516
00:21:41,200 --> 00:21:38,400
they're very sensitive to gravity

517
00:21:44,750 --> 00:21:41,210
actually as our all organisms that that

518
00:21:47,150 --> 00:21:44,760
live on earth and so we want to see what

519
00:21:49,490 --> 00:21:47,160
the effect is in space and just to give

520
00:21:52,880 --> 00:21:49,500
you a little background there since you

521
00:21:55,340 --> 00:21:52,890
Sheila mentioned by a serve by serve had

522
00:21:58,070 --> 00:21:55,350
flown and experiment a while back with a

523
00:22:01,310 --> 00:21:58,080
spider habitat where the fruit flies

524
00:22:03,710 --> 00:22:01,320
were used as food for the spider and so

525
00:22:05,750 --> 00:22:03,720
the cameras actually were more panning

526
00:22:07,700 --> 00:22:05,760
the spiders which you know is what the

527
00:22:10,499 --> 00:22:07,710
experiment was about but in that

528
00:22:12,989 --> 00:22:10,509
experiment with bias or we noticed that

529
00:22:15,180 --> 00:22:12,999
with some anomalous behavior of the

530
00:22:18,209 --> 00:22:15,190
fruit flies and that's what triggered

531
00:22:19,889 --> 00:22:18,219
this student experiment to then say that

532
00:22:22,829 --> 00:22:19,899
okay we've noticed something but though

533
00:22:24,599 --> 00:22:22,839
the images were not really you know

534
00:22:26,879 --> 00:22:24,609
geared towards looking at the Flies and

535
00:22:29,399 --> 00:22:26,889
so they built developed this camera in

536
00:22:32,039 --> 00:22:29,409
this habitat to get more close-up shots

537
00:22:34,979 --> 00:22:32,049
and get behavior of the Flies and see

538
00:22:37,199 --> 00:22:34,989

how the neurobehavioral system which is

539
00:22:41,269 --> 00:22:37,209
present in humans and flies and mice and

540
00:22:43,859 --> 00:22:41,279
all other organisms multicellular

541
00:22:47,159 --> 00:22:43,869
biological systems to see how they

542
00:22:48,749 --> 00:22:47,169
respond to space okay great finally we

543
00:22:50,879 --> 00:22:48,759
have dr. Globus who is the project

544
00:22:53,009 --> 00:22:50,889
scientist for the rodent habitat rodent

545
00:22:55,169 --> 00:22:53,019
research one study can you tell us a

546
00:22:57,839 --> 00:22:55,179
little bit about the study sure Thank

547
00:23:02,069 --> 00:22:57,849
You Stephanie this is the maiden voyage

548
00:23:07,680 --> 00:23:02,079
for the rodent research habitat system

549
00:23:11,069 --> 00:23:07,690
and this is a complex suite of hardware

550
00:23:13,609 --> 00:23:11,079
and operational capabilities that will

551
00:23:17,249 --> 00:23:13,619
make it possible for us to do

552
00:23:20,279 --> 00:23:17,259
experimentation in space using using

553
00:23:23,369 --> 00:23:20,289
rodents so this first flight is using

554
00:23:27,059 --> 00:23:23,379
mice it's considered a validation

555
00:23:29,909 --> 00:23:27,069
mission so we will be flying adult

556
00:23:33,989 --> 00:23:29,919
female mice they'll reside on the

557
00:23:38,849 --> 00:23:33,999
station for validation for 30 days after

558
00:23:42,569 --> 00:23:38,859
transit on SpaceX four and we'll be

559
00:23:44,339 --> 00:23:42,579
studying how the animals respond their

560
00:23:48,119 --> 00:23:44,349
health will be observing them while

561
00:23:51,239 --> 00:23:48,129
they're on station bye-bye video and as

562
00:23:55,649 --> 00:23:51,249
a consequence of this study will be able

563
00:23:58,109 --> 00:23:55,659

to support future research and determine

564
00:24:03,139 --> 00:23:58,119
some of the basic effects of spaceflight

565
00:24:07,680 --> 00:24:03,149
on the physiology of one step higher

566
00:24:10,139 --> 00:24:07,690
organism one step closer to humans we

567
00:24:13,319 --> 00:24:10,149
will also be carrying along with us on

568
00:24:16,589 --> 00:24:13,329
this first flight experiment from cases

569
00:24:18,799 --> 00:24:16,599
from a commercial partner who are who

570
00:24:21,799 --> 00:24:18,809
are flying animals that

571
00:24:24,139 --> 00:24:21,809
to study the effects of muscle wasting

572
00:24:27,259 --> 00:24:24,149
and the key components in the pathway

573
00:24:30,950 --> 00:24:27,269
that are involved in muscle atrophy in

574
00:24:31,940 --> 00:24:30,960
space so how can a month-long experiment

575
00:24:35,029 --> 00:24:31,950
help us learn about long-term

576
00:24:37,989 --> 00:24:35,039
spaceflight effects well one of the

577
00:24:41,629 --> 00:24:37,999
interesting things about about these

578
00:24:44,259 --> 00:24:41,639
model organisms is is typically their

579
00:24:47,600 --> 00:24:44,269
life spans are much shorter than ours

580
00:24:51,049 --> 00:24:47,610
that's especially true of rodents mice

581
00:24:53,810 --> 00:24:51,059
and rats typical life span is is two

582
00:24:56,539 --> 00:24:53,820
years we live we live seven or eight

583
00:24:59,749 --> 00:24:56,549
decades when all nine decades when all

584
00:25:02,600 --> 00:24:59,759
goes well and so when we look at what

585
00:25:05,769 --> 00:25:02,610
happens to rodents as they age they

586
00:25:09,859 --> 00:25:05,779
actually display many of the same

587
00:25:13,039 --> 00:25:09,869
degenerative processes over a two-year

588
00:25:16,580 --> 00:25:13,049

span that we see in humans over a 70

589
00:25:19,129 --> 00:25:16,590
year span and so because as already

590
00:25:22,810 --> 00:25:19,139
mentioned the pathways that are involved

591
00:25:26,080 --> 00:25:22,820
in in breaking down and maintaining

592
00:25:28,279 --> 00:25:26,090
tissues and body like muscle and bone

593
00:25:32,210 --> 00:25:28,289
cardiovascular system the immune system

594
00:25:36,379 --> 00:25:32,220
for defense against disease since all of

595
00:25:38,810 --> 00:25:36,389
those change in a more rapid pace in in

596
00:25:42,169 --> 00:25:38,820
an animal 30 days is is a bigger

597
00:25:46,009 --> 00:25:42,179
fraction of that life span in the past

598
00:25:48,529 --> 00:25:46,019
we've had shuttle flights a long history

599
00:25:53,810 --> 00:25:48,539
we've we've had 27 Shuttle missions

600
00:25:56,269 --> 00:25:53,820
where we've used the the original

601
00:25:58,789 --> 00:25:56,279
hardware that was modified for this and

602
00:26:00,710 --> 00:25:58,799
in those missions rats and mice were

603
00:26:03,830 --> 00:26:00,720
flown but never did were we able to

604
00:26:06,320 --> 00:26:03,840
achieve a flight experiment of this

605
00:26:10,310 --> 00:26:06,330
duration so we'll get some new

606
00:26:12,049 --> 00:26:10,320
information about aging and in space

607
00:26:14,419 --> 00:26:12,059
great we I know we have a couple

608
00:26:17,989 --> 00:26:14,429
questions already James Dean you had

609
00:26:19,580 --> 00:26:17,999
raised your hand thanks James name floor

610
00:26:20,570 --> 00:26:19,590
today I guess you just partly addressed

611
00:26:23,690 --> 00:26:20,580
us I'm just going to ask you if you had

612
00:26:26,239 --> 00:26:23,700
like a sort of brief history of rodent

613
00:26:29,899 --> 00:26:26,249

research in space I mean so 27 shuttle

614
00:26:32,180 --> 00:26:29,909
flights this is the first time on on I'm

615
00:26:34,039 --> 00:26:32,190
not the first time on station either or

616
00:26:36,139 --> 00:26:34,049
accounting that council shuttle flights

617
00:26:37,879 --> 00:26:36,149
mice have been on station before a

618
00:26:39,680 --> 00:26:37,889
different hardware system the mouse

619
00:26:42,230 --> 00:26:39,690
drawer system which was an Italian

620
00:26:44,869 --> 00:26:42,240
system that took my sup for a total

621
00:26:47,509 --> 00:26:44,879
period of 90 days some time ago that was

622
00:26:50,480 --> 00:26:47,519
a one-time flight there were 27 missions

623
00:26:52,759 --> 00:26:50,490
with the majority of those were rats but

624
00:26:55,519 --> 00:26:52,769
there were a few a few flights with mice

625
00:26:56,810 --> 00:26:55,529
that were on the shuttle and also the

626
00:27:01,159 --> 00:26:56,820
Russians have had a very vigorous

627
00:27:05,210 --> 00:27:01,169
program for many years a bio satellite

628
00:27:07,519 --> 00:27:05,220
program which is unmanned and those have

629
00:27:10,519 --> 00:27:07,529
those have included rodents as well so

630
00:27:12,470 --> 00:27:10,529
we we have a lot of basic knowledge in

631
00:27:15,710 --> 00:27:12,480
the short term about how animals were

632
00:27:18,379 --> 00:27:15,720
and mice and rats respond to spaceflight

633
00:27:22,159 --> 00:27:18,389
but very little information about long

634
00:27:23,930 --> 00:27:22,169
term and so again I realize this isn't

635
00:27:27,440 --> 00:27:23,940
like a first time thing or anything but

636
00:27:28,659 --> 00:27:27,450
how does a mouse experience a launch it

637
00:27:31,310 --> 00:27:28,669
seems like that would be a fairly

638
00:27:34,700 --> 00:27:31,320

traumatic event as we move into these

639
00:27:37,730 --> 00:27:34,710
higher organisms and you know do you

640
00:27:42,110 --> 00:27:37,740
ever worry about your you know sample

641
00:27:44,389 --> 00:27:42,120
making it all the way well thank you

642
00:27:46,669 --> 00:27:44,399
that's a that's a really good question I

643
00:27:48,860 --> 00:27:46,679
mean if people have seen videos or I'd

644
00:27:51,430 --> 00:27:48,870
see images from the movies of what

645
00:27:54,139 --> 00:27:51,440
happens to an astronaut during launch

646
00:27:56,269 --> 00:27:54,149
rodents are smaller so they experience

647
00:27:58,610 --> 00:27:56,279
the the increased gravity forces the

648
00:28:03,379 --> 00:27:58,620
hyper gravity force is much less than

649
00:28:07,190 --> 00:28:03,389
the large organism a human that said we

650
00:28:10,009 --> 00:28:07,200
we do careful ground-based studies in

651
00:28:13,279 --> 00:28:10,019
advance so we know from the shuttle

652
00:28:16,730 --> 00:28:13,289
which is from the shuttle that mice and

653
00:28:20,029 --> 00:28:16,740
rats tolerated this very well this is uh

654
00:28:22,700 --> 00:28:20,039
the the SpaceX Dragon vehicle it's a new

655
00:28:24,590 --> 00:28:22,710
system the the mechanical forces that

656
00:28:26,930 --> 00:28:24,600
the animals going to experience in the

657
00:28:30,110 --> 00:28:26,940
course of that are somewhat different

658
00:28:32,960 --> 00:28:30,120
they're quite similar to the Russian by

659
00:28:34,310 --> 00:28:32,970
a satellite though in those animals did

660
00:28:36,230 --> 00:28:34,320
quite do quite well in those

661
00:28:38,960 --> 00:28:36,240
circumstances but we did ground-based

662
00:28:42,289 --> 00:28:38,970
studies in the hardware that we intend

663
00:28:45,090 --> 00:28:42,299

to fly to to ensure that the animals are

664
00:28:47,680 --> 00:28:45,100
going to tolerate that

665
00:28:49,120 --> 00:28:47,690
I'm sorry the hardware is it another

666
00:28:50,590 --> 00:28:49,130
what you would describe is like a drawer

667
00:28:53,169 --> 00:28:50,600
or something like that or how do we yes

668
00:28:55,450 --> 00:28:53,179
let me take a moment quickly to describe

669
00:28:58,750 --> 00:28:55,460
so we have a we have a system it's

670
00:29:02,020 --> 00:28:58,760
called the transporter it's it basically

671
00:29:04,510 --> 00:29:02,030
provides food water and air flow the

672
00:29:06,549 --> 00:29:04,520
animals are housed in the transporter we

673
00:29:09,400 --> 00:29:06,559
have a total of twenty animals 10 on

674
00:29:11,640 --> 00:29:09,410
each side in that transporter once it

675
00:29:14,410 --> 00:29:11,650
arrives it station the crew will take

676
00:29:16,750 --> 00:29:14,420
what's called an animal access unit it's

677
00:29:19,450 --> 00:29:16,760
it's like a portable glove box that they

678
00:29:21,790 --> 00:29:19,460
can put on that and remove take the

679
00:29:24,070 --> 00:29:21,800
animals out of the transporter when

680
00:29:27,220 --> 00:29:24,080
they'll be transferred into a long-term

681
00:29:31,330 --> 00:29:27,230
house we call the habitat the animals

682
00:29:34,750 --> 00:29:31,340
reside in the habitat as for as long as

683
00:29:37,630 --> 00:29:34,760
30 days in this mission and and in

684
00:29:40,510 --> 00:29:37,640
future missions could be longer and the

685
00:29:43,200 --> 00:29:40,520
habitat has the capability has video

686
00:29:45,940 --> 00:29:43,210
were able to monitor on a daily basis

687
00:29:49,710 --> 00:29:45,950
their behavior and health status from

688
00:29:51,940 --> 00:29:49,720

the ground so I just like to point out

689
00:29:53,980 --> 00:29:51,950
Ruth is being modest earlier when she

690
00:29:55,750 --> 00:29:53,990
said was just really an adaptation of

691
00:29:58,510 --> 00:29:55,760
the shuttle based hardware systems this

692
00:30:00,100 --> 00:29:58,520
is a completely re-engineered system and

693
00:30:03,580 --> 00:30:00,110
it's very important because in National

694
00:30:05,410 --> 00:30:03,590
Academies reporter calls out for urgent

695
00:30:08,080 --> 00:30:05,420
need for rodent research capabilities

696
00:30:09,850 --> 00:30:08,090
and so what the key thing that this does

697
00:30:11,980 --> 00:30:09,860
is it allows us to start pushing out the

698
00:30:13,630 --> 00:30:11,990
time that we're exposing the rodents to

699
00:30:15,549 --> 00:30:13,640
microgravity so with the goal of

700
00:30:17,799 --> 00:30:15,559
initially near-term 60 days to

701
00:30:19,780 --> 00:30:17,809
eventually six months and the team of

702
00:30:21,640 --> 00:30:19,790
names did it and Ruth herself did a

703
00:30:24,070 --> 00:30:21,650
tremendous job it was a very challenging

704
00:30:25,540 --> 00:30:24,080
effort in order to bring this on board

705
00:30:28,210 --> 00:30:25,550
and get this ready for launch at this

706
00:30:30,000 --> 00:30:28,220
time I know we've got lots of questions

707
00:30:32,080 --> 00:30:30,010
we've got one waiting here the front

708
00:30:34,510 --> 00:30:32,090
sorry no James already covered

709
00:30:36,160 --> 00:30:34,520
everything that I had to ask ok so we'll

710
00:30:38,470 --> 00:30:36,170
go to you back there Marcia I know

711
00:30:41,080 --> 00:30:38,480
you've got one too and I can destroy the

712
00:30:43,510 --> 00:30:41,090
social media going back into the launch

713
00:30:45,970 --> 00:30:43,520

I mean do the rodents actually sit on

714
00:30:48,490 --> 00:30:45,980
like a foam pad or how are they

715
00:30:51,190 --> 00:30:48,500
cushioned during the launch they don't

716
00:30:52,960 --> 00:30:51,200
have they they are not cushioned that we

717
00:30:55,720 --> 00:30:52,970
don't have soft chairs for them they

718
00:30:57,459 --> 00:30:55,730
have their standard cage they actually

719
00:31:00,709 --> 00:30:57,469
in our

720
00:31:02,959 --> 00:31:00,719
pre-launch testing we mounted cameras so

721
00:31:05,959 --> 00:31:02,969
that we could see how they respond and

722
00:31:08,299 --> 00:31:05,969
we expose them both to the vibration and

723
00:31:11,709 --> 00:31:08,309
hyper gravity conditions that are

724
00:31:14,569 --> 00:31:11,719
anticipated to occur on Dragon and so

725
00:31:17,359 --> 00:31:14,579
they stay they moved to the bot in the

726
00:31:18,889 --> 00:31:17,369
in the condition of hypergravity they

727
00:31:21,769 --> 00:31:18,899
move to the bottom of the cage they

728
00:31:24,109 --> 00:31:21,779
don't and they hang tight until the ride

729
00:31:26,509 --> 00:31:24,119
is over it's relatively short period of

730
00:31:28,969 --> 00:31:26,519
time it's it's less than 10 minutes

731
00:31:32,149 --> 00:31:28,979
where these changes are occurring but we

732
00:31:35,259 --> 00:31:32,159
we we did our best on the ground to

733
00:31:38,089 --> 00:31:35,269
simulate those those launch conditions

734
00:31:40,159 --> 00:31:38,099
of course we have gravity sometimes I

735
00:31:42,259 --> 00:31:40,169
get the question well why don't you put

736
00:31:44,419 --> 00:31:42,269
them in take away gravity on the ground

737
00:31:46,039 --> 00:31:44,429
and test it and then make it exactly the

738
00:31:48,079 --> 00:31:46,049

same that we don't have that capability

739
00:31:51,439 --> 00:31:48,089
here which is why we're going to station

740
00:31:54,009 --> 00:31:51,449
so Marcia Don Marsh should any

741
00:31:56,869 --> 00:31:54,019
associated press a couple of questions

742
00:31:59,029 --> 00:31:56,879
will all the muscle studies be done

743
00:32:01,519 --> 00:31:59,039
after the flight i'm assuming and are

744
00:32:03,019 --> 00:32:01,529
the mice individually contained or they

745
00:32:07,489 --> 00:32:03,029
group together and somehow where they

746
00:32:08,959 --> 00:32:07,499
can mingle and in and i'd like to hear a

747
00:32:11,179 --> 00:32:08,969
little bit about the improvements of

748
00:32:13,339 --> 00:32:11,189
this habitat versus what what we've all

749
00:32:16,099 --> 00:32:13,349
seen for so many years I mean is it more

750
00:32:20,379 --> 00:32:16,109
comfortable Biggers but III just like to

751
00:32:22,729 --> 00:32:20,389
know some concrete differences sure so

752
00:32:25,549 --> 00:32:22,739
I'll try to remember all your questions

753
00:32:28,249 --> 00:32:25,559
I think I counted three the animals our

754
00:32:30,889 --> 00:32:28,259
group housed there so mice or social

755
00:32:33,049 --> 00:32:30,899
animals and so while some hardware in

756
00:32:36,169 --> 00:32:33,059
the past and and that has been developed

757
00:32:38,689 --> 00:32:36,179
as animals individually housed we know

758
00:32:40,879 --> 00:32:38,699
that rodents do better group housed and

759
00:32:43,669 --> 00:32:40,889
so that's this hardware is designed to

760
00:32:45,649 --> 00:32:43,679
do that so they live with their cage

761
00:32:49,579 --> 00:32:45,659
mates we acclimate them for prolonged

762
00:32:50,959 --> 00:32:49,589
period in there in there with their cage

763
00:32:52,399 --> 00:32:50,969

mates with their littermates so they

764
00:32:58,789 --> 00:32:52,409
don't have a stranger to take the ride

765
00:33:02,269 --> 00:32:58,799
with and so that's so so that's how the

766
00:33:03,769 --> 00:33:02,279
housing is handled that does not

767
00:33:05,749 --> 00:33:03,779
preclude the possibility in the future

768
00:33:08,719 --> 00:33:05,759
that the hardware can be adapted and

769
00:33:10,640 --> 00:33:08,729
dividers put in that would allow

770
00:33:12,320 --> 00:33:10,650
individually housed animals

771
00:33:15,380 --> 00:33:12,330
for validating the hardware this is our

772
00:33:17,900 --> 00:33:15,390
plan for this for this flight to answer

773
00:33:22,730 --> 00:33:17,910
the question about muscle the tissues

774
00:33:26,120 --> 00:33:22,740
are going to be analyzed after return to

775
00:33:30,230 --> 00:33:26,130
earth and your last question was

776
00:33:33,920 --> 00:33:30,240
improvements there were I think one of

777
00:33:37,670 --> 00:33:33,930
the most important improvements in in my

778
00:33:41,390 --> 00:33:37,680
view as a scientist is the addition of a

779
00:33:43,940 --> 00:33:41,400
video system that we can basically be

780
00:33:47,390 --> 00:33:43,950
observing animals both live and we can

781
00:33:50,870 --> 00:33:47,400
collect that and view it later and view

782
00:33:53,420 --> 00:33:50,880
it extensively to follow behavior and

783
00:33:55,670 --> 00:33:53,430
importantly the health of the animals in

784
00:33:58,760 --> 00:33:55,680
the past we've had much more limited

785
00:34:00,290 --> 00:33:58,770
capability to do that and I think we're

786
00:34:02,510 --> 00:34:00,300
going to really learn a lot about that

787
00:34:04,880 --> 00:34:02,520
we've also had to rely on the astronauts

788
00:34:07,670 --> 00:34:04,890

on the shuttle taking their time out of

789
00:34:09,680 --> 00:34:07,680
their busy days to go and and and open

790
00:34:11,570 --> 00:34:09,690
up the system and look in there was a

791
00:34:14,090 --> 00:34:11,580
lot of it there was there were changes

792
00:34:17,419 --> 00:34:14,100
to the lighting system which made it

793
00:34:20,389 --> 00:34:17,429
better from the perspective of

794
00:34:23,540 --> 00:34:20,399
entrainment to the circadian rhythm more

795
00:34:26,149 --> 00:34:23,550
and controlling the scientific variables

796
00:34:28,399 --> 00:34:26,159
that you would want to see controlled

797
00:34:30,409 --> 00:34:28,409
there were also had to be extensive

798
00:34:33,950 --> 00:34:30,419
hardware changes in order for it to

799
00:34:39,530 --> 00:34:33,960
interface with the Express rack on the

800
00:34:42,290 --> 00:34:39,540
ISS so those were the main changes can

801
00:34:44,600 --> 00:34:42,300
you had a question and kramer universe

802
00:34:46,250 --> 00:34:44,610
today in america space so can you tell

803
00:34:48,800 --> 00:34:46,260
out the mice are they part of the late

804
00:34:50,870 --> 00:34:48,810
stow cargo when are they going what's

805
00:34:52,730 --> 00:34:50,880
the power source for this transporter is

806
00:34:54,409 --> 00:34:52,740
do they have an independent power source

807
00:34:59,410 --> 00:34:54,419
you know some of those glacier freezers

808
00:35:01,760 --> 00:34:59,420
lost power sometimes and is there took a

809
00:35:05,540 --> 00:35:01,770
type of mice what was the mouse

810
00:35:09,920 --> 00:35:05,550
selection process okay so so they are

811
00:35:13,310 --> 00:35:09,930
they are late load I'm going to defer

812
00:35:14,740 --> 00:35:13,320
the power source question to to an

813
00:35:17,620 --> 00:35:14,750

engineer

814
00:35:20,350 --> 00:35:17,630
the power lock poker slot yard by ya is

815
00:35:31,150 --> 00:35:20,360
basics it's powered by SpaceX during

816
00:35:32,770 --> 00:35:31,160
launch innocent no no the UH and I'll

817
00:35:35,860 --> 00:35:32,780
get back to this in a moment your last

818
00:35:38,350 --> 00:35:35,870
question was how did you select the mice

819
00:35:41,350 --> 00:35:38,360
is there a particular of rice so we

820
00:35:45,010 --> 00:35:41,360
selected a strain an inbred strain

821
00:35:48,190 --> 00:35:45,020
called that's known as c57 black six

822
00:35:50,440 --> 00:35:48,200
these are black mice that these are

823
00:35:53,740 --> 00:35:50,450
females they get along well together on

824
00:35:57,670 --> 00:35:53,750
the ride and they are four month old so

825
00:35:59,680 --> 00:35:57,680
they are they are past puberty at four

826
00:36:02,890 --> 00:35:59,690
months of age they're considered adult

827
00:36:05,560 --> 00:36:02,900
mice and that's important for us in

828
00:36:07,540 --> 00:36:05,570
terms of being able to understand the

829
00:36:11,950 --> 00:36:07,550
changes in the adult organism instead of

830
00:36:14,200 --> 00:36:11,960
a growing animal and these are inbred

831
00:36:15,880 --> 00:36:14,210
mice and an important aspect of their

832
00:36:19,420 --> 00:36:15,890
selection is it's a very common

833
00:36:22,840 --> 00:36:19,430
background strain for transgenic and

834
00:36:27,070 --> 00:36:22,850
knockout animals so we anticipate in the

835
00:36:30,520 --> 00:36:27,080
future and that scientists will be

836
00:36:32,620 --> 00:36:30,530
flying experiments where they they want

837
00:36:35,830 --> 00:36:32,630
to use animals that have been

838
00:36:39,400 --> 00:36:35,840

genetically manipulated and so that is

839
00:36:43,780 --> 00:36:39,410
by establishing the c57 black six mouse

840
00:36:46,150 --> 00:36:43,790
as be as tolerating flight well then

841
00:36:49,390 --> 00:36:46,160
we'll be in good position to host those

842
00:36:51,310 --> 00:36:49,400
animals in the future as also the model

843
00:36:54,010 --> 00:36:51,320
strain has been used extensively and a

844
00:36:55,450 --> 00:36:54,020
lot of shuttle based experiments so

845
00:36:57,460 --> 00:36:55,460
there is that heritage ability to

846
00:36:59,770 --> 00:36:57,470
connect them what we want to do in

847
00:37:02,260 --> 00:36:59,780
extended time periods to what we've done

848
00:37:05,560 --> 00:37:02,270
in the past I'll show I think there was

849
00:37:07,510 --> 00:37:05,570
a question over here I'm neo auto from

850
00:37:09,610 --> 00:37:07,520
the social media I had a question about

851
00:37:12,760 --> 00:37:09,620
the behavior that you're looking for in

852
00:37:15,490 --> 00:37:12,770
the rodents from what I can imagine

853
00:37:16,720 --> 00:37:15,500
they're just free-floating in a cage are

854
00:37:18,580 --> 00:37:16,730
you looking for them to bounce off the

855
00:37:21,100 --> 00:37:18,590
walls and interact and like how are they

856
00:37:23,440 --> 00:37:21,110
to get their phone the first validation

857
00:37:25,360 --> 00:37:23,450
mission we're looking for evidence of

858
00:37:27,370 --> 00:37:25,370
normal behavior patterns and in fact

859
00:37:28,359 --> 00:37:27,380
what we think it's going to happen is

860
00:37:30,069 --> 00:37:28,369
what's been observed in

861
00:37:32,410 --> 00:37:30,079
previous missions and that is that

862
00:37:35,079 --> 00:37:32,420
rodents don't just kind of float around

863
00:37:37,569 --> 00:37:35,089

as and and have fun in the free space

864
00:37:41,529 --> 00:37:37,579
they tend to hold onto the walls they

865
00:37:44,859 --> 00:37:41,539
use their they use their paws they move

866
00:37:46,630 --> 00:37:44,869
around a lot like a monkey still in if

867
00:37:49,779 --> 00:37:46,640
you go to the zoo and observe observe

868
00:37:53,049 --> 00:37:49,789
monkey so they they run around they're

869
00:37:55,359 --> 00:37:53,059
very physically active they if you

870
00:37:58,839 --> 00:37:55,369
observe them during the sleep period

871
00:38:00,549 --> 00:37:58,849
they hunch together so there's not a lot

872
00:38:03,099 --> 00:38:00,559
of free-floating now that behavior

873
00:38:05,680 --> 00:38:03,109
pattern may change over time in space as

874
00:38:07,480 --> 00:38:05,690
you can imagine being into this novel

875
00:38:10,299 --> 00:38:07,490
environment yourself you might initially

876
00:38:13,720 --> 00:38:10,309
feel like holding on but that's one of

877
00:38:17,680 --> 00:38:13,730
the things we'll be learning I think

878
00:38:20,559 --> 00:38:17,690
there's a question here is megan gannon

879
00:38:21,700 --> 00:38:20,569
from space com so if all goes well with

880
00:38:24,400 --> 00:38:21,710
this mission what do you anticipate

881
00:38:29,589 --> 00:38:24,410
being able to test in the future and how

882
00:38:33,099 --> 00:38:29,599
long my future missions be well I think

883
00:38:35,440 --> 00:38:33,109
in terms of future mission duration dr.

884
00:38:38,380 --> 00:38:35,450
porterfield may want to discuss that

885
00:38:41,099 --> 00:38:38,390
there is the hope as scientists space

886
00:38:44,670 --> 00:38:41,109
biologists that we can move to

887
00:38:48,670 --> 00:38:44,680
multi-generations in space ultimately

888
00:38:51,880 --> 00:38:48,680

the there's a lot of interest closer to

889
00:38:56,319 --> 00:38:51,890
the near term in really drilling down

890
00:39:00,339 --> 00:38:56,329
and understanding the the molecular

891
00:39:02,739 --> 00:39:00,349
level what some of the causative factors

892
00:39:05,319 --> 00:39:02,749
for the tissue changes that we know

893
00:39:09,759 --> 00:39:05,329
occur in space that is the bone loss the

894
00:39:11,769 --> 00:39:09,769
muscle loss the immune changes and as

895
00:39:14,559 --> 00:39:11,779
another aspect of that an important

896
00:39:18,640 --> 00:39:14,569
aspect of that is to ask the question of

897
00:39:21,640 --> 00:39:18,650
whether ways we have of interfering in

898
00:39:23,589 --> 00:39:21,650
and and preventing those disease

899
00:39:26,979 --> 00:39:23,599
processes on earth whether they work as

900
00:39:29,620 --> 00:39:26,989
well in space and so that is also a

901
00:39:34,900 --> 00:39:29,630
strong motivator both for NASA funded

902
00:39:36,580 --> 00:39:34,910
pis and for the commercial sector one

903
00:39:39,510 --> 00:39:36,590
more question

904
00:39:44,110 --> 00:39:39,520
can you wait for the microphone sorry

905
00:39:45,550 --> 00:39:44,120
you said that they tend to unlike humans

906
00:39:47,260 --> 00:39:45,560
who don't have the luxury of being able

907
00:39:50,920 --> 00:39:47,270
to grab onto a cage they can move around

908
00:39:56,220 --> 00:39:50,930
a lot in regards to studying muscle

909
00:39:58,960 --> 00:39:56,230
atrophy would that possibly rule out

910
00:40:00,760 --> 00:39:58,970
rodents in in terms of being able to

911
00:40:03,550 --> 00:40:00,770
study muscle atrophy since they are so

912
00:40:05,590 --> 00:40:03,560
able to be so much more active that's

913
00:40:07,720 --> 00:40:05,600

that you that's a very astute question

914
00:40:10,150 --> 00:40:07,730
it's a good question but in fact what

915
00:40:12,130 --> 00:40:10,160
we've seen is that despite their ability

916
00:40:13,570 --> 00:40:12,140
to move around they still lack gravity

917
00:40:17,710 --> 00:40:13,580
so they don't have the weight of their

918
00:40:21,640 --> 00:40:17,720
bodies as they move and so they do in

919
00:40:24,520 --> 00:40:21,650
fact lose muscle mass and quite quite

920
00:40:26,140 --> 00:40:24,530
dramatically so despite their moving

921
00:40:28,600 --> 00:40:26,150
around the cage and their ability to

922
00:40:30,580 --> 00:40:28,610
move to their food and their water and

923
00:40:36,700 --> 00:40:30,590
and to interact socially with other

924
00:40:39,370 --> 00:40:36,710
animals they they do in fact lose muscle

925
00:40:42,430 --> 00:40:39,380
and and that's a that's an important

926
00:40:44,500 --> 00:40:42,440
area of research thank you all for

927
00:40:48,310 --> 00:40:44,510
joining us today any final thoughts or

928
00:40:50,320 --> 00:40:48,320
comments from any of our panelists ok

929
00:40:52,390 --> 00:40:50,330
just want to thank our P is for all the

930
00:40:54,070 --> 00:40:52,400
hard work and developing these payloads

931
00:40:56,980 --> 00:40:54,080
and delivering the science that that

932
00:40:59,320 --> 00:40:56,990
NASA is depending upon and in terms of

933
00:41:02,350 --> 00:40:59,330
advancing human exploration so personal

934
00:41:03,940 --> 00:41:02,360
thank you thank you thank you all for

935
00:41:06,000 --> 00:41:03,950
joining us today of course you can

936
00:41:08,200 --> 00:41:06,010
follow along our researchers and their

937
00:41:11,110 --> 00:41:08,210
experiments and studies online at

938
00:41:13,380 --> 00:41:11,120

nasa.gov slash station and find all the